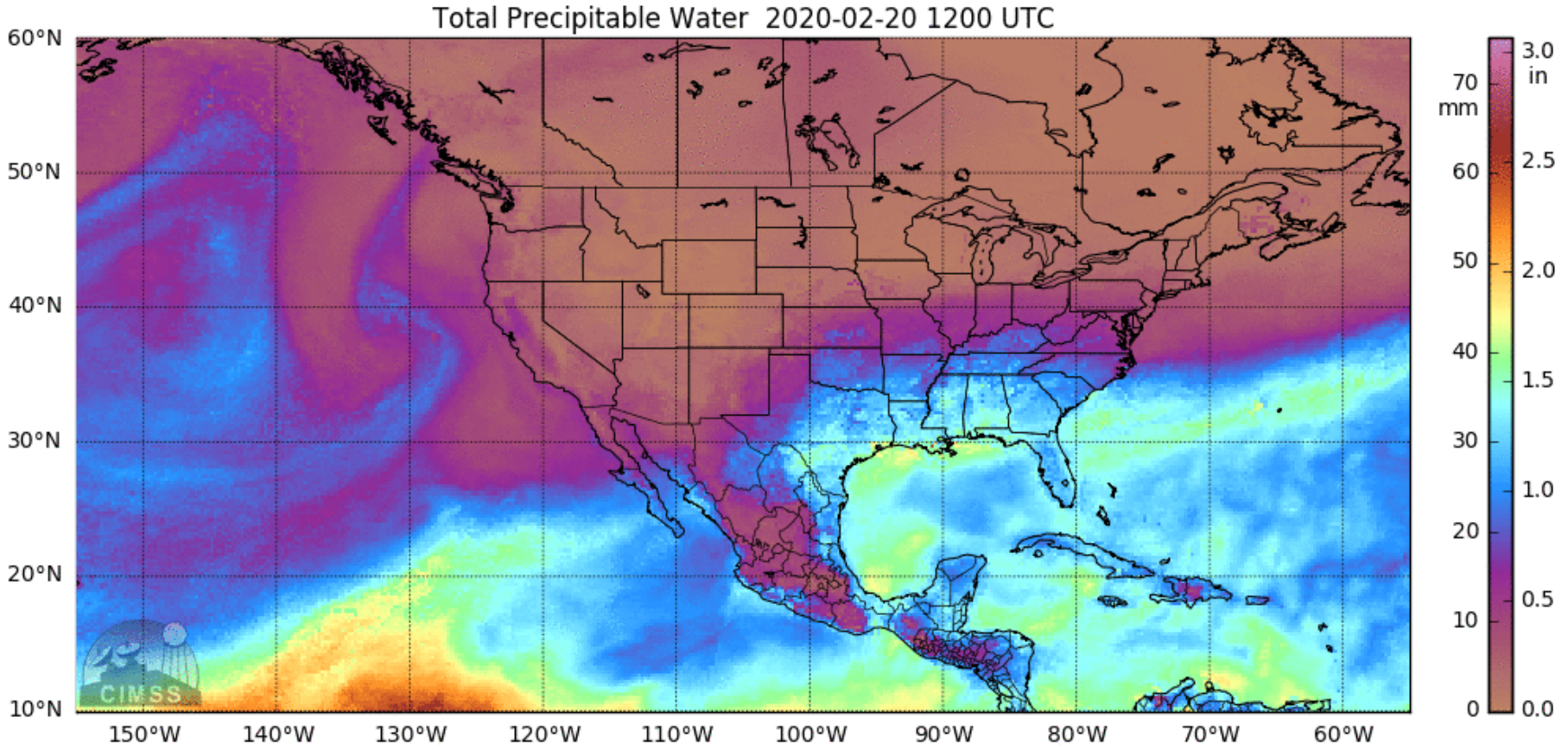
CW3E Event Summary: 21–23 Feb 2020

Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

Cutoff low and landfalling AR bring heavy rainfall and mountain snowfall to southwestern U.S.

- Southern Arizona experienced weak-to-moderate AR conditions for more than 24 hours [AR1/AR2 based on the *Ralph et al. (2019)* AR Scale]
- Some locations in central AZ received more than 2 inches of total precipitation from this event
- Significant snowfall (> 8 inches) also occurred over the higher terrain in south-central UT and central CO



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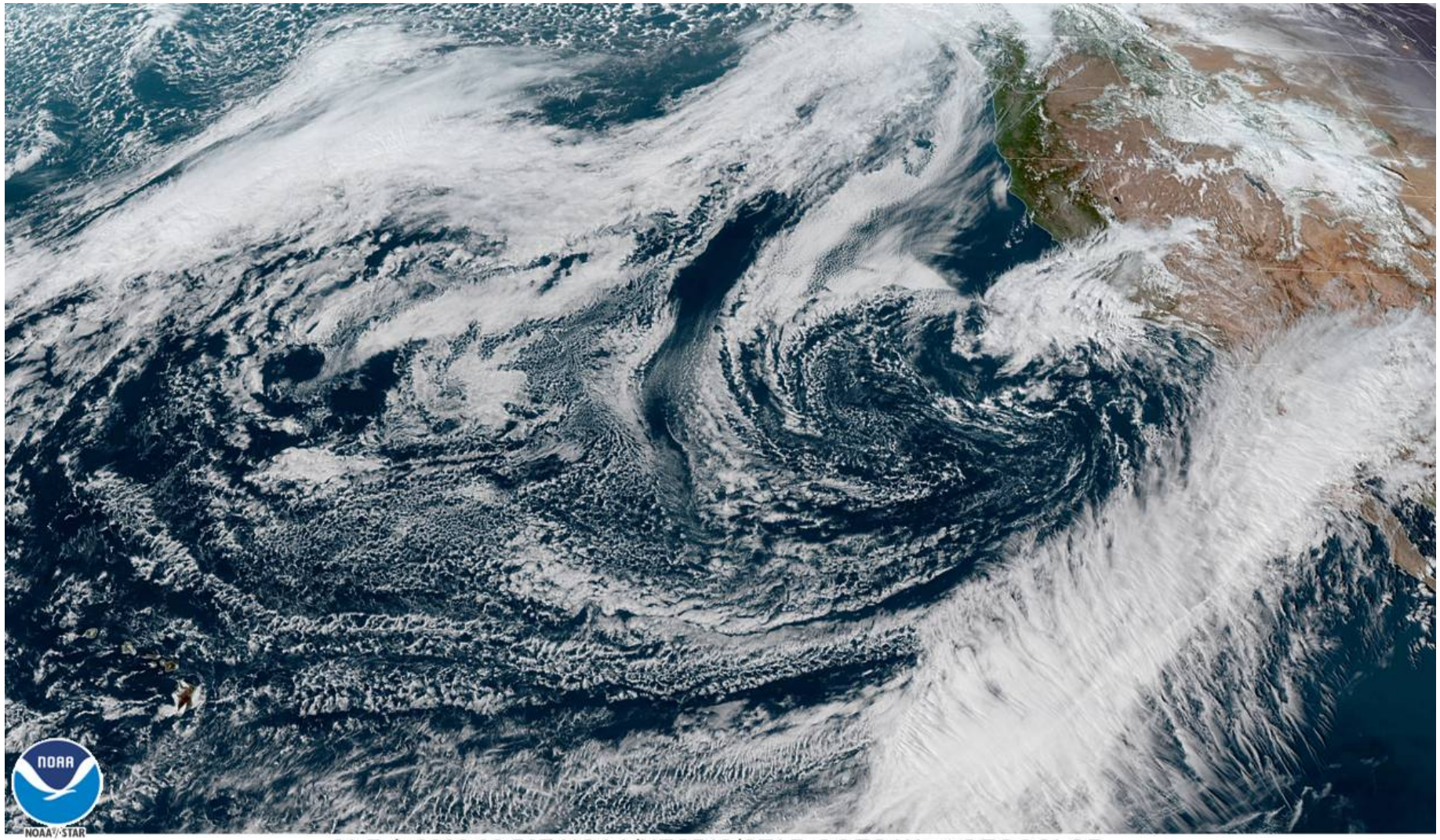

21 Feb 2020 22:56Z NOAA/NESDIS/STAR GOES-West GEOCOLOR

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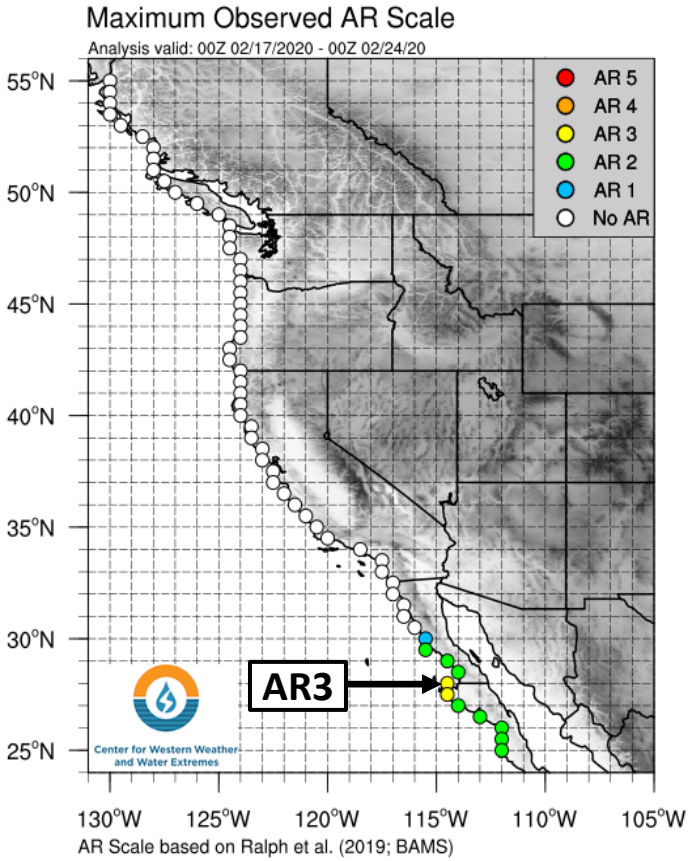
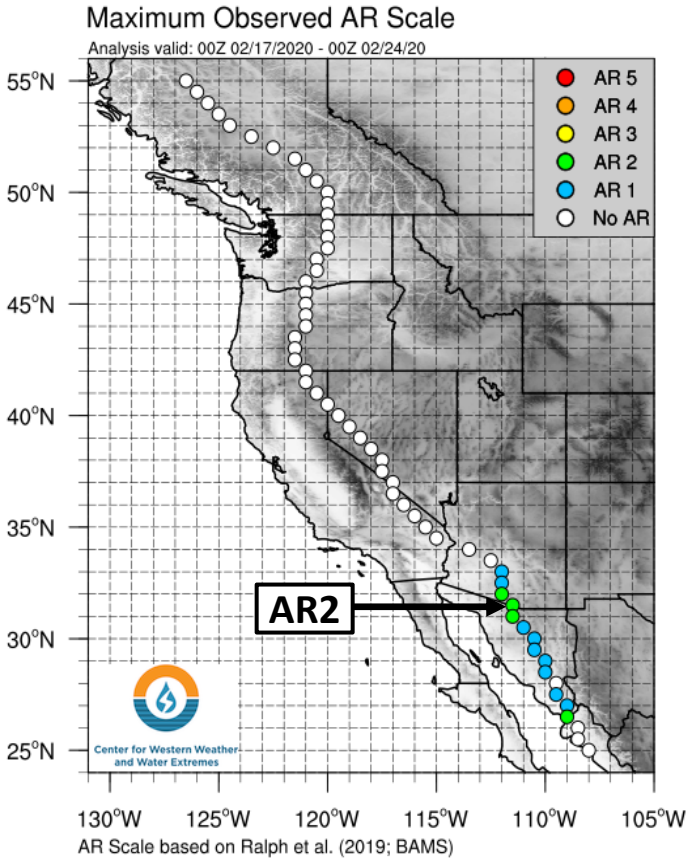
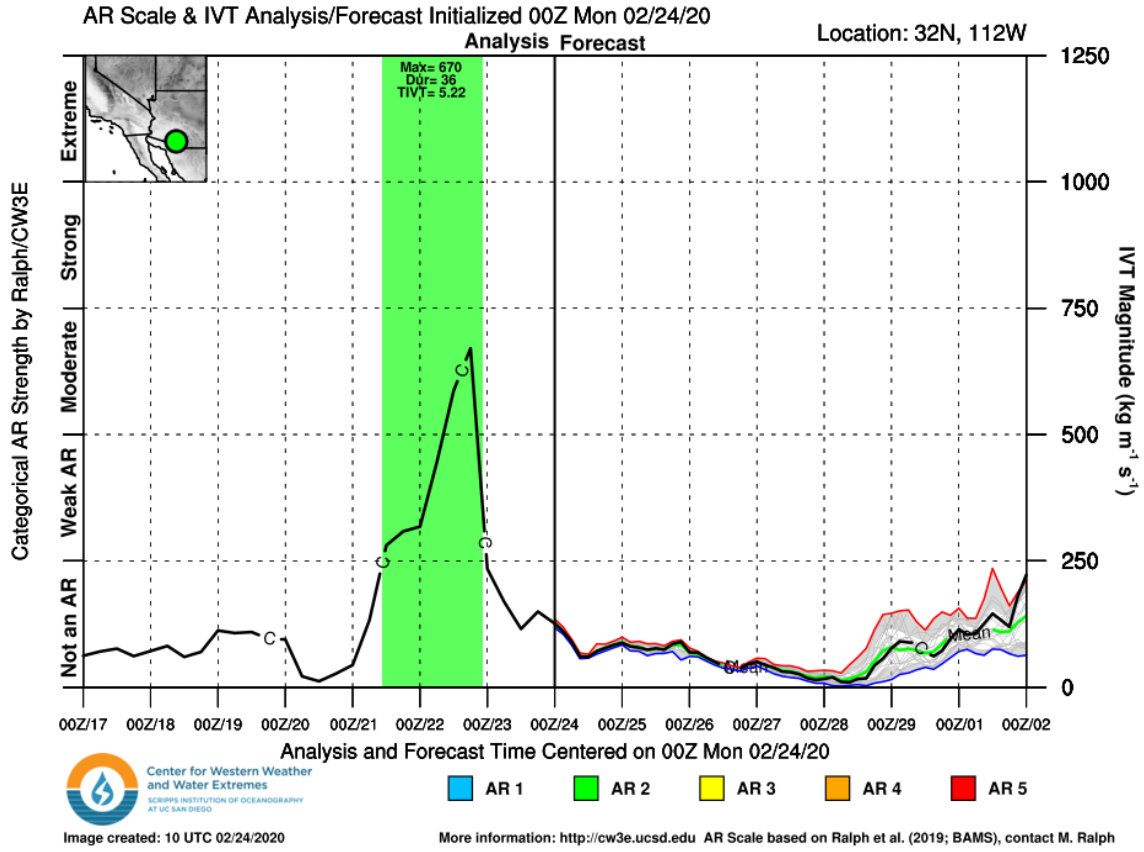
Coastal AR Scale Analysis



Inland AR Scale Analysis





- A landfalling AR brought AR2/AR3 conditions to the Baja Peninsula, with some places experiencing AR conditions for 48 hours
- Inland penetration of high IVT values resulted in AR1/AR2 conditions over Sonora and southern Arizona

CW3E Event Summary: 21–23 Feb 2020

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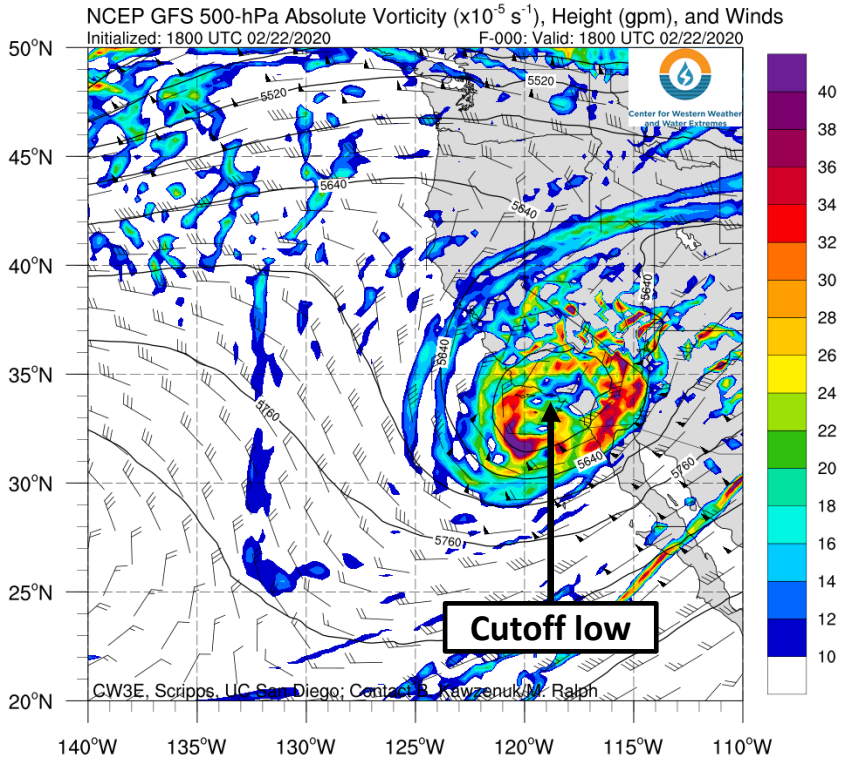
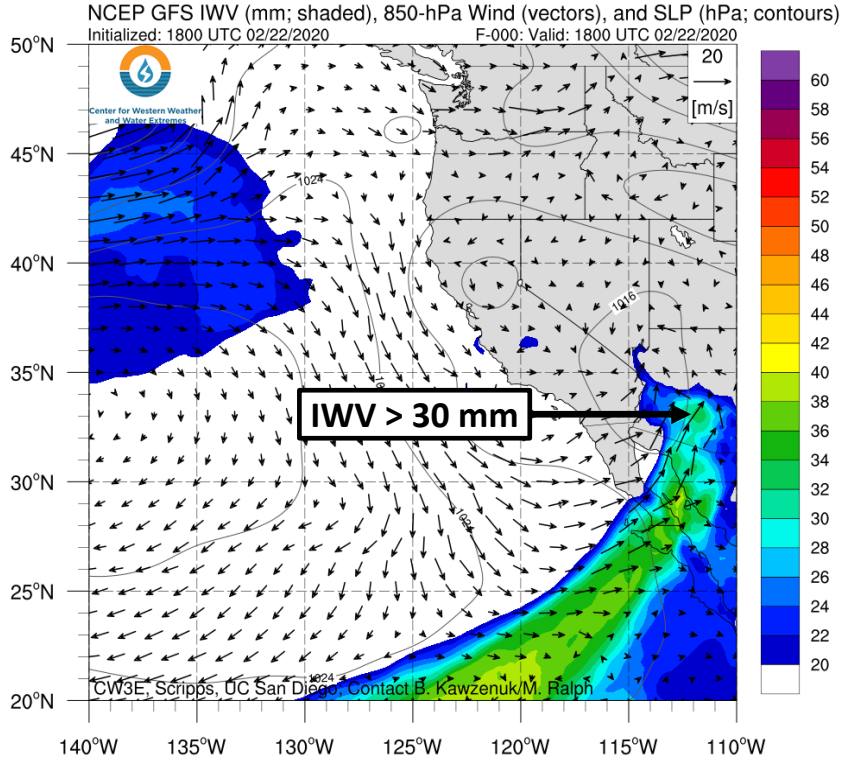
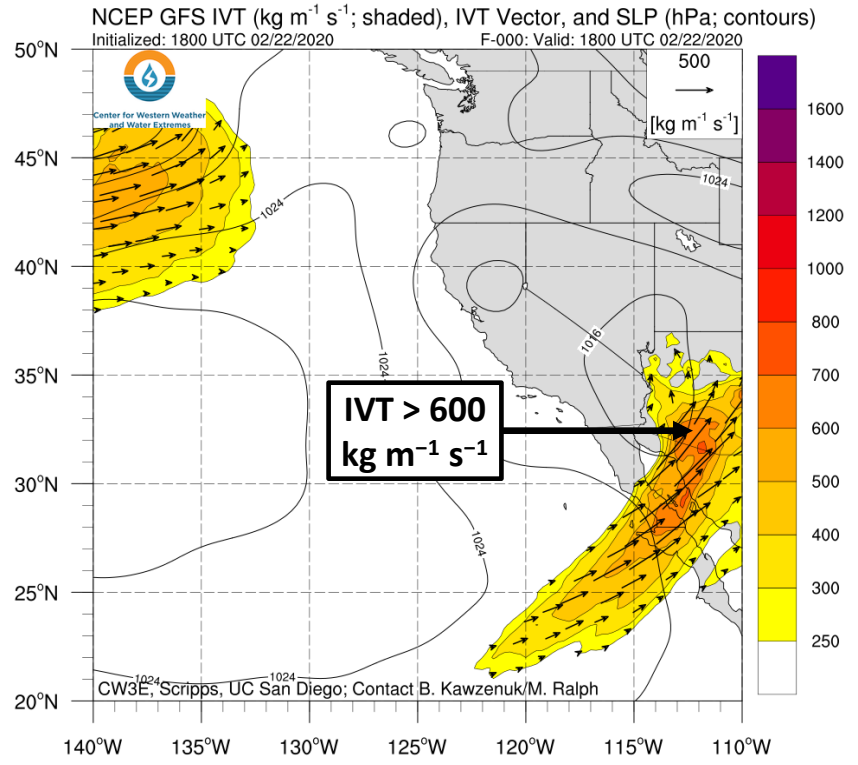
GFS Analyses: Valid 1800 UTC 22 Feb







- This AR formed as a result of the interaction between a cutoff near the CA coast and a region of tropical moisture over the Eastern Pacific Ocean
- Strengthening low-to-midlevel southwesterly flow downstream of the cutoff low led to the development of a region of enhanced IVT and an associated moisture plume over northwestern Mexico and southern AZ
- The orientation of the IVT vectors suggests that upslope moisture flux likely enhanced the precipitation over the elevated terrain in central AZ

CW3E Event Summary: 21–23 Feb 2020

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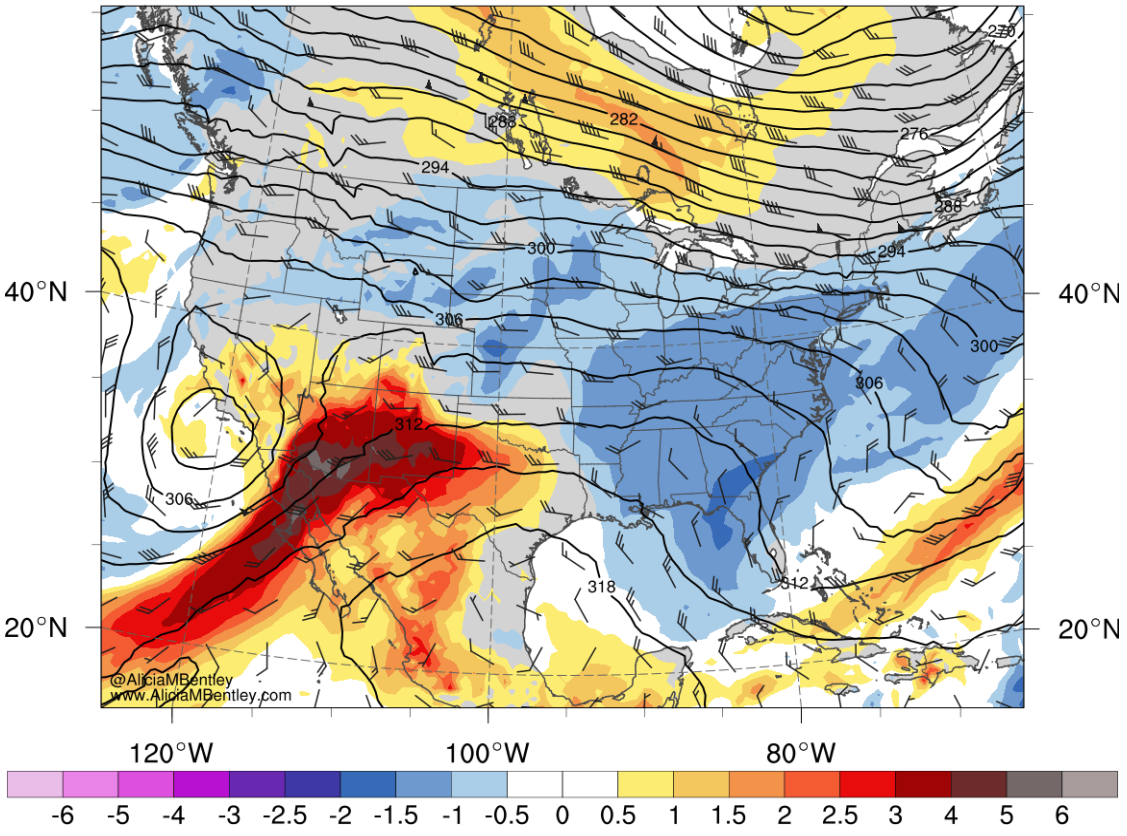
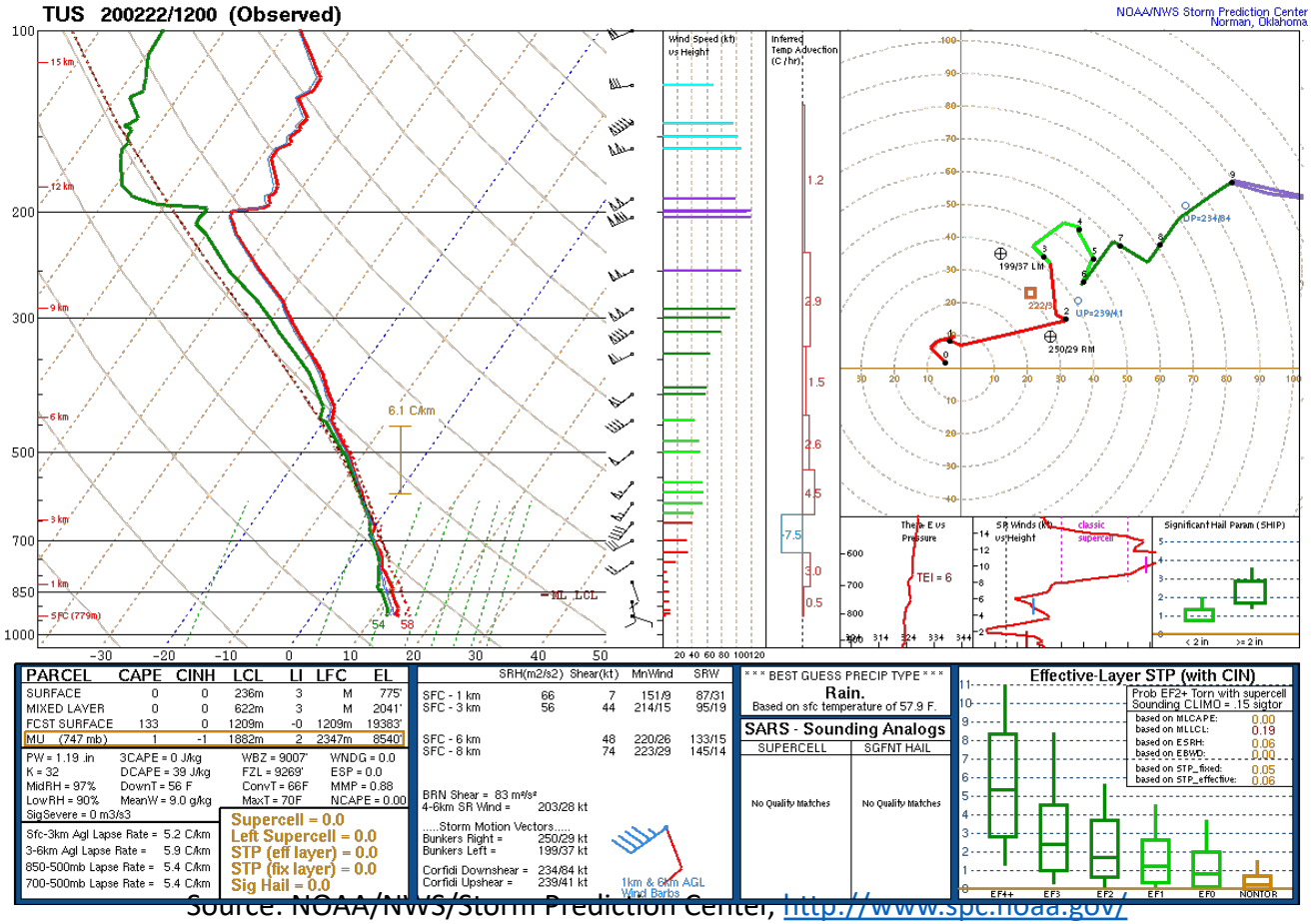
GFS Standardized PWAT Anomaly : 1200 UTC 22 Feb Analysis



Source: Alicia Bentley, http://www.atmos.albany.edu/student/abentley/realtime.html



Source: NOAA/NWS/Storm Prediction Center, http://www.spc.noaa.gov/

- **This AR transported deep moisture into the Desert Southwest, with precipitable water (PWAT) values exceeding 4 standard deviations above normal in portions of southern AZ and southern NM**
- **Tucson, AZ, set a record February PWAT value of 1.19 inches (340% of normal) at 1200 UTC 22 Feb**
- **The corresponding upper-air sounding shows nearly saturated conditions throughout the entire troposphere**

CW3E Event Summary: 21–23 Feb 2020

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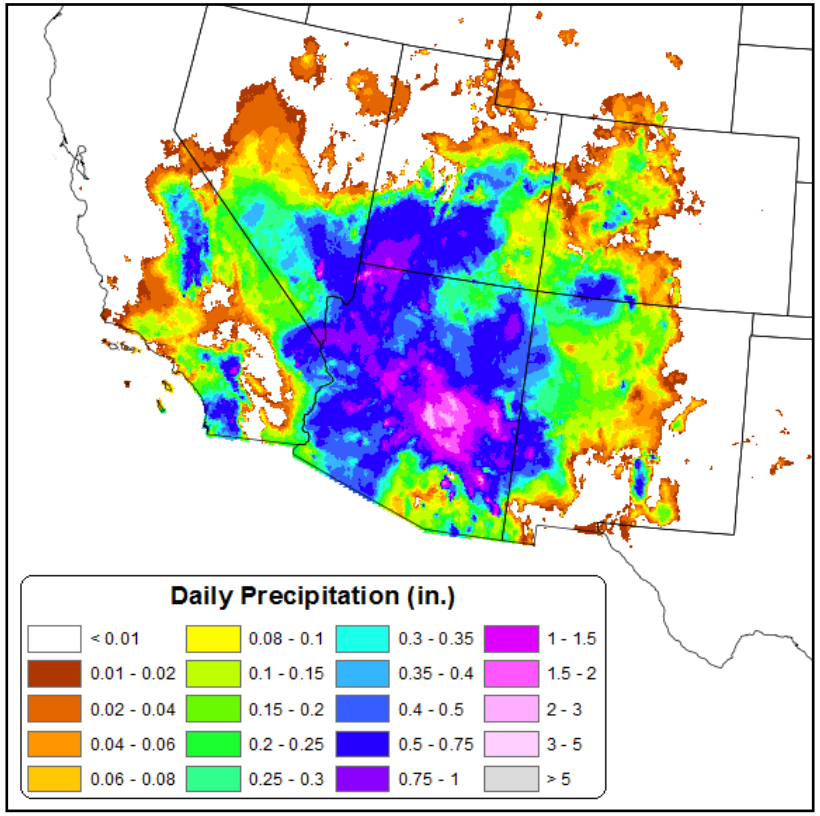
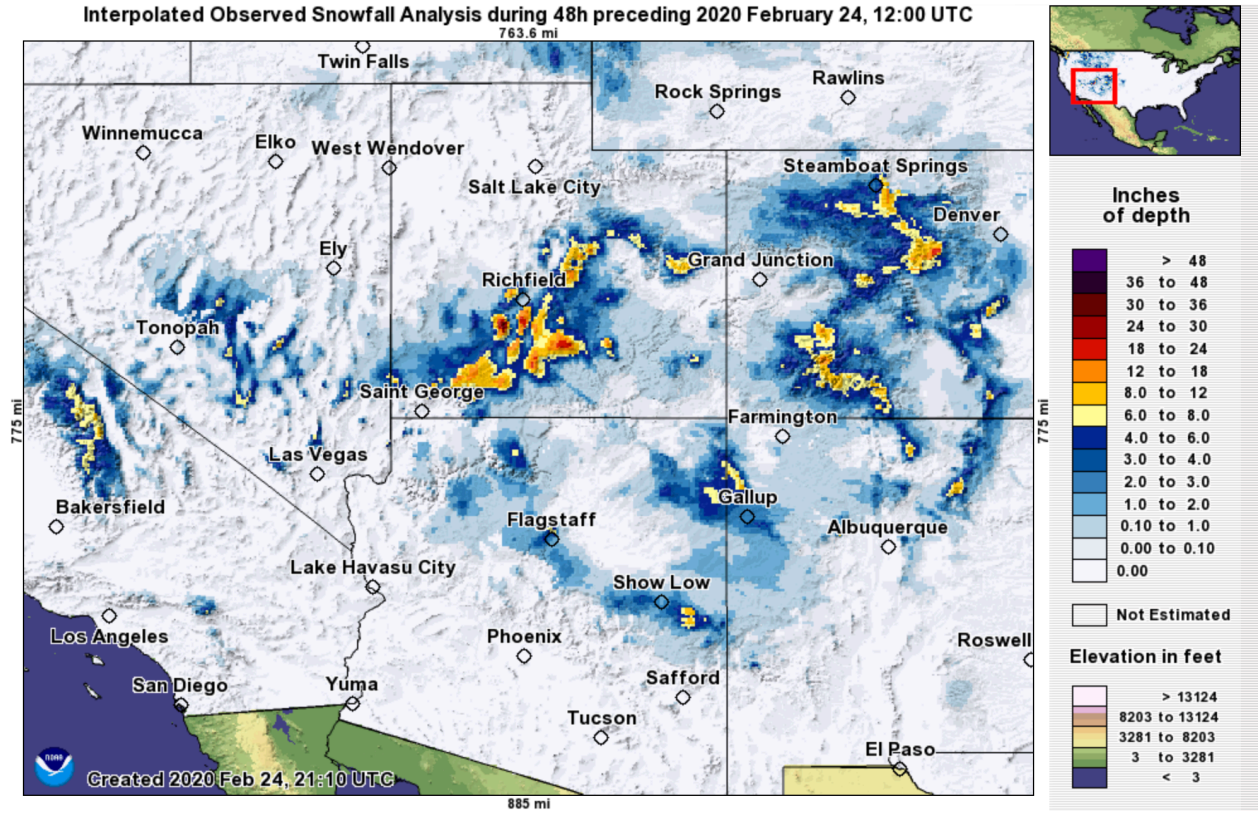
PRISM 24-h QPE: Valid 1200 UTC 23 Feb



Source: PRISM Climate Group, http://prism.oregonstate.edu/

48 Interpolated Snowfall: Valid 1200 UTC 24 Feb



Source: NOAA/NWS NOHRSC, https://www.nohrsc.noaa.gov/

- **Total estimated precipitation over the 24-hour period ending 1200 UTC (5 AM MST) 23 Feb exceeded 0.50 inches across much of Arizona and southwestern UT, with the highest amounts (> 1.50 inches) over the elevated terrain in central AZ**
- **Phoenix International Airport set a daily precipitation record (1.04 inches) and received 13% of its average annual precipitation on 22 Feb**
- **Other notable precipitation reports: Mt. Lemmon (3.59 inches), Pinaleno Peak (2.83 inches), Apache Junction 3.0 ESE (2.53 inches)**
- **This storm also produced significant snowfall accumulations at higher elevations in south-central UT and central CO**

CW3E Event Summary: 21–23 Feb 2020

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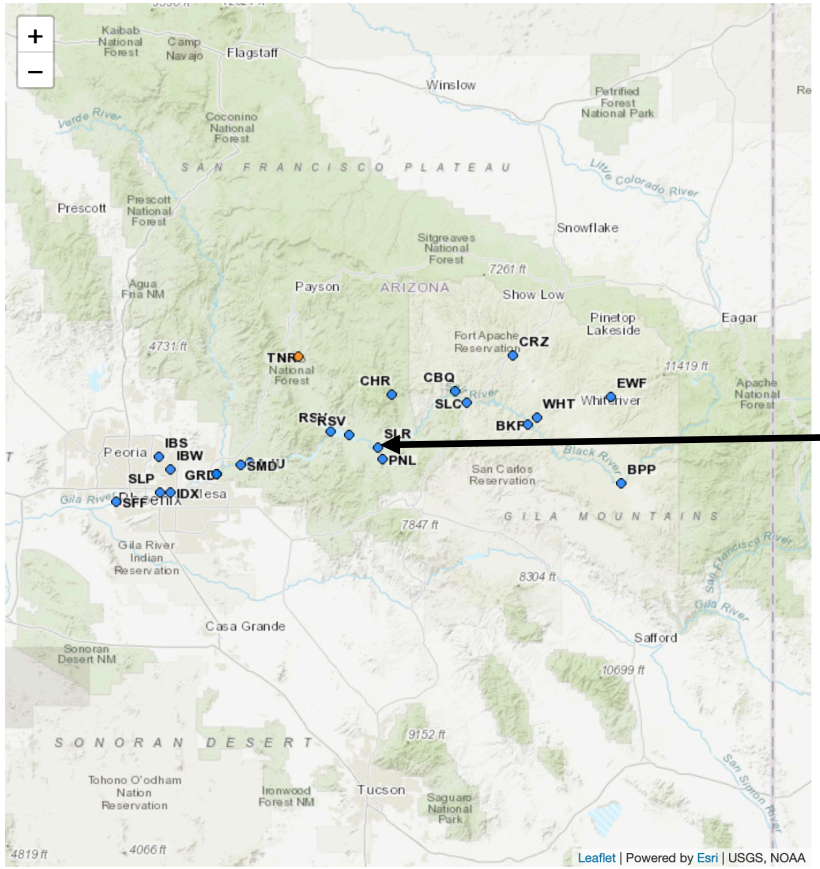

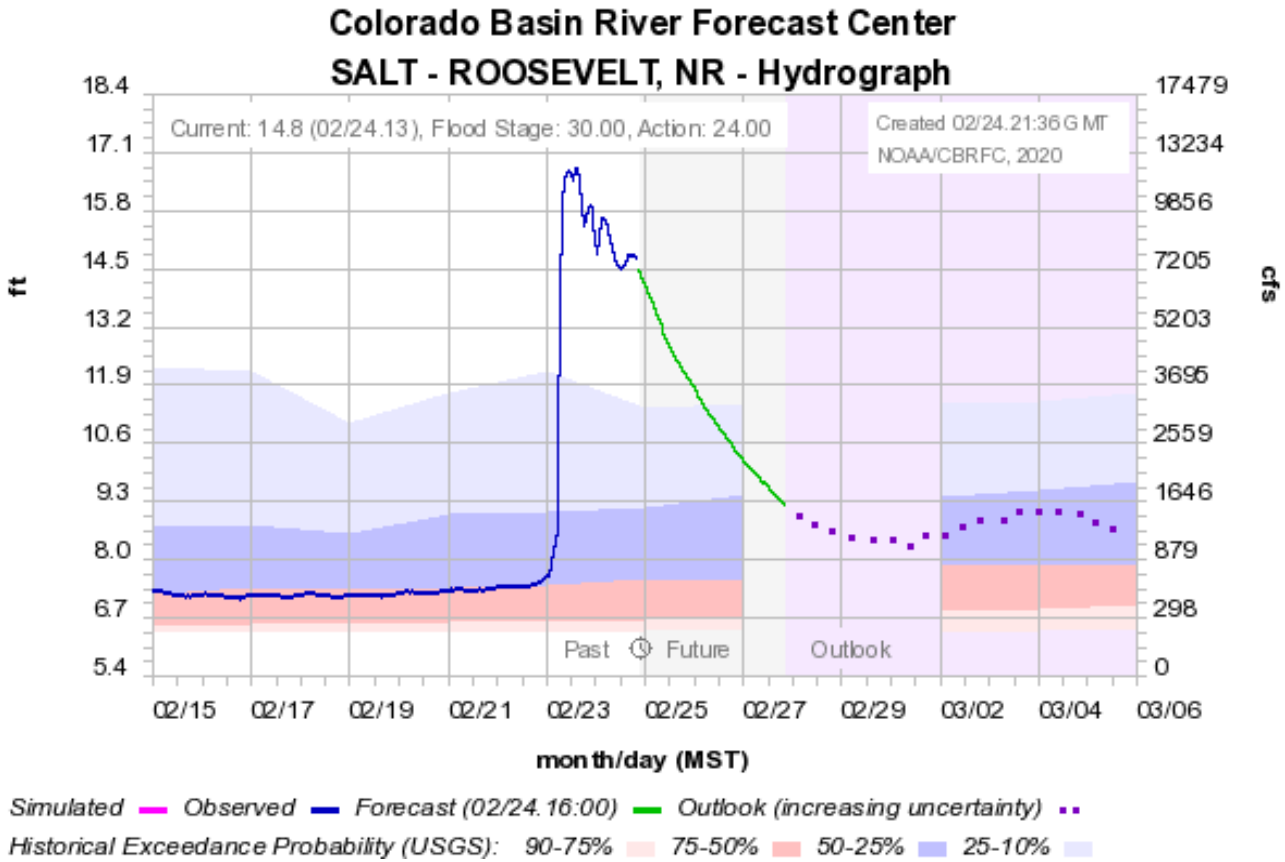

Source: NOAA/NWS Colorado Basin River Forecast Center, https://www.cbrfc.noaa.gov/

- **Heavy rainfall on 22 Feb produced localized flash flooding in Gila County, AZ**
- **The Salt River near Roosevelt Dam (SLR) rose more than 8 feet in a 6-hour period during the morning of 23 Feb**

CW3E Event Summary: 21–23 Feb 2020

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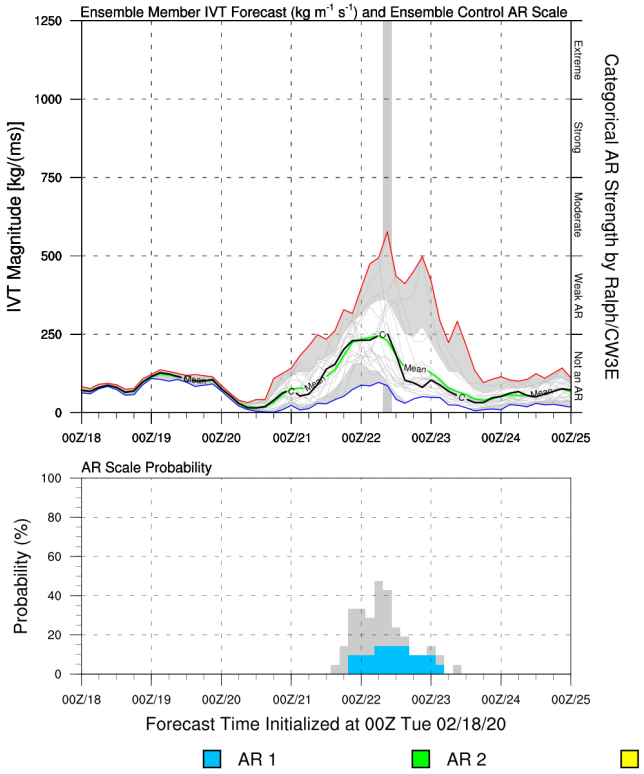
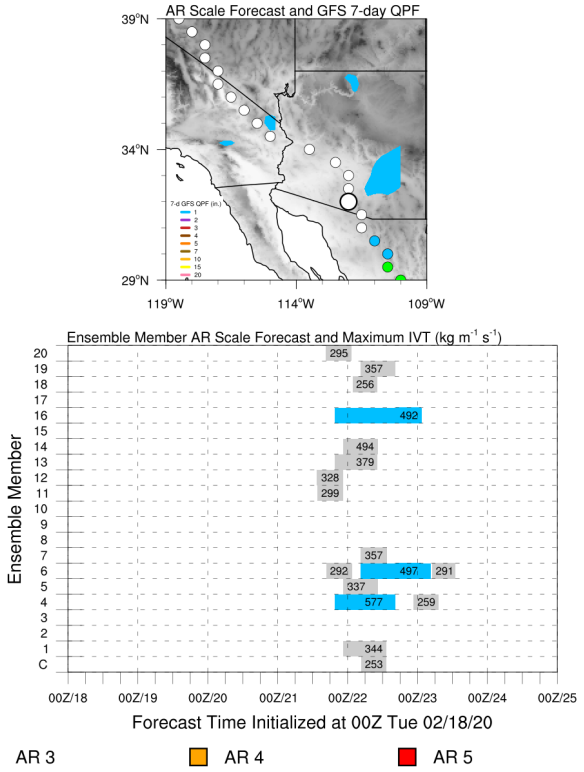
GEFS IVT Plume Forecasts

GFS Ensemble Inititialized: 00Z Tue 02/18/20



Location: 32°N 112°W

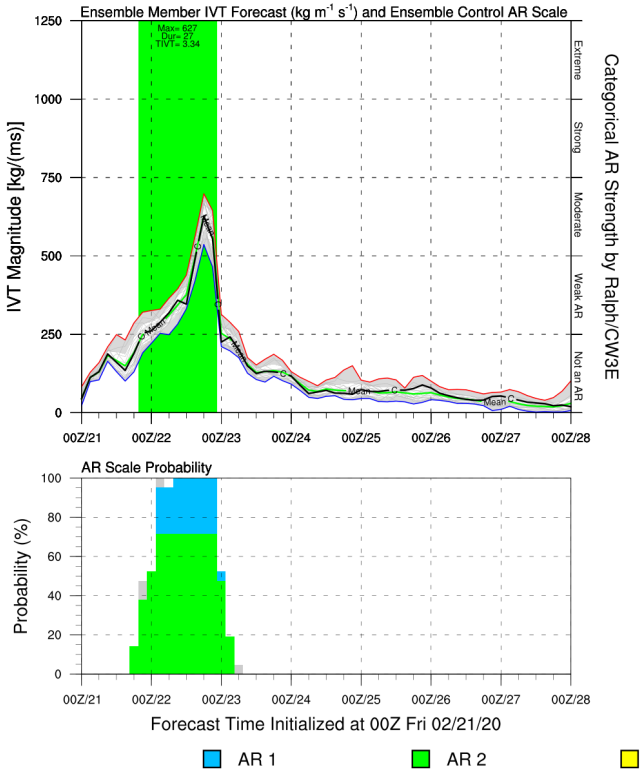


AR 1 AR 2 AR 3 AR 4 AR 5

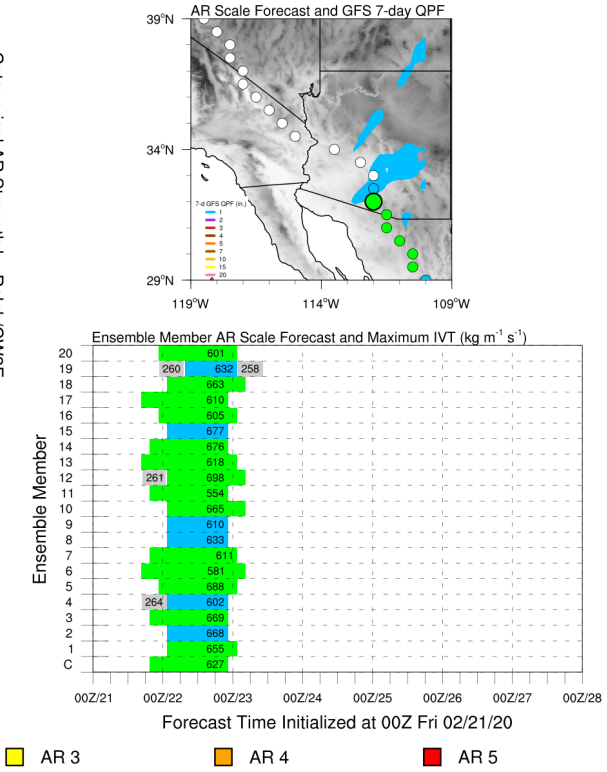
Image created: 10 UTC 02/18/2020

More information: http://cw3e.ucsd.edu AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

GFS Ensemble Inititialized: 00Z Fri 02/21/20



Location: 32°N 112°W



AR 1 AR 2 AR 3 AR 4 AR 5

Image created: 10 UTC 02/21/2020

More information: http://cw3e.ucsd.edu AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

- GEFS IVT forecasts showed a high degree of uncertainty in the duration and magnitude of AR conditions 3–4 days before the event
- Only 3/21 GEFS members from the 00Z 18 Feb run were predicting AR1 conditions at 32°N, 112°W
- Over the next 72 hours, the maximum forecast IVT magnitude and confidence in AR1/AR2 conditions significantly increased
- By 00Z 21 Feb, 15/21 GEFS members were predicting AR2 conditions at 32°N, 112°W
- GEFS control maximum forecast IVT increased from ~250 kg m^{-1} s^{-1} to 627 kg m^{-1} s^{-1} (observed value was 670 kg m^{-1} s^{-1})

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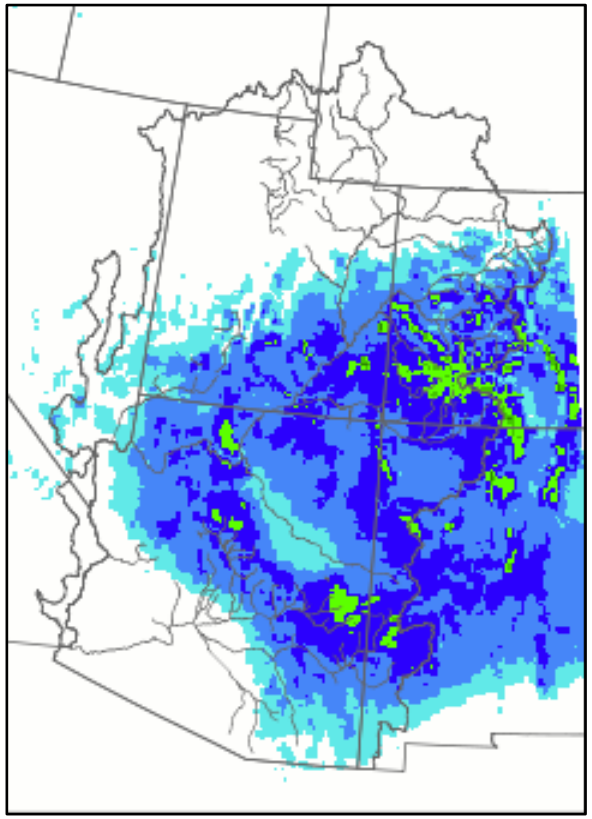
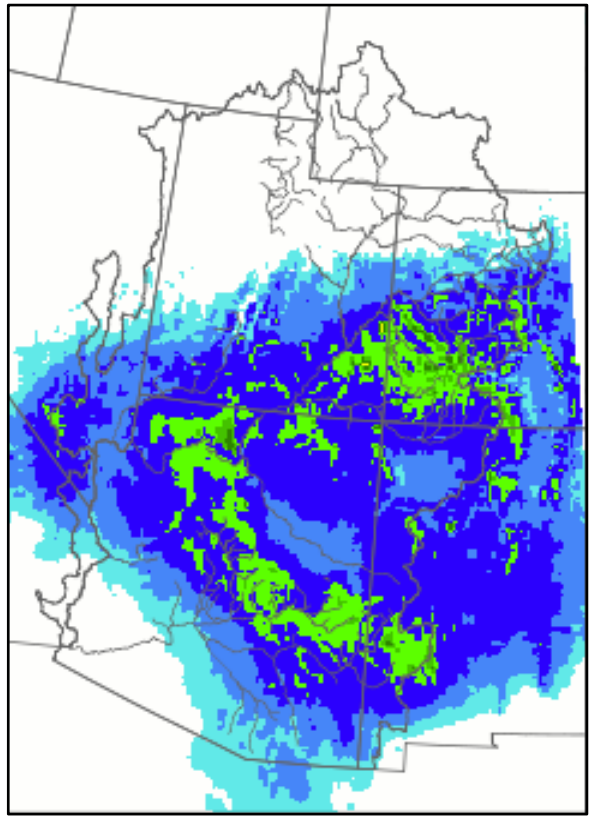
CBRFC 24-h QPF: Valid 1200 UTC 23 Feb

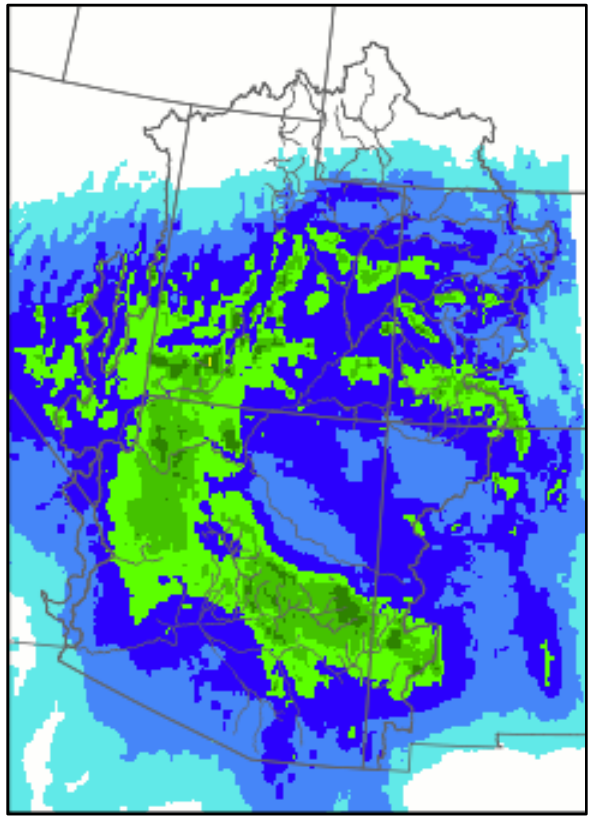
Issued: 1200 UTC 18 Feb



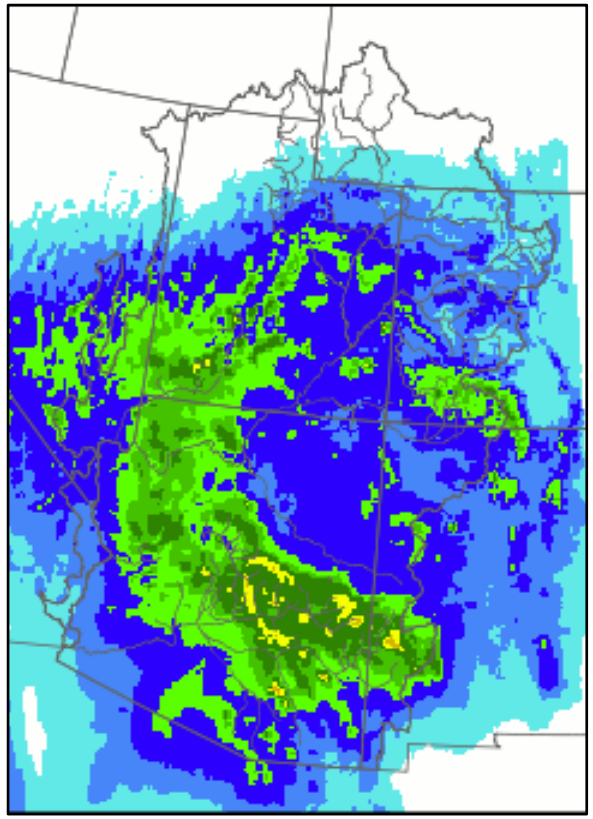
Issued: 1200 UTC 19 Feb

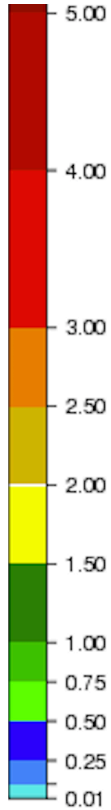


Issued: 1200 UTC 20 Feb



Issued: 1200 UTC 21 Feb





Source: NOAA/NWS Colorado Basin River Forecast Center, https://www.cbrfc.noaa.gov/

- **The spatial extent and intensity of forecast precipitation also increased between 18 Feb and 21 Feb**
- **As time progressed, the forecast precipitation region expanded into southwestern AZ, southern NV, and west-central UT**
- **On 18 Feb, 24-hour QPF amounts in excess of 0.50 inches were widely scattered across the higher elevations, but by 21 Feb, most of central AZ, northwestern AZ, and southwestern UT were forecast to receive more than 0.50 inches of precipitation**