

HMT-West 2008
Summary of IOP1
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IOP1 Start: 15 UTC 6 December 2007
IOP1 End: 19 UTC 7 December 2007

Non-autonomous instrument operation summary:

- ESRL HYDROX radar: 15 UTC 6 December to 13 UTC 7 December

Since the temperature at Blue Canyon was near or just below 0°C throughout the event, the snow that fell was heavy and sticky. A lot of snow stuck to the antenna, which was brushed off about every hour. However, over time a thin layer of ice formed on the front of the antenna, which led to a gradual loss in radar sensitivity, an effect that became obvious after around 08 UTC 7 December. Other parts of the antenna also became loaded with the heavy snow, which made it difficult for the elevation motors to tilt the radar upward. Eventually, the weight of the snow became too excessive and operations were halted at 13 UTC 7 December.

- Sloughhouse Soundings were launched at 15, 18, 21 UTC 6 December and 00, 03, 06, and 12 UTC 7 December. The launch attempted at 09 UTC 7 December failed.

Autonomous instrument operation problems:

- Sloughhouse (SHS) 915 MHz profiler was down until ~18 UTC 6 December, with a brief outage between ~07 and ~09 UTC 7 December.
- Huysink (HYS) surface meteorology data down throughout the IOP (battery discharged).
- Greek Store (GKS) surface meteorology data down throughout most of the IOP (battery discharged).
- Big Bend (BBD) tipping bucket precipitation gauge malfunctioned before ~23 UTC 6 December. Also, power to the site was lost between ~12 to ~20 UTC on 7 December, which means that power to the hotplate precipitation gauge and heater for the tipping bucket precipitation gauge was not available. Therefore, those measurements are of questionable quality.
- Alta (ATA) tipping bucket precipitation gauge recorded significantly less precipitation than nearby sites and the collocated raindrop disdrometer. Therefore, its data is of questionable quality.
- Chico (CCO) data was collected but a phone-line problem prevented the data from being telemetered back to Boulder.

Overview

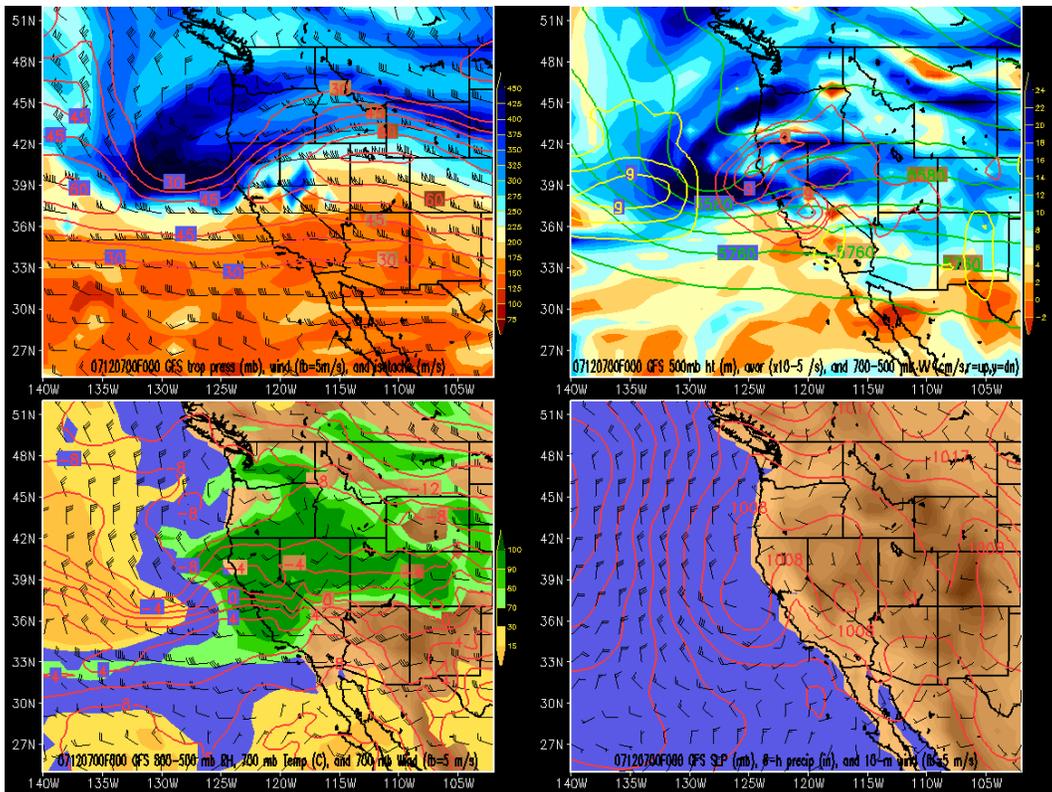
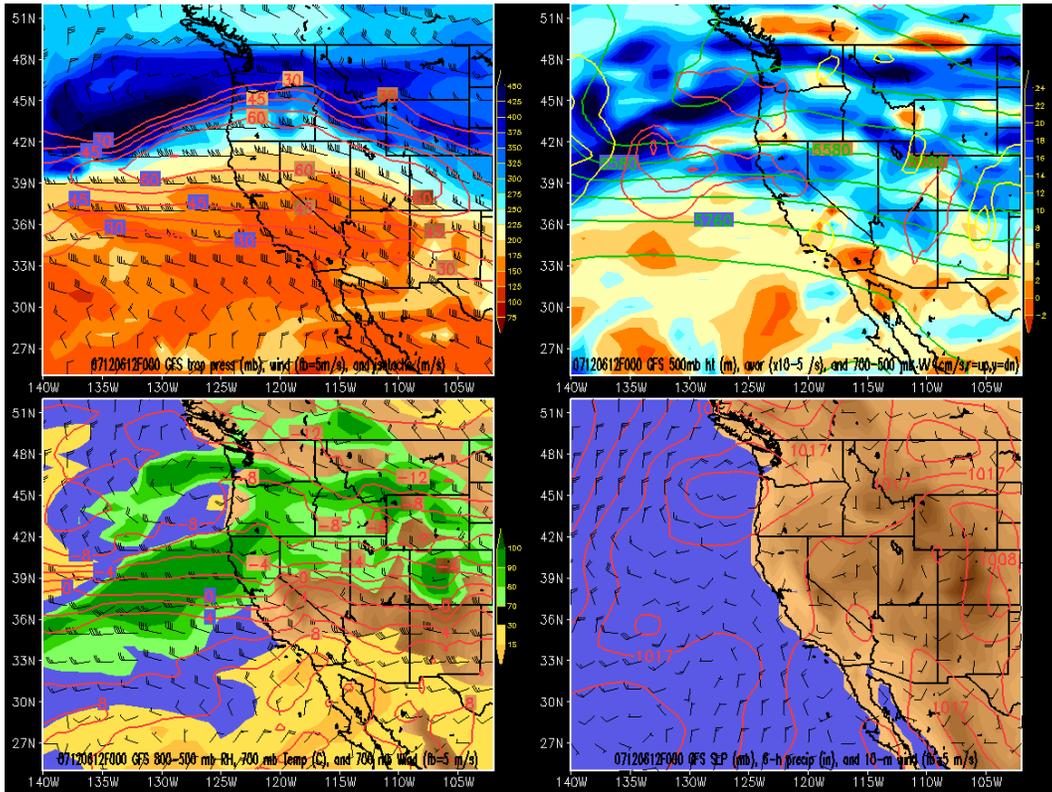
This IOP was associated with a shortwave trough that originated over the Gulf of Alaska and tracked directly over northern California. Further south, moisture in the subtropics was kicked poleward by a Kona low north of Hawaii. Some of this moisture was entrained by the shortwave, which created an integrated water vapor signature that met the criteria of an atmospheric river. However, the low-level flux of that moisture was not significant since the southwesterly flow at low levels offshore was not particularly strong early in the event and later in the event when winds speeds increased, flow was out of the northwest.

At 24 h lead time, QPF for the event was in the 1"-2" range. Precipitation accumulations turned out to be significantly larger. Sloughhouse had just under 2.5", Colfax had just over 3" and Blue Canyon had over 4" of liquid. Orographic enhancement of precipitation was relatively minimal for the event. One explanation for the underforecast of precipitation is that the shortwave trough unexpectedly slowed its southeastward movement for several hours while positioned just west of the American River Basin. This allowed a longer period of favorable dynamics for our area, which translated into more precipitation being deposited than forecast. The slowing of the shortwave trough may be related to an "instant occlusion", an evolution that Dave Reynolds observed a few times during his Sierra project experiences in the 1980's.

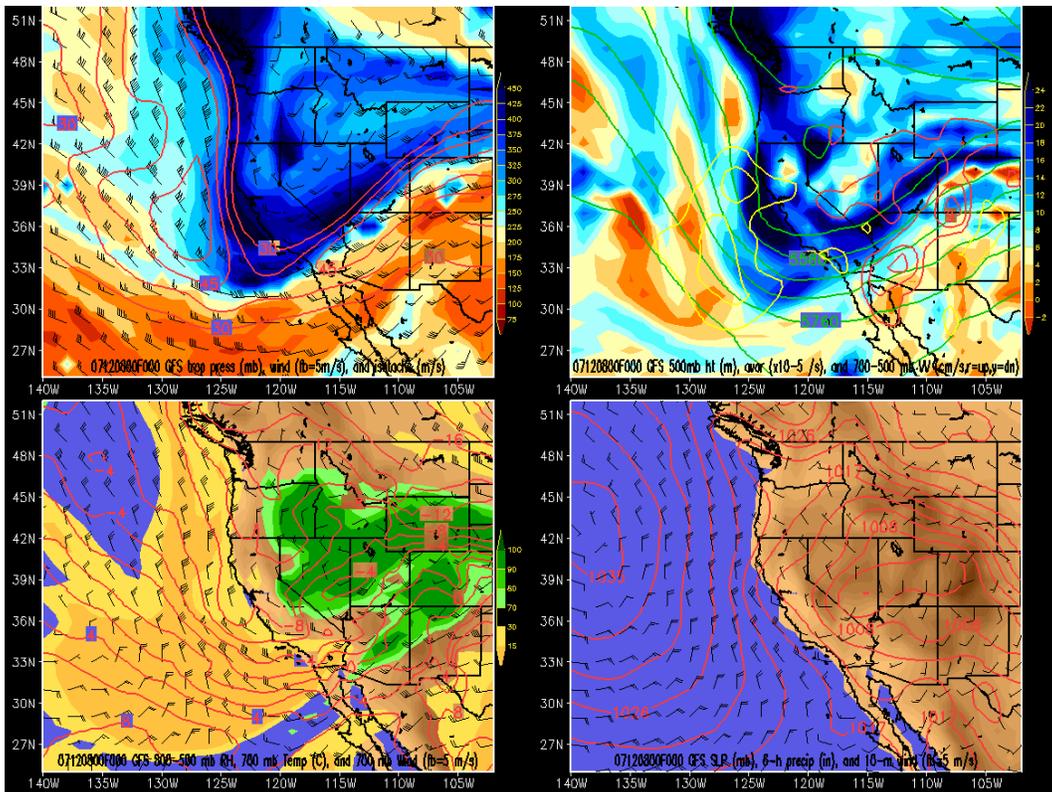
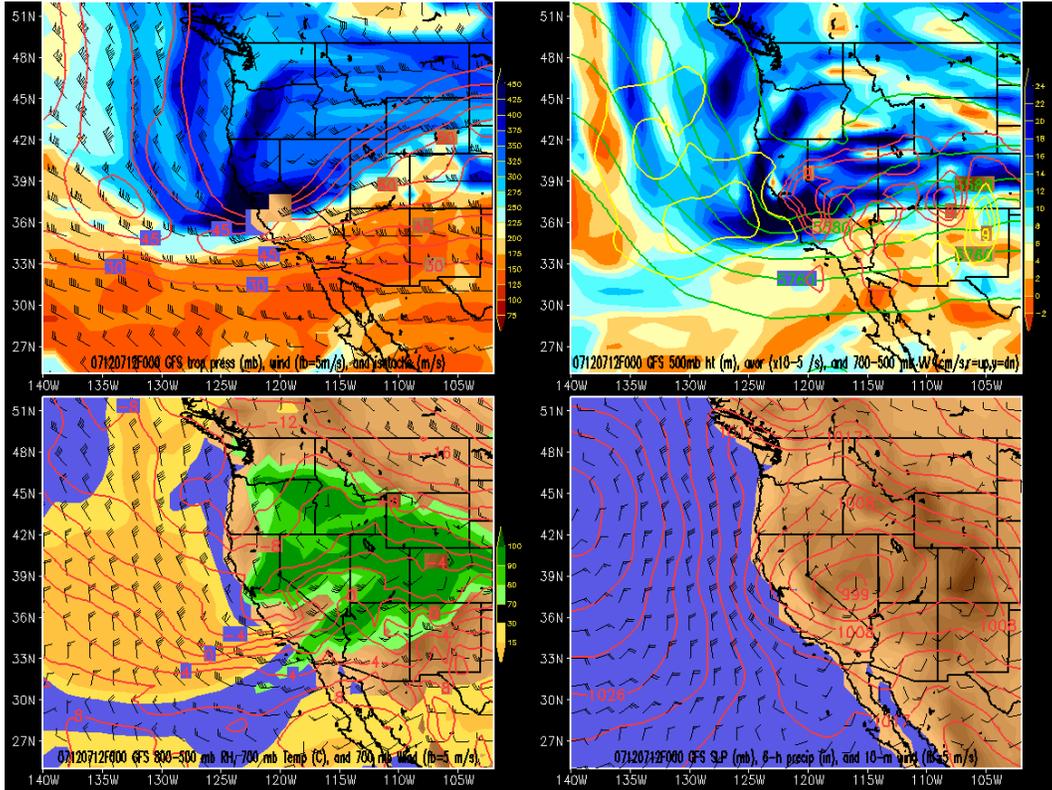
Snow levels for the IOP started out around 1.8-2.0 km, descended to around 1.6-1.8 km for the majority of the IOP and then eventually dropped down to around 1.2-1.4 km. Just under a foot of dense snow fell at Blue Canyon with about 18 inches at slightly higher elevations like Big Bend and Canada Hill

The images in the following pages provide some additional context for the event.

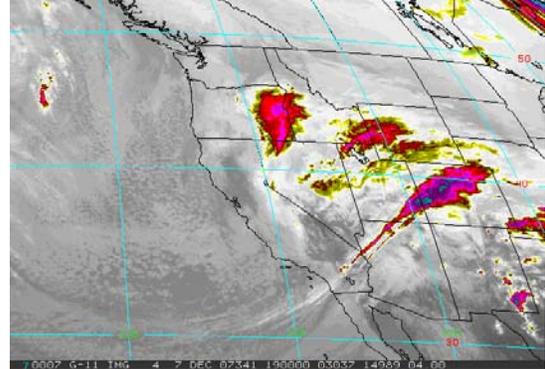
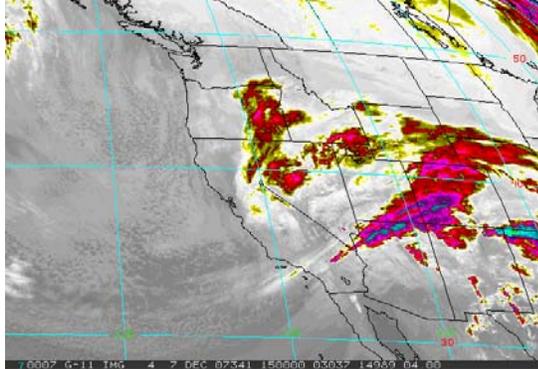
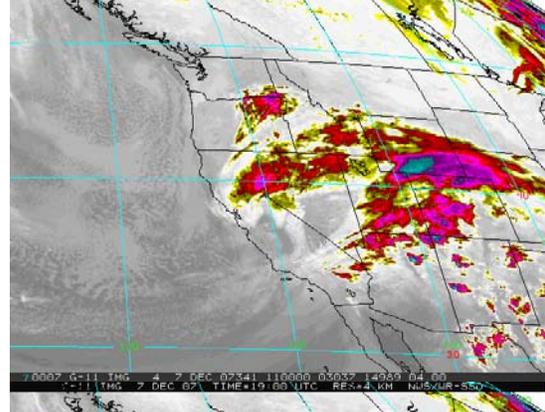
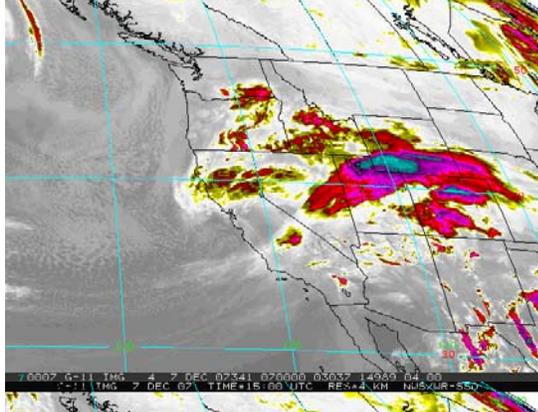
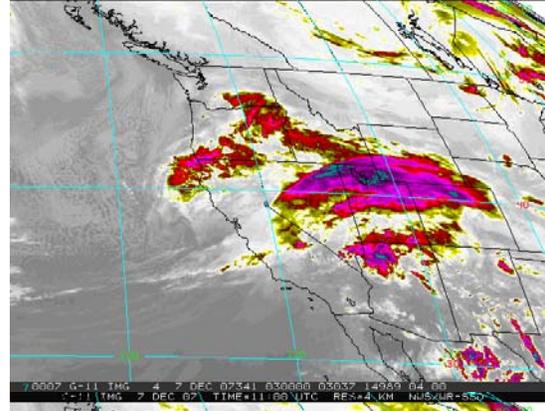
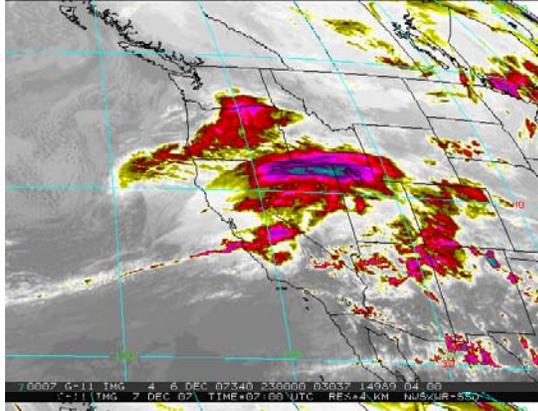
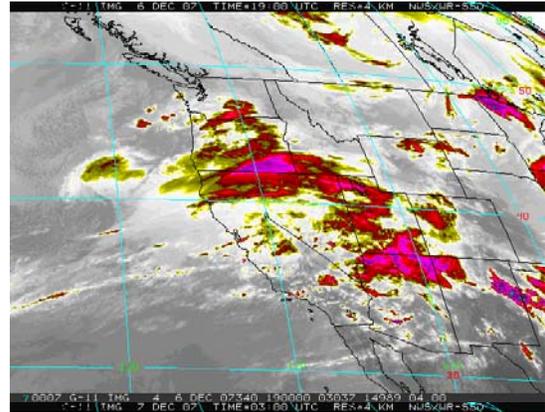
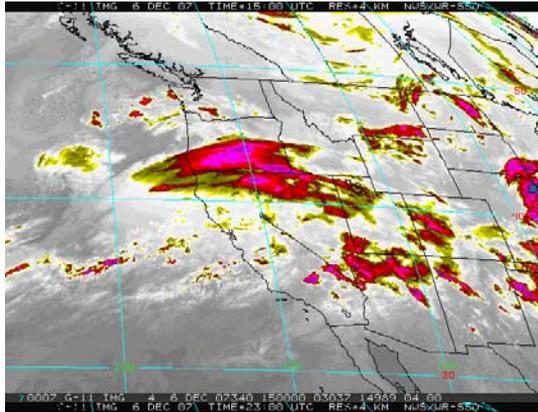
Synoptic 4-panel analyses for 12 UTC 6 December and 00 UTC 7 December



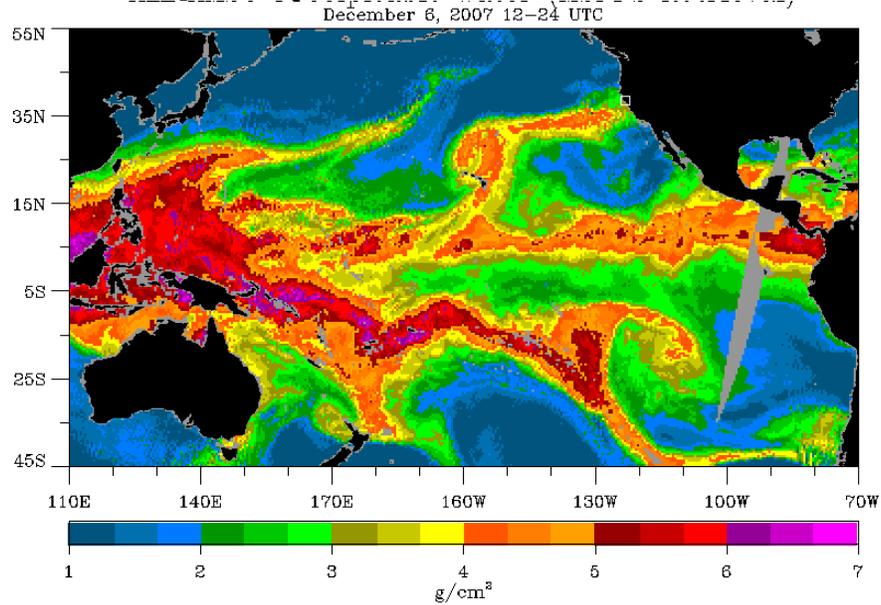
Synoptic 4-panel analyses for 12 UTC 7 December and 00 UTC 8 December



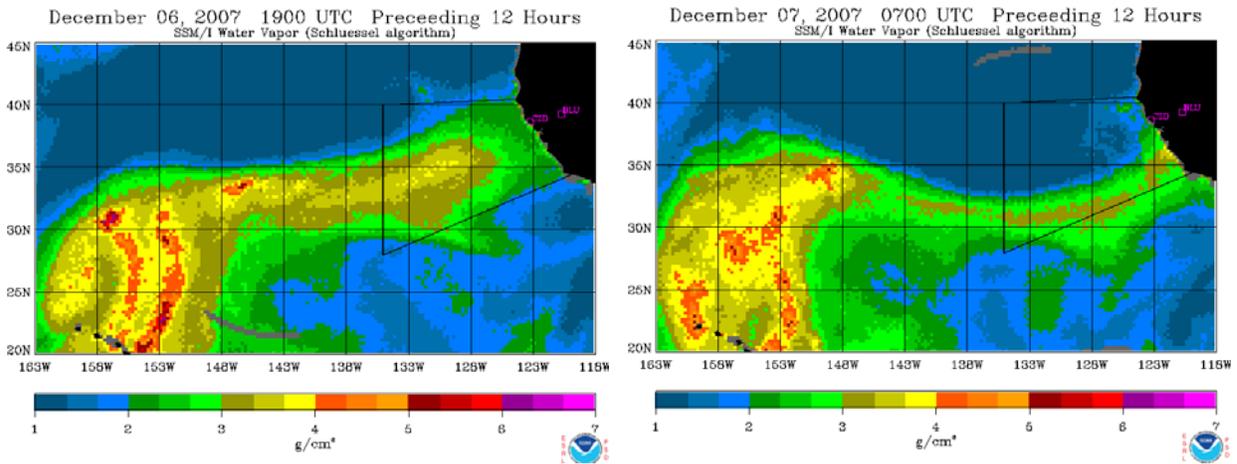
GOES IR Imagery for 15, 19 UTC 6 December and 03, 07, 11, 15, 19 UTC 7 December



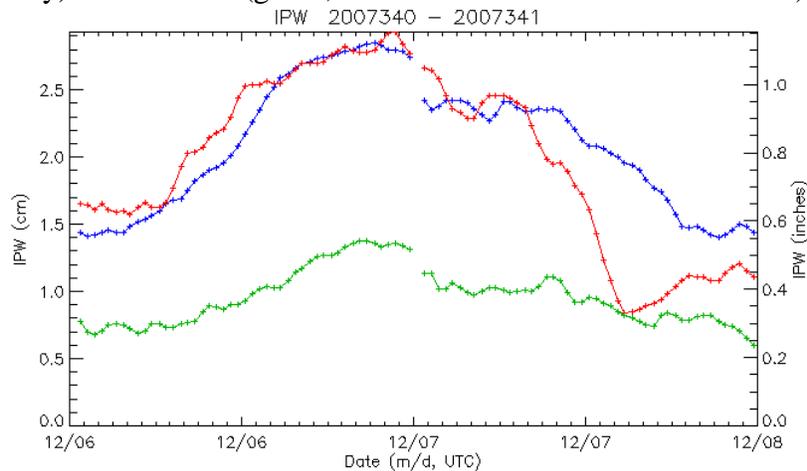
AMSU Integrated Water Vapor Composite from 12 UTC 6 December to 00 UTC 7 December



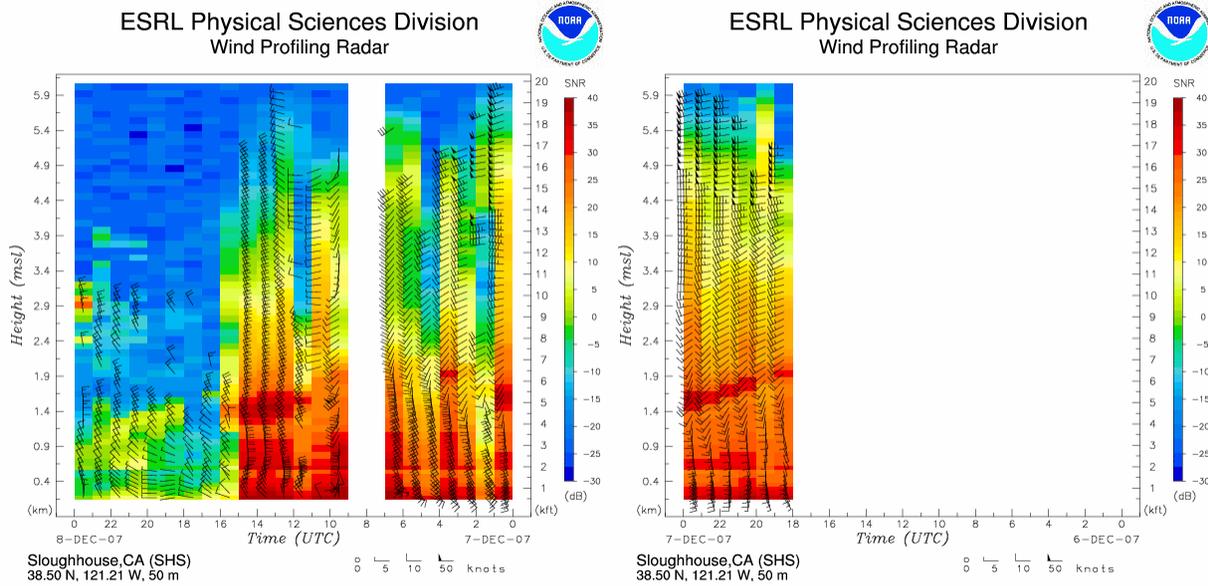
SSM/I Integrated Water Vapor Composites at 19 UTC 6 December and 07 UTC 7 December



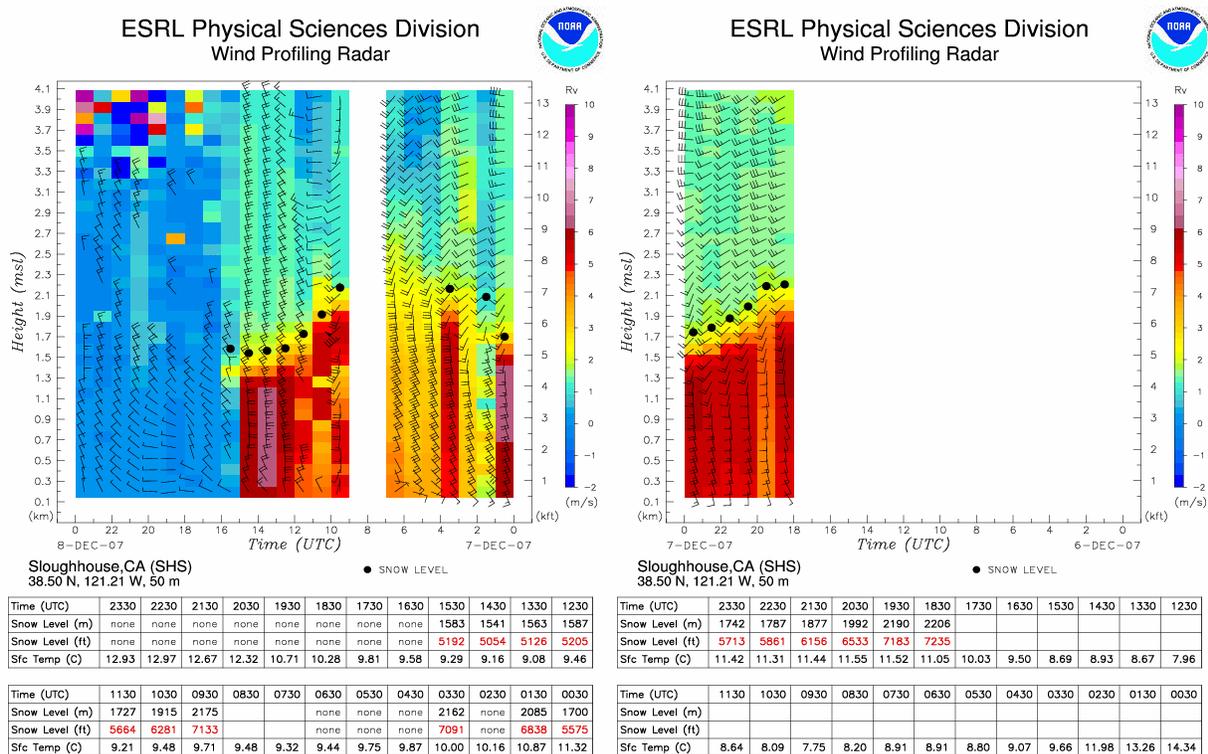
GPS Integrated Water Vapor time series from Bodega Bay (red, along the coast), Lincoln (blue, in the Central Valley) and Truckee (green, in the lee of the Sierra Nevada crest)



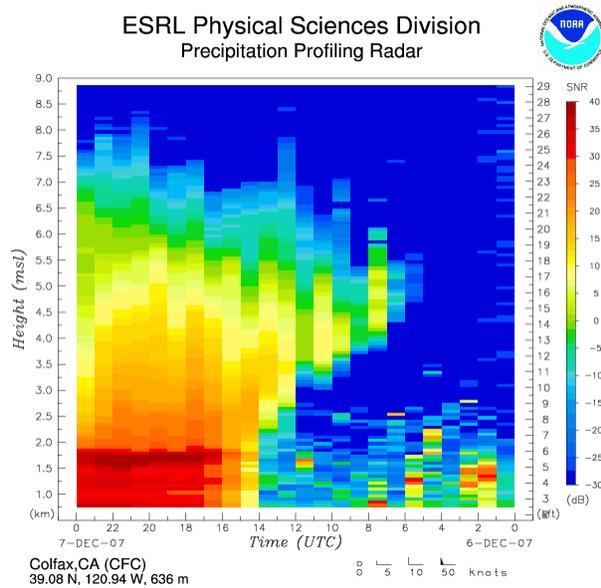
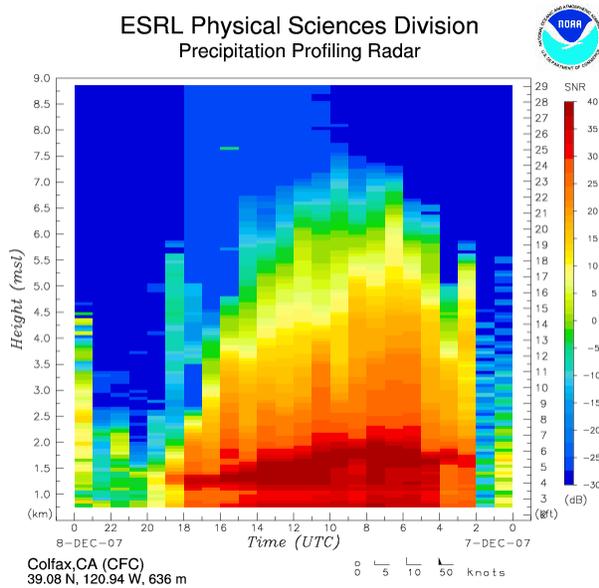
Sloughhouse 915 MHz profiler time-height series of winds and SNR for 6-7 December



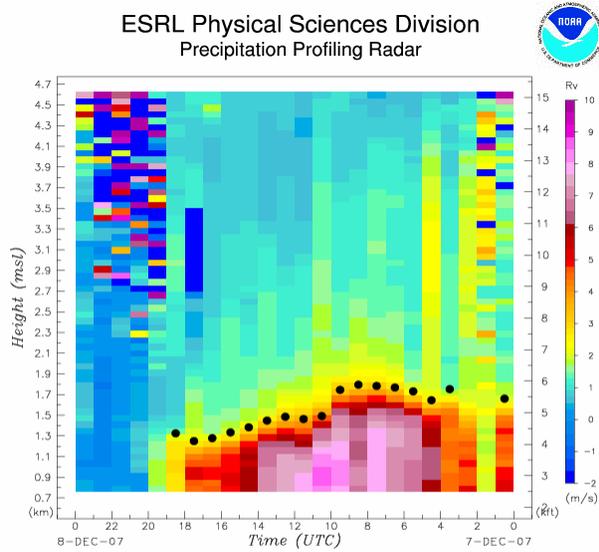
Sloughhouse 915 MHz profiler time-height series of Doppler vertical velocity and snow level for 6-7 December



Colfax S-band profiler time-height series of reflectivity for 6-7 December

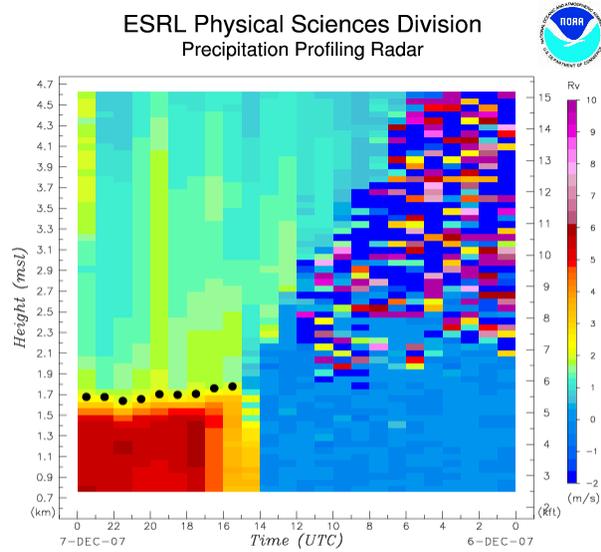


Colfax S-band profiler time-height series of Doppler vertical velocity and snow level for 6-7 December



Time (UTC)	2330	2230	2130	2030	1930	1830	1730	1630	1530	1430	1330	1230
Snow Level (m)	none	none	none	none	none	1325	1250	1278	1334	1383	1448	1485
Snow Level (ft)	none	none	none	none	none	4345	4099	4191	4375	4536	4749	4870
Sfc Temp (C)	7.88	9.15	8.57	7.76	6.57	6.08	5.03	4.82	4.63	4.66	4.62	4.71

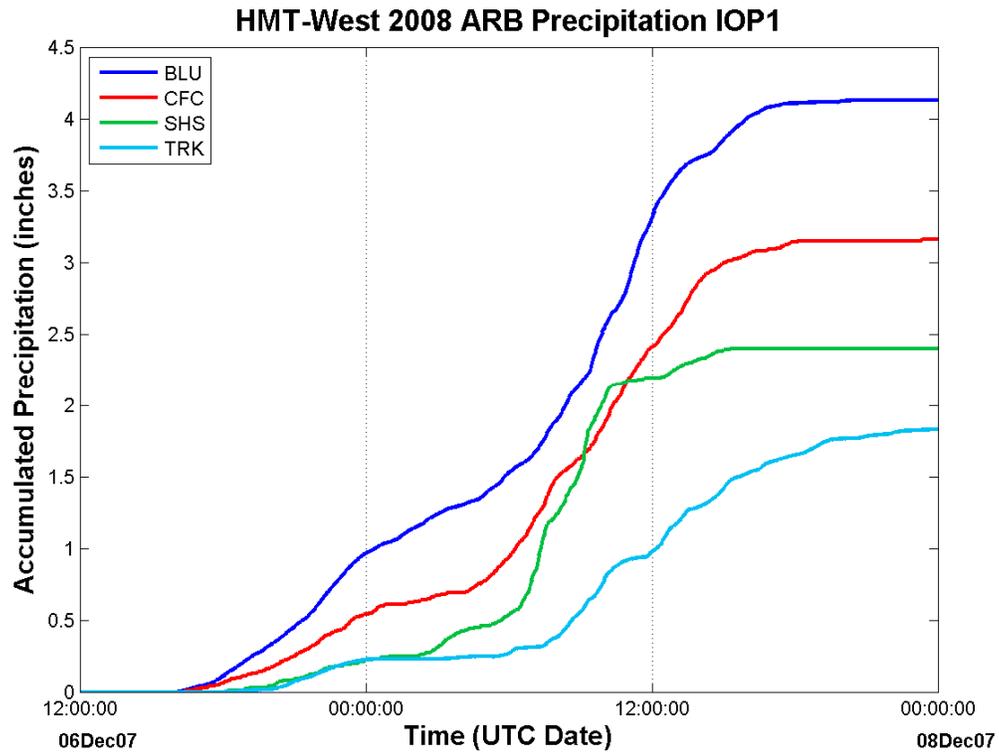
Time (UTC)	1130	1030	0930	0830	0730	0630	0530	0430	0330	0230	0130	0030
Snow Level (m)	1463	1492	1745	1795	1783	1768	1731	1645	1752	none	none	1660
Snow Level (ft)	4798	4893	5723	5887	5848	5799	5677	5395	5746	none	none	5444
Sfc Temp (C)	4.95	5.40	5.58	5.53	5.37	5.80	5.87	6.13	6.17	6.39	6.98	7.44



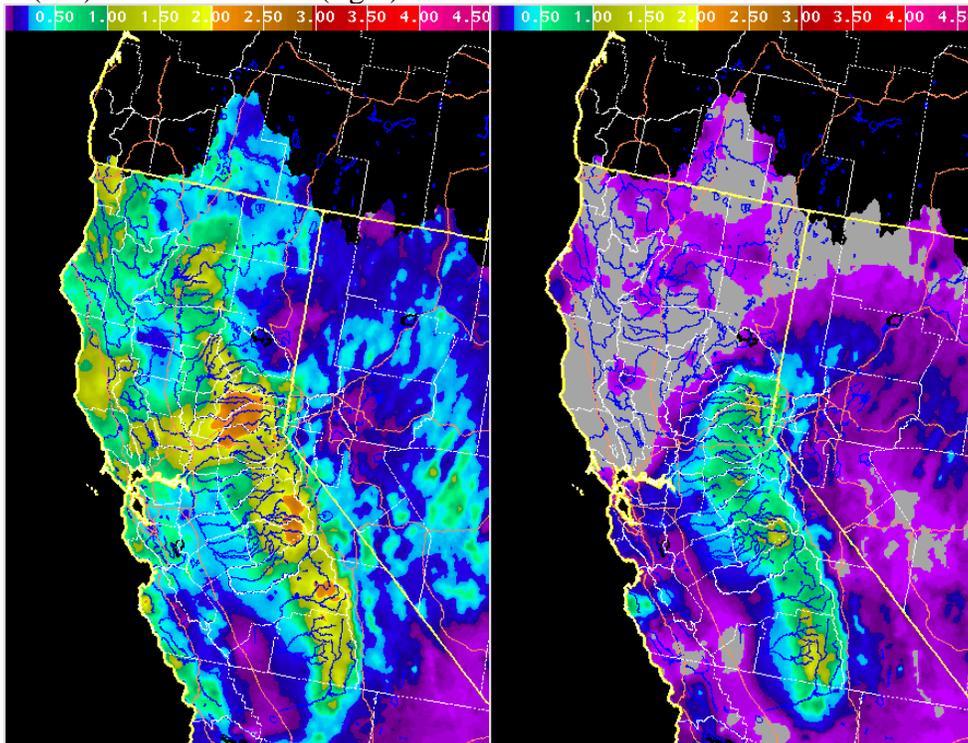
Time (UTC)	2330	2230	2130	2030	1930	1830	1730	1630	1530	1430	1330	1230
Snow Level (m)	1677	1676	1638	1656	1703	1697	1706	1760	1778	none	none	none
Snow Level (ft)	5500	5497	5372	5431	5585	5566	5595	5772	5831	none	none	none
Sfc Temp (C)	7.46	7.53	7.79	8.06	8.06	7.58	7.21	6.97	6.66	6.67	6.42	5.94

Time (UTC)	1130	1030	0930	0830	0730	0630	0530	0430	0330	0230	0130	0030
Snow Level (m)	none											
Snow Level (ft)	none											
Sfc Temp (C)	5.88	7.00	6.63	6.81	7.88	8.13	8.59	9.05	9.02	8.71	8.78	11.21

Time series of precipitation accumulation (liquid equivalent) from Sloughouse (SHS), Colfax (CFC), Blue Canyon (BLU) and Truckee (TRK).

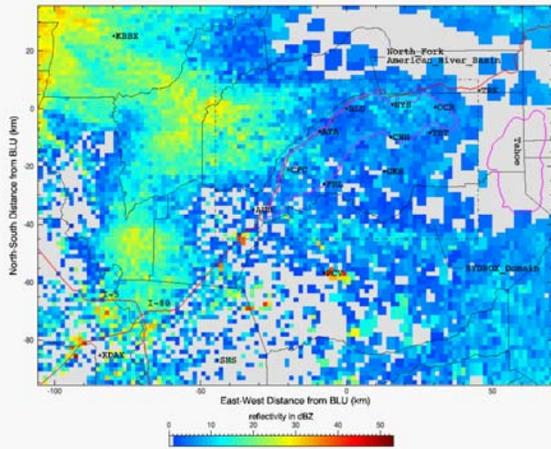


24-hour observed precipitation analysis from the CNRFC ending at 12 UTC for 6 December (left) and 7 December (right).

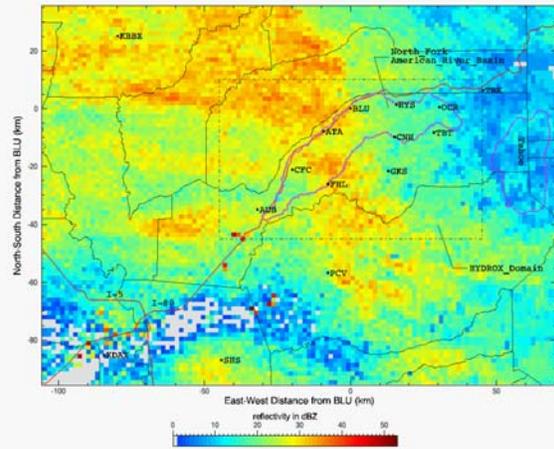


Radar reflectivity from KDAX at ~15 ~19 and ~23 UTC 6 December and ~03, ~07 and ~11 UTC 7 December

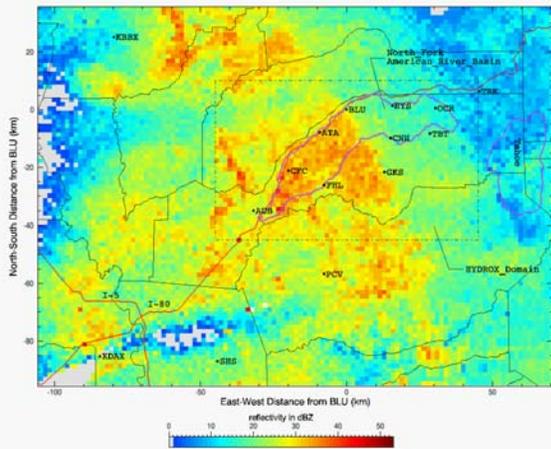
KDAX 0.5° Reflectivity (dBZ): 2007/12/06 15:02:02



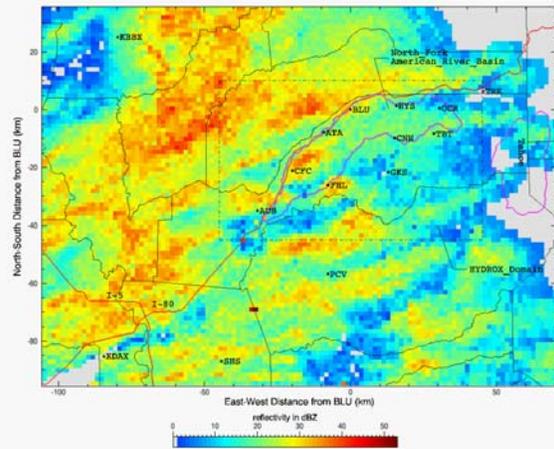
KDAX 0.5° Reflectivity (dBZ): 2007/12/06 18:58:15



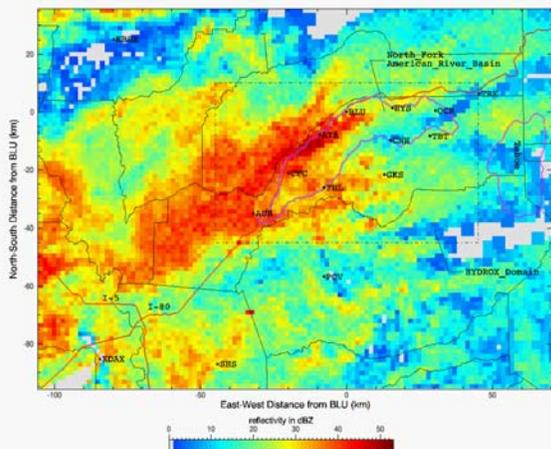
KDAX 0.5° Reflectivity (dBZ): 2007/12/06 23:01:49



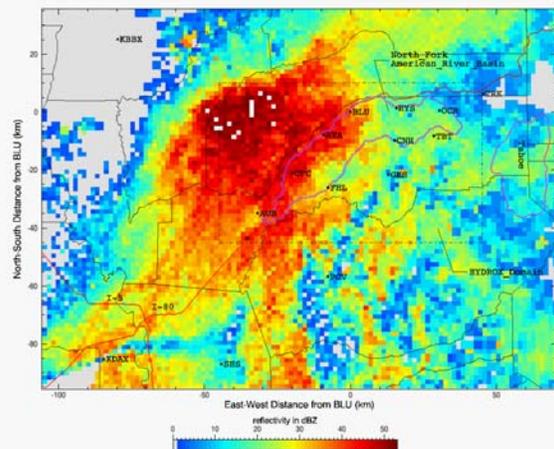
KDAX 0.5° Reflectivity (dBZ): 2007/12/07 03:02:05



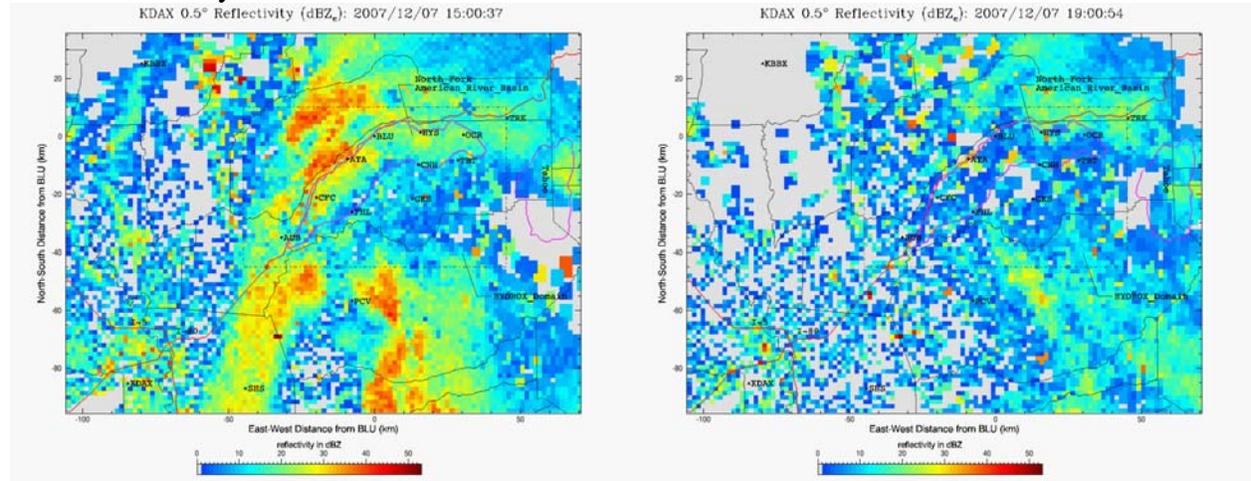
KDAX 0.5° Reflectivity (dBZ): 2007/12/07 07:01:15



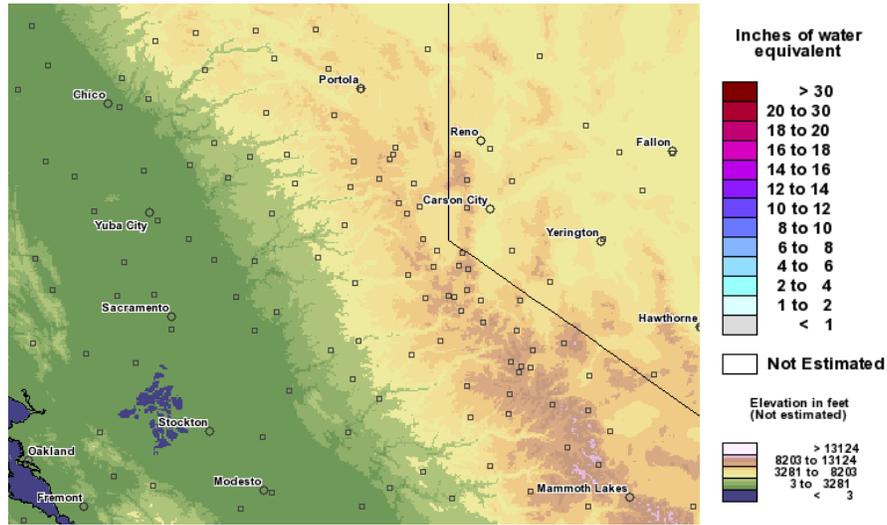
KDAX 0.5° Reflectivity (dBZ): 2007/12/07 11:01:26



Radar reflectivity from KDAX at ~15 and ~19 UTC 7 December



Map of snow water equivalent in our study area just before IOP1 (00 UTC 6 December)



Map of snow water equivalent in our study area just after IOP1 (00 UTC 8 December)

