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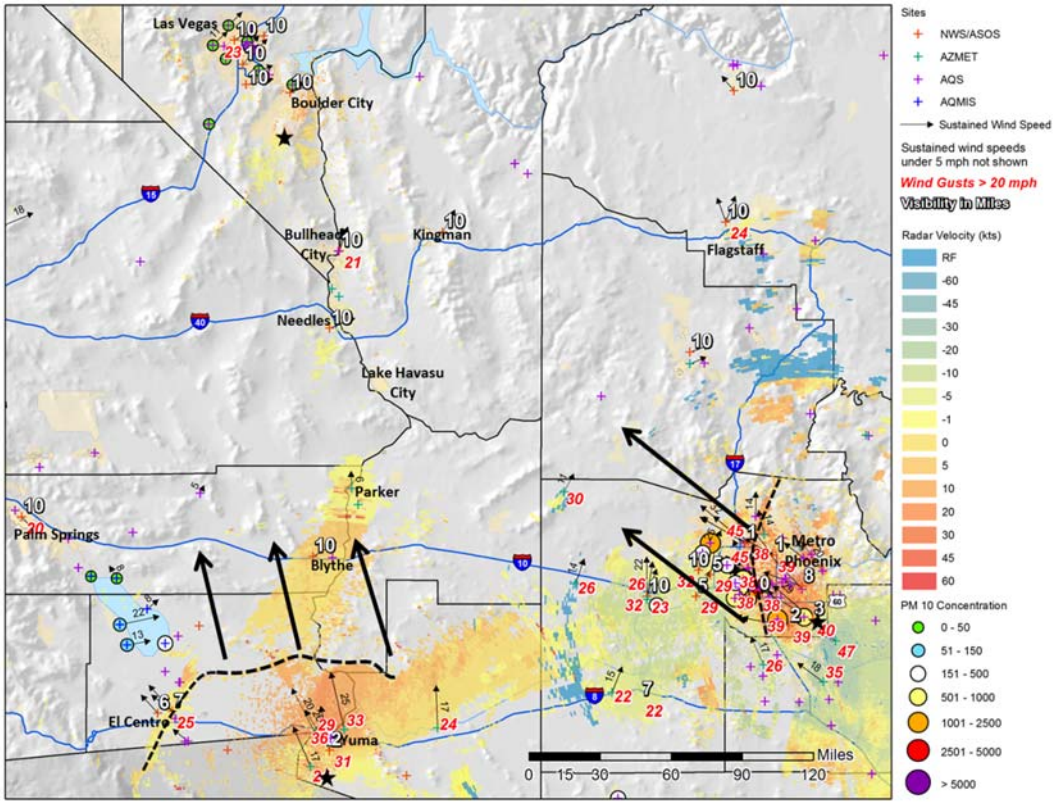
State of Arizona Exceptional Event Documentation for the Event of August 19, 2011, for the Bullhead City PM_{10} Maintenance Area



Final Report Prepared for

Arizona Department of Environmental Quality
Phoenix, AZ

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State of Arizona Exceptional Event Documentation for the Event of August 19, 2011, for the Bullhead City PM_{10} Maintenance Area

Final Report

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Cover graphic illustrates radar velocity, wind, visibility, and PM_{10} data across Arizona, southeastern California, and southern Nevada between 6:00 and 7:00 p.m. on August 18, 2011. See Section 3 for more information.

Acknowledgments

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1. Introduction

On August 19, 2011, the Bullhead City PM_{10} monitor recorded a 24-hr average PM_{10} concentration of 132 µg/m^3. While this value does not exceed the National Ambient Air Quality Standard (NAAQS) for 24-hr PM_{10}, the value is relevant to the Bullhead City PM_{10} maintenance area's eligibility for the Limited Maintenance Plan (LMP) option for demonstrating attainment with the NAAQS. A May 7, 2009, memorandum from William T. Harnett of the U.S. Environmental Protection Agency (EPA) states, "In determining eligibility for the limited maintenance plan option, the EPA will treat 24-hour average air quality data between 98 µg/m^3 and 155 µg/m^3 in a manner analogous to the treatment of exceedance data under the Exceptional Events Rule, provided the impacted data meet the general definition and criteria for exceptional events (natural event, or exceptional event that is not reasonably controllable or expected to recur.)[1]" The purpose of this report is to demonstrate that the high 24-hour average PM_{10} concentration observed on August 19, 2011, in Bullhead City was due to naturally occurring windblown dust, was not reasonably controllable or preventable, was historically unusual, and would not have occurred "but-for" the windblown dust and, therefore, is an Exceptional Event as defined by the EPA's Exceptional Events Rule (EER).

1.1 Report Contents

Section 2 of this assessment contains a conceptual model of the thunderstorm-driven, wind-blown dust event that occurred on August 19, 2011, providing a background narrative of the exceptional event and an overall explanation that the event affected air quality. Section 2 also provides evidence that the event was a natural event.

Section 3 of this assessment establishes a clear causal connection between the natural event on August 19, 2011, and the 24-hr average PM_{10} concentration at the monitoring station. The evidence in this section also confirms that the event in question both affected air quality and was the result of natural events.

Section 4 of this assessment contains data summaries and time-series graphs which help illustrate that the event of August 19, 2011, produced PM_{10} concentrations in excess of historical normal fluctuations.

Section 5 of this assessment details existing dust control measures and demonstrates that despite the presence and enforcement of these controls, the event of August 19, 2011, was not reasonably controllable or preventable.

Section 6 of this assessment builds upon the demonstration, showing a clear causal connection between the natural event and the observed PM_{10} concentrations, and concludes that the 24-hr average PM_{10} concentration observed on August 19, 2011, would not have occurred but for the event.

[1] The EPA memo regarding the LMP option and PM_{10} Exceptional Events can be found at http://www.epa.gov/ttn/caaa/t1/memoranda/lmp_final_harnett.pdf.

Appendix A contains time-series graphs and data tables to supplement Section 3. **Appendix B** contains weather statements and warnings issued by the National Weather Service.

1.2 Exceptional Event Rule Requirements

In addition to the technical requirements contained within the EER, procedural requirements must also be met in order for the EPA to grant an exceptional event designation. This section of the report describes the requirements of the EER and associated guidance and discusses how Arizona Department of Environmental Quality (ADEQ) addressed those requirements.

1.2.1 Public Notification That the Event Was Occurring (40 CFR 50.14(c)(1)(i))

ADEQ issued Dust Control Action Forecasts in the area advising citizens of the potential for high wind dust events due to thunderstorms during the August 18-19, 2011, time frame. More information on ADEQ's forecasting program can be found in Section 5.4 of this report. The forecast products that were issued for the August 27-28, 2011, period are included in Appendix B. Please note that these forecasts were issued for Maricopa County.

1.2.2 Place Informal Flag on Data in AQS (40 CFR 50.14(c)(2)(ii))

ADEQ and other operating air quality agencies in Arizona submit data into the EPA's Air Quality System (AQS), the official repository of ambient air quality data. This data submittal to AQS includes PM data from both filter-based and continuous monitors operated in Arizona.

When ADEQ and/or another agency operating monitors in Arizona suspect that data may be influenced by an exceptional event, ADEQ 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. ADEQ and/or other operating agencies also submit data from continuous monitors into AQS after quality assurance is complete.

If ADEQ and/or other operating air quality agencies have determined that a monitor's reading(s) may have been influenced by an exceptional event, a preliminary flag is submitted for the measurement(s) in AQS. The data are not official until they undergo more thorough quality assurance and quality control, leading to certification by May 1 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.

1.2.3 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))

ADEQ held informal conversations with EPA during July, 2012, to discuss all the days in calendar year 2011 that ADEQ intended to analyze under the Exceptional Events Rule. The 24-hour average PM_{10} concentration that occurred at the Bullhead City monitor on August 19,

2011, in the Bullhead City PM_{10} maintenance area was included in the discussions. This assessment report serves as demonstration supporting the flagging of these data.

1.2.4 Document That the Public Comment Process Was Followed for Event Documentation (40 CFR 50.14(c)(3)(iv))

ADEQ posted this assessment report on the ADEQ webpage and placed a hard copy of the report in the ADEQ Records Management Center for public review. ADEQ opened a 30-day public comment period on July 15, 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).

1.2.5 Submit Demonstration Supporting Exceptional Event Flag (40 CFR 50.14(a)(1-2))

At the close of the public comment period, and after ADEQ has had the opportunity to consider any comments submitted on this document, ADEQ will submit this document, the comments received, and ADEQ's responses to those comments to EPA Region 9 headquarters in San Francisco, California. The deadline for the submittal of this package is September 30, 2014.

1.2.6 Documentation Requirements (40 CFR 50.14(c)(3)(iii))

The EER states that in order to justify the exclusion of air quality monitoring data, evidence must be provided for the following elements:

1. The event satisfies the criteria set forth in 40 CFR 501(j) that
    a. the event affected air quality,
    b. the event was not reasonably controllable or preventable, and
    c. the event was caused by human activity unlikely to recur in a particular location or was a natural event;
2. There is a clear causal relationship between the measurement(s) under consideration and the event;
3. The event is associated with a measured concentration(s) in excess of normal historical fluctuations; and
4. There would have been no exceedance or violation but for the event.

2. Conceptual Model

This section provides a narrative background and summarizes the meteorological and air quality conditions in place on August 19, 2011, in the Bullhead City area. Elements described in this section include

- A description and map of the geographic setting of relevant air quality and meteorological monitors.
- A history of Bullhead City's PM_{10} attainment status.
- A description of Bullhead City's climate.
- An overall description of meteorological and air quality conditions on the event day.

2.1 Geographic Setting and Monitor Locations

Bullhead City is a mid-sized community about 220 miles northwest of Phoenix and about 90 miles southeast of Las Vegas, Nevada. Bullhead City is located in Mohave County on the Colorado River opposite Laughlin, Nevada, at an elevation of 540 feet above sea level. Bullhead City had a population of 39,540 as of the 2010 census. The regional area, consisting of Laughlin, Nevada; Needles, California; Fort Mohave, Arizona; and Bullhead City, had a population of about 115,000. The area is known to tourists for the casinos in Laughlin and for extensive outdoor recreation activities, including boating on the Colorado River and Lake Mohave.

The air quality and meteorological monitors in the Bullhead City area are shown in **Figure 2-1**. AQS monitors measure air quality and meteorological data; Arizona Meteorological Network (AZMET) and National Weather Service (NWS) monitors measure meteorological data only. The 24-hour PM_{10} concentration on August 19, 2011, discussed in this report was recorded at the Bullhead City monitor, which is located at the United States Post Office Building in Bullhead City and has been operated by ADEQ since November 1997.[2] The monitor is operated on a sampling period of once every six days. Two AZMET sites are in operation just south of Bullhead City. A NWS monitor is located at Laughlin-Bullhead City International Airport. Additional air quality and meteorological monitors with data relevant to this event are located in adjacent northwestern Arizona, southeastern California, and southern Nevada (**Figure 2-2**).

[2] Prior to 1998, ADEQ operated a PM_{10} monitor 0.5 miles south of the current location.

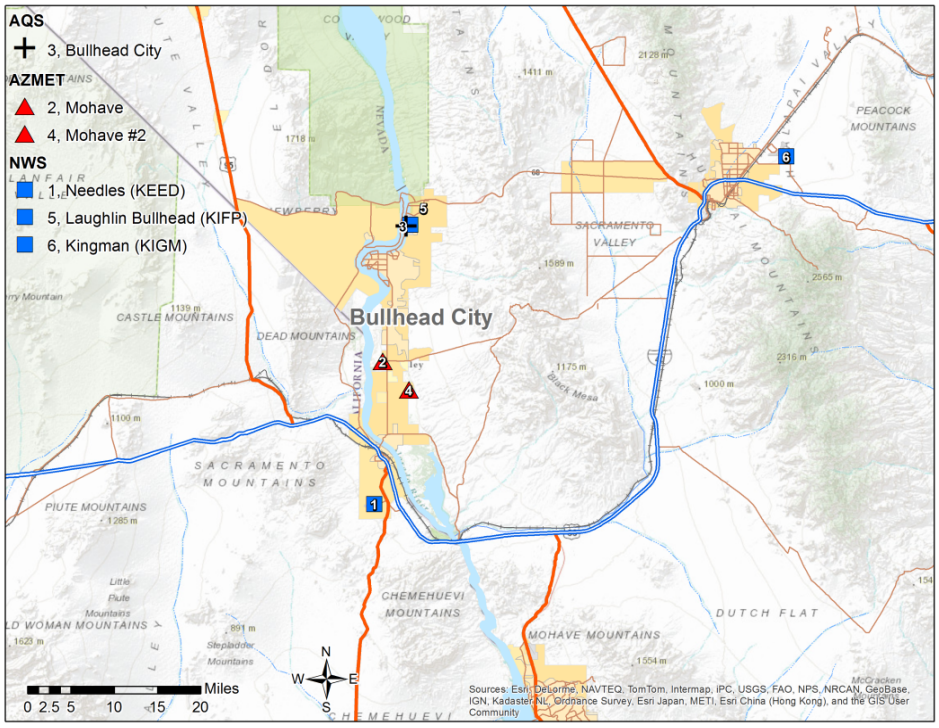


Figure 2-1. Air quality and meteorological monitors in the Bullhead City region.

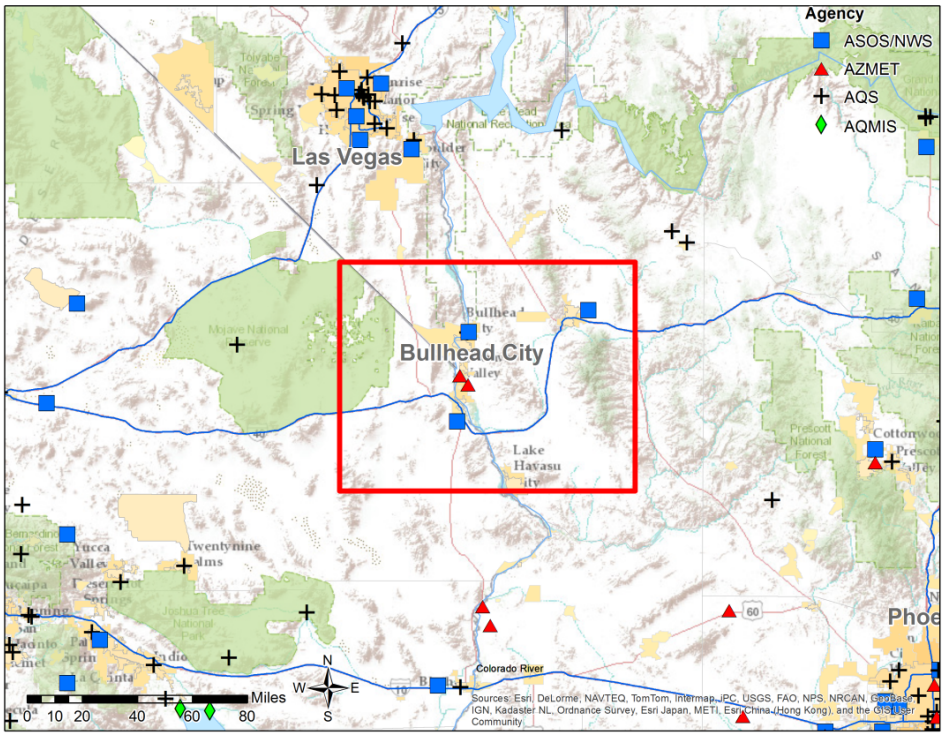


Figure 2-2. Air quality and meteorological monitors in northwestern Arizona, southern Nevada, and southeastern California. The red box denotes the area shown in Figure 2-1.

2.2 History of PM_{10} Attainment Status for Bullhead City

There are no significant permitted sources of air pollution in Bullhead City, and air quality measurements are typically well below the NAAQS for all criteria pollutants; however, fugitive dust from cleared land areas and travel on unpaved roads,[3] as well as naturally occurring windblown dust, have contributed to air quality issues in the past. On two days in 1989 and 1991, air quality monitors in the Bullhead City, Arizona, PM_{10} Planning Area recorded exceedances of the 24-hour PM_{10} NAAQS, and there was one exceedance of the annual PM_{10} NAAQS[4] in calendar year 1989. On December 21, 1993, EPA designated the Bullhead City, Arizona, area as a moderate PM_{10} nonattainment area, effective January 20, 1994 (58 FR 67334). As a result of this action, the state was required to submit to EPA a PM_{10} State Implementation Plan (SIP) which included an attainment demonstration for the area with projected attainment of the PM_{10} NAAQS by the year 2001.

From 1998 through 2000, the Bullhead City monitor recorded no exceedances of the 24-hour PM_{10} NAAQS, demonstrating that the Bullhead City area had attained the 24-hour PM_{10} NAAQS. As a result, ADEQ submitted the 2002 Bullhead City Moderate Area PM_{10} Maintenance Plan and Request for Redesignation to Attainment. The EPA redesignated the Bullhead City PM_{10} Planning Area from nonattainment to attainment, effective August 26, 2002 (67 FR 43020). Included in the plan was an assessment and demonstration of the Bullhead City area's eligibility for the Limited Maintenance Plan (LMP) option. The LMP is a streamlined alternative to the reporting required under a regular Maintenance Plan. Subsequent reports under the LMP option for the Bullhead City PM_{10} Planning Area were submitted to EPA as required and demonstrated continued attainment of the 24-hour PM_{10} NAAQS.

As stated in Section 1, the 24-hour PM_{10} concentration observed at the Bullhead City monitor on August 19, 2011, was not in exceedance of the 24-hour PM_{10} NAAQS, but it is relevant to the eligibility of the Bullhead City area for the LMP option. To be eligible for the LMP option, two criteria must be met:

- The PM_{10} design value (DV) for the area, based on the most recent five years of air quality data at all monitors in the area, should be at or below 98 $\mu g/m^3$ for the 24-hour PM_{10} NAAQS with no violations at any monitor in the nonattainment area.
- The area should expect only limited growth in on-road motor vehicle PM_{10} emissions (fugitive dust) and should meet the conditions of a motor vehicle regional emissions analysis test.

If all data from the past five years of certified air quality data (2007-2011) are incorporated, the five-year design value for Bullhead City is 132 $\mu g/m^3$; this design value exceeds the 98 $\mu g/m^3$ requirement for the LMP option. Excluding the August 19, 2011, event would result in a five-year design value of 98 $\mu g/m^3$, which would qualify the Bullhead City PM_{10} Maintenance Area for the LMP option. Thus, assessment of the August 19, 2011, event as an

[3] Gertler A. W., Douglas A.L., Coulombe W. G., "PM_{10} Source Apportionment Study in Bullhead City, Arizona", Journal of the Air And Waste Management Association, 1995, 45, 75-82.
[4] EPA revoked the Annual PM_{10} standard in a final rulemaking on October 17, 2006 (71 FR 61202).

exceptional event is relevant in determining the Bullhead City PM_{10} maintenance area's eligibility for the LMP option.

Analysis supporting the motor vehicle regional emission test for the LMP option can be found in the 2012 Update of the LMP for the Bullhead City PM_{10} Maintenance Area submitted to EPA on May 24, 2012. The analysis demonstrates that the Bullhead City area continues to pass the motor vehicle emissions requirement for LMP option eligibility.

2.3 Climate, Monsoon, and Thunderstorms

Bullhead City has a hot, arid climate typical of low latitude desert locations, with average high temperatures at or above 110°F in summer (**Figure 2-3**). Average annual rainfall is about six inches. The bulk of this rain usually falls from December through March during winter storms originating from the Pacific Ocean. A secondary precipitation maximum in August is associated with thunderstorms due to monsoonal moisture originating from the south.

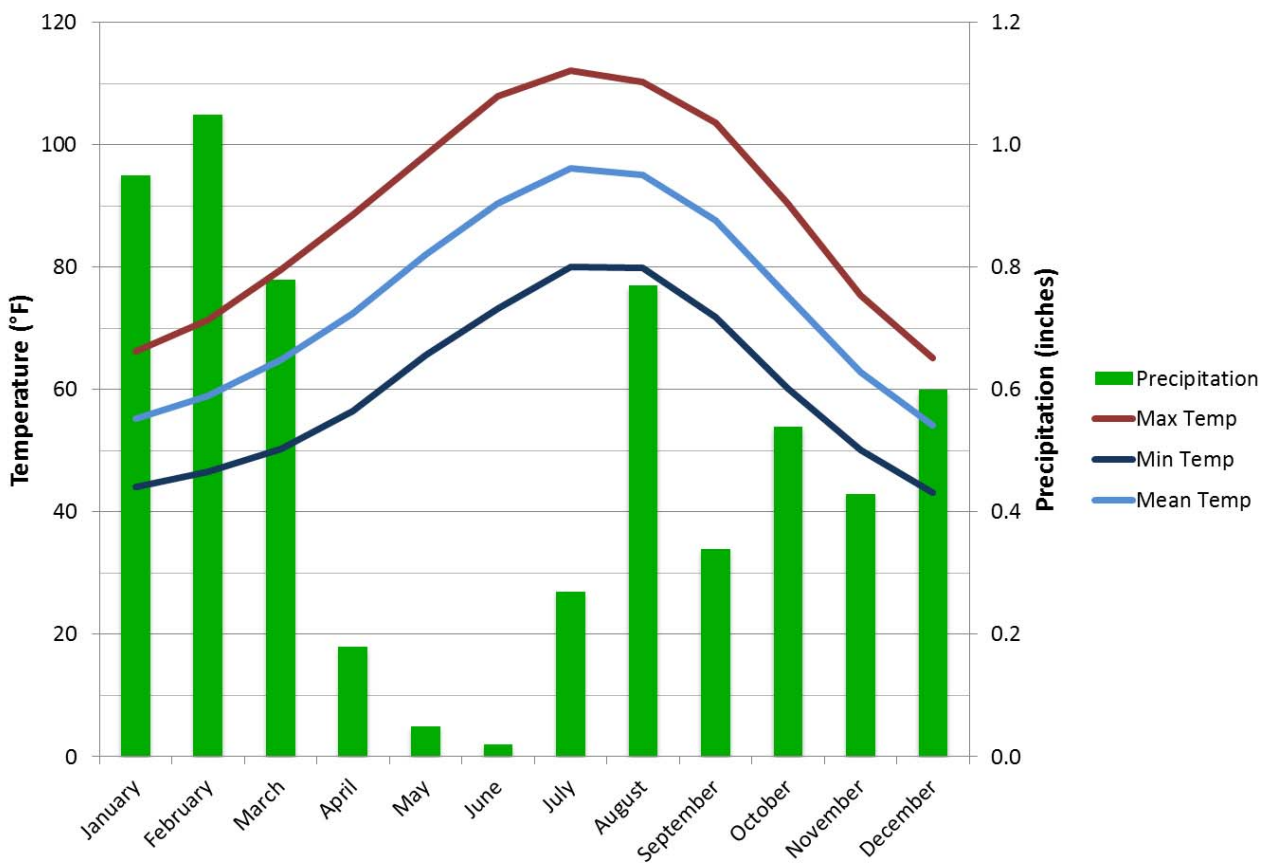
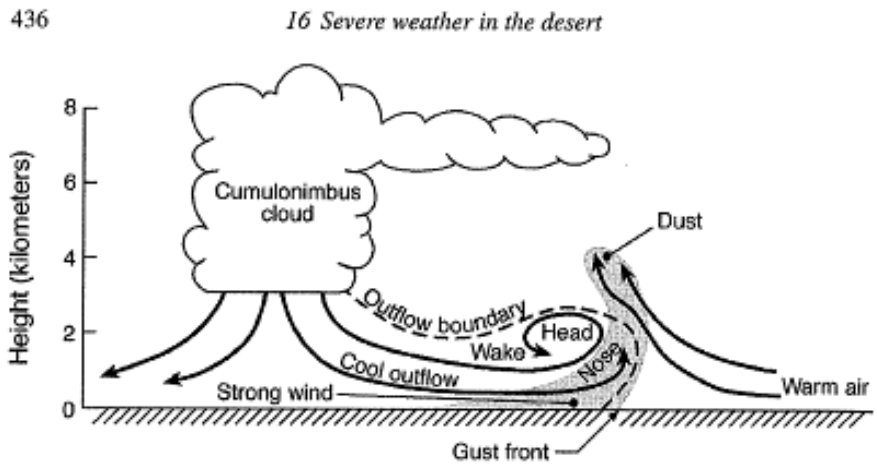


Figure 2-3. Average monthly temperatures and precipitation at Bullhead City, 1981–2010.

The influx of moisture associated with the monsoon, combined with strong solar heating, can result in unstable atmospheric conditions that are favorable for the development of

thunderstorms. Heavy precipitation associated with thunderstorms, and the eventual collapse or dissipation of thunderstorms, can generate "downbursts," the rapid descent of rain-cooled air in a thunderstorm. Upon reaching the surface, this air rapidly disperses horizontally away from the storm as outflow boundaries (also called gust fronts; see **Figure 2-4**). The high winds associated with outflow boundaries can efficiently loft dust into the air and transport the dust over long distances, resulting in dust storms (also called haboobs) with high PM_{10} concentrations and low visibilities.



Cross-section schematic of a haboob caused by the cool outflow from a thunderstorm, with the leading edge that is propagating ahead of the storm called an outflow boundary. The strong, gusty winds that prevail at the boundary are defined as a gust front. The leading edge of the cool air is called the nose, and the upward-protruding part of the features is referred to as the head. Behind the roll in the windfield at the leading edge is a turbulent wake. The rapidly moving cool air and the gustiness at the gust front raise dust (shaded) high into the atmosphere.

Figure 2-4. Cross-section of a thunderstorm creating an outflow boundary and haboob. (Source: *Desert Meteorology*, Thomas T. Warner, 2004.)

Dust storms associated with these thunderstorms typically occur in the early part of the monsoon season (July) before subsequent rains moisten the soil and limit potential lofting of soil into the air. However, depending on the amount and frequency of precipitation received during the monsoon season, extremely hot temperatures act to dry the surface soils very quickly; thus, dust storms can occur at any time during the year.

Specific PM_{10} source regions are difficult to determine during thunderstorm-driven dust storms because the thunderstorm outflow can carry dust over long distances that encompass many possible sources of dust. Therefore, we consider general PM_{10} source regions, which are typically identified by the locations of the thunderstorms that are believed to have generated the dust-laden outflow winds. In Arizona, the monsoon-season thunderstorms are most prevalent over the southern and eastern parts of the state. However, large thunderstorm complexes can generate long-lived outflow boundaries that transport dust across the state, including to the Bullhead City region of northwestern Arizona.

2.4 Event Day Summary

On the evening of August 18, 2011, numerous thunderstorms developed over southern Arizona and generated outflow boundaries that propagated northwestward across Arizona. This thunderstorm outflow resulted in a widespread dust storm across central and southern Arizona during the evening of August 18, 2011, which resulted in high PM_{10} concentrations and exceedances of the 24-hour PM_{10} NAAQS at numerous monitors in Maricopa, Pinal, and Pima Counties (**Table 2-1**). The dust-laden outflow continued northwestward during the overnight hours and impacted the Bullhead City region after 12:00 a.m. on August 19, 2011, and impacted the Las Vegas, Nevada, region several hours later (**Figure 2-5**). This windblown dust resulted in a 24-hr average PM_{10} concentration of 132 µg/m^3 at the Bullhead City monitor (**Table 2-2**); while this value is not in exceedance of the NAAQS, it does affect the eligibility of the Bullhead City PM_{10} maintenance area for the LMP option. The 24-hr average PM_{10} concentration measured at the Bullhead City monitor was in excess of normal historical fluctuations. The dust was naturally occurring and likely originated over undeveloped lands outside of Bullhead City, and sustained winds over 25 mph with wind gusts over 35 mph likely overwhelmed reasonable dust control measures. PM_{10} monitors in a broad area from Phoenix northwestward to Las Vegas also recorded high PM_{10} concentrations as the dust storm moved through, illustrating the regional nature of this event. Please note that at the time of this event, PM_{10} data at Bullhead City were filter-based 24-hr averages; thus, hourly PM_{10} data for Bullhead City were not available.

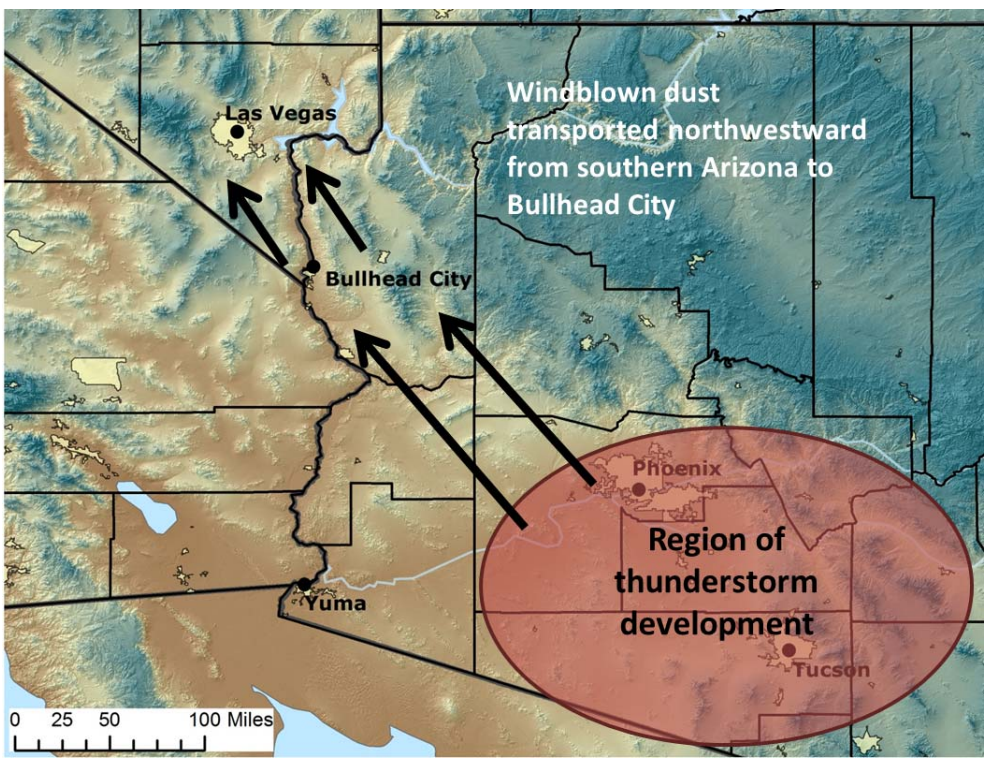


Figure 2-5. Outflow boundaries from thunderstorms over southern Arizona moved northwestward and transported dust to the Bullhead City area on August 18 and 19, 2011.

Table 2-1. PM_{10} measurements at monitors in Arizona on August 18, 2011.

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (MST)	AQS Qualifier Flag
Apache County							
N/A	TEOM	WMAT	04-001-1003-81102-1	9	29	0700	
Cochise County							
Chiricahua National Monument	GRAV	NPS	04-003-8001-85101-1	11	N/A	N/A	
N/A	GRAV	NPS	04-003-9000-85101-1	26	N/A	N/A	
Coconino County							
N/A	TEOM	NNIR	04-005-1237-81102-1	20	58	19:00	
N/A	GRAV	NPS	04-005-8100-85101-1	10	N/A	N/A	
N/A	GRAV	NPS	04-005-8102-85101-1	5	N/A	N/A	
N/A	GRAV	NPS	04-005-8103-85101-1	5	N/A	N/A	
Gila County							
Hayden Old Jail	TEOM	ADEQ	04-007-1001-81102-3	30	74	1200	
Maricopa County							
West Phoenix	TEOM	MCAQD	04-013-0019-81102-1	76	622	1900	
Glendale	TEOM	MCAQD	04-013-2001-81102-1	76	902	1900	
Central Phoenix	TEOM	MCAQD	04-013-3002-81102-4	232	4373	1800	RJ
Greenwood	TEOM	MCAQD	04-013-3010-81102-1	107	961	1800	
South Phoenix	TEOM	MCAQD	04-013-4003-81102-1	179	2496	1800	RJ
West Chandler	TEOM	MCAQD	04-013-4004-81102-1	186	1564	1800	RJ
Higley	TEOM	MCAQD	04-013-4006-81102-1	121	832	1900	
West 43rd Ave	TEOM	MCAQD	04-013-4009-81102-1	144	1300	1900	
Dysart	TEOM	MCAQD	04-013-4010-81102-1	71	723	1900	
Buckeye	TEOM	MCAQD	04-013-4011-81102-1	296	2946	2000	RJ
Zuni Hills	TEOM	MCAQD	04-013-4016-81102-1	100	1292	1800	
Durango Complex	TEOM	MCAQD	04-013-9812-81102-1	152	1395	1800	
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	80	985	1800	IJ
JLG Supersite	TEOM	ADEQ	04-013-9997-81102-4	87	1155	1800	IJ
Navajo County							
N/A	TEOM	WMAT	04-017-1002-81102-1	12	44	1300	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	206	1354	2100	RJ
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	18	N/A	N/A	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	65	758	1500	IJ
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	21	N/A	N/A	
Geronimo	TEOM	PCAQCD	04-019-1113-81102-1	21	132	1600	

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (MST)	AQS Qualifier Flag
Pinal County							
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	200	N/A	N/A	RJ
Stanfield	TEOM	PCAQCD	04-021-3008-81102-3	224	N/A	N/A	RJ
Combs	TEOM	PCAQCD	04-021-3009-81102-3	195	N/A	N/A	RJ
Maricopa	TEOM	PCAQCD	04-021-3010-81102-3	199	N/A	N/A	RJ
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	454	N/A	N/A	RJ
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	731	N/A	N/A	RJ
Santa Cruz County							
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	45	97	0400	
Yuma County							
Yuma Supersite	TEOM	ADEQ	04-027-8011-81102-3	42	262	1700	

TEOM: Tapered Element Oscillating Microbalance
BAM: Beta Attenuation Monitor
FRM: Federal Reference Method
WMAT: White Mountain Apache Tribe
ADEQ: Arizona Department of Environmental Quality
MCAQD: Maricopa County Air Quality Department
PCDEQ: Pima County Department of Environmental Quality
PCAQCD: Pinal County Air Quality Control District
RJ: qualifier flag for high winds, request data exclusion
IJ: qualifier flag for high winds, informational only

Table 2-2. PM_{10} measurements at monitors in Arizona and Clark County, Nevada, on August 19, 2011. Data from the Bullhead City monitor is shown in **bold green**.

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (MST)	AQS Qualifier Flag
ARIZONA							
Apache County							
N/A	TEOM	WMAT	04-001-1003-81102-1	25	101	1200	
N/A	GRAV	N/A	04-001-8001-81102-1	9	N/A	N/A	
Cochise County							
Paul Spur Chemical Lime Plant	GRAV	ADEQ	04-003-0011-81102-1	16	N/A	N/A	
Paul Spur Chemical Lime Plant	GRAV	ADEQ	04-003-0011-81102-2	15	N/A	N/A	
Douglas Red Cross	GRAV	ADEQ	04-003-1005-81102-1	27	N/A	N/A	

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (MST)	AQS Qualifier Flag
Chiricahua National Monument	GRAV	NPS	04-003-8001-85101-1	11	N/A	N/A	
N/A	GRAV	NPS	04-003-9000-85101-1	24	N/A	N/A	
Coconino County							
Flagstaff Middle School	GRAV	ADEQ	04-005-1008-81102-1	61	N/A	N/A	
N/A	TEOM	NNIR	04-005-1237-81102-1	24	59	1700	
N/A	GRAV	NPS	04-005-8102-85101-1	24	N/A	N/A	
N/A	GRAV	NPS	04-005-8103-85101-1	54	N/A	N/A	
Gila County							
Payson Well Site	GRAV	ADEQ	04-007-0008-81102-1	31	N/A	N/A	
Payson Well Site	GRAV	ADEQ	04-007-0008-81102-2	31	N/A	N/A	
Miami Ridgeline	GRAV	PDC	04-007-0009-81102-1	50	N/A	N/A	
Tonto	GRAV	NPS	04-007-0010-85101-1	33	N/A	N/A	
Hayden Old Jail	TEOM	ADEQ	04-007-1001-81102-3	32	141	1800	
Miami Golf Course	GRAV	ADEQ	04-007-8000-81102-1	47	N/A	N/A	
Miami Golf Course	GRAV	PDC	04-007-8000-81102-2	49	N/A	N/A	
Payson Well Site	GRAV	ADEQ	04-007-0008-81102-1	31	N/A	N/A	
Maricopa County							
West Phoenix	TEOM	MCAQD	04-013-0019-81102-1	55	145	1200	
Glendale	TEOM	MCAQD	04-013-2001-81102-1	59	136	1300	
Central Phoenix	TEOM	MCAQD	04-013-3002-81102-4	48	111	1200	
Greenwood	TEOM	MCAQD	04-013-3010-81102-1	53	124	1200	
South Phoenix	TEOM	MCAQD	04-013-4003-81102-1	51	139	1100	
West Chandler	TEOM	MCAQD	04-013-4004-81102-1	64	530	2100	
Higley	TEOM	MCAQD	04-013-4006-81102-1	55	268	2200	
West 43rd Ave	TEOM	MCAQD	04-013-4009-81102-1	51	161	1100	
Dysart	TEOM	MCAQD	04-013-4010-81102-1	51	168	1200	
Buckeye	TEOM	MCAQD	04-013-4011-81102-1	44	93	1200	
Zuni Hills	TEOM	MCAQD	04-013-4016-81102-1	46	141	1200	
Senior Center Air Monitoring Station	GRAV	SRPMIC	04-013-7020-81102-1	49	N/A	N/A	
Senior Center Air Monitoring Station	GRAV	SRPMIC	04-013-7020-81102-2	50	N/A	N/A	
High School Air Monitoring Station	GRAV	SRPMIC	04-013-7024-81102-1	58	N/A	N/A	
Durango Complex	TEOM	MCAQD	04-013-9812-81102-1	52	131	1100	
JLG Supersite	GRAV	NPS	04-013-9997-85101-2	41	N/A	N/A	
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	51	134	1200	
JLG Supersite	TEOM	ADEQ	04-013-9997-81102-4	43	114	1200	

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (MST)	AQS Qualifier Flag
Mojave County							
Bullhead City	**FRM**	**ADEQ**	**04-015-1003-81102-3**	**132**	**N/A**	**N/A**	**IJ**
N/A	GRAV	NPS	04-015-9000-85101-1	73	N/A	N/A	
Navajo County							
N/A	TEOM	WMAT	04-017-1002-81102-1	21	132	1200	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	48	147	0300	
Organ Pipe	GRAV	NPS	04-019-0005-85101-2	40	N/A	N/A	
Corona De Tucson	GRAV	PCDEQ	04-019-0008-81102-1	23	N/A	N/A	
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	39	N/A	N/A	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	45	114	1100	
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	33	N/A	N/A	
Prince Road	GRAV	PCDEQ	04-019-1009-81102-1	37	N/A	N/A	
Tangerine	GRAV	PCDEQ	04-019-1018-81102-1	36	N/A	N/A	
Santa Clara	GRAV	PCDEQ	04-019-1026-81102-1	30	N/A	N/A	
Geronimo	TEOM	PCAQCD	04-019-1113-81102-1	31	88	1500	
N/A	GRAV	NPS	04-019-9000-85101-1	26	N/A	N/A	
Pinal County							
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	57	N/A	N/A	
Apache Junction Fire Station	TEOM	PCAQCD	04-021-3002-81102-3	59	N/A	N/A	
Coolidge	GRAV	PCAQCD	04-021-3004-81102-1	37	N/A	N/A	
Pinal Air Park	GRAV	PCAQCD	04-021-3007-81102-1	40	N/A	N/A	
Stanfield	TEOM	PCAQCD	04-021-3008-81102-3	62	N/A	N/A	
Combs	TEOM	PCAQCD	04-021-3009-81102-3	45	N/A	N/A	
Maricopa	TEOM	PCAQCD	04-021-3010-81102-3	65	N/A	N/A	
Pinal County Housing	GRAV	PCAQCD	04-021-3011-81102-1	42	N/A	N/A	
Pinal County Housing	GRAV	PCAQCD	04-021-3011-81102-2	45	N/A	N/A	
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	56	N/A	N/A	
Cowtown	GRAV	PCAQCD	04-021-3013-81102-1	88	N/A	N/A	
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	90	N/A	N/A	
Santa Cruz County							
Nogales Post Office	GRAV	ADEQ	04-023-0004-81102-1	24	N/A	N/A	
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	28	53	0700	
Yavapai County							
Prescott Valley	GRAV	ADEQ	04-025-2002-81102-1	90	N/A	N/A	

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (MST)	AQS Qualifier Flag
N/A	GRAV	NPS	04-025-8104-85101-1	38	N/A	N/A	
Yuma County							
Yuma Supersite	TEOM	ADEQ	04-027-8011-81102-3	20	50	0300	
NEVADA							
Clark County							
Paul Meyer	BAM	CCDAQEM	32-003-0043-81102-1	42	85	1100	
Palo Verde	BAM	CCDAQEM	32-003-0073-81102-1	37	78	1200	
Joe Neal	BAM	CCDAQEM	32-003-0075-81102-1	60	126	1100	
Green Valley	BAM	CCDAQEM	32-003-0298-81102-1	66	161	0800	
Sunrise Acres	BAM	CCDAQEM	32-003-0561-81102-1	54	135	1000	
Boulder City	BAM	CCDAQEM	32-003-0601-81102-1	102	219	1100	
Jean	BAM	CCDAQEM	32-003-1019-81102-1	46	122	0900	
JD Smith	BAM	CCDAQEM	32-003-2002-81102-1	57	124	1000	

TEOM: Tapered Element Oscillating Microbalance
GRAV: Gravimetric Analysis
BAM: Beta Attenuation Monitor
FRM: Federal Reference Method
WMAT: White Mountain Apache Tribe
ADEQ: Arizona Department of Environmental Quality
NPS: National Park Service
NNIR: Navajo Nation
PDC: Phelps Dodge Corporation
MCAQD: Maricopa County Air Quality Department
SRPMIC: Salt River Pima-Maricopa Indian Community
PCDEQ: Pima County Department of Environmental Quality
PCAQCD: Pinal County Air Quality Control District
CCDAQEM: Clark County Department of Air Quality and Environmental Management
IJ: qualifier flag for high winds, informational only

3. Causal Relationship

3.1 Discussion

Meteorological and air quality observations indicate that dust carried by thunderstorm outflow was directly responsible for the high 24-hr average PM_{10} concentration observed in Bullhead City on August 19, 2011. On the evening of August 18, a large complex of thunderstorms developed over southern Arizona near the Phoenix area (**Figures 3-1 and 3-2**). These thunderstorms expanded northwestward and weakened during the overnight hours, but the thunderstorms generated dust-carrying outflow boundaries that propagated northwestward through the Phoenix area and toward Bullhead City, and later, Las Vegas. As stated in Section 2.3, thunderstorms associated with the summer monsoon season can generate strong winds and windblown dust across Arizona. The likely source regions for PM_{10} during the August 19, 2011, event were the deserts in southern Arizona and along the path of the outflow boundary from those deserts northwestward into the Bullhead City area. This region largely consists of natural, undisturbed desert. The last time Bullhead City recorded any measurable rainfall leading up to the August 19, 2011, dust event was on July 6, 2011. This combination of geography and lack of rainfall preceding the event resulted in a large fetch of soils that was particularly vulnerable to particulate suspension.

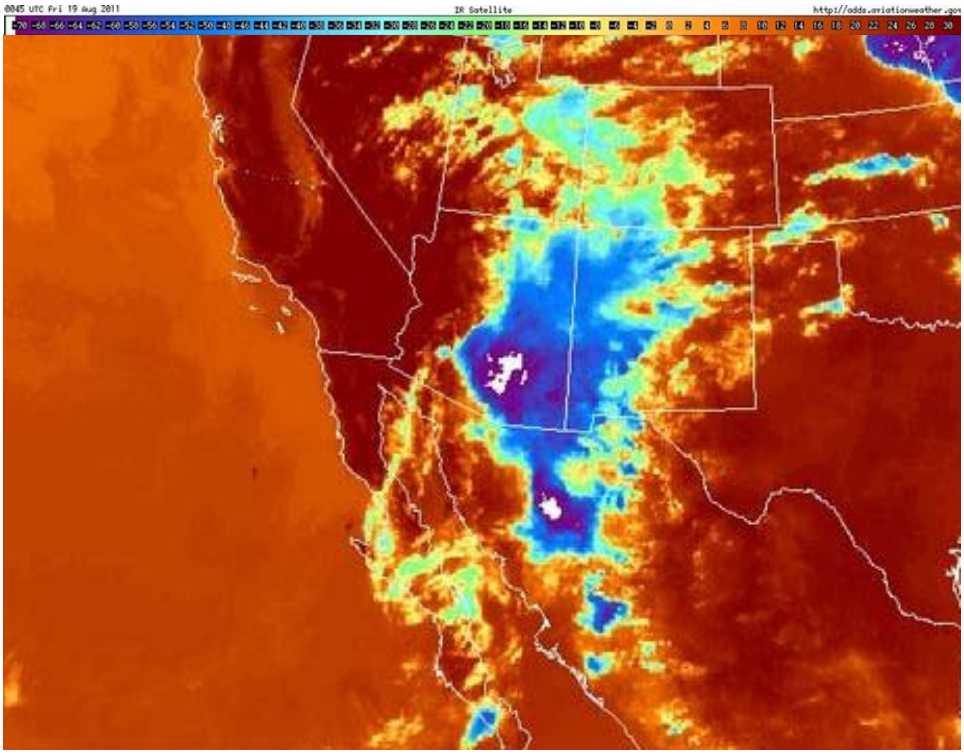


Figure 3-1. Infrared satellite image from 5:45 p.m. MST on August 18, 2011 (GOES-West). Colder temperatures (blues, purples, and white) indicate tall, convective (thunderstorm) clouds. A large complex of thunderstorms over southern Arizona generated outflow boundaries that carried dust northwestward into Bullhead City.

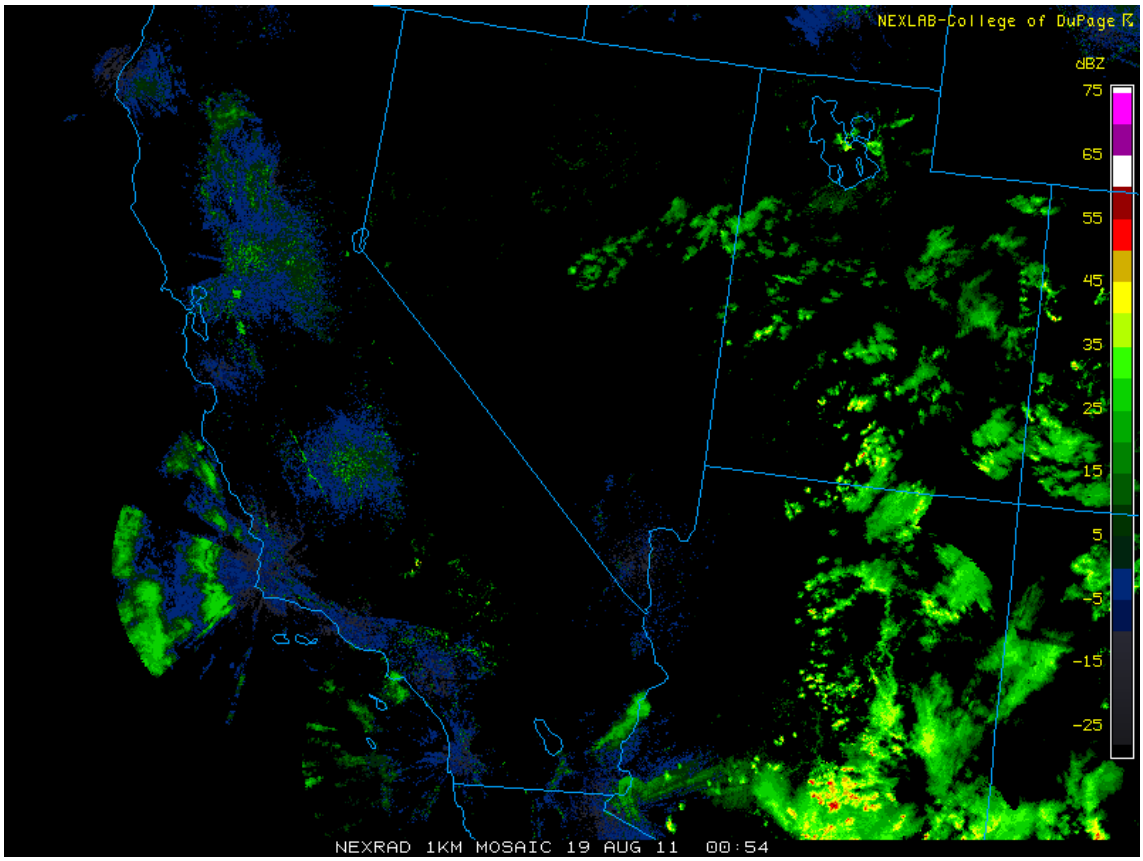


Figure 3-2. Regional radar image from 5:54 p.m. MST on August 18, 2011. A large complex of thunderstorms (green/yellow/red areas) was located over south-central Arizona. These storms moved northwestward and weakened, but they generated outflow boundaries that carried dust into the Bullhead City area.

At the time of this dust storm, hourly PM_{10} data were not collected at the Bullhead City monitor. However, using wind speed and direction, visibility, and regional radar velocity data, in addition to hourly PM_{10} measurements from other monitors along the path of the thunderstorm outflow, it is possible to estimate the time of arrival of the thunderstorm outflow and associated dust in the Bullhead City area. **Figures 3-3 through 3-7** summarize the progression of the thunderstorm outflow across Arizona, southeastern California, and southern Nevada at 6:00 p.m., 8 p.m., and 10 p.m. on August 18, and at midnight and 3:00 a.m. on August 19. These figures depict multiple data sets, including

- Radar velocity data from the Phoenix, Yuma, and Las Vegas National Weather Service offices. The radar locations are indicated by black stars. Green shadings indicate motion toward the radar site and orange/red shadings indicate motion away from the radar site.
- Hourly PM_{10} concentrations from available monitors (please note that NWS/ASOS and AZMET monitors do not measure PM_{10} concentrations).
- Hourly surface wind speed, wind gust, and visibility measurements (please note that only NWS/ASOS sites measure visibility).

These figures also include estimated locations of the outflow boundaries, based primarily on surface meteorological observations and radar velocity data. When observational data were not available, outflow boundary locations were extrapolated from estimated speed and direction of motion of the boundaries. Figures showing each hour of data from 6:00 p.m. on August 18 to 8:00 a.m. on August 19 can be found in Appendix A.

6:00 p.m., August 18 (Figure 3-3)

Between 6:00 and 8:00 p.m. on August 18, well-defined thunderstorm outflow boundaries were moving through the Phoenix, Yuma, and El Centro (Imperial County) areas. The estimated locations of the outflow boundaries are indicated by the dashed lines, with storm motion indicated by the solid black arrows. Widespread wind gusts of over 25 mph, reduced visibilities, and high hourly PM_{10} concentrations were reported across southern Arizona and southeastern California in association with these outflow boundaries as they propagated northwestward. Several PM_{10} monitors in the Phoenix area recorded exceedances of the NAAQS for 24-hr PM_{10}. Outflow boundaries and associated dust may have also impacted the area between Yuma and Phoenix; however, radar and surface observational data in this region were very limited.

8:00 p.m., August 18 (Figure 3-4)

Between 8:00 and 10:00 p.m. on August 18, the outflow boundaries continued north of the Yuma area and northwestward of the Phoenix area. Low visibilities and gusty southerly winds were reported at Blythe, California (north of Yuma), as the outflow boundary moved through. As the outflow and associated dust moved away from the central Phoenix area, PM_{10} concentrations and wind speeds decreased and visibilities improved, illustrating the causal relationship between the windblown dust and the high PM_{10} concentrations. Note that after 9:00 p.m. (Figure 3-6), the outflow boundaries moved out of range of the Yuma and Phoenix Doppler radars and were no longer detectable. Thus, the dashed lines indicate extrapolated locations of the outflow boundaries, based on surface wind and visibility observations and the general speed and direction of the outflow boundaries.

10:00 p.m., August 18 (Figure 3-5)

Between 10:00 p.m. on August 18 and 12:00 a.m. on August 19, the outflow boundaries continued north and northwestward toward Bullhead City. During this time period, the outflow was moving through data-sparse regions of northwestern Arizona and southeastern California; thus, the dashed lines indicate extrapolated locations of the outflow boundaries based on estimated speed and direction of motion. In addition, as the outflow boundaries continued northwestward away from their source regions and into increasingly rugged terrain, the boundaries likely became less well-defined. However, gusty winds associated with the boundaries likely continued to loft dust into the lower atmosphere, given the preceding dry surface conditions and the vast desert areas the boundaries were traversing.

12:00 a.m., August 19 (Figure 3-6)

Wind and visibility measurements indicate that the remnant thunderstorm outflow and associated dust arrived in the Bullhead City area between midnight and 2:00 a.m. on August 19.

Gusty southerly winds were reported at the Bullhead City, Needles, and Kingman airports during this time period. The arrival of the remnant outflow in the Bullhead City area after midnight is also consistent with the speed and north-northwestward motion of the outflow boundaries during preceding hours. Visibility reductions at the Bullhead City airport were also reported. Also note that in Arizona regions away from the remnant outflow, monitors were reporting lower wind speeds, lower PM_{10} concentrations, and improved visibilities compared to previous hours when the outflow was affecting those regions.

2:00 to 8:00 a.m., August 19

Between 2:00 and 4:00 a.m. on August 19, the remnant thunderstorm outflow and associated dust continued north-northwestward into southern Nevada (**Figure 3-7**). However, gusty winds and occasional reductions in visibility were still reported at the Bullhead City and Needles airports, indicating that dust was possibly still impacting the area.

The remnant thunderstorm outflow moved into the Las Vegas area after 4:00 a.m. on August 19. Doppler radar in Las Vegas showed a noticeable increase in radar returns during this time period, likely caused by suspended dust. South-southeasterly winds gusted over 20 mph at some Las Vegas area monitors, consistent with observations taken further south when the remnant outflow moved through the Bullhead City area. PM_{10} concentrations also increased at Las Vegas area monitors, initially at the Boulder City monitor and then at the central Las Vegas monitors. PM_{10} concentrations measured in the Las Vegas area in association with the remnant outflow were lower than the PM_{10} that had been measured when the outflow passed by monitors in central and southern Arizona. The lower PM_{10} concentrations are likely attributable to several factors, including a general weakening of the outflow boundary as it moved north-northwestward into Nevada, gradual deposition of dust along the path of the outflow before it reached Las Vegas, and the complex topography of southern Nevada and increase in elevation from Bullhead City (540 ft above sea level) to Las Vegas (2,001 ft above sea level). Las Vegas is also bounded by the McCullough Mountains immediately southeast of the city (2,000 to 5,000 ft above sea level); these mountains likely impeded some of the dust from reaching Las Vegas.

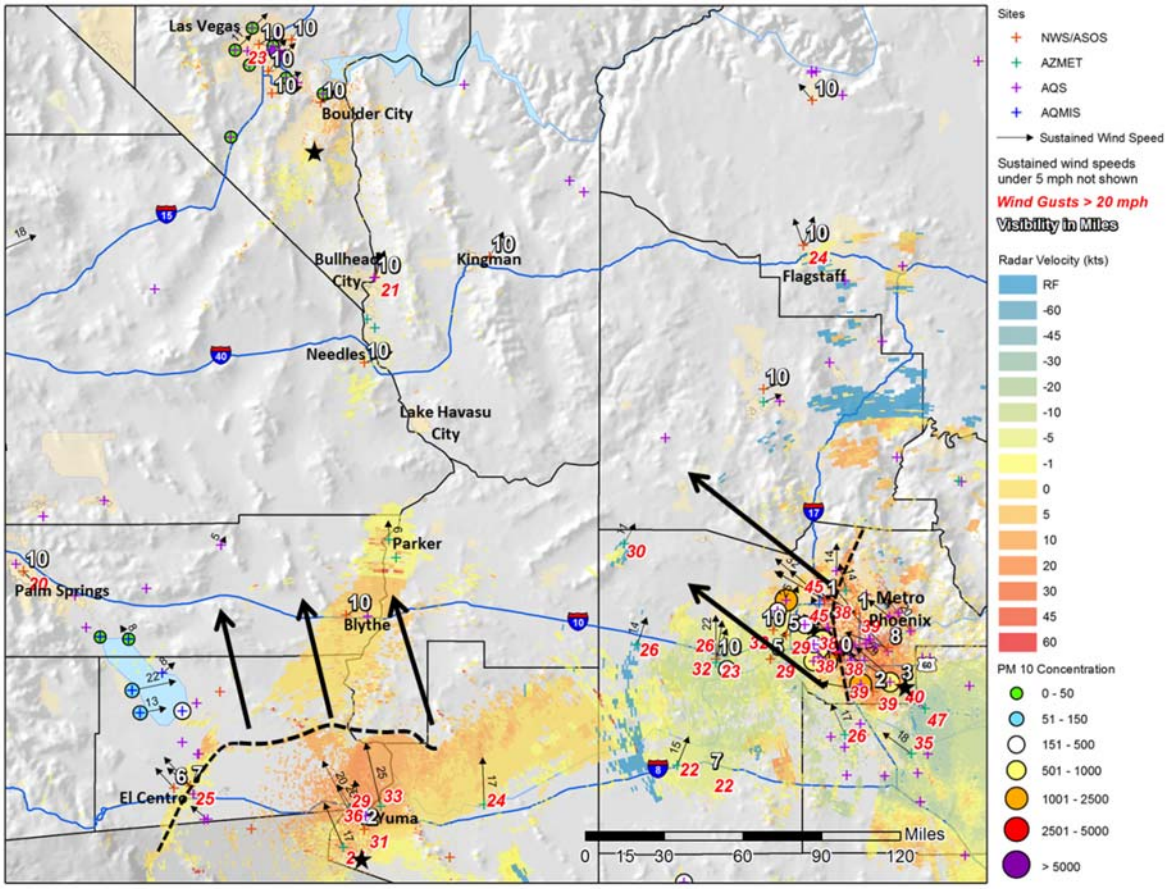


Figure 3-3. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 6:00 and 7:00 p.m. on August 18, 2011. Gusty winds, low visibilities, and high PM_{10} concentrations were reported in the Phoenix and Yuma areas as thunderstorm outflow and associated dust moved north-northwestward across Arizona.

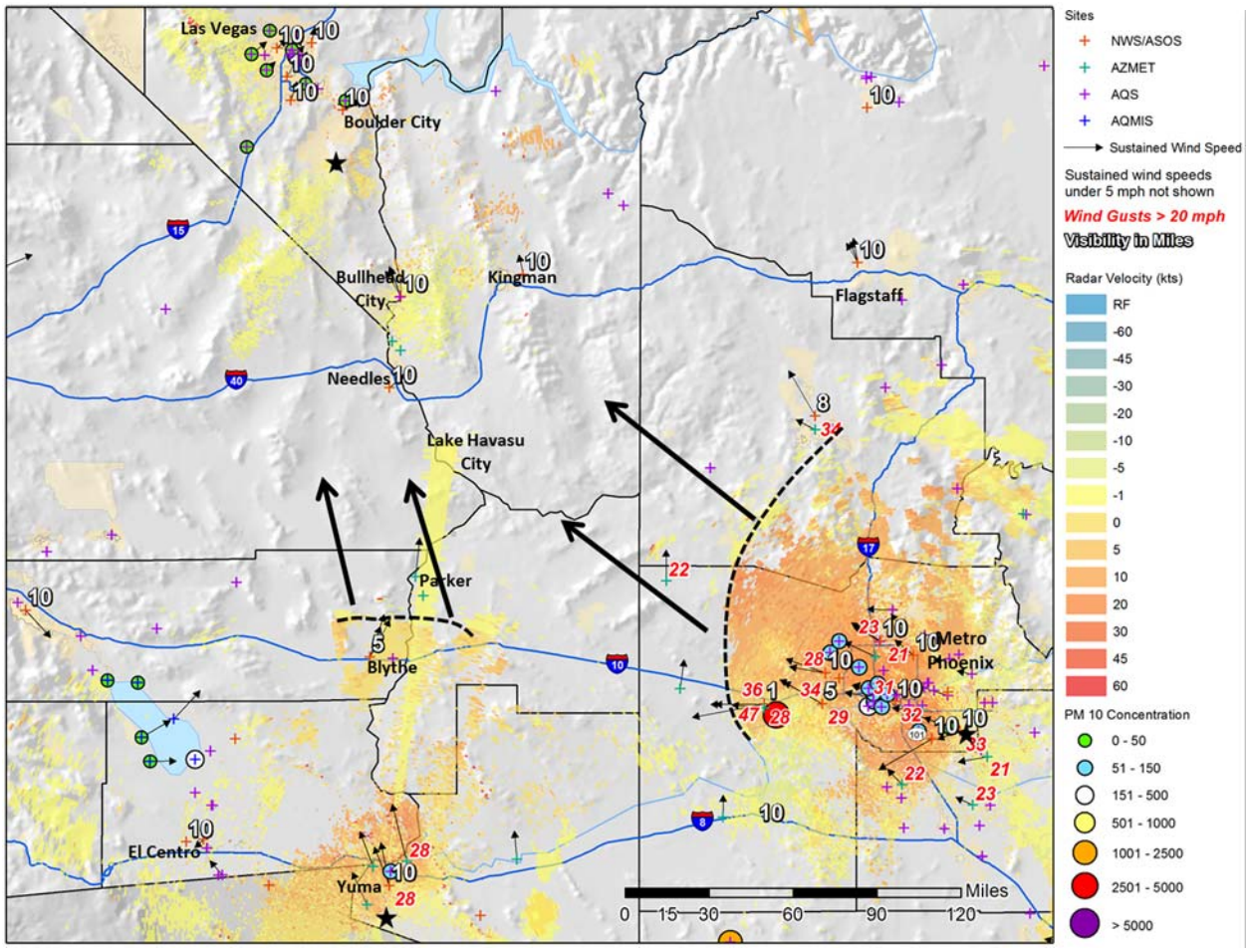


Figure 3-4. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 8:00 and 9:00 p.m. on August 18, 2011. Gusty winds and low visibilities were reported in the Blythe, California, area and the western Phoenix metropolitan area as thunderstorm outflow and associated dust moved north-northwestward across Arizona.

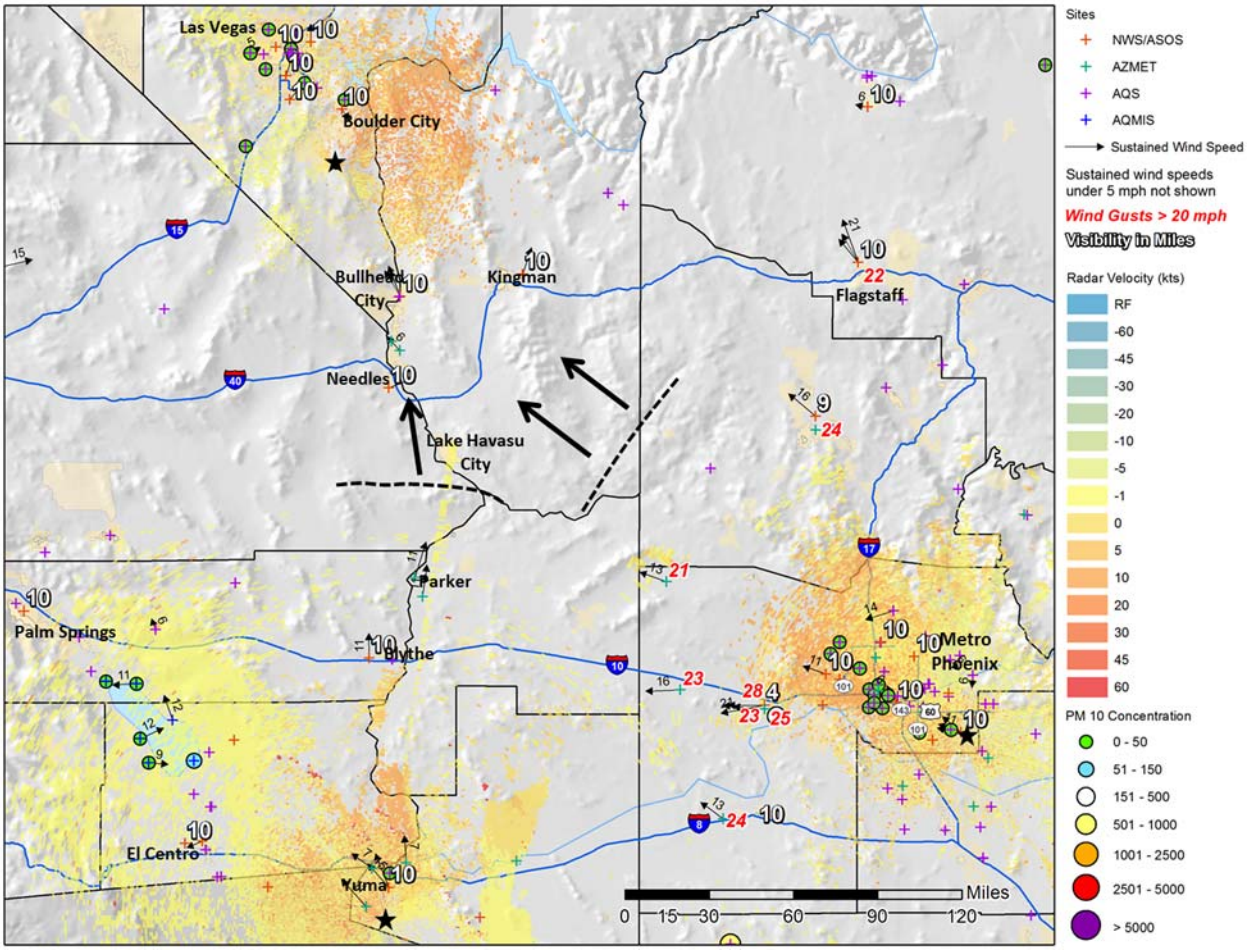


Figure 3-5. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 10:00 and 11:00 p.m. on August 18, 2011. Thunderstorm outflow and associated dust were moving north-northwestward across Arizona and southeastern California.

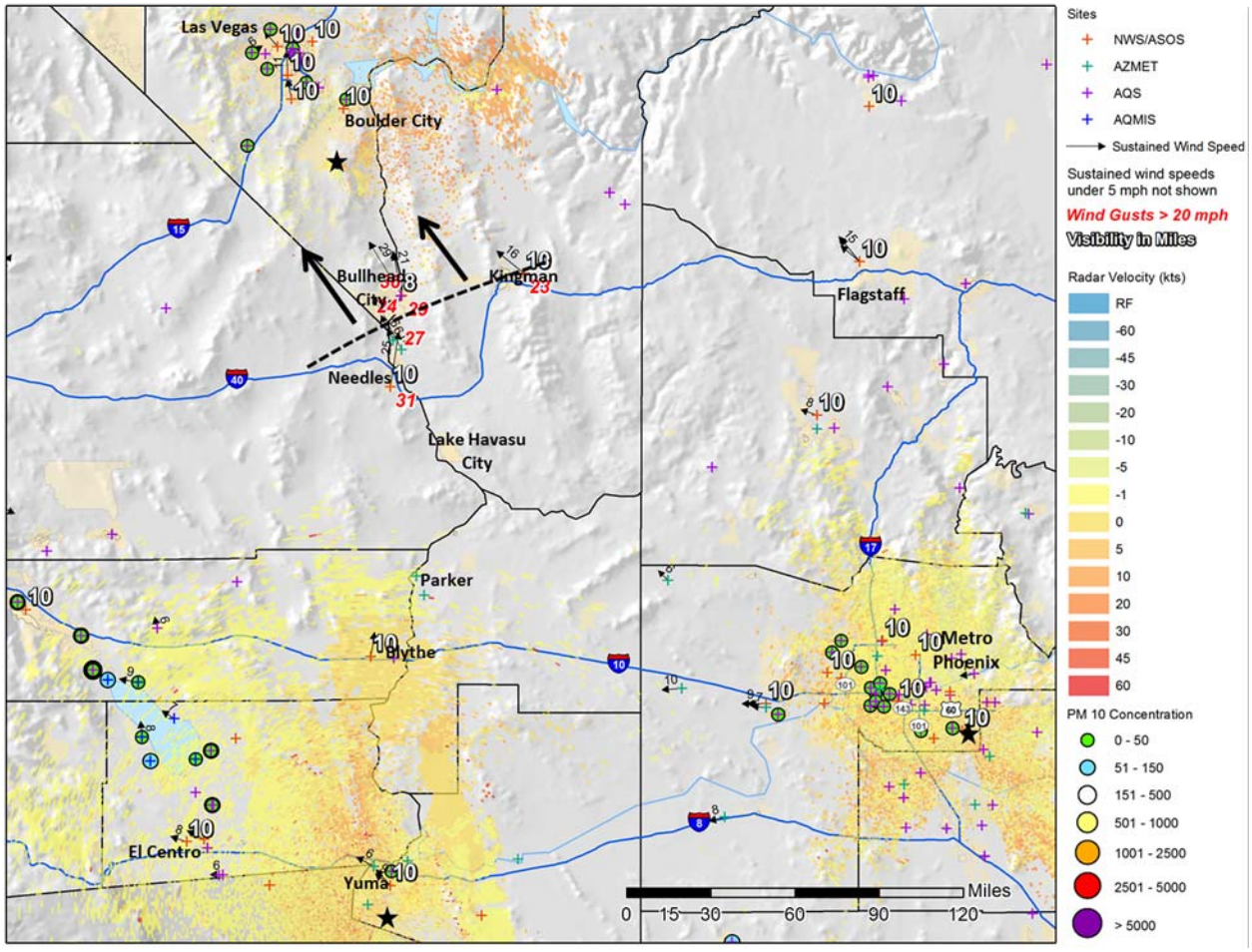


Figure 3-6. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between midnight and 1:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Bullhead City area, causing gusty south-southeasterly winds and reductions in visibility.

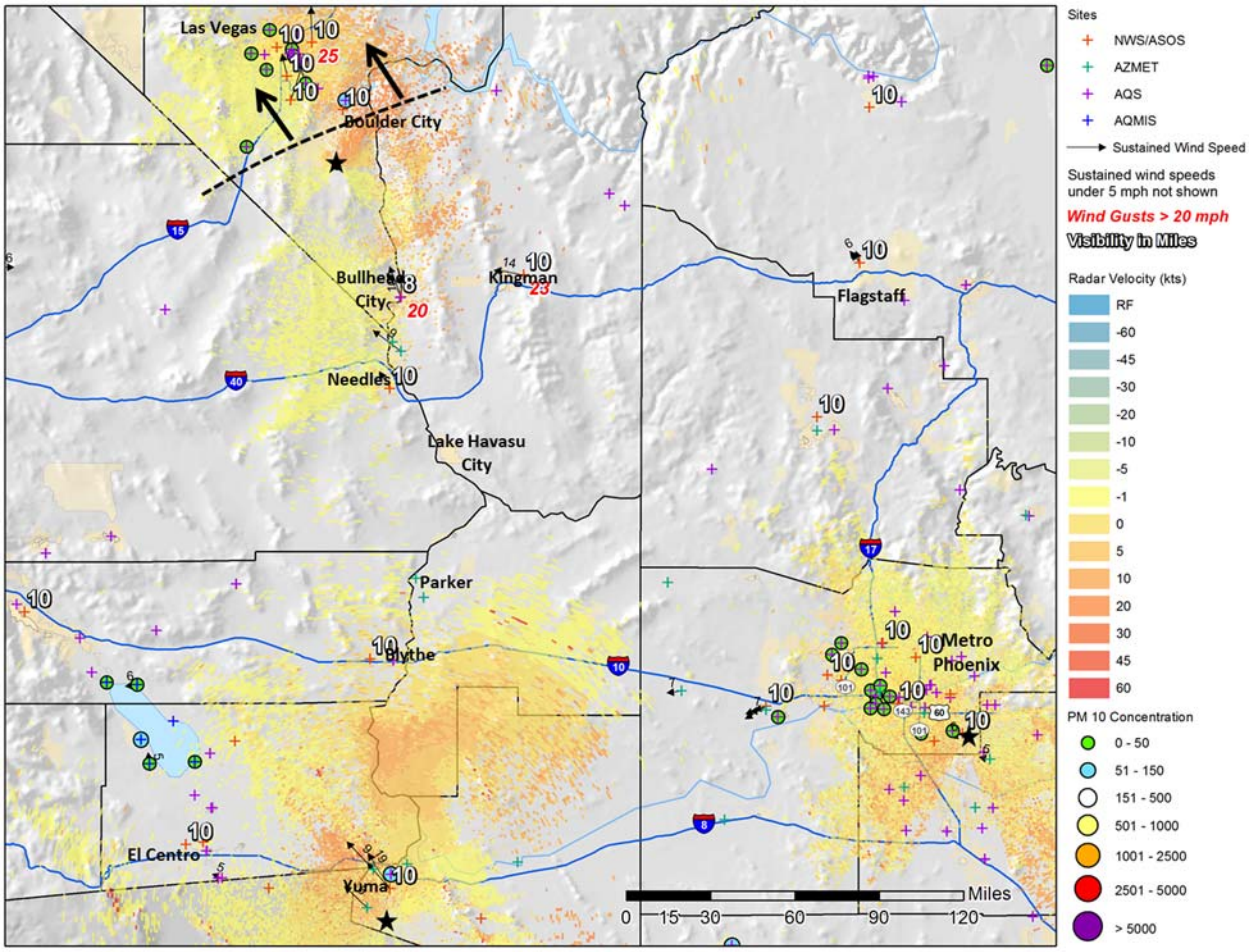


Figure 3-7. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 3:00 and 4:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving into the Boulder City, Nevada, area, causing an increase in PM_{10} concentrations.

Meteorological Conditions in Bullhead City

Time series of hourly meteorological data also illustrate the timing and spatial extent of the thunderstorm outflow as it moved through the Bullhead City area. At Laughlin Bullhead Airport, sustained winds peaked at 29 mph and wind gusts peaked at 35 mph at 12:00 a.m. on August 19, coincident with a reduction in visibility (**Figure 3-8**). This also corresponds with the extrapolated arrival time of the thunderstorm outflow based on radar data. Gusty winds of over 25 mph were also reported at nearby monitors in Mohave and Needles, California, during the midnight hour on August 19 (**Table 3-1**). Furthermore, relative humidity and dew point measurements show the arrival of a more humid air mass during the midnight hour on August 19 (**Figure 3-9**). The abrupt increase in humidity levels is typical during the passage of an outflow boundary, since the air mass following the boundary is cooled and humidified by the evaporation of rain.

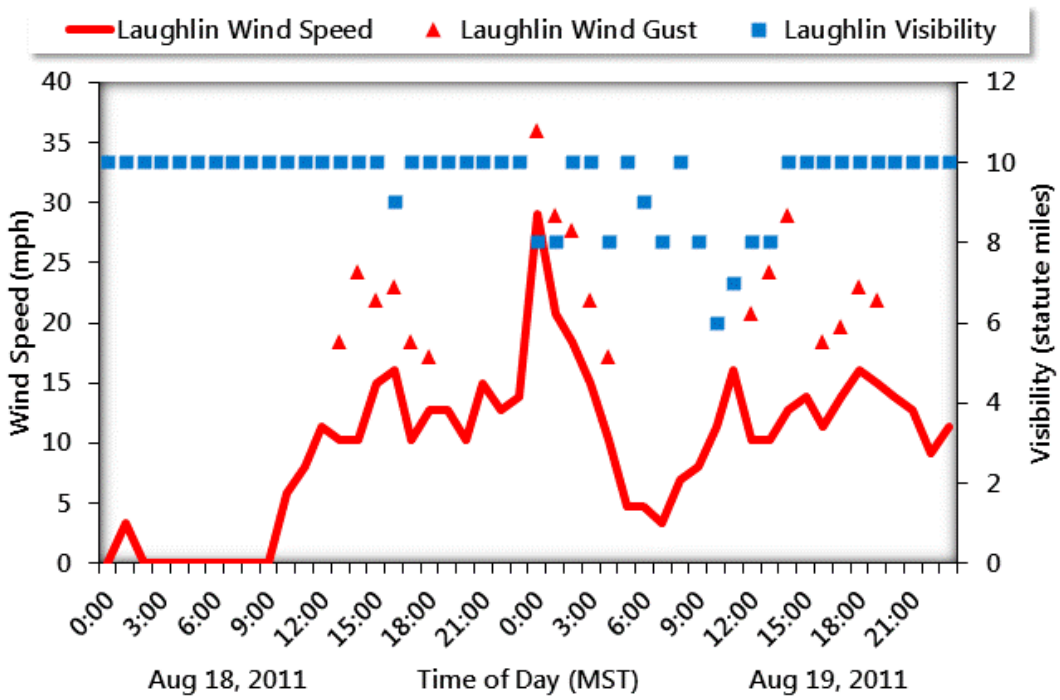


Figure 3-8. Hourly wind and visibility observations at Laughlin Bullhead City Airport on August 18 and 19, 2011. Wind speeds and gusts increased at 12:00 a.m. on August 19 coincident with a reduction in visibility, indicating the arrival of remnant thunderstorm outflow and associated dust in the Bullhead City area.

Table 3-1. Observed wind speeds and wind gusts at Bullhead City-area monitors on August 19, 2011. Gusty winds from the south and southeast were reported in the Bullhead City area between midnight and 1:00 a.m. on August 19 due to outflow from thunderstorms the evening before over central and southern Arizona. These winds transported dust to the Bullhead City area.

Monitor	Maximum Wind Speed (mph)	Wind Direction (degrees)	Date/Time (MST)	Maximum Wind Gust (mph)	Date/Time (MST)
Laughlin Bullhead	29	150	8/19/2011 0035	35	8/19/2011 0035
Needles	25	190	8/19/2011 0056	31	8/19/2011 0056
Mohave	8	158	8/19/2011 0100	13	8/19/2011 0100
Mohave #2	14	154	8/19/2011 0100	26	8/19/2011 0000

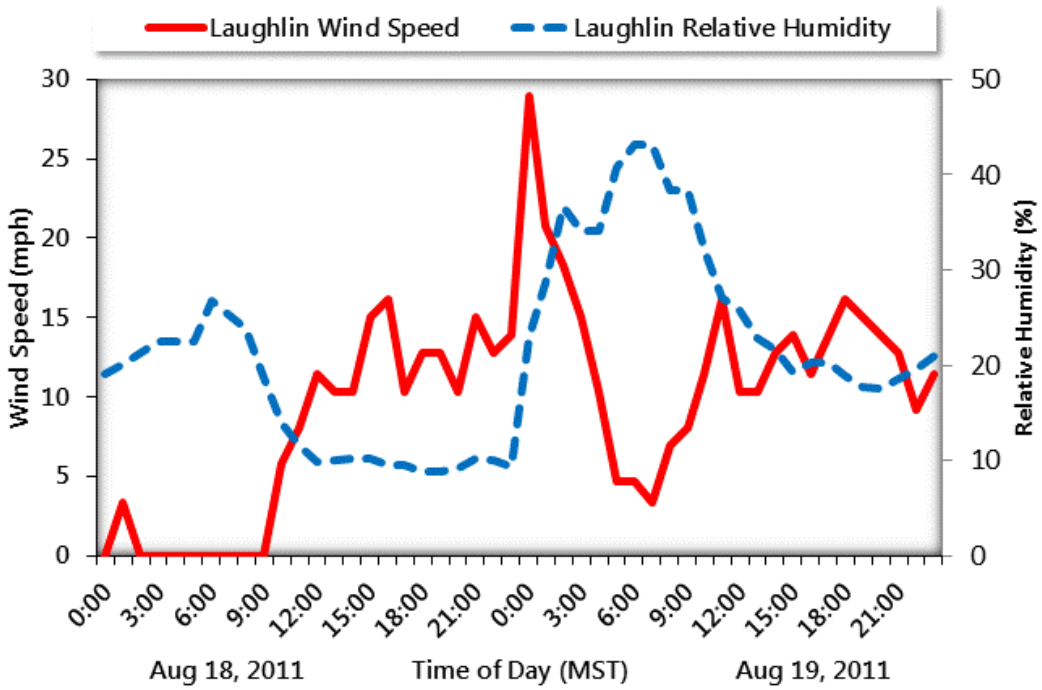


Figure 3-9. Hourly wind speed and humidity observations at Laughlin Bullhead City Airport on August 18 and 19, 2011. Wind speeds and relative humidity increased sharply at 12:00 a.m. on August 19, indicating the arrival of remnant thunderstorm outflow in the Bullhead City area.

Meteorological and Air Quality Conditions in the Las Vegas Area

Hourly PM_{10} concentrations and wind speeds at Boulder City, Nevada, indicate the arrival of remnant thunderstorm outflow and associated dust around 3:00 a.m. on August 19, with a sharp increase in PM_{10} concentrations and increase in wind speeds and gusts (**Figure 3-10**). This timing, roughly three hours after arriving in Bullhead City, is consistent with the speed and direction of motion of the remnant outflow. In addition, reduced visibility at the Boulder City airport coincided with the increase in PM_{10} concentrations (**Figure 3-11**). Finally, hourly PM_{10} measurements at southern Nevada monitors demonstrate the south-southeast to north-northwest path of the remnant thunderstorm outflow and associated dust, with PM_{10} concentrations increasing first at Boulder City, the southeasternmost monitor, and later at monitors farther north in the Las Vegas area (**Figure 3-12**). For reference, the locations of these monitors are shown in **Figure 3-13**.

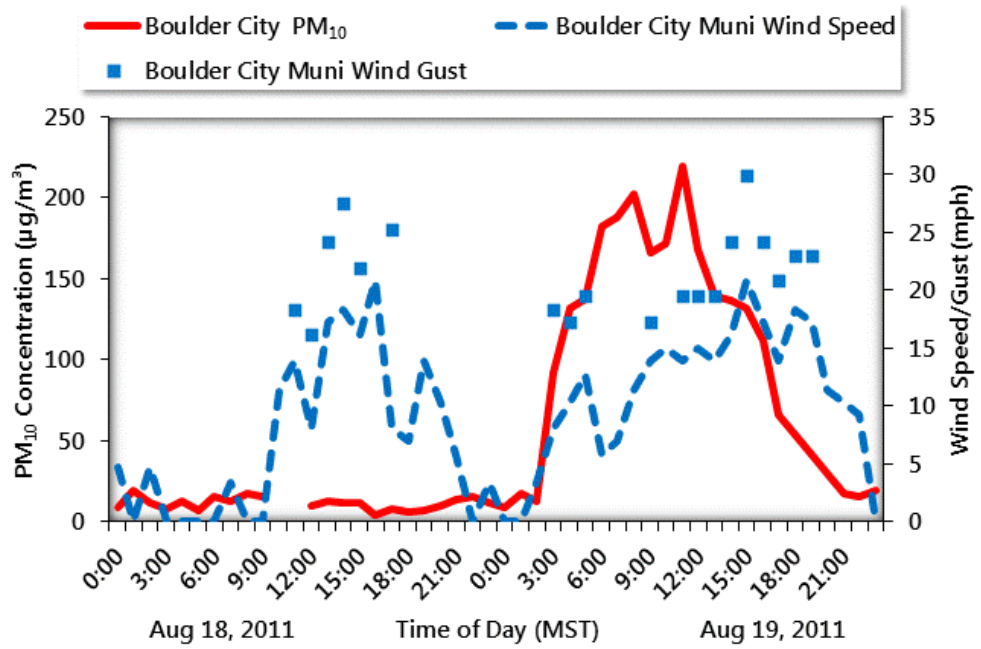


Figure 3-10. Hourly PM_{10} concentrations at the Boulder City, Nevada, monitor and wind speeds at the Boulder City Municipal Airport monitor on August 18 and 19, 2011. PM_{10} concentrations sharply increased at 3:00 a.m. on August 19 coincident with gusty winds, indicating the arrival of remnant thunderstorm outflow and associated dust in southern Nevada.

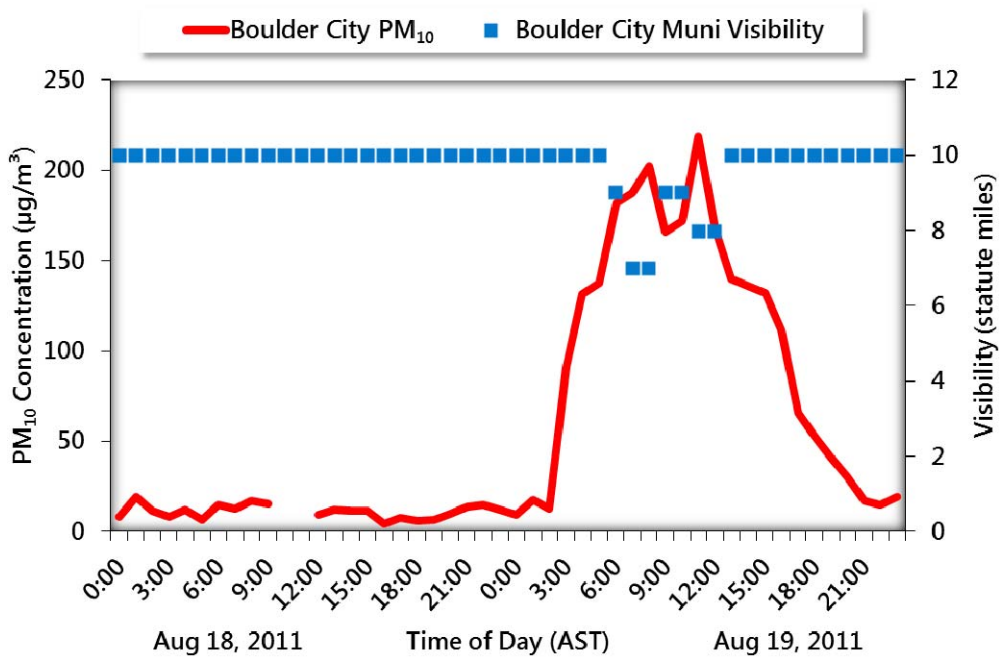


Figure 3-11. Hourly PM_{10} concentrations at the Boulder City, Nevada, monitor and visibility at Boulder City Municipal Airport. Visibility was reduced between 6:00 a.m. and 12:00 p.m. MST on August 19, coincident with the high PM_{10} concentrations, due to the arrival of remnant thunderstorm outflow and associated dust.

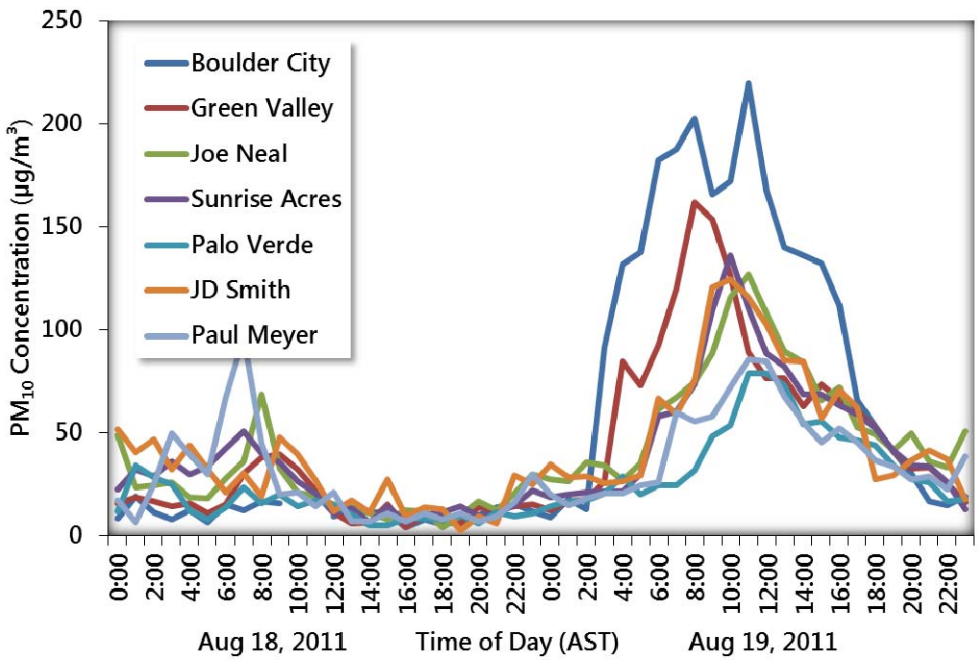


Figure 3-12. Hourly PM_{10} concentrations at the monitors in the Las Vegas area on August 18 and 19, 2011. PM_{10} concentrations increased at the Boulder City monitor at 3:00 a.m. on August 19, with later increases in PM_{10} concentrations at the other Nevada monitors. Boulder City is the southeasternmost monitor in the Las Vegas area. The timing of the increases in PM_{10} concentrations at these monitors is consistent with the arrival of remnant thunderstorm outflow and associated dust from the south-southeast.

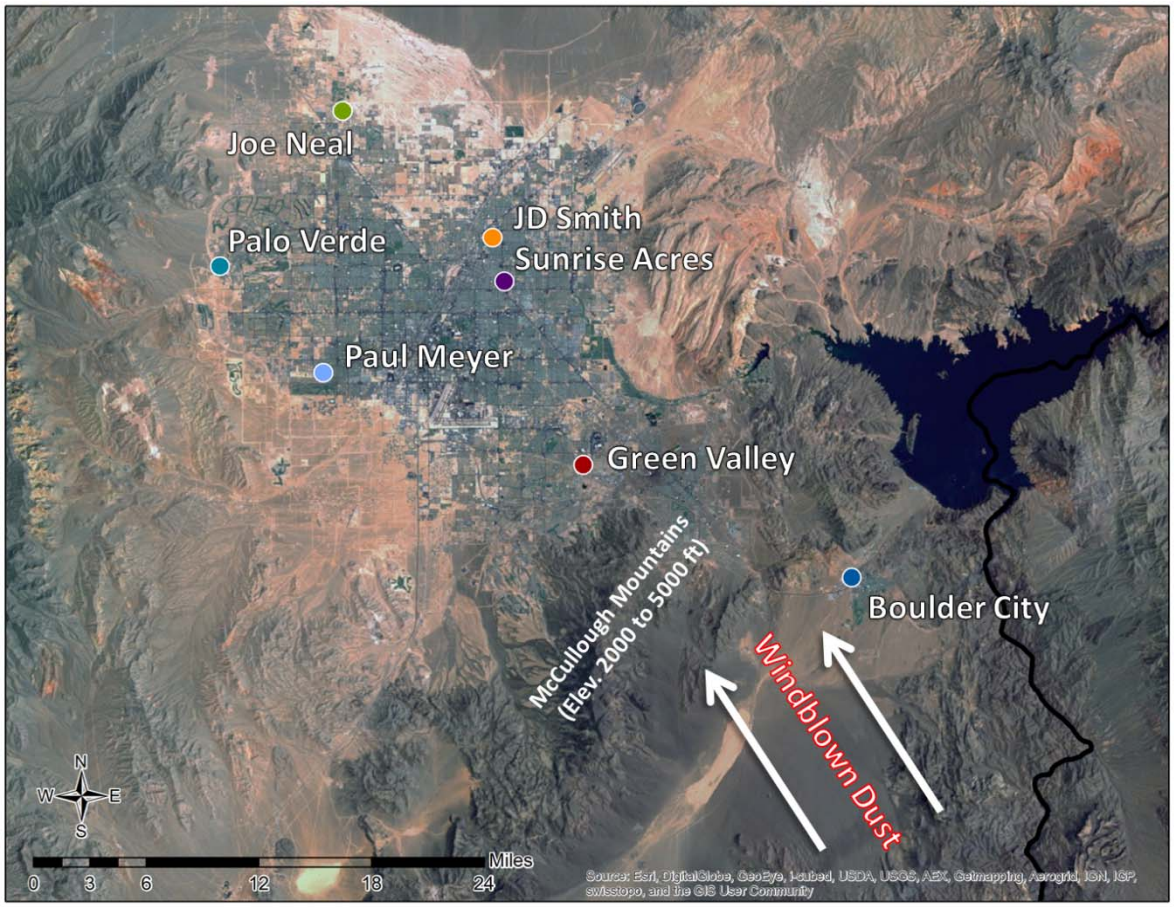


Figure 3-13. Locations of PM_{10} monitors in the Las Vegas area. Monitors are color coded to match PM_{10} time series in Figure 3-12.

3.2 Summary

The information presented in this section demonstrates a clear causal relationship between the thunderstorm-generated windblown dust and the unusually high 24-hr average PM_{10} concentration measured at the Bullhead City monitor on August 19, 2011. The PM_{10}, meteorological, and radar data shown in this section illustrate the spatial and temporal representation of the dust storm as it moved north-northwestward across southern Arizona, southeastern California, and southern Nevada. Numerous monitors across Arizona recorded exceedances of the 24-hr NAAQS for PM_{10} in association with this dust storm. Widespread wind speeds of over 25 mph and wind gusts of over 35 mph were sufficient to easily loft large amounts of dust from the dry, open desert areas southeast of Bullhead City and overcome reasonably available control measures. This analysis provides solid weight-of-evidence that demonstrates why the Bullhead City monitor recorded a 24-hr average PM_{10} concentration of 132 µg/m^3 on August 19, 2011.

4. Historical Norm

4.1 Analysis

The 24-hr PM_{10} concentration measured at the Bullhead City monitor on August 19, 2011, was unusual and in excess of normal historical fluctuations. To establish the severity of this event, the 24-hr PM_{10} concentration measured on August 19, 2011, was compared to a historical 2007–2011 5-year annual data set. Please note that during this five-year period, the PM_{10} monitor at Bullhead City was operated on a 1-in-6 day schedule. Time-series plots of the 24-hr average PM_{10} concentrations for the period January 1, 2007, through December 31, 2011, provide a historical perspective of PM_{10} concentrations (**Figure 4-1**). The 24-hr average PM_{10} concentration measured on August 19, 2011, is the highest daily average in the five-year period.

Historical daily cumulative distributions of the 24-hr average PM_{10} concentrations were created for the Bullhead City monitor for the 2007–2011 period to provide additional evidence for establishing the severity of this event. **Figure 4-2** shows a histogram of 24-hr average PM_{10} concentrations at the Bullhead City monitor and the corresponding 95th percentile. The 24-hr average PM_{10} concentration measured on August 19, 2011, was above the 95th percentile at the Bullhead City monitor. Concentrations in excess of the 95th percentile are considered to be unusual.[5]

4.2 Summary

Given the recorded values and using similar methodology to the one accepted by EPA, it is clear that the 24-hr average PM_{10} concentration observed on August 19, 2011, was outside of normal historical fluctuations. This analysis provides evidence that the event affected air quality on a historic scale.

[5] Excluding days on which concentrations caused by exceptional events exceed the 95th percentile threshold employs a general test of statistical significance and has the effect of ensuring that such concentrations would clearly fall beyond the range of normal expectations for air quality during a particular time of year. Source: “The treatment of Data Influenced by Exceptional Events,” 71 FR 12598.

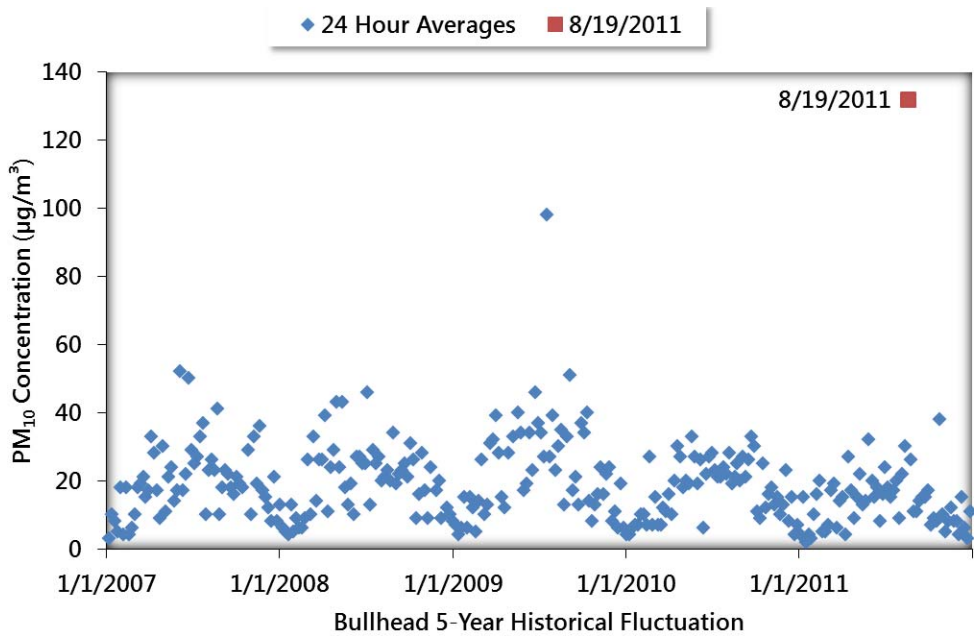


Figure 4-1. 24-hr average PM_{10} concentrations at the Bullhead City monitor (2007-2011). The 24-hr average PM_{10} concentration on August 19, 2011, is shown by the red square.

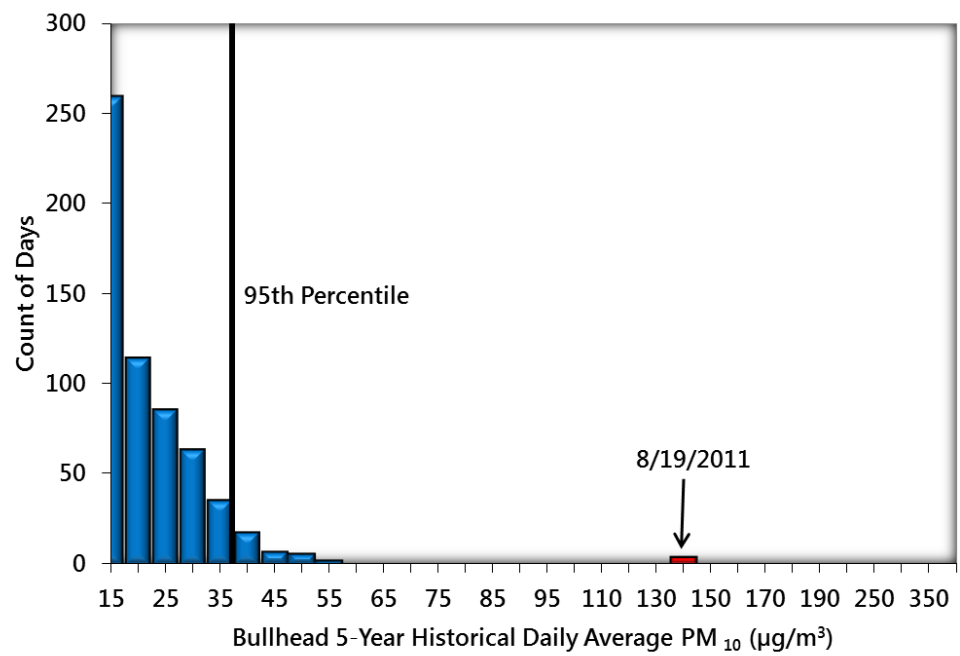


Figure 4-2. 24-hr average PM_{10} concentrations at the Bullhead City monitor for 2007-2011. The 24-hr average PM_{10} concentration on August 19, 2011, was in excess of the 95th percentile.

5. Not Reasonably Controllable or Preventable

Bullhead City was designated as a moderate PM_{10} nonattainment area by the EPA effective January 20, 1994. Improved air quality in subsequent years resulted in the EPA's redesignating Bullhead City as a PM_{10} maintenance area effective August 26, 2002. This section of the exceptional events demonstration describes control measures implemented to bring Bullhead City into attainment and maintain attainment status.

5.1 Reasonably Available Control Measures (RACM)

Since existing industrial sources contribute less than one percent to the total 2008 PM_{10} emission estimates (see Table 3.3 of the 2012 Bullhead City PM_{10} Limited Maintenance Plan), the reasonably available control technologies (RACT) requirement does not apply to the Bullhead City PM_{10} maintenance area with respect to primary or secondary PM_{10} emissions. PM_{10} emissions from existing industrial sources in the area are regulated under the ADEQ air permit program. Air quality permits are required for existing industrial sources, ensuring adequate control of PM_{10} emissions through controls such as production and discharge permits. In addition, air quality permits require the maintenance and installation of air pollution controls, including baghouses, water sprays, enclosures, shrouds, scrubbers, and the use of dust suppressants, soil stabilizers, or wetting agents on haul roads, storage piles, and parking areas. The air quality permits for industrial sources require annual reporting of compliance status to ADEQ and provide for inspection of the facilities to ensure compliance.

5.1.1 SIP Incorporated Control Measures

The following implemented control measures were responsible for bringing the Bullhead City area into attainment for PM_{10} and were approved by EPA in 2002 (67 FR 43020):

- State of Arizona
  - The Arizona Department of Transportation (ADOT) paved intersecting unpaved roads during active construction projects.
  - ADOT paved shoulders and installed curbs along Arizona State Highway 95, which runs through Bullhead City.
  - ADEQ issued Arizona Administrative Code (AAC) R18-2-607, which requires control of fugitive emissions from storage piles.[6]
- Bullhead City
  - Mohave County paved 12 miles of roads (in Bullhead City) that were unpaved in 1989.
  - EPA implemented new source performance standards for woodstoves in 1998.
- Mohave County
  - Mohave County paved previously unpaved parking areas and roadways and added sidewalks, curbs, and gutters in Davis Camp Park.

[6] R18-2-607 Storage Piles was submitted to EPA as R9-3-407 on January 4, 1979, and subsequently approved by EPA on April 23, 1982 (47 FR 17485). The rule was renumbered in 1993 to R18-2-607 and submitted to EPA for incorporation into the Arizona Applicable SIP on July 15, 1998.

- Mohave County paved 8.85 miles of roads (outside Bullhead City) that were unpaved in 1989.

5.1.2 Supplemental Control Measures

The following control measures are supplemental PM_{10} mitigation strategies included in the 1995 PM_{10} State Implementation Plan for the Bullhead City PM_{10} Nonattainment Area and 2002 Bullhead City Moderate Area PM_{10} Maintenance Plan and Request for Redesignation to Attainment, for which no emissions reduction credit was assumed[7]:

- Bullhead City
  - Implemented a grading ordinance requiring control of dust during grading and excavation and requiring that property be left in a condition that prevents dust from rising.[8]
  - For the period 2002–2011, Bullhead City paved an additional 7.5 miles of previously unpaved roads.
- State of Arizona[9]
  - ADOT specified that state contracts include dust control plan requirements for construction activities in PM_{10} nonattainment and maintenance areas.
  - In 2004, ADEQ rule AAC R18-2-702(B) was updated to require 20% opacity standards for areas in nonattainment or maintenance areas for particulate matter standards.[10] The early implementation of the contingency measure (area opacity standard revision from 40% to 20%) was not due to a contingency measure trigger.
  - Certified enhanced smoke management plan requirements were implemented by the USDA Forest Service, Bureau of Land Management, and Arizona Department of State Lands, in cooperation with ADEQ.[11]

These supplemental RACM contribute further to protection of public health and reductions in fugitive dust emissions. Continued implementation of these measures will help ensure that the Bullhead City area maintains compliance with the 24-hour PM_{10} NAAQS.

5.2 Permanent and Enforceable Control Measures

The Clean Air Act (CAA) requires that each maintenance plan demonstrate that the measures credited with bringing an area into NAAQS attainment are federally enforceable and continue in the future. The original attainment demonstration and maintenance plan submission

[7] The identified supplemental mitigation strategies are provided for informational purposes only and are not provided for approval into the Arizona Applicable SIP.
[8] Bullhead City Code of Ordinances, Chapter 15.40, Grading and Dust Control (Ord. 2008-46 §1(part))
[9] In the Maintenance Plan Approval, EPA identified ADOT rule R17-3-712, Encroachments in Highway Rights-of-way (renumbered without change to R17-3-702 in 1988), as a strategy implemented beyond SIP enforceable controls (67 FR 43020, 43023; June 26, 2002). R17-3-702 has since been repealed and should no longer be considered a supplemental strategy in effect in the area.
[10] R18-2-702, General Provisions, was incorporated by reference by EPA on August 24, 2004, effective September 23, 2004 (69 FR 51952).
[11] On October 2, 2007, ADEQ provided an “Enhanced Smoke Management Plan Certification” letter to Mr. Wayne Nastri of EPA outlining Arizona rules related to smoke management and regional haze.

for Bullhead City relied primarily on paving activities to reduce fugitive dust emissions. The specific paving measures identified in those reports are fully constructed and permanent, and ADOT continues to pave previously unpaved intersections to the ADOT right-of-way during construction projects. Therefore, the Bullhead City plan meets the CAA requirement for permanent and enforceable control measures.

5.3 Contingency Measures

Section 175A of the CAA requires that a maintenance plan include contingency provisions as necessary to promptly correct any violation of the NAAQS that may occur after redesignation of an area from nonattainment to attainment. EPA's memo, Limited Maintenance Plan (LMP) Option for Moderate PM_{10} Nonattainment Areas (Wegman, August 9, 2011)[12], states that the contingency measures do not have to be fully adopted, but should identify measures to be promptly adopted, if necessary. As previously noted, a 20% opacity standard was implemented in 2004 as a contingency measure.

Under the LMP option, the state is required to calculate the design value (or alternatively, the critical design value) for the area annually and determine whether the area is still eligible for the LMP option. If, after performing the annual calculation, the state determines that the area has exceeded the LMP option limit, the state commits to take action to attempt to reduce PM_{10} concentrations to a level that qualifies for the LMP option.

Further, the state commits to seek an expeditious remedy for any potential violation of the PM_{10} NAAQS that may occur. Specifically, the state commits to determine whether or not violations have been recorded within six months after the close of the calendar year, and to review and determine whether appropriate contingency measures have been implemented or are needed by the end of the same calendar year. The state commits to implementation of the selected contingency measures within one year after determining that a violation has occurred.

Table 5-1 contains contingency measures that will be considered for implementation in the event of a violation of either the 24-hour NAAQS or in the event that the area's design value exceeds the criteria for the LMP option. The cause of the violation of the LMP option will help to determine the appropriate contingency measures to be implemented.

[12] The EPA memo regarding the LMP option for Moderate PM_{10} Nonattainment Areas can be found at http://www.epa.gov/ttn/oarpg/t1/memoranda/lmp_final.pdf.

Table 5-1. Bullhead City Area Contingency Control Measures.

Implementing Agency	Reasonably Available Control Measure
Bullhead City	Review Bullhead City grading ordinance to determine whether additional action is needed.
	Increase dust control enforcement efforts or develop a compliance survey for standards for the installation and maintenance of landscaping and screening (Bullhead City Zoning Regulation, Chapter 17.48, Landscaping and Screening Regulations).
Bullhead City and/or Mohave County	Pave or stabilize unpaved roads located in the PM_{10} maintenance area.
Mohave County	Pave additional unpaved parking areas in Davis Camp Park (south beach parking areas).
	Clean up roadways after rainstorms.
	Increase dust control enforcement efforts or develop a compliance survey for the requirement of all commercial establishments to pave previously unpaved parking lots (Mohave County Zoning Regulations, Section 26 Off-Street Parking Standards).
USDA Forest Service, U.S. Bureau of Land Management, Arizona State Land Department, and ADEQ	Exercise authority under the Enhanced Smoke Management Plan—state and federal land managers conducting prescribed burning must register with ADEQ for proposed burning activities (Arizona Administrative Code R18-2-Article 15 - Forest & Range Management Burns). ADEQ maintains the ability to deny permission for burning on certain high-risk days (dependent on meteorological conditions) and may increase outreach and enforcement resources.
ADEQ	Review the requirement for dust control measures for material storage piles to determine whether revision is needed (AAC R18-2-607)

5.3.1 Review of Source-Permitted Inspections and Public Complaints

ADEQ's Arizona Unified Repository for Information Tracking of the Environment (AZURITE) database was queried to compile a list of inspections for the permitted sources in the Bullhead City area around the time of August 19, 2011. No inspections or complaints were received during the period from August 16 through August 21, 2011.

5.4 Forecasts and Warnings

The NWS offices in Phoenix, Tucson, and Flagstaff, Arizona, issued numerous special weather statements, severe thunderstorm warnings, and dust storm warnings during the afternoon and evening of August 18, 2011, due to the numerous thunderstorms that developed over central and southern Arizona (see Appendix B). These NWS statements covered areas in Coconino, Navajo, Yavapai, Maricopa, Gila, Pinal, Pima, Graham, Cochise, and Santa Cruz counties, demonstrating that this was a geographically extensive event. These thunderstorms weakened as they moved northwest, and thus severe weather warnings and advisories were not needed for the Bullhead City region.

5.5 Wind Observations

Numerous monitoring sites across Arizona, including observation sites in the Bullhead City region, reported sustained winds of over 25 mph and wind gusts of over 35 mph related to this thunderstorm outflow and dust storm event. Wind speeds of over 25 mph are normally sufficient to overcome most PM_{10} control measures. Please see Section 3 and Appendices A and B for detailed wind data from regional monitors.

5.6 Summary

The weather and air quality forecasts and warnings outlined in this section demonstrate that outflow winds from thunderstorms caused uncontrollable PM_{10} emissions across much of Arizona, including in the Bullhead City area. The RACM outlined in the Bullhead City PM_{10} Limited Maintenance Plan were in place at the time of the event. These control measures are required for areas designated as Moderate non-attainment for PM_{10}, such as the Bullhead City region. Thus, the RACM in place at the time of the event were reasonable. In addition, surface wind measurements in the Bullhead City area during the event were high enough (sustained winds over 25 mph and wind gusts over 35 mph) to overwhelm most reasonable PM_{10} control measures.

6. But-For Analysis

6.1 Discussion

Section 50.14(c)(3)(iv)(D) in 40 CFR Part 50 requires an exceptional event demonstration to satisfy the condition that "[t]here would have been no exceedance or violation but for the event." The prior sections of this submittal have provided detailed information in regard to the 24-hr PM_{10} concentration observed at the Bullhead City monitor on August 19, 2011, showing that

- the observed high 24-hr PM_{10} concentration was not reasonably controllable or preventable, and
- there was a clear causal relationship between PM_{10} transported from thunderstorm outflow originating in desert areas outside the Bullhead City PM_{10} maintenance area and the measured 24-hr PM_{10} concentration in Bullhead City.

The weight of evidence in these sections demonstrates that, but for the existence of dust emissions generated by thunderstorm outflow and the associated transport of PM_{10}, the 24-hr PM_{10} concentration measured on August 19, 2011, would have been lower.

As shown in Section 3, radar velocity data and time-series plots of PM_{10}, wind speeds, and visibility establish a clear causal relationship between the arrival of dust-laden thunderstorm outflow and elevated PM_{10} concentrations at the Bullhead City monitor. Multiple independent measurements of wind speed, wind direction, and visibility point to the presence of thunderstorm outflow as the mechanism for transport of PM_{10} into the Bullhead City PM_{10} maintenance area. High PM_{10} concentrations and gusty winds were also reported in other parts of Arizona and southern Nevada, illustrating the widespread, regional nature of this event. In addition, PM_{10} concentrations were much lower on days immediately before and after the windblown dust event. The source regions for the thunderstorm outflow and PM_{10} are identified as open, undeveloped desert areas southeast of the Bullhead City PM_{10} maintenance area. The weight of evidence presented in this submittal provides no alternative that could tie the 24-hr PM_{10} concentration observed in Bullhead City on August 19, 2011, to any causal source other than PM_{10} transported by thunderstorm outflow.

As detailed in Section 5, all reasonable control measures were in place and/or implemented on a continual basis. Air quality-related inspection and compliance data revealed no violations or complaints in the three days before and after the event. Local regulatory agencies, industry, and the general public were alerted to the possibility of dust storms due to thunderstorm activity via daily forecasts and media reports.

6.2 Summary

The weight of evidence presented in this submittal provides no alternative that could tie the high 24-hr PM_{10} concentration observed in Bullhead City on August 19, 2011, to any causal source except PM_{10} transported by thunderstorm outflow, confirming that the high 24-hr PM_{10} concentration would not have occurred but for the presence of this uncontrollable natural event.

7. Conclusions

The high 24-hr PM_{10} concentration that occurred in Bullhead City on August 19, 2011, satisfies the criteria of the EER, which states that in order to justify the exclusion of air quality monitoring data, evidence must be provided for the following elements:

1. The event satisfies the criteria set forth in 40 CFR 501(j) that
   a. the event affected air quality,
   b. the event was not reasonably controllable or preventable, and
   c. the event was caused by human activity unlikely to recur in a particular location or was a natural event;
2. There is a clear causal relationship between the measurement(s) under consideration and the event;
3. The event is associated with a measured concentration(s) in excess of normal historical fluctuations; and
4. There would have been no exceedance or violation but for the event.

7.1 Affects Air Quality

As stated in the preamble to the Exceptional Events Rule, the event in question is considered to have affected air quality if it can be shown that there is a clear causal relationship between the measured value and the event, and that the event is associated with a measured concentration in excess of normal historical fluctuations. Given the information presented in Sections 2, 3, 4, and 5, we can reasonably conclude that the event in question affected air quality. While the observed value is not in exceedance of the NAAQS for 24-hr PM_{10}, the value is relevant in determining the Bullhead City PM_{10} maintenance area's eligibility for the Limited Maintenance Plan (LMP) option.

7.2 Not Reasonably Controllable or Preventable

Section 50.1(j) of 40 CFR Part 50 requires that an event must be "not reasonably controllable or preventable" in order to be defined as an exceptional event. This requirement is met by demonstrating that despite reasonable control measures in place in Bullhead City, high winds overwhelmed all reasonably available controls. These winds were of sufficient strength to easily loft large amounts of dust from the dry, undeveloped, open desert areas southeast of Bullhead City. The 24-hr PM_{10} concentration discussed in this report was caused by naturally occurring thunderstorm outflow that transported dust into Bullhead City from areas largely outside the Bullhead City PM_{10} maintenance area. These facts provide strong evidence that the 24-hr PM_{10} concentration observed on August 19, 2011, was not reasonably controllable or preventable.

7.3 Natural Event

As discussed above, the high 24-hr PM_{10} concentration observed on August 19, 2011, was shown to be caused by transport of PM_{10} into Bullhead City from thunderstorm outflow. The event therefore qualifies as a natural event.

7.4 Clear Causal Relationship

The following points demonstrate that the high PM_{10} concentrations were caused by windblown dust:

- Meteorological, PM_{10}, and radar data were consistent with the timing and spatial extent of thunderstorm outflow and associated dust moving north-northwestward across Arizona, southeastern California, and southern Nevada (Section 3).
- High PM_{10} concentrations and gusty winds in association with this event were reported in the Bullhead City, Phoenix, Tucson, and Las Vegas areas, illustrating the widespread, regional, and uncontrollable nature of this event (Section 3).
- Dry conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by high winds (Section 3).

7.5 Historical Norm

The 24-hr average PM_{10} concentration measured at the Bullhead City monitor were historically unusual compared to a multi-year data set (Section 4).

7.6 But For

On the basis of the weight of evidence described above and in Section 6, the 24-hr PM_{10} concentration measured on August 19, 2011, at the Bullhead City monitor would not have occurred but for the thunderstorm-driven high winds and transport of dust from open desert areas southeast of Bullhead City, outside the Bullhead City PM_{10} maintenance area.

Appendix A: Air Quality and Meteorological Data for the Bullhead City Area

Figures A-1 through A-14 summarize the progression of the thunderstorm outflow across Arizona, southeastern California, and southern Nevada from 6:00 p.m. on August 18 to 8:00 a.m. on August 19, 2011. These figures depict multiple data sets, including

- Radar velocity data from the Phoenix, Yuma, and Las Vegas National Weather Service offices. The radar locations are indicated by black stars. Green shadings indicate motion toward the radar site and orange/red shadings indicate motion away from the radar site.
- Hourly PM_{10} concentrations from available monitors (please note that NWS/ASOS and AZMET monitors do not measure PM_{10} concentrations).
- Hourly surface wind speed, wind gust, and visibility measurements (please note that only NWS/ASOS sites measure visibility).

These figures also include estimated locations of the outflow boundaries, based primarily on surface meteorological observations and radar velocity data. When observational data were not available, outflow boundary locations were extrapolated from estimated speed and direction of motion of the boundaries.

Following the radar plots are tables of meteorological data for regional National Weather Service monitors on August 18 and 19, 2011 (**Figures A-15 through A-26**). The data depict the timing and spatial extent of thunderstorm outflow boundaries and associated dust as they moved north-northwestward across Arizona, southeastern California, and southern Nevada.

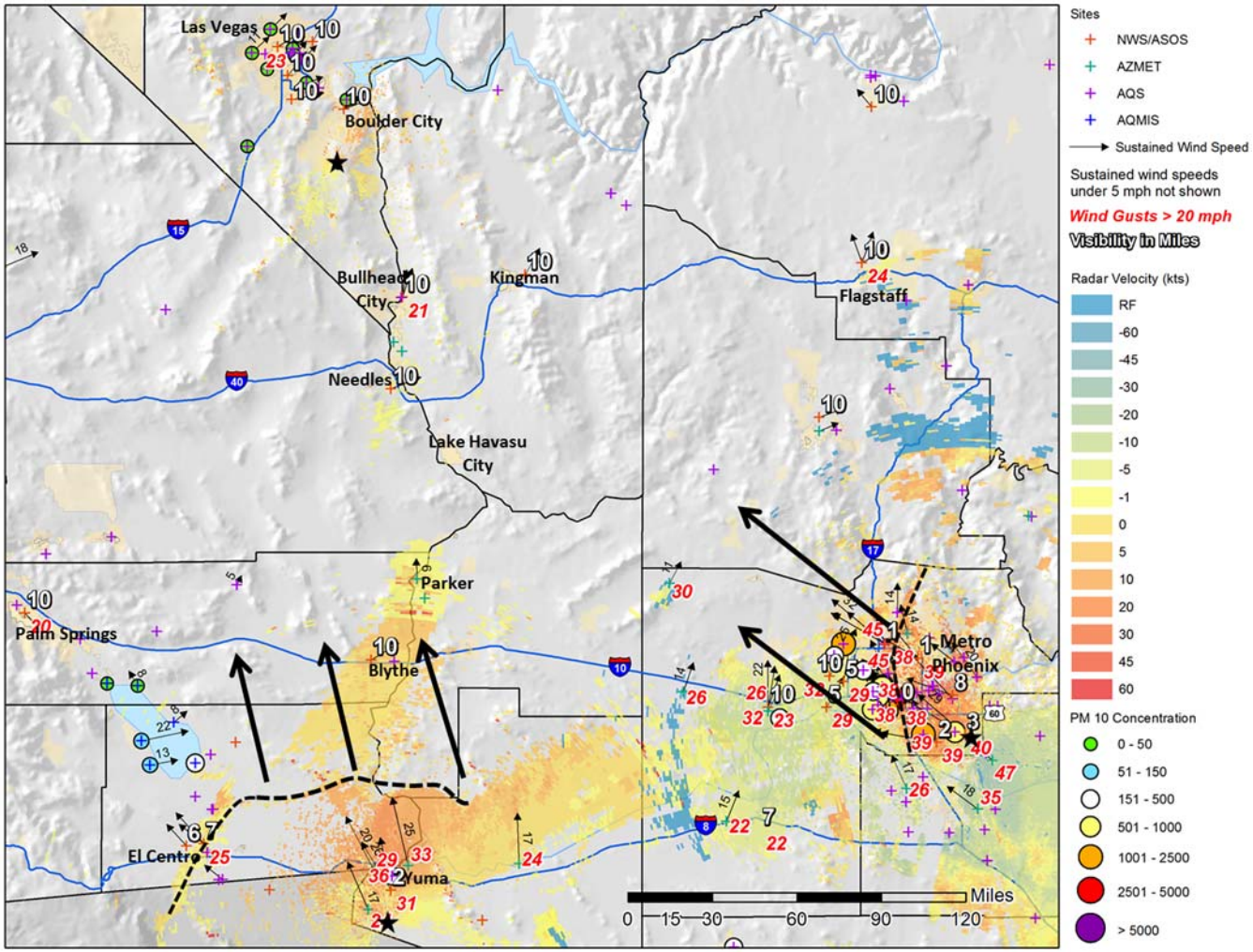


Figure A-1. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 6:00 and 7:00 p.m. on August 18, 2011. Gusty winds, low visibilities, and high PM_{10} concentrations were reported in the Phoenix and Yuma areas as thunderstorm outflow and associated dust moved north-northwestward across Arizona.

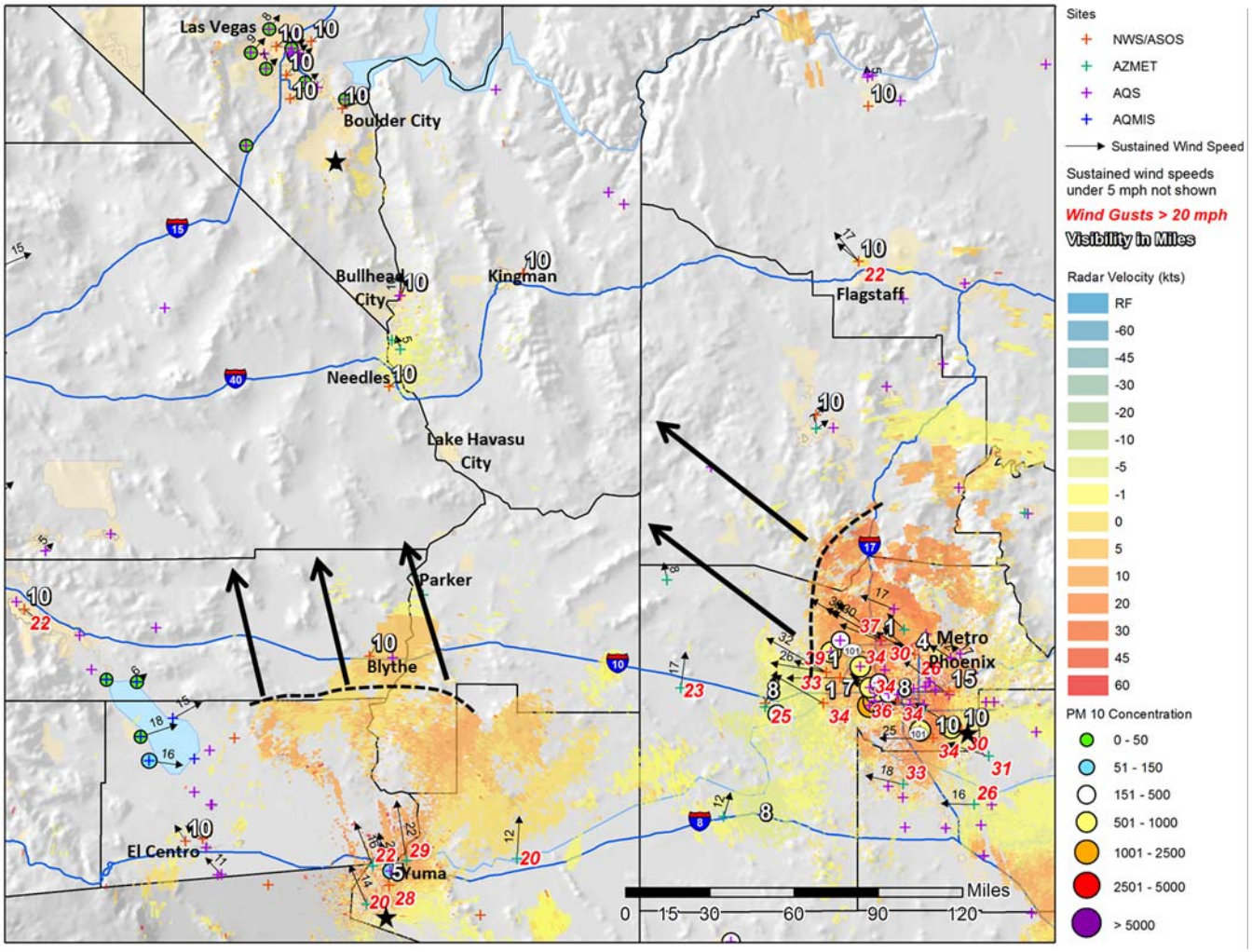


Figure A-2. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 7:00 and 8:00 p.m. on August 18, 2011. Gusty winds, low visibilities, and high PM_{10} concentrations were reported in the Phoenix and Yuma areas as thunderstorm outflow and associated dust moved north-northwestward across Arizona.

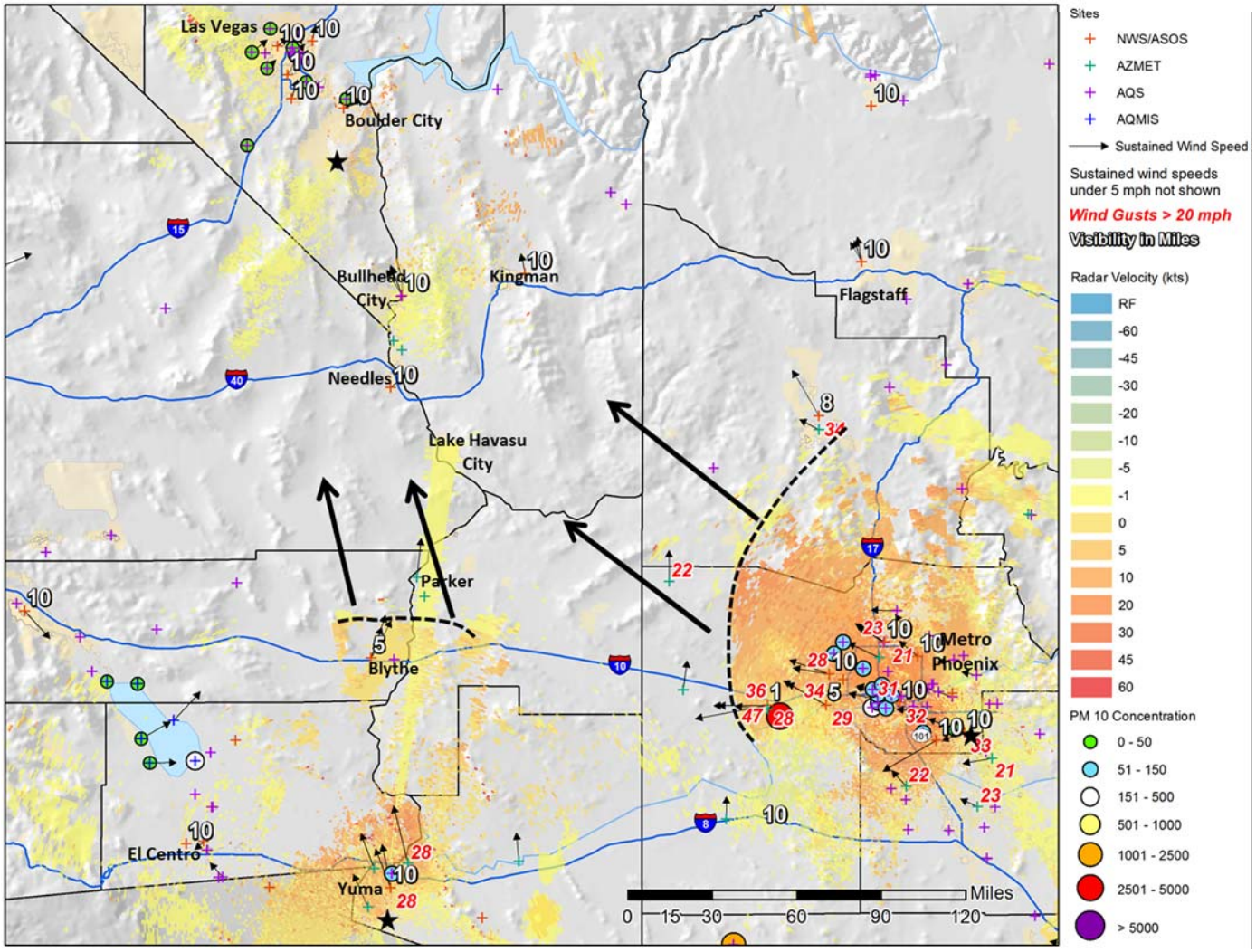


Figure A-3. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 8:00 and 9:00 p.m. on August 18, 2011. Gusty winds and low visibilities were reported in the Blythe, California, area and the western Phoenix metropolitan area as thunderstorm outflow and associated dust moved north-northwestward across Arizona.

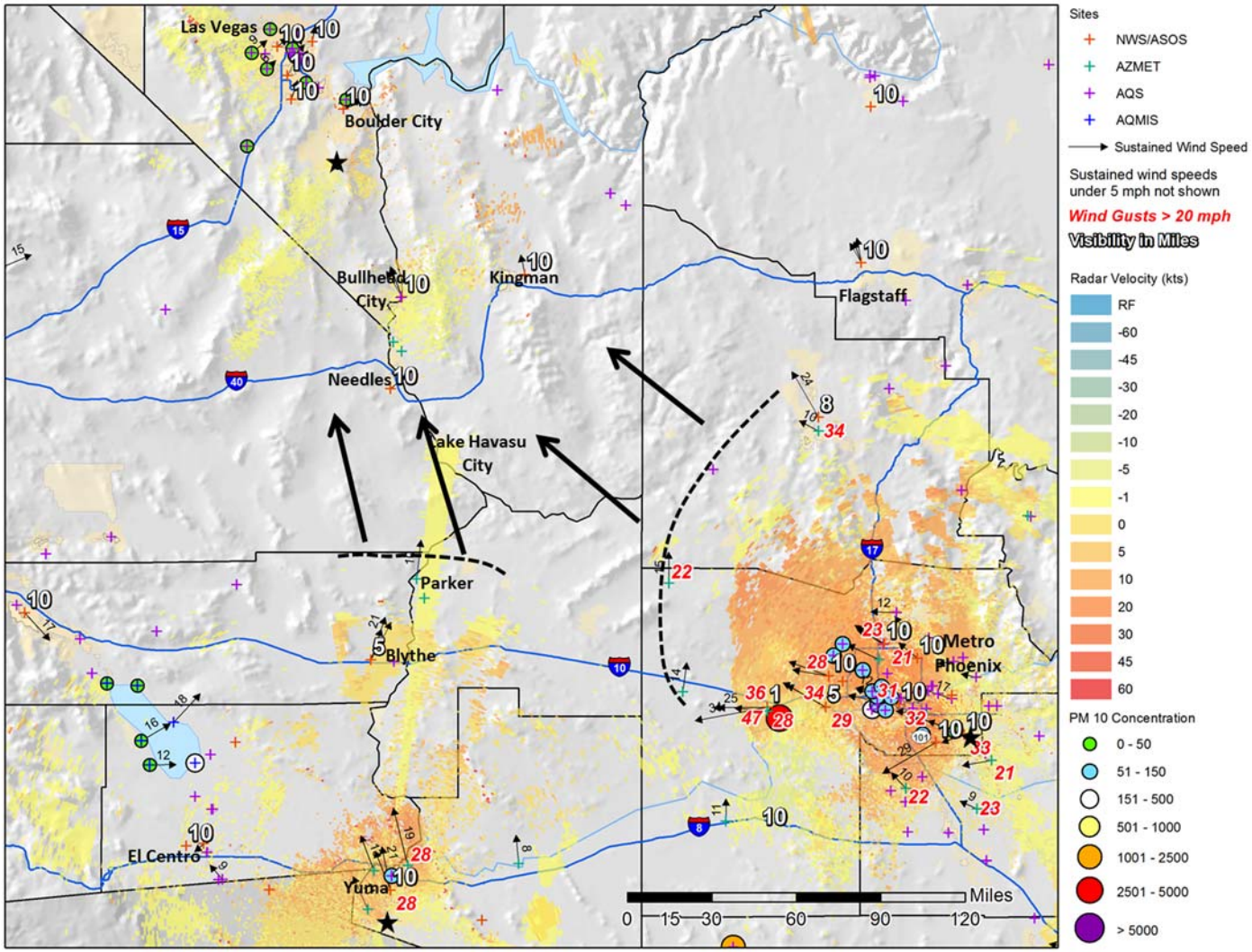


Figure A-4. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 9:00 and 10:00 p.m. on August 18, 2011. Thunderstorm outflow and associated dust were moving north-northwestward across Arizona and southeastern California.

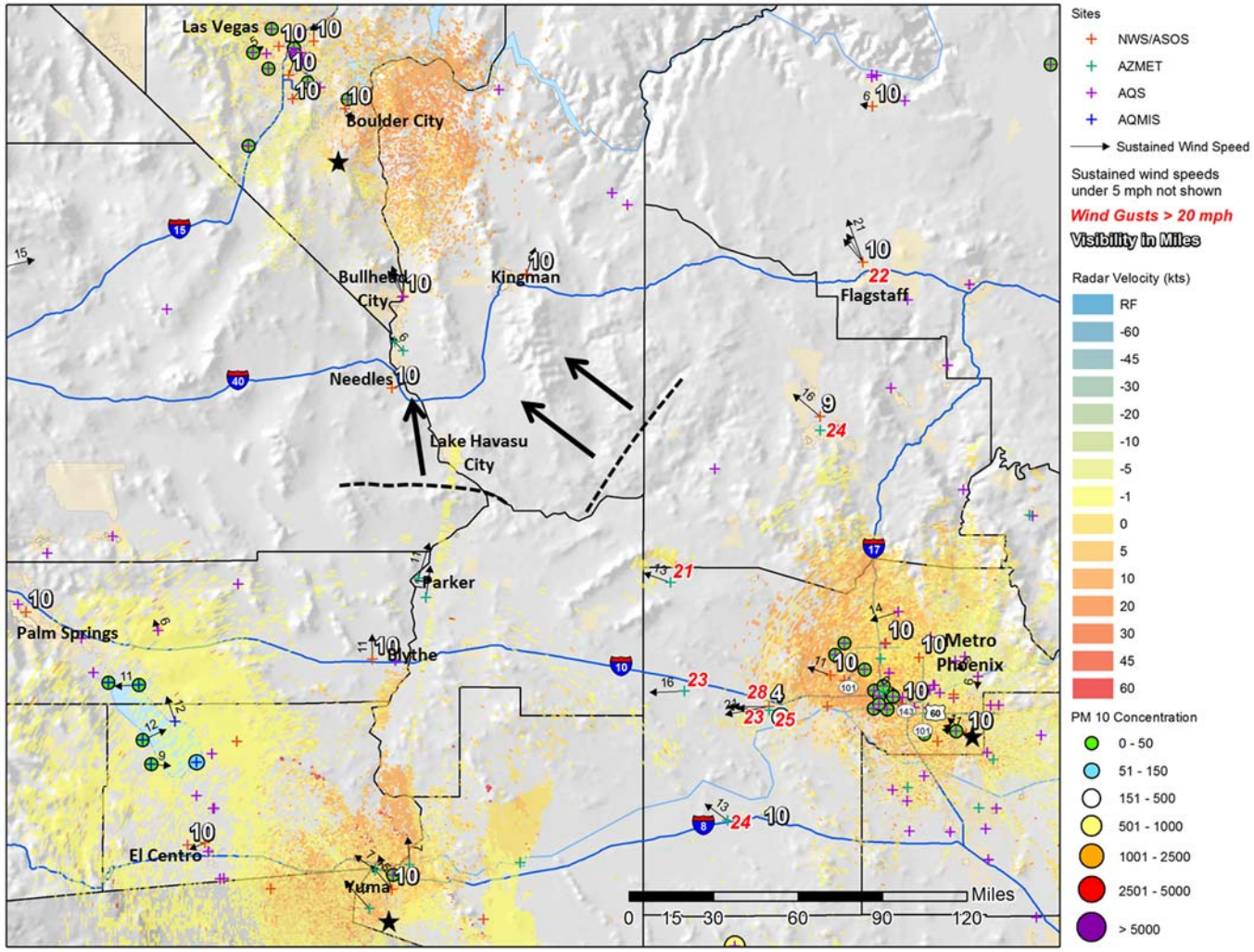


Figure A-5. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 10:00 and 11:00 p.m. on August 18, 2011. Thunderstorm outflow and associated dust were moving north-northwestward across Arizona and southeastern California.

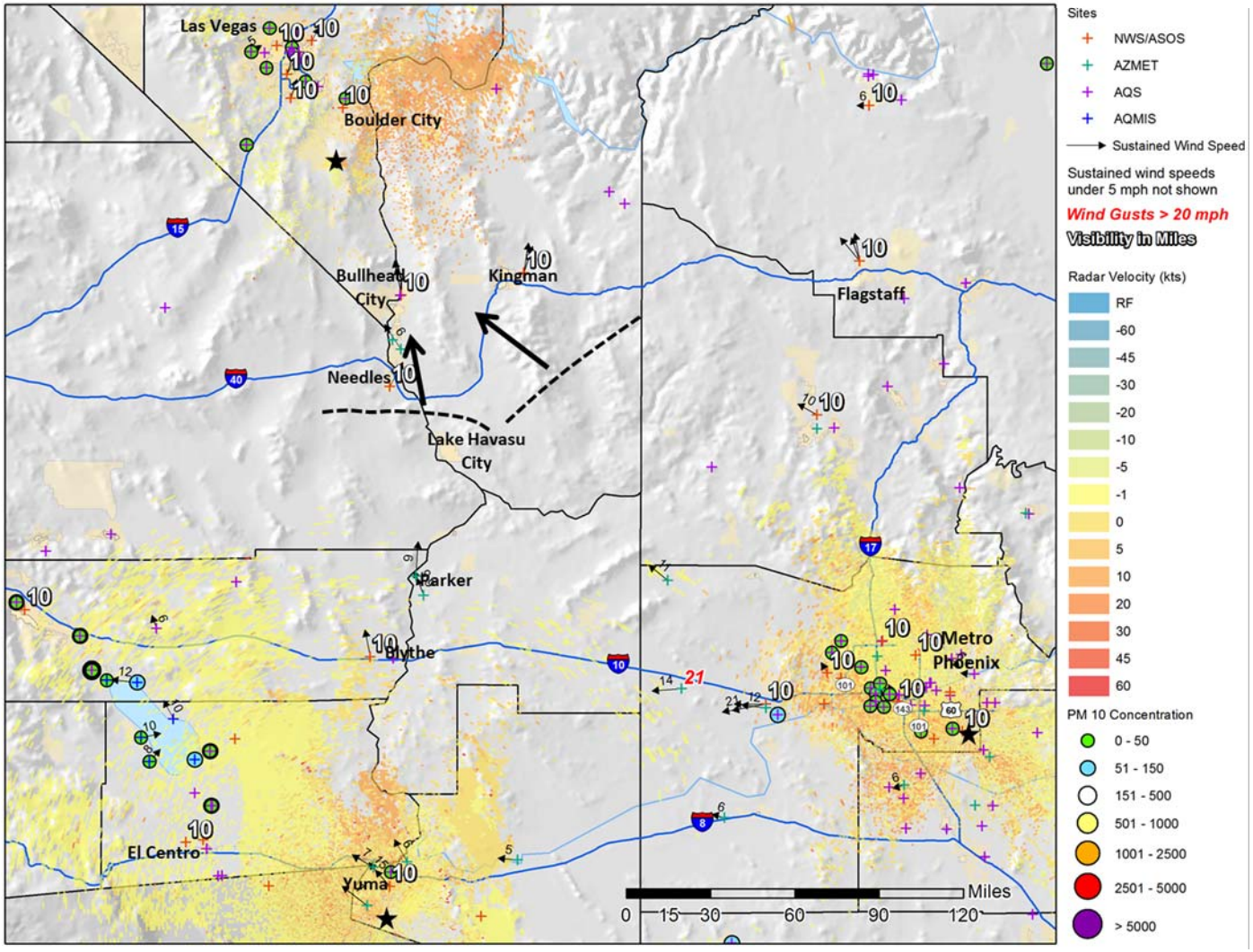


Figure A-6. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 11:00 p.m. on August 18, 2011, and 12:00 a.m. on August 19, 2011. Thunderstorm outflow and associated dust were moving north-northwestward across Arizona and southeastern California toward the Bullhead City area.

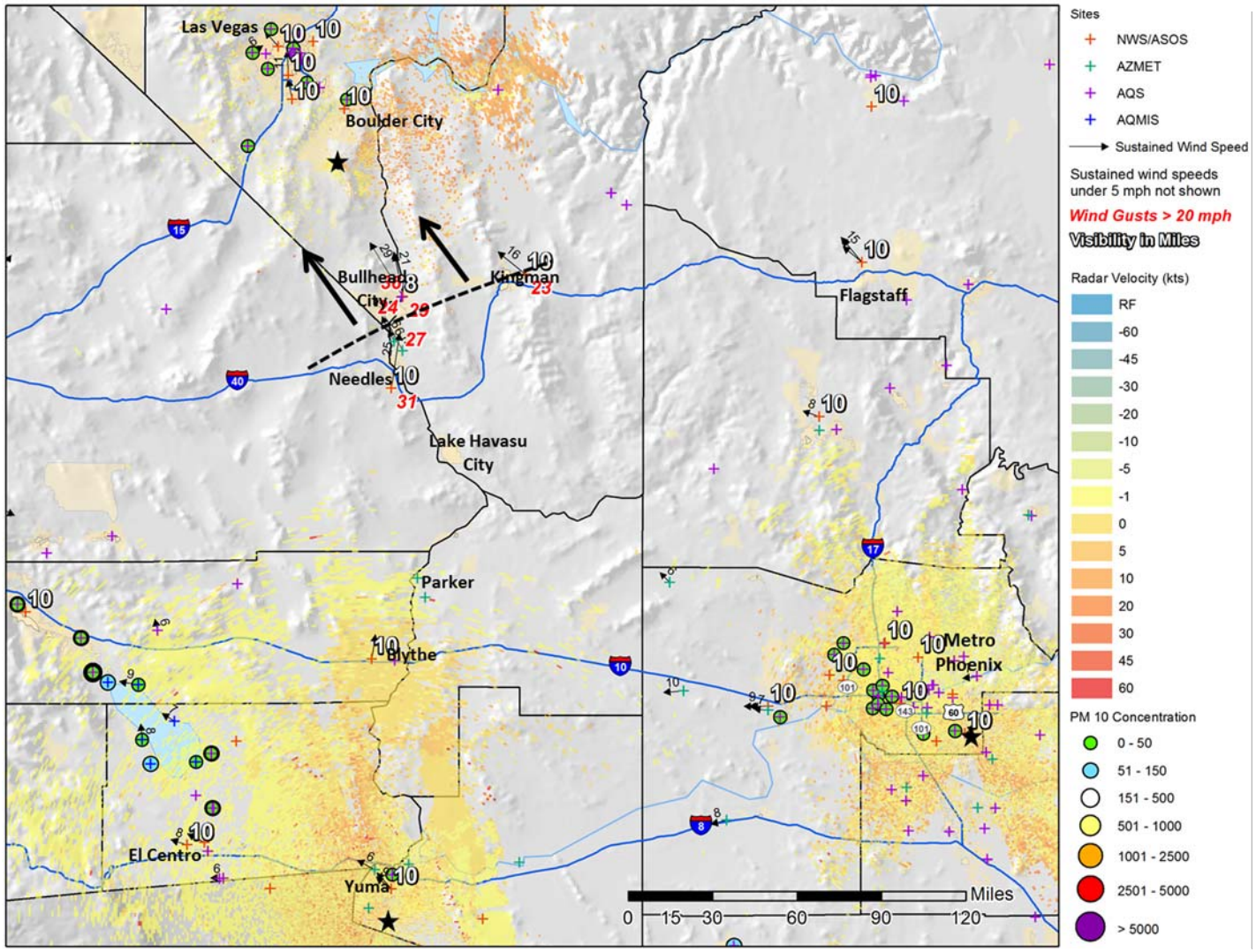


Figure A-7. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between midnight and 1:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Bullhead City area, causing gusty south-southeasterly winds and reductions in visibility.

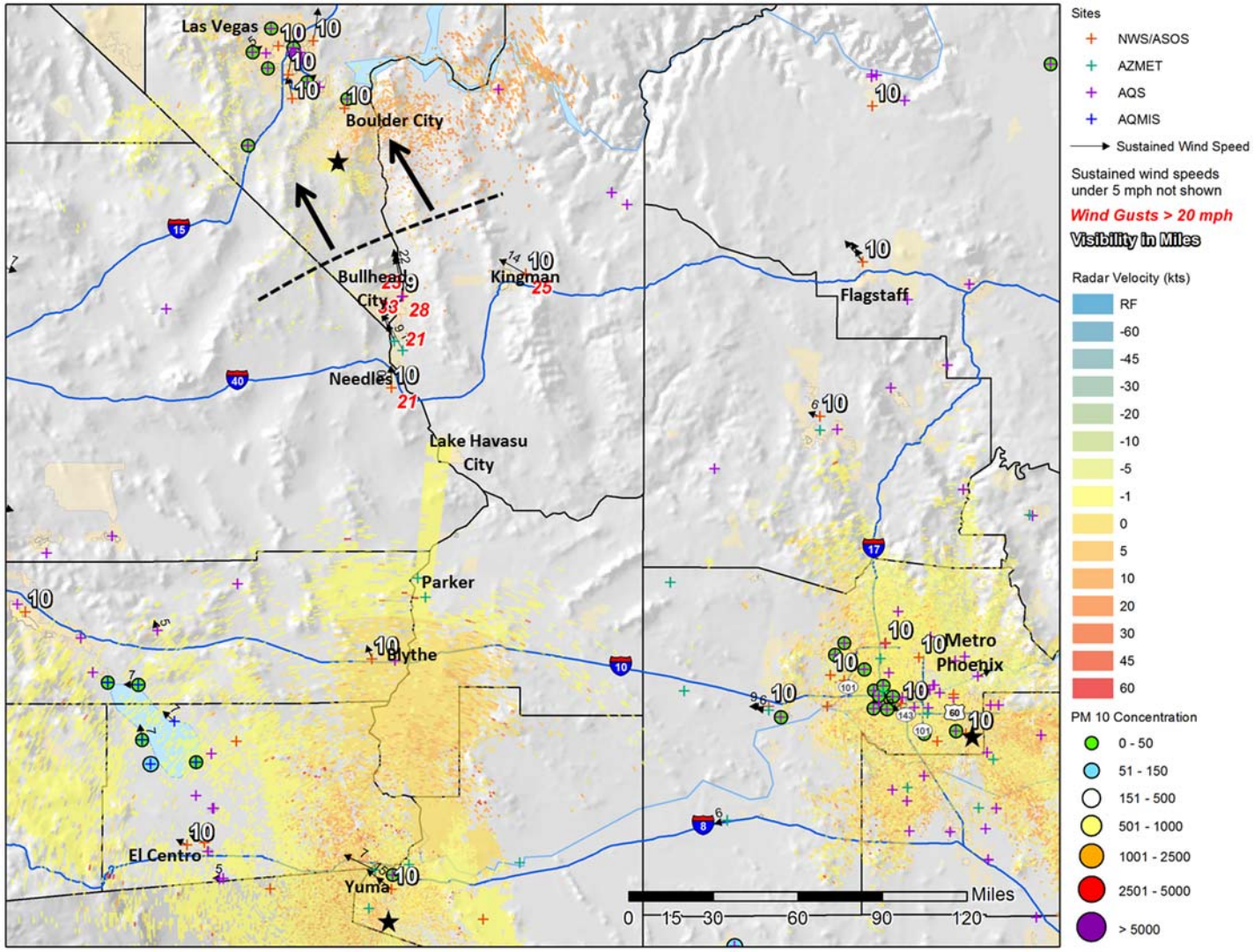


Figure A-8. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 1:00 a.m. and 2:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Bullhead City area, causing gusty south-southeasterly winds and reductions in visibility.

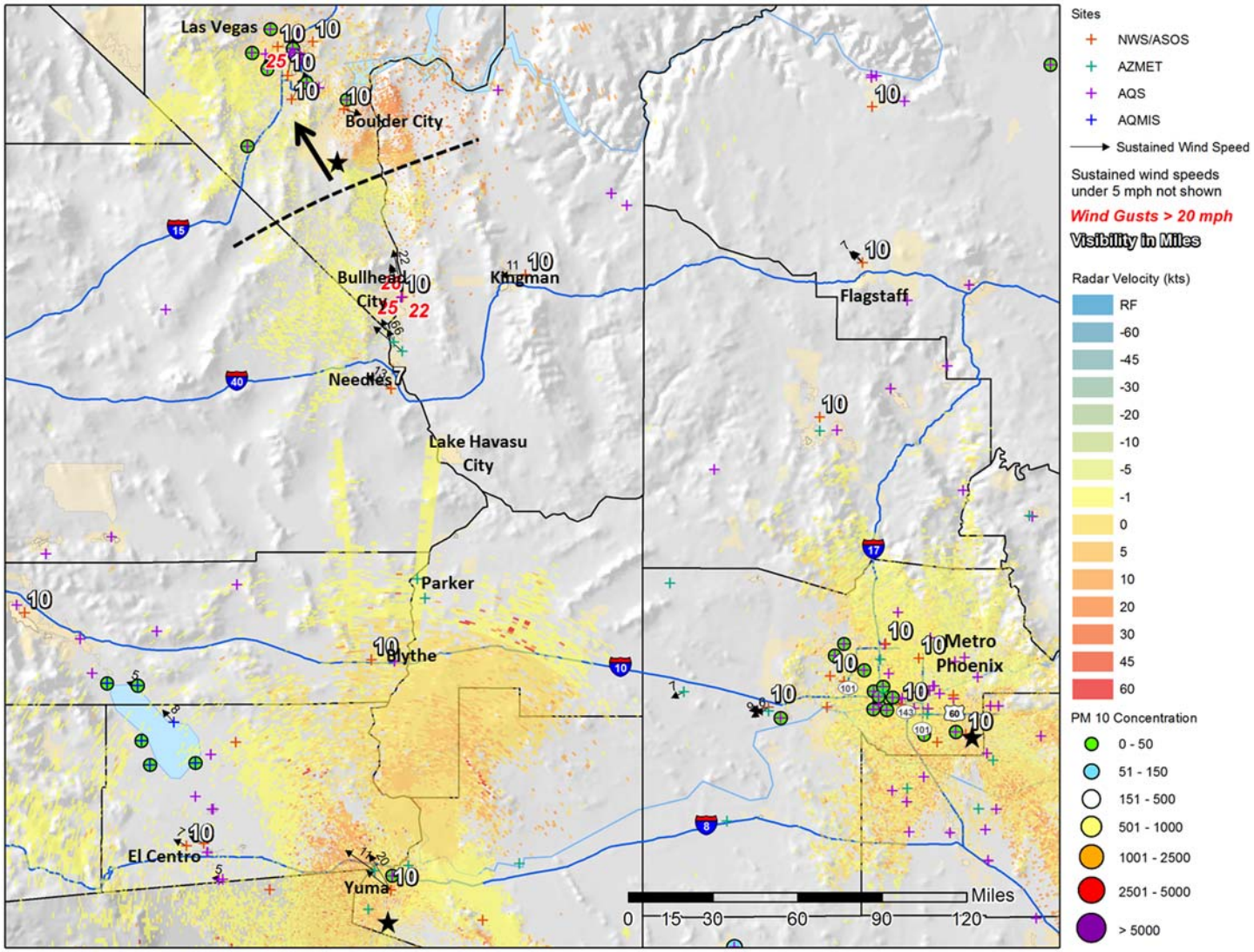


Figure A-9. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 2:00 a.m. and 3:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Bullhead City area and into southern Nevada, causing gusty south-southeasterly winds and reductions in visibility.

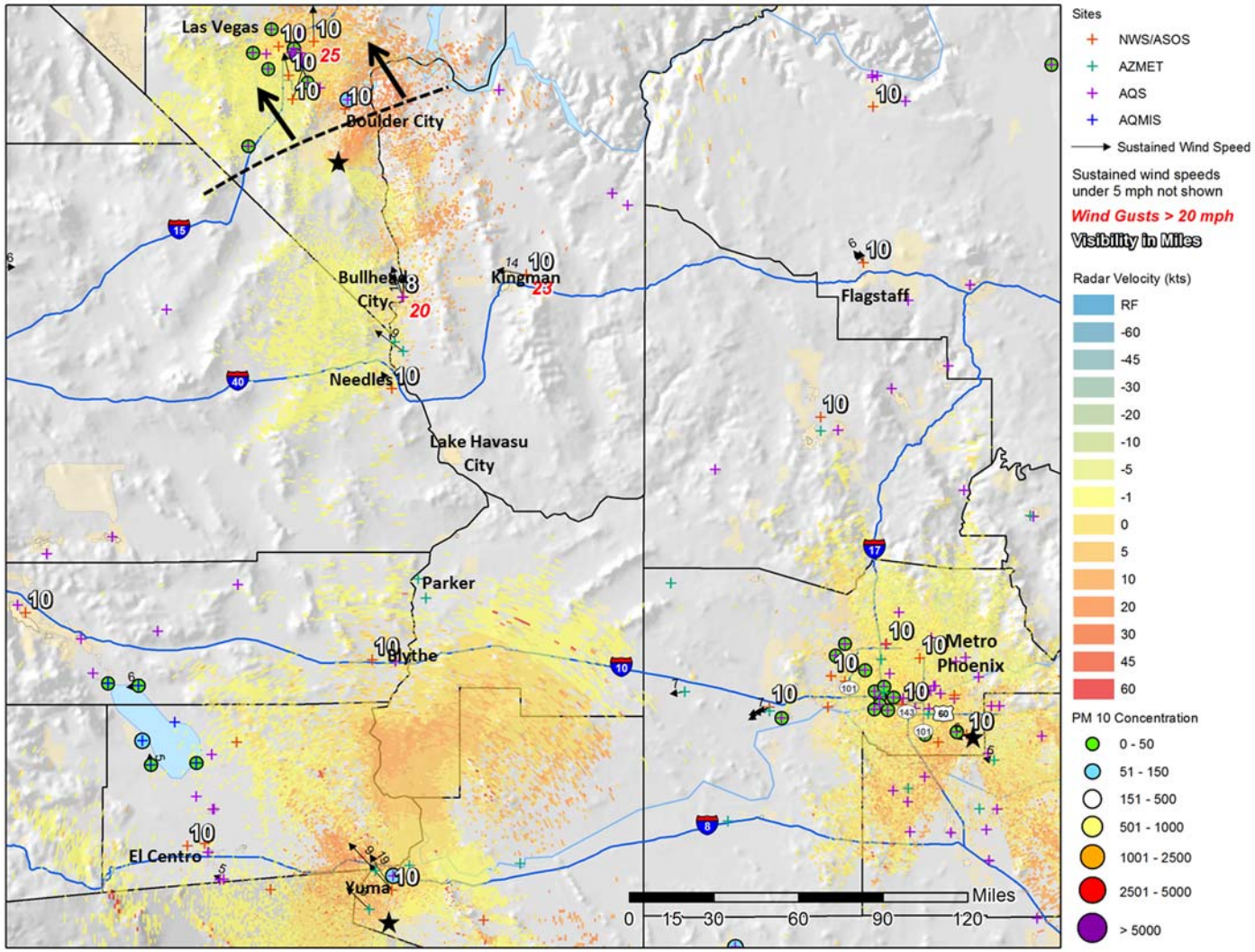


Figure A-10. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 3:00 a.m. and 4:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving into the Boulder City, Nevada, area, causing an increase in PM_{10} concentrations.

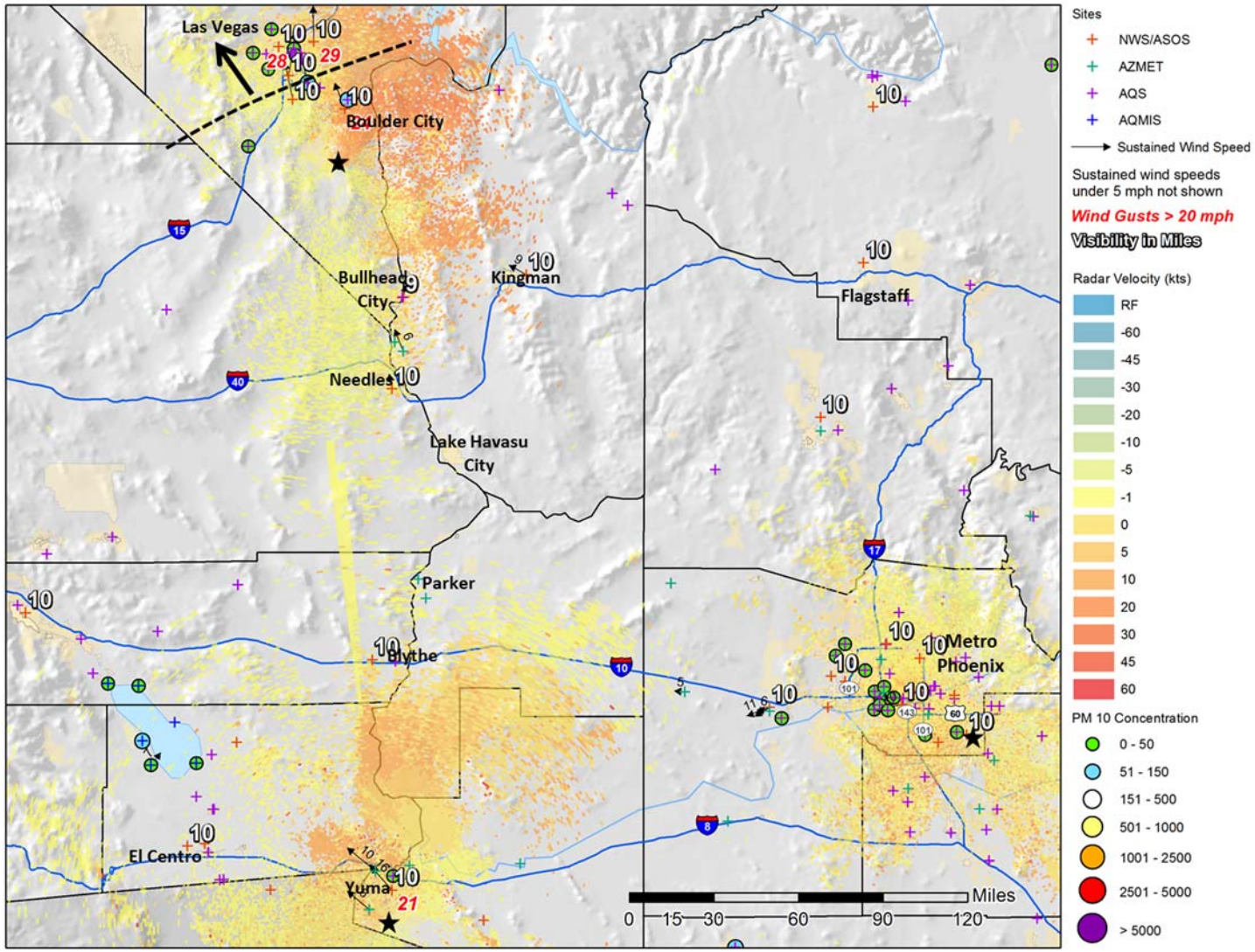


Figure A-11. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 4:00 a.m. and 5:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving into the Las Vegas, Nevada, area, causing gusty winds and an increase in PM_{10} concentrations.

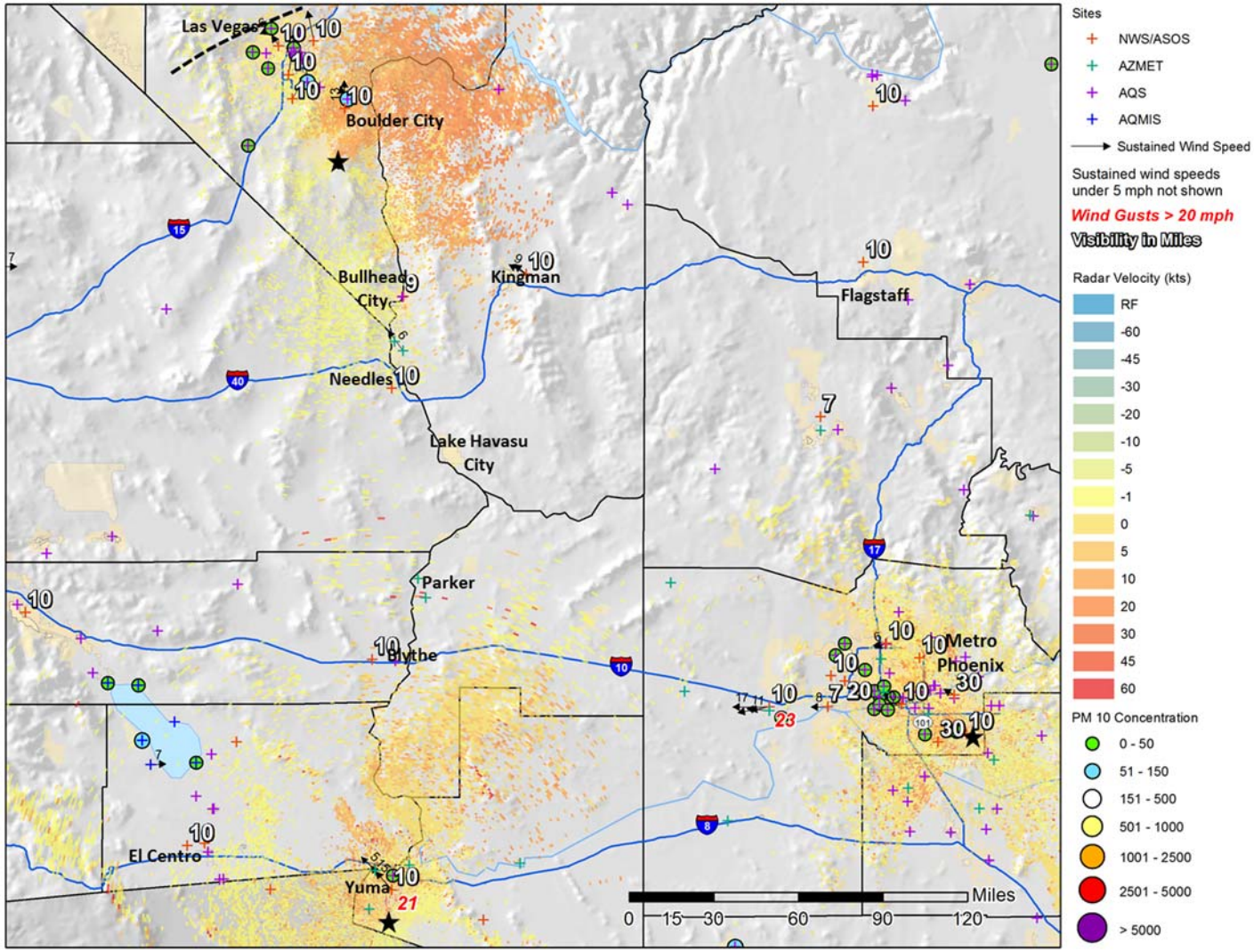


Figure A-12. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 5:00 a.m. and 6:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Las Vegas, Nevada, area, causing an increase in PM_{10} concentrations.

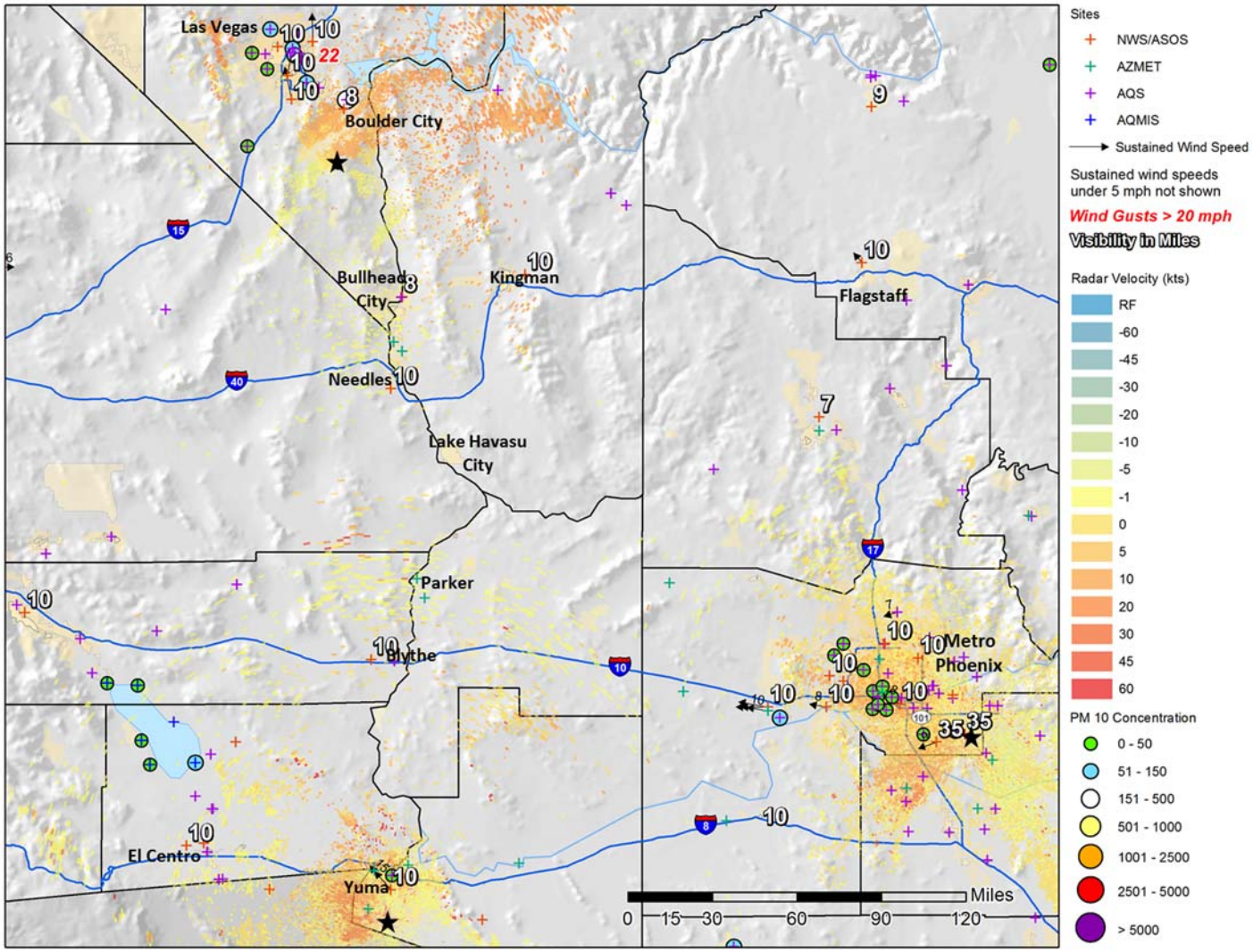


Figure A-13. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 6:00 a.m. and 7:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Las Vegas, Nevada, area, causing an increase in PM_{10} concentrations.

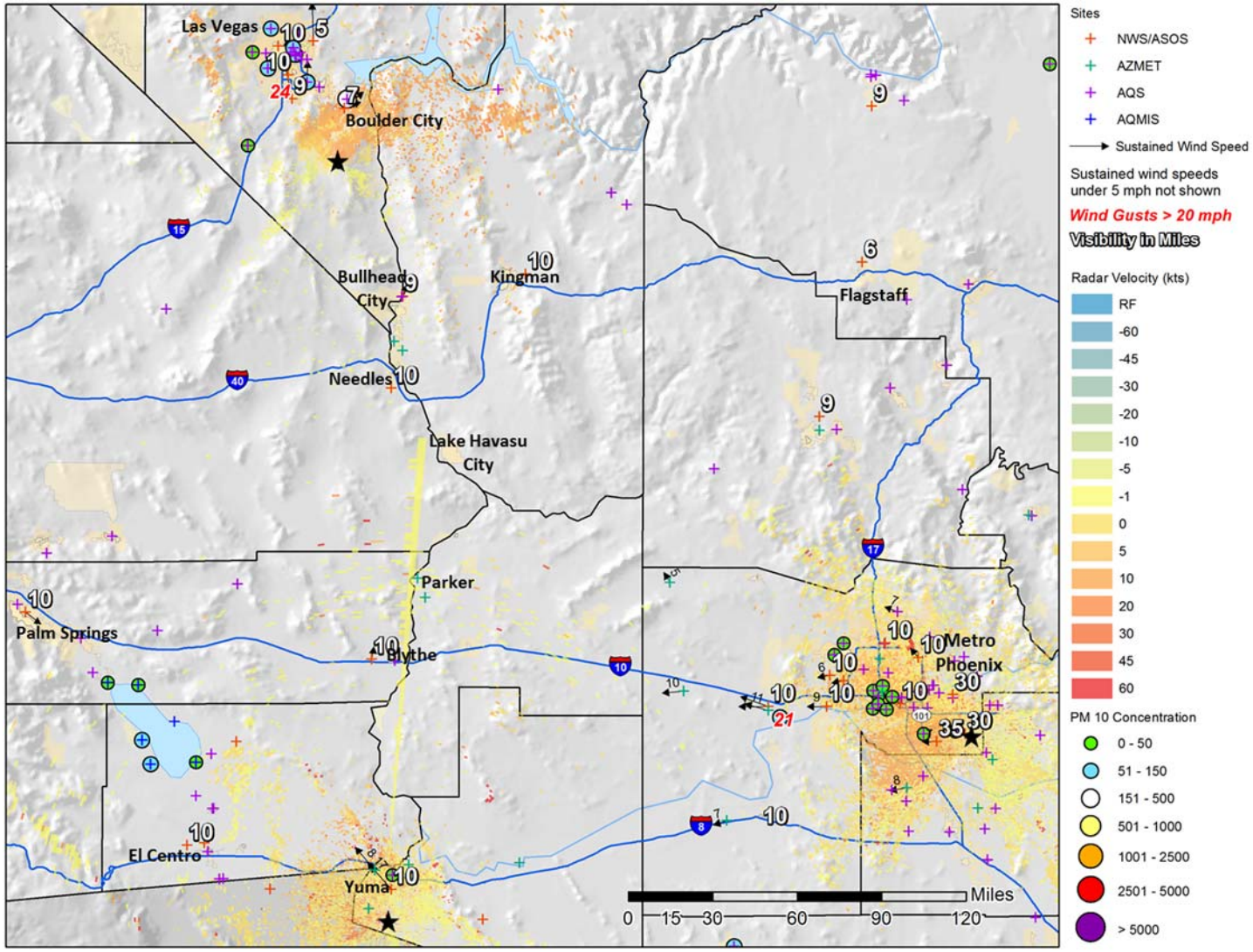


Figure A-14. Progression of the thunderstorm outflow boundaries (dashed lines) as shown by Arizona, California, and Nevada monitors between 7:00 a.m. and 8:00 a.m. on August 19, 2011. Remnant thunderstorm outflow and associated dust were moving through the Las Vegas, Nevada, area, causing gusty winds, reduced visibilities, and an increase in PM_{10} concentrations.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
LAUGHLIN/BULLHEAD INTL AIRPORT (53135)
BULLHEAD CITY, AZ (08/18/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 695 ft. above sea level
Latitude: 35.157
Longitude: -114.559

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18	0015	0	CLR	10.00		95	35.0	65	18.5	45	7.0	18	0	000		29.04			M	AA		29.78
18	0035	0	CLR	10.00		95	35.0	66	18.7	46	8.0	19	0	000		29.04			M	AA		29.78
18	0055	0	CLR	10.00		93	34.0	65	18.4	46	8.0	20	3	120		29.04			M	AA		29.78
18	0115	0	CLR	10.00		93	34.0	65	18.4	46	8.0	20	3	130		29.04			M	AA		29.78
18	0135	0	CLR	10.00		93	34.0	65	18.4	46	8.0	20	0	000		29.04			M	AA		29.78
18	0155	0	CLR	10.00		91	33.0	65	18.0	46	8.0	21	0	000		29.04			M	AA		29.78
18	0215	0	CLR	10.00		91	33.0	64	17.8	45	7.0	20	0	000		29.04			M	AA		29.78
18	0235	0	CLR	10.00		91	33.0	64	17.8	45	7.0	20	0	000		29.04			M	AA		29.78
18	0255	0	CLR	10.00		90	32.0	64	17.8	46	8.0	22	0	000		29.04			M	AA		29.78
18	0315	0	CLR	10.00		90	32.0	64	17.8	46	8.0	22	0	000		29.05			M	AA		29.79
18	0335	0	CLR	10.00		90	32.0	64	17.6	45	7.0	21	3	070		29.04			M	AA		29.78
18	0355	0	CLR	10.00		90	32.0	64	17.8	46	8.0	22	0	000		29.04			M	AA		29.78
18	0415	0	CLR	10.00		88	31.0	64	17.5	46	8.0	23	0	000		29.05			M	AA		29.79
18	0435	0	CLR	10.00		88	31.0	64	17.9	48	9.0	25	0	000		29.05			M	AA		29.79
18	0455	0	CLR	10.00		90	32.0	64	17.8	46	8.0	22	0	000		29.05			M	AA		29.79
18	0515	0	CLR	10.00		86	30.0	62	16.9	45	7.0	24	0	000		29.05			M	AA		29.79
18	0535	0	CLR	10.00		86	30.0	63	17.1	46	8.0	25	0	000		29.06			M	AA		29.80
18	0555	0	CLR	10.00		84	29.0	62	16.7	46	8.0	27	0	000		29.06			M	AA		29.80
18	0615	0	CLR	10.00		86	30.0	63	17.1	46	8.0	25	0	000		29.07			M	AA		29.81
18	0635	0	CLR	10.00		84	29.0	62	16.7	46	8.0	27	0	000		29.07			M	AA		29.81
18	0655	0	CLR	10.00		86	30.0	63	17.1	46	8.0	25	0	000		29.08			M	AA		29.82
18	0715	0	CLR	10.00		86	30.0	63	17.1	46	8.0	25	0	000		29.09			M	AA		29.83
18	0735	0	CLR	10.00		86	30.0	63	17.1	46	8.0	25	0	000		29.10			M	AA		29.84
18	0755	0	CLR	10.00		88	31.0	64	17.5	46	8.0	23	0	000		29.10			M	AA		29.84
18	0815	0	CLR	10.00		90	32.0	64	17.8	46	8.0	22	0	000		29.10			M	AA		29.84
18	0835	0	CLR	10.00		91	33.0	65	18.0	46	8.0	21	0	000		29.10			M	AA		29.84
18	0855	0	CLR	10.00		93	34.0	65	18.2	45	7.0	19	0	000		29.09			M	AA		29.83
18	0915	0	CLR	10.00		95	35.0	65	18.5	45	7.0	18	0	000		29.09			M	AA		29.83
18	0935	0	CLR	10.00		97	36.0	66	18.9	45	7.0	17	3	230		29.09			M	AA		29.83

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
18	0955	0	CLR	10.00		99	37.0	65	18.5	41	5.0	14	6	220		29.09			M	AA		29.83
18	1015	0	CLR	10.00		100	38.0	66	18.7	41	5.0	13	7	220		29.09			M	AA		29.83
18	1035	0	CLR	10.00		100	38.0	66	18.7	41	5.0	13	9	220		29.09			M	AA		29.83
18	1055	0	CLR	10.00		102	39.0	66	18.7	39	4.0	11	8	240		29.09			M	AA		29.83
18	1115	0	CLR	10.00		104	40.0	66	19.0	39	4.0	11	7	230		29.08			M	AA		29.82
18	1135	0	CLR	10.00		108	42.0	68	19.7	39	4.0	9	9	210		29.07			M	AA		29.81
18	1155	0	CLR	10.00		108	42.0	68	19.7	39	4.0	9	11	210		29.06			M	AA		29.80
18	1215	0	CLR	10.00		108	42.0	68	19.7	39	4.0	9	9	220		29.05			M	AA		29.79
18	1235	0	CLR	10.00		108	42.0	68	19.7	39	4.0	9	10	210		29.04			M	AA		29.78
18	1255	0	CLR	10.00		109	43.0	68	20.2	41	5.0	10	10	220	18	29.03			M	AA		29.77
18	1315	0	CLR	10.00		109	43.0	68	20.2	41	5.0	10	6	190		29.02			M	AA		29.76
18	1335	0	CLR	10.00		109	43.0	68	20.2	41	5.0	10	11	220	21	29.01			M	AA		29.75
18	1355	0	CLR	10.00		111	44.0	70	20.9	43	6.0	10	10	210	24	29.00			M	AA		29.74
18	1415	0	CLR	10.00		111	44.0	70	21.2	45	7.0	11	14	150	20	28.99			M	AA		29.73
18	1435	0	CLR	10.00		111	44.0	70	21.2	45	7.0	11	17	160	25	28.97			M	AA		29.71
18	1455	0	CLR	10.00		111	44.0	70	20.8	43	6.0	10	15	190	22	28.96			M	AA		29.70
18	1515	0	CLR	10.00		111	44.0	69	20.5	41	5.0	9	14	160		28.95			M	AA		29.69
18	1535	0	CLR	10.00		111	44.0	69	20.5	41	5.0	9	14	210	20	28.94			M	AA		29.68
18	1555	0	CLR	9.00		111	44.0	69	20.5	41	5.0	9	16	220	23	28.93			M	AA		29.67
18	1615	0	CLR	4.00	HZ	111	44.0	69	20.5	41	5.0	9	18	200	23	28.92			M	AA		29.66
18	1635	0	CLR	10.00		111	44.0	69	20.5	41	5.0	9	14	190		28.90			M	AA		29.64
18	1655	0	CLR	10.00		111	44.0	69	20.5	41	5.0	9	10	200	18	28.90			M	AA		29.64
18	1715	0	CLR	10.00		111	44.0	69	20.5	41	5.0	9	11	200	21	28.90			M	AA		29.64
18	1735	0	CLR	10.00		111	44.0	68	20.2	39	4.0	9	10	240	18	28.89			M	AA		29.63
18	1755	0	CLR	10.00		111	44.0	68	20.2	39	4.0	9	13	220	17	28.89			M	AA		29.63
18	1815	0	CLR	10.00		111	44.0	68	20.2	39	4.0	9	14	200	21	28.89			M	AA		29.63
18	1835	0	CLR	10.00		109	43.0	68	19.8	39	4.0	9	11	200		28.89			M	AA		29.63
18	1855	0	CLR	10.00		109	43.0	67	19.5	37	3.0	8	13	190		28.90			M	AA		29.64
18	1915	0	CLR	10.00		109	43.0	67	19.5	37	3.0	8	8	210		28.90			M	AA		29.64
18	1935	0	CLR	10.00		108	42.0	67	19.4	37	3.0	9	9	200		28.91			M	AA		29.65
18	1955	0	CLR	10.00		108	42.0	67	19.4	37	3.0	9	10	180		28.91			M	AA		29.65
18	2015	0	CLR	10.00		106	41.0	66	19.0	37	3.0	9	14	150		28.92			M	AA		29.66
18	2035	0	CLR	10.00		104	40.0	66	18.7	37	3.0	10	14	160		28.92			M	AA		29.66
18	2055	0	CLR	10.00		104	40.0	66	18.7	37	3.0	10	15	160		28.93			M	AA		29.67
18	2115	0	CLR	10.00		102	39.0	65	18.3	37	3.0	11	14	160		28.94			M	AA		29.68
18	2135	0	CLR	10.00		102	39.0	65	18.2	36	2.0	10	15	160		28.94			M	AA		29.68
18	2155	0	CLR	10.00		102	39.0	65	18.2	36	2.0	10	13	160		28.95			M	AA		29.69
18	2215	0	CLR	10.00		102	39.0	65	18.3	37	3.0	11	13	160		28.95			M	AA		29.69
18	2235	0	CLR	10.00		102	39.0	65	18.3	37	3.0	11	15	160		28.95			M	AA		29.69
18	2255	0	CLR	10.00		102	39.0	64	17.9	34	1.0	9	14	150		28.95			M	AA		29.69
18	2335	0	CLR	10.00		100	38.0	63	17.2	32	0.0	9	13	170		28.96			M	AA		29.70
18	2355	0	CLR	10.00		100	38.0	63	17.2	32	0.0	9	16	170		28.97			M	AA		29.71

Figure A-15. Quality controlled local climatological data hourly observations table for Laughlin/Bullhead International Airport (53135), Bullhead City, AZ (08/18/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
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QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
LAUGHLIN/BULLHEAD INTL AIRPORT (53135)
BULLHEAD CITY, AZ (08/19/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 695 ft. above sea level
Latitude: 35.157
Longitude: -114.559

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
19	0015	0	CLR	10.00		100	38.0	63	17.2	32	0.0	9	20	170	24	28.97			M	AA		29.71
19	0035	0	CLR	8.00		99	37.0	71	21.4	55	13.0	23	29	150	36	28.98			M	AA		29.72
19	0055	0	CLR	8.00		97	36.0	72	22.1	59	15.0	28	21	170	29	28.98			M	AA		29.72
19	0115	0	CLR	9.00		97	36.0	74	23.3	63	17.0	33	22	170	33	28.99			M	AA		29.73
19	0135	0	CLR	10.00		95	35.0	73	23.0	63	17.0	35	20	170	23	29.00			M	AA		29.74
19	0155	0	CLR	10.00		95	35.0	74	23.3	64	18.0	36	18	170	28	29.00			M	AA		29.74
19	0215	0	CLR	10.00		95	35.0	73	23.0	63	17.0	35	22	170	25	29.00			M	AA		29.74
19	0235	0	CLR	10.00		93	34.0	73	22.7	63	17.0	37	16	160	26	29.01			M	AA		29.75
19	0255	0	CLR	10.00		93	34.0	72	22.1	61	16.0	34	15	160	22	29.01			M	AA		29.75
19	0315	0	CLR	9.00		93	34.0	72	22.1	61	16.0	34	15	160	20	29.02			M	AA		29.76
19	0335	0	CLR	8.00		93	34.0	72	22.1	61	16.0	34	13	150		29.03			M	AA		29.77
19	0355	0	CLR	8.00		93	34.0	72	22.1	61	16.0	34	10	180	17	29.03			M	AA		29.77
19	0415	0	CLR	9.00		91	33.0	71	21.8	61	16.0	37	9	190		29.03			M	AA		29.77
19	0435	0	CLR	10.00		91	33.0	71	21.8	61	16.0	37	6	190		29.03			M	AA		29.77
19	0455	0	CLR	10.00		90	32.0	72	22.2	63	17.0	41	5	220		29.03			M	AA		29.77
19	0515	0	CLR	10.00		90	32.0	72	22.2	63	17.0	41	5	200		29.03			M	AA		29.77
19	0535	0	CLR	10.00		90	32.0	72	22.2	63	17.0	41	5	210		29.03			M	AA		29.77
19	0555	0	CLR	9.00		88	31.0	71	21.9	63	17.0	43	5	200		29.04			M	AA		29.78
19	0615	0	CLR	8.00		88	31.0	71	21.9	63	17.0	43	5	200		29.04			M	AA		29.78
19	0635	0	CLR	8.00		88	31.0	71	21.9	63	17.0	43	5	190		29.05			M	AA		29.79
19	0655	0	CLR	8.00		88	31.0	71	21.9	63	17.0	43	3	160		29.05			M	AA		29.79
19	0715	0	CLR	9.00		90	32.0	72	22.2	63	17.0	41	5	180		29.06			M	AA		29.80
19	0735	0	CLR	10.00		90	32.0	72	22.2	63	17.0	41	6	200		29.06			M	AA		29.80
19	0755	0	CLR	10.00		91	33.0	72	22.4	63	17.0	39	7	210		29.07			M	AA		29.81
19	0815	0	CLR	10.00		91	33.0	72	22.4	63	17.0	39	7	220		29.07			M	AA		29.81
19	0835	0	CLR	10.00		91	33.0	72	22.4	63	17.0	39	8	220		29.07			M	AA		29.81
19	0855	0	CLR	8.00		91	33.0	72	22.4	63	17.0	39	8	230		29.07			M	AA		29.81
19	0915	0	CLR	7.00		93	34.0	72	22.1	61	16.0	34	13	220	17	29.06			M	AA		29.80
19	0935	0	CLR	7.00		93	34.0	72	22.1	61	16.0	34	9	200		29.07			M	AA		29.81
19	0955	0	CLR	6.00	HZ	95	35.0	72	22.4	61	16.0	32	11	220		29.07			M	AA		29.81

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
19	1015	0	CLR	7.00		97	36.0	72	22.2	59	15.0	28	10	220		29.06			M	AA		29.80
19	1035	0	CLR	7.00		97	36.0	72	22.2	59	15.0	28	11	190	17	29.06			M	AA		29.80
19	1055	0	CLR	7.00		99	37.0	73	22.5	59	15.0	27	16	220		29.05			M	AA		29.79
19	1115	0	CLR	7.00		99	37.0	73	22.5	59	15.0	27	10	200	18	29.04			M	AA		29.78
19	1135	0	CLR	7.00		99	37.0	73	22.5	59	15.0	27	8	220	20	29.04			M	AA		29.78
19	1155	0	CLR	8.00		100	38.0	73	22.6	59	15.0	26	10	210	21	29.03			M	AA		29.77
19	1215	0	CLR	7.00		100	38.0	73	22.6	59	15.0	26	18	180	24	29.02			M	AA		29.76
19	1235	0	CLR	8.00		100	38.0	72	22.1	57	14.0	24	10	210		29.01			M	AA		29.75
19	1255	0	CLR	8.00		102	39.0	72	22.4	57	14.0	23	10	220	24	29.00			M	AA		29.74
19	1315	0	CLR	9.00		102	39.0	72	22.4	57	14.0	23	14	190	24	29.00			M	AA		29.74
19	1335	0	CLR	10.00		104	40.0	73	22.7	57	14.0	21	11	200	24	28.99			M	AA		29.73
19	1355	0	CLR	10.00		104	40.0	73	22.7	57	14.0	21	13	180	29	28.98			M	AA		29.72
19	1415	0	CLR	10.00		104	40.0	72	22.2	55	13.0	20	16	200	25	28.97			M	AA		29.71
19	1435	0	CLR	10.00		104	40.0	72	22.2	55	13.0	20	16	220	24	28.96			M	AA		29.70
19	1455	0	CLR	10.00		106	41.0	73	22.5	55	13.0	19	14	190		28.95			M	AA		29.69
19	1515	0	CLR	10.00		106	41.0	73	22.5	55	13.0	19	13	160	17	28.94			M	AA		29.68
19	1535	0	CLR	10.00		106	41.0	73	22.5	55	13.0	19	14	200	17	28.93			M	AA		29.67
19	1555	0	CLR	10.00		104	40.0	72	22.2	55	13.0	20	11	210	18	28.92			M	AA		29.66
19	1615	0	CLR	10.00		108	42.0	73	22.8	55	13.0	17	17	210	23	28.91			M	AA		29.65
19	1635	0	CLR	10.00		106	41.0	73	22.5	55	13.0	19	13	180	23	28.91			M	AA		29.65
19	1655	0	CLR	10.00		104	40.0	72	22.2	55	13.0	20	14	210	20	28.90			M	AA		29.64
19	1715	0	CLR	10.00		106	41.0	72	22.2	54	12.0	18	17	190	23	28.89			M	AA		29.63
19	1735	0	CLR	10.00		106	41.0	71	21.8	52	11.0	17	23	190	26	28.89			M	AA		29.63
19	1755	0	CLR	10.00		104	40.0	72	22.0	54	12.0	19	16	190	23	28.89			M	AA		29.63
19	1815	0	CLR	10.00		104	40.0	72	21.9	54	12.0	19	17	180	24	28.88			M	AA		29.62
19	1835	0	CLR	10.00		104	40.0	71	21.5	52	11.0	18	18	170	22	28.88			M	AA		29.62
19	1855	0	CLR	10.00		104	40.0	71	21.5	52	11.0	18	15	190	22	28.89			M	AA		29.63
19	1915	0	CLR	10.00		104	40.0	70	21.1	50	10.0	16	16	180	20	28.89			M	AA		29.63
19	1935	0	CLR	10.00		102	39.0	70	21.2	52	11.0	19	13	170		28.90			M	AA		29.64
19	1955	0	CLR	10.00		102	39.0	69	20.7	50	10.0	17	14	180		28.91			M	AA		29.65
19	2015	0	CLR	10.00		102	39.0	69	20.7	50	10.0	17	13	170		28.91			M	AA		29.65
19	2035	0	CLR	10.00		100	38.0	69	20.4	50	10.0	19	13	160		28.92			M	AA		29.66
19	2055	0	CLR	10.00		100	38.0	69	20.4	50	10.0	19	13	170		28.93			M	AA		29.67
19	2115	0	CLR	10.00		100	38.0	69	20.4	50	10.0	19	10	160		28.93			M	AA		29.67
19	2135	0	CLR	10.00		100	38.0	69	20.4	50	10.0	19	9	140		28.93			M	AA		29.67
19	2155	0	CLR	10.00		99	37.0	69	20.3	50	10.0	19	9	140		28.94			M	AA		29.68
19	2215	0	CLR	10.00		99	37.0	69	20.3	50	10.0	19	10	150		28.94			M	AA		29.68
19	2235	0	CLR	10.00		99	37.0	69	20.7	52	11.0	21	11	170		28.94			M	AA		29.68
19	2255	0	CLR	10.00		99	37.0	69	20.7	52	11.0	21	11	170		28.94			M	AA		29.68
19	2315	0	CLR	10.00		99	37.0	69	20.3	50	10.0	19	13	170		28.95			M	AA		29.69
19	2335	0	CLR	10.00		97	36.0	67	19.5	48	9.0	19	11	160		28.95			M	AA		29.69
19	2355	0	CLR	10.00		97	36.0	66	18.9	45	7.0	17	13	160		28.95			M	AA		29.69

Figure A-16. Quality controlled local climatological data hourly observations table for Laughlin/Bullhead International Airport (53135), Bullhead City, AZ (08/19/2011). Gusty south-southeasterly winds transported dust and PM_{10} into the Bullhead City area during the morning hours of August 19, 2011, causing several hours of reduced visibilities. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
KINGMAN AIRPORT (93167)
KINGMAN, AZ (08/18/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 3420 ft. above sea level
Latitude: 35.257
Longitude: -113.933

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18	0048	11	CLR	10.00		83	28.3	62	16.4	47	8.3	28	10	190		26.49			29.79	AA		30.04
18	0148	11	CLR	10.00		81	27.2	61	16.0	47	8.3	30	0	000		26.49			29.79	AA		30.04
18	0248	11	CLR	10.00		82	27.8	61	16.2	47	8.3	29	3	VR		26.48	7	001	29.78	AA		30.03
18	0348	11	CLR	10.00		80	26.7	61	15.8	47	8.3	31	0	000		26.48			29.78	AA		30.03
18	0448	11	CLR	10.00		75	23.9	59	14.8	47	8.3	37	7	130		26.48			29.79	AA		30.03
18	0548	11	CLR	10.00		73	22.8	58	14.4	47	8.3	40	7	140		26.48	5	002	29.80	AA		30.03
18	0648	11	CLR	10.00		80	26.7	61	16.1	48	8.9	33	10	130		26.49			29.80	AA		30.05
18	0748	11	CLR	10.00		88	31.1	64	17.8	49	9.4	26	14	120		26.50			29.81	AA		30.06
18	0848	11	CLR	10.00		91	32.8	64	17.6	46	7.8	21	5	240		26.50	3	008	29.82	AA		30.06
18	0948	11	CLR	10.00		96	35.6	64	17.9	43	6.1	16	8	250		26.50			29.81	AA		30.06
18	1048	11	CLR	10.00		99	37.2	64	18.0	41	5.0	14	16	240	28	26.50			29.80	AA		30.06
18	1148	11	CLR	10.00		99	37.2	65	18.6	44	6.7	15	25	220	32	26.49	0	000	29.79	AA		30.04
18	1248	11	CLR	10.00		101	38.3	66	19.1	45	7.2	15	25	210	32	26.47			29.77	AA		30.02
18	1348	11	CLR	10.00		102	38.9	66	18.9	43	6.1	13	17	230	29	26.45			29.75	AA		30.00
18	1448	11	CLR	10.00		101	38.3	66	18.9	44	6.7	14	17	200	28	26.42	8	017	29.72	AA		29.97
18	1548	11	CLR	10.00		100	37.8	66	18.7	44	6.7	15	11	200	25	26.39			29.69	AA		29.94
18	1648	11	CLR	10.00		99	37.2	65	18.3	43	6.1	15	22	210	26	26.38			29.68	AA		29.92
18	1748	11	CLR	10.00		99	37.2	65	18.3	43	6.1	15	11	230		26.37	6	023	29.67	AA		29.91
18	1848	11	CLR	10.00		96	35.6	64	17.6	42	5.6	15	14	210		26.38			29.68	AA		29.92
18	1948	11	CLR	10.00		92	33.3	62	16.7	41	5.0	17	10	200		26.39			29.69	AA		29.94
18	2048	11	CLR	10.00		86	30.0	60	15.4	40	4.4	20	9	170		26.40	3	004	29.70	AA		29.95
18	2148	11	CLR	10.00		87	30.6	61	15.8	41	5.0	20	10	190		26.41			29.71	AA		29.96
18	2248	11	CLR	10.00		87	30.6	60	15.4	39	3.9	18	13	200		26.40			29.70	AA		29.95
18	2348	11	CLR	10.00		86	30.0	58	14.6	36	2.2	17	14	190		26.41			29.71	AA		29.96

																	0	004				

Figure A-17. Quality controlled local climatological data hourly observations table for Kingman Airport (93167), Kingman, AZ (08/18/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
KINGMAN AIRPORT (93167)
KINGMAN, AZ (08/19/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 3420 ft. above sea level
Latitude: 35.257
Longitude: -113.933

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
19	0048	11	CLR	10.00		82	27.8	67	19.4	59	15.0	46	16	130	23	26.42			29.72	AA		29.97
19	0148	11	FEW038	10.00		80	26.7	68	19.7	61	16.1	52	14	120	25	26.43	1	009	29.73	AA		29.98
19	0248	11	CLR	10.00		79	26.1	67	19.2	60	15.6	52	11	090		26.43			29.73	AA		29.98
19	0348	11	CLR	10.00		79	26.1	67	19.2	60	15.6	52	14	100	23	26.44			29.74	AA		29.99
19	0448	11	CLR	10.00		78	25.6	66	18.7	59	15.0	52	9	120		26.43	0	001	29.74	AA		29.98
19	0548	11	CLR	10.00		77	25.0	65	18.3	58	14.4	52	7	130		26.43			29.74	AA		29.98
19	0648	11	CLR	10.00		74	23.3	63	17.1	56	13.3	54	3	140		26.45			29.77	AA		30.00
19	0748	11	CLR	10.00		80	26.7	66	18.8	58	14.4	47	0	000		26.46	3	007	29.77	AA		30.01
19	0848	11	CLR	10.00		85	29.4	66	19.1	56	13.3	37	5	240		26.46			29.77	AA		30.01
19	0948	11	CLR	10.00		88	31.1	68	19.9	57	13.9	35	5	VR		26.46			29.77	AA		30.01
19	1048	11	BKN038	9.00		89	31.7	68	20.0	57	13.9	34	8	230		26.46	8	001	29.77	AA		30.01
19	1148	11	FEW042	10.00		92	33.3	69	20.2	56	13.3	30	6	250	17	26.43			29.74	AA		29.98
19	1248	11	CLR	10.00		96	35.6	70	20.8	56	13.3	26	15	210	23	26.41			29.72	AA		29.96
19	1348	11	CLR	10.00		97	36.1	70	21.3	57	13.9	26	21	240	30	26.39	6	019	29.70	AA		29.94
19	1421	11	BKN085	10.00		93	34.0	70	21.2	59	15.0	32	24	120	28	26.39			M	SP		29.94
19	1426	11	BKN085	10.00		91	33.0	70	20.9	59	15.0	34	23	120	30	26.40			M	SP		29.95
19	1448	11	SCT080 SCT100	10.00		94	34.4	70	20.8	57	13.9	29	15	110		26.39			29.69	AA		29.93
19	1548	11	CLR	10.00		97	36.1	69	20.2	53	11.7	23	23	230	32	26.36			29.65	AA		29.90
19	1648	11	CLR	10.00		97	36.1	68	19.7	51	10.6	21	23	220		26.35	6	017	29.65	AA		29.89
19	1748	11	CLR	10.00		95	35.0	67	19.4	51	10.6	22	23	220	28	26.34			29.65	AA		29.88
19	1848	11	CLR	10.00		92	33.3	66	18.9	51	10.6	25	20	230		26.34			29.65	AA		29.88
19	1948	11	CLR	10.00		89	31.7	66	18.7	52	11.1	28	11	220		26.37	3	005	29.67	AA		29.91

19	2048	11	CLR	10.00		86	30.0	65	18.2	52	11.1	31	8	190		26.38			29.68	AA		29.92
19	2148	11	CLR	10.00		84	28.9	64	17.6	51	10.6	32	10	190		26.39			29.70	AA		29.94
19	2248	11	CLR	10.00		81	27.2	63	17.0	51	10.6	35	9	180		26.39	0	008	29.70	AA		29.93
19	2348	11	CLR	10.00		82	27.8	64	17.7	53	11.7	37	10	190		26.39			29.70	AA		29.94

Figure A-18. Quality controlled local climatological data hourly observations table for Kingman Airport (93167), Kingman, AZ (08/19/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
NEEDLES AIRPORT (23179)
NEEDLES, CA (08/18/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 890 ft. above sea level
Latitude: 34.767
Longitude: -114.618

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18	0056	12	CLR	10.00		98	36.7	61	16.1	27	-2.8	8	5	270		28.83	0	001	29.68	AA		29.80
18	0156	12	CLR	10.00		95	35.0	59	15.2	24	-4.4	8	7	220		28.83			29.68	AA		29.80
18	0256	12	CLR	10.00		91	32.8	59	15.1	30	-1.1	11	0	000		28.84			29.69	AA		29.81
18	0356	12	CLR	10.00		91	32.8	58	14.5	25	-3.9	9	5	250		28.84	3	002	29.69	AA		29.81
18	0456	12	CLR	10.00		89	31.7	58	14.2	26	-3.3	10	3	190		28.84			29.70	AA		29.82
18	0556	12	CLR	10.00		90	32.2	58	14.6	28	-2.2	11	7	300		28.87			29.72	AA		29.84
18	0656	12	CLR	10.00		95	35.0	63	17.2	38	3.3	14	0	000		28.87	3	013	29.73	AA		29.85
18	0756	12	CLR	10.00		97	36.1	64	17.7	39	3.9	13	5	110		28.87			29.73	AA		29.85
18	0856	12	CLR	10.00		102	38.9	65	18.5	38	3.3	11	3	090		28.87			29.73	AA		29.85
18	0956	12	CLR	10.00		106	41.1	67	19.2	38	3.3	10	0	000		28.87	8	002	29.72	AA		29.84
18	1056	12	CLR	10.00		107	41.7	68	20.0	42	5.6	11	0	000		28.84			29.70	AA		29.82
18	1156	12	CLR	10.00		112	44.4	69	20.6	41	5.0	9	15	210	24	28.83			29.67	AA		29.80
18	1256	12	CLR	10.00		114	45.6	69	20.7	39	3.9	8	17	170	23	28.79	8	027	29.63	AA		29.76
18	1322	12	CLR	10.00		113	45.0	68	20.2	37	3.0	7	7	220	21	28.78			M	SP		29.75
18	1356	12	FEW110	10.00		114	45.6	69	20.6	39	3.9	8	13	200	20	28.76			29.60	AA		29.73
18	1456	12	FEW110	10.00		113	45.0	69	20.6	40	4.4	8	11	180	23	28.73			29.58	AA		29.70
18	1539	12	FEW110	10.00		113	45.0	68	20.2	37	3.0	7	11	260		28.71			M	SP		29.68
18	1556	12	FEW110	10.00		113	45.0	68	20.2	37	2.8	7	18	240	24	28.70			29.55	AA		29.67
18	1656	12	FEW120	10.00		112	44.4	67	19.6	34	1.1	7	17	250	23	28.69			29.54	AA		29.66
18	1756	12	FEW110	10.00		110	43.3	66	19.0	32	0.0	7	15	250		28.70			29.55	AA		29.67
18	1856	12	CLR	10.00		107	41.7	66	18.6	33	0.6	8	13	230		28.72	3	006	29.57	AA		29.69
18	1956	12	CLR	10.00		105	40.6	64	18.0	31	-0.6	7	9	230		28.74			29.59	AA		29.71

18	2056	12	CLR	10.00		103	39.4	62	16.9	25	-3.9	6	13	230		28.75			29.60	AA		29.72
18	2156	12	CLR	10.00		99	37.2	61	16.1	25	-3.9	7	13	250		28.75	0	009	29.59	AA		29.72
18	2256	12	CLR	10.00		98	36.7	63	17.4	36	2.2	11	13	210		28.77			29.62	AA		29.74
18	2356	12	CLR	10.00		96	35.6	72	22.2	60	15.6	30	25	190	31	28.80			29.64	AA		29.77

Figure A-19. Quality controlled local climatological data hourly observations table for Needles Airport (23179), Needles, CA (08/18/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
NEEDLES AIRPORT (23179)
NEEDLES, CA (08/19/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 890 ft. above sea level
Latitude: 34.767
Longitude: -114.618

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
19	0056	12	CLR	10.00		94	34.4	72	22.2	61	16.1	33	10	180		28.80	1	018	29.65	AA		29.77
19	0156	12	OVC032	7.00		93	33.9	72	22.1	61	16.1	34	13	120	21	28.82			29.67	AA		29.79
19	0256	12	OVC034	10.00		92	33.3	72	21.9	61	16.1	36	9	150		28.82			29.67	AA		29.79
19	0356	12	FEW036	10.00		91	32.8	71	21.7	61	16.1	37	7	170		28.82	0	004	29.67	AA		29.79
19	0456	12	BKN040	10.00		89	31.7	70	21.1	60	15.6	38	0	000		28.82			29.67	AA		29.79
19	0556	12	OVC038	10.00		91	32.8	71	21.7	61	16.1	37	3	230		28.84			29.69	AA		29.81
19	0656	12	OVC032	10.00		93	33.9	72	22.1	61	16.1	34	5	090		28.84	3	012	29.71	AA		29.82
19	0756	12	OVC030	10.00		94	34.4	72	22.2	61	16.1	33	0	000		28.86			29.71	AA		29.83
19	0856	12	OVC030	10.00		98	36.7	72	22.0	58	14.4	26	6	160		28.86			29.70	AA		29.83
19	0956	12	OVC032	10.00		100	37.8	72	22.3	58	14.4	25	11	200	17	28.84	8	003	29.70	AA		29.82
19	1056	12	OVC032	10.00		102	38.9	73	22.6	58	14.4	23	7	VR		28.82			29.67	AA		29.79
19	1156	12	CLR	10.00		104	40.0	73	22.7	57	13.9	21	7	180		28.79			29.65	AA		29.76
19	1256	12	CLR	10.00		106	41.1	73	22.7	56	13.3	19	9	190		28.77	6	025	29.62	AA		29.74
19	1356	12	CLR	10.00		107	41.7	73	22.8	56	13.3	19	16	200	23	28.75			29.60	AA		29.72
19	1456	12	CLR	10.00		108	42.2	72	22.3	53	11.7	16	16	190	22	28.72			29.57	AA		29.69
19	1556	12	FEW110	10.00		107	41.7	72	21.9	52	11.1	16	11	220	23	28.70	6	022	29.55	AA		29.67
19	1656	12	CLR	10.00		106	41.1	71	21.5	51	10.6	16	15	220	20	28.69			29.54	AA		29.66
19	1756	12	CLR	10.00		104	40.0	70	21.0	50	10.0	16	15	200		28.69			29.54	AA		29.66
19	1856	12	CLR	10.00		103	39.4	70	20.9	50	10.0	17	9	190		28.71	3	003	29.57	AA		29.68
19	1956	12	CLR	10.00		102	38.9	70	20.9	51	10.6	18	10	210		28.73			29.58	AA		29.70
19	2056	12	CLR	10.00		99	37.2	69	20.5	51	10.6	20	8	200		28.74			29.59	AA		29.71
19	2156	12	CLR	10.00		97	36.1	68	19.9	50	10.0	20	0	000		28.75	1	012	29.60	AA		29.72

19	2256	12	CLR	10.00		94	34.4	62	16.8	37	2.8	14	6	230		28.75			29.61	AA		29.72
19	2356	12	CLR	10.00		94	34.4	61	15.9	31	-0.6	11	3	200		28.75			29.60	AA		29.72

Figure A-20. Quality controlled local climatological data hourly observations table for Needles Airport (23179), Needles, CA (08/19/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE GILA BEND AF AUX AIRPORT (03148) GILA BEND, AZ (08/18/2011)

Elevation: 846 ft. above sea level
Latitude: 32.883
Longitude: -112.716

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18	0655	0	CLR	10.00		90	32.0	70	21.0	59	15.0	35	2	110		28.94			29.79	AA		29.86
18	0755	0	CLR	10.00		95	35.0	72	22.4	61	16.0	32	2	160		28.95	2	014	29.80	AA		29.87
18	0855	0	CLR	10.00		100	38.0	73	22.6	59	15.0	26	3	VR		28.95			29.80	AA		29.87
18	0955	0	CLR	10.00		102	39.0	72	22.4	57	14.0	23	3	VR		28.96			29.80	AA		29.88
18	1055	0	CLR	10.00		106	41.0	73	23.0	57	14.0	20	6	VR		28.95	8	002	29.79	AA		29.87
18	1155	0	FEW140	10.00		108	42.0	72	22.1	52	11.0	16	5	VR		28.93			29.77	AA		29.85
18	1255	0	FEW140	10.00		109	43.0	73	22.7	54	12.0	16	10	220	15s	28.90			29.74	AA		29.82
18	1355	0	FEW170	10.00		111	44.0	74	23.2	55	13.0	16	3	VR		28.87	8	028	29.71	AA		29.79
18	1455	0	FEW160	10.00		113	45.0	74	23.5	55	13.0	15	7	VR		28.83			29.66	AA		29.74
18	1555	0	BKN080CB BKN150 BKN250	10.00		109	43.0	73	22.9	55	13.0	17	9	260	21	28.81			29.64	AA		29.72
18	1614	0	BKN080CB BKN150 BKN250	0.75	BLDU	99	37.0	73	23.0	61	16.0	29	36s	170	41	28.81			29.65	AA		29.72
18	1628	0	BKN080CB BKN150 BKN250	1.00	BLDU	95	35.0	75	23.8	66	19.0	39	30	170	45	28.82			29.67	AA		29.73
18	1655	0	BKN080CB BKN150 BKN250	7.00		95	35.0	75	23.8	66	19.0	39	25	170	34	28.84	5	009	29.68	AA		29.75
18	1755	0	BKN080CB BKN150 BKN250	4.00	BLDU	102	39.0	73	22.9	59	15.0	24	21	190	29	28.86			29.70	AA		29.77
18	1855	0	FEW080 FEW150 BKN250	7.00		100	38.0	71	21.6	55	13.0	22	21	190	25	28.87			29.71	AA		29.78
18	1955	0	BKN250	8.00		99	37.0	72	22.4	59	15.0	27	13	190		28.87	2	013	29.72	AA		29.79
18	2055	0	SCT130 BKN140	10.00		95	35.0	72	22.4	61	16.0	32	13	140		28.92			29.77	AA		29.84
18	2155	0	FEW130 BKN250	10.00		91	33.0	72	22.3	63	17.0	39	15	120		28.94			29.79	AA		29.86
18	2255	0	FEW130 BKN250	10.00		90	32.0	71	21.6	61	16.0	38	5	120		28.95	1	027	29.80	AA		29.87

Figure A-21. Quality controlled local climatological data hourly observations table for Gila Bend AF Auxiliary Airport (03148), Gila Bend, AZ (08/18/2011). Note in the Weather Type column that blowing dust (BLDU) was reported coincident with reduced visibilities and gusty winds during the afternoon hours. The strong winds were generated by thunderstorm outflow that was moving northwestward across Arizona and later affected the Bullhead City area after 12:00 a.m. on August 19, 2011. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
GILA BEND AF AUX AIRPORT (03148)
GILA BEND, AZ (08/19/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 846 ft. above sea level
Latitude: 32.883
Longitude: -112.716

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
19	0655	0	FEW250	10.00		91	33.0	70	21.2	59	15.0	34	2	110		28.92	2	011	29.78	AA		29.84
19	0755	0	FEW250	10.00		90	32.0	71	21.6	61	16.0	38	9	120		28.93			29.79	AA		29.85
19	0855	0	FEW250	10.00		93	34.0	72	22.1	61	16.0	34	9	110		28.94			29.80	AA		29.86
19	0955	0	SCT250	10.00		95	35.0	72	22.4	61	16.0	32	13	080		28.94	8	003	29.79	AA		29.86
19	1055	0	FEW160 FEW250	10.00		99	37.0	72	22.4	59	15.0	27	6	VR		28.93			29.78	AA		29.85
19	1155	0	FEW220	10.00		102	39.0	72	22.4	57	14.0	23	7	VR		28.91			29.76	AA		29.83
19	1255	0	FEW250	10.00		104	40.0	72	22.2	55	13.0	20	9	160		28.88	8	023	29.73	AA		29.80
19	1355	0	FEW080 FEW250	10.00		108	42.0	73	22.5	54	12.0	17	8	230	14s	28.86			29.70	AA		29.77
19	1455	0	FEW080 FEW250	10.00		108	42.0	72	22.1	52	11.0	16	11	180	14s	28.83			29.67	AA		29.74
19	1555	0	FEW080 FEW250	10.00		108	42.0	70	21.3	48	9.0	13	7	VR	17	28.80			29.64	AA		29.71

Figure A-22. Quality controlled local climatological data hourly observations table for Gila Bend AF Auxiliary Airport (03148), Gila Bend, AZ (08/19/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (may be updated)
HOURLY OBSERVATIONS TABLE
YUMA MCAS (03145), YUMA, AZ (08/18/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 213 ft. above sea level
Latitude: 32.65, Longitude: -114.616

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18	0055	5	CLR	10.00		92	33.3	75	24.1	68	20.0	45	6	150		29.54			29.75	AA		29.77
18	0155	5	CLR	10.00		92	33.3	74	23.5	66	18.9	42	6	150		29.53	8	006	29.75	AA		29.76
18	0255	5	CLR	10.00		90	32.2	73	22.8	65	18.3	44	0	000		29.53			29.75	AA		29.76
18	0355	5	CLR	10.00		91	32.8	73	23.0	65	18.3	42	0	000		29.53			29.75	AA		29.76
18	0455	5	CLR	10.00		89	31.7	73	22.7	65	18.3	45	5	240		29.54	3	003	29.75	AA		29.77
18	0555	5	CLR	10.00		89	31.7	73	22.7	65	18.3	45	3	220		29.55			29.77	AA		29.78
18	0655	5	FEW150	10.00		88	31.1	73	22.8	66	18.9	48	6	200		29.57			29.79	AA		29.80
18	0755	5	FEW150	10.00		91	32.8	75	23.6	67	19.4	45	8	180		29.58	1	016	29.80	AA		29.81
18	0855	5	FEW180	10.00		96	35.6	77	25.0	69	20.6	42	9	180		29.59			29.80	AA		29.82
18	0955	5	FEW200	10.00		98	36.7	76	24.7	67	19.4	36	8	190		29.60			29.82	AA		29.83
18	1055	5	FEW200	10.00		101	38.3	74	23.4	61	16.1	27	3	VR		29.59	0	001	29.80	AA		29.82
18	1155	5	FEW200	10.00		105	40.6	77	25.0	65	18.3	27	6	220		29.57			29.79	AA		29.80
18	1255	5	FEW200	10.00		108	42.2	78	25.7	66	18.9	26	9	200		29.55			29.76	AA		29.78
18	1355	5	FEW100	10.00		109	42.8	76	24.5	61	16.1	21	6	150		29.52	8	023	29.73	AA		29.75
18	1455	5	SCT080	10.00		112	44.4	76	24.4	59	15.0	18	13	180		29.48			29.70	AA		29.71
18	1555	5	SCT080 SCT120	10.00		111	43.9	75	24.0	58	14.4	18	14	180	17	29.44			29.66	AA		29.67
18	1655	5	CLR	10.00		111	43.9	76	24.5	60	15.6	19	14	190	20	29.42	6	032	29.64	AA		29.65
18	1736	5	BKN001	1.50	DU	106	41.0	77	24.9	64	18.0	26	30	160		29.43			M	SP		29.66
18	1755	5	BKN001	1.50	DU	104	40.0	76	24.6	64	17.8	27	26	150	37	29.44			29.65	AA		29.67
18	1829	5	SCT001	3.00	DU	100	38.0	75	24.0	64	18.0	31	25	170	36	29.45			M	SP		29.68
18	1855	5	SCT001	5.00	DU	99	37.2	77	24.8	67	19.4	35	25	170	31	29.46			29.68	AA		29.69
18	1955	5	CLR	10.00	DU	96	35.6	77	25.0	69	20.6	42	21	170		29.47	1	016	29.69	AA		29.70
18	2055	5	CLR	10.00	DU	93	33.9	77	25.2	71	21.7	49	20	160	28	29.50			29.71	AA		29.73
18	2155	5	CLR	10.00	DU	91	32.8	77	24.9	71	21.7	52	17	160		29.51			29.73	AA		29.74
18	2255	5	CLR	10.00	DU	90	32.2	75	24.1	69	20.6	50	15	140		29.52			29.74	AA		29.75

18	2355	5	CLR	10.00	DU	90	32.2	75	23.8	68	20.0	48	10	140		29.53	1	017	29.74	AA		29.76

Figure A-23. Quality controlled local climatological data hourly observations table for Yuma MCAS (03145), Yuma, AZ (08/18/2011). Note in the Weather Type column that dust (DU) was reported coincident with reduced visibilities and gusty winds during the evening hours. The strong winds were generated by thunderstorm outflow that was moving northwestward across Arizona and later affected the Bullhead City area after 12:00 a.m. on August 19, 2011. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (may be updated)
HOURLY OBSERVATIONS TABLE
YUMA MCAS (03145)
YUMA, AZ (08/19/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 213 ft. above sea level
Latitude: 32.65
Longitude: -114.616

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
19	0055	5	CLR	10.00		90	32.2	73	22.8	65	18.3	44	9	130		29.52			29.74	AA		29.75
19	0155	5	CLR	10.00		92	33.3	71	21.7	60	15.6	34	15	130		29.51	8	005	29.72	AA		29.74
19	0255	5	CLR	10.00		91	32.8	72	22.4	63	17.2	39	20	150		29.50			29.72	AA		29.73
19	0355	5	CLR	10.00		88	31.1	76	24.1	70	21.1	55	16	140		29.50			29.72	AA		29.73
19	0455	5	CLR	10.00		87	30.6	75	24.0	70	21.1	57	15	140	21	29.50	7	002	29.72	AA		29.73
19	0555	5	CLR	10.00		87	30.6	75	23.7	69	20.6	55	11	140		29.51			29.72	AA		29.74
19	0655	5	CLR	10.00		88	31.1	74	23.5	68	20.0	52	15	140		29.53			29.75	AA		29.76
19	0755	5	CLR	10.00		90	32.2	75	23.8	68	20.0	48	17	140		29.54	3	015	29.76	AA		29.77
19	0855	5	FEW200	10.00		92	33.3	75	23.8	67	19.4	44	14	160		29.55			29.77	AA		29.78
19	0955	5	FEW200	10.00		95	35.0	75	23.9	66	18.9	39	14	160		29.55			29.76	AA		29.78
19	1055	5	FEW200	10.00		98	36.7	74	23.2	62	16.7	31	8	170	20	29.54	8	000	29.76	AA		29.77
19	1155	5	FEW200	10.00		101	38.3	74	23.4	61	16.1	27	13	190	18	29.53			29.75	AA		29.76
19	1255	5	FEW200	10.00		103	39.4	73	22.6	57	13.9	22	8	180	17	29.51			29.72	AA		29.74
19	1355	5	FEW200	10.00		104	40.0	73	22.8	57	13.9	21	8	200		29.48	8	020	29.70	AA		29.71
19	1455	5	FEW200	10.00		105	40.6	72	22.2	54	12.2	18	8	220		29.46			29.67	AA		29.69
19	1555	5	CLR	10.00		107	41.7	71	21.8	51	10.6	15	9	200		29.43			29.65	AA		29.66
19	1655	5	CLR	10.00		106	41.1	70	21.3	49	9.4	15	9	210		29.42	6	022	29.64	AA		29.65
19	1755	5	CLR	10.00		105	40.6	71	21.7	52	11.1	17	13	150		29.41			29.62	AA		29.64
19	1855	5	CLR	10.00		101	38.3	72	22.1	56	13.3	22	15	160		29.41			29.63	AA		29.64

19	1955	5	CLR	10.00		97	36.1	72	21.9	58	14.4	27	14	160		29.43	3	005	29.65	AA		29.66
19	2055	5	CLR	10.00		94	34.4	71	21.7	59	15.0	31	15	150		29.46			29.68	AA		29.69
19	2155	5	CLR	10.00		92	33.3	68	20.1	54	12.2	28	16	150		29.47			29.69	AA		29.70
19	2255	5	CLR	10.00		90	32.2	68	19.8	54	12.2	29	13	160		29.48	1	014	29.69	AA		29.71
19	2355	5	CLR	10.00		89	31.7	68	20.1	56	13.3	33	14	150		29.48			29.70	AA		29.71

Figure A-24. Quality controlled local climatological data hourly observations table for Yuma MCAS (03145), Yuma, AZ (08/19/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE BLYTHE AIRPORT (23158) BLYTHE, CA (08/18/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 395 ft. above sea level
Latitude: 33.618
Longitude: -114.714

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
18	0052	12	CLR	10.00		94	34.4	68	20.2	53	11.7	25	6	240		29.35	8	003	29.74	AA		29.77
18	0152	12	CLR	10.00		89	31.7	65	18.1	48	8.9	24	0	000		29.35			29.74	AA		29.77
18	0252	12	CLR	10.00		86	30.0	63	17.3	47	8.3	26	3	040		29.35			29.74	AA		29.77
18	0352	12	CLR	10.00		86	30.0	60	15.5	38	3.3	18	3	350		29.35	3	001	29.75	AA		29.77
18	0452	12	CLR	10.00		84	28.9	59	15.1	38	3.3	19	0	000		29.36			29.76	AA		29.78
18	0552	12	CLR	10.00		86	30.0	66	18.8	53	11.7	32	0	000		29.37			29.77	AA		29.79
18	0652	12	CLR	10.00		91	32.8	72	22.4	63	17.2	39	0	000		29.39	3	013	29.78	AA		29.81
18	0752	12	CLR	10.00		95	35.0	74	23.0	63	17.2	35	5	170		29.39			29.78	AA		29.81
18	0852	12	CLR	10.00		102	38.9	71	21.7	54	12.2	20	10	170		29.40			29.79	AA		29.82
18	0952	12	CLR	10.00		106	41.1	70	20.9	47	8.3	14	9	140		29.39	8	000	29.78	AA		29.81
18	1052	12	CLR	10.00		109	42.8	69	20.6	43	6.1	11	11	170		29.37			29.76	AA		29.79
18	1152	12	CLR	10.00		111	43.9	69	20.4	40	4.4	9	13	170	17	29.35			29.74	AA		29.77
18	1252	12	CLR	10.00		113	45.0	69	20.6	39	3.9	8	13	230	26	29.32	8	022	29.72	AA		29.74
18	1352	12	CLR	10.00		113	45.0	70	21.1	42	5.6	9	16	190	25	29.29			29.68	AA		29.71
18	1452	12	CLR	10.00		113	45.0	71	21.4	44	6.7	10	11	200	22	29.26			29.65	AA		29.68
18	1552	12	CLR	10.00		113	45.0	70	20.9	41	5.0	9	17	250		29.23	6	032	29.62	AA		29.65
18	1652	12	CLR	10.00		112	44.4	69	20.3	38	3.3	8	16	250		29.22			29.62	AA		29.64
18	1752	12	CLR	10.00		110	43.3	67	19.5	35	1.7	8	15	240		29.24			29.64	AA		29.66
18	1852	12	CLR	10.00		106	41.1	66	19.0	36	2.2	9	9	210		29.26	3	012	29.66	AA		29.68
18	1913	12	BKN033	5.00	HZ	100	38.0	76	24.6	66	19.0s	33	21	200		29.27			M	SP		29.69

18	1927	12	OVC029	6.00	HZ	100	38.0	76	24.6	66	19.0	33	15	200		29.27			M	SP		29.69
18	1952	12	OVC029	6.00	HZ	100	37.8	77	24.9	67	19.4	34	20	210		29.29			29.68	AA		29.71
18	2003	12	OVC033	7.00		100	38.0	76	24.6	66	19.0	33	22	210	29	29.30			M	SP		29.72
18	2052	12	SCT045	10.00		96	35.6	76	24.3	67	19.4	39	15	180		29.32			29.71	AA		29.74
18	2152	12	CLR	10.00		94	34.4	75	24.1	67	19.4	41	11	180		29.32	1	020	29.72	AA		29.74
18	2252	12	CLR	10.00		92	33.3	75	23.8	67	19.4	44	13	170		29.34			29.73	AA		29.76
18	2352	12	CLR	10.00		92	33.3	73	22.8	64	17.8	40	11	190		29.34			29.74	AA		29.76

Figure A-25. Quality controlled local climatological data hourly observations table for Blythe Airport (23158), Blythe, CA (08/18/2011). Note in the Weather Type column that haze (HZ) was reported coincident with reduced visibilities and gusty winds during the evening hours. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
BLYTHE AIRPORT (23158)
BLYTHE, CA (08/19/2011)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 395 ft. above sea level
Latitude: 33.618
Longitude: -114.714

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
19	0052	12	CLR	10.00		91	32.8	73	22.7	64	17.8	41	7	160		29.34	0	005	29.73	AA		29.76
19	0152	12	CLR	10.00		90	32.2	72	22.2	63	17.2	41	5	180		29.33			29.72	AA		29.75
19	0252	12	CLR	10.00		89	31.7	72	22.1	63	17.2	42	0	000		29.33			29.72	AA		29.75
19	0352	12	CLR	10.00		86	30.0	71	21.6	63	17.2	46	3	010		29.33	6	004	29.72	AA		29.75
19	0452	12	CLR	10.00		86	30.0	70	21.3	62	16.7	45	0	000		29.33			29.72	AA		29.75
19	0552	12	CLR	10.00		88	31.1	72	21.9	63	17.2	43	0	000		29.35			29.74	AA		29.77
19	0652	12	CLR	10.00		91	32.8	72	22.1	62	16.7	38	6	190		29.37	3	013	29.76	AA		29.79
19	0752	12	CLR	10.00		93	33.9	72	22.4	62	16.7	36	8	170		29.37			29.77	AA		29.79
19	0852	12	CLR	10.00		94	34.4	73	22.6	62	16.7	35	3	190		29.37			29.77	AA		29.79
19	0952	12	CLR	10.00		97	36.1	74	23.0	62	16.7	31	7	170		29.37	0	000	29.76	AA		29.79
19	1052	12	CLR	10.00		99	37.2	74	23.3	62	16.7	30	6	VR		29.35			29.74	AA		29.77
19	1152	12	CLR	10.00		103	39.4	74	23.4	60	15.6	24	7	180	18	29.32			29.72	AA		29.74
19	1252	12	CLR	10.00		105	40.6	74	23.1	58	14.4	21	15	200	21	29.30	8	024	29.69	AA		29.72
19	1352	12	CLR	10.00		107	41.7	74	23.2	57	13.9	19	16	210	23	29.27			29.66	AA		29.69
19	1452	12	CLR	10.00		107	41.7	73	22.5	54	12.2	17	10	190		29.24			29.63	AA		29.66
19	1552	12	CLR	10.00		107	41.7	73	22.7	55	12.8	18	13	180		29.22	6	024	29.62	AA		29.64
19	1652	12	CLR	10.00		106	41.1	74	23.0	57	13.9	20	14	170		29.21			29.60	AA		29.63

19	1752	12	CLR	10.00		103	39.4	72	22.3	56	13.3	21	10	170		29.21			29.60	AA		29.63
19	1852	12	CLR	10.00		100	37.8	71	21.6	55	12.8	22	9	180		29.23	3	002	29.62	AA		29.65
19	1952	12	CLR	10.00		100	37.8	69	20.3	49	9.4	18	8	240		29.25			29.65	AA		29.67
19	2052	12	CLR	10.00		96	35.6	70	21.3	56	13.3	26	15	190		29.27			29.67	AA		29.69
19	2152	12	CLR	10.00		93	33.9	71	21.6	59	15.0	32	15	190		29.28	1	018	29.68	AA		29.70
19	2252	12	CLR	10.00		91	32.8	70	21.2	59	15.0	34	6	170		29.30			29.70	AA		29.72
19	2352	12	CLR	10.00		89	31.7	68	19.8	55	12.8	32	11	180		29.29			29.69	AA		29.71

Figure A-26. Quality controlled local climatological data hourly observations table for Blythe Airport (23158), Blythe, CA (08/19/2011). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

Appendix B:
ADEQ and NWS Forecast Products

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
338 PM MST FRI AUG 19 2011
THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
  CENTRAL YAVAPAI COUNTY IN WEST CENTRAL ARIZONA...
  THIS INCLUDES THE CITY OF CHINO VALLEY...
* UNTIL 415 PM MST
* AT 331 PM MST...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED A
  SEVERE THUNDERSTORM CAPABLE OF PRODUCING QUARTER SIZE HAIL...AND
  DAMAGING WINDS IN EXCESS OF 60 MPH. THIS STORM WAS LOCATED NEAR
  CHINO VALLEY...AND MOVING SOUTHEAST AT 5 MPH.
* THE SEVERE THUNDERSTORM WILL BE NEAR...
  CHINO VALLEY BY 410 PM MST...
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IN ADDITION TO LARGE HAIL AND DAMAGING WINDS...FREQUENT CLOUD TO
GROUND LIGHTNING IS OCCURRING WITH THIS STORM. MOVE INDOORS
IMMEDIATELY! LIGHTNING IS ONE OF NATURES NUMBER ONE KILLERS.
REMEMBER...IF YOU CAN HEAR THUNDER...YOU ARE CLOSE ENOUGH TO BE
STRUCK BY LIGHTNING.
&&
LAT...LON 3483 11238 3471 11246 3479 11260 3488 11253
TIME...MOT...LOC 2238Z 317DEG 3KT 3478 11249
$$
KD

SEVERE WEATHER STATEMENT
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
400 PM MST FRI AUG 19 2011
AZC025-192315-
/O.CON.KFGZ.SV.W.0023.000000T0000Z-110819T2315Z/
YAVAPAI AZ-
400 PM MST FRI AUG 19 2011
...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 415 PM MST
FOR CENTRAL YAVAPAI COUNTY...
AT 354 PM MST...NATIONAL WEATHER SERVICE DOPPLER RADAR CONTINUED TO
INDICATE A SEVERE THUNDERSTORM CAPABLE OF PRODUCING QUARTER SIZE
HAIL...AND DAMAGING WINDS IN EXCESS OF 60 MPH. THIS STORM WAS
LOCATED NEAR CHINO VALLEY...MOVING SOUTHEAST AT 5 MPH.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IN ADDITION TO LARGE HAIL AND DAMAGING WINDS...CONTINUOUS CLOUD TO
GROUND LIGHTNING IS OCCURRING WITH THIS STORM. MOVE INDOORS
IMMEDIATELY! LIGHTNING IS ONE OF NATURES NUMBER ONE KILLERS.
REMEMBER...IF YOU CAN HEAR THUNDER...YOU ARE CLOSE ENOUGH TO BE
STRUCK BY LIGHTNING.
&&
KD

SEVERE WEATHER STATEMENT
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
415 PM MST FRI AUG 19 2011
AZC025-192325-
/O.EXP.KFGZ.SV.W.0023.000000T0000Z-110819T2315Z/
YAVAPAI AZ-
415 PM MST FRI AUG 19 2011
...THE SEVERE THUNDERSTORM WARNING FOR CENTRAL YAVAPAI COUNTY HAS EXPIRED...
THE SEVERE THUNDERSTORM NEAR CHINO VALLEY WHICH PROMPTED THE WARNING HAS WEAKENED. HOWEVER THE STORM IS STILL PRODUCING SMALL HAIL TO DIME-SIZE AND HEAVY RAIN. AN URBAN AND SMALL STREAM FLOOD ADVISORY IS ALSO IN EFFECT FOR THE CHINO VALLEY AREA UNTIL 545 PM MST.
LAT...LON 3483 11238 3471 11246 3479 11260 3488 11253
TIME...MOT...LOC 2315Z 317DEG 3KT 3476 11246
$$

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
1135 AM MST THU AUG 18 2011
AZZ013-016-181845-
NAVAJO AZ-
1135 AM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS ISSUED A SIGNIFICANT WEATHER ADVISORY FOR...
SOUTH CENTRAL NAVAJO COUNTY IN NORTHEAST ARIZONA
AT 1129 AM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED AN AREA OF STRONG THUNDERSTORMS 8 MILES NORTH OF HEBER. THESE STORMS WERE MOVING EAST AT 5 MPH.
HAIL UP TO THE SIZE OF PENNIES IS EXPECTED WITH THESE STORMS.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IF YOU ARE IN THE ADVISORY AREA AND STORMS APPROACH...TAKE SHELTER IN A STURDY BUILDING.
IN ADDITION...VERY HEAVY RAINFALL MAY CAUSE TEMPORARY PONDING ON SOME ROADS AND MINOR FLOODING OF POOR DRAINAGE AREAS. IN HEAVY RAINFALL SLOW DOWN TO REDUCE THE RISK OF HYDROPLANING...AND LEAVE A SAFE DISTANCE BETWEEN YOURSELF AND OTHER VEHICLES.
&&

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
116 PM MST FRI AUG 19 2011
AZZ012-015-192030-
COCONINO AZ-
116 PM MST FRI AUG 19 2011
THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS ISSUED A SIGNIFICANT WEATHER ADVISORY FOR...
SOUTH CENTRAL COCONINO COUNTY IN NORTH CENTRAL ARIZONA
UNTIL 130 PM MST
AT 110 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A STRONG THUNDERSTORM NEAR AND JUST SOUTH OF TWIN ARROWS...MOVING SOUTHEAST AT 5 MPH.
HAIL UP TO THE SIZE OF PENNIES AND WIND GUSTS UP TO 40 MPH ARE EXPECTED WITH THIS STORM.
LOCATIONS IMPACTED INCLUDE...
MILEPOST 225 ON I-40...

PRECAUTIONARY/PREPAREDNESS ACTIONS...
VERY HEAVY RAINFALL MAY CAUSE TEMPORARY PONDING ON SOME ROADS. IN HEAVY RAINFALL SLOW DOWN TO REDUCE THE RISK OF HYDROPLANING...AND LEAVE A SAFE DISTANCE BETWEEN YOURSELF AND OTHER VEHICLES.
&&

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE FLAGSTAFF AZ
253 PM MST FRI AUG 19 2011
AZZ007-008-192200-
YAVAPAI AZ-COCONINO AZ-
253 PM MST FRI AUG 19 2011
THE NATIONAL WEATHER SERVICE IN FLAGSTAFF HAS ISSUED A
SIGNIFICANT WEATHER ADVISORY FOR...
WEST CENTRAL COCONINO COUNTY IN NORTH CENTRAL ARIZONA
EXTREME NORTHWESTERN YAVAPAI COUNTY IN WEST CENTRAL ARIZONA
UNTIL 300 PM MST
AT 249 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A STRONG THUNDERSTORM 8 MILES NORTHWEST OF SELIGMAN...REMAINING NEARLY STATIONARY. EXPECT WIND GUSTS APPROACHING 40 TO 50 MPH WITH THIS STORM.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
SOME UNSECURED OBJECTS WILL BE BLOWN AROUND...TREE LIMBS COULD BE SNAPPED OFF...AND ISOLATED POWER OUTAGES WILL BE POSSIBLE. SEEK SHELTER INDOORS UNTIL THE STORM PASSES.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
212 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
SOUTH CENTRAL GILA COUNTY IN EAST CENTRAL ARIZONA...
* UNTIL 300 PM MST
* AT 207 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING DAMAGING WINDS IN EXCESS OF 60 MPH. THIS STORM WAS LOCATED NEAR PERIDOT AND SAN CARLOS...OR 18 MILES EAST OF GLOBE...WITH LITTLE MOVEMENT.
* THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL AREAS OF THE INDICATED COUNTY.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IF YOU ARE IN THE WARNING AREA...GO INSIDE A STURDY BUILDING.
REMEMBER...A SEVERE THUNDERSTORM WILL PRODUCE DAMAGING WINDS AND DEADLY LIGHTNING.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
436 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
WEST CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA...
* UNTIL 500 PM MST
* AT 430 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING DAMAGING WINDS IN EXCESS

OF 60 MPH. IN ADDITION...DENSE BLOWING DUST MAY ACCOMPANY THIS
SEVERE STORM. THIS STORM WAS LOCATED OVER WEST CENTRAL PINAL
COUNTY...OR 11 MILES SOUTHWEST OF CASA GRANDE...AND MOVING EAST AT
10 MPH.
* THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL
AREAS OF THE INDICATED COUNTY.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THIS IS A DANGEROUS STORM. IF YOU ARE IN ITS PATH...PREPARE
IMMEDIATELY FOR DAMAGING WINDS AND DEADLY CLOUD TO GROUND LIGHTNING.
MOVE TO SHELTER INSIDE A STRONG BUILDING. STAY AWAY FROM WINDOWS.
IF YOU ARE IN A MOBILE HOME...EVACUATE IMMEDIATELY AND GET INSIDE A
STURDY BUILDING. IF YOU CANNOT QUICKLY WALK OR DRIVE TO SHELTER...LIE
FLAT IN THE NEAREST DITCH OR OTHER LOW SPOT AND COVER YOUR HEAD WITH
YOUR HANDS.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
454 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
EAST CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA...
CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA...
* UNTIL 545 PM MST
* AT 446 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED
SEVERE THUNDERSTORMS CAPABLE OF PRODUCING DAMAGING WINDS IN
EXCESS OF 60 MPH. IN ADDITION...DENSE BLOWING DUST MAY ACCOMPANY
THESE STORMS. THESE STORMS WERE LOCATED 14 MILES EAST OF
MAGMA...OR 6 MILES SOUTHEAST OF FLORENCE JUNCTION...AND WERE NEAR
STATIONARY.
* OTHER LOCATIONS IN THE WARNING INCLUDE BUT ARE NOT LIMITED TO
SANTAN AND SACATON
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THIS IS A DANGEROUS STORM. IF YOU ARE IN ITS PATH...PREPARE
IMMEDIATELY FOR DAMAGING WINDS AND DEADLY CLOUD TO GROUND LIGHTNING.
MOVE TO SHELTER INSIDE A STRONG BUILDING. STAY AWAY FROM WINDOWS.
&&

SEVERE WEATHER STATEMENT
NATIONAL WEATHER SERVICE PHOENIX AZ
520 PM MST THU AUG 18 2011
AZC013-021-190045-
/O.CON.KPSR.SV.W.0032.000000T0000Z-110819T0045Z/
PINAL AZ-MARICOPA AZ-
520 PM MST THU AUG 18 2011
...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 545 PM MST
FOR EAST CENTRAL MARICOPA AND CENTRAL PINAL COUNTIES...
AT 510 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED TWO
SEVERE THUNDERSTORMS IN THE WARNED AREA. SEVERE THUNDERSTORMS WERE
LOCATED SOUTHEAST OF SUN LAKES AND SOUTHEAST OF SAN TAN VALLEY. BOTH
STORMS WERE NEAR STATIONARY AND WERE PRODUCING STRONG OUTFLOW FINDS
IN EXCESS OF 60 MPH. OUTFLOW BOUNDARIES FROM THESE STORMS ARE ALSO
GENERATING AREAS OF BLOWING DUST.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THESE ARE DANGEROUS STORMS. INDIVIDUALS IN THE VICINITY SHOULD TAKE
COVE INDOORS.

REPORT SEVERE WEATHER TO THE NEAREST LAW ENFORCEMENT AGENCY. THEY
WILL RELAY YOUR REPORT TO THE NATIONAL WEATHER SERVICE FORECAST
OFFICE.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
612 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
  CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA...
  THIS INCLUDES THE CITIES OF...YOUNGTOWN...SURPRISE...SUN CITY
  WEST...SUN CITY...PEORIA...EL MIRAGE...
* UNTIL 700 PM MST
* AT 606 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED
  SEVERE THUNDERSTORMS CAPABLE OF PRODUCING DAMAGING WINDS IN
  EXCESS OF 60 MPH. THESE STORMS WERE LOCATED NEAR PEORIA...AND
  MOVING SOUTHEAST AT 5 MPH.
* THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL
  AREAS OF THE INDICATED COUNTY.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THESE ARE DANGEROUS STORMS. SEEK SHELTER NOW INSIDE A STURDY
STRUCTURE AND STAY AWAY FROM WINDOWS!
IF YOU ENCOUNTER DENSE BLOWING DUST WHILE DRIVING...PULL OVER AS FAR
OFF THE ROADWAY AS POSSIBLE AND PARK. TURN OFF YOUR HEADLIGHTS AND
KEEP YOUR FOOT OFF THE BRAKE.
&&

SEVERE WEATHER STATEMENT
NATIONAL WEATHER SERVICE PHOENIX AZ
640 PM MST THU AUG 18 2011
AZC013-190200-
/O.CON.KPSR.SV.W.0033.000000T0000Z-110819T0200Z/
MARICOPA AZ-
640 PM MST THU AUG 18 2011
...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 700 PM MST
FOR CENTRAL MARICOPA COUNTY...
AT 634 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS CONTINUED TO
DETECT SEVERE THUNDERSTORMS CAPABLE OF PRODUCING DAMAGING WINDS IN
EXCESS OF 60 MPH. THESE STORMS WERE LOCATED NEAR PEORIA AND WERE
NEAR STATIONARY.
THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL AREAS
OF THE INDICATED COUNTY.
THE STORMS HAVE WEAKENED...BURT WILL LIKELY REINTENSIFY AS THEY
INTERSECT AN OUTFLOW BOUNDARY APPROACHING FROM THE EAST.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IF YOU ARE IN THE WARNING AREA...GO INSIDE A STURDY BUILDING.
REMEMBER...A SEVERE THUNDERSTORM WILL PRODUCE DAMAGING WINDS AND
DEADLY LIGHTNING
REPORT SEVERE WEATHER TO THE NEAREST LAW ENFORCEMENT AGENCY. THEY
WILL RELAY YOUR REPORT TO THE NATIONAL WEATHER SERVICE FORECAST
OFFICE.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ

212 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
SOUTH CENTRAL GILA COUNTY IN EAST CENTRAL ARIZONA...
* UNTIL 300 PM MST
* AT 207 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A
SEVERE THUNDERSTORM CAPABLE OF PRODUCING DAMAGING WINDS IN
EXCESS OF 60 MPH. THIS STORM WAS LOCATED NEAR PERIDOT AND SAN
CARLOS...OR 18 MILES EAST OF GLOBE...WITH LITTLE MOVEMENT.
* THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL
AREAS OF THE INDICATED COUNTY.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
IF YOU ARE IN THE WARNING AREA...GO INSIDE A STURDY BUILDING.
REMEMBER...A SEVERE THUNDERSTORM WILL PRODUCE DAMAGING WINDS AND
DEADLY LIGHTNING.

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
421 PM MST THU AUG 18 2011
AZZ028-190100-
/O.NEW.KPSR.DS.W.0013.110818T2321Z-110819T0100Z/
/O.CON.KPSR.EH.W.0007.000000T0000Z-110819T0300Z/
NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...APACHE JUNCTION...CASA GRANDE...
FLORENCE
421 PM MST THU AUG 18 2011
...DUST STORM WARNING IN EFFECT UNTIL 6 PM MST THIS EVENING...
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A DUST STORM
WARNING...WHICH IS IN EFFECT UNTIL 6 PM MST THIS EVENING. AN
EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING.
* AFFECTED AREA: NORTHWEST PINAL COUNTY.
* LOCATIONS INCLUDE: APACHE JUNCTION...CASA GRANDE...FLORENCE...AND
COOLIDGE
* VISIBILITY: LESS THAN ONE QUARTER MILE DUE TO BLOWING DUST.
* IMPACTS: SUDDEN REDUCTION IN VISIBILITY CAN BE EXTREMELY HAZARDOUS
TO MOTORISTS. EXERCISE EXTREME CAUTION WHEN DRIVING. EXCESSIVELY
HOT TEMPERATURES CAN BE STRESSFUL FOR THE BODY. EXTREMELY WARM LOW
TEMPERATURES DO NOT ALLOW THE BODY TO COOL DOWN PROPERLY
OVERNIGHT...AND CAN MAKE EXTREME HEAT EVENMORE DANGEROUS DURING THE
DAYTIME HOURS.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE
AREAS OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY
REDUCED VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN
HAZARDOUS DRIVING CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN
DROP IN VISIBILITY TO NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN
WHILE DRIVING...AS OBJECTS ON AND NEAR ROADWAYS WILL BE SEEN ONLY
AT CLOSE RANGE. IF YOU ENCOUNTER BLOWING DUST OR BLOWING SAND ON
THE ROADWAY OR SEE IT APPROACHING...PULL OFF THE ROAD AS FAR AS
POSSIBLE AND PUT YOUR VEHICLE IN PARK. TURN THE LIGHTS ALL THE
WAY OFF AND KEEP YOUR FOOT OFF THE BRAKE PEDAL.
TAKE EXTRA PRECAUTIONS IF YOU WORK OR SPEND TIME OUTSIDE. WHEN

POSSIBLE...RESCHEDULE STRENUOUS ACTIVITIES TO EARLY MORNING OR
EVENING. KNOW THE SIGNS AND SYMPTOMS OF HEAT EXHAUSTION AND HEAT
STROKE. WEAR LIGHT WEIGHT AND LOOSE FITTING CLOTHING WHEN POSSIBLE
AND DRINK PLENTY OF WATER. IF YOU WEAR A WIDE-BRIMMED HAT...YOUR HEAD
AND BODY WILL BE MUCH COOLER. TO REDUCE RISK DURING OUTDOOR
WORK...THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION RECOMMENDS
SCHEDULING FREQUENT REST BREAKS IN SHADED OR AIR CONDITIONED
ENVIRONMENTS. ANYONE OVERCOME BY HEAT SHOULD BE MOVED TO A COOL AND
SHADED LOCATION. HEAT STROKE IS AN EMERGENCY...CALL 9 1 1.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
436 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
  WEST CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA...
* UNTIL 500 PM MST
* AT 430 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A
  SEVERE THUNDERSTORM CAPABLE OF PRODUCING DAMAGING WINDS IN EXCESS
  OF 60 MPH. IN ADDITION...DENSE BLOWING DUST MAY ACCOMPANY THIS
  SEVERE STORM. THIS STORM WAS LOCATED OVER WEST CENTRAL PINAL
  COUNTY...OR 11 MILES SOUTHWEST OF CASA GRANDE...AND MOVING EAST AT
  10 MPH.
* THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL
  AREAS OF THE INDICATED COUNTY.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THIS IS A DANGEROUS STORM. IF YOU ARE IN ITS PATH...PREPARE
IMMEDIATELY FOR DAMAGING WINDS AND DEADLY CLOUD TO GROUND LIGHTNING.
MOVE TO SHELTER INSIDE A STRONG BUILDING. STAY AWAY FROM WINDOWS.
IF YOU ARE IN A MOBILE HOME...EVACUATE IMMEDIATELY AND GET INSIDE A
STURDY BUILDING. IF YOU CANNOT QUICKLY WALK OR DRIVE TO SHELTER...LIE
FLAT IN THE NEAREST DITCH OR OTHER LOW SPOT AND COVER YOUR HEAD WITH
YOUR HANDS.
&&

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
444 PM MST THU AUG 18 2011
AZZ023-027-190100-
/O.EXA.KPSR.DS.W.0013.000000T0000Z-110819T0100Z/
/O.CON.KPSR.EH.W.0007.000000T0000Z-110819T0300Z/
GREATER PHOENIX AREA-SOUTHWEST MARICOPA COUNTY-
INCLUDING THE CITIES OF...BUCKEYE...MESA...PHOENIX...GILA BEND
444 PM MST THU AUG 18 2011
...**DUST STORM WARNING** IN EFFECT UNTIL 6 PM MST THIS EVENING...
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A DUST STORM
WARNING...WHICH IS IN EFFECT UNTIL 6 PM MST THIS EVENING. AN
EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING.
* AFFECTED AREA: SOUTHWEST AND CENTRAL MARICOPA COUNTY.
* LOCATIONS INCLUDE: GILA BEND...BUCKEYE...MESA...PHOENIX
* VISIBILITY: LESS THAN ONE QUARTER MILE DUE TO BLOWING DUST.
* IMPACTS: SUDDEN REDUCTION IN VISIBILITY DUE TO BLOWING DUST CAN BE

VERY HAZARDOUS...ESPECIALLY TO MOTORISTS. EXCESSIVELY HOT
TEMPERATURES CAN BE STRESSFUL TO HUMANS AND ANIMALS.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE
AREAS OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY
REDUCED VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN
HAZARDOUS DRIVING CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN
DROP IN VISIBILITY TO NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN
WHILE DRIVING...AS OBJECTS ON AND NEAR ROADWAYS WILL BE SEEN ONLY
AT CLOSE RANGE. IF YOU ENCOUNTER BLOWING DUST OR BLOWING SAND ON
THE ROADWAY OR SEE IT APPROACHING...PULL OFF THE ROAD AS FAR AS
POSSIBLE AND PUT YOUR VEHICLE IN PARK. TURN THE LIGHTS ALL THE
WAY OFF AND KEEP YOUR FOOT OFF THE BRAKE PEDAL.
TAKE EXTRA PRECAUTIONS IF YOU WORK OR SPEND TIME OUTSIDE. WHEN
POSSIBLE...RESCHEDULE STRENUOUS ACTIVITIES TO EARLY MORNING OR
EVENING. KNOW THE SIGNS AND SYMPTOMS OF HEAT EXHAUSTION AND HEAT
STROKE. WEAR LIGHT WEIGHT AND LOOSE FITTING CLOTHING WHEN POSSIBLE
AND DRINK PLENTY OF WATER. IF YOU WEAR A WIDE-BRIMMED HAT...YOUR HEAD
AND BODY WILL BE MUCH COOLER. TO REDUCE RISK DURING OUTDOOR
WORK...THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION RECOMMENDS
SCHEDULING FREQUENT REST BREAKS IN SHADED OR AIR CONDITIONED
ENVIRONMENTS. ANYONE OVERCOME BY HEAT SHOULD BE MOVED TO A COOL AND
SHADED LOCATION. HEAT STROKE IS AN EMERGENCY...CALL 9 1 1.
&&

NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...APACHE JUNCTION...CASA GRANDE...
FLORENCE
444 PM MST THU AUG 18 2011
...**DUST STORM WARNING** REMAINS IN EFFECT UNTIL 6 PM MST THIS
EVENING...
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING...
A DUST STORM WARNING REMAINS IN EFFECT UNTIL 6 PM MST THIS
EVENING. AN EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM
MST THIS EVENING.
* AFFECTED AREA: NORTHWEST PINAL COUNTY.
* LOCATIONS INCLUDE: APACHE JUNCTION...CASA GRANDE...FLORENCE
* VISIBILITY: LESS THAN ONE QUARTER MILE DUE TO BLOWING DUST.
* IMPACTS: SUDDEN REDUCTION IN VISIBILITY CAN BE EXTREMELY HAZARDOUS
TO MOTORISTS. EXERCISE EXTREME CAUTION WHEN DRIVING. EXCESSIVELY
HOT TEMPERATURES CAN BE STRESSFUL TO HUMANS AND ANIMALS.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE
AREAS OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY
REDUCED VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN
HAZARDOUS DRIVING CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN
DROP IN VISIBILITY TO NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN
WHILE DRIVING...AS OBJECTS ON AND NEAR ROADWAYS WILL BE SEEN ONLY
AT CLOSE RANGE. IF YOU ENCOUNTER BLOWING DUST OR BLOWING SAND ON
THE ROADWAY OR SEE IT APPROACHING...PULL OFF THE ROAD AS FAR AS
POSSIBLE AND PUT YOUR VEHICLE IN PARK. TURN THE LIGHTS ALL THE
WAY OFF AND KEEP YOUR FOOT OFF THE BRAKE PEDAL.
TAKE EXTRA PRECAUTIONS IF YOU WORK OR SPEND TIME OUTSIDE. WHEN
POSSIBLE...RESCHEDULE STRENUOUS ACTIVITIES TO EARLY MORNING OR
EVENING. KNOW THE SIGNS AND SYMPTOMS OF HEAT EXHAUSTION AND HEAT

STROKE. WEAR LIGHT WEIGHT AND LOOSE FITTING CLOTHING WHEN
POSSIBLE AND DRINK PLENTY OF WATER. IF YOU WEAR A WIDE-BRIMMED
HAT...YOUR HEAD AND BODY WILL BE MUCH COOLER. TO REDUCE RISK
DURING OUTDOOR WORK...THE OCCUPATIONAL SAFETY AND HEALTH
ADMINISTRATION RECOMMENDS SCHEDULING FREQUENT REST BREAKS IN
SHADED OR AIR CONDITIONED ENVIRONMENTS. ANYONE OVERCOME BY HEAT
SHOULD BE MOVED TO A COOL AND SHADED LOCATION. HEAT STROKE IS AN
EMERGENCY...CALL 9 1 1.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
454 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
  EAST CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA...
  CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA...
* UNTIL 545 PM MST
* AT 446 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED
  SEVERE THUNDERSTORMS CAPABLE OF PRODUCING DAMAGING WINDS IN
  EXCESS OF 60 MPH. IN ADDITION...DENSE BLOWING DUST MAY ACCOMPANY
  THESE STORMS. THESE STORMS WERE LOCATED 14 MILES EAST OF
  MAGMA...OR 6 MILES SOUTHEAST OF FLORENCE JUNCTION...AND WERE NEAR
  STATIONARY.
* OTHER LOCATIONS IN THE WARNING INCLUDE BUT ARE NOT LIMITED TO
  SANTAN AND SACATON
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THIS IS A DANGEROUS STORM. IF YOU ARE IN ITS PATH...PREPARE
IMMEDIATELY FOR DAMAGING WINDS AND DEADLY CLOUD TO GROUND LIGHTNING.
MOVE TO SHELTER INSIDE A STRONG BUILDING. STAY AWAY FROM WINDOWS.
&&

URGENT - WEATHER MESSAGE...UPDATED
NATIONAL WEATHER SERVICE PHOENIX AZ
544 PM MST THU AUG 18 2011
AZZ023-027-028-190145-
/O.EXP.KPSR.DS.W.0013.000000T0000Z-110819T0100Z/
/O.CON.KPSR.EH.W.0007.000000T0000Z-110819T0300Z/
GREATER PHOENIX AREA-SOUTHWEST MARICOPA COUNTY-
NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...BUCKEYE...MESA...PHOENIX...GILA BEND...
APACHE JUNCTION...CASA GRANDE...FLORENCE
544 PM MST THU AUG 18 2011
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING...
...**DUST STORM WARNING** REMAINS IN EFFECT UNTIL 6 PM MST THIS
EVENING...
A DUST STORM WARNING REMAINS IN EFFECT UNTIL 6 PM MST THIS EVENING. AN
EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS EVENING.
* AT 540 PM...THE LEADING EDGE OF GUSTY SOUTH TO SOUTHEAST WINDS 25
  TO 40 MPH HAD REACHED THE SOUTHEAST VALLEY. A DUST STORM...WITH
  VISIBILITY LESS THAN ONE QUARTER MILE AT TIMES...ACCOMPANIED THE
  GUSTY WINDS. THE GUST FRONT AND AREAS OF DENSE BLOWING DUST WILL
  PUSH TOWARD THE NORTH AND WEST...AND AFFECT MUCH OF THE CENTRAL AND
  SOUTHEAST PORTION OF THE GREATER PHOENIX METROPOLITAN AREA BY 6 PM.
* AFFECTED AREA: SOUTHWEST AND CENTRAL MARICOPA COUNTY.

* LOCATIONS INCLUDE:
  MESA...CHANDLER...PHOENIX...GILBERT...TEMPE...QUEEN CREEK...SCOTTSDALE
* VISIBILITY: LESS THAN ONE QUARTER MILE DUE TO BLOWING DUST.
* IMPACTS: SUDDEN REDUCTION IN VISIBILITY DUE TO BLOWING DUST
  CAN BE VERY HAZARDOUS...ESPECIALLY TO MOTORISTS. EXCESSIVELY
  HOT TEMPERATURES CAN BE STRESSFUL TO HUMANS AND ANIMALS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...
A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE
AREAS OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY
REDUCED VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN
HAZARDOUS DRIVING CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN
DROP IN VISIBILITY TO NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN
WHILE DRIVING...AS OBJECTS ON AND NEAR ROADWAYS WILL BE SEEN ONLY
AT CLOSE RANGE. IF YOU ENCOUNTER BLOWING DUST OR BLOWING SAND ON
THE ROADWAY OR SEE IT APPROACHING...PULL OFF THE ROAD AS FAR AS
POSSIBLE AND PUT YOUR VEHICLE IN PARK. TURN THE LIGHTS ALL THE
WAY OFF AND KEEP YOUR FOOT OFF THE BRAKE PEDAL.
WITH REGARD TO THE HEAT...TAKE EXTRA PRECAUTIONS IF YOU WORK OR
SPEND TIME OUTSIDE. WHEN POSSIBLE...RESCHEDULE STRENUOUS ACTIVITIES
TO EARLY MORNING OR EVENING. KNOW THE SIGNS AND SYMPTOMS OF HEAT
EXHAUSTION AND HEAT STROKE. WEAR LIGHT WEIGHT AND LOOSE FITTING
CLOTHING WHEN POSSIBLE AND DRINK PLENTY OF WATER. IF YOU WEAR A WIDE-
BRIMMED HAT...YOUR HEAD AND BODY WILL BE MUCH COOLER. TO REDUCE RISK
DURING OUTDOOR WORK...THE OCCUPATIONAL SAFETY AND HEALTH
ADMINISTRATION RECOMMENDS SCHEDULING FREQUENT REST BREAKS IN SHADED
OR AIR CONDITIONED ENVIRONMENTS. ANYONE OVERCOME BY HEAT SHOULD BE
MOVED TO A COOL AND SHADED LOCATION. HEAT STROKE IS AN
EMERGENCY...CALL 9 1 1.
&&

GREATER PHOENIX AREA-
INCLUDING THE CITIES OF...BUCKEYE...MESA...PHOENIX
600 PM MST THU AUG 18 2011
...**DUST STORM WARNING** NOW IN EFFECT UNTIL 8 PM MST THIS
EVENING...
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST THIS
EVENING...
THE DUST STORM WARNING IS NOW IN EFFECT UNTIL 8 PM MST THIS
EVENING. AN EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM
MST THIS EVENING.
* AT 555PM...THE LEADING EDGE OF GUSTY SOUTH TO SOUTHEAST WINDS 25 TO
  35 MPH HAD REACHED THE SOUTHEAST VALLEY...AND EXTENDED FROM SKY
  HARBOR AIRPORT TO DOWNTOWN SCOTTSDALE. A DUST STORM...WITH
  VISIBILITY LESS THAN ONE QUARTER MILE AT TIMES...ACCOMPANIED THE
  GUSTY WINDS. THE GUST FRONT AND AREAS OF DENSE BLOWING DUST WILL
  PUSH TOWARD THE NORTH AND WEST...AND AFFECT MUCH OF THE GREATER
  PHOENIX METROPOLITAN AREA BETWEEN 6 PM AND 8 PM. WIND SHOULD SLOWLY
  DECREASE WITH TIME...AND VISIBILITY WILL SLOWLY IMPROVE.
* AFFECTED AREA: SOUTHWEST AND CENTRAL MARICOPA COUNTY.
* LOCATIONS INCLUDE: MESA...CHANDLER...PHOENIX...GILBERT...
  TEMPE...QUEEN CREEK...SCOTTSDALE...PARADISE VALLEY
* VISIBILITY: LESS THAN ONE QUARTER MILE DUE TO BLOWING DUST.
* IMPACTS: SUDDEN REDUCTION IN VISIBILITY DUE TO BLOWING DUST
  CAN BE VERY HAZARDOUS...ESPECIALLY TO MOTORISTS. EXCESSIVELY
  HOT TEMPERATURES CAN BE STRESSFUL TO HUMANS AND ANIMALS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...
A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE AREAS OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY REDUCED VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN HAZARDOUS DRIVING CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN DROP IN VISIBILITY TO NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN WHILE DRIVING...AS OBJECTS ON AND NEAR ROADWAYS WILL BE SEEN ONLY AT CLOSE RANGE. IF YOU ENCOUNTER BLOWING DUST OR BLOWING SAND ON THE ROADWAY OR SEE IT APPROACHING...PULL OFF THE ROAD AS FAR AS POSSIBLE AND PUT YOUR VEHICLE IN PARK. TURN THE LIGHTS ALL THE WAY OFF AND KEEP YOUR FOOT OFF THE BRAKE PEDAL.
WITH REGARD TO THE HEAT...TAKE EXTRA PRECAUTIONS IF YOU WORK OR SPEND TIME OUTSIDE. WHEN POSSIBLE...RESCHEDULE STRENUOUS ACTIVITIES TO EARLY MORNING OR EVENING. KNOW THE SIGNS AND SYMPTOMS OF HEAT EXHAUSTION AND HEAT STROKE. WEAR LIGHT WEIGHT AND LOOSE FITTING CLOTHING WHEN POSSIBLE AND DRINK PLENTY OF WATER. IF YOU WEAR A WIDE- BRIMMED HAT...YOUR HEAD AND BODY WILL BE MUCH COOLER. TO REDUCE RISK DURING OUTDOOR WORK...THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION RECOMMENDS SCHEDULING FREQUENT REST BREAKS IN SHADED OR AIR CONDITIONED ENVIRONMENTS. ANYONE OVERCOME BY HEAT SHOULD BE MOVED TO A COOL AND SHADED LOCATION. HEAT STROKE IS AN EMERGENCY...CALL 9 1 1.
&&

SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE PHOENIX AZ
612 PM MST THU AUG 18 2011
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
* SEVERE THUNDERSTORM WARNING FOR...
  CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA...
  THIS INCLUDES THE CITIES OF...YOUNGTOWN...SURPRISE...SUN CITY WEST...SUN CITY...PEORIA...EL MIRAGE...
* UNTIL 700 PM MST
* AT 606 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED SEVERE THUNDERSTORMS CAPABLE OF PRODUCING DAMAGING WINDS IN EXCESS OF 60 MPH. THESE STORMS WERE LOCATED NEAR PEORIA...AND MOVING SOUTHEAST AT 5 MPH.
* THE SEVERE THUNDERSTORM WILL OTHERWISE REMAIN OVER MAINLY RURAL AREAS OF THE INDICATED COUNTY.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
THESE ARE DANGEROUS STORMS. SEEK SHELTER NOW INSIDE A STURDY STRUCTURE AND STAY AWAY FROM WINDOWS!
IF YOU ENCOUNTER DENSE BLOWING DUST WHILE DRIVING...PULL OVER AS FAR OFF THE ROADWAY AS POSSIBLE AND PARK. TURN OFF YOUR HEADLIGHTS AND KEEP YOUR FOOT OFF THE BRAKE.
&&

GREATER PHOENIX AREA-
INCLUDING THE CITIES OF...MESA...PHOENIX...SCOTTSDALE...PEORIA
|
719 PM MST THU AUG 18 2011
...**DUST STORM WARNING** REMAINS IN EFFECT UNTIL 8 PM MST THIS EVENING...
...EXCESSIVE HEAT WARNING IS CANCELLED...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS CANCELLED THE EXCESSIVE HEAT WARNING. A DUST STORM WARNING REMAINS IN EFFECT

UNTIL 8 PM MST THIS EVENING...MAINLY FOR THE NORTH AND WEST PORTION
OF THE GREATER PHOENIX AREA.
* AT 715PM...THE LEADING EDGE OF GUSTY SOUTH TO SOUTHEAST WINDS 25 TO
40 MPH HAD REACHED THE NORTH VALLEY. BETWEEN 630 AND 650 PM...DEER
VALLEY AIRPORT REPORTED A PEAK GUST OF 44 MPH...WHILE SCOTTSDALE
AIRPORT REPORTED A PEAK GUST OF 40 MPH. A DUST STORM..WITH
VISIBILITY OCCASIONALLY LESS THAN ONE QUARTER MILE...ACCOMPANIED
THE LEADING EDGE OF THE GUSTY WINDS. THE GUST FRONT WILL PUSH WEST
ACROSS MUCH OF THE WEST VALLEY...WITH LOCALIZED AREAS OF DENSE
BLOWING DUST POSSIBLE. VISIBILITY HAS IMPROVED OVER CENTRAL AND
SOUTHEAST PORTIONS OF THE GREATER PHOENIX AREA...THOUGH DUSTY
CONDITIONS PERSIST.
* AFFECTED AREA: CENTRAL AND NORTH-CENTRAL MARICOPA COUNTY.
* LOCATIONS INCLUDE: MESA...CHANDLER...PHOENIX...GILBERT...
TEMPE...QUEEN CREEK...SCOTTSDALE...PARADISE VALLEY
* VISIBILITY: OCCASIONALLY LESS THAN ONE QUARTER MILE DUE TO BLOWING
DUST...WITH WIDESPREAD VISIBILITY LESS THAN 2 MILES.
* IMPACTS: SUDDEN REDUCTION IN VISIBILITY DUE TO BLOWING DUST CAN BE
VERY HAZARDOUS...ESPECIALLY TO MOTORISTS.
PRECAUTIONARY/PREPAREDNESS ACTIONS...
A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE AREAS
OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY REDUCED
VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN HAZARDOUS DRIVING
CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN DROP IN VISIBILITY TO
NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN WHILE DRIVING...AS OBJECTS
ON AND NEAR ROADWAYS WILL BE SEEN ONLY AT CLOSE RANGE. IF YOU
ENCOUNTER BLOWING DUST OR BLOWING SAND ON THE ROADWAY OR SEE IT
APPROACHING...PULL OFF THE ROAD AS FAR AS POSSIBLE AND PUT YOUR
VEHICLE IN PARK. TURN THE LIGHTS ALL THE WAY OFF AND KEEP YOUR FOOT
OFF THE BRAKE PEDAL.
&&

AIRPORT WEATHER WARNING FOR SKY HARBOR AIRPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
553 PM MST THU AUG 18 2011
...AIRPORT WEATHER WARNING FOR SKY HARBOR AIRPORT IN EFFECT UNTIL
745 PM MST...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED AN AIRPORT WEATHER
WARNING FOR SKY HARBOR AIRPORT FOR STRONG GUSTY WINDS.
THUNDERSTORM WIND GUSTS BETWEEN 36 AND 40 KNOTS FROM THE SOUTHEAST.
VISIBILITY 1/4 MILE IN BLOWING DUST AT TIMES.
$$

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE PHOENIX AZ
918 PM MST FRI AUG 19 2011
AZZ023-028-200445-
PINAL AZ-MARICOPA AZ-
918 PM MST FRI AUG 19 2011
...SIGNIFICANT WEATHER ADVISORY...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
SIGNIFICANT WEATHER ADVISORY FOR...
CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA
WEST CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA
UNTIL 945 PM MST
AT 914 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A

STRONG THUNDERSTORM BETWEEN BAPCHULE AND SUN LAKES...MOVING EAST AT
10 MPH.
WIND GUSTS UP TO 40 MPH ARE EXPECTED WITH THIS STORM...ALONG WITH
HEAVY RAIN.
LOCATIONS IMPACTED INCLUDE...
BAPCHULE AND SUN LAKES...
OLBERG...
IF THIS STORM INTENSIFIES...A WARNING MAY BE NEEDED. STAY TUNED TO
NOAA WEATHER RADIO...LOCAL RADIO OR TV FOR THE LATEST UPDATES.
SOME UNSECURED OBJECTS COULD BE BLOWN AROUND. SEEK SHELTER INDOORS
UNTIL THE STORM PASSES.
BLOWING DUST IS POSSIBLE. IF YOU ENCOUNTER BLOWING DUST WHILE
DRIVING...PULL OVER AS FAR OFF THE ROADWAY AS POSSIBLE AND PARK.
TURN OFF YOUR HEADLIGHTS AND KEEP YOUR FOOT OFF THE BRAKE.
LAT...LON 3328 11169 3303 11170 3307 11201 3325 11200
TIME...MOT...LOC 0417Z 272DEG 7KT 3316 11190
$$

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE PHOENIX AZ
943 PM MST FRI AUG 19 2011
AZZ023-028-200515-
PINAL AZ-MARICOPA AZ-
943 PM MST FRI AUG 19 2011
...SIGNIFICANT WEATHER ADVISORY...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
SIGNIFICANT WEATHER ADVISORY FOR...
CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA
CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA
UNTIL 1015 PM MST
AT 940 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A
CLUSTER OF STRONG THUNDERSTORMS FROM NEAR FIREBIRD LAKE...TO 3 MILES
NORTHEAST OF BAPCHULE...MOVING EAST AT 15 MPH.
WIND GUSTS UP TO 50 MPH ARE EXPECTED WITH THIS STORM. WINDS WILL
SPREAD EAST OF THE STORM...AND AFFECT THE SOUTHEAST VALLEY WELL
BEFORE THE RAIN ARRIVES.
LOCATIONS IMPACTED INCLUDE...
GILBERT...
CHANDLER HEIGHTS...
QUEEN CREEK AND SAN TAN VALLEY...
IF THIS STORM INTENSIFIES...A WARNING MAY BE NEEDED. STAY TUNED TO
NOAA WEATHER RADIO...LOCAL RADIO OR TV FOR THE LATEST UPDATES.
SOME UNSECURED OBJECTS WILL BE BLOWN AROUND...TREE LIMBS COULD BE
SNAPPED OFF...AND ISOLATED POWER OUTAGES WILL BE POSSIBLE. SEEK
SHELTER INDOORS UNTIL THE STORM PASSES.
LOCALLY DENSE BLOWING DUST IS POSSIBLE. IF YOU ENCOUNTER BLOWING DUST
WHILE DRIVING...PULL OVER AS FAR OFF THE ROADWAY AS POSSIBLE AND
PARK. TURN OFF YOUR HEADLIGHTS AND KEEP YOUR FOOT OFF THE BRAKE.
VERY HEAVY RAINFALL MAY CAUSE TEMPORARY PONDING ON SOME ROADS AND
MINOR FLOODING OF POOR DRAINAGE AREAS.

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE PHOENIX AZ
1016 PM MST FRI AUG 19 2011
AZZ023-028-200600-
PINAL AZ-MARICOPA AZ-

1016 PM MST FRI AUG 19 2011
...SIGNIFICANT WEATHER ADVISORY...
THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A
SIGNIFICANT WEATHER ADVISORY FOR...
  EAST CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA
  CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA
UNTIL 1100 PM MST
AT 1010 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A
CLUSTER OF STRONG THUNDERSTORMS FROM 8 MILES EAST OF BAPCHULA...TO
NEAR SAN TAN VALLEY...MOVING EAST AT 10 MPH.
WIND GUSTS UP TO 50 MPH ARE EXPECTED WITH THIS STORM. WINDS WILL
SPREAD AHEAD OF THE STORMS...AND WILL MOVE THROUGH WELL BEFORE THE
RAIN BEGINS.
LOCATIONS IMPACTED INCLUDE...
   SAN TAN VALLEY...
   MAGMA...
IF THIS STORM INTENSIFIES...A WARNING MAY BE NEEDED. STAY TUNED TO
NOAA WEATHER RADIO...LOCAL RADIO OR TV FOR THE LATEST UPDATES.
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VERY HEAVY RAINFALL MAY CAUSE TEMPORARY PONDING ON SOME ROADS AND
MINOR FLOODING OF POOR DRAINAGE AREAS.