A Review of the South Oregon Coast Wind Event of February 7th 2002

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Event Sequence

On Thursday, February 7, 2002 a rapidly developing and fast moving eastern Pacific cyclone brought a 2 to 3 hour long episode of high winds to the Southern Oregon coast and subsequently to portions of the Umpqua and Willamette valleys. These winds were not adequately forecast. Wind gusts at Cape Blanco rose from 38 mph at 11 am to 89 mph at 1 pm, a peak gust of 85 mph was recorded at Gold Beach around 2 pm, and a gust in excess of 100 mph was recorded that afternoon at Winchester Bay. A tractor-trailer tipped over at Port Orford around 130 pm. By 3 pm, south winds at the coast had shifted to the west and began to decrease. By 4 pm sustained winds at Cape Blanco and Point St. George had returned to near 25 knots. Inland, Signal Tree RAWS recorded a peak gust of 77 mph between 330 pm and 430 pm, a peak gust of 39 mph was measured in Roseburg at 409 PM, and a peak gust of 70 mph was noted in Eugene at 440 pm. The high winds resulted in downed utility lines from a large number of fallen trees.

Most forecasters would agree that the AVN tends to provide the best model solution of conditions in the eastern Pacific. However on this day, it was noted that over the previous 24 hours the ETA had done a better job with the surface winds over the Southern Oregon coastal waters, while the AVN had over-forecast the winds by 10 to 15 knots. The preferred solution on the past 2 shifts had been that the coastal winds on Thursday would be strong southwest in the morning and back to east or southeast as an approaching weak surface low made landfall near Brookings. It was unclear whether the low would arrive as a closed low or a weak trough, which posed difficulty for the wind forecast. The winds would likely have an easterly component, but either southeast or northeast was unclear depending on the location and strength of the low.

On the early morning (midnight) shift of February 7th, the 00Z run of the AVN, ETA and NGM models had differences regarding the strength, timing and position of a disturbance expected to reach the south Oregon coast. The AVN 12-hr forecast surface chart indicated that a developing surface low near 38N 140W would move east to near 135W by 12Z (fig.1). The AVN forecast southerly winds of 40 to 45 knots in advance of the low over the far northern California coastal waters. It had the low move across the waters in the

afternoon
before heading east to northeast across Siskiyou County. The ETA model forecast was significantly weaker with the surface low pressure and forecast only an open wave trough with wind speeds of 15 to 25 knots in the southern Oregon coastal waters.

It was determined that the AVN model winds were more realistic than the ETA. This was based upon the Goes-10 IR satellite derived winds below 700 mb which showed 50 knots of wind along 35N between 130W and 140W. As a result, the forecast was tailored toward the AVN, but this was not deemed to be sufficient data to wholly follow the AVN solution. Less than 12 hours earlier, the AVN solution had noticeably forecast coastal wind speeds that were too strong, and the ETA model was deemed the better model at the time. Nonetheless, windy conditions were added to the forecast. This included mention of gusts to 40 mph along the Curry County coast and gusts of 35 knots over the coastal waters south of Cape Blanco. Also, wind gusts to 35 mph were included for the Rogue Basin and 40 mph for the Siskiyou mountains and east side. It was thought that the surface low would track along the Oregon/California border with the strongest southerly winds only affecting the South Coast, Rogue Basin, Cascades and South Central Oregon. Coordination calls were made to Eureka, Pendelton and Boise specifically to highlight that the AVN may be handling the offshore surface features better according to the observed satellite-derived winds. Winds of 20 to 30 mph with gusts to 40 mph in adjoining areas were suggested.

Based upon the morning briefing, coordination with the marine forecaster, and analysis of the differing 12Z model solutions it was determined on the morning of the day shift that a compromise between the AVN and ETA was the most prudent course. Despite differences in strength, both models were consistent and similar in tracking a weak low east from near 40N 135W into western Oregon between 12Z and 00Z (figs. 2a and 2b). Thus, the strongest winds were expected along the far northern California coast and a forecast of breezy conditions was issued along the Oregon coast with windy conditions at coastal headlands. The 00Z and 12Z runs of the MAV guidance both indicated sustained south winds of 30 knots for 00Z Thursday afternoon at Brookings. A wind advisory was issued for the Shasta Valley of Siskiyou county, California, which often receives strong south winds as strong surface lows move inland over the Pacific Northwest.

In the morning, south winds along the southern Oregon coast had been below 20 knots. Around 11 am, as the rapidly developing surface low approached the coast, coastal wind speeds increased to near what they had to been forecast to be. Satellite features between 1030Z and 1930Z showed classic cyclogenesis features including a baraoclinic leaf, dry slot intrusion, and cusp formation, which should have helped forecasters identify the surface low position and rapid development (see Satellite loop). The indication of a more northerly storm track, growth of the dry slot behind the storm, and the fact that the storm was not yet at the coast were all indications that winds in the afternoon would be stronger than forecast. However, wind speeds were still not expected to be significantly stronger than forecast and a decision was made not to update the forecast given the rapid movement of the storm and the fact that the forecast had been updated only 15 minutes earlier. At around noon, wind gusts at Cape Blanco jumped to 60 mph from 38 mph the previous hour. At 1 pm, a peak gust of 84 mph was recorded at Cape Blanco. A Nowcast was issued for the Curry County coast at 107 pm followed by a High Wind Warning for the Coos and Curry County coast at 116 pm. South winds veered to west and began to decrease at the coast around 300 pm.

Conclusion:

This type of event is rare but such an event is likely to occur again in Oregon. The most important lesson is that forecasters must be able to recognize the precursors of explosive marine cyclogenesis. An explosive cyclone is defined as one in which the surface pressure is falling at a rate exceeding one Bergeron per day.
At 40N this would equate to a pressure fall of 18 mb or greater in 24 hours.

In their paper, "Explosive Marine Cyclogenesis: Surface and Upper Air Indices", Lyons and Scoggins note 5 features normally present prior to or during such an event:

1. A pre-existing baroclinic zone with strong meridional temperature gradients and strong west or southwest winds from 500 mb upward to 200 mb.

These conditions were present in this case. Note the low level thermal gradient over the eastern pacific in the 12Z AVN 850 mb chart (fig.3).

2. A strong jet streak west or northwest of a pre-existing surface cyclone accompanied by a strong cyclonic vorticity center and associated PVA into the area above the surface cyclone.

There was a strong 100 to 135 knot jet streak at 300 mb (fig.4) and a strong vorticity center at 500 mb (fig.5) overtaking the low level thermal gradient.

3. A synoptic scale north to south oriented upper level trough becoming negatively tilted with time.

The SPENES message of 1445Z from the satellite analysis branch of NESDIS noted the trough beginning to take on a negative tilt with a baroclinic leaf signature ahead of the vorticity center (See Satellite Loop). The upper trough became negatively tilted between 12z and 00z (figs. 6a and 6b).

4. Strong upper level divergence to the east of the upper trough axis, and strong low level convergence beneath the upper level divergence region.

The storm encountered a dual jet stream structure along the Oregon coast which enhanced upper level divergence in the vicinity of the developing surface low. The right rear quadrant of a westerly jet streak over Washington overlapped with the left front quadrant of the approaching southwesterly jet streak offshore (fig. 7).

5. Development of strong convection in the vicinity of the surface cyclone center as the cyclone begins to develop.

Convection was not observed.

Lessons Learned:

1. Due primarily to much improved computer model forecasts, forecasters have to ward off the reluctance of issuing a forecast that diverges strongly from the model data. Be vigilant in determining when observed conditions vary from the model solution.

2. Forecasters need to remember that the model that verified well yesterday may not have a good solution today. Also, a consistent model forecast is not necessarily an accurate model forecast.

3. As our relationship with neighboring offices continues transition from coordination of written forecasts to the era of collaboration with GFE, communication between offices will take on increased importance. Occasionally, much stronger winds may be confined to one office's area. Smoothing of adjacent grids is possible without neighboring offices having an overall forecast of similar conditions.

4. The forecast for this event was hampered by a dearth of observed surface conditions in the vicinity of the developing surface low. There were no ships reports in the area, the wind sensor at Buoy 06 (40.8N 137.5W, just north of the low track) had been inoperative since October 2001, and Buoy 59 (38N 130W, just south of the low track) was out of service. Also, the storm made landfall nearly at the center of the largest stretch of the United States west coast without a near shore buoy. The satellite derived winds (labeled as "below 700

mb") were perhaps the most important precursor to the rapid cyclone development. The 40 kt southwest winds derived in the vicinity ahead of the the developing surface low were much stronger than model data indicated. Also, skillful analysis of infrared and water vapor satellite imagery and an accurate determination of how conditions aloft will translate to the surface are both imperative.

5. Forecasters from Pacific Northwest marine offices should maintain an annual review of the precursors to explosive cyclogenesis as outlined by Lyons and Scoggins.

6. In the operational environment, identification of the problems of the day, and an awareness that these may change over the course of the day are vital in maintaining a constant weather watch.

Figure 1

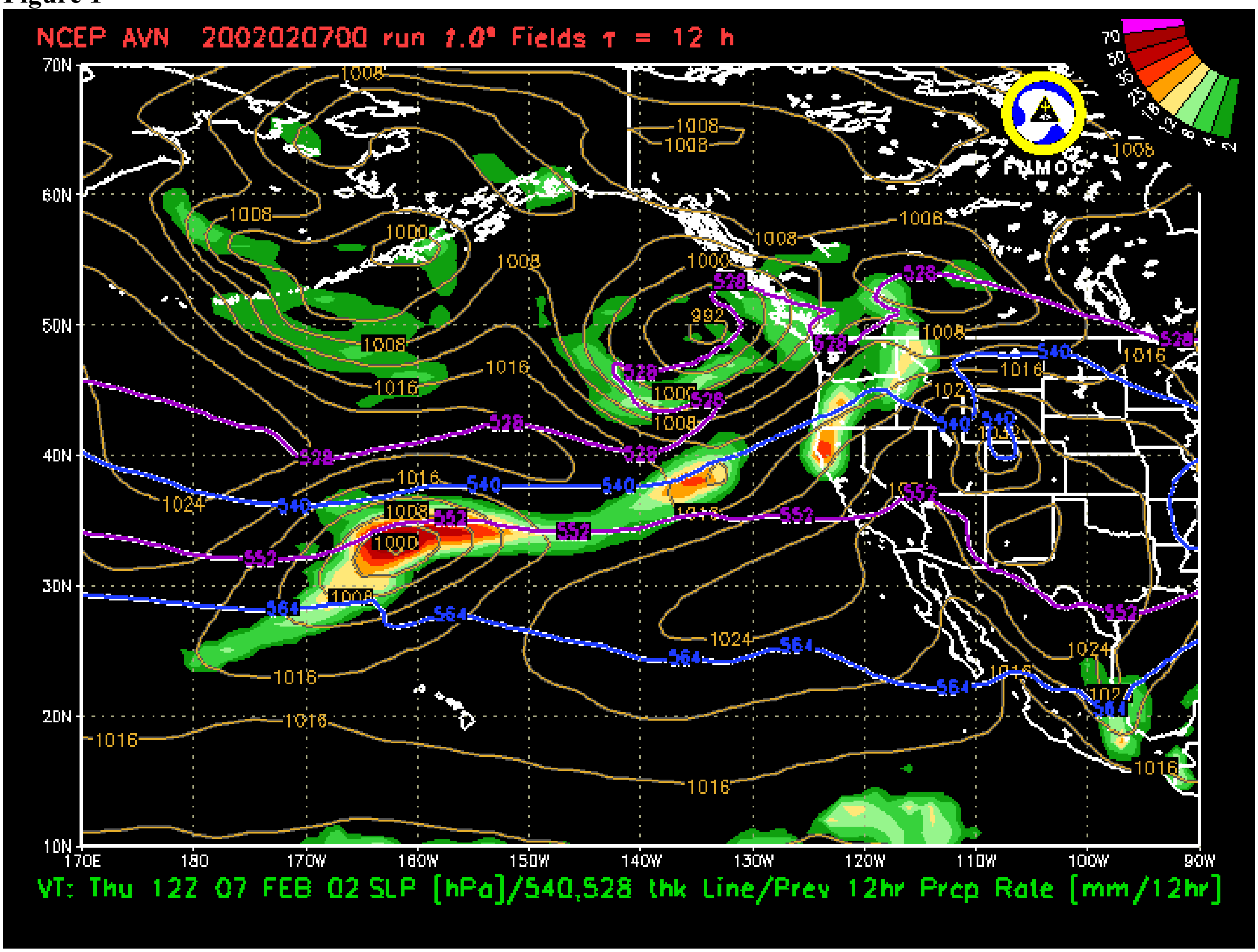


Figure 2a

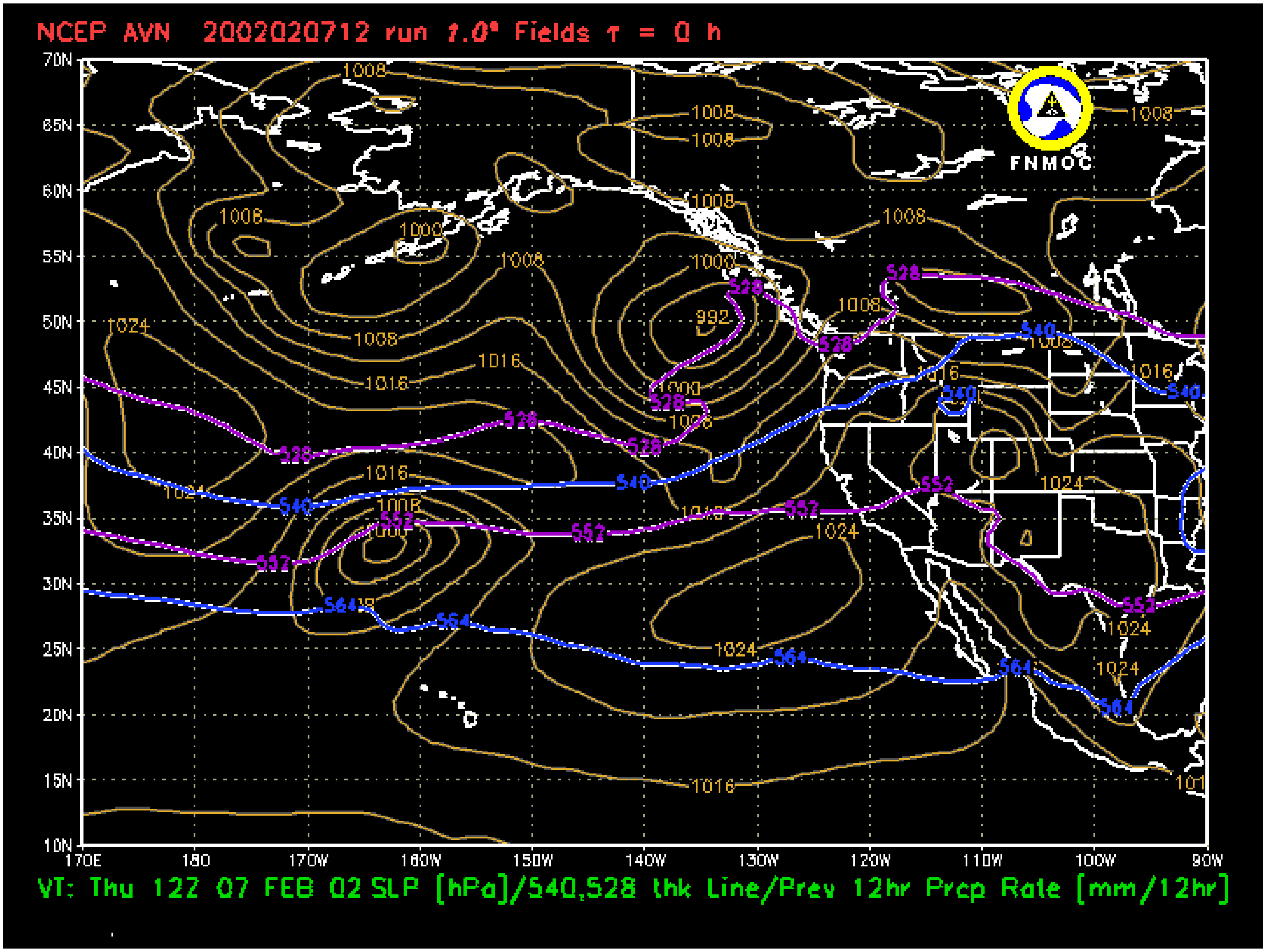

NCEP AVN 2002020712 run 1.0° Fields τ = 0 h
FNMOC
VT: Thu 12Z 07 FEB 02 SLP [hPa]/540,528 thk Line/Prev 12hr Prcp Rate [mm/12hr]

Figure 2b

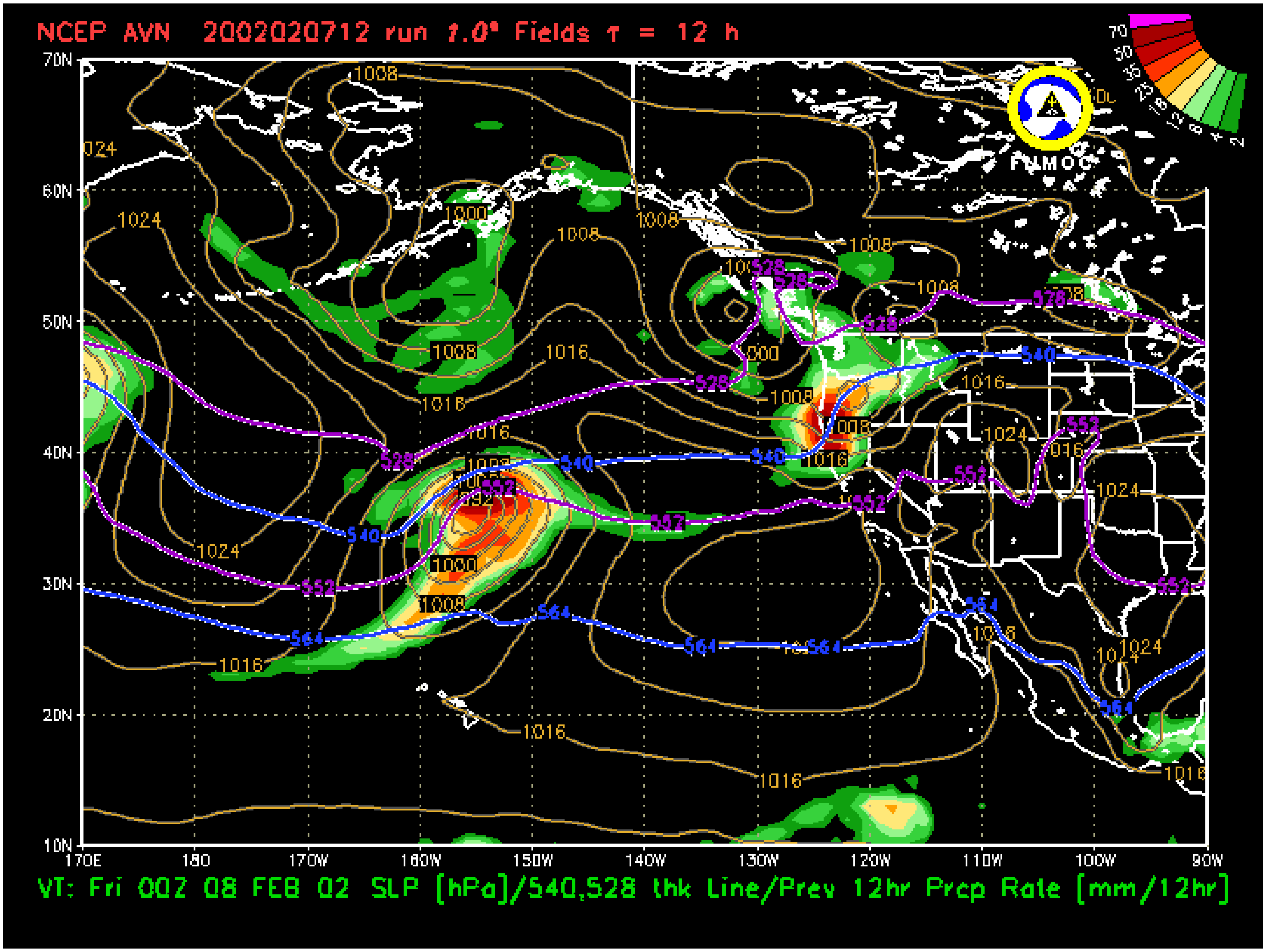

NCEP AVN 2002020712 run 1.0° Fields τ = 12 h
VT: Fri 00Z 08 FEB 02 SLP [hPa]/540,528 thk Line/Prev 12hr Prcp Rate [mm/12hr]
FNMOC
70N
60N
50N
40N
30N
20N
10N
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W

Figure 3

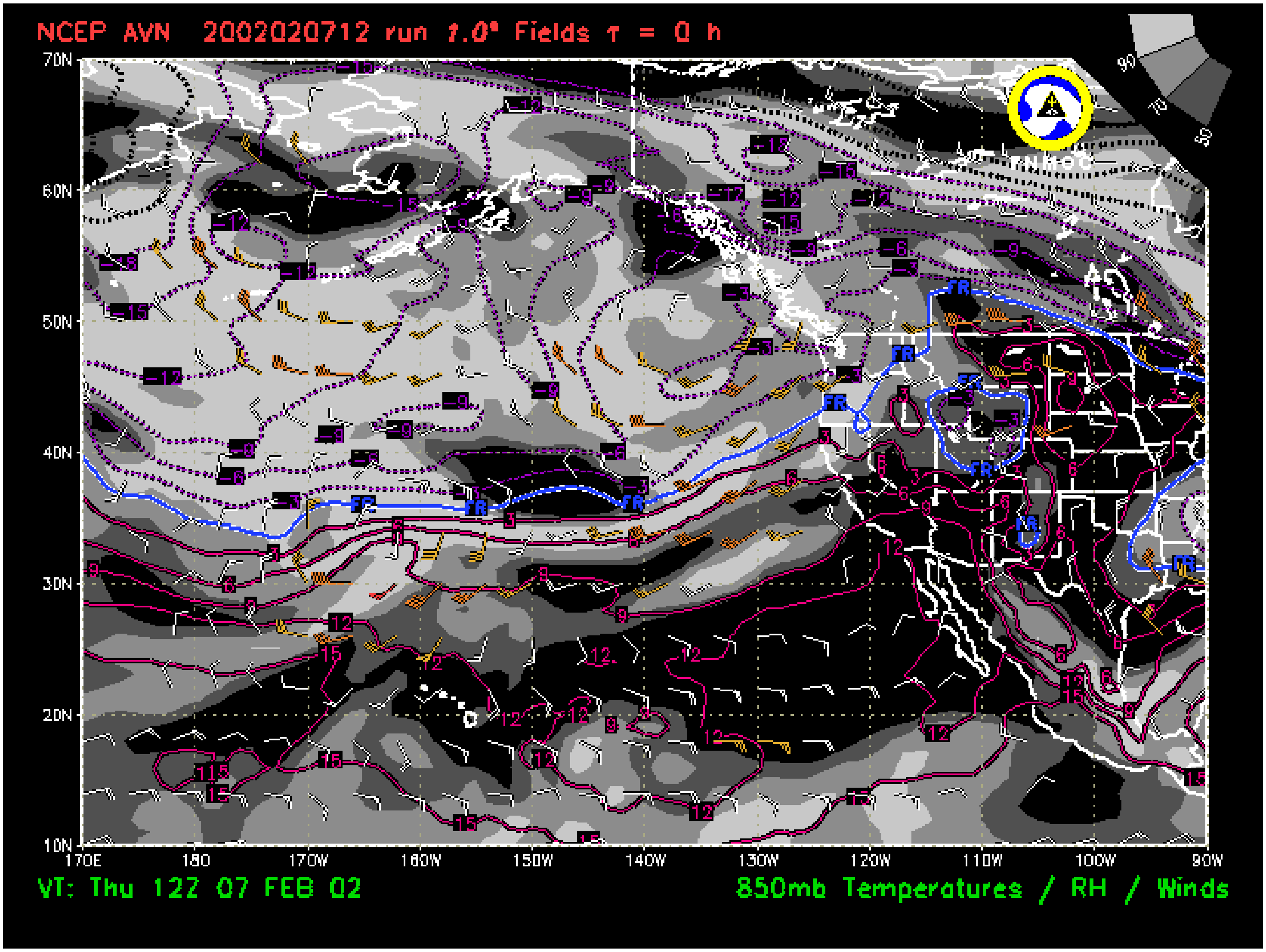
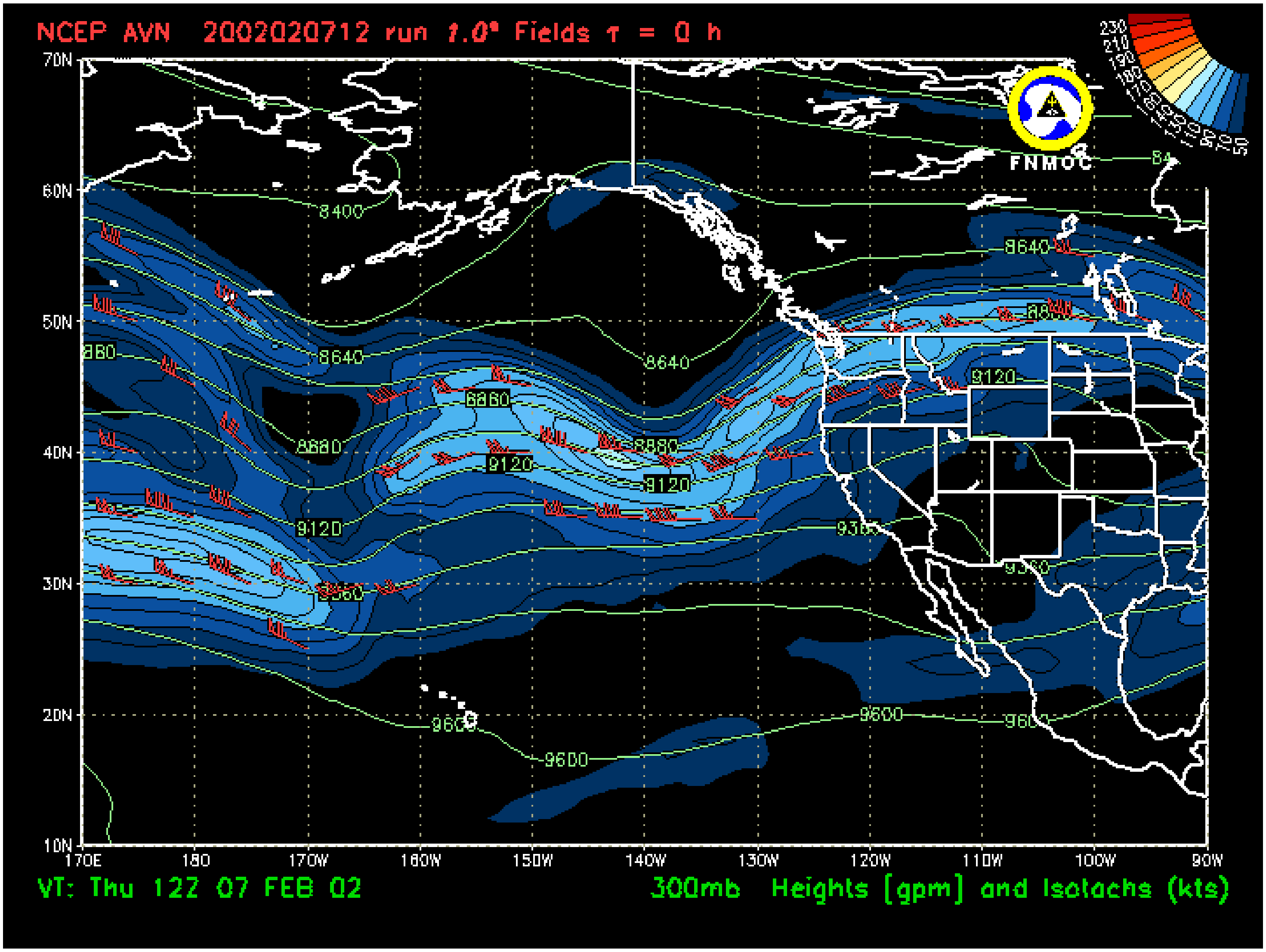

NCEP AVN 2002020712 run 1.0° Fields τ = 0 h
VT: Thu 12Z 07 FEB 02
850mb Temperatures / RH / Winds
70N
60N
50N
40N
30N
20N
10N
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
90
70
50
FNMOC

Figure 4



NCEP AVN 2002020712 run 1.0° Fields τ = 0 h
FNMOC
VT: Thu 12Z 07 FEB 02
300mb Heights [gpm] and Isotachs (kts)

Figure 5

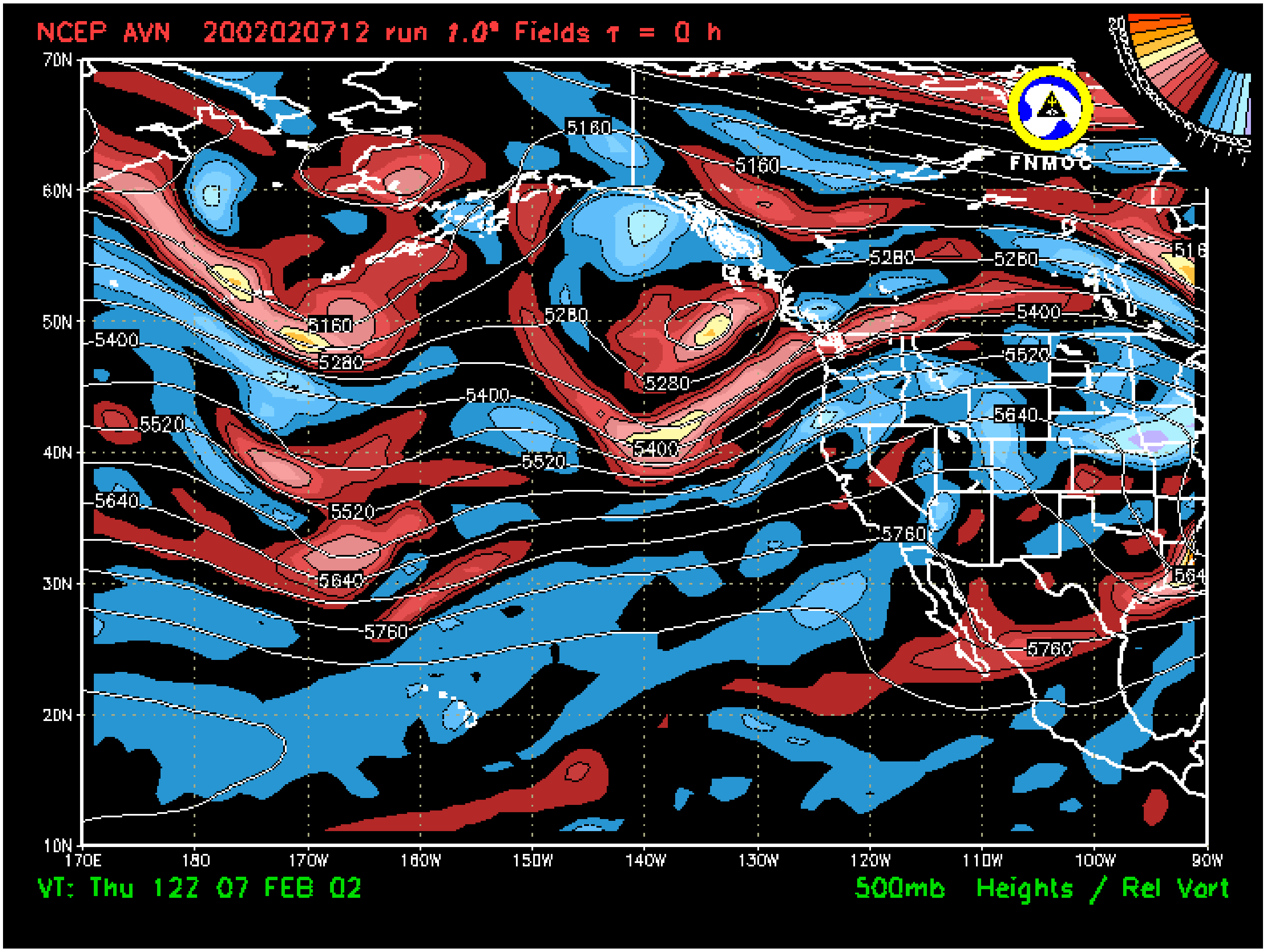

NCEP AVN 2002020712 run 1.0° Fields τ = 0 h
FNMOC
70N
60N
50N
40N
30N
20N
10N
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
5160
5280
5400
5520
5640
5760
VT: Thu 12Z 07 FEB 02
500mb Heights / Rel Vort

Figure 6a

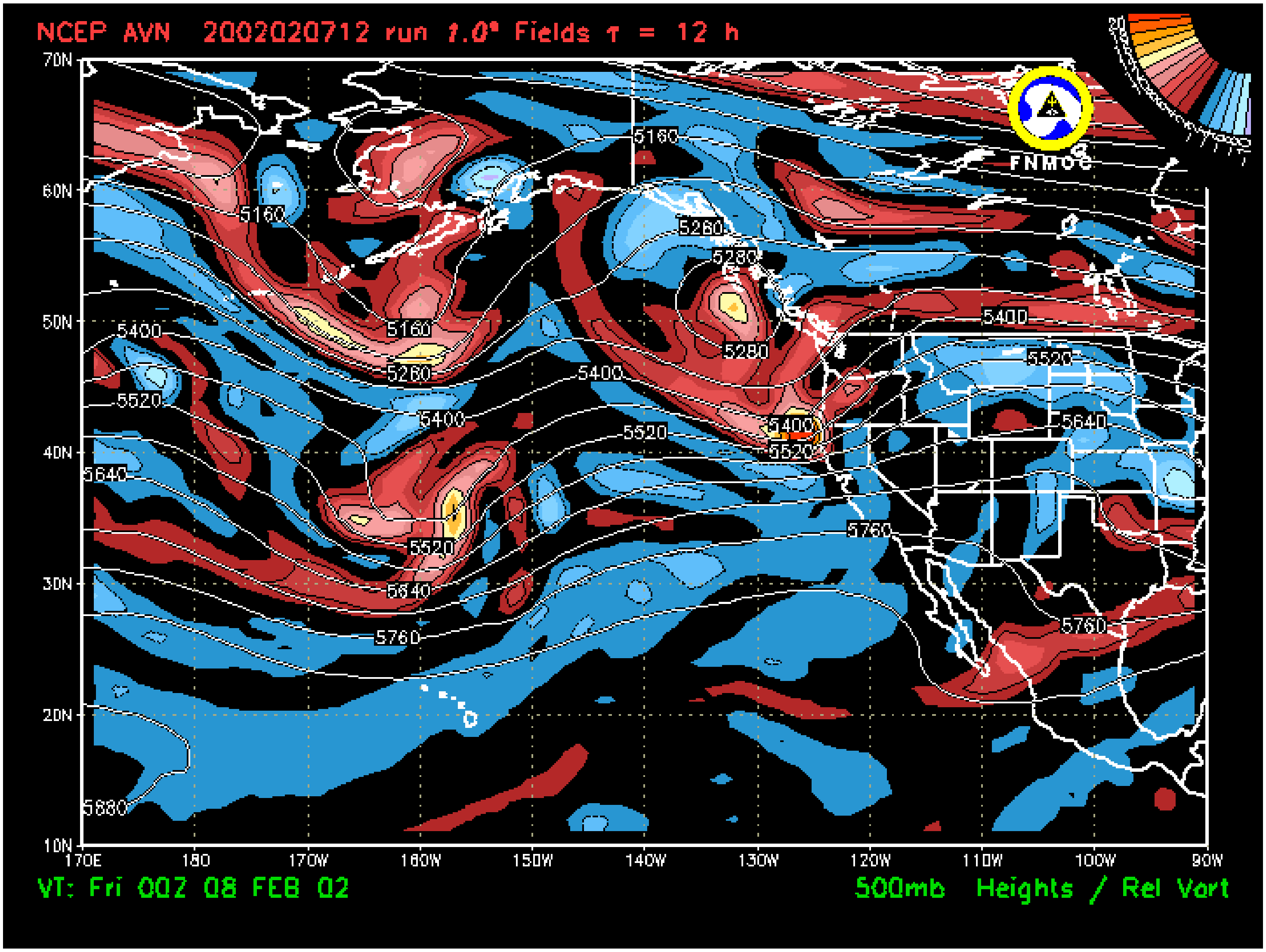
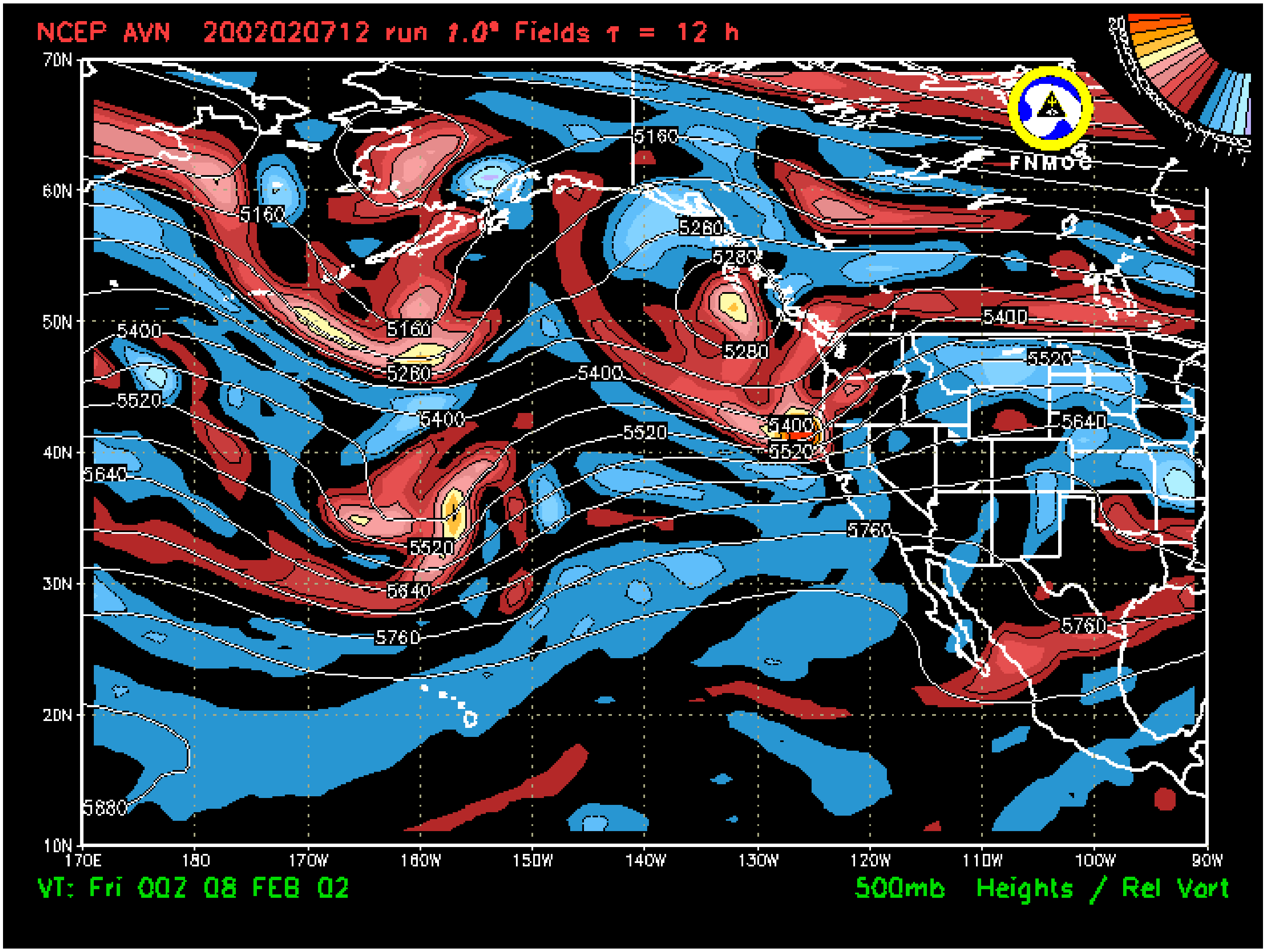

NCEP AVN 2002020712 run 1.0° Fields τ = 12 h
FNMOC
70N
60N
50N
40N
30N
20N
10N
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
5160
5260
5280
5400
5520
5640
5760
5880
VT: Fri 00Z 08 FEB 02
500mb Heights / Rel Vort

Figure 6b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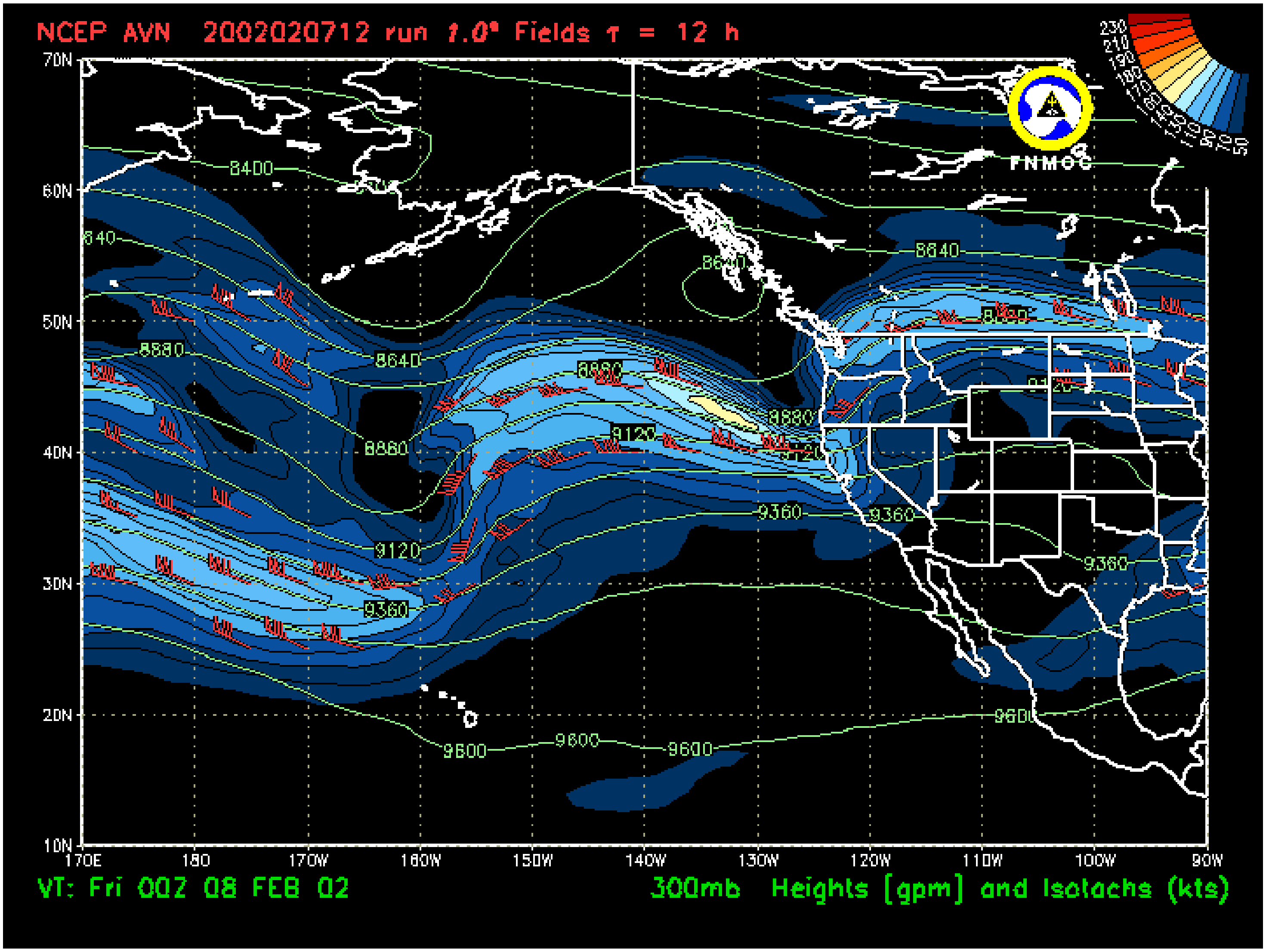
FNMOC
VT: Fri 00Z 08 FEB 02
500mb Heights / Rel Vort

Figure 7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FNMOC
VT: Fri 00Z 08 FEB 02
300mb Heights [gpm] and Isotachs (kts)