Technical Support Document For the May 22 and 23, 2010, Alamosa, Pagosa Springs, and Grand Junction Exceptional Event

Colorado Department of Public Health and Environment

Prepared by the Technical Services Program
Air Pollution Control Division
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Executive Summary

In 2005, Congress identified a need to account for events that result in exceedances of the National Ambient Air Quality Standards (NAAQS) that are exceptional in nature[1] (e.g., not expected to reoccur or caused by acts of nature beyond man-made controls). In response, EPA promulgated the Exceptional Events Rule (EER) to address exceptional events in 40 CFR Parts 50 and 51 on March 22, 2007 (72 FR 13560). On May 2, 2011, in an attempt to clarify this rule, EPA released draft guidance documents on the implementation of the EER to State, tribal and local air agencies for review. The EER allows for states and tribes to "flag" air quality monitoring data as an exceptional event and exclude those data from use in determinations with respect to exceedances or violations of the NAAQS, if EPA concurs with the demonstration submitted by the flagging agency.

Due to the semi-arid nature of parts of the state, Colorado is highly susceptible to windblown dust events. These events are often captured by various air quality monitoring equipment throughout the state, sometimes resulting in exceedances or violations of the 24-hour PM_{10} NAAQS. This document contains detailed information about the large regional windblown dust event that occurred on May 22 and 23, 2010. The Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (APCD) has prepared this report for the U.S. Environmental Protection Agency (EPA) to demonstrate that the elevated PM_{10} concentrations were caused by a natural event.

On May 22 and 23 of 2010, a powerful spring storm system caused multiple exceedances of the twenty-four hour PM_{10} NAAQS in west-central and southwest Colorado. On May 22, 2010, exceedances were recorded at the Adams State College monitor in Alamosa with a concentration of 260 $\mu g/m^3$, the Alamosa Municipal Building monitor with a concentration of 194 $\mu g/ m^3$ and the Pagosa Springs School monitor with a concentration of 187 $\mu g/ m^3$. The following day, May 23, 2010, exceedances were documented at the Clifton monitor (approximately 6 miles to the east of Grand Junction) with a concentration of 189 $\mu g/m^3$ and the Mesa County Powell Building monitor in Grand Junction with a concentration of 155 $\mu g/m^3$. These high readings and other PM_{10} concentrations across Colorado are plotted on the maps for May 22 and 23, 2010, in Figure 1 and Figure 2 respectively.

All of the noted May 22 and 23, 2010, twenty-four-hour PM_{10} concentrations were above the 90^{th} percentile concentrations for their locations (see Table 26 and Table 27). This event produced the maximum value in one of the five datasets and exceeded the 98th% value of any evaluation criteria for the other four sites. The statistical and meteorological data clearly shows that but for this high wind blowing dust event, Alamosa, Pagosa Springs, and Grand Junction would not have exceeded the 24-hour NAAQS on May 22 and 23, 2010. Since at least 2005, there has not been an exceedance that was not associated with high winds carrying PM_{10} dust from distant sources in these areas. This is evidence that the event was associated with a measured concentration in excess of normal historical fluctuations including background.

This large regional dust storm adversely affected the air quality exceeding the 24-hour PM_{10} NAAQS in Alamosa, Pagosa Springs, and Grand Junction and impacted PM_{10} concentrations at several other monitoring stations in Colorado.

Specifically, these high values on both days were the consequence of strong southwesterly prefrontal winds beginning on May 22 and extending through May 23 in combination with dry

[1] Section 319 of the Clear Air Act (CAA), as amended by section 6013 of the Safe Accountable Flexible Efficient-Transportation Equity Act: A Legacy for Users (SAFE-TEA-LU of 2005, required EPA to propose the Federal Exceptional Events Rule (EER) no later than March 1, 2006.

conditions which caused significant blowing dust across much of Arizona, northwest New Mexico, southeast Utah and southwest Colorado. These winds were the result of a strong short wave in the upper atmosphere that was moving across the Great Basin and the associated surface cold front and low pressure system. This storm system transported PM_{10} dust into the southwestern portion of Colorado.

Widespread restrictions to visibility occurred in southwest Colorado during the afternoon and evening hours on May 22, 2010 and west-central Colorado during the afternoon and evening hours of May 23, 2010 as the impacts of the system shifted north and west.

EPA's June 2012 draft Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Affected by High Winds under the Exceptional Events Rule states "the EPA will accept a threshold of a sustained wind of 25 mph for areas in the west provided the agencies support this as the level at which they expect stable surfaces (i.e., controlled anthropogenic and undisturbed natural surfaces) to be overwhelmed..." In addition, in both eastern and western Colorado it has been shown that wind speeds of 30 mph or greater and gusts of 40 mph or greater can cause blowing dust (see reference for the Technical Support Document for the January 19, 2009 Lamar Exceptional Event and Appendix A - Grand Junction, Colorado, Blowing Dust Climatology at the end of this document). For this blowing dust event, it has been assumed that sustained winds of 25 mph and higher or wind gusts of 40 mph and higher can cause blowing dust in northeast Arizona, northwest New Mexico, southeast Utah and west-central and southwest Colorado.

The Albuquerque, Flagstaff, and Grand Junction NWS Forecast Offices issue weather warnings and advisories for northeast Arizona, most of New Mexico, eastern Utah, and western and southwestern Colorado. The weather warnings and advisories issued by theses offices for May 22 and 23, 2010, are presented in Appendix B. These warnings and advisories show that strong winds and areas of blowing dust were expected and experienced across this region on these days.

The blowing dust climatology for the Four Corners area indicates that the area can be susceptible to blowing dust when winds are high. Landform imagery shows that northeastern Arizona and southeastern Utah in particular have experienced a long-term pattern of wind erosion and blowing dust when winds have been southwesterly and blowing into western and southern Colorado. Forecast products from the Navy Aerosol Analysis and Prediction System model provide evidence for a widespread blowing dust event in the Four Corners states, suggesting that significant source regions for dust in Colorado were located in arid regions of Arizona, New Mexico and Utah. NOAA HYSPLIT forward and backward trajectories provide clear supporting evidence that dust from desert regions of Arizona, northwest New Mexico and southeast Utah caused the PM_{10} exceedances measured across portions of west-central and southwest Colorado on May 22 and 23, 2010.

The Drought Monitor map of the western U.S. for May 18, 2010, shows that soils across northeastern Arizona, most of Utah, and parts of western Colorado had below normal soil moisture. Northeast Arizona was classified as "Abnormally Dry", with an area of "Moderate" to "Severe" drought in the Painted Desert region. Soils in the Four Corners area of northeast Arizona, northwest New Mexico and southeast Utah were dry enough to produce blowing dust when winds were above the thresholds for blowing dust.

The surface weather associated with this storm on May 22, 2010 is presented in Figure 3 and Figure 4; the surface analyses for 5 AM MST and 5 PM MST May 22, 2010, respectively. Surface weather for May 23, 2010, is displayed in Figure 5 and Figure 6; the surface analyses for 5 AM MST and 5 PM MST May 23, 2010, respectively. Significant surface features included a stationary front stretching from Colorado into southern California. The combination of strong

winds aloft, deep mixing, and the tight pressure gradients associated with the surface low pressure system caused surface winds of up to 41 mph with gusts to 56 mph. The synoptic weather conditions on May 22 and 23, 2010, (illustrated in Figures 3 through 16) show that the conditions necessary for widespread strong gusty winds and transport of blowing dust were in place over the area of concern.

MODIS and GOES satellite imagery show that the Painted Desert and Four Corners area in general were source regions for the blowing dust on May 22 and 23, 2010. This is consistent with the climatology for many dust storms in Colorado as described in the Grand Junction, Colorado, Blowing Dust Climatology report contained in Appendix A of this document. The observations of winds above blowing dust thresholds and restricted visibilities in the areas of concern demonstrate that this is a natural event that cannot be reasonably controlled or prevented.

The Center for Snow and Avalanche Studies has been studying the effects of wind-blown desert dust from Arizona, New Mexico, and Utah on snowpack albedo and snowmelt in the San Juan Mountains of Colorado. The Center for Snow and Avalanche Studies lists May 22, 2010, as one of nine Dust-on-Snow events for the 2009/2010 water year, and this provides clear supporting evidence that a regional blowing dust event with long-range transport caused the PM10 exceedances measured across portions of Colorado on May 22, 2010. Snow cover data provide strong evidence that a widespread, regional, blowing dust event caused exceedances at these locations. In addition, NOAA and USGS scientists reported significant dust transport from the Four Corners area into southern and western Colorado on May 22 and 23, 2010.

Friction velocities provide a measure of the near-surface meteorological conditions necessary to cause blowing dust. Friction velocities were high enough to sustain blowing dust over undisturbed soils in northern Arizona, northwest New Mexico, southeast Utah, and west-central and southwest Colorado during this event.

The PM_{10} exceedances in Alamosa, Pagosa Springs, and Grand Junction on May 22 and 23, 2010, would not have occurred if not for the following: (a) dry soil conditions over northeast Arizona, northwest New Mexico, most of Utah, and parts of western Colorado with 30-day precipitation totals below the threshold identified as a precondition for blowing dust in northeastern Arizona; (b) a surface low pressure system and cold front that were associated with a strong upper-level trough that caused strong prefrontal surface winds over the area of concern; and (c) friction velocities over regions of northern Arizona, northwest New Mexico, and southeast Utah that were high enough to allow entrainment of dust from natural sources with subsequent transport of the dust to Colorado in strong winds. These PM_{10} exceedances were due to an exceptional event associated with regional windstorm-caused emissions from erodible soil sources over a large area of northeast Arizona, northwest New Mexico, most of Utah, and parts of western Colorado. These sources are not reasonably controllable during a significant windstorm under abnormally dry or moderate drought conditions.

APCD is requesting concurrence on exclusion of the PM_{10} values from Alamosa-Adams State College (08-003-0001), Alamosa-Municipal Building (08-003-0003), and Pagosa Springs-Middle School (08-007-0001) on May 22, 2010. APCD is also requesting concurrence on exclusion of the PM_{10} values taken in Grand Junction at the Powell Building (08-077-0017) and Clifton Sanitation (08-077-0019) on May 23, 2010.

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Appendix D – Copy of Affidavit of Public Notice

1.0 Exceptional Events Rule Requirements

In addition to the technical requirements that are contained within the EER, procedural requirements must also be met in order for EPA to concur with the flagged air quality monitoring data. This section of the report lays out the requirements of the EER and discusses how the APCD addressed those requirements.

1.1 Procedural Criteria

This section presents a review of the procedural requirements of the EER as required by 40 CFR 50.14 (Treatment of Air Quality Monitoring Data Influenced by Exceptional Events) and explains how APCD fulfills them.

The Federal EER requirements include public notification that an event was occurring, the placement of informational flags on data in EPA's Air Quality System (AQS), submission of initial event description, the documentation that the public comment process was followed, and the submittal of a demonstration supporting the exceptional events flag. ACPD has addressed all of these procedural and documentation requirements.

Public notification that event was occurring (40 CFR 50.14(c)(1)(i))
APCD issued Blowing Dust Advisories for Western and Southwestern Colorado advising citizens of the potential for high wind/dust events on May 22 and 23, 2010. This area includes: Alamosa, Grand Junction, Rifle, Montrose, Pagosa Springs, Delta, Cortez, Durango, Telluride, and nearby towns. The advisories that were issued on May 22 and 23, 2010, can be viewed at: http://www.colorado.gov/airquality/forecast_archive.aspx?seeddate=05%2f22%2f2010 and http://www.colorado.gov/airquality/forecast_archive.aspx?seeddate=05%2f23%2f2010 and are included in Appendix B.

Place informational flag on data in AQS (40 CFR 50.14(c)(2)(ii))
APCD and other applicable agencies in Colorado submit data into EPA's AQS. Data from both filter-based and continuous monitors operated in Colorado are submitted to AQS.

When APCD and/or another agency operating monitors in Colorado suspects that data may be influenced by an exceptional event, APCD and/or the other operating agency expedites analysis of the filters collected from the potentially-affected filter-based air monitoring instruments, quality assures the results and submits the data into AQS. APCD and/or other operating agencies also submit data from continuous monitors into AQS after quality assurance is complete.

If APCD and/or the applicable operating agency have determined a potential exists that the sample value has been influenced by an exceptional event, a preliminary flag is submitted for the measurement when the data is uploaded to AQS. The data are not official until they are certified by May 1st of the year following the calendar year in which the data were collected (40 CFR 58.15(a)(2)). The presence of the flag can be confirmed in AQS.

Notify EPA of intent to flag through submission of initial event description by July 1 of calendar year following event (40 CFR 50.14(c)(2)(iii))
In early 2011, APCD and EPA Region 8 staff agreed that the notification of the intent to flag data as an exceptional event would be done by submitting data to AQS with the proper flags and the initial event descriptions. This was deemed acceptable, since Region 8 staff routinely pull the data to review for completeness and other analyses.

On May 22 and 23, 2010, five sample values greater than 150 $\mu g/m^3$ were taken at multiple sites across southwestern Colorado during the high wind event that occurred that day. These were the monitors located in Alamosa at Adams State College (SLAMS), Alamosa at the Municipal

Building (SLAMS), Pagosa Springs at the school (SLAMS), Grand Junction at the Powell Building (SLAMS), and Grand Junction at Clifton Sanitation (SLAMS). All of these monitors are operated by APCD in partnership with local operators.

Document that the public comment process was followed for event documentation (40 CFR 50.14(c)(3)(iv))
APCD posted this report on the Air Pollution Control Division's webpage for public review. APCD opened a 30-day public comment period on May 28, 2013. A copy of the public notice certification, along with any comments received, will be submitted to EPA, consistent with the requirements of 40 CFR 50.14(c)(3)(iv). See Appendix D for a copy of the affidavit of public notice.

Submit demonstration supporting exceptional event flag (40 CFR 50.14(a)(1-2))
At the close of the comment period, and after APCD has had the opportunity to consider any comments submitted on this document, APCD will submit this document, along with any comments received (if applicable), and APCD's responses to those comments to EPA Region VIII headquarters in Denver, Colorado. The deadline for the submittal of this demonstration package is June 30, 2013.

1.2 Documentation Requirements

Section 50.14(c)(3)(iv) of the EER states that in order to justify excluding air quality monitoring data, evidence must be provided for the following elements:

a. The event satisfies the criteria set forth in 40 CFR 501(j) that:
   (1) the event affected air quality,
   (2) the event was not reasonably controllable or preventable, and
   (3) the event was caused by human activity unlikely to recur in a particular location or was a natural event;

b. There is a clear causal relationship between the measurement under consideration and the event;

c. The event is associated with a measured concentration in excess of normal historical fluctuations; and

d. There would have been no exceedance or violation but for the event.

2.0 Meteorological analysis of the May 22 and 23, 2010, blowing dust event and PM_{10} exceedance – Conceptual Model and Wind Statistics

On May 22 and 23 of 2010, a powerful spring storm system caused multiple exceedances of the twenty-four hour PM_{10} standard in west-central and southwest Colorado. On May 22, 2010, exceedances were recorded at the Adams State College monitor in Alamosa with a concentration of 260 $\mu g/m^3$, the Alamosa Municipal Building monitor with a concentration of 194 $\mu g/ m^3$ and the Pagosa Springs School monitor with a concentration of 187 $\mu g/ m^3$. The following day, May 23, 2010, exceedances were documented at the Clifton monitor (approximately 6 miles to the east of Grand Junction) with a concentration of 189 $\mu g/m^3$ and the Mesa County Powell Building monitor in Grand Junction with a concentration of 155 $\mu g/m^3$. These high readings and other PM_{10} concentrations across Colorado are plotted on the maps for May 22 and 23, 2010, in Figure 1 and Figure 2 respectively. The exceedances were the consequence of strong south to southwesterly prefrontal surface winds over dry soils which caused significant blowing dust across much of Arizona, northwest New Mexico, southeast Utah and west-central and southwest Colorado. These high winds were the result of an intensifying surface low pressure system and developing cold front that were associated with a strong upper-level trough that was moving across the western United States. This single storm system caused blowing dust during the afternoon and evening hours of May 22, 2010, and again on the afternoon and evening of May 23, 2010.

EPA's June 12, draft Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Affected by High Winds under the Exceptional Events Rule states, "the EPA will accept a threshold of a sustained wind of 25 mph for areas in the west provided the agencies support this as the level at which they expect stable surfaces (i.e., controlled anthropogenic and undisturbed natural surfaces) to be overwhelmed…". In addition, in both eastern and western Colorado it has been shown that wind speeds of 30 mph or greater and gusts of 40 mph or greater can cause blowing dust (see reference for the Technical Support Document for the January 19, 2009 Lamar Exceptional Event and Attachment A – Grand Junction, Colorado, Blowing Dust Climatology at the end of this document). For this blowing dust event, it has been assumed that sustained winds of 25 mph and higher or wind gusts of 40 mph and higher can cause blowing dust in northeast Arizona, northwest New Mexico, southeast Utah and west-central and southwest Colorado.

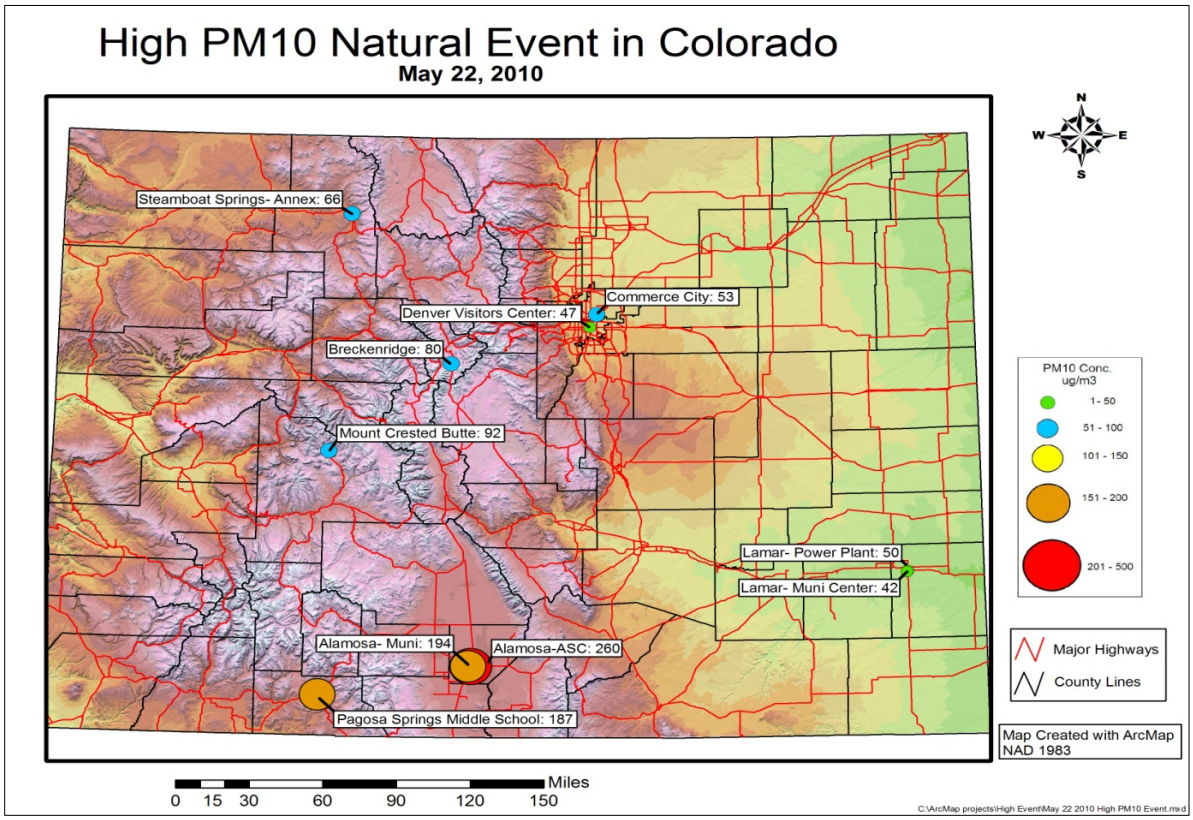

Figure 1: 24-hour PM_{10} concentrations for May 22, 2010.

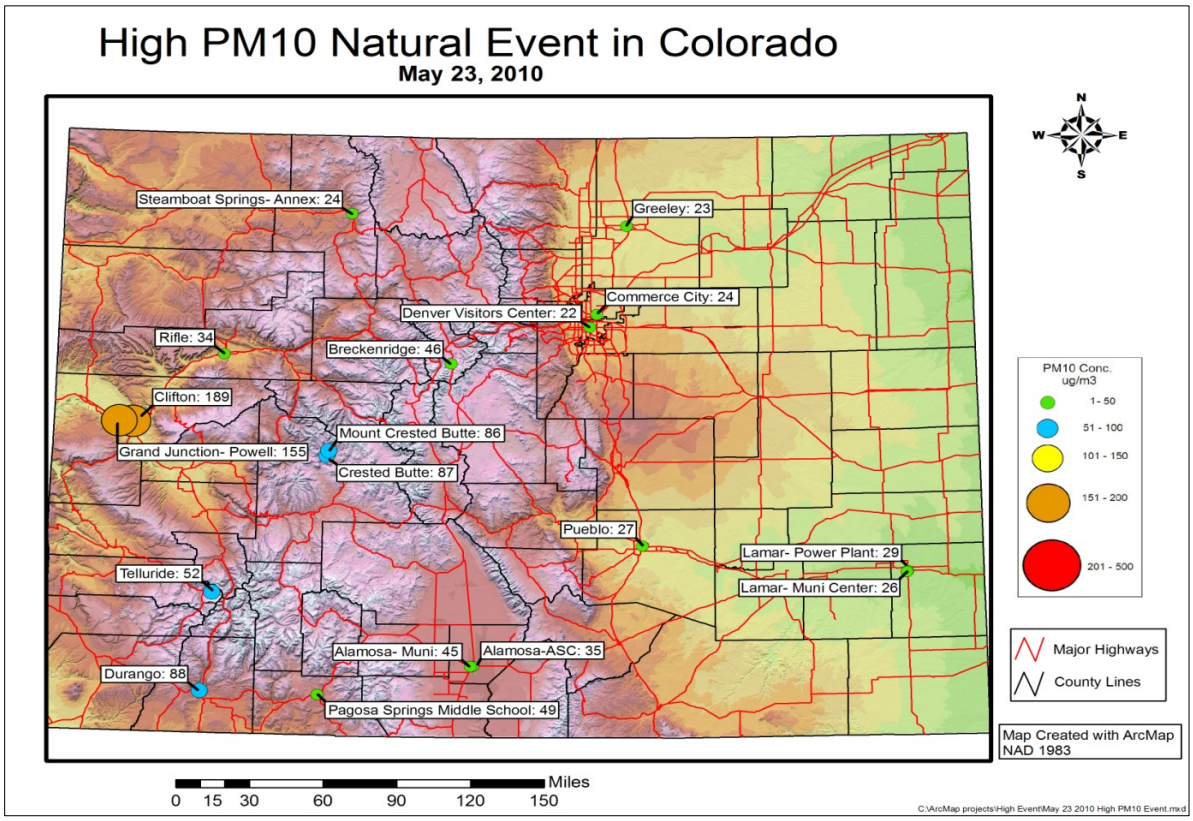

Figure 2: 24-hour PM_{10} concentrations for May 23, 2010.

The surface weather associated with this storm on May 22, 2010 is presented in Figure 3 and Figure 4; the surface analyses for 5 AM MST and 5 PM MST May 22, 2010, respectively. Surface weather for May 23, 2010, is displayed in Figure 5 and Figure 6; the surface analyses for 5 AM MST and 5 PM MST May 23, 2010, respectively. Significant surface features included a stationary front stretching from Colorado into southern California. This front gradually developed an area of surface low pressure over the southern Great Basin by May 23, 2010, that moved northeastward into western Colorado. A cold front also formed on May 23, 2010, and swept across the Desert Southwest and southern Rockies.

The upper-level trough associated with this storm is shown in Figure 7, Figure 8 and Figure 9. Figure 7 and Figure 8 show the 500-mb height analysis maps for 5 AM and 11 AM MST respectively on May 22, 2010. The 500 mb level is roughly 6 kilometers above mean sea level (MSL). These two maps show that a deep trough was located in the western United States. Figure 8 shows the jet stream maximum winds around the base of the trough from California through Wyoming. Figure 9 shows the trough at the 700 mb level which is approximately 3 kilometers above MSL. Upper-level winds at the base of the trough ranged from 40 to 90 knots at 500 mb (Figure 8). Concurrently at the 700 mb level, peak winds of 30-50 knots could be found over the Painted Desert of east-central Arizona (Figure 9).

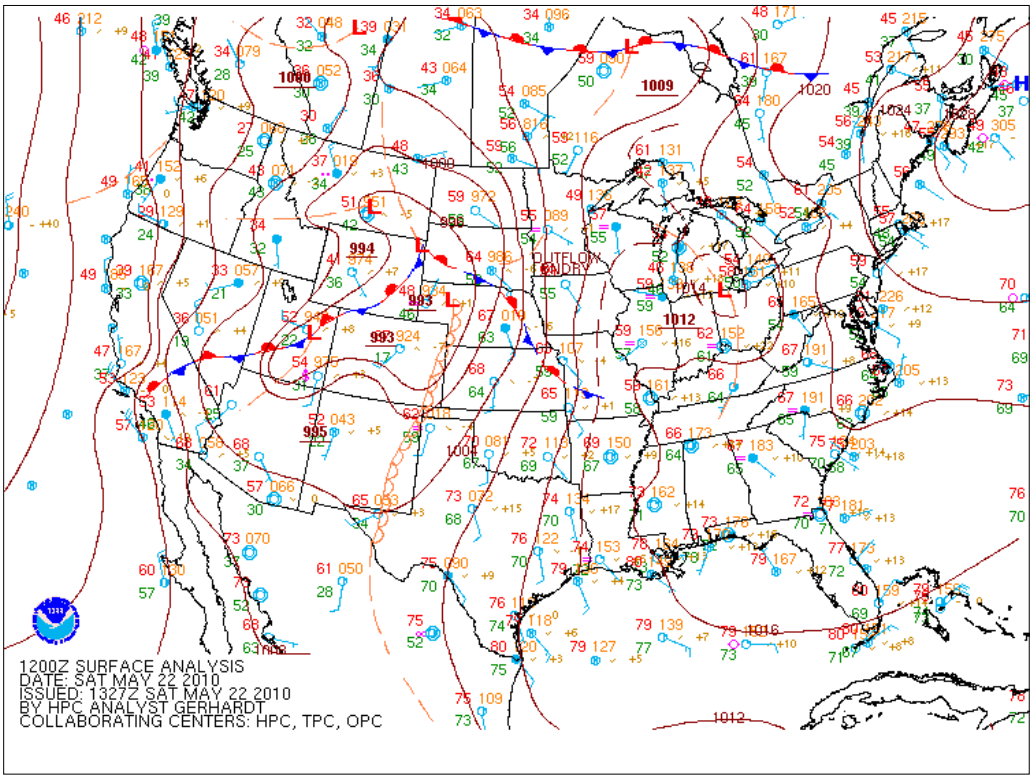

Figure 3: Surface analysis for 12Z May 22, 2010, or 5 AM MST May 22, 2010 (source: http://nomads.ncdc.noaa.gov/ncep/NCEP).

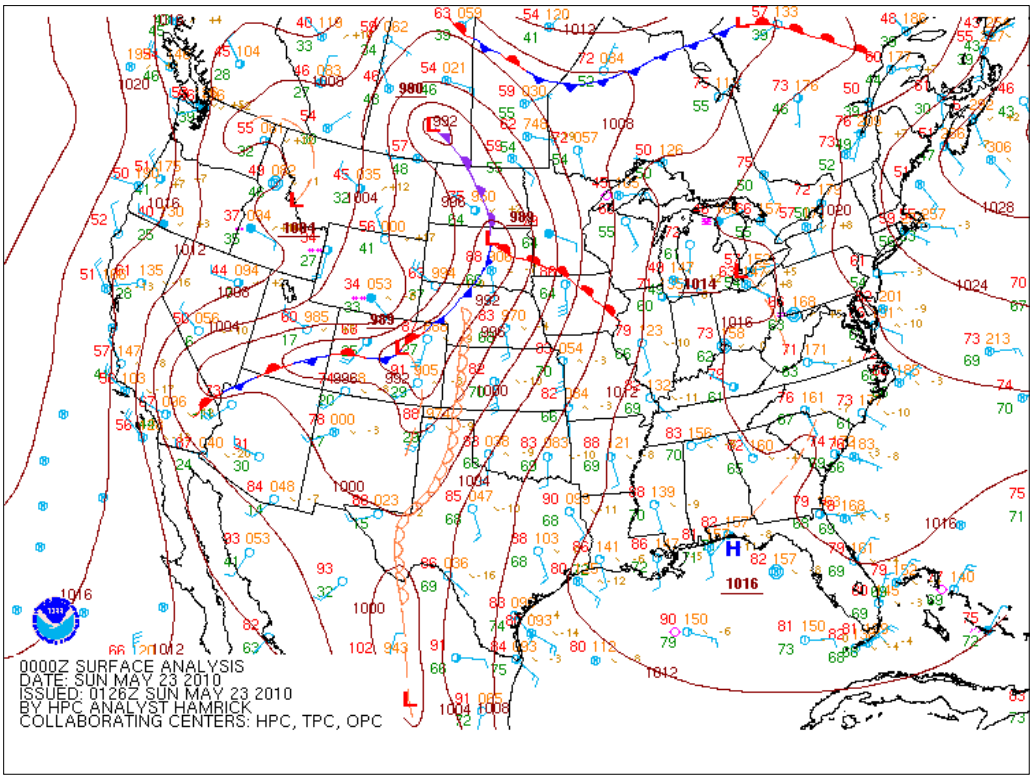

Figure 4: Surface analysis for 00Z May 23, 2010, or 5 PM MST May 22, 2010 (source: http://nomads.ncdc.noaa.gov/ncep/NCEP).

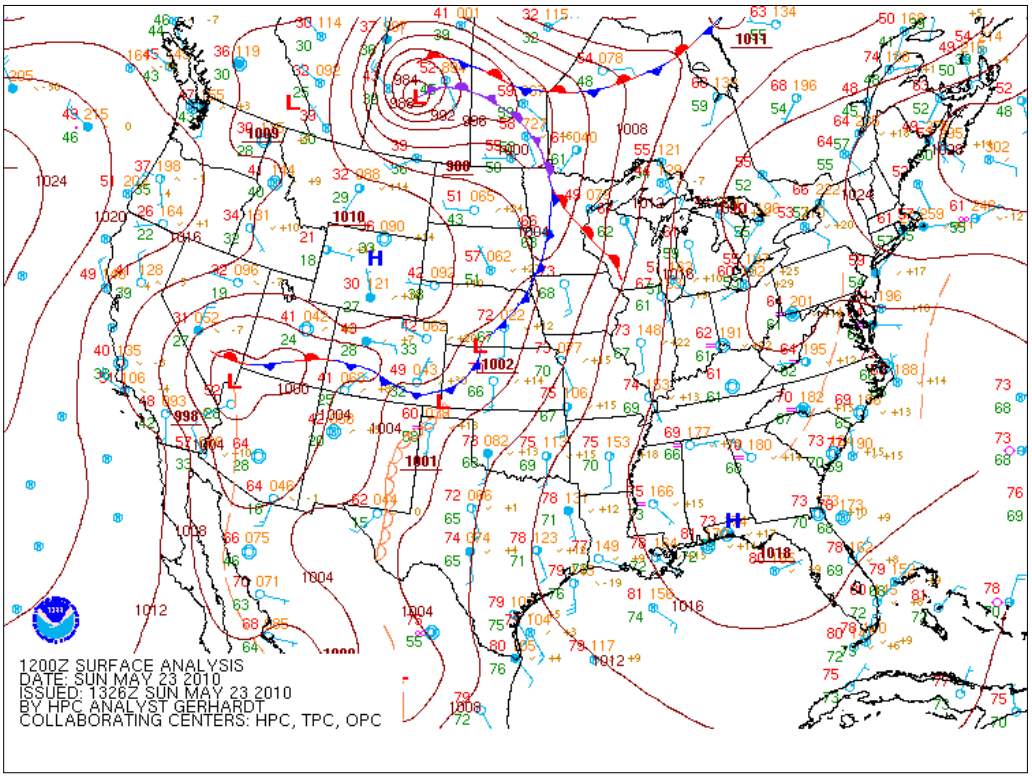

Figure 5: Surface analysis for 12Z May 23, 2010, or 5 AM MST May 23, 2010 (source: http://nomads.ncdc.noaa.gov/ncep/NCEP).

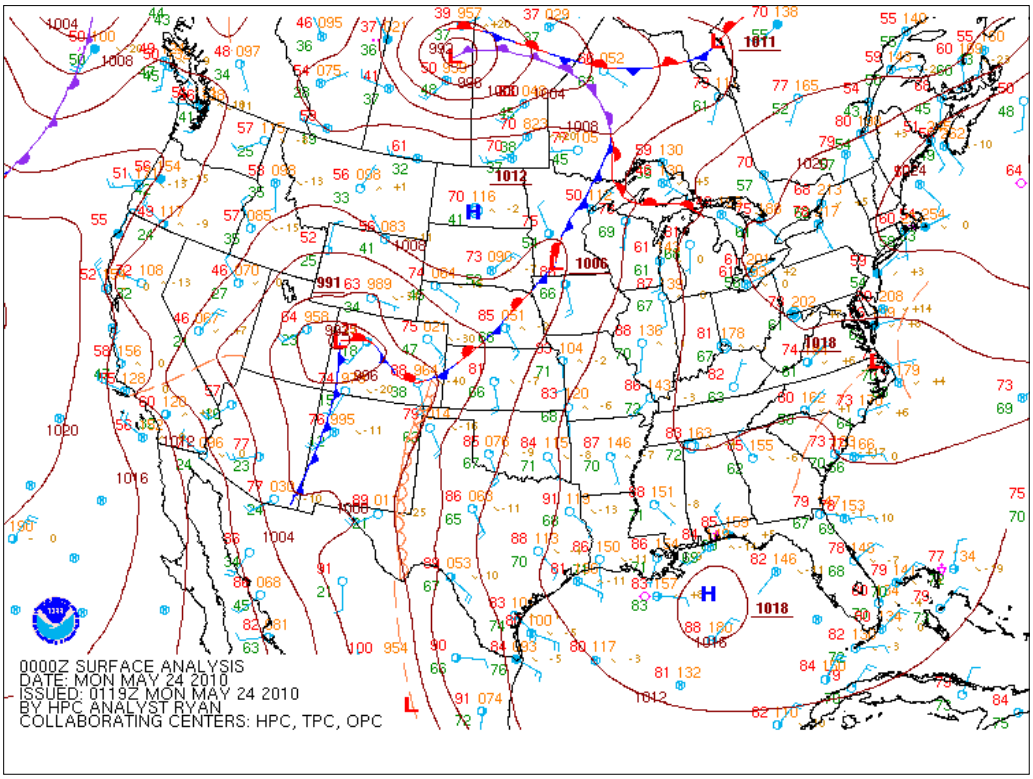

Figure 6: Surface analysis for 00Z May 24, 2010, or 5 PM MST May 23, 2010 (source: http://nomads.ncdc.noaa.gov/ncep/NCEP).

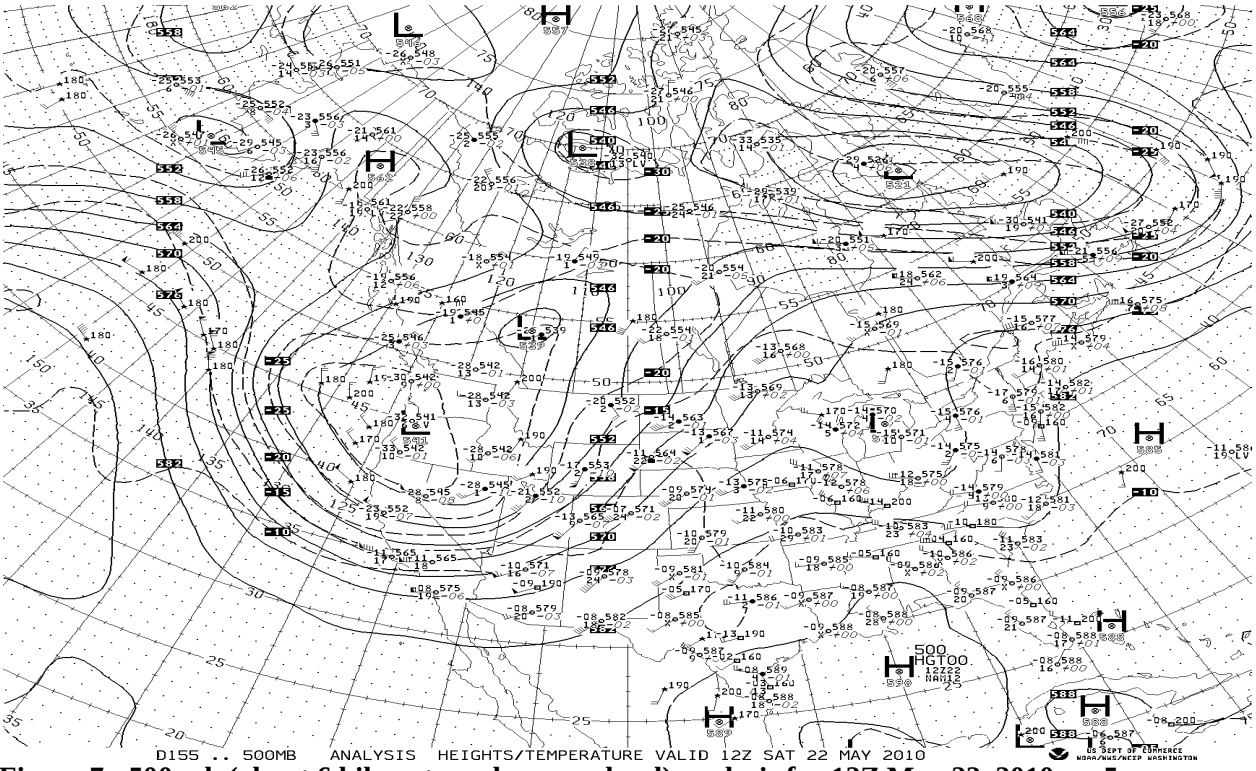

Figure 7: 500 mb (about 6 kilometers above sea level) analysis for 12Z May 22, 2010, or 5 AM MST May 22, 2010 (source: http://nomads.ncdc.noaa.gov/ncep/NCEP).

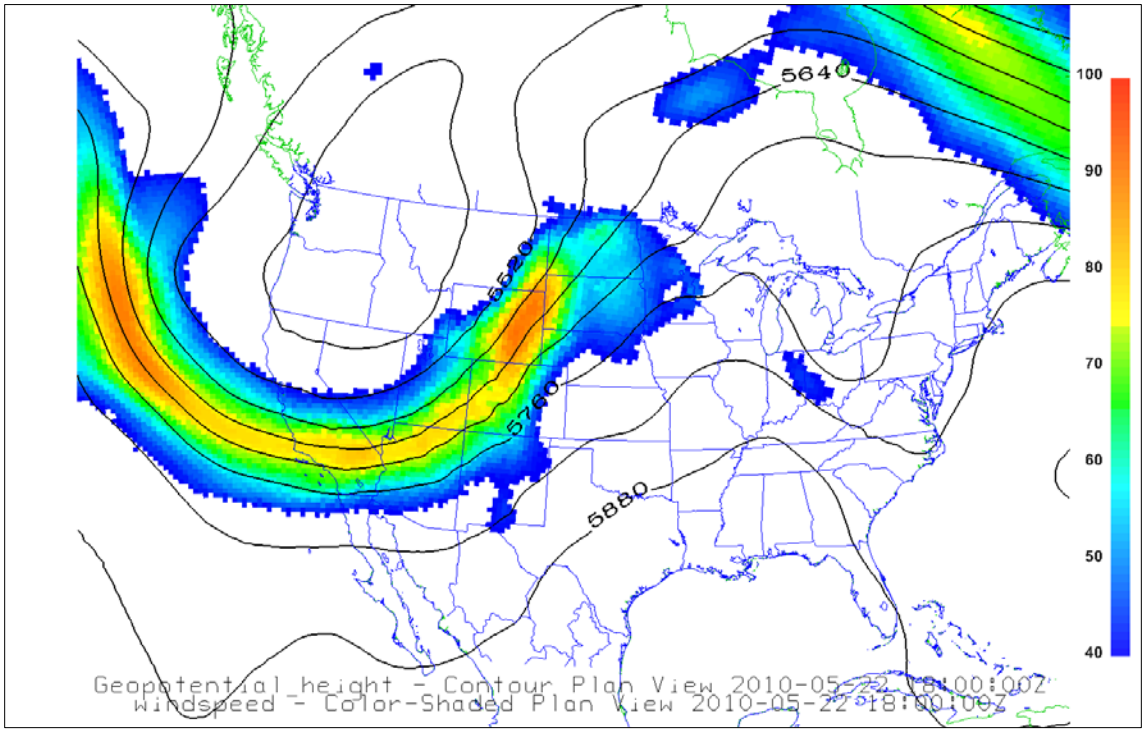

Figure 8: NARR (North American Regional Reanalysis) 500 mb (about 6 kilometers above sea level) analysis for 18Z May 22, 2010, or 11 AM MST May 22, 2010, showing wind speeds in knots. Only speeds greater than 40 knots are plotted.

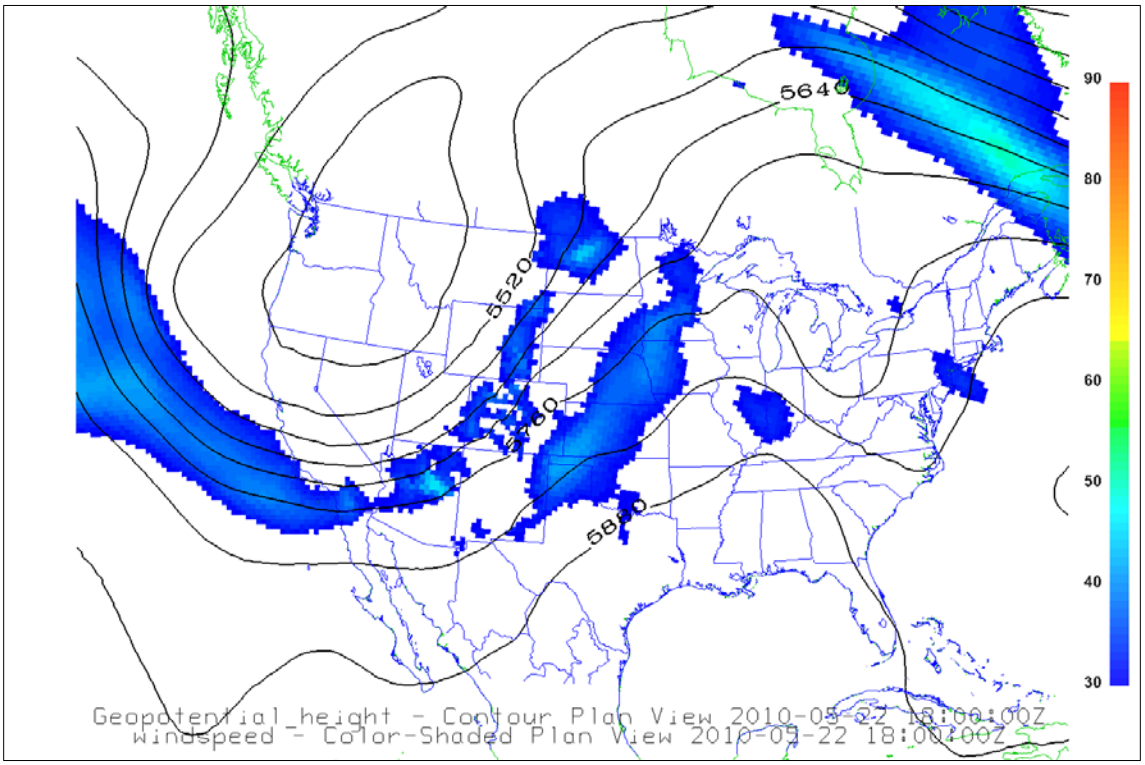

Figure 9: NARR 700 mb (about 3 kilometers above sea level) analysis for 18Z May 22, 2010, or 11 AM MST May 22, 2010, showing wind speeds in knots. Only speeds greater than 30 knots are plotted.

The upper level trough affected winds near the surface in two ways. First of all, the trough generated a surface low-pressure system with tight pressure gradients that created strong winds at the surface. Secondly, momentum associated with the strong winds aloft at the base of the trough was transferred to the surface because of deep vertical mixing in the area of the strong winds aloft. Figure 10 shows the height of the top of the mixed layer in kilometers above MSL at 11 AM MST on May 22, 2010. Mixing as deep as 3 to 6 kilometers above MSL would have been sufficient to transfer momentum to the surface from the zone of strong winds evident at 700 and 500 mb over the Four Corners area and southern Colorado. When blowing dust occurs with strong winds at the surface and aloft along with deep mixing, dust can be suspended for many hours and transported long distances. These conditions are the hallmarks of a regional dust transport event.

Figure 11 and Figure 12 show the winds at 700 mb and the height of the mixed layer respectively at 5 PM MST on May 22, 2010. The wind speed maximum at 700 mb remained in the 30-50 knot range while the depth of the mixing had increased considerably since 11 AM MST. Figure 12 reveals that the mixing was as deep as 5 to 9 kilometers above MSL in the Four Corners region.

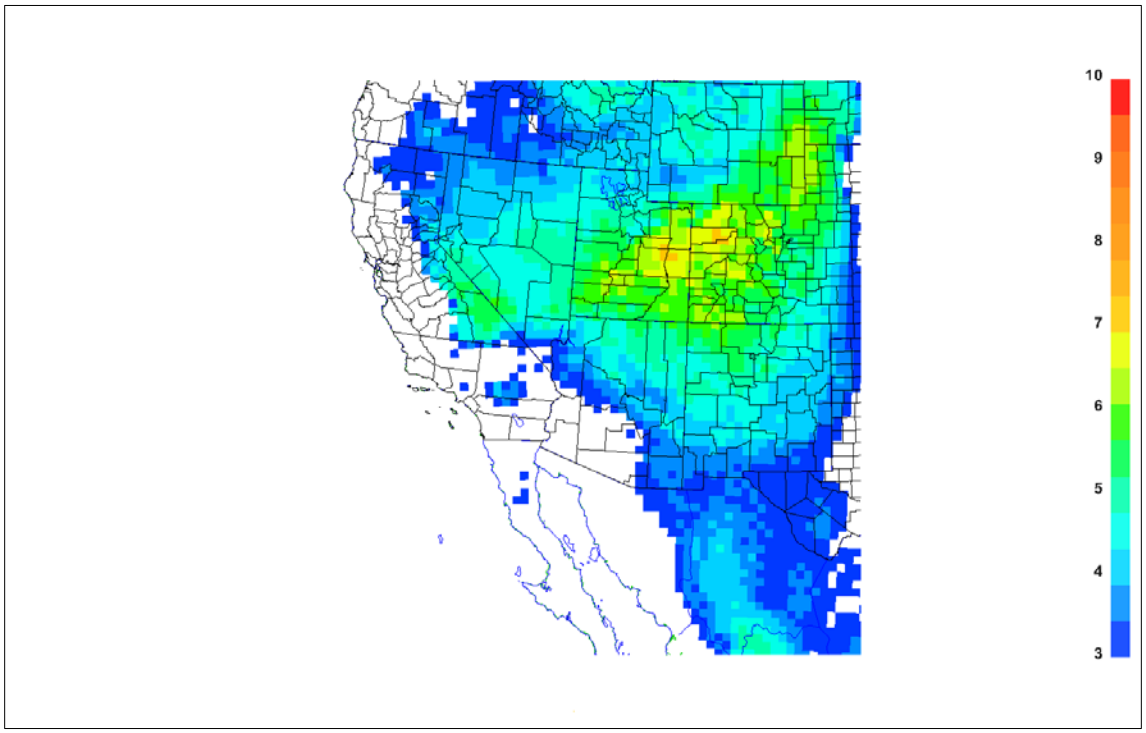

Figure 10: Height of the mixed layer in kilometers above sea level from the NARR at 18Z May 22, 2010, or 11 AM MST May 22, 2010, showing mixing as deep as 3 to 6 kilometers above MSL in the Four Corners area.

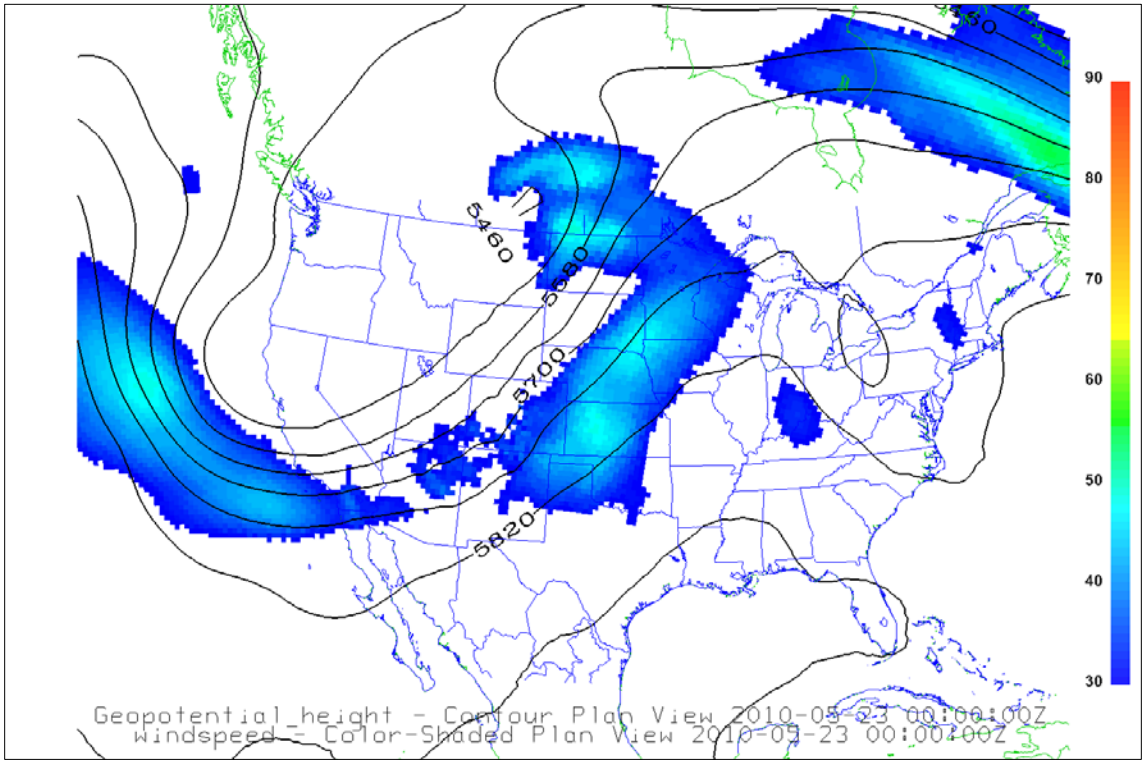

Figure 11: NARR 700 mb (about 3 kilometers above sea level) analysis for 00Z May 23, 2010, or 5 PM MST May 22, 2010, showing wind speeds in knots. Only speeds greater than 30 knots are plotted.

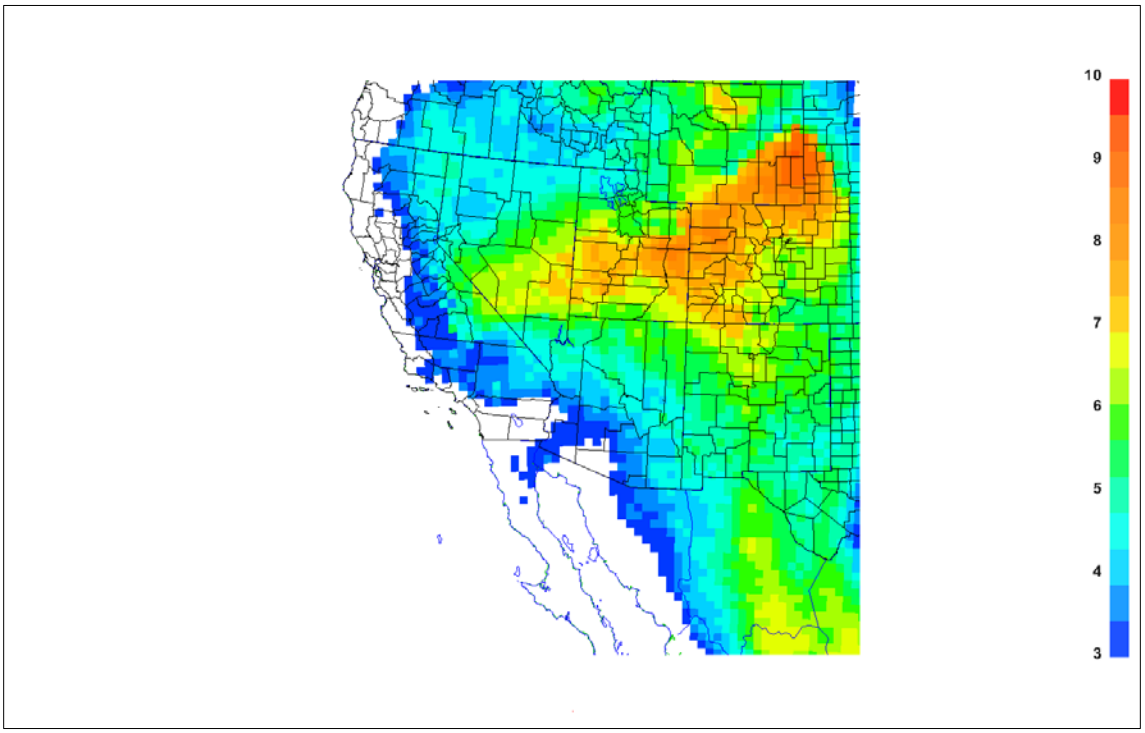

Figure 12: Height of the mixed layer in kilometers above sea level from the NARR at 00Z May 23, 2010, or 5 PM MST May 22, 2010, showing mixing as deep as 5 to 9 kilometers above MSL in the Four Corners area.

By the following day (May 23, 2010), the center of the upper-level trough had deepened and drifted further to the south over central and southern California. Figure 13 and Figure 14 show the 500-mb height analysis map and winds for 5 AM MST and 11 AM MST respectively on May 23, 2010. The jet stream maximum winds extended from southern California through Arizona and into Utah, western Colorado and southern Wyoming. Figure 15 shows the 700 mb analysis and winds at 11 AM MST on May 23, 2010. An area of strong winds (30-50 knots) was located over Arizona and stretched northeastward into Utah along with west-central and southwest Colorado. The mixing height analysis for 11 AM MST May 23, 2010, is presented in Figure 16. Mixing was as deep as 4 to 7 kilometers above MSL in eastern Utah and western Colorado. The coincidence of deep mixing and strong winds aloft would have enabled the transfer of momentum from the upper level winds to the surface in these areas.

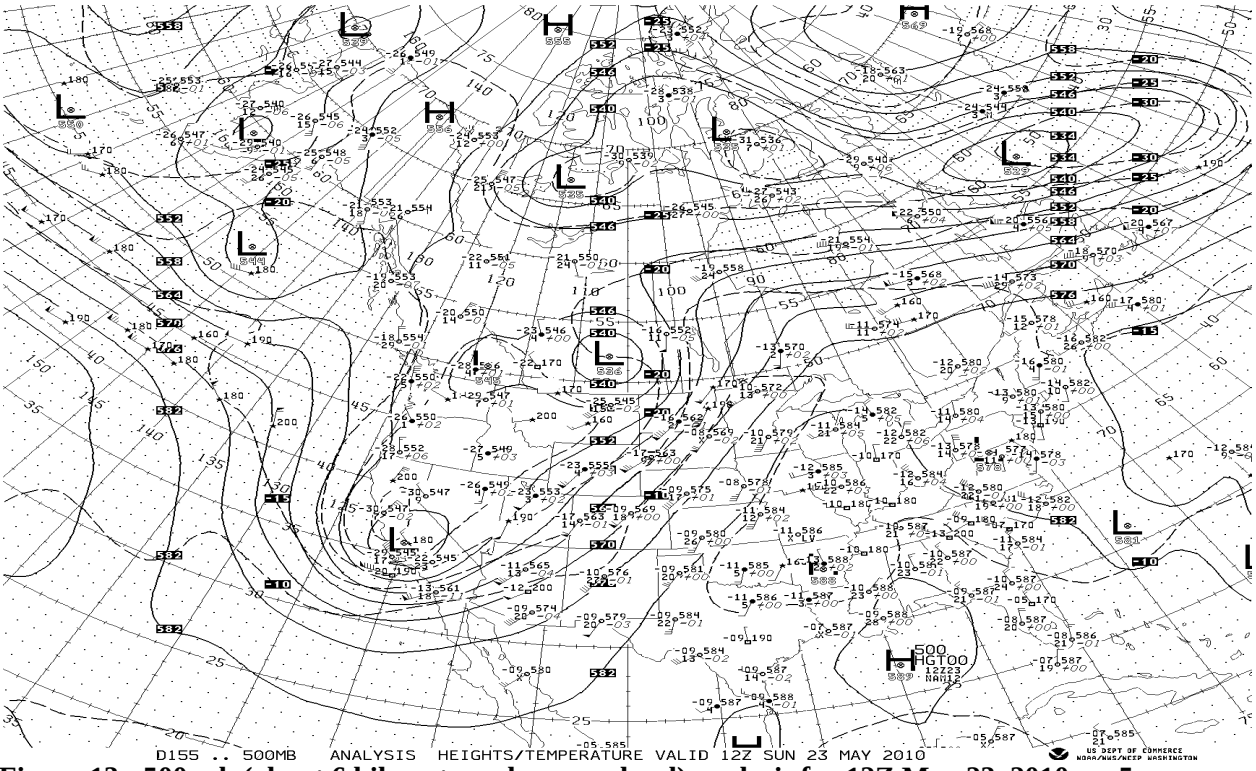

Figure 13: 500 mb (about 6 kilometers above sea level) analysis for 12Z May 23, 2010, or 5 AM MST May 23, 2010 (source: National Weather Service fax maps http://nomads.ncdc.noaa.gov/ncep/NCEP).

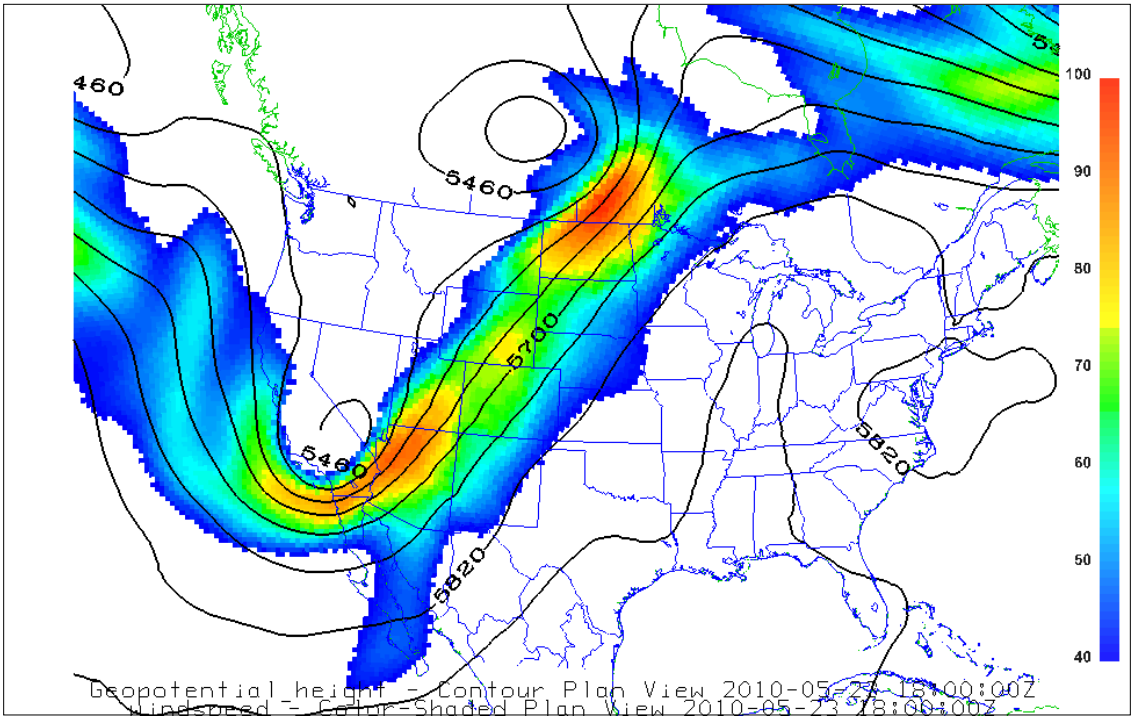

Figure 14: NARR 500 mb (about 6 kilometers above sea level) analysis for 18Z May 23, 2010, or 11 AM MST May 23, 2010, showing wind speeds in knots. Only speeds greater than 40 knots are plotted.

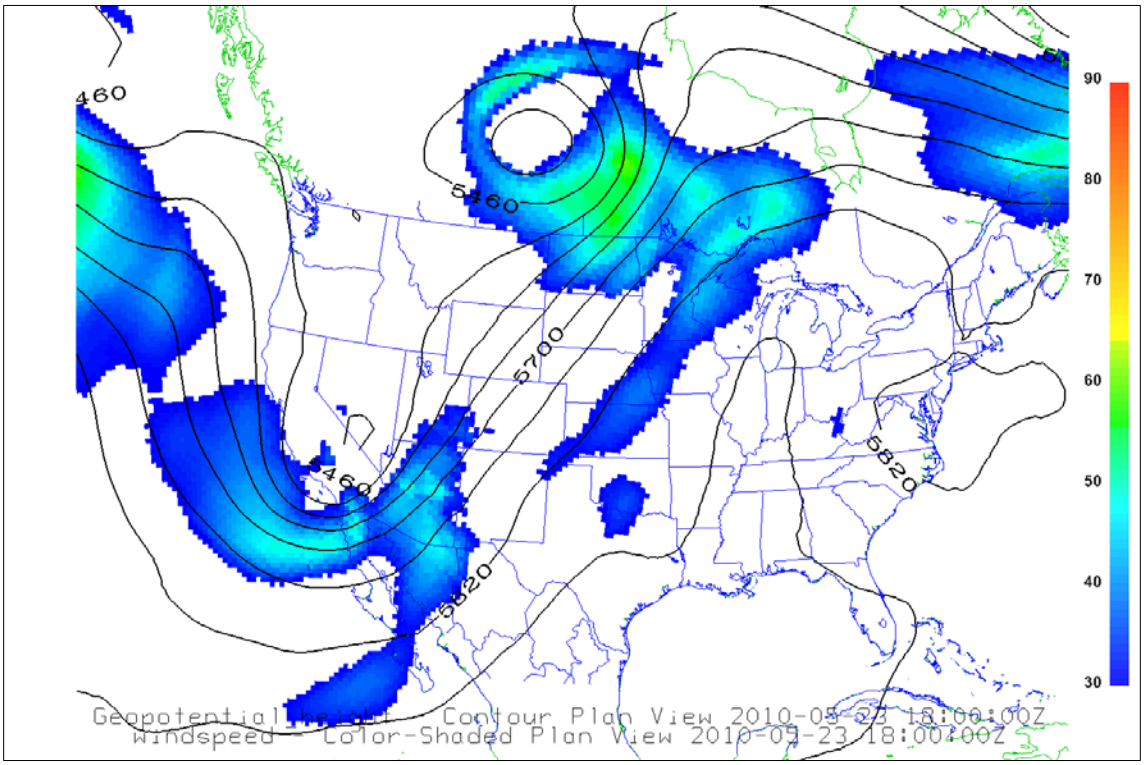

Figure 15: NARR (North American Regional Reanalysis) 700 mb (about 3 kilometers above sea level) analysis for 18Z May 23, 2010, or 11 AM MST May 23, 2010, showing wind speeds in knots. Only speeds greater than 30 knots are plotted.

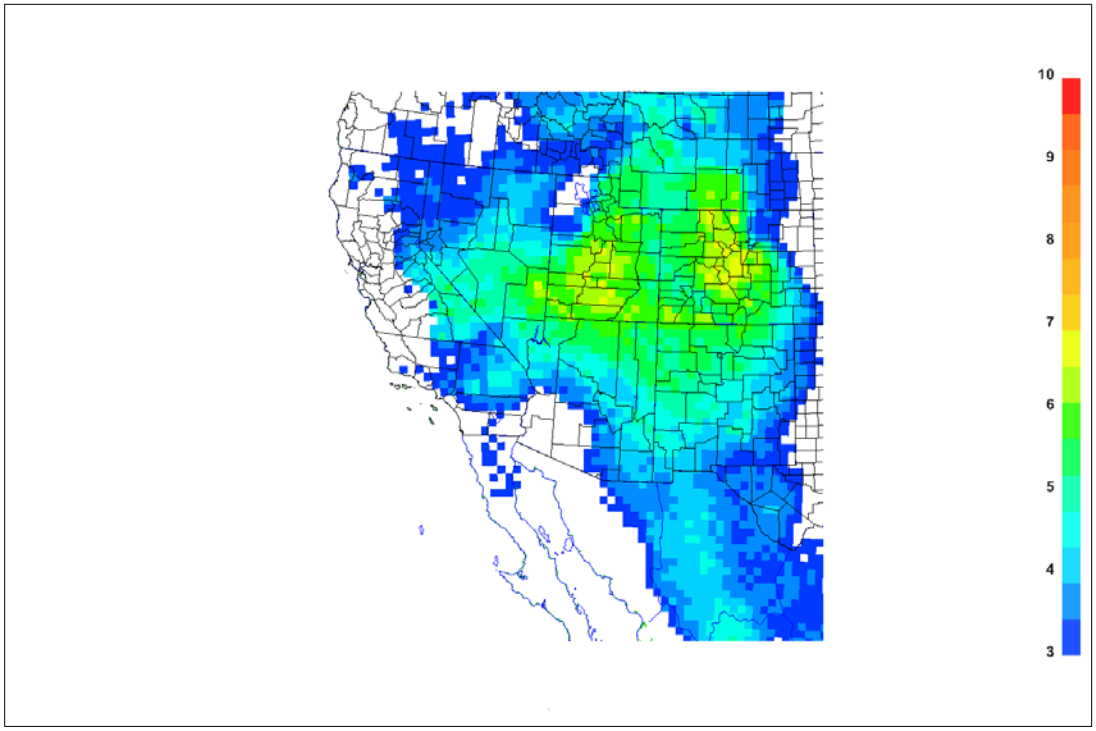

Figure 16: Height of the mixed layer in kilometers above sea level from the NARR analysis at 18Z May 23, 2010, or 11 AM MST May 23, 2010, showing mixing as deep as 4 to 7 kilometers above MSL in eastern Utah and western Colorado.

The combination of strong winds aloft, deep mixing, and the tight pressure gradients associated with the surface low pressure system caused surface winds of up to 41 mph with gusts to 56 mph. Winds of this strength will cause blowing dust if soils are dry. Recall that wind speeds of 30 mph or greater and/or gusts of 40 mph or higher have been shown to cause blowing dust in Colorado (see reference for the *Technical Support Document for the January 19, 2009, Lamar Exceptional Event* and Appendix A - Grand Junction, Colorado, Blowing Dust Climatology at the end of this document). ***The synoptic weather conditions on May 22 and 23, 2010, (illustrated in Figures 3 through 16) show that the conditions necessary for widespread strong gusty winds and transport of blowing dust were in place over the area of concern.***

Figures 17 through 20 show surface weather observations for 2:43 PM and 5:43 PM MST May 22, 2010, and 11:43 AM and 6:43 PM MST May 23, 2010, respectively. These maps cover Colorado and the areas of Arizona, Utah, and New Mexico that were upwind of the portions of Colorado that experienced exceedances of the PM_{10} standard. These surface analyses shows that winds above 30 mph with gusts above 40 mph occurred in areas south of the stationary front and surface low pressure complex shown in Figures 3-6. On the map in Figure 17, the station plot for Cortez, CO (CEZ) at 2:43 PM MST is accompanied by the infinity sign (∞) which is the weather symbol for haze. Haze is often reported during dust storms, and in dry and windy conditions haze typically refers to blowing dust. By 5:43 PM MST (Figure 18), the station observation for Chama, NM (E33) just a few miles south of the Colorado state line shows a dollar sign ($). The dollar sign is the weather symbol for dust or sand raised by wind at the time of the observation. It should also be noted from Figure 18 that haze had increased across southwest Colorado being reported in Montrose (MTJ) and Telluride (TEX), while continuing in Cortez (CEZ) with visibility reduced to 3 statute miles.

The focus of blowing dust and haze shifted to the west and north on May 23, 2010. On the map in Figure 19, Blanding, UT (4BL) shows an observation at 11:43 AM MST which includes the dollar sign (wind-driven dust or sand). By 6:43 PM MST (Figure 20), dust had spread northward producing observations of haze in Grand Junction, CO (GJT) and Moab, UT (CNY) with visibility reduced to 4 and 5 statute miles respectively. Additional surface weather maps not included here show that haze and blowing dust were reported in other parts of Arizona, New Mexico, Utah and Colorado during the afternoon and evening hours of May 22 and 23, 2010. ***Surface weather maps for the Four Corners states show evidence of widespread blowing dust and winds above the threshold speeds for blowing dust on May 22 and 23, 2010***.

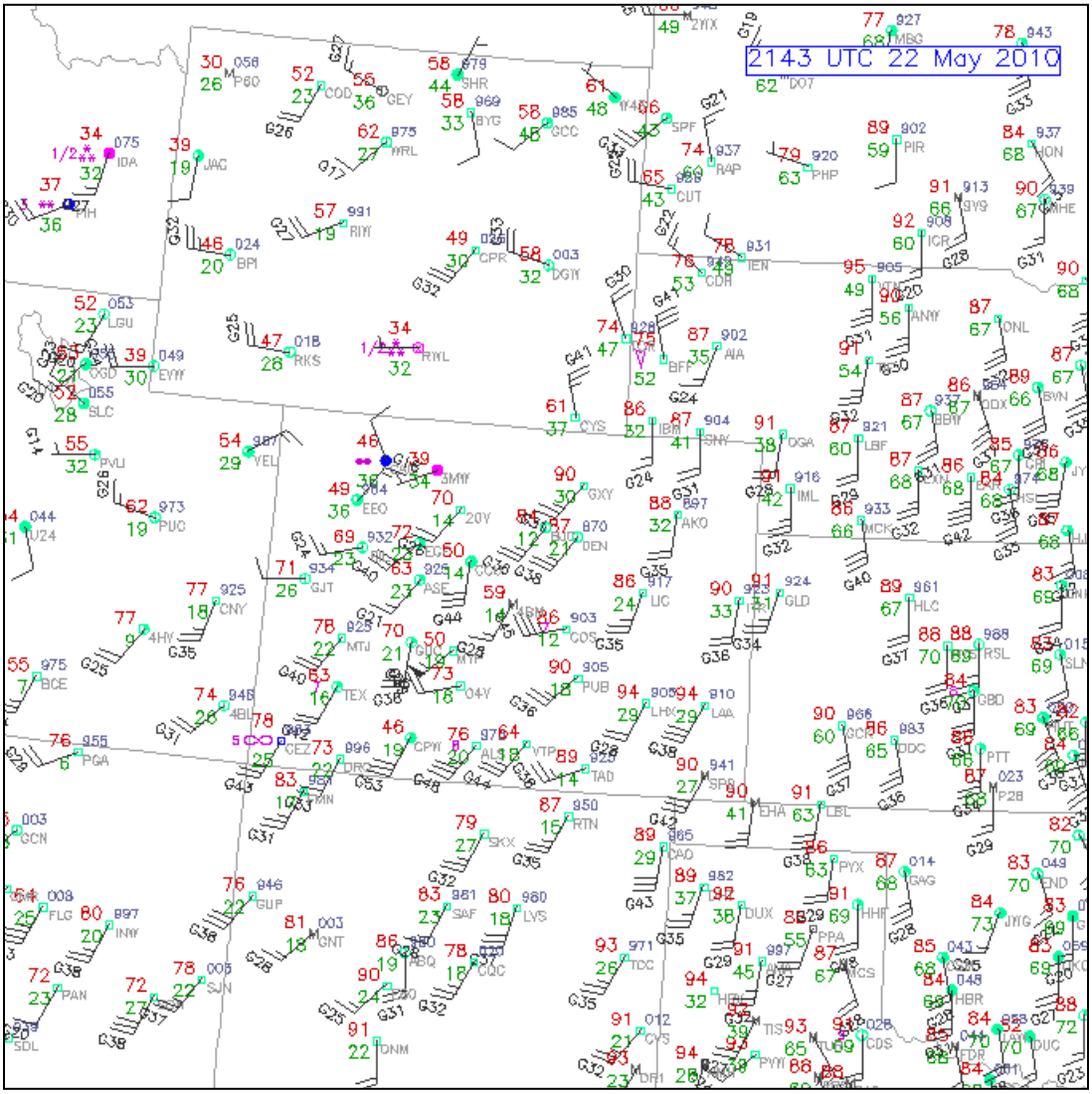

Figure 17: NCAR RAP Real-Time Weather Data website DEN sector surface analysis for 2143Z May 22, 2010, or 2:43 PM MST May 22, 2010 (source: http://www.rap.ucar.edu/weather/).

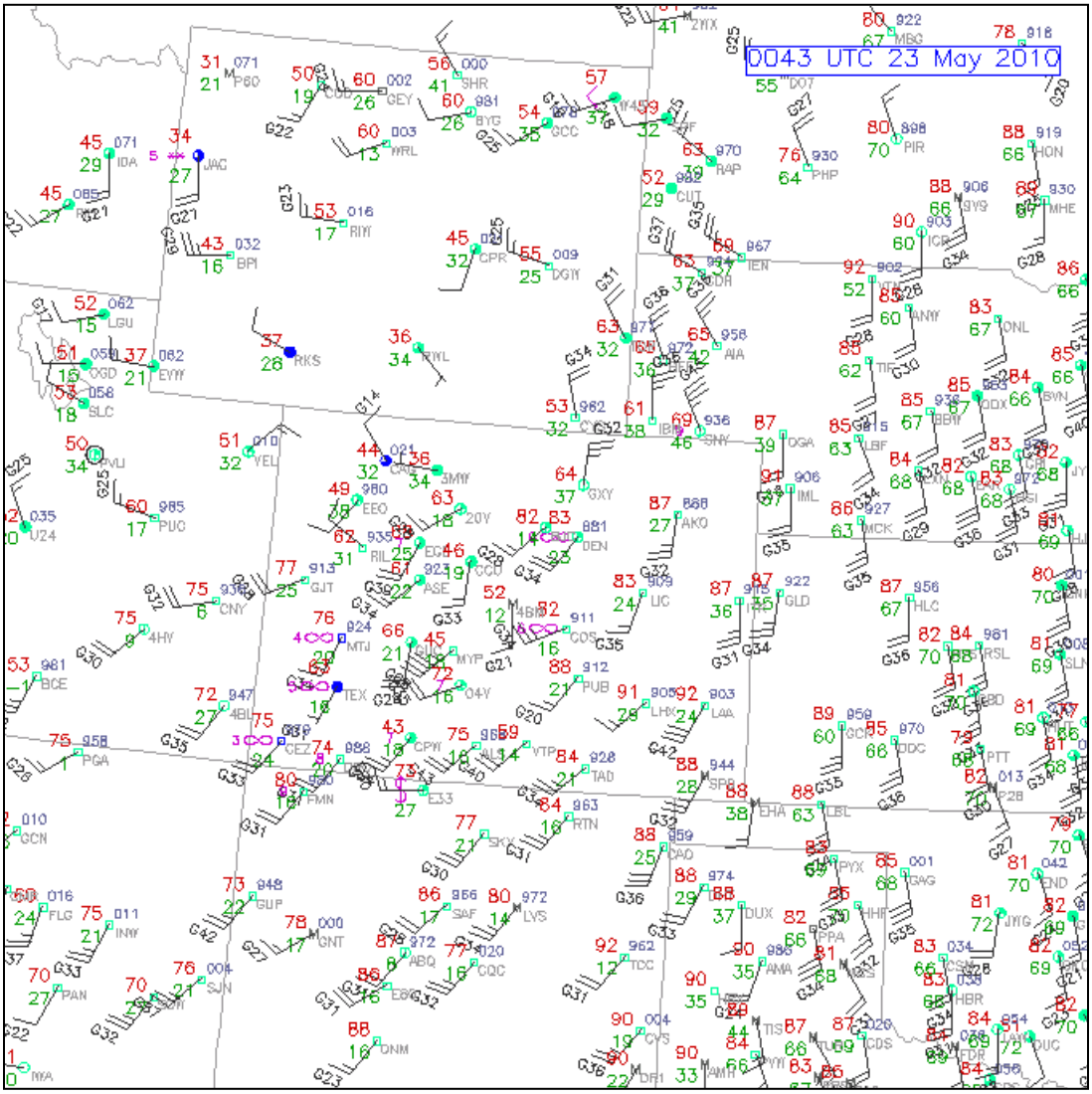

Figure 18: NCAR RAP Real-Time Weather Data website DEN sector surface analysis for 0043Z May 23, 2010, or 5:43 PM MST May 22, 2010 (source: http://www.rap.ucar.edu/weather/).

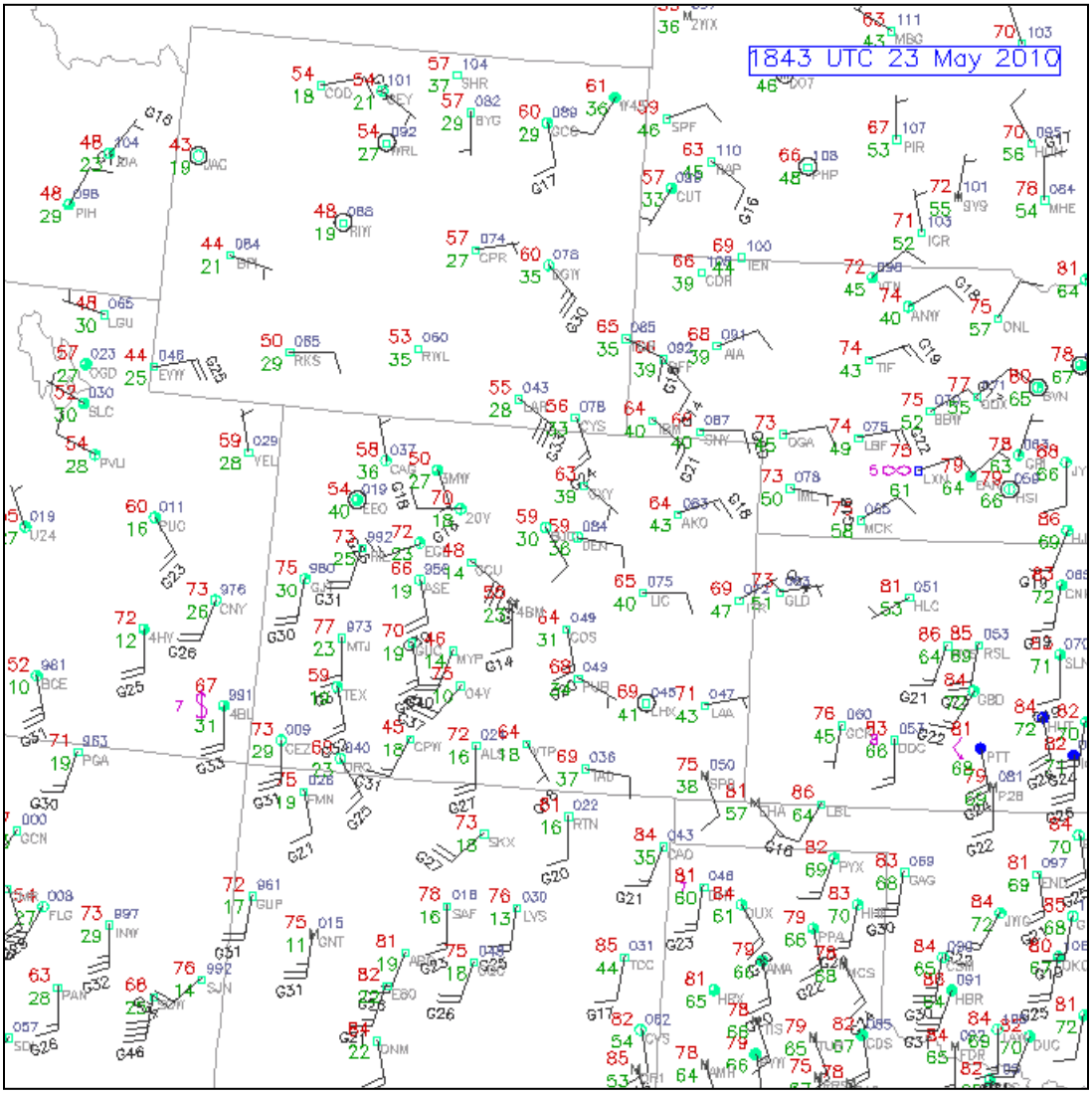

Figure 19: NCAR RAP Real-Time Weather Data website DEN sector surface analysis for 1843Z May 23, 2010, or 11:43 AM MST May 23, 2010 (source: http://www.rap.ucar.edu/weather/).

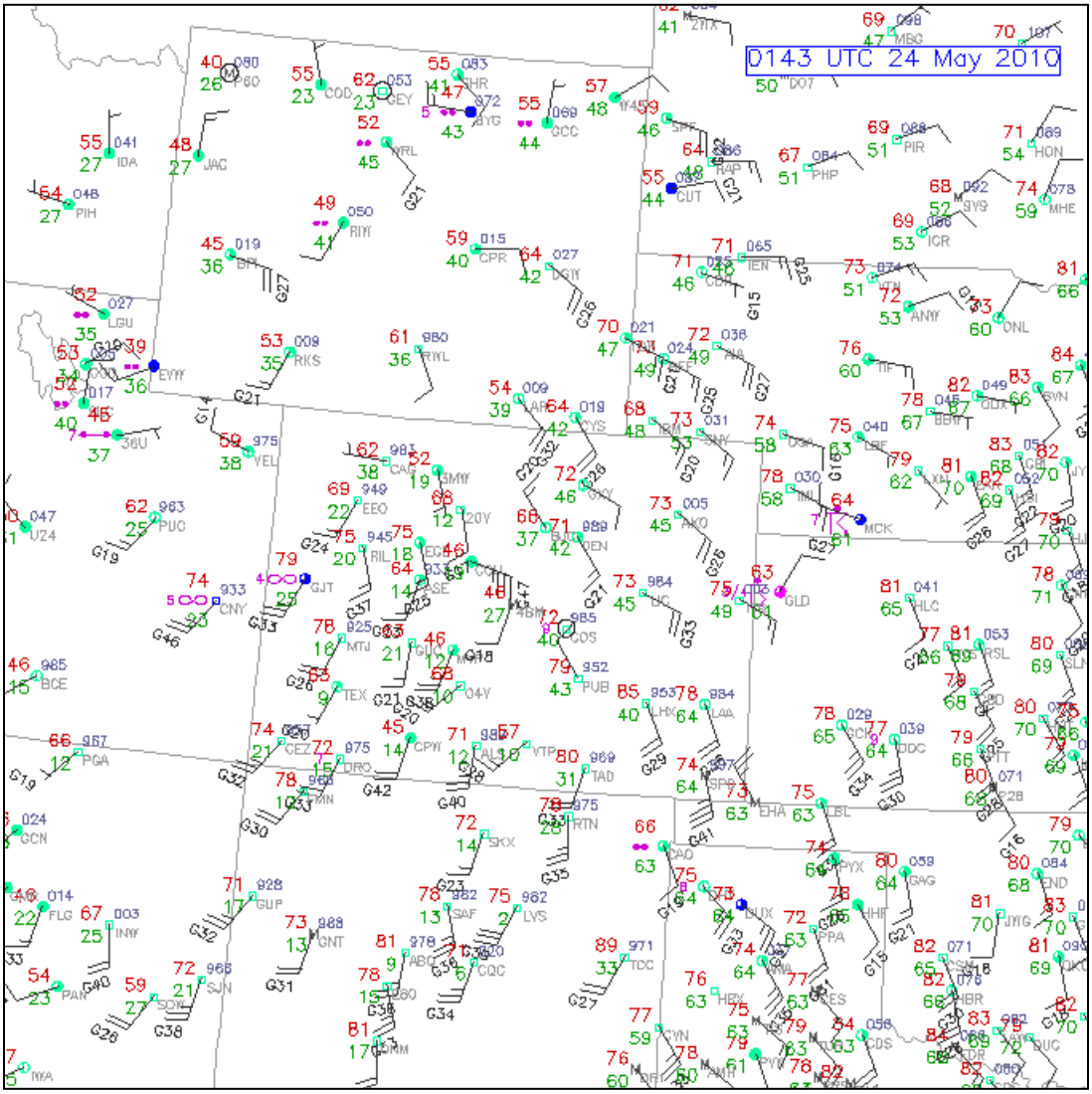

Figure 20: NCAR RAP Real-Time Weather Data website DEN sector surface analysis for 0143Z May 24, 2010, or 6:43 PM MST May 23, 2010 (source: http://www.rap.ucar.edu/weather/).

Tables 1 through 10 contain the surface weather observations for Winslow, Hopi and Window Rock, Arizona, and Gallup and Farmington, New Mexico for May 22 and 23, 2010. These locations are either in or near the areas in northeast Arizona and northwest New Mexico that are known sources for blowing dust as described in Appendix A (Grand Junction, Colorado, Blowing Dust Climatology - at the end of this document). At these locations sustained wind speeds were as high as 41 mph and wind gusts were as high as 56 mph, well above the blowing dust thresholds already identified. Tables 11-13 include weather observations from Blanding, Moab and Monticello, Utah for May 23, 2010. Only data for May 23, 2010, are included as the Utah observation locations were not considered dust source regions for the exceedances of May 22, 2010.

Tables 14 through 21 list observations for Alamosa, Pagosa Springs, Cortez, Montrose, Durango and Grand Junction. These are the National Weather Service sites in Colorado south of the stationary front in Figures 3-6. For space constraints, only data relevant to the PM_{10} exceedances were included in this section of tables. Therefore only May 22, 2010 data for Alamosa and Pagosa Springs were necessary for this study while Durango and Grand Junction required weather observations solely from May 23, 2010.

Collectively these weather observation sites experienced many hours of reduced visibility along with sustained wind speeds and gusts at or above the thresholds for blowing dust. ***Observations of sustained wind speeds and gust speeds above the blowing dust thresholds and reduced visibilities on May 22 and 23, 2010, at weather stations in northeast Arizona, northwest New Mexico, southeast Utah and west-central and southwest Colorado show that a regional dust storm event occurred under south to southwesterly flow. The weather system causing the winds affected southwest Colorado during the afternoon and evening hours on May 22, 2010 and west-central Colorado during the afternoon and evening hours of May 23, 2010 as the impacts of the system shifted north and west. These observations contribute to the body of evidence that shows that a regional dust storm caused the PM_{10} exceedances at the monitoring sites in question.***

Table 1: Wind and weather observations for Winslow, Arizona, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:56	61	25	4				10
1:56	64	23	13		200		10
2:56	63	23	19	23	180		10
3:56	63	23	15	24	170		10
4:56	59	27	10		160		10
5:56	61	24	12	17	150		10
6:56	66	20	8	17	160		10
7:56	71	14	22	27	210		10
8:56	74	12	28	35	200		10
9:56	77	11	24	37	220		10
10:56	78	11	27	39	200		10
11:56	80	10	33	39	200		10
12:56	81	10	28	44	200		10
13:56	80	11	31	44	210		10
14:56	79	10	31	46	220		10
15:56	77	11	31	44	220		10
16:56	75	13	30	38	210		10
17:56	73	15	25	36	220		10
18:56	69	17	27	32	210		10
19:56	65	22	12		220		10
20:56	63	24	13		220		10
21:56	62	22	13		210		10
22:56	60	20	17		210		10
23:56	59	21	12		190		10

Table 2: Wind and weather observations for Winslow, Arizona, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:56	51	30	4		130		10
1:56	53	32	7		130		10
2:56	48	39	7		130		10
3:56	47	40	0				10
4:56	46	40	4		140		10
5:56	47	42	6		110		10
6:56	55	32	0				10
7:56	64	24	18	25	200		10
8:56	68	24	24	33	190		10
9:56	71	21	29	39	180		10
10:56	73	19	27	37	180		10
11:56	74	17	38	52	190		10
12:56	74	16	41	56	180		8
13:56	74	17	33	48	200		10
14:56	73	19	38	52	200		10
15:56	72	18	36	51	190		10
16:56	70	18	39	48	180		10
17:56	67	20	25	46	180		10
18:56	61	24	28	35	200		10
19:56	55	29	16		210		10
20:56	52	31	17	27	220		10
21:56	50	27	18		230		10
22:56	48	27	14		210		10
23:56	46	32	8		230		10

Table 3: Wind and weather observations for Hopi, Arizona, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:13	59	26	15	19	188		
1:13	61	26	16	26	199		
2:13	62	25	27	36	204		
3:13	61	23	28	39	204		
4:13	59	25	23	33	202		
5:13	58	27	21	30	189		
6:13	61	25	27	36	196		
7:13	64	23	29	38	195		
8:13	68	16	23	37	197		
9:13	71	15	28	38	209		
10:13	73	13	29	42	217		
11:13	74	13	34	46	234		
12:13	75	13	34	46	229		
13:13	76	13	31	51	224		
14:13	76	14	29	44	224		
15:13	75	13	32	46	221		
16:13	73	14	31	43	226		
17:13	71	16	28	39	214		
18:13	68	17	26	38	210		
19:13	64	19	22	36	218		
20:13	61	21	17	31	215		
21:13	57	24	13	29	197		
22:13	54	29	13	18	206		
23:13	52	28	9	14	186		

Table 4: Wind and weather observations for Hopi, Arizona, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:13	54	28	14	18	190		
1:13	52	28	11	19	196		
2:13	51	29	11	15	185		
3:13	52	30	15	19	181		
4:13	52	31	17	24	183		
5:13	51	32	14	22	183		
6:13	54	31	14	21	184		
7:13	58	29	15	20	167		
8:13	61	25	23	33	200		
9:13	63	24	27	35	201		
10:13	67	25	31	44	203		
11:13	68	23	35	47	206		
12:13	69	21	33	47	207		
13:13	70	20	37	51	217		
14:13	68	20	37	51	211		
15:13	66	21	34	52	212		
16:13	65	23	35	54	211		
17:13	63	24	30	52	212		
18:13	62	24	30	45	218		
19:13	56	28	23	41	237		
20:13	52	30	22	34	253		
21:13	49	36	18	28	241		
22:13	45	38	19	28	272		
23:13	45	33	19	26	263		

Table 5: Wind and weather observations for Window Rock, Arizona, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	57	28	12		180		10
1:53	55	31	6		180		10
2:53	51	36	6		140		10
3:53	51	35	6		120		10
4:53	54	30	7		160		10
5:53	50	34	6				10
6:53	53	32	8		150		10
8:53	61	27	22	31	210		10
9:53	64	21	29	40	220		10
10:53	67	20	29	52	210		9
11:53	69	17	25	41	230		10
12:53	71	16	33	47	210		10
13:53	73	13	29	44	220		10
14:53	73	14	30	41	230		10
15:53	73	14	21	45	210		10
16:53	72	15	28	47	230		10
17:53	71	16	24	36	210		10
18:53	68	17	23	40	210		10
19:53	64	19	27	37	210		10
20:53	61	21	20	28	210		10
21:53	59	24	16	22	230		10
22:53	58	26	13	20	220		10
23:53	53	33	4		200		10

Table 6: Wind and weather observations for Window Rock, Arizona, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	51	36	5		180		10
1:53	49	39	4		170		10
2:53	47	42	0				10
3:53	46	47	4		130		10
4:53	47	45	5		200		10
5:53	46	49	0				10
6:53	43	57	0				10
7:53	53	43	5		150		10
8:53	58	34	10	20	170		10
9:53	63	25	15	35	200		10
10:53	67	19	27	36	220		10
11:53	69	16	22	37	200		10
12:53	71	13	27	40	200		10
13:53	73	12	28	46	200		10
14:53	73	12	30	43	220		10
15:53	73	13	30	40	220		10
16:53	72	13	29	41	200		10
17:53	70	14	23	36	220		10
18:53	68	16	29	44	220		10
19:53	63	19	27	35	220		10
20:53	57	28	16	23	230		10
21:53	53	31	18	28	230		10
22:53	51	36	14	20	210		10
23:53	48	39	16	23	220		10

Table 7: Wind and weather observations for Gallup, New Mexico, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	60	24	13		200		10
1:53	58	26	15		200		10
2:53	56	28	10		190		10
3:53	50	36	6		220		10
4:53	56	28	17	23	210		10
5:53	56	28	17		200		10
6:53	56	28	20	31	200		10
7:53	60	25	23	39	200		10
8:53	63	25	33	50	210		10
9:53	66	23	30	40	220		10
10:53	69	20	24	38	200		10
11:53	72	15	30	41	230		10
12:53	73	13	31	43	240		10
13:53	76	13	28	44	220		10
14:53	76	13	32	44	220		10
15:53	76	14	29	44	220		10
16:53	75	14	32	51	240		10
17:53	73	15	28	48	220		10
18:53	70	16	30	48	230		10
19:53	66	18	28	40	230		10
20:53	63	21	21	33	220		10
21:53	60	23	13		210		10
22:53	56	29	8		210		10
23:53	54	31	8		200		10

Table 8: Wind and weather observations for Gallup, New Mexico, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	53	33	9		200		10
1:53	54	32	13		200		10
2:53	55	34	15		230		10
3:53	50	41	6		170		10
4:53	49	42	9		170		10
5:53	48	46	7		170		10
6:53	50	39	8		150		10
7:53	57	33	9	18	160		10
8:53	62	27	14	20	190		10
9:53	65	21	24	31	200		10
10:53	70	18	17	35	190		10
11:53	72	12	23	36	190		10
12:53	75	11	23	39	200		10
13:53	77	10	23	35	210		10
14:53	77	10	25	39	210		10
15:53	77	8	29	47	200		10
16:53	75	9	30	40	190		10
17:53	73	11	27	48	220		10
18:53	71	13	28	37	220		10
19:53	67	19	16	27	240		10
20:53	61	23	20	30	230		10
21:53	56	29	23	31	240		10
22:53	54	32	15	23	210		10
23:53	52	36	20	27	240		10

Table 9: Wind and weather observations for Farmington, New Mexico, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	64	18	10		60		10
1:53	64	19	5		150		10
2:53	65	19	0				10
3:53	61	24	9		100		10
4:53	59	28	9		90		10
5:53	61	23	9		90		10
6:26	63	20	15	25	180		9
6:53	63	20	12		180		10
7:53	65	20	18	28	170		10
8:53	68	17	17	28	170		10
9:53	71	15	21	27	160		10
10:53	75	12	15	27	200		10
11:45	77	10	16	30	230		10
11:53	79	9	28	36	230		10
12:53	82	8	25	32	210		10
13:53	83	9	17	32	210		10
14:53	83	9	27	36	210		10
15:53	83	9	28	38	200		10
16:53	82	8	23	33	230		9
17:53	80	9	24	36	220		9
18:53	77	10	28	36	240		8
19:53	73	12	20	32	230		10
20:53	70	14	23	29	220		10
21:53	68	15	18	28	210		10
22:53	66	16	15		230		10
23:53	61	22	6		160		10

Table 10: Wind and weather observations for Farmington, New Mexico, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	59	24	0				10
1:53	57	27	9		100		10
2:53	60	25	9		210		10
3:53	57	28	7		90		10
4:53	56	30	9		90		10
5:53	59	29	12	18	170		10
6:53	56	34	6		80		10
7:53	61	31	7		100		10
8:53	65	27	8		150		10
9:53	70	20	12	21	130		10
10:53	73	15	15	21	150		10
11:53	75	12	10	24	170		10
12:53	78	10	18	30	160		10
13:53	81	8	17	33	190		10
14:53	82	7	18	25	180		10
15:53	84	6	24	32	210		10
16:53	83	7	24	31	200		10
17:53	81	7	24	39	220		10
18:53	78	8	25	35	220		10
19:53	73	12	20		240		10
20:53	68	15	10		250		10
21:53	63	20	9		240		10
22:53	60	23	10		240		10
23:53	61	24	20	25	230		10

Table 11: Wind and weather observations for Blanding, Utah, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:55	53	24	10		210		
1:55	52	28	6		190		
2:55	50	27	4		100		
3:55	48	34	4		140		
4:55	48	34	5		100		
5:55	50	34	6		170		
6:55	48	46	0				
7:55	57	33	10		160		
8:55	63	27	22	30	160		
9:55	63	27	25	35	170		
10:55	66	24	25	41	190		
11:55	68	23	30	41	180		
12:55	66	24	24	43	180		
13:55	70	21	30	40	190		
15:55	72	19	38	47	200		
16:55	72	17	29	45	190		
18:55	66	22	27	39	220		
19:55	64	24	28	38	220		
21:55	59	27	17	24	220		
22:55	55	30	22	28	220		
23:55	54	32	20	32	220		

Table 12: Wind and weather observations for Moab, Utah, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	53	13	12		270		
1:53	52	13	9		270		
2:53	50	13	5		40		
3:53	50	12	6		40		
4:53	47	13	0				
5:53	40	20	0				
6:53	44	20	0				
7:53	53	17	4		250		
8:53	60	18	6		120		
9:53	69	18	14	22	140		
10:53	69	18	21	30	190		
11:53	73	17	23	30	200		
12:53	74	17	21	38	190		
13:53	75	16	22	33	200		
14:53	75	17	24	39	180		
15:32	72	20	23	38	130		
15:53	72	19	27	37	180		
16:53	72	21	21	25	250		
17:53	72	20	9	20	240		
18:53	74	15	30	53	220		
19:53	72	14	31	46	200		
20:53	68	17	16	27	220		
21:53	66	15	18	29	220		
22:53	62	17	8		220		
23:53	60	24	18	27	230		

Table 13: Wind and weather observations for Monticello, Utah, reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:10	50	23	10	15	214		
1:10	48	25	11	17	215		
2:10	46	28	10	13	201		
3:10	43	31	8	12	219		
4:10	43	33	9	12	229		
5:10	42	38	7	8	222		
6:10	43	41	9	13	238		
7:10	47	39	13	17	208		
8:10	52	36	18	27	183		
9:10	55	32	26	38	176		
10:10	55	32	36	41	180		
11:10	59	28	31	44	177		
12:10	59	28	32	50	182		
13:10	58	29	32	41	186		
14:10	59	28	31	45	184		
15:10	61	27	29	34	193		
16:10	62	24	27	42	184		
17:10	62	23	36	48	191		
18:10	60	25	27	47	203		
19:10	58	28	30	41	203		
20:10	55	30	25	42	205		
21:10	53	31	22	35	202		
22:10	51	32	21	29	207		
23:10	48	37	19	28	222		

Table 14: Wind and weather observations for Alamosa, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:52	57	23	5		140		10
1:52	54	30	5		130		10
2:52	48	39	4		100		10
3:52	53	31	16		160		10
4:52	56	25	16	30	250		10
5:52	55	27	22	29	250		10
6:52	57	25	17	27	240		10
7:52	61	21	31	40	240		10
8:52	65	18	24	33	220		10
9:52	69	14	21	35	240		10
10:52	71	13	29	37	230		10
11:52	73	12	31	44	220		10
12:52	74	13	31	53	220		10
13:52	75	13	41	54	210		9
14:52	76	12	39	55	220		8
15:52	76	12	41	56	220		9
16:52	77	11	32	47	220		10
17:52	75	11	28	50	230		10
18:52	72	12	33	47	220		10
19:52	67	16	23	41	220		10
20:52	63	21	23	32	230		10
21:52	59	25	23		230		10
22:52	57	28	20		220		10
23:52	58	26	29	39	230		10

Table 15: Wind and weather observations for Pagosa Springs, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:55	52	24	4		40		10
1:55	48	29	0				10
2:55	54	26	7		130		10
3:55	45	39	6		30		10
4:55	45	42	0				10
5:55	43	45	0				10
6:55	46	42	7		30		10
7:55	55	28	7		120		10
8:55	59	25	9	23	150		10
9:55	61	20	16	27	210		10
10:55	63	16	21	29	180		10
11:55	64	14	18	28	210		10
12:55	66	13	18	30	230		7
13:55	70	12	27	37	220		7
14:55	72	11	23	39	220		10
15:55	70	11	25	44	230	haze	5
16:55	70	11	29	38	220	haze	4
17:55	70	11	22	33	210	haze	5
18:55	68	11	23	38	200	haze	5
19:55	64	13	24	33	200	haze	4
20:55	63	16	15	24	210	haze	5
21:55	61	18	16	25	210	haze	5
22:55	59	20	13	24	200		7
23:55	59	20	16	25	210		10

Table 16: Wind and weather observations for Cortez, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	66	19	23	37	200		10
1:53	64	22	24	37	190		10
2:53	64	24	20	29	190		10
3:53	62	25	15	23	200		10
4:53	54	34	6		230		10
6:53	53	36	0				10
7:53	63	24	15	21	200		10
8:53	67	20	18	30	190		10
9:53	69	21	20	27	190		10
10:53	72	17	29	38	210		10
11:53	74	16	30	39	210		10
12:53	75	16	29	36	220		10
13:53	78	15	33	40	210		10
14:53	78	14	30	50	210	haze	5
15:53	79	13	31	47	210	haze	4
16:53	78	13	33	45	220	haze	3
17:53	75	15	30	38	220	haze	3
18:53	72	16	21	32	230	haze	5
19:53	69	16	23	38	230	haze	4
20:53	65	20	14	28	200	haze	6
21:53	62	23	10	22	200		9
22:53	59	26	16		210		10
23:53	57	29	9		180		10

Table 17: Wind and weather observations for Cortez, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	57	29	12		220		10
1:53	53	33	0				10
2:53	49	42	4				10
3:53	55	34	13		190		10
4:53	47	48	0				10
5:53	48	47	0				10
6:36	55	35	13		150		10
6:53	56	35	14		140		10
7:53	60	33	20	30	150		10
8:53	65	29	18	28	170		10
9:53	69	25	18	29	190		10
10:53	71	23	27	33	170		10
11:53	73	19	28	36	180		10
12:53	75	17	21	37	160		10
13:53	79	14	33	45	170		10
14:53	80	12	30	45	180		10
15:53	80	10	29	45	200		10
16:53	76	14	30	40	210		10
17:53	76	13	33	43	220		10
18:53	74	14	27	37	220		10
19:53	70	16	23	35	220		10
20:53	64	24	14	24	200		8
21:53	61	27	13		200		9
22:53	61	26	17		220		10
23:53	57	31	10		240		9

Table 18: Wind and weather observations for Montrose, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 22, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 22	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	70	15	23	35	200		10
1:53	68	16	22	33	210		10
2:53	67	16	23	37	210		10
3:53	65	18	23	31	200		10
4:53	65	18	20	30	200		10
6:53	63	21	9		190		10
7:53	67	17	10	16	190		10
8:53	70	15	20	32	210		10
9:53	71	14	24	38	220		10
10:53	74	13	23	37	230		10
11:53	76	13	32	46	230		9
12:53	76	13	30	39	230		10
13:53	78	12	30	48	230		10
14:53	78	12	30	46	220		10
15:53	78	12	28	39	210		10
16:53	76	13	30	44	220	haze	4
17:53	76	12	18	39	210	haze	4
18:53	74	12	24	41	220	haze	5
19:53	72	14	27	36	210	haze	5
20:53	72	15	16	32	200		7
21:53	67	18	10		220		7
22:53	65	20	9		210		9
23:53	63	21	4		220		7

Table 19: Wind and weather observations for Montrose, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	62	22	7		170		9
1:53	60	24	4				10
2:53	55	30	9		40		10
3:53	58	27	12	21	100		10
4:53	59	26	4				10
5:53	57	30	10		110		10
6:53	55	34	6		160		10
7:53	64	26	8	23	130		10
8:26	66	22	14	25	210		10
8:53	70	18	17	29	140		10
9:53	71	16	30	41	190		10
10:53	75	15	24	31	180		10
11:53	77	13	23	36	180		10
12:53	78	12	27	39	200		10
13:53	80	10	28	39	190		10
14:53	80	8	18	38	190		10
15:53	80	9	25	32	180		10
16:53	78	11	16	23	170		10
17:53	78	10	24	37	170		10
18:53	78	10	21	30	210		10
19:53	73	13	14		230		10
20:53	74	12	22	32	230		10
21:35	68	19	18	27	240	haze	5
21:53	67	21	20	30	250	haze	4
22:53	65	24	8		100	haze	4
23:53	62	28	18	36	230	haze	6

Table 20: Wind and weather observations for Durango, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	44	43	0				10
1:53	47	39	9		10		10
2:53	41	48	5		10		10
3:53	40	53	5		50		10
4:53	38	57	5		90		10
5:53	41	53	4		40		10
6:53	46	47	5		70		10
7:53	55	38	6		80		10
8:53	59	34	6		70		10
9:53	63	29	12		140		10
10:53	65	27	8	22	110		10
11:53	69	17	16	29	150		10
12:50	70	17	14	25	120		10
12:53	70	17	8	23	150		10
13:53	74	14	16	22	190		10
14:53	73	11	18	40	180		10
15:53	76	9	27	41	170		10
16:53	74	9	22	36	180		10
17:53	74	11	20	35	200		10
18:53	72	11	22	38	210		7
19:53	69	12	20	28	230		9
20:53	65	16	15	22	240		10
21:53	62	20	13		230		10
22:53	58	25	8		250		10
23:53	54	30	7		230		8

Table 21: Wind and weather observations for Grand Junction, Colorado reported by the University of Utah MesoWest site (http://www.met.utah.edu/mesowest/) for May 23, 2010. Speeds at or above the blowing dust thresholds, weather and visibility (caused by or reduced by dust) have been highlighted in yellow.

Time MST May 23	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:53	51	41	0				10
1:53	45	43	0				10
2:53	46	45	0				10
3:53	48	46	0				10
4:53	43	60	4		360		10
5:53	43	57	4				10
6:53	47	52	5		180		10
7:53	51	52	4		360		10
8:53	59	39	0				10
9:53	64	37	5				10
10:53	68	28	5				10
11:53	75	19	24	35	190		10
12:53	78	17	31	43	180		10
13:53	81	16	25	39	210		10
14:53	81	14	24	38	200		10
15:53	83	12	30	40	190		10
16:53	82	13	22	37	190		10
17:53	80	13	25	32	180		7
18:53	78	13	27	37	210	haze	5
19:12	79	14	27	38	210	haze	4
19:53	76	14	21	32	210	haze	4
20:53	73	17	24	32	220	haze	4
21:53	71	19	21	33	210	haze	5
22:53	69	21	20	30	200	haze	6
23:05	70	20	18	28	190		7
23:53	67	21	16		190		7

The Albuquerque, Flagstaff and Grand Junction National Weather Service Forecast Offices issue weather warnings and advisories for northeast Arizona, most of New Mexico, eastern Utah, and western and southwest Colorado. The weather warnings and advisories issued by theses offices for May 22 and 23, 2010, are presented in Appendix B. These warnings and advisories show that strong winds and areas of blowing dust were expected and experienced across this region on both of these days.

Figure 21and Figure 22 show the NOAA HYSPLIT 12-hour forward matrix trajectories (Draxler and Rolph, 2012) for northeast Arizona and northwest New Mexico starting at 11 AM MST May 22, 2010 and for northeast Arizona, northwest New Mexico and southeast Utah starting at 11 AM MST May 23, 2010 respectively (see the following link for more information on HYSPLIT: http://ready.arl.noaa.gov/HYSPLIT.php). These analyses show the transport of air from these areas into Colorado on May 22 and 23, 2010. HYSPLIT 12-hour back trajectories for 11 AM MST May 22, 2010, in Alamosa, CO and 3 PM May 22, 2010 in Pagosa Springs, CO are presented in Figure 23 and Figure 24 respectively. These figures also show that Arizona and northwest New Mexico were source regions for air transported into Colorado on May 22, 2010. Similarly, the HYSPLIT 12-hour back trajectories for 5 PM MST May 23, 2010, for Grand Junction in Figure 25 show that Arizona, northwest New Mexico and southeast Utah were source regions for air transported into Colorado on May 23, 2010. ***NOAA HYSPLIT forward and backward trajectories provide clear supporting evidence that dust from desert regions of Arizona, northwest New Mexico and southeast Utah caused the PM_{10} exceedances measured across portions of west-central and southwest Colorado on May 22 and 23, 2010.***

Figure 26 and Figure 27 show the output for blowing dust from the Navy Aerosol Analysis and Prediction System (NAAPS) Global Aerosol Model for 5 PM May 22 (00Z May 23), 2010, and 5 PM May 23 (00Z May 24), 2010, respectively (source: http://www.nrlmry.navy.mil/aerosol-bin/aerosol/display_directory_all?DIR=/web/aerosol/public_html/globaer/ops_01/wus/). The NAAPS system models blowing dust emissions and transport based on soil moisture content, soil erodibility factors, and a variety of meteorological factors known to be conducive to blowing dust (for a description of NAAPS see: http://www.nrlmry.navy.mil/aerosol_web/Docs/globaer_model.html).

The forecast panel in the lower left of both Figure 26 and Figure 27 shows blowing dust generation over northeast Arizona, northwest New Mexico and southeast Utah. The NAAPS model can overestimate dust emissions, and in this case it shows high concentrations of dust in southeast Colorado that were not actually observed. The model output, however, does suggest that the Four Corners areas of Arizona, New Mexico and Utah were major source regions for blowing dust on May 22 and 23, 2010. ***Forecast products from the Navy Aerosol Analysis and Prediction System model provide evidence for a widespread blowing dust event in the Four Corners states, suggesting that significant source regions for dust in Colorado were located in arid regions of Arizona, New Mexico and Utah.***

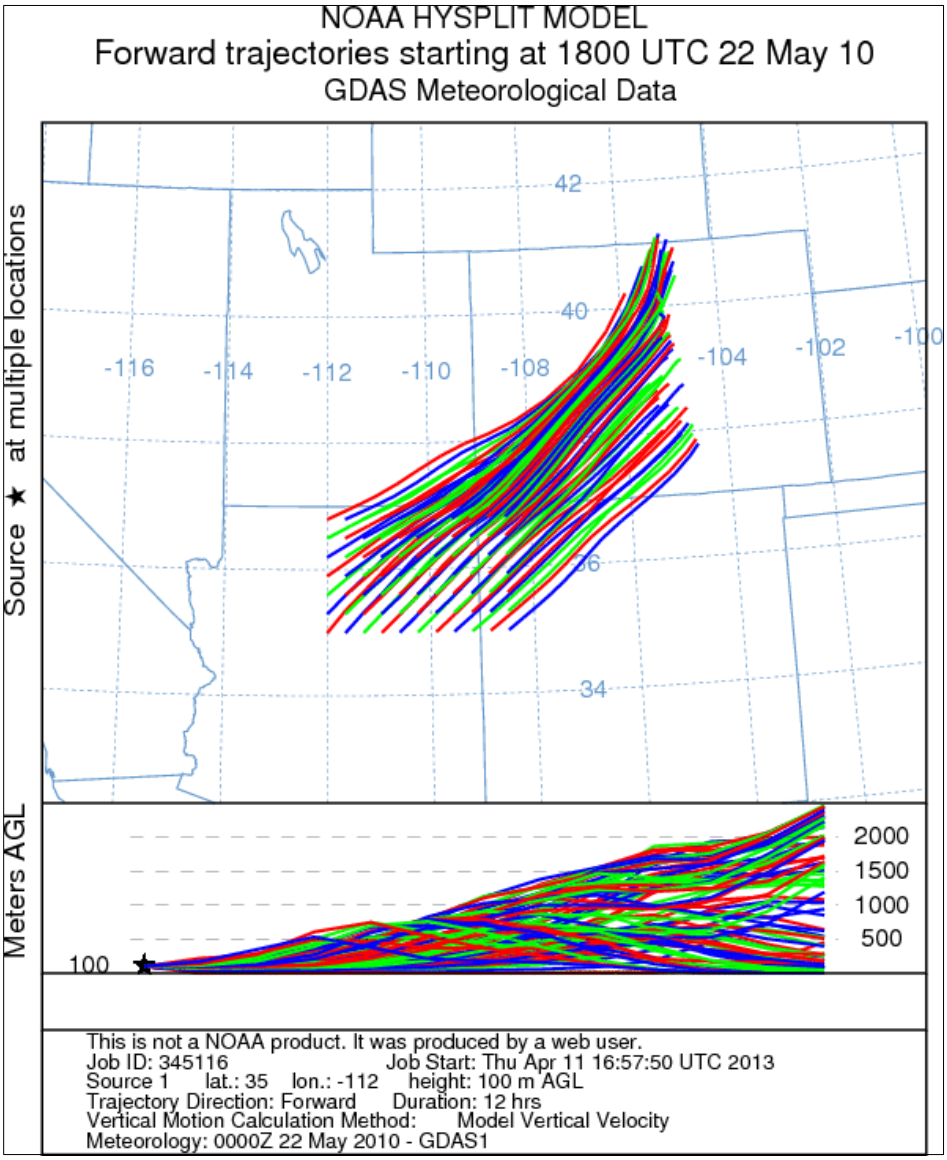

Figure 21: NOAA HYSPLIT 12-hour forward trajectories for northeast Arizona and northwest New Mexico for 11 AM MST May 22 (18Z May 23), 2010, (source: NOAA Air Resources Laboratory at: http://ready.arl.noaa.gov/HYSPLIT.php).

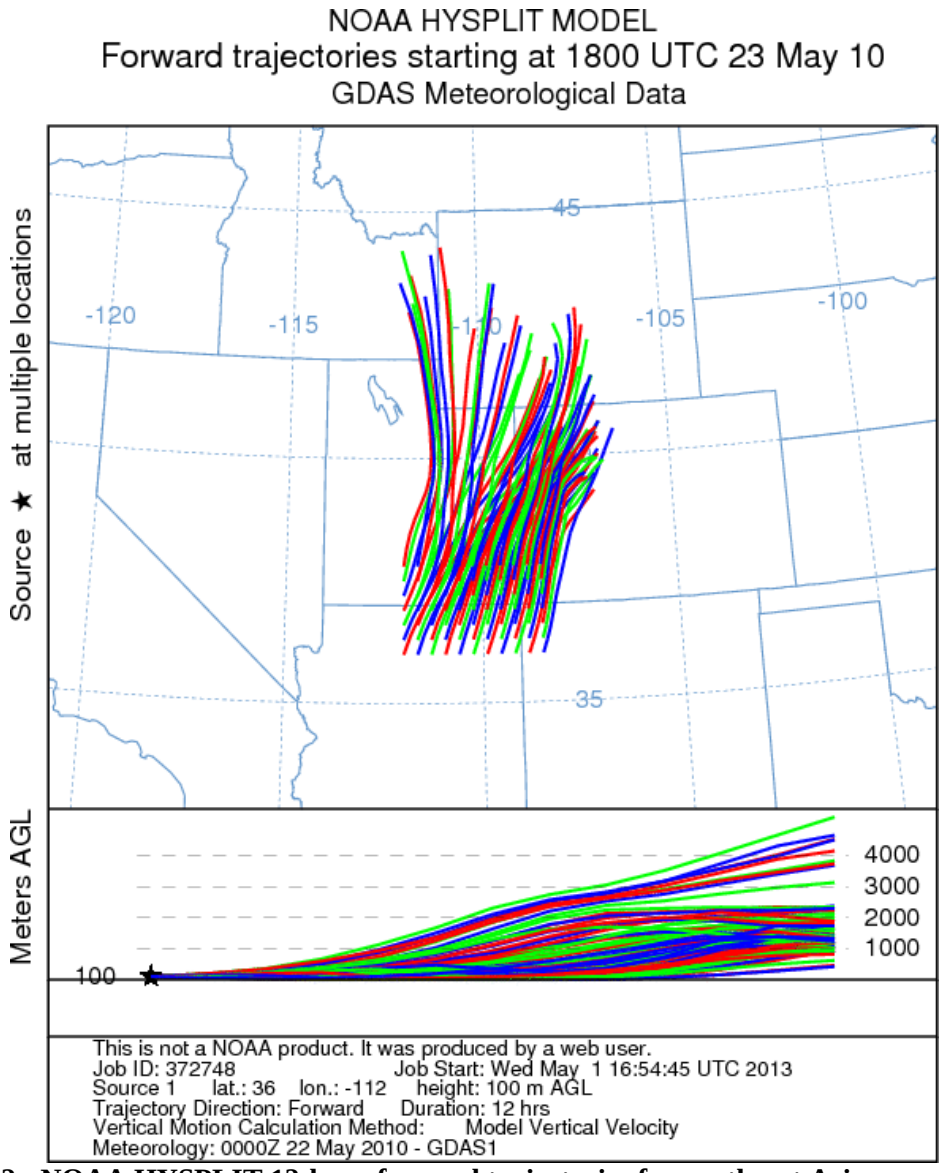

Figure 22: NOAA HYSPLIT 12-hour forward trajectories for northeast Arizona, southeast Utah and northwest New Mexico for 11 AM MST May 23 (18Z May 23), 2010, (source: NOAA Air Resources Laboratory at: http://ready.arl.noaa.gov/HYSPLIT.php).

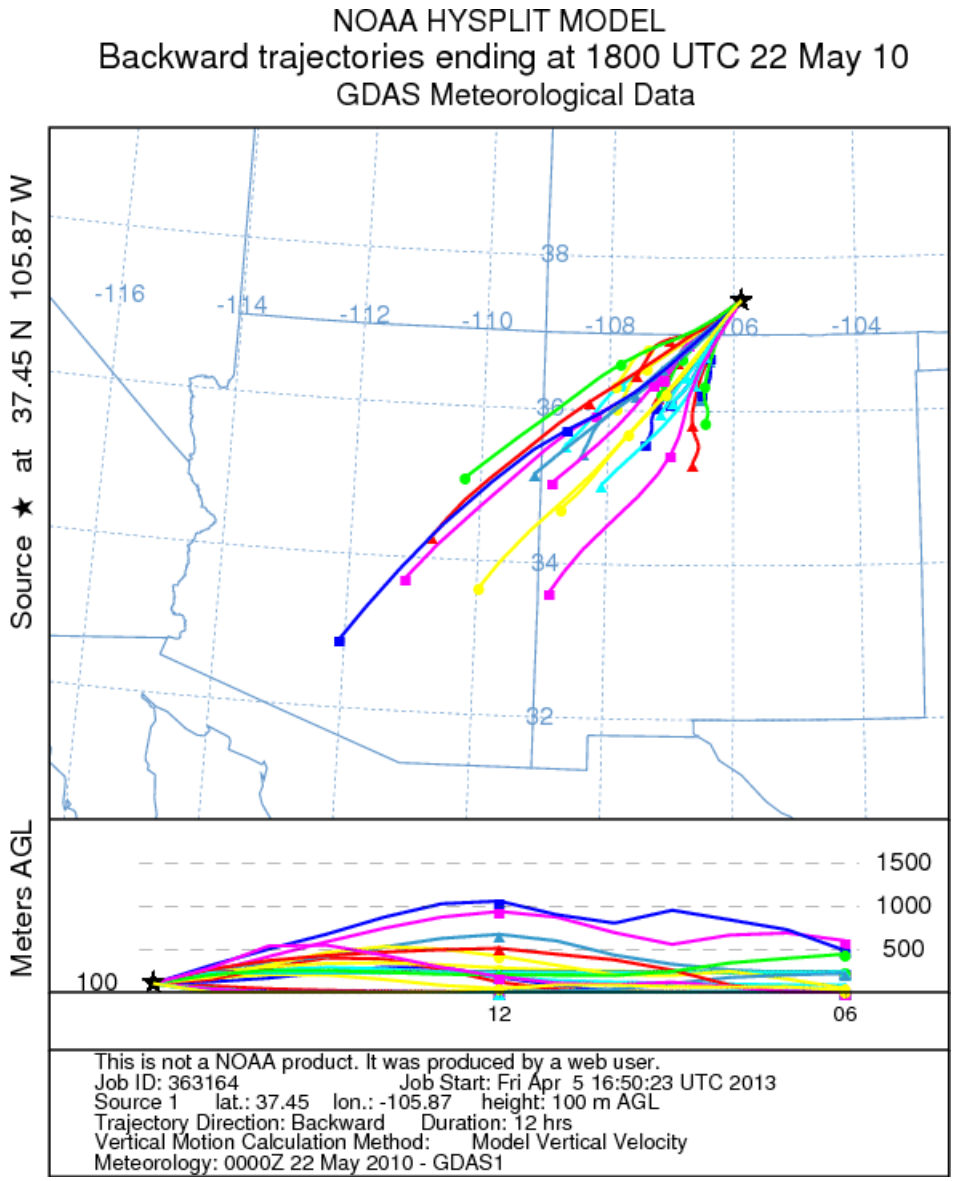

Figure 23: NOAA HYSPLIT 12-hour back trajectories for Alamosa, Colorado, for each hour from 11 PM MST May 21, 2010, to 11 AM MST May 22, 2010 (source: NOAA Air Resources Laboratory at: http://ready.arl.noaa.gov/HYSPLIT.php).

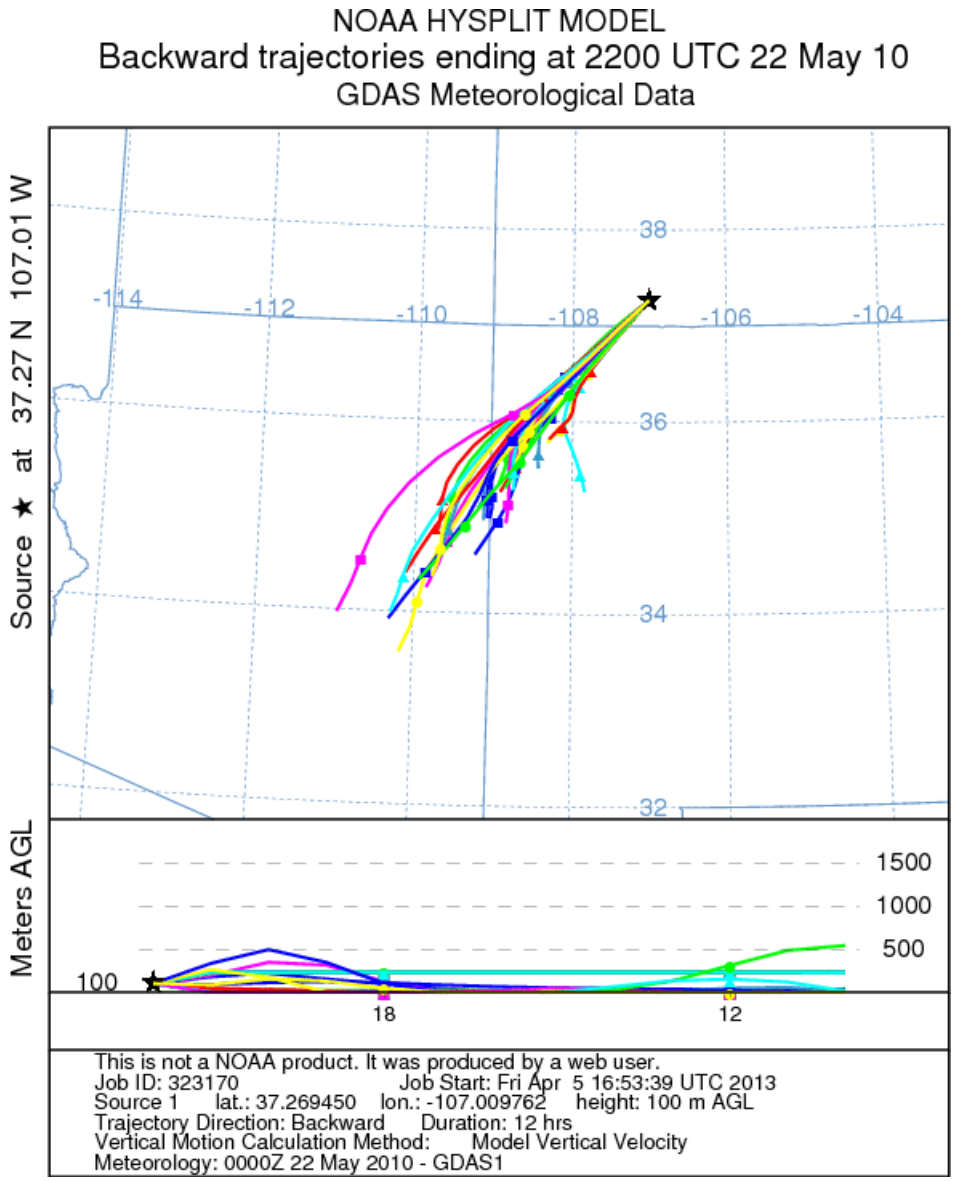

Figure 24: NOAA HYSPLIT 12-hour back trajectories for Pagosa Springs, Colorado, for each hour from 3 AM MST May 22, 2010, to 3 PM MST May 22, 2010 (source: NOAA Air Resources Laboratory at: http://ready.arl.noaa.gov/HYSPLIT.php).

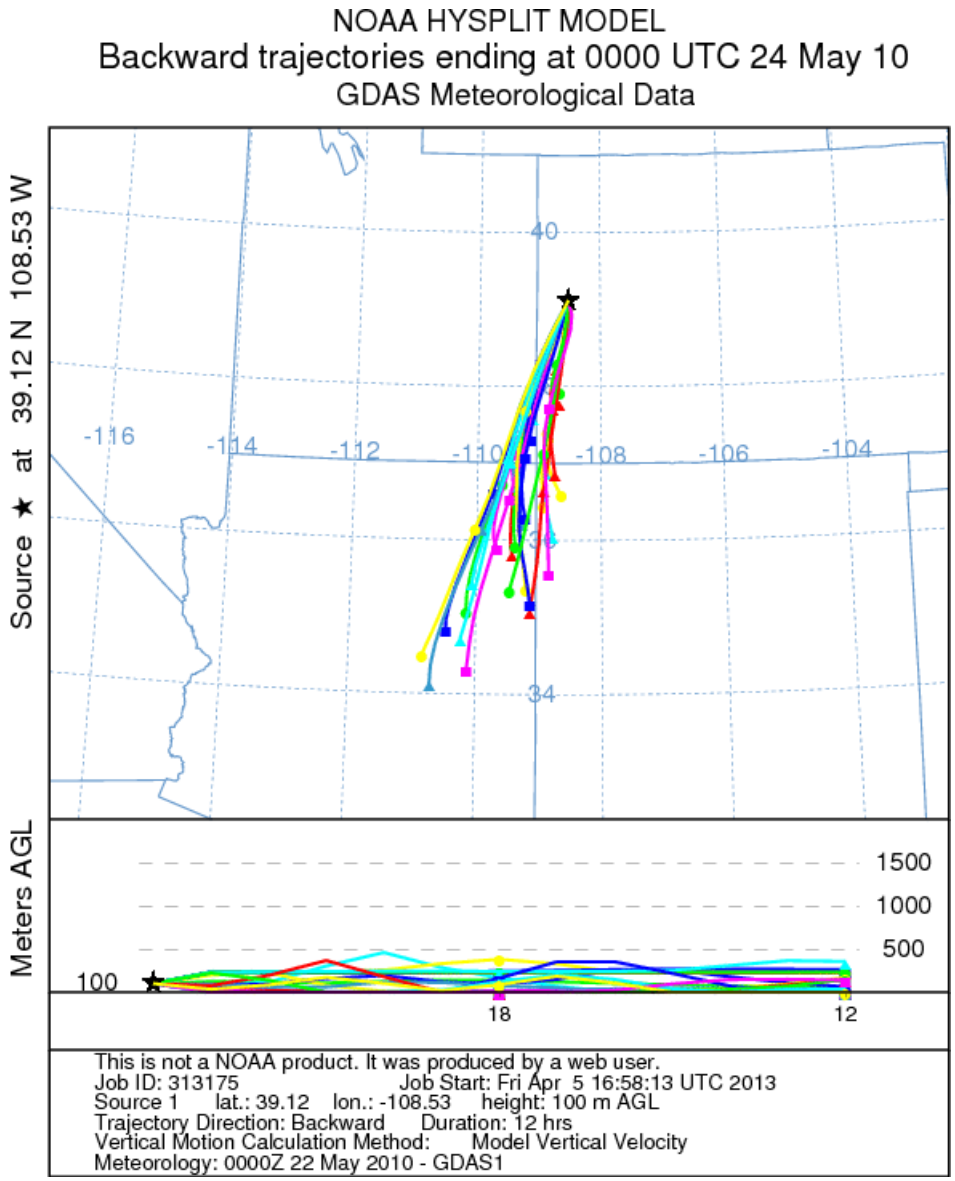

Figure 25: NOAA HYSPLIT 12-hour back trajectories for Grand Junction, Colorado, for each hour from 5 AM MST May 23, 2010, to 5 PM MST May 23, 2010 (source: NOAA Air Resources Laboratory at: http://ready.arl.noaa.gov/HYSPLIT.php).

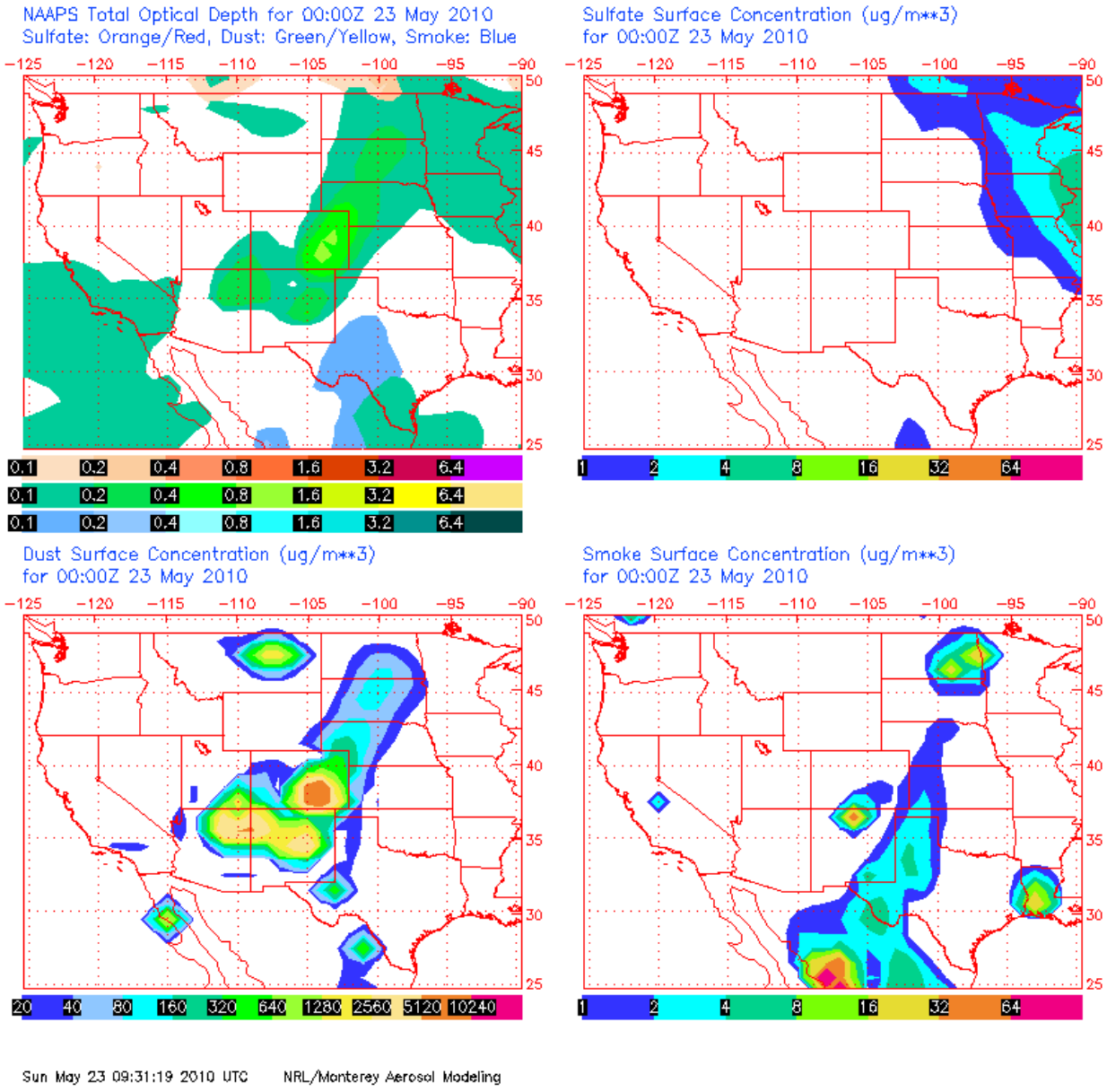

Figure 26: NAAPS forecasted dust concentrations for 5 PM May 22 (00Z May 23), 2010 (source: http://www.nrlmry.navy.mil/aerosol-bin/aerosol/display_directory_all?DIR=/web/aerosol/public_html/globaer/ops_01/wus/).

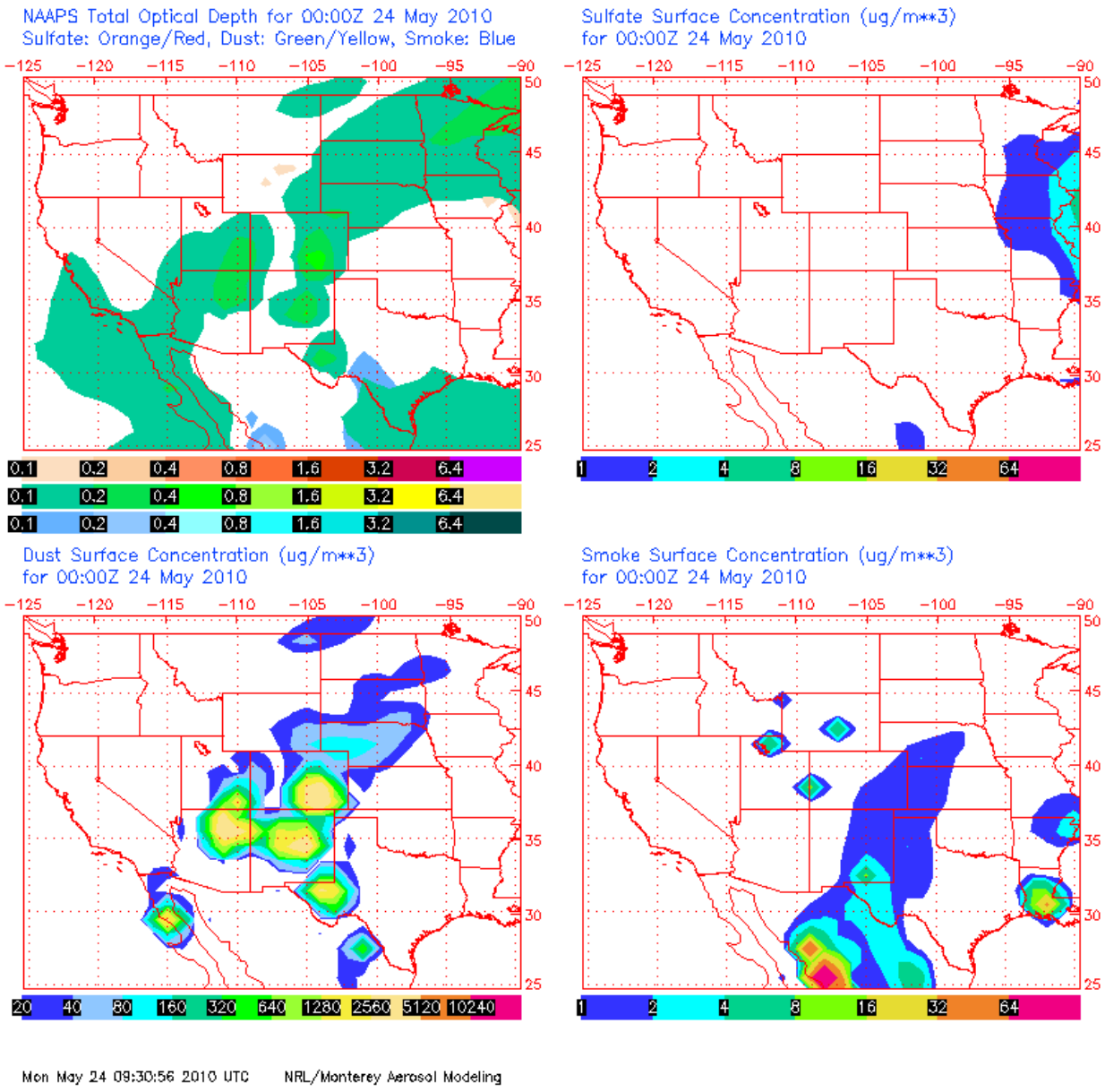

Figure 27: NAAPS forecasted dust concentrations for 5 PM May 23 (00Z May 24), 2010 (source: http://www.nrlmry.navy.mil/aerosol-bin/aerosol/display_directory_all?DIR=/web/aerosol/public_html/globaer/ops_01/wus/).

The Center for Snow and Avalanche Studies has been studying the effects of wind-blown desert dust from Arizona, New Mexico, and Utah on snowpack albedo and snowmelt in the San Juan Mountains of Colorado.

Figure 28: Dust-on-Snow Deposition Events Log at the Senator Beck Basin Study Area at Red Mountain Pass, Colorado. (source: Chris Landry. September 24, 2010).

is the Center's log of events that are associated with deposits or layers of wind-blown dust on or within the snowpack of the San Juan Mountains. ***The Center for Snow and Avalanche Studies lists May 22, 2010, as one of nine Dust-on-Snow events for the 2009/2010 water year, and this provides clear supporting evidence that a regional blowing dust event with long-range transport caused the PM10 exceedances measured across portions of Colorado on May 22, 2010.***

Colorado Dust-on-Snow (CODOS)

Dust-on-Snow Deposition Events Log

Thanks to our original National Science Foundation research grants for collaborative research (grants ATM-0432327 to Painter at National Snow and Ice Data Center and ATM-0431955 to Landry at Center for Snow and Avalanche Studies), and to the subsequent support of the Colorado Dust-on-Snow program by Colorado water districts the State of Colorado, the U.S. Bureau of Reclamation, and others, this program has accumulated several seasons of dust-on-snow observations at our Senator Beck Basin Study Area (SBBSA) at Red Mountain Pass, summarized in the table below. It is reasonable to assume that our skill at detecting dust-on-snow events has improved and that we may have failed to observe very small events during the early years of this work. Therefore the table represents an absence of events in grey for the first two years of observation but thereafter indicates an absence of observed events as "0" (zero).

Dust-on-Snow Events Documented per Month, by Winter
Senator Beck Basin Study Area at Red Mountain Pass – San Juan Mountains

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	**Total**
2002/2003					2		1			**3**
2003/2004							2	1		**3**
2004/2005	0	0	0	0	0	1	2	1	0	**4**
2005/2006	0	0	1	0	1	1	3	2	0	**8**
2006/2007	0	0	1	0	1	1	3	1	1	**8**
2007/2008	0	0	0	0	0	3	3	1	0	**7**
2008/2009	1	0	1	0	1	4	5	0	0	**12**
2009/2010	1	0	0	0	0	1	4	3	0	**9**

Dates of the events, by winter/spring season, were as follows (WY = Water Year):

2002/2003 (WY2003): Feb 3, Feb 22, Apr 2-3

2003/2004 (WY 2004): Apr 17, Apr 28, May 11

2004/2005 (WY 2005): Mar 23, Apr 4, Apr 8, May 9

2005/2006 (WY 2006): Dec 23, Feb 15, Mar 26, Apr 5, Apr 15, Apr 17, May 22, May 27

2006/2007 (WY 2007): Dec 17, Feb 27, Mar 27, Apr 15, Apr 18, Apr 24, May 4, Jun 6

2007/2008 (WY 2008): Mar 16, Mar 26-27, Mar 30-31, Apr 15, Apr 21, Apr 30, May 12

2008/2009 (WY 2009): Oct 11, Dec 13, Feb 27, Mar 6, Mar 9, Mar 22, Mar 29, Apr 3, Apr 8, Apr 15, Apr 24, Apr 25

2009/2010 (WY 2010): Oct 27, March 30, April 3, April 5, April 12, April 28, May 9, May 11, May 22

Figure 28: Dust-on-Snow Deposition Events Log at the Senator Beck Basin Study Area at Red Mountain Pass, Colorado. (source: Chris Landry. September 24, 2010).

Figure 29 shows the MODIS Aqua satellite image for the Four Corners region of Arizona, New Mexico, Utah and Colorado on the afternoon of May 22, 2010. Plumes of blowing dust can be seen originating in the Painted Desert region of northeast Arizona and northwest New Mexico, then spread to the northeast into southwest Colorado and extreme southeast Utah.

Blowing dust is not as discernible on the MODIS Aqua satellite image during the afternoon of May 23, 2010 (Figure 30) as surface features are obscured by cloud cover in eastern Utah and western Colorado. However, a distinct north-south orientation of cloud cover gives a strong indication of the air flow from the arid Painted Desert region of northeast Arizona and northwest New Mexico northward into Utah and western Colorado. Clear evidence of blowing dust in this region can be found with the 3:00 PM MST (22Z May 23, 2010) GOES 11 Longwave Infared Difference image (Figure 31). This product employs a color enhancement to emphasize the negative temperature differences for select wavelengths associated with blowing dust. Blowing dust is generally noted by orange and red colors (see the following link for more information: http://rammb.cira.colostate.edu/ramsdis/online/goes-r.asp). Plumes of dust are distinctly visible in northeast Arizona spreading northward into southeast Utah.

MODIS and GOES satellite imagery show that the Painted Desert and Four Corners area in general were source regions for the blowing dust on May 22 and 23, 2010. This is consistent with the climatology for many dust storms in Colorado as described in the Grand Junction, Colorado, Blowing Dust Climatology report contained in Appendix A of this document.

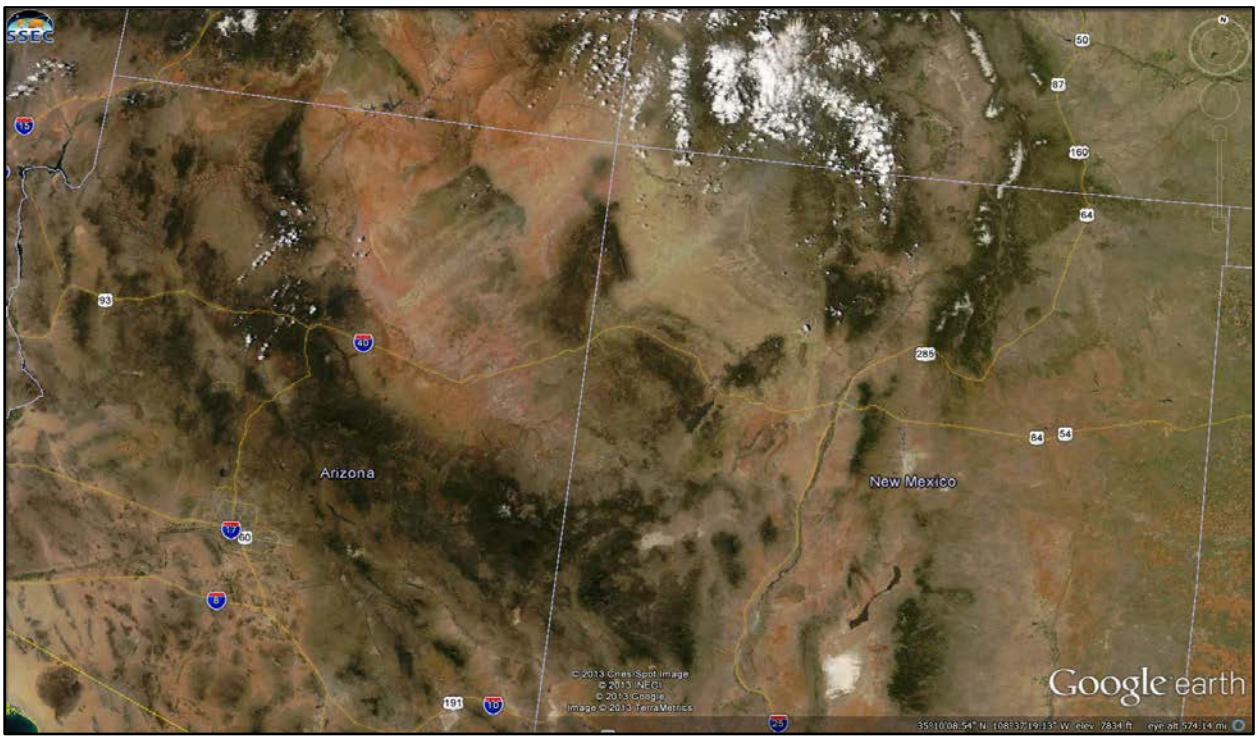

Figure 29: MODIS Aqua satellite image of the Four Corners region on May 22, 2010 (source: http://ge.ssec.wisc.edu/modis-today/index.php).

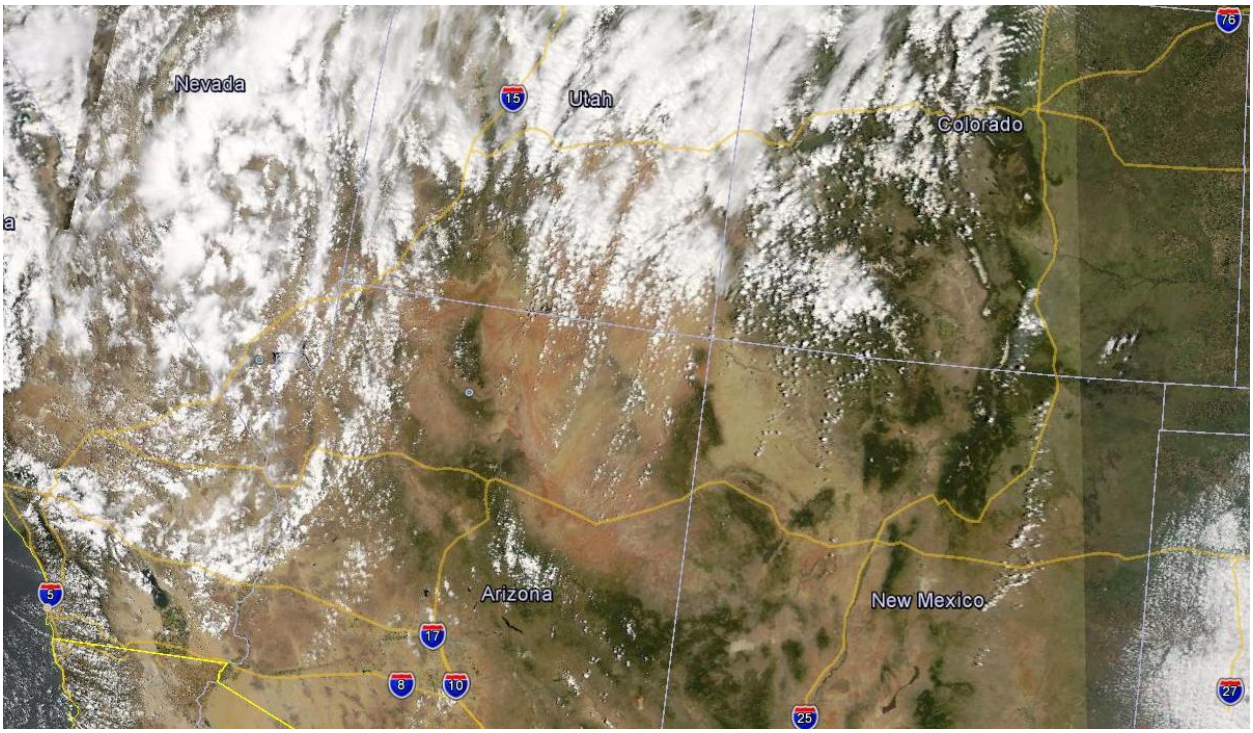

Figure 30: MODIS Aqua satellite afternoon image of the Four Corners region on May 23, 2010 (source: http://ge.ssec.wisc.edu/modis-today/index.php).

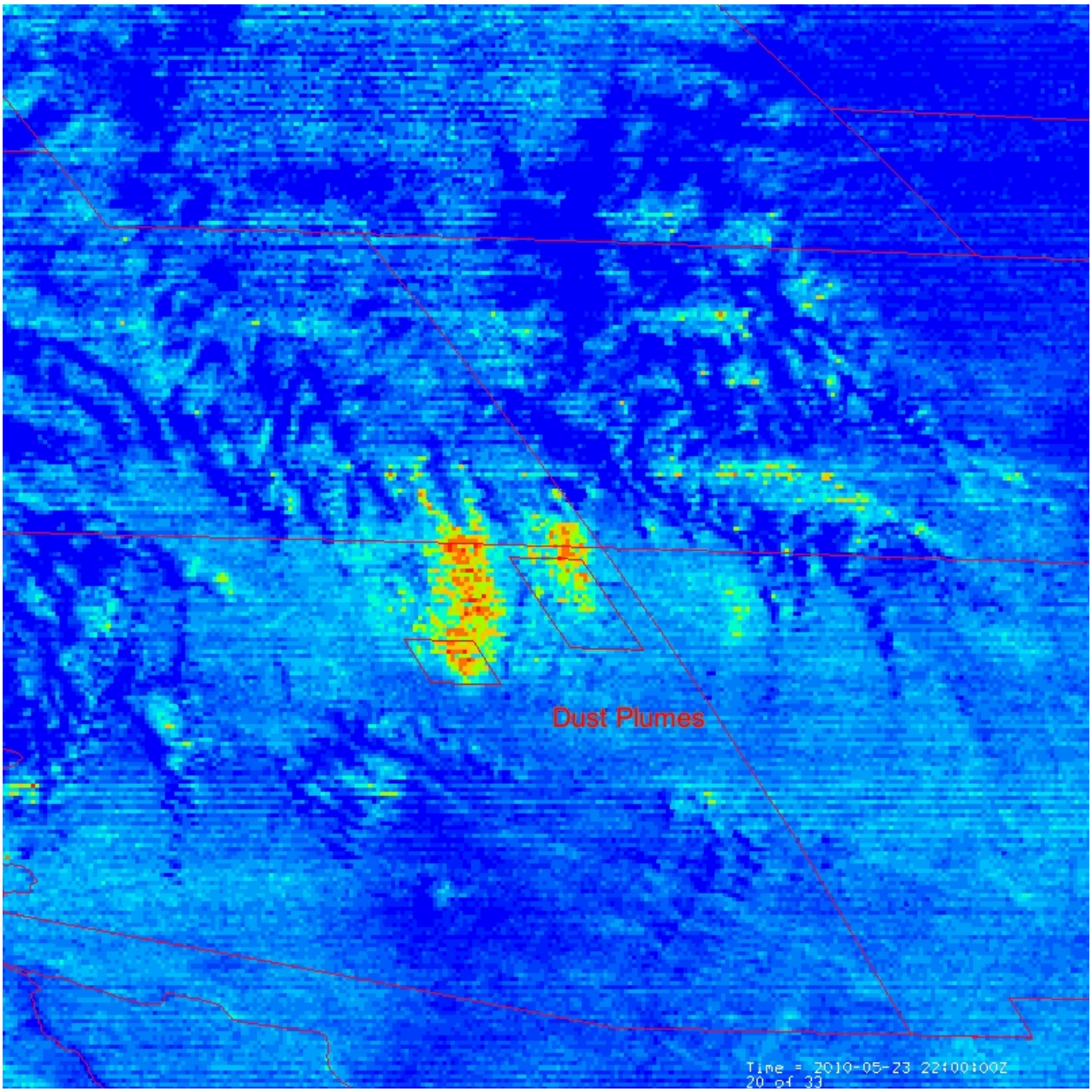

Figure 31: GOES-11 Longwave Infrared Difference image for 3:00 PM MST May 23, 2010 (source: http://sgst.wr.usgs.gov/dust_detection/dust-events/2010-2/may-23rd-2010/).

The Smoke Text Product from the National Oceanic and Atmospheric Administration (NOAA) Satellite Services Division - Descriptive Text Narrative for Smoke/Dust Observed in Satellite Imagery through 0145Z May 23, 2010 (6:45 PM MST, May 22) (http://www.ssd.noaa.gov/PS/FIRE/DATA/SMOKE/2010/2010E230603.html) describes dust from Arizona and New Mexico moving across Colorado on May 22, 2010:

> "A large area of blowing dust has been kicked up due to strong winds associated with a potent storm system. The blowing dust is emanating from northeast Arizona, northwest New Mexico and southwest/central Colorado. The dust is moving quickly to the northeast and extends from northeast Arizona, extreme southeast Utah and northwest New Mexico across Colorado and into the Nebraska Panhandle."

NOAA's Satellite Services Division issued another Smoke Text Product for satellite observations through 0215Z May 24, 2010 (7:15 PM MST, May 23). This narrative refers to the events of May 23, 2010. It was brief and contained one inaccuracy (the author mentions "Minnesota" when the intent was likely "Arizona"):

> "Strong winds have generated another blowing dust storm over northeast Minnesota which is lifting into eastern Utah and western Colorado."

The United States Geological Survey (USGS) Southwest Geographic Science Team: Dust Monitoring web pages (http://sgst.wr.usgs.gov/dust_detection/dust-events/2010-2/may-22nd-2010/ and http://sgst.wr.usgs.gov/dust_detection/dust-events/2010-2/may-23rd-2010/) list May 22 and 23, 2010, as dust event days. The web pages for both days have various satellite pictures, videos, and time lapse imagery of the dust storm. The web page for May 22, 2010, provides an overview for both days:

> "The first of a two day long change in pressure systems brought consistently high winds to the Four Corners Region again this year. The resulting significant dust emissions from the Navajo Reservation reached well into southern Colorado and Utah on each day."

NOAA and USGS scientists with expertise in the analysis of dust storms have indicated that a regional dust storm occurred in the Four Corners area and directly impacted southern and western Colorado on May 22 and 23, 2010.

Figure 32 and Figure 33 show the total precipitation in inches for the western U.S. for the period of April 28-May 11, 2010, and May 8-May 21, 2010, respectively. It shows that most of northeast Arizona, northwest New Mexico and southeast Utah had less than 0.5 inches of precipitation during the April 28-May 21, 2010, time frame. This is an approximate threshold below which blowing dust can occur in the Painted Desert area when winds are above the blowing dust thresholds. The precipitation threshold is reported in Appendix A that shows that blowing dust occurs in northeastern Arizona source regions when soils are dry (typically less than 0.5 inches in a 30-day period at Hopi, Arizona) and winds are strong. Figure 34 is the Drought Monitor report for the western U.S. It shows that northeast Arizona was classified as "Abnormally Dry", with an area of "Moderate" to "Severe" drought in the Painted Desert region. ***Soils in the Four Corners area of northeast Arizona, northwest New Mexico and southeast Utah were dry enough to produce blowing dust when winds were above the thresholds for blowing dust.***

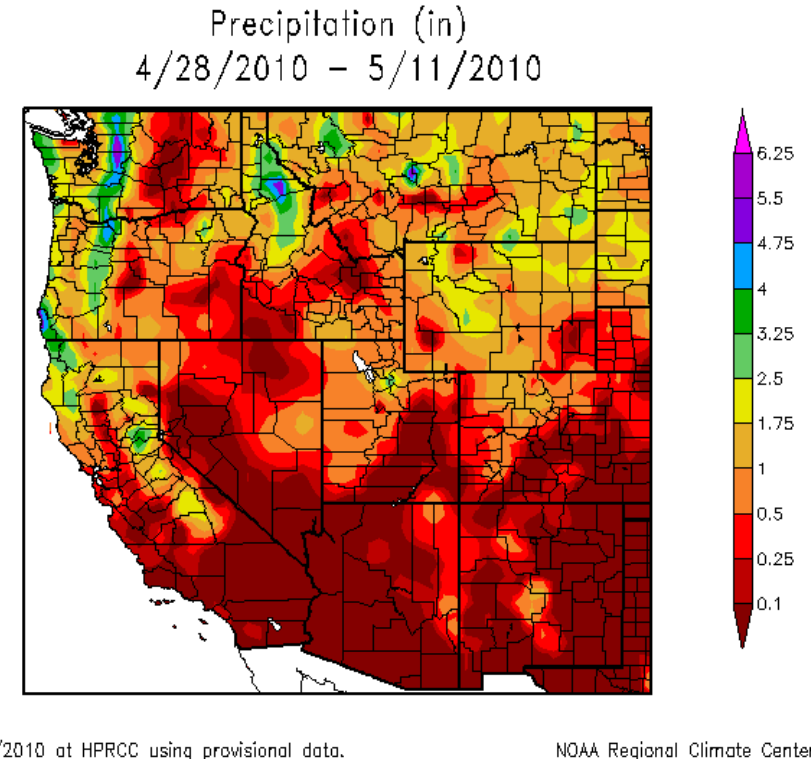

Figure 32: Total precipitation in inches for April 28-May 11, 2010 (source: http://www.hprcc.unl.edu/maps/current/index.php?action=update_region&region=WRCC)

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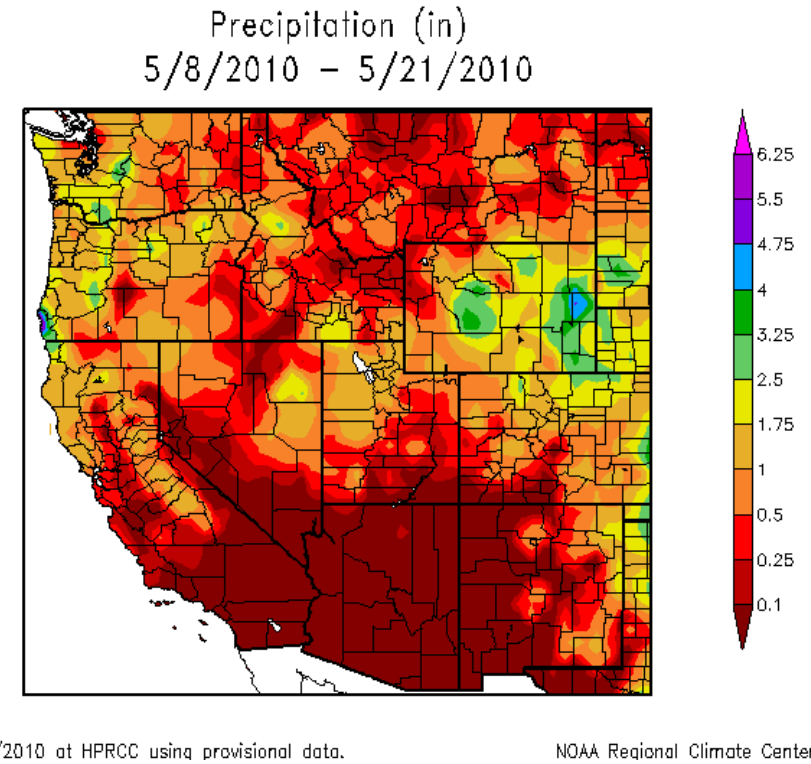

Figure 33: Total precipitation in inches for May 8-May 21, 2010 (source: http://www.hprcc.unl.edu/maps/current/index.php?action=update_region&region=WRCC)

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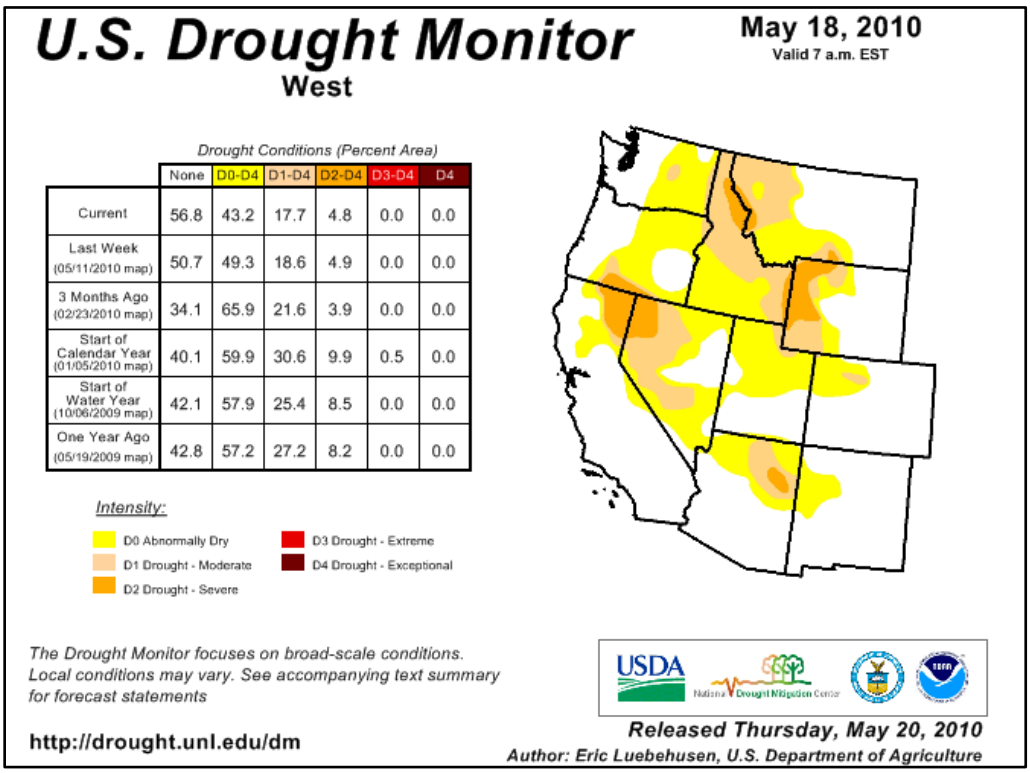


Figure 34: Drought status for the western U.S. on May 18, 2010 (source: the USDA, NOAA, and the National Drought Mitigation Center at: http://drought.unl.edu/dm/archive.html).

In a 1997 paper "Factors controlling threshold friction velocity in semiarid and arid areas of the United States" (Marticorena et al., 1997), the authors characterized the erodibility of both disturbed and undisturbed desert soil types. The threshold friction velocity, which is described in detail in this paper, is a measure for conditions necessary for blowing dust and is higher for undisturbed soils and lower for disturbed soils.

Friction velocities have been calculated for 5 PM MST May 22, 2010, and 11 AM MST May 23, 2010, using the NAM12 model (data source: http://nomads.ncdc.noaa.gov/data.php?name=access#hires_weather_datasets). These friction velocities are shown in Figure 35 and Figure 36, respectively. According to Marticorena and coauthors (1997), even undisturbed desert soils normally resistant to wind erosion will be susceptible to emission of blowing dust when threshold friction velocities are greater than about 1.0 to 2.0 meters per second. These figures show that a wide area of northern Arizona, northwest New Mexico, southeast Utah, and west-central and southwest Colorado had friction velocities above 1.0 meters per second during the afternoon hours of both May 22 and 23, 2010. High values were present within the Little Colorado River Valley and Painted Desert region of northeast Arizona where satellite imagery shows the eruption of large plumes of blowing dust and where 30-day precipitation totals were near or below 0.5 inches. Frictional velocities were also high enough for dust from undisturbed soils in parts of southwest Colorado, including western sections of the arid San Luis Valley upwind of Alamosa. Note that blowing dust will typically only occur where friction velocities are high and the soils are dry and not protected by vegetation, forest cover, boulders, rocks, etc. This is why blowing dust occurred in the desert and more arid areas of northeast Arizona, northwest New Mexico, southeast Utah, and west-central and southwest Colorado on May 22 and 23, 2010.

The elevated friction velocities shown in Figure 35 and Figure 36***, the data on soil moisture conditions presented elsewhere in this report, and the prevalence of winds above blowing dust***

thresholds (all occurring in traditional source regions in northeast Arizona, northwest New Mexico and southeast Utah) prove that this dust storm was a natural event that was not reasonably controllable or preventable.

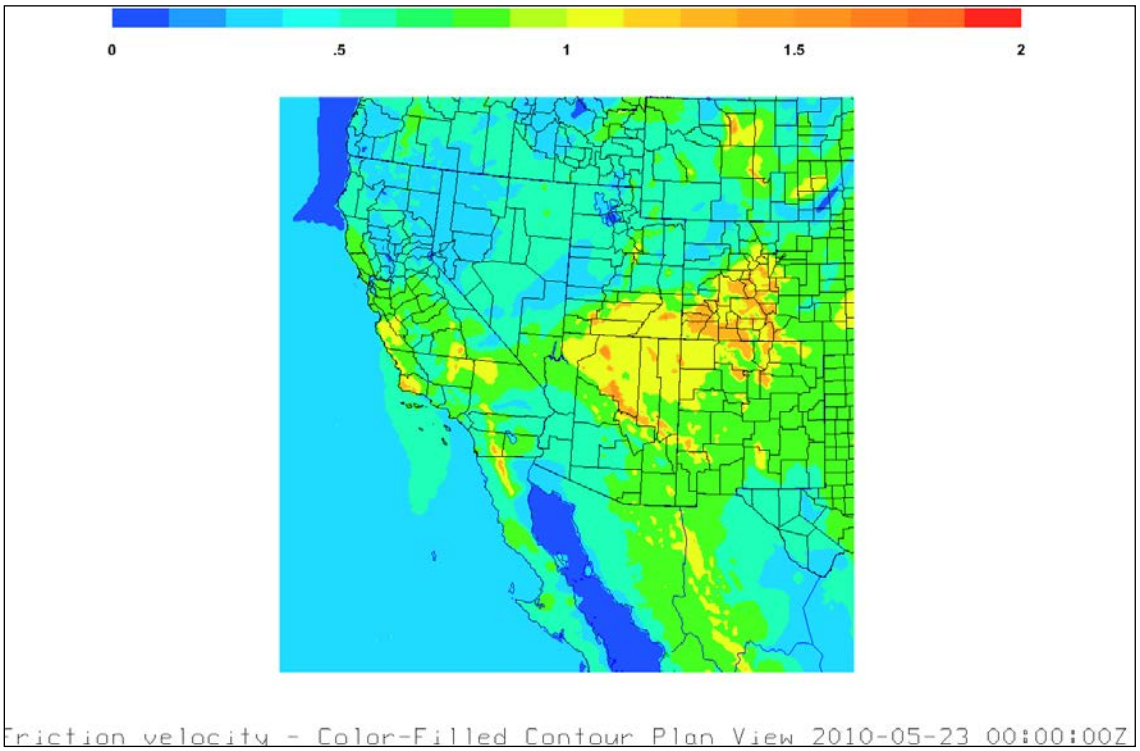


Figure 35: Friction velocities in meters/second from the NOAA NCEP North American Model with 12 kilometer grid spacing at 00Z May 23, 2010 (5 PM MST May 22, 2010).

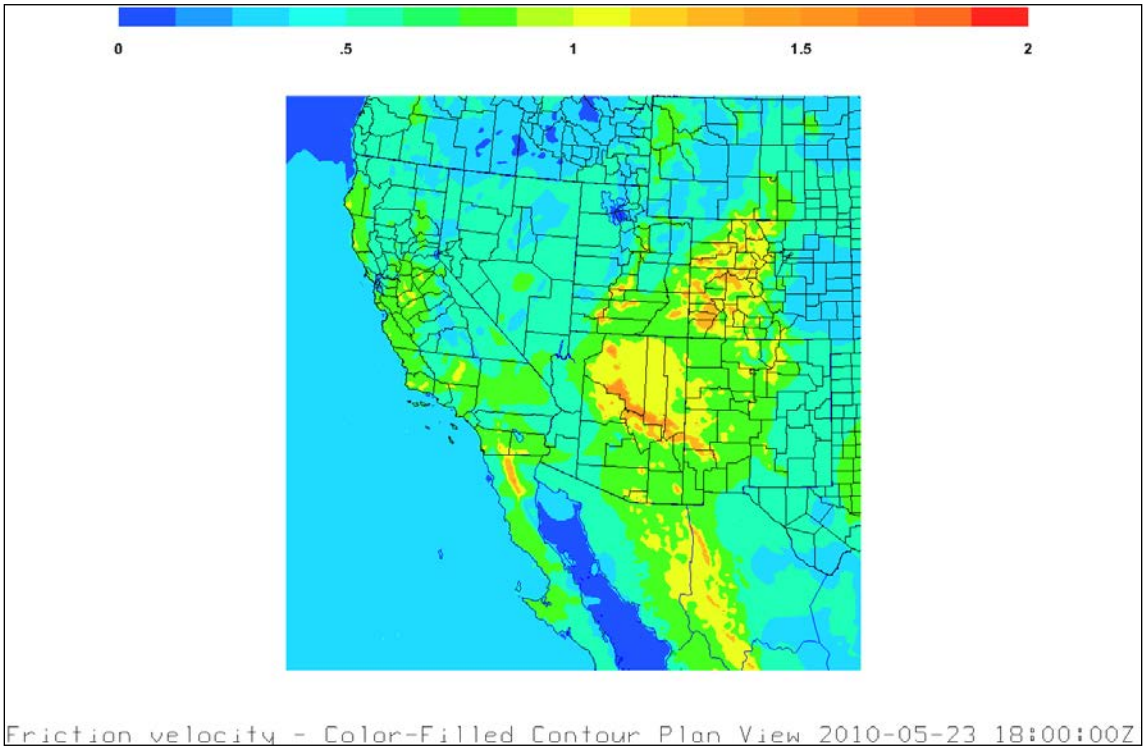


Figure 36: Friction velocities in meters/second from the NOAA NCEP North American Model with 12 kilometer grid spacing at 18Z May 23, 2010 (11 AM MST May 23, 2010).

3.0 Evidence-Ambient Air Monitoring Data and Statistics

PM_{10} concentrations that exceeded the level of the twenty-four-hour PM_{10} NAAQS were monitored across a broad geographical area of Colorado on May 22 and 23, 2010. On May 22 PM_{10} samples in excess of 150 $\mu g/m^3$ were recorded at Alamosa - Adams State College (Alamosa ASC, 260 $\mu g/m^3$), Alamosa Municipal (Alamosa Muni, 197 $\mu g/m^3$), and Pagosa Springs (184 $\mu g/m^3$). Additionally, an exceptionally high samples (greater than the 99th percentile for the site) were recorded at the PM_{10} monitors in Mt. Crested Butte (92 $\mu g/m^3$) and Breckenridge (80 $\mu g/m^3$). On May 23 samples in excess of 150 $\mu g/m^3$ were recorded at Grand Junction – Powell (Powell, 155 $\mu g/m^3$) and Clifton (189 $\mu g/m^3$). Additional high samples were taken at the PM_{10} monitors in Parachute (125 $\mu g/m^3$), Crested Butte (87 $\mu g/m^3$), Mt. Crested Butte (86 $\mu g/m^3$), Durango (88 $\mu g/m^3$) and Telluride (52 $\mu g/m^3$). These high values would not have occurred if not for the following: (a) dry soil conditions over northeast Arizona, northwest New Mexico, most of Utah, and parts of western Colorado with 30-day precipitation totals below the threshold identified as a precondition for blowing dust in northeastern Arizona; (b) a surface low pressure system and cold front that were associated with a strong upper-level trough that caused strong prefrontal surface winds over the area of concern; and (c) friction velocities over regions of northern Arizona, northwest New Mexico, and southeast Utah that were high enough to allow entrainment of dust from natural sources with subsequent transport of the dust to Colorado in strong winds. This weather system adversely affected the air quality in much of western Colorado.

For maps of the Colorado PM_{10} monitoring sites and all valid PM_{10} concentrations on May 22 and 23, 2010, see Figure 1 and Figure 2 respectively. Section 2 provides the meteorological evidence for the spatial extent of this regional blowing dust event including the dust on snow data from the Colorado Dust-on-Snow (CODOS) network. The CODOS network clearly shows that the spatial extent of this dust storm was quite large, covering thousands of square miles.

The APCD reviewed PM_{10} monitoring data in southwestern Colorado in the path of the dust storm (see Section 3.1). The PM_{10} concentrations at affected sites were compared using time series plots for a number of days pre and post event. The time series graphs clearly show that the regional blowing dust storm adversely affected the air quality in Alamosa, Pagosa Springs and Grand Junction on May 22 and 23, 2010. PM_{10} samples the day before and the day two days after the event were typical of samples at each affected site.

3.1 Historical Fluctuations of PM_{10} Concentrations in Alamosa, Pagosa Springs, and Durango

This evaluation of PM_{10} monitoring data for sites affected by the May 22/23 2010 event event was made using valid samples from PM_{10} samplers in Alamosa, Pagosa Springs and Grand Junction from 2005 through 2011, APCD has been monitoring PM_{10} concentrations in these areas since 1985. On-going data collection at all the sites affected by the event began in 2005, with the exception of PM_{10} data collected at Clifton; data collection began at this monitor late in 2007. Data presented for Clifton includes complete years from 2008 through 2011. Data in this analysis for sites affected by the event is from January 2005 through the end of 2011. The overall data summary for the sites recording concentrations in excess of 150 $\mu g/m^3$ is presented in Table 22, all data values are presented in $\mu g/m^3$:

Table 22: May 22 and 23, 2010, Event Data Summary

	Alamosa ASC	Alamosa Muni	Pagosa Springs	Powell	Clifton
May 22	**260**	**194**	**187**	n/a	n/a
May 23	35	45	49	**155**	**189**
Mean	22.1	27.9	22.7	25.8	26.7
Median	18	23	20	22.75	21
Mode	16	20	16	20	20
St. Dev	24.0	26.8	17.0	16.1	19.3
Samp. Var	578.3	716.4	290.6	258.7	373.4
Minimum	1	1	2	4	4
Maximum	473	635	349	197.8	189
Count	2214	2168	2287	790	507

As this table demonstrates the spatial scope of this event, addressed elsewhere in this document, was broad and had an impact on PM_{10} concentrations at multiple sites covering an extensive geographical area. Since the event will affect attainment status of Alamosa, Pagosa Springs, Grand Junction and Clifton only these data sets will be discussed in detail. A snapshot summary of data from all those sites affected by the event is presented in Table 23 **and** Table 24, along with the approximate percentile value that data point represents for each site for their unique historical data sets, for the month of the event (every sample in any May), and for the year of the event. All percentile calculations presented in this section were made using the entire dataset, including known high wind events. There is no difference between the two datasets (with and without high wind events) in regards to percentile calculations. Percentile calculations for all sites affected by the event are presented in Table 23 and Table 24, only those sites for which samples concentrations were in excess of 150 $\mu g/m^3$ will be discussed in detail.

Table 23: May 22, 2010, Site Percentile (All Affected Sites)

Evaluation	Alamosa ASC	Alamosa Muni	Pagosa Springs	Mt. Crested Butte
5/22/2010	**260 $\mu g/m^3$**	**194 $\mu g/m^3$**	**187 $\mu g/m^3$**	92 $\mu g/m^3$
Overall	99.77%	99.68%	99.78%	99.56%
All May	99.90%	99.21%	99.44%	99.25%
2010	99.68%	99.65%	99.35%	99.44%

Table 24: May 23, 2010, Site Percentile (All Affected Sites)

Evaluation	Parachute	Crested Butte	Mt. Crested Butte	Durango	Powell	Clifton	Telluride
5/23/2010	125 $\mu g/m^3$	87 $\mu g/m^3$	86 $\mu g/m^3$	88 $\mu g/m^3$	**155 $\mu g/m^3$**	**189 $\mu g/m^3$**	52 $\mu g/m^3$
Overall	99.63%	98.55%	99.38%	99.26%	99.87%	Max Value	96.81%
All May	98.28%	97.99%	99.15%	94.23%	99.23%	Max Value	92.64%
2010	100.00%	99.15%	99.16%	97.27%	Max Value	Max Value	96.52%

Of those samples in excess of 150 $\mu g/m^3$ generated by this event resulted in the maximum value at Clifton for any criteria, and the maximum value at Powell for 2010 and the second highest sample overall. The samples at Alamosa ASC, Alamosa Muni and Pagosa Springs on May 22

exceeded the 99th% value of any evaluation criteria. The overall magnitude and broad geographical extent of affected sites suggests that there was a common contribution to each sample from other than local sources.

Those data sets for sites with samples for which exclusion is being requested are further summarized by month. As with previous submittals these summaries the data presents no obvious 'season'; PM_{10} levels at any particular site in Colorado do not necessarily fluctuate by season. Of greater importance affecting day-to-day, typical PM_{10} concentrations are local sources, e.g. road sanding and sweeping, local burning from agriculture and residential heating, vehicle contributions via road dust, unpaved lots or roads, etc. While the historic monthly mean values for the affected sites can be higher during the winter and spring months there is little month-to-month variation. Additionally, some of the sites exhibit monthly medians over these periods (winter and early spring) that are generally lower than other months of the year. This time frame (winter and early spring) is that which is most likely to experience the regional meteorological and dry soil conditions necessary for this type of event and are discussed elsewhere in this document. Although the maximum values for these months (winter and early spring) are the highest in the data set the 'typical' data (i.e. day-to-day, reflective of local conditions) are similar or lower than the same 'typical' data for the rest of the year. The summary data for the month of May (all samples in any May) and for 2010 for Alamosa ASC, Alamosa Muni, Pagosa Springs, Powell, and Clifton are presented here, in Table 25**:**

Table 25: May 22 and 23, 2010, PM_{10} Evaluation by Month and Year

	Alamosa ASC		Alamosa Muni		Pagosa Springs		Grand Junction - Powell		Clifton	
	May	2010	May	2010	May	2010	May	2010	May	2010
Mean	25.4	23.5	33.7	26.6	29.3	24.3	32.5	22.9	33.3	23.0
Median	18	19	24	22	23	18	26	20	25	18
Mode	9	20	20	19	23	18	26	20	25	17
Std. Dev	30.3	26.5	34.3	22.8	26.8	28.7	29.7	17.2	27.5	19.9
Samp. Var.	916.8	704.1	1176.4	519.9	715.8	824.3	883.5	295.4	754.0	397.6
Minimum	2	2	1	5	2	4	4	4	6	5
Maximum	285	285	236	236	200	349	197.8	155	125	189
Count	193	314	202	285	204	310	69	108	40	120

Alamosa ASC – 080030001

The PM_{10} sample on May 22, 2010, at Alamosa ASC of 285 $\mu g/m^3$ exceeds the 99th percentile value for all may data, exceeds the 99th percentile value for all 2010 data, and is greater than the 99th percentile value (97 $\mu g/m^3$) for the entire dataset. Overall, this sample is the sixth largest sample in the entire data set and the second largest sample in 2010. The five samples greater than the event sample are all associated with high wind events. There are 2214 samples in this dataset. The sample of May 22 clearly exceeds the typical samples for this site.

The following plots graphically characterize the Alamosa ASC PM_{10} data. Figure 37, is a simple time series; every sample in this dataset (2005 – 2011) greater than 150 $\mu g/m^3$ is identified. Note the overwhelming number of samples occupying the lower end of the graph; an interested reader can count the number of samples greater than 100 $\mu g/m^3$. Of the 2214 samples in this data set less than 1% is greater than 100 $\mu g/m^3$.

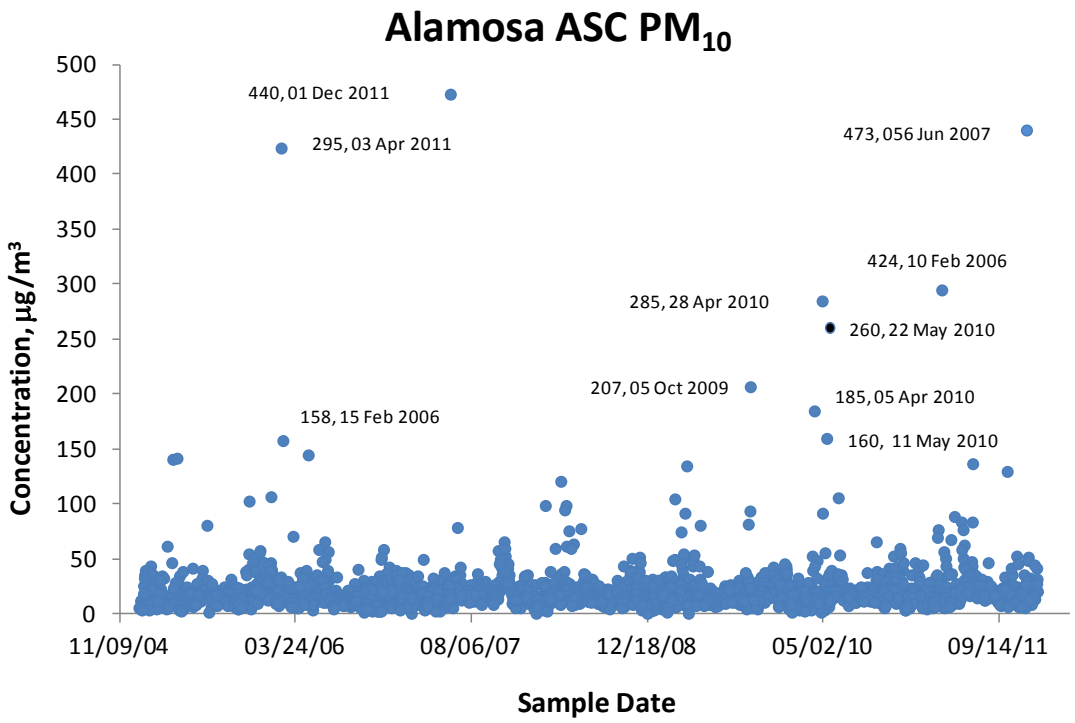


Figure 37: Alamosa Adams State College PM_{10} Time Series

Figure 38 is a simple histogram, demonstrating the overwhelming weight of samples on the low end of the curve. This range of data can be considered typical, representing contributions from local sources. Over 60% of the samples in this data set are less than 20 µg/m^3. Even in the highly variable month of winter and early spring over 90% of the samples are less than 50 µg/m^3. Clearly the sample on May 22, 2010, exceeds what is typical for this site.

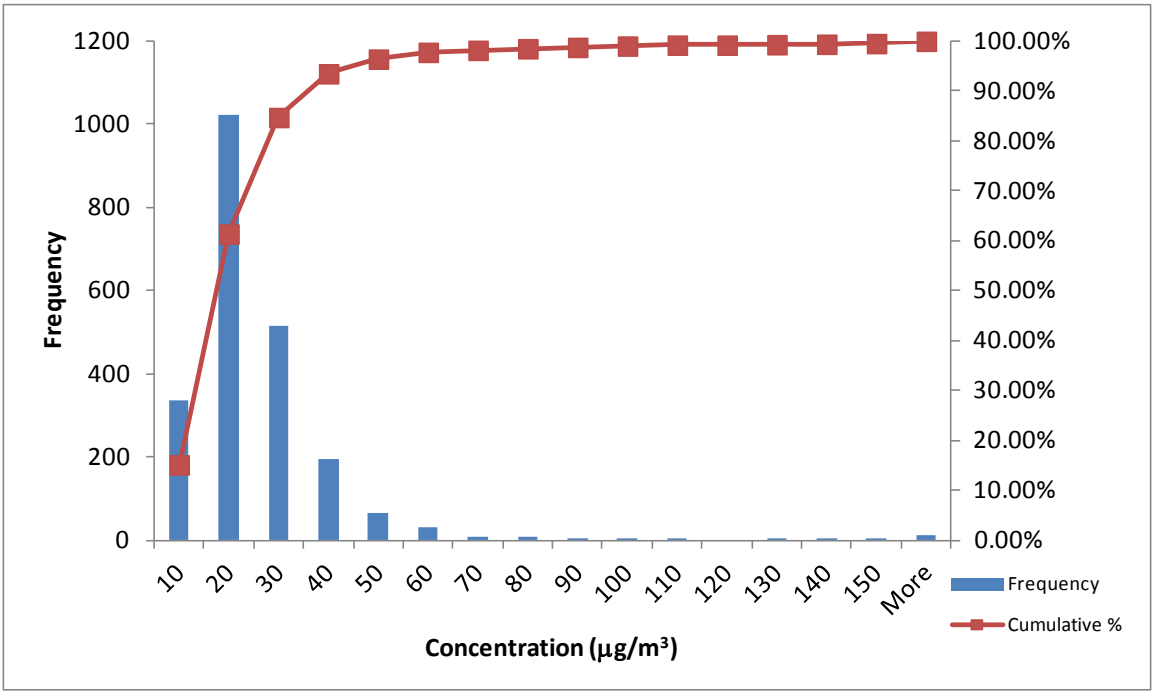


Figure 38: Alamosa Adams State College PM_{10} Histogram

The monthly box-whisker plot in Figure 39 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that's accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on May 22, 2010. Although these high values affect the variability and central tendency (average) of the dataset they aren't representative of what is typical at the site.

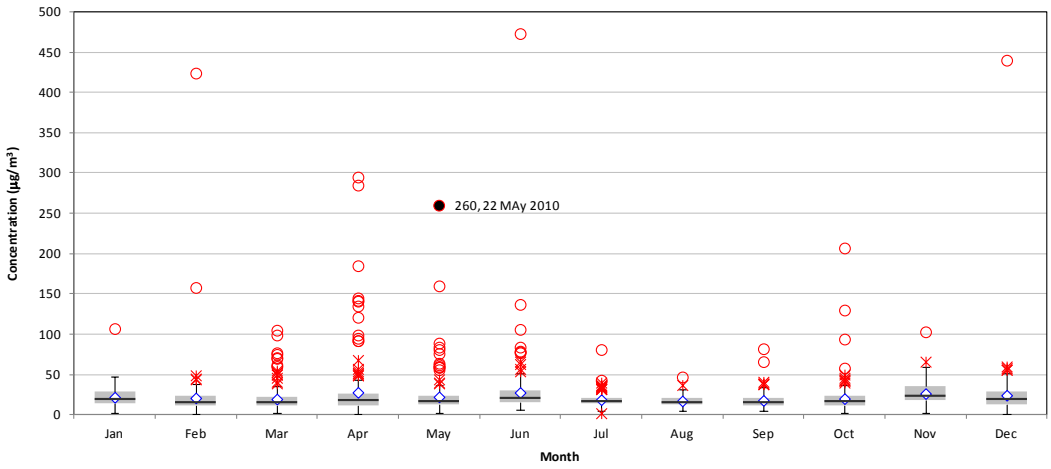


Figure 39: Alamosa Adams State College PM_{10} Box-whisper Plot

The box-whisper plots graphically represent the overall distribution of each data set including the mean (◊), the inner quartile range (IQR, defined to be the distance between the 75th% and 25th%), the median (represented by the horizontal black line) and two types of outliers identifed in these plots: outliers greater than 75th% +1.5*IQR (✳)and outliers greater than 75th% + 3*IQR (○). The outliers that satisfy the last criteria and are greater than 150 µg/m^3 are labeled with sample value and sample date. Each of these outliers is associated with a known high-wind event similar to that of 05 April.

The presence of the extreme values distorts the graph, losing definition and distorting information presented across the range where the majority of data resides. The same plot graphed to 100 µg/m^3, which includes almost 99% of all the data, is presented in Figure 40. This expanded plot demonstrates that November is the month where contributions from local sources are the highest of the year; November is the month with the highest median value, the broadest inter-quartile range and a monthly median value only slightly less than the monthly average.

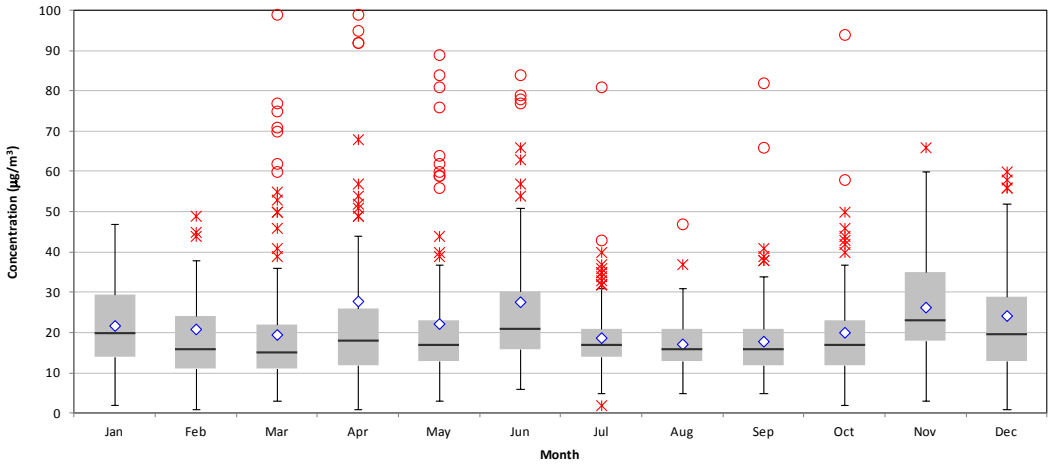


Figure 40: Alamosa Adams State College PM_{10} Box-whisper Plot, Reduced Scale

Note the degree to which the data in the months of winter and spring, including May, is skewed. The May mean (22.3 µg/m^3) is only slightly less than the 75th percentile value (23 µg/m^3). This is due to the presence of a handful of extreme values and can create the perception that those months experiencing these high wind events are somehow 'dirtier' than other months of the year. This data exposes that perception as flawed as the typical data is similar to every other month of the year. The sample of May 22, 2010, clearly exceeds the typical data at this site.

Alamosa Municipal – 080030003

The PM_{10} sample on May 22, 2010, at Alamosa Muni of 194 $\mu g/m^3$ exceeds the 99th percentile value for all May data, is the second highest value of all 2010 data, and is greater than the 99th percentile value (109 $\mu g/m^3$) for the entire dataset. Overall, this sample is the eighth highest sample in the entire data set and the second largest sample in 2010. The seven samples greater than the event sample are all associated with high wind events. There are 2168 samples in this dataset. The sample of May 22, 2010, clearly exceeds the typical samples for this site.

The following plots graphically characterize the Alamosa Muni PM_{10} data. Figure 41 is a simple time series, the sample of May 22 is identified. Note the overwhelming number of samples occupying the lower end of the graph; an interested reader can count the number of samples greater than 100 $\mu g/m^3$. Of the 2168 samples in this data set less than 1% are greater than 80 $\mu g/m^3$.

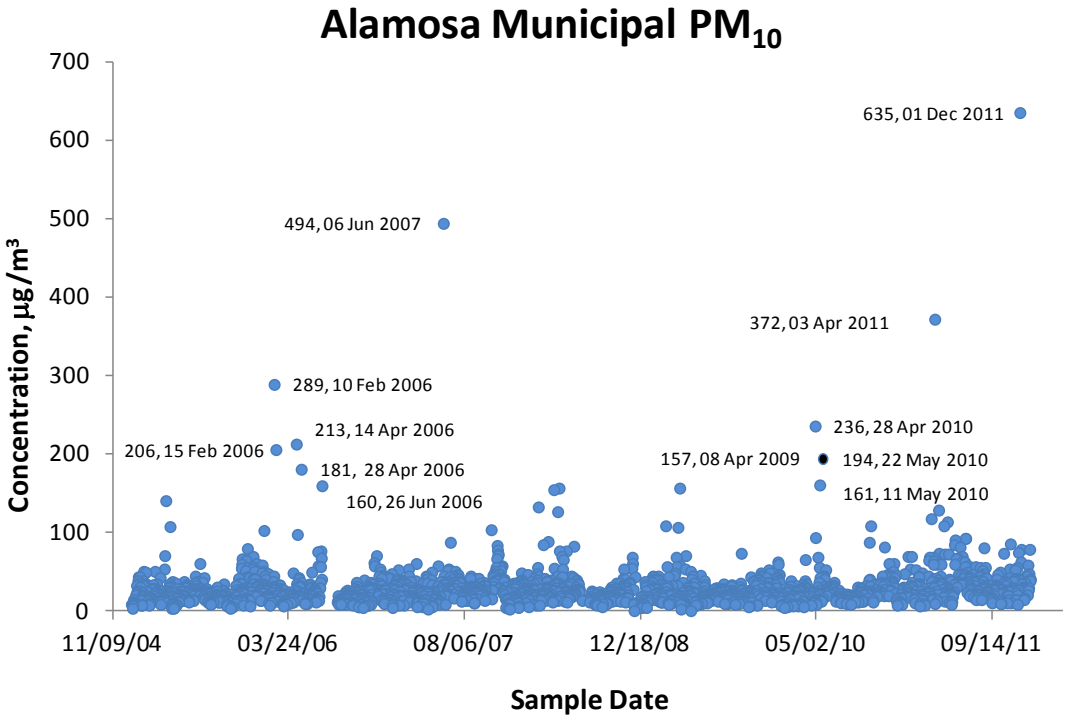


Figure 41: Alamosa Municipal PM_{10} Time Series

Figure 42 , is a simple histogram, demonstrating the overwhelming weight of samples on the low end of the curve. Over 80% of the samples in this data set are less than 30 $\mu g/m^3$. Even in the highly variable months subject to similar conditions typified by this event over 90% of the samples are less than 40 $\mu g/m^3$. Clearly the sample on May 22, 2010, exceeds what is typical for this site.

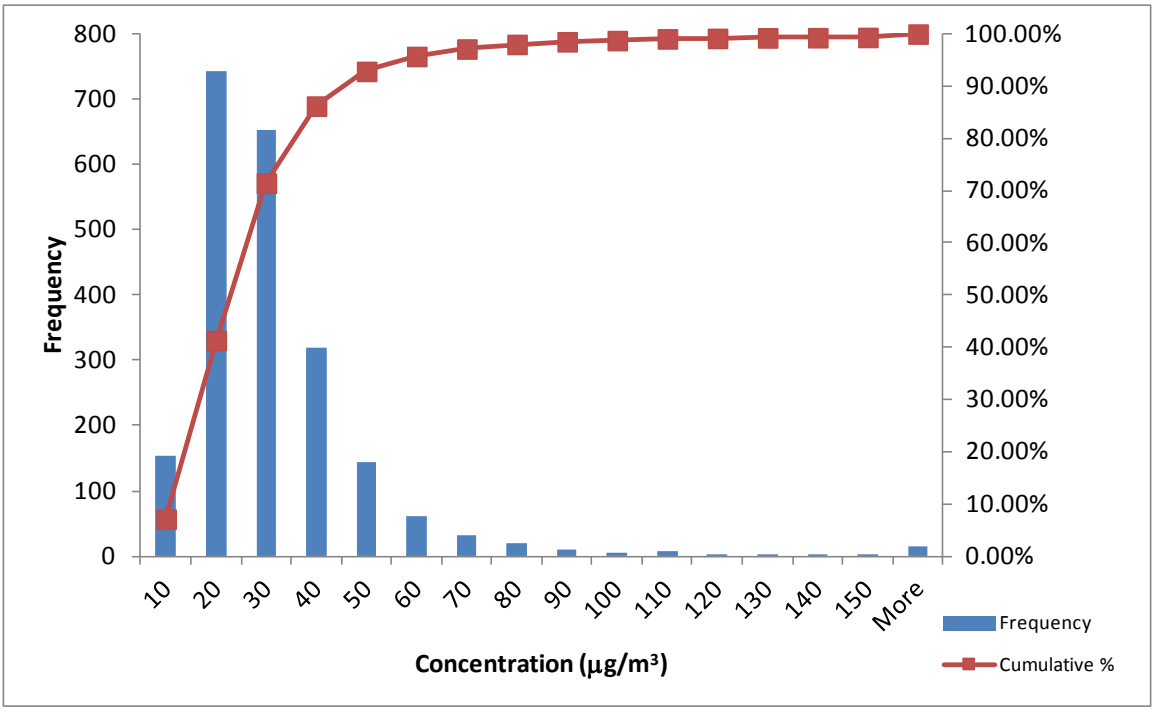


Figure 42: Alamosa Municipal PM_{10} Histogram

The monthly box-whisker plot in Figure 43 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that's accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on May 22. Although these high values affect the variability and central tendency (average) of the dataset they aren't representative of what is typical at the site.

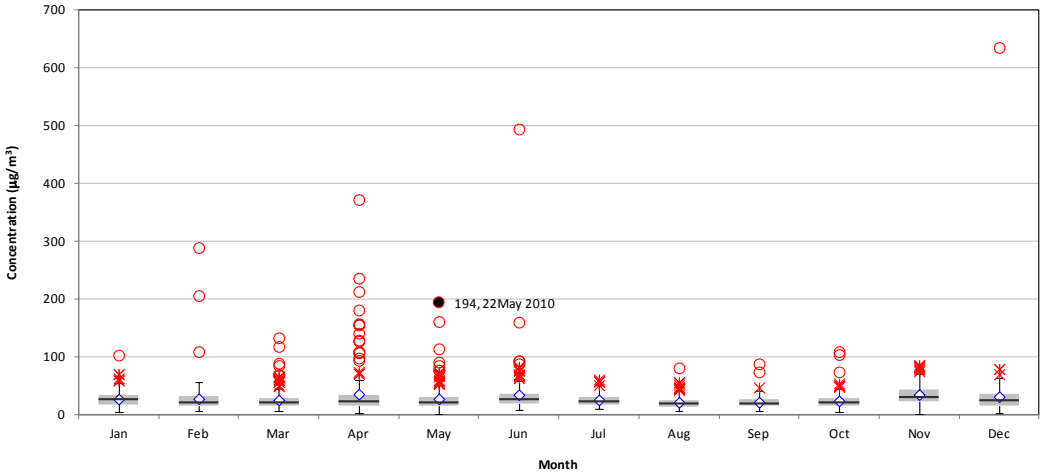


Figure 43: Alamosa Municipal PM_{10} Box-whisper Plot

The presence of the extreme values distorts the graph, losing definition and distorting information presented across the range where the majority of data resides. The same plot graphed to 100 $\mu g/m^3$, which includes almost 99% of all the data, is presented in Figure 44. As with Figure 40,

this expanded plot demonstrates that November is the month where contributions from local sources are the highest of the year; November is the month with the highest median value, the broadest inter-quartile range and a monthly median value only slightly less than the monthly average.

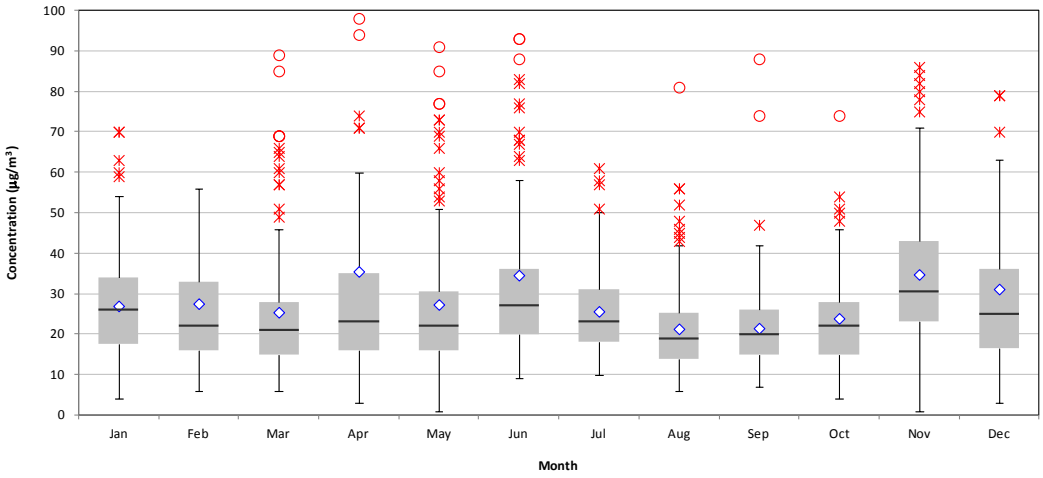


Figure 44: Alamosa Municipal PM_{10} Box-whisper Plot, Reduced Scale

Note the degree to which the data from the months of winter/spring, including May, is skewed. The May mean (27.3 µg/m^3) is nearly equivalenct to the 75th percentile value (30 µg/m^3). This is due to the presence of a handful of extreme values and can create the perception that those months experiencing these high wind events are somehow 'dirtier' than other months of the year. This data exposes that perception as flawed as the typical data is similar to every other month of the year. The sample of May 22, 2010, clearly exceeds the typical data at this site.

Pagosa Springs - 080070001

The PM_{10} sample on May 22, 2010, at Pagosa Springs of 187 µg/m^3 is greater than the 99th percentile value for any May, exceeds the 99th percentile value for any data in 2010, and exceeds the 99th percentile value for all data in this data set. There are 2287 samples in this dataset. The sample of May 22, 2010, clearly exceeds the typical samples for this site.

The following plots graphically characterize the Pagosa Springs PM_{10} data. Figure 45, is a simple time series, the sample of May 22 has been identified. Note the overwhelming numbers of samples occupying the lower end of the graph; of the 2287 samples in this data set less than 1% are greater than 110 µg/m^3.

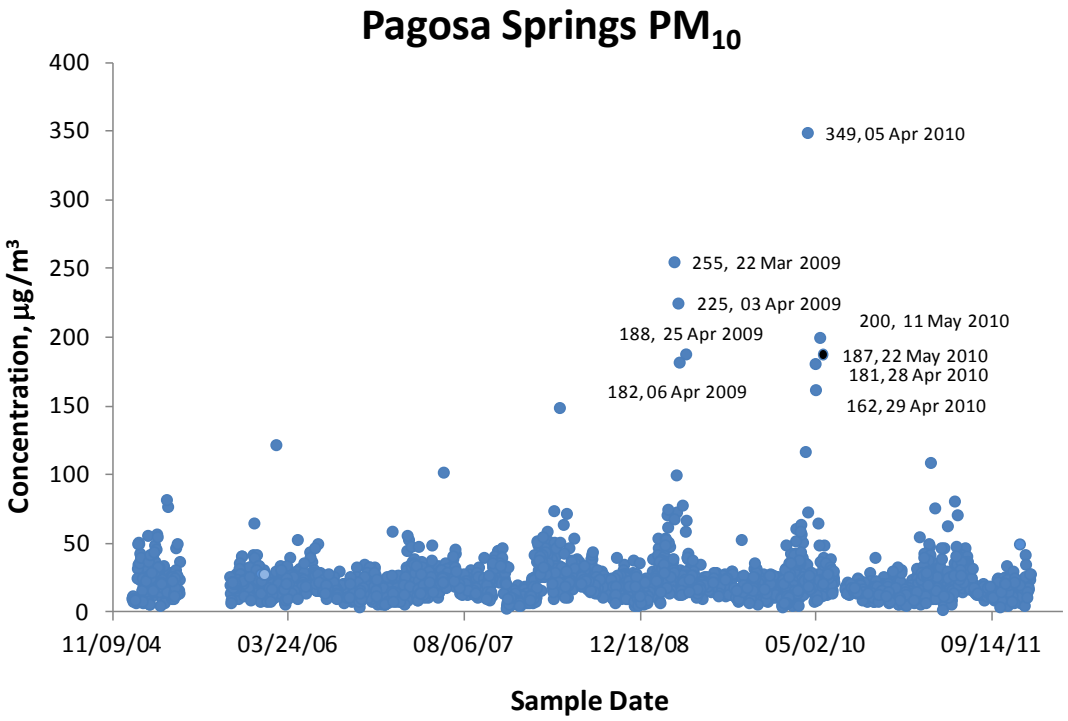


Figure 45: Pagosa Springs PM_{10} Time Series

Figure 46, is a simple histogram, demonstrating the overwhelming weight of samples on the low end of the curve. Over 50% of the samples in this data set are less than 20 µg/m^3. Even in the highly volatile month of May, 95% of the samples are less than 50 µg/m^3. Clearly the sample on May 22, 2010, exceeds what is typical for this site.

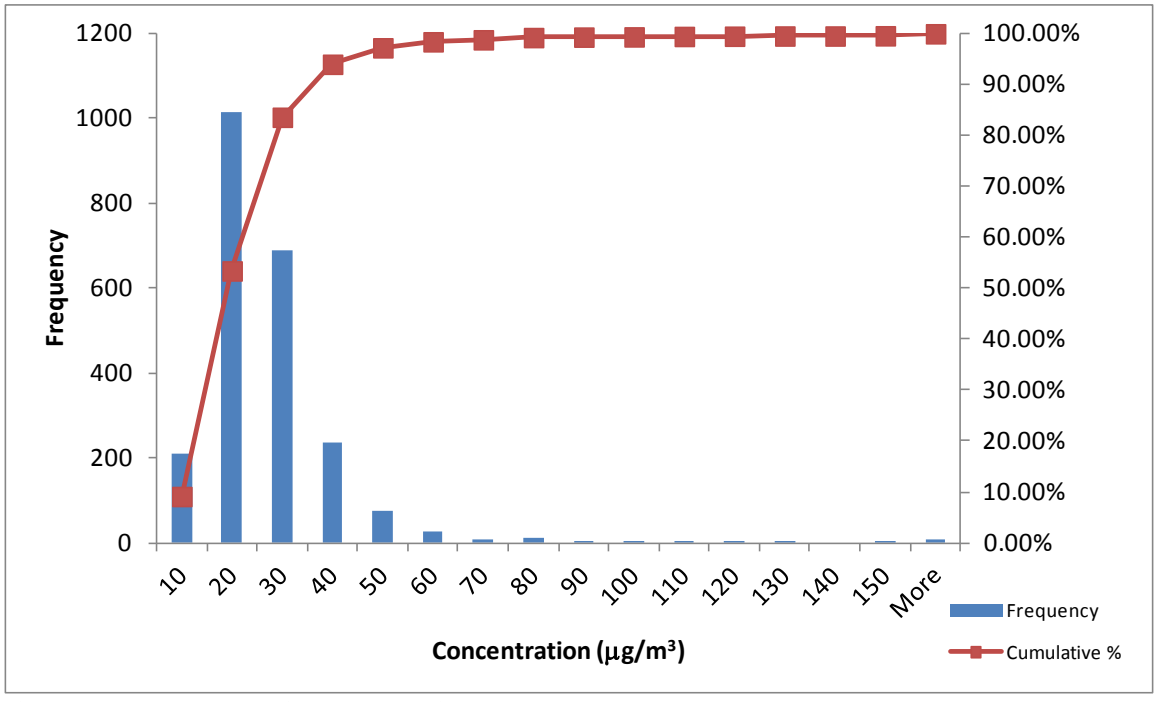


Figure 46: Pagosa Springs PM_{10} Histogram

The monthly box-whisker plot in Figure 47 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that's accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on May 22 and May 23, 2010. Although these high values affect the variability and central tendency of the dataset they aren't representative of what is typical at the site.

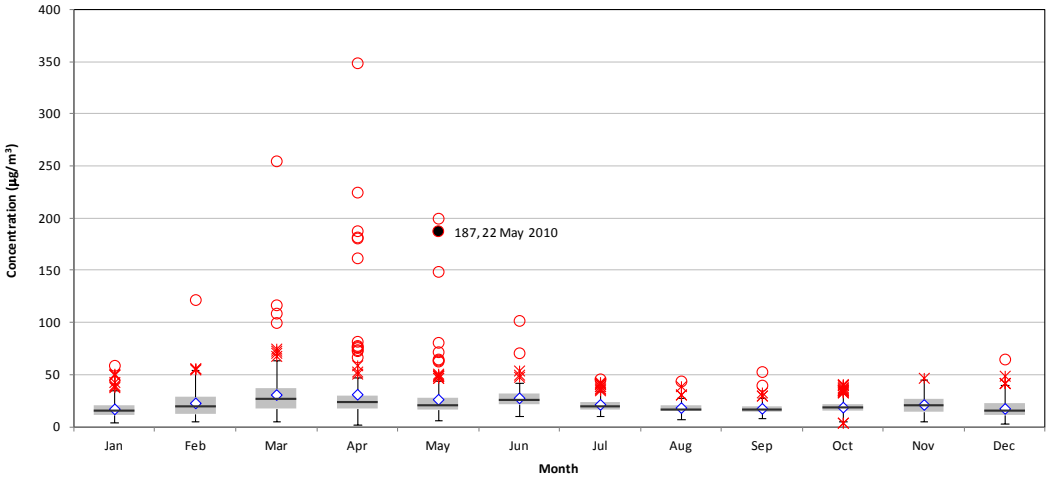


Figure 47: Pagosa Springs PM_{10} Box-Whisker Plot

As with the previous box-whisper plots the event sample is identified by concentration and date. Each of the samples greater than 150 µg/m^3 is associated with a known high-wind event similar to that of May 22 and May 23, 2010. The presence of these extreme values distorts the graph, losing definition and distorting information presented across the range where the majority of data resides. The same plot graphed to 100 µg/m^3, which includes almost 99% of all the data, is presented in Figure 48.

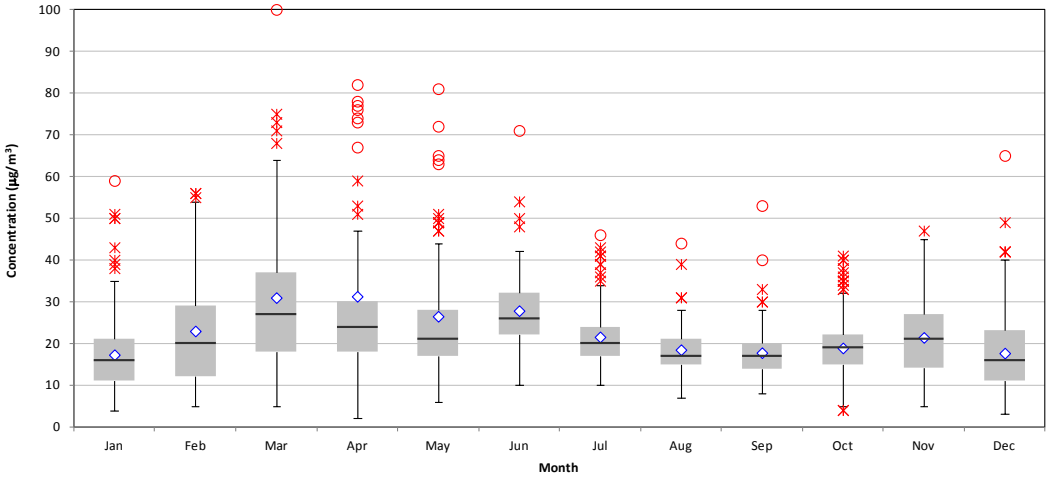


Figure 48: Pagosa Springs PM_{10} Box-whisper Plot, Reduced Scale

Grand Junction - Powell - 080770017

The PM_{10} sample on May 23, 2010, at Grand Junction – Powell (Powell) of 155 μg/m^3 is the 2nd largest sample in the data set, is the largest sample of all May samples and is the largest sample in 2010; there are 790 samples in this dataset. The sample of May 23 clearly exceeds the typical samples for this site.

The following plots graphically characterize the Powell PM_{10} data. Figure 49, is a simple time series, every sample in this dataset (2005 – 2011) greater than 150 μg/m^3 is identified. As with the previous time series an overwhelming number of samples occupy the lower end of the graph, 99% of all the samples in this dataset are less than 80 μg/m^3. Of the 790 samples in this data set exactly two are greater than 150 μg/m$^{3;}$ the other sample is related to a high wind event similar to this event. Clearly, the May 23 sample is not typical of samples at this site.

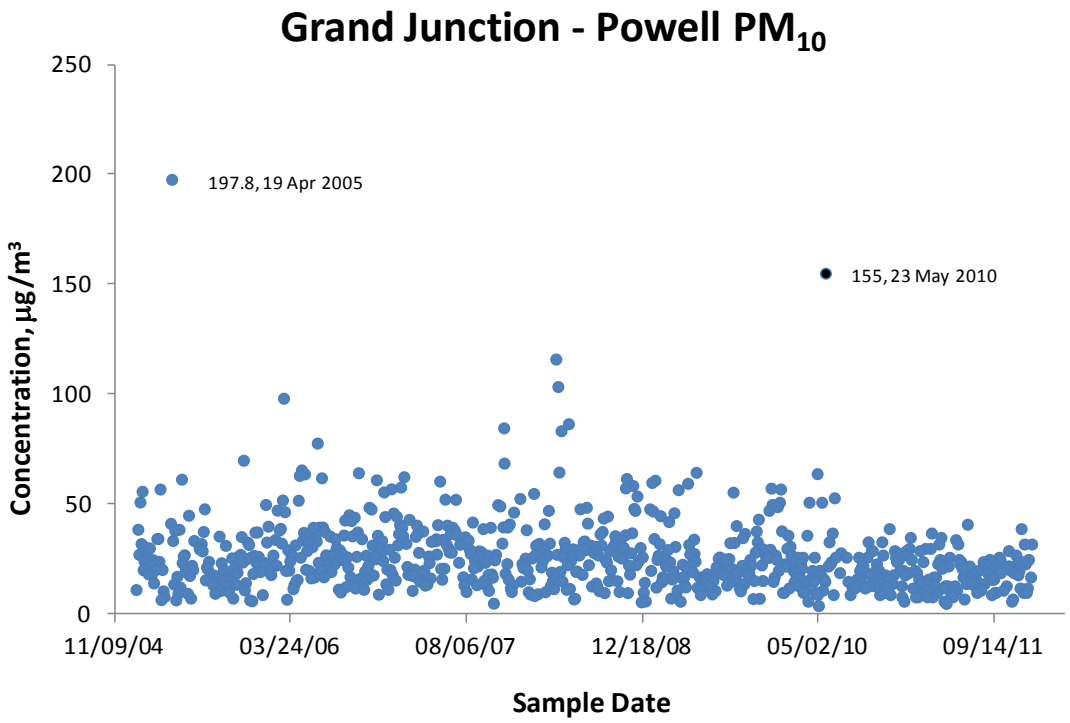


Figure 49: Grand Junction - Powell PM_{10} Time Series

Figure 50, is a simple histogram demonstrating the overwhelming weight of samples on the low end of the curve. Almost 50% of the samples in this data set are less than 25 μg/m^3. Even in the highly volatile months in winter/early spring, including May, over 90% of the samples are less than 50 μg/m^3. Clearly, the sample on May 23 exceeds what is typical for this site.

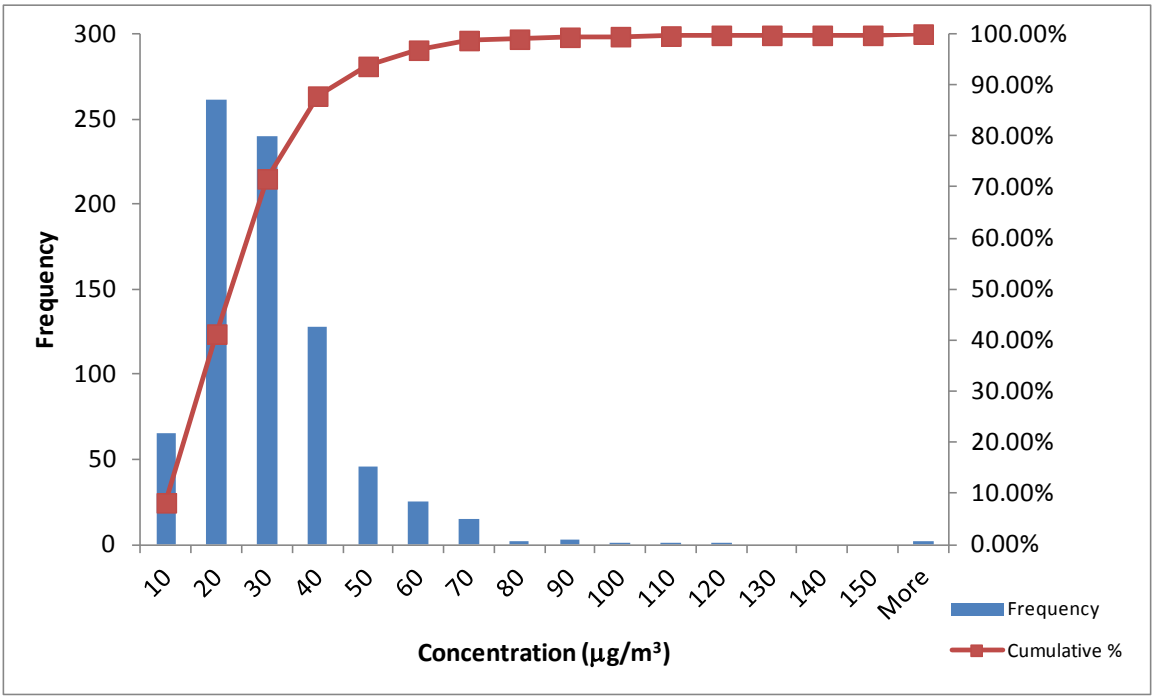


Figure 50: Grand Junction - Powell PM_{10} Histogram

The monthly box-whisker plot in Figure 51 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that's accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on May 23. Although these high values affect the variability and central tendency of the dataset they aren't representative of what is typical at the site.

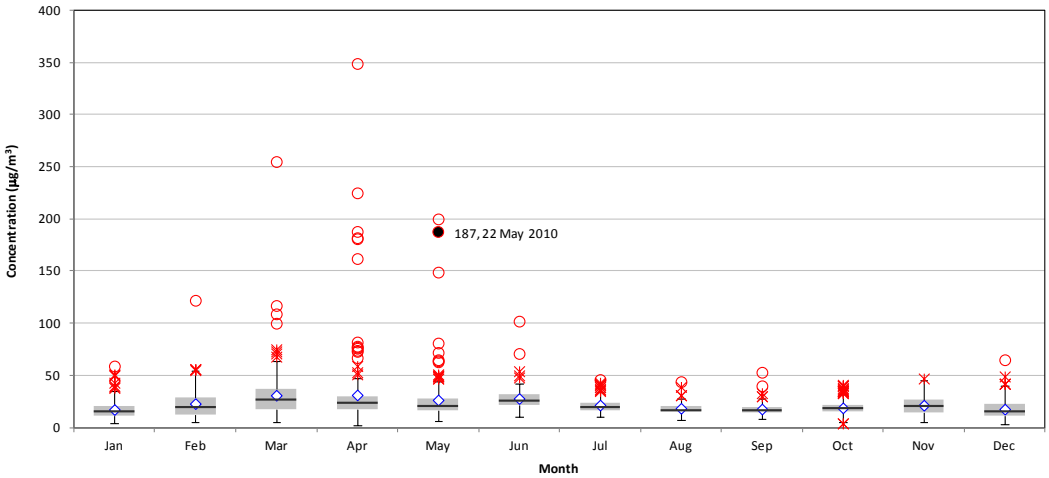


Figure 51: Grand Junction - Powell PM_{10} Box-whisper Plot

As with the previous box-whisper plots the event sample is identified by concentration and date. Each of the samples greater than 150 µg/m^3 is associated with a known high-wind event similar to that of May 22 and May 23, 2010. The presence of these extreme values distorts the graph,

losing definition and distorting information presented across the range where the majority of data resides. The same plot graphed to 100 μg/m^3, which includes over 99% of all the data, is presented in Figure 52.

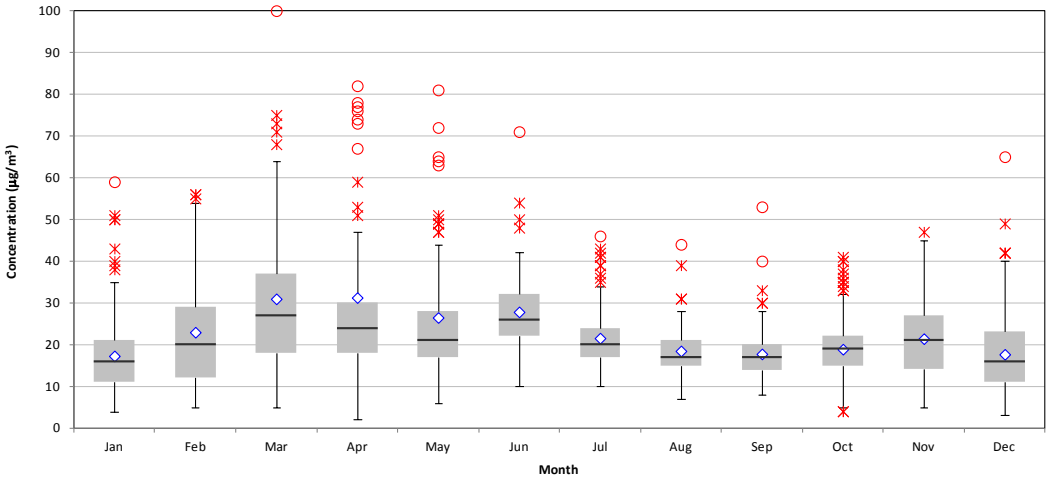


Figure 52: Grand Junction - Powell Box-whisper Plot, Reduced Scale

Clifton - 080770019

The PM_{10} sample on May 23, 2010, at Clifton of 89 μg/m^3 is the largest sample in the data set, is the largest sample of all May samples and is the largest sample in 2010; there are only 507 samples in this dataset. The sample of May 23 clearly exceeds the typical samples for this site.

The following plots graphically characterize the Clifton PM_{10} data. The first is a simple time series, Figure 53. Every sample in this dataset (2008 – 2011) greater than 150 μg/m^3 is identified. As with the previous time series an overwhelming number of samples occupy the lower end of the graph, 99% of all the samples in this dataset are less than 90 μg/m^3. Of the 507 samples in this data set this is the only one greater than 150 μg/m^3. Clearly, the sample of May 23 is not typical of samples at this site.

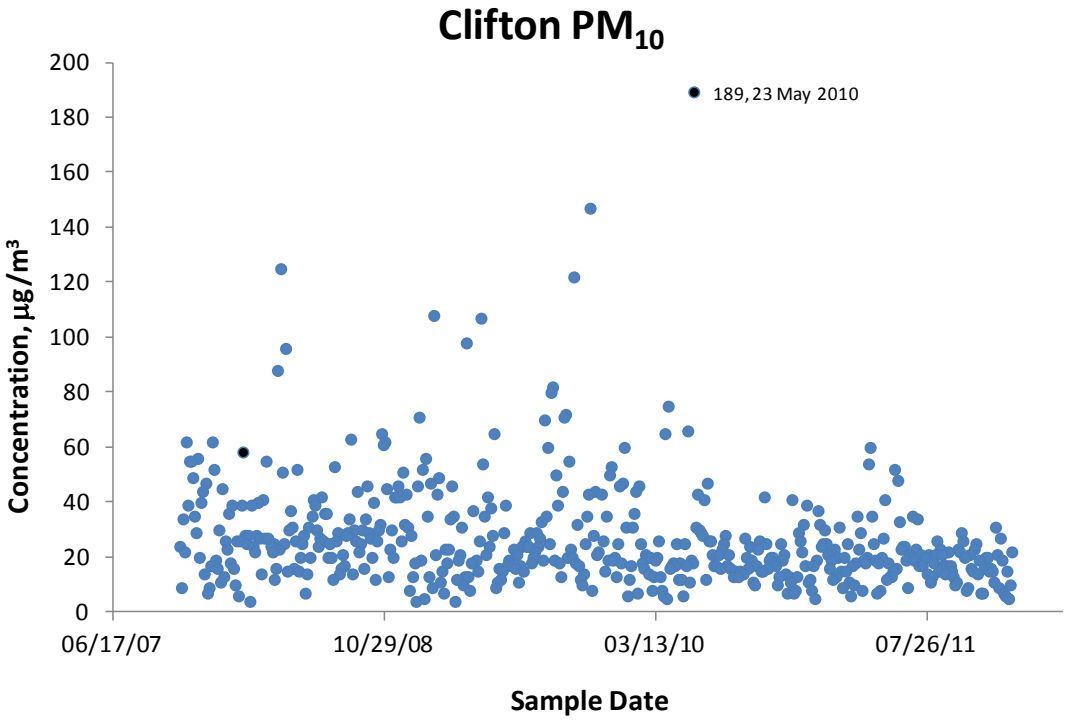


Figure 53: Clifton PM_{10} Time Series

Figure 54, is a simple histogram demonstrating the overwhelming weight of samples on the low end of the curve. Almost 75% of the samples in this data set are less than 30 µg/m^3. Even in the highly volatile months in winter/early spring, including May, over 90% of the samples are less than 50 µg/m^3. Clearly, the sample on May 23 exceeds what is typical for this site.

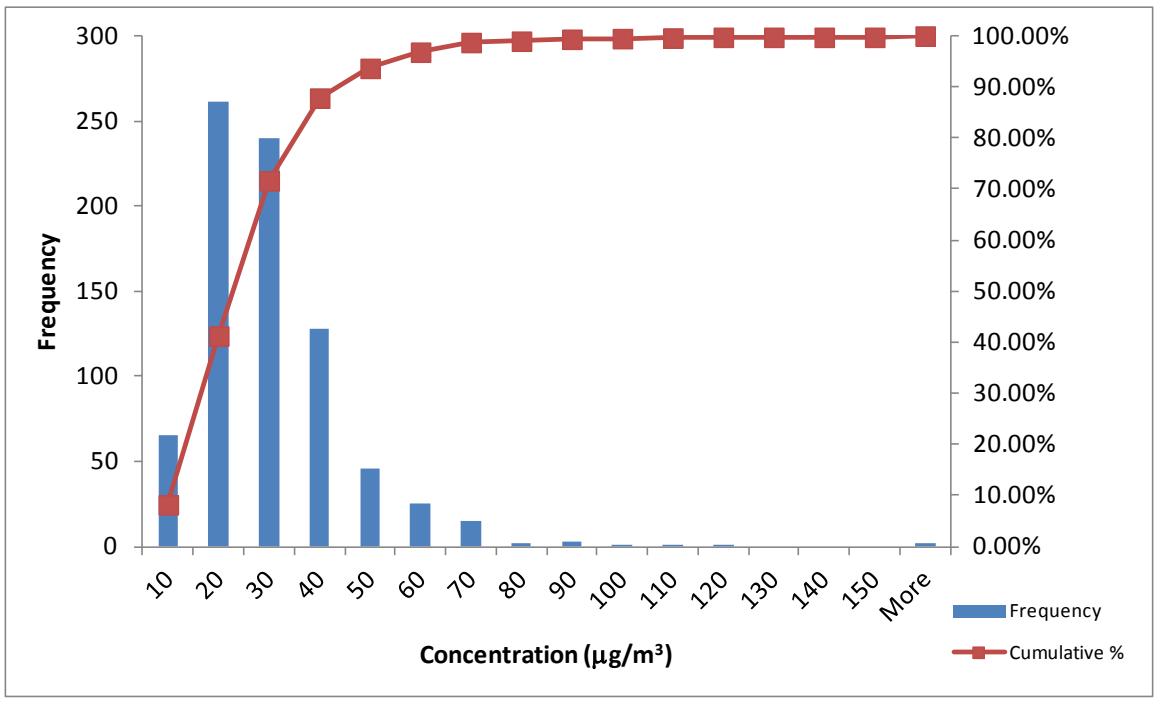


Figure 54: Clifton PM_{10} Histogram

The monthly box-whisker plot in Figure 55 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that's accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on May 23. Although these high values affect the variability and central tendency of the dataset they aren't representative of what is typical at the site.

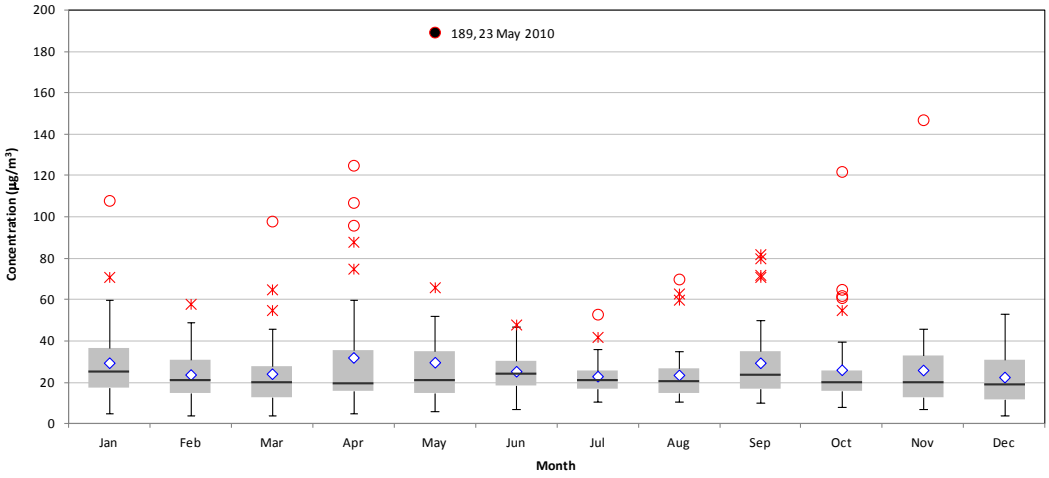


Figure 55: Clifton PM_{10} Box-whisper Plot

As with the previous box-whisper plots the event sample is identified by concentration and date. Most of the outliers on this Figure are associated with a known high-wind event similar to that of May 22 and May 23, 2010. The presence of these extreme values distorts the graph, losing definition and distorting information presented across the range where the majority of data resides. The same plot graphed to 100 µg/m^3, which includes all but six of the 507 samples, is presented in Figure 56.

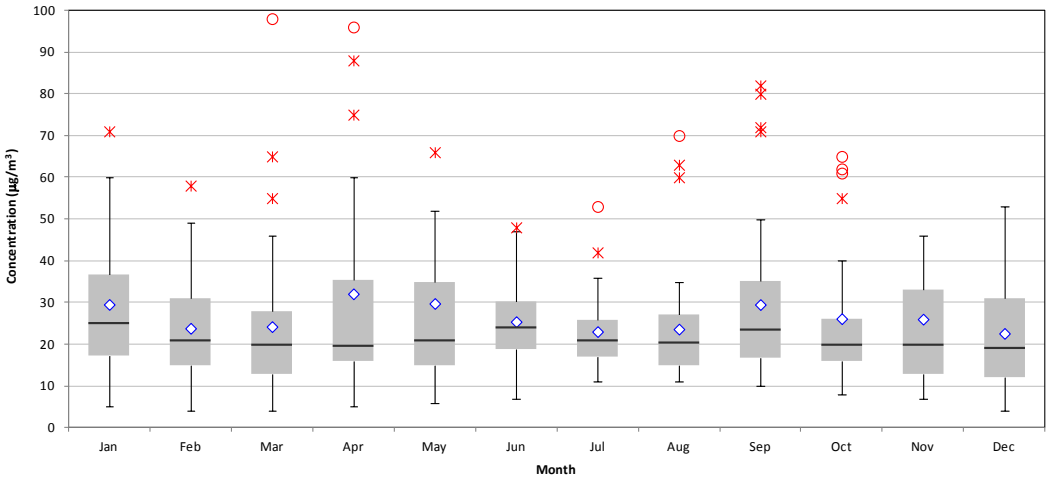
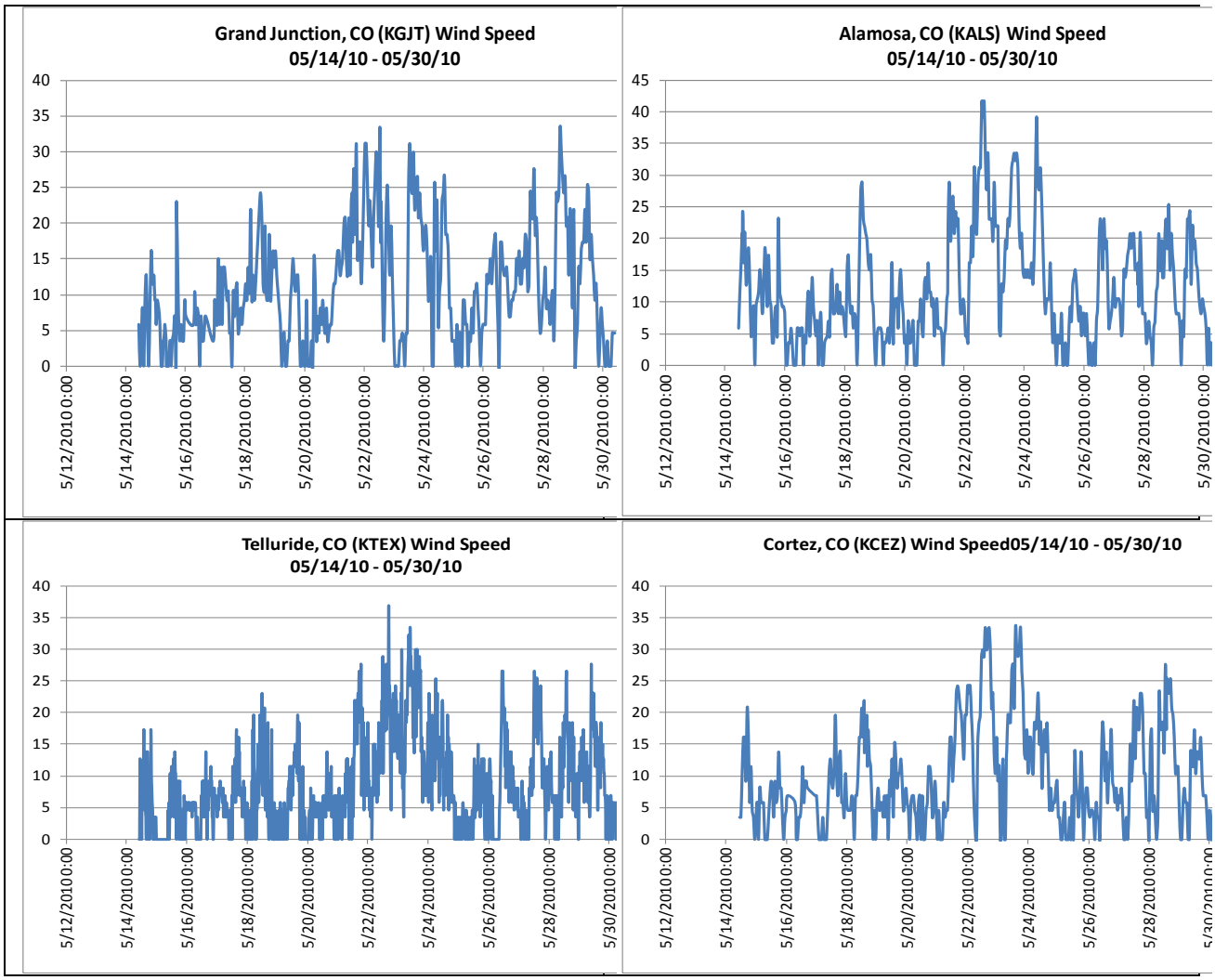


Figure 56: Clifton PM_{10} Box-whisper Plot, Reduced Scale

3.2 Wind Speed Correlations

Wind speeds around the region (Southwest Colorado, Northeast Arizona, Northwest New Mexico) increased early in the morning May 22 and stayed elevated through late afternoon of May 23, gusting to speeds in excess of 60 mph. The following charts display wind speed (mph) as a function of date from six widely dispersed stations throughout the region. Every one of these stations, despite being in completely disparate locations, exhibits nearly the same behavior in regards to the sustained high winds from May 22nd and 23rd.



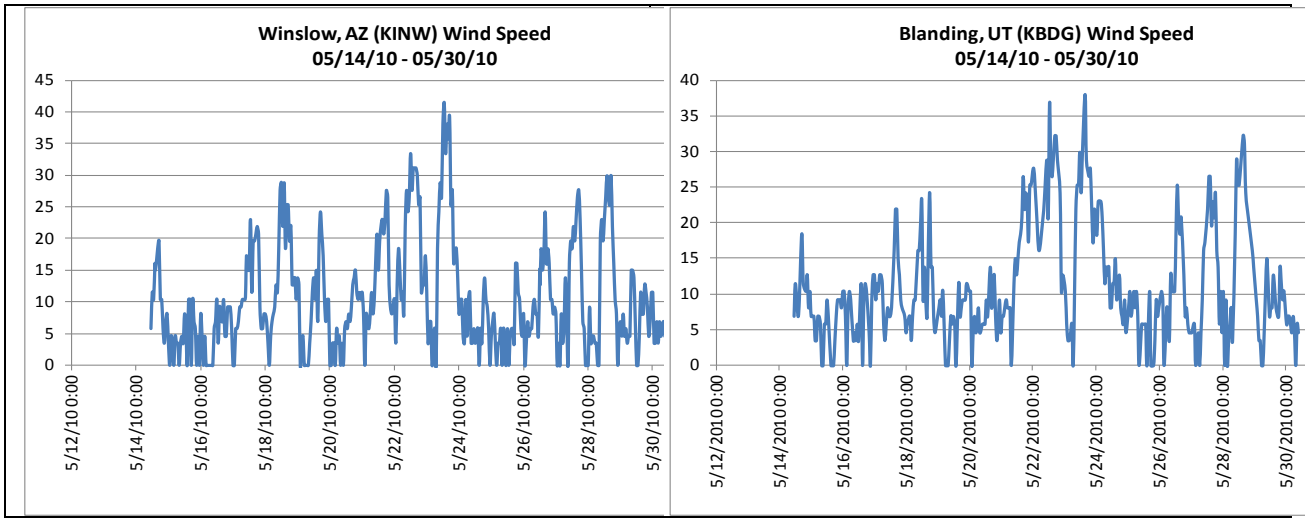


Figure 57: Wind Speed (mph) Various Stations, 05/14/2010 - 05/30/2010

Figure 58 plots PM_{10} concentrations from the affected sites in Colorado for the period for seven days prior to and following the sample(s) of May 22 and May 23, 2010.

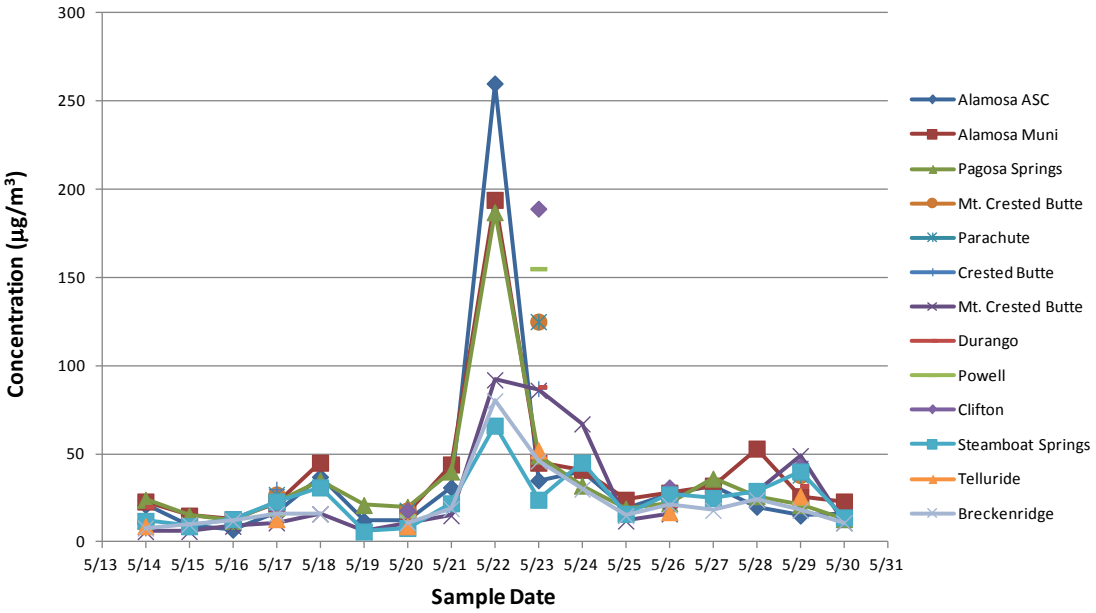


Figure 58: PM_{10} Concentrations, Affected Sites, 05/14/2010 - 05/30/2010

Figure 58 mimics the plots for wind speed, suggesting an association between the regional high winds and PM_{10} concentrations at the affected sites. Although not every sample from May 22 and May 23 is in excess of 150 elevated µg/m^3 the elevated concentrations are clearly associated with the elevated wind speeds. Given the spatial dislocation of the sites (meteorological and PM_{10}) the relationship between the two data sets would suggest that the regional high winds had an effect on PM_{10} samples across a broad spatial region in Colorado.

3.3 Percentiles

Monthly percentile plots in Figure 59 demonstrate a high degree of association between monthly median values and relatively high monthly percentile values, e.g. the r^2 value between the Alamosa ASC monthly 90th percentile value and the Alamosa ASC monthly median is 0.699. The same value(s) for Alamosa Muni and Pagosa Springs are 0.751 and 0.827, respectively. As the percentile value decreases (i.e. 85%, 75%, etc) the correlation between those values and the median increases sharply. The monthly percentile plots for each site are presented here (the black line is the 85th percentile):

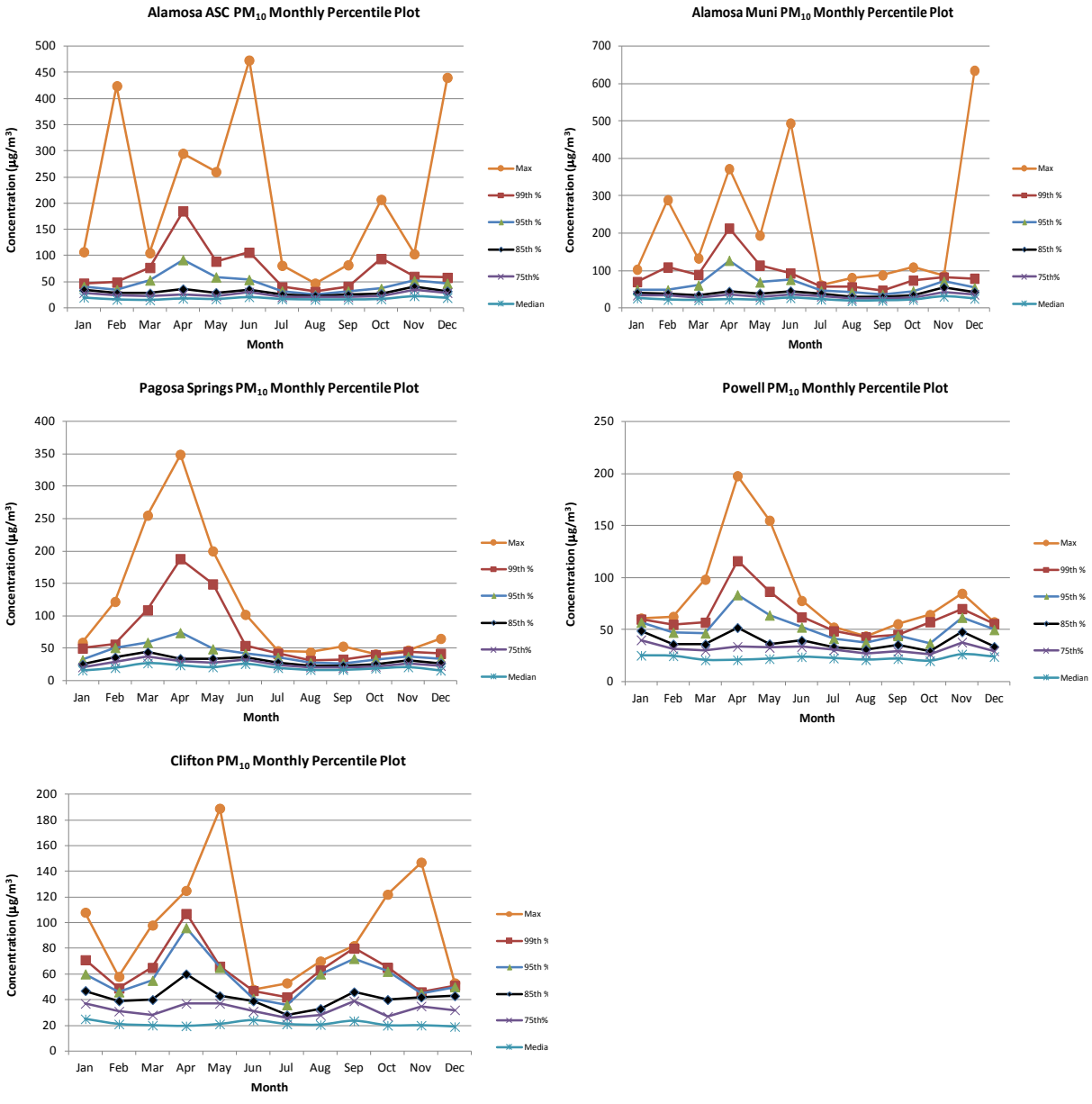


Figure 59: Monthly PM_{10} Percentile Plots

It is certainly the case that monthly median values are indicative of typical, day to day concentrations. Additionally, there is a range of samples that are a product of normal variation subject to typical, day to day local effects. This range may be restricted to percentile values that

are well correlated with the median. For the three larger data sets (Alamosa ASC, Alamosa Muni, and Pagosa Springs) a conservative estimate of the percentile value that is reflective of typical, day to day variation is the 90th percentile value. Nearly all of the variation in the monthly 84th percentile values of these three data sets can be explained by the variation in monthly medians; for these three sites the correlation between the median and 84th percentile values vary from an $r^2 = 0.88$ (Pagosa Springs) to an $r^2 = 0.94$ (Alamosa Muni). For the two smaller data sets a good estimate of the percentile value that is reflective of typical, day to day variation is the 70th percentile value. Using the 70th percentile value as the maximum amount contributed from local sources may artificially increase the indicated amount due to the event; based on the results from the larger data sets the 70th percentile value is an extremely conservative estimate. For the three larger data sets the 90th percentile represents a reasonable estimate of the contribution that could have come from local sources; the portion of the sample concentration remaining would be due to the event. The following tables identify various percentile values that are representative of the maximum contribution due to local sources for each site from all May data for both sample dates. In Table 26, the range estimate in the 'Est. PM_{10} Contribution' column is derived using the difference between the actual sample value and the 90th percentile as the minimum event contribution estimate and the difference between the actual sample value and the 84th percentile as the maximum event contribution estimate. This column represents the estimated contribution to the May 22, 2010, sample at the sites listed in the table from the high wind event. In Table 27, the estimate in the last column is simply the difference between the actual sample value and the 70th percentile value as the maximum event contribution estimate for the affected sites on May 23, 2010.

Table 26: Estimated Maximum Event PM_{10} Contribution - Alamosa ASC, Alamosa Muni, Pagosa Springs

Site	Event Day Concentration ($\mu g/m^3$)	May Median ($\mu g/m^3$)	May Average ($\mu g/m^3$)	May 75th % ($\mu g/m^3$)	May 84th % ($\mu g/m^3$)	May 90th % ($\mu g/m^3$)	Est. PM_{10} Contribution ($\mu g/m^3$)
Alamosa ASC	260	17	22.2	23	33	35	**225 - 227**
Alamosa Muni	194	22	27.3	30	38	45	**149 - 156**
Pagosa Springs	187	21	26.5	28	33	38	**149 - 154**

Table 27: Estimated Maximum Event PM_{10} Contribution - Powell, Clifton

Site	Event Day Concentration ($\mu g/m^3$)	May Median ($\mu g/m^3$)	May Average ($\mu g/m^3$)	May 70th % ($\mu g/m^3$)	Est. PM_{10} Contribution ($\mu g/m^3$)
Powell	155	22	27.0	27.7	**127**
Clifton	189	21	30.0	25	**164**

Clearly, there would have been no exceedance but for the additional contribution to the PM_{10} samples provided by the event.

Since the local anthropogenic sources are well controlled in Alamosa, Pagosa Springs, and Grand Junction and the sustained surface wind speeds were well above 25 mph in the region of the dust storm, it follows that the dust was transported into the region on May 22 and 23, 2010. This high wind blowing dust event affected the air quality in Alamosa, Pagosa Springs, and Grand Junction

in the state of Colorado on May 22 and 23, 2010. The size, extent, and origination of the blowing dust storm made the event not preventable and it could not be reasonably controlled. Statistical data clearly shows that but for this high wind blowing dust event in Alamosa, Pagosa Springs, and Grand Junction would not have exceeded the 24-hour NAAQS on May 22 and 23, 2010.

4.0 News and Credible Evidence

High winds create havoc across southern Colorado

by Matthew Kruger

Posted: 05.24.2010 at 4:06 PM

Read more: Local, State,Environment, Weather, High Wind Warning, Power Lines,Power Outage, Windy,Winds, Pueblo, Colorado Springs

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High winds / FOX21/Matthew Kruger

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COLORADO SPRINGS, COLO. -- Extreme gusty winds, sometime hurricane-force, blew across southern Colorado Monday.

Winds all over El Paso County gusted upwards of 70 mph. These winds blew on already-stressed trees, knocking them down. Some trees fell on power lines, taking out power to some homes and even sparking some fires.

The winds are downslope, which dry out the atmosphere. These downslope winds increase fire danger to the "high" category.

The Colorado Springs Fire Department wants the public to be aware of damage reporting procedures. If it is an emergency, or if you see a small fire or smoke, call 9-1-1.

If is non-emergency damage, call (719) 444-7000.

Click on the video icon to view the story as it aired on FOX21 News.

http://www.fox21news.com/news/story.aspx?id=461361#.UYpf1qLFXYw

High winds rip through Colorado's Front Range

POSTED: 05/25/2010 01:00:00 AM MDT
UPDATED: 05/25/2010 05:56:59 AM MDT

By Joey Bunch
The Denver Post

John Willey checks the damage to his car at East 11th Avenue and Grant Street in Denver after fierce winds toppled a cottonwood Monday. Weather experts say such winds at this time of year are unusual. (RJ Sangosti, The Denver Post)

The pounding winds that raked the Front Range on Saturday and Monday were unseasonal, coincidental and unlikely to repeat themselves right away, weather experts said.

The 70-mph gusts and sustained winds of up to 45 mph mowed down trees and blew down branches, peeled off part of the roof at Aurora's Range view High School, and caused numerous flight cancellations and delays at Denver International Airport.

Eastbound Interstate 70 outside Aurora was closed for a time because of the winds. Four semi-trucks and one RV blew over on I-70 between Watkins and Limon on Monday afternoon, but only minor injuries were reported.

The winds were partly caused by strong low-pressure systems in Wyoming, according to the National

HIGH WINDS

- **View** images of Colorado's day of high winds, Monday, May 21.

Weather Service. At the same time, there was a great pressure difference between the cold, damp Western Slope and the hot, dry Eastern Plains.
As a result, the Front Range, caught in the middle, became a wind tunnel, said Jim Kalina, a meteorologist at the National Weather Service in Boulder.

"This is not completely uncommon, but it's a little out of season," he said. "Usually, the strongest winds we get in Colorado come in January from the chinook winds. That's our windy season."

Kalina said the dynamic stems from bora winds, a downslope similar to the chinooks, but colder and drier. Bora winds originate from inland areas of Canada and the Arctic, rather than from the Pacific Ocean.

Bora winds usually pass over Colorado in late winter or earlier in the spring, he said.

And such winds don't stick around. By midnight Monday, the gusts that rocked the Rockies were expected to be in eastern Montana, he said.

High-wind warnings for the Front Range expired at 7 p.m.

The Front Range will remain breezy for a few days. Wind gusts are expected to hit 25 mph through Wednesday, with 37-mph gusts Thursday. High temperatures in the 80s are expected all week, with little chance of rain.

COLORADO WEATHER

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While the winds have brought down a number of limbs across the Denver-metro region, any future damage depends on the trees' health long before the recent winds, said Jill McGranahan, spokeswoman for the Denver Parks and Recreation Department, which oversees the city's trees.

Trees most likely to come down in strong winds are those with shallow roots, such as evergreens, she said. Also, most big limbs that fall were sickly before.

The city doesn't require residents to hire a tree service to inspect damage, but it's recommended to check and trim limbs that might have cracked, McGranahan said.

"This is one of those situations where an ounce of prevention really is worth a pound of cure," she said. "It's best to stay on top of it before you get the high winds that will eventually bring a limb down."

Monday's blow was, at times, chaotic and violent, prying up a 50-foot-square portion of roof at Rangeview High. No one was injured. School is out for the summer, and the few students on campus for activities were not threatened, according to a school spokesperson.

DIA's largest carrier, United, canceled more than four dozen flights, and delays of more than 30 minutes were common.

Xcel Energy spokesman Mark Stutz said the wind caused several dozen small outages, "galloping wires and some snap-offs" of lines. Several thousand customers were temporarily without power Monday.

A 3,200-acre fire near Telluride, which was fortunately tamped down by overnight rain and snow, remained under control Monday.

In Agate, northwest of Limon, the post office branch closed after the postmistress spotted cracks in the building from the wind, and an attached building collapsed.

Staff writers Kieran Nicholson, Howard Pankratz and Ann Schrader contributed to this report. Joey Bunch: 303-954-1174 or jbunch@denverpost.com

osted: Mon 6:05 PM, May 24, 2010

A A

Reporter: James Hopkins Email

Updated: Tue 9:40 AM, May 25, 2010

Back to Weather

High winds ruin weekend plans

GRAND JUNCTION, Colo. (KKCO) - For the fourth day in a row, the Grand Valley had to fight strong winds, blowing dust and cooler temperatures.

Good news, the end is near. The winds should be gone shortly after sunset Monday.

Just like the seemingly never–ending winter, this spring has been full of surprises. Unlike most spring storms, this one is a very slow mover and the relentless wind is starting to rub people the wrong way.

It all started Friday afternoon. Winds came out of the southwest around 20 miles an hour with gusts up to 40 and they only got stronger.

"Sometimes the wind got so heavy my coat blew off my shoulders," says Andrew Fodera.

"I've never seen anything like it in all my life," says Penny Hopson.

"The wind is terrible, I'd much rather have snow and rain than wind any day," Jerry Card.

Winds topped out around the Grand Valley near 50 miles an hour,
and in some places, between 60 and 70 miles an hour, which ruined some weekend plans.

"My wife had a baby shower in Palisade and it ruined it, they had to move the shower inside," says Card.

"We tried to plant flowers and it blew the flowers and the dirt away," says Hopson.

All that dirt made breathing and seeing a challenge. "I couldn't walk anywhere for the fact of all the dust," says Fodera.

"I could see the outline of the Mesa and the mountains and down the road a few miles," says Card.

Early Monday morning, the Grand Junction Fire Department was called out to a fire in the Redlands. "It started with a controlled burn that got out of control," says Mike Page of the Grand Junction Fire Department.

The strong winds caused the fire to spread quickly and break out of the planned boundary. "They had a cleared space that would have been great on a day when the wind wasn't blowing," says Page.

The wind was caused by a slow moving, but strong, cold front. The front passed through Sunday night, knocking Monday's daytime high down by 20 degrees. "I woke up this morning and it was 44 degrees and I was cold," says Hopson.

But for most, the cooler temperatures are a welcome sight, if that means the wind will soon be gone. "If that's the case then back to normal life, mountain biking and fun stuff like coming outside," says Card.

The Fire Department recommends for people who want to burn to use common sense. Even if there isn't Red Flag warning, don't burn on days when the winds are forecasted to be high.

http://www.nbc11news.com/weather/headlines/94785124.html

Wind, Sand And More Wind

May 11, 2010

Lake Powell

View from our Lake Powell Campsite

Heidi's first water adventure

Show all 16 photos

We've spent the last several days exploring the desert around the Utah/Arizona borders. We are getting our fill of warm, dry and bug-free weather before we head east.

We stayed a couple nights at Lake Powell – a man-made lake on the Colorado River, north of the Grand Canyon. Lake Powell was created when the Glen Canyon Dam was built managing the flow of the Colorado. It is a very scenic area with many natural geologic wonders. Lake Powell is part of the Glen Canyon National Recreation Area controlled by the National Park System.

We spent a day on the lake in our Achilles inflatable boat. This was Heidi's first experience on the water and we were thrilled with how calm and comfortable she was in the boat. She did not attempt to get into the water and we did not encourage it. The water was cold and neither Marty nor I wanted to get wet in case Heidi needed assistance. We will reserve that excitement for later in the summer.

We continued our journey just north of the Arizona border into Monument Valley. Monument Valley is part of the Navaho Nation Indian Reservation and not a National or State Park. It gained fame in the 1930's as a setting for many movie westerns and was favored by director John Ford and actor John Wayne (Stagecoach). We stayed at the only place around – Goulding's Resort – which provides camping and hotel lodging – along with a restaurant, gas station, grocery store, museum and gift shop.

Our stay at Monument Valley was frustrating. The wind was howling and tearing through the Valley, whipping up the sand and making being outside torture. According to the employees, sand storms are not uncommon. Dirt, grit and sand obliterated the Valley

views and got into our eyes, ears and mouths. Cold and snow is much more acceptable than high winds and blowing sand. It was miserable.

We had one clear day and we took the Jeep out on the “17-mile” drive. It is a rough dirt road that traverses the valley. You can take one of the guided tours for $40+ a person – in a very uncomfortable looking, open air truck – or drive it yourself for $5 a person. The road was particularly bad in only a few spots and there were numerous Europeans driving their rental motorhomes down the road. This made for some additional entertainment and a reason not to rent out your RV.

While I found Monument Valley to be spectacular and beautiful, it is in an out of the way location, expensive and has limited things to do. I would not recommend it as a vacation destination unless you’ve already seen your fill of Bryce, Zion, Capital Reef and Arches National Parks. The National Parks offer so much more for a family to do, easier access and a better dollar value with similar stunning views.

The wicked winds appear to be following us as we continue our eastward travels, so I’ll keep repeating…it is all part of the adventure!

http://www.mytripjournal.com/travel-516529-lake-powell-monument-valley-national-sand-canyon-part

Winds push San Miguel Canyon fire to 3,200 acres

POSTED: 05/24/2010 01:00:00 AM MDT

By Jessica Fender
The Denver Post

A wind-whipped wildfire that started near Norwood in the San Miguel Canyon corridor of western Colorado grew to more than 3,200 acres Sunday evening as flames moved mostly into parkland and authorities struggled with complex terrain.

The 45- to 60-mph gusts that kicked up Saturday may have sparked the fire by knocking a tree onto a power line, San Miguel County Commissioner Joan May said.

Officials with the Montrose Interagency Fire Management Unit, which is battling the blaze with dozers and more than 180 firefighters, said downed power lines caused the blaze.

There was no estimate on when crews would contain the fast-moving blaze, said Chris Barth, spokesman for the interagency response team.

"This is a particularly complicated fire," he said. "There's a lot of diverse terrain — valley bottoms to mesa tops — and there's a lot of fuel."

Given the soggy spring, May said, the fire has taken local residents by surprise.

"It's been a pretty wet spring, but the wind just dried everything out so quickly. Lots of trees are down all over," May said. "The people in Norwood are just paying attention and on alert."

Authorities believe the fire started Saturday afternoon near the intersection of Colorado 145 and Goodenough Road, about a mile southeast of Norwood.

Residents in areas bordering the U.S. Bureau of Land Management and Forest Service property — Wrights Mesa, Iron Springs, Brown Ranch and MacKensie Mesa — have been asked to clear downed trees and dried brush from around their homes. They've also been asked to ready their personal belongings and livestock for a possible evacuation.

Along Sanborn Park Road, the three caretakers at the Cascabel private fly- fishing resort spent Saturday night crammed into a camper trailer at the top of Sanborn Hill.

They returned to the property Sunday but are ready to evacuate if the winds change, said Tyler Cramer.

"On top of Sanborn, you could see a huge plume of smoke. It seems to have calmed down a little bit, but it's really windy," said Cramer, who brought along the property's two cats and dog on the brief evacuation. "It was so windy and smoky that we couldn't let them out."

While the rising tower of gray smoke is visible from Norwood, no evacuation warnings have been issued there, members of the community said.

The flames soared 300 feet into the air at their highest point. Crews worked through Saturday night and used the morning to set strategy and bulldoze new fire lines, Barth said.

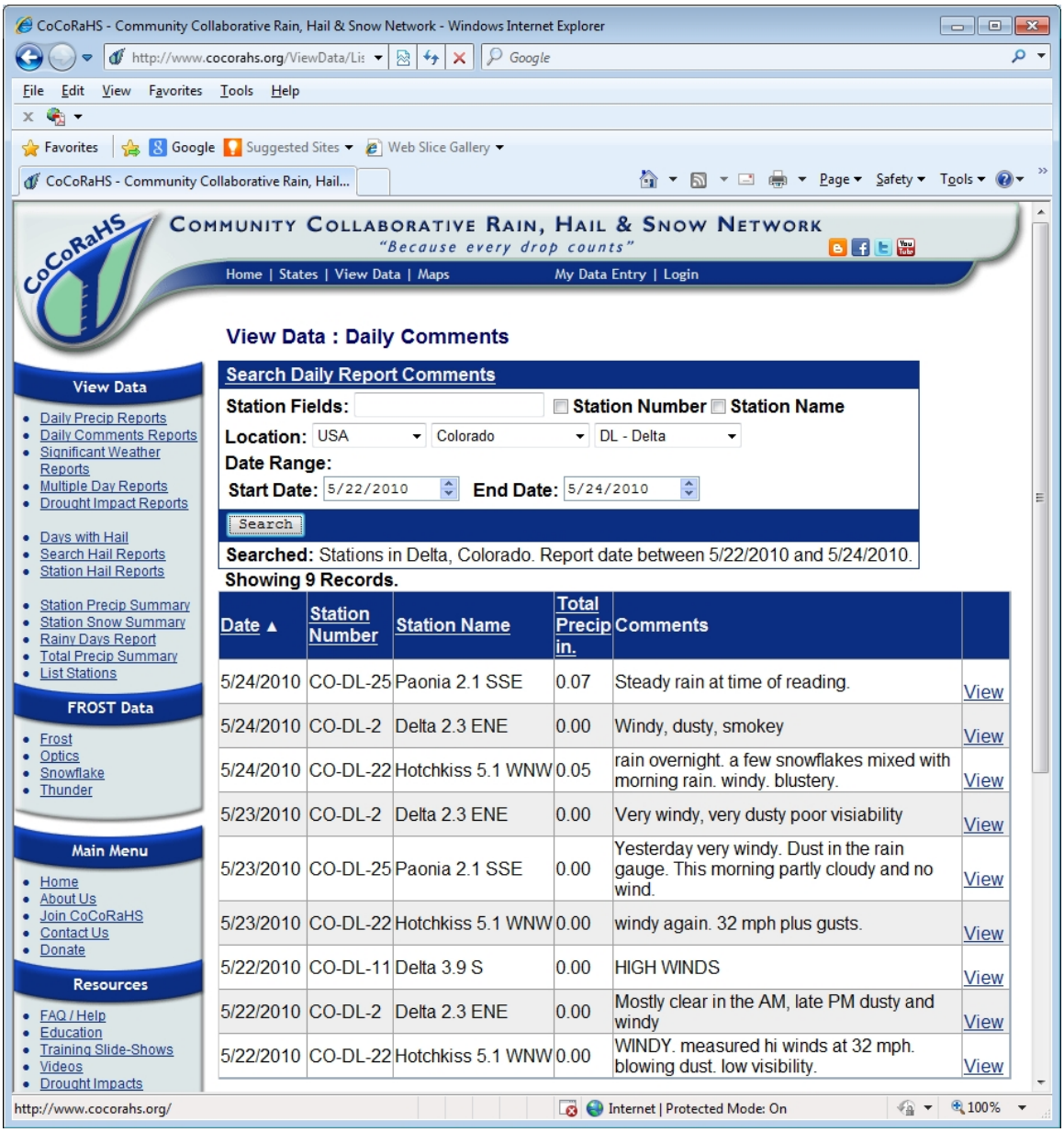
Residents can sign up to receive evacuation notices through the county's Wireless Emergency Notification System at the county's website,www.sanmiguelcounty.org.

Colorado 145, closed Saturday, was reopened overnight, although the fire is raging on both sides of the main artery to Telluride, said San Miguel County Commissioner Art Goodtimes.

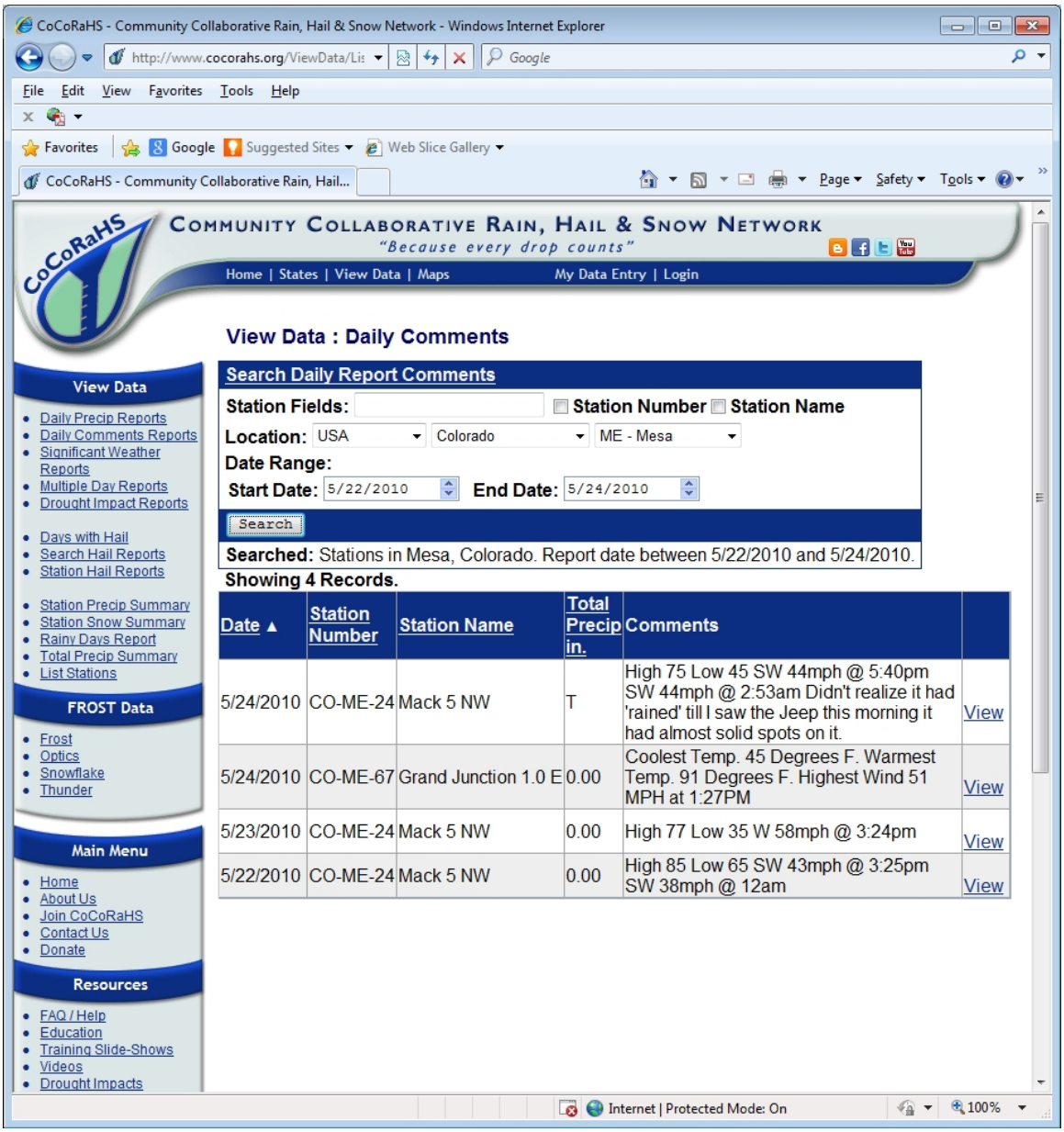
He said air support has been stymied by the high winds, and fire-resistant trees such as willows and cottonwoods are burning.

"It is scary. Because of the winds, it's been really dry," Goodtimes said.

Jessica Fender: 303-954-1244 or[*jfender@denverpost.com*](mailto:jfender@denverpost.com)



(NOTE: CoCoRaHS "Daily Comments" reports are submitted at approx. 7:00 a.m.)



(NOTE: CoCoRaHS "Daily Comments" reports are submitted at approx. 7:00 a.m.)

5.0 Not Reasonably Controllable or Preventable: Local Particulate Matter Control Measures

While it is likely that some dust was generated within the local communities as gusts from the regional dust storm passed through the area, the amount of dust generated locally was easily overwhelmed by, and largely unnoticeable as compared to the dust transported in from the source regions of the dust storm. The following sections will describe in detail the regulations and programs in place designed to control PM_{10} in each affected community. These sections will demonstrate that the event was not reasonably controllable, as laid out in Section 50.1(j) of Title 40 CFR 50, within the context of reasonable local particulate matter control measures. As shown from the meteorological and monitoring analyses (Sections 2 and 3), the source region for the associated dust that occurred during the May 22 and 23, 2010, event originated outside of the monitored areas, primarily from northeast Arizona, northwest New Mexico, and most of Utah.

The Colorado Air Pollution Control Division (Division) conducted thorough analyses and outreach with local governments to confirm that no unusual anthropogenic PM10-producing activities occurred in these towns and that despite reasonable control measures in place, high wind conditions overwhelmed all reasonably available controls. The following subsections describe in detail Best Available Control Measures (BACM), other reasonable control measures, applicable federal, state, and local regulations, appropriate land use management, and an in-depth analysis of potential areas of local soil disturbance for each affected community during the May 22 and 23, 2010 event, as well as subsequent outreach designed to administer these activities. This information shall confirm that no unusual anthropogenic actions occurred in the local areas of Alamosa, Pagosa Springs, or Grand Junction during this time.

Regulatory Measures- State
The Division's regulations on PM_{10} emissions are summarized in Table 28.

Table 28: State Regulations Regulating Particulate Matter Emissions

Rule/Ordinance	Description
Colorado Department of Public Health and Environment Regulation 1- Emission Control For Particulate Matter, Smoke, Carbon Monoxide, And Sulfur Oxides	Applicable sections include but are not limited to: Everyone who manages a source or activity that is subject to controlling fugitive particulate emissions must employ such control measures and operating procedures through the use of all available practical methods which are technologically feasible and economically reasonable and which reduce, prevent and control emissions so as to facilitate the achievement of the maximum practical degree of air purity in every portion of the State. Section III.D.1.a) Anyone clearing or leveling of land greater than five acres in attainment areas or one acre in non-attainment areas from which fugitive particulate emissions will be emitted are required to use all available and practical methods which are technologically feasible and

	economically reasonable in order to minimize fugitive particulate emissions.(Section III.D.2.b) Control measures or operational procedures for fugitive particulate emissions to be employed may include planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks and other methods or techniques approved by the Division. (Section III.D.2.b) Any owner or operator responsible for the construction or maintenance of any existing or new unpaved roadway which has vehicle traffic exceeding 200 vehicles per day in the attainment/maintenance area and surrounding areas must stabilize the roadway in order to minimize fugitive dust emissions (Section III.D.2.a.(i))
Colorado Department of Public Health and Environment Regulation 3- Stationary Source Permitting and Air Pollutant Emission Notice Requirements	Construction Permit required if a land development project exceeds 25 acres and spans longer than 6 months in duration (Section II.D.1.j)
Colorado Department of Public Health and Environment Regulation 6- Standards of Performance for New Stationary Sources	Implements federal standards of performance for new stationary sources including ones that have particulate matter emissions. (Section I)
Colorado Department of Public Health and Environment Regulation 9- Open Burning, Prescribed Fire, and Permitting	Prohibits open burning throughout the state unless a permit has been obtained from the appropriate air pollution control authority. In granting or denying any such permit, the authority will base its action on the potential contribution to air pollution in the area, climatic conditions on the day or days of such burning, and the authority's satisfaction that there is no practical alternate method for the disposal of the material to be burned. Among other permit conditions, the authority granting the permit may impose conditions on wind speed at the time of the burn to minimize smoke impacts on smoke-sensitive areas. (Section III)
Federal Motor Vehicle Emission Control Program	The federal motor vehicle emission control program has reduced PM_{10} emissions through a continuing process of requiring diesel engine manufacturers to produce new vehicles that meet tighter and tighter emission standards. As older, higher emitting diesel vehicles are replaced with newer vehicles; the PM_{10} emissions in areas will be reduced.

5.1 Alamosa

Natural Events Action Plan (NEAP)

The Final NEAP for High Wind Events in Alamosa, Colorado was completed in May 2003. The NEAP addresses public education programs, public notification and health advisory programs, and determines and implements Best Available Control Measures (BACM) for anthropogenic sources in the Alamosa area. The Division followed up with the City and County of Alamosa in January 2007 and in the spring of 2013 on whether the NEAP mitigation measures and commitments were satisfied, the results of which are detailed below. The City of Alamosa, Alamosa County, the Division, and participating federal agencies worked diligently to identify contributing sources and to develop appropriate BACM as required by the Natural Events Policy.

Regulatory Measures- City
The Division and the City of Alamosa are responsible for implementing regulatory measures to control emissions from agricultural sources, stationary sources, fugitive dust sources, and open burning within Alamosa. Alamosa's ordinances of PM_{10} emissions are summarized in Table 29.

Table 29: Rules and Ordinances Regulating Particulate Matter Emissions in Alamosa

Rule/Ordinance	Description
City of Alamosa Code of Ordinances Article VII of Section 21-140 (5)	Addresses dust control for home occupations
City of Alamosa Code of Ordinances Article V Sec. 17-87(3))	Requires all new roads and alleys to be paved
City of Alamosa Code of Ordinances (Article VI Sec. 21-119(g)(3)).	New large commercial/retail establishments must install underground automatic irrigation systems for all landscaped areas

City of Alamosa
The City of Alamosa has been active in addressing potential PM_{10} sources within the Alamosa area through various efforts. Some of these efforts, plus other potential future measures, include the adoption of local ordinances to reduce PM_{10}. Copies of current ordinances and any related commitments are included in the NEAP in Appendix C. According to the City's Public Works Director, as of 2013, the City is planning on adding additional dust control best management practices to the International Building Codes that are adopted by the city in the next update. The best management practices will include requiring a Dust Control Plan for any site that is issued a clearing permit for any site over 2 acres. The City is also currently (as of 2013) working on revising part of their landscaping ordinances to require mulch in areas that are not vegetated or covered by rock to help mitigate fugitive particulate emissions. These efforts have been stalled in the past due to employee turnover at City Manager's Office.

Street Sweeping
The City of Alamosa sweeps on an every 4-week schedule or as needed, as determined by local officials on a case by case situation (e.g., following each snowstorm and/or where sand was applied). Sweeping occurs on every single City street with an emphasis on the downtown corridor where public exposure is expected to be greatest. In fact as of Spring 2013, street sweeping in the downtown corridor currently takes place twice per week according to the City's Public Works Director.

According to the City's Public Works Director, the city currently (as of 2013) owns an Elgin Pelican (mobile mechanical sweeper) and a Tymko 600 (brush-assisted head) street sweeper. As of June 2013, the City will also own a new Elgin Broom Badger street sweeper at which time the Tymko 600 will be sent in for a re-build. The new Elgin Broom Badger street sweeper can be used in the winter months when the Tymko cannot due to freezing of the water delivery system.

Unpaved Roads within the City
The City of Alamosa (as of 2008) requires all new roads and alleys to be paved according to the Municipal Code (Article V Sec. 17-87(3)) and some existing unpaved roads are being treated with dust suppressants until all underground utilities are installed. No new development is allowed until paving is complete unless a performance bond is in place.

According to the City's Public Works Director, as of 2013, less than 3% of City roads are unpaved; most of these unpaved roads are legacy annexations. One of these unpaved roads is scheduled for paving this year (2013). The remaining unpaved roads are all low traffic (less than 100 ADT) and the City continues to seek funding sources for paving these streets.

Sod/Vegetative Cover Projects in the City of Alamosa
As of 2008, the City of Alamosa placed vegetative cover in all city parks and has installed irrigation systems to maintain the cover. As of 2013, the City has been emphasizing more low-water use landscaping with shrubs, mulch, etc. including both organic and rock. All turf areas do have irrigation systems which utilize drip systems for specimen plantings.

Alamosa County
Alamosa County has also been active in addressing blowing dust and is preparing a county ordinance as such.

Unpaved Roads
Alamosa County is presently addressing unpaved roads and lanes that are anticipated to contribute to PM_{10} emissions in the community. As of 2002, Alamosa County was nearing the end of its five-year road paving plan and was developing their next plan with the intention of paving on a yearly basis, based on traffic, community needs/priorities, and funding availability.

In 2002, Alamosa County addressed approximately ten (10) miles of unpaved roads. This includes the stabilization of approximately five section roads, the seal coating of two roads, and the overlay (repaving) of four (4) additional roads.

In 2003, approximately 14 miles of roads were paved. This includes the Seven Mile Road (three miles long), Road 109 (one mile long), and 10^{th} Street (also one mile long). These roads are in close proximity to the City of Alamosa, are upwind (prevailing) from the city, and have heavy traffic. Paving is anticipated to greatly reduce blowing dust and impacts in the vicinity.

No paving projects took place between 2004 and 2010 due to lack of funding. Between 2010 and 2013 the County was able to get funding but only for maintenance paving on previously paved roads that needed repair. Now that the county is caught up on maintenance paving, it is focusing on paving the remaining unpaved roads. The County's goal is to pave about 2.5 miles of unpaved road per year depending on funding availability.

As of 2013, Alamosa County has funding to pave approximately 2.5 miles of the 106 North which is currently unpaved. After this paving project the County will only have 2.5 miles of unpaved road remaining on the 106 North which is anticipated to be paved in the summer of 2014.

In the summer time the County regularly hauls water and wets down the unpaved roads (mostly gravel, clay and sand) to reduce the fugitive particulate emissions. The County wets the unpaved roads on an as needed basis based on weather conditions and traffic volume. In addition, when it gets cold enough in the area, the County wets down some of the more sandy roads. Once the water soaks in and freezes, good dust suppression is seen. Road construction areas are being dampened with water for dust control. These practices reduce PM_{10} emissions in and near Alamosa. This control measure is balanced with the availability of water in the area.

Alamosa County used to assess the need to use $MgC1_2$ treatment on roads in front of residences that request such service. This practice stopped in 2004 when funding was lost. Assessments included the sensitivity to dust of residents, the materials of the road base for safety reasons, and possible environmental concerns of the neighborhood. Most requests for treatment are were granted. Other areas for treatment, such as commercial construction zones or gravel pits, are investigated on a case by case basis. The County hopes to be able to start offering this service again when funding is restored.

Dust Control Plans

Alamosa County may consider changes in local ordinances governing dust control plans at construction sites. This would be addressed through the revision of Alamosa County's Comprehensive Plan and supporting zoning codes. Alamosa County is reviewing language from other successful dust control programs for inclusion in their local ordinances.

The County may update the Comprehensive Plan to include a dust control plan. The Land Use Administrator is researching the potential for a dust control ordinance. This effort is anticipated to reduce PM_{10} emissions in Alamosa, especially as it relates to impacts on the community and high recorded PM_{10} values. At the time of this submittal (June 2013), this effort is still underway.

Wind Erosion of Open Areas

To reduce PM_{10} emissions from open areas outside of the City limits, low tilling and other soil conservation practices continue to be utilized in the community. In addition, the community is using in strategic areas the State of Colorado Agricultural Office's program to purchase and plant shelter trees to reduce wind erosion in open areas. These trees have a demonstrated advantage for the community and for air quality. Once the trees reach maturity, it is anticipated that the equivalent of 112 miles of double-rowed trees will be in place. The survival rate of the tree seedlings varies but according to the District Coordinator for the Seedling Tree Program, potted seedlings have about a 60% to 80% survival rate and the bare root seedlings have about a 40 to 60% survival rate. The Seedling Program recommends Siberian elm and Rocky Mountain juniper trees for low maintenance, drought resistance windbreaks in the valley. In addition, there is ongoing planting of trees (approximately 50) on newly developed Alamosa County property south/southwest of Alamosa (prevailing winds from southwest) and the Airport south of Alamosa for added air quality improvement.

Windblown Dust from Disturbed Soils

Alamosa has a semi-arid climate with approximately 7.25 inches of precipitation annually. The San Luis Valley, as noted within 25 miles of the San Luis Valley Regional Airport in Alamosa, is primarily comprised of forests (43%) and shrublands (42%). Consequently, soils in all areas are typically a mixture of silt and sand with limited vegetation due to low precipitation. In winter and spring, windstorms are common, especially in drier years. It is due to these high velocity windstorms that Alamosa experiences most of the PM_{10} problems for the area.

Figure 1 illustrates potential areas of local soil disturbance that have been evaluated by the Division for the Alamosa Adams State PM_{10} monitor.

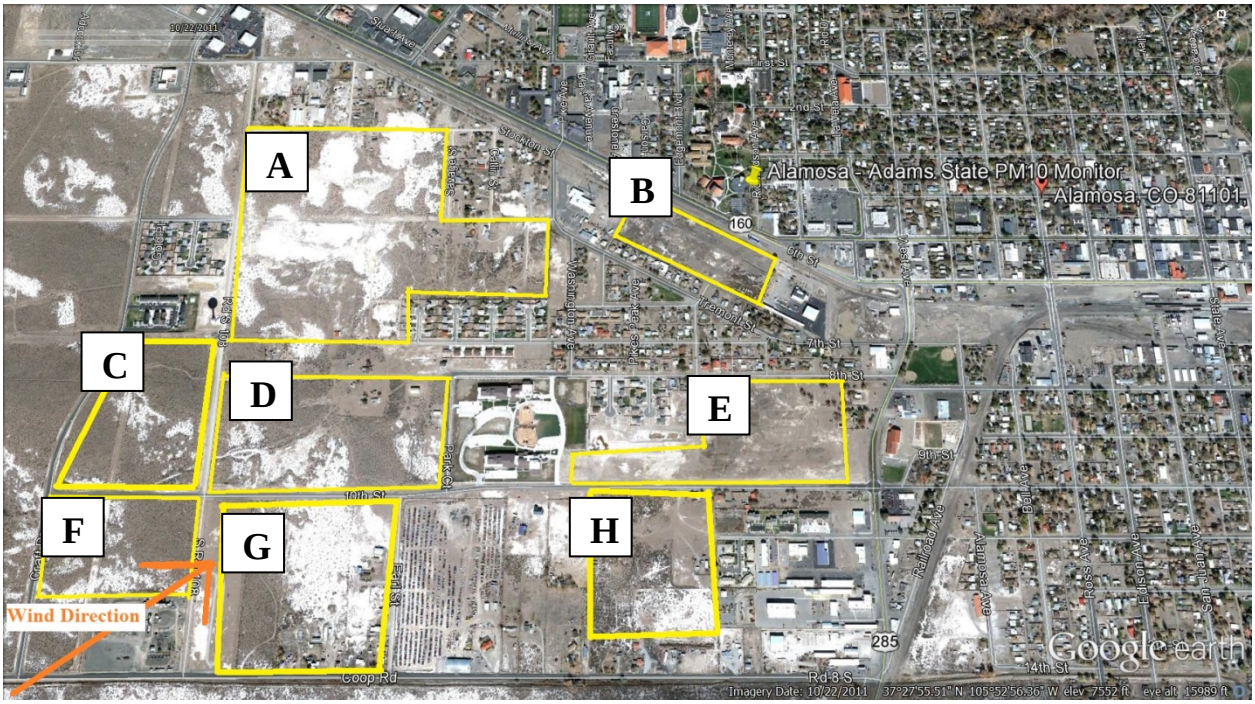


Figure 60: Relative positions of Adam's State College PM_{10} Monitor and potential disturbed soil. (Image from Google Earth 2007)

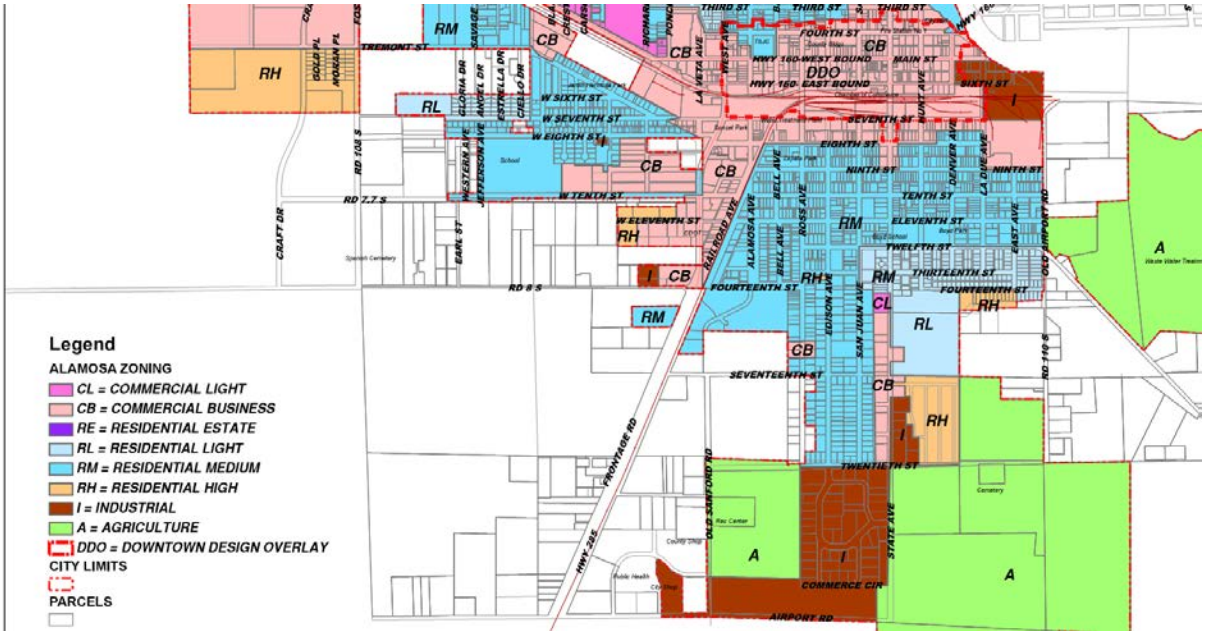


Figure 61: 2011 City of Alamosa Zoning Map (Provided by the Public Works Department)

Site A in Figure 60 (approximately 85 acres) is East of Rd S 108 and South of Chico St. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 61. The eastern portion of Area A is being considered for annexation into the City.

Site C in Figure 60 (approximately 25 acres) is north of 10th St, West of Road 108, and east of Craft St. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 61.

Site D in Figure 60 (approximately 34 acres)is north of 10th street, east of Rd S 108, west of Park Ct, and south of 8th St. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 61.

Site F in Figure 60 (approximately 31 acres)is south of 10th St, east of Craft Dr, west of S Rd 108, and North of Coop Rd. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 61.

Site G in Figure 60 (approximately 41 acres) is east of S Rd 108, north of Coop Rd, west of Earl St, and South of 10th St. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 61.

Sites A, C, D, F, and G are noted by the City of Alamosa's Public Works Director to be vacant land with natural vegetation (i.e. shrubland) with no artificial irrigation and no access restriction. The City emphasizes that the areas are not suited for motorized travel. These lots are not considered to be anthropogenically disturbed soils and should be considered to be natural sources at this time. If future high wind or other exceptional events occur, the Division will re-assess these lots to determine if they are still natural sources.

Site B in Figure 60 (approximately 22 acres) is south of Highway 160 and north east of Tremont St. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 61. Site E in Figure 60 (approximately 30 acres) is north of 10th St, south of 8th St, east of Park Ct, and west of West Ave. It is zoned mostly as a "Commercial Business" as shown in Figure 61. There is a small portion in the top right corner that is zoned outside of the city's limits by the city as a "Parcel". Site H (approximately 23 acres) in Figure 60 is east of Earl St, south of 10th St, and north of Rd 8 S. It is zoned as "Commercial business", "Residential High" and a little "Industrial" as shown in Figure 61. Sites B, E, and H are naturally vegetated and potentially irrigated as shown in Figure 62. Figure 62 demonstrates that these sites are minimally (if at all) disturbed soil areas.

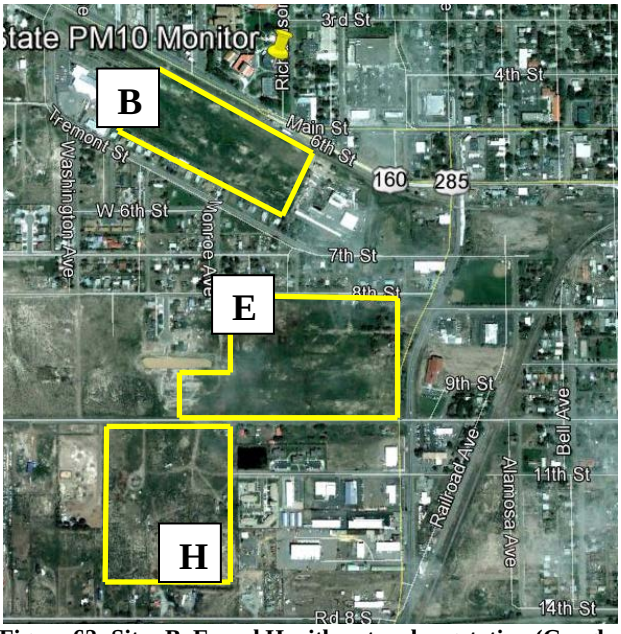


Figure 62: Sites B, E, and H with natural vegetation (Google Earth 2007)

The Division conducted thorough assessments to determine if the potential soil disturbances shown in Figure 60 were present during the 2010 exceedances. During the course of these assessments, the Division discovered that these sites were either reasonably controlled or

considered to be natural sources during the May 22 and 23, 2010 high wind event. Therefore, these sites were not significant contributors to fugitive dust in the Alamosa area during the May 22 and 23, 2010 high wind event.

The Division is currently investigating the applicable area around the Alamosa Municipal Building (08-003-0003) PM_{10} monitor in coordination with the County and City of Alamosa, shown in Figure 1. The Division plans to submit an in-depth analysis similar to the analysis for the Alamosa Adams State PM_{10} monitor.Figure 63 illustrates potential areas of local soil disturbance that have been evaluated by the Division for the Alamosa Municipal Building (08-003-0003) PM_{10} monitor.

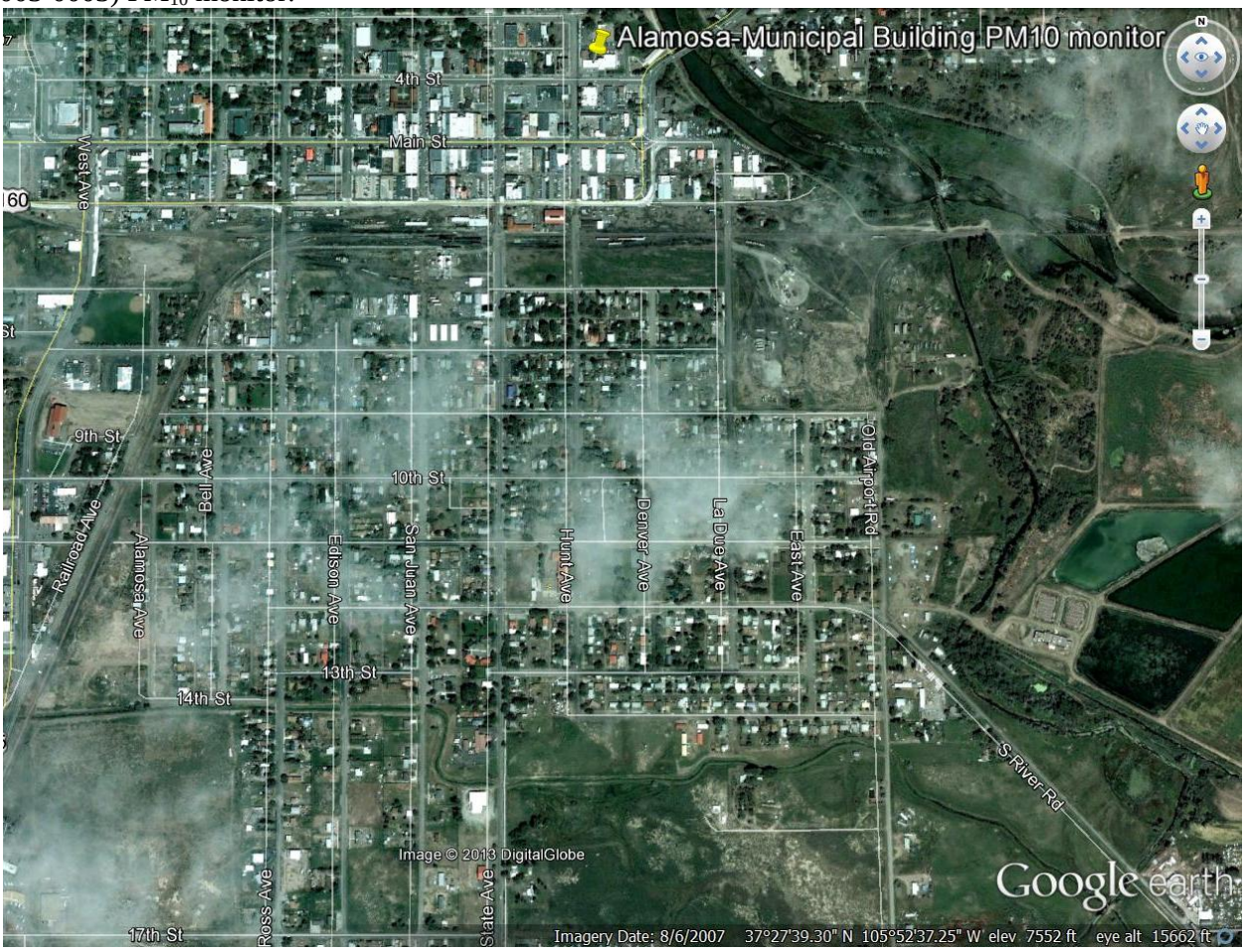


Figure 63: Relative positions of Municipal Building PM10 Monitor and potential disturbed soil. (Image from Google Earth 2007)

Sod and Vegetative Projects in the County

The development and construction of a local park, Eastside Park, is complete in Alamosa County. It has been completed with turf grass, shrubs, and landscape rock. No exposed soil remains. This park has reduced blowing dust from this previously undeveloped site.

Numerous other projects to reduce blowing dust and its impacts have happened or are happening at the County Airport. For example:

- Through additional grounds maintenance of the 40-acre Alamosa County airport south of the city, grass is being grown for aesthetics and dust control.

- Sodding and the placement of decorative rock and ground cover have been implemented in the landscaping of the Alamosa County property (2007-2012). These measures have directly abated blowing dust at the Airport.

- Also, the widening of the airport's safety areas (250 feet on either side of the runway) is now complete and seeding of natural grasses was incorporated in the project. Trees and grass were incorporated in the approaches to the airport and have provided additional wind-break advantages to South Alamosa.

In other areas where watering is a problem, xeriscape (the use of native drought resistant vegetation and/or rock cover) is being encouraged for County owned property and for all other property owners.

Colorado State University Co-Op Extension Office
In response to extremely dry conditions, the need to maintain area topsoil, and reduce impacts, the Colorado State University Co-Op Extension Office of Alamosa County provides the following outreach efforts and recommendations:

- Modification of grazing practices to improve protective crop cover
- Increasing crop residues left in the fields to reduce blowing dust
- Planting of Fall crops to maintain fields
- Application of manure to protect top soils from blowing away
- Staggering of the harvest to minimize blowing dust
- Outreach programs on soil conservation efforts
- Development of outreach/education materials (e.g., news articles, newsletters, fact sheets, etc.), and
- Attendance at Statewide workshop to educate other Co-Op offices to various practices to reduce blowing top soil and minimize impacts.

These control strategies are not meant to be enforceable. They are meant only to demonstrate the regional nature of cooperation in addressing blowing dust and its impacts on the community.

Natural Resources Conservation Service (NRCS)
Alamosa County is a predominately agricultural area where limited water, coupled with the frequent high winds experienced during late fall and early spring, can destroy crops, encourage pests, and damage soil surfaces lending them susceptible to wind erosion. Thus, activities that improve the topsoil and prevent its lifting during high wind events are encouraged. Some notable NRCS and agricultural examples include:

- Cover crops and perennial crops (e.g., alfalfa) are recommended to protect soils;
- NRCS works with area farmers in the development of conservation compliance plans to also protect topsoil;
- NRCS encourages the use of perennial crops or the leaving in place of weeds on the corners of area acreage (instead of tilling that might lead to open, barren lands) to reduce the lifting of topsoil;
- NRCS "cost shares" on conservation practices with local farmers to prevent soil erosion, and;
- The NRCS works with Colorado State University to identify other strategies that minimize blowing dust.

Other successful agricultural practices encouraged in the area include: timing of tillage, crop rotation, amount of crop residue left on the land, and proper water usage. These control strategies

are not meant to be enforceable. They are meant only to demonstrate the regional nature of cooperation in addressing blowing dust and its impacts on the community.

Please refer to the Final NEAP in Appendix C for more detail if needed.

5.2 Pagosa Springs

Regulatory Measures- City and County
The Division and the Archuleta County Air Quality Department are responsible for implementing regulatory measures to control emissions from agricultural sources, stationary sources, fugitive dust sources, and open burning within Pagosa Springs. Archuleta County regulations of PM_{10} emissions are summarized in Table 30.

Table 30: Rules and Ordinances Regulating Particulate Matter Emissions in Archuleta County

Rule/Ordinance	Description
Pagosa Springs Land Use and Development Code 6.6.3(h)	Requires that all new developments have paved streets.
Pagosa Springs Land Use and Development Code 6.6.3(m)(i)	All new roads having a projected trip generation of 200 or greater ADT (average daily traffic) shall be paved.

The following control measures resulted in the area‘s attainment of the PM_{10} NAAQS, and these measures should ensure continued maintenance of the PM_{10} NAAQS through the year 2021, which is the duration of the maintenance period.

Control of Emissions through Road Paving
The Town of Pagosa Springs paved 6.5 miles of unpaved roads during 1992, 1993, and 1994 in order to reduce PM_{10} emissions. This strategy was adopted locally in 1991 and included in State regulation in 1992 (Section I.B. of the State Implementation Plan-Specific Regulations for Nonattainment - Attainment/Maintenance Areas (Local Elements)). The rule was approved by EPA in 1994 and was removed from the Colorado regulation in 2000 as the paving requirements had been completed.

Street Sanding Controls
There is a requirement that any user that applies street sanding material on Highway 160 and Highway 84 in the Pagosa Springs attainment/maintenance area must use materials containing less than one percent fines. Users of street sand on these highways must also use 15 percent less sand than an established base sanding amount. These strategies were adopted in 1992 and approved by EPA in 1994, and they are defined in detail in Sections I.B. and C., respectively, of the ―State Implementation Plan-Specific Regulations for Nonattainment - Attainment/Maintenance Areas (Local Elements) Regulations (5 CCR 1001-20).

Control of Emissions from Stationary Sources
Although there are no stationary sources located in the Pagosa Springs attainment/maintenance area, the State‘s comprehensive permit rules will limit emissions from any new source that may, in the future, locate in the area. These rules are outlined in Table 28.

As indicated above, emissions from new or modified major stationary sources emissions of PM10 are controlled under AQCC Regulation No. 3's nonattainment-area (NAA) new source review (NSR) permitting requirements. The NSR provisions require all new and modified major

stationary sources to apply emission control equipment that achieves the "lowest achievable emission rate" (LAER) and to obtain emission offsets from other stationary sources of PM_{10}.

The EPA approval of the original PM_{10} Maintenance Plan, effective on 08/14/01, reinstates the prevention of significant deterioration (PSD) permitting requirements in the Pagosa Springs Attainment/Maintenance area. The federal PSD requirements are considered a relaxation from the NAA NSR requirements, as LAER is no longer required and is replaced by the less stringent "best available control technology" (BACT), along with the removal of the requirement to offset PM_{10} emissions. The future reapplication of NAA NSR provisions appears unlikely in the Pagosa Springs Attainment/Maintenance area based on current PM_{10} monitoring trends.

Voluntary and State-Only Measures

In addition to the mandatory control measures discussed above, there are other activities that result in the reduction of PM_{10} emissions that are not classified as “federally enforceable control measures.” Some notable examples include:

The Town of Pagosa Springs has historically cleaned Highway 160 in town throughout the winter and spring using regenerative air vacuum sweepers. The frequency of this voluntary sweeping/cleaning has been about once after each street sanding deployment. The Town of Pagosa Springs is committed to regularly vacuum sweep/clean Highway 160 within four days of the roadway becoming free and clear of snow and ice following each street sanding deployment, as weather, temperature, and street conditions permit, between the intersections of Highway 84 to the east and 14th street to the west. The town also street sweeps regularly on the side streets.

The Town of Pagosa Springs encourages private businesses to properly clean/sweep private parking lots on a regular basis. These strategies are considered to be voluntary local initiatives intended to reduce PM10 emissions. These strategies are not intended to be federally enforceable.

The city of Pagosa Springs has completed the road paving (100% of total segment) of Hot Springs
Boulevard.

The city of Pagosa Springs is gradually paving Majestic Road (see Figure 64) depending on funding sources.

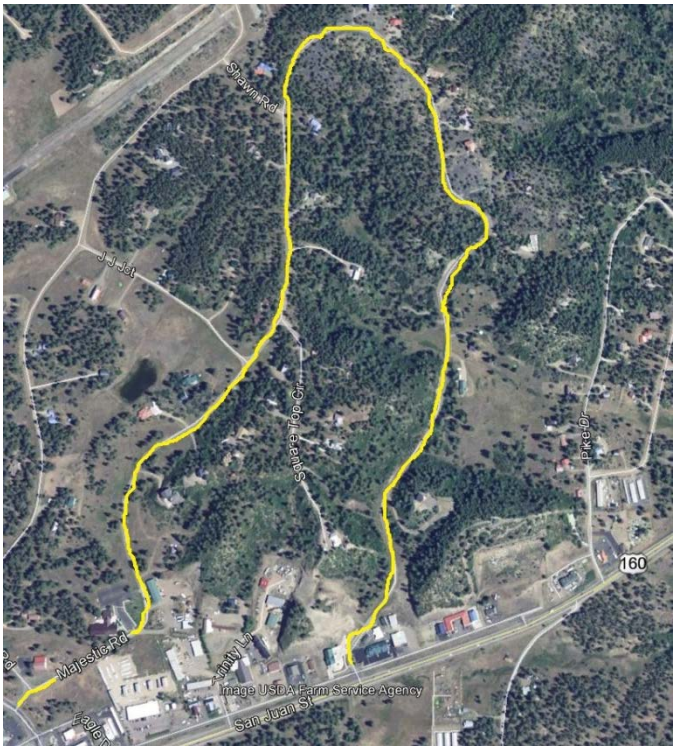


Figure 64: Majestic Road Highlighted in Yellow (Google Earth 2011)

Windblown Dust from Disturbed Soils

Pagosa Springs has a semi-arid climate with approximately 17 inches of precipitation annually. The town is located about 35 miles north of the New Mexico border at 7,000 feet. This area is considered a high desert plateau, creating an unusually mild climate. In winter and spring, regional windstorms are common, especially in drier years. It is during these high velocity windstorms that Pagosa Springs experiences PM_{10} issues. Figure 65 illustrates potential areas of local soil disturbance that have been evaluated by the Division.

Figure 65: Relative positions of Pagosa Springs PM_{10} monitor and known or potential disturbed soil. (Image from EPA)

Site A in Figure 65 shows a 1 acre vacant lot that previously contained a small convenience store which was torn down by the new owner between March and April of 2006. Division conversations with neighboring local business owners indicate the owner seeded the vacant lot (site A) with grass soon after demolishing the building. According to several nearby businesses and a court house clerk, the lot has been under continuous vegetative cover since the seeding in 2006. The grass is well maintained and is enclosed by a small fence (shown in Figure 66) to deter people from walking on the grass. Moreover, the lot is not used for parking or storage.

Figure 66: View of the fence surrounding the vacant lot (Site A)- Google Image 12-2007

Site B in Figure 65 (approximately 2 acres) shows The Springs Resort and Spa. The resort underwent an expansion; construction began in June 2008 and was completed in May 2009. By April 2009, the entire construction site was paved and the building was constructed; the interior was just being finished. Therefore, this project was completed and did not contribute to the May 22 and 23, 2010 exceptional event.

Site C in Figure 65 is a 35-acre area of vacant land. According to the Pagosa Springs Parks Department, the area is private property and is entirely naturally vegetated because of a continuous supply of ground water from the nearby stream. The Parks Department also indicates that off-road recreational vehicles are prohibited on the property. The Parks Department is very aware of dust prevention practices and does not believe that the area is a significant source of dust during high winds. With regard to AQCC Regulation 1 requirements (Section III.D.2.b), the Division considers the natural vegetation with regular ground water availability due to the low-lying terrain to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this lot at this time. Local sources, including the Pagosa Daily Post, cite the proposed future 35-acre hotel expansion (Site C) to be projected to occur in several phases over a 10-15 year time period.

The Division will conduct appropriate outreach and compliance assistance so the hotel is aware of potentially applicable AQCC Regulation 1 (Section III.D.2.b) and Regulation 3 (Construction Permit required if the project exceeds 25 acres and spans longer than 6 months in duration) requirements for future construction projects. The Division has specific Air Pollutant Emissions Notices (APENs) for land development and associated guidance documents posted on its website for these type of sources. Additionally, the Division has staff that conduct Small Business Assistance outreach as warranted. Compliance and enforcement inspectors from the Division are assigned regions throughout the state. As part of their workplans, they are required to be reasonably (within 1-2 business days) responsive to community and local government concerns and complaints regarding air quality issues, including fugitive dust.

Site D in Figure 65 is Yamaguchi Park, a 16-acre park consisting mostly of well-maintained turf and some stabilized clay associated with a baseball field. The entire park is irrigated on a regular basis to both maintain the vegetation and to mitigate dust. In the fall of 2008, Pagosa Springs hydro-seeded the park and vegetation emerged around April 2009 which was watered on a regular basis to help the vegetation grow. In Figure 67 below, it is apparent that the park has well maintained vegetation and a small amount of stabilized clay. With regard to AQCC Regulation 1 requirements (Section III.D.2.b), the Division considers hydro-seeding to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this magnitude of construction project.

Figure 67: Yamaguchi Park- Google Image from 10-2011

The Division conducted thorough assessments to determine if the potential soil disturbances shown in Figure 5 were present during the 2010 exceedances. During the course of these assessments, the Division discovered that these sites were reasonably controlled during the May 22 and 23, 2010 high wind event. Therefore, these sites were not significant contributors to fugitive dust in the Pagosa Springs area during the May 22 and 23, 2010 high wind event.

5.3 Grand Junction

Mesa County Voluntary Control Measures

The County actively responds to blowing dust complaints in accordance with a delegation contract with the Division. When Mesa County Health Department receives a dust related complaint, the following general response is initiated. Each complaint is unique, so these measures may not apply to all situations. Both the complainant and source are notified to gain as much information as possible, including frequency of violation, and how the parties would like to be notified as the investigation proceeds. Research of applicable regulations is performed and records are researched. Helpful records can include emissions permits or prior complaints. A site visit is performed to verify information and document observations. Based on findings, the investigation is then completed. If the complaint is valid, this could involve numerous outcomes. Possible resolutions include referral to the Division or another government agency, formal warnings, or voluntary compliance by the source. A record of the investigation is maintained by Mesa County Health Department.

Regulatory Measures- County
The Division and the Mesa County Air Quality Department are responsible for implementing regulatory measures to control emissions from agricultural sources, stationary sources, fugitive dust sources, and open burning within Mesa County. Mesa County ordinances of PM_{10} emissions are summarized in Table 31.

Table 31: Rules and Ordinances Regulating Particulate Matter Emissions in Mesa County

Rule/Ordinance	Description
Mesa County Land Development Code (effective May 2000) §7.16.1 Streets and Roads	When a development plan proposes improvements to a street or road that requires right-of-way in excess of the minimum requirements of the Mesa County Standard Specifications for Road and Bridge Construction, additional right-of-way will be required from the developer to accommodate the proposed plan. Streets, roads and pedestrian/bicycle paths shall be designed as shown in any adopted Transportation or Circulation Plan and constructed in conformance with the current Mesa County Stand Specifications for Road and Bridge Construction and its appendix, the Road Access Policy. *All new public or private roads constructed within Mesa County shall be paved.* Farm service and canal/ditch/drainage maintenance roads are exempt from this paving requirement.
The Mesa County Air Pollution Control Resolution on Open Burning (MCM 2002-066)	Prohibits open burning throughout the Grand Valley Airshed unless a valid permit has been obtained from the appropriate air pollution or fire control authority. In granting or denying any such permit, the authority shall base its action on the potential contribution to air pollution in the area, climatic conditions on the day(s) of such burning, and the authority's satisfaction that there is no practical alternative for the disposal of the material to be burned. Open burning permits will only be issued during the spring and fall burning seasons.
The Stormwater Management Manual Section 1503.1 "Stormwater Discharge Limitations"	Off-site vehicle tracking of sediments shall be minimized. Land disturbances shall be conducted in a manner to effectively reduce accelerated soil erosion and sedimentation.

Mesa County Air Quality Planning Committee
Established in 1992 as an advisory committee to the Mesa County Board of Health, the sixteen member committee consists of representatives from government, industry, education, medical and legal sectors of the community. The purpose of the MCAQPC is: To provide a forum to discuss and evaluate air quality impacts, processes and planning in the Grand Valley airshed; To act as the lead air quality planning agency for Mesa County; To make air quality protection recommendations to local elected officials.

Mesa County Solid Waste Management
The composting facility opened in Mesa County in September of 2001. Goals of the facility includes; improvement of Mesa County's air quality, providing a valuable soil amendment, and extending landfill life. Burning leaves and other yard wastes pollutes the air and can lead to uncontrolled fires. Yard waste smoke that lingers in the Grand Valley is an eyesore and can make breathing difficult for people who suffer from asthma, emphysema, or seasonal allergies. The composting facility utilizes an aerated windrow method of composting, which is the most common method of composting in Colorado. This involves stacking the yard waste into rows that are periodically turned, blended, and aerated.

Stormwater Management Manual (SWMM)
As mandated under the Clean Water Act, the U.S. Environmental Protection Agency (EPA) has developed a National Pollutant Discharge Elimination System (NPDES) stormwater permitting program consisting of two phases. Phase I, started in 1990, addresses the large metropolitan areas of the country. Phase II, started in 2003, smaller urbanized areas, such as the Grand Valley. As with stormwater quantity many agencies are involved with stormwater quality, Mesa County, City of Grand Junction, Town of Palisade, Grand Junction Drainage District, Orchard Mesa Irrigation District, Grand Valley Water Users, and School District 51 are all regulated by Phase II stormwater regulations. The Stormwater Management Manual (SWMM) addresses particulates in Section 1503.1 as summarized in Table 29.

City of Grand Junction Air Quality Control Measures:

Regulatory Measures- City

The Division and the City of Grand Junction are responsible for implementing regulatory measures to control emissions from agricultural sources, stationary sources, fugitive dust sources, and open burning within Grand Junction. Grand Junction's ordinances of PM_{10} emissions are summarized in Table 32.

Table 32: Rules and Ordinances Regulating Particulate Matter Emissions in Grand Junction

Rule/Ordinance	Description
Code of Ordinances Article VI. Air Pollution Sec 16-128. Air quality; declaration of policy.	Air quality is an important part of the health, safety and welfare of the community. City Council desires to protect and improve air quality in and around the City, not only for the health, safety and general welfare or its citizens, but also because air pollution resulting from the use of wood stoves hurts the aesthetic and economic welfare of the community. Present levels of air pollution which occur during winter inversions in the Grand Valley are unacceptable. The Grand Valley Air Quality Planning Committee has studied and made recommendations concerning local efforts which can protect the air quality in the Grand Valley. The City Council endorses such efforts.
Code of Ordinances Article VI. Air Pollution Sec 16-126. Control of dust-producing areas	It shall be unlawful for any person to own, possess or control a cleared area, parking lot, vacant lot or other site used by vehicular traffic without implementing an effective abatement or preventive fugitive dust-control measure, as may be required, which may include, but is not limited to, the following: 1. Wetting down of the dust-producing area; 2. Landscaping; 3. Covering, shielding or enclosing; 4. Paving on a temporary or permanent basis; 5. Treating through the use of palliative and chemical stabilization.
Code of Ordinances No. 3824: Stormwater Pollution Prevention Sec. 16-143. Control of Stormwater Discharges from Construction and Post-Construction Activities	BMPs shall be implemented to prevent the release of sediment from construction sites and development. Disturbed area(s) shall be minimized and disturbed soil, including but not limited to construction sites and entrances and exits there from, shall be managed to prevent tracking, blowing and fugitive emissions release.
Zoning and Development Code Chapter Six: Design and Improvement Standards Sec. 6.2 B. Streets, Alleys, Trails and Easements: Design Standards.	Street and alley layouts shall conform to adopted street plans and other policies, as well as Transportation Engineering Design Standards. Streets, alleys, sidewalks, trails and bike paths shall be constructed in accordance with applicable City standards.
Zoning and Development Code Chapter Six: Design and Improvement Standards Sec. 6.6 A. Off –Street Parking Vehicle Traffic Areas	All driveways and parking areas, except for a single welling on one lot, shall comply with the following: a. All required parking and vehicular traffic surfaces shall drain and be surfaced with concrete or bituminous pavement in accordance with City standards. The City Engineer may permit a gravel surface in overflow parking areas, a low traffic storage yard, or if the applicant establishes that very little dust will be generated. "Overflow parking" is defined as "parking in addition to the minimum required by ordinance which is

	designed not to be used more than ten times per year." A "low-traffic storage yard" is defined as "a storage area generating less than thirty average daily trips." Industrial yards that accommodate large trucks and/or heavy equipment shall be surface and maintained with materials to prevent dust, mud and debris from leaving the site and being tracked onto the public right-of-way. b. All surfaces shall be maintained in good condition free of weeks, dust trash and debris. c. A temporary parking lot shall be used after the owner has an approved site plan for up to 24 months from issuance of a city site plan for such parking use. The temporary parking lot shall be maintained in good condition free of weeds, dust, trash and debris.
Municipal Standards A. Transportation Engineering Design Standards	The City of Grand Junction / Mesa County Transportation Engineering Design Standards require all commercial, industrial, urban residential, collector and rural streets be surfaced with hot bituminous pavement or Portland cement concrete.
Municipal Standards B. Grand Valley Circulation Plan Integrated Transportation System	The Integrated Transportation System is designed to create an integrated system of streets, subdivisions and developments to provide for the efficient movement of vehicular and other traffic to and from adjacent developments while encouraging the use of mass transit. This avoids traffic congestion which could impact localized air quality problems. Proposed development projects must submit for review an analysis of the transportation impacts of a project. This analysis includes a transportation impact analysis, total traffic projections, site design and circulation evaluation, trip generation, trip distribution and assignment of project traffic to minimize traffic congestion. The Riverside Parkway project, recently completed in August 2008, was designed primarily to alleviate congestion and route traffic away from the downtown core area, increasing traffic efficiency and minimizing localized concentrations of vehicle exhaust.

Control Programs

A. Municipal street sweeping measures

The City of Grand Junction utilizes modern regenerative street sweepers as well as mechanical street sweepers to clean streets on a frequent basis to control fugitive dust and particulate matter and improve stormwater quality. Downtown streets are swept at least once per week. Principal arterial and minor arterial streets are swept one to two times per month. Collector and residential streets are swept once every two months.

B. De-icing procedures

The City of Grand Junction uses a combination of Ice Slicer (salt treated with magnesium chloride, potassium chloride and rust inhibitors) and magnesium chloride liquid solution to improve public safety and control ice on city streets. Ice Slicer and magnesium chloride are used instead of sand in order to control particulate dust emissions and because it is more effective in preventing (anti-ice operations) and fighting ice build up (de-icing operations) on streets. The City's Snow Plan and map of City streets that receive de-icing treatments is available upon request from the Neighborhood Services Manager.

Windblown Dust from Disturbed Soils

The city of Pagosa Springs Grand Junction has a semi-arid climate, almost grading into an arid type, with approximately 9 inches of precipitation annually. Grand Junction sits in a large area termed the 'Grand Valley' of "high desert" lands in western Colorado. In winter and spring, windstorms are common,

especially in drier years. It is due to these high velocity windstorms that Grand Junction experiences most of the PM_{10} problems for the area. Figure 68 illustrates potential areas of local soil disturbance that have been evaluated by the Division.

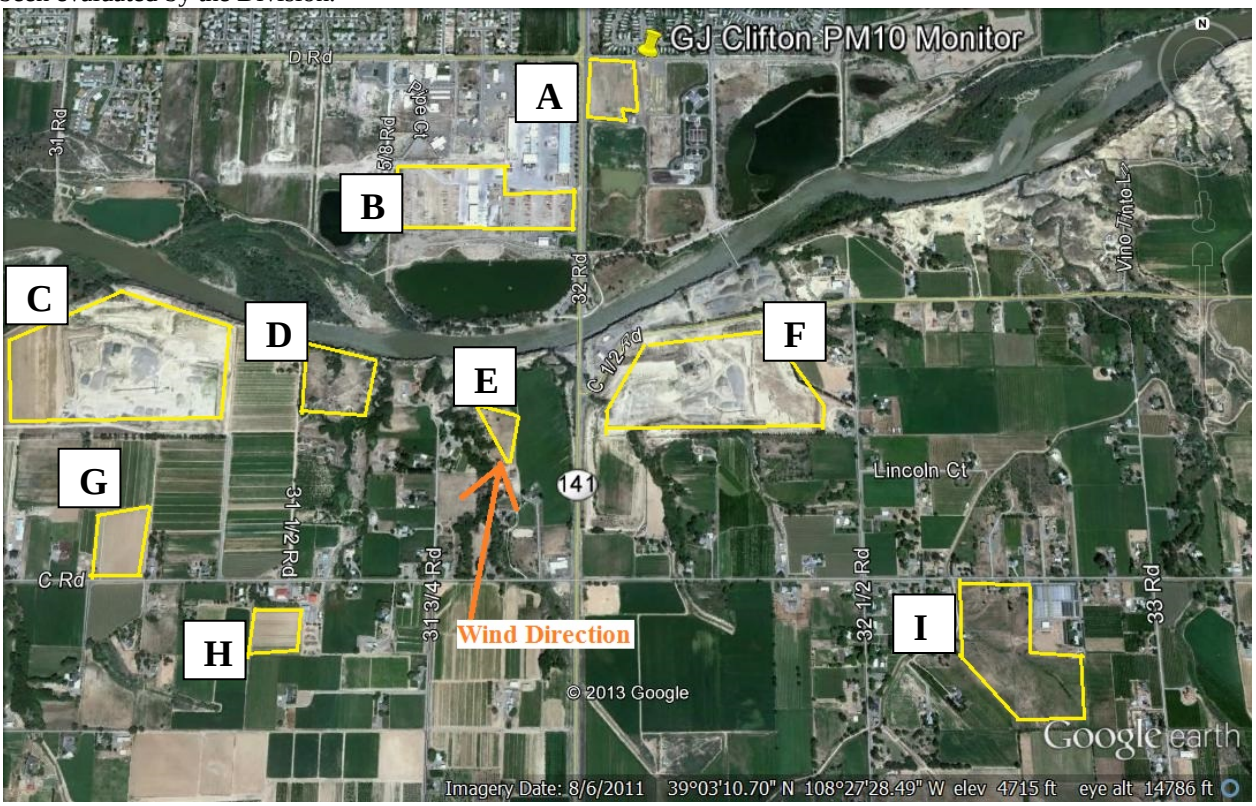


Figure 68: Grand Junction Clifton PM10 Monitor with winds originating from the south on May 23, 2010. (Google Earth Image 2011)

Site A (approximately 7 acres) in Figure 68 is east of 32 Rd, west of 32 ½ Rd, south of D Rd, and north of the river. The land is owned by the Clifton Sanitation District. It is zoned outside of the city's limits by the city as a "Rural" according to Grand Junction's Zoning Map. As shown in Figure 69 and Figure 70, Site A is well-maintained vegetated land. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 69: Site A Vegetated (Google image 2006)

Figure 70: Site A Vegetated (2010 Mesa County GIS Fly Over Photo)

Site B (approximately 17 acres) in Figure 68 is west of 32 Rd, south of D Rd, east of 31 5/8 Rd, and north of the river. The land is owned by Halliburton Energy Services. It is zoned inside of the city's limits by the city as a "light industrial" according to Grand Junction's Zoning Map. This is a staging area for trucks before they go out into the field that is partially paved. Repairs are also preformed here. The entrance to the facility is landscaped and irrigated. Halliburton contracts a third party watering truck to come and treat the facility for dust on an as needed basis. This frequency can be up to as much as twice daily depending on conditions. The lot is grated about once per year also on an as needed basis. As part of the company's dust control plan, Halliburton also treats the lot with magnesium chloride every 3-5 years as needed. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider the dust control plan and associated dust mitigation activities to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Site C (approximately 63 acres) in Figure 68 is north of C Rd, west of 31 ½ Rd, east of 30 ½ Rd, and south of the river. The land is owned by A & G Partnership LLP. It is zoned inside of the city's limits by the city for agricultural use according to Grand Junction's Zoning Map. This is known as the "DeVries pit" or the "31 Road Gravel Pit". It is owned by Alan Parkerson. The site has a Conditional Use Permit that has been in place since 1987 (APCD Construction Permit #87ME343F). The site also has a Particulate Emissions Control Plan, which it adheres to which includes:

1. Adequate soil moisture must be maintained in topsoil and overburden to control emissions during removal. Watering shall be implemented if necessary.
2. Topsoil and overburden stockpiles shall be revegetated within one year.
3. Emissions from material handling (i.e. removal, loading, and hauling) shall be controlled by watering at all times unless natural moisture is sufficient to control emissions.
4. Vehicle speed on unpaved roads and disturbed areas shall not exceed a maximum of 10 m.p.h. Speed limit signs shall be posted.
5. Unpaved haul roads shall be graveled and maintained to control fugitive particulate emissions.
6. Reclamation works and sequential extraction of material shall be initiated to keep the total disturbed areas at any one time to a minimum

With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider the permit, dust control plan, and associated dust mitigation activities to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Site D (approximately 8 acres) in Figure 68 is east of 31 ½ Rd, west of 31 ¾ Rd. north of C Rd, and south of the river. The land is owned by Raley Francis T. It is zoned inside of the city's limits by the city for agricultural use according to Grand Junction's Zoning Map. This is private property and access is restricted. A significant fraction of the land has vegetated ground cover (as

shown in Figure 71). With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 71: Site D Vegetated (2007 Mesa County GIS Fly Over Photo)

Site E (approximately 3 acres)in Figure 68 is east of 31 ¾ Rd, south of the river, north of C Rd, and west of 32 Rd. The land is owned by Degabriele Becky S. It is zoned outside of the city's limits by the city for agricultural use according to Grand Junction's Zoning Map. As shown in Figure 72, Site E is vegetated land. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 72: Site E Vegetated (Google image 2006)

Site F (approximately 39 acres) in Figure 68 is east of 32 Rd, west of 32 ½ Rd, north of C Rd, and south of the river. The land is owned by A & G Partnership LLP. It is zoned outside of the city's limits by the city as "Agricultural Forestry Transitional" according to Grand Junction's Zoning Map. This is known as the "Parkerson" gravel pit or the "32 Road Gravel Pit". It is owned by Alan Parkerson. The site has a Conditional Use Permit that has been in place since 1986 (APCD Construction Permit #86ME024F). The site also has a Particulate Emissions Control Plan, which it adheres to which includes:

1. Conveyors and transfer points shall be controlled by water spray.
2. Vehicle speed on unpaved areas shall not exceed 5 m.p.h.

3. Vehicle speed on unpaved haul roads shall not exceed 7 m.p.h. and this speed limit shall be posted.
4. Haul roads shall have a gravel surface.
5. Mining shall be limited to approximately 2 acres per year and material handling and storage to approximately 2 acres per year.
6. Disturbed areas shall be revegetated after completion of activities in that area.
7. Load size shall be limited to prevent spillage onto paved surfaces.
8. Entryways onto paved surfaces shall have a gravel surface.
9. Any carryout of mud and dirt onto paved surfaces shall be cleaned up daily.
10. Gravel shall be wetted prior to extraction from the pit and stockpiles.
11. Unpaved and disturbed areas shall be watered during operation of the gravel pit.
12. Gravel shall maintain a minimum of 4% moisture.

There is a berm along the gravel pit's border with a stand of cottonwood trees along it to shield it from wind to reduce blowing dust. Alan Parkerson notes that they try not to work in this pit during the months of March and April, as those months are notorious for high winds and blowing dust. The State has preformed inspections at this site and has not found any violations. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider the permit, dust control plan, and associated dust mitigation activities to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Site G (approximately 5 acres) in Figure 68 is north of C Rd, east of 31 Rd, south of the river, and west of 31 ½ Rd. The land is owned by Melgosa Richard A. It is zoned outside of the city's limits by the city for agricultural use according to Grand Junction's Zoning Map. As shown in Figure 73, Site G is well-maintained, irrigated, and vegetated land. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 73: Site G Vegetation Shown in Red (2003 Mesa County GIS Fly Over Infrared Photo)

Site H (approximately 4 acres)in Figure 68 is south of C Rd, north of B ¾ Rd, east of 31 Rd, and west of 31 ¾ Rd. The land is owned by Devries Darius W. It is zoned outside of the city's limits by the city for agricultural use according to Grand Junction's Zoning Map. As shown in Figure 74, Site H is well-maintained, irrigated, and vegetated land. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 74: Site H Vegetated (Google image 2006)

Site I (approximately 23 acres) in Figure 68 is south of C Rd, west of 33 Rd, east of 32 ½ Rd, and north of B ½ Rd. The land is owned by Mcclellan Beulah J, Aharek Ventures Llc, Touron Barbara, and Oharek Daniel. It is zoned outside of the city's limits by the city mostly for agricultural use according to Grand Junction's Zoning Map. As shown in Figure 75, Site I is well-maintained, irrigated, and vegetated land. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 75: Site I Vegetation Shown in Red (2003 Mesa County GIS Fly Over Infrared Photo)

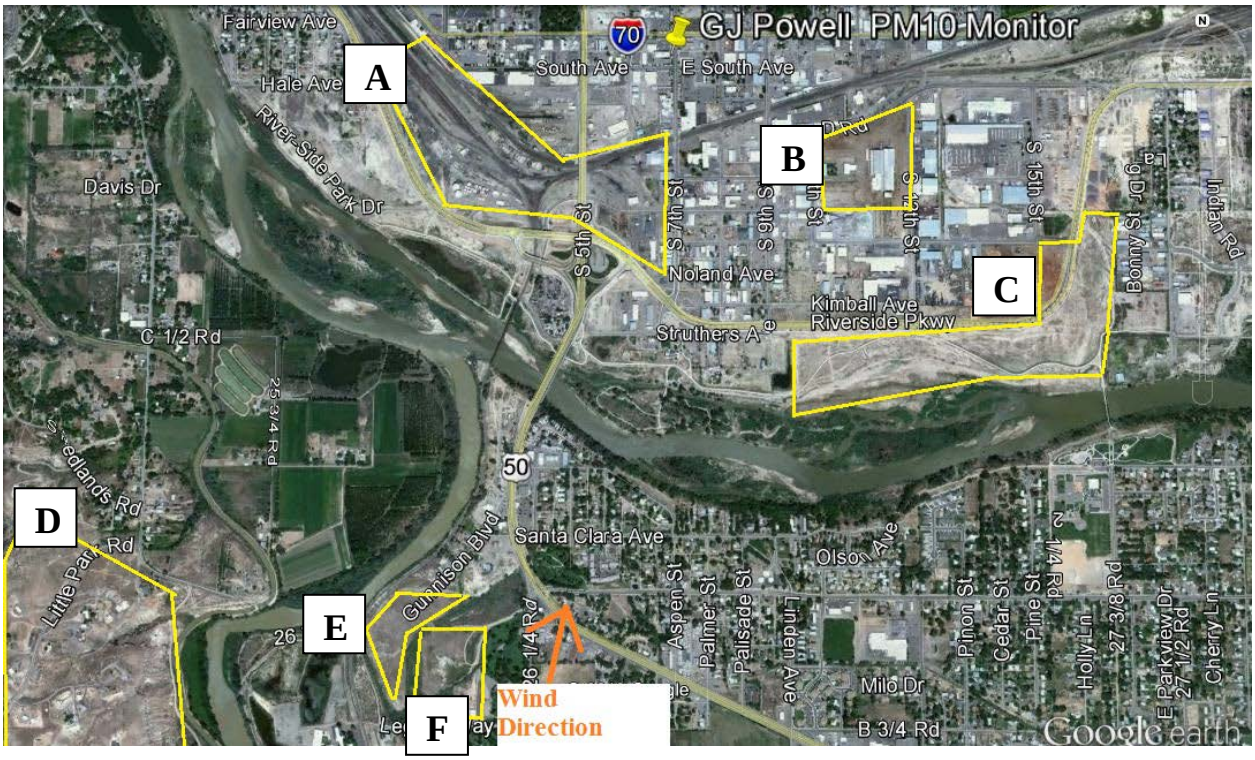


Figure 76: Grand Junction Powell PM10 Monitor with winds originating from the south on May 23, 2010 (Google Earth Image 2011)

Site A in Figure 76 (approximately 52 acres) is north of Highway 50, south of South Ave, west of S 5th St, and east of Broadway. The land is owned by Union Pacific Railroad CO. It is zoned inside of the city's limits by the city as "General Industrial" according to Grand Junction's Zoning Map. This is private property owned by the Railroad. To control dust emissions from onsite the speed limit is 5 miles per hour on the unpaved roads. Some onsite roads are already paved. All dirt roads were covered with gravel in 2010. As funding permits roads within the property are paved. All the train tracks are raised up on 3 inch diameter rock and tracks. Areas that are not used by the railroad are allowed to be naturally vegetated with Xeriscape**.** Most of the onsite land surface is hard packed clay or compacted soil that is undisturbed. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider reduced road speeds, gravel and paving, and Xeriscape vegetation to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Site B in Figure 76 (approximately 19 acres) is west of S 10th St, east of S 12 St, north of 4th Ave, and south of D Rd. The land is owned by IPE Holdings LLC. It is zoned inside of the city's limits by the city as "General Industrial" according to Grand Junction's Zoning Map. This is the Grand Junction Steel Company founded in 1947 and owned by Hirschfeld Industries LP as of 2007. The company fabricated steel. Access to the site is restricted by an electrical security fence. This steel facility closed in September of 2009. Between 2009 and 2012 the company preformed abatement activities on all hydraulic fluid and cleaned up the land by removing all hardware. The company installed a layer of crushed lime stone over the top soil to control dust. In January of 2012 the land was released back to the land owner. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider crushed lime stone cover and restricted access to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Site C in Figure 76 (approximately 57 acres) is south of Riverside Pkwy, north of the river, east of 9th St, and west of 27 ½ Rd. The land is owned by the City Of Grand Junction. It is zoned inside of the city's limits by the city as "Community Services and Rec." according to Grand Junction's Zoning Map. Site C is

part of the River Front recreational trail system. As shown in Figure 77, Site C is vegetated land. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider vegetation cover to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

Figure 77: Site C Vegetated (2007 Mesa County GIS Fly Over Photo)

Site D in Figure 76 (approximately 100 acres) is west of Gunnison Dam Rd, east of Little Park Rd, and south of Rosevale Rd. The land is zoned inside of the city's limits by the city mostly as "Residential, 2-4 units/acre" according to Grand Junction's Zoning Map. It is a subdivision called "Bonnie Brae". Many of the private residences have landscaping and well maintained land. This site is at very high in elevation and natural vegetation is sparse. Much of this land is open space that is used for public recreational use (hiking, biking, etc.). With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider private residence maintenance and natural vegetation to be appropriate available and practical methods that are technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source. Additionally, as described earlier in this section, The County actively responds to blowing dust complaints in accordance with a delegation contract with the Division and has a response coordination system with the Division as warranted.
Site E and Site F (approximately 18 acres total) in Figure 76 are southeast of the river, north of Legacy Way, and west of 26 ¼ Rd. The land is owned by the City of Grand Junction Potter's Field Municipal Cemetery. It is zoned inside of the city's limits by the city as "Community Services and Rec." according to Grand Junction's Zoning Map. This is a very old pioneer cemetery that had its first known burial in 1909. Access to the Cemetery is controlled by a barbed wire fence that has a small break for an entrance. In 1985 the local chapter of the Telephone Pioneers of American adopted Potter's Field. Each year since they have a "work party" to clean up this historic cemetery and in doing so have preserved, protected and cared for it. Members do all of this at their own expense to preserve this part of local heritage. With regard to AQCC Regulation 1 requirements (Section III.D), the Division and Mesa County Health Department consider community maintenance and restricted access to be the appropriate available and practical method that is technologically feasible and economically reasonable in order to minimize fugitive particulate emissions for this type of source.

In summary, the Division conducted thorough assessments to determine if the potential soil disturbances shown in Figure 68 and Figure 76 were present during the 2010 exceedances. During the course of these assessments, the Division discovered that these sites were reasonably controlled during the May 22 and 23, 2010 high wind event. Therefore, these sites were not significant contributors to fugitive dust in the Grand Junction area during the May 22 and 23, 2010 high wind event.

6.0 Summary and Conclusions

APCD is requesting concurrence on exclusion of the PM_{10} values from Alamosa-Adams State College (08-003-0001), Alamosa-Municipal Building (08-003-0003), and Pagosa Springs-Middle School (08-007-0001) on May 22, 2010. APCD is also requesting concurrence on exclusion of the PM_{10} values taken in Grand Junction at the Powell Building (08-077-0017) and Clifton Sanitation (08-077-0019) on May 23, 2010.

Elevated 24-hour PM_{10} concentrations were recorded across Colorado on May 22 and 23, 2010. All of the noted May 22 and 23, 2010, twenty-four-hour PM_{10} concentrations were above the 90^{th} percentile concentrations for their locations (see Table 26 and Table 27). This event produced the maximum value in one of the five datasets and exceeded the 98th% value of any evaluation criteria for the other four sites. The statistical and meteorological data clearly shows that but for this high wind blowing dust event, Alamosa, Pagosa Springs, and Grand Junction would not have exceeded the 24-hour NAAQS on May 22 and 23, 2010. Since at least 2005, there has not been an exceedance that was not associated with high winds carrying PM_{10} dust from distant sources in these areas. This is evidence that the event was associated with a measured concentration in excess of normal historical fluctuations including background.

The PM_{10} exceedances in Alamosa, Pagosa Springs, and Grand Junction on May 22 and 23, 2010, would not have occurred if not for the following: (a) dry soil conditions over northeast Arizona, northwest New Mexico, most of Utah, and parts of western Colorado with 30-day precipitation totals below the threshold identified as a precondition for blowing dust in northeastern Arizona; (b) a surface low pressure system and cold front that were associated with a strong upper-level trough that caused strong prefrontal surface winds over the area of concern; and (c) friction velocities over regions of northern Arizona, northwest New Mexico, and southeast Utah that were high enough to allow entrainment of dust from natural sources with subsequent transport of the dust to Colorado in strong winds.

Surface weather maps for the Four Corner States show evidence of widespread blowing dust and winds above the threshold speeds for blowing dust on May 22 and 23, 2010. The combination of strong winds aloft, deep mixing, and the tight pressure gradients associated with the surface low pressure system from this storm caused surface winds of up to 41 mph with gusts to 56 mph. These speeds are above the thresholds for blowing dust identified in EPA draft guidance and in detailed analyses completed by the State of Colorado. Specifically, these high values on both days were the consequence of strong southwesterly prefrontal winds beginning on May 22 and extending through May 23 in combination with dry conditions which caused significant blowing dust across much of Arizona, northwest New Mexico, southeast Utah and southwest Colorado. These PM_{10} exceedances were due to an exceptional event associated with regional windstorm-caused emissions from erodible soil sources over a large area of northeastern Arizona, most of Utah, and parts of western Colorado. These sources are not reasonably controllable during a significant windstorm under abnormally dry or moderate drought conditions.

The blowing dust climatology for the Four Corners area indicates that the area can be susceptible to blowing dust when winds are high. Landform imagery shows that northeastern Arizona and southeastern Utah in particular have experienced a long-term pattern of wind erosion and blowing dust when winds have been southwesterly and blowing into western and southern Colorado. Forecast products from the Navy Aerosol Analysis and Prediction System model provide evidence for a widespread blowing dust event in the Four Corners states, suggesting that significant source regions for dust in Colorado were located in arid regions of Arizona, New Mexico and Utah. NOAA HYSPLIT forward and backward trajectories provide clear supporting evidence that dust from desert regions of Arizona, northwest New Mexico and southeast Utah caused the PM_{10} exceedances measured across portions of west-central and southwest Colorado

on May 22 and 23, 2010. Soils in the Four Corners area of northeast Arizona, northwest New Mexico and southeast Utah were dry enough to produce blowing dust when winds were above the thresholds for blowing dust.

Both wind speeds and soil moisture in the Four Corners area and northeastern Arizona were conducive to the generation of significant blowing dust. Multiple sources of data for the event in question and analyses of past dust storms in this area prove that this was a natural event and, more specifically, a significant natural dust storm originating in northeastern Arizona and northwestern New Mexico and spreading into southwestern Colorado. But for the dust storm on May 22 and 23, 2010, this exceedance would not have occurred.

Friction velocities provide a measure of the near-surface meteorological conditions necessary to cause blowing dust. Friction velocities northern Arizona, northwest New Mexico, southeast Utah, and west-central and southwest Colorado were above 1.0 meters per second on May 22 and 23, 2010. Even undisturbed desert soils normally resistant to wind erosion will be susceptible to blowing dust when friction velocities are greater than about 1.0 to 2.0 meters per second. Note that blowing dust will typically only occur where these values are high and the soils are dry and not protected by vegetation, forest cover, boulders, rocks, etc. Friction velocities were high enough to sustain blowing dust over undisturbed soils in each of the Four Corners states during this event. This is why blowing dust occurred in the desert and more arid areas of northern Arizona, northwest New Mexico, southeast Utah, and west-central and southwest Colorado on May 22 and 23, 2010. These elevated friction velocities (shown in Figure 35 and Figure 36) and the data on soil moisture conditions presented elsewhere in this report, and the prevalence of winds above blowing dust thresholds (all occurring in traditional source regions in northeastern Arizona and northwestern New Mexico) prove that this dust storm was a natural event that was not reasonably controllable or preventable.

MODIS and GOES satellite imagery show that the Painted Desert and Four Corners area in general were source regions for the blowing dust on May 22 and 23, 2010. This is consistent with the climatology for many dust storms in Colorado as described in the Grand Junction, Colorado, Blowing Dust Climatology report contained in Appendix A of this document. The observations of winds above blowing dust thresholds and restricted visibilities in the areas of concern demonstrate that this is a natural event that cannot be reasonably controlled or prevented.

The Center for Snow and Avalanche Studies has been studying the effects of wind-blown desert dust from Arizona, New Mexico, and Utah on snowpack albedo and snowmelt in the San Juan Mountains of Colorado. The Center for Snow and Avalanche Studies lists May 22, 2010, as one of nine Dust-on-Snow events for the 2009/2010 water year, and this provides clear supporting evidence that a regional blowing dust event with long-range transport caused the PM10 exceedances measured across portions of Colorado on May 22, 2010. Snow cover data provide strong evidence that a widespread, regional, blowing dust event caused exceedances at these locations. In addition, NOAA and USGS scientists reported significant dust transport from the Four Corners area into southern and western Colorado on May 22 and 23, 2010.

As demonstrated in Section 3 and particularly in Table 23 and Table 24 the PM_{10} exceedances and other elevated PM_{10} concentrations in Alamosa, Pagosa Springs, and Grand Junction on May 22 and 23, 2010, would not have occurred “but for” the large regional dust storm on May 22 and 23, 2010.

7.0 References

Colorado Department of Public Health and Environment, City of Lamar, Prowers County Commissioners, *Natural Events Action Plan for High Wind Events – Lamar, Colorado*, April 1998.

Draxler, R.R. and Rolph, G.D., 2012. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://ready.arl.noaa.gov/HYSPLIT.php). NOAA Air Resources Laboratory, Silver Spring, MD.

Marticorena, B., G. Bergametti, D. Gillette, and J. Belnap, 1997, Factors controlling threshold friction velocity in semiarid and arid areas of the United States, *Journal of Geophysical Research 102 D19*, 23,277-23, 287.

Technical Services Program, Air Pollution Control Division, Colorado Department of Public Health and Environment, November 22, 2011,*Technical Support Document for the January 19, 2009 Lamar Exceptional Event.*

United States Environmental Protection Agency, June 2012, draft Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Affected by High Winds under the Exceptional Events Rule

Appendix A- Grand Junction, Colorado, Blowing Dust Climatology January 24, 2012

There can be significant transport of regional blowing dust into Grand Junction from source regions in Utah and Arizona. While there are sources for wind-blown dust within the Grand Valley and Grand Junction itself, there is evidence from the analysis of soil features, wind and precipitation climatology, and statistical analyses of Grand Junction exceedances of the PM10 standard that regional sources often play a significant role during these blowing dust events. This document provides a weight of evidence analysis for dust transport into Colorado.

Grand Junction, Colorado, is located in a part of the country that is largely arid to semi-arid. Figure A-1 through A-3 show the annual average precipitation for Colorado, Arizona, and Utah, respectively. Grand Junction is in the Grand Valley of Western Colorado where the annual precipitation is typically less than 10 inches. Northeastern Arizona, which is frequently upwind of Grand Junction during blowing dust events, receives between 5 and 15 inches of precipitation each year. The Colorado River Basin in eastern and southeastern Utah, which is also frequently upwind of Grand Junction during blowing dust events, also receives 5 to 10 inches per year.

Figure A-4 shows the 1971-2000 monthly normal precipitation amounts for Grand Junction, Colorado. The annual average for this time period is 8.99 inches. The wettest months are March through May and August through October. The driest months are January, February, June, July, November, and December. These months receive an average of 0.57 inches per month. The annual monthly average precipitation is 0.75 inches.

Arid to semi-arid soils make much of the region susceptible to blowing dust. The map in Figure A-5 shows that portion of the Colorado Plateau (circled in red) where modern wind erosion features are common and clearly visible in Google Earth images. These features include longitudinal dunes and other sand or soil erosion structures with a predominant southwest to northeast orientation. This orientation is the result of the predominant southwesterly flow that occurs during high wind and blowing dust events in the region. Figures A-6 through A-12 present aerial views of ubiquitous erosion features in northeastern Arizona and southeastern Utah. The Painted Desert of northeastern Arizona is frequently the source for much of the blowing dust in the Four Corners region. Figure A-13 provides a particularly good satellite image of a blowing dust event originating in the Painted Desert and extending northeastward across the junction of the Four Corners (source: NASA Tera satellite, http://earthobservatory.nasa.gov/IOTD/view.php?id=37791). Strong southwesterly winds caused this blowing dust event.

The text that accompanies this image on NASA's Earth Observatory 10th Anniversary page follows below:

> "A dust storm struck northeastern Arizona on April 3, 2009. With winds over 145 kilometers (90 miles) per hour reported near Meteor Crater, east of Flagstaff, the storm reduced visibility and forced the temporary closure of part of Interstate 40, according to *The Arizona Republic.*
>
> The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured this image on April 3, 2009. Clear skies allow a view of multiple source points of this dust storm. The source points occur along an arc that runs from northwest to southeast.

This dust storm occurred in the area known as Arizona's Painted Desert, and the dust plumes show why. Whereas many dust plumes are uniform in color, these plumes resemble a band of multicolored ribbons, ranging from pale beige to red-brown, reflecting the varied soils from which the plumes arise. The landscapes of the Painted Desert are comprised mostly of Chinle Formation rocks—remains of sediments laid down during the time of the first dinosaurs, over 200 million years ago."

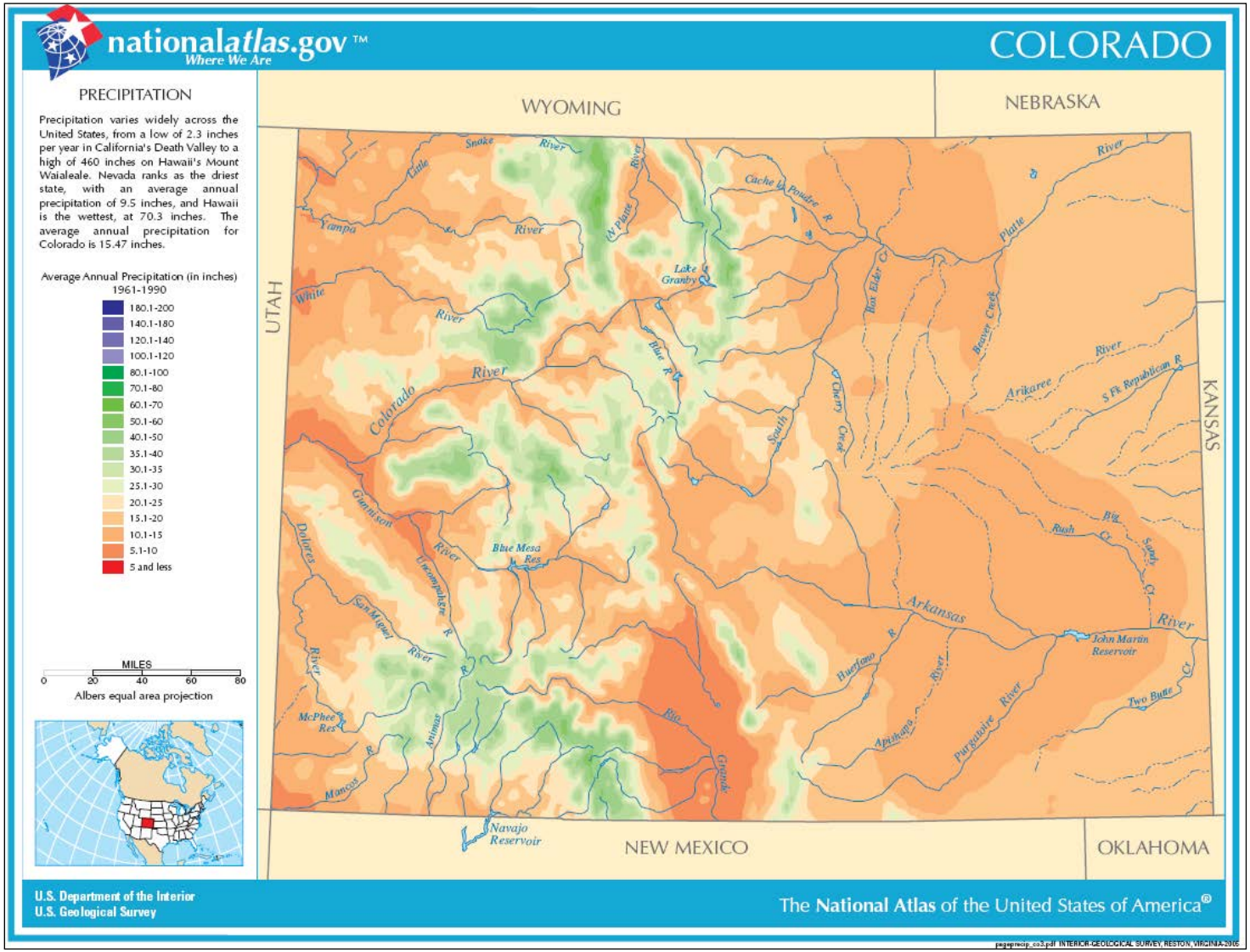


Figure A-1. Average annual precipitation in Colorado based on 1961-1990 normals.

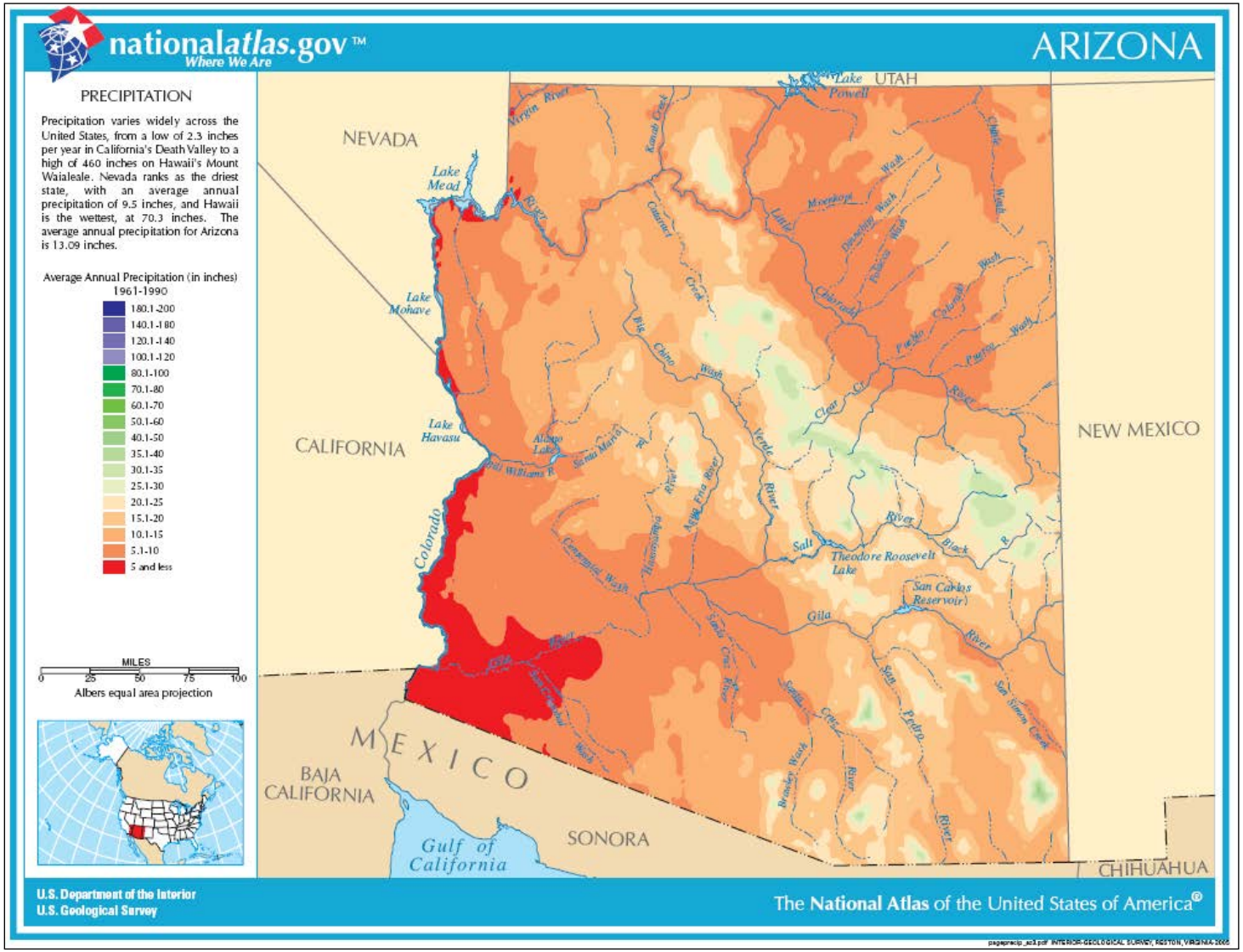


Figure A-2. Average annual precipitation in Arizona based on 1961-1990 normals.

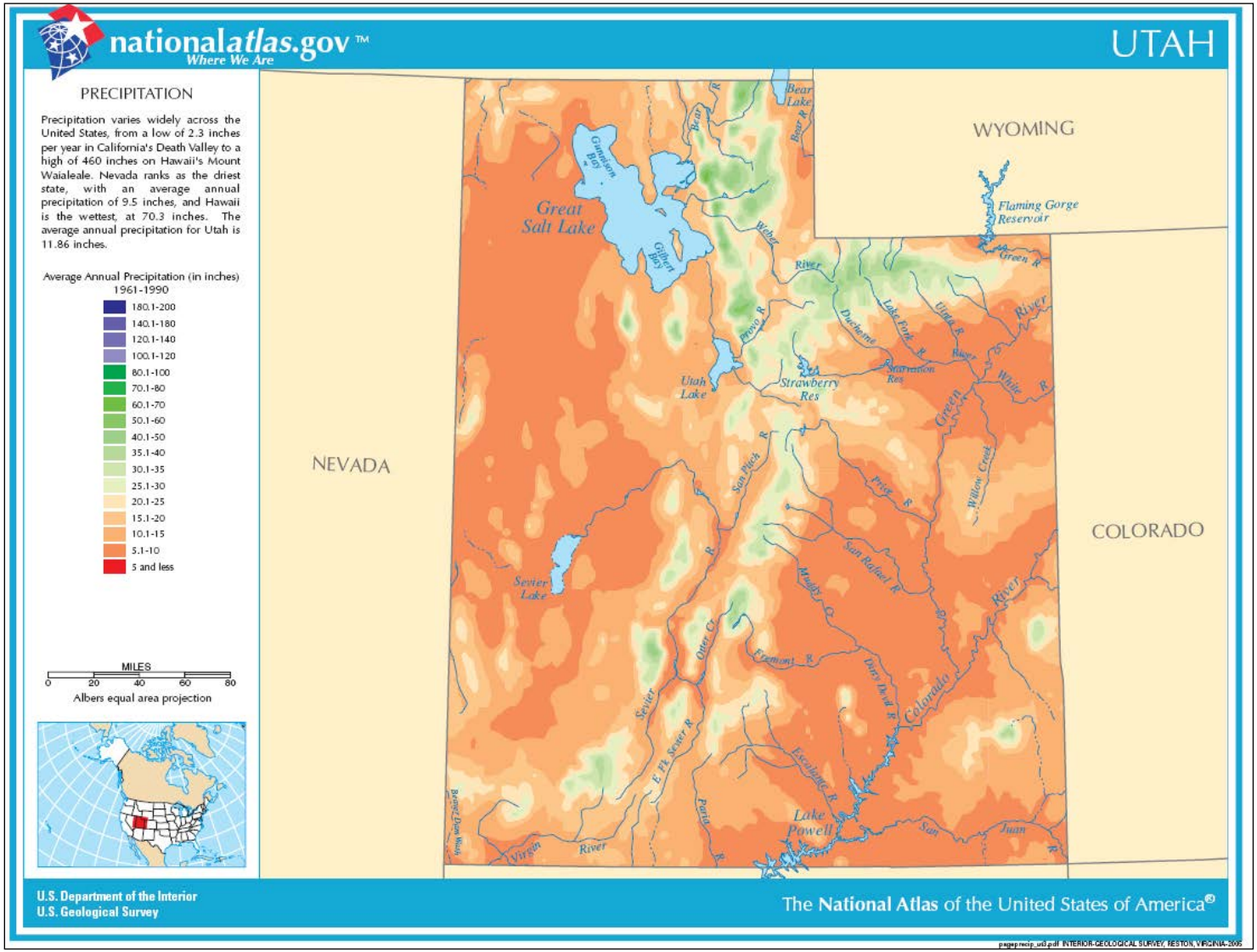


Figure A-3. Average annual precipitation in Utah based on 1961-1990 normals.

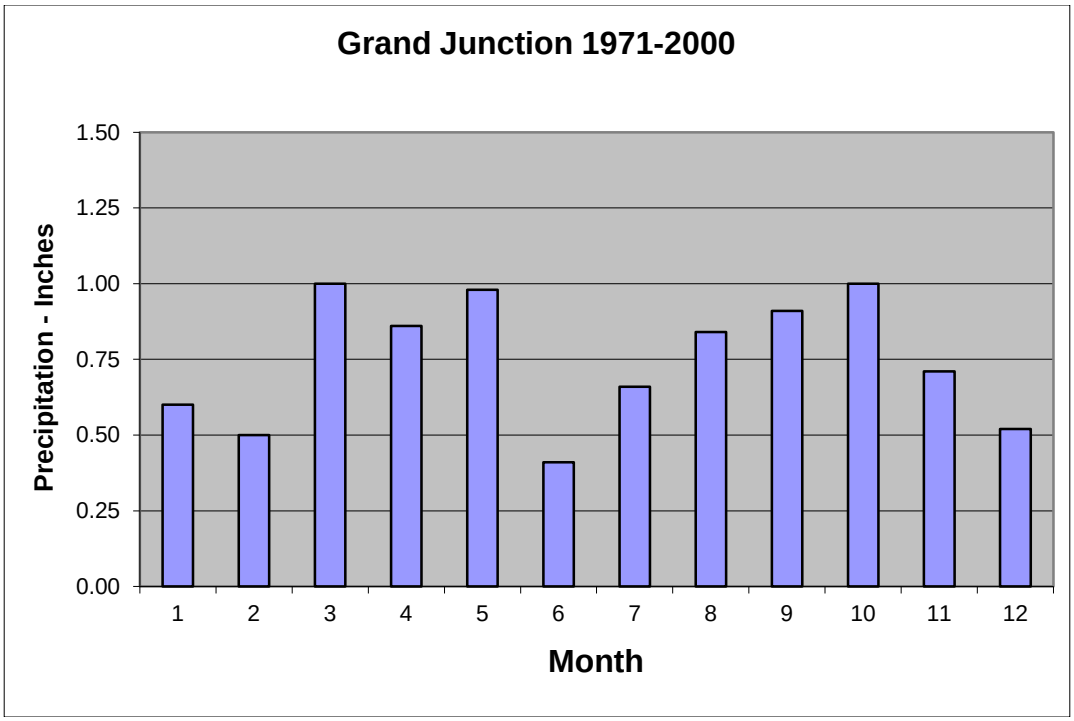


Figure A-4. 1971-2000 monthly normal precipitation in Grand Junction Colorado.

Figure A-5. The portion of the Colorado Plateau in Utah, Arizona, and New Mexico that exhibits widespread surface soil and sand erosion features in Google Earth imagery. Much of the highlighted area within Arizona is within the Painted Desert.

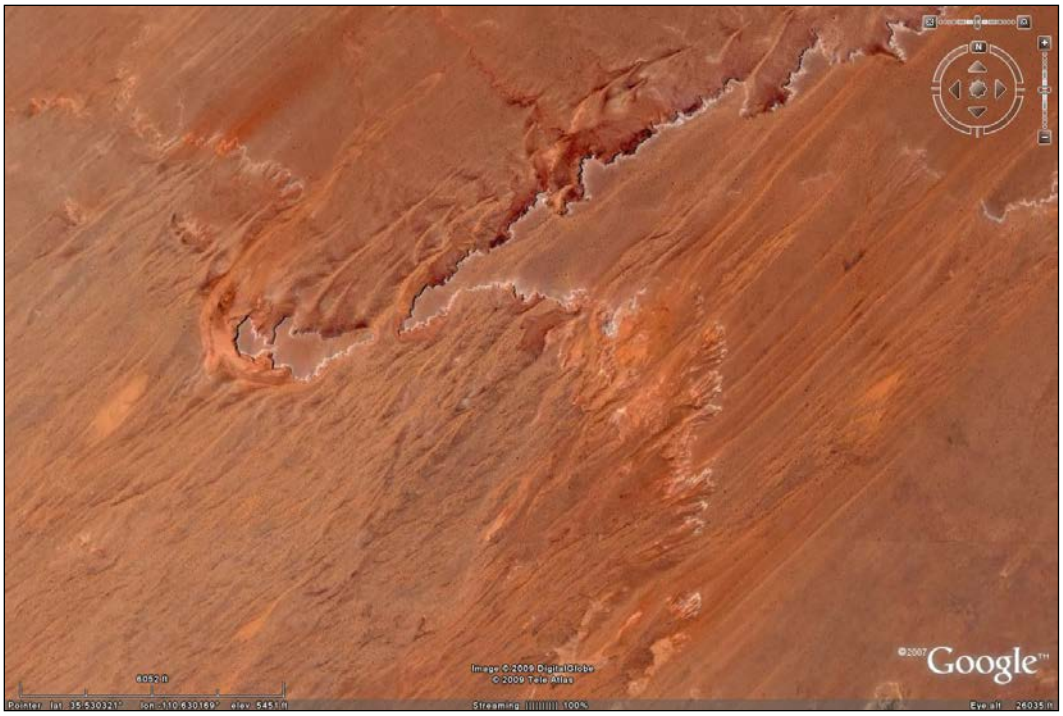


Figure A-6. Southwest to northeast soil and sand erosion structures in southeastern Utah.

Figure A-7. Southwest to northeast soil and sand erosion structures in northeastern Arizona (Painted Desert).

Figure A-8. Southwest to northeast soil and sand erosion structures in southeastern Utah.

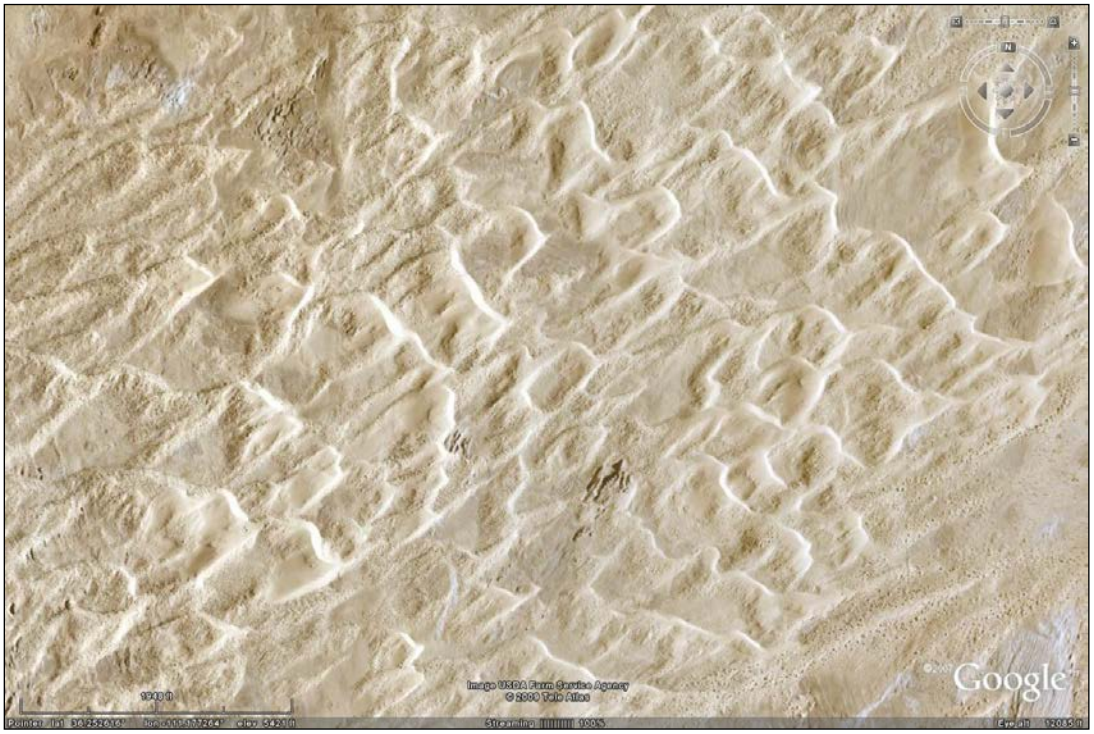


Figure A-9. Southwest to northeast soil and sand erosion structures in northeastern Arizona (Painted Desert). The slip faces of dunes (lighter bands) face in the direction of wind flow – toward the northeast.

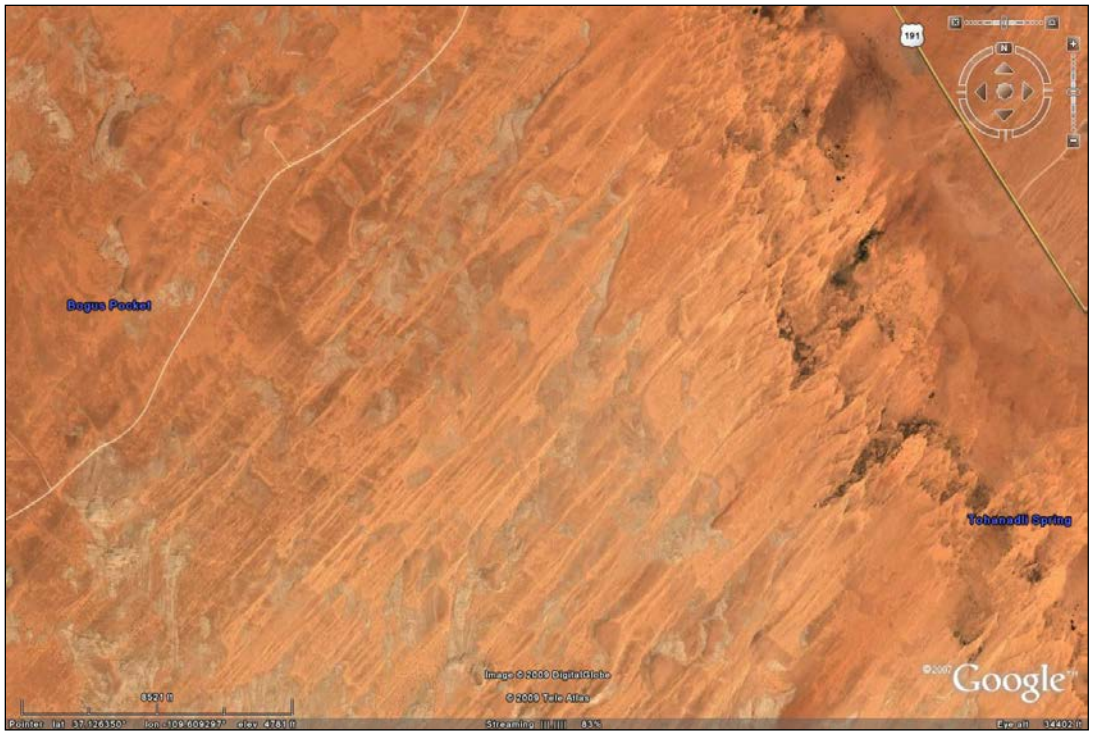


Figure A-10. Southwest to northeast soil and sand erosion structures in southeastern Utah.

Figure A-11. Southwest to northeast soil and sand erosion structures in northeastern Arizona (Painted Desert).

Figure A-12. Southwest to northeast soil and sand erosion structures in northeastern Arizona (Painted Desert).

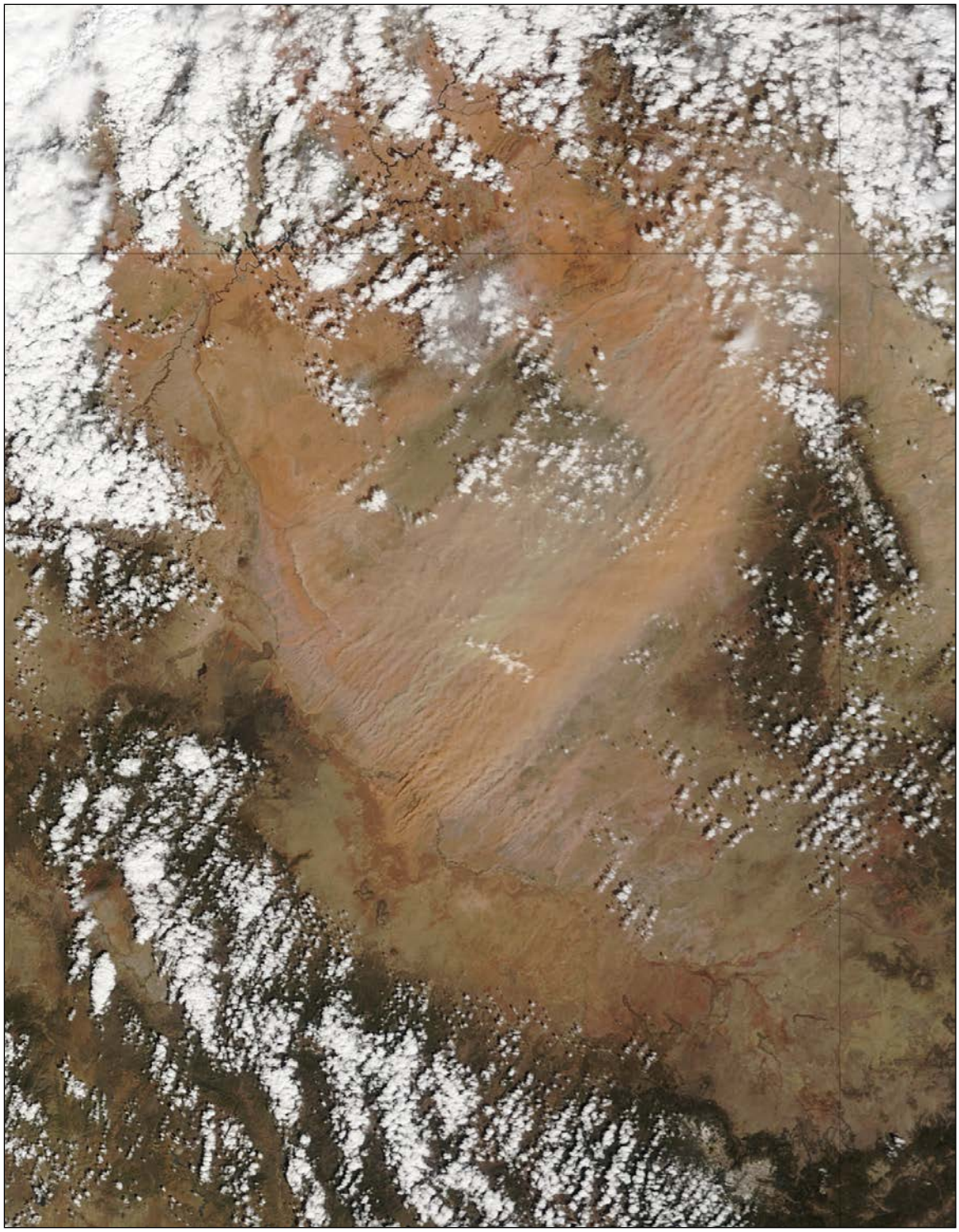


Figure A-13. NASA Tera satellite image of a dust storm on April 3, 2009, in southwesterly flow over the Painted Desert of northeastern Arizona (http://earthobservatory.nasa.gov/IOTD/view.php?id=37791).

Figure A-14 displays the surface weather map for this event (00Z April 4, 2009, or 5 PM MST April 3, 2009). A strong low pressure system in southern Colorado, strong southwesterly winds in the Four Corners area, and the blowing dust symbol (infinity sign) at Farmington (New Mexico) and Cortez (Colorado) are evident in this map. Blowing dust in this region is frequently associated with southwesterly flow.

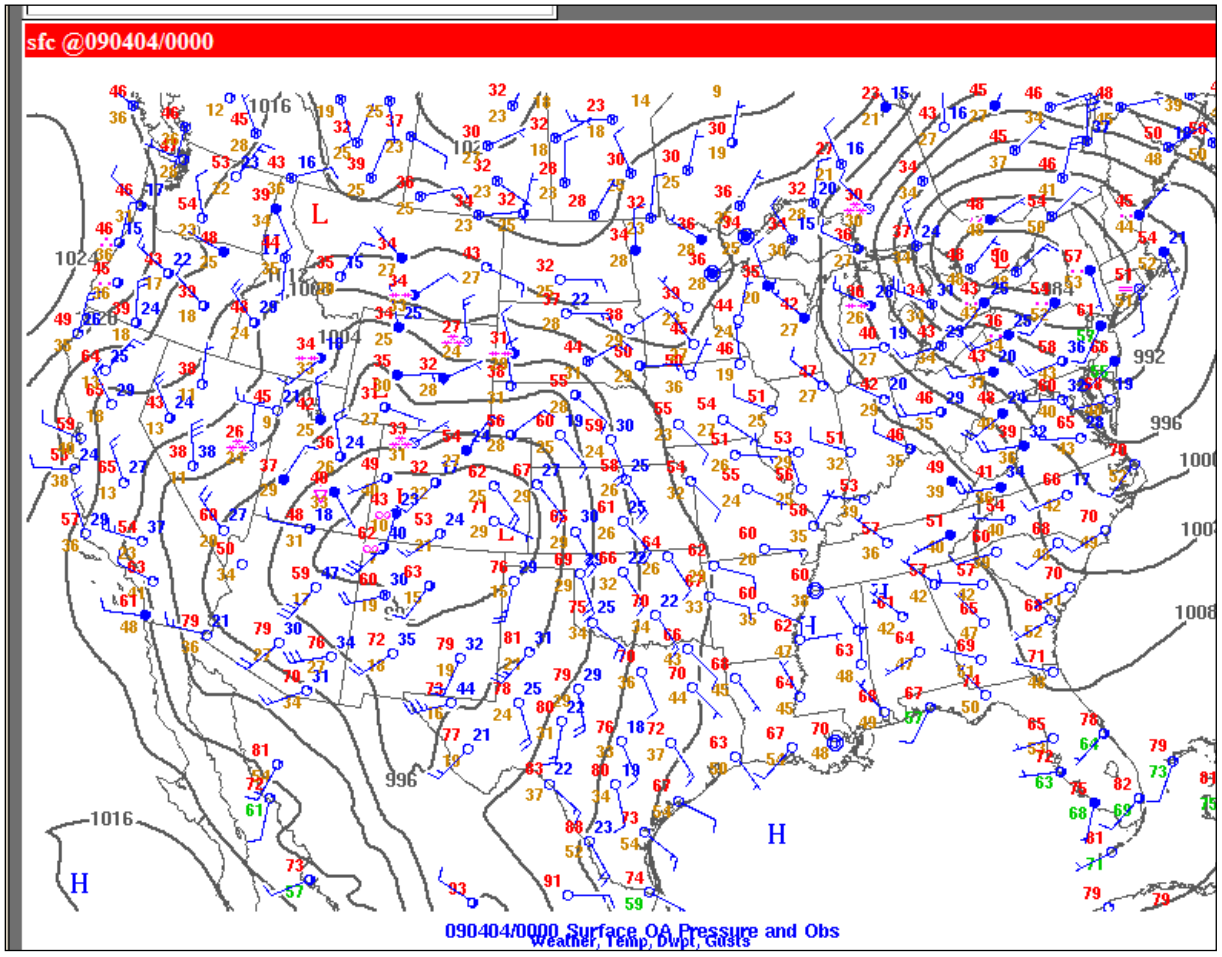


Figure A-14. Surface weather map for 00Z April 4, 2009, (5 PM MST April 3, 2009), showing a strong low pressure system in southern Colorado, strong southwesterly winds in the Four Corners area and the blowing dust symbol (infinity sign) at Farmington (New Mexico) and Cortez (Colorado).

A USGS map of the Colorado Plateau in Figure A-15 shows the prevalence of eolian or wind-blown sand deposits in southeastern Utah and northeastern Arizona. An analysis of the annual frequency of dust storms (Orgill and Sehmel, 1976) in the western half of the U.S. suggests that portions of eastern and western Utah and northeastern Arizona are source regions for blowing dust (see Figure A-16). Soil and sand structures point to the prevalence of southwesterly flow during blowing dust events, and precipitation climatology highlights the potential for blowing dust across much of the region. In addition, an analysis of back trajectories associated with high PM10 concentration events in Grand Junction discussed in the next section of this document supports the conclusion that soils in Arizona and

Utah are likely significant contributors to PM10 measured during many dust storms affecting Grand Junction.

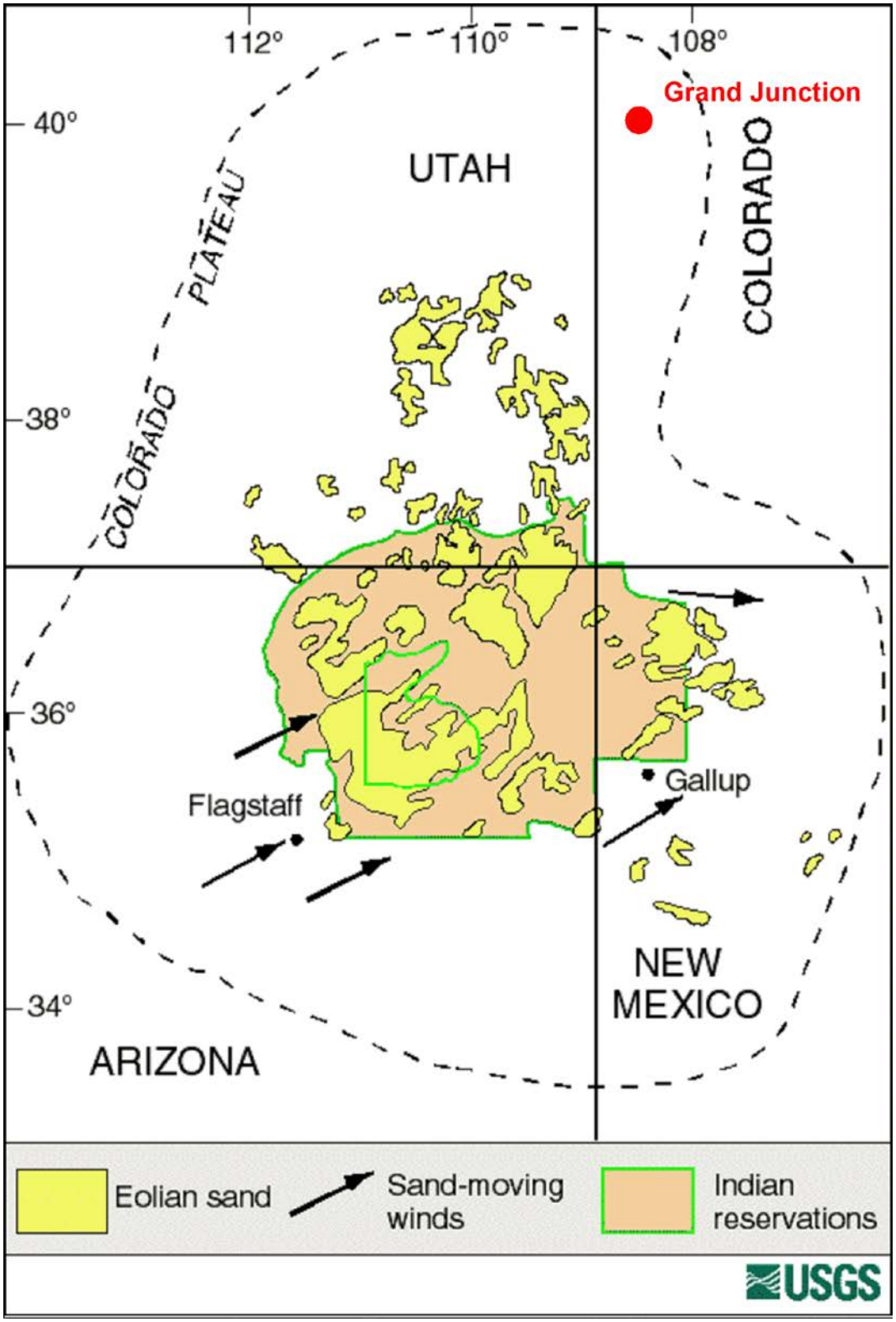


Figure A-15. USGS map of eolian sand features on the Colorado Plateau

(http://geochange.er.usgs.gov/sw/impacts/geology/sand/).

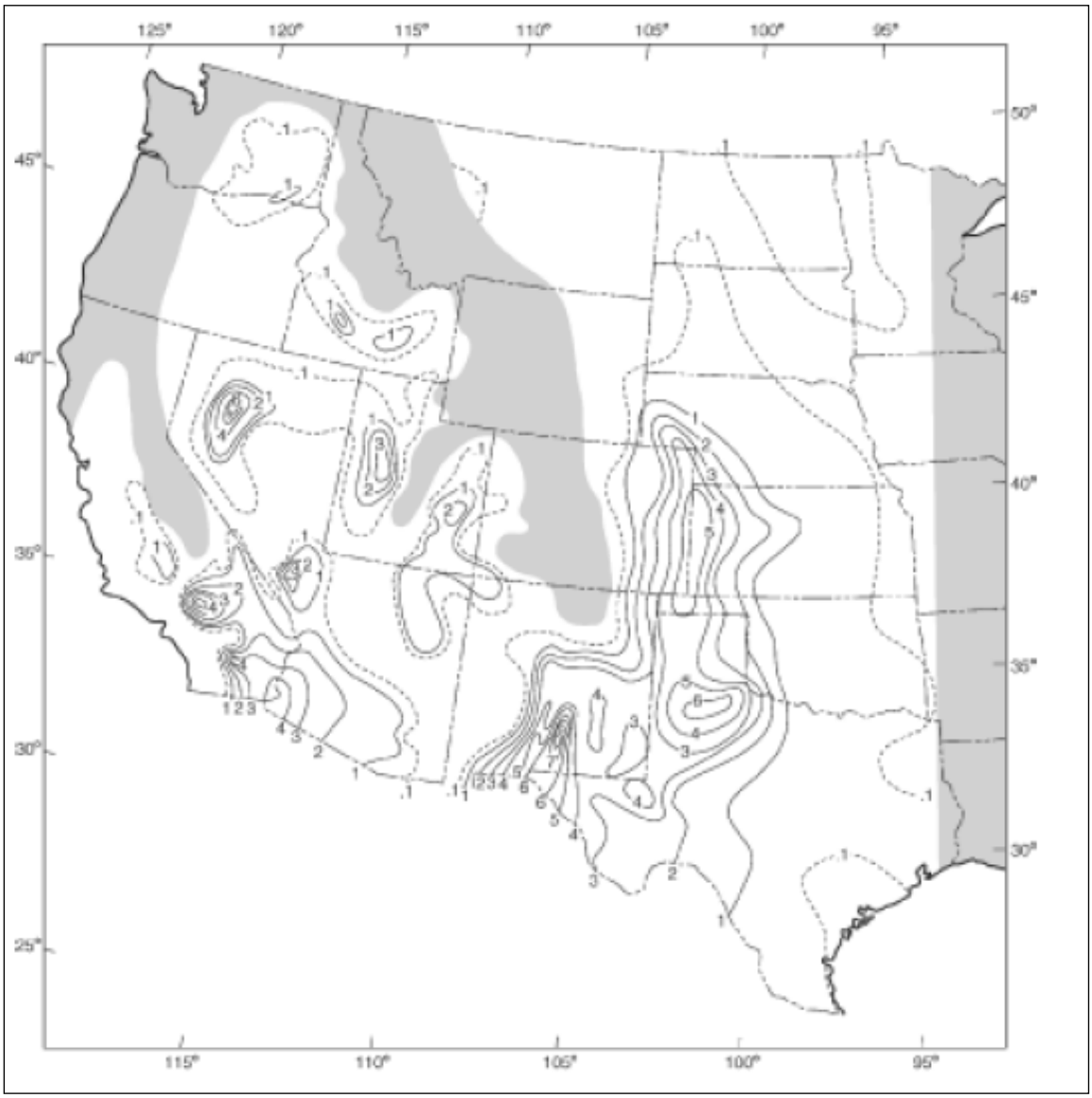


Figure A-16. Number of dust storms per year from: Orgill, M.M., Sehmel, G.A., 1976. Frequency and diurnal variation of dust storms in the contiguous USA. **Atmospheric Environment 10**, 813‑825.

NOAA HYSPLIT 36-hour back trajectories were calculated for Grand Junction for the eight 24-hour periods from 2004 through early 2009 with the Powell monitor PM10 concentrations in excess of 75 ug/m3, strong regional winds, and dry soils. Trajectories were modeled every 4 hours for each day. Data presented later in this document provides evidence that the moderate to high PM10 levels on these days were from blowing dust. The 6 back trajectories for each day were calculated for an arrival height of 500 meters using EDAS40 data and model vertical velocities (see: http://www.arl.noaa.gov/HYSPLIT.php). The eight days used in the analysis and the Powell monitor concentrations measured on these days are presented in Table A-1.

The back trajectories for these high-concentration days are shown in Figure A-17. Transport was generally from the west through southwest. A high density of trajectory points is found in northeast Arizona and southeast Utah. Most of these trajectories in Figure A-17 are also consistent with transport from or across suspected or known blowing dust source regions highlighted in Figures A-5, A-13, A-15, and A-16.

Table A-1. Grand Junction Powell monitor days with concentrations in excess of 75 ug/m3 and blowing dust conditions (from 2004 through early 2009).

Year	Month	Day	Powell 24-hour PM10 concentration in ug/m3
2005	4	19	197.8
2008	4	15	116.1
2008	4	21	103.6
2004	9	3	102
2006	3	3	98.3
2008	5	21	86.7
2008	4	30	83.5
2006	6	7	77.9

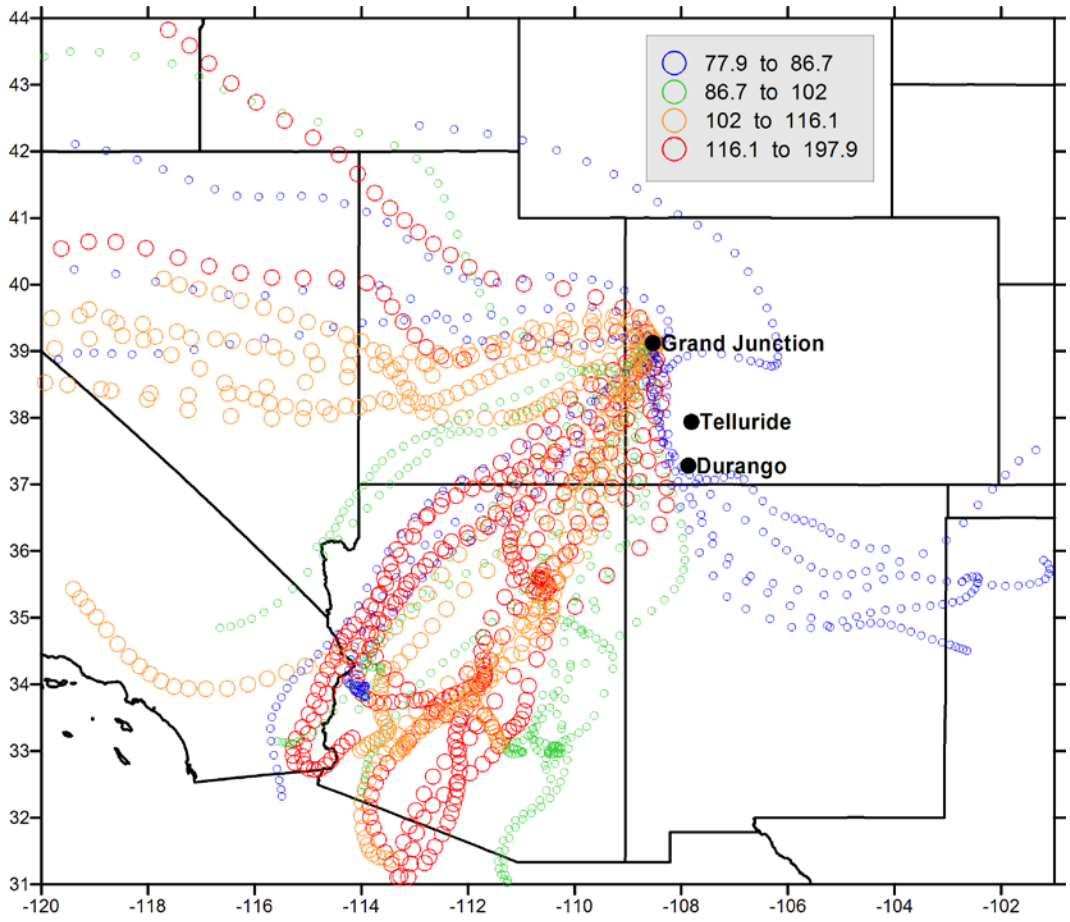


Figure A-17. NOAA HYSPLIT 36-hour back trajectories for Grand Junction for those eight 24-hour periods from 2004 through early 2009 with the Powell monitor PM10 concentrations in excess of 75 ug/m3, strong regional winds, and dry soils. Trajectory points are sized and color-coded to reflect 24-hour PM10 concentrations in ug/m3. Trajectories were calculated every 4 hours for each day.

The trajectories in Figure A-17 point to the possibility that, at times, dust from Utah and Arizona can have a major impact on Grand Junction and less of an impact elsewhere in western Colorado. This non-homogeneity is possible given the fact that dust storms are frequently organized into discreet plumes from discreet areas that maintain their integrity for long distances. An example of this can be seen in Figure A-18 that shows plumes of dust in New Mexico during a windstorm on May 20, 2008.

Figure A-19 shows the NOAA HYSPLIT back trajectories for the highest concentration day during the 2004 through early 2009 period: April 19, 2005. Twenty-four hour back trajectories for each hour during the period with high winds (using EDAS40 data and 500-meter arrival heights) show that the back trajectories for Grand Junction were more likely to have crossed the Painted Desert and southeastern Utah than those for Telluride and Durango, which measured lower PM10 concentrations on this day.

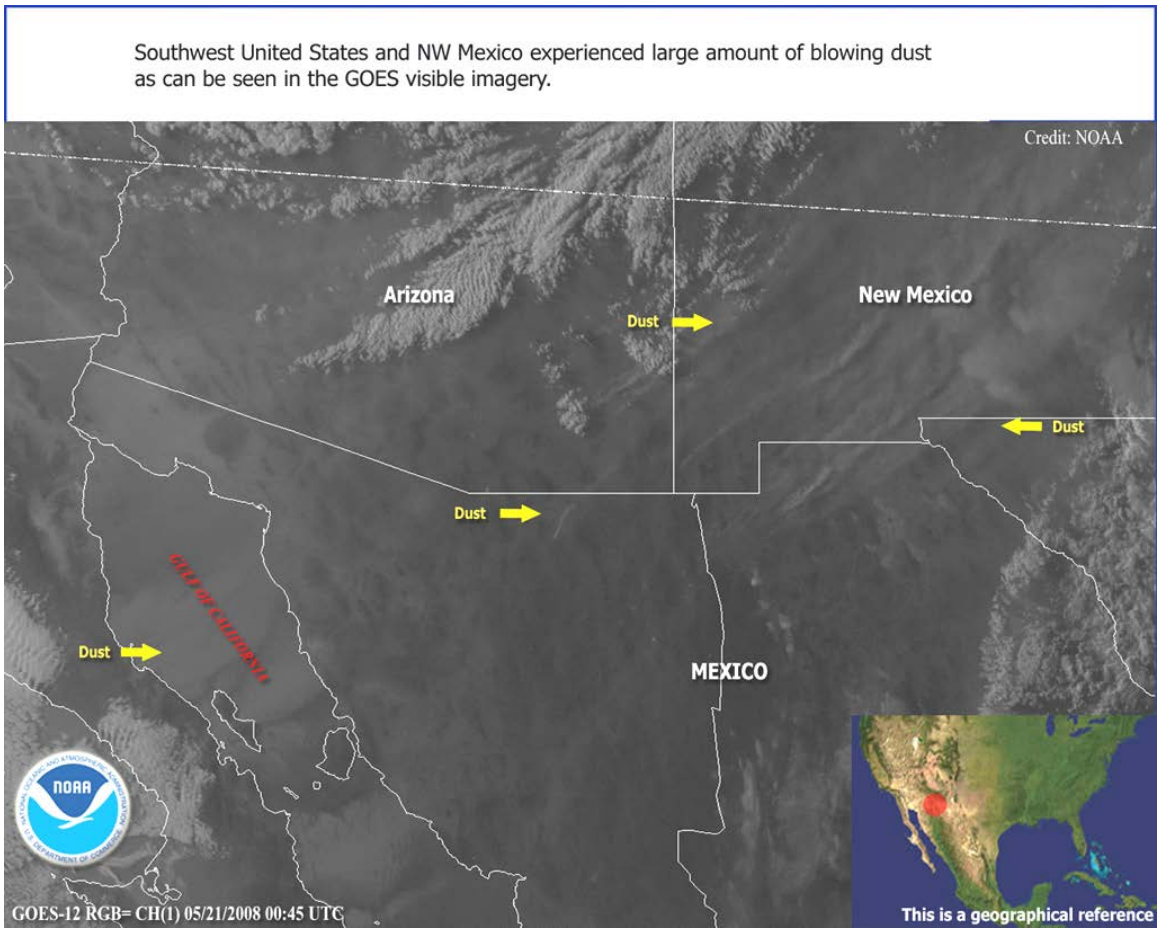


Figure A-18. Discreet plumes of blowing dust in New Mexico, Mexico, and Arizona visible in GOES satellite imagery for May 20, 2008 (http://www.osei.noaa.gov/Events/Dust/US_Southwest/2008/DSTusmx142_G12.jpg).

K-means cluster analysis has been applied to Grand Junction Powell PM10 concentrations, Grand Junction and Painted Desert 30-day total precipitation for each PM10 monitoring day, and Grand Junction and Painted Desert

daily maximum wind gust speeds for each monitoring day. K-means cluster analysis is a statistical method for identifying clusters or groupings of values for many variables. For environmental variables, these clusters often represent distinct processes, conditions, or events. In this case, cluster analysis differentiates PM10 concentrations associated with strong winds, low soil moistures, and blowing dust by providing mean values for these 5 variables for 5 distinct categories of PM10 events. The period of record considered was from January 2004 through March 2009. The Hopi weather station located in the central portion of the Painted Desert was used to represent Painted Desert conditions in northeastern Arizona, and the Grand Junction National Weather Service station was used to represent Grand Junction conditions. The 30-day total precipitation values appear to be a better metric for blowing dust conditions than shorter-term totals.

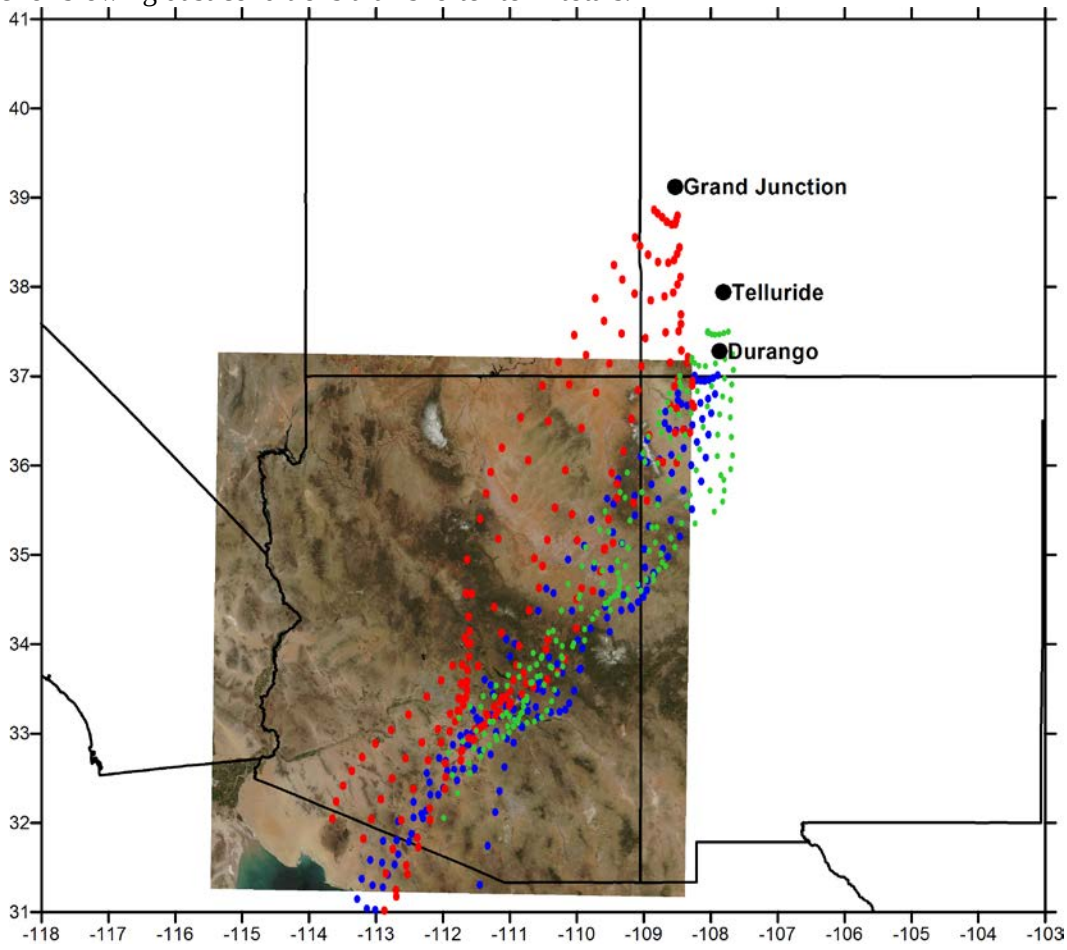


Figure A-19. 24-hour NOAA HYSPLIT back trajectories for every hour from 1500 MST to 2200 MST for Grand Junction (red), Telluride (green), and Durango (blue) for the dust storm of April 19, 2005.

The results of the cluster analysis are presented in Table A-2 below. Cluster 1 represents high soil moisture conditions, moderate gust speeds, and low PM10 concentrations. Cluster 2 represents very low soil moisture, moderate PM10, and low gust speeds. Cluster 3 represents low soil moisture, moderate gusts, and low PM10. Cluster 4 represents moderate soil moisture, low gusts, and low PM10. Finally, Cluster 5 represents high PM10, high gusts, and low soil moisture. Cluster numbers, Grand Junction Powell PM10 concentrations, and Grand Junction daily maximum gust speeds are plotted in Figure A-20.

The data in Figure A-20 clearly show that the highest PM10 concentrations tend to occur in Cluster 5 with gusts above 40 mph. The only exceedance in this period occurred on a day with a peak gust of 43 mph. Cluster 2 is

likely to be indicative of wintertime inversion conditions with lighter winds and moderately elevated PM10. Figure A-21 shows the concentrations and cluster values associated with Hopi station daily maximum gust speeds. The overall pattern is similar. The highest concentration day is associated with a peak gust of 47 mph at Hopi. All of the days/events presented in Figure A-17, A-19, and Table A-1 were classified as Cluster 5.

Table A-2. K-means cluster analysis means for Grand Junction PM10 and meteorological variables.

Cluster Variables	Cluster 1 Means	Cluster 2 Means	Cluster 3 Means	Cluster 4 Means	Cluster 5 Means
Powell 24-hour PM10 in ug/m3	24.5	37.3	24.3	21.8	74.9
Hopi Wind Gust in mph	20.8	18.0	32.5	20.7	40.5
Grand Junction Wind Gust in mph	20.4	16.5	31.8	19.6	43.1
Grand Junction 30-day Precipitation	1.7	0.4	0.5	0.8	0.6
Hopi 30-day Precipitation	1.8	0.2	0.5	0.7	0.3
Count	85	120	170	147	24

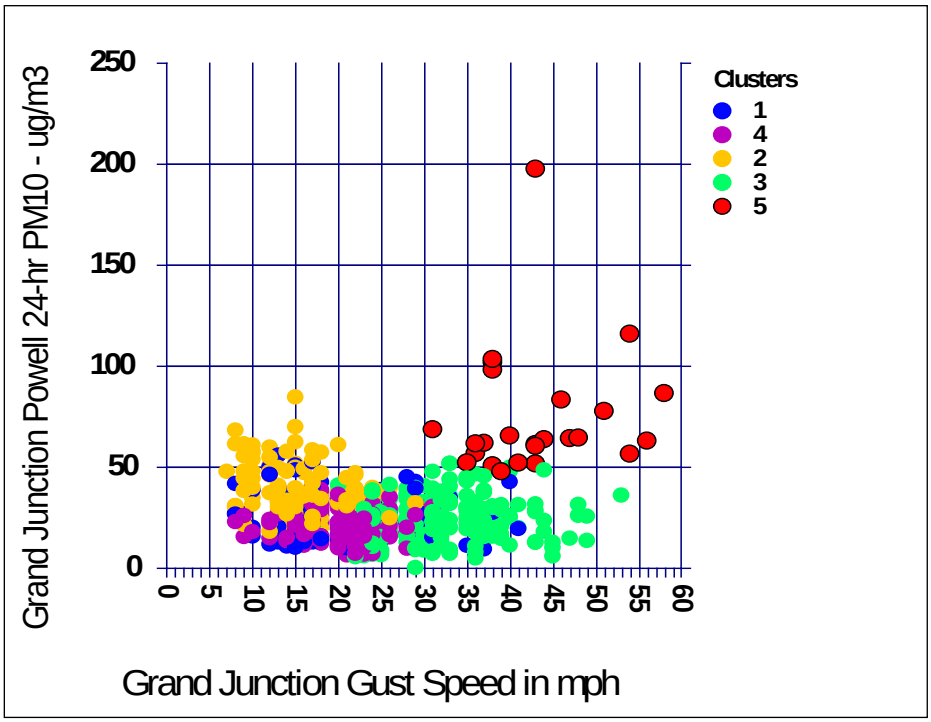


Figure A-20. Grand Junction Powell 24-hour PM10 concentrations versus Grand Junction gust speed by cluster.

Figures A-22 and A-23 show Powell PM10 concentrations versus Grand Junction and Hopi 30-day precipitation totals, respectively, by cluster. The blowing dust group, Cluster 5, is generally associated with 30-day precipitation totals of less than 1.00 inches at Grand Junction and less than 0.50 inches at Hopi. While this is not proof that the measured dust in Grand Junction is from Arizona, it adds to the weight of evidence that the Painted Desert makes a significant contribution to PM10 concentrations in Grand Junction during many blowing dust events. Of interest in this regard are the two high concentrations (greater than 100 ug/m3) that occurred when Grand Junction 30-day precipitation totals were greater than an inch (see Figure A-22). One of these occurred when transport was from the southwest. On this day (April 21, 2008) the NOAA Satellite Smoke Text Archive reported the following (see http://www.ssd.noaa.gov/PS/FIRE/smoke.html):

"Blowing dust is seen over most of Utah (and part of western Nevada) and the dust is moving toward the northeast, reaching into northwestern Colorado and southern Wyoming."

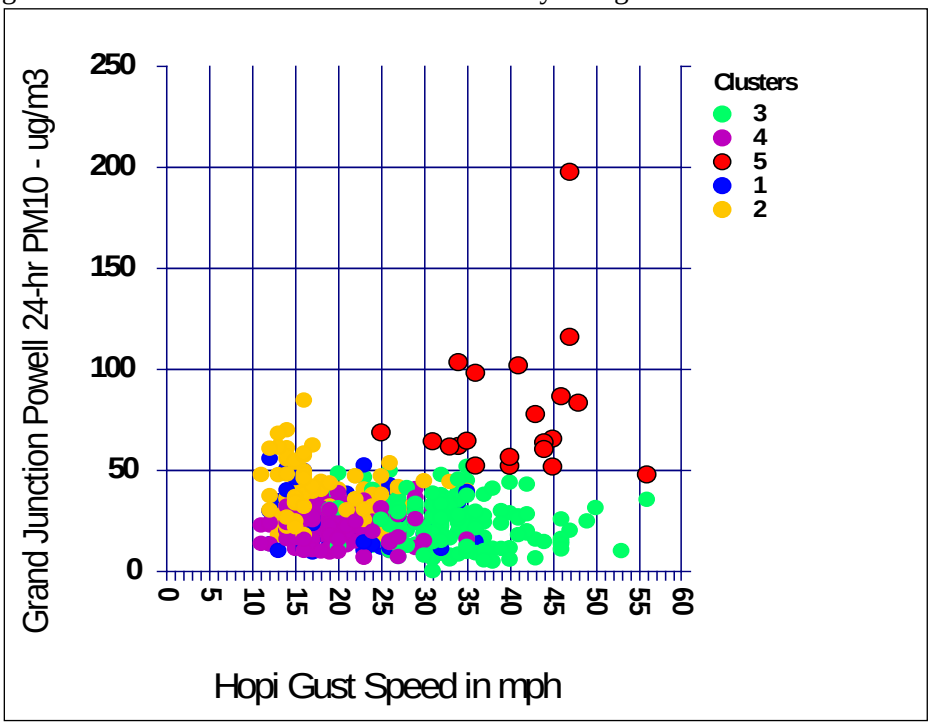


Figure A-21. Grand Junction Powell 24-hour PM10 concentrations versus Hopi gust speed by cluster.

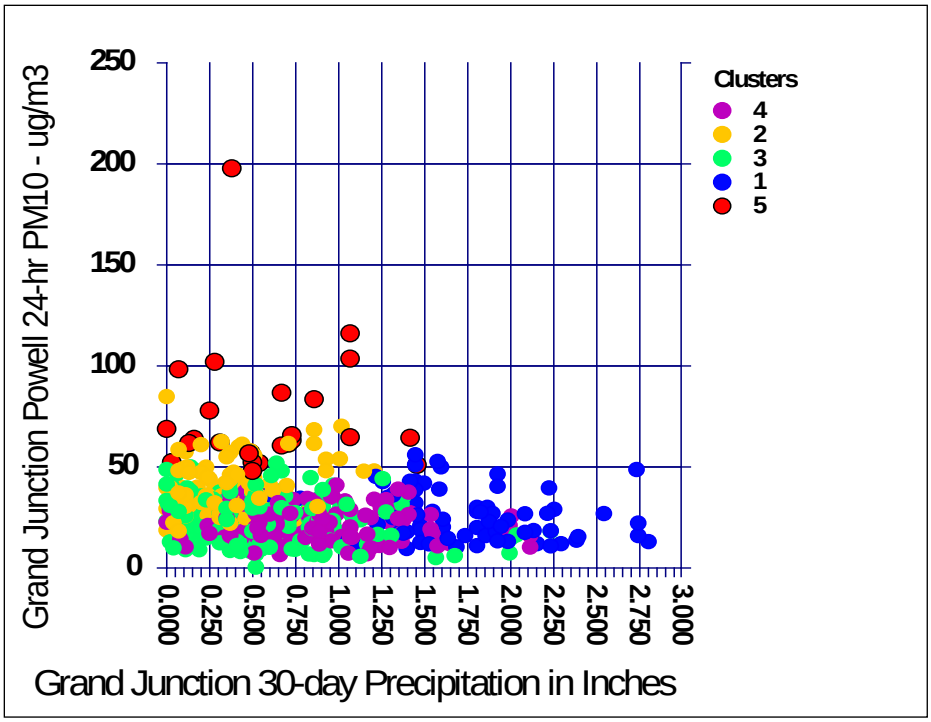


Figure A-22. Grand Junction Powell 24-hour PM10 concentrations versus Grand Junction 30-day total precipitation by cluster.

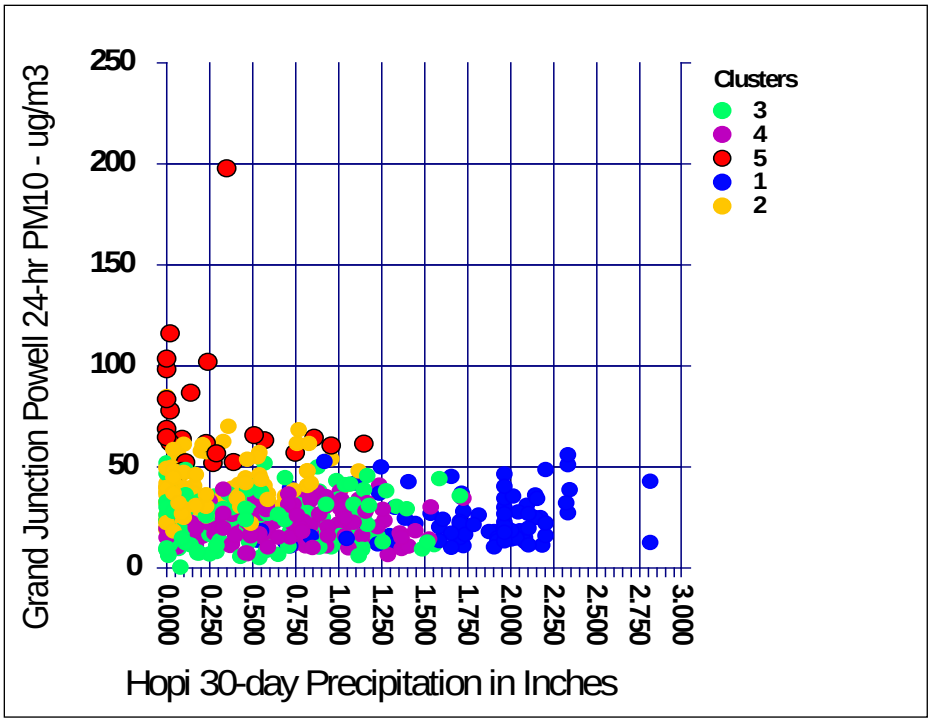


Figure A-23. Grand Junction Powell 24-hour PM10 concentrations versus Hopi 30-day total precipitation by cluster.

The other occurred on April 15, 2008, when the flow was from Arizona and southeast Utah. The transport conditions, the discrepancy between high recent precipitation in Grand Junction and low recent precipitation at Hopi for these two days, and, in one case, analyst discussion of what was visible in satellite images suggest that much of the dust might have originated from outside of the Grand Junction environment.

Figure A-24 shows Grand Junction Powell 24-hour PM10 concentrations versus peak gust wind directions at the Little Delores RAWS weather station about 25 miles west-southwest of Grand Junction. Grand Junction is situated on the floor of the Grand Valley, a major northwest to southeast trending basin than can force or channel synoptic scale flows. As a result, surface wind directions in Grand Junction may not be useful indicators of the direction of longer-range transport. Little Delores is on the Umcompahgre Plateau, and winds here are more likely to reflect the larger-scale transport directions for the region. This graph indicates that high PM10 at Grand Junction (Cluster 5) is associated with winds from the south-southeast to west-southwest at Little Delores. These directions point to dust sources in southeast Utah and northeastern Arizona. This is further evidence that dust from these areas may make a significant contribution to PM10 measured in Grand Junction during blowing dust events.

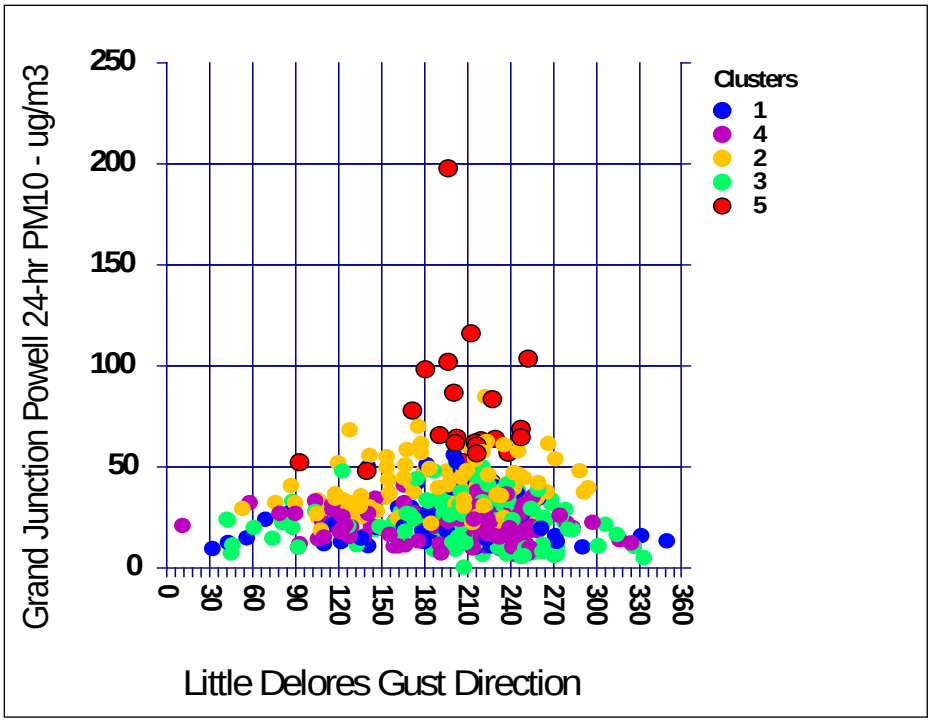


Figure A-24. Grand Junction Powell 24-hour PM10 concentrations versus peak gust wind directions at the Little Delores RAWS weather station, by cluster.

Figure A-25 presents monthly percentiles for Grand Junction gust speeds. Wind gusts generally considered to be high enough for significant blowing dusts (40 mph or higher) are within the upper 5 to 15 percent during each month of the year. Consequently, these events can be viewed as exceptional rather than normal. Gusts in this category can occur any month of the year, but are most likely in March, April, May and October. Figure A-4 shows that in Grand Junction these are typically among the wettest months of the year. It is in drier years, therefore, that blowing dust may be most prevalent during the spring and fall months. January, February, and June are typically very dry, and might be expected to have a significant proportion of blowing dust events.

Figures A-26 and A-27 show histograms for Grand Junction and Hopi wind gusts, respectively. The 95th percentile gust speed for Grand Junction is 43 mph. For Hopi it is 41 mph. For both sites, it is clear that gusts in the range that is associated with blowing dust are the exception rather than the rule. Cluster analysis also shows that the blowing dust events represent only 4% of the PM10 sample days (from Table A-2, Cluster 5 had 24 cases out of a total of 546). The weight of evidence presented in this document clearly suggests that source regions in Arizona and Utah can have a significant impact on PM10 concentrations in Grand Junction during blowing dust events and that these events occur when dry soils are affected by winds of exceptional strength. Control of these sources, which are outside of Colorado, may not be reasonably achievable or possible.

The precipitation climatology for the Four Corners area indicates that the area can be susceptible to blowing dust when winds are high. Landform imagery shows that northeastern Arizona and southeastern Utah in particular have experienced a long-term pattern of wind erosion and blowing dust when winds have been southwesterly and blowing into western and southern Colorado. Back trajectories, case studies, satellite imagery, and statistical analyses have also shown that northeastern Arizona and southeastern Utah are a significant source for blowing dust transported into Colorado. Elevated PM10 in Grand Junction during windstorms is generally associated with wind gusts of 40 mph or higher at Grand Junction and Hopi in northeastern Arizona and southwesterly flow in Grand Junction. Elevated PM10 in Grand Junction is generally

associated with 30-day precipitation totals of less than 1.00 inches at Grand Junction and less than 0.50 inches at Hopi.
Reference:

Orgill, M.M., Sehmel, G.A., 1976. Frequency and diurnal variation of dust storms in the contiguous USA. **Atmospheric Environment 10**, 813-825

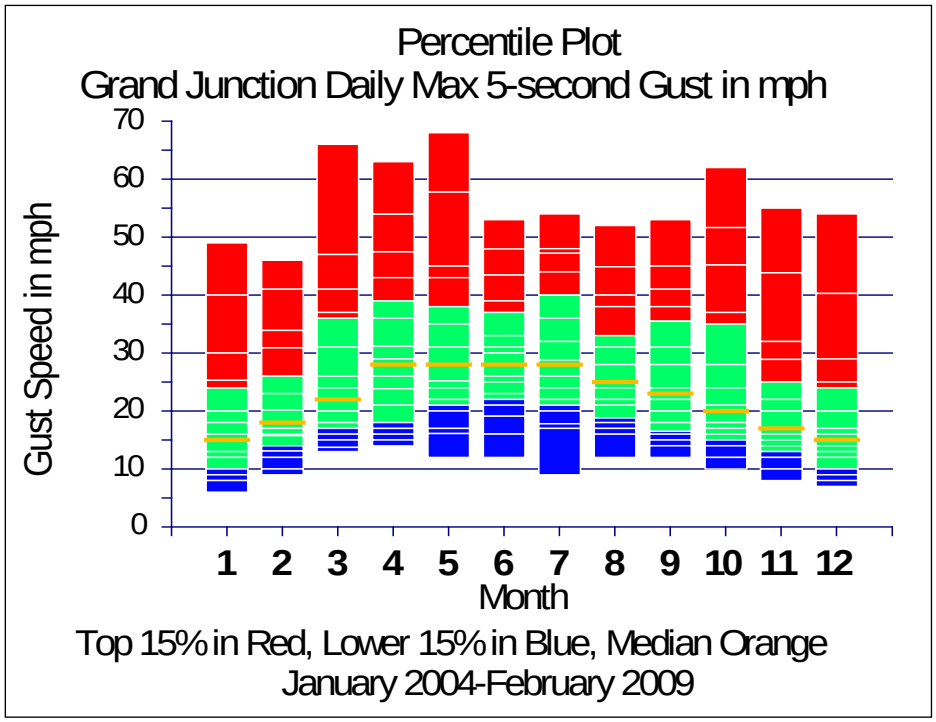


Figure A-25. Percentile plot of Grand Junction daily maximum 5-second gust speed in miles per hour showing that gusts of 40 mph or greater always occur within the top 15 percentile speeds for each month of the year.

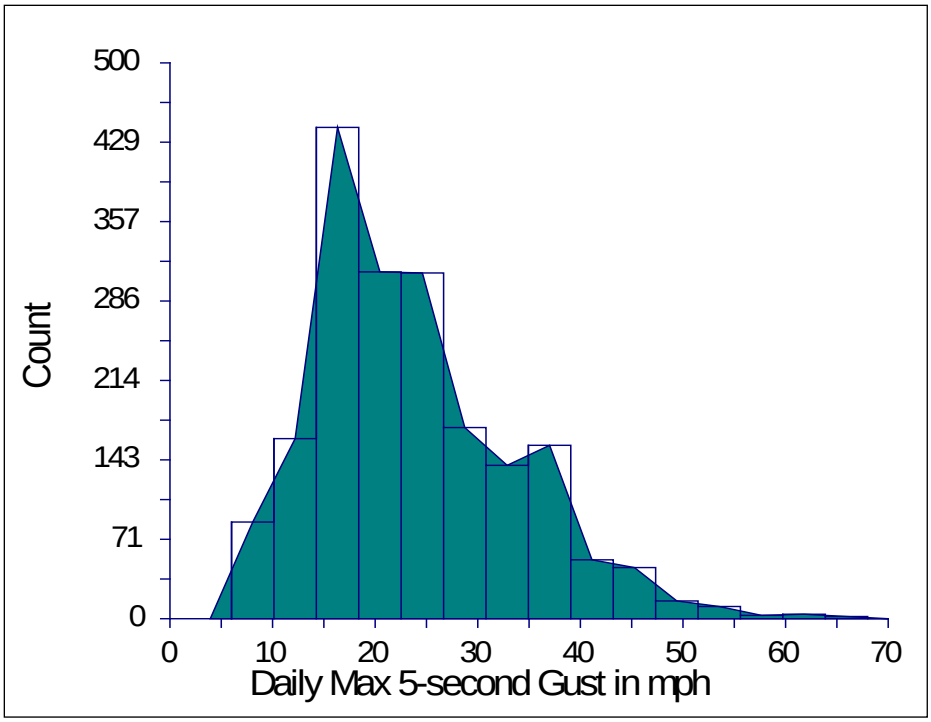


Figure A-26. Histogram of daily maximum 5-second wind gusts at Grand Junction based on January 2004 – February 2009.

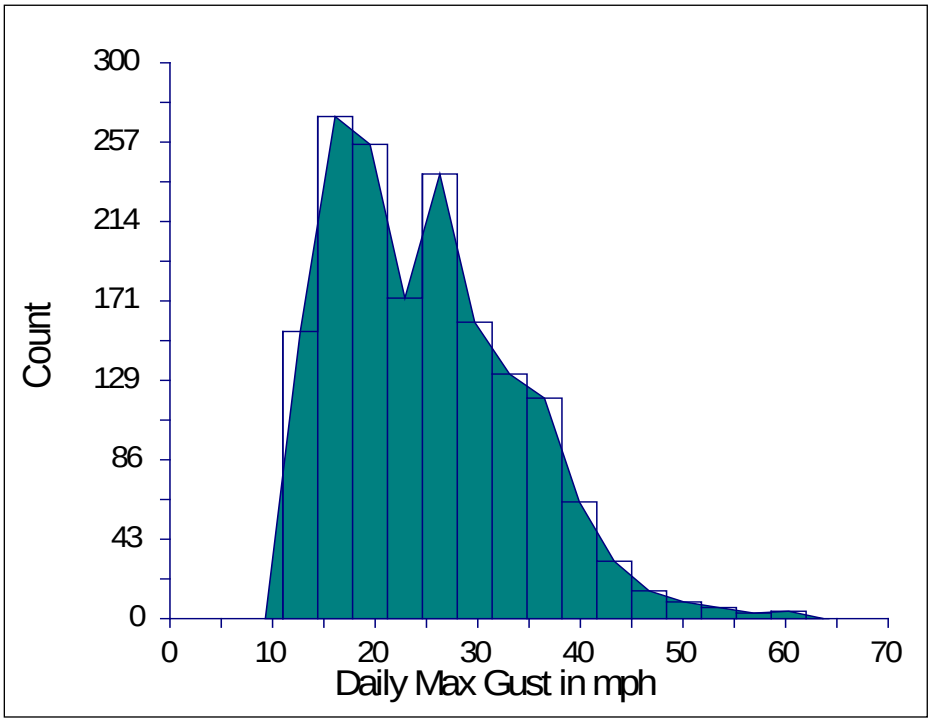


Figure A-27. Histogram of daily maximum 5-second wind gusts at Hopi based on January 2004 – February 2009.

Appendix B- Weather Warnings and Blowing Dust Advisories for May 22 and 23, 2010

WWUS75 KABQ 221000
NPWABQ

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
400 AM MDT SAT MAY 22 2010

...STRONG WINDS RETURN TODAY...

.A STRONG UPPER LEVEL LOW OVER OREGON AND NORTHERN CALIFORNIA THIS MORNING WILL DIVE SOUTHEAST INTO THE GREAT BASIN LATER THIS WEEKEND. WINDS WILL STRENGTHEN AT THE MID LEVELS OF THE ATMOSPHERE WHILE A SURFACE LOW PRESSURE AREA DEEPENS OVER EASTERN COLORADO. THE COMBO OF INCREASING SURFACE PRESSURE GRADIENT ACROSS THE STATE AND HEATING INDUCED MIXDOWN OF THE WINDS ALOFT WILL RESULT IN STRONG SOUTHWEST SURFACE WINDS OVER ALL OF NORTHERN AND CENTRAL NEW MEXICO THIS AFTERNOON AND EARLY EVENING.

NMZ501>540-230200-
/O.CON.KABQ.WI.Y.0029.100522T1800Z-100523T0200Z/
NORTHWEST PLATEAU-CHUSKA MOUNTAINS-FAR NORTHWEST HIGHLANDS-
NORTHWEST HIGHLANDS-WEST CENTRAL PLATEAU-WEST CENTRAL MOUNTAINS-
WEST CENTRAL HIGHLANDS-SOUTHWEST MOUNTAINS-
SAN FRANCISCO RIVER VALLEY-SAN JUAN MOUNTAINS-JEMEZ MOUNTAINS-
WEST SLOPES SANGRE DE CRISTO MOUNTAINS-
NORTHERN SANGRE DE CRISTO MOUNTAINS ABOVE 9500 FEET/RED RIVER-
SOUTHERN SANGRE DE CRISTO MOUNTAINS ABOVE 9500 FEET-
EAST SLOPES SANGRE DE CRISTO MOUNTAINS-UPPER RIO GRANDE VALLEY-
LOWER CHAMA RIVER VALLEY-SANTA FE METRO AREA-
ALBUQUERQUE METRO AREA-LOWER RIO GRANDE VALLEY-
SANDIA/MANZANO MOUNTAINS-ESTANCIA VALLEY-CENTRAL HIGHLANDS-
SOUTH CENTRAL HIGHLANDS-UPPER TULAROSA VALLEY-
SOUTH CENTRAL MOUNTAINS-RATON RIDGE/JOHNSON MESA-
FAR NORTHEAST HIGHLANDS-NORTHEAST HIGHLANDS-UNION COUNTY-
HARDING COUNTY-EASTERN SAN MIGUEL COUNTY-GUADALUPE COUNTY-
QUAY COUNTY-CURRY COUNTY-ROOSEVELT COUNTY-DE BACA COUNTY-
CHAVES COUNTY PLAINS-EASTERN LINCOLN COUNTY-
SOUTHWEST CHAVES COUNTY-
400 AM MDT SAT MAY 22 2010

...WIND ADVISORY REMAINS IN EFFECT FROM NOON TODAY TO 8 PM MDT THIS EVENING...

A WIND ADVISORY REMAINS IN EFFECT FROM NOON TODAY TO 8 PM MDT THIS EVENING.

* LOCATION...ALL OF NORTHERN AND CENTRAL NEW MEXICO.

* WINDS...SUSTAINED SOUTHWEST WINDS 25 TO 40 MPH WITH GUSTS TO 50 MPH THIS AFTERNOON AND EARLY EVENING.

* TIMING...WINDS WILL INCREASE MID TO LATE MORNING AND REACH
  ADVISORY LEVELS BETWEEN 12 PM AND 8 PM MDT TODAY. WINDS WILL
  THEN SUBSIDE AFTER SUNSET.

* VISIBILITY...MAY BE REDUCED AT TIMES TO LESS THAN 3 MILES IN
  BLOWING DUST THIS AFTERNOON.

* LOCAL IMPACTS...GUSTY CROSS WINDS WILL IMPACT SOUTHWEST TO
  NORTHEAST ORIENTED ROADWAYS. HIGH PROFILE VEHICLES WILL BE
  AFFECTED BY THE WINDS ON MOST HIGHWAYS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

MOTORISTS SHOULD EXERCISE CAUTION WHILE TRAVELING. SUDDEN GUSTS
OF WIND MAY CAUSE YOU TO LOSE CONTROL OF YOUR VEHICLE. EXTRA
ATTENTION SHOULD BE GIVEN TO CROSS WINDS.

&&

$$

WWUS75 KABQ 231001
NPWABQ

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE ALBUQUERQUE NM
401 AM MDT SUN MAY 23 2010

...WINDY CONDITIONS EXPECTED OVER MUCH OF NORTHERN AND CENTRAL NEW
MEXICO AGAIN TODAY...

.A STOUT UPPER LEVEL LOW PRESSURE SYSTEM IS CURRENTLY DIVING
INTO THE SOUTHWESTERN U.S. WITH A STRONG BELT OF SOUTHERLY
WINDS DEVELOPING AHEAD OF IT. THESE STRONG WINDS ALOFT WILL MIX
DOWN TO THE SURFACE THROUGH THE LATE MORNING AND EARLY AFTERNOON
AS A SURFACE LOW TAKES SHAPE JUST NORTHEAST OF THE FOUR CORNERS
REGION. WINDS WILL BE STRONGEST ALONG THE WESTERN TIER OF THE
STATE. WINDS ARE EXPECTED TO DECREASE NEAR SUNSET IN MOST CENTRAL
TO EASTERN SECTIONS OF THE STATE WHILE THE WESTERN SECTIONS REMAIN
BREEZY TO WINDY THROUGH MUCH OF THE EVENING.

NMZ501-502-505-506-508-509-231800-
/O.NEW.KABQ.WI.Y.0030.100523T1700Z-100524T0400Z/
NORTHWEST PLATEAU-CHUSKA MOUNTAINS-WEST CENTRAL PLATEAU-
WEST CENTRAL MOUNTAINS-SOUTHWEST MOUNTAINS-
SAN FRANCISCO RIVER VALLEY-
401 AM MDT SUN MAY 23 2010

...WIND ADVISORY IN EFFECT FROM 11 AM THIS MORNING TO 10 PM MDT
THIS EVENING...

THE NATIONAL WEATHER SERVICE IN ALBUQUERQUE HAS ISSUED A WIND
ADVISORY...WHICH IS IN EFFECT FROM 11 AM THIS MORNING TO 10 PM
MDT THIS EVENING.

* LOCATION...THIS WIND ADVISORY AFFECTS WESTERN PORTIONS OF NEW MEXICO FROM THE NORTHWEST PLATEAU TO THE CHUSKA...WEST CENTRAL...AND SOUTHWESTERN MOUNTAINS AS WELL AS ADJACENT HIGHLANDS.

* WINDS...SUSTAINED SOUTHERLY WINDS OF 25 TO 40 MPH ARE EXPECTED WITH OCCASIONAL GUSTS TO 50 AND 55 MPH.

* TIMING...WINDS WILL BECOME STRONG BY LATE MORNING...CONTINUING TO STRENGTHEN INTO THE AFTERNOON. WINDS ARE EXPECTED TO GRADUALLY DECREASE IN SPEED BY THE MID TO LATE EVENING HOURS.

* VISIBILITY...OCCASIONAL REDUCTIONS IN VISIBILITY ARE EXPECTED IN AREAS OF BLOWING DUST.

* LOCAL IMPACTS...STRONG CROSS WINDS ARE EXPECTED ON WEST TO EAST ORIENTED ROADS SUCH AS INTERSTATE 40...AND AREAS OF BLOWING DUST WILL ALSO BE POSSIBLE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

MOTORISTS SHOULD EXERCISE CAUTION WHILE TRAVELLING. SUDDEN GUSTS OF WIND MAY CAUSE YOU TO LOSE CONTROL OF YOUR VEHICLE. EXTRA ATTENTION SHOULD BE GIVEN TO CROSS WINDS.

&&

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NMZ503-504-507-510>534-537-539-540-231800-
/O.NEW.KABQ.WI.Y.0030.100523T2000Z-100524T0200Z/
FAR NORTHWEST HIGHLANDS-NORTHWEST HIGHLANDS-
WEST CENTRAL HIGHLANDS-SAN JUAN MOUNTAINS-JEMEZ MOUNTAINS-
WEST SLOPES SANGRE DE CRISTO MOUNTAINS-
NORTHERN SANGRE DE CRISTO MOUNTAINS ABOVE 9500 FEET/RED RIVER-
SOUTHERN SANGRE DE CRISTO MOUNTAINS ABOVE 9500 FEET-
EAST SLOPES SANGRE DE CRISTO MOUNTAINS-UPPER RIO GRANDE VALLEY-
LOWER CHAMA RIVER VALLEY-SANTA FE METRO AREA-
ALBUQUERQUE METRO AREA-LOWER RIO GRANDE VALLEY-
SANDIA/MANZANO MOUNTAINS-ESTANCIA VALLEY-CENTRAL HIGHLANDS-
SOUTH CENTRAL HIGHLANDS-UPPER TULAROSA VALLEY-
SOUTH CENTRAL MOUNTAINS-RATON RIDGE/JOHNSON MESA-
FAR NORTHEAST HIGHLANDS-NORTHEAST HIGHLANDS-UNION COUNTY-
HARDING COUNTY-EASTERN SAN MIGUEL COUNTY-GUADALUPE COUNTY-
QUAY COUNTY-DE BACA COUNTY-EASTERN LINCOLN COUNTY-
SOUTHWEST CHAVES COUNTY-
401 AM MDT SUN MAY 23 2010

...WIND ADVISORY IN EFFECT FROM 2 PM THIS AFTERNOON TO 8 PM MDT THIS EVENING...

THE NATIONAL WEATHER SERVICE IN ALBUQUERQUE HAS ISSUED A WIND ADVISORY...WHICH IS IN EFFECT FROM 2 PM THIS AFTERNOON TO 8 PM MDT THIS EVENING.

* LOCATION...THIS WIND ADVISORY INCLUDES MANY
  WESTERN...CENTRAL...AND NORTHEASTERN AREAS OF NEW MEXICO FROM
  THE NORTHWESTERN AND WESTERN HIGHLANDS TO THE CENTRAL VALLEYS
  AND CENTRAL MOUNTAIN CHAIN TO THE NORTHEASTERN PLAINS.

* WINDS...SUSTAINED SOUTHERLY WINDS OF 25 TO 35 MPH ARE EXPECTED
  WITH OCCASIONAL GUSTS TO 45 AND 50 MPH.

* TIMING...WINDS WILL STRENGTHEN BY EARLY AFTERNOON AND WILL
  PERSIST THROUGH THE EARLY EVENING. DECREASED SPEEDS ARE EXPECTED
  NEAR OR SHORTLY AFTER SUNSET.

* VISIBILITY...OCCASIONAL REDUCTIONS TO VISIBILITY ARE EXPECTED IN
  AREAS OF BLOWING DUST.

* LOCAL IMPACTS...STRONG CROSS WINDS ARE EXPECTED ON WEST TO EAST
  ORIENTED ROADS SUCH AS INTERSTATE 40...AND AREAS OF BLOWING
  DUST WILL ALSO BE POSSIBLE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

MOTORISTS SHOULD EXERCISE CAUTION WHILE TRAVELLING. SUDDEN GUSTS
OF WIND MAY CAUSE YOU TO LOSE CONTROL OF YOUR VEHICLE. EXTRA
ATTENTION SHOULD BE GIVEN TO CROSS WINDS.

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WWUS75 KFGZ 220534
NPWFGZ

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
1034 PM MST FRI MAY 21 2010

AZZ010-012-040-221345-
/O.CAN.KFGZ.WI.Y.0014.000000T0000Z-100522T0700Z/
/O.CON.KFGZ.WI.Y.0015.100522T1500Z-100523T0700Z/
CHINLE VALLEY-LITTLE COLORADO RIVER VALLEY IN COCONINO COUNTY-
NORTHEAST PLATEAUS AND MESAS SOUTH OF HWY 264-
INCLUDING THE CITIES OF...CHINLE...KAYENTA...DILKON
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT
MST SATURDAY NIGHT...
...WIND ADVISORY IS CANCELLED FOR FRIDAY NIGHT...

THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS CANCELLED THE WIND
ADVISORY FOR FRIDAY NIGHT. A WIND ADVISORY REMAINS IN EFFECT FROM 8 AM
SATURDAY TO MIDNIGHT MST SATURDAY NIGHT.

* TIMING: STRONG SOUTHWEST WINDS ARE FORECAST TO INCREASE ONCE
  AGAIN ON SATURDAY MORNING AND CONTINUE THROUGH MIDNIGHT MST
  SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS ON SATURDAY 30 TO 40 MPH AND
  GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT
  DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH
  PROFILE VEHICLE. AREAS OF BLOWING DUST AND SAND ARE ALSO
  POSSIBLE...CAUSING LOCALIZED VISIBILITY TO DROP ON SATURDAY AS
  LOW AS A HUNDRED FEET OR LESS.

* BLOWING DUST AND SAND THREAT: POSSIBLE REDUCTION IN VISIBILITY
  DUE TO BLOWING DUST AND SAND ALONG I-40 FROM TWO GUNS TO
  AROUND WINSLOW...AS WELL AS POINTS NORTHWARD THROUGH LEUPP AND
  DILKON ALONG HIGHWAY 15. PORTIONS OF HIGHWAY 89 FROM GRAY
  MOUNTAIN TO AROUND THE TUBA CITY TURNOFF MAY ALSO SEE
  LOCALIZED BLOWING DUST AND SAND. BEWARE OF SUDDEN ACCUMULATION
  OF SAND ON AREA ROADWAYS...THIS MAY CAUSE YOU TO LOOSE CONTROL
  OF YOUR VEHICLE...DRIVERS ARE CAUTION TO GO SLOW IN THESE
  ADVERSE CONDITIONS OR POSTPONE TRAVEL FOR ANOTHER DAY WHEN THE
  WEATHER IS BETTER.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST
12 HRS...

TUBA CITY ..... 43 MPH.
HOPI RAWS ..... 40 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.
CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ011-221345-
/O.CAN.KFGZ.WI.Y.0014.000000T0000Z-100522T0700Z/
/O.CON.KFGZ.WI.Y.0015.100522T1500Z-100523T0700Z/
CHUSKA MOUNTAINS AND DEFIANCE PLATEAU-
INCLUDING THE CITIES OF...WINDOW ROCK...GANADO
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT
MST SATURDAY NIGHT...
...WIND ADVISORY IS CANCELLED FOR FRIDAY NIGHT...

THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS CANCELLED THE WIND ADVISORY FOR FRIDAY NIGHT. A WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT MST SATURDAY NIGHT.

* TIMING: STRONG SOUTHWEST WINDS ARE FORECAST TO INCREASE AGAIN BY SATURDAY MORNING AND CONTINUE THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS OF 30 TO 40 MPH AND GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH PROFILE VEHICLE. LOCALIZED BLOWING DUST AND SAND ARE ALSO POSSIBLE.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST 12 HRS...

HOUSE ROCK RAWS ..... 53 MPH.
FOUR SPRINGS RAWS ..... 48 MPH.
WINDOW ROCK AIRPORT ..... 37 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES. CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ004-005-221345-
/O.CAN.KFGZ.WI.Y.0014.000000T0000Z-100522T0700Z/
/O.EXT.KFGZ.WI.Y.0015.100522T0534Z-100523T0700Z/
KAIBAB PLATEAU-MARBLE AND GLEN CANYONS-
INCLUDING THE CITIES OF...FREDONIA...PAGE
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY NOW IN EFFECT UNTIL MIDNIGHT MST SATURDAY NIGHT...

THE WIND ADVISORY IS NOW IN EFFECT UNTIL MIDNIGHT MST SATURDAY NIGHT.

* TIMING: STRONG SOUTHWEST WINDS WILL CONTINUE THIS EVENING AS AN APPROACHING COLD FRONT PASSES THROUGH NORTHERN ARIZONA AFTER MIDNIGHT. STRONG WINDS ARE FORECAST TO CONTINUE THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS OF 20 TO 30 MPH WITH GUSTS FROM 35

TO 50 MPH THIS EVENING...INCREASING AGAIN ON SATURDAY MORNING 30 TO 40 MPH AND GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH PROFILE VEHICLE. LOCALIZED BLOWING DUST AND SAND ARE ALSO POSSIBLE.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST 12 HRS...

HOUSE ROCK RAWS ..... 53 MPH.
FOUR SPRINGS RAWS ..... 48 MPH.
WINDOW ROCK AIRPORT ..... 37 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES. CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ009-039-221345-
/O.CAN.KFGZ.WI.Y.0014.000000T0000Z-100522T0700Z/
/O.EXT.KFGZ.WI.Y.0015.100522T0534Z-100523T0700Z/
NORTHEAST PLATEAUS AND MESAS HWY 264 NORTHWARD-BLACK MESA AREA-
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY NOW IN EFFECT UNTIL MIDNIGHT MST SATURDAY NIGHT...

THE WIND ADVISORY IS NOW IN EFFECT UNTIL MIDNIGHT MST SATURDAY NIGHT.

* TIMING: SOUTHWEST WINDS WILL CONTINUE THIS EVENING...WITH STRONGER WIND SPEEDS FROM SATURDAY MORNING THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS OF 20 TO 30 MPH WITH GUSTS FROM 30 TO 45 MPH THIS EVENING...INCREASING AGAIN ON SATURDAY TO 30 TO 40 MPH AND GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH PROFILE VEHICLE. AREAS OF BLOWING DUST AND SAND ARE ALSO POSSIBLE...CAUSING LOCALIZED VISIBILITY TO DROP TO A HALF MILE OR LESS TODAY WITH EVEN WORSE VISIBILITY ON SATURDAY AS LOW AS A HUNDRED FEET OR LESS.

* BLOWING DUST AND SAND THREAT: POSSIBLE REDUCTION IN VISIBILITY

DUE TO BLOWING DUST AND SAND. BEWARE OF SUDDEN ACCUMULATION OF SAND ON AREA ROADWAYS...THIS MAY CAUSE YOU TO LOSE CONTROL OF YOUR VEHICLE...DRIVERS ARE CAUTION TO GO SLOW IN THESE ADVERSE CONDITIONS OR POSTPONE TRAVEL FOR ANOTHER DAY WHEN THE WEATHER IS BETTER.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST 12 HRS...

TUBA CITY ..... 43 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES. CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ006-007-221345-
/O.CAN.KFGZ.WI.Y.0014.000000T0000Z-100522T0700Z/
/O.EXT.KFGZ.WI.Y.0015.100522T0534Z-100523T1500Z/
GRAND CANYON COUNTRY-COCONINO PLATEAU-
INCLUDING THE CITIES OF...GRAND CANYON VILLAGE...SUPAI
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY NOW IN EFFECT UNTIL 8 AM MST SUNDAY...

THE WIND ADVISORY IS NOW IN EFFECT UNTIL 8 AM MST SUNDAY.

* TIMING: SOUTHWEST WINDS WILL CONTINUE THIS EVENING...WITH STRONGER WIND SPEEDS FROM SATURDAY MORNING THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS OF 20 TO 30 MPH WITH GUSTS FROM 30 TO 40 MPH THIS EVENING...INCREASING AGAIN ON SATURDAY TO 30 TO 40 MPH AND GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH PROFILE VEHICLE. LOCALIZED BLOWING DUST AND SAND ARE ALSO POSSIBLE.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST 12 HRS...

GRAND CANYON AIRPORT ..... 44 MPH.
GRAND CANYON NATIONAL PARK ..... 43 MPH.
FRAZIER WELLS ..... 40 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.
CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ013-014-221345-
/O.CON.KFGZ.WI.Y.0015.100522T1500Z-100523T0700Z/
LITTLE COLORADO RIVER VALLEY IN NAVAJO COUNTY-
LITTLE COLORADO RIVER VALLEY IN APACHE COUNTY-
INCLUDING THE CITIES OF...WINSLOW...HOLBROOK...SNOWFLAKE...
ST. JOHNS...SPRINGERVILLE
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT
MST SATURDAY NIGHT...

A WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT
MST SATURDAY NIGHT.

* TIMING: STRONG WINDS ARE FORECAST TO RETURN ON SATURDAY
  MORNING AND CONTINUE THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS OF 30 TO 40 MPH AND GUSTS FROM
  45 TO 55 MPH ON SATURDAY.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT
  DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH
  PROFILE VEHICLE. AREAS OF BLOWING DUST AND SAND ARE ALSO
  POSSIBLE...CAUSING LOCALIZED VISIBILITY TO DROP AS LOW AS A
  HUNDRED FEET OR LESS ON SATURDAY.

* BLOWING DUST AND SAND THREAT: POSSIBLE REDUCTION IN VISIBILITY
  DUE TO BLOWING DUST AND SAND. BEWARE OF SUDDEN ACCUMULATION OF
  SAND ON AREA ROADWAYS...THIS MAY CAUSE YOU TO LOSE CONTROL OF
  YOUR VEHICLE...DRIVERS ARE CAUTIONED TO GO SLOW IN THESE ADVERSE
  CONDITIONS OR POSTPONE TRAVEL FOR ANOTHER DAY WHEN THE WEATHER
  IS BETTER.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST
12 HRS...

SAINT JOHNS ..... 41 MPH.
WINSLOW AIRPORT ..... 38 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.

CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ015-221345-
/O.CON.KFGZ.WI.Y.0014.000000T0000Z-100523T0700Z/
WESTERN MOGOLLON RIM-
INCLUDING THE CITY OF...FLAGSTAFF
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY REMAINS IN EFFECT UNTIL MIDNIGHT MST SATURDAY
NIGHT...

A WIND ADVISORY REMAINS IN EFFECT UNTIL MIDNIGHT MST SATURDAY
NIGHT.

* TIMING: STRONG SOUTHWEST WINDS WILL CONTINUE THIS EVENING... FOR
  AREAS EAST OF FLAGSTAFF ALONG PORTIONS OF HIGHWAY 89 FROM SUNSET
  CRATER SOUTH THROUGH DONEY PARK AND FROM EAST FLAGSTAFF ALONG
  INTERSTATE 40 THROUGH COSNINO AND WINONA. WINDS ARE FORECAST TO
  INCREASE AGAIN ACROSS THE REGION BY SATURDAY MORNING AND
  CONTINUE THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT STRONG SOUTHWEST WINDS OF 20 TO 30 MPH WITH
  GUSTS FROM 40 TO 55 MPH THIS EVENING AND OVERNIGHT FOR AREAS
  EAST OF FLAGSTAFF... INCREASING AGAIN ON SATURDAY TO 30 TO 40
  MPH AND GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE
  DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A
  HIGH PROFILE VEHICLE. LOCALIZED BLOWING DUST AND SAND ARE ALSO
  POSSIBLE.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST
12 HRS...

DONEY PARK ..... 49 MPH.
FLAGSTAFF AIRPORT ..... 41 MPH.
WUPATKI RAWS ..... 38 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.
CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ016-017-221345-
/O.CON.KFGZ.WI.Y.0015.100522T1500Z-100523T0700Z/
EASTERN MOGOLLON RIM-WHITE MOUNTAINS-
INCLUDING THE CITY OF...SHOW LOW
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT MST SATURDAY NIGHT...

A WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT MST SATURDAY NIGHT.

* TIMING: SOUTHWEST WINDS WILL INCREASE AGAIN BY SATURDAY MORNING AND CONTINUE THROUGH MIDNIGHT MST SATURDAY NIGHT.

* WINDS: EXPECT SOUTHWEST WINDS ON SATURDAY FROM 30 TO 40 MPH AND GUSTS FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A HIGH PROFILE VEHICLE. LOCALIZED BLOWING DUST AND SAND ARE ALSO POSSIBLE.

STRONGEST WIND GUSTS FROM SELECTED STATIONS OVER THE PAST 12 HRS...

LIMESTONE CANYON RAWS ..... 40 MPH.
MOGOLLON AIRPARK ..... 38 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES. CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ008-018-037-038-221345-
/O.CON.KFGZ.WI.Y.0015.100522T1500Z-100523T0700Z/
YAVAPAI COUNTY MOUNTAINS-NORTHERN GILA COUNTY-
YAVAPAI COUNTY VALLEYS AND BASINS-OAK CREEK AND SYCAMORE CANYONS-
INCLUDING THE CITIES OF...PRESCOTT...PAYSON...COTTONWOOD...
CAMP VERDE...SEDONA
1034 PM MST FRI MAY 21 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT MST SATURDAY NIGHT...

A WIND ADVISORY REMAINS IN EFFECT FROM 8 AM SATURDAY TO MIDNIGHT MST SATURDAY NIGHT.

* TIMING: STRONG SOUTHWEST WINDS WILL DEVELOP ON SATURDAY
  MORNING AND LAST UNTIL AROUND MIDNIGHT SATURDAY NIGHT.

* WINDS: EXPECT STRONG SOUTHWEST WINDS SUSTAINED FROM 25 TO 35
  MPH AND GUSTS FROM 40 TO 50 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE
  DIFFICULT DRIVING CONDITIONS...ESPECIALLY IF YOU ARE DRIVING A
  HIGH PROFILE VEHICLE. LOCALIZED BLOWING DUST AND SAND ARE ALSO
  POSSIBLE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.
CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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WWUS75 KFGZ 231007
NPWFGZ

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
307 AM MST SUN MAY 23 2010

AZZ012-013-040-231815-
/O.NEW.KFGZ.DS.W.0002.100523T1700Z-100524T0200Z/
/O.CON.KFGZ.HW.W.0008.100523T1400Z-100524T0200Z/
LITTLE COLORADO RIVER VALLEY IN COCONINO COUNTY-
LITTLE COLORADO RIVER VALLEY IN NAVAJO COUNTY-
NORTHEAST PLATEAUS AND MESAS SOUTH OF HWY 264-
INCLUDING THE CITIES OF...WINSLOW...HOLBROOK...SNOWFLAKE...DILKON
307 AM MST SUN MAY 23 2010

...HIGH WIND WARNING REMAINS IN EFFECT FROM 7 AM THIS MORNING TO
7 PM MST THIS EVENING...

...DUST STORM WARNING IN EFFECT FROM 10 AM THIS MORNING TO 7 PM
MST THIS EVENING...

THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS ISSUED A DUST STORM
WARNING...WHICH IS IN EFFECT FROM 10 AM THIS MORNING TO 7 PM MST
THIS EVENING. A HIGH WIND WARNING REMAINS IN EFFECT FROM 7 AM
THIS MORNING TO 7 PM MST THIS EVENING.

* TIMING: EXPECT SOUTHWEST WINDS TO INCREASE EARLY THIS MORNING.
  WIND SPEEDS WILL STEADILY INCREASE THROUGH THE DAY...WITH THE
  STRONGEST WINDS FROM MID-AFTERNOON THROUGH EARLY EVENING.

* WINDS: EXPECT SOUTHWEST WINDS FROM 25 TO 35 MPH WITH GUSTS

FROM 45 TO 55 MPH THIS MORNING. WINDS WILL BE STRONGER THIS AFTERNOON WITH SUSTAINED SPEEDS FROM 35 TO 45 MPH AND GUSTS FROM 55 TO 65 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT DRIVING CONDITIONS...ESPECIALLY FOR HIGH PROFILE VEHICLES. AREAS OF BLOWING DUST AND SAND ARE POSSIBLE...CAUSING VISIBILITY TO DROP TO NEAR ZERO IN SOME AREAS. I-40 FROM TWO GUNS TO WINSLOW WILL LIKELY BE AFFECTED BY BLOWING DUST.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A HIGH WIND WARNING MEANS A HAZARDOUS HIGH WIND EVENT IS EXPECTED OR OCCURRING...WITH SUSTAINED WIND SPEEDS GREATER THAN 40 MPH OR GUSTS GREATER THAN 58 MPH. WINDS THIS STRONG CAN CAUSE PROPERTY DAMAGE. CONTINUE TO MONITOR THE LATEST FORECASTS. ADDITIONAL WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

A DUST STORM WARNING MEANS VISIBILITIES ARE LESS THAN ONE QUARTER MILE DUE TO BLOWING DUST. TRAVEL COULD BECOME EXTREMELY DANGEROUS. PERSONS WITH RESPIRATORY PROBLEMS SHOULD MAKE PREPARATIONS TO STAY INDOORS UNTIL THE STORM PASSES. ADDITIONAL WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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AZZ009>011-015-039-231815-
/O.NEW.KFGZ.DS.W.0002.100523T1700Z-100524T0200Z/
/O.CON.KFGZ.WI.Y.0017.100523T1400Z-100524T0200Z/
NORTHEAST PLATEAUS AND MESAS HWY 264 NORTHWARD-CHINLE VALLEY-
CHUSKA MOUNTAINS AND DEFIANCE PLATEAU-WESTERN MOGOLLON RIM-
BLACK MESA AREA-
INCLUDING THE CITIES OF...CHINLE...KAYENTA...WINDOW ROCK...
GANADO...FLAGSTAFF
307 AM MST SUN MAY 23 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 7 AM THIS MORNING TO 7 PM MST THIS EVENING...

...DUST STORM WARNING IN EFFECT FROM 10 AM THIS MORNING TO 7 PM MST THIS EVENING...

THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS ISSUED A DUST STORM WARNING...WHICH IS IN EFFECT FROM 10 AM THIS MORNING TO 7 PM MST THIS EVENING. A WIND ADVISORY REMAINS IN EFFECT FROM 7 AM THIS MORNING TO 7 PM MST THIS EVENING.

* TIMING: EXPECT SOUTHWEST WINDS TO INCREASE EARLY THIS MORNING. WIND SPEEDS WILL STEADILY INCREASE THROUGH THE DAY...WITH THE STRONGEST WINDS FROM MID-AFTERNOON THROUGH EARLY EVENING.

* WINDS: EXPECT SOUTHWEST WINDS FROM 20 TO 30 MPH WITH GUSTS FROM 40 TO 45 MPH THIS MORNING. WINDS WILL BE STRONGER THIS

AFTERNOON WITH SUSTAINED SPEEDS FROM 25 TO 35 MPH AND GUSTS
FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE
DIFFICULT DRIVING CONDITIONS...ESPECIALLY FOR HIGH PROFILE
VEHICLES. AREAS OF BLOWING DUST AND SAND MAY CAUSE VISIBILITY
TO DROP BELOW 1/4 MILE IN SOME AREAS OF NORTHEASTERN ARIZONA.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.
CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

A DUST STORM WARNING MEANS VISIBILITIES ARE LESS THAN ONE QUARTER
MILE DUE TO BLOWING DUST. TRAVEL COULD BECOME EXTREMELY
DANGEROUS. PERSONS WITH RESPIRATORY PROBLEMS SHOULD MAKE
PREPARATIONS TO STAY INDOORS UNTIL THE STORM PASSES. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

&&

$$

AZZ014-231815-
/O.CON.KFGZ.HW.W.0008.100523T1400Z-100524T0200Z/
LITTLE COLORADO RIVER VALLEY IN APACHE COUNTY-
INCLUDING THE CITIES OF...ST. JOHNS...SPRINGERVILLE
307 AM MST SUN MAY 23 2010

...HIGH WIND WARNING REMAINS IN EFFECT FROM 7 AM THIS MORNING TO
7 PM MST THIS EVENING...

A HIGH WIND WARNING REMAINS IN EFFECT FROM 7 AM THIS MORNING TO
7 PM MST THIS EVENING.

* TIMING: EXPECT SOUTHWEST WINDS TO INCREASE EARLY THIS MORNING.
WIND SPEEDS WILL STEADILY INCREASE THROUGH THE DAY...WITH THE
STRONGEST WINDS FROM MID-AFTERNOON THROUGH EARLY EVENING.

* WINDS: EXPECT SOUTHWEST WINDS FROM 25 TO 35 MPH WITH GUSTS
FROM 45 TO 55 MPH THIS MORNING. WINDS WILL BE STRONGER THIS
AFTERNOON WITH SUSTAINED SPEEDS FROM 35 TO 45 MPH AND GUSTS
FROM 55 TO 65 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT
DRIVING CONDITIONS...ESPECIALLY FOR HIGH PROFILE VEHICLES. AREAS
OF BLOWING DUST AND SAND ARE POSSIBLE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A HIGH WIND WARNING MEANS A HAZARDOUS HIGH WIND EVENT IS EXPECTED
OR OCCURRING...WITH SUSTAINED WIND SPEEDS GREATER THAN 40 MPH OR

GUSTS GREATER THAN 58 MPH. WINDS THIS STRONG CAN CAUSE PROPERTY
DAMAGE. CONTINUE TO MONITOR THE LATEST FORECASTS. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

&&

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AZZ004>008-016>018-037-038-231815-
/O.CON.KFGZ.WI.Y.0017.100523T1400Z-100524T0200Z/
KAIBAB PLATEAU-MARBLE AND GLEN CANYONS-GRAND CANYON COUNTRY-
COCONINO PLATEAU-YAVAPAI COUNTY MOUNTAINS-EASTERN MOGOLLON RIM-
WHITE MOUNTAINS-NORTHERN GILA COUNTY-
YAVAPAI COUNTY VALLEYS AND BASINS-OAK CREEK AND SYCAMORE CANYONS-
INCLUDING THE CITIES OF...FREDONIA...PAGE...
GRAND CANYON VILLAGE...SUPAI...PRESCOTT...SHOW LOW...PAYSON...
COTTONWOOD...CAMP VERDE...SEDONA
307 AM MST SUN MAY 23 2010

...WIND ADVISORY REMAINS IN EFFECT FROM 7 AM THIS MORNING TO 7 PM
MST THIS EVENING...

A WIND ADVISORY REMAINS IN EFFECT FROM 7 AM THIS MORNING TO 7 PM
MST THIS EVENING.

* TIMING: EXPECT SOUTHWEST WINDS TO INCREASE EARLY THIS MORNING.
  WIND SPEEDS WILL STEADILY INCREASE THROUGH THE DAY...WITH THE
  STRONGEST WINDS FROM MID-AFTERNOON THROUGH EARLY EVENING.

* WINDS: EXPECT SOUTHWEST WINDS FROM 20 TO 30 MPH WITH GUSTS
  FROM 40 TO 45 MPH THIS MORNING. WINDS WILL BE STRONGER THIS
  AFTERNOON WITH SUSTAINED SPEEDS FROM 25 TO 35 MPH AND GUSTS
  FROM 45 TO 55 MPH.

* IMPACTS: STRONG CROSS WINDS ON AREA ROADWAYS MAY CAUSE DIFFICULT
  DRIVING CONDITIONS...ESPECIALLY FOR HIGH PROFILE VEHICLES.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT SUSTAINED WINDS OF 30 TO 39 MPH...OR
GUSTS FROM 40 TO 57 MPH...ARE EXPECTED. WINDS THIS STRONG CAN
MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES.
CONSIDER SECURING LOOSE BELONGINGS ON YOUR PROPERTY. ADDITIONAL
WEATHER INFORMATION IS ON THE WEB AT WWW.WEATHER.GOV/FLAGSTAFF.

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WWUS75 KGJT 240248
NPWGJT

URGENT - WEATHER MESSAGE

NATIONAL WEATHER SERVICE GRAND JUNCTION CO
848 PM MDT SUN MAY 23 2010

...GUSTY WINDS WILL REMAIN STRONG WITH BLOWING DUST UNTIL MIDNIGHT...

.GUSTY SOUTH TO SOUTHWEST WINDS WILL PERSIST THROUGH MIDNIGHT AS A DEEP TROUGH APPROACHES FROM THE WEST. THESE STRONG WINDS WILL CONTINUE PRODUCING WIDESPREAD BLOWING DUST...REDUCING VISIBILITY TO BETWEEN 1 AND 5 MILES.

FOR THE LATEST FORECAST UPDATES...CHECK YOUR FAVORITE SOURCE OF WEATHER INFORMATION OR VISIT WEATHER.GOV/GJT.

COZ006-009-011-017>022-UTZ022-027>029-240600-
/O.EXT.KGJT.WI.Y.0012.000000T0000Z-100524T0600Z/
GRAND VALLEY-GRAND AND BATTLEMENT MESAS-
CENTRAL GUNNISON AND UNCOMPAHGRE RIVER BASIN-
UNCOMPAHGRE PLATEAU AND DALLAS DIVIDE-
NORTHWEST SAN JUAN MOUNTAINS-SOUTHWEST SAN JUAN MOUNTAINS-
PARADOX VALLEY/LOWER DOLORES RIVER-
FOUR CORNERS/UPPER DOLORES RIVER-ANIMAS RIVER BASIN-
SOUTHEAST UTAH-ARCHES/GRAND FLAT-LA SAL AND ABAJO MOUNTAINS-
CANYONLANDS/NATURAL BRIDGES-
INCLUDING THE CITIES OF...GRAND JUNCTION...FRUITA...PALISADE...
SKYWAY...CEDAREDGE...DELTA...HOTCHKISS...MONTROSE...RIDGWAY...
GLADE PARK...OURAY...TELLURIDE...LAKE CITY...SILVERTON...RICO...
HESPERUS...GATEWAY...NUCLA...CORTEZ...DOVE CREEK...MANCOS...
DURANGO...BAYFIELD...IGNACIO...BLANDING...BLUFF...MEXICAN HAT...
MOAB...CASTLE VALLEY...THOMPSON SPRINGS...MONTICELLO AND VICINITY
848 PM MDT SUN MAY 23 2010

...WIND ADVISORY NOW IN EFFECT UNTIL MIDNIGHT MDT TONIGHT...

THE WIND ADVISORY IS NOW IN EFFECT UNTIL MIDNIGHT MDT TONIGHT.

* WINDS...SOUTH TO SOUTHWEST 15 TO 30 MPH WITH OCCASIONAL GUSTS TO 50 MPH. IN THE MOUNTAINS ABOVE 9000 FEET...WIND SPEEDS OF 20 TO 35 MPH WITH OCCASIONAL GUSTS TO 60 MPH.

* VISIBILITY...BLOWING DUST WILL REDUCE VISIBILITY TO JUST A FEW MILES AT TIMES...WITH SOME AREAS EXPERIENCING VISIBILITY RESTRICTED TO ONE MILE OR LESS FOR BRIEF PERIODS.

* IMPACTS...STRONG CROSSWINDS...ESPECIALLY ALONG INTERSTATE 70... WILL MAKE FOR HAZARDOUS DRIVING CONDITIONS FOR MOTORCYCLES AND HIGH PROFILE VEHICLES.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT A SIGNIFICANT WIND EVENT IS EXPECTED OR OCCURRING. WINDS THIS STRONG CAN MAKE DRIVING DIFFICULT. USE EXTRA CAUTION.

PEOPLE...ESPECIALLY THOSE WITH RESPIRATORY ILLNESSES... HEART

DISEASE...THE ELDERLY...AND CHILDREN ARE RECOMMENDED TO STAY
INDOORS AND AVOID PROLONGED OUTDOOR EXERCISE OR HEAVY EXERTION
DUE TO WIND-BLOWN DUST.

Appendix C- Final Natural Events Action Plan For High Wind Events, Alamosa, Colorado

FINAL NATURAL EVENTS ACTION PLAN

FOR

HIGH WIND EVENTS

ALAMOSA, COLORADO

Colorado Department
of Public Health
and Environment

CITY OF ALAMOSA,
ALAMOSA COUNTY,
and
COLORADO AIR POLLUTION CONTROL DIVISION
4300 Cherry Creek Drive South
Denver, Colorado 80222-1530
(303) 692-3100

May 2003

I. EXECUTIVE SUMMARY

On March 31 and April 9, 1999 and again on April 18 and December 17, 2000, the monitor located in Alamosa, Colorado recorded exceedances of the 24-hour National Ambient Air Quality Standard (NAAQS) for PM10 (particulate matter having a nominal aerodynamic diameter equal to or less than 10 microns). Each of these exceedances was associated with high winds and blowing dust in the Alamosa area.

Recognizing that certain uncontrollable natural events, such as high winds, wildfires, and volcanic/seismic activity can have on the NAAQS, the Environmental Protection Agency (EPA) issued a Natural Events Policy (NEP) on May 30, 1996. The NEP sets forth procedures through the development of a Natural Events Action Plan (NEAP) for protecting public health in areas where the PM10 standard may be violated due to these uncontrollable natural events. The guiding principles of the policy are:

1. Federal, State, and local air quality agencies must protect public health;

2. The public must be informed whenever air quality is unhealthy;

3. All valid ambient air quality data should be submitted to the EPA Aerometric Information Retrieval System (AIRS) and made available for public access;

4. Reasonable measures safeguarding public health must be taken regardless of the source of PM10 emissions; and,

5. Emission controls should be applied to sources that contribute to exceedances of the PM10 NAAQS when those controls will result in fewer violations of the standards.

In response to Alamosa's four exceedances of the PM10 NAAQS in 1999 and 2000, the Colorado Department of Public Health and Environment's Air Pollution Control Division (Division), in conjunction with the City of Alamosa, Alamosa County, and other agencies developed a NEAP for the Alamosa area. The referenced NEAP was developed based on Natural Events Policy that calls for states to "develop a NEAP for any area where natural events cause or have caused a PM10 NAAQS to be violated within eighteen (18) months of the date of the violation." April 18, 2000 was the triggering event for the development of the NEAP. The referenced NEAP was developed and submitted to EPA in October 2001. A revised version of the NEAP (including U.S. EPA recommendations) was submitted February 2002. A copy of the letter of concurrence for these submittals is available in the Appendix.

The Natural Events Policy also indicates that in attainment areas (such as Alamosa), best available control measures (BACM) must be implemented within three (3) years after the triggering event. With that, this *Final Natural Events Action Plan for Alamosa, Colorado*

includes BACM not identified in the February 2002 submittal and includes additional efforts in the community to limit blowing dust and its impacts on public health.

The *Final Natural Events Action Plan* also addresses PM10 exceedances experienced in the area that have occurred since the December 17, 2000 event.

The plan provides analysis and documentation of the exceedances as attributable to uncontrollable natural events due to unusually high winds. In addition, the NEAP is designed to protect public health, educate the public about high wind events; mitigate health impacts on the community during future events; and, identify and implement Best Available Control Measures (BACM) for anthropogenic sources of windblown dust.

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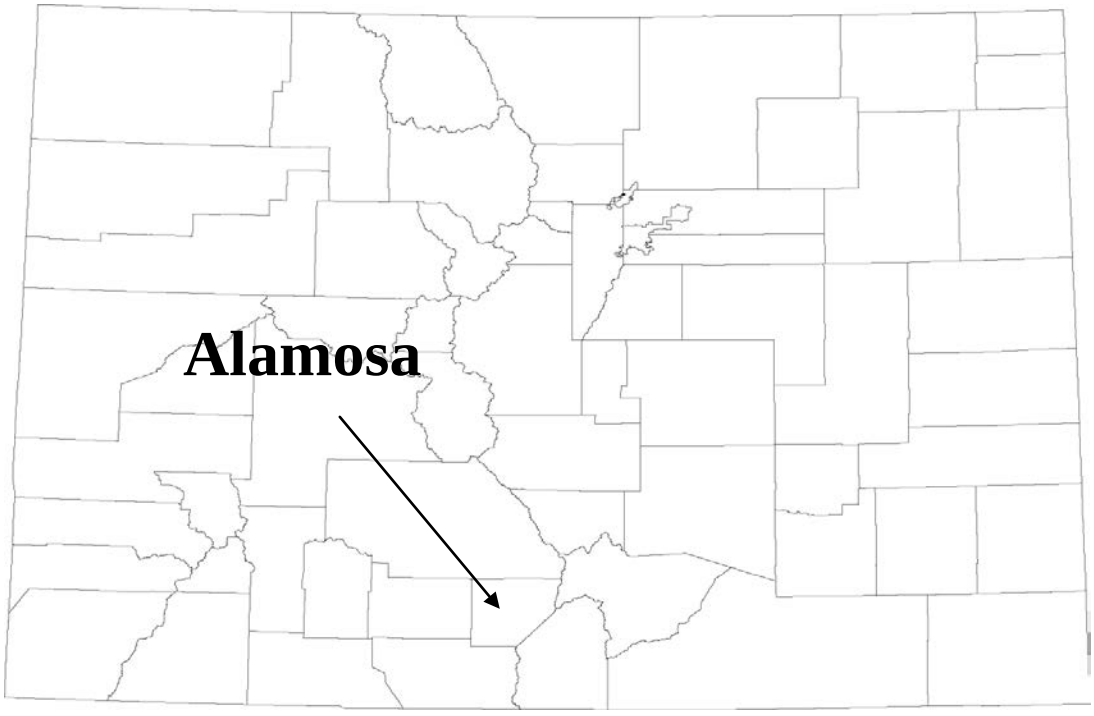
II. INTRODUCTION

The City of Alamosa is located in Alamosa County in south central Colorado. Situated in the San Luis Valley, Alamosa serves as one of the largest cities and the agricultural center for south central Colorado. The area surrounding Alamosa consists of gently rolling to nearly level uplands where the dominant slopes are less than 3 percent. The climate is generally mild and semiarid. Annual precipitation is about 7.5 inches. Summers are considered short and cool, with winters long and cold. In winter and spring, windstorms are common, especially in drier years. It is due to these high velocity windstorms that Alamosa experiences most of the PM10 problems for the area.

Area Map



On March 31 and April 9, 1999 and again on April 18 and December 17, 2000 the PM10 monitor located on the roof of Alamosa's Adams State College recorded exceedances of the primary 24-hour NAAQS for PM10. The PM10 concentrations of 263 $\mu g/m^3$, 190 $\mu g/m^3$, 238 $\mu g/m^3$, and 217 $\mu g/m^3$ respectively, were recorded on these days - as were unusually high wind speeds and little or no precipitation. The circumstances surrounding the Alamosa exceedances has provided

adequate reason for the Division to believe the high wind events and blowing dust have caused exceedances of the NAAQS that otherwise would not have occurred.

As required by the NEP, each of the exceedances was flagged by the Division's Technical Services Program in the AIRS system. The flags appear after the recorded values in AIRS with the descriptor code "A" for high winds. According to EPA guidance the type and amount of documentation provided for each event should be sufficient to demonstrate that the natural event occurred, and that it impacted a particular monitoring site in such a way as to cause the PM10 concentrations measured. This documentation has been previously submitted to EPA.

Recognizing the need to protect public health in areas where PM10 exceeds the NAAQS due to natural events such as the unusually high winds, a Natural Events Action Plan has been developed for the Alamosa area based on the NEP guidance. This plan outlines specific procedures to be taken in response to future high wind events. In short, the purpose of the plan is to:

%撻Ĉz□□□崩□□亠崩兀彬□彬 □□彬猟彬□亠崩 □□ Educate the public about the problem;
2. Mitigate health impacts on exposed populations during future events; and
3. Identify and implement Best Available Control Measures (BACM) for anthropogenic sources of windblown dust.

A. Background

High winds are common to the southern region of Colorado. Under some conditions, these winds are strong enough to lift particulate matter into the air and cause elevated levels of PM10 above the Federal and State standards. Due to observed problems in Alamosa, particulate monitoring of total suspended particulate pollution was instituted at the Adams State College monitoring site in 1970. In 1989, monitoring for PM10 began.

More recently, an additional monitoring site has been established in the Alamosa area. Specifically, a second PM10 monitor was established at the Alamosa Municipal Building to ensure adequate coverage of local air quality monitoring and to ensure protection of public health. This monitor, like the first PM10 monitor at Adams State College, operates on an everyday sampling protocol.

Alamosa's monitoring history shows that the annual PM10 standard of 50 $\mu g/m^3$ (averaged over an annual period) has never been exceeded. The 24-hour PM10 standard of 150 $\mu g/m^3$ has been exceeded on a number of occasions. However, all exceedances have been due to natural events. The associated weather conditions on each of the exceedance days conform to a repeated pattern of regional high winds and blowing dust. In each case an intense, fast-moving, surface low-

pressure system tracked through Colorado. Typically these systems had surface lows that were not collocated with a closed upper low or nearly-closed upper level trough. This distinction is important because the collocated or vertically "coupled" systems usually bring significant up slope snow or rain to the region. The intensity of the lows associated with the PM10 exceedances is evident in the average central pressure of 990 mb (corrected to sea level). This value is typical of a deep, well-organized system. Such well-organized systems usually generate high winds in the vicinity of the low center.

The NEP applies only to emissions caused by natural events that have occurred since January 1, 1994. Only those high wind events experienced since that time are addressed by this NEAP. This submittal includes those exceedances occurring since the previous NEAP submittal as well. See table on page 6 for more details of all area exceedances.

B. The Natural Events Policy

1. Background

On May 30, 1996, EPA issued the Natural Events Policy in a memorandum from Mary D. Nichols, Assistant Administrator for Air and Radiation. In this memorandum EPA announced its new policy for protecting public health when the PM10 NAAQS are violated due to natural events. Under this policy three categories of natural events are identified as affecting the PM10 NAAQS: (1) volcanic and seismic activity; (2) wildland fires; and, (3) high wind events. Only high wind events will be addressed in this NEAP.

Based on EPA's natural events policy high winds are defined as uncontrollable natural events under the following conditions: (1) the dust originated from non-anthropogenic sources; or, (2) the dust originated from anthropogenic sources controlled with best available control measures (BACM). Furthermore, the conditions that create high wind events vary from area to area with soil type, precipitation, and the speed of wind gusts.

2. Content

In order for exceedances of the NAAQS to be considered as due to a natural event, a Natural Events Action Plan must be developed to address future events. The following is a summary of the specific EPA guidance regarding development of a NEAP.

1. Analysis and documentation of the event should show a clear causal relationship between the measured exceedance and the natural event. The type and amount of documentation

provided should be sufficient to demonstrate that the natural event occurred, and that it impacted a particular monitoring site in such a way as to cause the PM10 concentrations measured.

2. Establish education programs. Such programs may be designed to educate the public about the short-term and long-term harmful effects that high concentrations of PM10 could have on their health and inform them that: (a) certain types of natural events affect the air quality of the area periodically, (b) a natural event is imminent, and (c) specific actions are being taken to minimize the health impacts of events.

3. Minimize public exposure to high concentrations of PM10 through a public notification and health advisory program. Programs to minimize public exposure should (a) identify the people most at risk, (b) notify the at-risk population that a natural event is imminent or currently taking place, (c) suggest actions to be taken by the public to minimize their exposure to high concentrations of PM10, and (d) suggest precautions to take if exposure cannot be avoided.

4. Abate or minimize appropriate contributing controllable sources of PM10. Programs to minimize PM10 emissions for high winds may include: the application of BACM to any sources of soil that have been disturbed by anthropogenic activities. The BACM application criteria require analysis of the technological and economic feasibility of individual control measures on a case-by-case basis. The NEAP should include analyses of BACM for contributing sources. If BACM are not defined for the anthropogenic sources in question, step 5 listed below is required.

5. Identify, study, and implement practical mitigating measures as necessary. The NEAP may include commitments to conduct pilot tests of new emission reduction techniques. For example, it may be desirable to test the feasibility and effectiveness of new strategies for minimizing sources of windblown dust through pilot programs. The plan must include a timely schedule for conducting such studies and implementing measures that are technologically and economically feasible.

6. Periodically reevaluate: (a) the conditions causing violations of a PM10 NAAQS in the area, (b) the status of implementation of the NEAP, and (c) the adequacy of the actions being implemented. The State should reevaluate the NEAP for an area every 5 years at a minimum and make appropriate changes to the plan.

7. The NEAP should be developed by the State in conjunction with the stakeholders affected by the plan.

8. The NEAP should be made available for public review and comment and may, but is not

required, to be adopted as a revision to the State Implementation Plan (SIP) if current SIP rules are not revised.

9. The NEAP should be submitted to the EPA for review and comment.

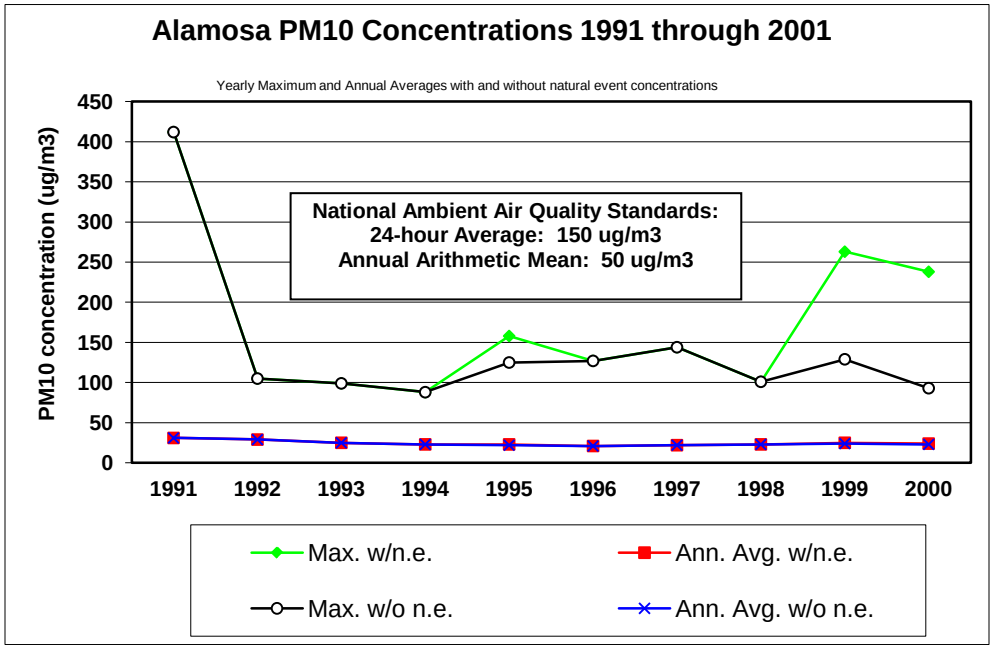
The following text describes the Alamosa NEAP and its conformance with the above-described EPA guidance on natural events.

III. NATURAL EVENTS ACTION PLAN

A. Element 1: Documentation & Analysis

On March 31 and April 9, 1999 and again on April 18 and December 17, 2000, the air quality monitor located in Alamosa, Colorado recorded exceedances of the 24-hour National Ambient Air Quality Standard (NAAQS) for PM10 (Figure 1). Each of these exceedances was associated with unusually high winds in the Alamosa area (Table 1).

Figure 1. Recent Alamosa PM10 Concentrations



n.e.- Natural Event

On October 29, 1999 and again on March 30, 2000 the Division submitted documentation to EPA Region VIII in support of Alamosa's most recent exceedances of the PM10 NAAQS due to natural events. The documentation contained monitoring data, meteorological data, PM10 filter analysis and receptor model results, maps of the area, news accounts of the events and other miscellaneous supporting material. On July 3, 2001, EPA concurred that the aforementioned natural events were, in fact, high wind events (Table 1). The EPA letter of concurrence can be found in the Appendix of this NEAP.

More recently (since the February 2002 submittal), several additional exceedances of the PM10 NAAQS have been experienced in the community. These exceedances were recorded at the Adams State site only; none have been seen at the recently sited PM10 monitor at the Municipal Complex. Details are included in the table below and documentation for these events is on file with EPA.

Table 1. Recent 24 Hour PM-10 Values in Alamosa Colorado

EVENT Date	**PM-10 Concentration**	***Details***
3/31/99	263 ug/m^3	Natural Event- EPA concurrence on July 3, 2001
4/9/99	190 ug/m^3	Natural Event- EPA concurrence on July 3, 2001
4/18/00	238 ug/m^3	Natural Event- EPA concurrence on July 3, 2001
12/17/00	217 ug/m^3	Natural Event- EPA concurrence on July 3, 2001
2/8/02	215 ug/m^3	Natural Event Under EPA consideration
2/25/02	182 ug/m^3	Natural Event Under EPA consideration
3/23/02	164 ug/m^3	Natural Event Under EPA consideration
5/21/02	160 ug/m^3	*Natural Event Under EPA consideration*

Taken together, the supporting documentation establishes a clear, casual relationship between the measured exceedances and the natural events as required by the NEP. On the days of Alamosa's PM10 exceedances, unusually high winds and/or wind gusts were experienced over a prolonged period of time. For example, meteorological data in and around the area (Trinidad, Colorado) demonstrate that on April 18, 2000, maximum wind speeds were over 41 miles per hour and gust speeds were as high as nearly 59 miles per hour. Meterological data for the December 18, 2000 event indicate that gusts were as high as 49 miles per hour in the Alamosa area. Both events were coupled with dry periods of weather.

According to the Natural Events Policy, "the conditions that create high wind events vary from area to area with soil type, precipitation and the speed of wind gusts." Thus, states are to determine the conditions that define high winds in an area. Making a precise determination,

however, is a complex task that requires detailed information on soil moisture, daily wind speeds, temperature, and a number of other variables that are not readily available at this time. Until such research and/or guidance is available, the Division will use the definition of high winds included in the *Guideline on the Identification and Use of Air Quality Data Affected by Exceptional Events* for the Alamosa area. According to this guidance, high winds are defined as: "An hourly wind speed of greater than or equal to 30 mph or gusts equal to or greater than 40 mph, with no precipitation or only a trace of precipitation." In all these high wind events, hourly wind speeds and/or wind gust data coupled with low precipitation levels meet this high wind definition.

The analysis and documentation of the natural high wind events fulfill Element 1 as described on page 3 of this NEAP.

B. Element 2: Public Education Programs

The purpose of this program is to inform and educate the public about the problem. The Division has worked with the City of Alamosa, Alamosa County Commissioners, and interested stakeholders to educate the public about the problems associated with elevated levels of PM10 in the Alamosa area. Several meetings have taken place with the City and County governments to discuss these issues and to develop a plan to address future high wind events in Alamosa. Elements of the public education program include: informing the public when air quality in the area is unhealthy; explaining what the public can expect when high wind events occur; what steps will be taken to control dust emissions during future high wind events; and, how to minimize the public's exposure to high concentrations of PM10 during high wind conditions. The public notification and education programs will include but are not limited to:

- An informational and health-related brochure has been and will continue to be distributed by the local governments, the Alamosa County Health Nurses, and Alamosa County conservation and agricultural extension agencies to sensitive populations (elderly and local school districts) as well as the general public. Distribution of the *Blowing Dust Health Advisory Brochure* began in March 2000. A copy of this brochure is available in the Appendix. More recent (since the February 2002 submittal of the NEAP) activities include: 1) the revision of the area brochure to highlight additional activities in the community and make the document more reader friendly; 2) a review of the effectiveness of the brochure distribution in the community. The brochure is now available at additional sites in the community (e.g., County Land Use office), and; 3) the development of a Spanish version of the brochure.

- Beginning in February 2002, blowing dust watches and health advisories are being issued by the Alamosa County Public Health Nursing office during the high wind season (see

Appendix for details). More recent (since the February 2002 submittal of the NEAP) activities include: 1) expanding the public education effort to include staff from the County Land Use office; 2) meetings with city, county, and local public health nurse to devise improved ways to educate/reach the community regarding blowing dust and its impacts.

- Media press releases for both the print and local radio will be issued in the community as needed. More recent (since the February 2002 submittal of the NEAP) activities include: 1) newspaper articles highlighting the significant impacts of the drought on blowing dust in the Alamosa area (e.g., "Biblical Level Help Needed for Drought," *The Denver Post*, April 22, 2002. This referenced article also highlighted some of the mitigation strategies underway to limit impacts), and; 2) identifying possible Public Service Announcement outlets for additional outreach into the community and the ongoing development of an area press release on the NEAP development and control strategies.

- Meetings have been held to review the requirements of and local involvement in the NEAP. Other meetings will be convened as deemed necessary by State and/or local agencies.

- Advertising at local meetings (e.g. Sunshine Festival - Summer 2003) of ongoing efforts to reduce blowing dust and its impacts. This is new effort not part of the February 2002 submittal.

- Development of a logo/brand to better familiarize area residents to the NEAP and components of that plan including the blowing dust advisory. An example of that logo can be found on the revised *Blowing Dust Health Advisory Brochure,* located in the Appendix. This is new effort not part of the February 2002 submittal.

- Ongoing development of educational materials to be made available through the County's tax announcement (2004). These educational materials will be distributed in the mail alongside tax announcements and are expected to go to all area residents (approximately 13,000 notices). Materials are likely to be in both English and Spanish. This is new effort not part of the February 2002 submittal.

- The Division in conjunction with the area County Public Health Nurse is revising the blowing dust education/notification procedure to highlight public health issues associated with blowing dust.

- Finally, County building inspectors will also educate citizens (home owners and contractors) about blowing dust issues and strategies to minimize such. This will be done in all construction zones in the county and documented as an item on the inspector's

checklist of building issues covered during the permitting process. This is new effort not part of the February 2002 submittal.

This section fulfills the requirement of Element 2 as described on page 4.

C. Element 3: Public Notification Program and Health Advisory Program

The Blowing Dust Health Advisory program will notify the public that a high wind/blowing dust event is imminent or currently taking place, and will include an advisory suggesting what actions can be taken to minimize PM10 emissions and exposure to high concentrations of particulate matter.

Advisories are issued by the Alamosa area Public Health Nursing office, with forecasting assistance provided by the National Weather Service (Pueblo) and the Colorado Air Pollution Control Division. Since 2002, five (5) advisories have been issued locally. The forecasting methodology, the public education brochure, and a copy of the text of blowing dust forecasts and health advisories are provided in the Appendix.

Alamosa County will be investigating, during 2003, the possibility of modifying the 911 data base for reverse notification of sensitive populations during high wind events. This is new activity not included in the February 2002 submittal.

Finally, high winds are currently being documented to determine if the Division and the local agencies can better address these issues. For example, the Alamosa County Public Health Nursing office maintains records of all blowing wind events and the associated notifications. Included in this analysis is a rudimentary review of the high wind data to identify patterns of events and possible solutions to minimize public exposure. Given the drought conditions affecting the Alamosa area over the past several years, no consistent pattern (outside of extremely dry conditions and lack of rainfall) has been noted. Nonetheless, the Division is committed to continually investigating this issue and improving the advisory as possible. Ongoing review of those records will continue to investigate patterns of the exceedances and the notifications. This is a new activity that was not part of the February 2002 submittal and demonstrates additional efforts by the Division and the local agencies to minimize blowing dust and protect public health.

This section fulfills the requirement of Element 3 as described on page 4.

D. Element 4: Determination and Implementation of BACM

1. BACM Determination

According to the NEP, Best Available Control Measures (BACM) must be implemented for anthropogenic sources contributing to NAAQS exceedances in attainment and unclassifiable areas, like Alamosa. BACM must be in place for those contributing sources within *three years* after the first NAAQS violation attributed to high wind event(s) for sources in the Alamosa area. BACM must be in place no later than April 18, 2003. BACM for PM10 are defined (in 59 F.R. 42010, August 16, 1994) as techniques that achieve the maximum degree of emissions reduction from a source as determined on a case-by-case basis considering technological and economic feasibility.

On September 2, 1999 the Division attended several meetings in Alamosa with officials representing the City of Alamosa and Alamosa County Commissioners. Discussed were the monitoring data, meteorological data, potential contributing sources to the high wind events, the development of a NEAP, and possible control measures. In addition, meetings in December 2001 and February 2002 and numerous correspondences at other times have covered the same. The meetings, coupled with the analyses of the supporting documentation, identified two distinct sets of circumstances that lead to Alamosa's high wind/blowing dust exceedances of the PM10 NAAQS:

1. High concentrations of PM10 caused by a mixture of anthropogenic and non-anthropogenic sources coming largely from outside the area under high wind conditions; and,

2. Prolonged climatic conditions of low precipitation over an extended period of time that act to dry area soils, making them more susceptible to airborne activity under high wind conditions.

Discussions with the community stakeholders also covered local agricultural practices. Alamosa County is a predominately agricultural area where a lack of water, coupled with the frequent high winds experienced during late fall and early spring, can destroy crops, encourage pests, and damage soil surfaces lending them susceptible to wind erosion.

Other potential contributing sources may include construction sites, wind erosion of open areas, paved and unpaved roads, residential wood burning, and/or open burning. See below for more details on each of these potentially contributing sources and their consideration for BACM.

2. BACM Options Considered

Based on the contributing source analysis and/or in review with community stakeholders, the following BACM options were considered as possible PM10 control measures for the community:

a) Street Sweeping Activities- community street sweeping programs have demonstrated effectiveness in other communities. Such activities were considered as a local control measure. Expanding the current street sweeping program was also reviewed.

b) Construction/Demolition Activity – local ordinances to control emissions from construction and demolition sites have been implemented in other parts of the state with good success.

c) Wind Erosion of Open Areas – several practices were reviewed regarding the wind erosion of open areas, including both local and regional efforts.

d) Control of Stationary Source Emissions- as identified elsewhere in this NEAP, a review of stationary sources and their relative contribution to overall PM concentrations was completed. It was determined that six PM-10 sources exist in the area, appearing to contribute a small amount of particulate matter to the overall inventory.

e) Road Stabilization- In a effort to better understand the effects of road stabilization, several options were reviewed including the use of chemical stabilizers and water as a stabilizing measure.

Also, periodic assessments to determine if traffic levels on unpaved roads surpass Colorado Regulation No. 1 limits were considered. If daily traffic counts exceed 200 trips per day on unpaved roads, state regulations apply that reduce PM-10 emissions from those roads. Specifically, periodic assessments of traffic levels on unpaved roads within the city limits and within one mile of the city limits were considered. State regulation calls for a road traffic count and dust control plan for roads that exceed the 200 trips threshold.

In addition, Alamosa currently suggests that drivers maintain their vehicles at a slow speed on unpaved roads and other dirt surfaces to reduce dust emissions.

f) Woodburning Curtailment Programs- the possibility of instituting a citywide curtailment program was reviewed and considered. This consideration includes discouraging wood burning on high wind days.

g) Open Burning- The usefulness of imposing and maintaining an open burning curtailment program during high wind events was reviewed. Current state air pollution control laws and regulations provide some guidance on the effort.

h) Avoidance of Dust Producing Equipment- The effectiveness of avoiding the use of dust producing equipment has also been considered. Currently Alamosa discourages the use of dust-producing equipment (e.g., leaf blowers) in an effort to reduce PM10 emissions and does so through public education and outreach efforts.

(i) Reducing or Postponing Tilling and Plowing or Other Agricultural Practices that Contribute to PM10 Emissions- It is well recognized that dust-producing activities such as tilling, plowing, and other agricultural practices increase the amount of PM10 released. As such, these control measures were discussed as part of the effort to reduce PM10 impacts on Alamosa. Review of existing and potentially future control practices were considered at the local, regional, state, and federal (e.g., Natural Resources Conservation Service) level.

j) Wind Break- Various trees are found throughout Alamosa. However, the placement of one row of barrier trees (e.g., Russian Olives) would block potential contributing sources. The Russian Olive is a quick growing large shrub/small tree will do well given the windy climate of Alamosa. According to section 3.5.2.1 of EPA guidance entitled Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures, dated September 1992, one-row of trees is considered an effective windbreak.

k) Vegetative Cover/Sod- Efforts elsewhere in the State have demonstrated the usefulness of using a vegetative cover at sites where dust is known to blow. Efforts to use this control measure were reviewed for applicability and effectiveness.

Alamosa PM10 Stationary Source Emissions

To ensure that PM10 emissions from local stationary sources are not a significant contributing factor to area exceedances, an emission inventory was prepared and reviewed. Identified stationary sources are as follows: Public Service Company (natural gas/fuel oil plant), Rakhra Mushroom Farm Corporation (coal-fired boilers and one natural gas fired boiler), Rocky Mountain Soils (fugitive dust emissions), Rogers Family Mortuary (crematorium), San Luis Valley Regional Medical Center (biomedical waste incinerator), and Southwest Ready Mix (concrete batch plant). While no emission inventory of natural sources was prepared as part of this NEAP, appreciation for the significant sand dunes at Great Sand Dunes National Monument highlights that these few and limited stationary sources have very little effect on the total PM10 emission inventory for the Alamosa area. The following table demonstrates their limited impacts on the total emission estimation.

Alamosa PM10 Emission Inventory (circa 2003)

Source	Emissions in lbs/day
Public Service Company of Colorado	44.4
Southwest Ready Mix	4.4
San Luis Valley Regional Medical Center	0.1
Rakhra Mushroom Farm Corp.	11.1
Rocky Mountain Soils, Inc.	11.5
Rogers Family Mortuary	0.5
TOTAL EMISSIONS	***72.1***

Limited Stationary Source Impacts
The largest of these stationary sources, Public Service Company of Alamosa (PSC), is 44.4 pounds per day of particulate matter (as reported to the Colorado APCD). At PSC, the site consists of two turbines that can run on natural gas, #1 fuel oil, #2 fuel oil, or a combination thereof. PSC must stay in compliance with Colorado Air Quality Regulation No. 1 particulate standard. PSC must also meet the state 20% opacity standard.

Other Alamosa area stationary sources have considerably smaller particulate matter emissions than PSC and their own existing control measures in place. For example:

Southwest Ready-Mix has a concrete batch plant in the City of Alamosa. Southwest Ready-Mix has several outside storage piles for their raw materials (sand & aggregate). There exists a sprinkler system at the facility to keep these piles watered. Cement and fly ash are stored in silos, each controlled with a baghouse to capture particulate when the silos are being loaded. When all of the raw materials are loaded into the concrete trucks, 25% of the total water is loaded first, followed by rock, sand, cement, and then the remaining water. This helps to minimize the particulate emissions from the truck during loading. The baghouses are part of the Southwest Ready-Mix permit, and as such are required. This source is also subject to the 20% opacity standard. Finally, Southwest Ready-Mix may be upgrading their baghouses.

San Luis Valley Regional Medical Center has a permit for a biomedical waste incinerator, which is natural gas fired. The incinerator is subject to New Source Performance Standards which limit opacity to 10% and also has a particulate standard. Ash removal from the incinerator must be done in an enclosed area to limit particulate emissions. Ash must be completely enclosed during transport as well.

3. BACM Options Discounted

Several BACM options were discounted from further consideration based on meteorological analysis, on-site inspections, and discussions with local government officials and sources.

Woodburning curtailment was discounted because high wind events are actually beneficial to good atmospheric clearing of particulate matter. In addition, woodburning curtailment was not recognized as an effective control measure on high wind days. Lastly, many of the community citizens rely on woodburning as their sole source of home heating- reducing or eliminating wood burning is thus not an option.

BACM of stationary sources at great distances from the City were discounted as their impacts would be negligible, if seen at all.

Finally, for this revised NEAP (since the February 2002 submittal), the community remains committed to meet BACM in all instances, as feasible. For example, meetings with local officials indicate that the ongoing regional drought may significantly impact the amount of water available as a control measure (e.g., watering of roads to reduce PM10). With that, water restrictions (and related economic impacts of the drought) will likely dictate the utility of this control measure.

4. BACM Implemented

Refer to the stakeholder agreements for details of selected BACM.

IV. STAKEHOLDER AGREEMENTS

The City of Alamosa, Alamosa County, the Division, and participating federal agencies have been working diligently to identify contributing sources and to develop appropriate BACM as required by the Natural Events Policy. A copy of relevant agreements and supplemental information are included in the Appendix**.** This section fulfills the requirements of Element 4 as described on page 4.

City of Alamosa

The City of Alamosa has been active in addressing potential PM10 sources within the Alamosa area through various efforts. Some of these efforts, plus other potential future measures, include the adoption of local ordinances to reduce PM10. Copies of current ordinances and any related commitments are included in the Appendix.

Street Sweeping
Currently, the City of Alamosa sweeps on an every 6-week schedule or as needed, as determined by local officials on a case by case situation (e.g., following each snowstorm and/or where sand was applied). Sweeping occurs on every single City street with an emphasis on the downtown corridor where public exposure is expected to be greatest. In fact, street sweeping in the downtown corridor currently takes place three times per week.

In addition, the City recently agreed to lease/own a new TYMCO 600 (brush-assisted head) sweeper. Efforts are underway to get this effective piece of equipment into place immediately. This new sweeper will complement a mobile mechanical sweeper already in use.

Unpaved Roads within the City
While very few unpaved roads exist in the City of Alamosa, the city did recently annex new land. This annexation includes roadways not currently paved. The City of Alamosa is discussing the paving of these annexed roads. At a minimum, the City of Alamosa commits to continually provide in-kind engineering services for the development of the annexed lands.

Sod/Vegetative Cover Projects in the City of Alamosa
The development and construction of a local park, Eastside Park, is underway in Alamosa. It is anticipated that sodding at the park will take place this year. This commitment is anticipated to reduce blowing dust from this previously undeveloped site.

Alamosa County

Alamosa County has also been active in addressing blowing dust and is preparing county ordinance as such. Examples can be found below and available supporting documents in the Appendix.

Unpaved Roads
Alamosa County is presently addressing unpaved roads and lanes that are anticipated to contribute to PM10 emissions in the community. As of 2002, Alamosa County was nearing the end of its five-year road paving plan and was developing their next plan with the intention of paving on a yearly basis, based on traffic and community needs/priorities.

In 2002, Alamosa County addressed approximately ten (10) miles of unpaved roads. This includes the stabilization of approximately five section roads, the seal coating of two roads, and the overlay (repaving) of four (4) additional roads.

For 2003, approximately 14 miles of roads are scheduled for paving. This includes the Seven Mile Road (three miles long), Road 109 (one mile long), and 10th Street (also one mile long). These roads are in close proximity to the City of Alamosa, are upwind (prevailing) from the city,

and have heavy traffic. Paving is anticipated to greatly reduce blowing dust and impacts in the vicinity.

In addition, once it gets cold enough in the area, the County will wet down some of the more sandy roads. Once the water soaks in and freezes, it is anticipated that good dust suppression will be seen. These commitments are anticipated to reduce PM10 emissions in and near Alamosa. This control measure will be balanced with the availability of water in the area.

Finally, Alamosa County assesses the need to use $MgC1_2$ treatment on roads in front of residences that request such service. Assessments include the sensitivity to dust of residents, the materials of the road base for safety reasons, and possible environmental concerns of the neighborhood. Most requests for treatment are granted. Road construction areas are being dampened with water for dust control. Other areas for treatment, such as commercial construction zones or gravel pits, are investigated on a case by case basis.

Dust Control Plans

Alamosa County is considering changes in local ordinances governing dust control plans at construction sites. This will be addressed through the revision of Alamosa County's Comprehensive Plan and supporting zoning codes. Alamosa County is currently reviewing language from other successful dust control programs for inclusion in their local ordinances. The process is due for completion in December 2003 or early 2004 and will specifically include dust control language. This effort is anticipated to reduce PM10 emissions in Alamosa, especially as it relates to impacts on the community and high recorded PM10 values. The Division commits to providing copies of this language to EPA upon finalization and availability.

Wind Erosion of Open Areas

To reduce PM10 emissions from open areas outside of the City limits, low tilling and other soil conservation practices will continue to be utilized in the community. In addition, the community is using in strategic areas the State of Colorado Agricultural Office's program to purchase and plant shelter trees to reduce wind erosion in open areas. These trees have a demonstrated advantage for the community and for air quality. Once the trees reach maturity, it is anticipated that the equivalent of 112 miles of double-rowed trees will be in place.

In addition, there is ongoing planting of trees (approximately 50) on newly developed Alamosa County property south/southwest of Alamosa (prevailing winds from southwest) and the Airport south of Alamosa for added air quality improvement.

These commitments are anticipated to further reduce the PM-10 emissions in Alamosa.

Sod and Vegetative Projects in the County
Numerous projects to reduce blowing dust and its impacts have happened or are happening at the County Airport. For example:

- Through additional grounds maintenance of the 40-acre Alamosa County airport south of the city, grass is being grown for aesthetics and dust control.

- Sodding and the placement of decorative rock and ground cover will be implemented in the landscaping of the Alamosa County property, as well. These measures will directly abate blowing dust at the Airport.

- Also, the widening of the airport's safety areas (250 feet on either side of the runway) is now complete and seeding of natural grasses was incorporated in the project. Trees and grass were incorporated in the approaches to the airport and have provided additional wind-break advantages to South Alamosa.

In other areas where watering is a problem, xeriscape (the use of native drought resistant vegetation and/or rock cover) is being encouraged for County owned property and for all other property owners.

These efforts are anticipated to further reduce PM10 emissions in Alamosa.

Open Burning Issues at the County
The Colorado air pollution control laws and regulations prohibit open burning throughout the state unless a permit has been obtained from the appropriate air pollution control authority. In granting or denying any such permit, the authority will base its action on the potential contribution to air pollution in the area, climatic conditions on the day or days of such burning, and the authority's satisfaction that there is no practical alternate method for the disposal of the material to be burned. No open burning is allowed when local wind speeds exceed 5 miles per hour.

Colorado State University Co-Op Extension Office
In response to extremely dry conditions, the need to maintain area topsoil, and reduce impacts, the Colorado State University Co-Op Extension Office of Alamosa County provides the following outreach efforts and recommendations:

- Modification of grazing practices to improve protective crop cover
- Increasing crop residues left in the fields to reduce blowing dust
- Planting of Fall crops to maintain fields
- Application of manure to protect top soils from blowing away
- Staggering of the harvest to minimize blowing dust

- Outreach programs on soil conservation efforts
- Development of outreach/education materials (e.g., news articles, newsletters, fact sheets, etc.), and
- Attendance at Statewide workshop to educate other Co-Op offices to various practices to reduce blowing top soil and minimize impacts

These control strategies are not meant to be enforceable. They are meant only to demonstrate the regional nature of cooperation in addressing blowing dust and its impacts on the community.

Natural Resources Conservation Service
As stated elsewhere in this NEAP, Alamosa County is a predominately agricultural area where limited water, coupled with the frequent high winds experienced during late fall and early spring, can destroy crops, encourage pests, and damage soil surfaces lending them susceptible to wind erosion. Thus, activities that improve the topsoil and prevent its lifting during high wind events are encouraged. Some notable NRCS and agricultural examples include:

- Cover crops and perennial crops (e.g., alfalfa) are recommended to protect soils;
- NRCS works with area farmers in the development of conservation compliance plans to also protect topsoil;
- NRCS encourages the use of perennial crops or the leaving in place of weeds on the corners of area acreage (instead of tilling that might lead to open, barren lands) to reduce the lifting of topsoil;
- NRCS “cost shares” on conservation practices with local farmers to prevent soil erosion, and;
- The NRCS works with Colorado State University to identify other strategies that minimize blowing dust.

Other successful agricultural practices encouraged in the area include: timing of tillage, crop rotation, amount of crop residue left on the land, and proper water usage.

These control strategies are not meant to be enforceable. They are meant only to demonstrate the regional nature of cooperation in addressing blowing dust and its impacts on the community.

Natural Events Policy guidance indicates that control options must be implemented within three years of the exceedance in question. For Alamosa, BACM must be in place no later than April 18, 2003. This submittal is meant to meet that three year commitment.

This section fulfills the requirement of Element 4.

V. PUBLIC REVIEW AND PERIODIC EVALUATION

This section describes the public process used to develop this NEAP and the commitment made to periodically evaluate the plan.

Stakeholder Involvement
The EPA's NEAP development guidance states that the NEAP should be developed by the State in conjunction with the stakeholders affected by the Plan. The Colorado APCD worked with stakeholders mentioned throughout this document. Numerous meetings and telephone conversations occurred with stakeholders, and the final agreement here reflects control measures offered as part of the NEAP.

Public Review
The Division made this documentation available for and presented the NEAP and its strategies to the public to ensure public review and comment. Examples of these efforts in Alamosa, beginning with the earliest community involvement, include:

- Briefing of the San Luis Valley County Commissioners, "Air Quality Briefing," San Luis Valley County Commissioners' Association Meeting, September 1999.
- "Control Alamosa's Dust? Lots of Luck." Newspaper article appearing in *Pueblo Chieftan* indicating the area is developing a plan (NEAP) to address blowing dust – November 1, 2001.
- Briefing of the Alamosa City Council, "Alamosa Air Quality and the Development of a Local Natural Events Action Plan," a meeting to reintroduce the NEAP to City Council staff, February 6, 2002.
- Placement of *Natural Events Action Plan for Alamosa, Colorado* at the area library (Southern Peaks Public Library) for public review, February 2002.
- "Odd Issues Keep Alamosa Busy." Newspaper article appearing in *Valley Courier* indicating NEAP being developed and available for public review at the Southern Peaks Public Library, February 2002.
- Briefing of the Alamosa City Council, "Alamosa Natural Events Action Plan," a meeting to incorporate comments from the City Council, local stakeholders, and the public, February 20, 2002.
- Briefing of the Colorado Air Quality Control Commission, "Natural Events Action Plan for Alamosa, Colorado," May 2002.
- Briefing of the Colorado Air Quality Control Commission, "Alamosa Natural Events Action Plan – Final Activities," January 2003.
- Public Notice, "Natural Events Action Plan for Alamosa, Colorado" Available for Public Review and Comment at the Public Library, April 2003.
- "Media Advisory" notifying public of upcoming Alamosa City Council meeting to

discuss the NEAP, monthly city council meeting agenda published in the area newspaper, May 2003.
- "Media Advisory" notifying public of City Council meeting to discuss the NEAP, Channel Ten Cable Access Channel Public Service Announcement, May 2003.
- Briefing of the Alamosa City Council, "Final Alamosa Natural Events Action Plan," May 2003.

Periodic Evaluation

EPA's Natural Events Policy guidance requires the state to periodically reevaluate: 1) the conditions causing violations of the PM10 NAAQS in the area, 2) the status of implementation of the NEAP, and 3) the adequacy of the actions being implemented. The State will reevaluate the NEAP for Alamosa at a minimum of every 5 years and make appropriate changes to the plan accordingly.

Evaluation of the effectiveness of the NEAP included several key strategies to ensure protection of public health and a robust plan. Strategies included: review of Natural Events Policy in specific relation to the Alamosa community, review of the effectiveness/appropriateness of ongoing control strategies, consideration of new/additional control options, review of meteorological and climatological conditions leading to blowing dust, review of local and regional PM10 monitoring data, discussions with other States (e.g., South Dakota, Washington) and Federal (US EPA) personnel regarding NEAP updates and protocols, review of the established emission inventory and identification of any new emission sources, review of the blowing dust advisory protocol and notification records, public/stakeholder meetings and community outreach/education efforts, etc.

The Division commits to continually review the effectiveness of the Alamosa Natural Events Action Plan and improve the effort, where feasible.

The Division commits to evaluate the NEAP at a minimum of every five years.

Submittal to EPA

The NEAP was submitted in its initial form to EPA in October 2001. Following EPA comment and input from stakeholders, appropriate changes were made to the NEAP. The Alamosa City Council heard and approved the NEAP in February 2002. Since that period, meetings with local agencies and stakeholders have led to finalization of stakeholder agreements (found elsewhere in the NEAP). The *Final Natural Events Action Plan for Alamosa, Colorado* and its Best Available Control Measures, where feasible, are presented here as required under the Natural Events Policy.

This section fulfills the requirements of Elements 6, 7, 8, and 9 as described on page 4 and 5.

Appendix D – Copy of Affidavit of Public Notice