

Arizona and the Summer Monsoon

Mike Crimmins
Professor & Extension Specialist
Dept. of Environmental Science
& Arizona Cooperative Extension
The University of Arizona

James "Bo" Insogna
Striking Photography MrBo.com

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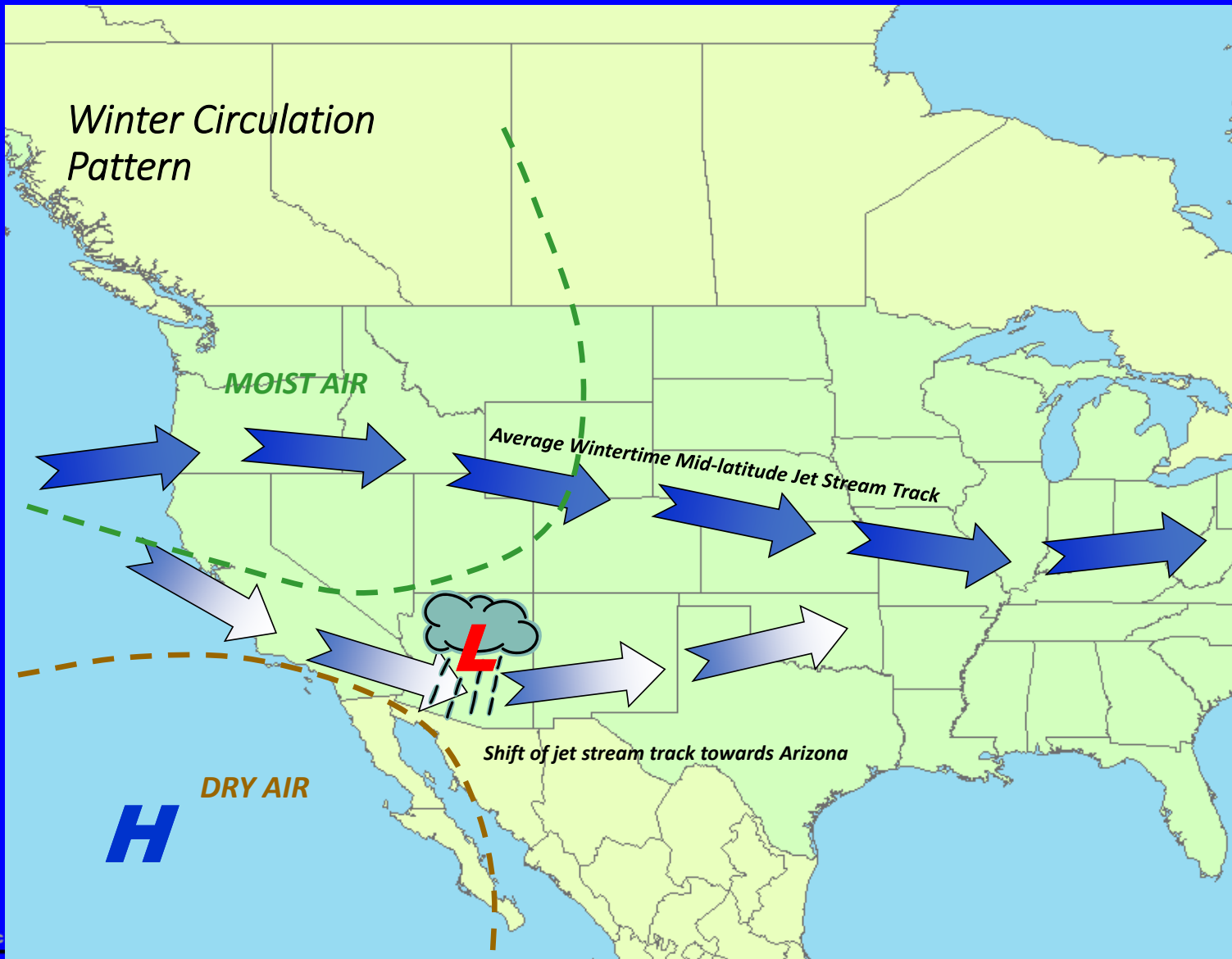
Winter vs Summer Weather Patterns



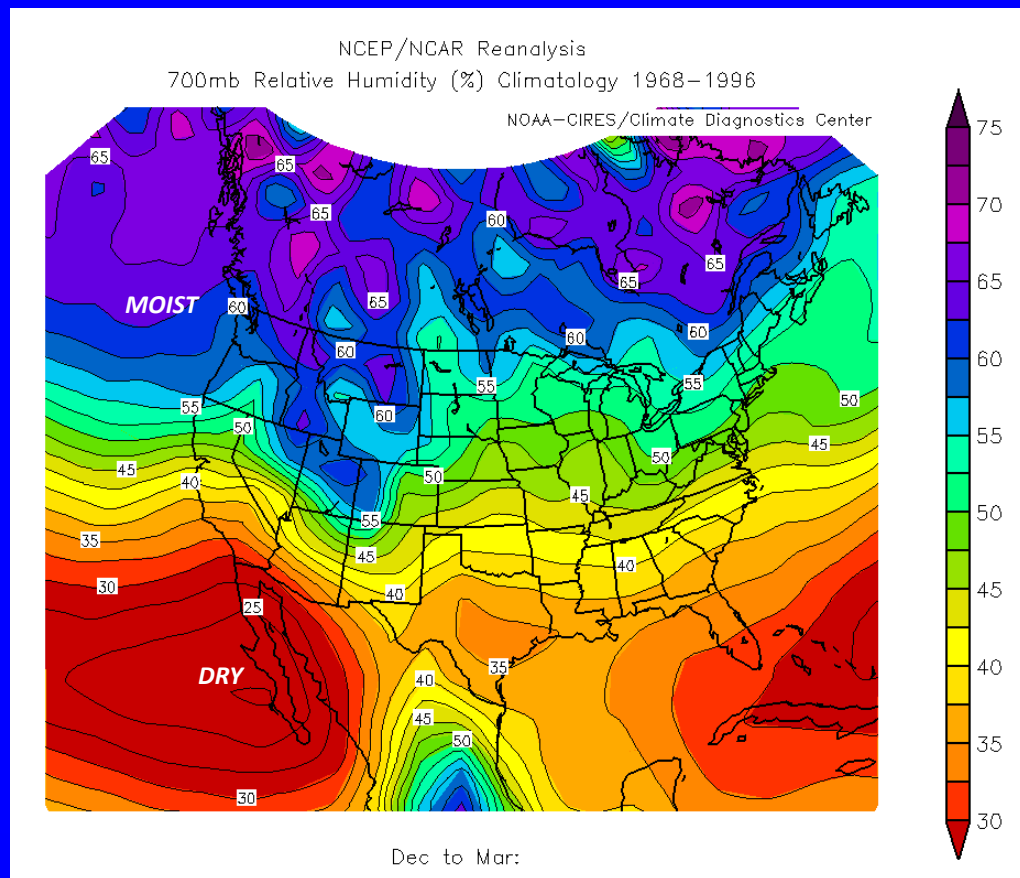
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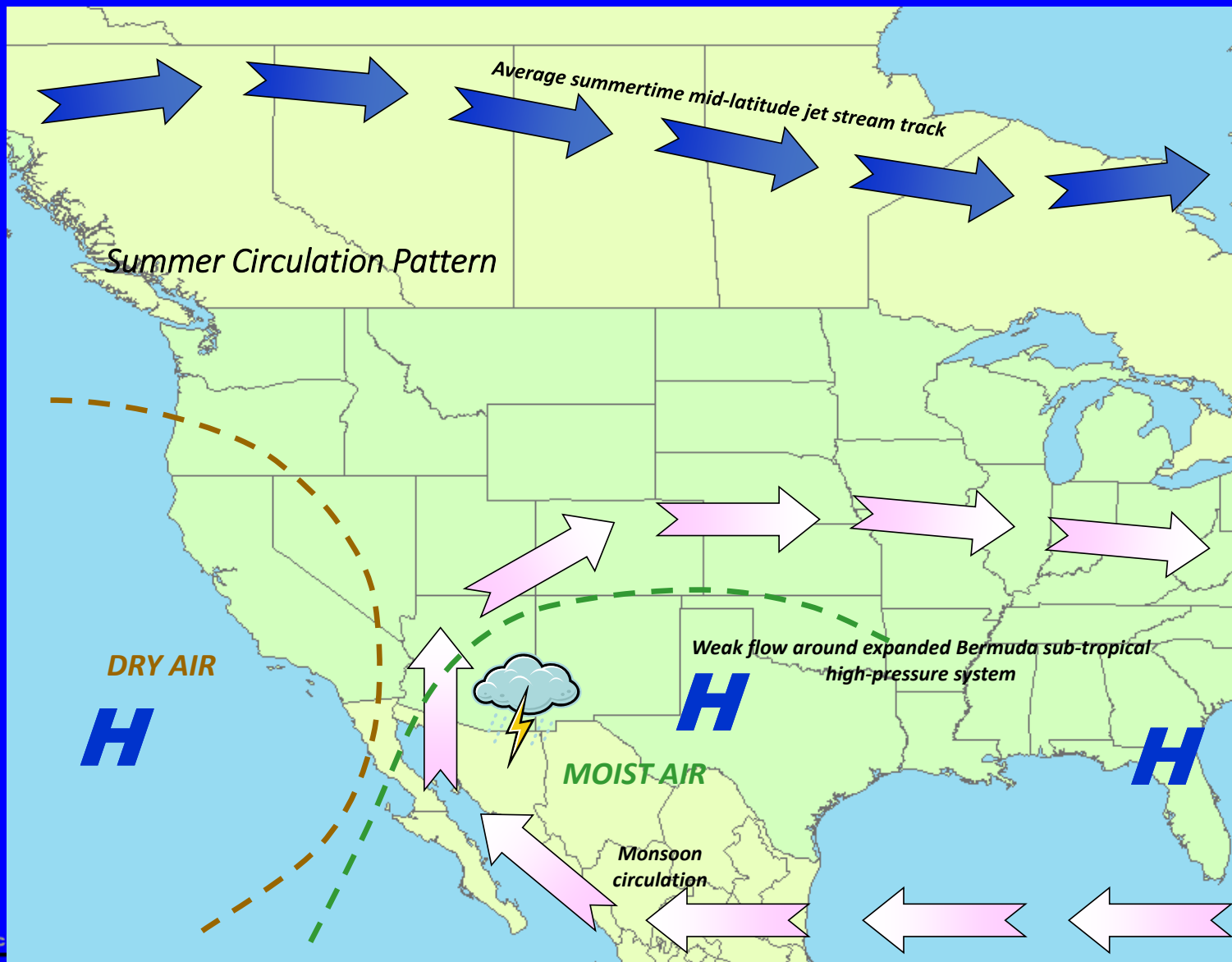


Winter Circulation Pattern

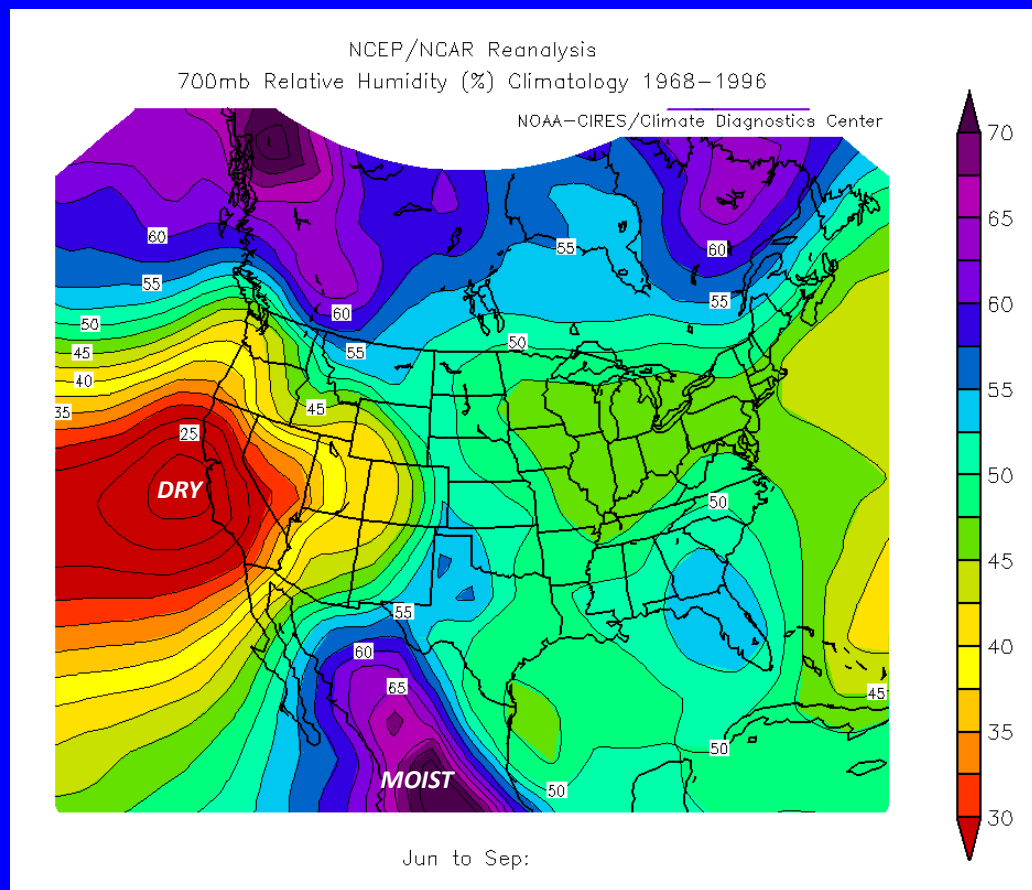


Atmospheric Moisture: Winter





Atmospheric Moisture: Summer



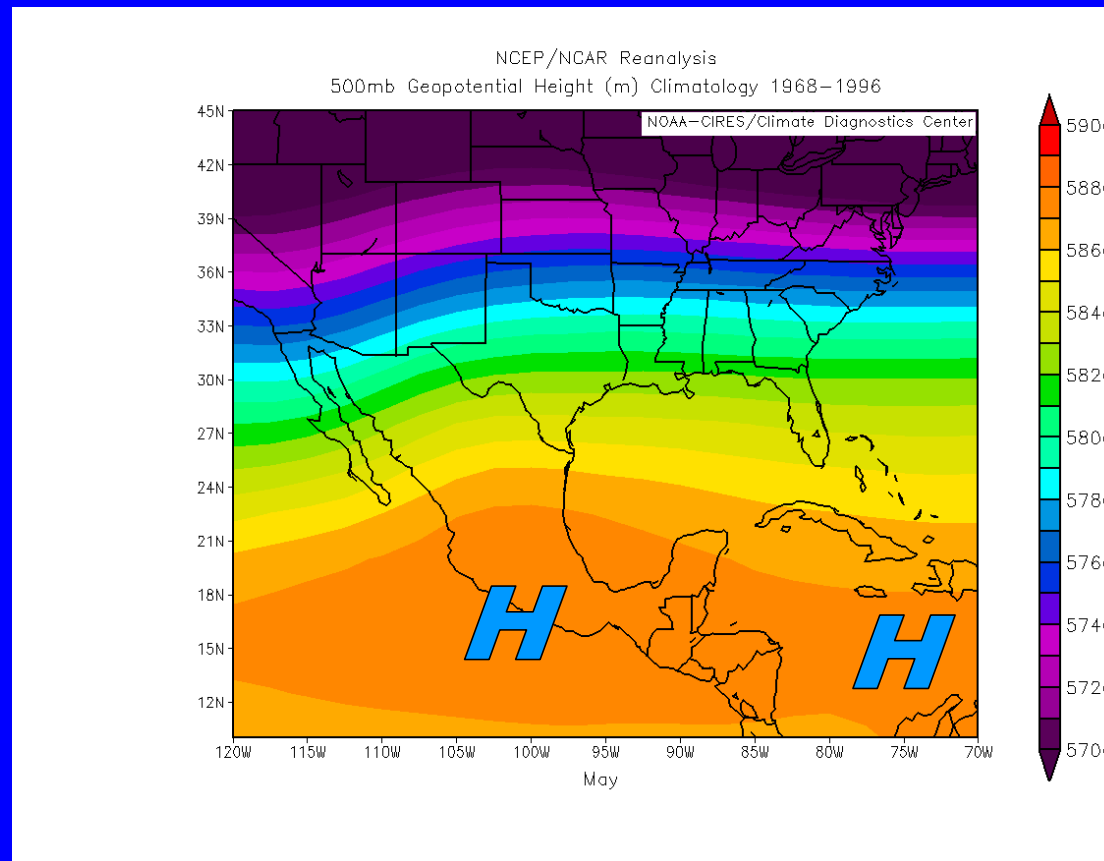
North American Monsoon System



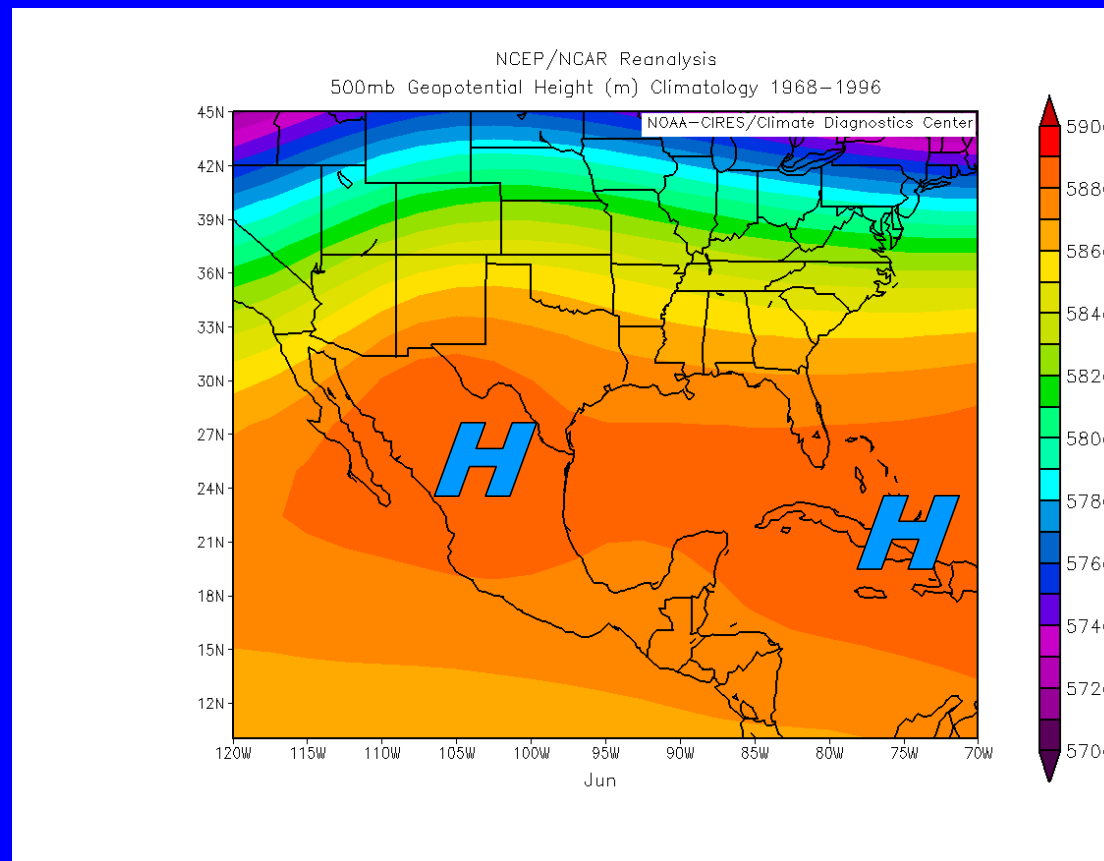
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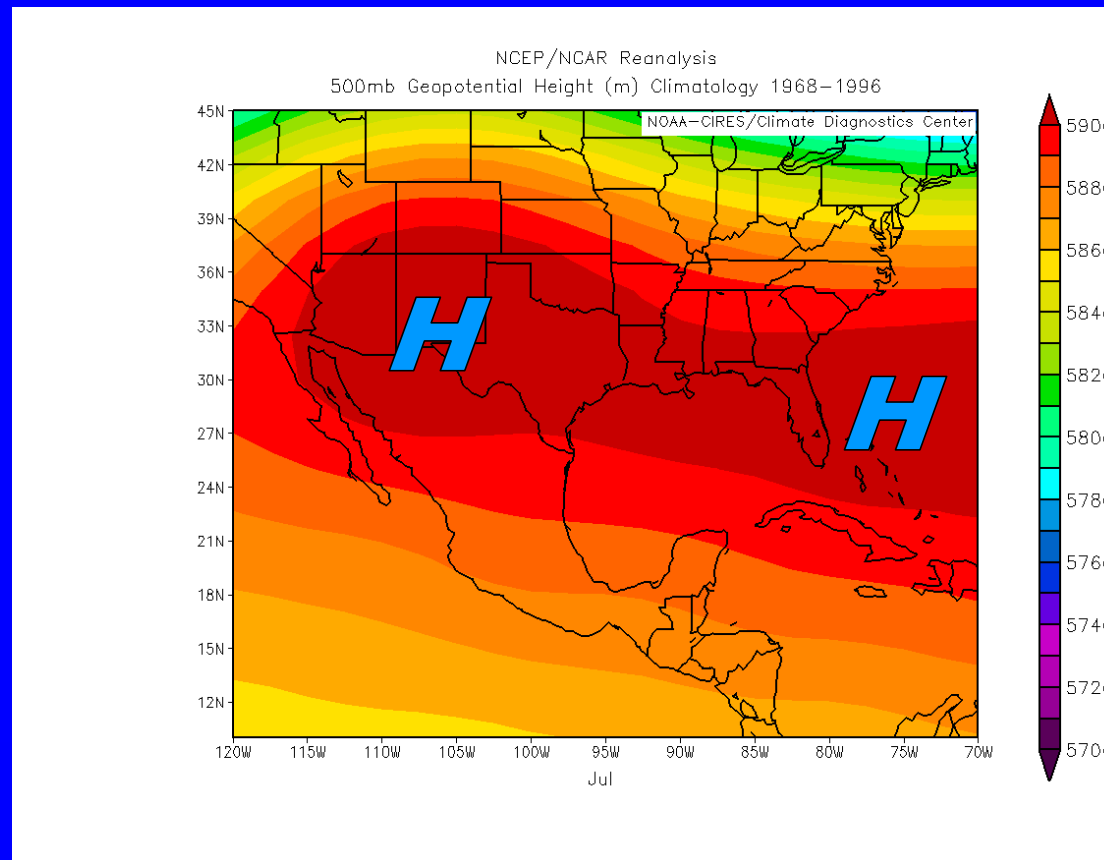
Upper Level Flow - May



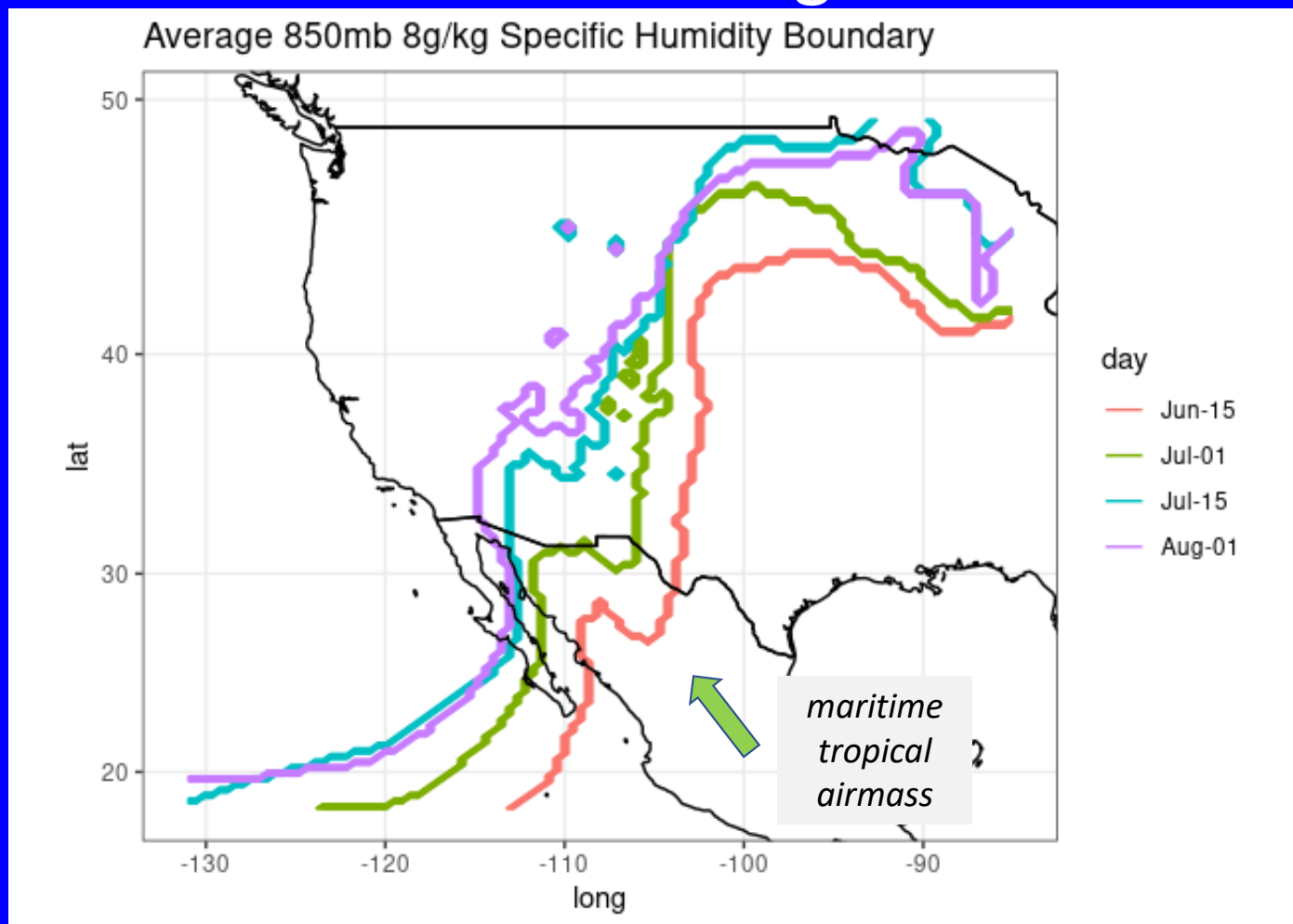
Upper Level Flow - June



Upper Level Flow - July



Monsoon season air mass change

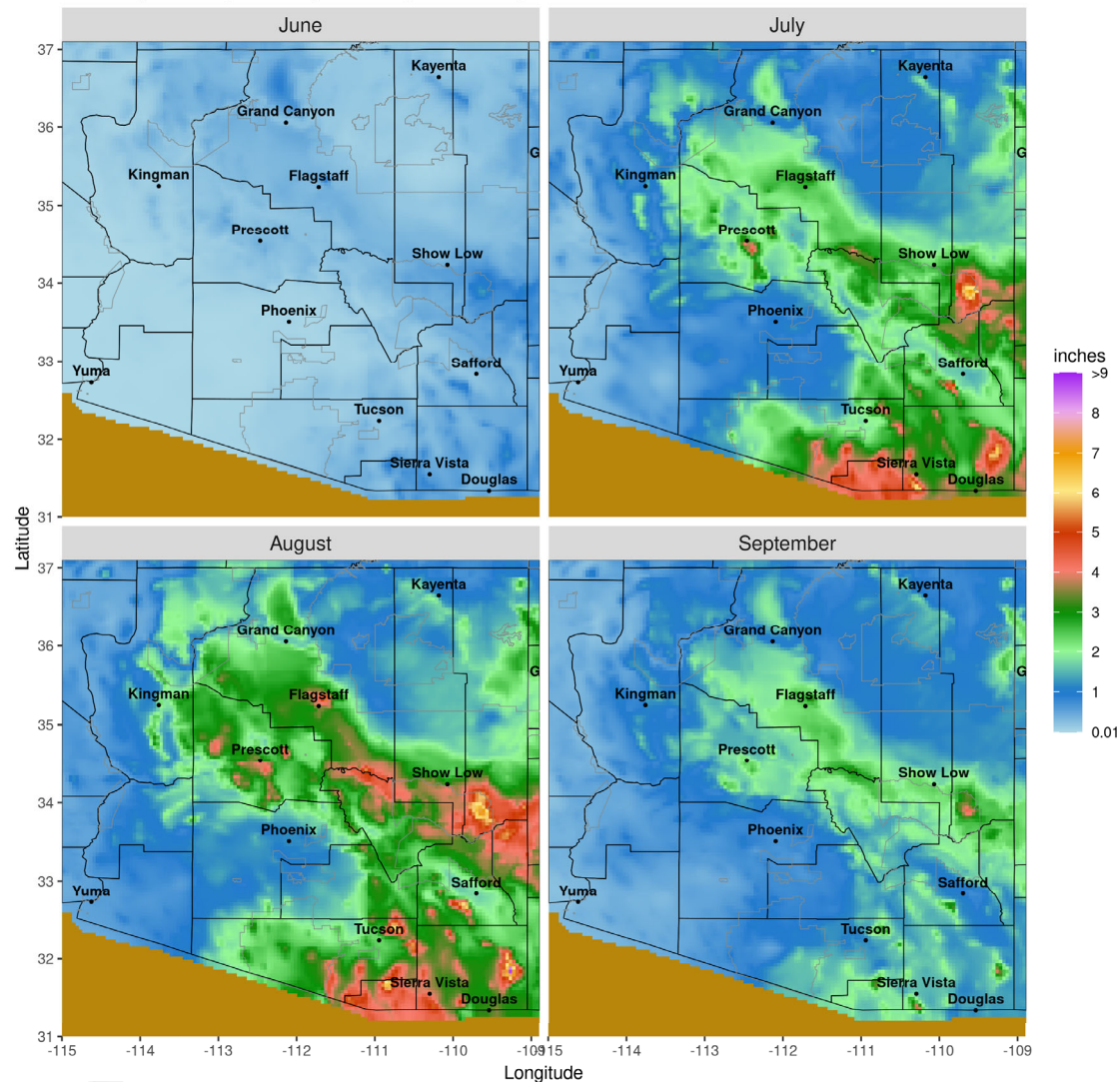




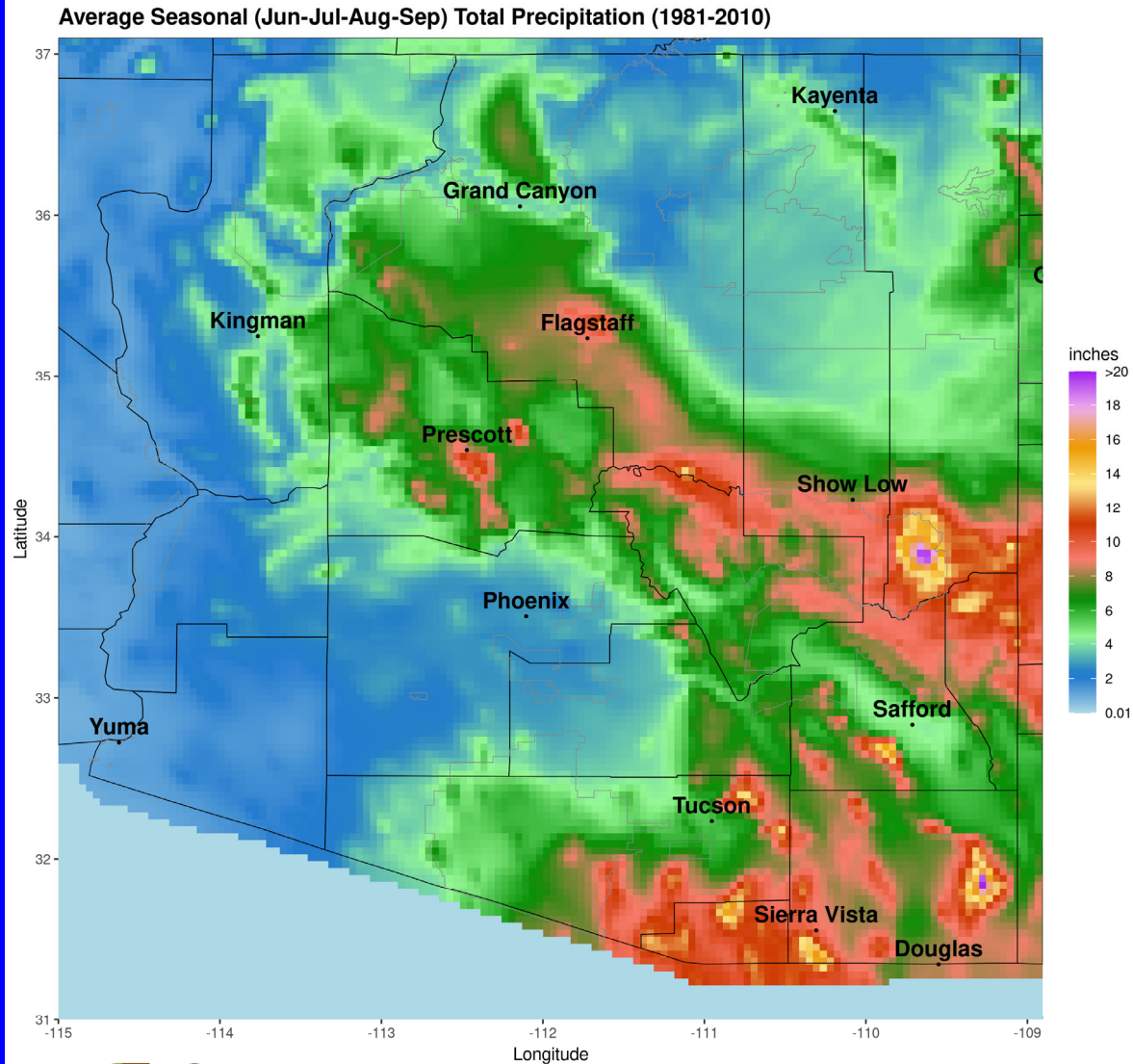
Conceptual diagram of key circulation features of the North American Monsoon System

Monthly average precipitation: June - Sept

Monthly Average Precipitation (1981-2010)



Total average precipitation: June - Sept



Plot created: 2020-05-19
The University of Arizona
<https://cals.arizona.edu/climate/>
Data Source: PRISM Climate Group

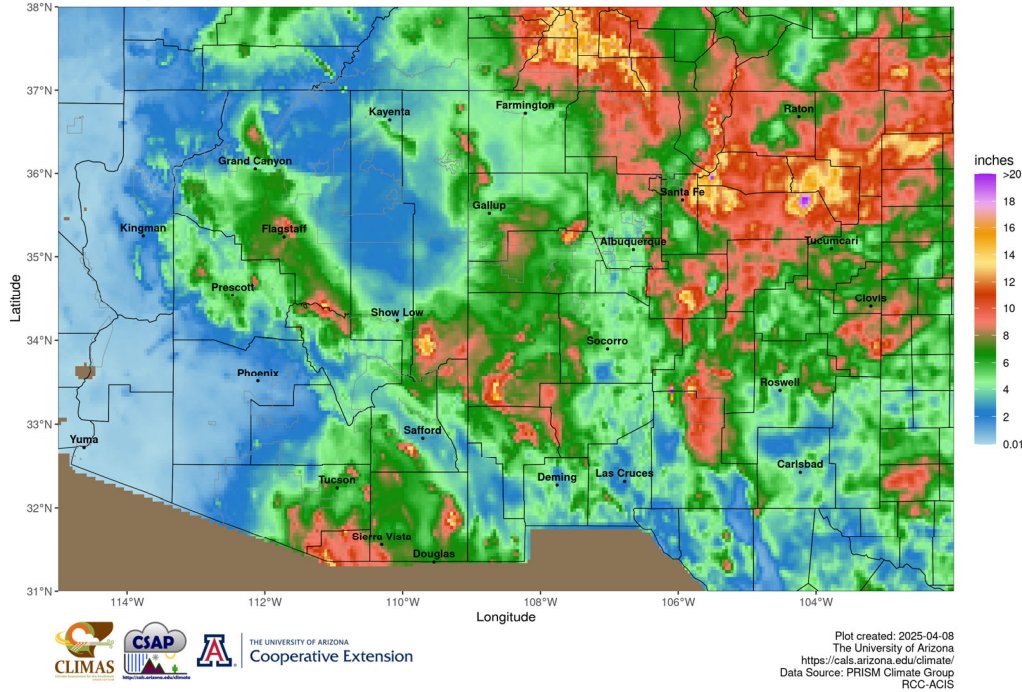
What happened in 2024?



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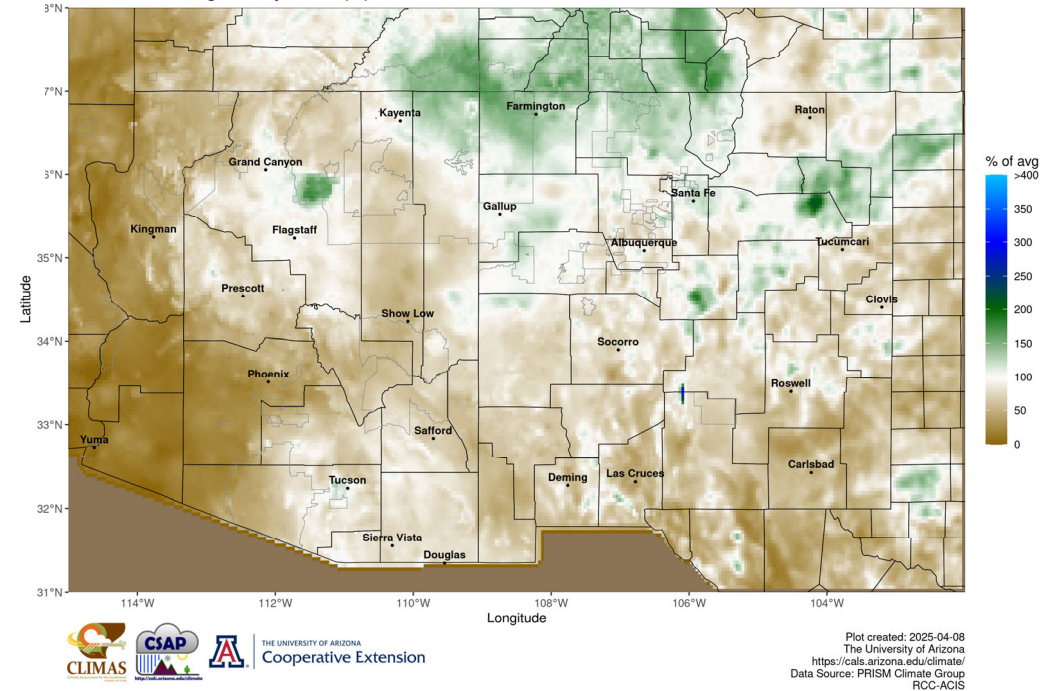


Total Precipitation (in.): 2024-06-15 to 2024-09-30



2024 Monsoon Precipitation (6/15-9/30)

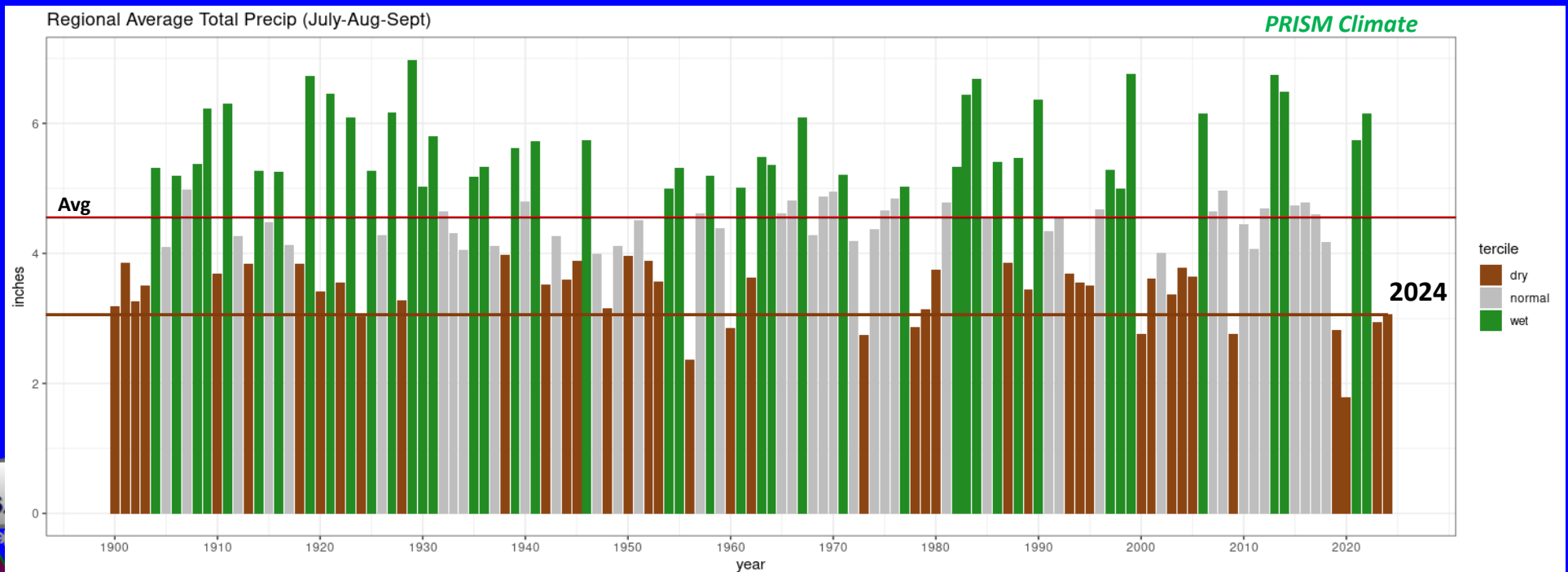
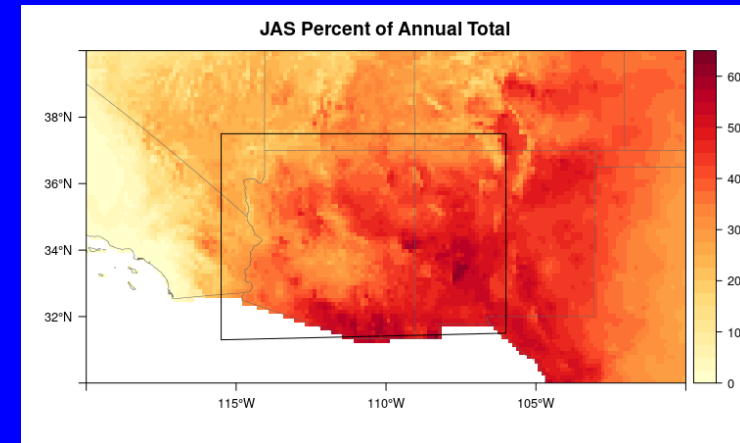
Percent of Average Precipitation (%): 2024-06-15 to 2024-09-30



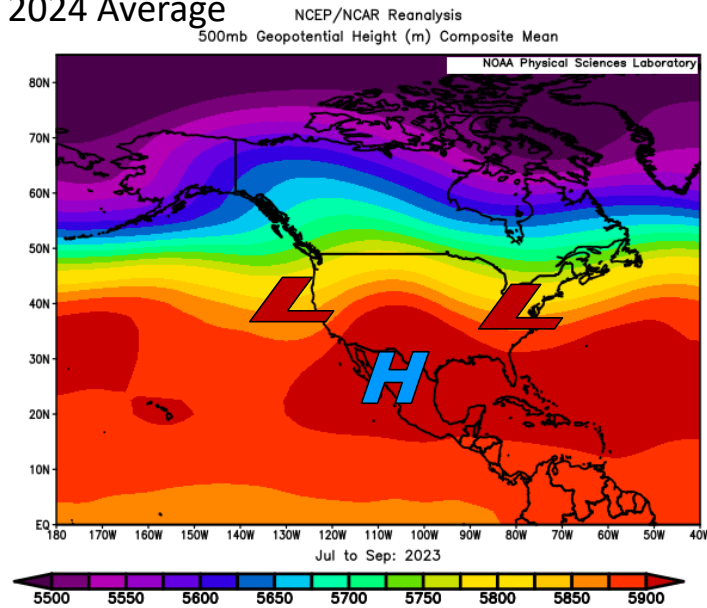
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Regional Precipitation 1900-2024

| Rank - driest | Year | Avg Precip (in) |
|---------------|------|-----------------|
| 1 | 2020 | 1.79 |
| 2 | 1956 | 2.36 |
| 3 | 1973 | 2.73 |
| 4 | 2009 | 2.75 |
| 5 | 2000 | 2.76 |
| 10 | 2024 | 3.05 |



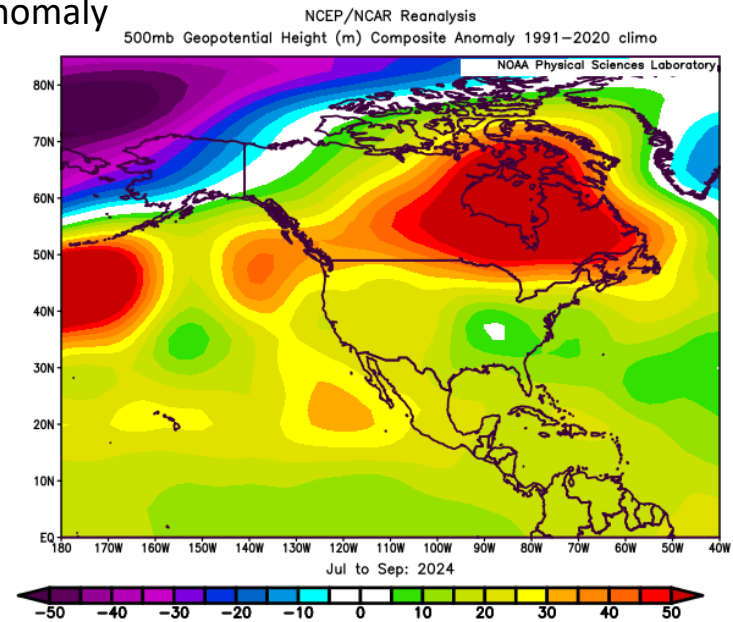
2024 Average



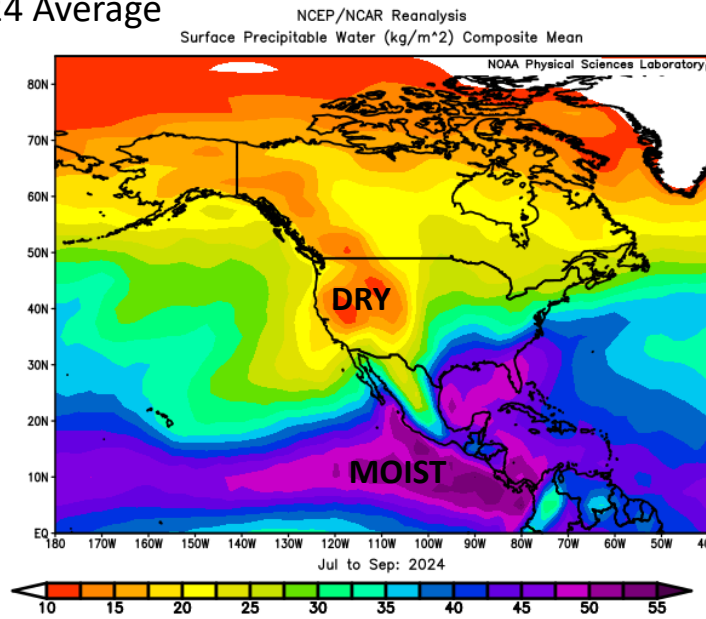
Upper level wind pattern

500mb GH: July -Sep

Anomaly

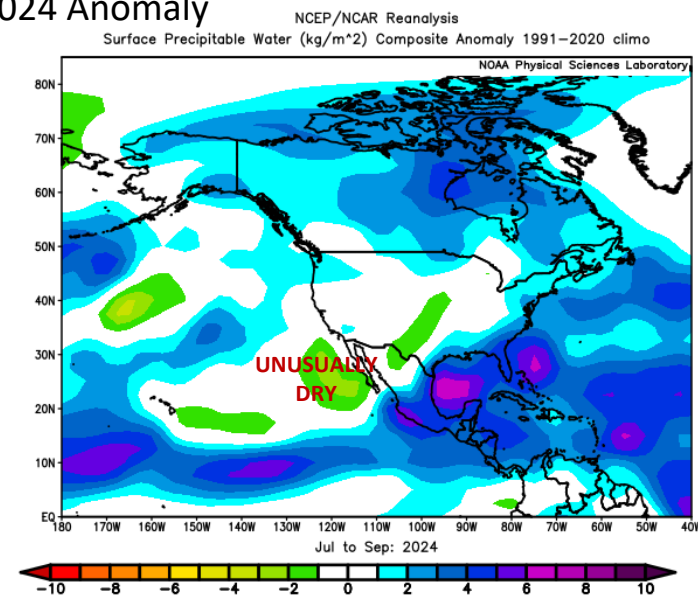


2024 Average



Precipitable Water: July 1-Sept 30th

2024 Anomaly



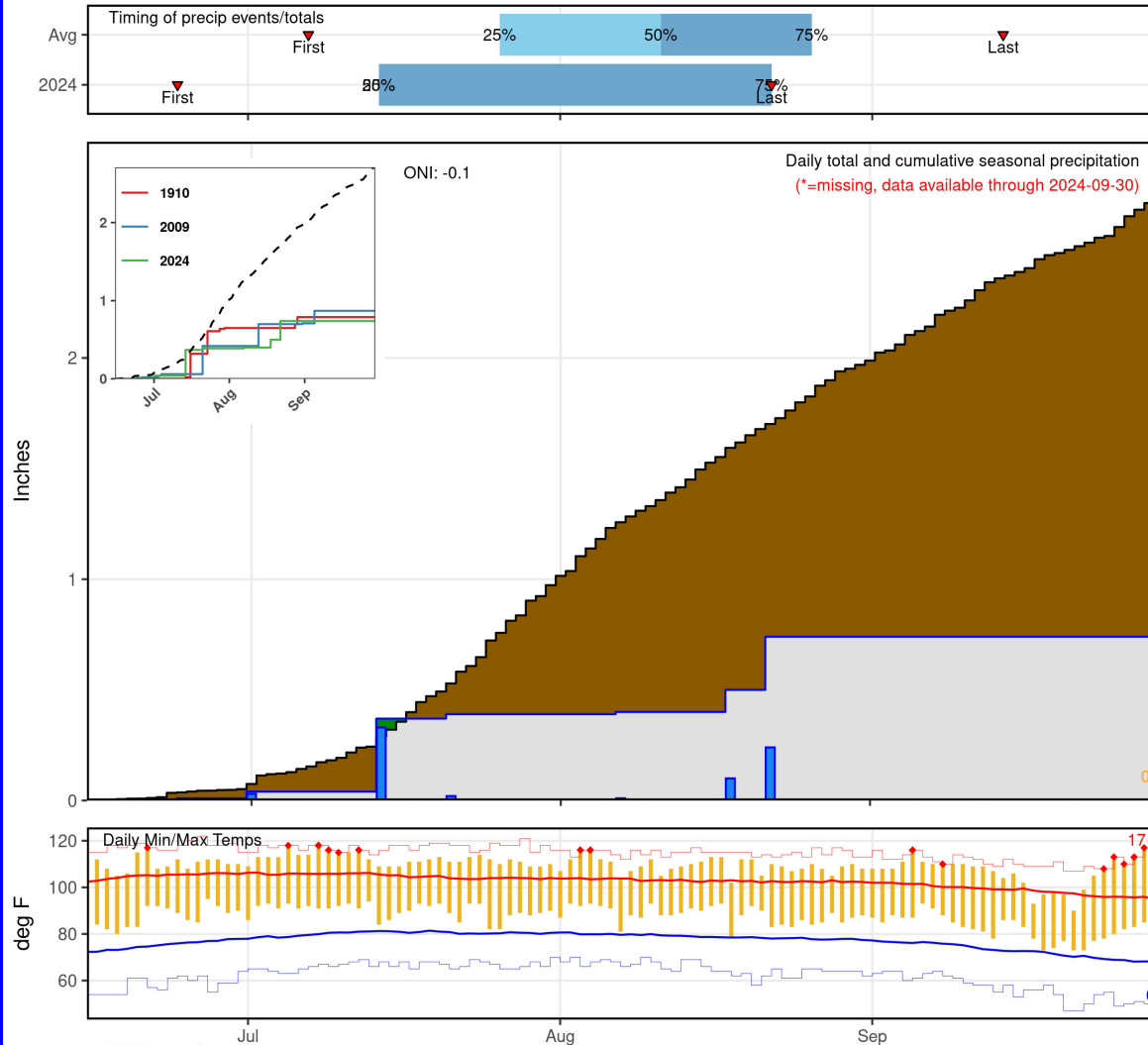
Atmospheric Moisture

CSAP

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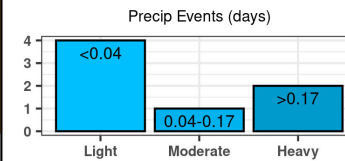
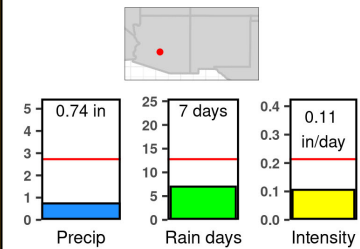
LIMAS
Assessment for the Southwest
A NOAA CAPWIS TEAM

Station Climate Summary: 06-15-2024 to 09-30-2024 (Monsoon Season)



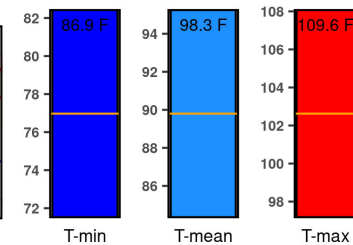
Phoenix Area

Elevation (ft):
Period of record: 1896-2024
Years in record: 129
Precip rank: 122.5 (1-wettest)
Temp rank: 1 (1-warmest)
Missing in 2024: 0
Total snow (in): 0 (NaN % avg)



Dry Spells

Avg length: 7 days (avg: 7)
Max length: 39 days (avg: 30)



Data from <http://www.rcc-acis.org/>
Plot created: 12-31-2024
The University of Arizona
<https://cais.arizona.edu/climate/>



THE UNIVERSITY OF ARIZONA
Cooperative Extension

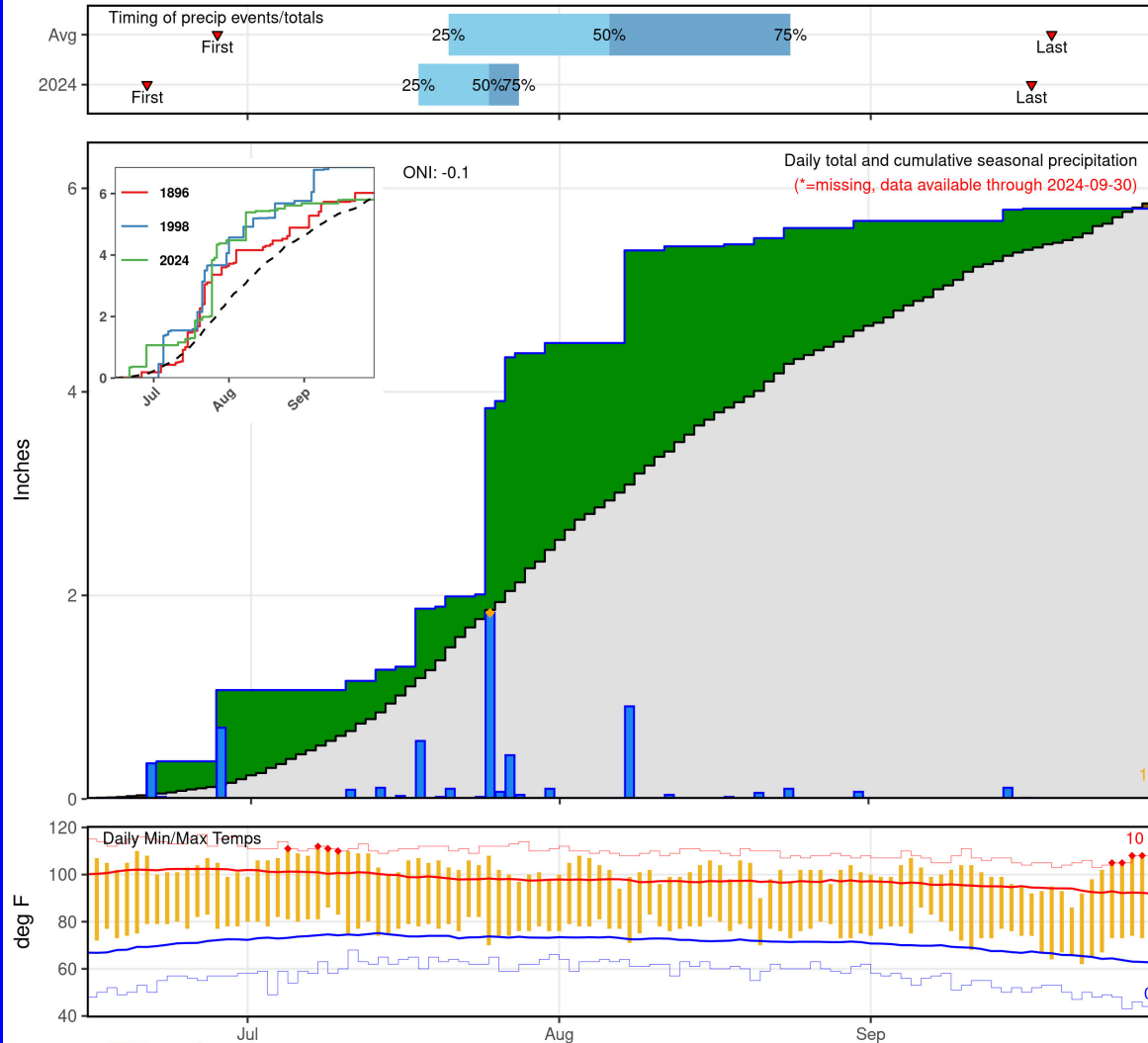
<https://cais.arizona.edu/climate/misc/stations/>



State Assessment for the Southwest
© NOAA CAPS/ISA TEAM

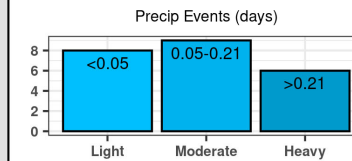
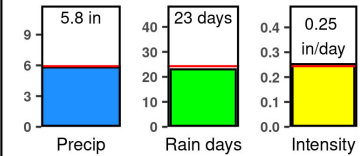
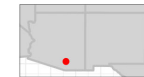


Station Climate Summary: 06-15-2024 to 09-30-2024 (Monsoon Season)



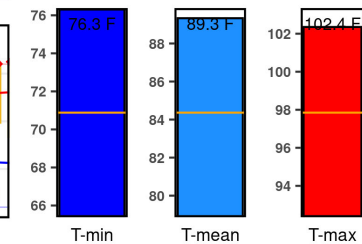
Tucson Area

Elevation (ft):
 Period of record: 1895-2024
 Years in record: 130
 Precip rank: 61 (1-wettest)
 Temp rank: 3 (1-warmest)
 Missing in 2024: 0
 Total snow (in): 0 (NaN % avg)



Dry Spells

Avg length: 3 days (avg: 4)
 Max length: 14 days (avg: 21)



Data from <http://www.rcc-acis.org/>
 Plot created: 12-31-2024
 The University of Arizona
<https://cais.arizona.edu/climate/>

<https://cais.arizona.edu/climate/misc/stations/>

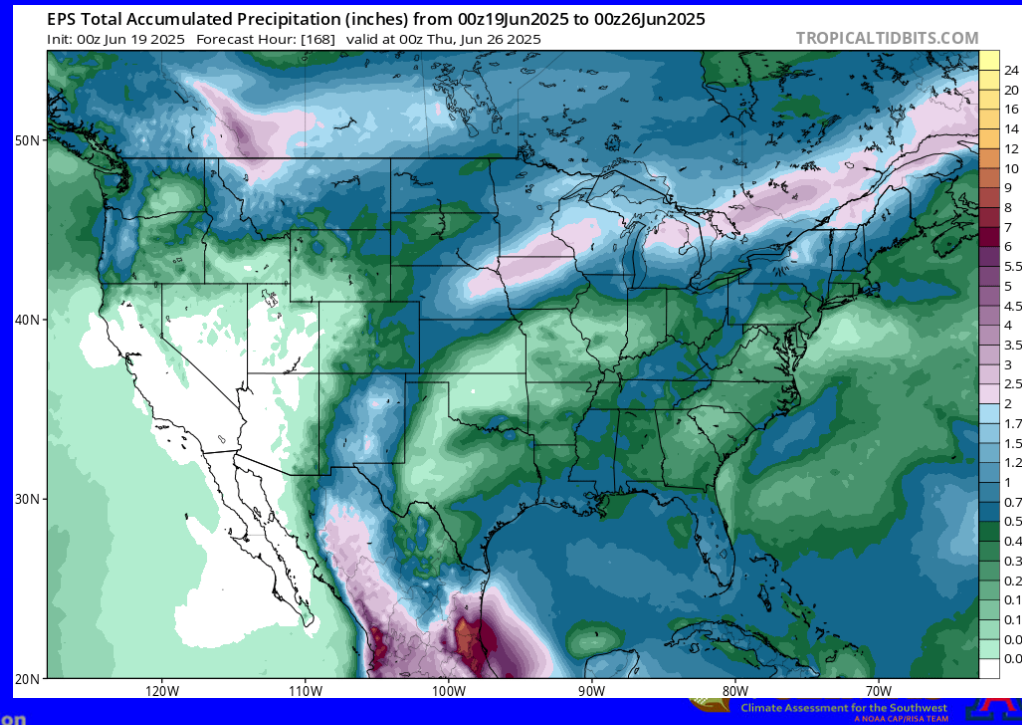
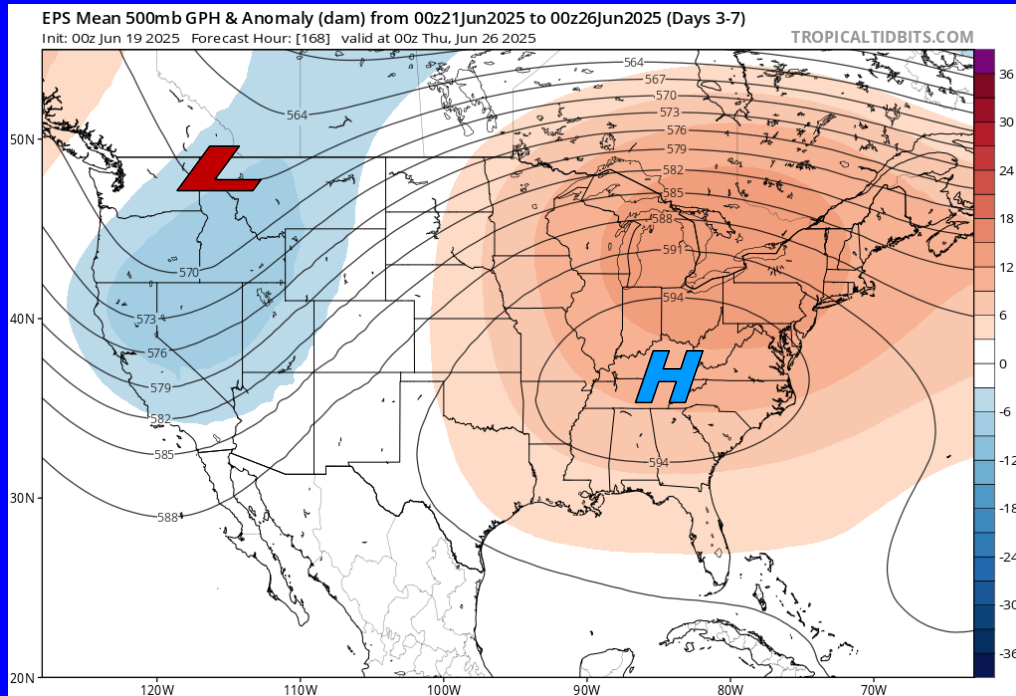
Looking ahead



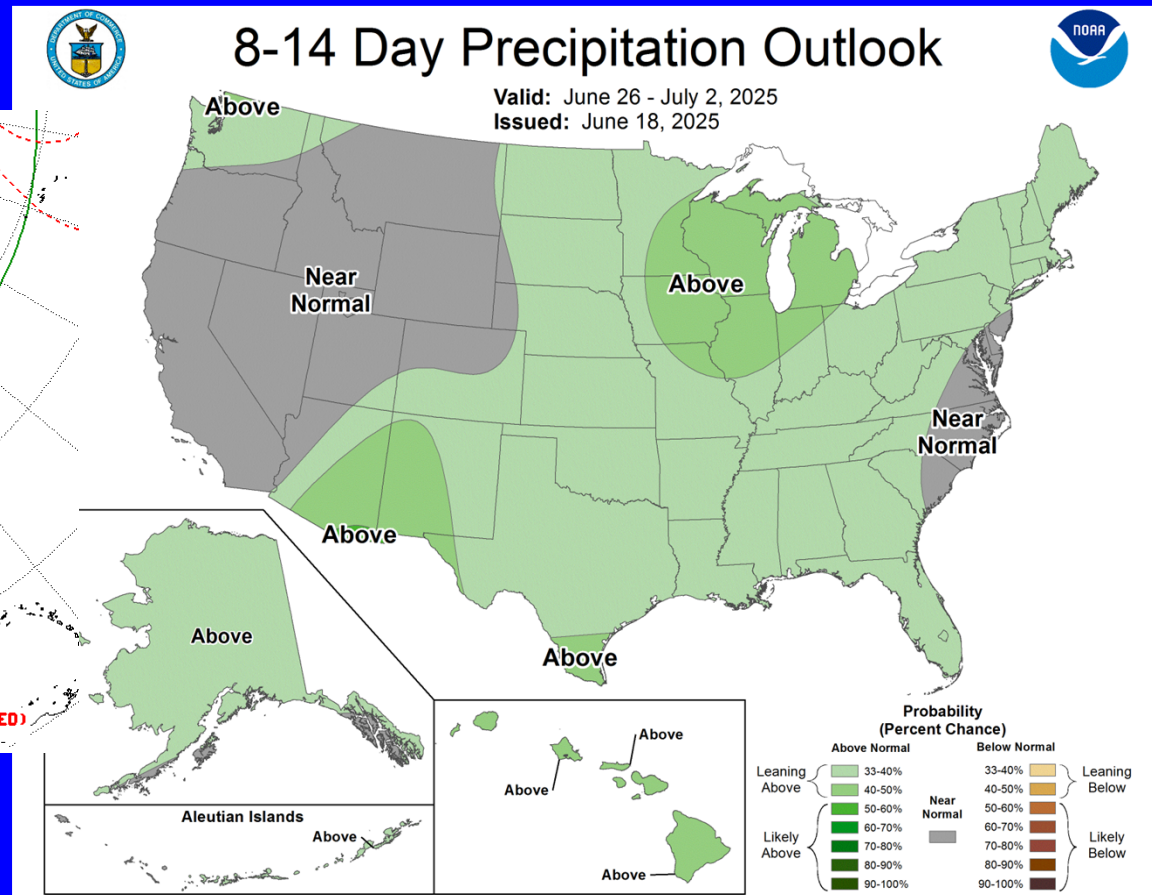
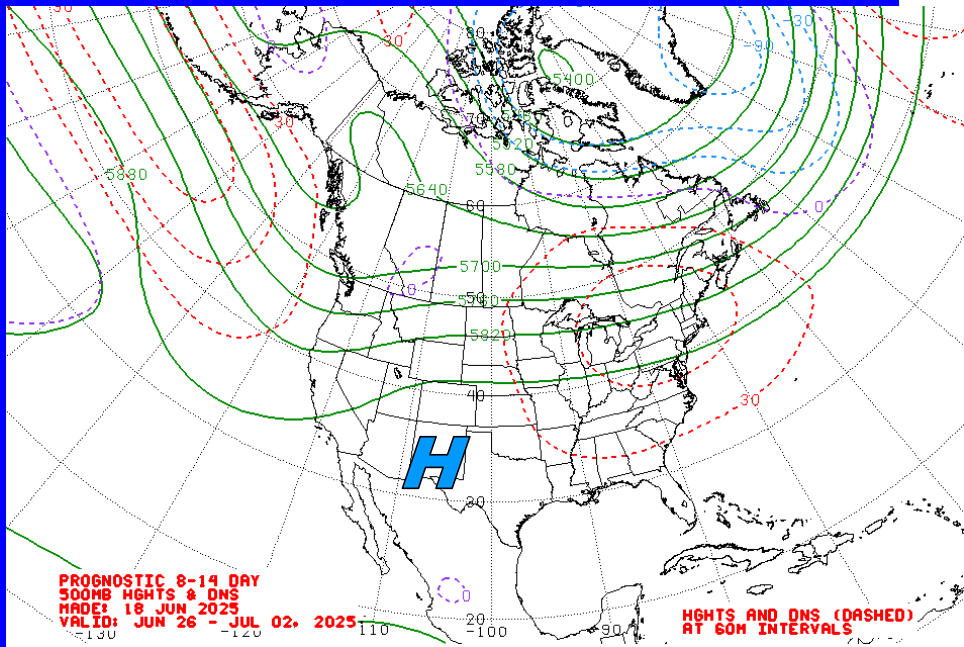
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7-day Forecast (ECMWF-Ensemble Prediction System)



8-14 day Outlook: June 26 – July 2



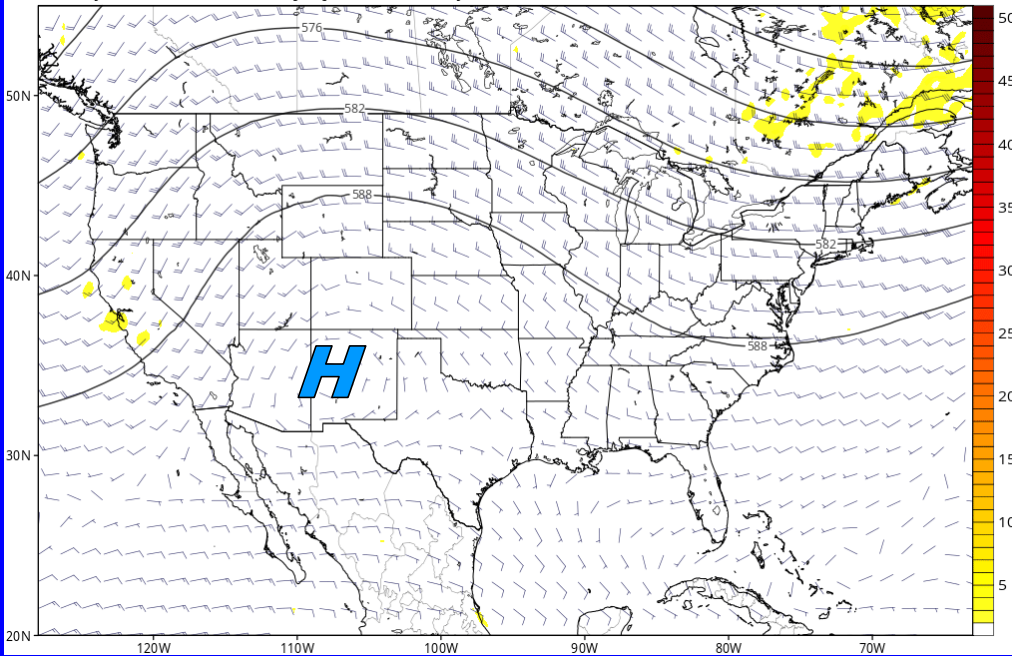
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Forecast Snapshot: July 2nd (Hour 330, EPS)

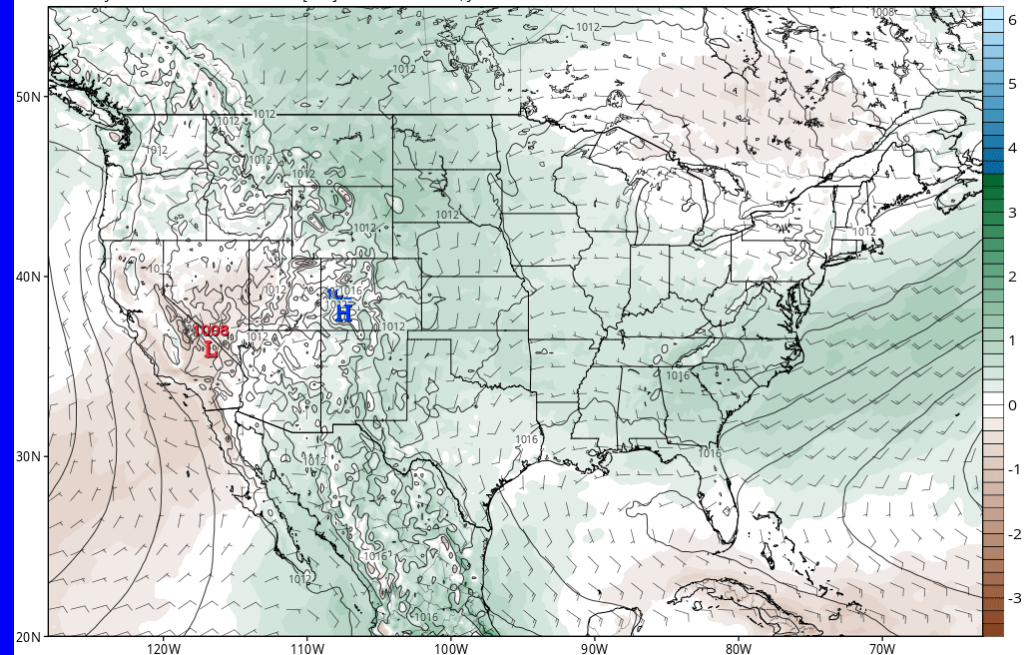
EPS 500mb Geopotential Height (dam), Cyclonic Vorticity (10^5 s^{-1} , shaded), and Wind (kt)
Init: 00z Jun 19 2025 Forecast Hour: [330] valid at 18z Wed, Jul 02 2025

TROPICALTIDBITS.COM



EPS MSLP (mb), Total Precipitable Water Normalized Anomaly, & 850mb Wind (kt)
Init: 00z Jun 19 2025 Forecast Hour: [330] valid at 18z Wed, Jul 02 2025

TROPICALTIDBITS.COM



CSAP

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Climate Assessment for the Southwest
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National Multi-model Ensemble – Precipitation Outlooks (July-Sep)

<https://www.cpc.ncep.noaa.gov/ucts/NMME/seasanom.shtml>



Climate Science App

NMME

Prob fcst

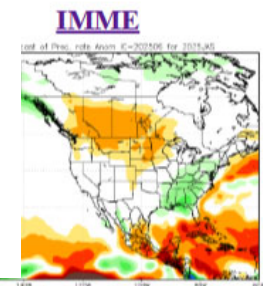
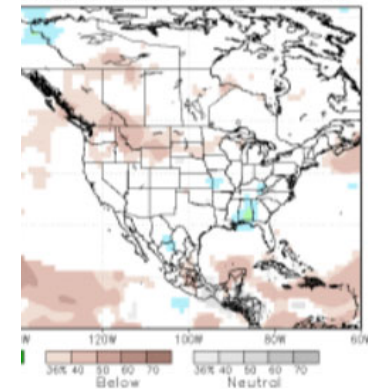
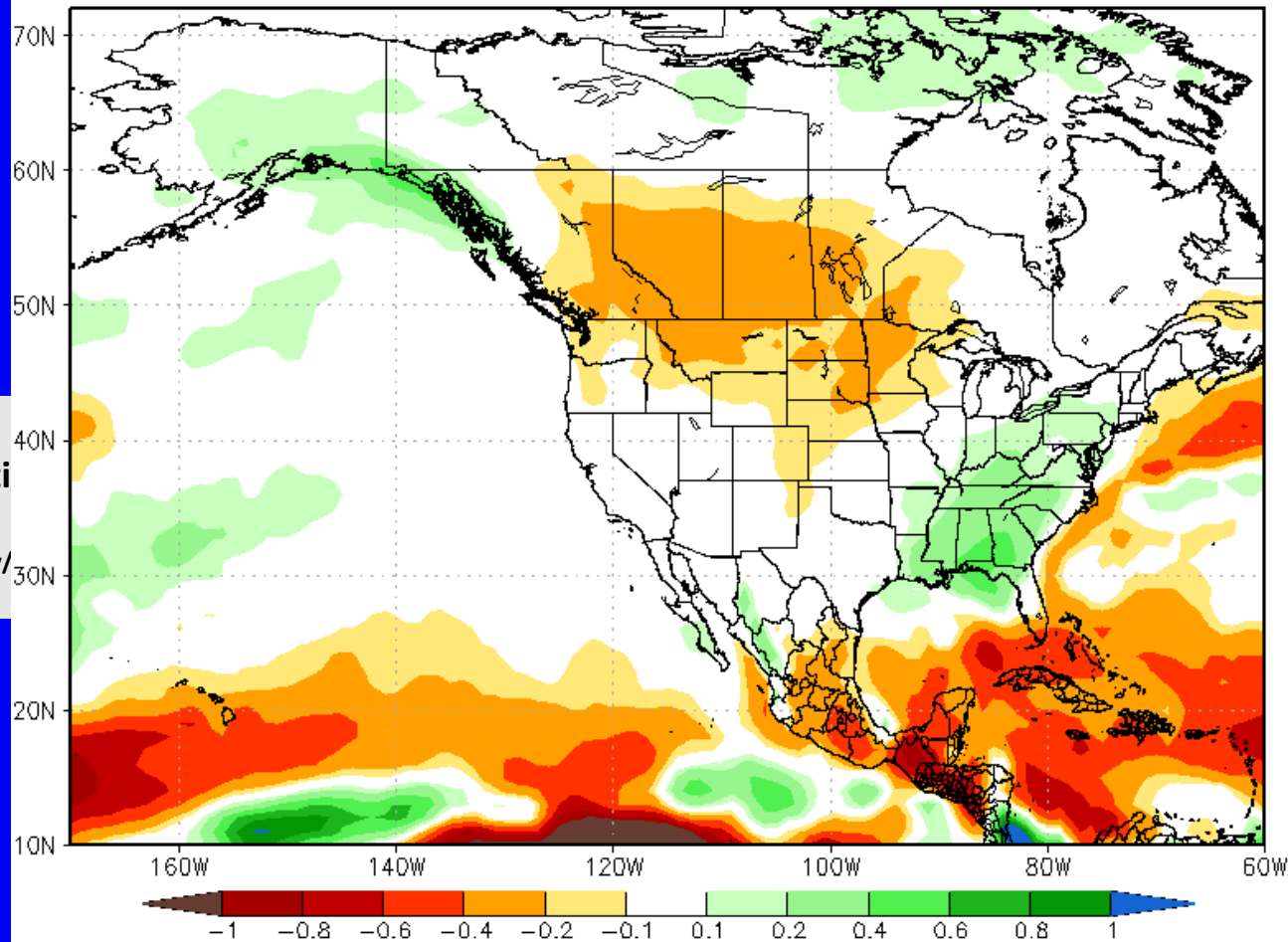
PAC calib. prob fcst

NMME Forecast of Prec. rate Anom IC=202506 for Lead 1 2025JAS

NMME prob fcst Prob IC=202506 for lead 1 2025 JAS

NMME prob fcst Prob IC=202506 for lead 1 2025 JAS

IMME Forecast of Prec. rate Anom IC=202506 for 2025JAS



July-Sept Outlook

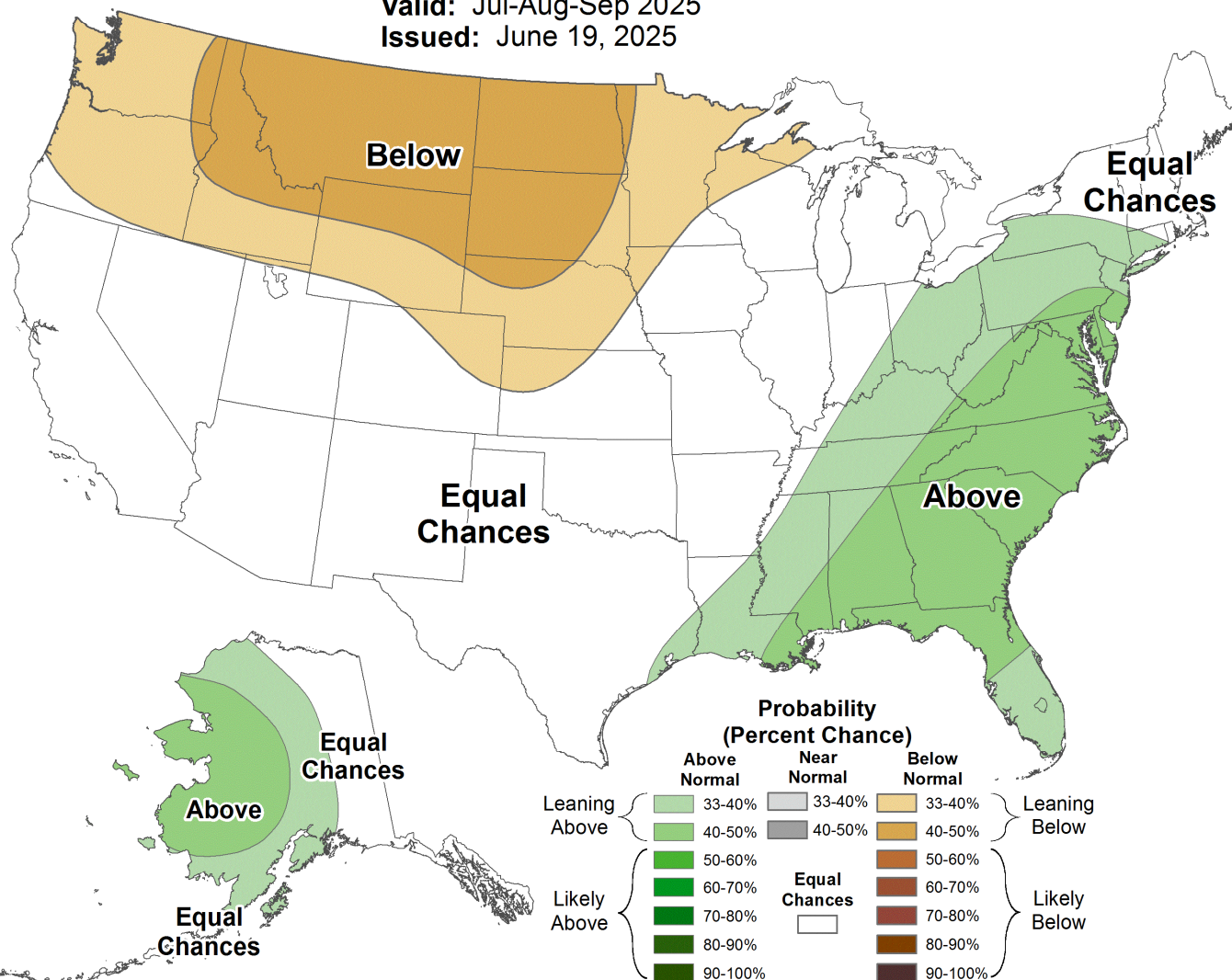


Seasonal Precipitation Outlook



Valid: Jul-Aug-Sep 2025

Issued: June 19, 2025



Closing thoughts

- Precipitation is forecast to progress north into northern Mexico over next 7 days, good sign for average progression!
- Watching sea surface temperatures in Gulf of California – above average for mid-June and should continue to warm rapidly; important for ‘gulf surges’ of moisture in desert Southwest
- NOAA-CPC outlook for below-average eastern Pacific hurricane activity, but has been active early on; can be sources of moisture later in season
- Overall, limited signals point to either wetter or drier seasonal totals...will have to wait and see!



Thanks!

crimmins@arizona.edu
<http://cals.arizona.edu/climate>



<https://monsoontantasy.arizona.edu/>



<https://climas.arizona.edu/podcasts>



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