

Mount Shasta Area Heavy Snow Event for the Weather Event Simulator (WES)

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Introduction:

This WES case involves a snow event in which Mount Shasta City CA received over 2 feet of snow in a 36 hour period beginning the morning of December 19, 2002. Heavy snow events are not uncommon in this area but they tend to be difficult to forecast for a couple of reasons. First of all, snow levels are very difficult to predict in this area. The snow level can be as much as 4,000 feet below the freezing level and 2-3,000 feet below wet-bulb zero. In this case, snow level prediction was not a problem for the Mount Shasta area as the wet-bulb zero height was a little below 3000 feet. Mount Shasta city lies at 3600 feet. Interestingly enough though, snow in this case accumulated at elevations as low as 1000 feet. Secondly, there are many cases of strong moist orographic inflow into the region during the winter, but only a few cases of heavy snow. Thus, there is more to predicting heavy snow (or heavy precipitation) over the region than just strong moist southerly flow at the lower levels of the troposphere.

Synopsis:

A deep upper level trough was nearly stationary off the Pacific Northwest coast with a closed circulation center around 45N 133W. With time the trough became more negatively tilted, a characteristic that would affect the direction of the low level winds and enhance the orographic lift across our area of interest. Also, it would also make the conditions more favorable for damaging winds in portions of the Rogue Valley near Medford OR. A cold front paralleled the coastline, remaining just offshore during the early portion of the event. A couple of short-wave troughs rotated through the trough aloft during the simulation, temporarily enhancing the precipitation rates. This can be seen in the satellite imagery ([figure 1](#)).

Discussion:

The Eta and AVN models appeared to be handling the broad scale features well. From the 12Z runs two features from the kinematic fields stand out. First of all, looking at the 300 mb wind field, you can see the coupled jet structure very apparent at 18Z ([figure 2](#)). One jet streak lies to the north of Medford while another jet is nosing into northern California. The Mount Shasta area is squarely between the two, being in the right rear quadrant of the jet to the north and the left front quadrant of the jet nosing into California. The result is very strong divergence at that level which implies strong UVV. Looking at the 700 mb wind field at the same time ([figure 3](#)), you can see strong southerly flow that maximizes itself over the region near Mount Shasta. A look at the entire wind field would reveal the presence of a low level jet in this area. This maximizes the orographic lift at the same time that the synoptic scale lift is greatest. The end result was precipitation rates that ranged from moderate to heavy for several hours on either side of 18Z.

How well did the Eta and AVN do so far as their precipitation fields were concerned? Both the Eta and the AVN (only ETA shown) placed the greatest precipitation along the coast to the southwest of the Mount Shasta area ([figure 4](#)). They greatly underforecast the precipitation which actually fell over the region. The lesson to be learned here is that the models can do well in pointing out areas of greatest lift (which should roughly correlate to greatest precipitation, at least at the synoptic scale), and yet provide poor guidance in their precipitation fields. In this case the low level southerly jet and the coupled upper level jet over the region provided the forecaster with more than enough evidence that precipitation rates would be significant.

Figure 1

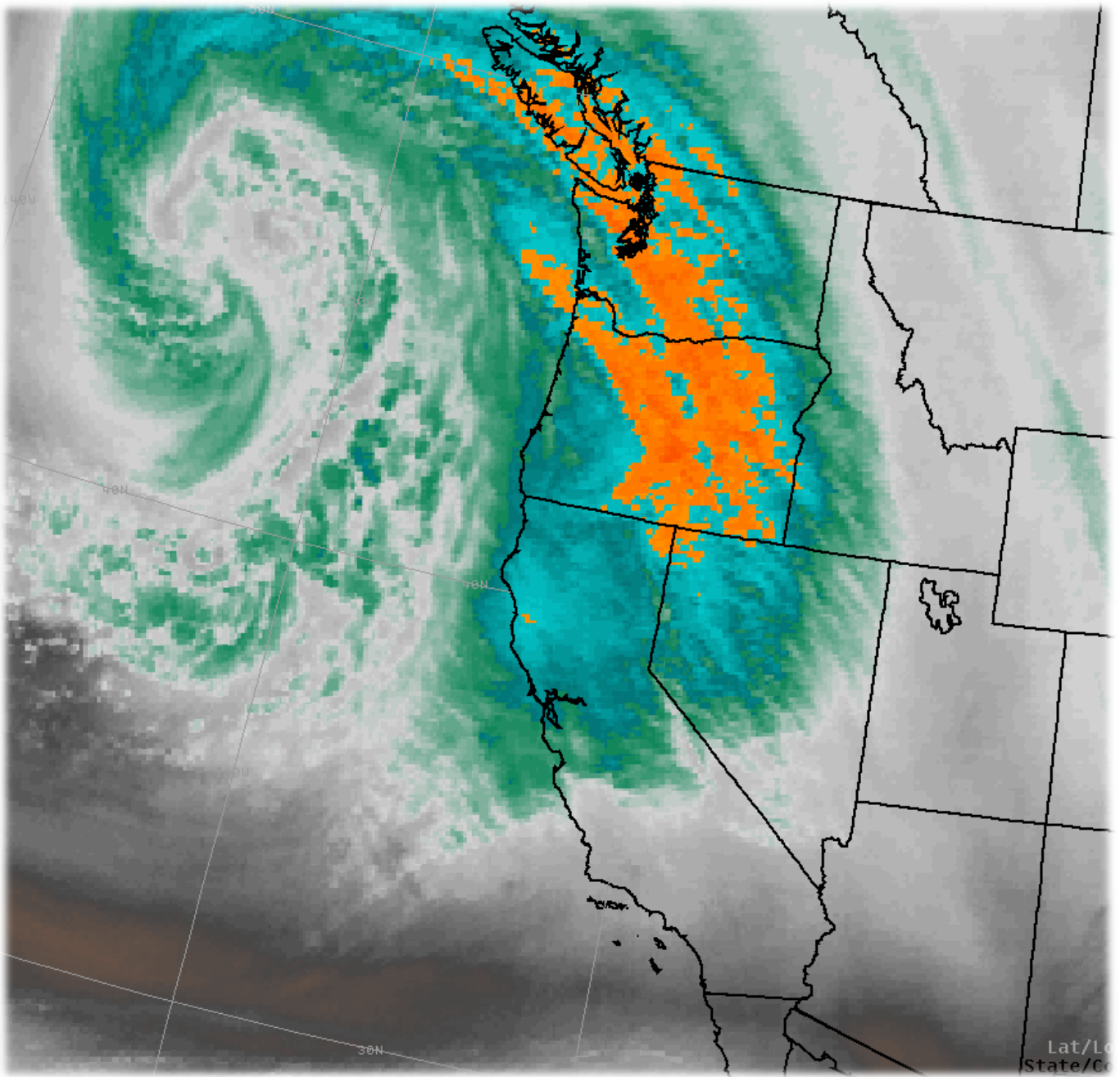


Figure 2

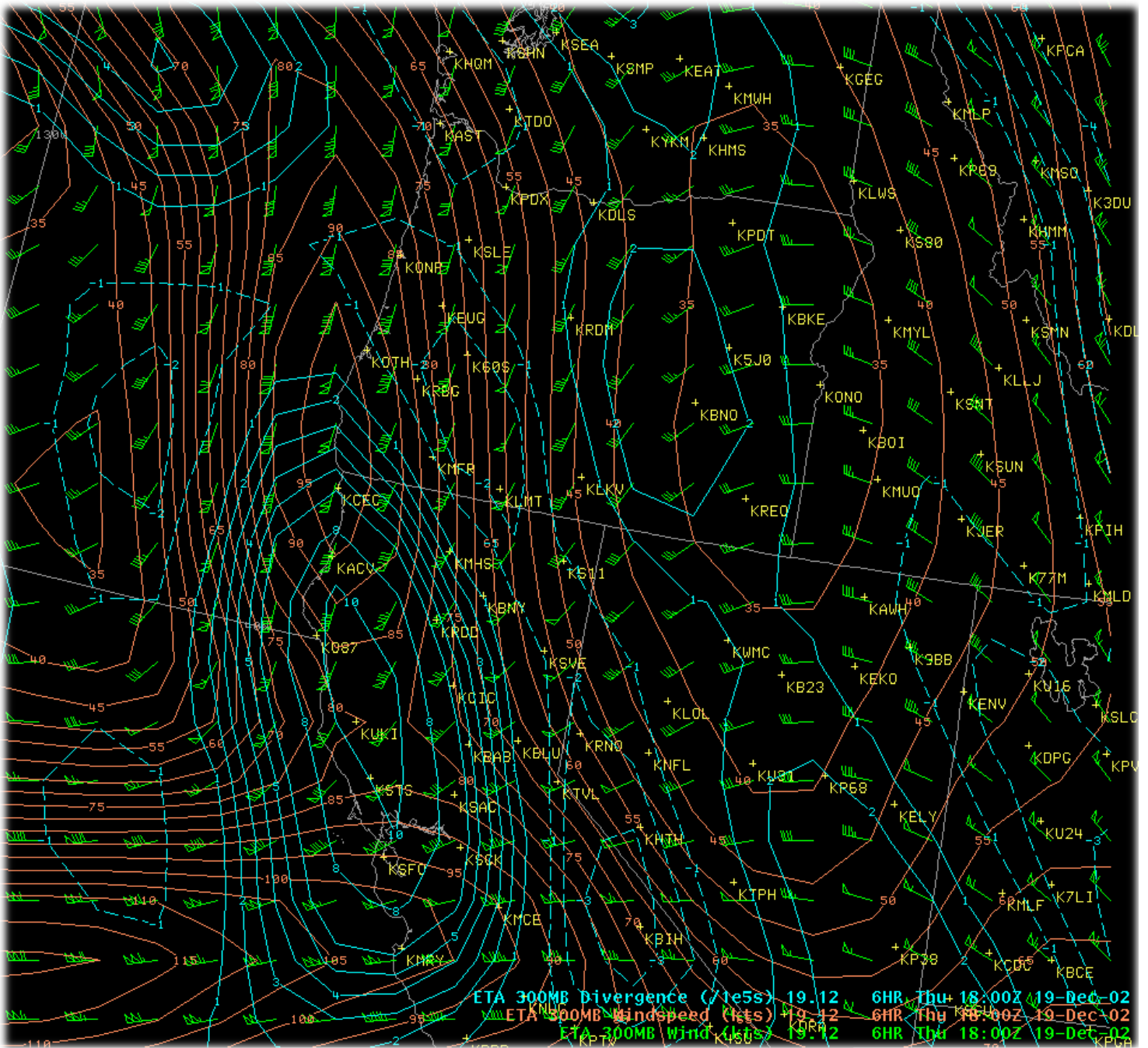


Figure 3

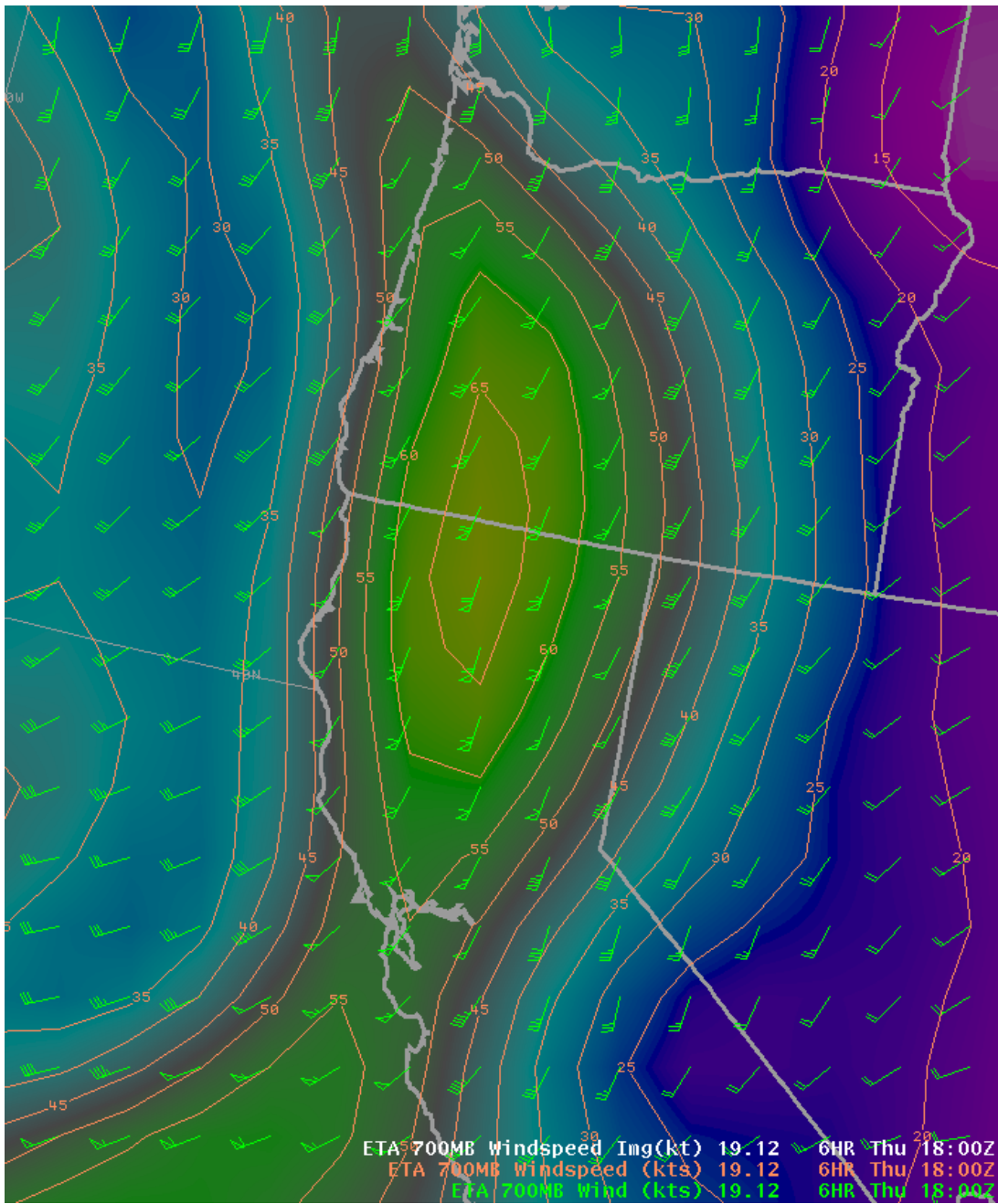


Figure 4

