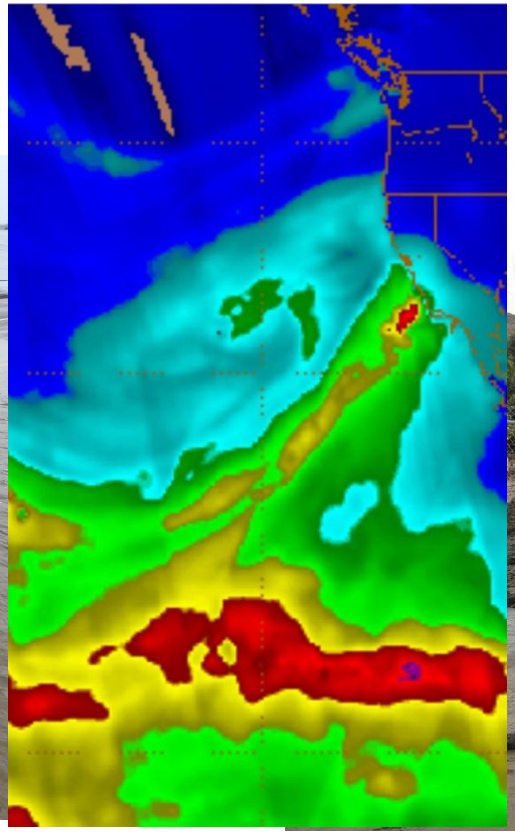
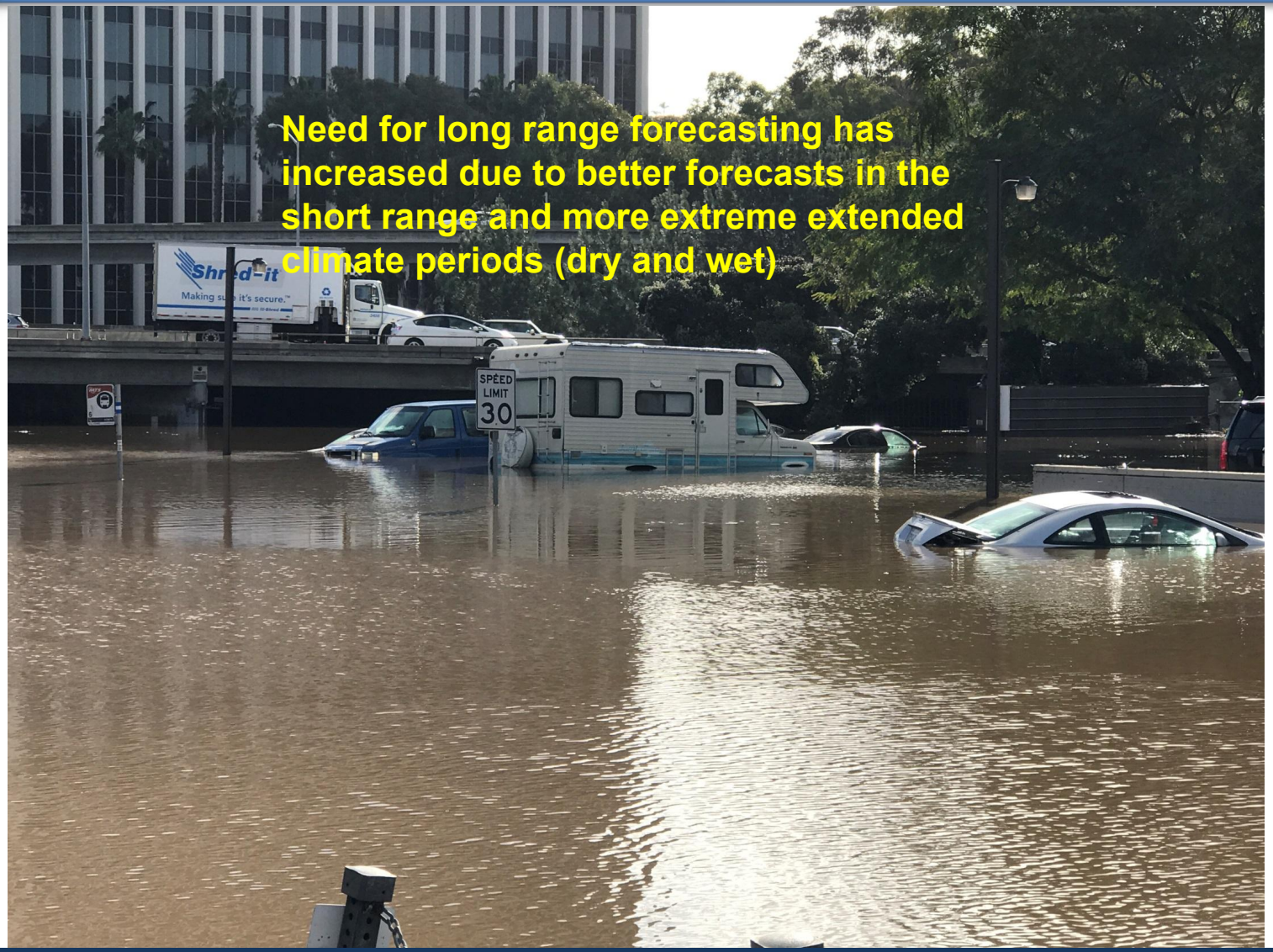
Using CFSv2 for long range pattern change and hydrological potential



Alex Tardy- NWS San Diego

Alexander.Tardy@noaa.gov

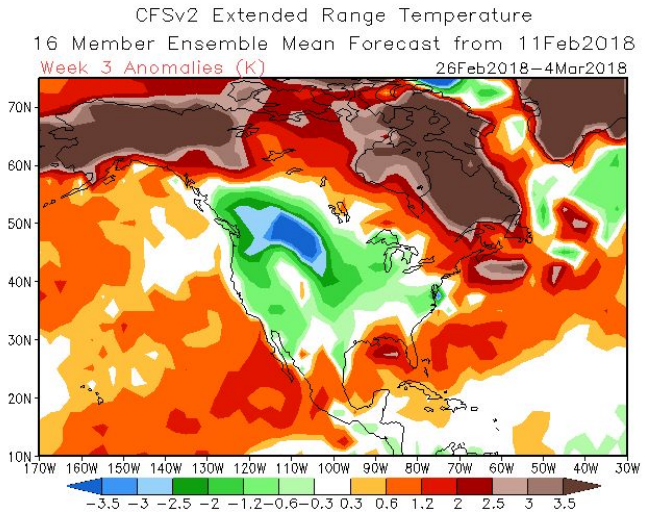
Decision makers want long range prediction beyond week 1

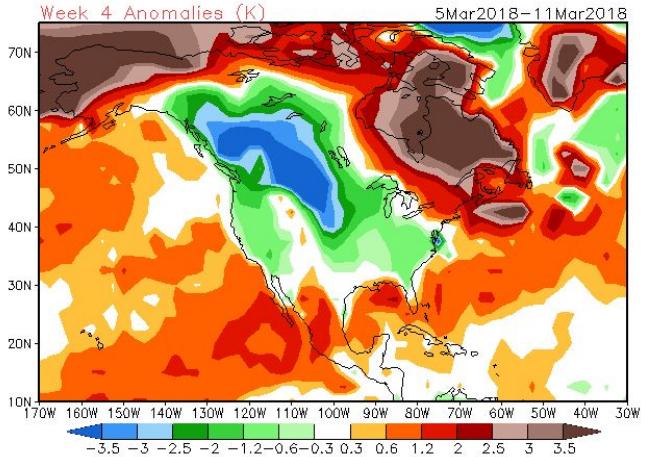


Using Climate Forecast System

Daily output – 16 member ensemble mean anomalies

Temperature

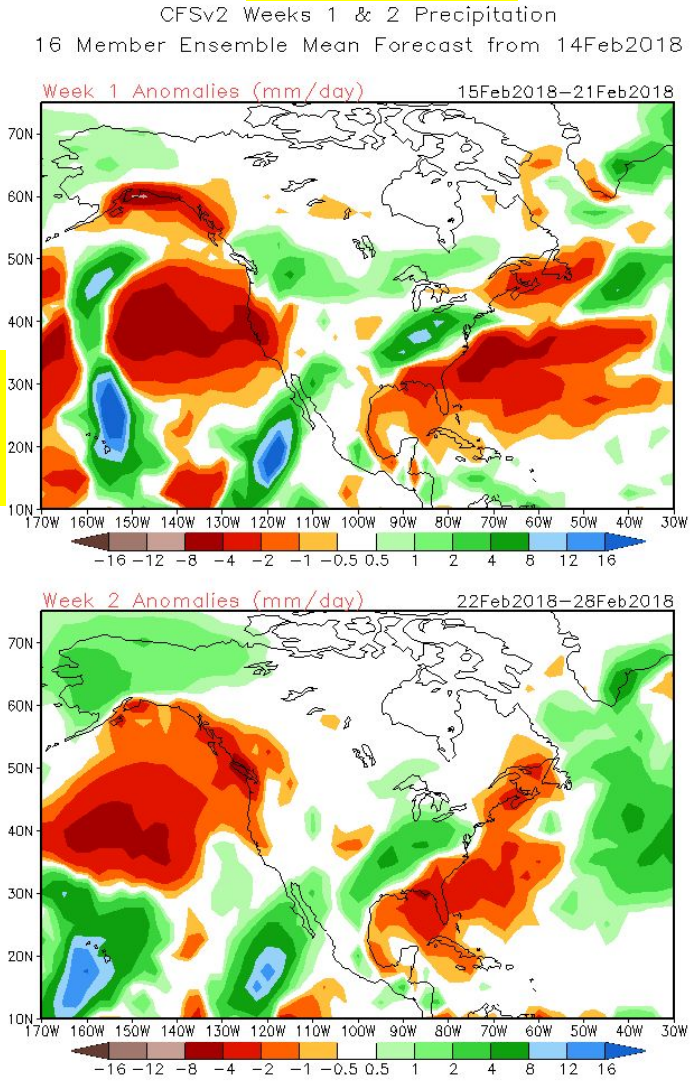




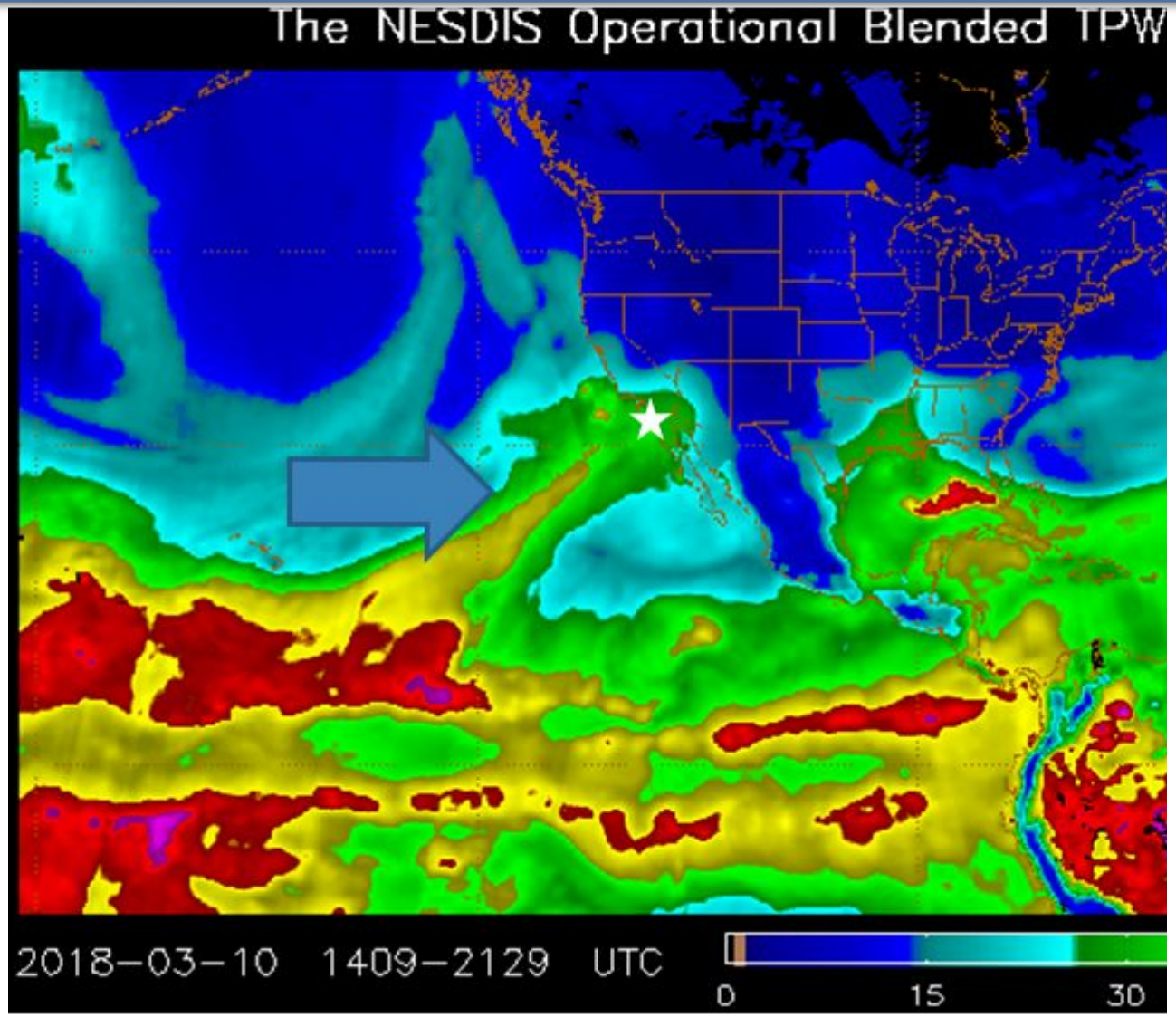
Green/blue = wet

Brown/red = dry

Precipitation



Atmospheric River and weak upper trough yielded orographic heavy rain

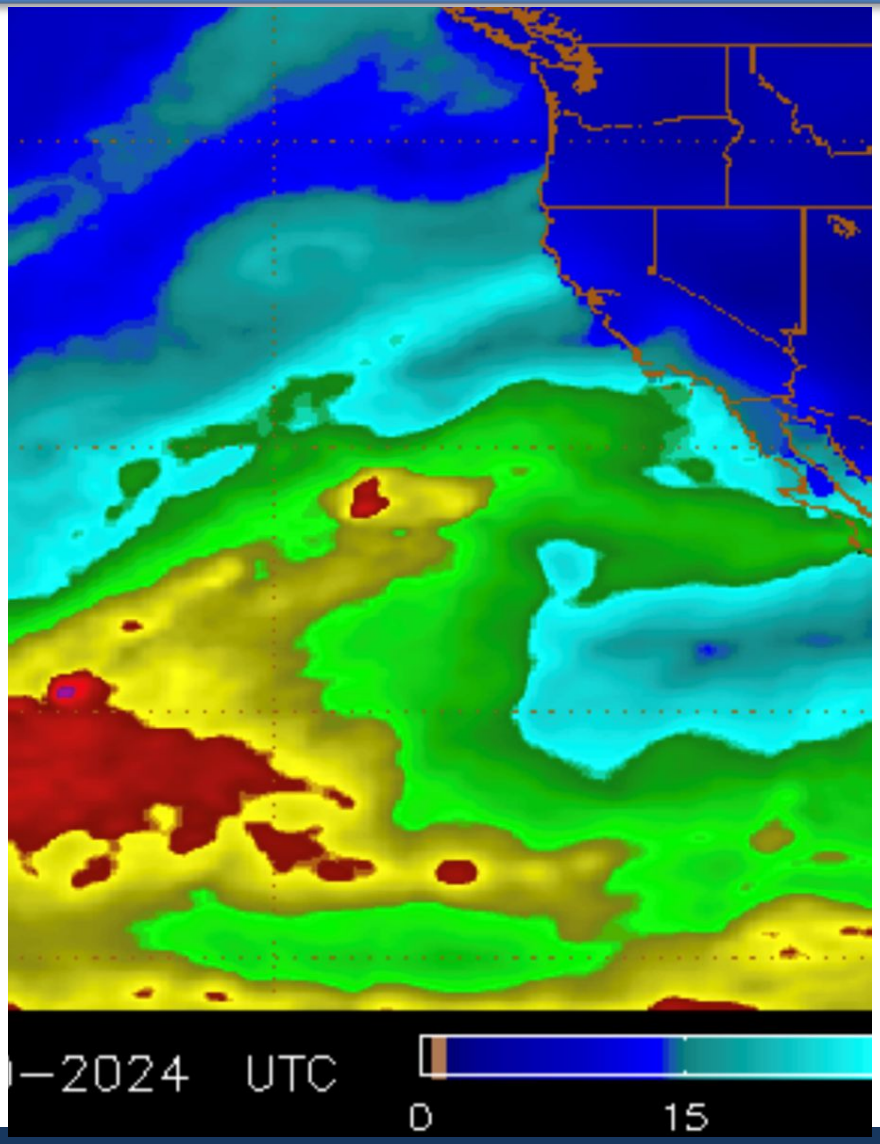


Long range forecasting
Atmospheric River March 10-11, 2018

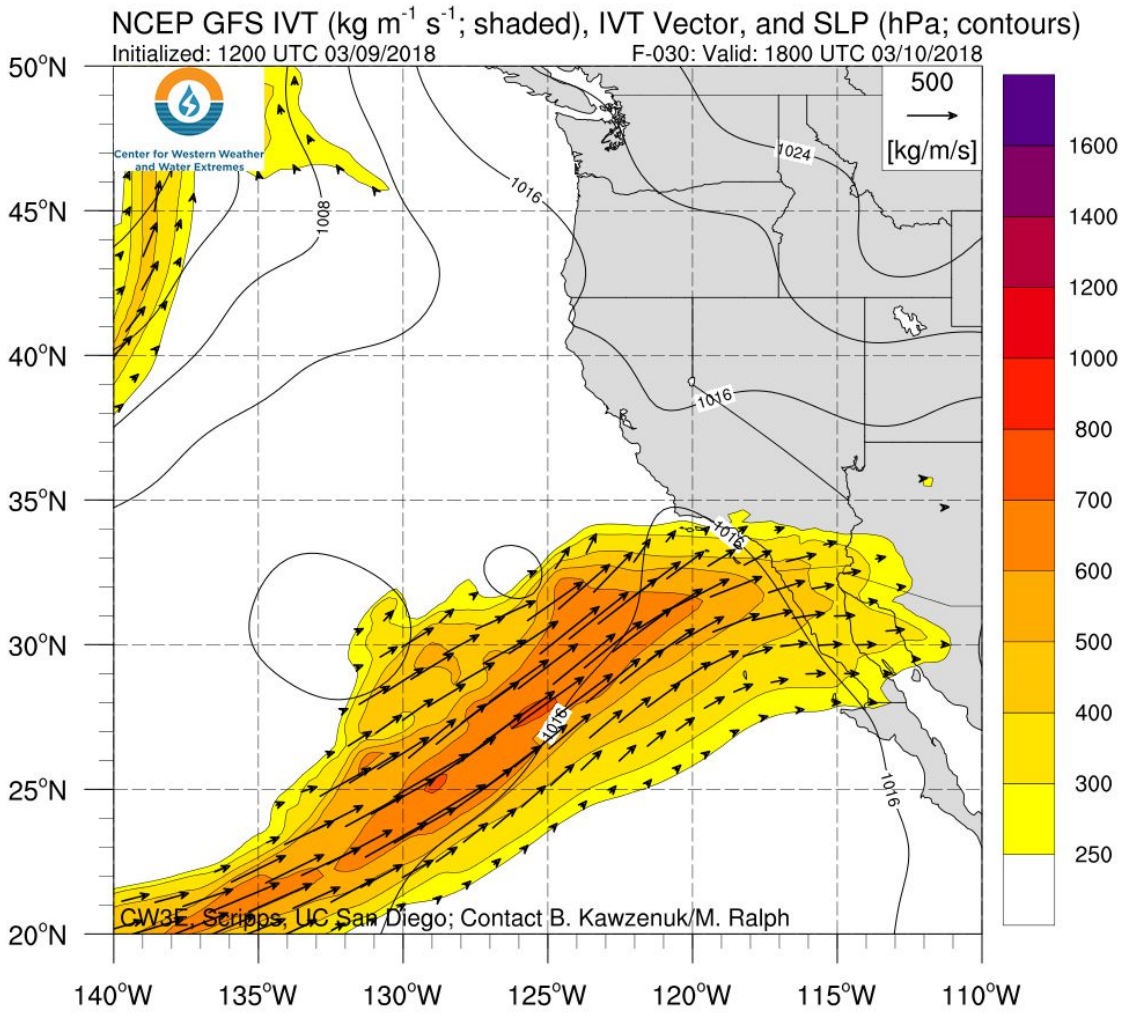
- The main trough was forecast to be weak (flat) and progressive
- The atmospheric river was well captured in the IVT (integrated water vapor transport over 500 into Orange and San Diego counties)
- The WPC, CNRFC and WFO forecasts were significant underforeast QPF prior to March 10
- March 10 WPC QPF and WFO QPF totals were doubled
- The rain was mostly 24 hours or less 4 pm Saturday to 1 am Sunday was the heaviest
- Drizzle and light rain (few hundreths) was widespread Saturday morning and afternoon on coast and inland valleys with upslope enhancement
- Orographic coastal slopes received 1.5 to 3.5 inches (Palomar Mtn highest)
- Spill over into High Deserts (0.25 to 0.50) and Coachella Valley (0.10 or less)
- Orange and Inland Empire received 0.50 to 0.90 inches, and only small shadow area near Perris

Start of the AR approaching Socal

Friday
March 9



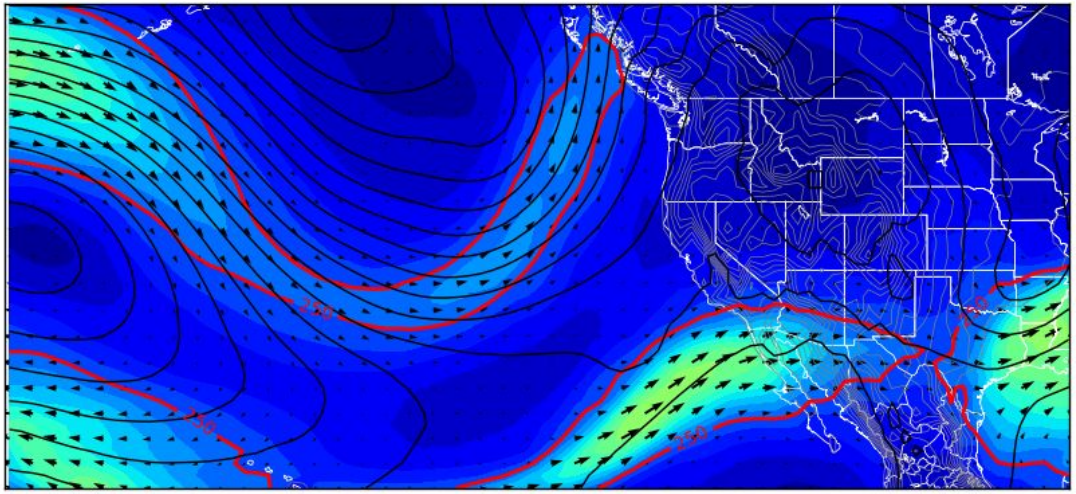
12 UTC 9 March GFS
30-h forecast of AR potential



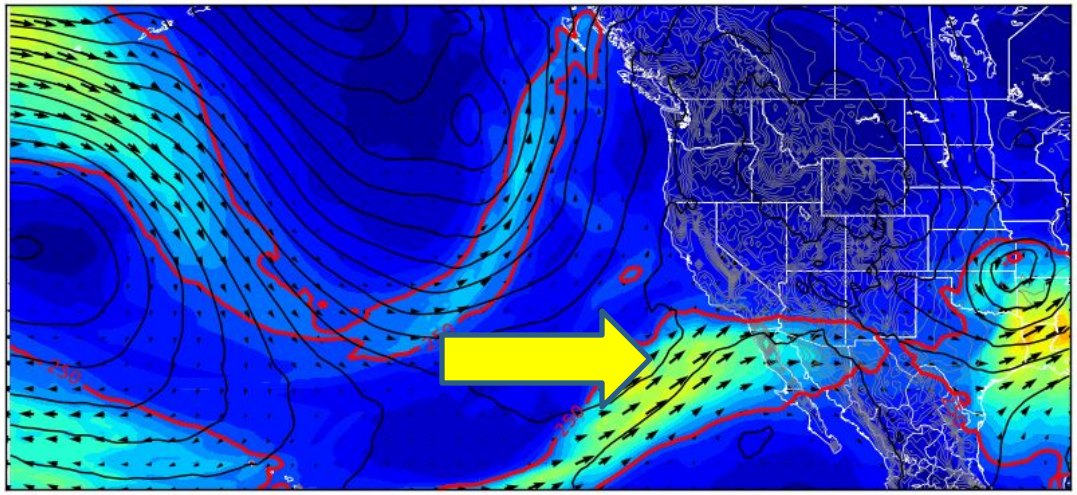
120 hour GFS
Finding an Atmospheric River

Integrated Water Vapor Transport (kg m^{-1} s^{-1})
120-h forecast valid 00:00 UTC Sun 11 Mar 2018

GEFS
Ensemble
Mean

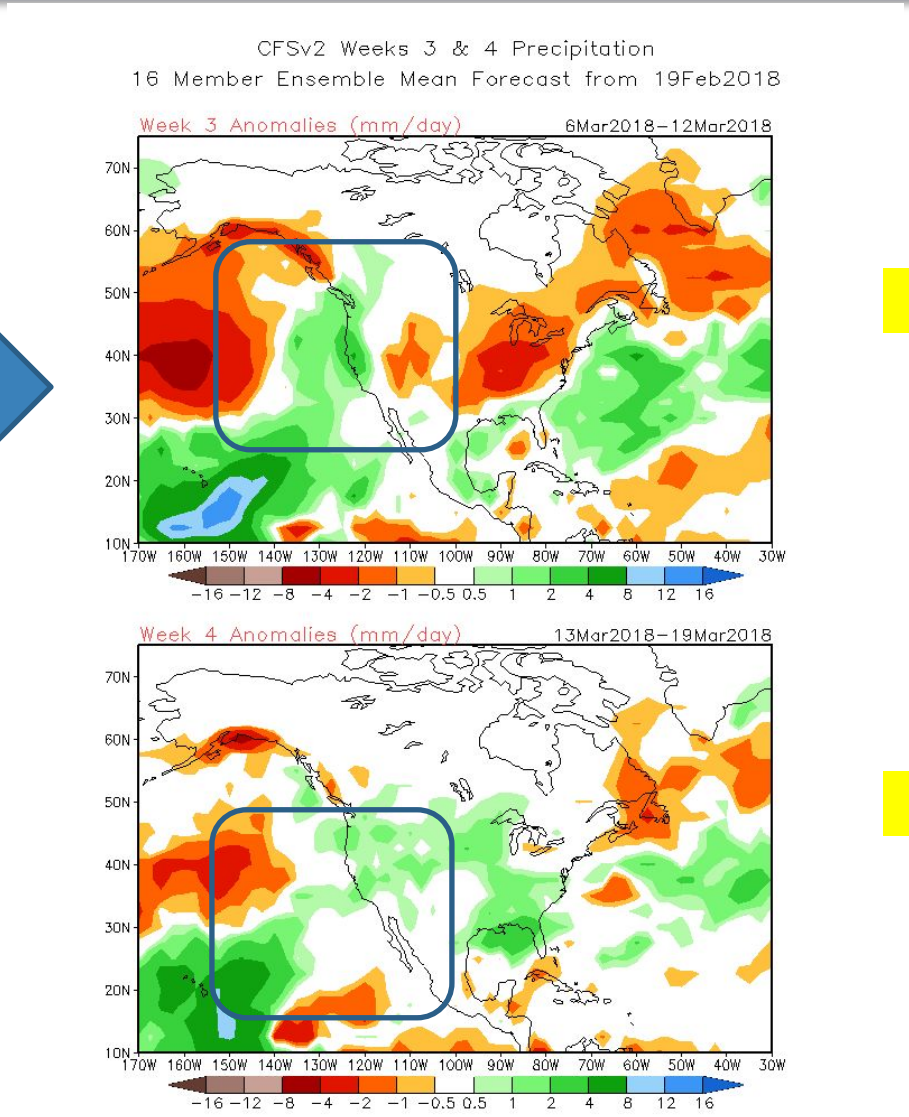


GFS



CFSv2 week 3 and 4 - Precipitation issued February 19

3-week lead

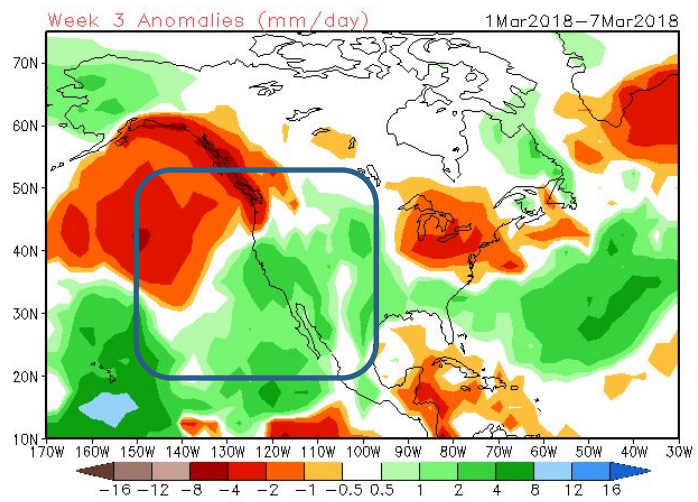


Valid March 6-12

Valid March 13-19

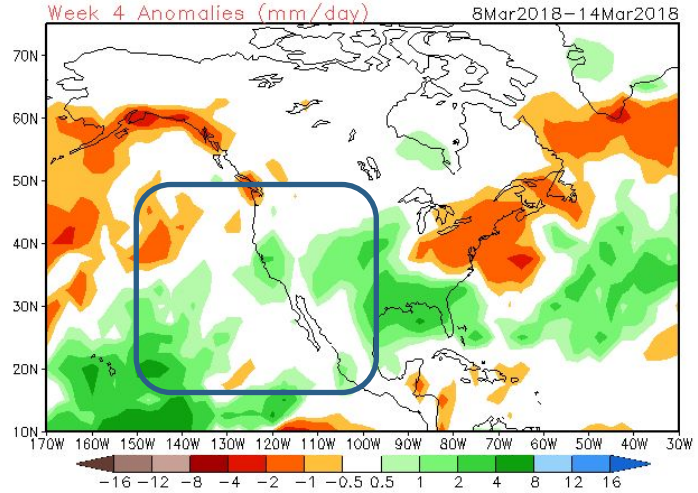
CFSv2 week 3 and 4 - Precipitation issued February 14

3-week lead



Valid March 1-7

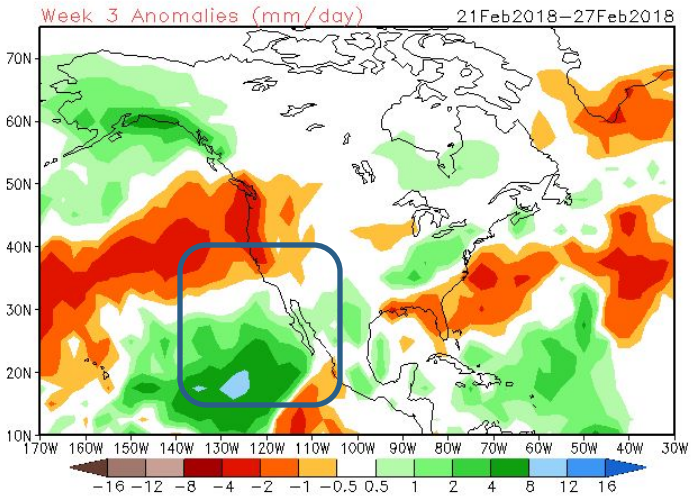
4-week lead



Valid March 8-14

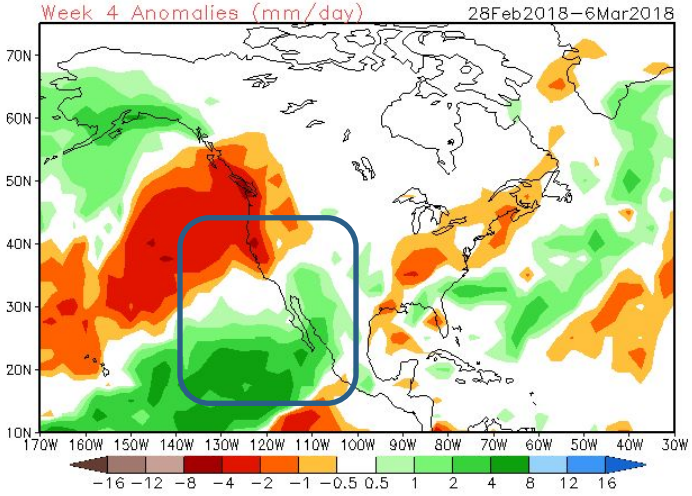
CFSv2 week 3 and 4 - Precipitation issued February 6 (tropical signal)

Other than January 10-11, 2018 event, 2017-2018 was off to the driest start to the water year through January 5



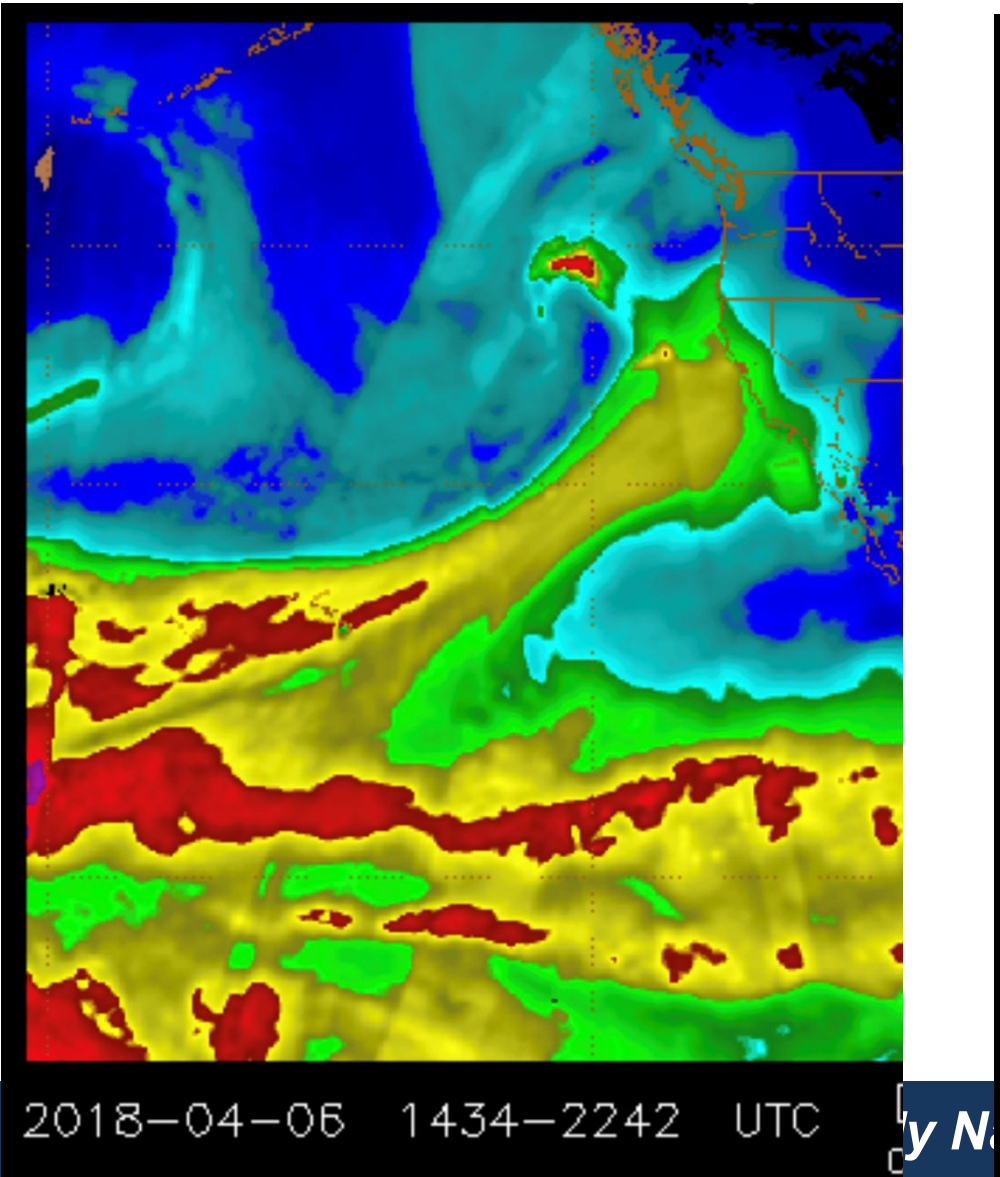
Valid Feb 21-27

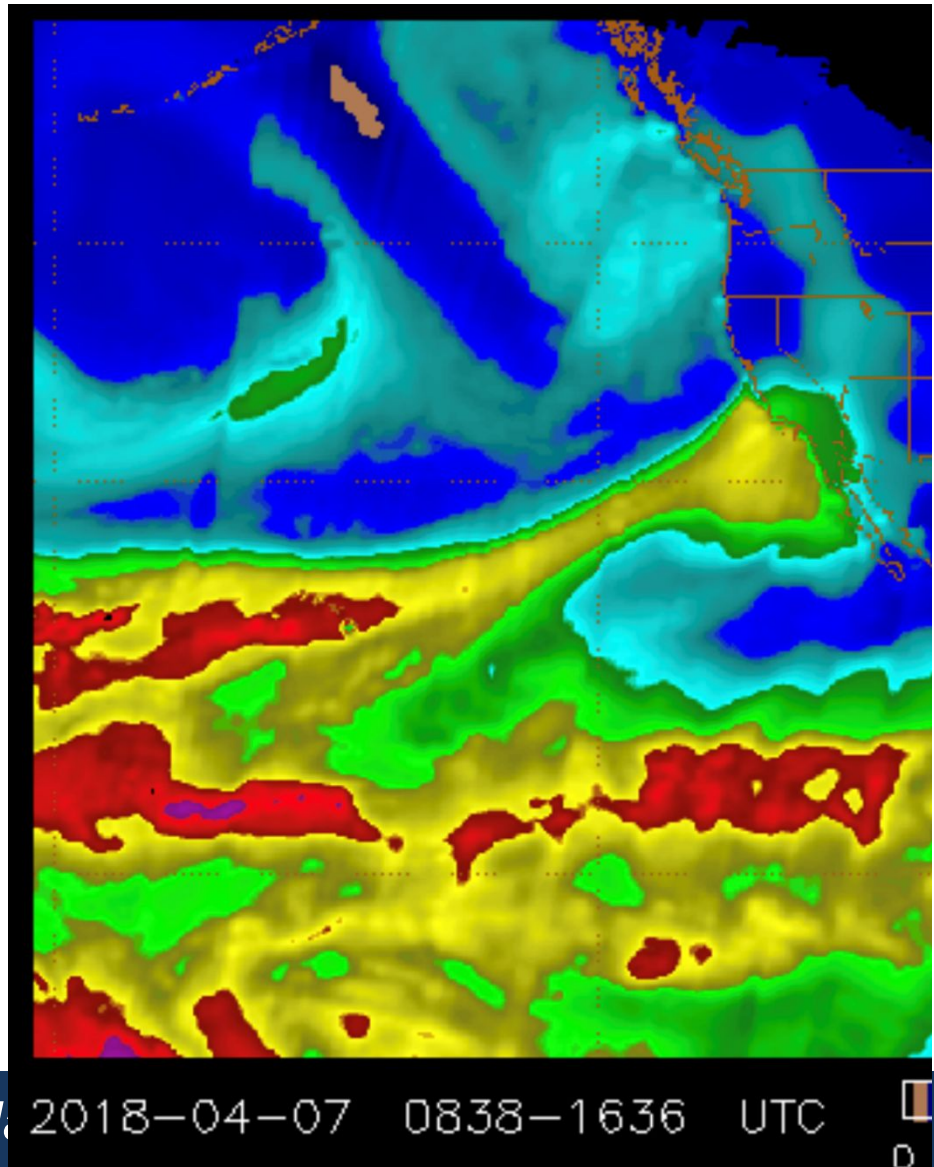
4-week lead



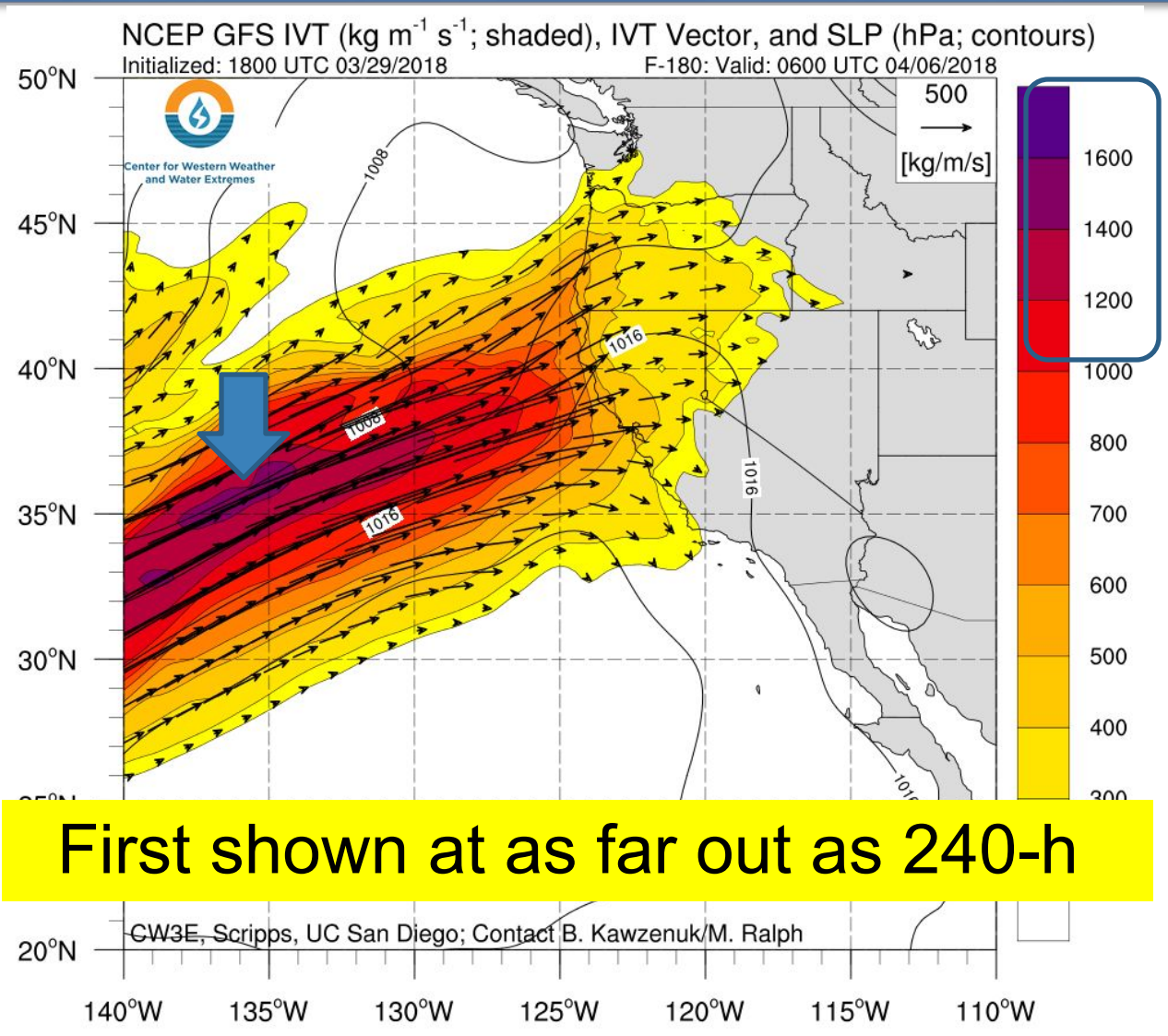
Valid February 28-March 6

Atmospheric River landfall
April 6, 2018



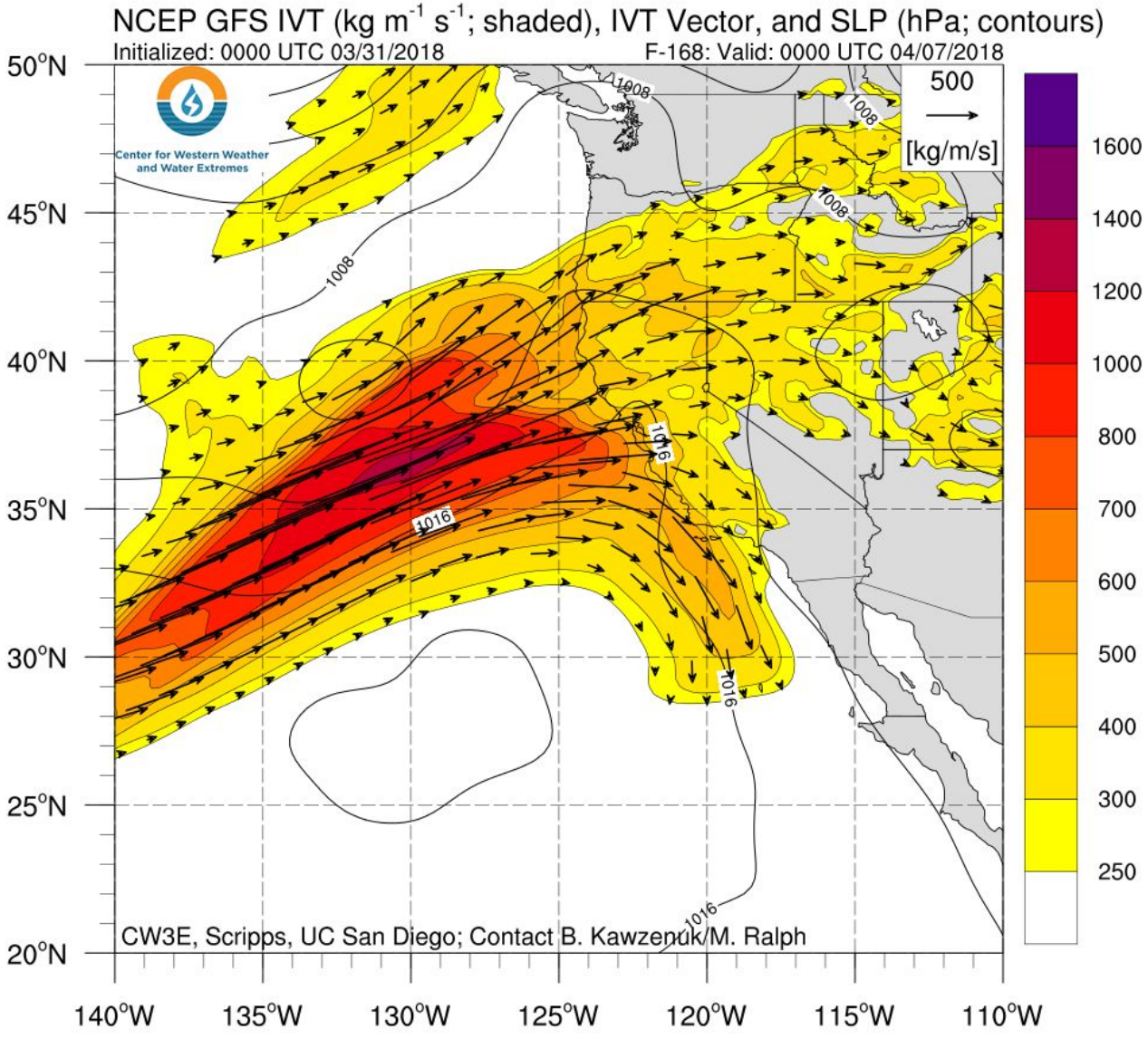


180-h IVT plume from GFS (as early as 240-h)

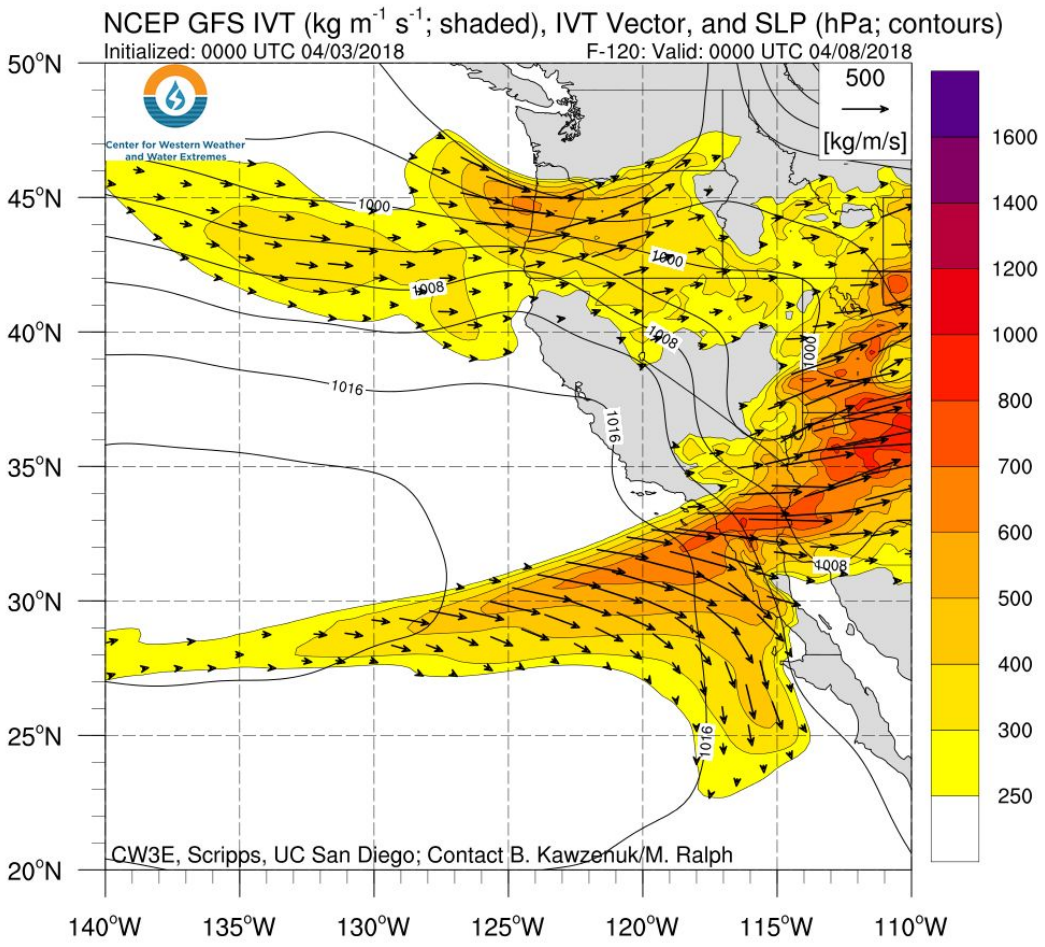


First shown at as far out as 240-h

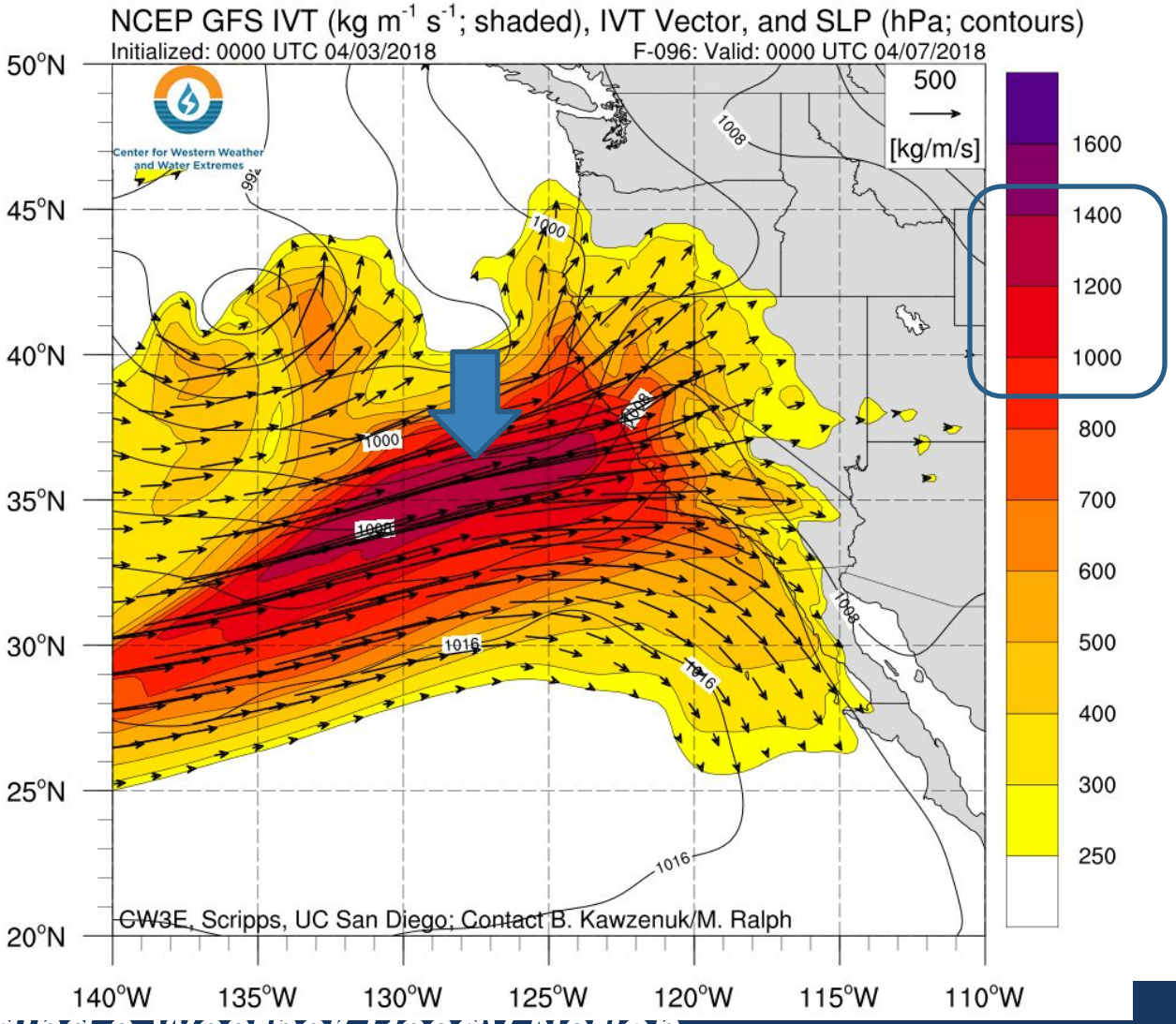
168-h IVT from GFS



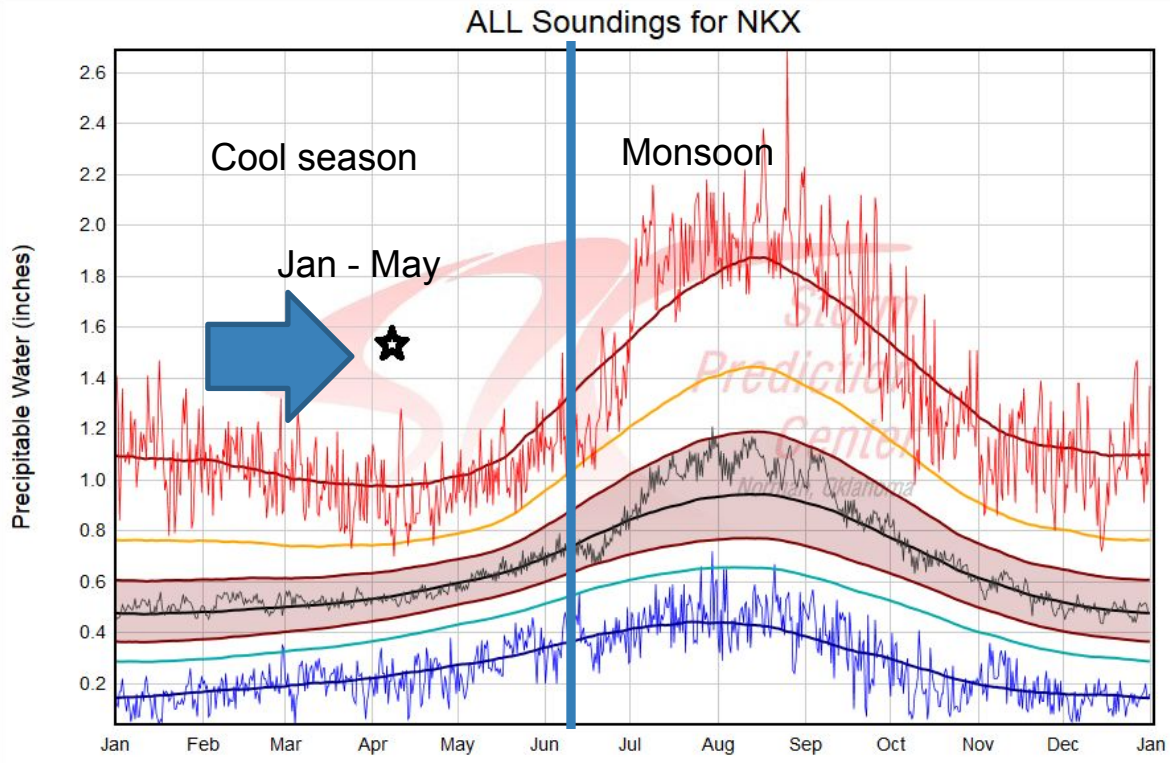
120-h IVT plume from GFS remnants of AR hits Socal



96-h IVT plume from GFS



Record Precipitable water at San Diego (NKX)



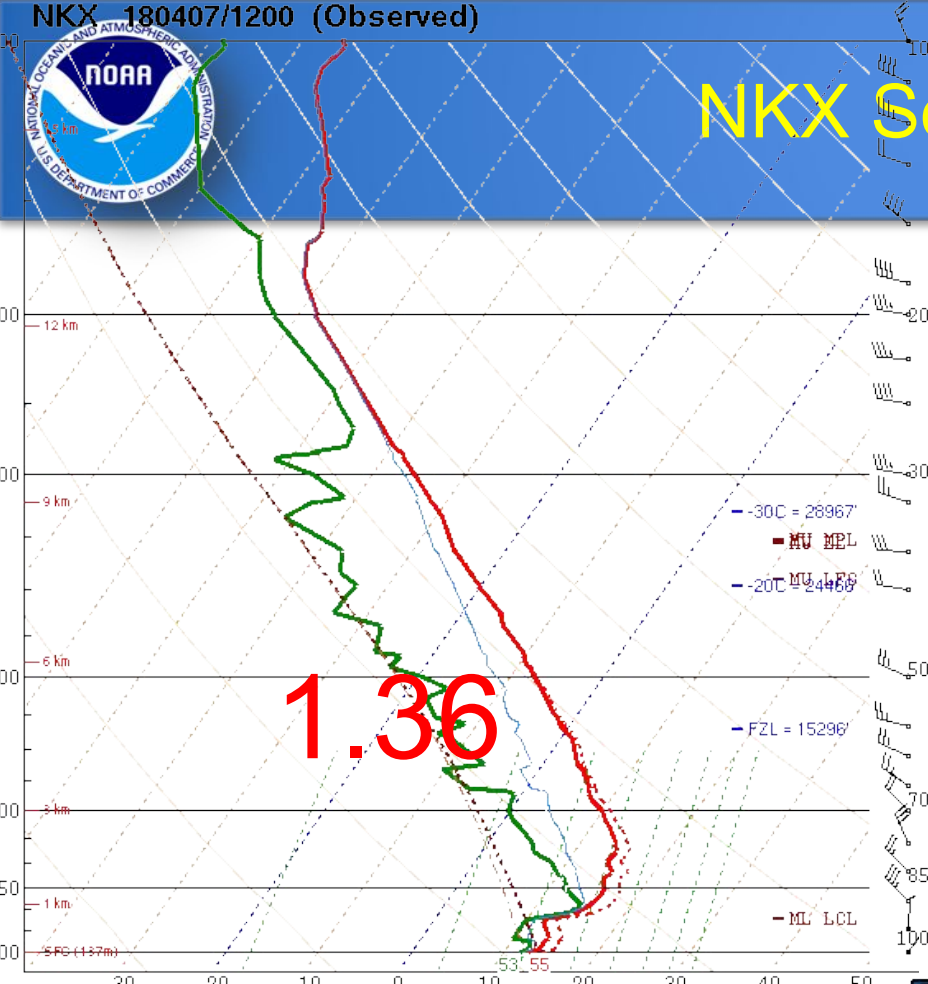
Daily Min (Thin Line): 0.17
Min Moving Average: 0.20
10% Moving Average: 0.33
25% Moving Average: 0.41

Median Moving Average: 0.51
Daily Mean (Thin Line): 0.52

75% Moving Average: 0.62
90% Moving Average: 0.74
Max Moving Average: 1.00
Daily Max (Thin Line): 0.84

Period of Record
NZY (1948/01/02-1956/06/15; 5556 soundings)
SAN (1956/06/16-1989/09/13; 24168 soundings)
NKX (1989/09/15-2014/10/26; 22315 soundings)

NKX Soundings



PARCEL	CAPE	CINH	LCL	LI	LFC	EL
SURFACE	0	0	114m	15	M	374'
MIXED LAYER	0	0	665m	10	M	2183'
FCST SURFACE	0	0	1681m	5	M	5514'
MU (889 mb)	2	-403	1058m	1	7577m	27045'

PW = 1.36 .in | 3CAPE = 0 J/kg | WBZ = 11762' | WNDG = 0.0
K = 25 | DCAPE = 480 J/kg | FZL = 15296' | ESP = 0.0
MidRH = 56% | DownT = 65 F | ConvT = M | MMP = 0.16
LowRH = 87% | MeanW = 9.2 g/kg | MaxT = 79F | NCAPE = 0.00
SigSevere = 0 m3/s3

Sfc-3km Agl Lapse Rate = 1.1 C/km
3-6km Agl Lapse Rate = 6.7 C/km
850-500mb Lapse Rate = 5.7 C/km
700-500mb Lapse Rate = 6.6 C/km

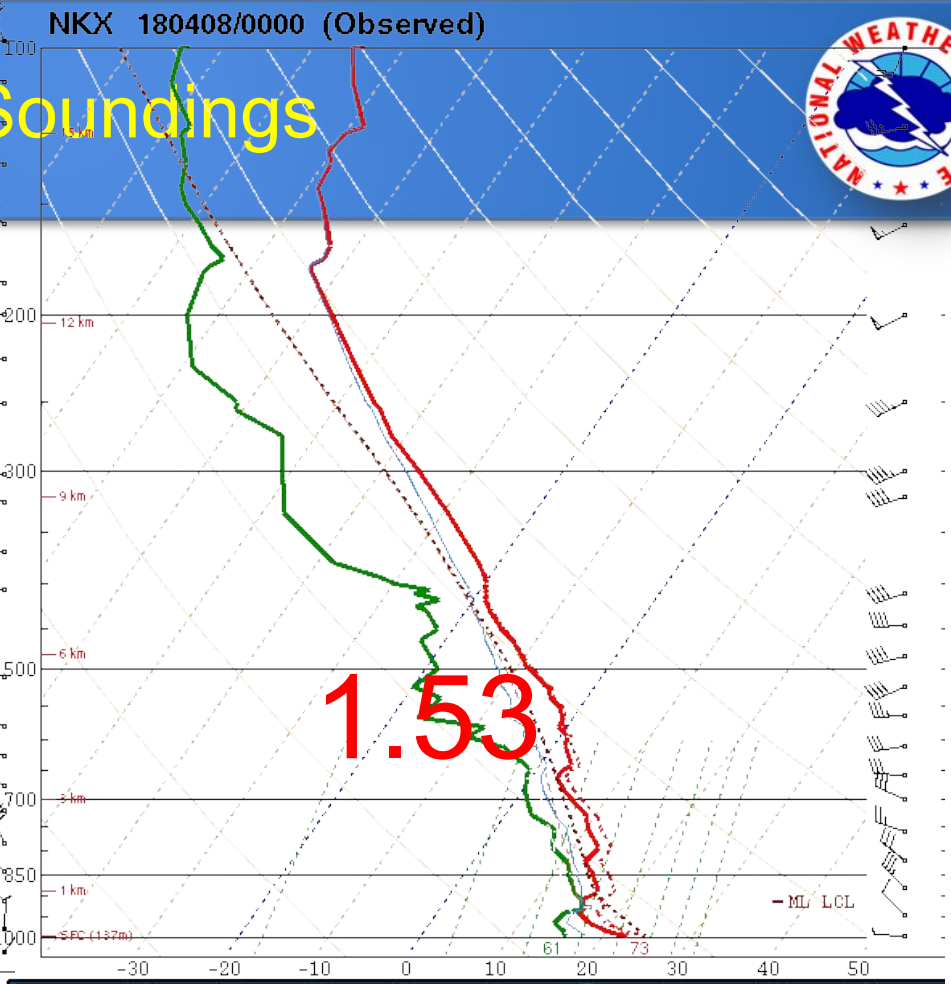
Supercell = 0.0
Left Supercell = 0.0
STP (eff layer) = 0.0
STP (fix layer) = 0.0
Sig Hail = 0.0

	SRH(m2/s2)	Shear(kt)
SFC - 1 km	75	31
SFC - 3 km	61	22
SFC - 6 km		27
SFC - 8 km		29

BRN Shear = 46 m²/s²
4-6km SR Wind = 211/21 kt

.....Storm Motion Vectors.....
Bunkers Right = 337/30 kt
Bunkers Left = 268/20 kt

Corfidi Downshear = 290/36 kt
Corfidi Upshear = 274/12 kt



PARCEL	CAPE	CINH	LCL	LI	LFC	EL
SURFACE	0	0	889m	2	M	2917'
MIXED LAYER	0	0	760m	3	M	2491'
FCST SURFACE	27	-145	1324m	0	6039m	24033'
MU (889 mb)	0	0	1338m	1	M	4388'

PW = 1.53 .in | 3CAPE = 0 J/kg | WBZ = 12704' | WNDG = 0.0
K = 30 | DCAPE = 618 J/kg | FZL = 14545' | ESP = 0.0
MidRH = 76% | DownT = 63 F | ConvT = 88F | MMP = 0.19
LowRH = 86% | MeanW = 11.6 g/kg | MaxT = 80F | NCAPE = 0.00
SigSevere = 0 m3/s3

Sfc-3km Agl Lapse Rate = 5.9 C/km
3-6km Agl Lapse Rate = 5.9 C/km
850-500mb Lapse Rate = 5.6 C/km
700-500mb Lapse Rate = 5.7 C/km

Supercell = 0.0
Left Supercell = 0.0
STP (eff layer) = 0.0
STP (fix layer) = -0.0
Sig Hail = 0.0

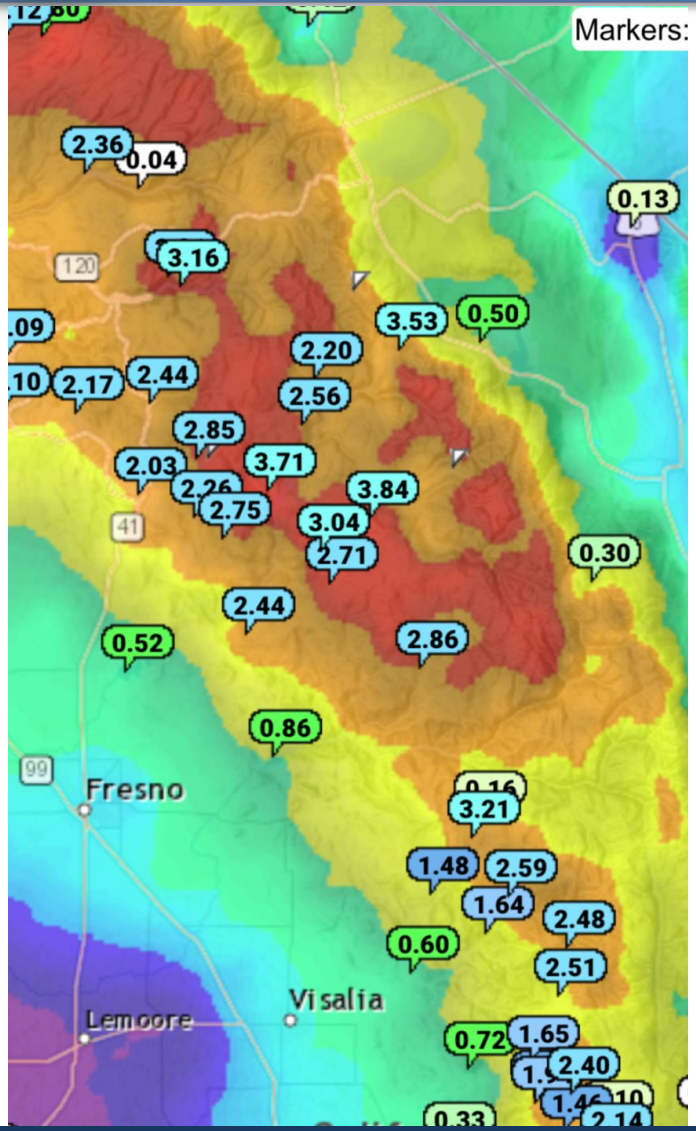
	SRH(m2/s2)	Shear(kt)	MnW
SFC - 1 km	-78	28	308/
SFC - 3 km	-64	26	304/
SFC - 6 km		33	288/
SFC - 8 km		37	282/

BRN Shear = 36 m²/s²
4-6km SR Wind = 188/29 kt

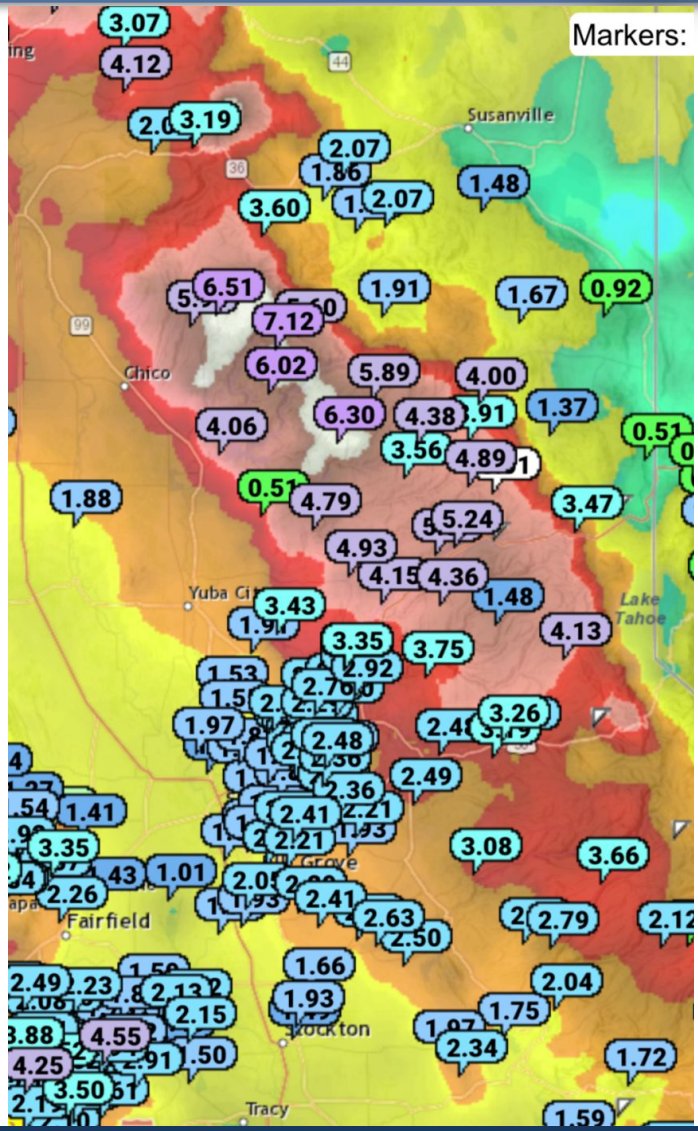
.....Storm Motion Vectors.....
Bunkers Right = 305/36 kt
Bunkers Left = 250/21 kt

Corfidi Downshear = 251/53 kt
Corfidi Upshear = 227/23 kt

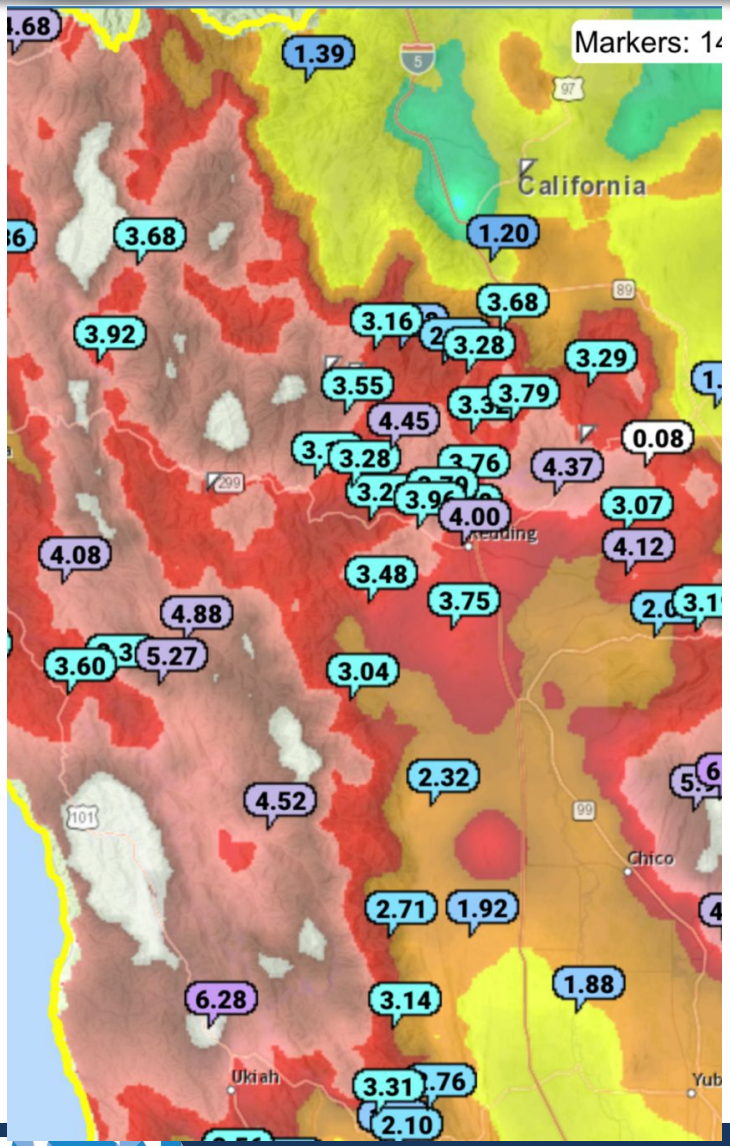
April 5-6, 2018 precipitation

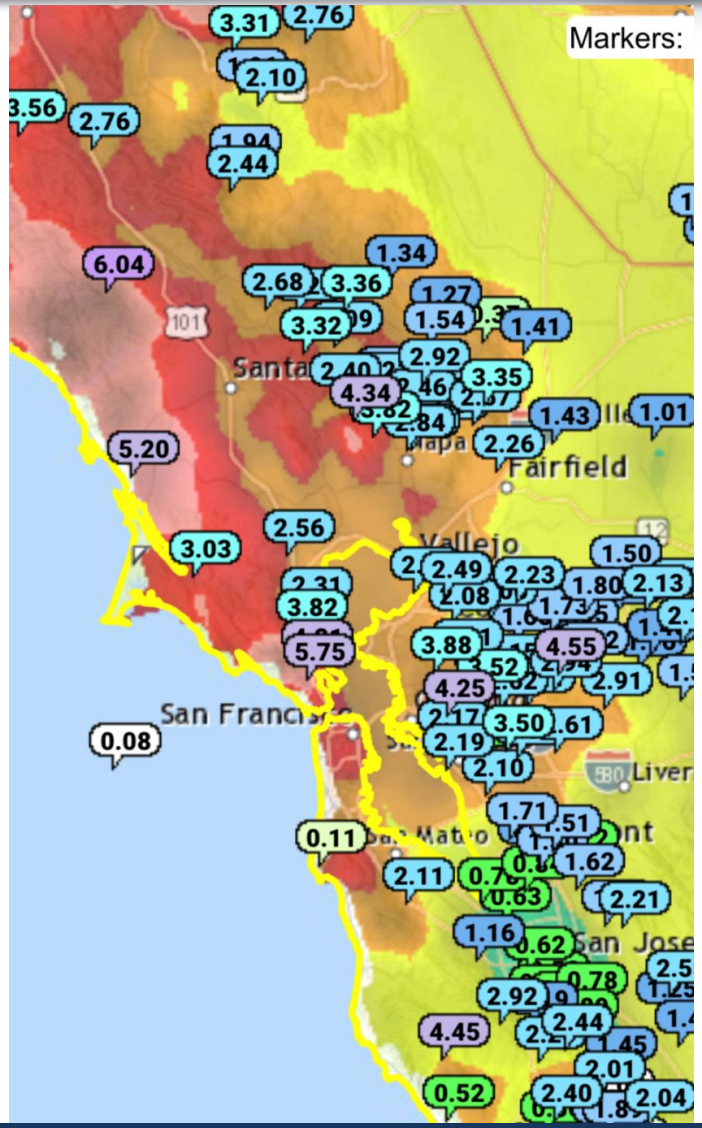


Sierra Nevada

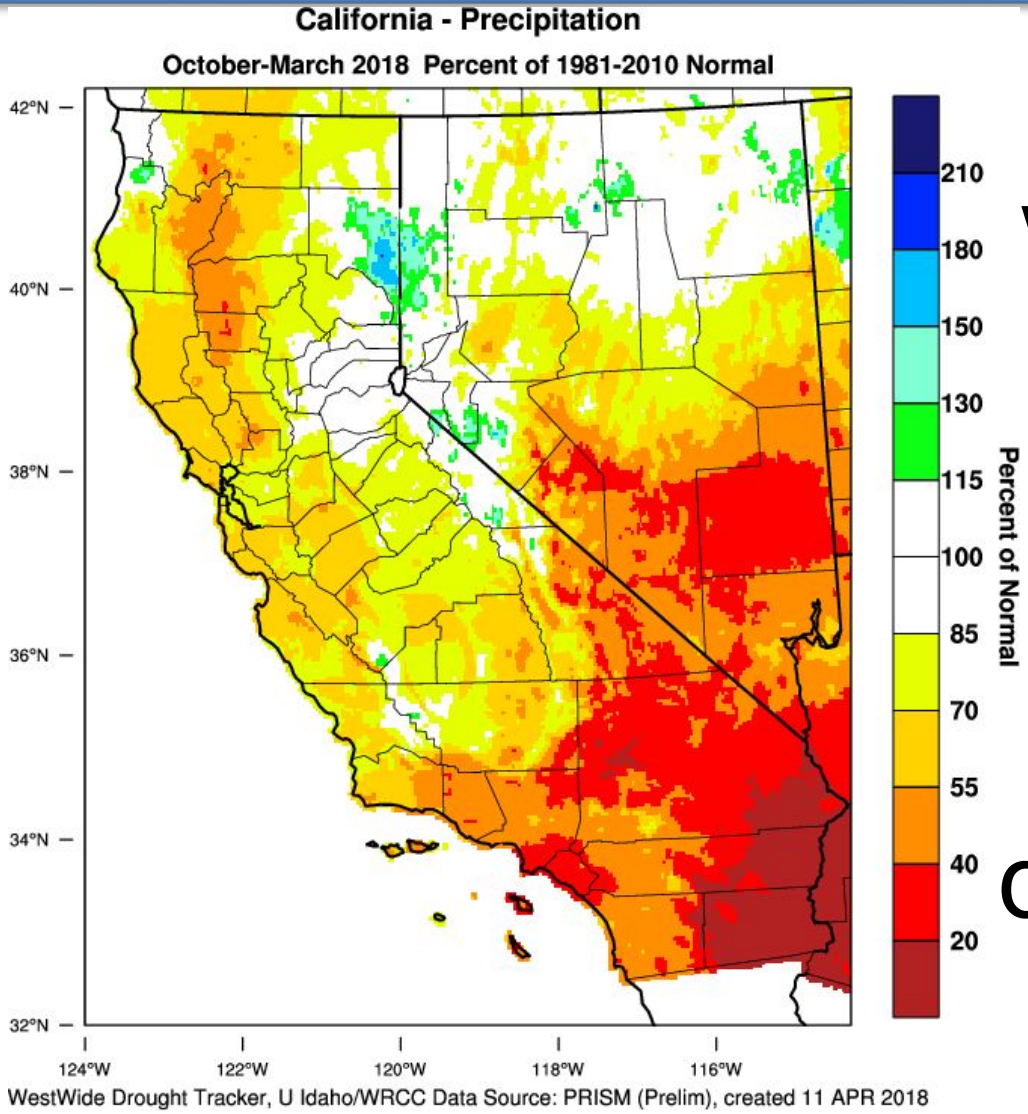


April 5-6, 2018
Precipitation North Coast-Shasta





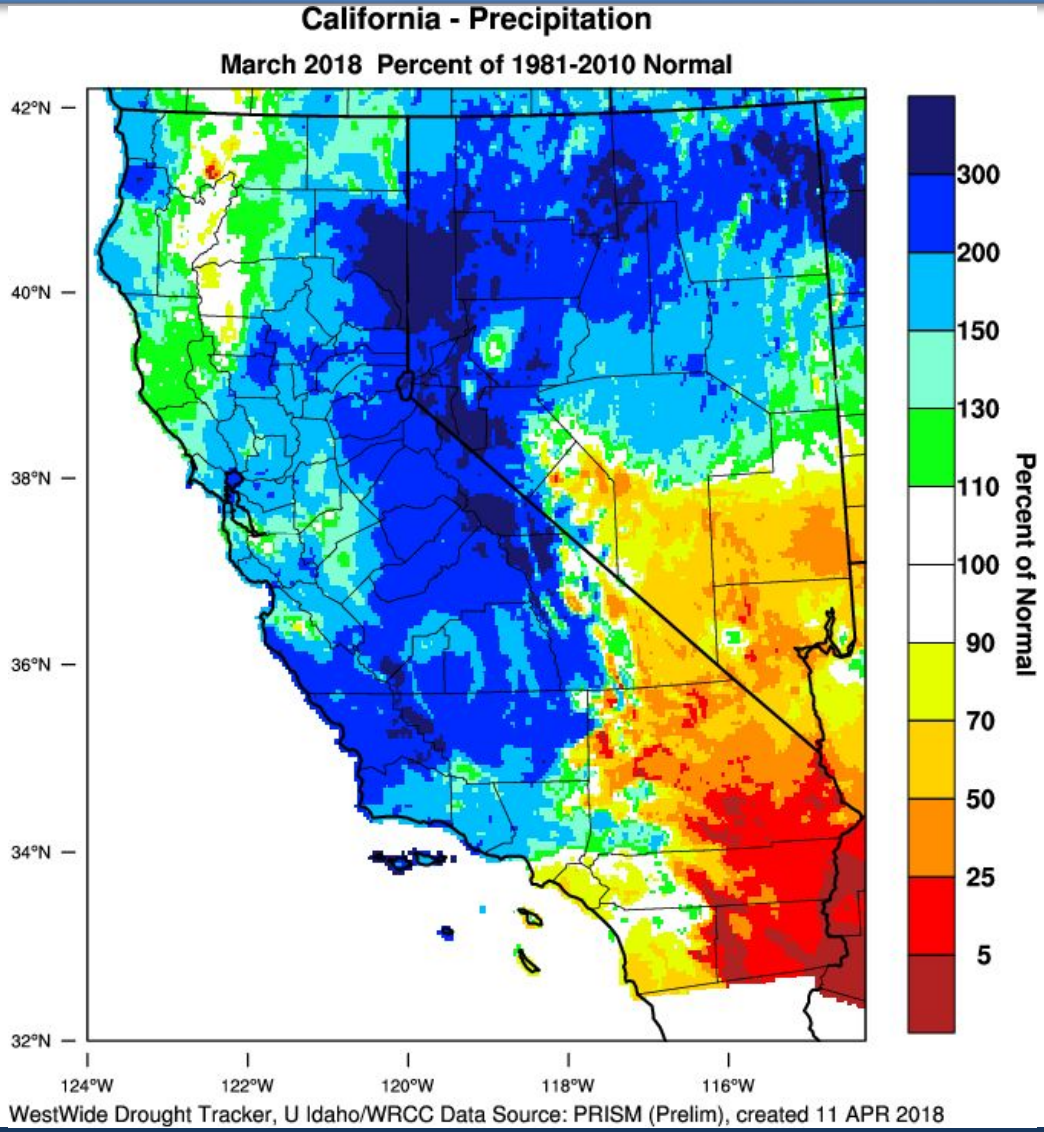
Water Year Precipitation October to March percent of normal



wet

dry

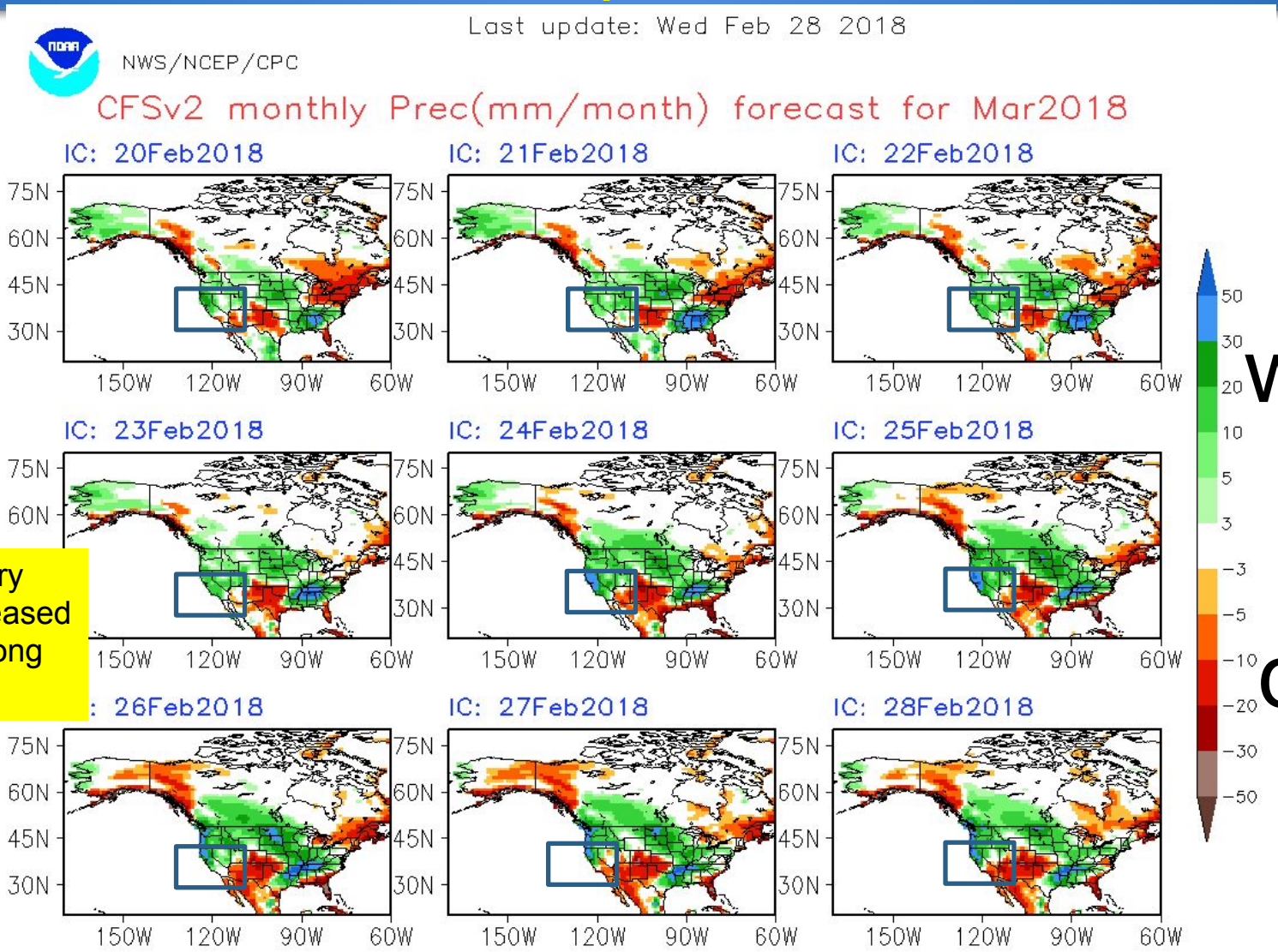
March 2018 precipitation percent of normal
Miracle March?



wet

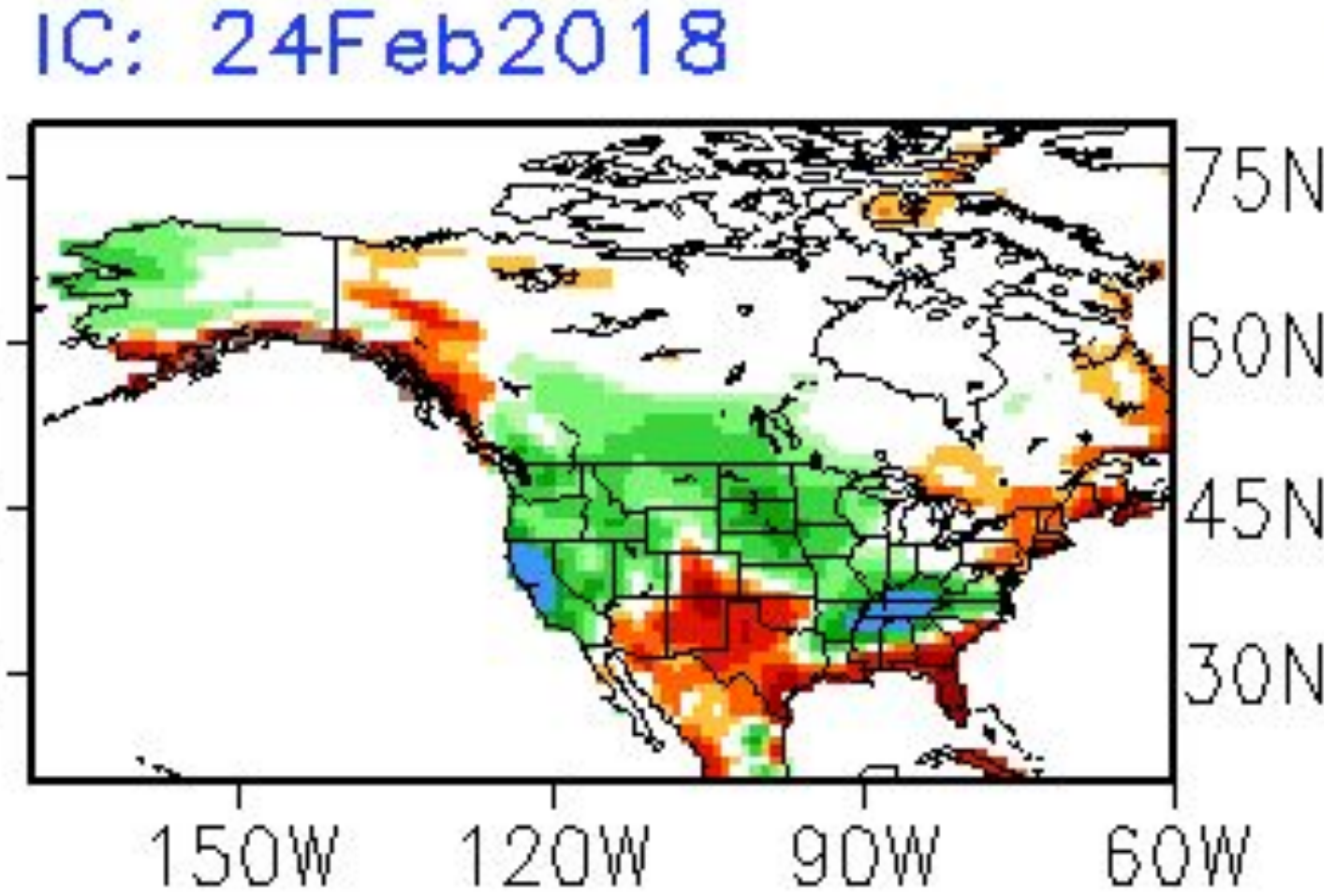
dry

CFS monthly forecasts for March 2018 Anomalies predictable?

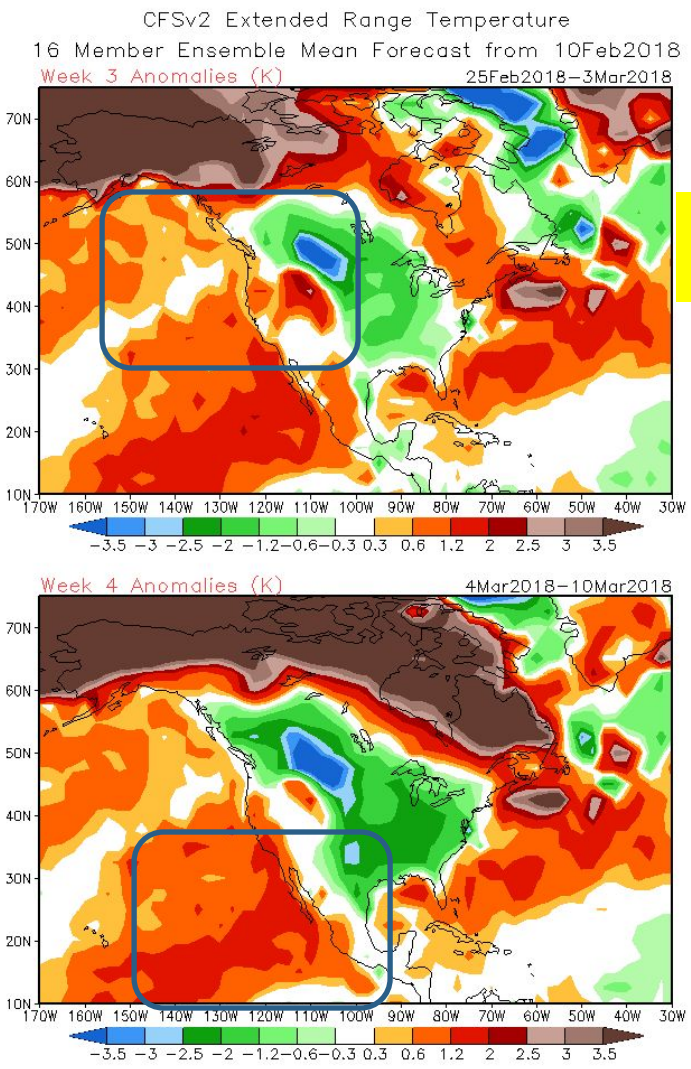


Wet and dry anomaly increased creating strong gradient

Example of February 24 forecast for March



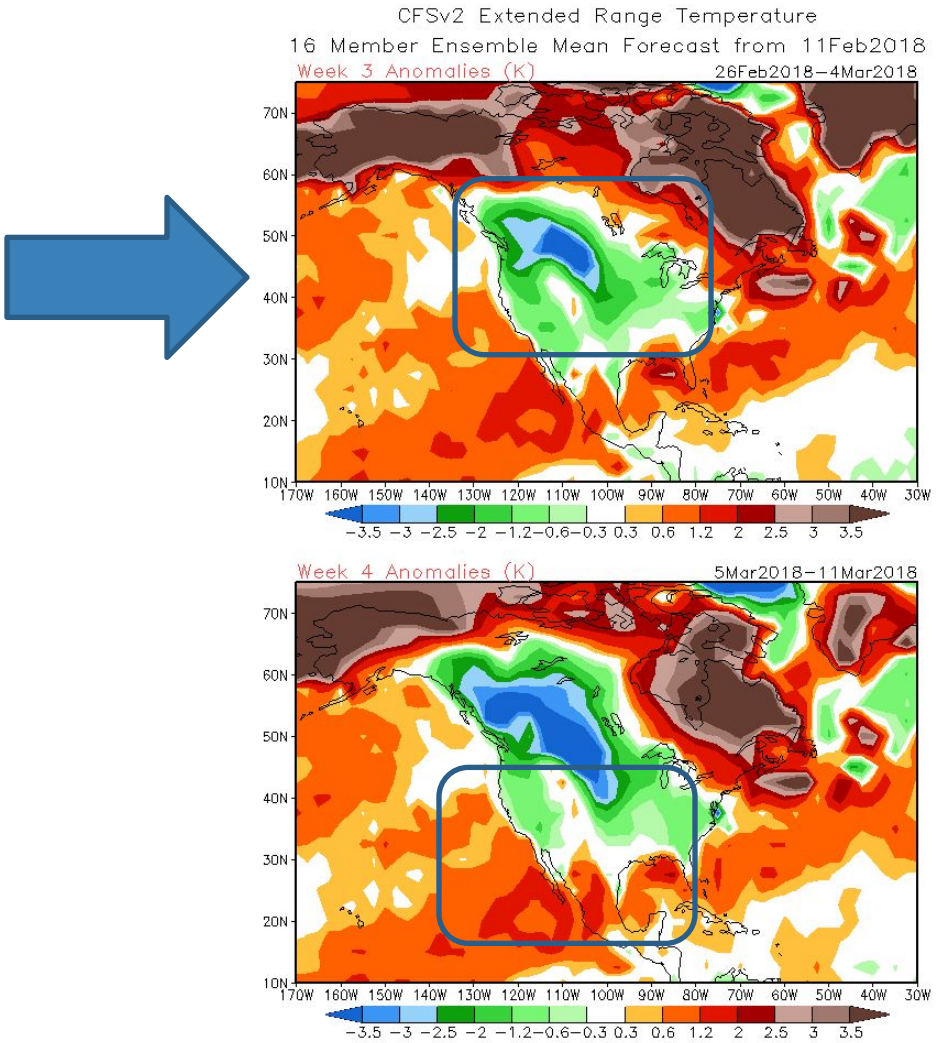
Cold Air Outbreaks



CFSv2 February 10 run

CFSv2 depicts warmth continuing weeks 3-4

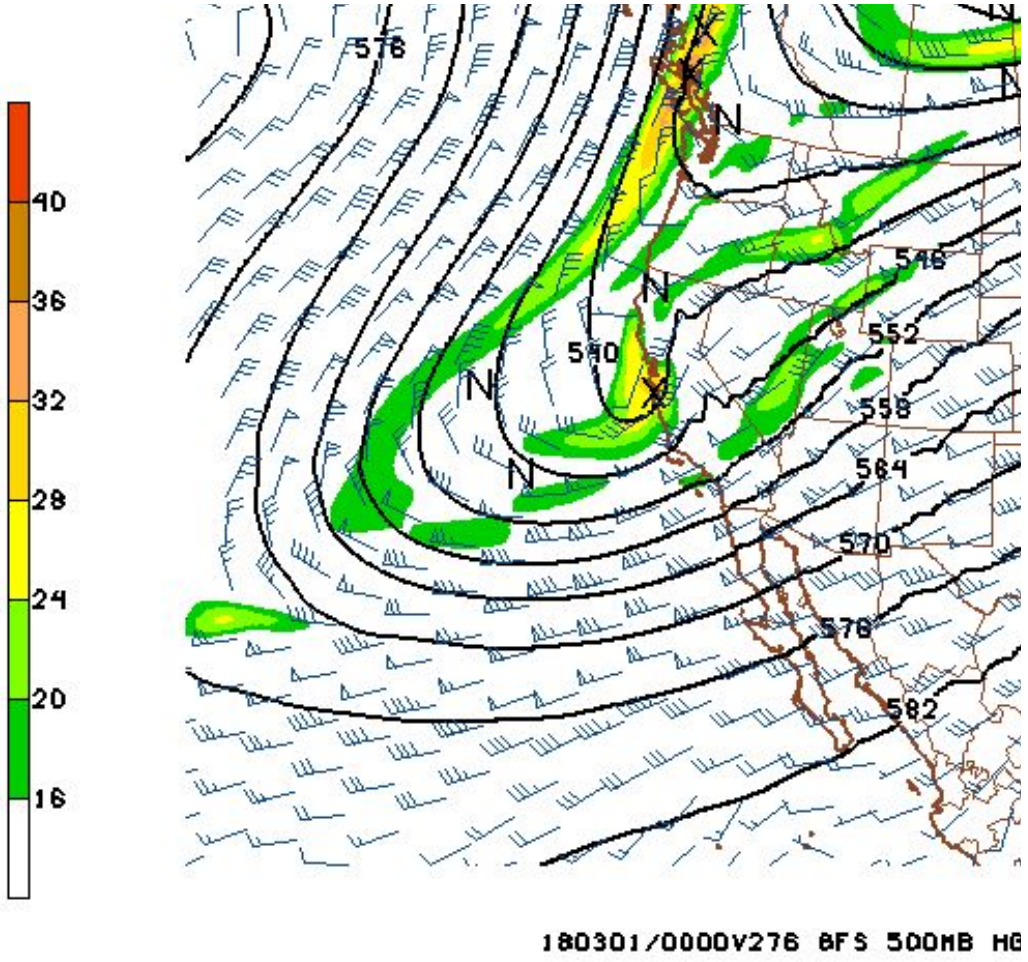
Cold Air Outbreaks – pattern change



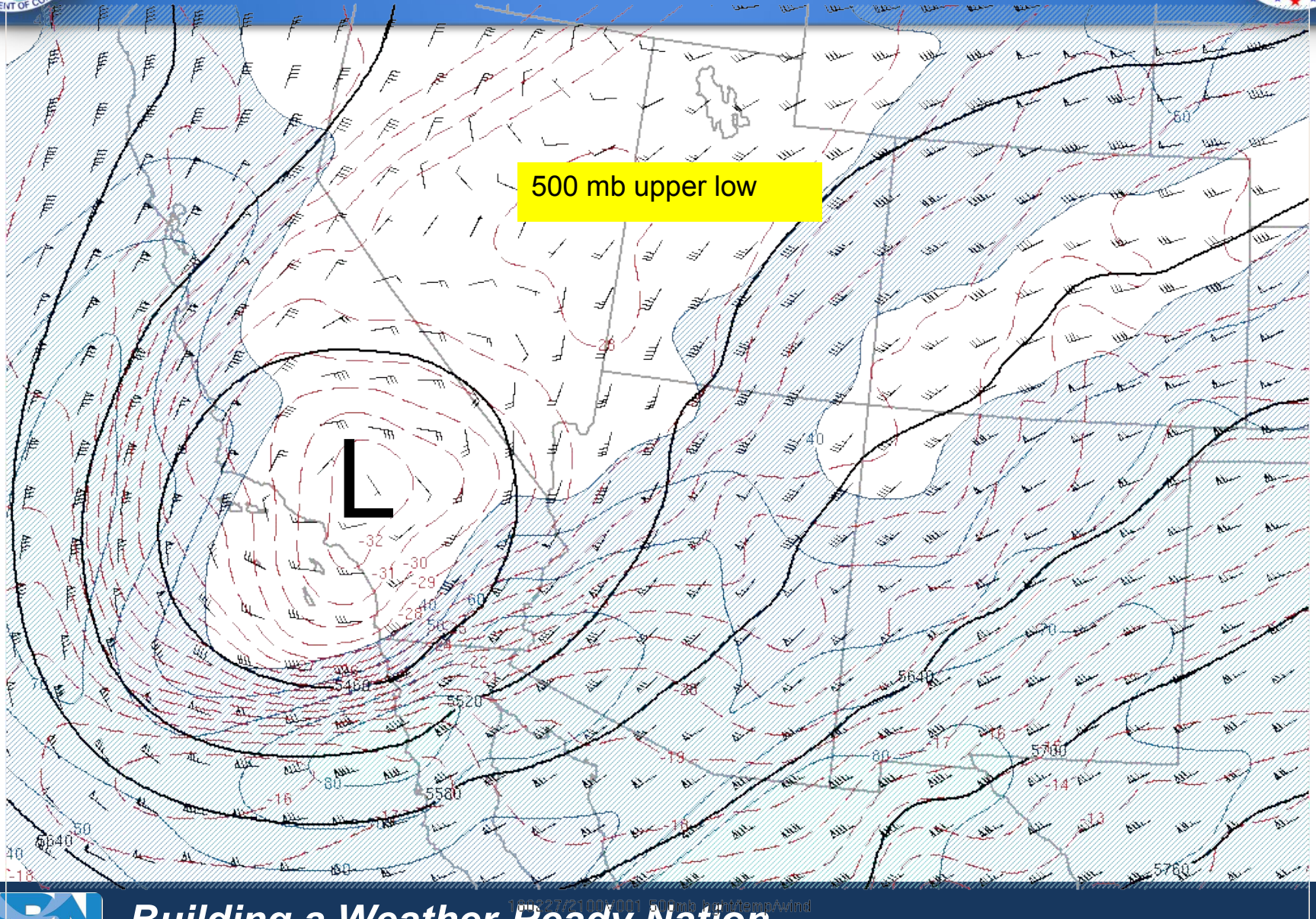
CFSv2 began February 11 run

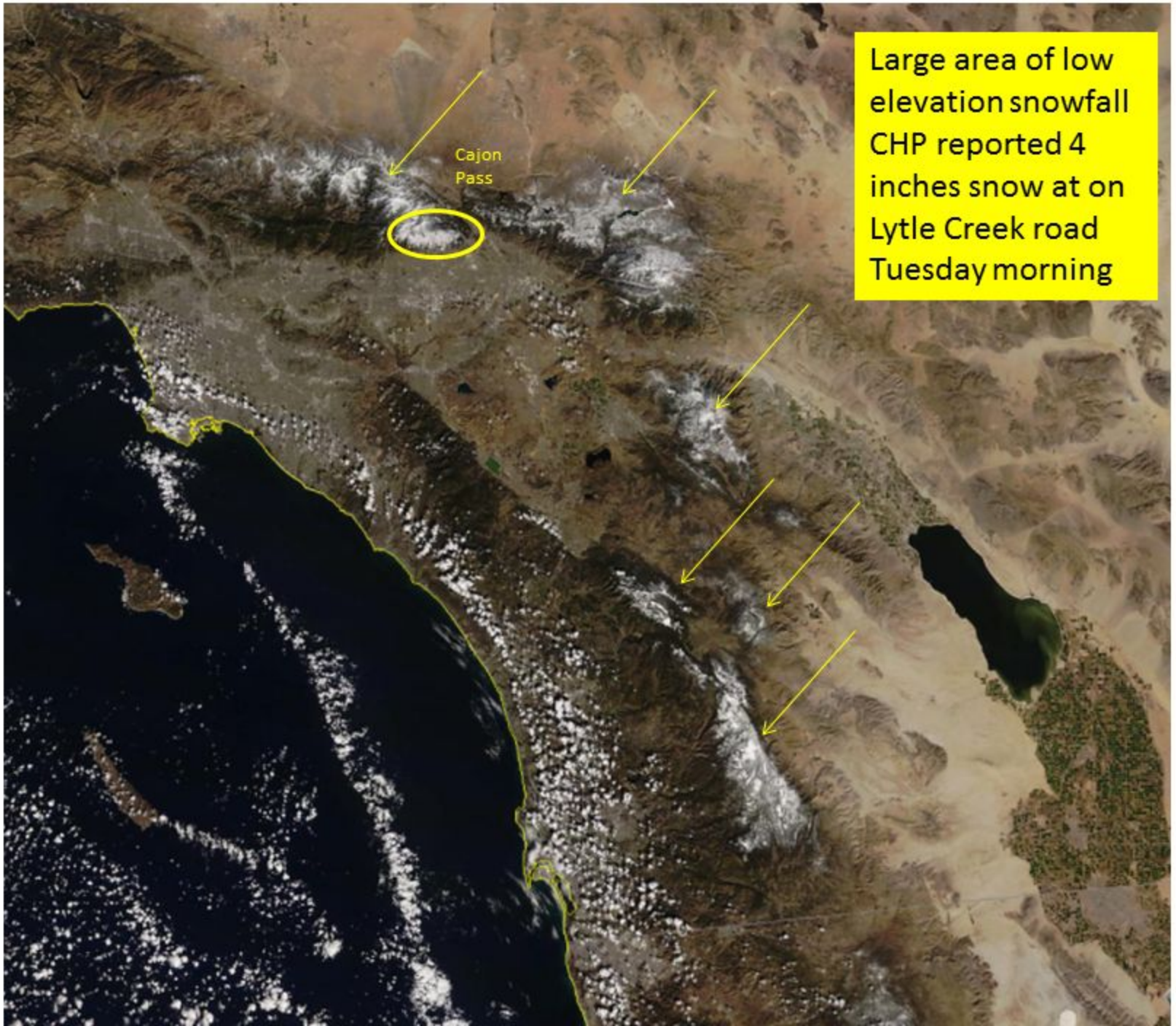
weeks 3-4
Valid February 26-March 11

The 276 hours (12 days)GFS!
# Indicates deeper trough offshore for February 28



February 27, 2018




Cajon
Pass
Large area of low elevation snowfall CHP reported 4 inches snow at on Lytle Creek road Tuesday morning

Cajon Pass early February 27

dozen vehicle pile up including semi and 2 hour closure of highway 138

NWS San Diego @NWSSanDiego

Tweets	Following	Followers	Likes	Lists	Moments
24.8K	575	17.2K	1,683	0	0

6 14

You Retweeted

Caltrans District 8 @Caltrans8 · 16m

SR 138 at SR 2 - still closed

1 4 5

NWS San Diego @NWSSanDiego · 20m

Snow in the high desert at Phelan. #cawx #snow

Caltrans District 8 @Caltrans8 · 1h

Cajon Pass current conditions. #caltrans8

Translate from French

4 21 18

Summary of CFS use for long range forecasts

2nd International AR conference 2018

- Partners want long range information on a pattern change (dry to wet or wet to dry) more than Equal Chances
- CPC provides experimental 3 to 4 week forecasts (tend to be very low probability and not daily)
- CFSv2 (daily) shows strong promise for weeks 2 to 3 and possibly week 4
- The 1-week anomaly (precipitation or temperature) can not be used for specific timing for location (proximity)
- The CFSv2 precipitation can we used for decision makers seeking potential for AR development in the Pacific Basin or unusual cold periods
- These cases showed up to 3-4 week lead time for AR development and potential landfall in California and the tropical Pacific
- Deterministic and ensemble data captured the AR strength and occurrence 180 to 240h – *moisture fields are only part of the process for hydrological forecasts*
- CFS week 2 to 4 during the historical strongest (2.6C) El Nino 2015-16 generally carried too much bet bias

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