

A Look at the February 25-28, 2003 Winter Storm for Southeast Arizona Using WES

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Introduction

The winter storm that moved across Southeast Arizona at the end of February, 2003, provided a forecast challenge due to its duration. Here was a situation where the initial forecast and lead-times were quite accurate, but where we subsequently fell into the trap of trying to end the weather too quickly. After an initial 6 to 12 inches in the mountains of Southeast Arizona which verified a series of well advertised advisories and warnings, residual conditions combined with a pair of follow on impulses to bring another two separate periods of advisory level snows, with additional accumulations ranging from 6 to 16 inches. We shall look at these initial conditions and subsequent forecast indicators using the Weather Event Simulator (WES).

Discussion

On February 24, a storm with a typical genesis in the north Pacific dug ([Figure 1](#)) moved down the coast of California before swinging through central Arizona on Tuesday the 25th and Wednesday the 26th. The GFS seemed to have a fair handle on things early on, advertising our best chance of precipitation Tuesday and Tuesday night with the main 500 Mb low and vigorous short wave ([Figure 2](#)). This turned out to be about 6 hours early, but had the right idea. A key twist to this storm was also hinted at by the GFS: a pair of follow-on impulses would carve into the mean trough position and through the area Wednesday night and Friday ([Figure 3](#)). By Monday afternoon on the 24th, it was clear that as the main portion of the storm tracked through Arizona, the best forcing would come together behind initial strong upslope conditions on the southern White mountains, which are part of the east-central Arizona mountains in the northern part of our CWA. The previously issued Winter Storm Watch was upgraded to a Heavy Snow Warning for that area, while the remainder of southeast Arizona were changed to a Snow Advisory above 6000 ft. After fighting through initial dry-slotting early Tuesday ([Figure 4](#)), the afternoon saw showers spread across the area with isolated thunder and initial snow levels around 7500 ft. Precipitable water values below 0.5 of an inch in the dry slot quickly moistened to around 0.7 of an inch. Our well advertised winter storm products did well overnight, with totals of 12 inches at Hannagan Meadow (200 miles NE of Tucson in the southern White Mountains) verifying the warning, and 6 to 8 inches at Mt. Lemmon (in the Catalinas Mountains just north of Tucson) and Mt. Graham (roughly mid way between the previously mentioned points) verifying advisories.

There was enough of a break Wednesday morning for solar insolation to help us climb to convective temperatures given the residual moisture that remained in the lower levels and boundary layer. This combined with a follow-on impulse directly across south central Arizona ([Figure 5](#)) to give Mt Lemmon another 6 to 8 inches of snow Wednesday and Wednesday night. In addition, a rather deep marine later, as evident in the San Diego sounding, ([Figure 6](#)) remained upstream and was tapped to actually reinforce the recycled moisture for this, and the subsequent third impulse. This third impulse carved through Thursday night and Friday. It was a little stronger than the previous disturbance, but had a track a little farther north ([Figure 7](#)). Both Mt. Lemmon and Hannagan meadow reported an additional 8 inches.

Summary

This storm was well handled on the front end. There was good lead time with a Special Weather Statement that led into a Winter Storm Watch and subsequent Warnings/Advisories. Hints at subsequent weather after the initial and most significant portion of the storm were not as well keyed into as additional accumulations were under forecast. This is a good example of how a well handled weather situation on the front end can succumb to a general tendency of moving systems out of the CWA too quickly, and not tuning in sufficiently to the secondary and tertiary system. This case was subsequently selected as a training scenario to help prepare for winter weather this season. WES enabled this to be very good learning experience.

Acknowledgement

Thanks to all of the forecasters at WFO Tucson, especially Chris Rasmussen, for their valuable insights into this complicated WES case.

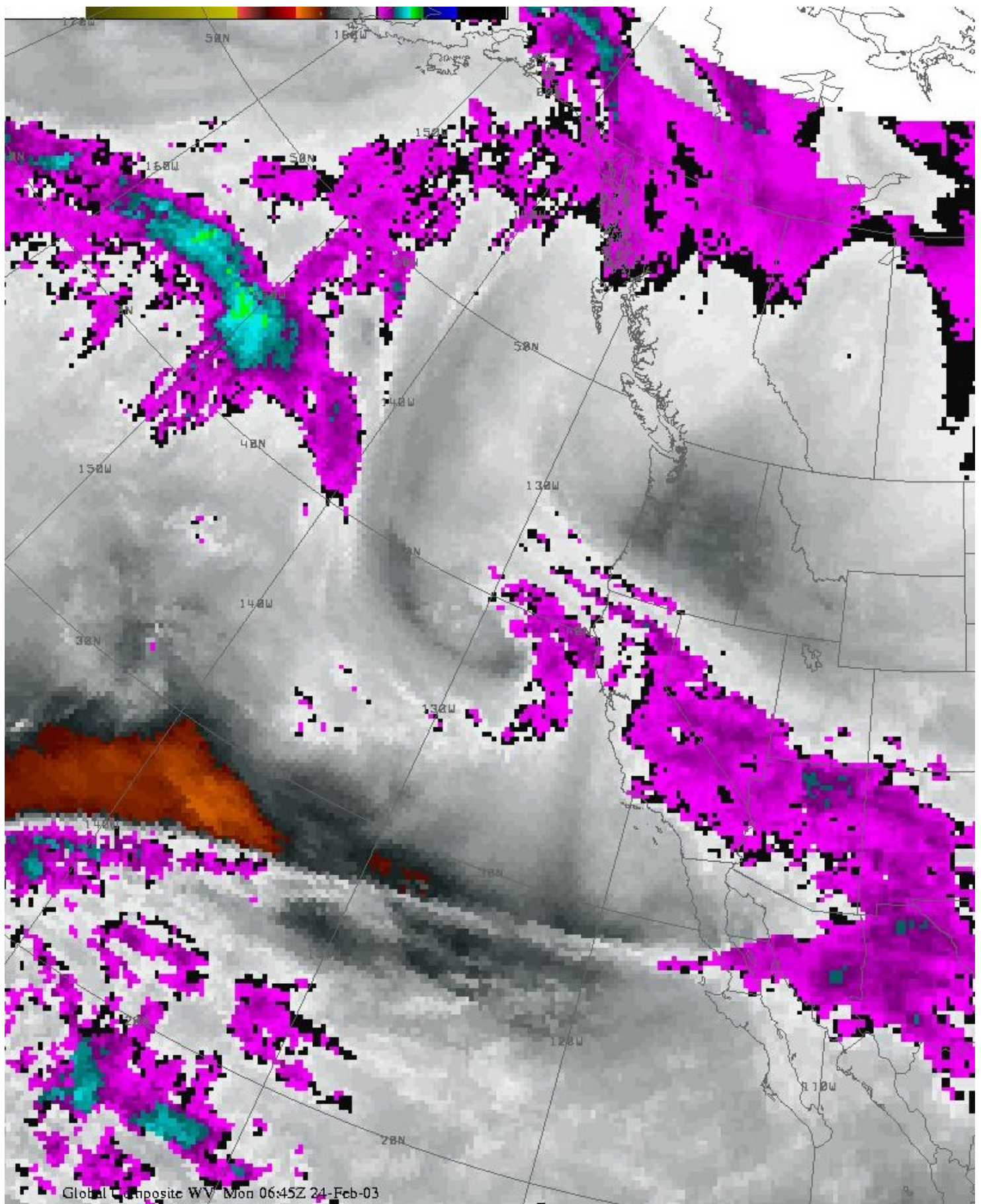
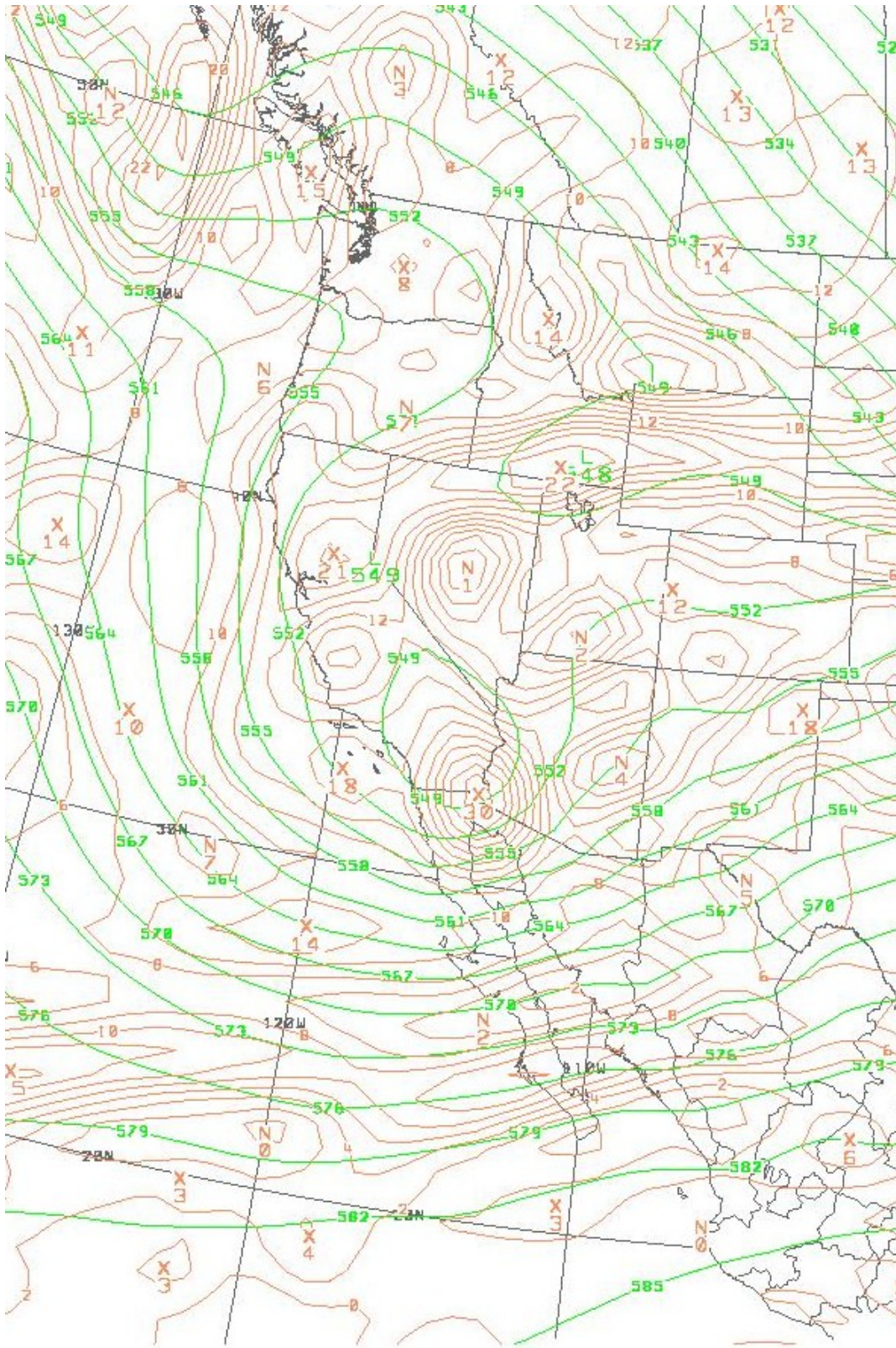


Figure 2



AVN 500MB Vorticity (/1e5s) 26.00 0HR Wed 00:00Z 26-Feb-03
 AVN 500MB Height (dam) 26.00 0HR Wed 00:00Z 26-Feb-03

Figure 3

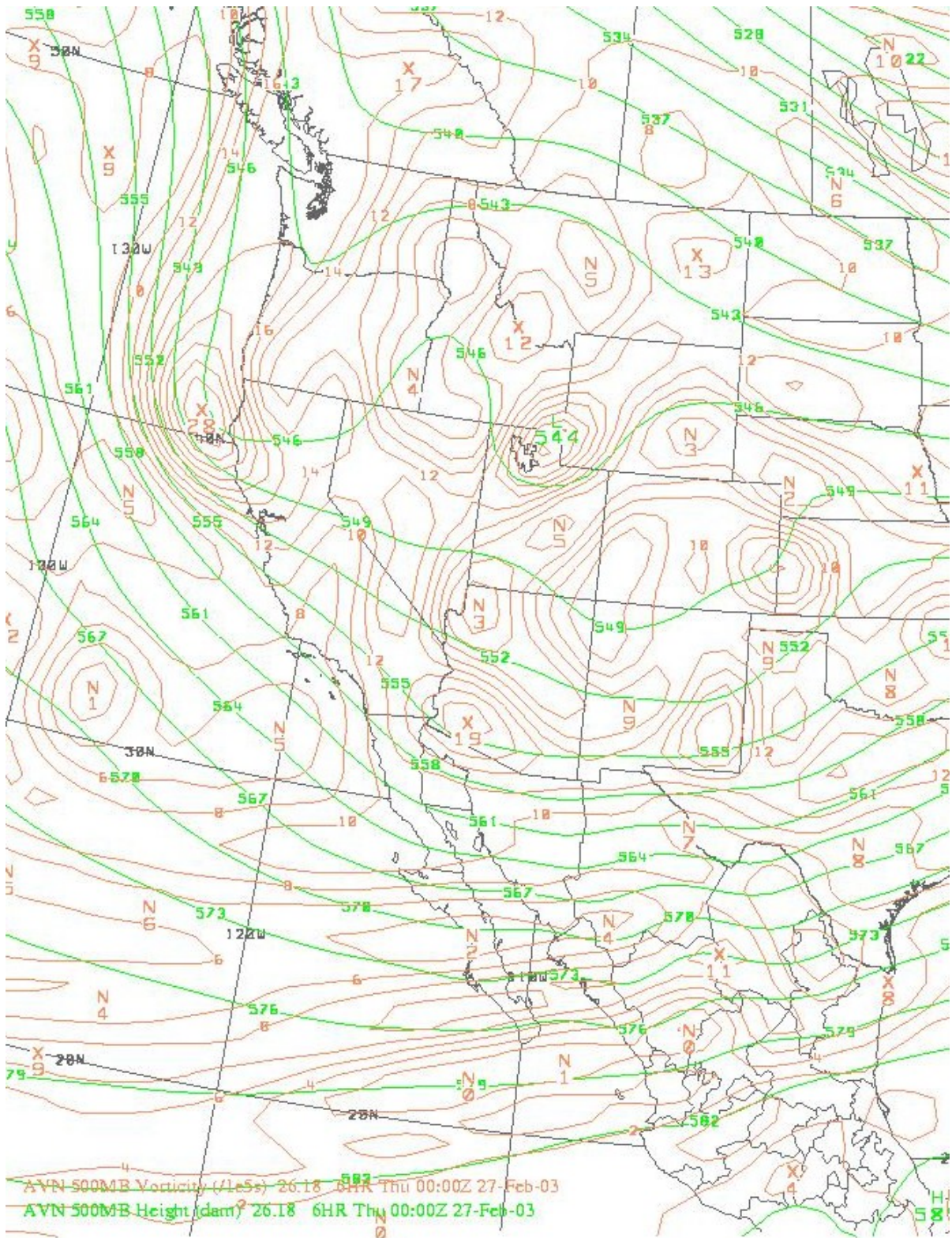
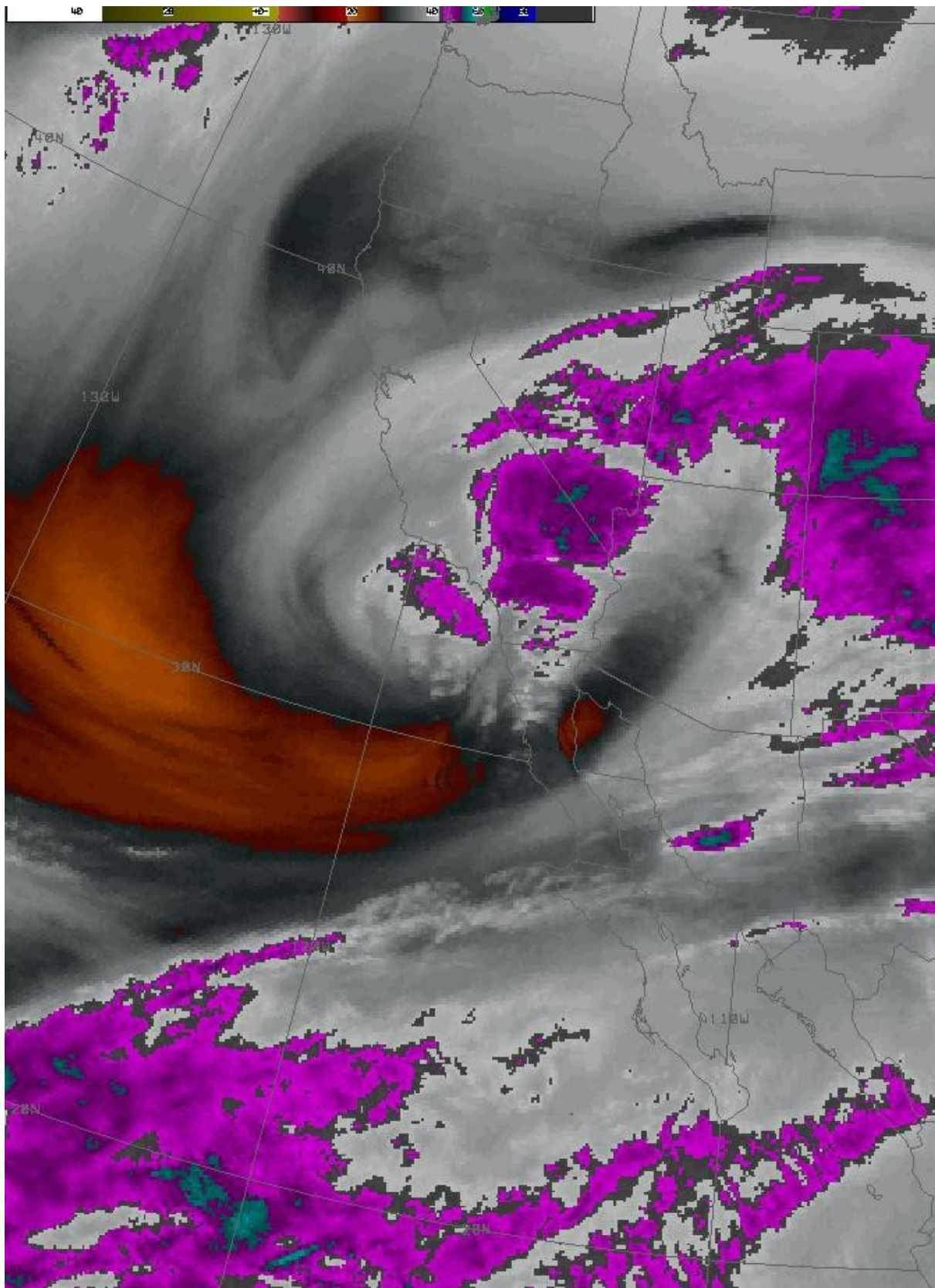
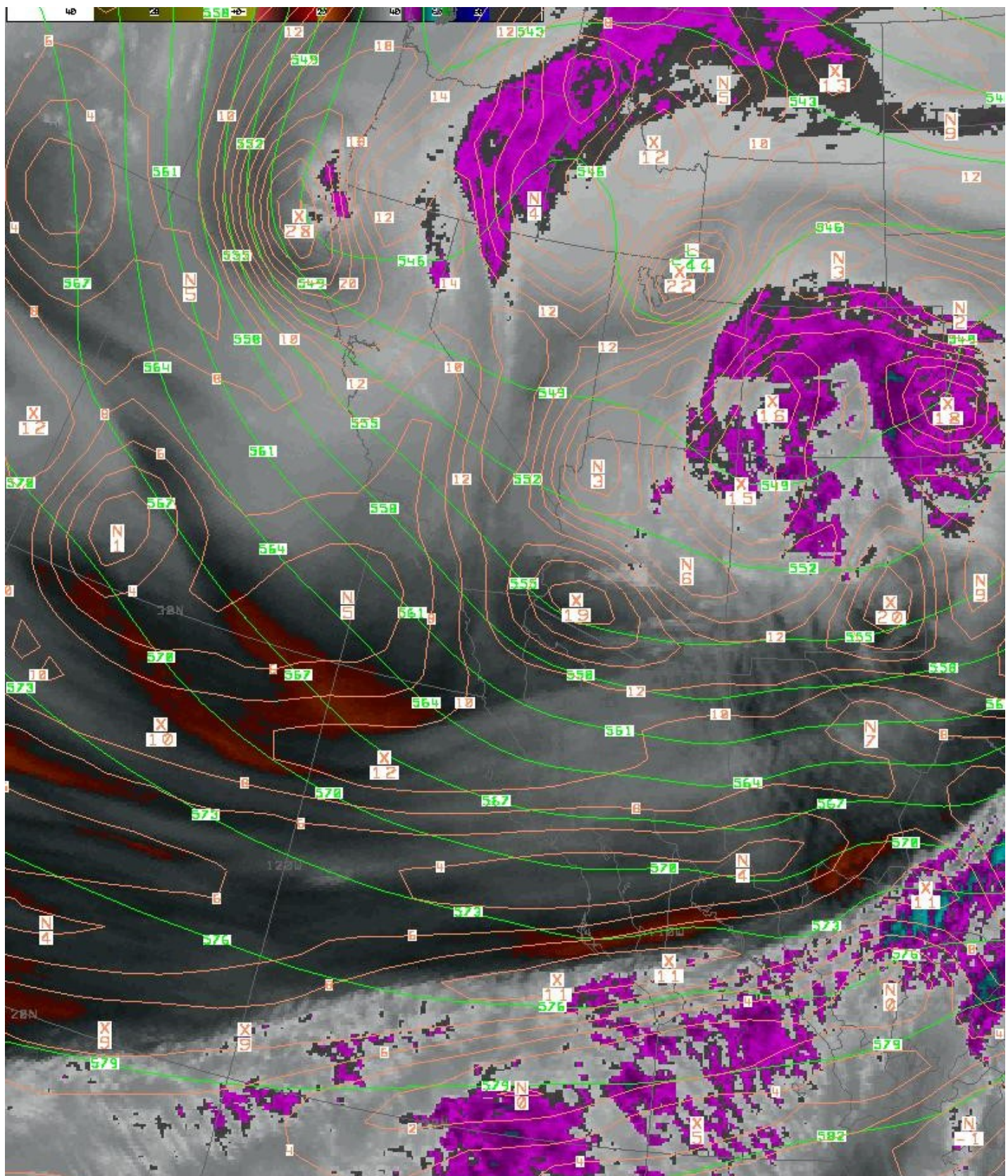


Figure 4



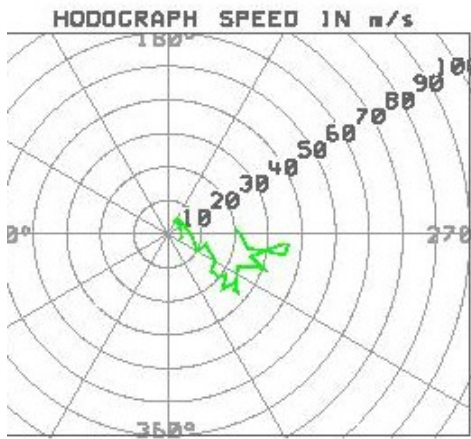
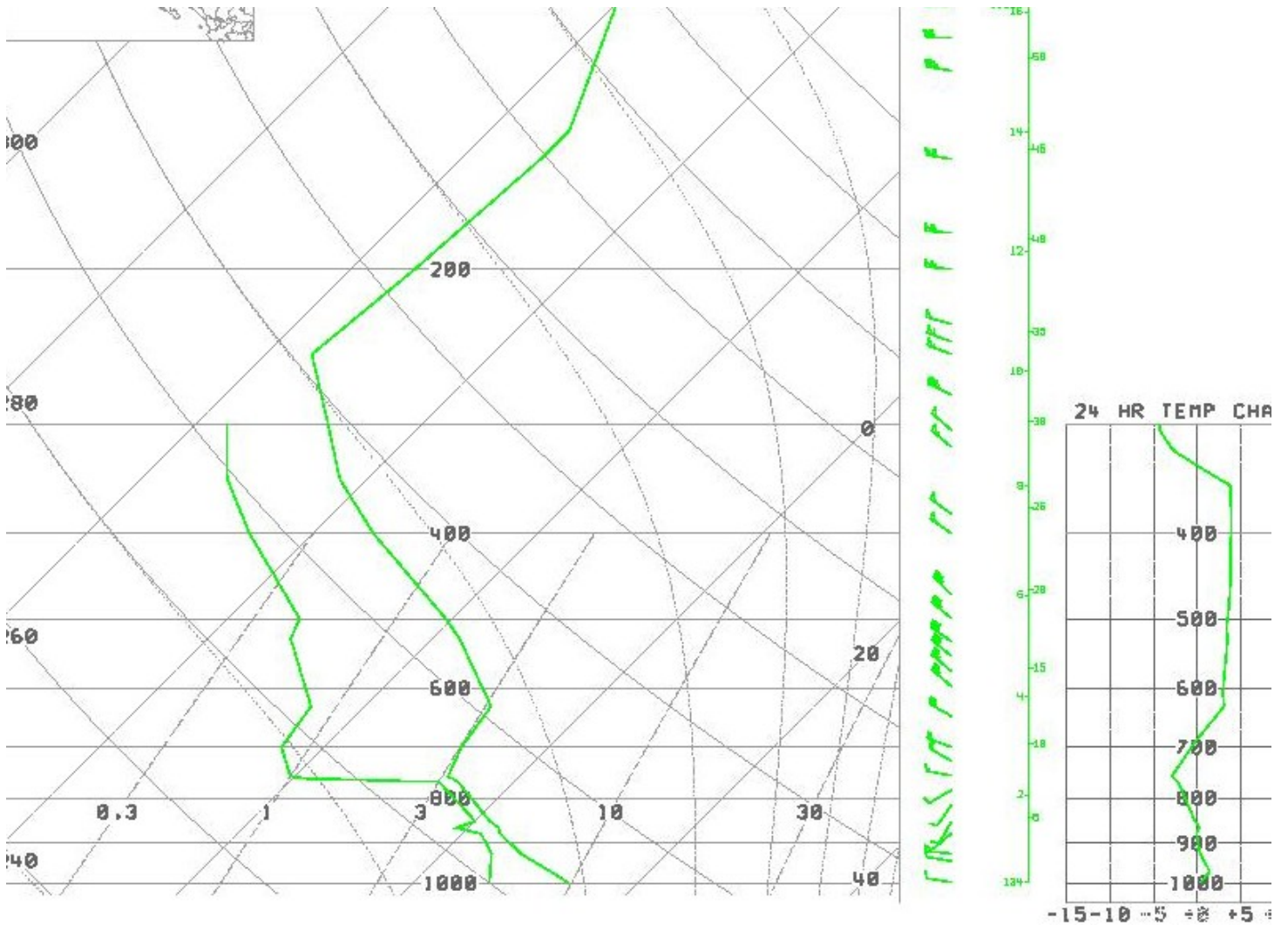
Water Vapor Satellite Tue 15:30Z 25-Feb-03

Figure 5



AVN 500MB Vorticity (/1e5s) 26.18 6HR Thu 00:00Z 27-Feb-03
 AVN 500MB Height (dam) 26.18 6HR Thu 00:00Z 27-Feb-03
 Water Vapor Satellite Wed 23:00Z 26-Feb-03

Figure 6



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PRECIP WATER= 0.33 in
K-INDEX= 6
TOTALS INDEX= 42
SWEAT INDEX= 61
DRY MICROBURST PDT=2: GBT 4 38 km
FREEZING LEVEL= 3244 ft ASL
WET-BULB ZERO HGT= 5194 ft ASL
0-5 KM AVG WIND= 255°/19 kts
0-5 KM BTH ATN (30075)= 325°/14 km
0-3 KM STR REL HELICITY= 68 m²/s²
FORECAST MAX TEMP=NA
TRIGGER TEMP= 13° C/36° F
SOARING INDEX=NA
MOP1/WINDEN = 0.85/28

-PARCEL- T=SFC;Td=SFC
INIT PARCEL P= 397 56 44 " mb
INIT PARCEL T/Ta= 56/44° F:13/6° C
CONVECTIVE TEMP= 56° F
LIFTED INDEX= 5.8
CCL= 3137 ft ASL/ 983 mb
LCL= 3321 ft ASL/ 957 mb
LFC= 3321 ft ASL/ 957 mb
MAX HAIL SIZE= 1.8 cm/0.4 in
MAX VERTICAL VELOCITY= 14 m/s
EQUIL LEVEL= 10416 ft ASL/603 mb
APPROX CLOUD TP= 13203 ft ASL
POSITIVE ENERGY ABV LFC= 148 J/KG
NEGATIVE ENERGY BLW LFC=NONE
BULK RICHARDSON NUMBER= 2.2

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KNKX Skewt Thu 00:00Z 27-Feb-03

Figure 7

