

# **Local Service Assessment: 18-23 January 2010 Arizona Winter Storms**

**U.S. Department of Commerce  
National Oceanic and Atmospheric Administration**

**National Weather Service**

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Weather Forecast Office Tucson, AZ  
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Colorado Basin River Forecast Center, Salt Lake City, UT**



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## I. Introduction

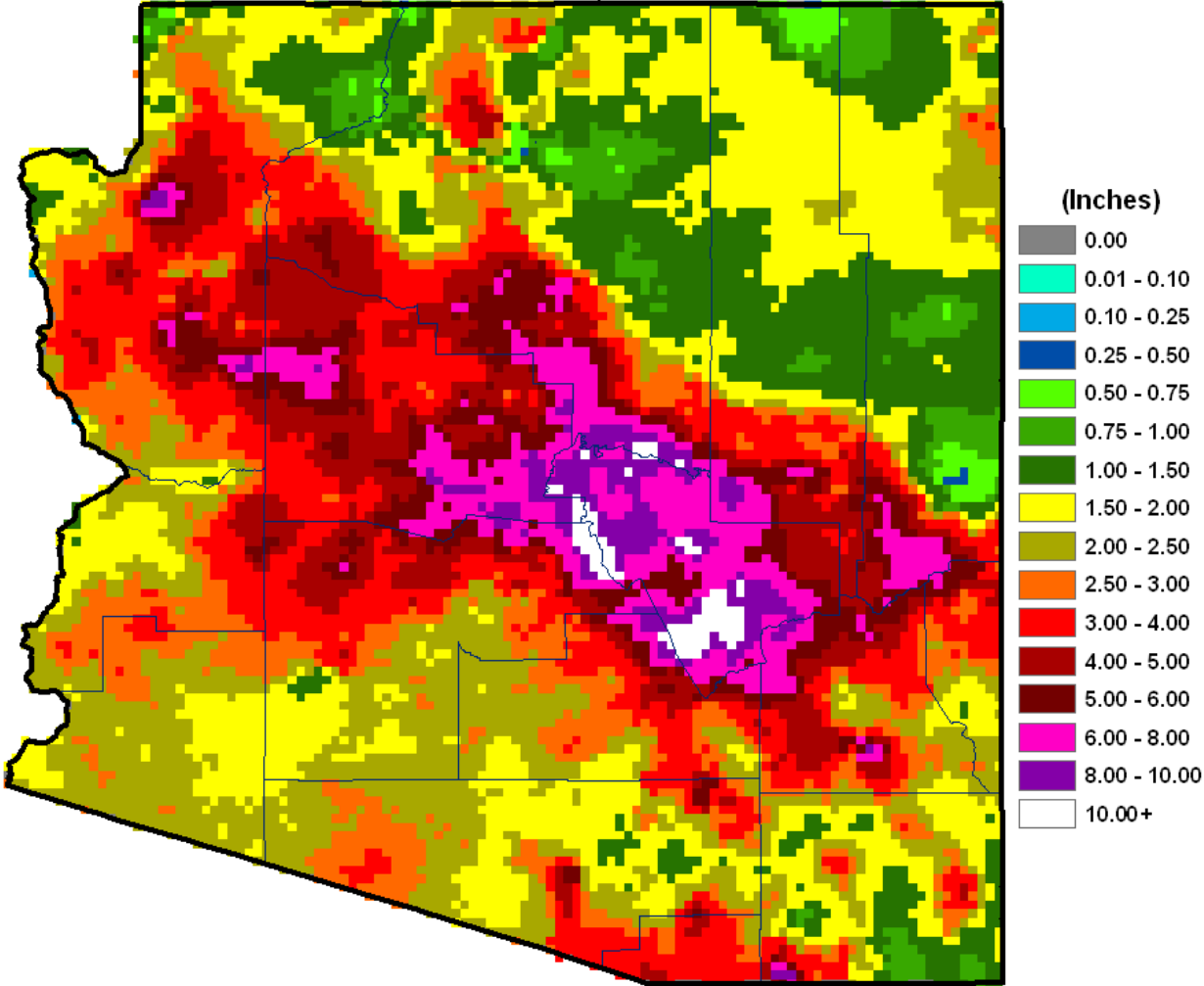
A series of three low pressure systems traversed Arizona during the week of 18-23 January 2010, causing extreme snowfall, intense rainfall, and strong winds, which combined to cause widespread impacts to the people and infrastructure of the state (Table 1). Heavy snow was primarily confined to elevations above 6,500 feet, with record flooding below 5,500 feet south and west of the Mogollon Rim (Gila, Maricopa, and Yavapai Counties). The third event in the series, which occurred primarily on 21 January 2010, was, by far, the most intense: this storm brought record low barometric pressure readings, unusually heavy precipitation, anomalously strong surface gradient winds with dense blowing dust, and isolated severe thunderstorms. A tornado was confirmed near the Arizona border town of Blythe, California.

Precipitation totals for the entire week exceeded ten inches in some areas (Figure 1), while high elevation snowfall totals were measured in feet rather than inches. For the three events, 40 to 60+ inches of snow fell over much of the Mogollon Rim above 7,000 feet, with a few reports of over 90 inches at the highest elevations (Figure 2). Eighteen to forty inches of snow fell over parts of the Navajo and Hopi reservations in Northeast Arizona, severely hampering services in the area. The Flagstaff Airport received 54.2 inches of snow during this period, the fifth greatest snow total on record. Snow water equivalent (Figure 3) was unusually high, which increased the threat that flooding could be exacerbated, especially if a warm rain event suddenly released much of the stored moisture.

**Table 1.** Time line of events during the week.

<b>Event Number</b>	<b>Dates</b>	<b>Impacts</b>
<b>Event 1</b>	Early Morning of 18 January 2010 through the Morning of 19 January 2010	Eight to twelve inches of snow and 0.5 to 1.0 inches of rain below the snow level with the bulk of the precipitation over Central and Northern Arizona.
<b>Event 2</b>	Late 19 January 2010 through the Morning of 20 January 2010	Eight to fifteen inches of snow and 0.5 to 1.5 inches of rain below the snow level state-wide.
<b>Event 3</b>	Early Morning Thursday 21 January 2010 through 23 January 2010	The most significant event of the week. Thirty to fifty-five-plus inches of additional snow above 7,000 feet, and rainfall amounts of 5 to 10 inches at lower elevations mainly on the favored upslope locations just south of the Mogollon Rim. Winds of 40 to 70 mph occurred, mainly in advance of a cold front that moved east across Arizona the evening of 21 January. Several strong to severe thunderstorms occurred in conjunction with the frontal passage.

# Storm Total Precipitation 18-23 January 2010



**Fig. 1.** Storm total precipitation (liquid equivalent), from 18 January 2010 through 23 January 2010.

Modeled Total Snow Depth (Hourly) for 2010 January 24, 12:00 Z

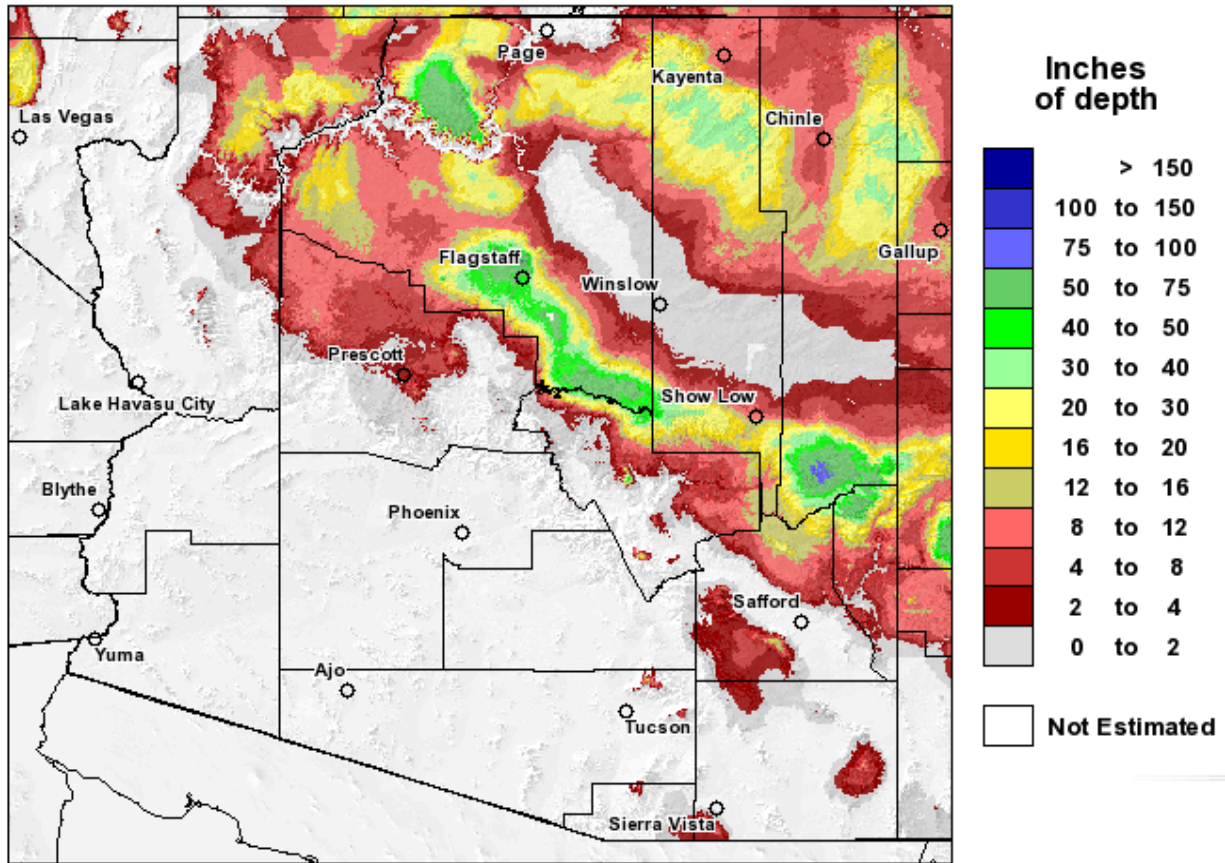
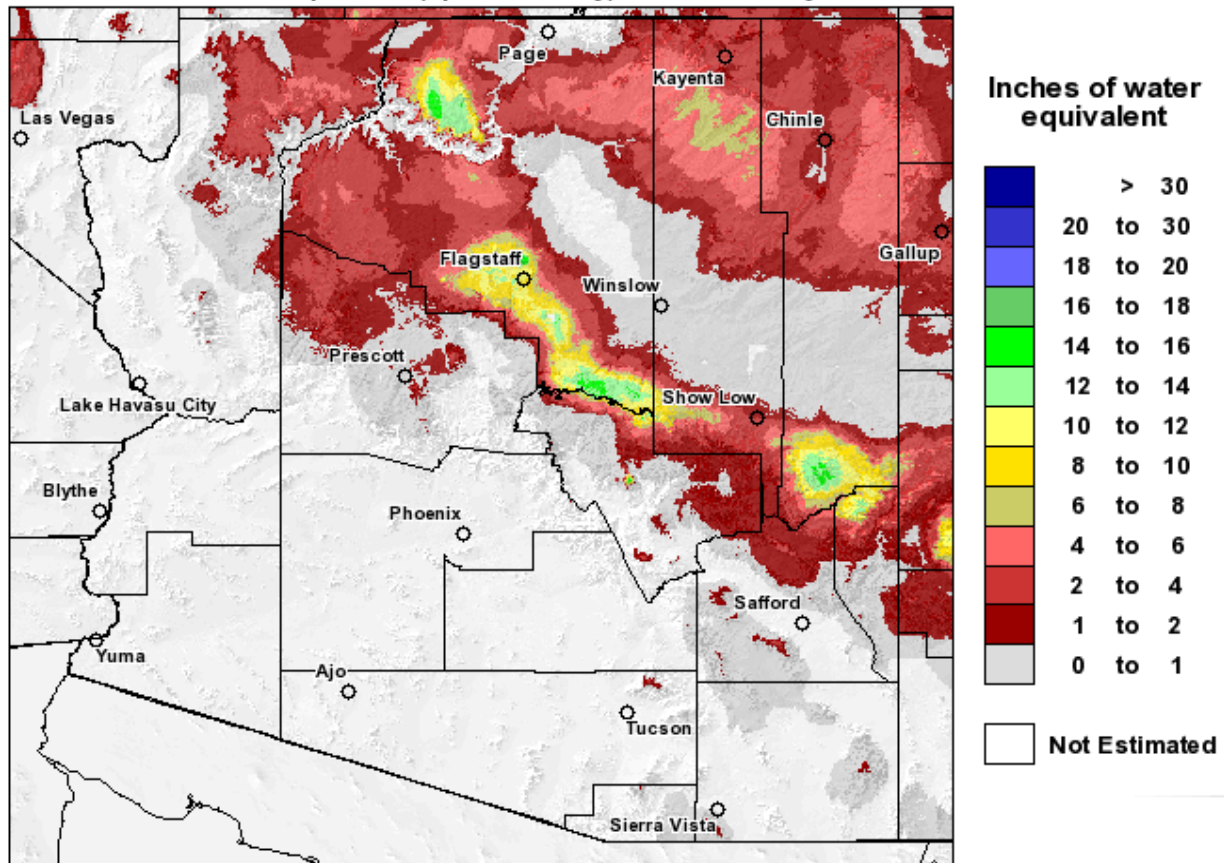


Fig. 2. Snow depth total across Arizona at 5 AM 24 January 2010 (courtesy of the NOAA National Operational Hydrologic Remote Sensing Center (NOHRSC)).

**Modeled Snow Water Equivalent (updated hourly) for 2010 January 24, 12:00 Z**



**Fig. 3.** Snow water equivalent across Arizona at 5 AM 24 January 2010 (courtesy of the NOAA NOHRSC).

Given the fact that several strong storm systems affected Arizona in less than one week, and the unusual intensity of the third storm in the series, it is not surprising that significant impacts, including loss of life, were experienced. Flooding was observed at many locations along, south, and west of the Mogollon Rim from late 21 January 2010 through 23 January 2010, with some of the worst flooding along the Agua Fria River in Black Canyon City, along Tonto Creek at Tonto Basin, and along Centennial Wash in Wenden. High snowfall amounts resulted in the closing of major highways across Northern Arizona, a temporary loss of access and basic services, and some structural damage due to the unusually deep and moist snow.

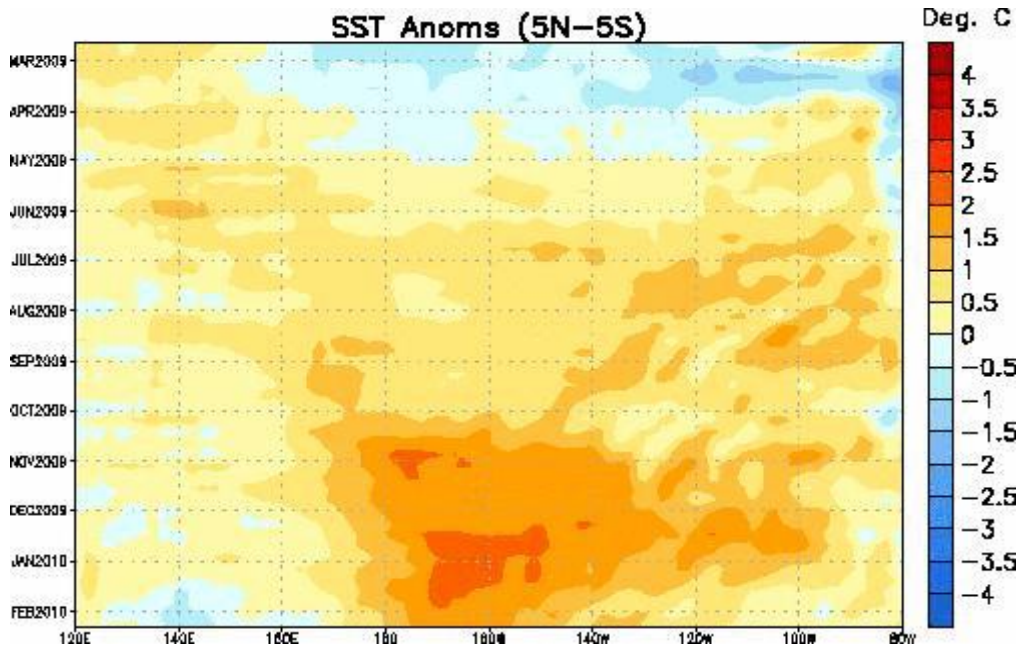
This report, a collaborative effort of the four National Weather Service (NWS) Weather Forecast Offices (WFOs) that serve Arizona, reviews the meteorological conditions (Section 2) and the services provided by the National Weather Service (Section 3) during this week of extraordinary winter weather.

## II. Meteorological and Hydrological Conditions and Impacts

### A. Development of El Niño

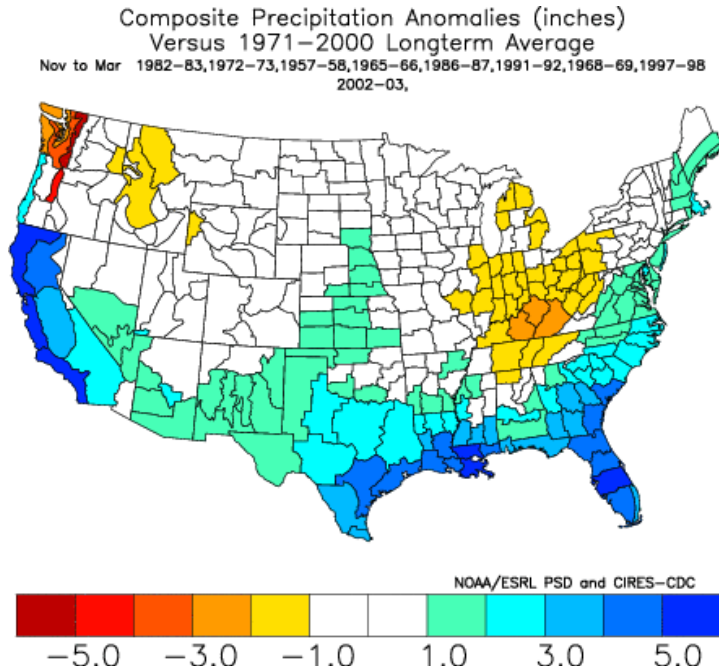
The winter of 2009-2010 proved to be quite active across Arizona, thanks in part to a strong El Niño (Fig. 4). El Niño, a periodic warming of sea surface temperatures in the equatorial Pacific Ocean, influences weather patterns across Earth. Past El Niño events have typically been associated with above normal winter precipitation for the Southern United States, including Arizona (Fig. 5); as expected, above normal winter precipitation occurred over Arizona in conjunction with the El Niño of 2009-2010 (Fig. 6).

Development of El Niño conditions was expected well ahead of time: the NOAA Climate Prediction Center (CPC) forecasted an enhanced probability for above normal rainfall across the southern United States during the 2009-2010 winter as early as June 2009 (Fig. 7). From September 2009 through December 2009, the NWS WFOs in Arizona provided localized outlook information on their web sites pertaining to the expected impacts of El Niño during the coming winter. A joint briefing between the NWS WFOs and the NOAA CPC was conducted in December for local media and emergency managers.

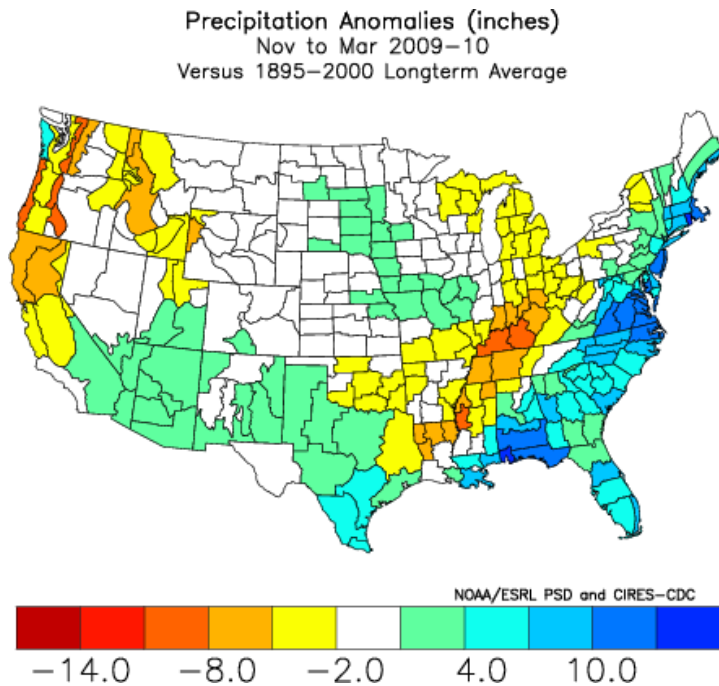


**Fig. 4.** Sea surface temperature anomalies (SSTAs) of the equatorial Pacific waters (5°S to 5°N and 120°E to 80°W) from March 2009 (top) to February 2010 (bottom). The darker orange colors in the center-bottom of the graph indicate warmer-than-normal SSTAs (El Niño) developed during Fall 2009 and continued through Winter 2009-2010.



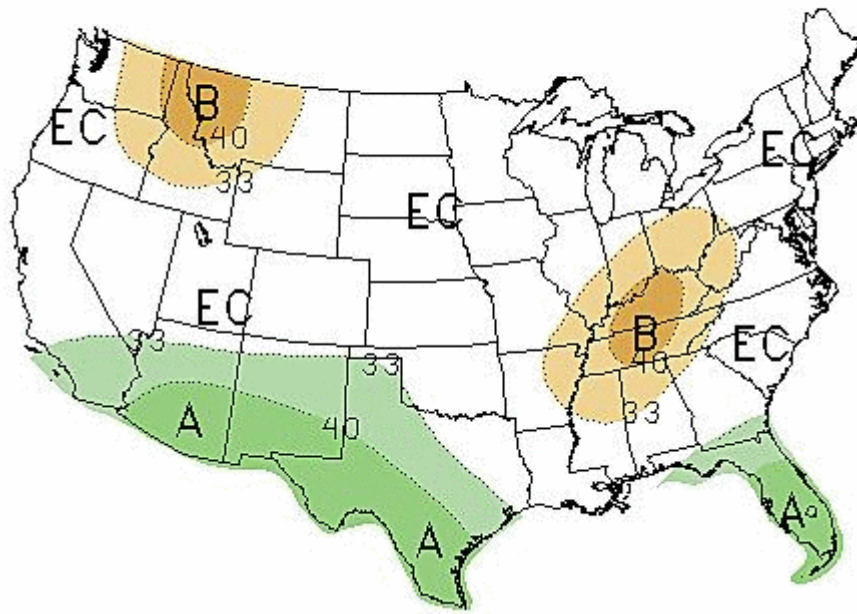


**Fig. 5.** Precipitation anomaly (in inches) by climate division during nine previous El Niño events. Blue (orange) shadings represent above (below) average November through March precipitation. Above average precipitation is common across the Southern United States and the Eastern Seaboard during an El Niño winter.



**Fig. 6.** Precipitation anomaly (in inches) by climate division during the wet season of 2009-2010. Blue (orange) shadings represent above (below) average November through March precipitation. Above average precipitation was measured across the Southwest and the Eastern Seaboard.

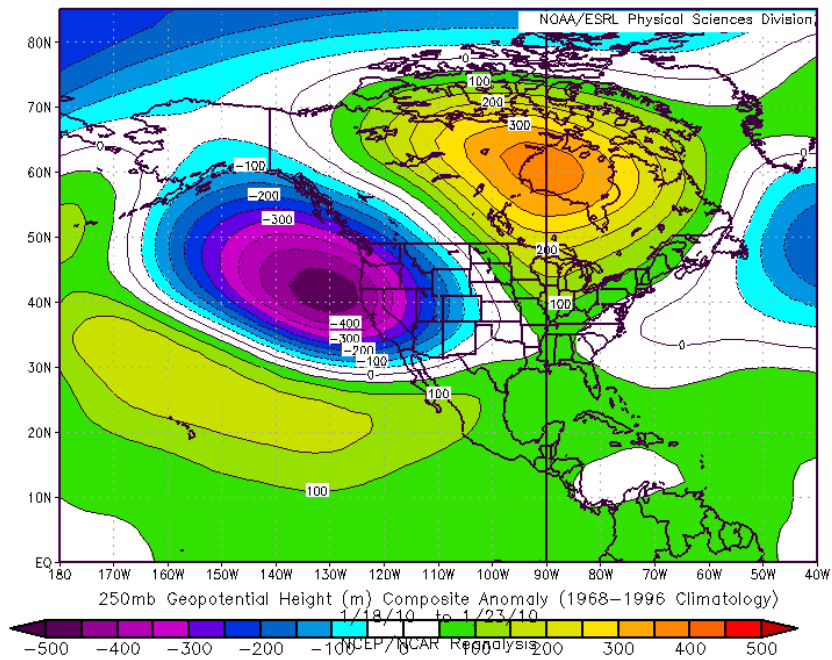
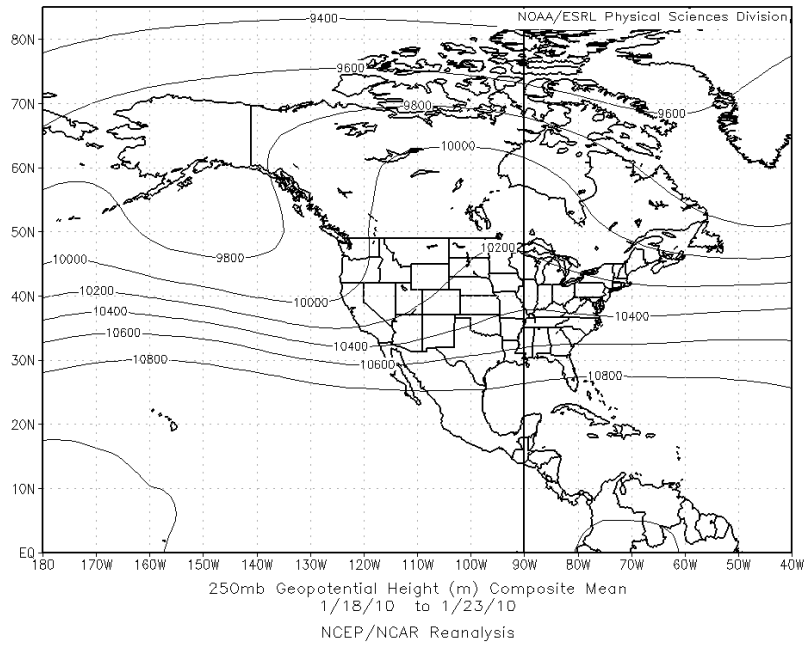
December - February 2009-10  
Precipitation



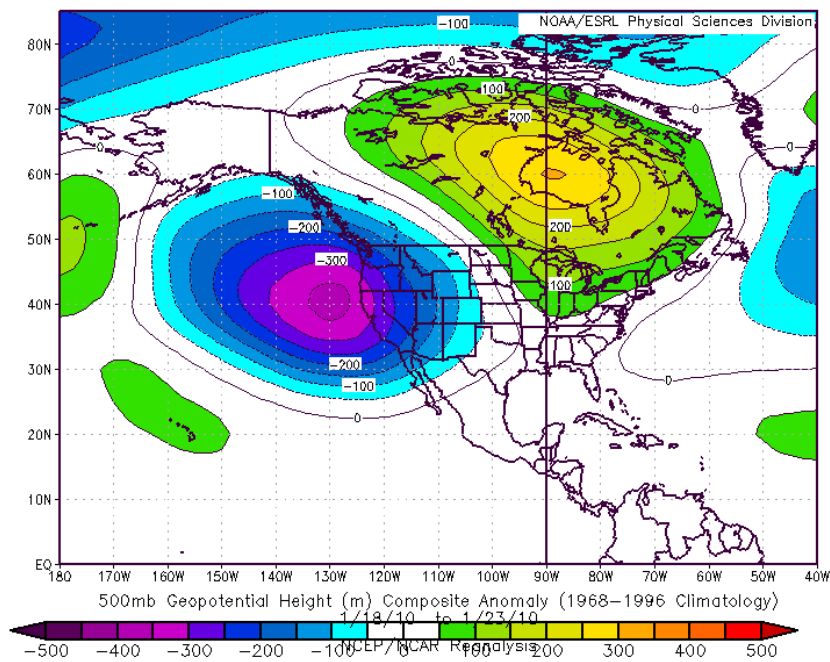
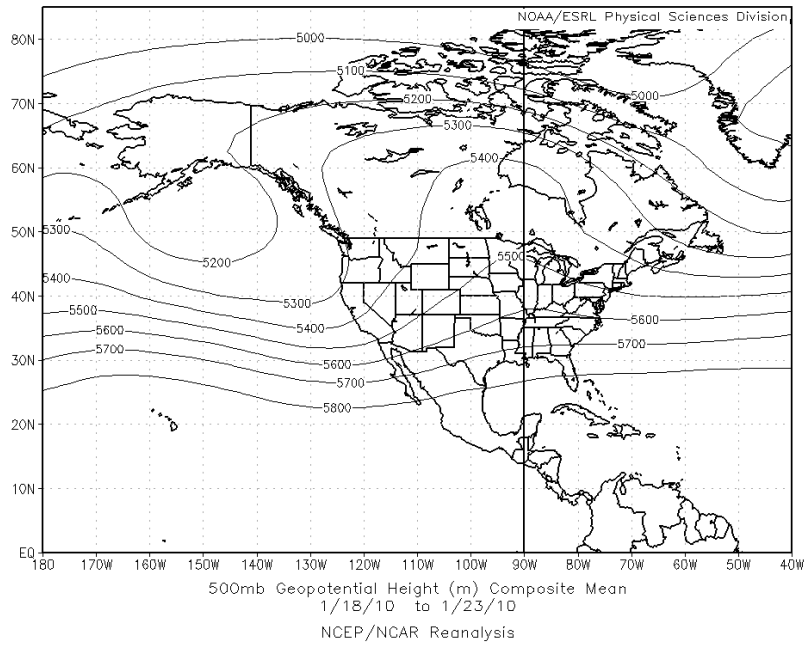
**Fig. 7.** Climate outlook for December-January-February 2009-2010 issued June 2009 by the NOAA Climate Prediction Center. The green areas across portions of the Southern U.S. represent an enhanced probability for above normal precipitation.

### **B. Weather Pattern of 18-23 January 2010 Overview**

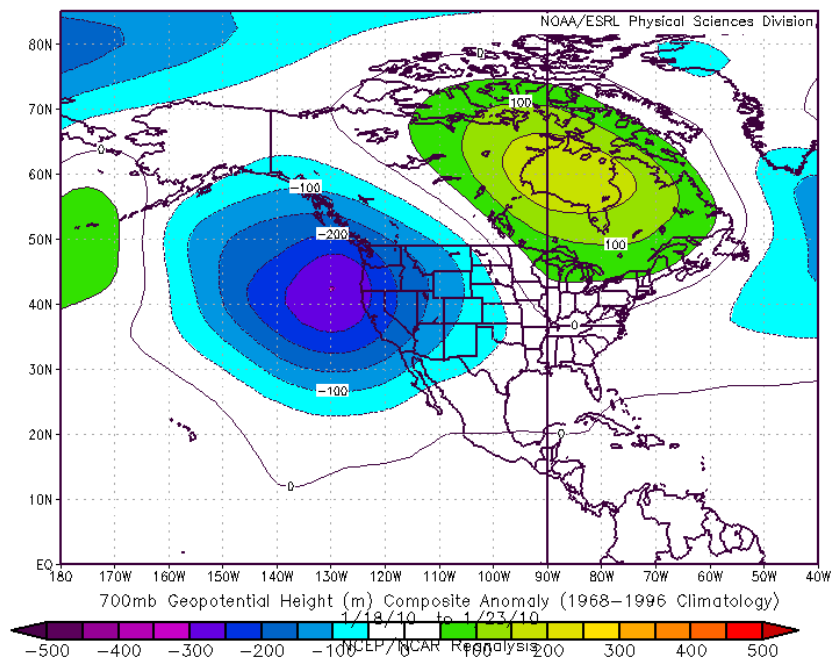
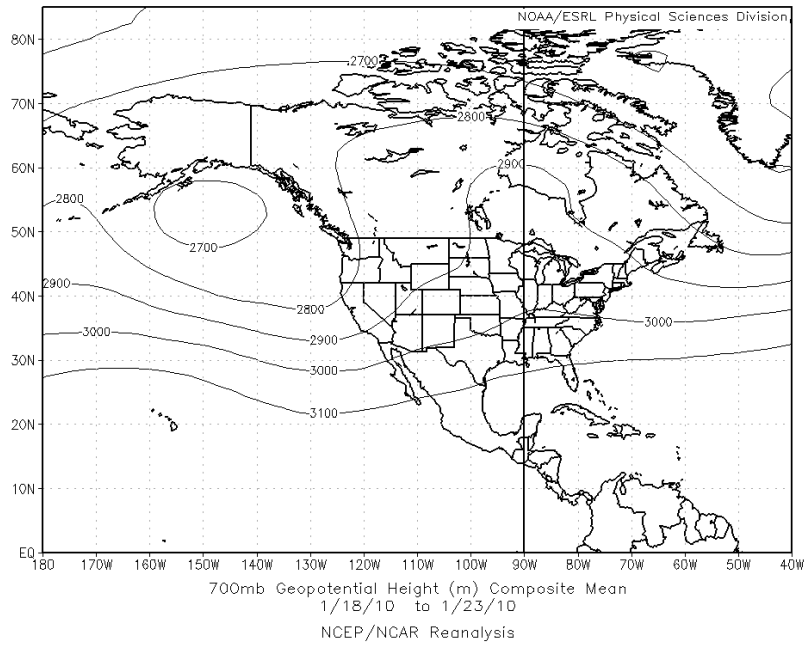
Given the extreme weather observed over much of Arizona during the week of 18-23 January, highly anomalous synoptic-scale weather conditions had to exist. Figures 8-17 depict observed mean conditions and anomaly maps for a series of key weather parameters.



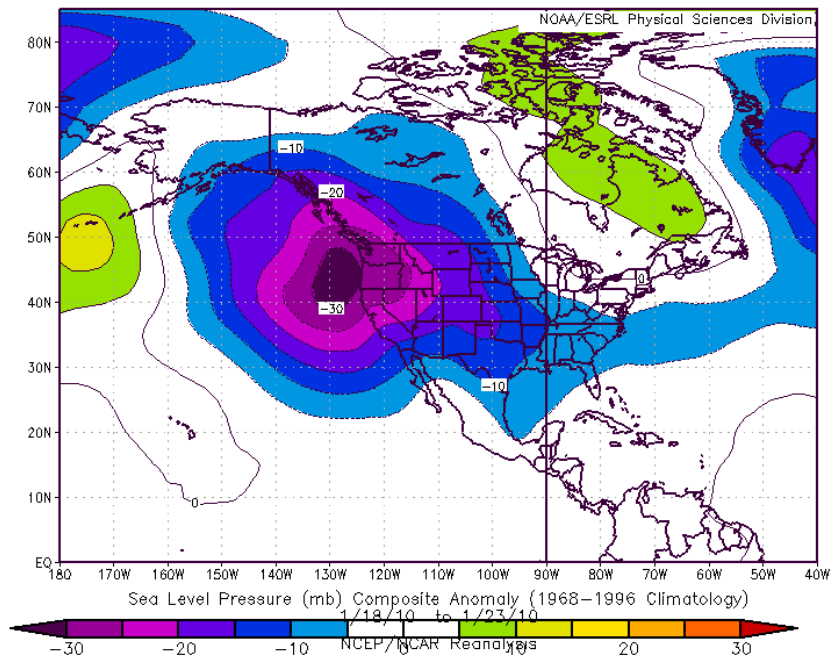
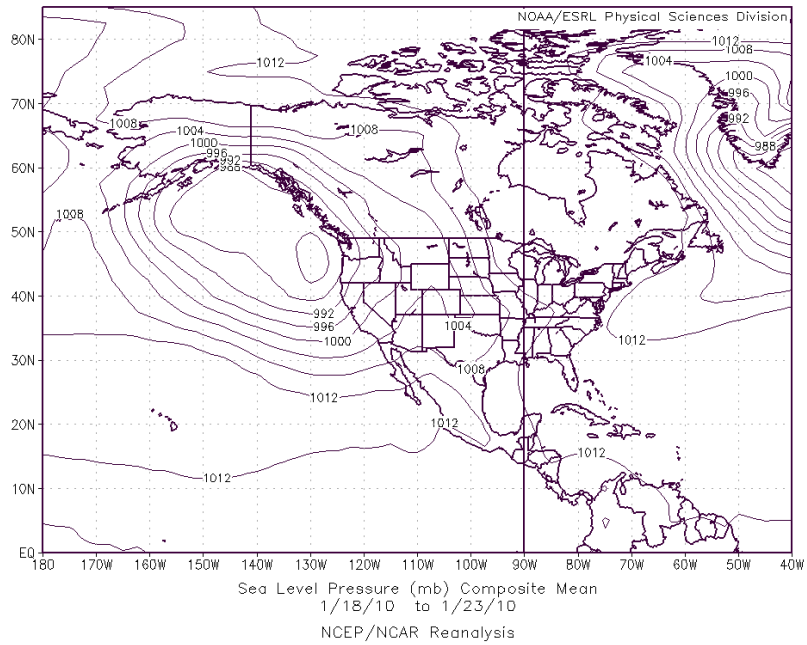
**Fig. 8.** 250mb height (top) and anomaly (bottom) maps during the period 18-23 January 2010. A very deep and large low height system, nearly 500 meters below normal, was centered just off the Northern California coast while a height anomaly nearly 400 meters above normal was centered over Hudson Bay.



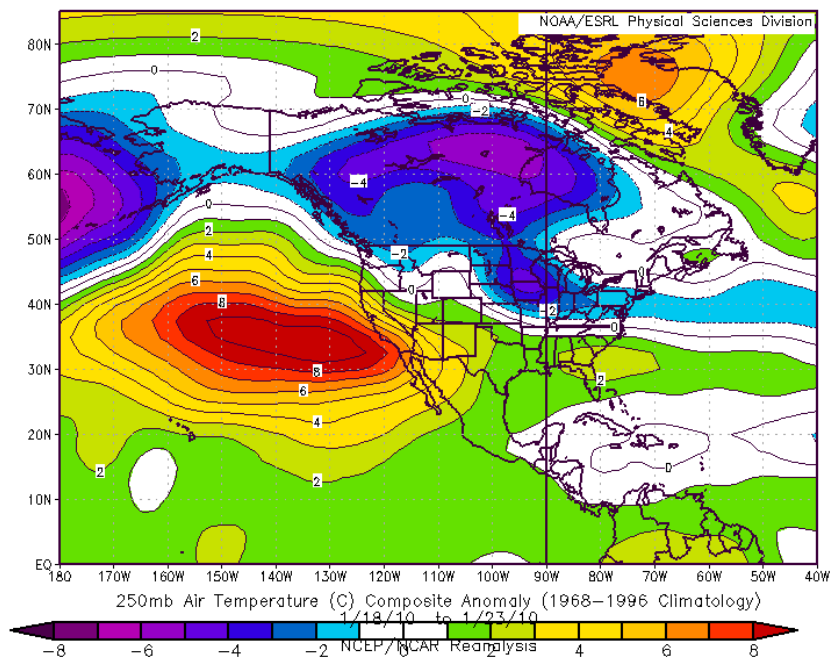
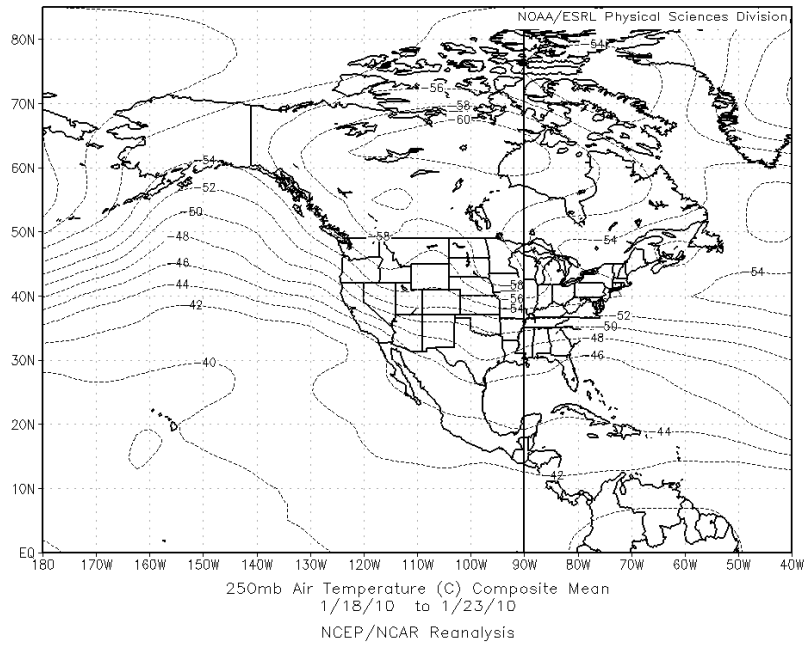
**Fig. 9.** 500mb height (top) and anomaly (bottom) maps during the period 18-23 January 2010. A very deep and large low height system, over 300 meters below normal, was centered just off the Northern California coast while a height anomaly in excess of 250 meters above normal was centered over Hudson Bay.



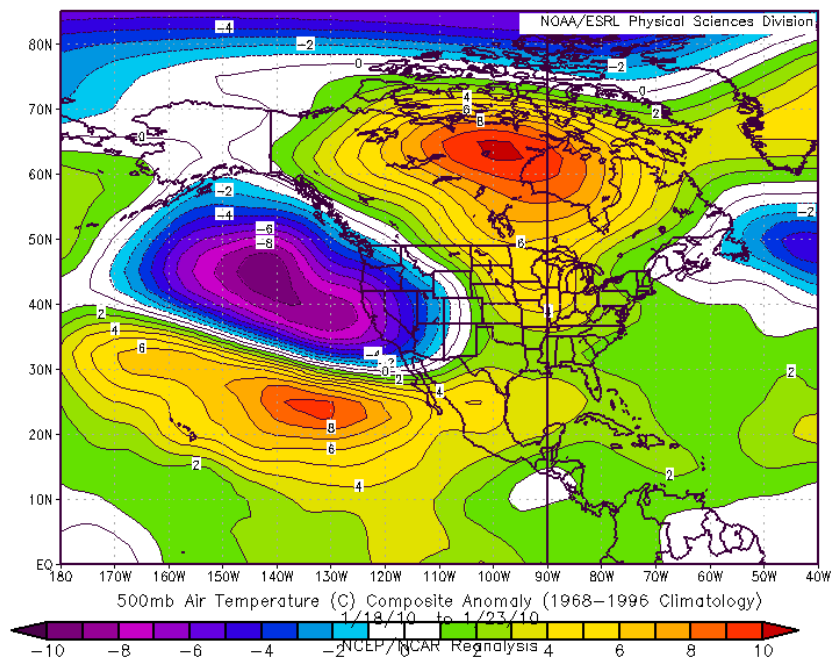
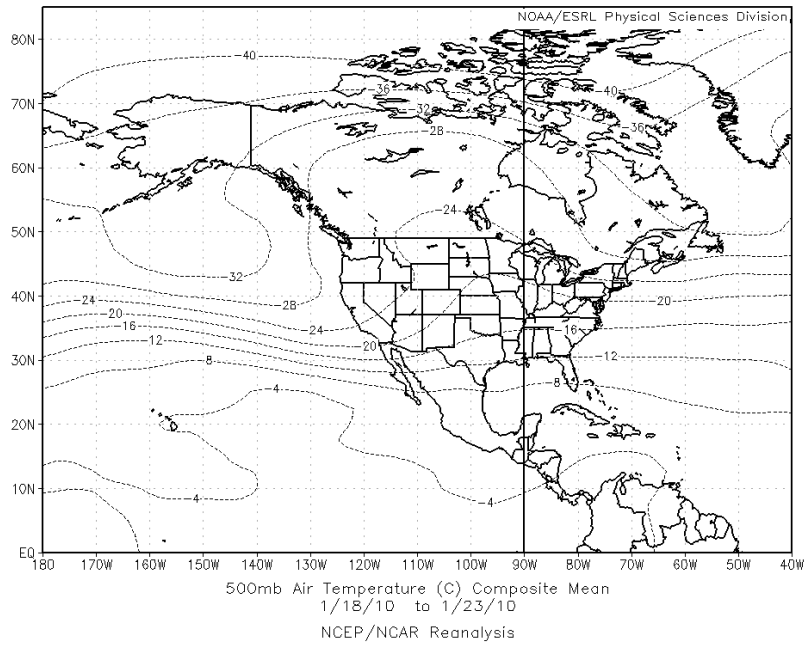
**Fig. 10.** 700mb height (top) and anomaly (bottom) maps during the period 18-23 January 2010. A very deep and large low height system, over 250 meters below normal, was centered just off the Northern California coast while an anomaly over 150 meters above normal was centered over Hudson Bay.



**Fig. 11.** Sea level pressure (top) and anomaly (bottom) maps during the period 18-23 January 2010. A very deep and large low pressure system, over 30mb below normal just off the Oregon coast, dominated the western half of the North American continent.

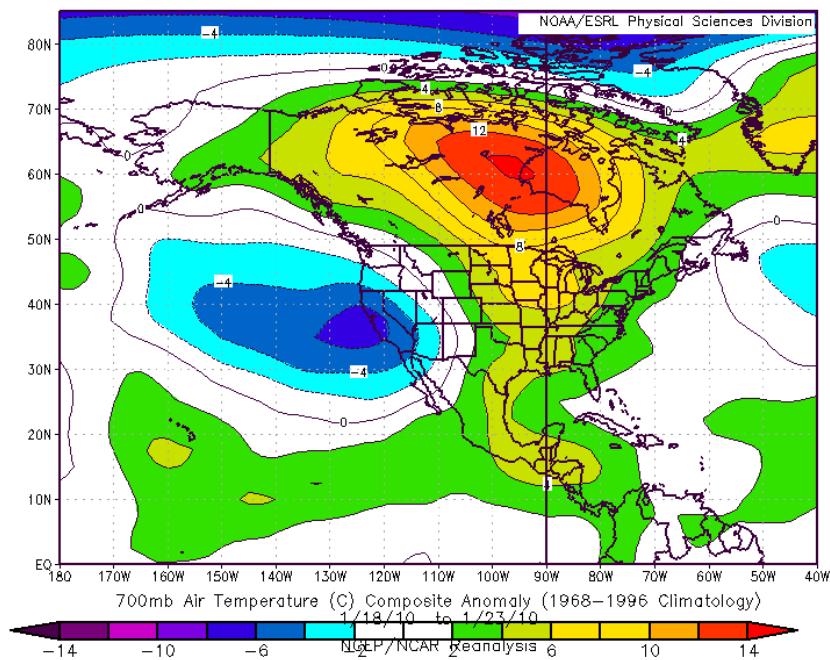
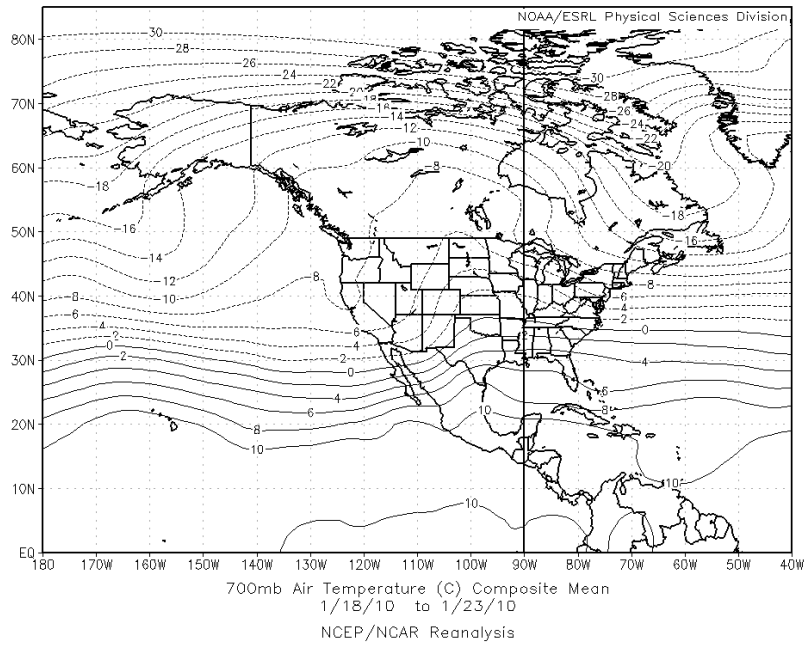


**Fig. 12.** 250mb temperature (top) and anomaly (bottom) maps during the period 18-23 January 2010. Unusually warm temperatures in the upper levels of the atmosphere over the Eastern Pacific Ocean occurred as a result of large-scale latent heat release.

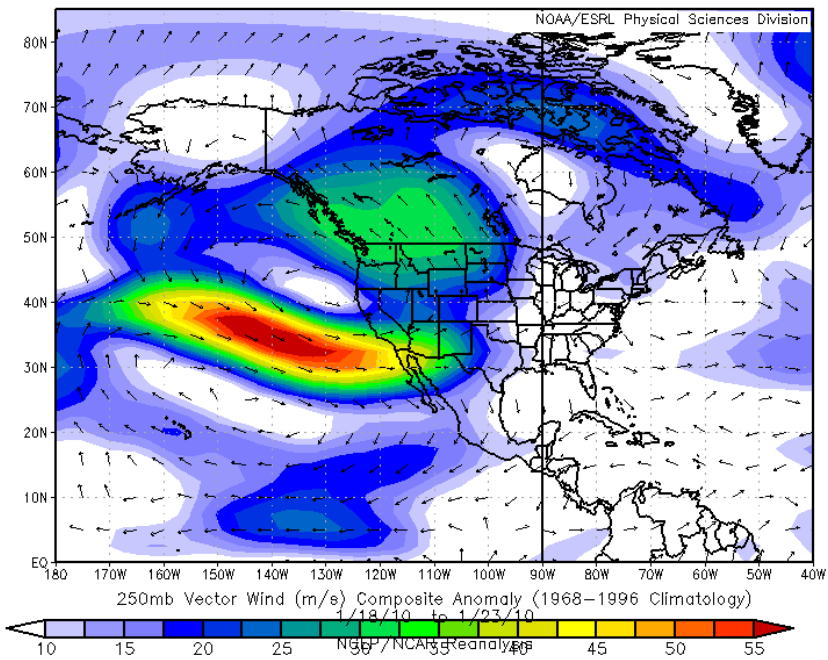
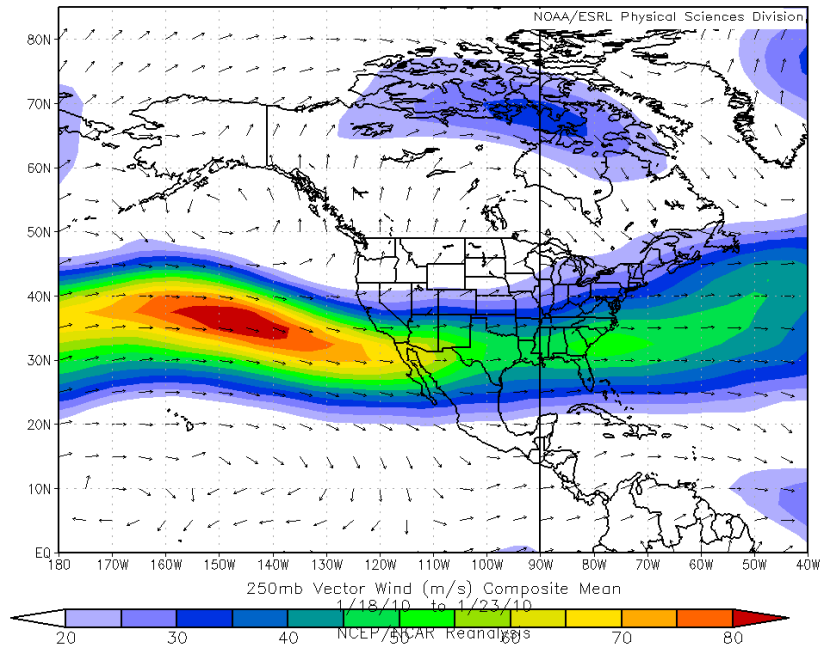


**Fig. 13.** 500mb temperature (top) and anomaly (bottom) maps during the period 18-23 January 2010. A very strong baroclinic zone (tight gradient between below average and above average temperatures) helped create a very strong upper level jet, which in turn led to the development of several highly baroclinic disturbances (short wave troughs) that crossed Arizona.

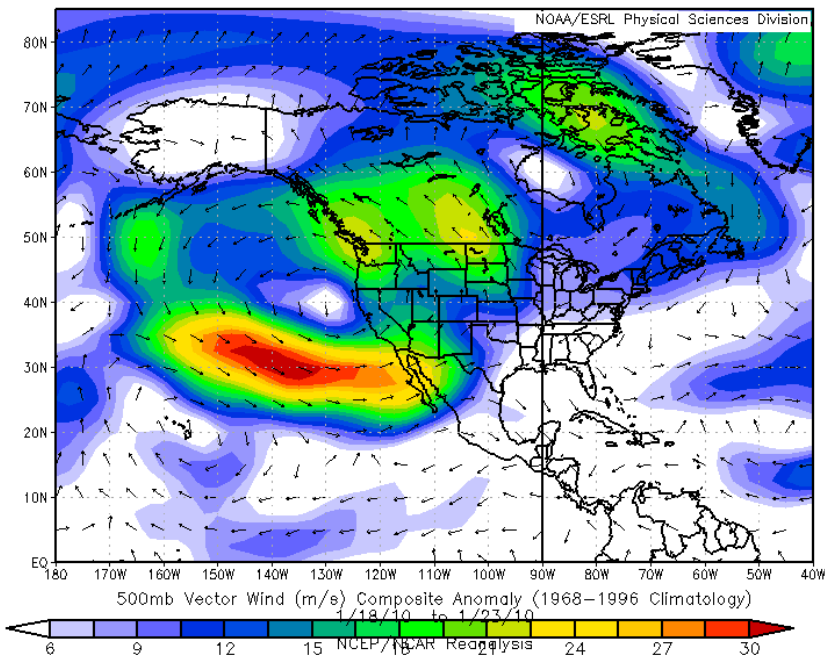
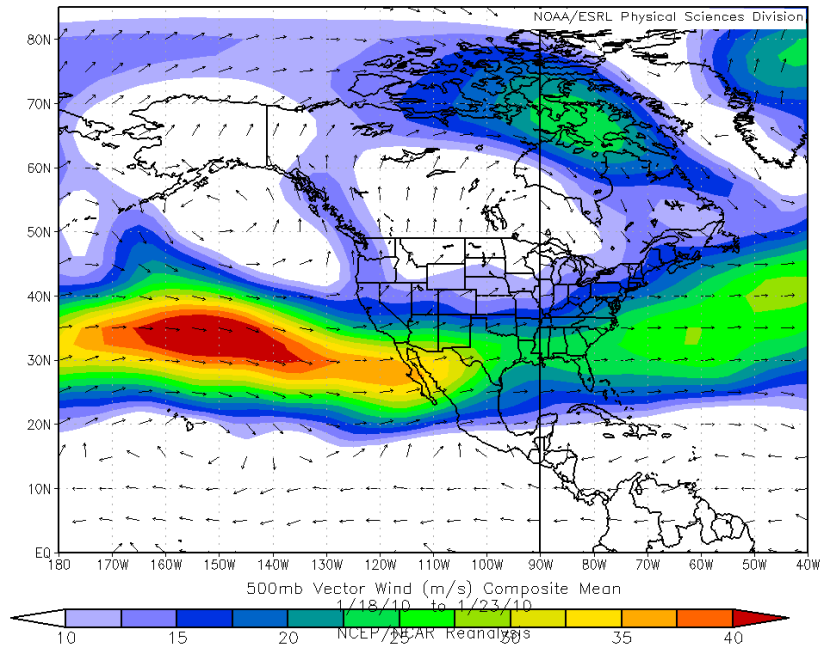




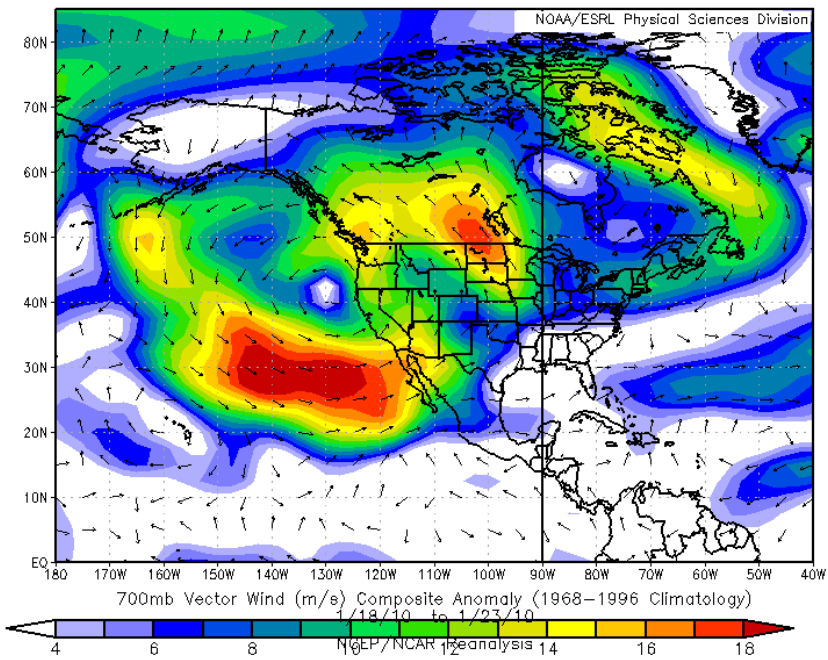
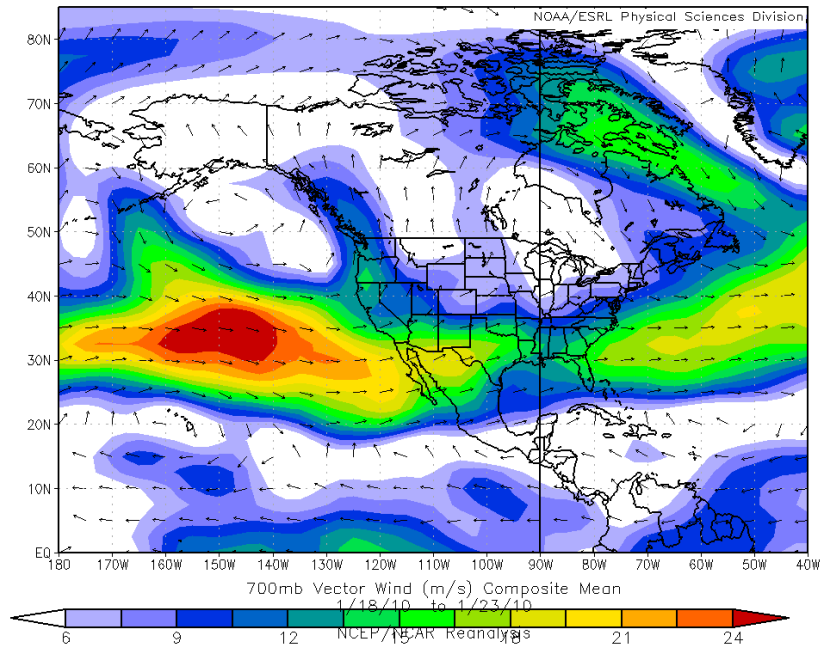
**Fig. 14.** 700mb temperature (top) and anomaly (bottom) maps during the period 18-23 January 2010. Anomalously cool temperatures extended from the Northeast Pacific Ocean into the Southwest U.S, with anomalously warm temperatures over Canada and the north-central United States.



**Fig. 15.** 250mb vector wind (top) and anomaly (bottom) maps during the period 18-23 January 2010. Anomalously strong upper level winds extended from the Central Pacific into the Desert Southwest.



**Fig. 16.** 500mb vector wind (top) and anomaly (bottom) maps during the period 18-23 January 2010. Anomalously strong upper level winds extended from the Central Pacific into Northern Baja and portions of Arizona.

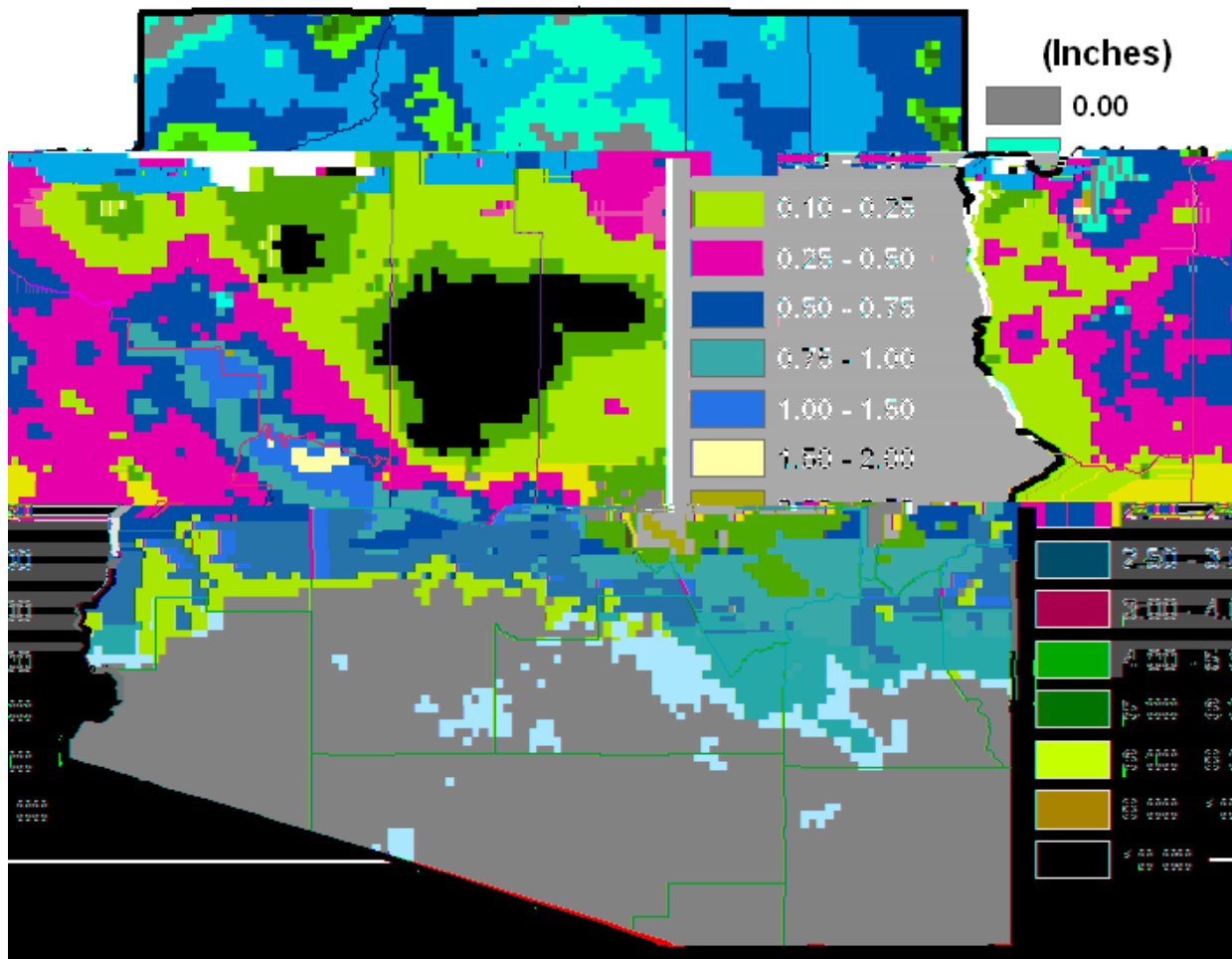


**Fig. 17.** 700mb vector wind (top) and anomaly (bottom) maps during the period 18-23 January 2010. Anomalously strong upper level winds extended from the Central Pacific into Southern California, Northern Baja and Arizona.

### C. Event 1 - 18-19 January 2010

The first weather event associated with the anomalous large-scale weather pattern occurred during the early morning hours of 18 January 2010 through the early morning of 19 January 2010. This event was associated with the first significant baroclinic disturbance (short wave trough) to move through the persistent west to southwest flow pattern. The primary impacts with this event were felt across Central and Northern Arizona, where light to moderate rainfall of generally one inch or less occurred in the lower elevations (Fig. 18) while moderate snowfall of 8 to 12 inches occurred in the mountains of Northern Arizona mainly above 6,500 feet. The main lifting mechanism in the early stages of this event was primarily from warm air advection and orographic enhancement into the Mogollon Rim, associated with 50 knot southwesterly flow at 700mb. As the short wave skirted through Northern Arizona during the early morning hours of 19 January 2010, upslope enhancement continued, while precipitation was enhanced along a cold front that eventually became quasi-stationary across the state. This 'set the stage' for the next weather event.

### Precipitation 5AM 18 JAN 2010 to 5AM 19 JAN 2010

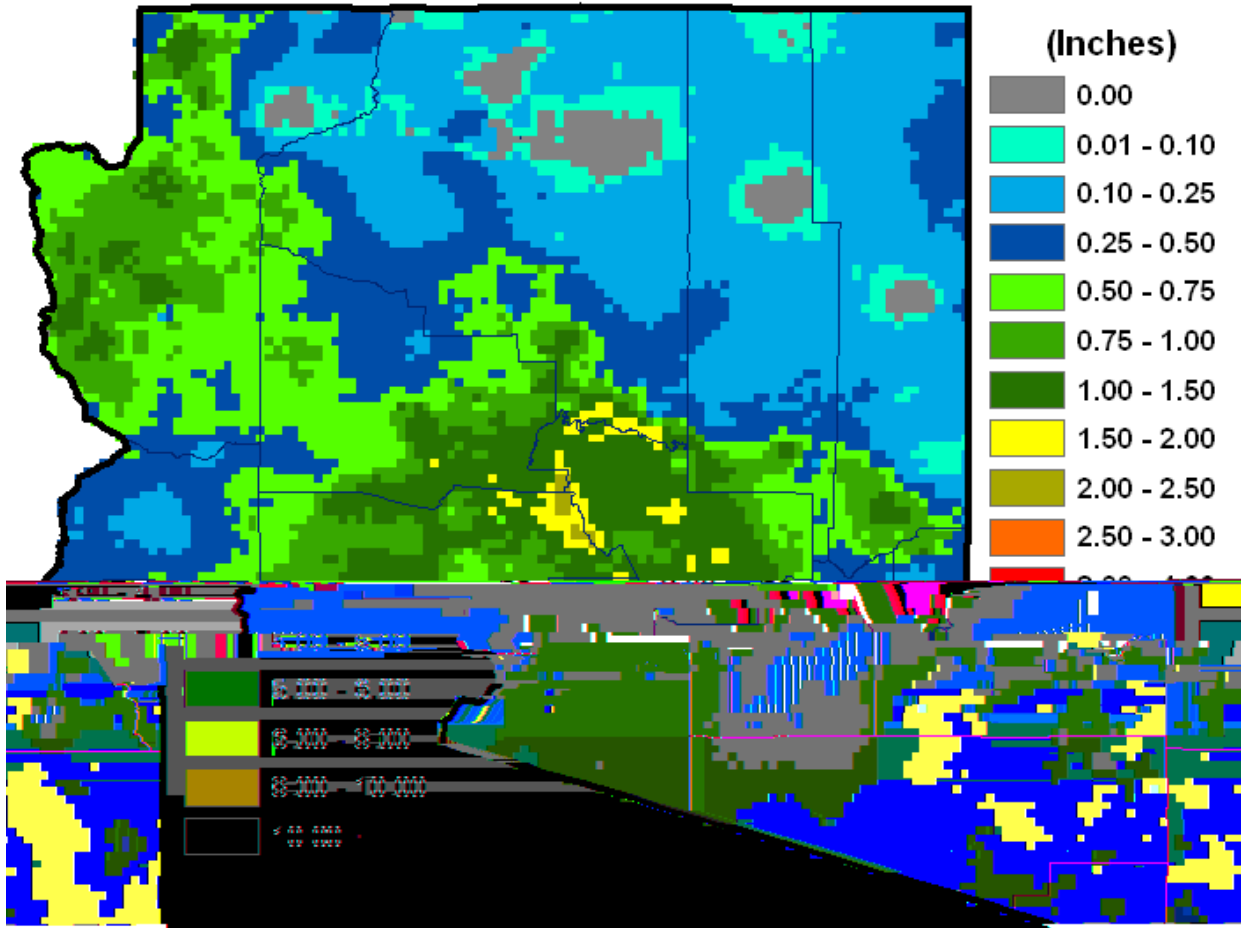


**Fig. 18.** Precipitation (liquid equivalent) totals from 5 AM 18 January 2010 to 5 AM 19 January 2010.

#### D. Event 2 - 19-20 January 2010

The second event to impact Arizona occurred primarily from 19 January 2010 into 20 January 2010. This weather disturbance produced gusty winds, light to moderate valley rainfall and heavy mountain snowfall. In and of itself, this was a moderate impact event. Liquid equivalent precipitation generally ranged from 0.25" to 1.50" across most of the state (Fig. 19). Given the return mild southerly flow ahead of this stronger short wave and associated cold front (compared to Event 1), snow levels were initially rather high, mainly above 7000 feet. Once the cold front moved through, snow levels dropped to 5000-5500 feet. Even though wind speeds topped off at 50 kts at 850mb and 60 kts at 700mb, widespread surface wind gusts of 35 to 50 knots were observed across Southeast Arizona. A peak wind gusts of 60 knots was measured at Fort Huachuca. Heaviest rain fell over south-central Arizona, with 0.5" to 1.25" observed over and near Phoenix (Phoenix Sky Harbor ASOS recorded 0.87" on 19 January).

### Precipitation 5AM 19 JAN 2010 to 5AM 20 JAN 2010



**Fig. 19.** Precipitation (liquid equivalent) totals from 5 AM 19 January 2010 to 5 AM 20 January 2010.

### **E. Event 3 - 21-23 January 2010**

This was the most intense and unusual storm in the series. Many all-time lowest barometric pressure readings were established on 21 January, including the following; Phoenix Sky Harbor (29.20"), Yuma (29.12"), Las Vegas McCarran (29.03"), Los Angeles International (29.07"), San Diego Lindbergh Field (29.15"), Reno-Tahoe International (28.99") , and Eureka, CA (28.90"). Figure 20 depicts MSL pressure at 0000Z 22 January 2010. Not surprisingly, heavy precipitation and unusually high winds accompanied this storm system.

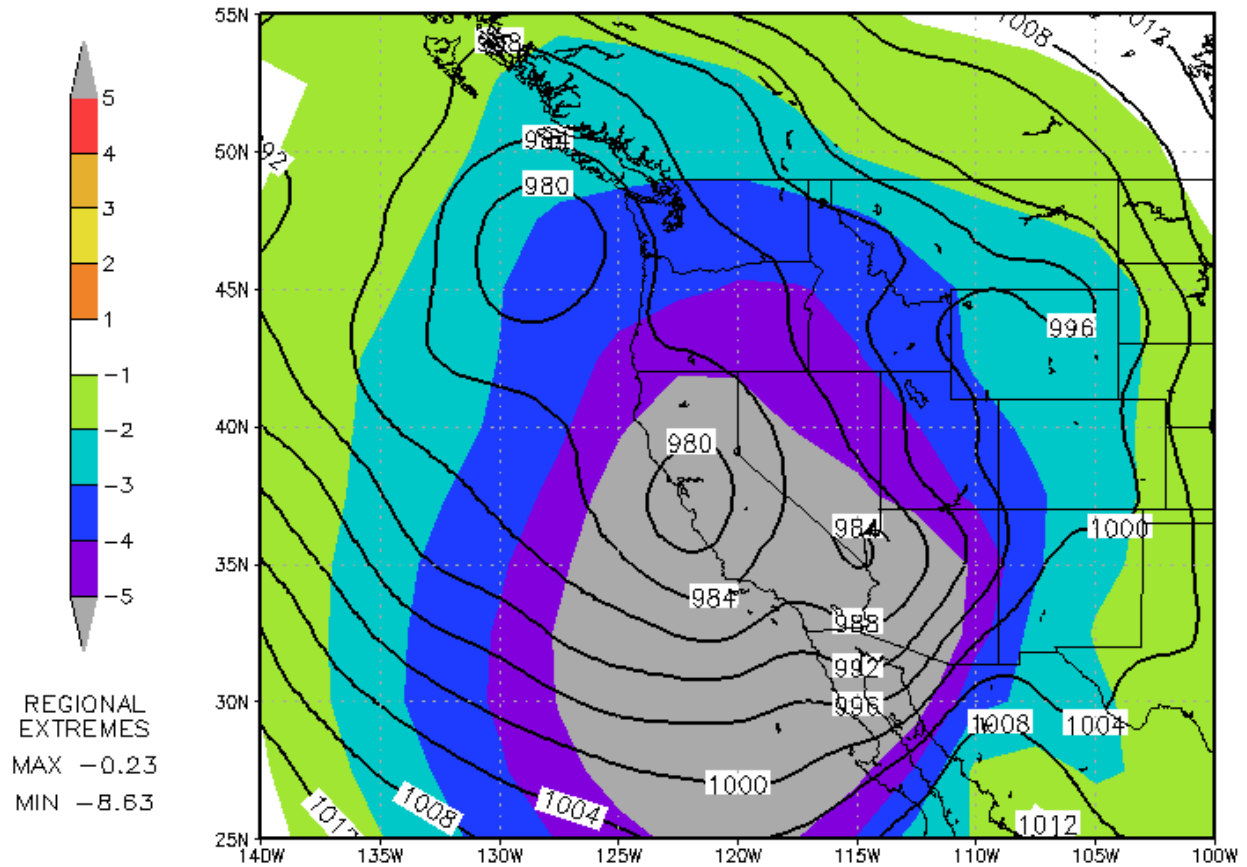
For lower elevations, heavy rainfall, in conjunction with runoff from previous heavy rainfall over the upstream higher terrain, resulted in flooding, especially over central and northern Arizona, downstream from the Mogollon Rim where the greatest amount of precipitation was observed. Yuma, Arizona, established its all time greatest 1-day precipitation amount for a January day, with 1.95" falling on 21 January. Arizona set its all-time 1-day snowfall record, when 48" fell at Sunrise Mountain from 1200Z 21 January to 1200Z 22 January.

Very high winds occurred across much of central and southern Arizona on 21 January. Wind gusts of 45 to 65 mph were widespread, with localized gusts in excess of 90 mph (Figs. 21 & 22). An observer in Ajo, a small town in western Pima County, measured a peak wind gust of 94 mph. These strong winds resulted in considerable damage, especially across central and western Pima County. Strong southerly winds caused significant problems at both Phoenix Sky Harbor and Tucson International Airports, since both airports employ west-east runways. The unusually strong and persistent crosswinds caused many flights to be cancelled, and some airlines ceased operations at those airports through much of the afternoon and evening. Localized reports of reduced visibility due to blowing dust were received, primarily over the lower deserts of south-central Arizona during the afternoon, where very little rain had occurred. For elevations above 7,000 feet, where moderate to heavy snow was falling, high winds produced areas of blizzard conditions, a relatively rare phenomenon for Arizona. The good news concerning this wind event was: for several days prior to 21 January, numerical weather models had forecast a very strong low level jet, with southerly wind in excess of 80 knots at 850mb (approximately 5,000 ft MSL) and 90 knots at 700mb (approximately 10,000 ft MSL), to develop over southwest and south-central Arizona on 21 January, so forecasters were better able to highlight the potential for strong, possibly damaging gradient wind associated with this unusual storm system.

During the afternoon and evening hours of the 21st, a narrow line of thunderstorms formed along and just in advance of a cold front that moved from west to east across southeast California and Arizona. Unusually strong low-mid level wind shear combined with modest instability to increase the chance for severe multicell and supercell storms, with the possibility for tornadoes and even stronger straight line wind. This prompted the NWS Storm Prediction Center to issue a rare Tornado Watch for most of Southern Arizona and the adjacent portion of far Southeast California: this was the first tornado watch issued for any portion of Arizona since 18 January 1993 and only the third tornado watch issued for Arizona since 1971. As the front advanced eastward, NWS Doppler Radar detected and NWS meteorologists observed a Line Echo Wave Pattern (LEWP), with bowing line segments along the line of storms. A few storms exhibited moderate-strong low-mid level rotation, and several tornado warnings were issued by the NWS for these storms. Only one tornado was confirmed: an EF1 tornado occurred near Blythe,

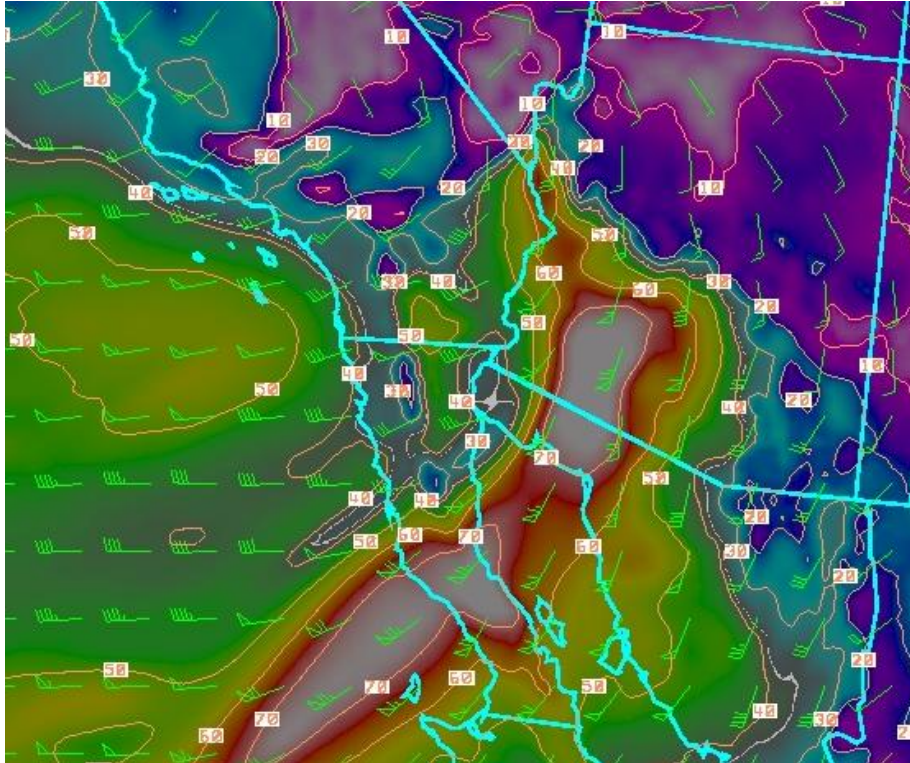
California, shortly before 325 pm PST (a tornado warning was in effect for the area). Multiple reports of a tornado in North Scottsdale were received by WFO Phoenix while a tornado warning was in effect for that area; however, a damage survey conducted by NWS meteorologist the following day concluded that straight line winds were to blame for the observed damage.

GEFS EM MSLP (MB) AND STANDARDIZED ANOMALY  
 00Z22JAN2010 FORECAST VALID 00Z22JAN2010

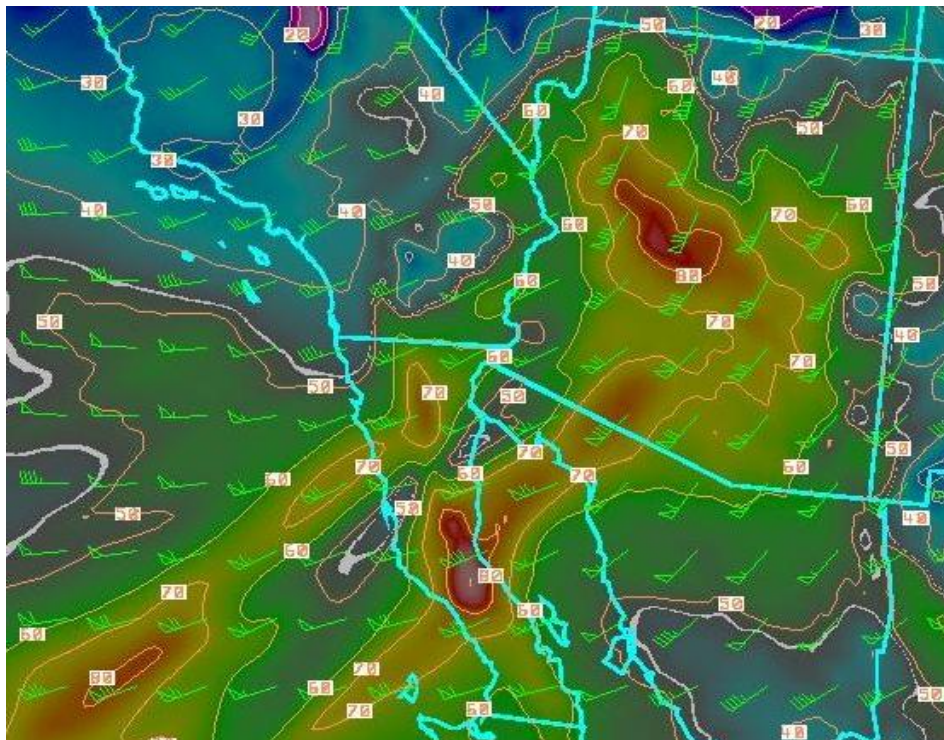


**Fig. 20.** GEFS MSLP (solid lines) and standardized anomaly (colored image) map from initialization on 00Z 22 January 2010 run. A large area of greater than five standard deviations below normal extends from much of Arizona across California and into the Eastern Pacific.



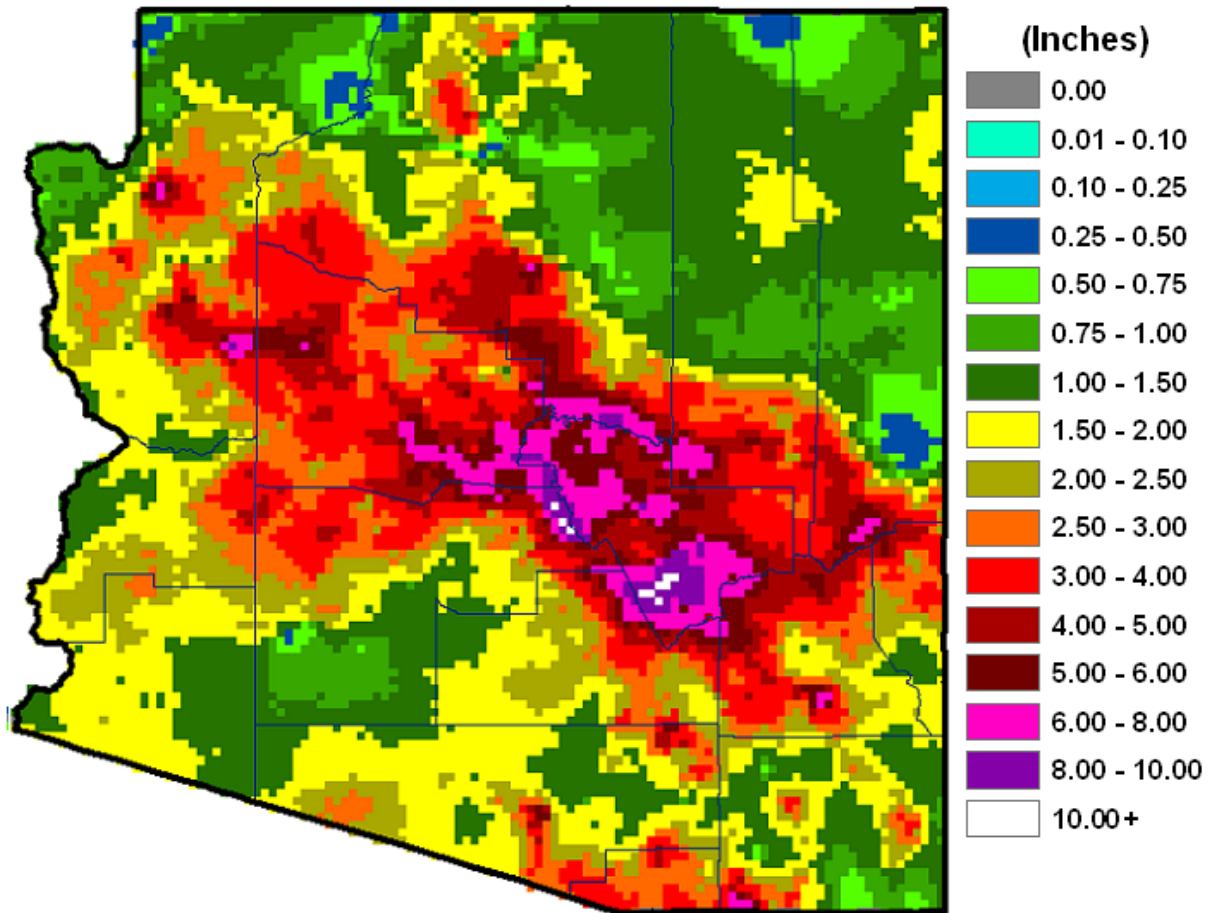


**Fig. 21.** NAM12 initialization field of 850mb (approximately 5,000 ft) winds valid 00Z January 22nd. A low level jet of 80 knots (90 mph, white areas) can be seen across Southwest Arizona.



**Fig. 22.** NAM12 initialization field of 700mb (approximately 10,000 ft) winds valid 00Z 22 January 2010. A low level jet of 70-80 knots (80-90 mph, red areas) can be seen across Arizona.

# Precipitation 5AM 20 JAN 2010 to 23 JAN 2010



**Fig. 23.** Precipitation (liquid equivalent) totals from 5 AM 20 January 2010 to 5 AM 23 January 2010. Totals in areas mainly affected by snow were likely underestimated.

Certainly, high winds created a huge impact across most of Arizona; however, heavy valley rainfall and blizzard conditions in the mountains were also high-impact events. Mountain blizzard conditions were also significant events. Precipitable water values in excess of one inch helped lead to rainfall amounts of one to two inches in the valleys, with localized values in excess of four inches (Fig. 23). These higher values were most common in the mountain foothills where strong orographic lifting enhanced the precipitation. Liquid equivalent precipitation across the foothills and mountains north and east of Phoenix were in excess of ten inches in some locations. Specific precipitation totals for this event: Yuma, Arizona, received 1.95” of rain, its wettest January day on record; Flagstaff Arizona received 3.39” on 21 January, a record 1-day amount for January (old record: 2.08” on 1 January 1910) and a 2-day total of 4.2” (21-22 January); Tucson International Airport reported 1.11” on 22 January, a record for the date and fifth wettest January day on record; and Phoenix Sky Harbor recorded 1.33” of rain on 21 January, a record for the date and fourth wettest January day on record.

Warm southerly winds ahead of the cold front resulted in very high snow levels, above 8500 feet, early in the event; however, snow level quickly lowered to near 6000 feet as the front swept through, then briefly lowered below 3500 feet the morning of 22 January (a quick burst of heavy snow resulted in 4-6” of accumulation in the Globe area). As previously mentioned, blizzard or near-blizzard conditions occurred in the high country where high winds occurred in conjunction with falling snow. Where heavy rainfall occurred on pre-existing snow cover, enhanced runoff and localized flooding occurred; for example, a record flood crest was observed on the Agua Fria River near Rock Springs, and additional flooding occurred on the San Carlos River and numerous small streams in central Arizona. However, the rapid lowering of snow level overnight resulted in less runoff than had been expected in some areas, including through the Oak Creek Canyon.

The last part of this event occurred from late on 22 January through the morning of 23 January, as a short wave trough moved east across the region. This disturbance provided ample lift, which acted on the already established deep moisture profile to produce additional valley rain and higher elevation snowfall. As this shortwave originated from higher latitudes, and with colder air already in place, snow levels were considerably lower for this portion of the event. Snow was observed as low as 3,500 feet with a light accumulating snowfall between 4,000 to 5,000 feet range with even higher amounts above 5,000 feet. Valley rainfall averaged one quarter to three quarters of an inch.

## **F. Weather Summary and Impacts**

### **1. Snow**

Three separate snow events combined to produce enormous snowfall totals for the week-long storm. Table 2 shows the snowfall totals (in inches) for each of the three separate snow events within the week-long larger storm, along with a total for the entire week. Locations in which totals for individual events were unavailable are listed in Table 2 with M for “missing.” Asterisks (“\*”) denote those locations where estimated or interpolated snowfall amounts may have been higher than what is reported here.

Although Table 2 lists impressive snowfall amounts for Event 3, as well as for the entire week, it should be noted that snowfall amounts over much of the Mogollon Rim would have been significantly higher if the snow would not have changed to rain during the afternoon and evening hours of 21 January 2010.

**Table 2.** Snowfall amounts for each event as well as the weekly storm total (inches).

<b>Location</b>	<b>Event 1</b>	<b>Event 2</b>	<b>Event 3</b>	<b>Week Storm Total</b>
Sunrise Mountain	12*	10*	40-60*	90-96*
AZ Snowbowl	8-12	7-10	30-40*	67-92*
Forest Lakes	M	M	M	72
Hannagan Meadow	M	M	40*	50-70*
Kachina Village	8-9*	8-9*	34*	50-65*
Greer	M	M	50	60
Clints Well	3-4	16	30-37	50-60
Pinetop	7*	8*	35-45	50-60*
Mt. Graham	M	12	20*	40-60*
Grand Canyon N Rim	M	M	M	57
Flagstaff Airport (KFLG)	9.4	8.9	36.4	55.4
Bellefont (NWS office)	9.8	4.9	38	52.7
Heber	3-4	13	30-36	47-53
Munds Park	M	M	M	50
Mt. Lemmon	M	9	12*	30-50*
Parks	6	4-7	30*	43*
McNary	5	8.3	24-30	37-43
Williams	4-7	4.5	28-32	39-43
Tonto Village	6.5	6	30	41
Show Low	M	M	M	32-36



**Fig. 24.** Roofs of several business in Flagstaff collapsed, including a fabric and bookstore (left), and a community ice rink (right).

Heavy, wet snowfall of this magnitude resulted in extreme snow loading of roofs over much of the Mogollon Rim. Numerous flat roofs in Flagstaff collapsed under the weight of the snow; businesses that sustained significant roof damage included Bookman’s Entertainment Exchange, its neighbor Jo-Ann Fabrics and Crafts, and the Jay Lively Ice Rink and Recreation Center (Fig. 24). The roof of the Pinetop-Lakeside Fire Station Number 2 in Pinetop also collapsed. In addition, widespread power outages, which lasted up to several days, were reported across much of the Eastern Mogollon Rim and White Mountains.

Eighteen to forty inches of snow fell over parts of the Navajo and Hopi Reservations, severely hampering services in the area. Due to the rural and remote nature of parts of these reservations, many roads remained impassable for days. When snow finally began to melt, mud became a problem, which prevented travel on many primitive roads. Two deaths were associated with snowbound vehicles during the latter portion of the storm. Other problems experienced on the reservations included shortages of food, water, and medicine, delayed clearing of paths and roadways, broken or limited communication, widespread power outages, and delayed rescue services.

## **2. Heavy Rain and Flooding**

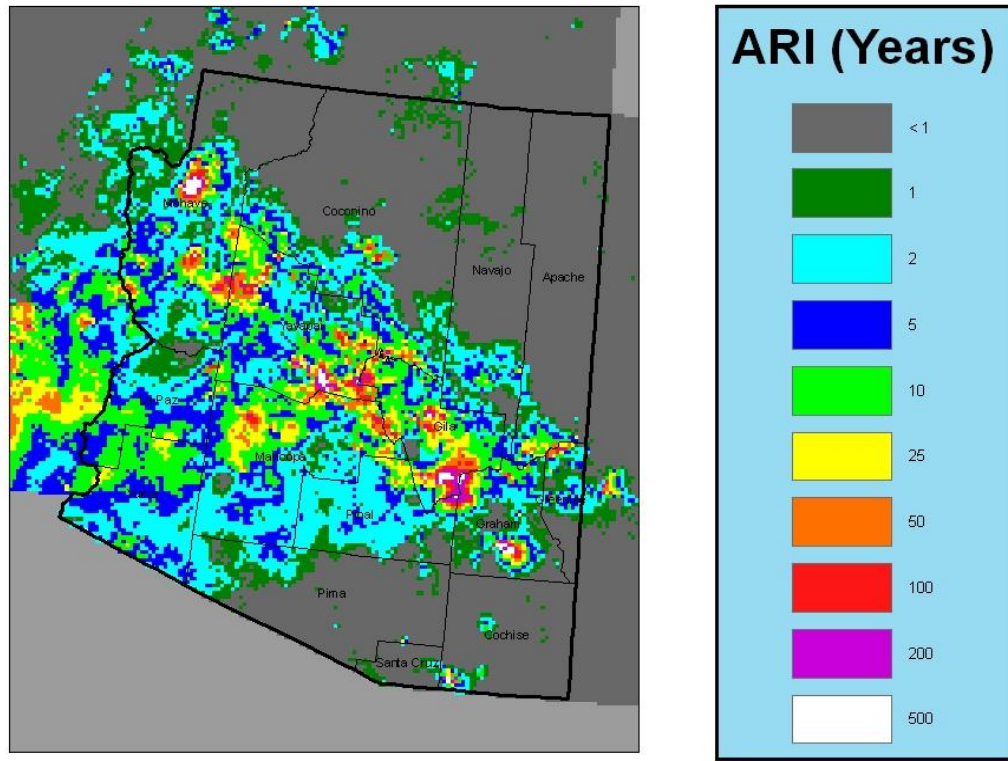
Light to moderate rain fell below 6500 feet during Events 1 and 2; however the heaviest rain of the week fell during Event 3. Although much of this precipitation fell as snow above 6,500 feet, lower elevations received anywhere from 4 to 10 inches of rain during Event 3, the heaviest of which fell over Gila and Southern Yavapai counties. Table 3 lists rain and melted snow amounts (inches) for a few selected locations for the period 18-23 January 2010. The extreme precipitation amounts during 19-22 January 2010 were, for a four day period, 1 in 100 year events for many places, and even reached 1 in 500 year levels for isolated locations (Fig. 25). Note that a 1 in 100 year (500 year) event means a 1% (0.2%) chance that an event of that magnitude would occur in any given year.

The heaviest rain impacted the Tonto Creek and Agua Fria basins, and consequently resulted in rapid and significant rises in Tonto Creek and the Agua Fria River. The Agua Fria River at Black Canyon City and Rock Springs crested near 28 feet, high enough to result in widespread flooding of land adjacent to the river, including several neighborhoods and mobile home parks. Farther upstream, along the Agua Fria at Mayor, a six year old boy was swept to his death by flood waters after his parents' vehicle became stalled in a flooded wash and was eventually overcome by flood waters. Fortunately, the victim's parents and one sibling survived the ordeal. Tonto Creek also experienced significant flooding, which resulted in evacuations along the creek in the communities of Tonto Basin and Gisela. Flooding along the Centennial Wash prompted evacuations in the town of Wenden, a community in west-central Arizona that had experienced very significant flooding back in October 2000.

Several other creeks, river tributaries, and washes across northern Arizona, but south of the Mogollon Rim, experienced flooding. Table 4 summarizes creek and river crests and associated impacts across northern and central Arizona. Fortunately, the upper basins along and just south of the Mogollon Rim, including Oak Creek and the Verde River, were spared significant flooding. Several factors led to these upper basins being spared, including:

- A lower snow level at the onset of the precipitation during the morning of 21 January 2010 (Event 3) before the change-over to rain later in the morning. Snow fell for several hours as low as 4,500 feet that morning .
- Much of the rainfall over the higher terrain was absorbed by a deep snow pack which prevented runoff into the lower elevation basins.
- The heaviest rain during Event 3 fell across the lower basins, generally below 3,500 feet. Much of the rainfall runoff across these lower basins drained into Tonto Creek and the Agua Fria River.

## January 19 - 22, 2010 Precipitation 4-Day Average Recurrence Interval



**Fig. 25.** Recurrence intervals for 19-22 January 2010 total precipitation. A few locations experienced rainfall amounts that equate to a 1 in 500 year event, or a 0.2% probability of occurring in a given year.

**Table 3.** Total liquid precipitation (rain and/or melted snow) amounts in inches.

<b>Location</b>	<b>Liquid Precipitation (Rain and/or Melted Snow in inches)</b>
Wet Bottom Creek near Childs	12.17
Globe	11.99
Tonto Creek Fish Hatchery	11.12
Payson	9.35
Happy Jack	7.90
Oak Creek Canyon	7.34
Pleasant Valley	7.10
Sedona	6.99
Prescott City	5.54
Flagstaff	5.27
Fort Valley	4.95
Bellefont	4.66
Bagdad	3.78
Heber	3.48
Prescott Airport	3.33
Window Rock	2.81
Ash Fork	2.50
Phoenix	2.40
Grand Canyon Airport	2.15
Winslow	2.00
Tucson	1.77
Page	1.12
St. Johns	0.89



**Table 4.** River crests and impacts during Event 3.

<b>River or Creek &amp; Location</b>	<b>Flood Stage (Feet)</b>	<b>Event Crest (feet) and Date/Time (MST)</b>	<b>Impacts</b>
Oak Creek at Sedona	14.0	6.2 21 Jan 2010 at 9 PM	None reported.
Oak Creek at Cornville	9.0	9.9 22 Jan 2010 at 1 AM	Minor flooding adjacent to creek
Verde River at Clarkdale	14.0	9.3 22 Jan 2010 at 5 PM	None reported.
Verde River at Camp Verde	25.0	13.3 22 Jan 2010 at 7 AM	None reported.
Granite Creek at Prescott	11.0	14.1 21 Jan 2010 at 8 PM	Significant flooding of downtown Prescott. Untreated sewage overflowed into the Prescott Basin. Significant mud deposits throughout the city.
Aqua Fria River at Mayer	14.8	16.6 21 Jan 2010 at 11 PM	Significant flooding adjacent to the river. A 6 year old boy swept to his death by swift flowing water.
Agua Fria River at Black Canyon City	16.0	27.9 21 Jan 2010 at 11 PM	The Rivers Edge RV Park in Black Canyon City was hard hit with many homes inundated with flood waters 15-20 feet deep. Numerous people rescued from rising flood waters.
Santa Maria River at Bagdad	11.0	7.4 22 Jan 2010 at 12 AM	None reported.
Centennial Wash at Wenden	6.0	6.9 22 Jan 2010 at 3 AM	Widespread flooding with some evacuations.
Cave Creek near Cave Creek Road	10.0	9.9 21 Jan 2010 at 11 PM	Nearby roads flooded.
Tonto Creek at Roosevelt	16.0	17.0 21 Jan 2010 at 11 PM	None reported.
San Carlos River near Peridot	11.0	14.0 22 Jan 2010 at 4 AM	Some homes near the river flooded. A shelter was opened for storm victims.

### 3. High Winds and Thunderstorms

A period of strong winds (Table 5) accompanied the trough passage during the evening of 21 January 2010. In addition, a band of thunderstorms produced a period of stronger winds as it crossed Arizona that evening. As a result of the strong winds, a portion of a roof was blown off a police substation south of Prescott, and a large tree was blow down onto two homes in Williams. There was also considerable damage due to thunderstorm winds in portions of the Phoenix Metro area, including numerous trees down and damage at a popular outdoor auto auction.

**Table 5.** Peak winds associated with Event 3 (21 Jan 2010).

<b>Location</b>	<b>Peak Wind Gusts Thursday and Thursday Evening (MPH)</b>
Ajo	94
Hamburg Creek	76
Stanton	69
Prescott Airport	67
Goodwin Mesa	62
Ash Fork	56
Pleasant Valley	56
Phoenix Sky Harbor Airport	55
Sedona Airport	54
Cherry	52
Deer Valley Airport	51
Yuma Airport	51
Flagstaff	50
Scottsdale Airport	49
Tucson Airport	48
Show Low	47
Frazier Wells	46
Douglas Airport	46
Nogales Airport	46
Grand Canyon Airport	43
Sunset Point	43
Saint Johns	40
Winslow	40

### **III. Summary of Services Provided by the National Weather Service**

#### **A. WFO Flagstaff, Arizona**

One week before the series of winter storms produced record setting heavy snow and rainfall across Northern Arizona, meteorologists at WFO Flagstaff were already conveying their concerns on potential significant impacts to city/county leaders and emergency managers. The Warning Coordination Meteorologist (WCM), George Howard, and Meteorologist In Charge (MIC), Brian Klimowski, coordinated this outreach effort with multiple e-mails and phone calls to 'get the word out' on the potential for record setting snowfall and flooding across Northern Arizona. Products issued from WFO Flagstaff highlighted this storm starting on 12 January 2010 with a Hazardous Weather Outlook. This product was followed up by a Special Weather Statement issued on 15 January 2010, discussing the potential for heavy rain and snow for several days over the upcoming work week.

During the days leading up to the storm, WFO Flagstaff received many reports from the public of rumors that the area would receive 8 to 10 feet of snow during the upcoming week. However, no forecasts in this range were ever issued by WFO Flagstaff, and the office staff worked hard to quell these rumors and to ensure that a clear and consistent forecast message was being released to the public. A timeline of WFO Flagstaff products and services that were delivered to the public during this event is shown in Fig. 26.

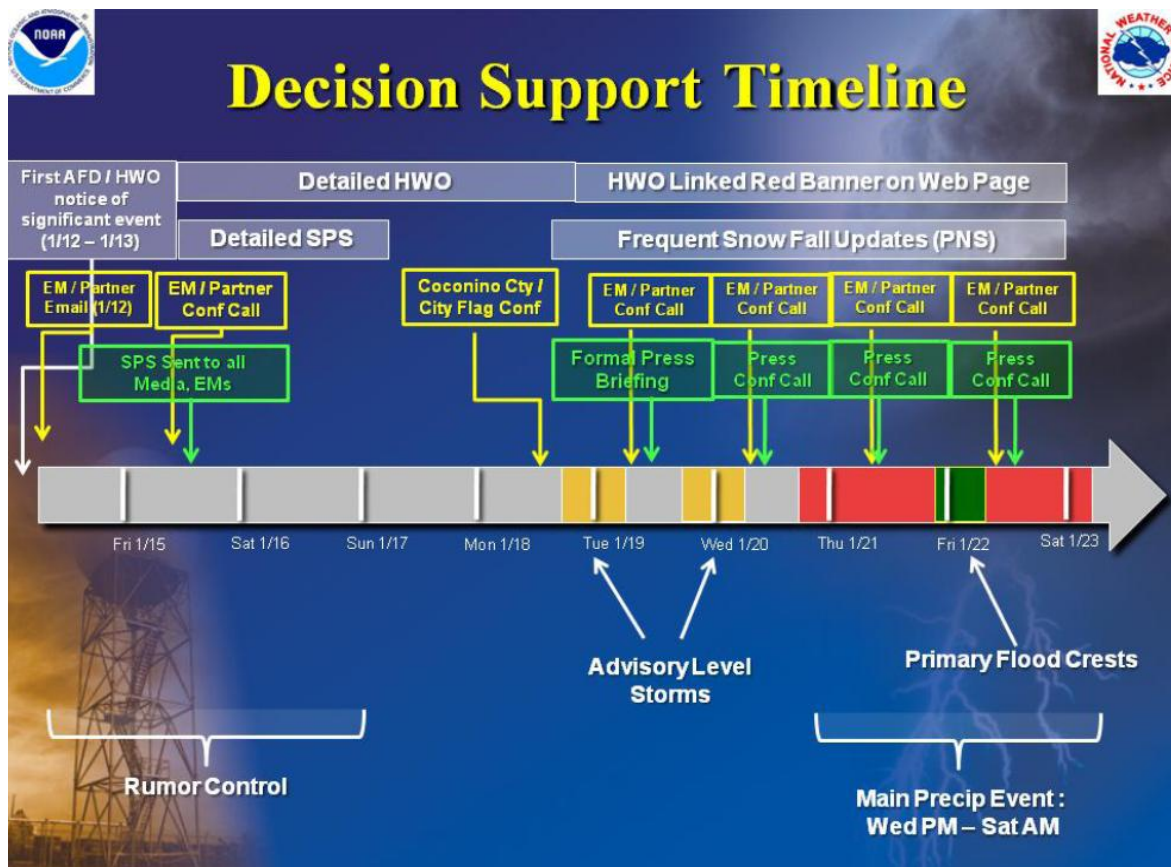
The first two events, from 18 January 2010 through 20 January 2010, brought widespread rain and snow to Northern Arizona with 12 to 24 inches of snowfall reported at many locations above 6,500 feet. Routine forecast staffing during these first two events was augmented by middle-upper level station managers, which provided assistance to enhance weather reporting operations with higher frequency updates via Public Information Statements and conference calls, as well as providing assistance to the day shift regarding watch/warning products. During these first two events, no additional staffing was needed overnight, however the public forecaster was allowed to come into work one hour early on the midnight shift rotation in order to dedicate more time to producing the morning forecast grid package. By late in the afternoon on 20 January 2010, WFO Flagstaff received reports that the Payson NOAA Weather Radio transmitter had failed on Mount Ord. Due to the high likelihood of flooding in Northern Gila County, two WFO Flagstaff Electronics Technicians were immediately dispatched to repair the transmitter. The flexibility of staff in responding to these first two storm events enabled WFO Flagstaff to provide a high level of continuous forecast support to the public, local leaders and emergency managers.

By 21 January 2010, the strongest of the three events was moving into Arizona, with forecasts of 30 to 40 additional inches of snowfall expected. The MIC adjusted staffing levels that afternoon, and eight meteorologists and technicians were held over to work the event with the anticipation of the imminent closure of Interstate 40, the office's only access road. Over the next 30 to 36 hours, this 8 person forecast team worked rotating shifts and provided continuous high level forecast support to the public with high frequency updates to winter storm warnings, hydrological flood watches/warnings, Public Information Statements and the latest Local Storm Reports. Heavy snowfall caused problems with data reception on the SBN satellite dish; consequently, WFO Flagstaff staff contacted the AWIPS Network Control Facility and requested

that the office's data download stream be converted to a backup phone line. At 10 PM MST 21 January 2010, the office's outbound phone lines, along with its communication link to the radar (KFSX), was broken due to a severed fiber optic line near Phoenix. WFO Flagstaff's backup office, NWS Las Vegas, was contacted and asked to assist the Flagstaff office with the dissemination of the office's products. The two WFO's coordinated a method in which draft products from Flagstaff were e-mailed to the Las Vegas office, and subsequently issued there.

By the morning of 22 January 2010, an additional 30 to 60 inches of snowfall at higher elevations and 5 to 10 inches of rain at lower elevations had fallen across the region. That afternoon, the WFO Flagstaff MIC arranged special permission with the Coconino County Sheriff's Department to allow WFO employees to use Interstate 40 before the highway was officially opened to the general public, so that shift swaps could be completed to relieve the staff that had been at the office for more than 30 hours. Operations gradually returned to normal that evening as the incoming swing shift helped to wrap up the event.

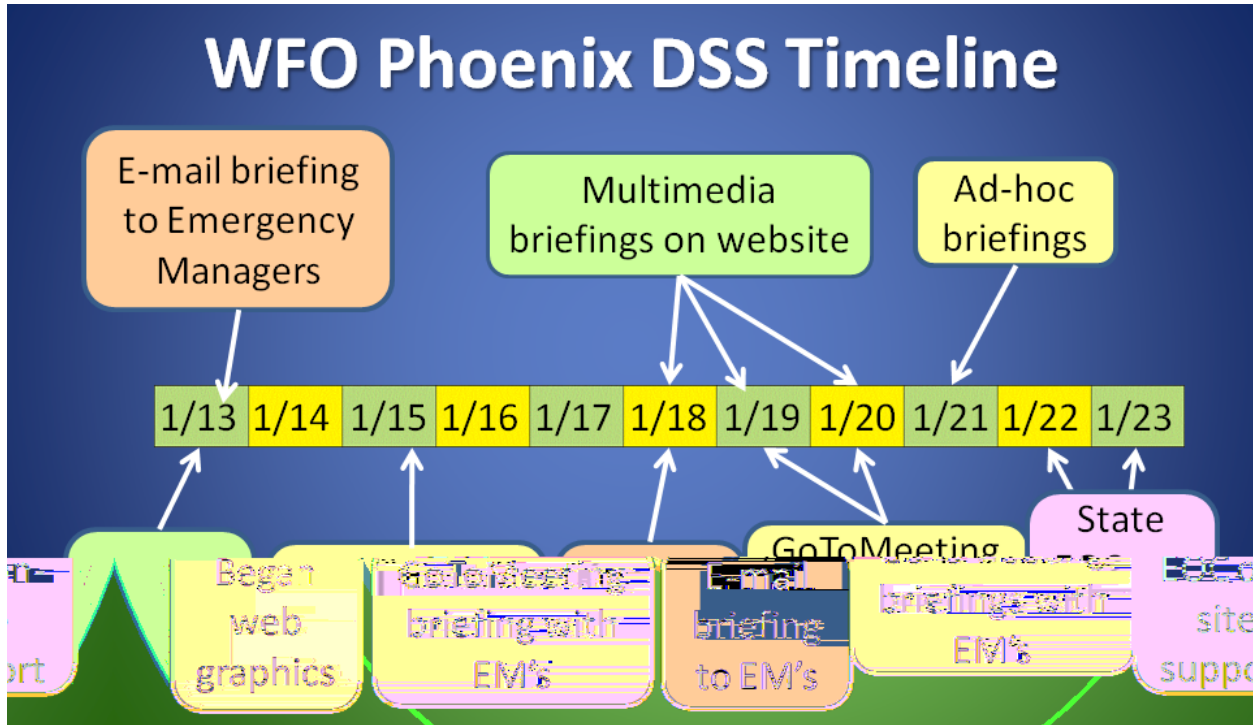
Following this weeklong winter storm event, WFO Flagstaff received praise from several county emergency managers, law enforcement agencies and community leaders for timely and accurate forecast support. The lead time and level of forecast accuracy for this winter storm was better than any previous storms. The keys to the WFO's success with this storm were 1) the accuracy and consistency of the forecast model guidance and 2) the flexibility and dedication of the WFO's staff.



**Fig. 26.** Timeline of products/services provided by WFO Flagstaff.

## B. WFO Phoenix, Arizona

WFO Phoenix provided heightened levels of service beginning 13 January, and continuing through 23 January 2010 (Fig. 27).



**Fig. 27.** Timeline of decision support services provided by WFO Phoenix.

### 1. Long Range Outlooks

Forecasters at WFO Phoenix began to recognize the potential for a prolonged and significant rainfall event more than a week before the first drops even fell. The forecast discussion issued during the afternoon of 10 January 2010 highlighted the potential for a wet weather pattern to set in commencing the week of 18-24 January.

AREA FORECAST DISCUSSION  
NATIONAL WEATHER SERVICE PHOENIX AZ  
319 PM MST SUN JAN 10 2010

NOTE...FOR SEVERAL DAYS...GFS/ECMWF OPERATIONAL RUNS AND ENSEMBLE CAST MEMBERS HAVE BEEN ADVERTISING A MUCH WETTER WEATHER PATTERN WILL EXIST OVER THE SOUTHWEST UNITED STATES COMMENCING THE WEEK OF 18-24 JANUARY...WITH RATHER STRONG SOUTHERN BRANCH OF THE JET NEAR OUR LATITUDE OVER MUCH OF THE PACIFIC OCEAN. STAY TUNED.

AREA FORECAST DISCUSSION  
NATIONAL WEATHER SERVICE PHOENIX AZ  
350 AM MST MON JAN 11 2010

A SIGNIFICANT CHANGE IN THE WEATHER PATTERN IS EXPECTED NEXT WEEK. GFS/ECMWF OPERATIONAL RUNS HAVE BEEN ADVERTISING A MUCH WETTER WEATHER PATTERN WILL EXIST OVER THE SOUTHWEST UNITED STATES COMMENCING THE WEEK OF 18-24 JANUARY. ALTHOUGH STILL FAR OUT IN THE EXTENDED FORECAST...THERE COULD BE A SIGNIFICANT AMOUNT OF RAIN NEXT WEEK AS A STRONG JET STREAM DEVELOPS ACROSS THE EASTERN PACIFIC INTO THE SOUTHWESTERN UNITED STATES.

AREA FORECAST DISCUSSION  
NATIONAL WEATHER SERVICE PHOENIX AZ  
355 PM MST WED JAN 13 2010

GFS/ECMWF IN AGREEMENT INTO EARLY NEXT WEEK...INDICATING A DEVELOPING AND HIGHLY AMPLIFIED LONGWAVE TROUGH JUST OFF THE WEST COAST ALONG WITH THE PRESENCE OF AN EL NINO-LIKE 180+ KT JET WEST OF BAJA. SEVERAL LOW PRESSURE SYSTEMS ARE EXPECTED TO IMPACT THE FORECAST AREA...BRINGING VALLEY RAIN AND THE CHANCE FOR MOUNTAIN SNOW. WHILE THE EXACT TIMING OF THE RAIN/NO-RAIN PERIODS IS STILL SOMEWHAT UNCERTAIN...FCST POPS WERE INCREASED MON NIGHT AND TUE ABOVE THE LATEST NUMERICAL GUIDANCE...DUE TO THE STRONG RUN TO RUN CONSISTENCY OF BOTH THE GFS AND ECMWF. STRONG NEGATIVE HEIGHT AND POSITIVE MOISTURE FLUX ANOMALIES REMAIN OFFSHORE THROUGH MIDWEEK...WHICH PORTEND THE CONTINUED THREAT FOR WET WEATHER...PARTICULARLY ACROSS SE CA DURING THE MID TO LATE WEEK PERIOD. FCST TEMPS WERE ALSO DROPPED A FEW DEGREES...GIVEN THE EXPECTED INCREASE IN CLOUDS.

Subsequent forecast discussions introduced the possibility for not just wet weather, but significant impacts, including heavy rain and snow. By 14 January 2010, confidence reached a point where a Special Weather Statement, the first of many, was issued, detailing some of the potential impacts and timing of the storm systems expected to impact far southeast California as well as southwest and south-central Arizona.

SPECIAL WEATHER STATEMENT  
NATIONAL WEATHER SERVICE PHOENIX AZ  
245 PM MST THU JAN 14 2010

...WET WEATHER TO AFFECT SOUTHEAST CALIFORNIA AND SOUTH  
CENTRAL ARIZONA NEXT WEEK...

A MAJOR SHIFT IN THE WEATHER PATTERN WILL TAKE PLACE EARLY  
NEXT WEEK...AS HIGH PRESSURE MOVES INTO THE CENTRAL PLAINS AND  
AS A SERIES OF STORMS MOVE ONSHORE FROM THE PACIFIC. STRONG  
WINDS IN THE UPPER LEVELS OF THE ATMOSPHERE WILL BRING A  
SERIES OF LOW PRESSURE SYSTEMS INTO SOUTHERN CALIFORNIA AND  
SOUTHERN ARIZONA ...EACH BRINGING AN INCREASED CHANCE OF  
DESERT RAINS AND MOUNTAIN SNOWS TO THE REGION.

WHILE THERE IS STILL SOME UNCERTAINTY IN THE EXACT TIMING...  
THE FIRST AREA OF LOW PRESSURE IS EXPECTED TO ARRIVE MONDAY  
AFTERNOON AND BRING PRECIPITATION TO THE REGION THROUGH MONDAY  
NIGHT. A SECOND DISTURBANCE IS EXPECTED TO ARRIVE TUESDAY  
NIGHT WITH A THIRD POSSIBLE LATER IN THE WEEK. THE TOTAL  
AMOUNT OF PRECIPITATION EXPECTED OVER THE COURSE OF NEXT WEEK  
IS A BIT UNCERTAIN AT THIS TIME...HOWEVER THERE ARE  
INDICATIONS THAT SEVERAL INCHES OF RAIN WILL BE POSSIBLE  
ESPECIALLY IN THE HIGHER TERRAIN EAST OF PHOENIX.

LOCALIZED FLOODING OF LOW LYING AREAS COULD OCCUR IF STORMS  
REMAIN OVER THE SAME AREA FOR A PROLONGED PERIOD OF TIME.  
NORMALLY DRY WASHES AND UNREGULATED STREAMS AND CREEKS WILL  
LIKELY SEE A SIGNIFICANT INCREASE IN FLOW NEXT WEEK.

SNOW LEVELS EARLY IN THE WEEK ARE EXPECTED TO BE ABOVE 8000  
FEET BUT WILL GRADUALLY LOWER TO 6000 FEET ON TUESDAY AND TO  
5500 FEET ON WEDNESDAY. MOUNTAIN SNOW ACCUMULATIONS WILL  
BECOME A POSSIBILITY FROM TUESDAY ONWARD ESPECIALLY ACROSS THE  
HIGHER TERRAIN OF SOUTHERN GILA AND NORTHERN MARICOPA  
COUNTIES.

GIVEN THE EXTENDED PERIOD OF RELATIVELY DRY WEATHER ACROSS THE  
REGION AND THE BUILDUP OF OIL AND DUST ON AREA ROADS AND  
HIGHWAYS...THIS CHANGE WILL LIKELY RESULT IN SLIPPERY ROAD  
CONDITIONS NEXT WEEK. MOTORISTS SHOULD BE ALERT FOR SLICK  
CONDITIONS AND TAKE THE PROPER PRECAUTIONS IF PLANNING TRAVEL  
NEXT WEEK.

STAY UP-TO-DATE ON THE LATEST FORECASTS BY LISTENING TO  
WEATHER RADIO ON THE PUBLIC SERVICE BAND. MORE DETAILED  
INFORMATION IS AVAILABLE FROM THE NATIONAL WEATHER SERVICE IN  
PHOENIX ON THE INTERNET AT WEATHER.GOV/PHOENIX.

## 2. Probability of Precipitation and Quantitative Precipitation Forecast Performance/Trends

Generally speaking, precipitation chances were exceptionally high several days before any of the events impacted WFO Phoenix's county warning area (CWA). The probability of precipitation (PoP) forecasts were very aggressive from the outset, with the series of storms expected (Table 6). For the most significant event (Thursday and Thursday night, 21 January 2010), the Day 7/168-hour forecast featured PoPs that averaged 31% and 61%, respectively. As the event drew closer, PoPs steadily increased, especially for Thursday night, with average PoP for the CWA nearly 90% three days in advance.

**Table 6.** Trends in the probability of precipitation (PoP) during the period 18-23 January for WFO Phoenix's county warning area (CWA). PoPs for days one through seven represent the average value for the entire CWA. Verification is compared to the coverage of the CWA that received precipitation. Average precipitation is also provided for comparison purposes.

<b>Date</b>	<b>Average Precip.</b>	<b>Coverage</b>	<b>Day 1 Fcst</b>	<b>Day 2 Fcst</b>	<b>Day 3 Fcst</b>	<b>Day 4 Fcst</b>	<b>Day 5 Fcst</b>	<b>Day 6 Fcst</b>	<b>Day 7 Fcst</b>
<b>Monday 18 JAN 2010</b>	0.04"	80%	50%	54%	54%	39%	40%	27%	10%
<b>Mon Night 19 JAN 2010</b>	0.11"	85%	83%	78%	72%	56%	50%	35%	35%
<b>Tuesday 19 Jan 2010</b>	0.12"	94%	67%	65%	53%	40%	38%	38%	32%
<b>Tue Night 20 JAN 2010</b>	0.67"	100%	82%	72%	79%	67%	55%	34%	23%
<b>Wednesday 20 JAN 2010</b>	0.01"	11%	20%	32%	40%	23%	28%	36%	29%
<b>Wed Night 21 JAN 2010</b>	0.41"	100%	73%	63%	60%	56%	37%	22%	22%
<b>Thursday 21 JAN 2010</b>	0.95"	100%	93%	77%	72%	66%	51%	49%	31%
<b>Thu Night 22 JAN 2010</b>	0.74"	99%	95%	95%	89%	81%	79%	75%	61%
<b>Friday 22 JAN 2010</b>	0.11"	61%	64%	58%	57%	58%	56%	55%	55%
<b>Fri Night 23 JAN 2010</b>	0.05"	40%	49%	43%	31%	31%	34%	43%	46%
<b>Saturday 23 JAN 2010</b>	0.00"	11%	24%	24%	23%	21%	21%	23%	39%



### 3. Watches, Warnings, and Advisories

The strongest in the series of storms (Event 3) affected WFO Phoenix's CWA on 21-22 January 2010. This storm prompted the majority of the "legacy" hazardous weather products from WFO Phoenix. A Flash Flood Watch was issued for the western two-thirds of the CWA the morning of 20 January 2010, and was expanded to cover the entire CWA early on 21 January 2010. From 5 AM 21 January 2010 to 5 AM 22 January 2010, WFO Phoenix issued a total of 15 Flash Flood Warnings, 4 River Flood and Areal Flood Warnings, and 22 Flood Statements.

WFO Phoenix issued a High Wind Watch for its central and western CWA at midday on 20 January 2010, valid for 21 January. This was believed to be the first time a High Wind Watch had ever been posted for the Arizona portion of the CWA. The High Wind Watch was upgraded to a High Wind Warning the morning of 21 January 2010. Based on expectation of high winds, several Airport Weather Warnings were issued for Phoenix Sky Harbor International Airport during the event. Terminal Aerodrome Forecasts (TAFs) beginning with the 00Z 21 January 2010 issuance consistently featured southerly winds of 35 kts, with gusts to near 50 kts, between 22Z 21 January 2010 and 04Z 22 January 2010, which alerted airport personnel to the high likelihood of high-impact crosswinds.

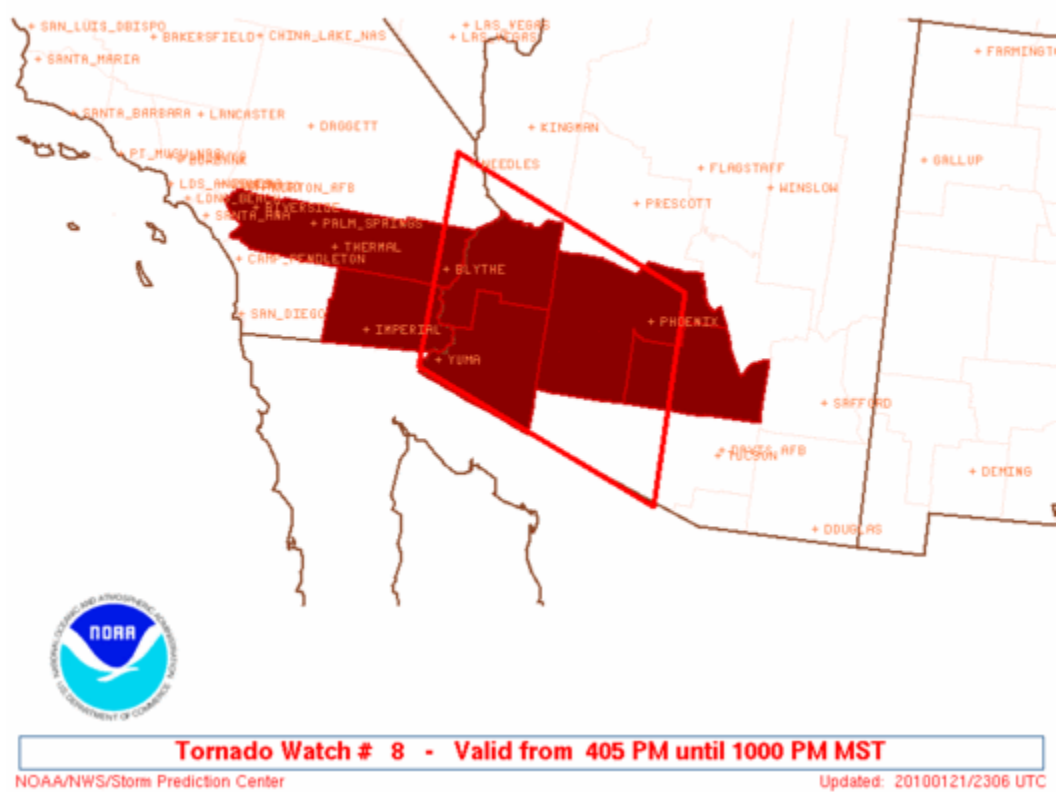
During the afternoon of 21 January 2010, the NWS Storm Prediction Center (SPC) issued Tornado Watch #8 for far Southeast California and much of southwest and south-central Arizona, valid from 405 PM through 1000 PM (Fig. 28), the first Tornado Watch SPC had issued for any of WFO Phoenix's CWA since January 1993. During the watch, WFO Phoenix issued 4 Severe Thunderstorm Warnings and 4 Tornado Warnings (Fig. 29). While only one confirmed tornado was documented (in/near Blythe, CA, just across the California-Arizona border), high winds uprooted trees and damaged buildings within two of the other three Tornado Warnings. Though a tornado was reported over North Scottsdale the evening of 21 January, a damage survey conducted the following day found no evidence of tornado damage.

PUBLIC INFORMATION STATEMENT  
NATIONAL WEATHER SERVICE PHOENIX AZ  
439 PM MST FRI JAN 22 2010

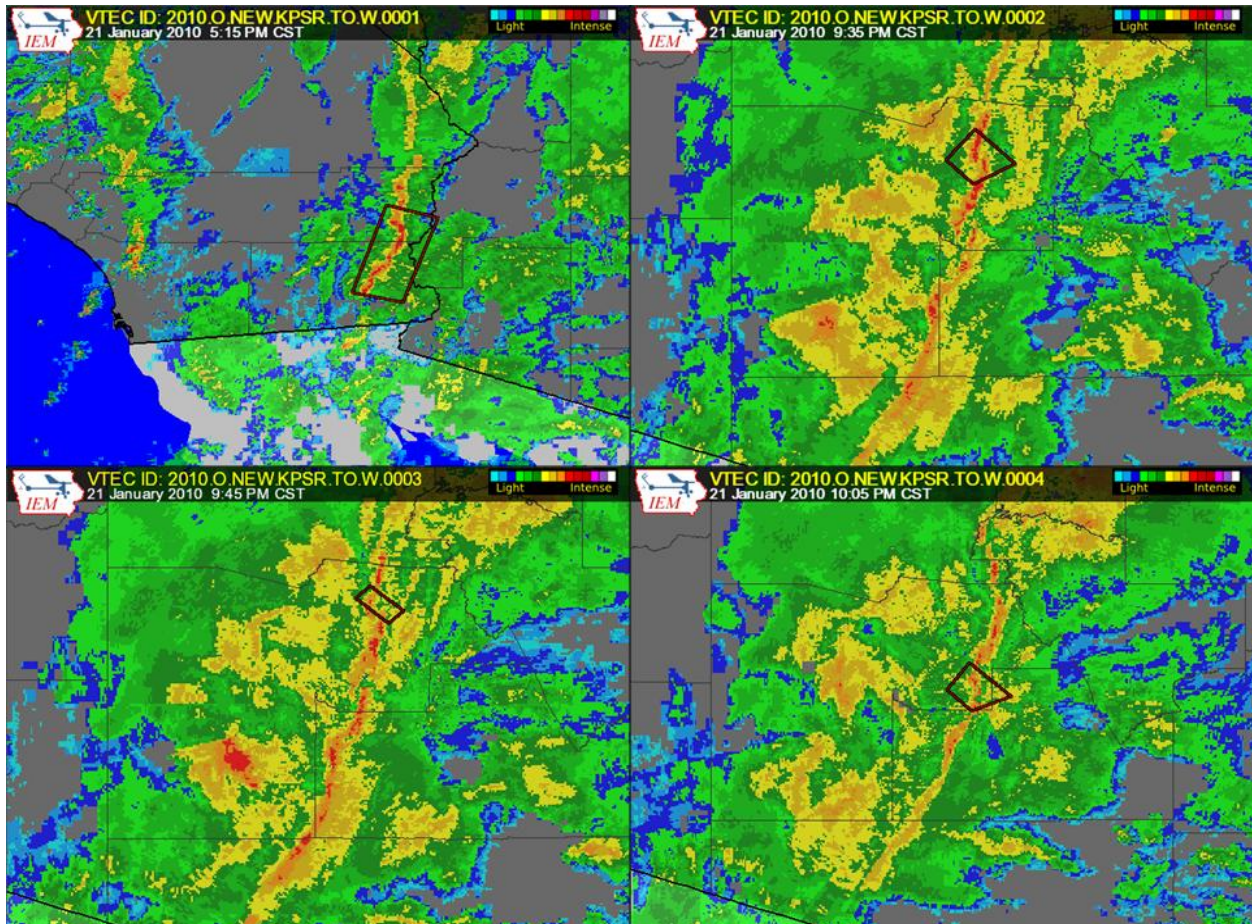
...RESULTS OF NORTH PHOENIX/NORTH SCOTTSDALE DAMAGE SURVEY...

ON FRIDAY AFTERNOON...NATIONAL WEATHER SERVICE STAFF TOURED THE LOOP 101 CORRIDOR FROM NORTHEAST PHOENIX TO NORTHWEST SCOTTSDALE. THE MOST SIGNIFICANT DAMAGE...IN THE FORM OF UPROOTED TREES...WAS OBSERVED SOUTH OF LOOP 101 NEAR PRINCESS DRIVE. DAMAGE TO TREE LIMBS AND FENCES WAS OBSERVED WEST TO NEAR LOOP 101 AND TATUM BOULEVARD. BASED ON THE OBSERVED IMPACTS...STRAIGHT-LINE WINDS LIKELY MOVED THROUGH THE AREA ON THURSDAY EVENING. MAXIMUM WINDS WERE NEAR 60 MPH NEAR THE PRINCESS DRIVE AREA.

Low snow levels nearing 3,500 feet and continuing precipitation toward the end of Event 3 prompted WFO Phoenix meteorologists to issue a Winter Storm Warning for Southern Gila County. Globe received 3 to 8 inches of snow, mainly during the morning of 22 January 2010.



**Fig. 28.** Outline of Tornado Watch #8 (heavy red line) and counties included (maroon shading).



**Fig. 29.** Four tornado warnings issued by WFO Phoenix. All four warnings were based on tornadic radar signatures and storm environment, as determined by WFO Phoenix meteorologists. A tornado was confirmed with one of the four warnings (top-left, in Blythe, CA). Straight line wind damage occurred while the second warning (top-right) was in effect. No tornado damage was reported with the last two warnings.

## **4. Enhanced Services**

### **a) Weather Story Graphics**

Exceptionally consistent numerical guidance in advance of this event allowed the WFO Phoenix staff to provide a series of web-based decision support services. “Weather Story” graphics posted to the WFO Phoenix Web page first mentioned the possibility of a wet pattern on the afternoon of 10 January 2010. On 12 January 2010, the Weather Story began graphically depicting the potential impacts (Fig. 30). Later, Weather Stories illustrated the ingredients coming into play, and provided more detail regarding potential impacts. Weather Stories shifted from a “strategic” (large-scale, outlook) to a “tactical” (small-scale, near-term, short-fused) focus as the strongest storm, Event 3, unfolded (Figs. 31-33).

### **b) Multimedia Web Briefings**

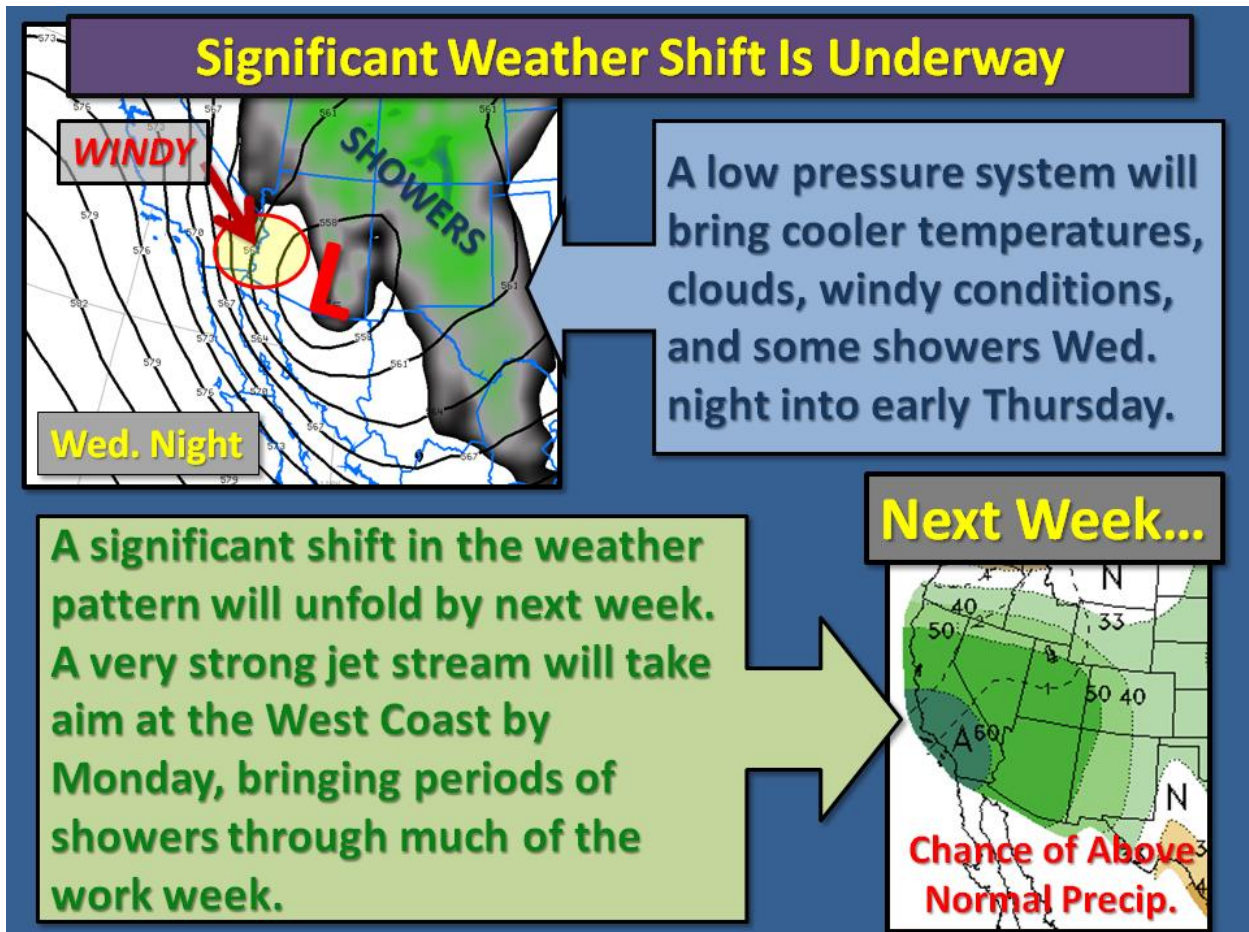
WFO Phoenix staff posted its first-ever locally-generated multimedia weather briefings to the WFO Phoenix website; a total of 3 separate briefings were created and posted during the mornings of 15 January 2010, 17 January 2010, and 20 January 2010. Briefings, between three and four minutes in length, provided an overview of large-scale weather features, expected impacts, and safety/preparedness tips (Fig. 34).

### **c) Emergency Management**

Briefings for emergency management partners began on 12 January 2010, when the upcoming pattern change was discussed at a regional meeting. The WFO Phoenix WCM sent E-mail briefings to emergency managers, spotter coordinators, and first responder agencies on 13 January 2010. Approximately 100 addressees are on this mailing list; however, the list was further expanded as some emergency managers forwarded the briefings to their own mailing lists.

On the afternoons of 15 January 2010, 19 January 2010, and 20 January 2010, WFO Phoenix staff conducted GoToMeeting-based online briefings for emergency management partners, with content similar to the pre-recorded multimedia presentations discussed above. Attendees then had the opportunity to ask questions and get additional interpretation from WFO Phoenix meteorologists.

Late in the evening of 21 January 2010, officials from the La Paz County Mobile Command Center contacted WFO Phoenix. The center was stationed in Wenden near Centennial Wash. Water in the wash had begun to recede, and the command center staff asked about standing down. Based on observations of additional rain upstream, NWS meteorologists advised that the wash could refill and that the center not stand down. Late during the night of 21 January 2010, the wash began to rise again. Since the command center staff was in place, they were able to quickly execute the evacuation of threatened homes near the wash.



**Fig. 30.** Weather Story issued during the afternoon of 13 January 2010 indicating the increasing probability that a wet weather pattern would develop the next week.

# A Very Wet Week Lies Ahead

Several rounds of showers will hit the SW US during the next week. The first will arrive Mon/Tue.

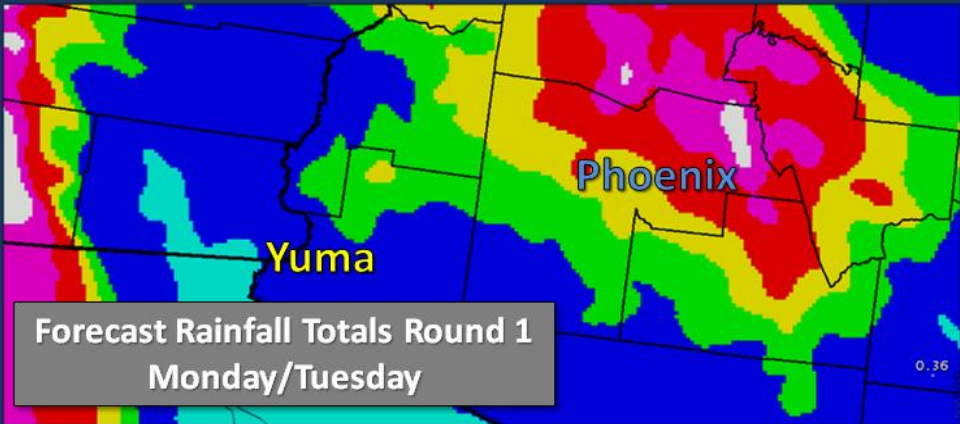
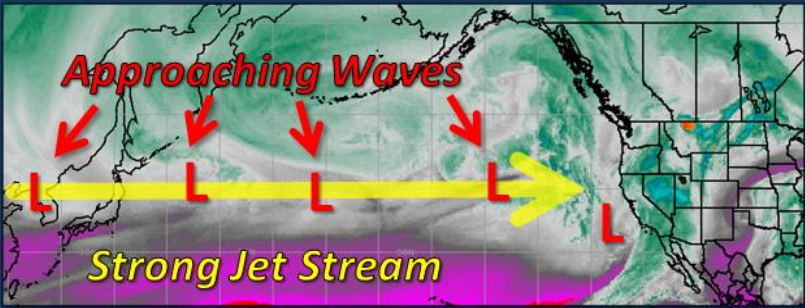
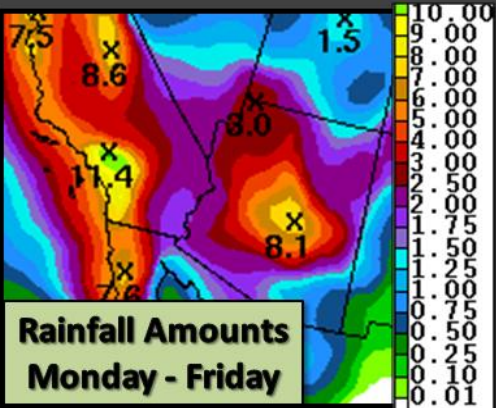
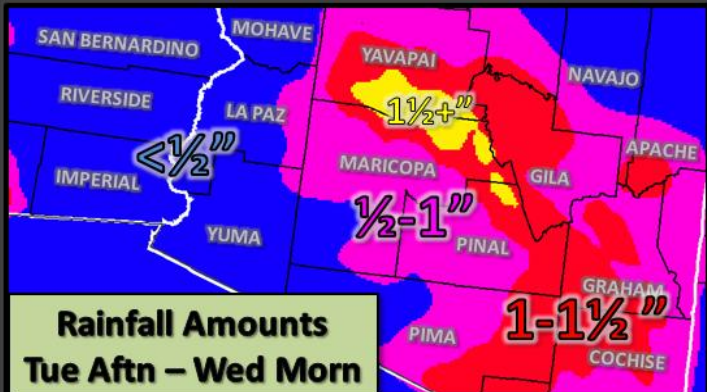


Fig. 31. Weather Story issued 16 January 2010 depicting several storm systems moving across the Pacific Ocean (top) and forecast rainfall amounts with Event 1 (bottom).

# Very Wet Week Ahead – Be Prepared!



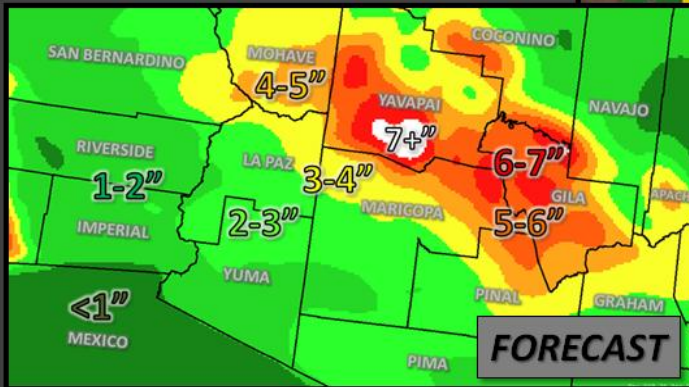
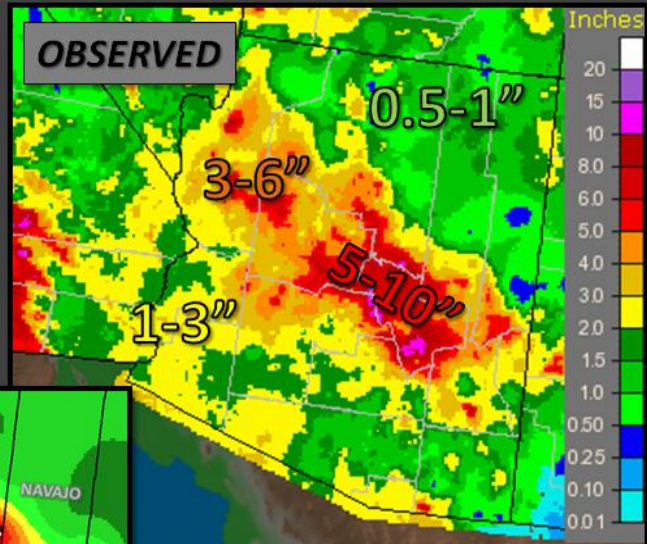
Significant rain is expected this week as *several* storms will roll through the Southwest. **Flooding is likely by mid-week.**



**Fig. 32.** Weather Story issued 18 January 2010 depicting rainfall amounts expected with Event 1 (top left), Event 2 (bottom left) and precipitation totals through the week (bottom right). The possibility of flooding is explicitly mentioned.

## Total Rainfall Through Friday Morning

Precipitation will be winding down today across Arizona. The biggest amounts were in Central Arizona, where over 10" of rain was measured.



Compare forecast rain amounts (left) to observed (above).

**Fig. 33.** Weather Story issued 23 January 2010 comparing forecast rainfall amounts (bottom left) to observed rainfall amounts (top right) for the past several days.

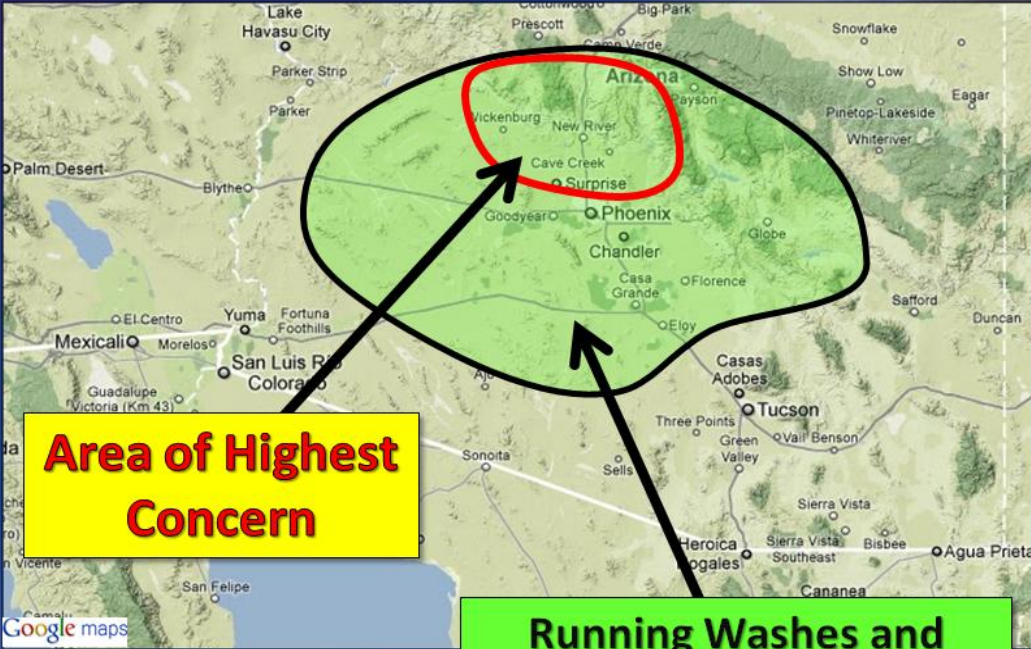




National Weather Service – Phoenix, AZ  
Weather.gov/Phoenix



# Very High Flood/Flash Flood Threat!



**Area of Highest Concern**

**Running Washes and Flooding Likely**

Fig. 34. Example of material included in the third multimedia briefing, posted during the evening hours of 20 January 2010. The threat of flooding was given a high amount of attention.

The Arizona Division of Emergency Management activated the state Emergency Operations Center (EOC) the evening of 21 January 2010. On the morning of 22 January 2010, after receiving a request from the EOC, WFO Phoenix dispatched staff to serve in a liaison role at the state EOC. Liaison activities extended from 7AM through midnight that day, and from 7AM to 1PM the following day. While stationed at the EOC, NWS meteorologists provided weather analysis, periodic briefings, and forecast interpretation to EOC personnel. On the morning of 23 January 2010, the WFO Phoenix liaison to the EOC provided a personal briefing to Arizona Governor Jan Brewer in support of the Governor's request for federal disaster assistance.

#### **d) Media**

WFO Phoenix staff actively partnered with local media outlets before and during the events. Staff members conducted at least 47 interviews between 14 January 2010 and 23 January 2010. Highlights of the media interaction included interviews with USA Today, AP Radio Network, and Arizona Radio News Network.

NWSChat proved to be valuable for technical collaboration with media partners. A communications failure the afternoon of 21 January 2010 negatively impacted the ability to run NWSChat. However, quick action by our Electronics Technicians provided limited NWSChat capability until full communications were restored.

#### **e) Storm Spotters**

Storm spotters across the WFO Phoenix CWA provided timely reports of storm impacts. Amateur radio coordinators in the Phoenix Metropolitan Area gathered and relayed storm reports to the NWS. Spotters in the general public utilized e-mail, eSpotter, and telephone to provide reports of heavy rain, flooding, and wind damage.

#### **f) Aviation**

Strong crosswinds the evening of 21 January 2010 caused major impacts to aviation operations at Phoenix Sky Harbor International Airport (PHX). On the afternoon of 20 January 2010, the WFO Phoenix aviation forecaster collaborated with the NWS Central Weather Service Unit in Albuquerque (ZAB) and PHX TRACON regarding the likelihood of strong crosswinds at PHX the following day. ZAB passed this information along to TMU and other partners, and PHX TRACON followed up with several contacts through the event. Briefings from WFO Phoenix focused on the onset and ending time of the 27+ knot winds, and allowed TRACON staff to adapt their operations and staffing plans accordingly.

At least two airlines contacted the WFO Phoenix aviation forecaster for briefings and updates: Southwest Airlines called on the afternoon of 20 January 2010 and, based on input they received, started adjusting their operations plans for the following day. Alaska Airlines made contact on the evening of 21 January 2010 regarding wind trends for the rest of the night. Based on the forecast of decreasing wind speeds and crosswind component, Alaska Airlines was able to send aircraft on to PHX that had been diverted to Las Vegas, thus eliminating flight cancellations on the following morning.

### **C. WFO Tucson, Arizona**

An exceptionally strong Pacific storm system impacted the WFO Tucson CWA on 21 January 2010 into 22 January 2010. This storm produced a wide variety of weather across Southeast Arizona, necessitating a large number of products and services from WFO Tucson. The combination of heavy rain and melting mountain snowpack resulted in several flooding issues, while a significant wind event resulted in strong and damaging winds being reported in many locations across Southeast Arizona. High winds resulted in blowing dust in the typical dust prone locales during the height of the storm. While WFO Tucson deals with dust issues quite frequently, the high winds also combined with heavy snow in the mountains to produce blizzard conditions in the higher elevations, a far rarer phenomena for Southeast Arizona. In addition, severe thunderstorms caused significant wind damage across portions of Pima County including the Tucson metro area during the evening hours of 21 January 2010.

WFO Tucson began working with its customers and partners with over five days lead time in many instances, in preparation for this incoming storm system. All computer models displayed an unusually early and strong consistency regarding their forecasts for this storm, increasing forecast confidence and allowing services provided by WFO Tucson to begin much sooner than is often the case. The WFO Tucson WCM delivered the first email briefings to emergency management describing the approaching storm as early as 12 January 2010. The WCM also facilitated GoToMeeting online briefings with local and state emergency management, the media, the forest services, and local flood control personnel on 15 January 2010 continuing through 20 January 2010. These live briefings proved to be an excellent way to keep our partners and customers informed, and they maintained public awareness of the unusually strong storm as it approached Arizona.

One of the primary ways in which WFO Tucson served its customers and partners was through multimedia web briefings on its website. For the first time in the history of the office, WFO Tucson staff posted webcasts on its website each day starting 19 January 2010 and continuing through 22 January 2010, outlining forecast thinking and illustrating the magnitude of the storm system. These webcasts were very well received by users, with several positive written comments received. The media also responded very positively to this new source of information. It is rare when Southeast Arizona weather warrants the issuing of special webcasts, but it is clear given the magnitude of the storm, and the multiple and complex threats it posed, the information provided by WFO Tucson on the internet was much needed and well received.

In addition to the multimedia web briefings, weather story graphics that are normally available on WFO Tucson's website were enhanced to provide direct decision support information to partners and customers. Early on, as much as a week before the onset of the 21-22 January 2010 storm, weather story graphics depicted the strong 200+ kt jet stream approaching from the Pacific. Weather story graphics were routinely updated during the passage of the storm, emphasizing the primary sensible weather impacts expected. Weather story graphics were very important, for example, in depicting exactly when and where the high wind threat was the greatest during 21 January 2010 and the early morning hours of 22 January 2010.

Unusually strong and consistent model agreement allowed WFO Tucson to forecast the incoming storm aggressively, increasing the PoP forecast to very high levels at very long lead times. PoP forecasts exceeded 80% as early as five days before the impending storm. WFO Tucson also issued its first ever blizzard watch with over 48 hours of lead time as it was clear that the combination of the extreme wind fields and heavy mountain snow would result in blizzard conditions of the type very rarely seen in Arizona. Other very rare products were issued by WFO Tucson in preparation for this event, including excessive rainfall outlooks issued by the hydrologist on the afternoons of 19 and 20 January 2010. These hydrological discussions are only very rarely issued by WFO Tucson, but they were well warranted in this case, emphasizing the flooding that was expected to result from the combination of heavy rain and melting snowpack.

The most dangerous aspect of this storm, and what would impact the public the most, would be the high winds. In anticipation of this, a high wind watch was issued for the entire Southeast Arizona CWA on 19 January 2010. As the storm approached, WFO Tucson purposely mentioned in the high wind watch product that hurricane force wind gusts would be possible, especially on the higher terrain. This enhanced wording was an excellent way to differentiate the incoming weather event from a more routine product issuance. This high wind watch would be upgraded to a high wind warning, effective from the morning of 20 January 2010 through the following morning, and would later verify with many reports of damaging winds across Southeast Arizona.

As expected, several urban/small stream flood advisories were required across the CWA, as heavy rainfall combined with initially rather high snow levels and melting snowpack. Advisories were issued for rising washes in Central and Western Pima county during 21 January 2010, as well as for Eastern Pima county including Tucson. Advisories issued by WFO Tucson helped notify the public of the dangers that the rising water posed. For example, 16 hikers were trapped by rising waters in Sabino Canyon near Tucson on 21 January 2010. Also, several roads were closed by the high waters around the Tucson metro area, with at least one swift water rescue performed on a stranded motorist during the early morning of 22 January 2010 in the Canada del Oro wash. More flood advisories were issued for the Eastern CWA through the next morning, with more reports of swift water rescues being performed in Graham county during the late evening hours of 21 January 2010. The flood advisory for Central Pima county was upgraded to a flood warning during the early morning hours of 22 January 2010 for the Vamori and San Simon washes, and then extended into that afternoon as areas near the wash continued to flood during the day. WFO Tucson also had to contend with the prospect of mainstem river flooding, with flood warnings issued for the Blue River near Clifton, the San Carlos River near Peridot, and the Gila River near Duncan on 22 January 2010.

Perhaps the most memorable aspect of this strong Pacific storm for Southeast Arizona will be its severe weather potential. While instability remained marginal, extremely strong wind fields created very strong wind shear during the afternoon and evening hours of 21 January 2010, and created an extremely rare kinematic environment in which high levels of helicity encouraged storms to rotate. Convection remained generally linear across the Western and Central CWA during the afternoon/evening hours of 21 January 2010, but nonetheless observed LEWPs and bow echoes embedded in the convective lines were enough for the NWS SPC to issue an extremely rare tornado watch for Arizona. Initially, it was decided by the WFO Tucson staff to

include only Pinal county in the tornado watch, but with the radar trends across the Western CWA it soon became apparent that the tornado watch was needed for all of Pima county including the Tucson metro area. The evening shift at WFO Tucson was instrumental in coordinating with the SPC on extending the tornado watch in space and time to include Pima county. This process resulted in extensive coordination with the media and other customers, mainly to clarify what a tornado watch technically means, and to clarify the watch area. It is believed this has been the only tornado watch issued for the WFO Tucson CWA, so understandably there were many questions and concerns from partners, customers, and the public in general. Fortunately, the need for additional staffing was foreseen for this evening shift, and the very heavy workload was handled well by the expanded evening shift team. Davis-Monthan Air Force Base and City of Tucson Communications requested and received information on the tornado watch. WFO Tucson staff called all three local television stations, informing them of the tornado watch issuance for Pima county for their 10 PM newscasts. Later, media meteorologists praised the NWS staff for keeping them abreast of the rapidly changing, and exceedingly rare, weather situation. During this busy coordination, NWS staff also performed interviews regarding the storm for the print media as well, including the Sierra Vista Herald and the Arizona Daily Star.

No tornadoes were officially reported in Southeast Arizona. The primary threat would be damaging straightline winds, as any convection easily transported the very strong momentum aloft down to the surface. Several severe thunderstorm warnings were issued from WFO Tucson, progressing from west to east with the cold frontal passage. The first severe thunderstorm warning was issued for Western Pima county from 730-830 pm on the evening of 21 January 2010, with enhanced text in the warning product mentioning that destructive wind gusts over 80 mph would be possible. Subsequent severe thunderstorm warnings were issued for Western Pima and Southwest Pinal counties, Central Pima county, and finally Eastern Pima county including Tucson from 1130 PM through 1215 AM Friday morning. Specific information was included in the warning text, explaining that despite their relative lack of lightning, showers and thunderstorms along and just ahead of the cold front would produce the strongest winds. Warnings continued to mention the possibility of wind gusts near 80 mph on higher terrain, such as near the Catalina Mountains as the storms approached Tucson.

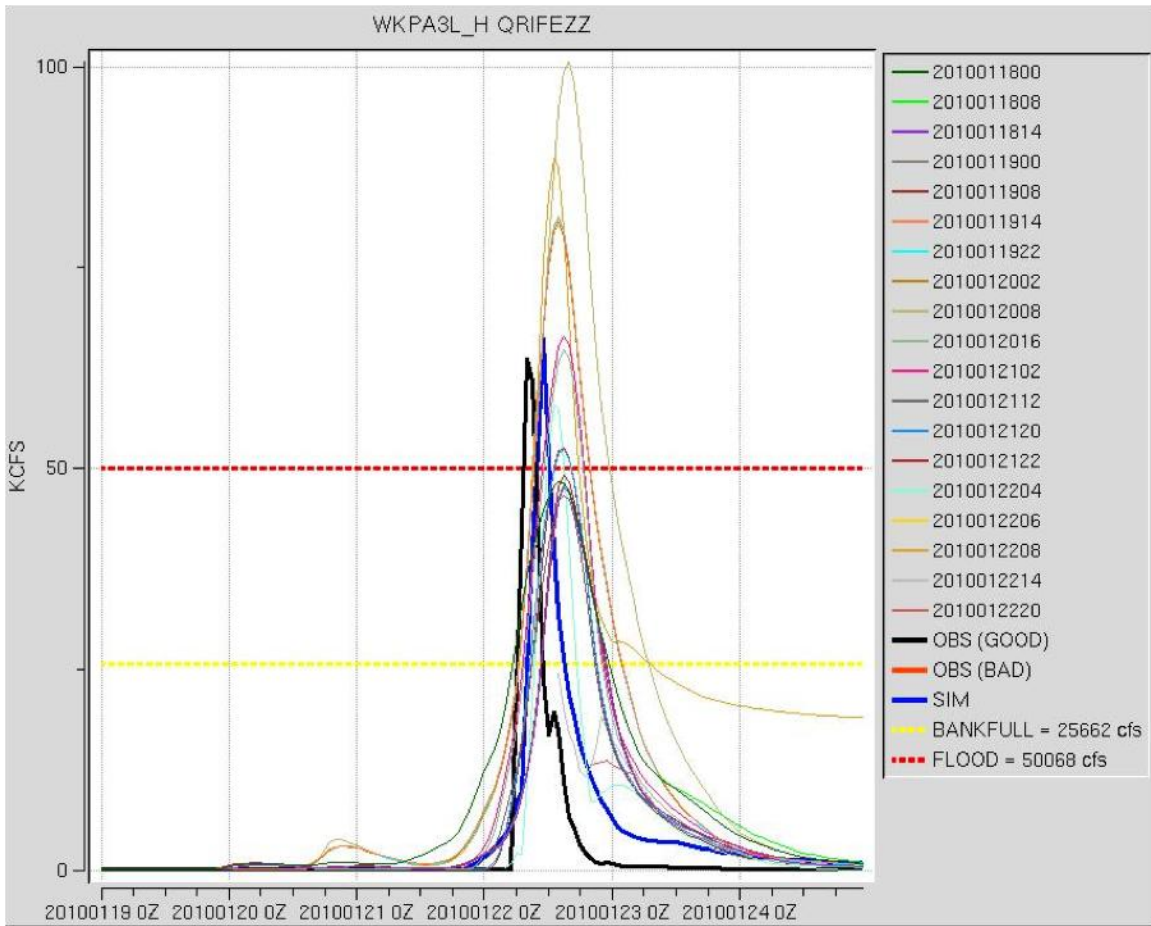
The remarkable ability of computer models to forecast this storm many days in advance allowed WFO Tucson ample time to plan how services would be provided. For example, adequate operational staffing was critical for the week of 18-22 January 2010. The addition of a day shift event coordinator not only unified our message to partners and customers, but freed up other staff to perform various tasks. With the help of planning and the additional staff, WFO Tucson was able to improve and expand its services to the public regarding this strong winter storm.

#### **D. Colorado River Basin River Forecast Center**

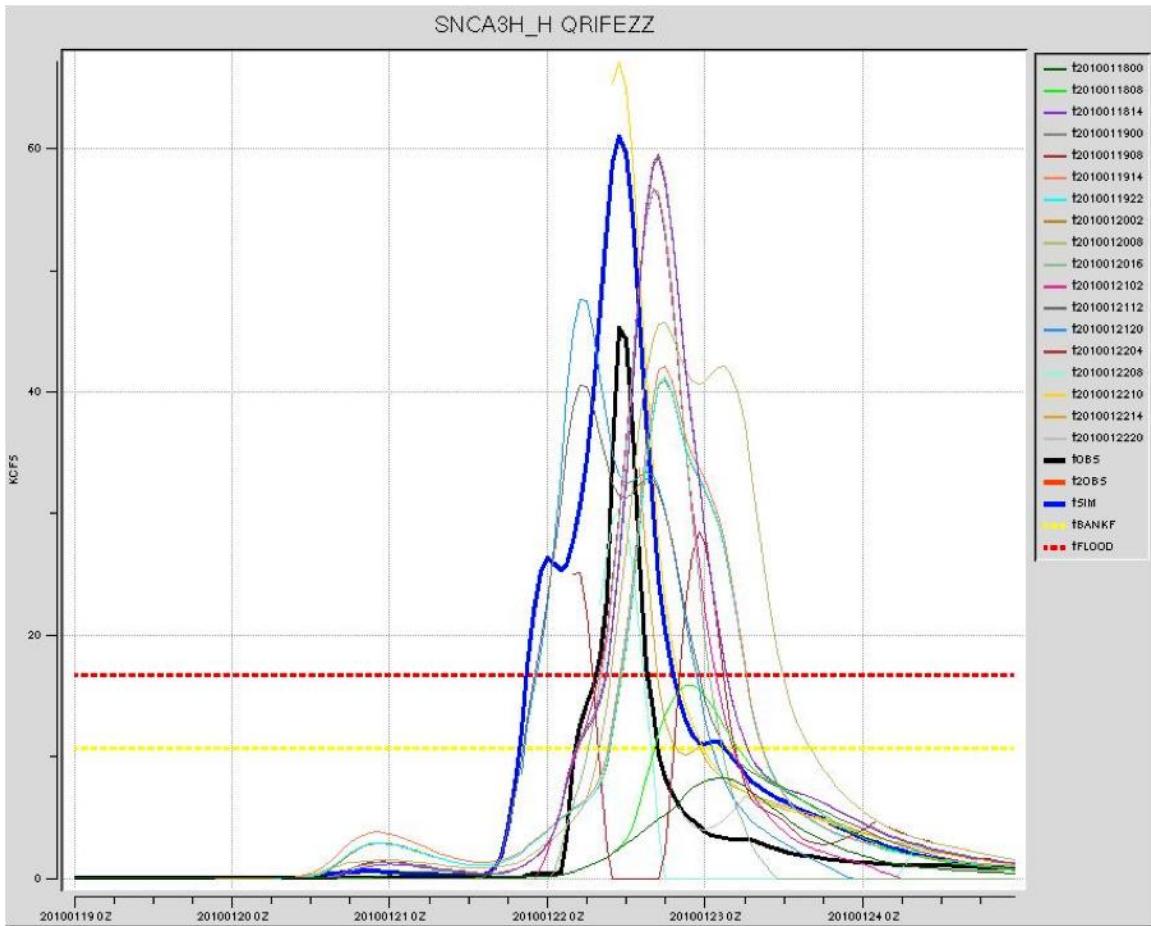
The Colorado Basin River Forecast Center (CBRFC) issued multiple forecasts for affected streamflow forecast points during the event. CBRFC forecasters covered additional hours from 19 January 2010 through 23 January 2010 and was staffed continuously from 5AM 20 January 2010 through 5PM 23 January 2010. During this time period, CBRFC worked closely with the affected WFOs to issue and update forecasts as requested. CBRFC updated forecasts as conditions in the streams warranted or as discussions with WFO forecasters demanded. Depending on the basin, between 5 and 10 additional forecast updates were generated in addition to the normal three times daily forecasts issued by the CBRFC. The CBRFC also participated in GoToMeetings with users hosted by both WFOs Flagstaff and Las Vegas.

Streamflow forecast error generally reflected quantitative precipitation forecast (QPF) error. Forecast points in areas where the QPF verified reasonably well generally verified equally as well. Specific forecasts are shown for a few forecast points below. Fig. 35 shows the forecasts, simulated, and observed streamflow for the Big Sandy Wash near Wikieup. This is a fairly typical point where the streamflow forecasts were very near the observed in both timing and peak flow magnitude. Fig. 36 shows streamflow at the San Carlos River near Peridot, where a very significant, and possibly record-setting, flooding event occurred. The forecasts were quite good for this point.

Fig. 37 shows a point on the Verde River where problems getting current ratings curves existed. Finally, Fig. 38 shows streamflow at Oak Creek near Sedona. This point was very significantly overforecast. Much of the overforecast was due to overdone QPF and possibly to freezing levels. It was unclear whether the gage was bad, and there was a delay in being able to communicate with anyone in Sedona for a real time update. This kept the official forecast too high extending into the early morning hours.

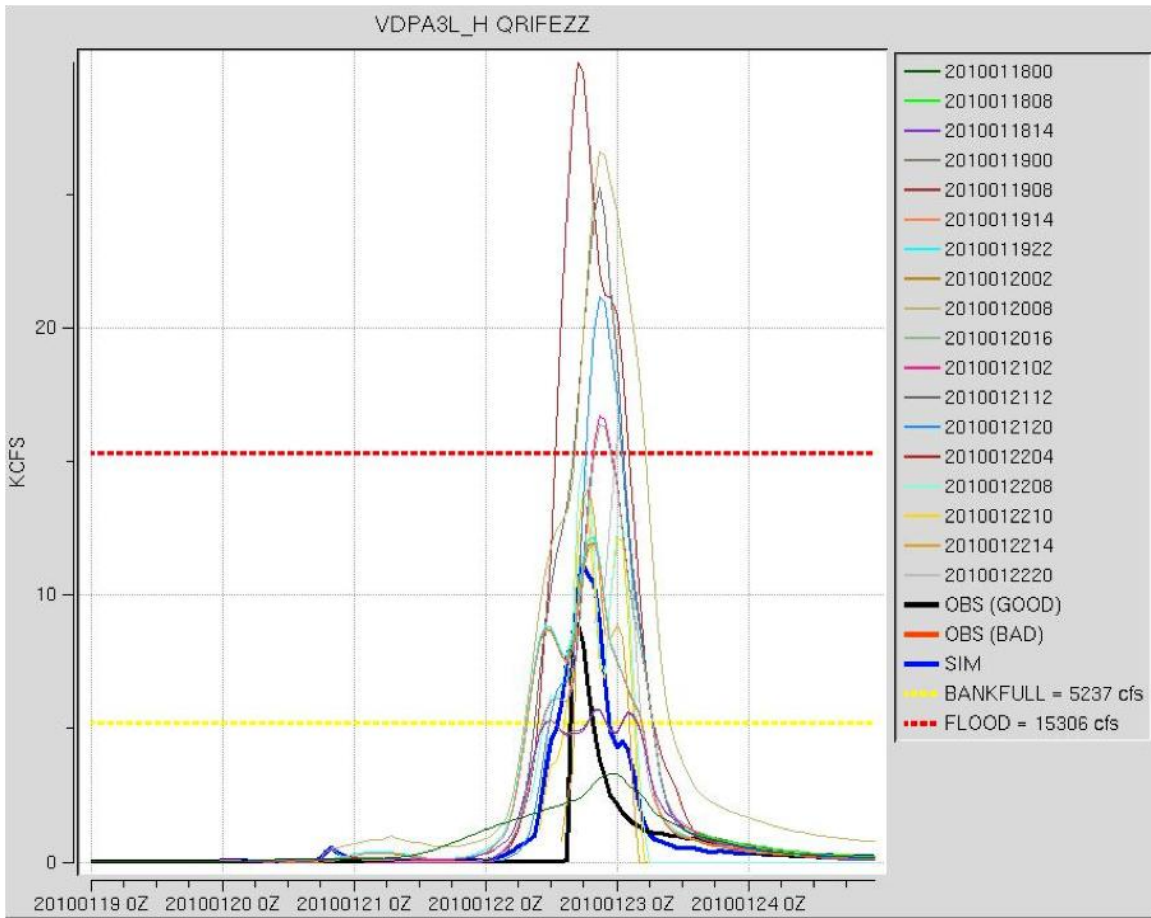


**Fig. 35.** Hydrograph for Big Sandy near Wikieup. Time series are shown for streamflow forecasts, simulation (heavy blue), and observations (heavy black) for 19-24 January 2010. Forecasts are shown in the multiple colors. Simulated streamflow is the modeled streamflow with the observed temperature.

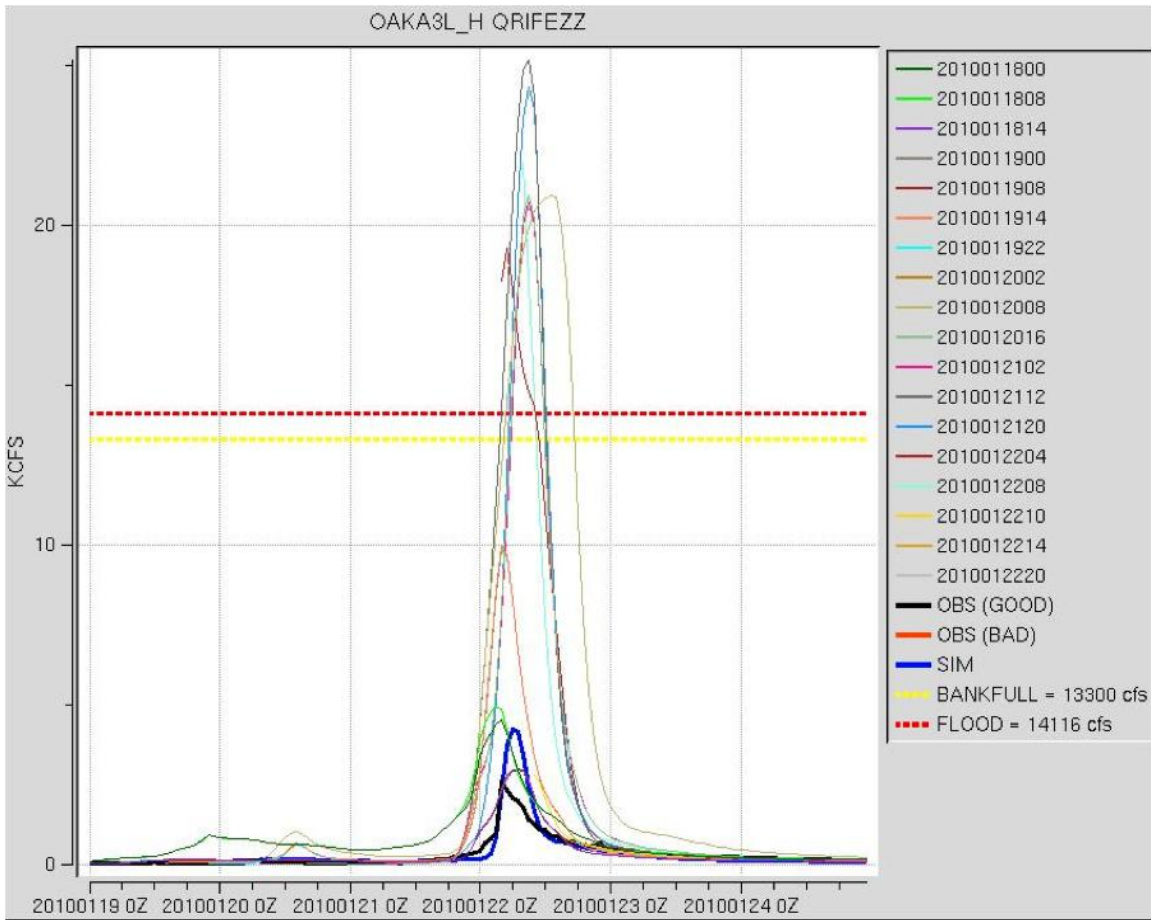


**Fig. 36.** San Carlos near Peridot. Convention the same as Fig. 34.





**Fig. 37.** Verde River near Paulden. Convention the same as Fig. 34.



**Fig. 38.** Oak Creek near Sedona. Convention the same as Fig. 34.

#### **IV. Facts, Findings, Recommendations, and Best Practices**

**FACT:** Decision support services provided by WFO Phoenix enabled emergency managers, first responders, FAA TRACON, and at least two airlines to alter their operations in advance of the impacts.

**FACT:** Some of the WFO Phoenix staff were “rusty” regarding the use of NWS hydrologic software. This possibly resulted in a delayed Flood Warning issuance.

**ACTION ITEM:** The WFO Phoenix SOO, Senior Service Hydrologist (SSH), and Observation Program Leader (OPL) will collaborate on a hydrology drill and scenario review for the operational staff.

**FACT:** WFO Phoenix staff issued a Tornado Warning 17 minutes in advance of the Blythe, CA tornado. The tornado was a “front flank” tornado at the leading edge of a squall line, making recognition of the WSR-88D radar signature challenging especially given the fact that the storm was 75 miles north of the KYUX WSR-88D.

**FACT:** On the mid-afternoon of 21 January 2010, WFO Phoenix’s NOAAPort modem failed. AWIPS functionality was never lost, as communications switched to the frame relay network. NOAAPort was not restored until the mid-afternoon of 22 January 2010. According to electronics staff, this failure has occurred at other WFOs. During the NOAAPort outage, WFO Phoenix staff set up laptop computers and utilized the Salt River Project’s wireless network. This enabled them to monitor crucial websites, check spotter reports sent via e-mail, and operate NWSChat.

**ACTION ITEM:** The cause of these failures must be determined and eliminated. Guidance or reminders to WFOs on procedures for escalating trouble reports to NOAAPort/Sprint should be distributed.

**FACT:** Neighboring offices could not access WFO Phoenix’s Sharepoint pages containing critical WFO or county contact information.

**ACTION ITEM:** WFO Phoenix will collaborate with backup offices to grant access to these particular pages.

**FACT:** NWSChat was critical in exchanging reports with media, and keeping media up-to-the minute on storm reports and product changes.

**FACT:** WFO Tucson and WFO Phoenix issued their first ever web video briefings lasting about 5 minutes in duration. These were extremely well received by the emergency managers, public, and media. These took one to two hours to prepare.

**ACTION ITEM:** Each WFO should issue these web briefings during future high impact events, train additional staff on how to create them, and streamline the production process to reduce preparation time.

**FACT:** WFO Tucson employed a day shift event coordinator, who handled media calls, routine product editing and took the lead to unify the overall key office ‘message’ between the public, fire weather, aviation and public service desks.

**FACT:** WFOs Phoenix and Tucson conducted live GoToMeeting briefings with emergency management partners. Partners stated that information in the briefings was valuable. However, the times of WFO Phoenix's briefings sometimes conflicted with briefings offered by WFO Tucson.

**ACTION ITEM:** WFOs will collaborate with neighboring offices when scheduling future GoToMeeting briefings, and ensure that time conflicts are reduced or eliminated.

**FACT:** Confusion existed regarding how to expand/extend a previously issued SPC Tornado Watch. This issue was exacerbated by the fact that WFO Phoenix has GFE control of Pinal County for watches, even though southeast Pinal County is in WFO Tucson's CWA. Bottom line: WFO Tucson staff scrambled to get the word out on Tornado Watch expansion at 10 PM for Southeast Pinal/Pima County. WFO Tucson issued a Special Weather Statement to reiterate the Tornado Watch extension and individually called each media outlet shortly after 10 PM to make sure each station knew about the watch extension.

**ACTION ITEM:** Step-by-step watch box extension/expansion instructions will be a part of upcoming training.

**FACT:** WFO Tucson lead forecasters noted the need in advance for possible additional staffing needs on 21 January 2010 for the evening shift and made appropriate notification to bring in an extra person and hold over staff.

**FACT:** The Watch/Warning/Advisory map on WFO Tucson's Web page was misleading with blizzard watches/warning areal coverage for WFO Tucson CWA given zone configuration. However, hazard grids available in the National Digital Forecast Database displayed the proper warning coverage.

**ACTION ITEM:** WFO Tucson will submit justification to NWS Western Region Headquarters (WRH) for new zone configuration and complete new zone testing. Management will work with WRH and NWS Headquarter (WSH) to ease display of hazard grids on NWS web pages.

**FACT:** Confusion occurred regarding flooding on the San Carlos River at Peridot. WFO Tucson staff was unsure whether responsibility was WFO Tucson or WFO Phoenix's and how to best issue the flood warning. WFO Tucson did appropriately issue areal flood warning for specific point, but with no lead time. With much going on, the staff did not see this gauge was indicating flooding until it was too late, and notified by CBRFC call regarding forecast flow.

**ACTION ITEM:** Discuss with CBRFC whether to make San Carlos at Peridot an Official Forecast Point. Review the procedures with this point and create clear documentation in the hydrologic services manual regarding responsibility split with WFO Phoenix. Configure AWIPS to red banner San Carlos at Peridot when streamflow exceeds bankfull.

**FACT:** Confusion occurred with regard to what quantitative precipitation forecast (QPF) was used to generate streamflow forecasts.

**ACTION ITEM:** The WFO/RFC offices need to come to a consensus on the methodology of creating QPF, which agency should be responsible for creating the "official" QPF product, and what software should be used. Also, there should be an agreement on which model should be a starting point for the forecast process.

**FACT:** There was concern from WFO Las Vegas and from Clark County Flood control about the quality of the forecast on the Muddy Creek.

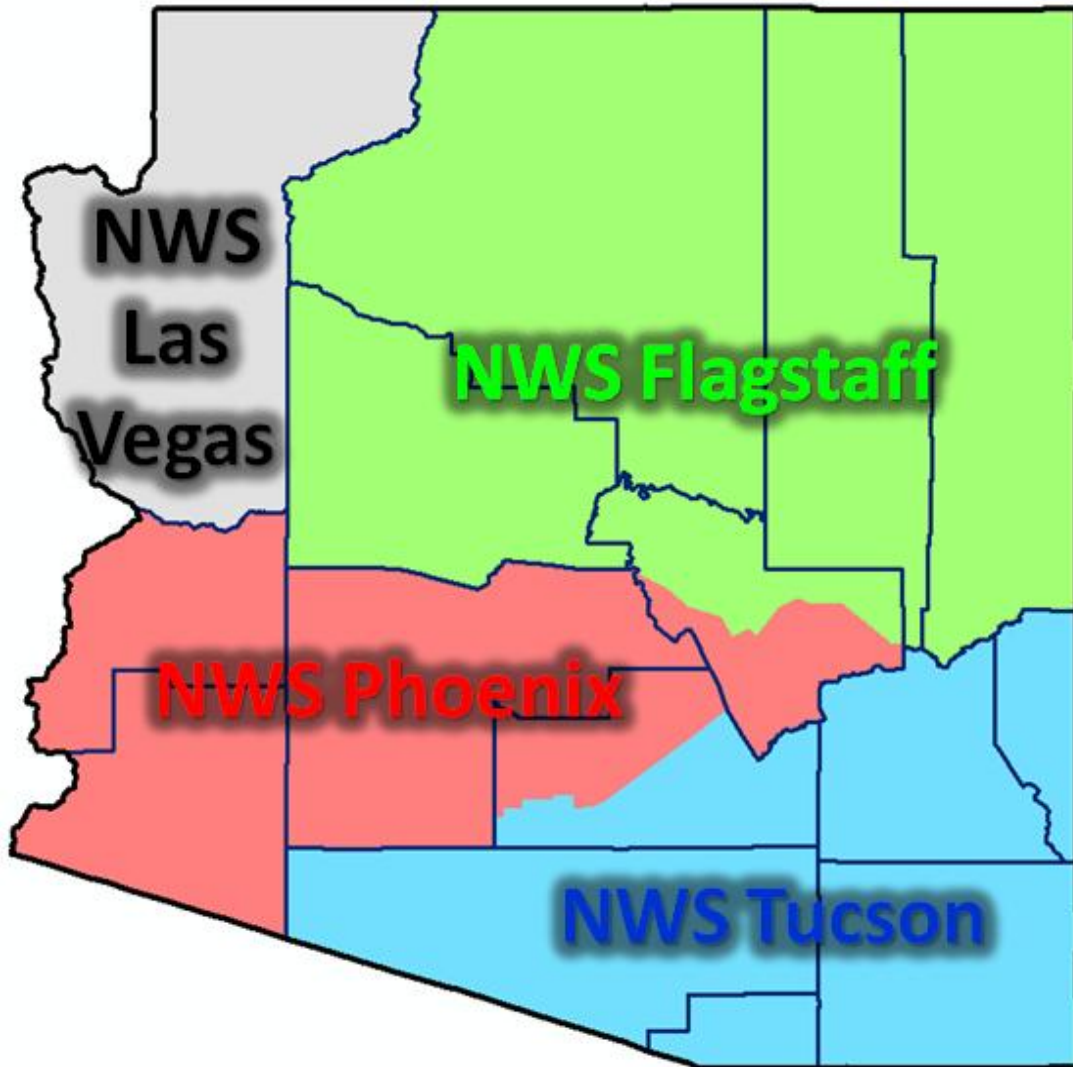
**ACTION ITEM:** The WFO and the RFC need to work with city/county and local authorities for funding on placement of more stream flow/precipitation gages in the Muddy basin. Therefore, simulations in the future might be more optimal for the WFO Las Vegas forecasters and end users.

**FACT:** WFO forecasters could not drop/cancel a warning when a streamflow forecast indicated peaks above flood stage. This usually occurred when a gage started to turn over or the rate of rise dropped significantly so it was evident the peak wouldn't be reached. CBRFC forecasters would have to restart the model, go in and make whatever mods were needed to reduce the simulation. Once done and sent, a different WFO would call with the same issue, and the process would be repeated. This was a very slow process in order to satisfy their request.

**ACTION:** CBRFC and WFOs need a more rapid way to update forecasts and warnings once peak flows have been observed and the hydrograph is falling.

**V. Appendices**

**A. Appendix I - County Warning Areas of Arizona**



## **B. Appendix II - Common Acronyms**

**AWIPS** - Advanced Weather Interactive Processing System

**CBRFC** - National Weather Service Colorado River Basin River Forecast Center

**CPC** - Climate Prediction Center

**CWA** - County Warning Area

**FGZ** - National Weather Service Flagstaff, AZ

**MIC** - Meteorologist in Charge

**NOAA** - National Oceanic and Atmospheric Administration

**NWS** - National Weather Service

**PSR** - National Weather Service Phoenix, AZ

**SPC** - Storm Prediction Center

**TWC** - National Weather Service Tucson, AZ

**WCM** - Warning Coordination Meteorologist

**WFO** - Weather Forecast Office

**WSH** - National Weather Service Headquarters

**WRH** - National Weather Service Western Region Headquarters

## C. Appendix III - Local Storm Reports

### ...HEAVY RAIN...

0510 PM HEAVY RAIN 2 S BULLHEAD CITY 35.12N 114.56W  
01/19/2010 E0.50 INCH MOHAVE AZ TRAINED SPOTTER  
SEVERAL INCHES OF WATER WERE REPORTED ON HIGHWAY 95 SOUTH  
OF BULLHEAD CITY.

0725 PM HEAVY RAIN TOPOCK 34.72N 114.47W  
01/19/2010 M1.05 INCH MOHAVE AZ TRAINED SPOTTER  
MEASURED OVER A FOUR AND HALF HOUR PERIOD THIS AFTERNOON.

0500 PM HEAVY RAIN CASTLE HOT SPRINGS 33.98N 112.36W  
01/21/2010 M3.55 INCH YAVAPAI AZ TRAINED SPOTTER  
3.55 INCHES OF PRECIPITATION HAS FALLEN OVER THE PAST 24  
HOURS.

0800 PM HEAVY RAIN 10 N BLACK CANYON CITY 34.21N 112.11W  
01/21/2010 M6.57 INCH YAVAPAI AZ PARK/FOREST SRVC  
6.57 INCHES OF PRECIPITATION HAS FALLEN OVER THE PAST 24  
HOURS AT THE SUNSET POINT RAW'S OBSERVATION SITE.

0800 PM HEAVY RAIN CROWN KING 34.21N 112.34W  
01/21/2010 M6.50 INCH YAVAPAI AZ PARK/FOREST SRVC  
6.50 INCHES OF PRECIPITATION HAS FALLEN OVER THE PAST 24  
HOURS.

0805 PM HEAVY RAIN 1 NNE AVONDALE 33.44N 112.34W  
01/21/2010 U0.00 INCH MARICOPA AZ TRAINED SPOTTER  
1/2 MILE VISIBILITY IN HEAVY RAIN

0820 PM HEAVY RAIN PAYSON 34.24N 111.33W  
01/21/2010 M4.01 INCH GILA AZ TRAINED SPOTTER  
4.01 INCHES OF PRECIPITATION HAS FALLEN OVER THE PAST 24  
HOURS.

0920 PM HEAVY RAIN 6 N CASA GRANDE 32.98N 111.74W  
01/21/2010 M1.00 INCH PINAL AZ TRAINED SPOTTER  
TRAINED SPOTTER MEASURED 1 INCH WITHIN 30 MINUTES.  
VISIBILITY DROPPED BELOW 20 FT IN HEAVY RAIN. ESTIMATED  
WIND SPEEDS OF UP TO 50 MPH.

0600 AM HEAVY RAIN 5 S RYE 34.04N 111.36W  
01/22/2010 M11.46 INCH GILA AZ AMATEUR RADIO  
STORM TOTAL RAINFALL WAS 11.46 INCHES FROM MONDAY THROUGH  
FRIDAY. OBSERVED AT DEER CREEK VILLAGE ALONG STATE ROUTE  
87.

### ...FLOOD...

0830 AM FLOOD 1 NE MARTINEZ LAKE 32.98N 114.46W  
01/21/2010 YUMA AZ TRAINED SPOTTER  
WATER FOUR FEET DEEP ALONG RED CLOUD MINE ROAD NEAR  
MARTINEZ LAKE.



1017 AM FLOOD 3 WSW LUKE AFB 33.51N 112.42W  
01/21/2010 MARICOPA AZ LAW ENFORCEMENT  
SHERIFF REPORTS CLOSURE AT COTTON ROAD AND CAMELBACK.

1130 AM FLOOD SABINO CANYON 32.34N 110.81W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
SIXTEEN HIKERS TRAPPED ON SABINO CANYON TRAIL AFTER  
STREAM RISE COVERED LOW WATER CROSSINGS.

0500 PM FLOOD 10 S PAYSON 34.10N 111.33W  
01/21/2010 GILA AZ AMATEUR RADIO  
FLOODING REPORTED ALONG TONTO CREEK IN GISELA.

0500 PM FLOOD 30 S PAYSON 33.81N 111.33W  
01/21/2010 GILA AZ AMATEUR RADIO  
FLOODING REPORTED ALONG TONTO CREEK AT TONTO BASIN.

0610 PM FLOOD 1 E LAVEEN 33.42N 112.11W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
APS POWER LINES DOWN FROM RUSHING WATER IN SALT RIVER.

0645 PM FLOOD 5 S TOLLESON 33.38N 112.24W  
01/21/2010 MARICOPA AZ COUNTY OFFICIAL  
STREETS CLOSED DUE TO FLOODING OF SALT RIVER AFTER WATER  
RELEASE.

0930 PM FLOOD BLACK CANYON CITY 34.06N 112.11W  
01/21/2010 YAVAPAI AZ FIRE DEPT/RESCUE  
MAJOR FLOODING REPORTED IN BLACK CANYON CITY WITH  
EVACUATION ORDERS ISSUED FOR COMMUNITIES ALONG THE AGUA  
FRIA RIVER AND BLACK CANYON CREEK.

0930 PM FLOOD PISINEMO 32.04N 112.32W  
01/21/2010 PIMA AZ OTHER FEDERAL  
SAN SIMON WASH ROSE 1-2 FT OUT OF ITS BANKS...STILL  
FLOODED.

0930 PM FLOOD SANTA CRUZ 31.96N 112.35W  
01/21/2010 PIMA AZ OTHER FEDERAL  
VAMORI WASH ROSE 1-1.5 FT OUT OF ITS BANKS. WASH STILL  
FLOODED.

0200 AM FLOOD SAN CARLOS 33.35N 110.46W  
01/22/2010 GILA AZ LAW ENFORCEMENT  
SAN CARLOS WASH AT BANKFUL. RESIDENTS EVACUATED ALONG THE  
WASH SOUTH OF SAN CARLOS PROPER.

0330 AM FLOOD 15 SE ROSE PEAK 33.29N 109.19W  
01/22/2010 GREENLEE AZ OTHER FEDERAL  
BLUE RIVER UPSTREAM FROM CLIFTON ROSE OUT OF ITS BANKS.  
STILL ABOVE BANKFULL AT 8 AM.

0343 AM FLOOD 3 SE WIKIEUP 34.66N 113.58W  
01/22/2010 MOHAVE AZ NEWSPAPER  
THE U.S.G.S. GAUGE ON THE BIG SANDY RIVER NEAR WIKIEUP  
CRESTED AT 17.9 FEET. THIS SET AN ALL-TIME RECORD CREST  
AND BROKE THE PREVIOUS RECORD OF 16.42 FEET SET ON MARCH  
1 1978. A NUMBER OF ROADS THAT CROSS THE RIVER WERE  
WASHED AWAY.

0348 AM FLOOD WENDEN 33.82N 113.55W  
01/22/2010 LA PAZ AZ COUNTY OFFICIAL  
FLOOD WATERS IN CENTENNIAL WASH AT WENDEN CAME OUT OF ITS  
BANK SHORTLY AFTER 130 AM. 10 THSD CFS. LAW ENFORCEMENT  
OFFICIALS EVACUATING RESIDENTS IN THE NEARBY FLOOD PLAIN.

0500 AM FLOOD 2 NNE SAGUARO NATIONAL 32.21N 110.72W  
01/22/2010 PIMA AZ BROADCAST MEDIA  
SEVERAL ROADS BARRICADED NEAR FLOWING WASHES ON EAST SIDE  
OF TUCSON.

0500 AM FLOOD 2 NW SAGUARO NATIONAL P 32.30N 111.22W  
01/22/2010 PIMA AZ DEPT OF HIGHWAYS  
SEVERAL ROADS FLOODED IN AVRA VALLEY DUE TO FLOWING  
WASHES.

0800 AM FLOOD CATALINA 32.50N 110.92W  
01/22/2010 PIMA AZ NEWSPAPER  
MOTORIST TRAPPED IN FLOODED CANADA DEL ORO WASH NEAR  
RANCHO DEL LAGO. SWIFT WATER RESCUE.

**...FLASH FLOOD...**

1017 AM FLASH FLOOD 2 ESE ANTHEM 33.84N 112.10W  
01/21/2010 MARICOPA AZ LAW ENFORCEMENT  
DPS REPORTS 19TH AND DESERT HILLS FLASH FLOOD.

1017 AM FLASH FLOOD 3 ESE ANTHEM 33.83N 112.10W  
01/21/2010 MARICOPA AZ LAW ENFORCEMENT  
DPS REPORTS FLOODING.

1017 AM FLASH FLOOD 5 SE NEW RIVER 33.87N 112.06W  
01/21/2010 MARICOPA AZ LAW ENFORCEMENT  
DPS REPORTS FLASH FLOOD AT NEW RIVER ROAD AND HONDA BOW

1155 AM FLASH FLOOD 9 SE MARTINEZ LAKE 32.87N 114.38W  
01/21/2010 YUMA AZ LAW ENFORCEMENT  
CORRECTED TIME. YUMA PROVING GROUND REPORTS ABERDEEN ROAD  
AND AZ HWY 95 FLOODED STRANDING OVER 400 PERSONS.

0123 PM FLASH FLOOD 5 SW ANTHEM 33.80N 112.20W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
AZ HWY 74 CAREFREE HIGHWAY IMPASSABLE.

0248 PM FLASH FLOOD 2 SE KINGMAN 35.19N 114.01W  
01/21/2010 MOHAVE AZ TRAINED SPOTTER  
A SPOTTER REPORTED A DRIVEWAY WAS WASHED OUT AND 4 TO 6  
INCHES OF WATER WAS FLOWING DOWN SOME STREETS IN KINGMAN.

0530 PM FLASH FLOOD 1 S OATMAN 35.03N 114.38W  
01/21/2010 MOHAVE AZ NEWSPAPER  
OATMAN HIGHWAY WAS CLOSED DUE TO FLOODWATERS FROM  
THURSDAY EVENING THROUGH FRIDAY MORNING. THE TIME OF THIS  
EVENT IS ESTIMATED.

0530 PM FLASH FLOOD 2 WSW KINGMAN 35.19N 114.07W  
01/21/2010 MOHAVE AZ NEWSPAPER  
SEVERAL ROADS WERE CLOSED IN THE KINGMAN AREA DUE TO  
FLASH FLOODING...INCLUDING INTERSTATE 40 AT THE  
INTERSECTION OF U.S. HIGHWAY 93 AND BANK STREET.

0530 PM FLASH FLOOD 7 S MEADVIEW 35.90N 114.05W  
01/21/2010 MOHAVE AZ NEWSPAPER  
DIAMOND BAR ROAD WAS CLOSED DUE TO FLOODWATERS. THE EVENT  
TIME IS ESTIMATED.

0945 PM FLASH FLOOD 6 NW SACATON 33.14N 111.82W  
01/21/2010 PINAL AZ TRAINED SPOTTER  
ONE FOOT OF WATER FLOODED 4 HOMES NEAR INTERSECTION OF  
HIGHWAY 87 AND SACATE ROAD. MANY ROADWAYS IMPASSABLE DUE  
TO HIGH WATER.

0945 PM FLASH FLOOD 7 NW COOLIDGE 33.05N 111.61W  
01/21/2010 PINAL AZ TRAINED SPOTTER  
18 INCHES OF WATER FLOWING ACROSS INTERSECTION OF  
BLACKWATER AND TOKI ROADS. SIX INCHES OF WATER IN 4  
HOUSES NEAR THIS INTERSECTION.

**...BLIZZARD...**

1000 AM BLIZZARD 1 W MOUNT LEMMON/SUMMER 32.44N 110.78W  
01/22/2010 PIMA AZ PUBLIC  
MOUNT LEMMON TELESCOPES AT 9100FT. AT LEAST 12 INCHES OF  
SNOW. DRIFTS 2 TO 3 FEET. SEVERAL TREES DOWNED NEAR THE  
TELESCOPE COMPLEX.

1000 AM BLIZZARD 13 NNW MORENCI 33.23N 109.39W  
01/22/2010 GREENLEE AZ DEPT OF HIGHWAYS  
THU-FRI STORM TOTAL 13-20 INCHES OF SNOW ALONG HIGHWAY  
191 AT GRAYS PEAK. DRIFTS SEVERAL FEET DEEP IN PLACES.

1000 AM BLIZZARD 8 S HANNAGAN MEADOW 33.52N 109.31W  
01/22/2010 GREENLEE AZ COUNTY OFFICIAL  
THU-FRI STORM TOTAL AT LEAST 40 INCHES OF SNOW. 70-80 MPH  
WINDS OVERNIGHT. DRIFTS SEVERAL FEET DEEP.

1000 AM BLIZZARD MOUNT GRAHAM 32.70N 109.87W  
01/22/2010 GRAHAM AZ TRAINED SPOTTER  
THU-FRI STORM TOTAL AROUND 36 INCHES OF SNOW. DRIFTS UP  
TO 5 FT BURIED AT LEAST ONE VEHICLE. WIND GUSTS 60-80 MPH  
FOR MUCH OF THE NIGHT.

1000 AM BLIZZARD ROSE PEAK 33.44N 109.37W  
01/22/2010 GREENLEE AZ DEPT OF HIGHWAYS  
THU-FRI STORM TOTAL 35-40 INCHES. DRIFTS SEVERAL FEET  
DEEP. WIND GUSTS 70-80 MPH OVERNIGHT AND THIS MORNING.

**...SNOW...**

0100 AM SNOW 7 N I-40 AT FORT ROCK 35.29N 113.37W  
01/20/2010 M2.5 INCH MOHAVE AZ CO-OP OBSERVER  
DIAMOND M RANCH REPORTED 2 INCHES OF SNOW BETWEEN MIDNIGHT  
MIDNIGHT AND 1 AM THIS MORNING AT AN ELEVATION OF 5480  
FEET.

0900 AM SNOW ASH FORK 35.22N 112.49W  
01/21/2010 M9.0 INCH YAVAPAI AZ TRAINED SPOTTER  
9 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

1000 AM SNOW PRESCOTT 34.58N 112.45W  
01/21/2010 E7.0 INCH YAVAPAI AZ TRAINED SPOTTER  
UP TO 7 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM

1030 AM SNOW 7 N I-40 AT FORT ROCK 35.29N 113.37W  
01/21/2010 M8.5 INCH MOHAVE AZ CO-OP OBSERVER  
A STORM TOTAL OF 8.5 INCHES OF SNOW WAS MEASURED AT  
DIAMOND M RANCH AT AN ELEVATION OF 5480 FEET SINCE LAST  
EVENING. SNOW WAS STILL FALLING AT THE TIME OF THIS  
REPORT.

1107 AM SNOW HUALAPAI MOUNTAIN 35.10N 113.89W  
01/21/2010 M9.0 INCH MOHAVE AZ PARK/FOREST SRVC  
9.0 INCHES OF SNOW FELL SINCE YESTERDAY EVENING AT AN  
ELEVATION OF 6600 FEET. SNOW WAS STILL FALLING.

0126 PM SNOW KACHINA VILLAGE 35.10N 111.69W  
01/21/2010 M18.6 INCH COCONINO AZ TRAINED SPOTTER  
18.6 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0209 PM SNOW HEBER-OVERGAARD 34.41N 110.57W  
01/21/2010 M18.0 INCH NAVAJO AZ TRAINED SPOTTER  
18 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0319 PM SNOW PINETOP-LAKESIDE 34.15N 109.97W  
01/21/2010 E10.0 INCH NAVAJO AZ TRAINED SPOTTER  
OVER 10 INCHES OF NEW SNOWFALL REPORTED OVER LAST 24  
HOURS.

0345 PM SNOW CLINTS WELL 34.55N 111.31W  
01/21/2010 E15.0 INCH COCONINO AZ PUBLIC  
15 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0350 PM SNOW WINDOW ROCK 35.67N 109.06W  
01/21/2010 E8.0 INCH APACHE AZ BROADCAST MEDIA  
8 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0357 PM SNOW ALPINE 33.85N 109.14W  
01/21/2010 M20.0 INCH APACHE AZ TRAINED SPOTTER  
20 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0445 PM SNOW FOREST LAKES 34.34N 110.80W  
01/21/2010 M26.0 INCH COCONINO AZ TRAINED SPOTTER  
26 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0500 PM SNOW 5 W FLAGSTAFF 35.19N 111.71W  
01/21/2010 M20.2 INCH COCONINO AZ CO-OP OBSERVER  
20.2 INCHES OF NEW SNOWFALL REPORTED WITH LATEST STORM.

0500 PM SNOW FLAGSTAFF 35.19N 111.62W  
01/21/2010 M16.7 INCH COCONINO AZ CO-OP OBSERVER  
16.7 INCHES OF NEW SNOWFALL REPORTED AT PULLIAM AIRPORT  
IN FLAGSTAFF.

0500 PM SNOW GRAND CANYON VILLAGE 36.05N 112.15W  
01/21/2010 M10.0 INCH COCONINO AZ CO-OP OBSERVER  
10 INCHES OF NEW SNOWFALL REPORTED WITH THE LATEST STORM.

**...HEAVY SNOW...**

0937 AM HEAVY SNOW CHIRICAHUA NATIONAL MON 32.01N 109.36W  
01/20/2010 M3.5 INCH COCHISE AZ CO-OP OBSERVER  
STORM TOTAL AT BASE ELEVATION OF 5300FT.

0937 AM HEAVY SNOW MOUNT LEMMON/SUMMERHAVE 32.44N 110.76W  
01/20/2010 E9.0 INCH PIMA AZ PARK/FOREST SRVC  
STORM TOTAL. SIGNIFICANT BLOWING AND DRIFTING OVERNIGHT.

0937 AM HEAVY SNOW NNW CHIRICAHUA NATIONAL 32.01N 109.36W  
01/20/2010 M3.5 INCH COCHISE AZ CO-OP OBSERVER  
STORM TOTAL AT BASE ELEVATION OF 5300FT.

0945 AM HEAVY SNOW ENE ROSE PEAK 33.44N 109.37W  
01/20/2010 E10.0 INCH GREENLEE AZ DEPT OF HIGHWAYS  
STORM TOTAL. HEAVY DRIFTING. DRIFTS UP TO 3FT BETWEEN  
ROSE PEAK AND HANNAGAN MEADOW. SNOW LEVEL DOWN TO 5000FT.

1030 PM HEAVY SNOW FLAGSTAFF 35.19N 111.62W  
01/21/2010 E0.0 INCH COCONINO AZ NEWSPAPER  
BOOKMANS ENTERTAINMENT EXCHANGE AND ITS NEIGHBOR JO-ANN  
FABRICS AND CRAFTS ROOFS COLLAPSE.

0600 AM HEAVY SNOW MOUNT LEMMON/SUMMERHAVE 32.44N 110.76W  
01/22/2010 U0.0 INCH PIMA AZ BROADCAST MEDIA  
SNOWFALL RATES WELL OVER 1 INCH PER HOUR. VISIBILITY  
BELOW 1/4 MILE.

0800 AM HEAVY SNOW HUALAPAI MOUNTAIN 35.10N 113.89W  
01/22/2010 M15.0 INCH MOHAVE AZ PUBLIC  
FROM WEDNESDAY EVENING THROUGH FRIDAY MORNING A TOTAL OF  
15.0 INCHES OF SNOW FELL ON HUALAPAI MOUNTAIN AT 6300  
FEET IN ELEVATION.

1100 AM HEAVY SNOW FLAGSTAFF 35.19N 111.62W  
01/22/2010 M50.7 INCH COCONINO AZ OFFICIAL NWS OBS  
50.7 INCHES OF SNOW, 3RD HIGHEST 5 DAY TOTAL.

1200 AM HEAVY SNOW FLAGSTAFF 35.19N 111.62W  
01/22/2010 U0.0 INCH COCONINO AZ NEWSPAPER  
JAY LIVELY ICE RING AND RECREATION CENTER ROOF COLLAPSED,  
TIME UNKNOWN, OVERNIGHT THURSDAY OR EARLY FRIDAY MORNING.

1200 AM HEAVY SNOW FLAGSTAFF 35.19N 111.62W  
01/22/2010 U0.0 INCH COCONINO AZ NEWSPAPER  
OLD PLANET NISSAN, BACK ROOF COLLAPSES, TIME OF COLLAPSE  
UNKNOWN.

0130 PM HEAVY SNOW PINETOP-LAKESIDE 34.15N 109.97W  
01/22/2010 U0.0 INCH NAVAJO AZ PUBLIC  
AZ WATER OFFICE, ROOF COLLAPSES.

1200 PM HEAVY SNOW PINETOP-LAKESIDE 34.15N 109.97W  
01/22/2010 U0.0 INCH NAVAJO AZ PUBLIC  
FIRE STATION NUMBER 2, ROOF COLLAPSES.

**...TSTM WND GST...**

1057 AM TSTM WND GST MOUNT LEMMON/SUMMERHAVE 32.44N 110.76W  
01/21/2010 M64.00 MPH PIMA AZ MESONET

0436 PM TSTM WND GST KINGMAN 35.21N 114.03W  
01/21/2010 M101 MPH MOHAVE AZ TRAINED SPOTTER  
A SPOTTER MEASURED A 101 MPH WIND GUST IN KINGMAN.

0520 PM TSTM WND GST 1 S AJO 32.37N 112.87W  
01/21/2010 E94.00 MPH PIMA AZ TRAINED SPOTTER

0933 PM TSTM WND GST SASABE 31.49N 111.54W  
01/21/2010 M58.00 MPH PIMA AZ MESONET

1137 PM TSTM WND GST 3 SSE MOUNT LEMMON/SUMM 32.40N 110.73W  
01/21/2010 M49.00 MPH PIMA AZ MESONET  
SCOUT CAMP RAW

**...HAIL...**

0345 PM HAIL 3 NNW APACHE JUNCTION 33.45N 111.56W  
01/22/2010 M0.25 INCH PINAL AZ TRAINED SPOTTER  
PEA SIZE HAIL MEASURED BY TRAINED SPOTTER AT MCKELLIPS  
BLVD. AND IRONWOOD DRIVE.

0345 PM HAIL 4 ESE MESA 33.40N 111.67W  
01/22/2010 M0.25 INCH MARICOPA AZ NWS EMPLOYEE  
PEA SIZE HAIL REPORTED FROM NWS EMPLOYEE AT POWER ROAD  
AND LOOP 202.

0346 PM HAIL 3 NNW APACHE JUNCTION 33.45N 111.56W  
01/22/2010 M0.25 INCH PINAL AZ TRAINED SPOTTER  
PEA SIZE HAIL MEASURED BY A SECOND TRAINED SPOTTER AT  
MCKELLIPS BLVD. AND IRONWOOD DRIVE.

0442 PM HAIL 5 SE QUEEN CREEK 33.19N 111.59W  
01/22/2010 M0.25 INCH PINAL AZ TRAINED SPOTTER  
PEA SIZE HAIL OBSERVED BY TRAINED SPOTTER FOR THE LAST  
5-10 MINUTES AT HUNT HWY AND SKYLINE DRIVE.

0545 PM HAIL 1 SW SACATON 33.07N 111.76W  
01/22/2010 M0.25 INCH PINAL AZ TRAINED SPOTTER  
TRAINED SPOTTER...PIL206...MEASURED PEA SIZE HAIL IN  
SACATON AT THE HOSPITAL.

**...NON-TSTM WND GST...**

1025 PM NON-TSTM WND GST ORACLE 32.62N 110.78W  
01/19/2010 M43.00 MPH PINAL AZ MESONET

1037 PM NON-TSTM WND GST 5 ESE MOUNT GRAHAM 32.67N 109.79W  
01/19/2010 M40.00 MPH GRAHAM AZ MESONET  
NOON CREEK RAW

1115 PM NON-TSTM WND GST FORT HUACHUCA 31.59N 110.35W  
01/19/2010 M69.00 MPH COCHISE AZ ASOS  
FORT HUACHUCA ASOS MEASURED A WIND GUST OF 69 MPH.

1130 PM NON-TSTM WND GST TUCSON 32.24N 110.94W  
01/19/2010 M59.00 MPH PIMA AZ MESONET  
ROOF OF ATMOSPHERIC SCIENCES BUILDING...UNIVERSITY OF  
ARIZONA. ROOFTOP ANEMOMETER.

1153 PM NON-TSTM WND GST 7 N SONOITA 31.78N 110.64W  
01/19/2010 M48.00 MPH PIMA AZ MESONET  
EMPIRE RAW

0105 AM NON-TSTM WND GST 11 NW KLONDYKE 32.93N 110.49W  
01/20/2010 M47.00 MPH PINAL AZ MESONET  
HORSE CAMP CANYON RAW

0228 AM NON-TSTM WND GST VAIL 32.05N 110.71W  
01/20/2010 M42.00 MPH PIMA AZ TRAINED SPOTTER

0319 AM NON-TSTM WND GST 3 S MADERA CANYON 31.68N 110.88W  
01/20/2010 M41.00 MPH SANTA CRUZ AZ MESONET  
MT. HOPKINS RAW

0319 AM NON-TSTM WND GST BISBEE 31.43N 109.89W  
01/20/2010 M45.00 MPH COCHISE AZ MESONET

1230 AM NON-TSTM WND GST SAN SIMON 32.27N 109.23W  
01/20/2010 M46.00 MPH COCHISE AZ DEPT OF HIGHWAYS

1250 AM NON-TSTM WND GST BOWIE 32.33N 109.49W  
01/20/2010 M46.00 MPH COCHISE AZ DEPT OF HIGHWAYS

1255 AM NON-TSTM WND GST TUCSON INTERNATIONAL AI 32.12N 110.94W  
01/20/2010 M37.00 MPH PIMA AZ ASOS

0547 AM NON-TSTM WND GST MOUNT LEMMON/SUMMERHAVE 32.44N 110.76W  
01/21/2010 M60.00 MPH PIMA AZ MESONET

0845 AM NON-TSTM WND GST 8 NNW JUNCTION OF HIGHW 31.76N 111.54W  
01/21/2010 M52.00 MPH PIMA AZ PARK/FOREST SRVC  
REPORTED BY PORTABLE RAW SITE NEAR BABOQUIVARI MOUNTAINS  
ON THE TOHONO OODHAM NATION.

1120 AM NON-TSTM WND GST TUCSON 32.24N 110.94W  
01/21/2010 M57.00 MPH PIMA AZ MESONET  
ROOF OF ATMOSPHERIC SCIENCES BUILDING...UNIVERSITY OF  
ARIZONA. ROOFTOP ANEMOMETER.

0137 PM NON-TSTM WND GST MOUNT LEMMON/SUMMERHAVE 32.44N 110.76W  
01/21/2010 M75.00 MPH PIMA AZ MESONET  
MEASURED WIND GUST OF 75 MPH AT SUMMERHAVEN ON MOUNT  
LEMMON

0153 PM NON-TSTM WND GST 7 N SONOITA 31.78N 110.64W  
01/21/2010 M54.00 MPH PIMA AZ MESONET  
EMPIRE RAWS

0154 PM NON-TSTM WND GST 1 NE FORTUNA FOOTHILLS 32.67N 114.40W  
01/21/2010 E40 MPH YUMA AZ TRAINED SPOTTER  
ESPOTTER REPORT FROM SPOTTER AT FRONTAGE ROAD AND  
FOOTHILLS ROAD.

0155 PM NON-TSTM WND GST FORT HUACHUCA 31.59N 110.35W  
01/21/2010 M63.00 MPH COCHISE AZ ASOS  
ASOS AT FORT HUACHUCA MEASURED A WIND GUST OF 63 MPH AT  
155 PM MST.

0255 PM NON-TSTM WND GST SIERRA VISTA 31.55N 110.29W  
01/21/2010 M63.00 MPH COCHISE AZ ASOS

0319 PM NON-TSTM WND GST TUCSON 32.24N 110.94W  
01/21/2010 M73.00 MPH PIMA AZ MESONET  
73 MPH MEASURED WIND GUST ON THE U OF A CAMPUS.

0355 PM NON-TSTM WND GST RYAN FIELD 32.14N 111.17W  
01/21/2010 M57.00 MPH PIMA AZ AWOS

0459 PM NON-TSTM WND GST 4 N CHANDLER 33.35N 111.87W  
01/21/2010 E65 MPH MARICOPA AZ TRAINED SPOTTER  
NEAR ALMA SCHOOL AND ELLIOT.

0520 PM NON-TSTM WND GST 1 S AJO 32.37N 112.87W  
01/21/2010 M94 MPH PIMA AZ TRAINED SPOTTER

0531 PM NON-TSTM WND GST KINGMAN AIRPORT 35.26N 113.93W  
01/21/2010 M59.00 MPH MOHAVE AZ ASOS  
A 59 MPH WIND GUST OCCURRED AT 631 PM MST AT THE KINGMAN  
AIRPORT.

0645 PM NON-TSTM WND GST 4 WNW FIREBIRD LAKE 33.30N 112.03W  
01/21/2010 E45 MPH MARICOPA AZ TRAINED SPOTTER  
NEAR 13TH AND CHANDLER.

0645 PM NON-TSTM WND GST FLAGSTAFF 35.19N 111.62W  
01/21/2010 M50 MPH COCONINO AZ ASOS  
PEAK WIND GUST OF 50 MPH REPORTED FROM PULLIAM FIELD  
AIRPORT ASOS IN FLAGSTAFF.

0654 PM NON-TSTM WND GST PRESCOTT 34.58N 112.45W  
01/21/2010 M67 MPH YAVAPAI AZ ASOS  
PEAK WIND GUST REPORTED AT LOVE FIELD AIRPORT ASOS IN  
PRESCOTT.



0805 PM NON-TSTM WND GST 12 NW KLONDYKE 32.94N 110.49W  
01/21/2010 M48.00 MPH PINAL AZ MESONET  
HORSE CAMP CANYON RAWS

0807 PM NON-TSTM WND GST SIERRA VISTA 31.55N 110.29W  
01/21/2010 M59.00 MPH COCHISE AZ ASOS

0835 PM NON-TSTM WND GST ORACLE 32.62N 110.78W  
01/21/2010 M52.00 MPH PINAL AZ MESONET

0837 PM NON-TSTM WND GST 11 E SAGUARO NATIONAL P 32.21N 110.55W  
01/21/2010 M49.00 MPH PIMA AZ MESONET  
RINCON RAWS

0857 PM NON-TSTM WND GST SW RUCKER CANYON 31.76N 109.35W  
01/21/2010 M45.00 MPH COCHISE AZ MESONET

1013 PM NON-TSTM WND GST TUCSON INTERNATIONAL AI 32.12N 110.94W  
01/21/2010 M48.00 MPH PIMA AZ ASOS

1039 PM NON-TSTM WND GST BISBEE 31.43N 109.89W  
01/21/2010 M67.00 MPH COCHISE AZ TRAINED SPOTTER

1130 PM NON-TSTM WND GST 6 NW PEARCE-SUNSHITES 32.00N 109.87W  
01/21/2010 M78.00 MPH COCHISE AZ TRAINED SPOTTER  
MEASURED GUST BEFORE ANEMOMETER AND REST OF THE WEATHER  
STATION BLEW AWAY. TWO AMATEUR RADIO ANTENNA BLOWN DOWN.  
DEBRIS SCATTERED ACROSS OWNER'S BACKYARD.

1149 PM NON-TSTM WND GST NOGALES 31.36N 110.93W  
01/21/2010 M56.00 MPH SANTA CRUZ AZ ASOS

0119 AM NON-TSTM WND GST 3 S MADERA CANYON 31.68N 110.88W  
01/22/2010 M63.00 MPH SANTA CRUZ AZ MESONET  
MOUNT HOPKINS RAWS

1204 AM NON-TSTM WND GST GUTHRIE 32.95N 109.25W  
01/22/2010 M69.00 MPH GREENLEE AZ MESONET  
GUTHRIE RAWS

**...NON-TSTM WND DMG...**

1100 AM NON-TSTM WND DMG HICKIWAN 32.36N 112.49W  
01/21/2010 PIMA AZ EMERGENCY MNGR  
SEVERAL REPORTS OF WIND DAMAGE TO ROOFS IN THE TOHONO  
O'ODHAM NATION. 1 ROOF DAMAGED IN SELLS, 1 ROOF IN GU VO,  
AND 3 ROOFS DAMAGED IN HICKIWAN. RESIDENTS OF DAMAGED  
HOMES DISPLACED INTO SHELTERS.

0300 PM NON-TSTM WND DMG 5 NW TUCSON 32.29N 111.00W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
POWER POLE DOWNED AT WETMORE AND LA CHOLLA RDS. TIME  
APPROXIMATE.

0300 PM NON-TSTM WND DMG PICACHO 32.72N 111.50W  
01/21/2010 PINAL AZ BROADCAST MEDIA  
TRACTOR TRAILER OVERTURNED ON I-10 NEAR PICACHO. TIME  
APPROXIMATE.

0300 PM NON-TSTM WND DMG THREE POINTS 32.07N 111.28W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
ROOF TORN OFF HOUSE

0327 PM NON-TSTM WND DMG 4 N CHANDLER 33.35N 111.87W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
LARGE TREE REPORTED BLOCKING ELIOT ROAD BETWEEN DOBSON  
AND ALMA SCHOOL

0330 PM NON-TSTM WND DMG 2 N GREEN VALLEY 31.88N 111.01W  
01/21/2010 PIMA AZ EMERGENCY MNGR  
TRAFFIC SIGNALS DAMAGED AT DUVAL MINE AND LA CANADA  
RDS...AND AT CALLE VERDE AND NOGALES HWY. TIME  
APPROXIMATE.

0400 PM NON-TSTM WND DMG 1 SE SAHUARITA 31.95N 110.94W  
01/21/2010 PIMA AZ EMERGENCY MNGR  
PARTIAL ROOF DAMAGE TO PECAN PROCESSING PLANT

0400 PM NON-TSTM WND DMG ORO VALLEY 32.42N 110.96W  
01/21/2010 PIMA AZ LAW ENFORCEMENT  
SEVERAL POWER LINES DOWNED. TIME APPROXIMATE.

0400 PM NON-TSTM WND DMG SAHUARITA 31.96N 110.95W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
SEVERAL TREES DOWNED.

0400 PM NON-TSTM WND DMG SAHUARITA 31.96N 110.95W  
01/21/2010 PIMA AZ EMERGENCY MNGR  
TRAFFIC SIGNAL DAMAGED ON SAHUARITA BLVD.

0402 PM NON-TSTM WND DMG 4 NE MESA 33.45N 111.69W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
ESTIMATED WINDS 50-60 MPH WITH SOME TREES DOWN AT  
SOUTHERN AND GREENFIELD RDS

0452 PM NON-TSTM WND DMG TACNA 32.70N 113.95W  
01/21/2010 YUMA AZ BROADCAST MEDIA  
FIVE SEMI TRUCKS BLOWN OVER ON I-8 AT MILEPOST 44.

0500 PM NON-TSTM WND DMG 5 NW SAGUARO NATIONAL P 32.23N 110.78W  
01/21/2010 PIMA AZ NEWSPAPER  
TREE DOWNED ON A HOUSE NEAR HARRISON RD. ON EAST SIDE OF  
TUCSON.

0528 PM NON-TSTM WND DMG 12 N TUCSON 32.41N 110.94W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
PARKING AWNING DAMAGED AT APPARTMENT COMPLEX AT INA AND  
MONA LISA

0600 PM NON-TSTM WND DMG SIERRA VISTA 31.55N 110.29W  
01/21/2010 COCHISE AZ NEWSPAPER  
70FT POWER POLE DOWNED ALONG BUFFALO SOLDIER TRAIL. TIME  
APPROXIMATE.

0615 PM NON-TSTM WND DMG 4 SSW SCOTTSDALE 33.63N 111.89W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
HIGH WIND BLEW DOWN TREES CAUSING DOWNED POWER LINES  
WHICH CAUSED HOUSE FIRE. WINDS ESTIMATED 45MPH.

0615 PM NON-TSTM WND DMG 4 SSW SCOTTSDALE 33.63N 111.89W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
SEVERAL LARGE TENTS AT PUBLIC AUTO AUCTION BLOWN DOWN.

0630 PM NON-TSTM WND DMG RAMSEY CANYON PRESERVE 31.45N 110.31W  
01/21/2010 COCHISE AZ NEWSPAPER  
SEVERAL POWER POLES DOWNED. TIME APPROXIMATE.

0647 PM NON-TSTM WND DMG 1 N APACHE JUNCTION 33.42N 111.55W  
01/21/2010 PINAL AZ TRAINED SPOTTER  
SEVEN-INCH DIAMETER TREE BLOWN DOWN BLOCKING ROAD.

0735 PM NON-TSTM WND DMG PHOENIX 33.61N 111.98W  
01/21/2010 MARICOPA AZ AMATEUR RADIO  
24 INCH DIAMETER TREE DOWN FROM STRONG WINDS AT TATUM AND  
THUNDERBIRD RD

0736 PM NON-TSTM WND DMG WILLIAMS 35.26N 112.17W  
01/21/2010 COCONINO AZ LAW ENFORCEMENT  
WILLIAMS P.D. CONFIRMED A VERY LARGE TREE BLEW INTO 2  
HOUSES IN WILLIAMS. NO INJURIES REPORTED.

0900 PM NON-TSTM WND DMG 5 W TUCSON 32.24N 111.03W  
01/21/2010 PIMA AZ TRAINED SPOTTER  
TREE DOWN NEAR CONGRESS AND GRANDE

0100 AM NON-TSTM WND DMG CHIRICAHUA NATIONAL MON 32.01N 109.36W  
01/22/2010 COCHISE AZ PARK/FOREST SRVC  
TREES DOWNED ACROSS MONUMENT ROADWAY. TIME APPROXIMATE.

0100 AM NON-TSTM WND DMG MOUNT LEMMON/SUMMERHAVE 32.44N 110.76W  
01/22/2010 PIMA AZ BROADCAST MEDIA  
DOZENS OF TREES AND SOME POWER LINES DOWNED ON MT. LEMMON  
THROUGHOUT THE EVENING AND NIGHT. POWER COMPLETELY OUT ON  
MT. LEMMON.

**...HIGH SUST WINDS...**

1240 PM HIGH SUST WINDS 5 NNW ELOY 32.81N 111.65W  
01/21/2010 E40 MPH PINAL AZ TRAINED SPOTTER  
BLOWING DUST REDUCING VISIBILITY TO ONE HALF MILE.

**...TSTM WND DMG...**

0450 PM TSTM WND DMG 3 N LAKE HAVASU CITY 35.24N 114.03W  
01/21/2010 MOHAVE AZ TRAINED SPOTTER  
TWENTY POWER POLES WERE SNAPPED ON THE NORTH SIDE OF  
KINGMAN. STOPS SIGNS WERE BENT AT A 45 DEGREE ANGLE.

0459 PM TSTM WND DMG EHRENBERG 33.62N 114.49W  
01/21/2010 LA PAZ AZ TRAINED SPOTTER  
REPORTS OF AT LEAST TWO SEMI TRUCKS BLOWN OVER ON I-10.  
LOCATION ESTIMATED.

0515 PM TSTM WND DMG 2 NW KINGMAN 35.23N 114.05W  
01/21/2010 MOHAVE AZ NEWSPAPER  
THUNDERSTORM WINDS TORE A CARPORT OFF A HOME AND BLEW IT  
DOWN THE STREET. THE CARPORT WAS THEN WRAPPED AROUND A  
UTILITY POLE.

0528 PM TSTM WND DMG 12 N TUCSON 32.41N 110.94W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
PARKING AWNING DAMAGED AT APPARTMENT COMPLEX AT INA AND  
MONA LISA

0830 PM TSTM WND DMG 7 N PHOENIX 33.64N 112.05W  
01/21/2010 MARICOPA AZ TRAINED SPOTTER  
3 TREES...6-8 INCHES IN DIAMETER...BLOWN OVER AT BELL  
ROAD AND 16TH STREET

0845 PM TSTM WND DMG 8 NNW SACATON 33.19N 111.80W  
01/21/2010 PINAL AZ TRAINED SPOTTER  
TWO POWER POLES BLOWN DOWN AT INTERSECTION OF GILBERT  
ROAD AND HUNT HIGHWAY.

0900 PM TSTM WND DMG SELLS 31.92N 111.88W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
MAIN TRANSMISSION POWER LINE DOWNED ON THE TOHONO OODHAM  
NATION. MUCH OF THE NATION...OVER 15000 PEOPLE...LOST  
POWER. TIME APPROXIMATE.

1100 PM TSTM WND DMG 8 SW ORO VALLEY 32.33N 111.05W  
01/21/2010 PIMA AZ BROADCAST MEDIA  
POWER LINE DOWNED ON SEVERAL MOBILE HOMES. SMALL FIRE  
STATRED ON ONE HOME...BUT QUICKLY EXTINGUISHED. TIME  
APPROXIMATE.

1120 PM TSTM WND DMG 4 NE ORO VALLEY 32.46N 110.91W  
01/21/2010 PIMA AZ NWS EMPLOYEE  
12-15FT DIAMETER TREE DOWNED NEAR WILDS RD. AND ORACLE  
RD. TIME APPROXIMATE.

**...DUST STORM...**

0228 PM DUST STORM DAVIS-MONTHAN AIR FORCE 32.18N 110.87W  
01/21/2010 PIMA AZ OTHER FEDERAL  
1/4 MILE VISIBILITY REPORTED FROM AIR TRAFFIC CONTROL  
TOWER.

0315 PM DUST STORM 4 WNW ELOY 32.76N 111.67W  
01/21/2010 PINAL AZ TRAINED SPOTTER  
THIRTY FOOT VISIBILITY REPORTED IN BLOWING DUST.

0415 PM DUST STORM 8 NW TUCSON 32.32N 111.03W  
01/21/2010 PIMA AZ TRAINED SPOTTER  
NEAR ZERO VISIBILITY IN AVRA VALLEY NEAR PUMP STATION  
ROAD AND THE AIRPORT

0459 PM DUST STORM 2 SSW MAGMA 33.10N 111.51W  
01/21/2010 PINAL AZ TRAINED SPOTTER  
VISIBILITY 1/4 MILE.