

HMT-West 2008  
Summary of IOP 7  
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Forecaster: Ed Szoke

IOP7 Start 21 Feb 15UTC  
IOP7 End 23 Feb 03UTC

#### Non-autonomous Instrument Operations Summary:

- ESRL HYDROX Radar began operations 23 Feb /16UTC and shut down 23 Feb /01UTC. The event was all snow at the radar site requiring the crew to constantly clean snow off the dish. Data quality is in some doubt.
- Slough House sondes and special RAOBS from OAK and RNO began at 21 Feb/ 15UTC at three-hour intervals. Goal was to sample what little warm advection was occurring with this event. Last sonde at SHS was at 22 Feb/12UTC; last special sondes at OAK and RNO were 22Feb/ 09UTC. All sondes were successful.
- Two weather recon flights were launched for special dropsondes on Feb 22 to and Feb 23 mostly to support IOP8

#### Autonomous Instrument Operations Summary:

- ETI instruments at Greek Store and Huysink were not operative.
- All other sites appeared to remain up and operative during the event.

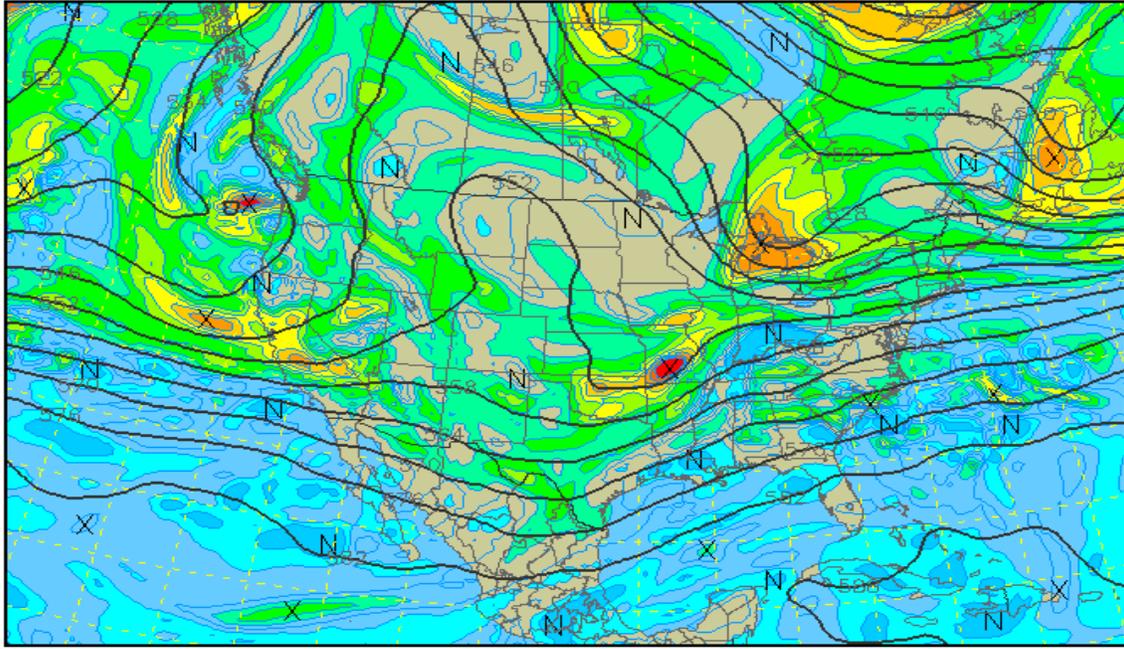
#### Weather Overview

IOP 7 was generated by strong W-E flow into the ARB and a persistent reverse tilted trough with numerous jet streaks moving into central California. Vertical motion was produced by these waves moving into the background diffluent zone creating mass-momentum imbalances. These created moisture surges and bands of precipitation that allowed precipitation totals to reach well above an inch over the area. IPW diagnostics early in the event indicated a 25mm band aimed at central California. Freezing levels remained low over the ARB owing to a lack of meridional flow that would have advected warm air northward. Indeed, OAK had a freezing level of 6500ft on the morning of the event, but this air never moved northward. National-scale NWP prior to the event indicated a total of about of an inch of liquid for the two days. The local ensemble was indicating 1.5 to 2.5 inches from the ensemble mean. Precipitation amounts totaled 0.9 to near 2 inches in the ARB. All in all an interesting event that was again too cold for rain at BLU and thwarting an ideal radar data set.

# 500 mb Heights (dm) / Abs. Vorticity ( $\times 10^{-5} \text{ s}^{-1}$ )

Analysis valid 1200 UTC Fri 22 Feb 2008

NAM (WRF-NMM) (12z 22 Feb)



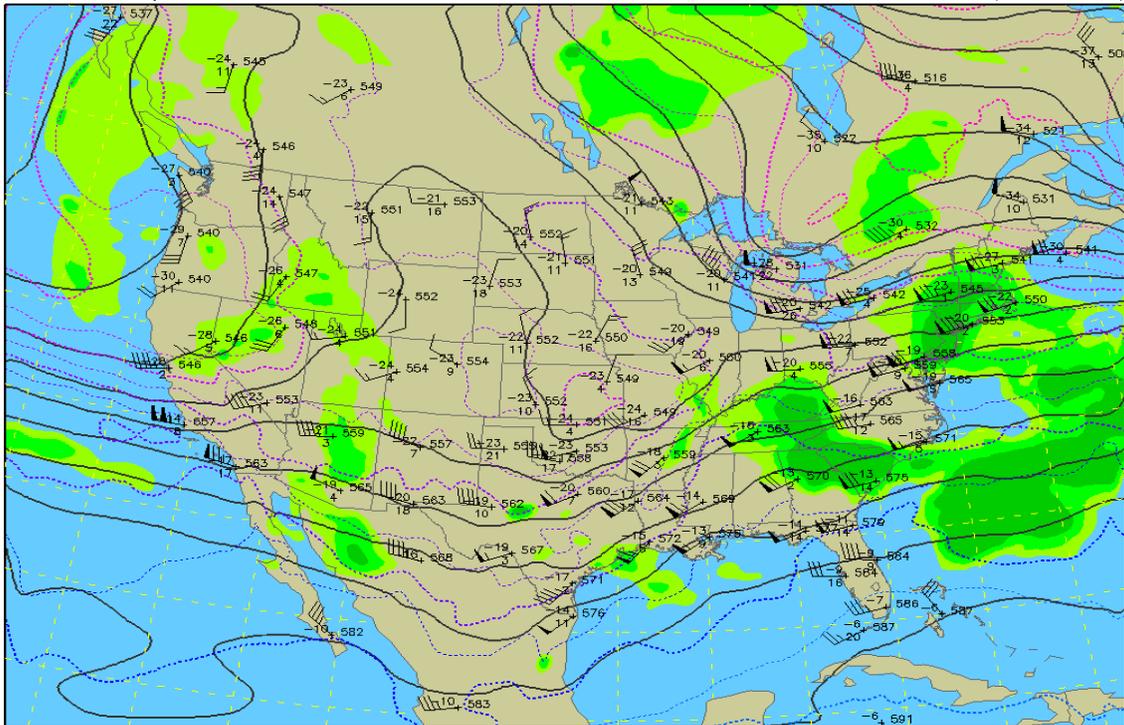
0 3 6 9 12 15 18 21 24 27 30  $\times 10^{-5} \text{ s}^{-1}$

500 mb rawinsonde data 12z Fri 22 Feb 2008

# 500 mb Heights (dm) / Temperature ( $^{\circ}\text{C}$ ) / Humidity (%)

0-hour analysis valid 1200 UTC Fri 22 Feb 2008

RUC (12z 22 Feb)



70 80 90 (percent)

Fig 1a(top): 500MB trough at a mid point in the IOP showing reverse tilted trough and imbedded short waves (vorticity maxima). 1b (bottom) showing plotted observations at 500mb both for 12UTC on 22 Feb

### Surface (10m) Wind Speed (knots) / MSLP (mb)

Analysis valid 1200 UTC Fri 22 Feb 2008

NAM (WRF-NMM) (12z 22 Feb)

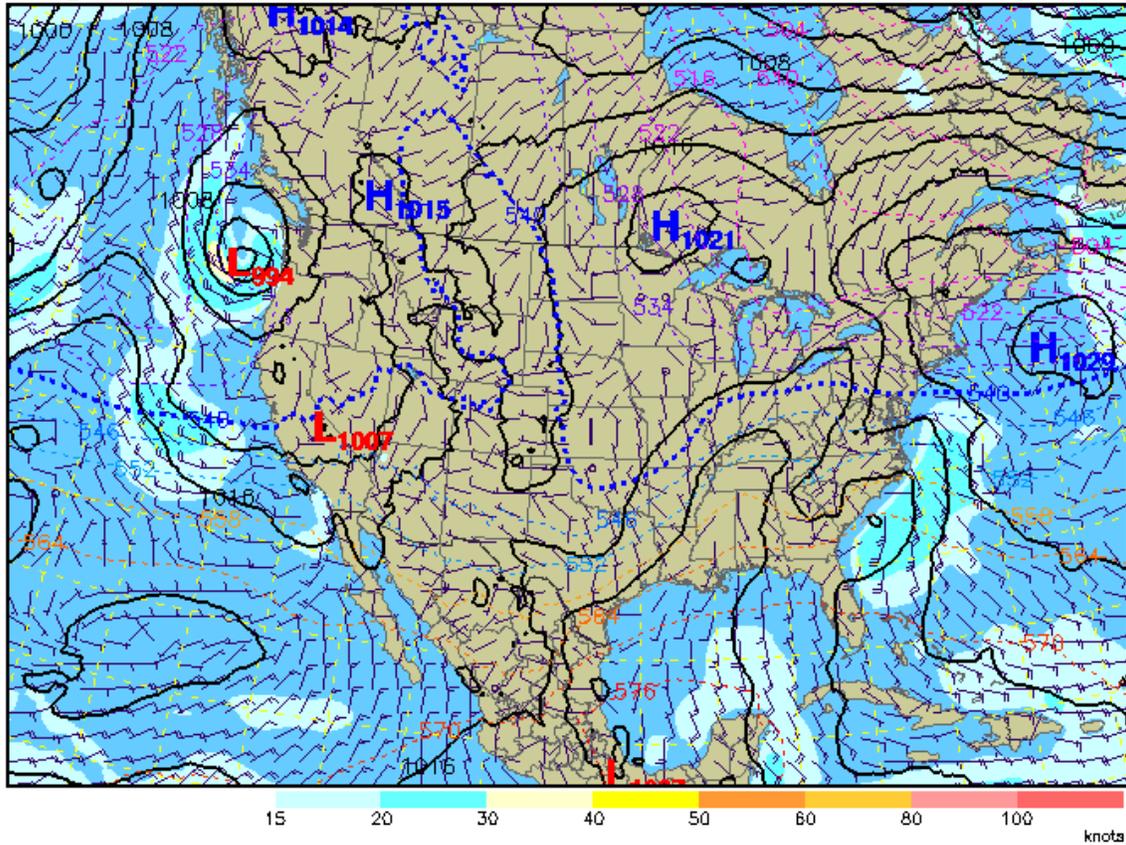


Fig 2. NAM Surface Analysis for 22 Feb 12UTC about mid event. Note cold thickness (<540dm) over the ARB. BLU never recorded rain.

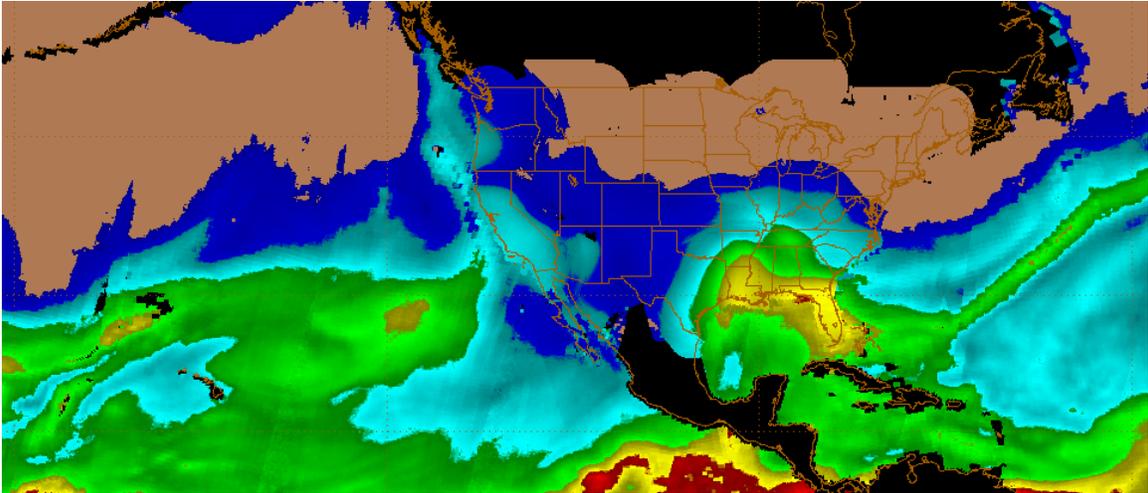


Fig. 3: Satellite IPW for early in the event of IOP7 (22Feb 00UTC). Green color is >25mm. There was a weak river feed into central CA.

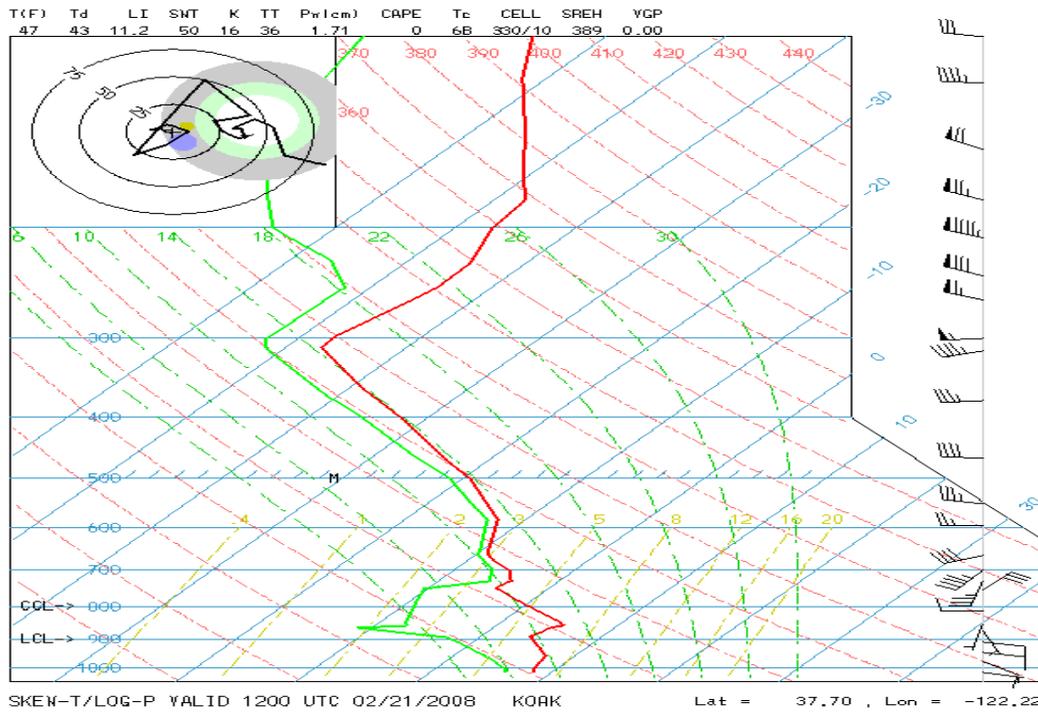


Fig 4. Sounding from OAK at 21 Feb 12UTC showing freezing level at 6500ft. However, warm air never made it to BLU who stayed in snow throughout IOP7

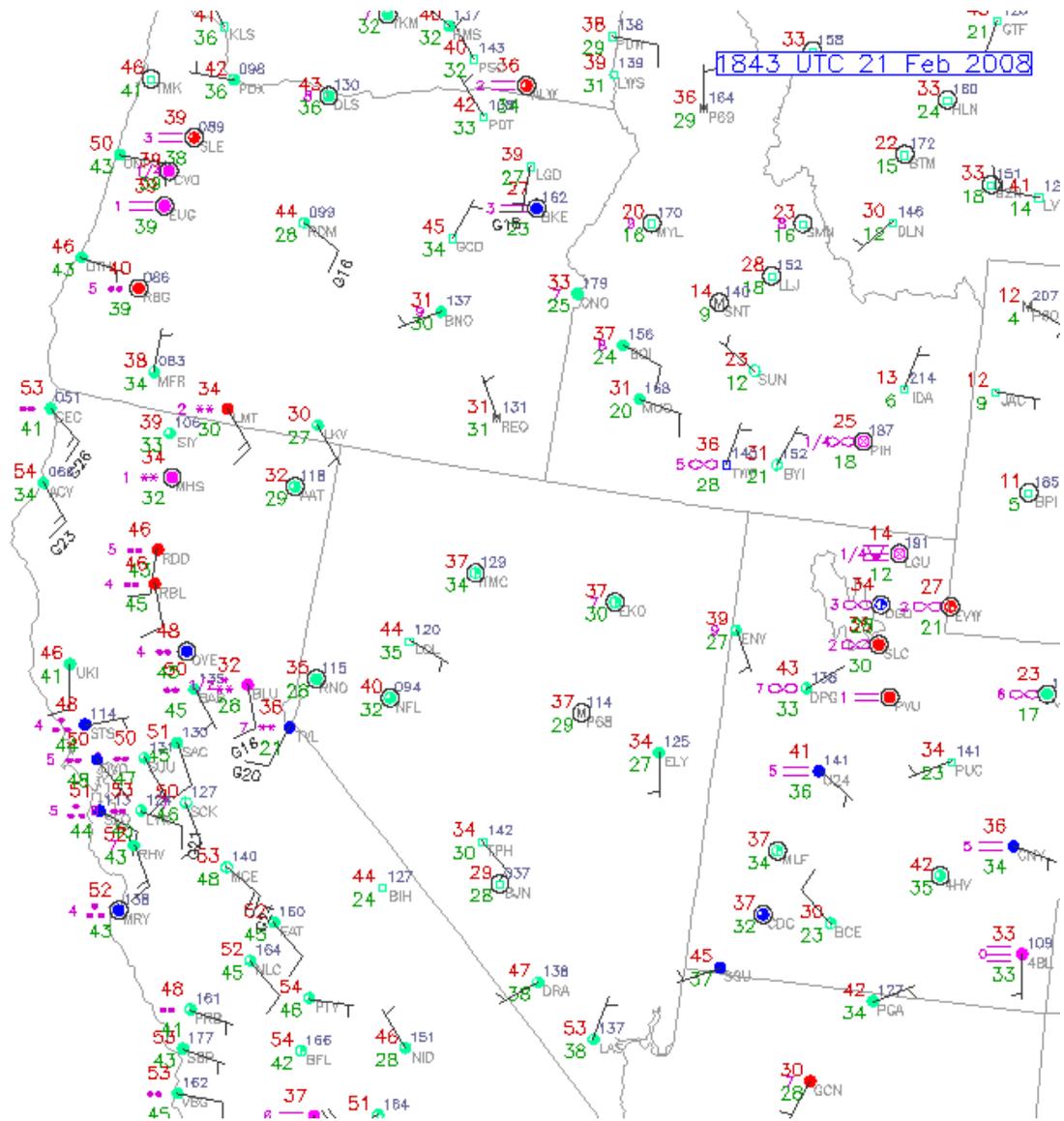
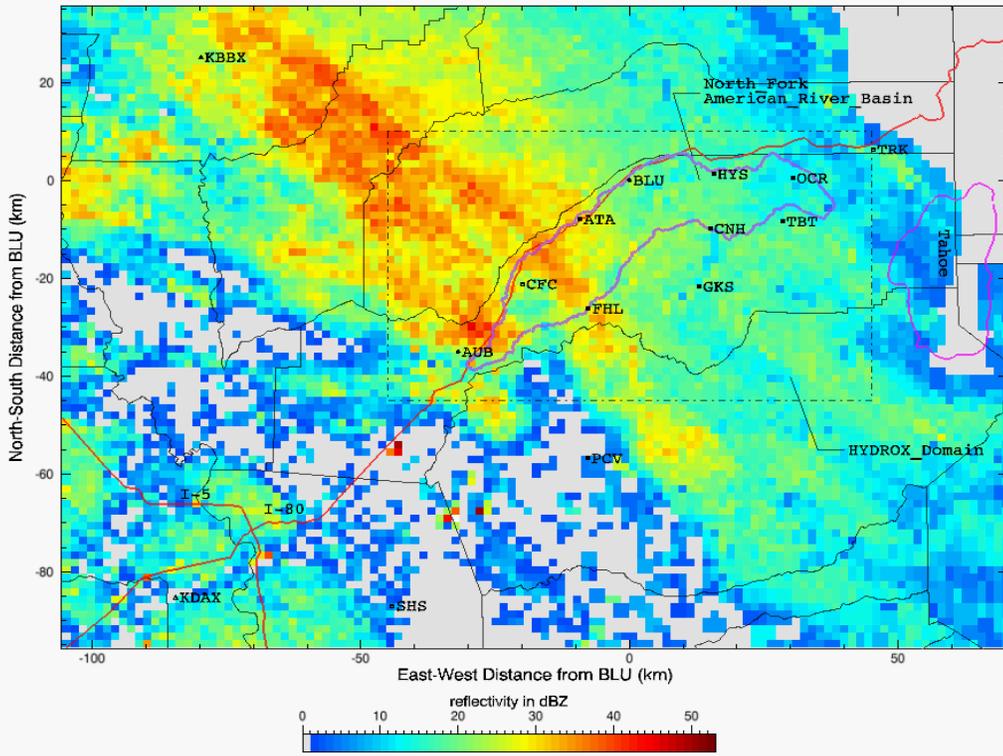


Fig 5. Surface observations at 21 Feb 18UTC showing the onset of moderate snow in the BLU area. This chart is for roughly the same time as the radar observations below.

KDAX 0.5° Reflectivity (dBZ<sub>e</sub>): 2008/02/21 18:35:42



ESRL HYDROX 3.6° Reflectivity (dBZ<sub>e</sub>): 2008/02/21 18:31:00 UTC

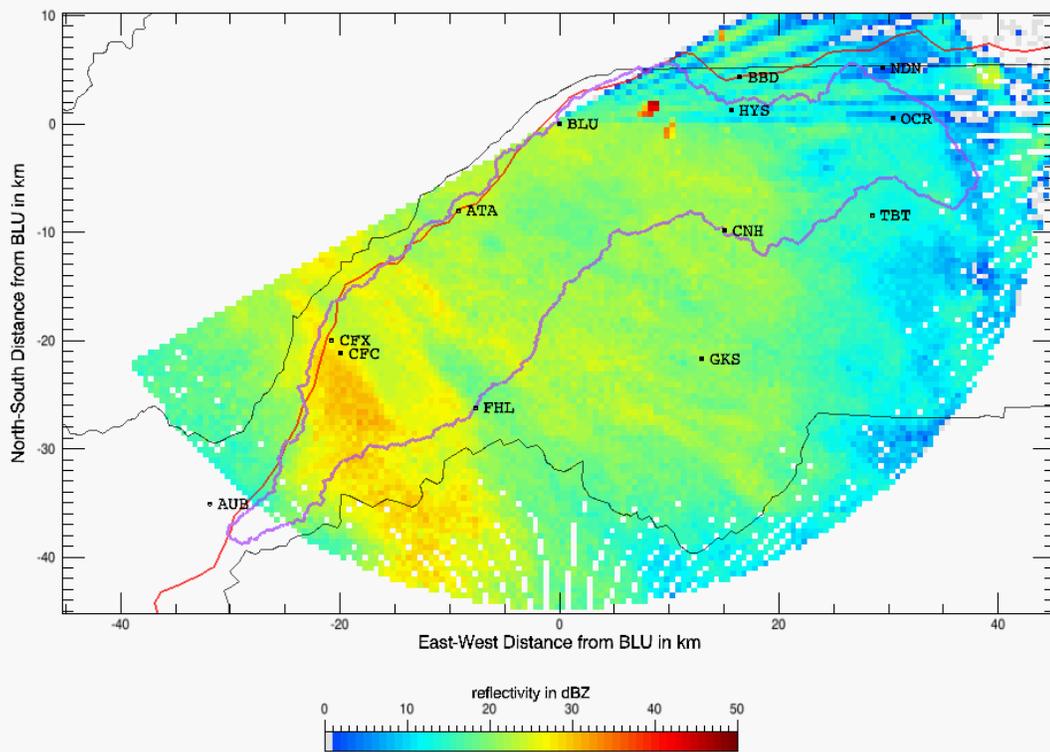
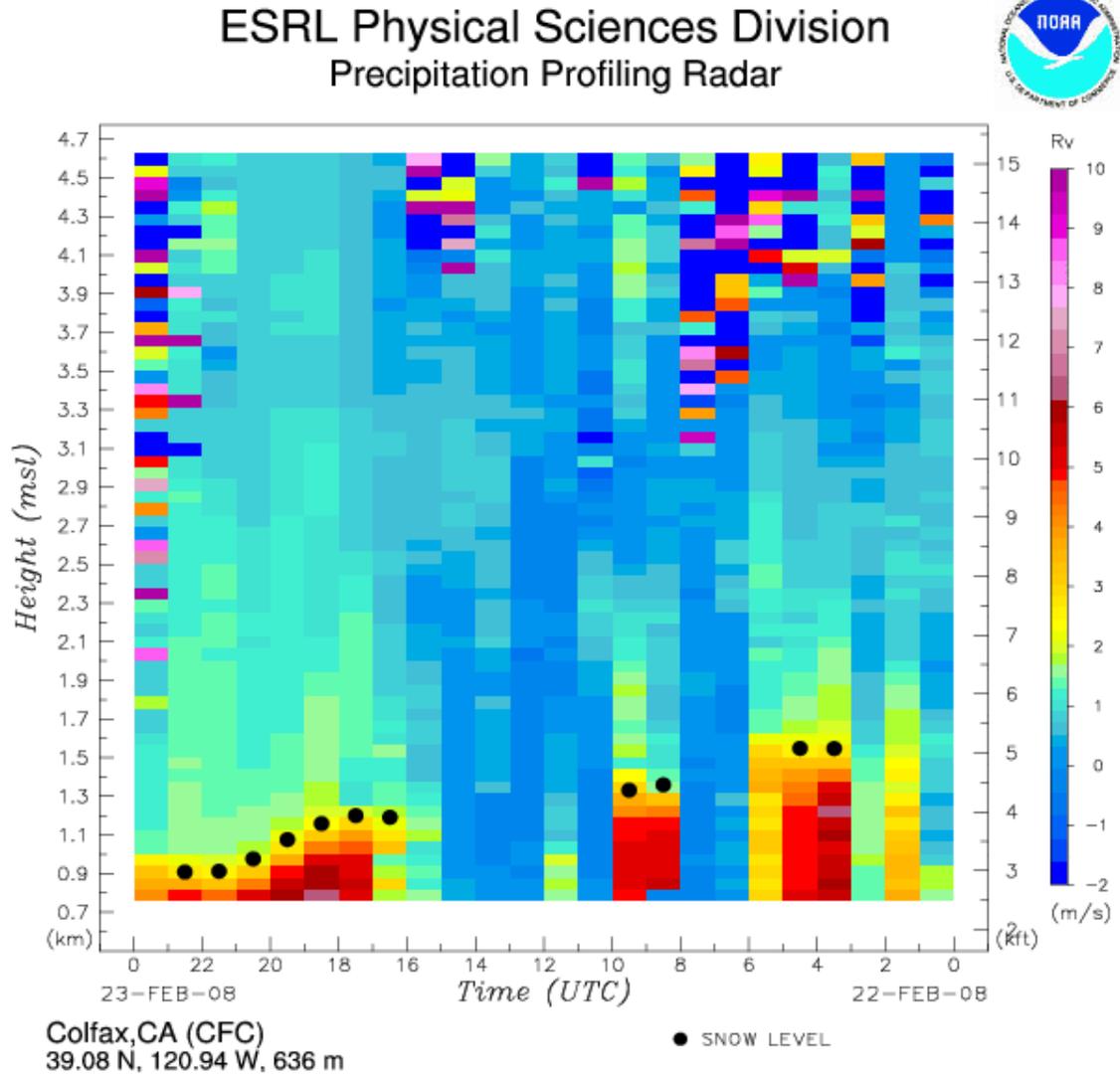


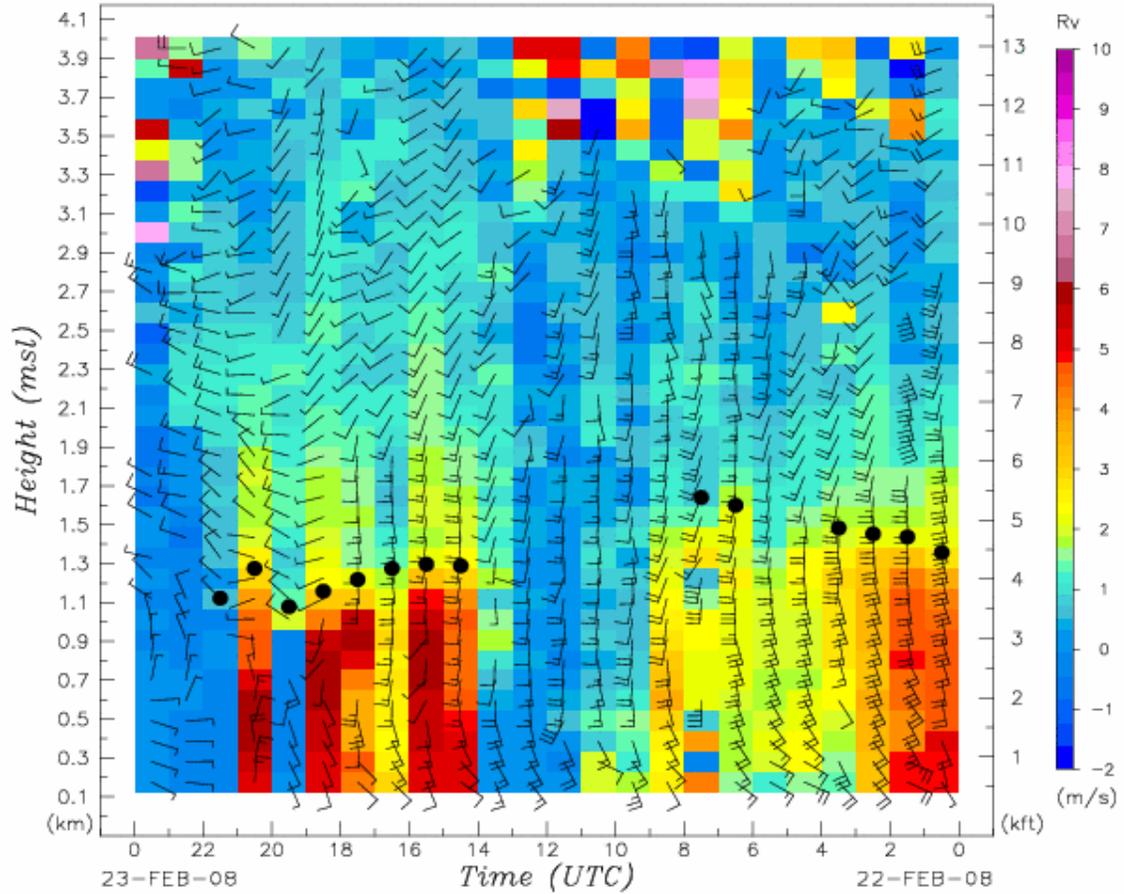
Fig 6: DAX (top) and HYDROX (bottom) reflectivity near the ARB showing onset of the first round of precipitation associated with IOP7 (21 Feb 18UTC). Both show the approach of precipitation from the first significant rain band of IOP7. Rain and snow bands were common throughout IOP 7.



Time (UTC)	2330	2230	2130	2030	1930	1830	1730	1630	1530	1430	1330	1230
Snow Level (m)	none	908	912	976	1076	1159	1200	1191	none	none	none	none
Snow Level (ft)	none	2978	2991	3201	3529	3801	3935	3906	none	none	none	none
Sfc Temp (C)	4.22		3.72	4.19		4.86	4.96	4.98	5.07	5.07	5.24	5.46

Time (UTC)	1130	1030	0930	0830	0730	0630	0530	0430	0330	0230	0130	0030
Snow Level (m)	none	none	1332	1359	none	none	none	1548	1547	none	none	none
Snow Level (ft)	none	none	4368	4457	none	none	none	5077	5074	none	none	none
Sfc Temp (C)	5.62	5.85	5.49	5.85	5.66	5.41		5.31	5.30	5.23		5.50

# ESRL Physical Sciences Division Wind Profiling Radar

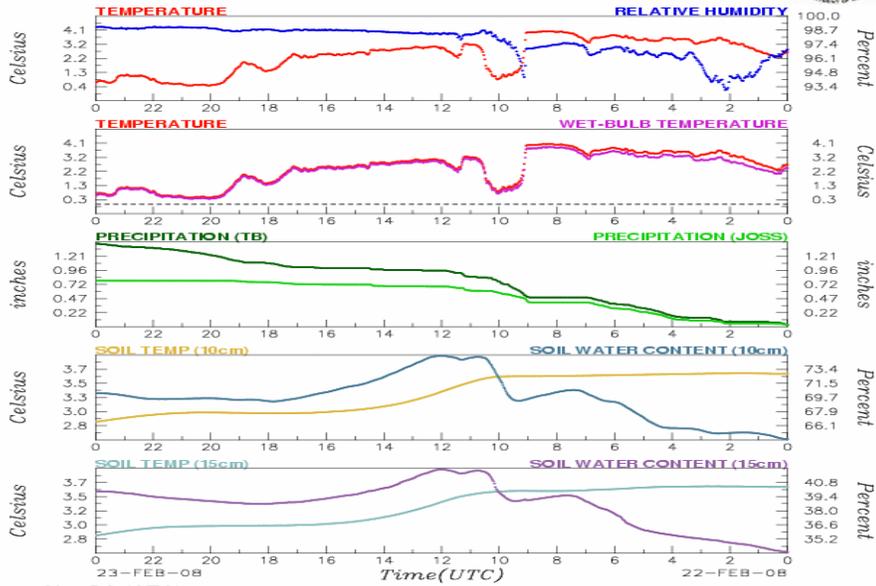


Time (UTC)	2330	2230	2130	2030	1930	1830	1730	1630	1530	1430	1330	1230
Snow Level (m)	none	none	1122	1275	1078	1158	1218	1275	1297	1289	none	none
Snow Level (ft)	none	none	3680	4181	3535	3798	3995	4181	4254	4227	none	none
Sfc Temp (C)	11.60	11.04	7.90	9.46	10.77	9.70	9.64	8.89	8.69	8.63	8.90	9.04

Time (UTC)	1130	1030	0930	0830	0730	0630	0530	0430	0330	0230	0130	0030
Snow Level (m)	none	none	none	none	1640	1600	none	none	1483	1453	1437	1357
Snow Level (ft)	none	none	none	none	5379	5247	none	none	4864	4765	4713	4450
Sfc Temp (C)	9.11	8.93	8.93	8.82	8.80	8.88	8.76	8.44	8.54	8.75	9.05	9.26

Fig 7: Colfax (top) profiling radar showing the freezing level through most of IOP7. Starting at about 5500ft it slowly descended. Further north at Chico (bottom) there was a warm surge up to about 5500ft at 7UTC on the 22<sup>nd</sup>. BLU stayed snow during this time

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Surface Meteorology and Physics



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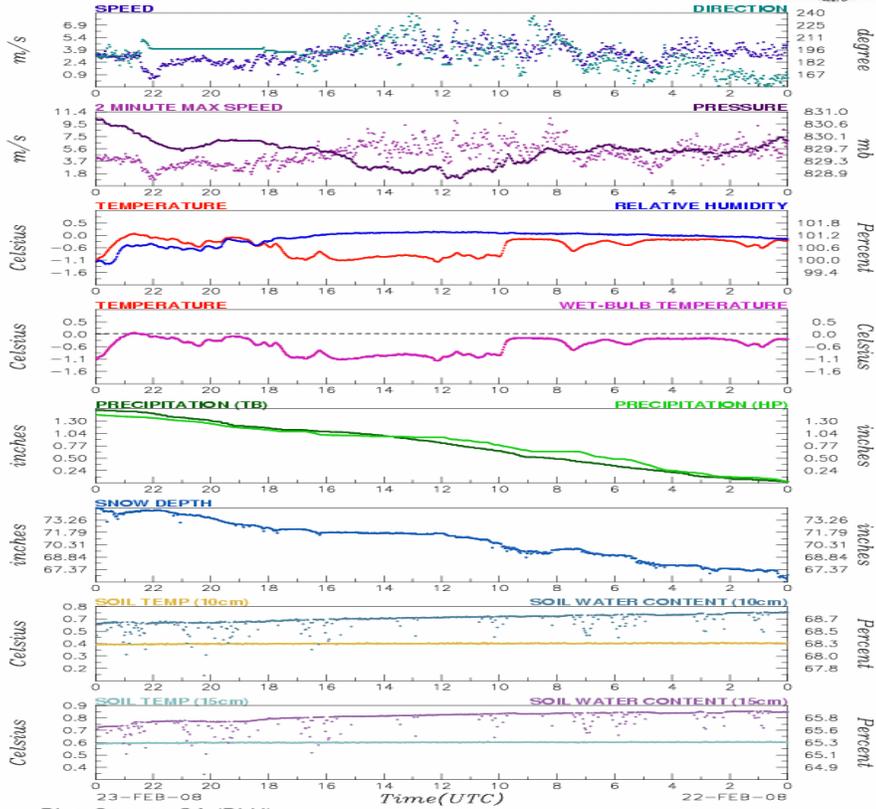


Fig 8. Series of time plots for the heaviest precipitation periods for the Alta (top) observing site from 22 Feb 00UTC to 23 Feb 00UTC: Alta had rain for the most part until late on the 22<sup>nd</sup>. BLU (bottom) for the same period had freezing temperature throughout and about 12 inches of new snow.

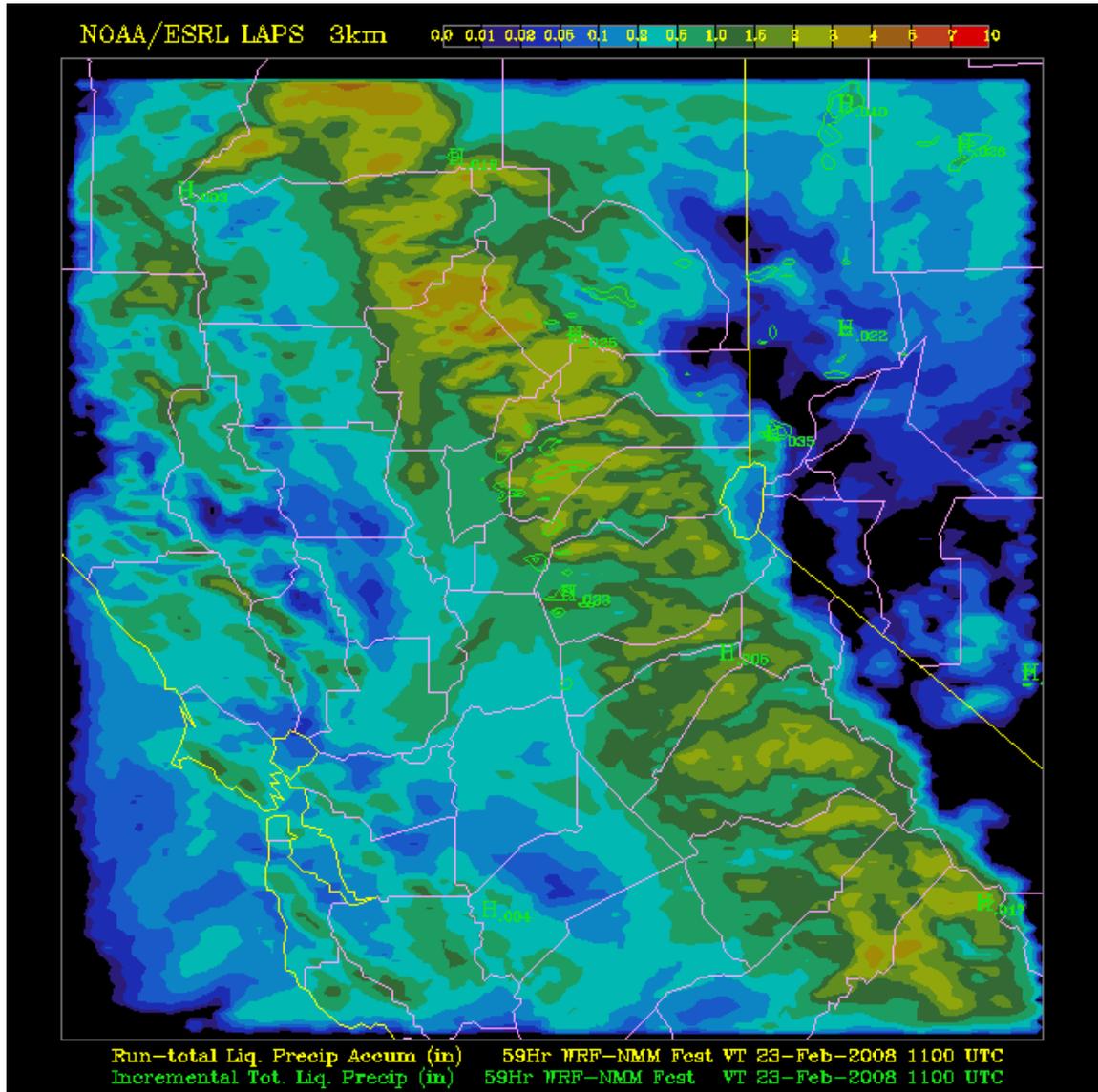


Fig.9.HMT 3-km ensemble mean total liquid precipitation for central California for the duration of IOP7 (59 hrs of a 72 hr forecast initialized on 21 Feb 00UTC).

### HMT-West 2008 ARB Precipitation IOP-7

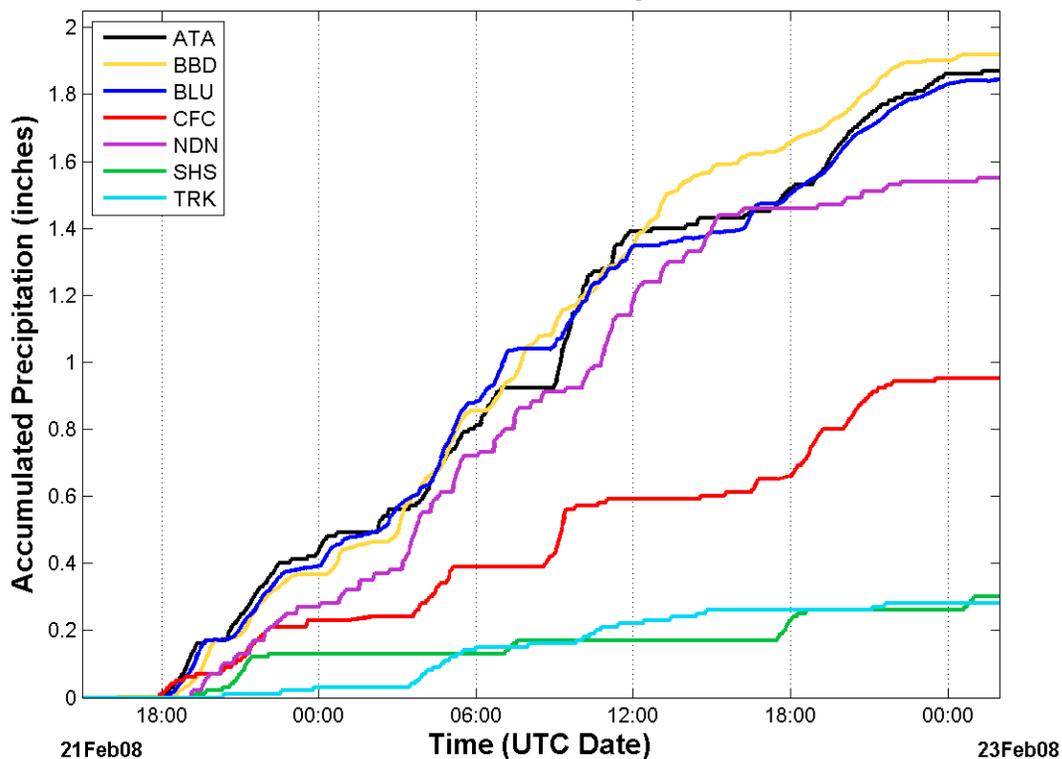
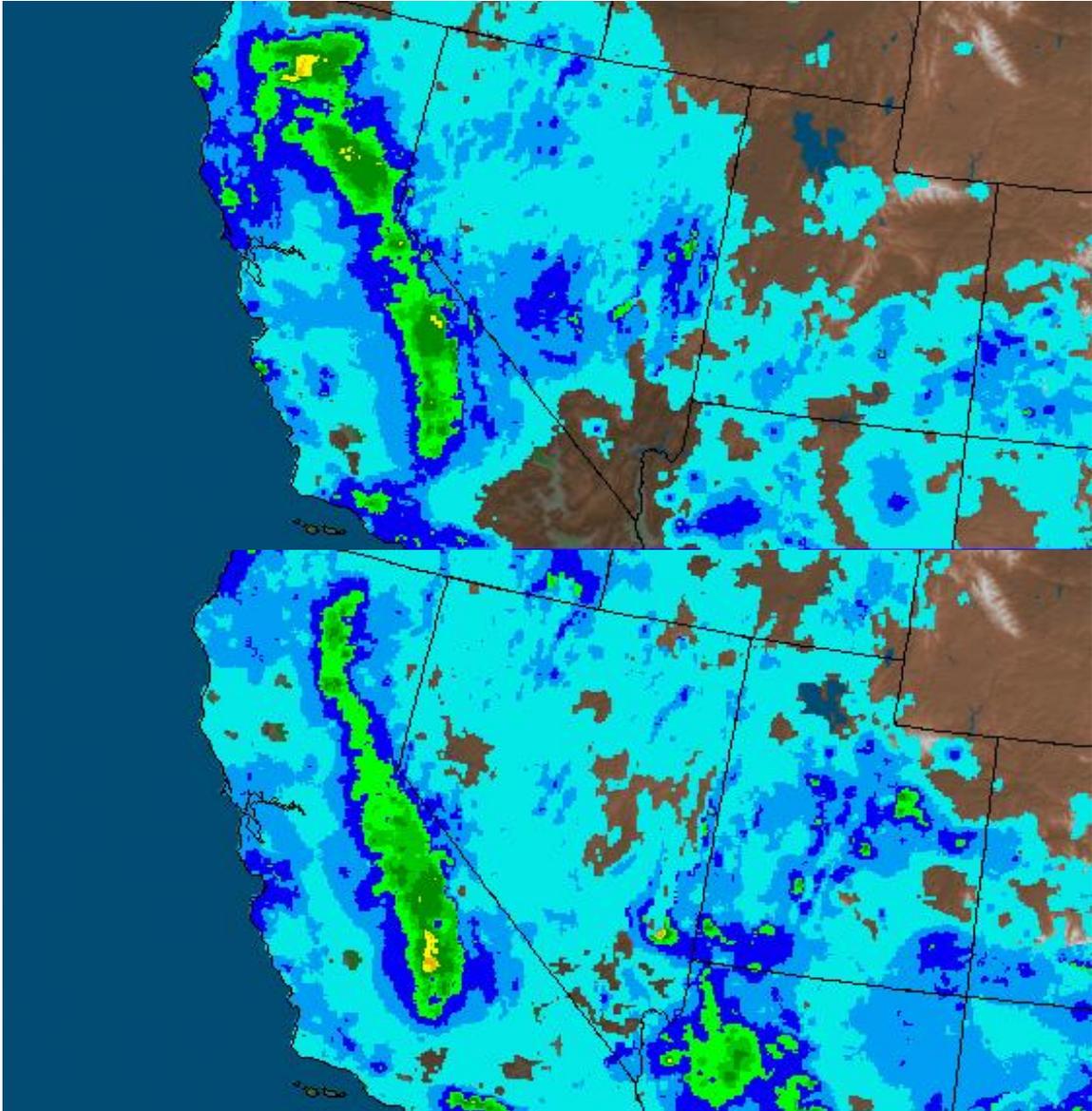


Figure 10. Precipitation for IOP7 at sites up the North Fork of the ARB. Comparisons of these observations with HMT ensemble mean: CFC fcst 1.7 observed 0.93; ATA fcst 1.9 obsv 1.85; BLU fcst 2.0 obsv 1.82; BBD fcst 1.7 obsv 1.90; TRK fcst 0.4 obsv 0.29; SHS fcst 0.6 obsv 0.28. HMT Ensemble was generally positively biased.



*Figure 11: Total precipitation ending 24hrs 22 Feb 12UTC (top) and 23 Feb 12UTC (bottom). Total for IOP7 requires adding these up. See color key below. Generally good agreement was seen with the gauge observations and these products. Also note the ensemble mean predictions and the totals for the areas in the Sierras north and south of the ARB.*

