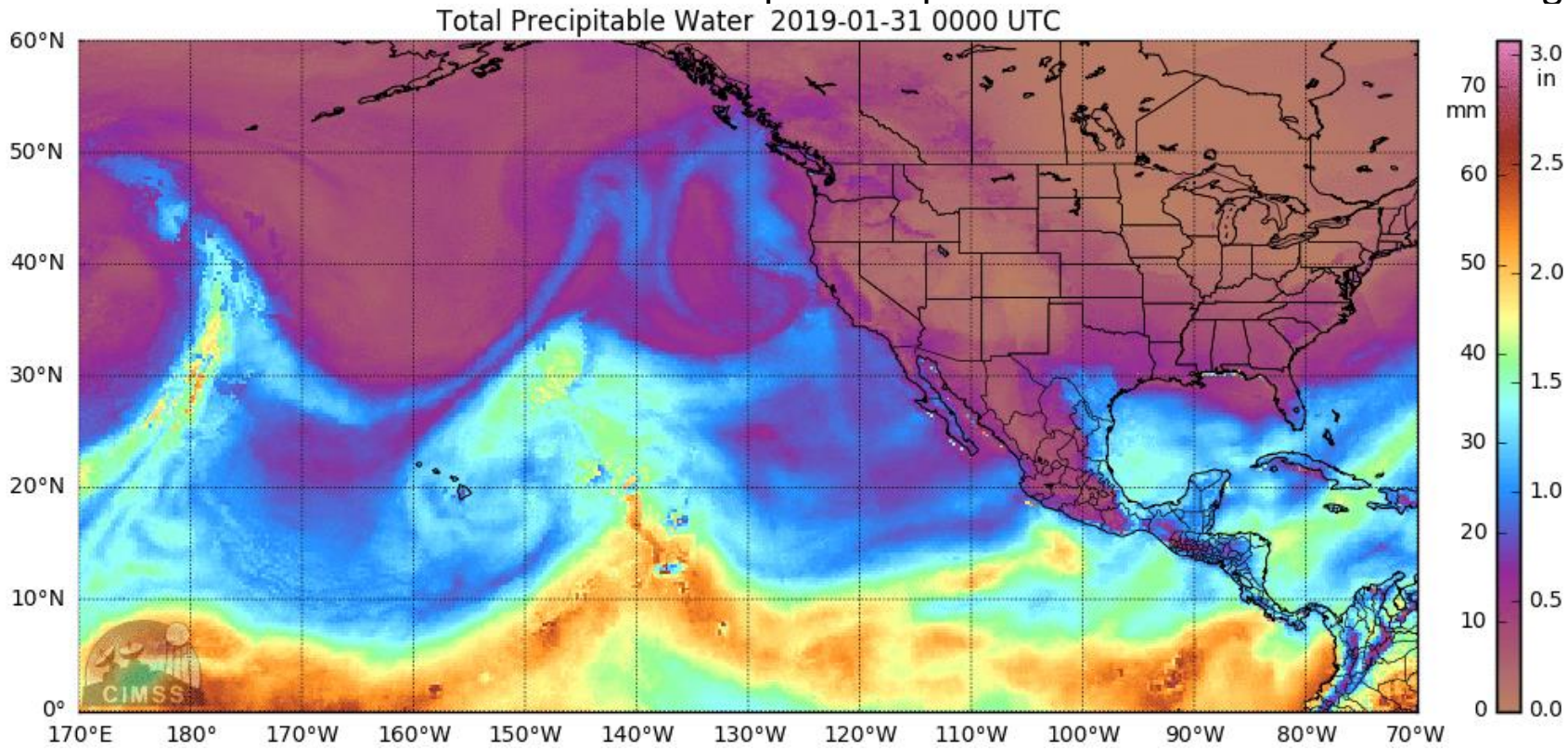
CW3E Post Event Summary: 02 February 2019 AR

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

Atmospheric River Impacts California

- The major storm that struck California on 2-3 February 2019 was an Atmospheric river storm.
- At landfall, the new AR Scale characterized it as an “AR Cat 3” along the Central California Coast using the Ralph et al (2019) AR impacts scale. It reached “strong” intensity.
- The merger of a tropical and mid-latitude system led to the development of a strong AR over the Eastern Pacific
- The strong AR brought heavy precipitation and created numerous impacts.
- Several locations in Southern California experienced flash flooding and mud flow conditions, closing numerous roads.
- A narrow cold frontal rain band developed and produced the heaviest short-lasting rain rates and peak winds in key areas.



For California DWR’s AR Program

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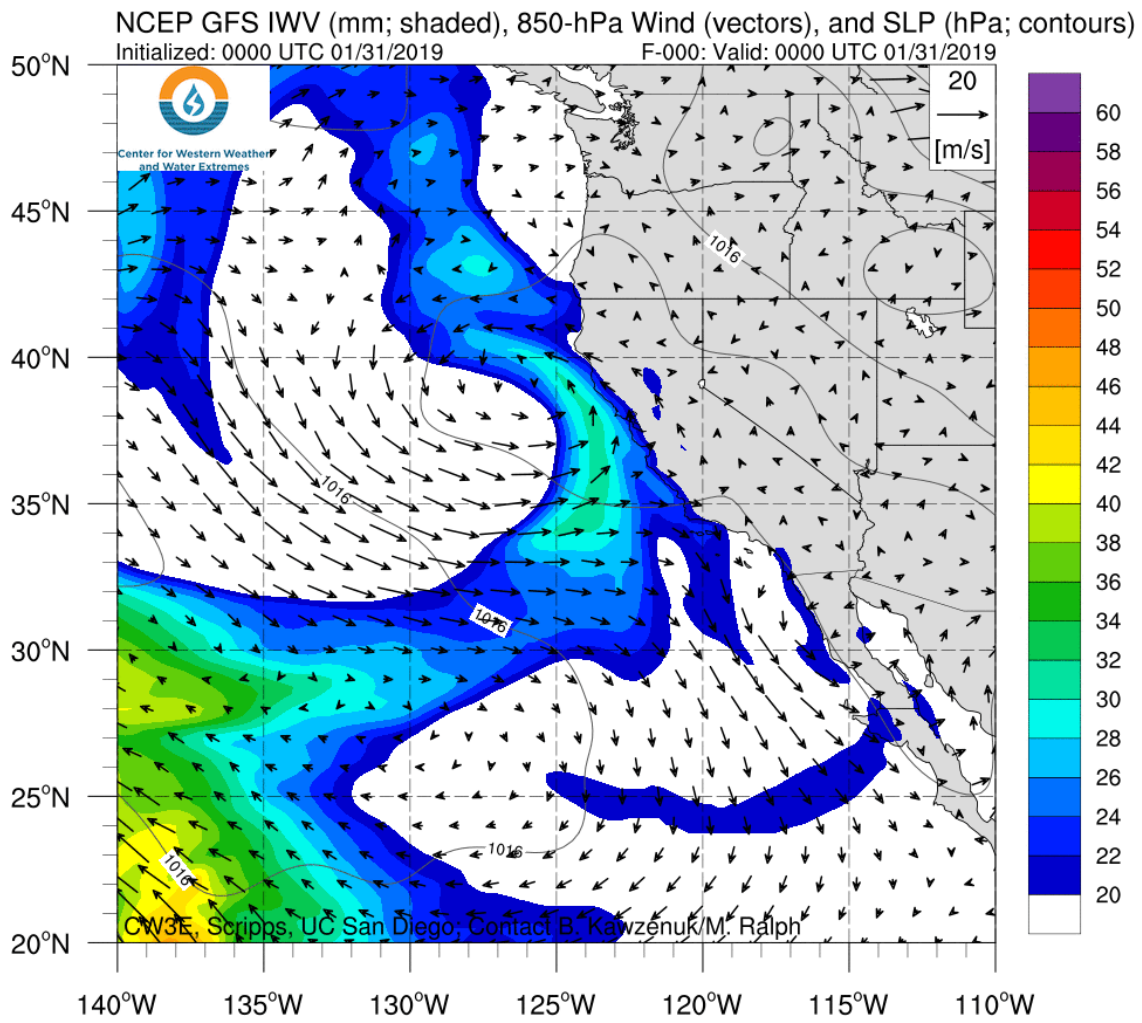
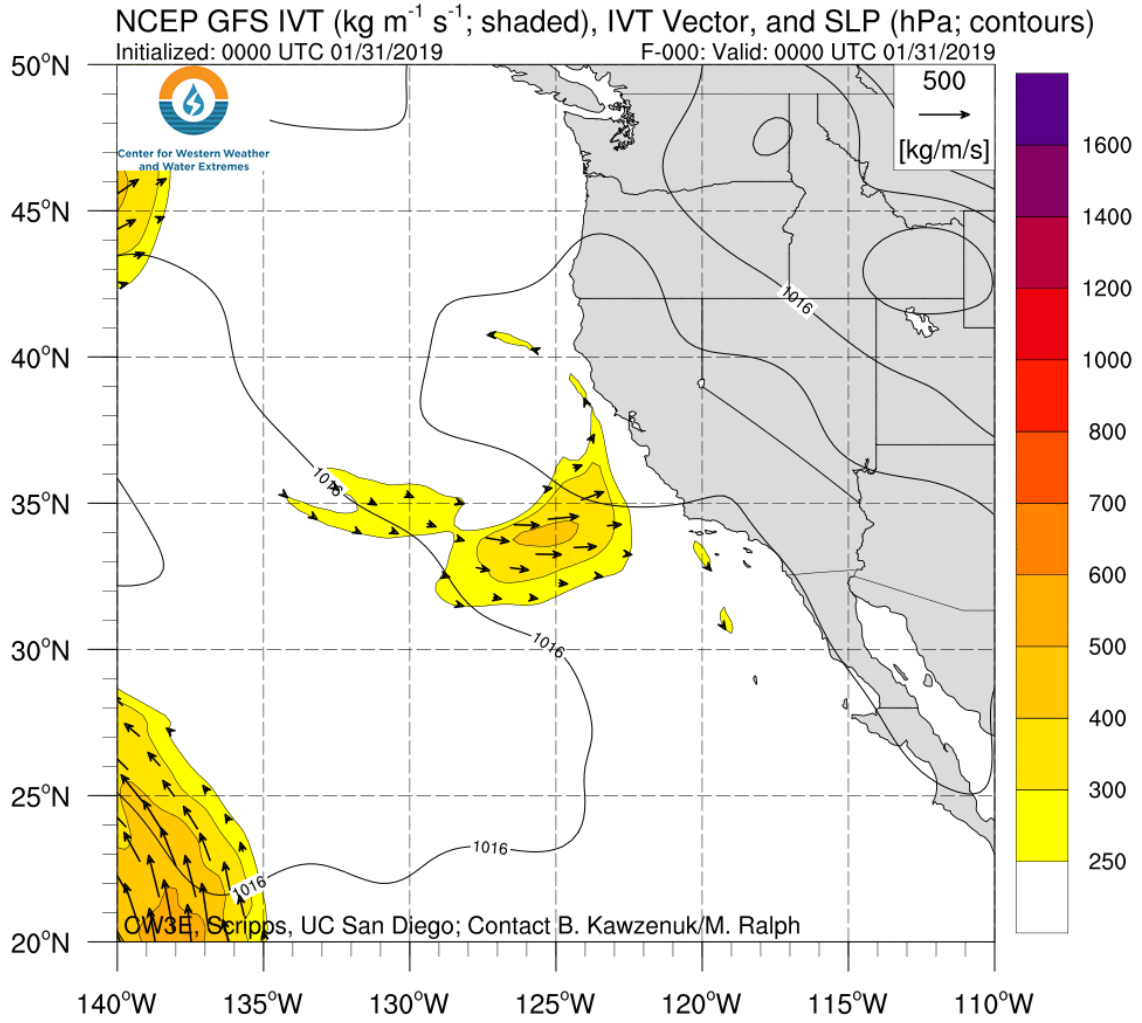
NCEP GFS Analysis 00 UTC 31 January to 18 UTC 03 February 2019

SLP, IWV and 850-hPa Wind



SLP, IVT, and IVT Vector



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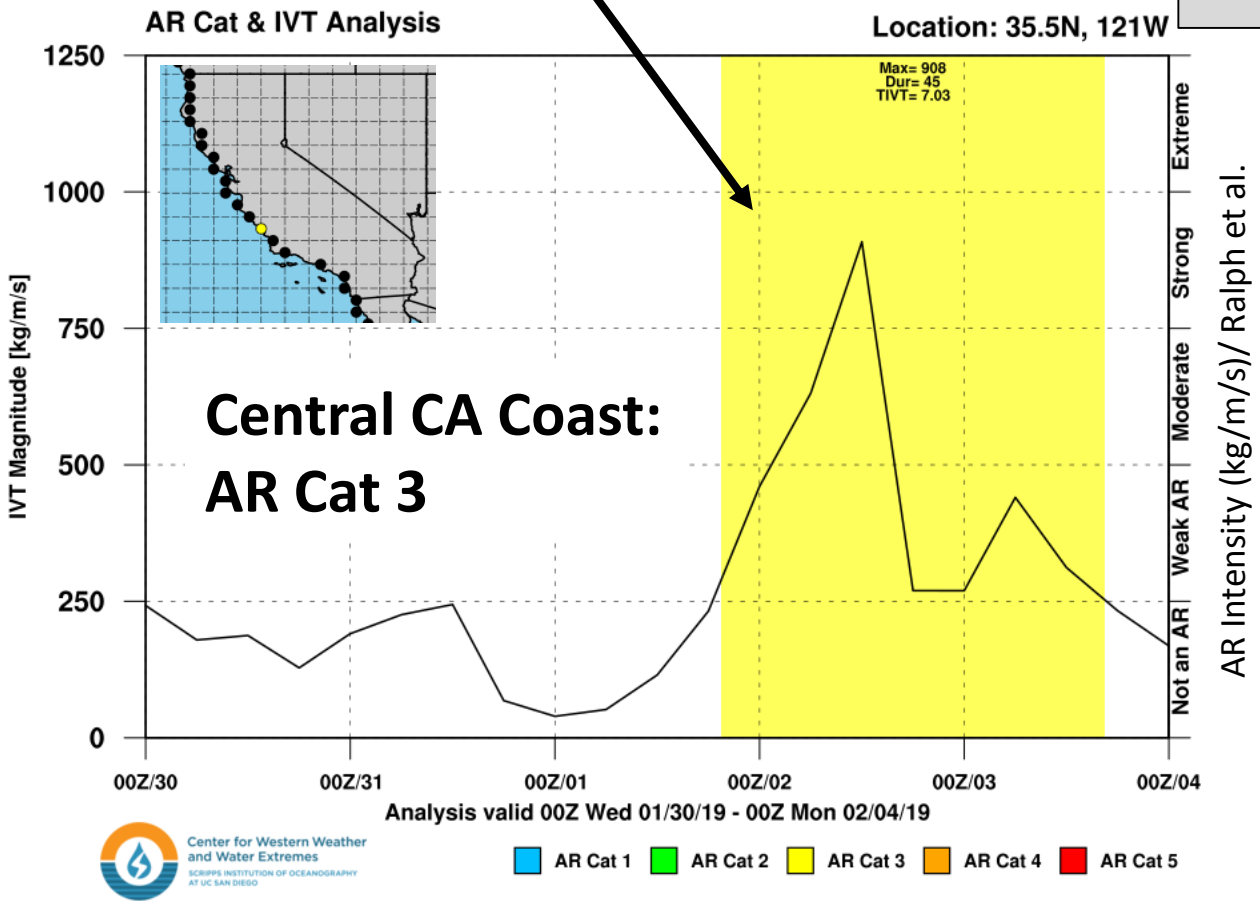
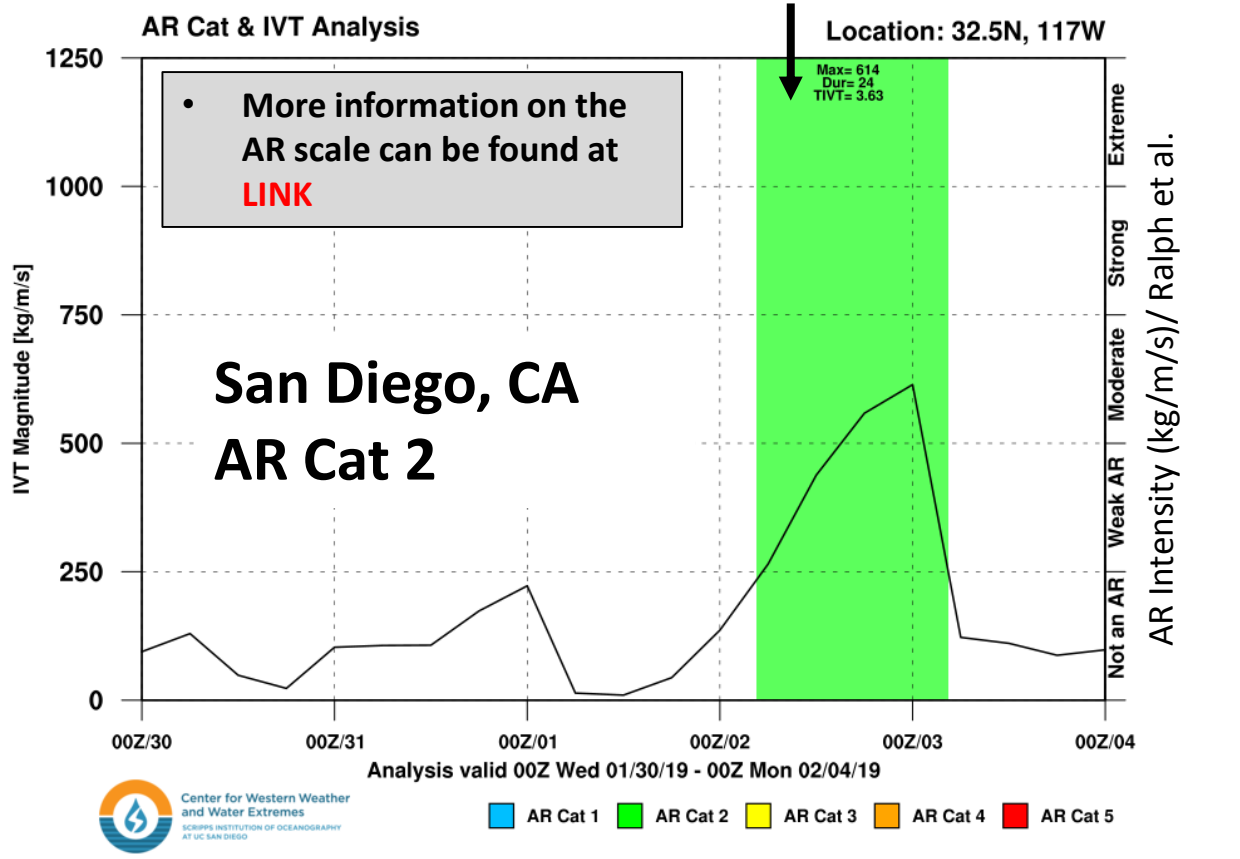
A scale for atmospheric river intensity and impacts was published in the *Bulletin of the American Meteorological Society on 5 February 2019*. This is its first application to a current event.

- **A coastal location over Central CA experienced a max IVT of 908 kg/m/s and AR conditions lasted 45 hours, which is an Atmospheric River Category 3 (Based on GFS Analysis) using the Ralph et al scale.**

- **The AR Category scale was developed by CW3E director F. Martin Ralph (lead) with J. Rutz, M. Anderson, J. Cordeira, M. Dettinger, D. Reynolds, L. Schick and C. Smallcomb. *(Ralph et al. 2019)***

- **Other Coastal Locations such as San Diego County experienced an AR Cat 2 event**





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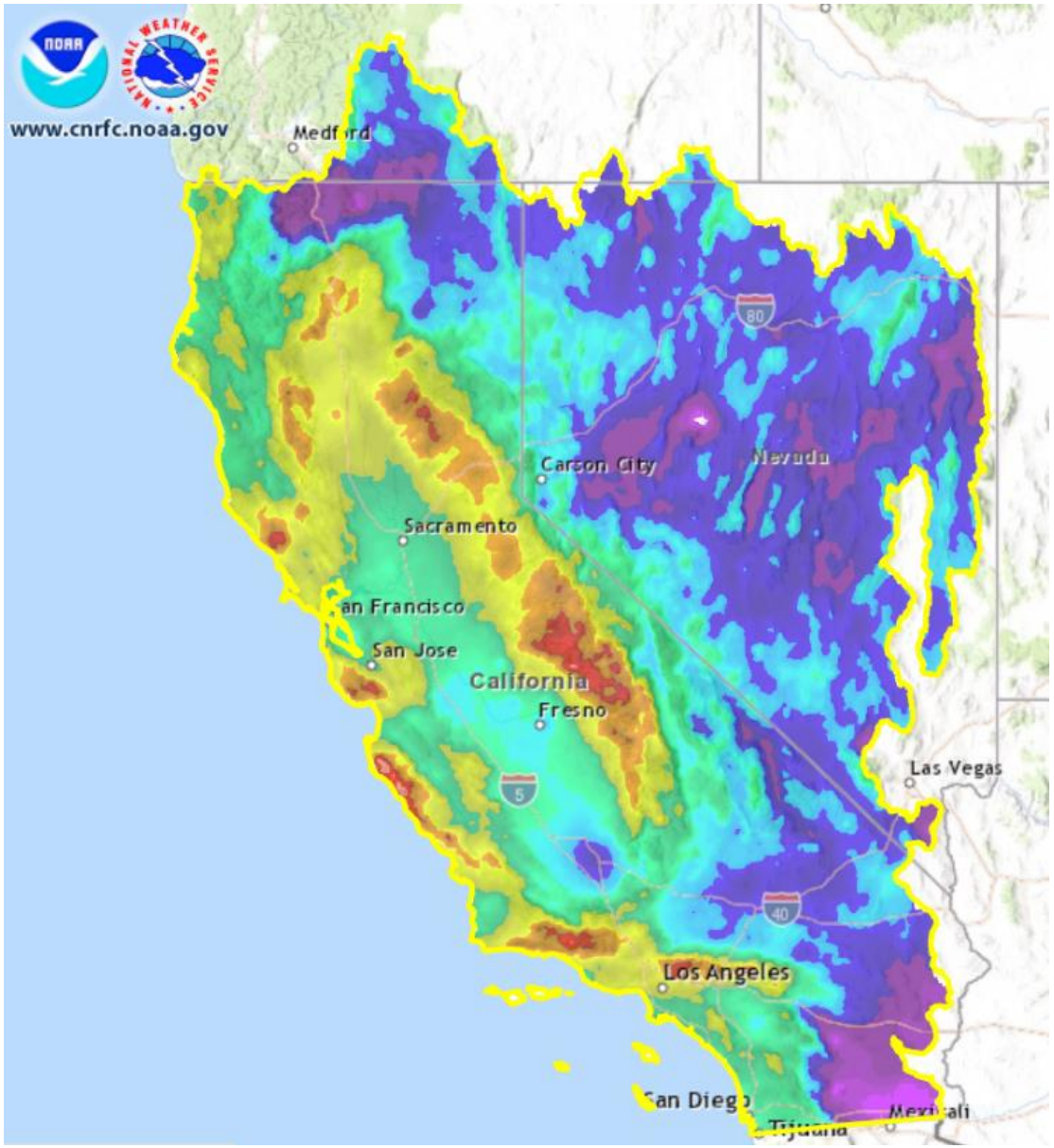

- **Numerous high elevation locations across California received greater than 6 inches of precipitation from 12Z 01 through 12Z 04 February 2019 (4 AM to 4 AM PST)**

<u>Statewide Maxima</u>
Southern High Sierra: 7.2 inches
Costal Big Sur: 8.85 inches
Sierra Madre Mountains: 7.75 inches
San Gabriel Mountains: 7.25 inches

- **Other low elevation locations, such as the Central Valley, the Los Angeles Basin, San Francisco Bay Area, Orange County, and San Diego County received 1–2 inches or precipitation**

NWS CNRFC Quantitative Precipitation Estimates available at https://cnrfc.noaa.gov/

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- **The landfall of the AR and the high precipitation rates produced by the associated NCFR led to numerous impacts across much of Southern CA**
- **Highway 101 through Montecito (in vicinity of Thomas Fire burn area) was closed in both directions and multiple road closures throughout the Malibu/Santa Monica Mountains area (in vicinity of Woolsey Fire burn area) were reported, in both cases, due to water, mud, and debris in roadways.**
- **Numerous Flash Flood and Hydrologic warnings were issued by the National Weather Service as well as several evacuations around recently burned areas across Southern California**
- **There were also two severe wind reports (Mariposa and Sutter County California) as well as a tornado report in Mariposa County associated with this system**

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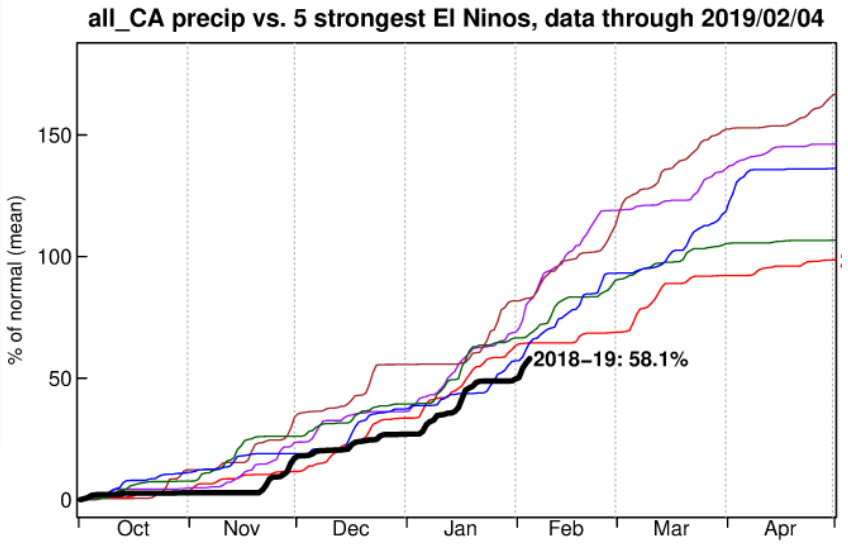
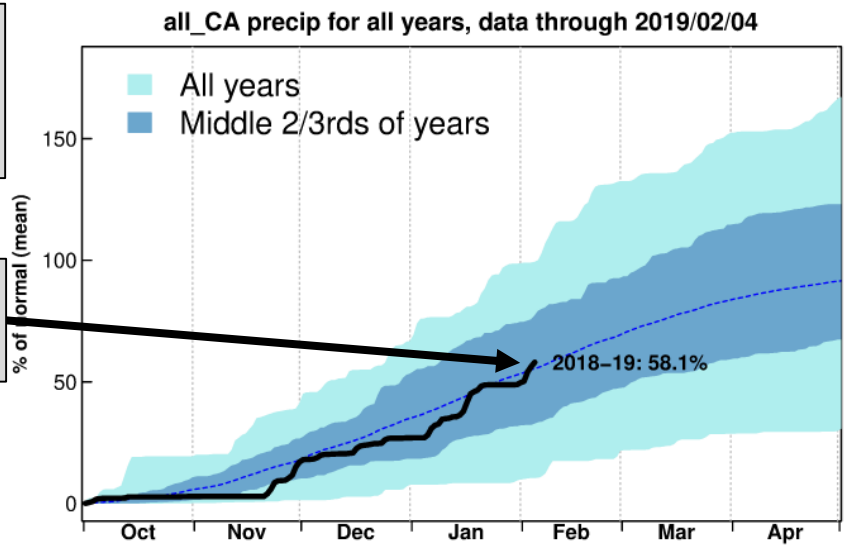
Current:	59.0%	1-day Δ:	2.27%	2-day Δ:	3.27%	3-day Δ:	8.83%
	(1963/02/04)						
Rec_low:	5.6%	50-ptile:	0.63%	50-ptile:	1.05%	50-ptile:	1.38%
Typ_low:	21.6%	90-ptile:	4.44%	90-ptile:	6.65%	90-ptile:	8.56%
Mean:	47.2%	95-ptile:	6.14%	95-ptile:	9.51%	95-ptile:	11.78%
Typ_high:	68.3%	99-ptile:	10.50%	99-ptile:	17.09%	99-ptile:	20.78%
Rec_high:	129.2%	Record:	31.62%	Record:	44.98%	Record:	58.15%
	(1993/02/04)		(1927/02/16)		(1927/02/17)		(1927/02/17)



- **The State of California saw a 3-day change of total WY precipitation percent of normal of 8.83% (50.17% of normal to 59% percent of normal), which is above the 90th percentile of 3-day increases since records began**

- **This 3-day increase of 8.83% of normal WY Precipitation brought WY 2019 to above normal for WY to date precipitation (Water Year begins October 1)**



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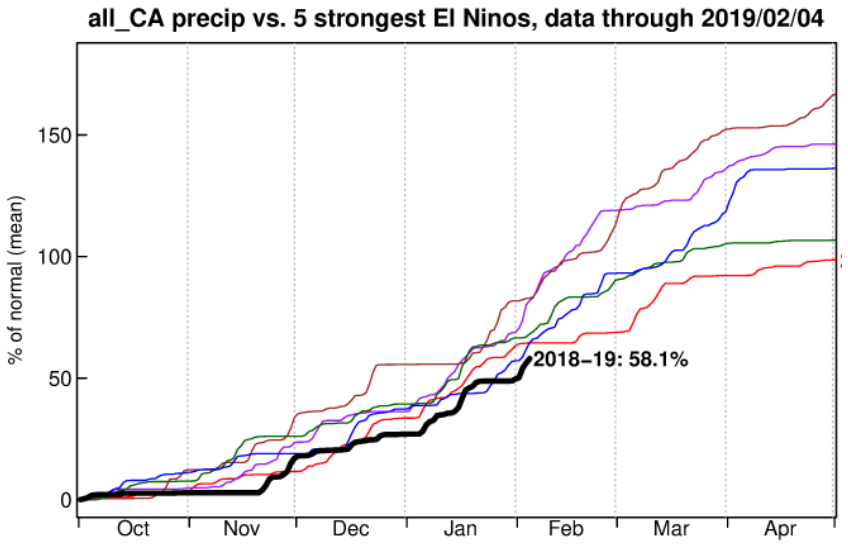
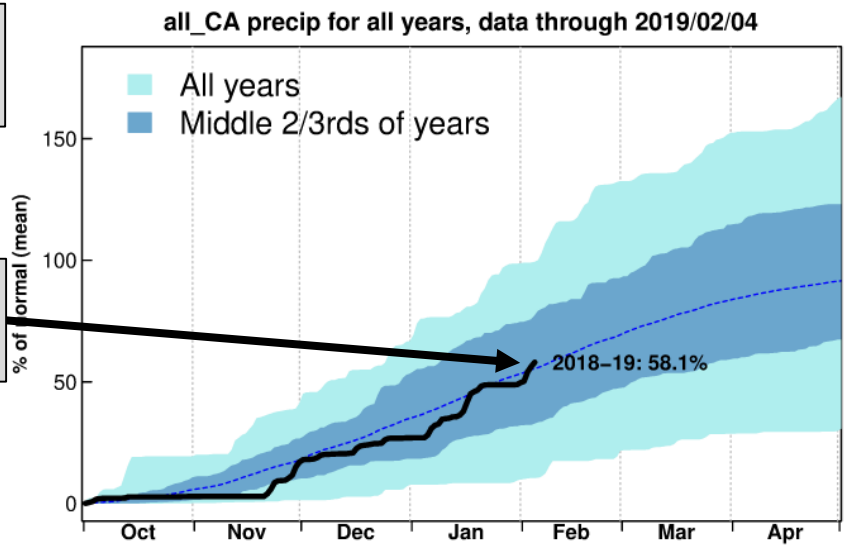
Current:	84.3%	1-day Δ:	3.57%	2-day Δ:	7.14%	3-day Δ:	17.48%
	(1963/02/04)						
Rec_low:	6.2%	50-ptile:	0.39%	50-ptile:	0.64%	50-ptile:	0.96%
Typ_low:	25.0%	90-ptile:	4.80%	90-ptile:	7.53%	90-ptile:	9.46%
Mean:	52.5%	95-ptile:	7.30%	95-ptile:	11.35%	95-ptile:	14.61%
Typ_high:	81.3%	99-ptile:	13.31%	99-ptile:	20.64%	99-ptile:	27.12%
Rec_high:	136.3%	Record:	23.35%	Record:	42.66%	Record:	49.58%
	(2005/02/04)		(1956/01/26)		(1943/01/23)		(1943/01/24)

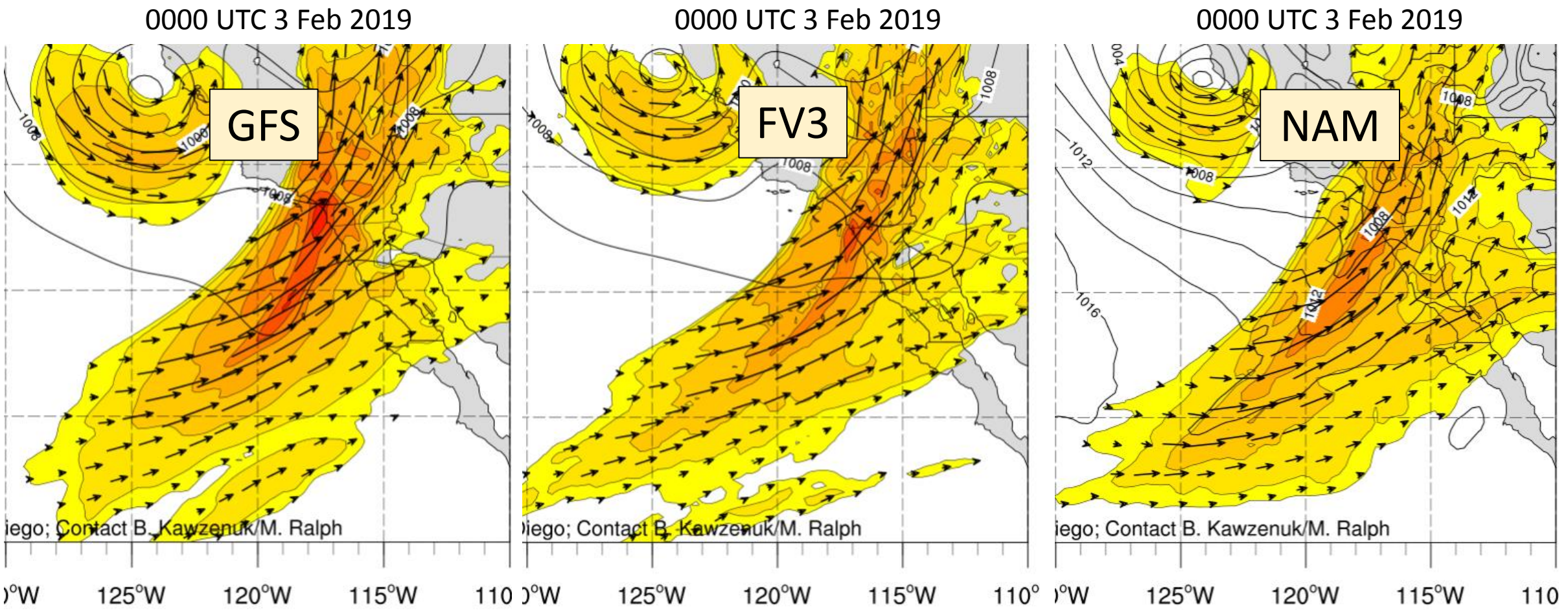


- **The Los Angeles Basin saw a 3-day percent of total normal WY precipitation change of 17.48%, which is well above the 95th percentile of 3-day increases**

- **This 3-day increase of 17.48% of normal brought WY 2019 to 59% of normal total WY precipitation, which is above normal for this date**



Three weather models predicted significantly different AR landfalls 2.5 days before landfall. Illustrates forecast uncertainty that was the focus of the first AR Recon flights of 2019.



Initialized at 0600 UTC 31 Jan 2019

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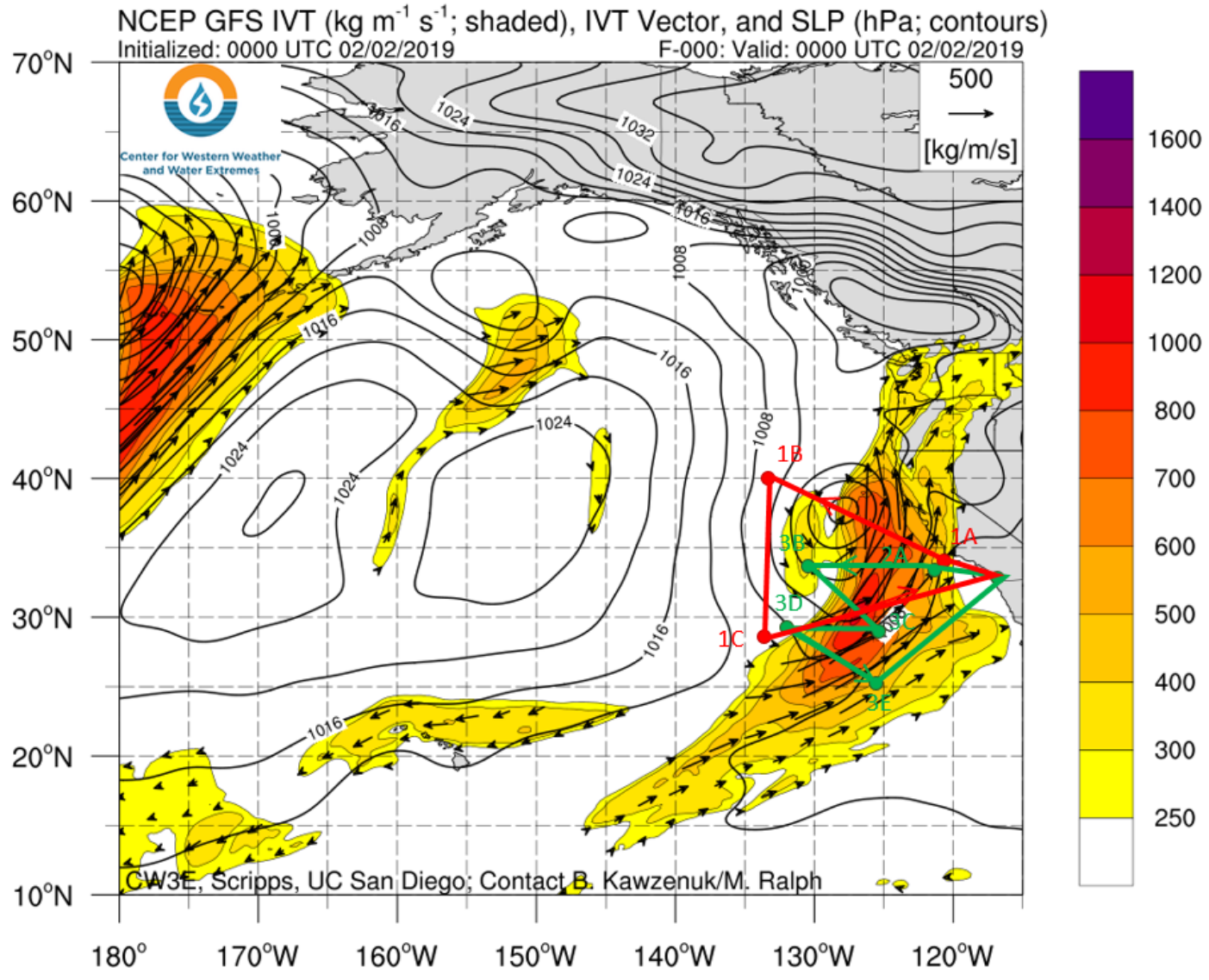

- **This AR coincided with the start of Atmospheric River Reconnaissance, a field project led by CW3E Director F. M. Ralph (PI) and V. Tallapragada of NWS (Co-PI). It involves CW3E staff and numerous other collaborators, such as the Air Force 53rd Weather Reconnaissance Squadron.**

- **Two Air Force C-130s flew out of Brown Field in San Diego to release dropsondes that measured vertical profiles of wind, temperature and water vapor throughout this AR. The data were sent to the global data system for use by global weather prediction models aimed at improved prediction of the AR and associated precipitation.**

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- **Numerous CW3E scientists were deployed to Bodega Bay, CA in Sonoma County and Ukiah, CA in Mendocino County to launch weather balloons in order to collect atmospheric profiles of the AR**
- **A team was also deployed to collect stream samples throughout the East Fork Russian River watershed to further understand the hydrological processes that lead to high flows into Lake Mendocino**
- **This data collection effort is a part of the larger Lake Mendocino Forecast Informed Reservoir Operations (http://cw3e.ucsd.edu/firo/)**