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Rio Grande | Bravo

CLIMATE IMPACTS & OUTLOOK

June 2018

Summary

Forecasts favor above-average temperatures for the entire Rio Grande/Bravo region, and below-average precipitation for South Texas and Northeast Mexico through September.

AT A GLANCE

1 **New Mexico**
All of New Mexico remains in a state of drought, with extreme to exceptional drought conditions covering more than half the state.

2 **Mexico-Texas Border**
A heat wave in early June set new high temperature records all the way from Brownsville to El Paso. In Laredo and Brownsville, records were broken on six consecutive days from June 1-6.

3 **South Texas/Northeast Mexico**
Forecasts favor below-average precipitation through September

REGIONAL CLIMATE OVERVIEW
MARCH I APRIL I MAY

Temperatures over the past three months (March-May) were 2-5 °F (1.1-2.8 °C) above average for most of New Mexico and Texas (Figure 1; left). Precipitation over the same time period was 0-50% of average for most of both states, with small pockets in Texas experiencing precipitation 110-150% of average (Figure 1; right).

Temperatures for January-May have been record warmest for El Paso, Texas and Albuquerque, New Mexico. Temperatures in May were the second warmest on record in Texas, and third warmest for New Mexico, and precipitation was much below normal for both states during the month. In Texas during May, there were several tornadoes and reports of golfball- to baseball-sized hail across the state (NOAA State of the Climate).

Temperatures from June 1-19 were 2-6 °F (1.1-3.3 °C) above average in most of New Mexico and Texas. Areas in North-Central Texas experienced temperatures 6-8 °F (3.3-4.4 °C) above average (figure not shown). Precipitation over the same time period was 200-800% of average for the western half of New Mexico, as well as the Southeast corner of the state on the border with Texas. Northeast New Mexico and most of Texas received precipitation 0-75% of average.

With the exception of parts of Baja California and southern Chihuahua, most of Northwest Mexico continued to experience above-average temperatures from March to May. The highest positive anomalies, greater than 9 °F (5 °C), occurred in regions of Chihuahua and Durango; while areas in the Northeast had close to normal temperatures (Figure 2, left). Southern Sonora and Chihuahua, as well as northern Sinaloa, experienced the greatest number of days (50 days) with maximum temperatures at or above 104 °F (40 °C) (Figure 2, right). The areas that experienced between 1 to 10 days were in Sonora, Chihuahua, Sinaloa, Durango and Coahuila.

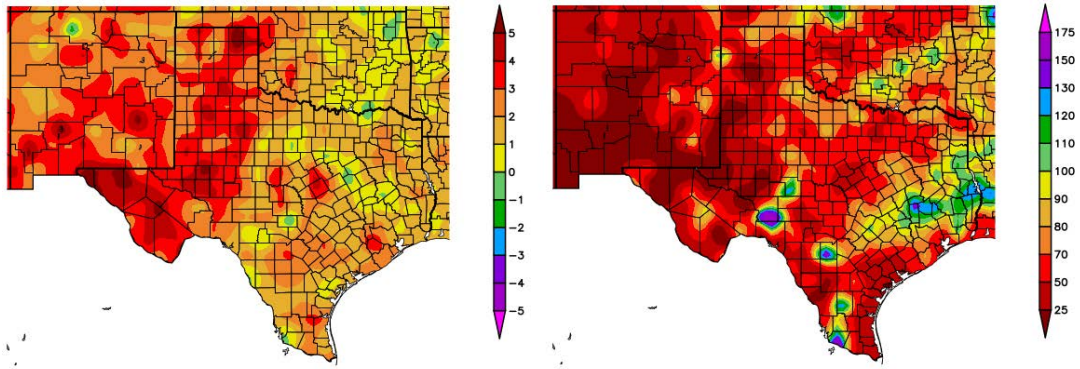


Figure 1 (above): Departure from average temperature in degrees F (left) and percent of average precipitation (right), compared to the 1981–2010 climate average, for 3/1/2018–5/31/2018. Maps from HPRCC

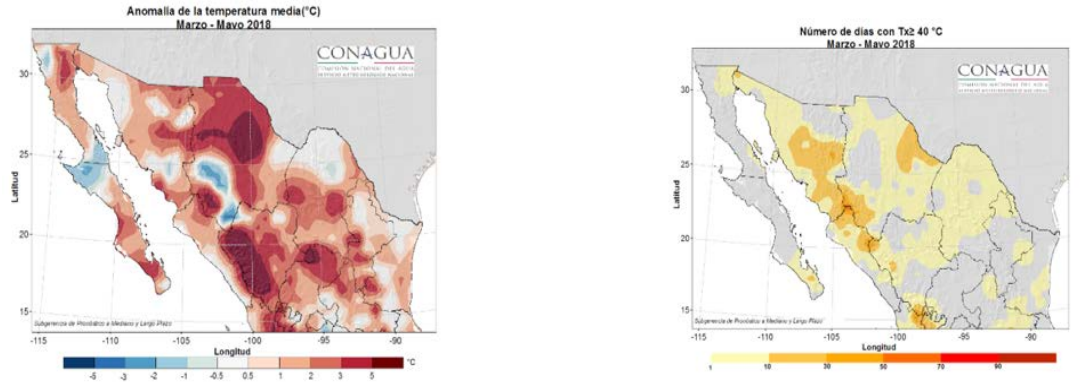


Figure 2 (above): Temperature anomalies in °C (left) and number of days with maximum temperatures at or above 104 °F (40 °C) (right) for March–May. Maps from SMN.

Between March and May, the only region in Mexico with above-normal rainfall was the Northeast part of the country where precipitation was 4-8 inches (100-200 mm) from March-May, more than 15% above average (Figure 3, left). Alternatively, drought intensified in the Northwest, with less than 0.2 inches (5 mm) of precipitation in most of Sonora and Sinaloa, and between 0.4 and 0.8 inches (10 and 20 mm) in Chihuahua and Durango, less than 25% of average (Figure 3, right). According to Figure 3, precipitation associated with the monsoon was not observed in northwestern Mexico until May 31.

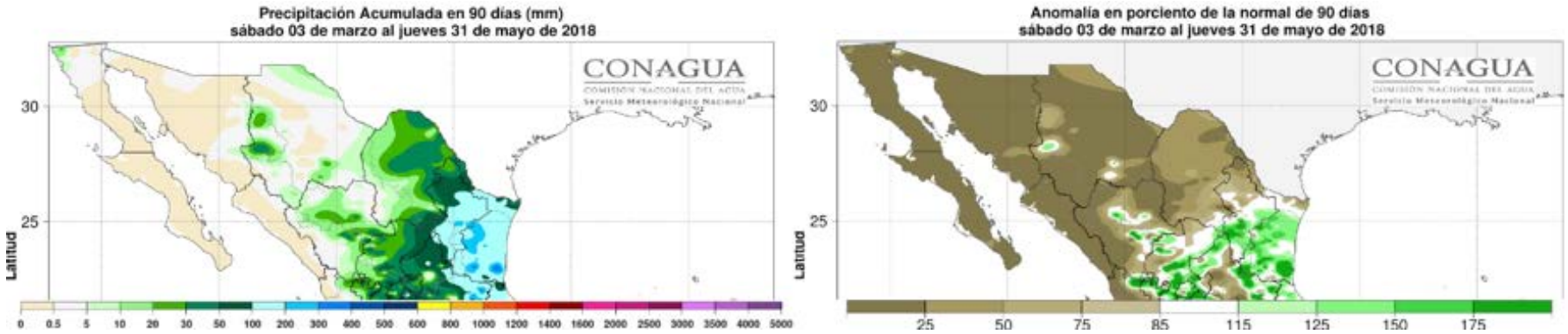


Figure 3 (above): Accumulated precipitation in mm (left) and percent of normal (right) for March–May. Maps from SMN.

DROUGHT

Drought conditions intensified in New Mexico over the past month, but improved slightly in Texas and northern Mexico, according to the North American Drought Monitor (NADM) (Figure 4). Exceptional and extreme drought conditions expanded in New Mexico to cover the northern half of the state. In Texas, severe to exceptional drought persists in the panhandle, and along the U.S.-Mexico border near Del Rio, and abnormally dry conditions persist in the northern Mexico states. Drought development is likely in Central Texas by the end of September, and drought conditions are predicted to persist on the U.S.-Mexico border near Del Rio and in eastern and North-Central Texas, according to the U.S. Seasonal Drought Outlook. Drought is predicted to remain but become less severe in most of New Mexico and the western Texas panhandle, and termination of drought conditions is likely in southern Texas.

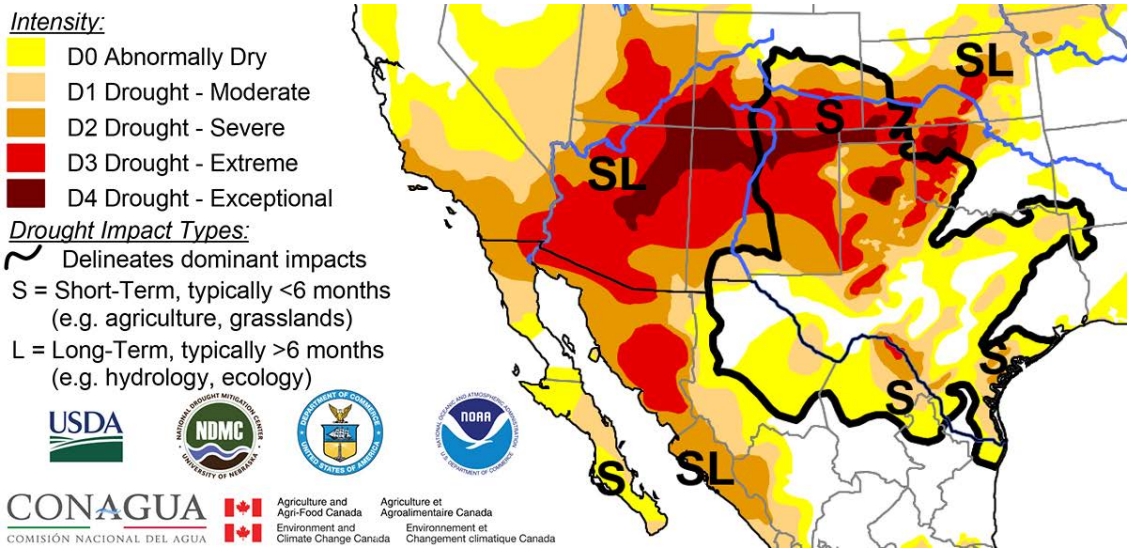


Figure 4 (above): North American Drought Monitor, released June 8, 2018.

FORECAST
JULY | AUGUST | SEPTEMBER

TEMPERATURE

The three-month NOAA temperature outlook (July-September; Figure 5) favors chances for above-average temperatures for all of New Mexico and Texas through September. The one-month outlook favors chances for above-average temperatures in most of Texas and equal chances for below-average, average, or above-average temperatures for New Mexico and West Texas for July (figure not shown).

The forecast from CONAGUA´s Servicio Meteorológico Nacional (SMN) for July predicts above-average maximum temperatures in the Baja California Peninsula, middle and southern Chihuahua, Coahuila, Nuevo León and Tamaulipas (Figure 6; left). Below-average anomalies are predicted for Northwest and southern Sonora. For August, forecasts predict above-average anomalies in Tamaulipas, Nuevo León and Coahuila, and below-average anomalies in some areas of the Baja California Peninsula and Chihuahua (Figure 6; right).

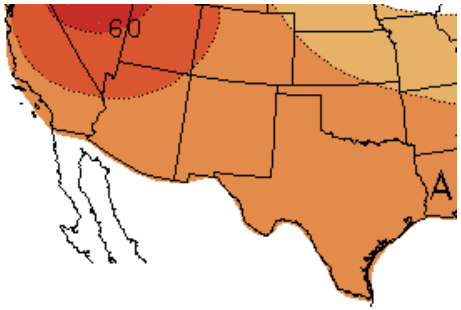
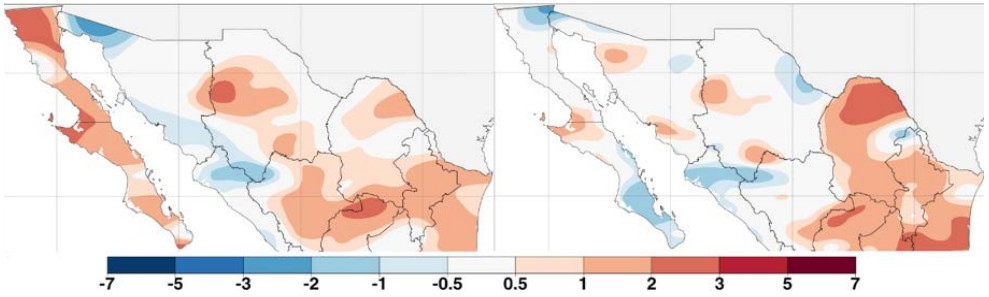


Figure 5 (left): NOAA three-month temperature outlook (July-September). Forecast made on June 21, 2018 by CPC.

Figure 6 (below): Predicted maximum temperature anomalies for northern Mexico in (°C), July 2018 (left) and August 2018 (right). Forecast made on June 1, 2018 by SMN.



PRECIPITATION

The NOAA three-month precipitation outlook (July-September; Figure 7) predicts equal chances for below-average, average, or above-average precipitation for the eastern half of New Mexico and the western half of Texas through September. Forecasts also favor increased chances of below-average precipitation for eastern and southern Texas during the same time period, and above-average precipitation for the wetern half of New Mexico, due to the predicted transition to El Niño during the summer and fall. The one-month NOAA outlook (July; figure not shown) shows a pattern of forecast probabilities similar to the three-month outlook.

For July, the SMN precipitation outlook predicts above-average precipitation in Sonora, northern Baja California, and some regions of Chihuahua, and below-average precipitation in Tamaulipas, Nuevo León, Coahuila, eastern Chihuahua and the rest of the Baja California Peninsula (Figure 8; left). The precipitation forecast for August shows above-average precipitation in some regions of the Baja California Peninsula, Sonora and Chihuahua, and below-average precipitation in Tamaulipas, Nuevo León, Coahuila, eastern and Northeast Chihuahua, Northeast and Northwest Sonora and northern Baja California (Figure 8; right).

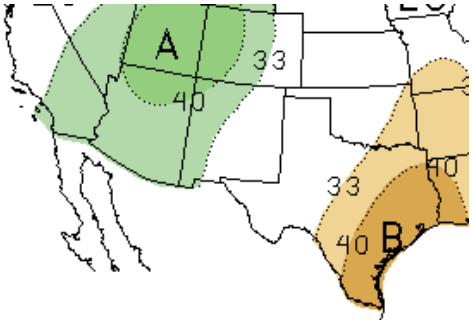
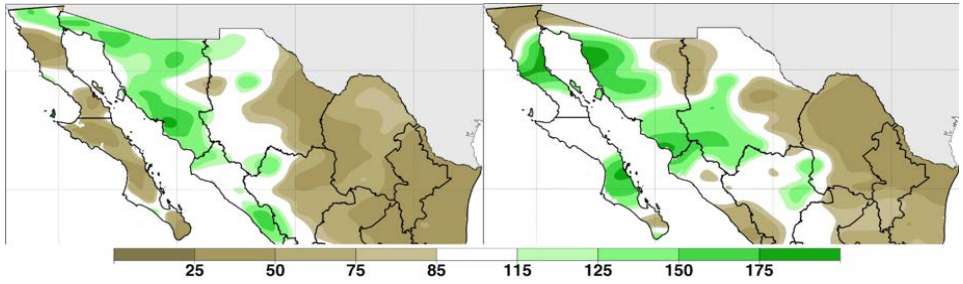


Figure 7 (left): NOAA three-month precipitation outlook (July-September). Forecast made on June 21, 2018 by CPC.

Figure 8 (below): Predicted precipitation anomalies for northern Mexico (in %), June 2018 (left) and July 2018 (right). Forecast made on June 1, 2018 by SMN.



FIRE

According to the North American Seasonal Fire Assessment and Outlook, windy and dry conditions in New Mexico and West Texas helped drive fire growth in both states over the past month. Since early May, over 247,000 acres (100,000 hectares) burned in Mexico, with Chihuahua, Jalisco, and Durango experiencing the greatest burned areas. Summer monsoon rains moving in to the Southwest U.S. and northern Mexico in July and August are anticipated to mitigate fire conditions. Forecasts for July and August indicate normal fire potential for all of the Southwest U.S. and Mexico, except for Baja California.

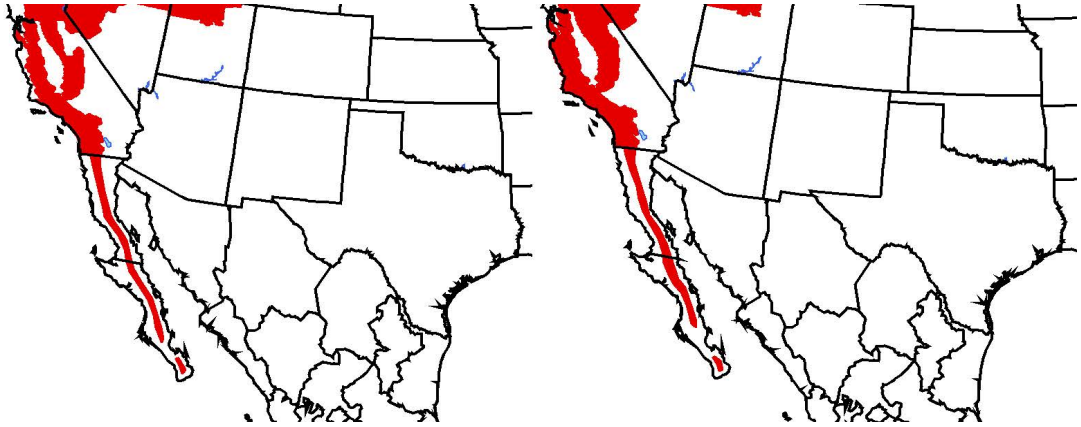


Figure 9 (above): Fire outlook for July (left) and August (right). Red shading indicates conditions that favor increased fire potential. Green shading indicates conditions that favor decreased fire potential. Forecast made on June 11, 2018 from NIFC and SMN.

EL NIÑO-SOUTHERN OSCILLATION (ENSO)

As of mid-June, sea-surface temperatures and atmospheric conditions in the tropical Pacific Ocean continue to indicate ENSO-neutral conditions. An ongoing build-up of heat in the tropical Pacific is leading to predictions of El Niño conditions by the fall (IRI; NOAA). Neutral conditions are forecasted to persist through the summer, and chances of El Niño have increased from last month's forecasts, nearing 50% during the fall and ~65% during winter (Figure 10). There is considerable uncertainty in ENSO forecasts made during the spring, but that barrier has mostly passed and forecasters have come to a consensus that El Niño will develop later this year. If forecasts are correct, chances of a wet winter in the Southwest U.S. and northern Mexico are likely to increase.

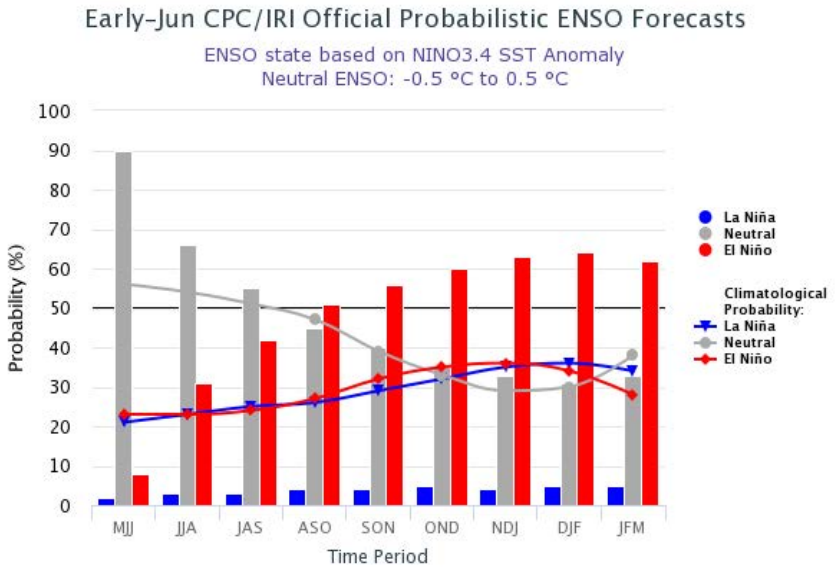


Figure10 (above): Probabilistic ENSO Forecast from IRI.

For more ENSO information:

English: http://iri.columbia.edu/our-expertise/climate/enso/enso-essentials/ y http://www.ncdc.noaa.gov/teleconnections/enso/.

Spanish: http://smn.cna.gob.mx/es/climatologia/diagnostico-climatico/enos y http://www.smn.gov.ar/?mod=biblioteca&id=68

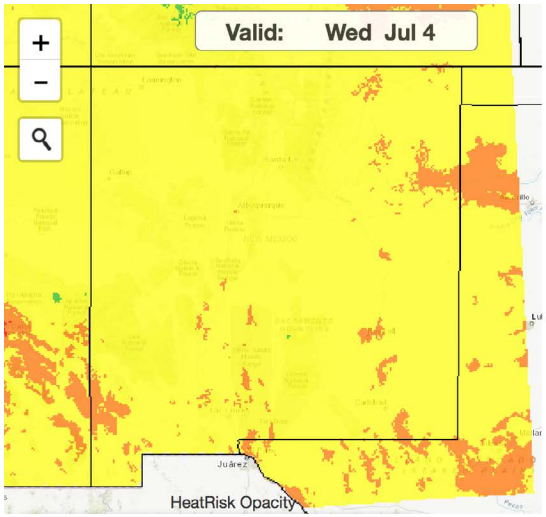
HEAT WATCH

In typical summer fashion, temperatures have ramped up across the Southwest U.S. and northern Mexico over the past month. Several cities along the Rio Grande have experienced multiple heat waves and have set high temperature records. In mid-May, a heat wave in Laredo set records on four consecutive days, with temperatures ranging from 100-104 °F from May 15-18. A similar heat wave in Del Rio, TX on May 26-29, when temperatures ranged from 103-106 °F, set records on 3 of 4 days. Brownsville, TX also set record highs on May 25-26 with temperatures reaching 97 °F. Then, in early June, a heat wave broke records along the entire border reaching all the way from Brownsville to El Paso. Both Laredo and Brownsville set new high temperature records on 6 consecutive days, from June 1-6, with temperatures ranging from 105-108 °F in Laredo and 97-98 °F in Brownsville. El Paso set records on May 31 and June 2, with temperatures of 102 °F and 106 °F, respectively. Further into June, Santa Fe set records on June 12 and 14, with temperatures of 97 °F and 95 °F, respectively. Looking forward, forecasts indicate that temperatures will be above-average over the next month for Texas (Figure 5).

In Mexico, the highest temperatures recorded in the most populated cities across Northwest Mexico were 113 °F (45 °C) in Mexicali on June 12; 111.2 °F (44 °C) in Hermosillo and Ciudad Obregón, Sonora, on June 4 and 12, respectively. Ciudad Juárez, Chihuahua reached 105.8 °F (41 °C) on June 11-12, Culiacán, Sinaloa reached 104.9 °F (40.5 °C) on June 2, and Chihuahua, Chihuahua reached 104 °F (40 °C) on May 30. None of these temperatures broke previous records.

A new heat forecasting tool produced by the U.S. National Weather Service provides additional insight into near future temperatures. HeatRisk is an experimental forecasting tool that visualizes heat risk potential one-week in advance (Figure 11). It is designed to provide guidance to decision makers and heat-sensitive populations (such as outdoor workers and those with young children) on when to take action in preparation of a heat event. Each color category shown in the map represents a different population that is at risk. For example, yellow is a low-level of risk and means that those who are extremely sensitive to heat should take action to prevent illness. When the highest level (magenta) is forecasted, the entire population is at risk, due to long-duration heat with little to no relief overnight. HeatRisk can be accessed from the National Weather Service page for most cities (https://www.wrh.noaa.gov/wrh/heatrisk/?wfo=epz).

Extreme heat causes the most deaths in the U.S. of any weather-related disaster. During this time of year in the Southwest U.S. and northern Mexico, prior to the start of the North American monsoon, it is particularly important to be prepared for the unrelenting heat. Populations at increased risk of heat-related illness include children, pregnant women, elderly, those taking medications, those working outdoors, those with disabilities, those without adequate cooling, and the socially isolated. Be sure to check on loved ones and neighbors and call 911 if anyone is experiencing symptoms of heat stroke (e.g., headache, fast pulse, confusion, nausea, loss of consciousness). For more information on vulnerable populations, the symptoms of heat-related illness, and what to do to prepare, visit the CDC extreme heat webpage (en Espanol: https://www.cdc.gov/es/disasters/extremeheat/index.html).



Category	Level	Meaning
Green	0	No Elevated Risk
Yellow	1	Low Risk for those extremely sensitive to heat, especially those without effective cooling and/or adequate hydration
Orange	2	Moderate Risk for those who are sensitive to heat, especially those without effective cooling and/or adequate hydration
Red	3	High Risk for much of the population, especially those who are heat sensitive and those without effective cooling and/or adequate hydration
Magenta	4	Very High Risk for entire population due to long duration heat, with little to no relief overnight

Figure 11 (right): Screenshot of NWS HeatRisk for July 4. The table (right) describes the meaning of each color.

MONSOON TRACKER & HURRICANE BUD

***The following summary is adapted from the June 2018 issue of the CLIMAS Southwest Climate Outlook.**

Monsoon season has officially begun in the Southwest U.S and northern Mexico. In 2008, the U.S. National Weather Service (NWS) changed the definition of the start of the North American monsoon from a variable date based on locally measured conditions to a fixed date of June 15th. Prior to 2008, the start date reflected the seasonal progression of the monsoon (Figure 12), based on larger seasonal atmospheric patterns.

This gradient is linked to seasonal atmospheric patterns and the establishment of the 'monsoon ridge' in the Southwest (Figure 13). The heating of the complex topography of the western U.S. with the increasing sun angle and contrast with the cooler water of the adjacent Pacific Ocean lead to the establishment of this upper-level ridge of high pressure over the Southwest U.S. (also known as Four Corners High). This flow around this upper level ridge shifts from a dry southwesterly fetch in May to a moisture rich southerly-southeasterly fetch in late June/early July.

In southern Arizona, the start date was originally based on the average daily dewpoint temperature. Phoenix and Tucson NWS offices used the criteria of three consecutive days of daily average dewpoint temperature above a threshold (55 degrees in Phoenix, 54 degrees in Tucson) to define the start date of the monsoon. The average daily dewpoint temperature is still a useful tool to track the onset and progression of conditions that favor monsoon events, and the NWS includes a dewpoint tracker in their suite of monsoon tools.

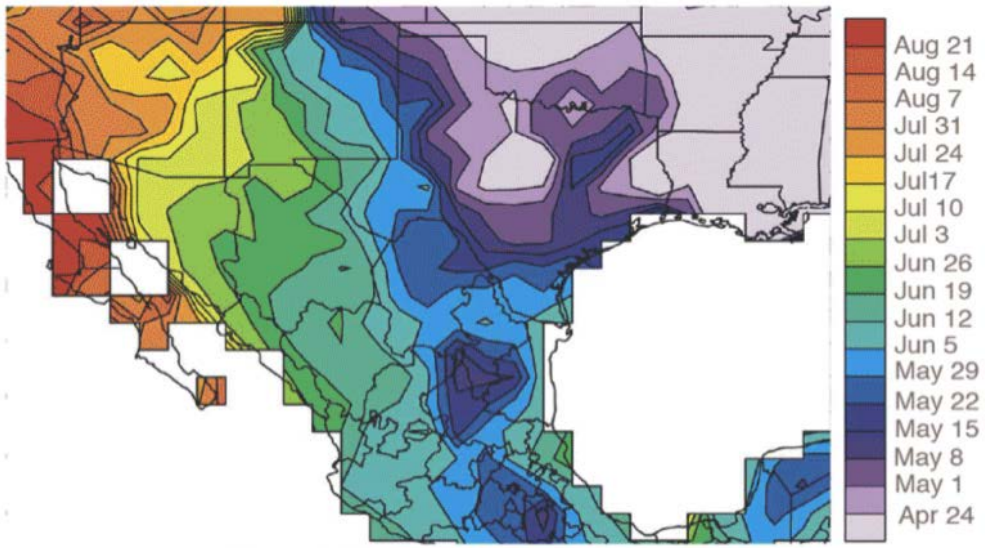


Figure 12: Historical Monsoon Onset Date. Source: Australian Bureau of Meteorology

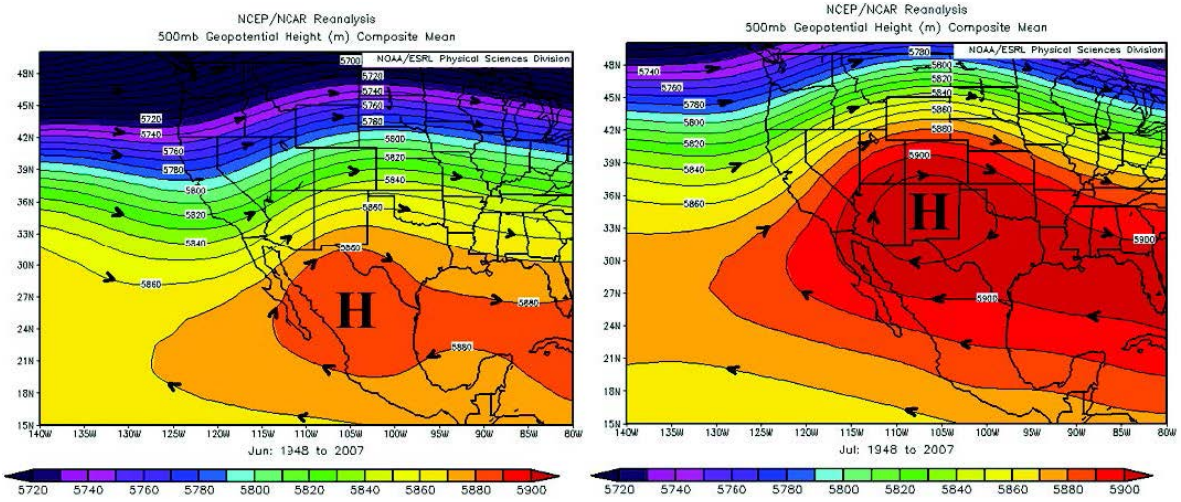


Figure 13: NCEP/NCAR Mean 500mb Geopotential Height (1948-2007) – June (left), July (right).

MONSOON TRACKER & HURRICANE BUD CONT'D

Thirty-year averages for daily dewpoint and precipitation demonstrate the gradual increase in dewpoint temperatures during the monsoon season, as well as the variability of precipitation observed over the same window (Figure 14).

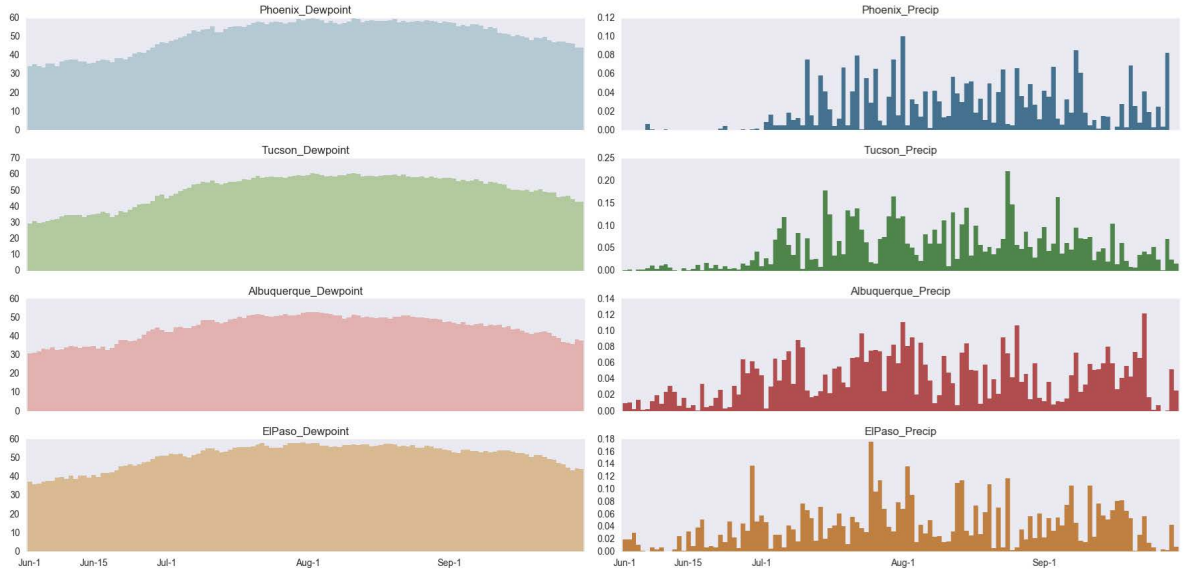


Figure 14 (left): Average daily dewpoint temperature (left) and average daily precipitation (right).

The updated definition of the monsoon identifies a season that lasts for 108 days with defined start and end dates of June 15 and Sept 30. Dewpoint and precipitation may provide a more granular assessment of monsoon activity, but the seasonal designation allows for easier comparisons between years and focuses planning activities on a discrete monsoon season. Although monsoon storm activity begins in June for Albuquerque and El Paso, the majority of activity occurs in July and August (Figure 15), with some lingering activity into September (occasionally augmented by eastern Pacific tropical storms). Thus, the recent incursion of moisture from Tropical Storm Bud was a welcome change to the typical mid-June dry heat. Arriving on June 16th for southern New Mexico and West Texas, Bud raised the question: Did this moisture qualify as "monsoon"?

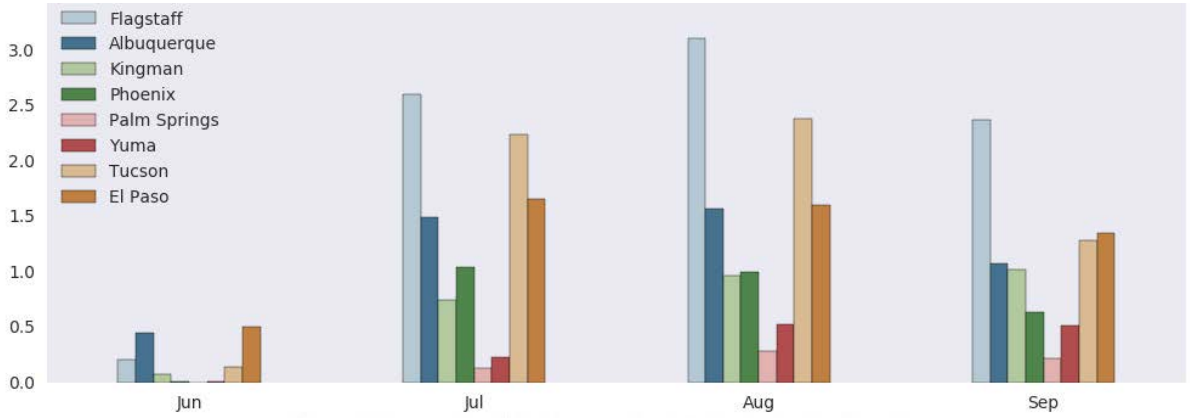


Figure 15 (left): Average monthly monsoon precipitation in the Southwest U.S.

MONSOON TRACKER & HURRICANE BUD CONT'D

The moisture from Tropical Storm Bud was key to the widespread event, but the rain also was dependent on a low-pressure system that happened to be nearby. Bud was caught between a trough of low pressure off the coast of California and the subtropical ridge which was displaced well to the east over the Gulf of Mexico. The flow pattern over this event resembled a 'transition' pattern typically seen at the end of the monsoon season (Figure 16), when the mid-latitude jet stream becomes more active and the monsoon ridge starts to retreat south. Together these features helped guide the storm into southern New Mexico and West Texas.

The approaching trough of low pressure was also critical to cooling upper-level air temperatures, increasing the instability of the very moist airmass at the surface, and providing wind shear to help organize any storms that formed. This kind of assist is possible at the beginning of the monsoon in June but is much more common in late summer when we are transitioning out of the monsoon. It rarely occurs in the middle of the monsoon because of the dominance of the subtropical ridge pattern that limits how close mid-latitude storms can get to the Southwest.

Ultimately, the storm was less dependent on the exact track that Bud took in mid-June (Figure 17), and more dependent on larger atmospheric patterns that came together to bring welcome – if unexpected precipitation to the Southwest. Figure 18 shows storm totals for some cities in the region.

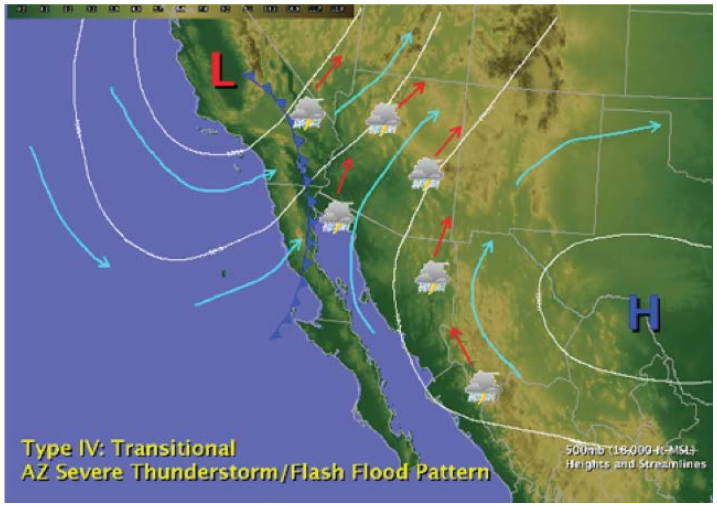


Figure 16 (above): Type IV Monsoon Transitional Pattern (Source: NWS Tucson)

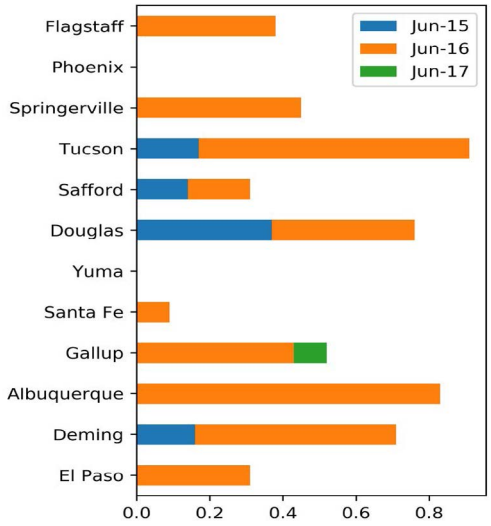


Figure 18 (above): SW Regional Storm Totals – June 15 – 17, 2018.

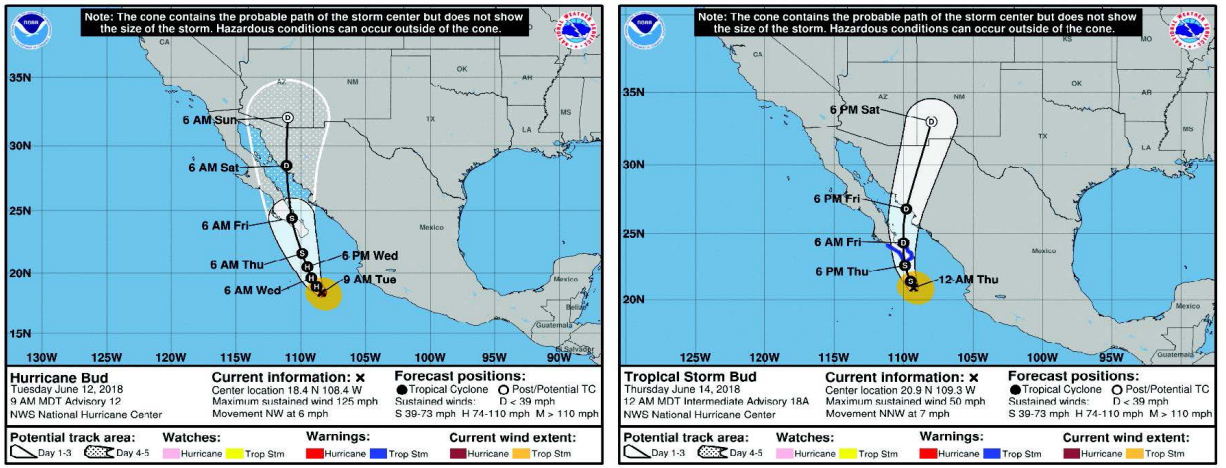


Figure 17 (above): Hurricane/TS Bud – National Hurricane Center Advisory Maps for June 12 (left) and June 14 (right).

Additional Monsoon Resources:

- NWS: http://www.wrh.noaa.gov/twc/monsoon/monsoon_info.php
- CLIMAS: http://www.climas.arizona.edu/sw-climate/monsoon
- CONAGUA: http://www.gob.mx/conagua/prensa/inicio-el-monzon-de-norteamerica-en-el-noroeste-de-mexico

MONSOON TRACKER & HURRICANE BUD CONT'D

Hurricane Bud, which reached category 4 by June 12, entered the southern Baja California Peninsula as a tropical storm on June 15. Cloud bands covered portions from central Sinaloa to southern Sonora, leaving the highest accumulations of rainfall between June 11 and 15 of 6.5 inches (165.0 mm) in San Lorenzo, Sinaloa; 6.2 inches (157.6 mm) in Andrew Weiss, Sinaloa; and 6.0 inches (152.6 mm) in Alamos, Sonora (Figure 19).

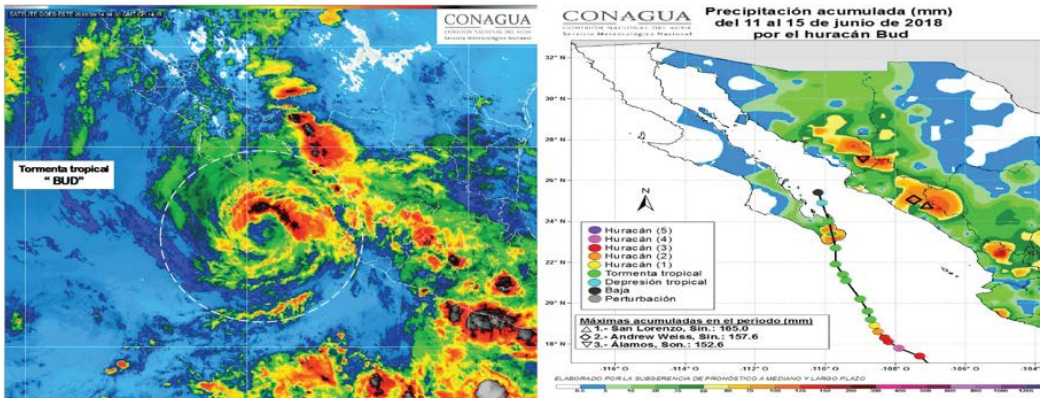


Figure 19 (right): Cloudiness associated with hurricane / tropical storm Bud (left). Total rainfall from June 11 to 15, 2018 by the passage of Bud (right). Cyclonic trajectory obtained from the NHC, satellite image and rain data of the SMN.

ANNOUNCEMENTS

RESEARCH ARTICLE IDENTIFIES TRANSBOUNDARY HYDROGEOLOGICAL UNITS SHARED BETWEEN TEXAS, MEXICO

New research, published in the *Journal of Hydrology: Regional Studies*, identifies and classifies 15 transboundary aquifers between Mexico and Texas, based on aquifer potential and water quality. The lead author of the article hopes that the research will support the development of transboundary management regimes that will protect future water supplies in the borderland region.

2018 ONE WATER SUMMIT

This national summit will focus on how we value and manage water to foster economic prosperity and environmental sustainability, and what it will take to secure a sustainable water future for everyone. The summit will be in Minneapolis, MN from July 10-12, 2018.

33RD ANNUAL WATEREUSE SYMPOSIUM

The symposium will be held September 9-12, 2018 in Austin, Texas, and will address advancing the policy, technology, innovation and public acceptance of water reuse.

BORDER ENERGY FORUM XXII

Hosted by the North American Development Bank, the Border Energy Forum brings together local and state officials, private sector developers and investors, academics, and energy experts from the U.S. and Mexico to discuss topics including energy prosperity, innovation, financing, and cross-border opportunities. The forum is September 26-27 in San Antonio, TX.

NEWS

Two storms drop almost an inch of rain on Albuquerque, June 16, 2018
El río Bravo se está secando, May 30, 2018
Lluvias en Tamaulipas dejan bajo el agua tres municipios, June 20, 2018