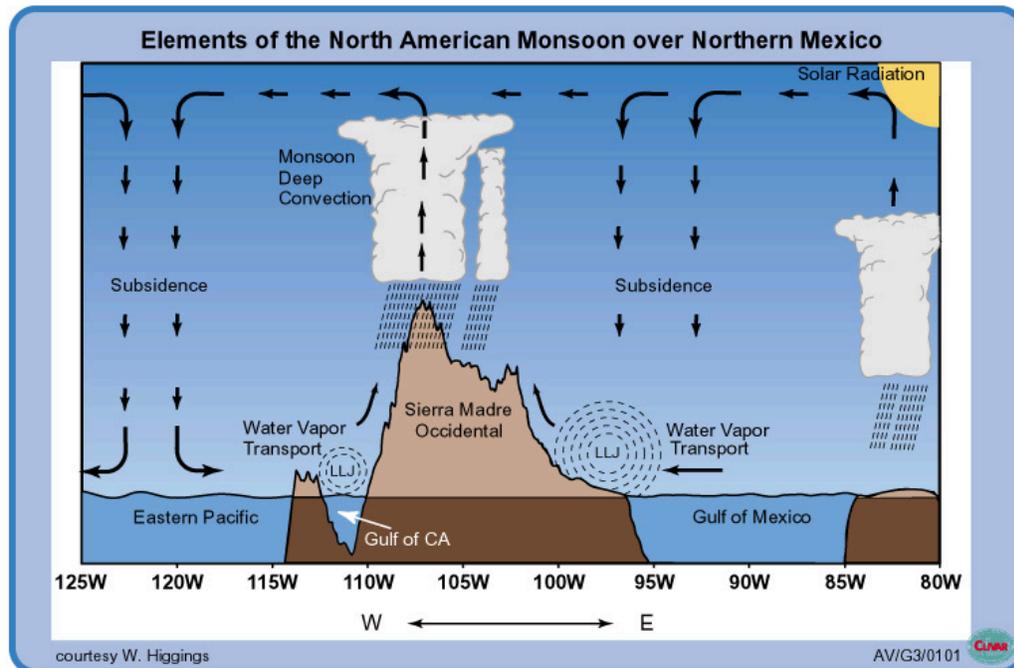


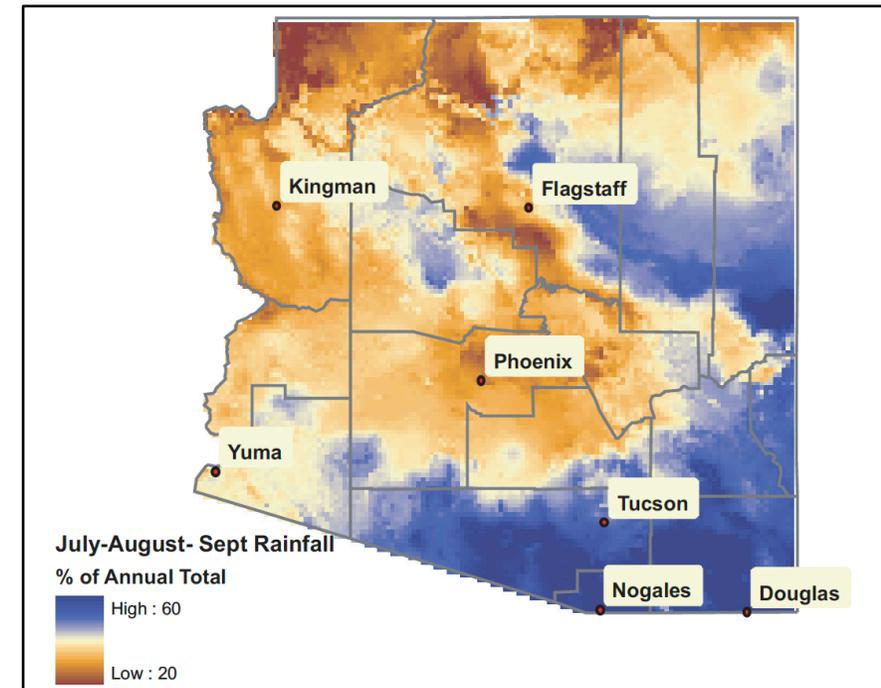
2020 North American Monsoon Recap

2020 North American Monsoon season characterized by extreme heat and lack of rainfall

- The North American Monsoon (NAM) refers to a shift in the synoptic-scale wind pattern that transports low-to-midlevel moisture from the Eastern Pacific, Gulf of California, and Gulf of Mexico into the southwestern US during summer
- The NAM is an important source of annual precipitation for parts of the southwestern US
- Unlike the stronger Indian Monsoon, the NAM is characterized by episodic bursts of moisture transport and rainfall
- Persistent circulation anomalies during July–September 2020 resulted in an abnormally inactive monsoon season
- The Southwest climate region experienced its warmest and driest July–September period on record
- Anomalously warm and dry summer weather further exacerbated existing drought conditions over the western US



Source: NOAA/NWS Climate Prediction Center, <https://www.cpc.ncep.noaa.gov/>

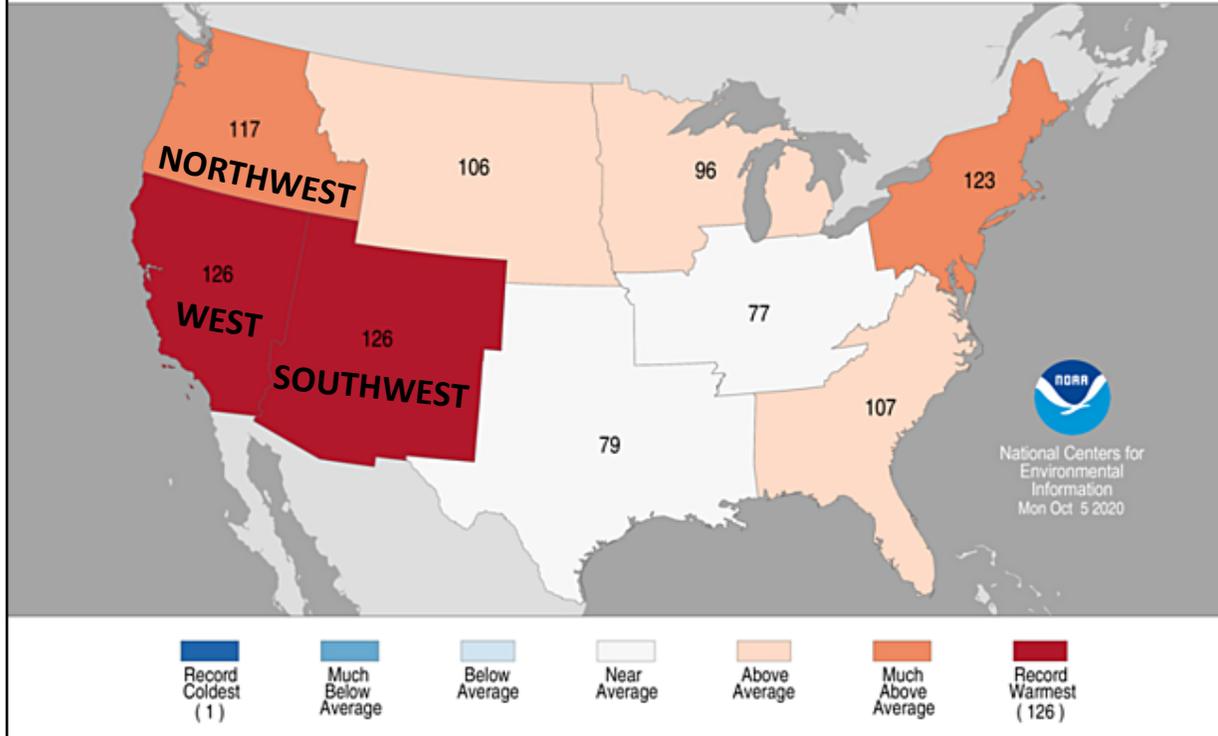


Source: Cooperative Extension, University of Arizona, <https://extension.arizona.edu/>

2020 North American Monsoon Recap

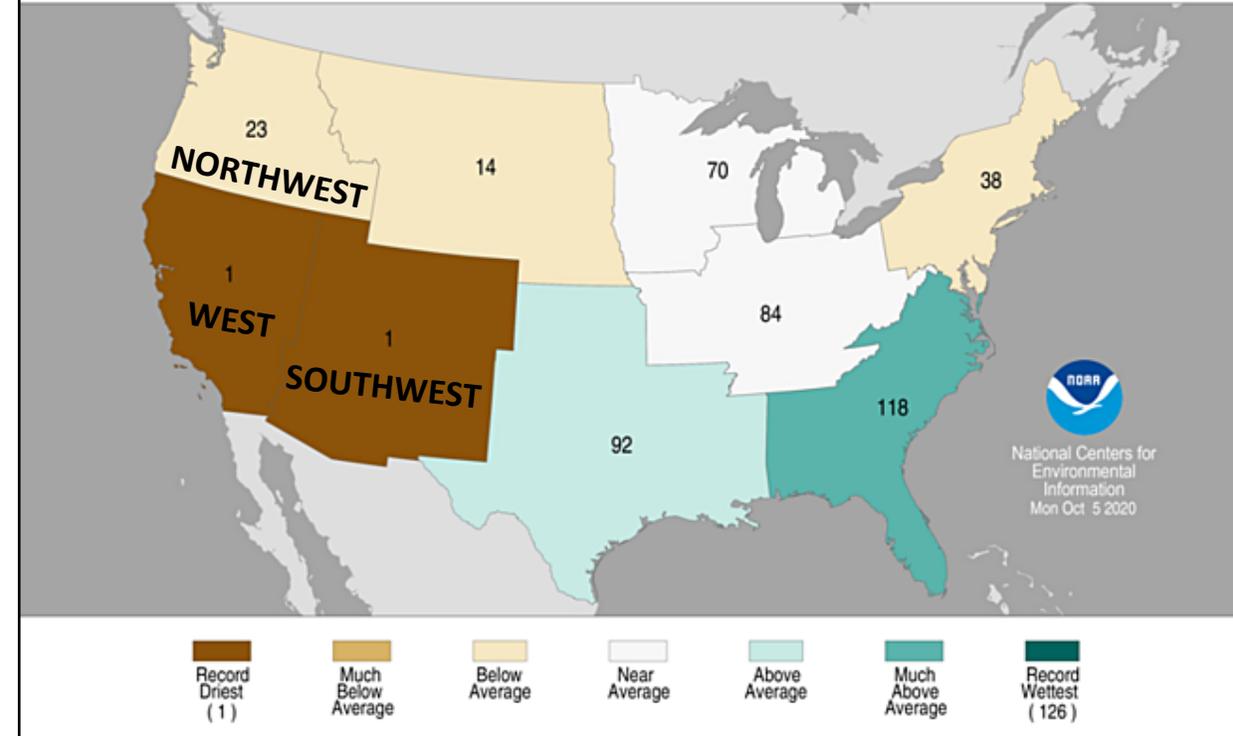
Regional Average Temperature Ranks

July–September 2020
Period: 1895–2020



Regional Precipitation Ranks

July–September 2020
Period: 1895–2020



Source: NOAA National Centers for Environmental Information, <https://www.ncei.noaa.gov/>

- The West and Southwest climate regions recorded their warmest and driest July–September period (since 1895)
- The Northwest climate region recorded its 10th warmest and 23rd driest July–September period
- As of 21 Oct, Phoenix, AZ, has set a new record for number of days in a year with a maximum temperature $\geq 100^{\circ}\text{F}$ (145 days)

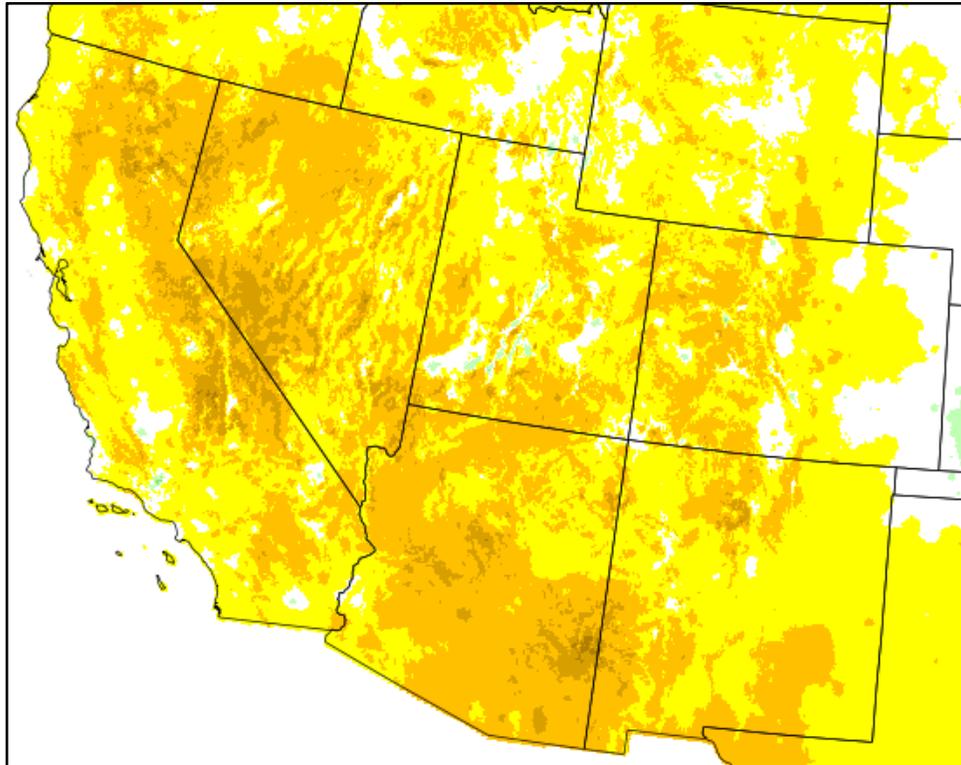
2020 North American Monsoon Recap

Daily Mean Temperature Anomaly: Jul 2020 - Sep 2020

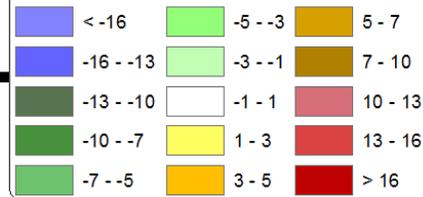
Period ending 7 AM EST 30 Sep 2020

Base period: 1981-2010

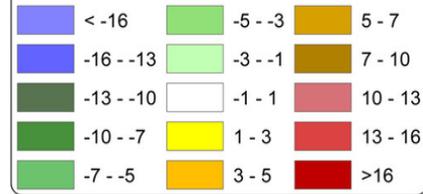
(Map created 02 Oct 2020)



Temperature Anomaly (°F)



Dewpoint Temp Anomaly (°F)

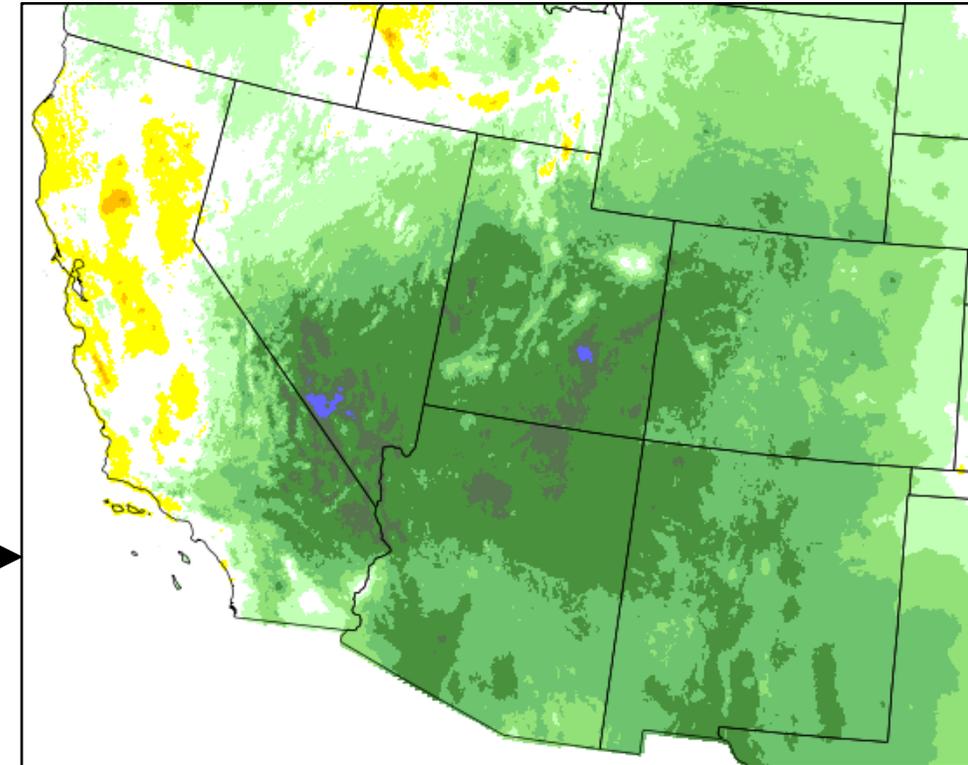


Dewpoint Temperature Anomaly: Jul 2020 - Sep 2020

Period ending 7 AM EST 30 Sep 2020

Base period: 1981-2010

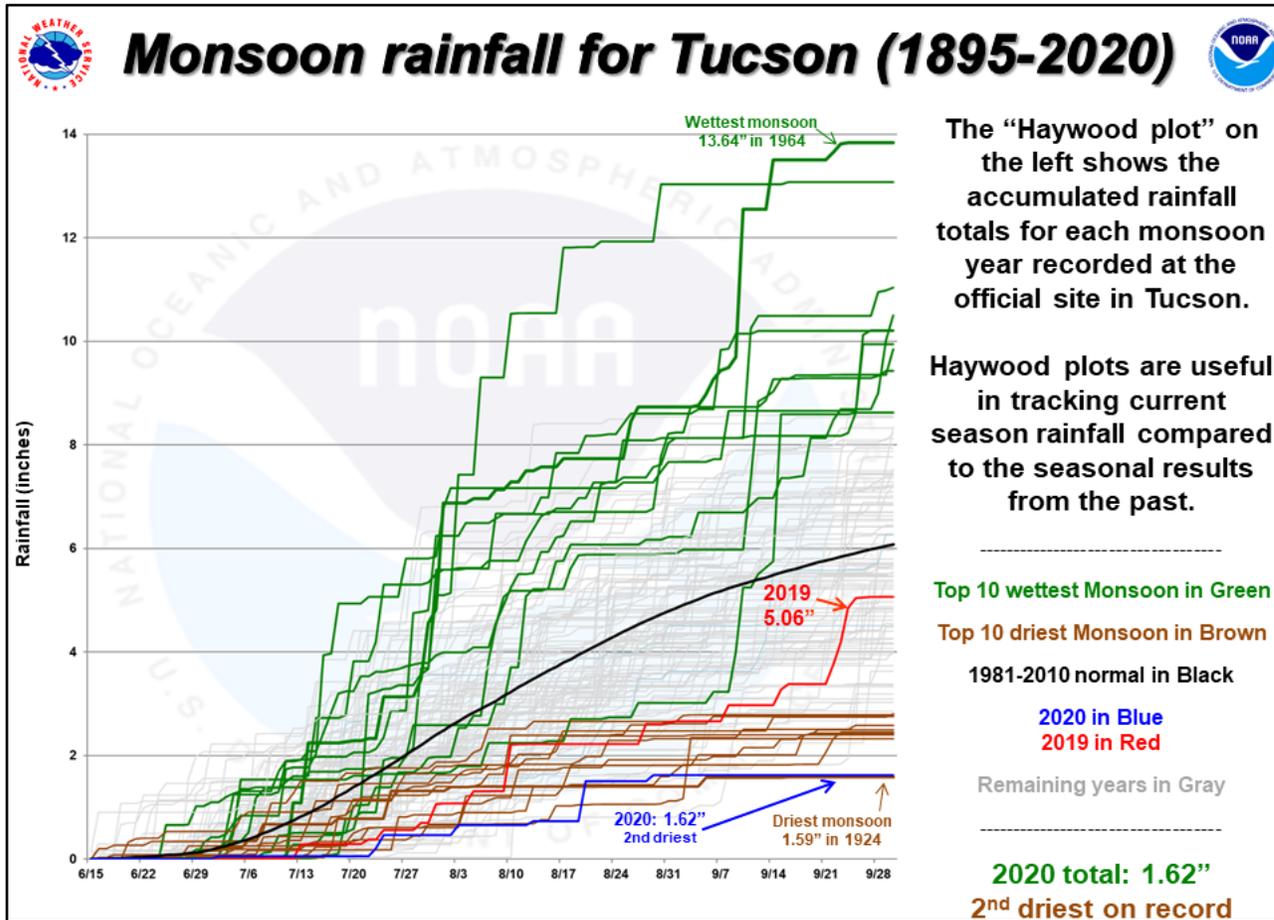
(Map created 02 Oct 2020)



Source: PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu/>

- Observed daily mean temperature during the July–September period was significantly above normal (+3–5°F anomaly) across much of the southwestern US, with daily mean temperature anomalies exceeding +5°F in some locations
- The lack of monsoon activity is highlighted by widespread large negative dewpoint anomalies (roughly 5–10°F below normal)

2020 North American Monsoon Recap

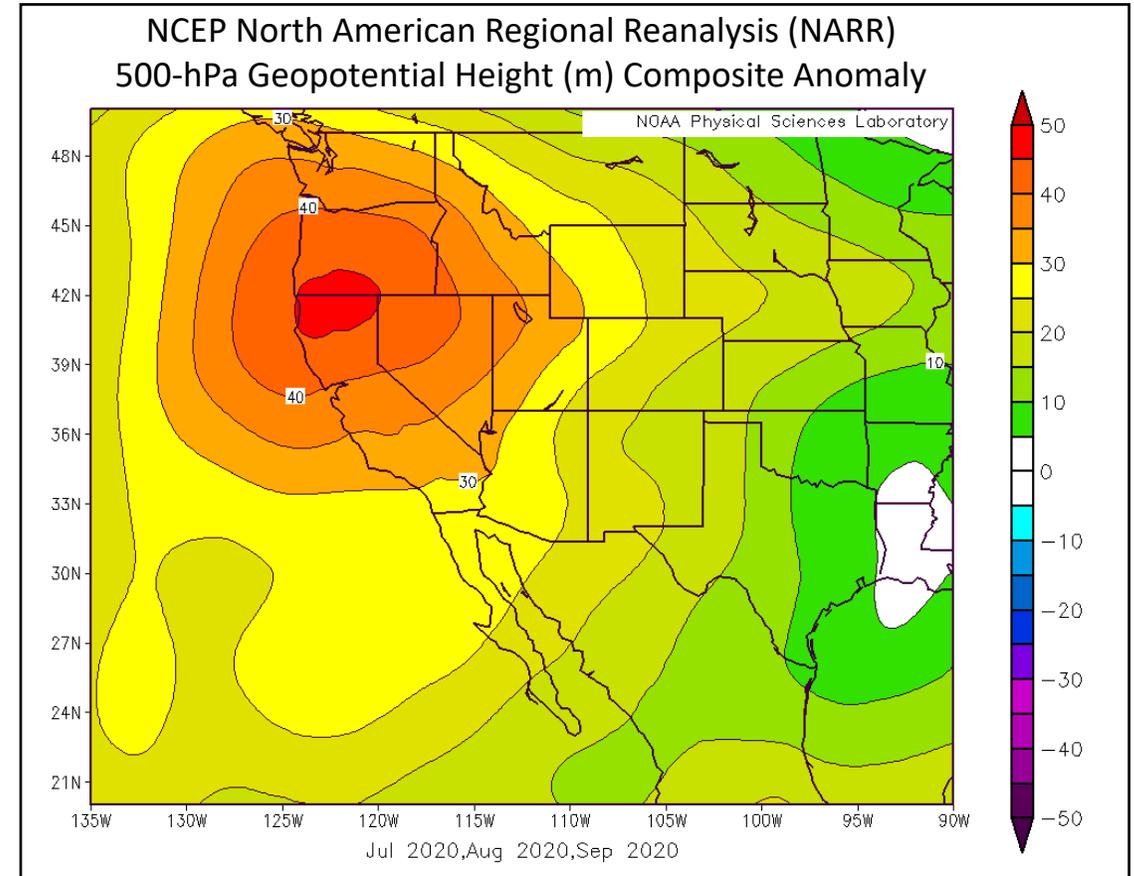
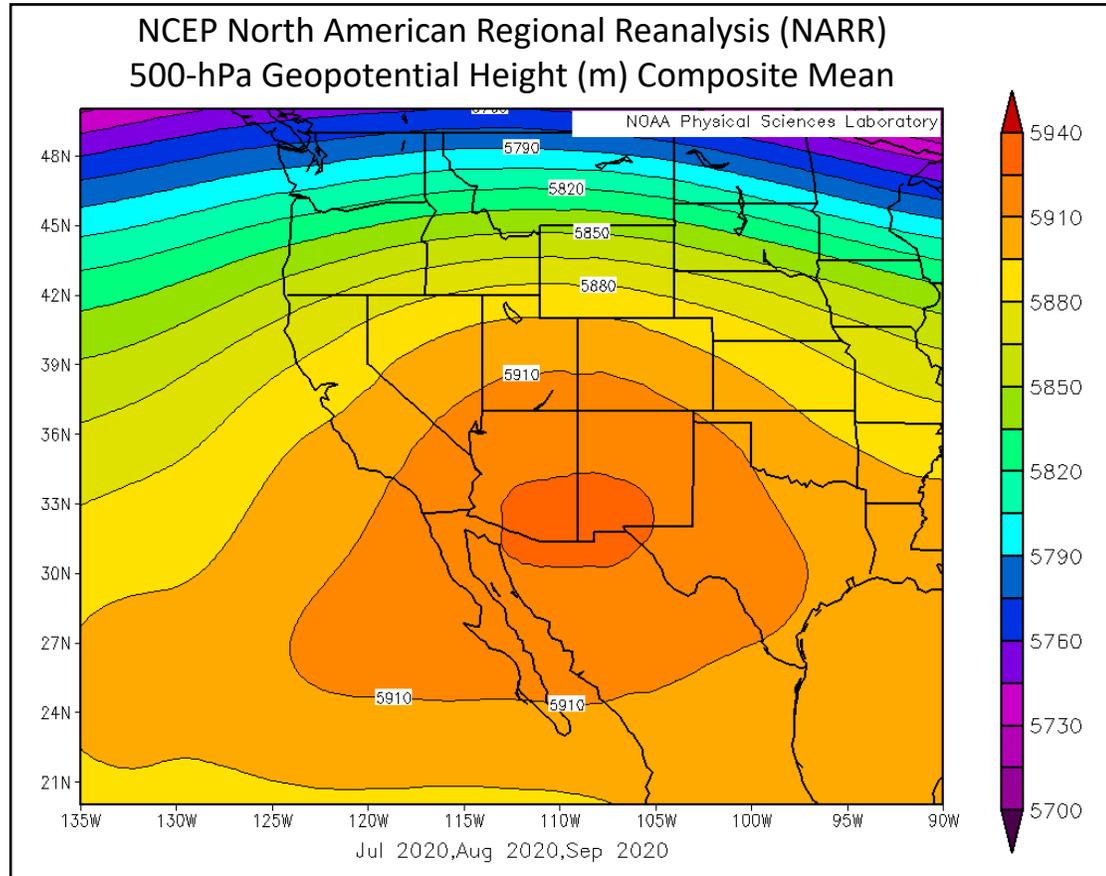


| Location | 2020 Monsoon Rainfall (in) | Normal Monsoon Rainfall (in) |
|-----------------|----------------------------|------------------------------|
| Flagstaff, AZ | 1.78 | 8.31 |
| Kingman, AZ | 0.25 | 2.82 |
| Phoenix, AZ | 1.00 | 2.71 |
| Tucson, AZ | 1.62 | 6.08 |
| Yuma, AZ | 0.00 | 1.29 |
| Las Vegas, NV | Trace | 1.01 |
| Albuquerque, NM | 2.62 | 4.61 |
| El Paso, TX | 2.11 | 5.14 |

Source: NWS Tucson, <https://www.weather.gov/twc/>

- Tucson, AZ, recorded its second driest monsoon season (defined as 15 June–30 September) since 1895, with only 1.62 inches of rainfall
- For comparison, the normal (1981–2010) monsoon rainfall is 6.08 inches, and last year’s monsoon rainfall was 5.06 inches
- Flagstaff, AZ (1.78 inches), Yuma, AZ (0.00 inches), and Las Vegas, NV (Trace), recorded their driest monsoon seasons
- Kingman, AZ (0.25 inches), and El Paso, TX (2.11 inches), recorded their 3rd and 9th driest monsoon seasons, respectively

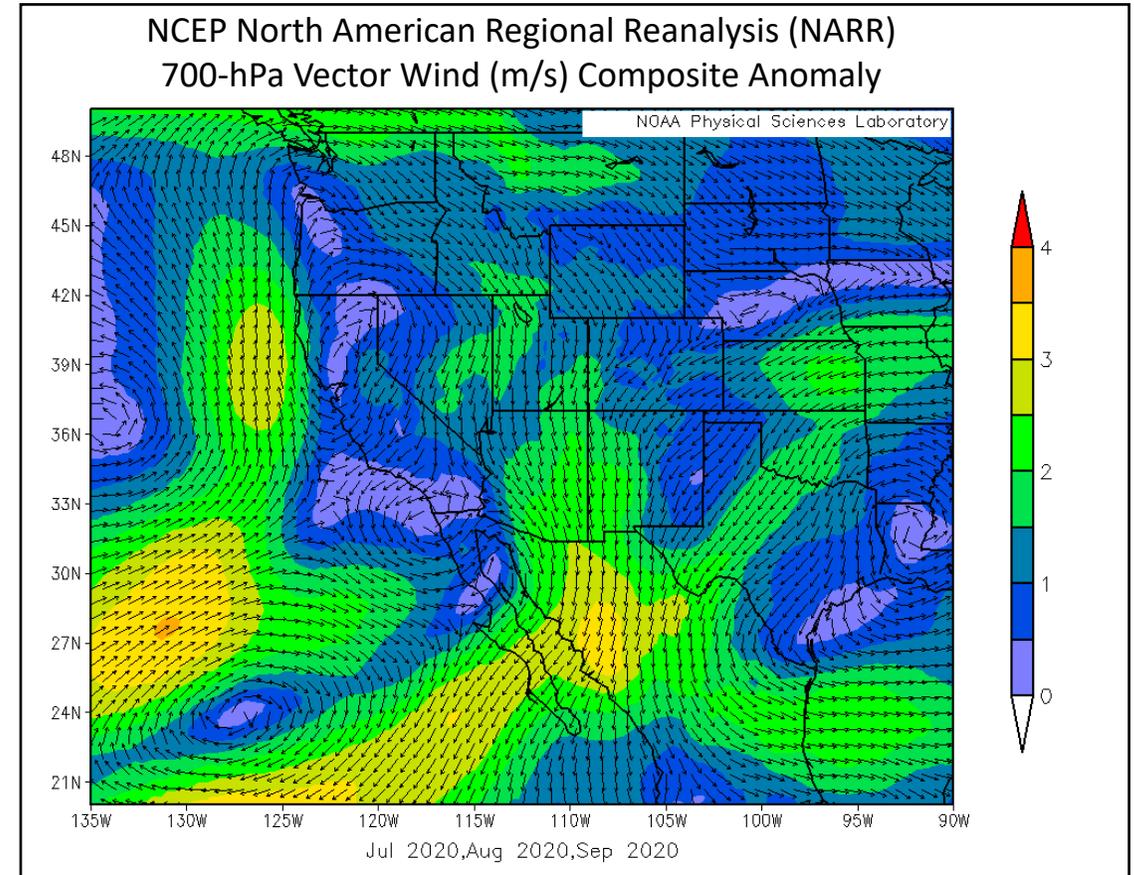
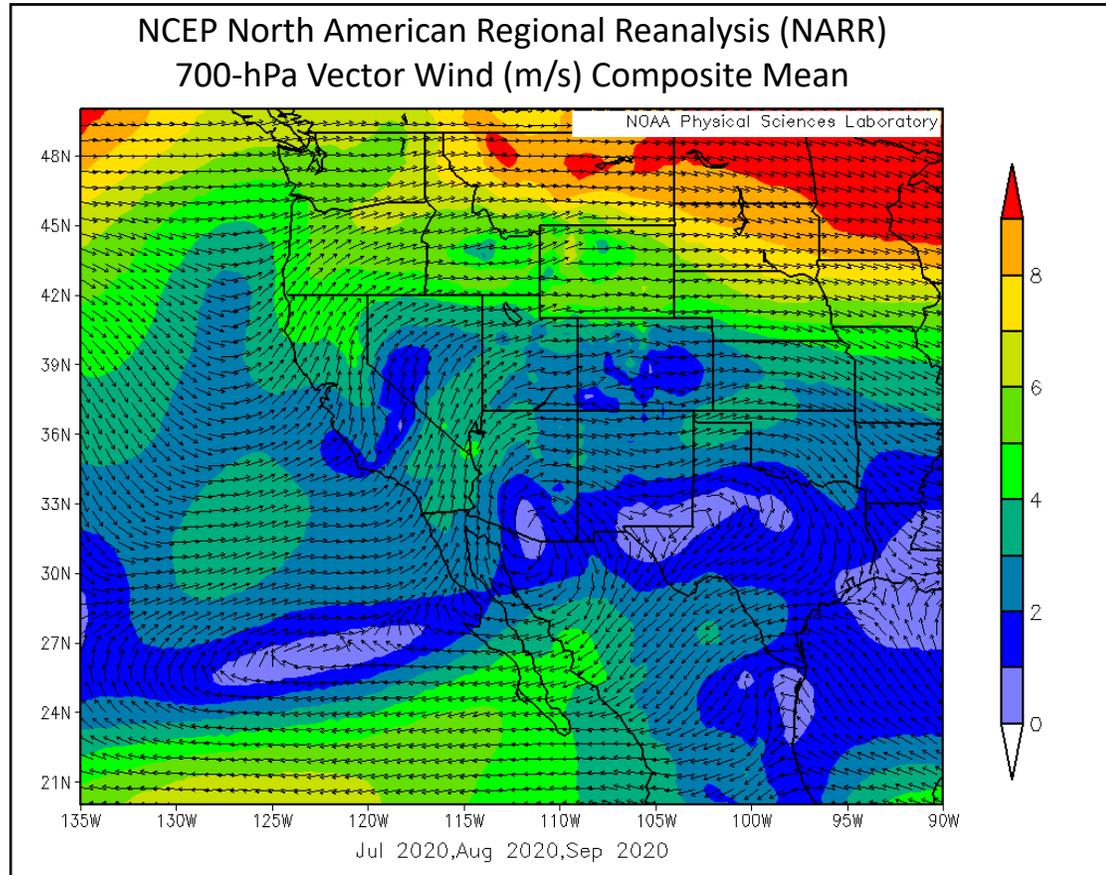
2020 North American Monsoon Recap



Source: NOAA Physical Sciences Laboratory, <https://psl.noaa.gov/>

- The lack of monsoon activity was due to persistent synoptic-scale circulation patterns that enhanced subsidence (sinking motion that promotes evaporation) and suppressed moisture transport over the southwestern US
- NARR July–September mean 500-hPa geopotential height field shows a broad ridge centered over the Arizona–New Mexico border, with positive geopotential height anomalies throughout the western US (maximized over the California–Oregon border)

2020 North American Monsoon Recap



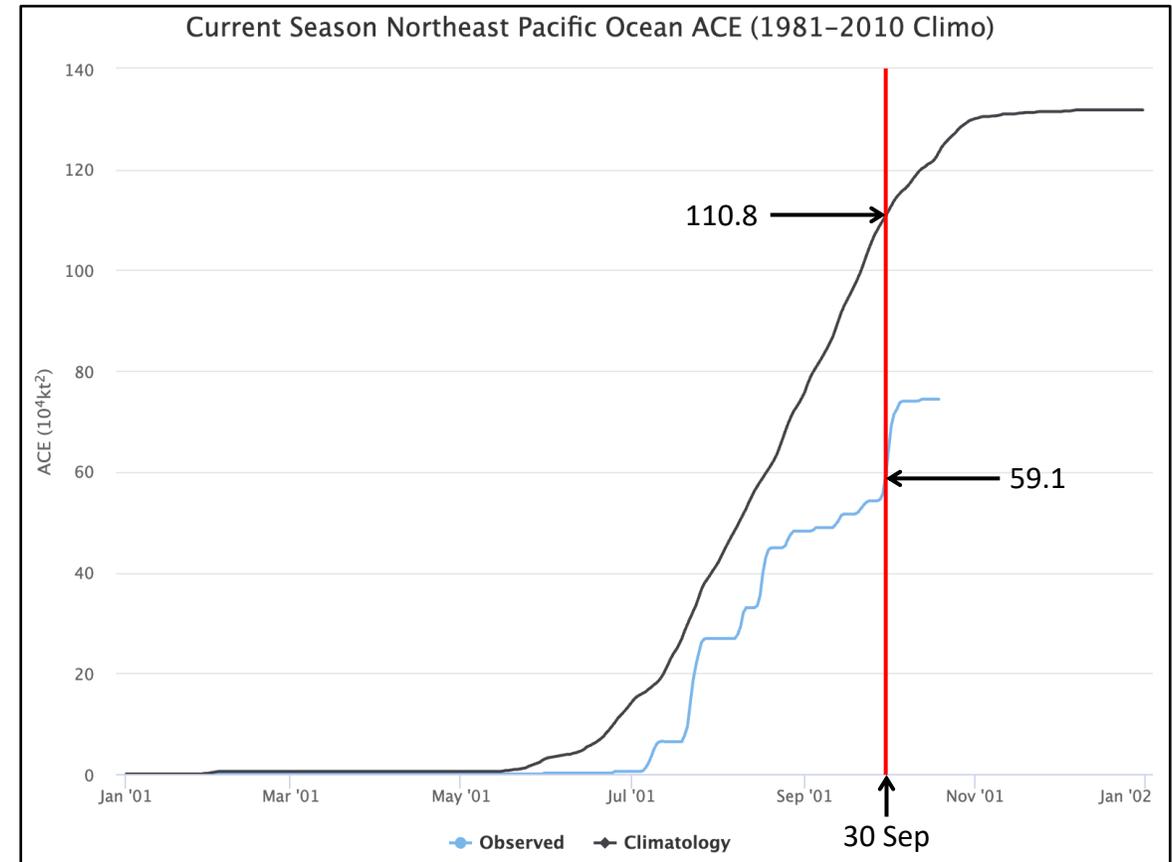
Source: NOAA Physical Sciences Laboratory, <https://psl.noaa.gov/>

- NARR July–September mean 700-hPa vector wind field shows a region of anticyclonic flow centered over south-central Arizona, as well as a zonally elongated region of anticyclonic flow west of the Baja Peninsula
- This pattern produced northerly-to-northwesterly wind anomalies across Arizona, New Mexico, and northwestern Mexico, which limited the low-to-midlevel poleward moisture transport that typically occurs over the Gulf of California during the monsoon season

2020 North American Monsoon Recap

2020 Tropical Cyclone Activity Through 21 October

| Basin | Named Storms | Named Storm Days | Hurricanes | Hurricane Days | Major Hurricanes | Major Hurricane Days | Accumulated Cyclone Energy |
|---|--------------|------------------|------------|----------------|------------------|----------------------|----------------------------|
| North Atlantic | 26 (10.6) | 89.25 (51.9) | 10 (5.5) | 23.75 (21.5) | 4 (2.5) | 6.00 (5.7) | 127.1 (93.7) |
| Northeast Pacific (East of 180°) | 14 (15.7) | 48.50 (68.8) | 4 (8.4) | 14.25 (28.4) | 3 (4.2) | 5.00 (8.6) | 74.4 (125.1) |
| Northwest Pacific (West of 180°) | 18 (21.7) | 53.00 (108.9) | 8 (13.6) | 18.25 (52.5) | 3 (6.8) | 5.25 (17.5) | 88.2 (232.0) |
| North Indian | 2 (2.7) | 5.75 (7.1) | 2 (0.7) | 4.00 (1.5) | 1 (0.4) | 2.25 (0.6) | 19.2 (9.4) |
| Northern Hemisphere | 60 (50.7) | 196.50 (236.7) | 24 (28.2) | 60.25 (103.9) | 11 (13.9) | 18.50 (32.4) | 308.9 (460.2) |
| South Indian (West of 135°E) | 0 (0.8) | 0.00 (1.9) | 0 (0.1) | 0.00 (0.1) | 0 (0.0) | 0.00 (0.0) | 0 (1.3) |
| South Pacific (East of 135°E) | 0 (0.0) | 0.00 (0.1) | 0 (0.0) | 0.00 (0.0) | 0 (0.0) | 0.00 (0.0) | 0 (0.1) |
| Southern Hemisphere | 0 (0.8) | 0.00 (2.0) | 0 (0.1) | 0.00 (0.1) | 0 (0.0) | 0.00 (0.0) | 0 (1.4) |

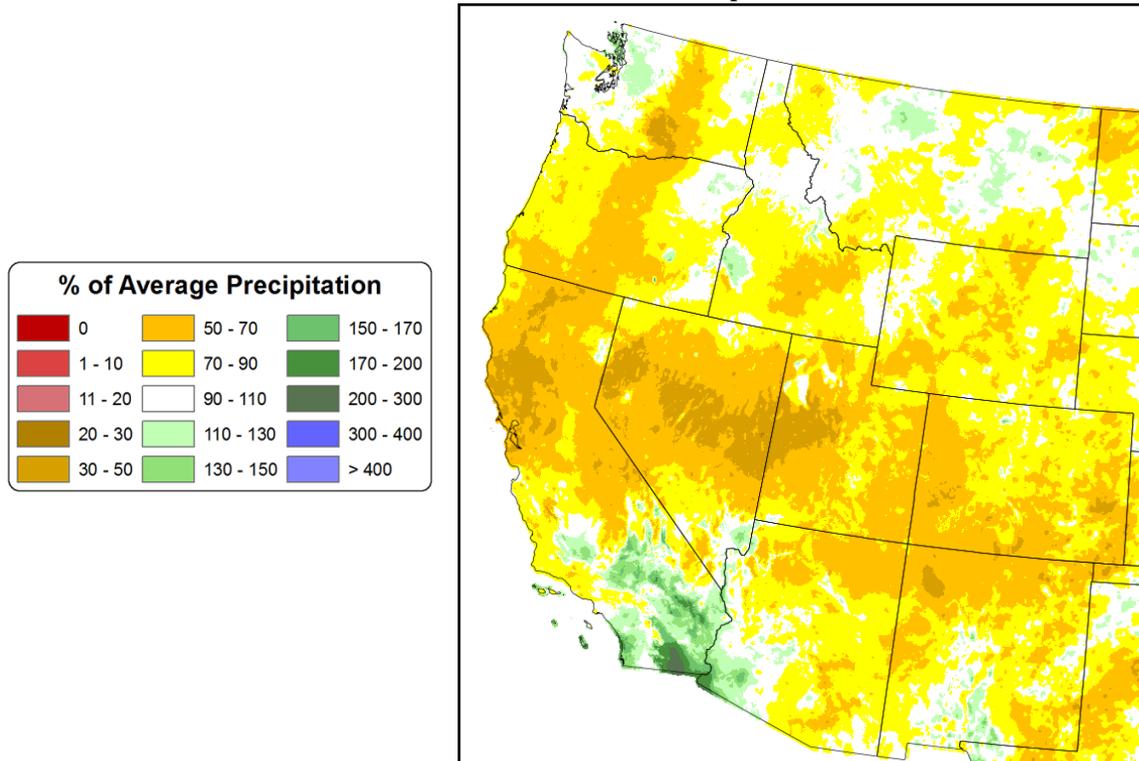


Source: Colorado State University, <https://tropical.colostate.edu/>

- Tropical cyclones can provide an important source of moisture during active NAM monsoon periods
- The 2020 tropical cyclone season has been characterized by below-normal tropical cyclone activity over the Northeast Pacific Ocean, with accumulated cyclone energy (ACE) nearly 50% below normal as of 30 September
- While the number of named storms (14) as of 21 Oct is near the 1981–2010 climate normal (15.7), there have been significantly fewer hurricane days (14.25) than normal (28.4), and only 4 tropical cyclones have reached hurricane strength (normal is 8.4)

2020 North American Monsoon Recap

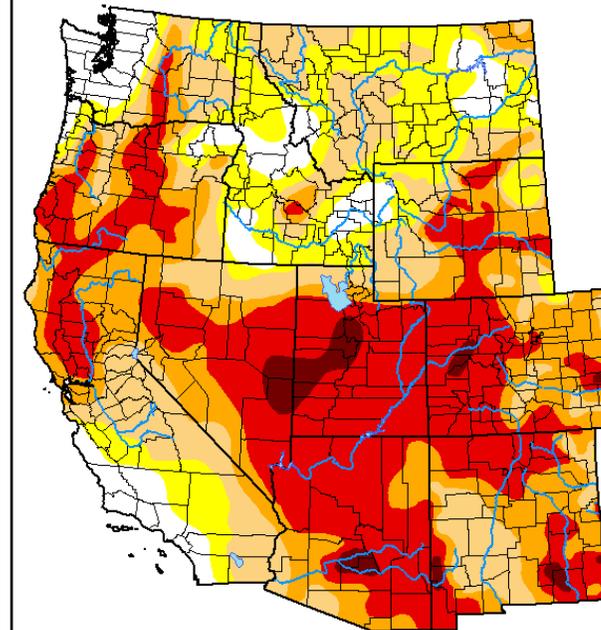
Total Precipitation Anomaly: Oct 2019 - Sep 2020
Period ending 7 AM EST 30 Sep 2020
Base period: 1981-2010



Source: PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu/>

U.S. Drought Monitor West

September 29, 2020
(Released Thursday, Oct. 1, 2020)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|-------|-------|-------|-------|-------|------|
| Current | 8.51 | 91.49 | 78.07 | 54.55 | 33.11 | 2.31 |
| Last Week 09-22-2020 | 7.72 | 92.28 | 73.37 | 52.86 | 29.21 | 1.29 |
| 3 Months Ago 06-30-2020 | 35.15 | 64.85 | 45.24 | 22.93 | 5.00 | 0.12 |
| Start of Calendar Year 12-31-2019 | 59.17 | 40.83 | 18.17 | 7.12 | 0.00 | 0.00 |
| Start of Water Year 10-01-2019 | 68.40 | 31.60 | 16.32 | 3.16 | 0.00 | 0.00 |
| One Year Ago 10-01-2019 | 68.40 | 31.60 | 16.32 | 3.16 | 0.00 | 0.00 |

Intensity:

| | |
|---------------------|------------------------|
| None | D2 Severe Drought |
| D0 Abnormally Dry | D3 Extreme Drought |
| D1 Moderate Drought | D4 Exceptional Drought |

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Brad Rippey
U.S. Department of Agriculture



droughtmonitor.unl.edu

Source: National Drought Mitigation Center, UNL, <https://droughtmonitor.unl.edu>

- The 2020 monsoon season put an exclamation mark on an anomalously dry water year across much of the western US
- Portions of interior Washington and Oregon, Northern California, the Great Basin, and the Four Corners Region received less than 70% of normal water year (October–September) precipitation, with some areas receiving less than 50% of normal precipitation
- Between 30 June and 29 September, the percentage of the western US (by area) experiencing severe (D2), extreme (D3), or exceptional (D4) drought conditions increased from 23% to 55%