

## The 12 February 2003 Rain Event in Clark County, NV

### A Weather Event Simulation

Stan Czyzyk, WFO Las Vegas NV

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#### Introduction:

Prior to the February 12, 2003 rain event, the winter of 2002-2003 had been extremely dry across the southern Great Basin and Mojave Desert. The GFS model began indicating a change in the pattern which was more typical of a classic El Nino regime a week prior to the actual event. The GFS depicted an upper-level low off the California coast with a significant fetch of subtropical moisture feeding into the southwest U.S. Precipitable water values from both GOES and GFS model output were in excess of two inches across a large area ahead of the approaching trough. The system unfolded in three separate phases; the initial round of moisture/light precipitation associated with a weak short-wave in advance of the main dynamics (February 11), the main precipitation with significant upper-level support and enhanced dynamics (February 12), and the instability showers associated with the main upper level low (February 13/14). The tap of subtropical air/moisture was key in this event and was also responsible for the warm nature of the system. This kept snow levels predominantly at 7500 feet and above and the associated meteorological challenge mainly in the form of rain. The predominant low level flow on February 12 was from the southeast which enabled orographic enhancement of the precipitation across the higher terrain to the west of the Las Vegas. The Spring Mountains west of Las Vegas peak at nearly 12,000 feet at Mount Charleston.

#### Discussion:

The upper-level low off the coast of California began to impact the region late on February 10 and during the morning of February 11. A short-wave moved through the region in advance of the main dynamics and upper level support. Significant amounts of moisture were transported to the north ahead of the trough into southern Nevada and provided a rapid moistening of the low levels, enough to provide light rainfall ahead of the main dynamics. Rainfall amounts in the Las Vegas Valley on February 11 ranged from a trace to 0.10 of an inch.

This was then followed by a vigorous south to north oriented jet that moved into the southwest U.S. and directly across southern Nevada on February 12 and 13. The GFS indicated a 120 kt jet streak moving through southern California with the nose of the jet moving into southern Nevada at 00Z on February 13 ([Figure 1](#)). Both the 12Z GFS and ETA models on February 12 had 00-hr initializations indicating a jet core of 130 knots moving into southern California at 250 mb. However, the 12Z sounding from Las Vegas already indicated a 155 kt wind speed at 250 mb and the sounding from Edwards Air Force Base CA at the same time indicated a 170 kt wind speed. The weaker jet indicated by the models appeared to have more of a negative impact on the ETA than the GFS, with ETA indicating weaker forcing and lower precipitation amounts. The nose of the jet at 00Z on February 13 coincided with the peak in negative omega between 00Z and 06Z over southern Nevada with a bulls-eye over the higher terrain of western Clark County ([Figure 2](#) and [Figure 5](#)). Looking at the 700/250 mb convergence/divergence product from the GFS at 00Z on February 13, one can see a significant couplet located over Clark County implying strong UVV, with the low-level convergence also centered over the higher terrain ([Fig 3](#) and [Fig 5](#)). The low-level flow was predominantly from the southeast providing additional orographic lift. This resulted in light to moderate precipitation across the valley and moderate to heavy precipitation in the higher terrain. Due to the warm nature of the system (700 mb temperatures mainly 0 to -2 C), the snow levels were seasonably high for mid February and averaged out at 7500 feet MSL. As the jet and associated dynamics began to shift further east beyond 06Z, the precipitation began to relax across the area.

Las Vegas McCarran Airport received the bulk of its rainfall (0.50 inches) between 00Z and 06Z on February 13. The precipitation output from the GFS was reasonably accurate during the event. Although in the valley, the GFS precipitation values were overdone, the cumulative precipitation values in excess of two inches were in good agreement with the reported readings across the higher terrain of western Clark County. Mt. Charleston reported three inches of liquid water equivalent during the event. Additionally, the GFS indicated approximately 0.50 inches of rain would fall between 00Z and 06Z on February 13 ([Figure 4](#)) and McCarran Airport reported 0.50 inches during that time frame. McCarran Airport surpassed its normal monthly rainfall for February (0.69) in less than 24 hours as 0.74 inches fell by midnight on February 12. This was the third highest daily precipitation at McCarran in the last six years. By the morning of February 13, most of the Las Vegas valley received between 0.5 to 1.0 inches of rain with amounts ranging from 1.0-3.0 inches in the higher terrain to the west.

The main upper-level low/trough pushed through the region on the February 14, destabilizing the airmass via a cold pool aloft. The 12Z run of GFS, ETA and NGM on February 14 all indicated 12-hr forecasts of 700-500 mb lapse rates around 7 C/km and lifted indices of 0 to -2. This provided the necessary instability to initiate scattered showers mainly across the higher elevations of the county.

#### Figure 1

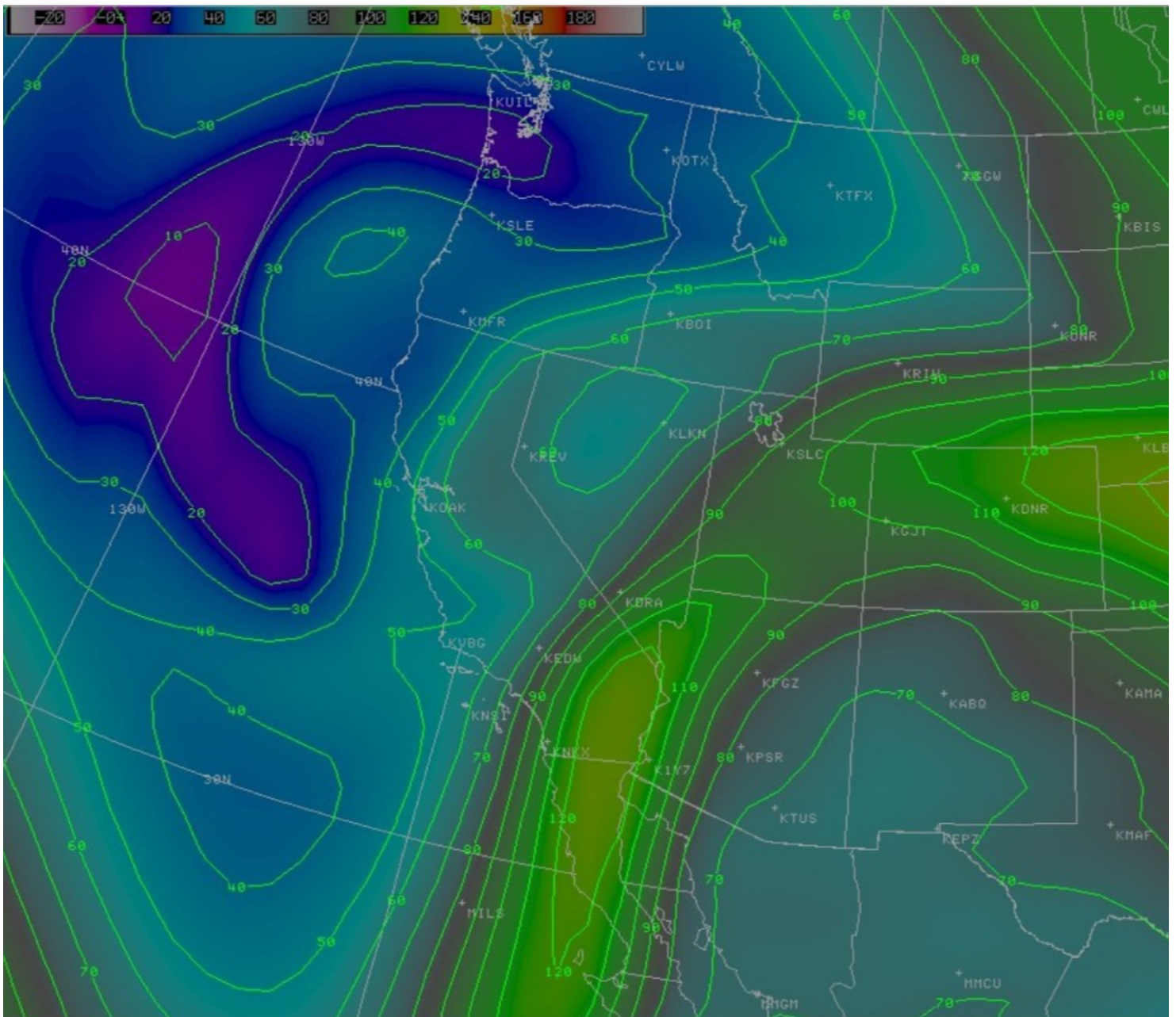


Figure 1. AVN 12-hr forecast at 13/00Z of 250 mb wind speed.

Figure 2



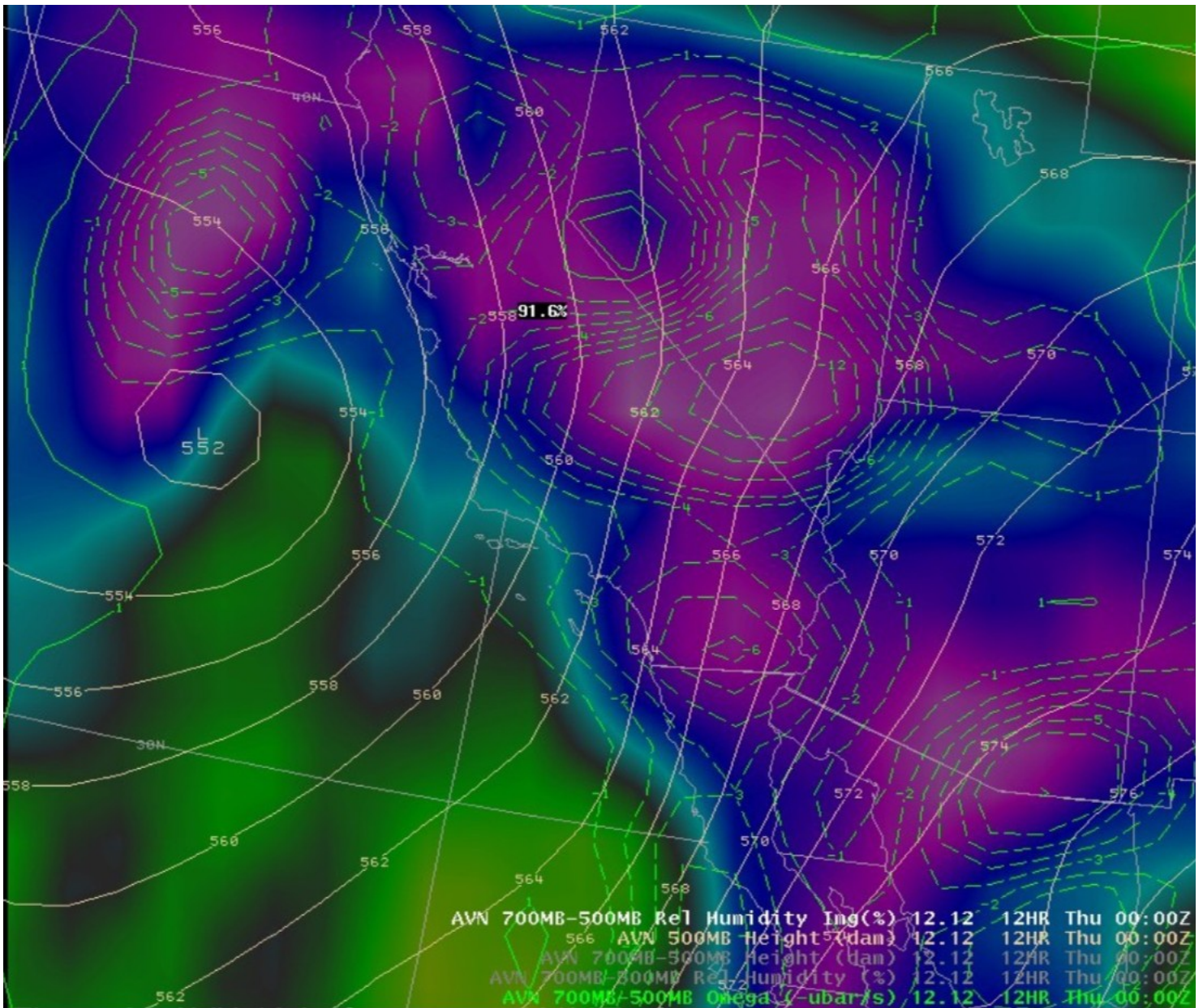


Figure 2. AVN 12-hr forecast of 13/00Z of 700-500 mb layer Omega and Relative Humidity

Figure 3



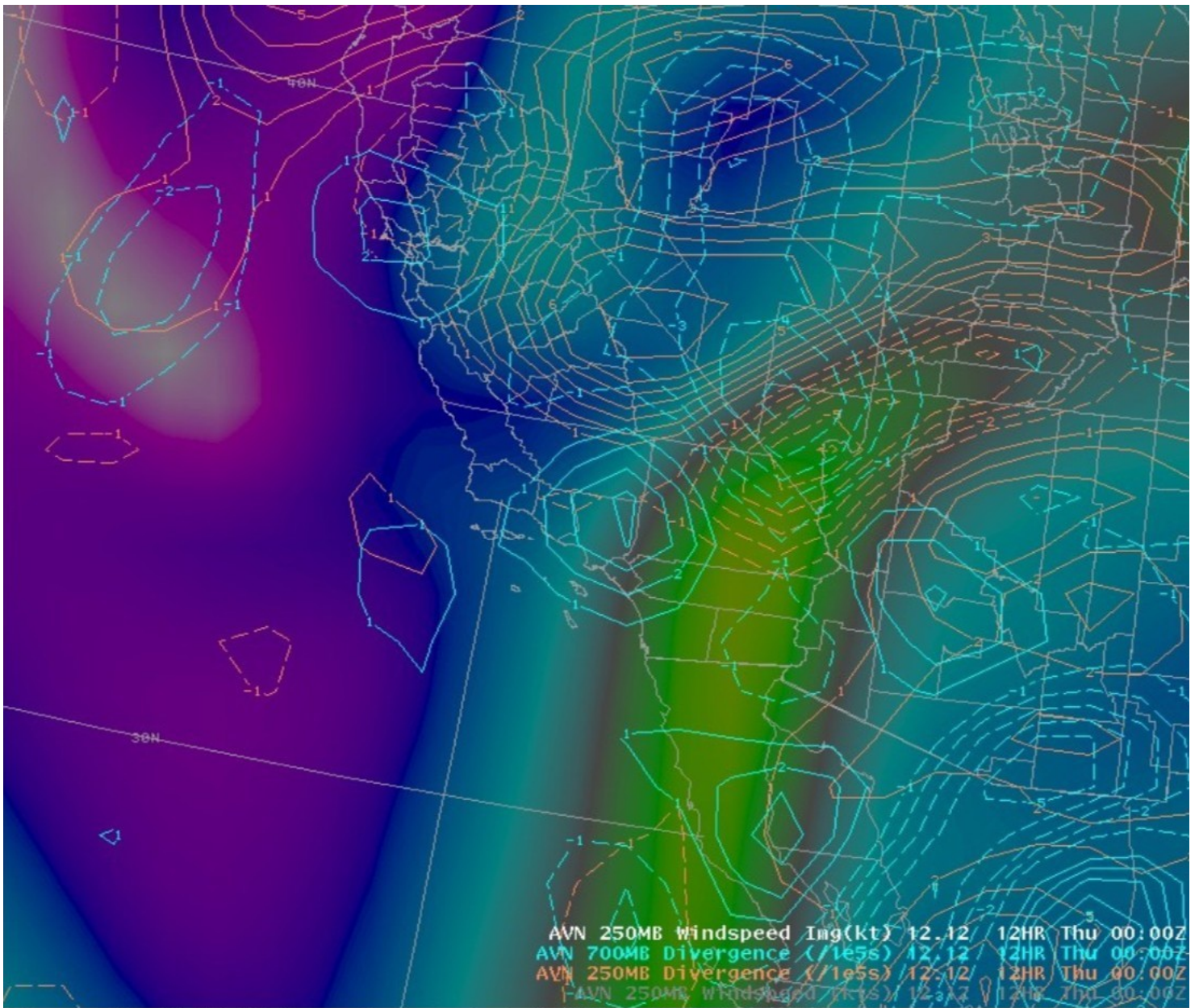


Figure 3. AVN 12-hour forecast at 13/00Z of 250 mb Wind Speed, 700 mb divergence and 250 mb divergence

Figure 4



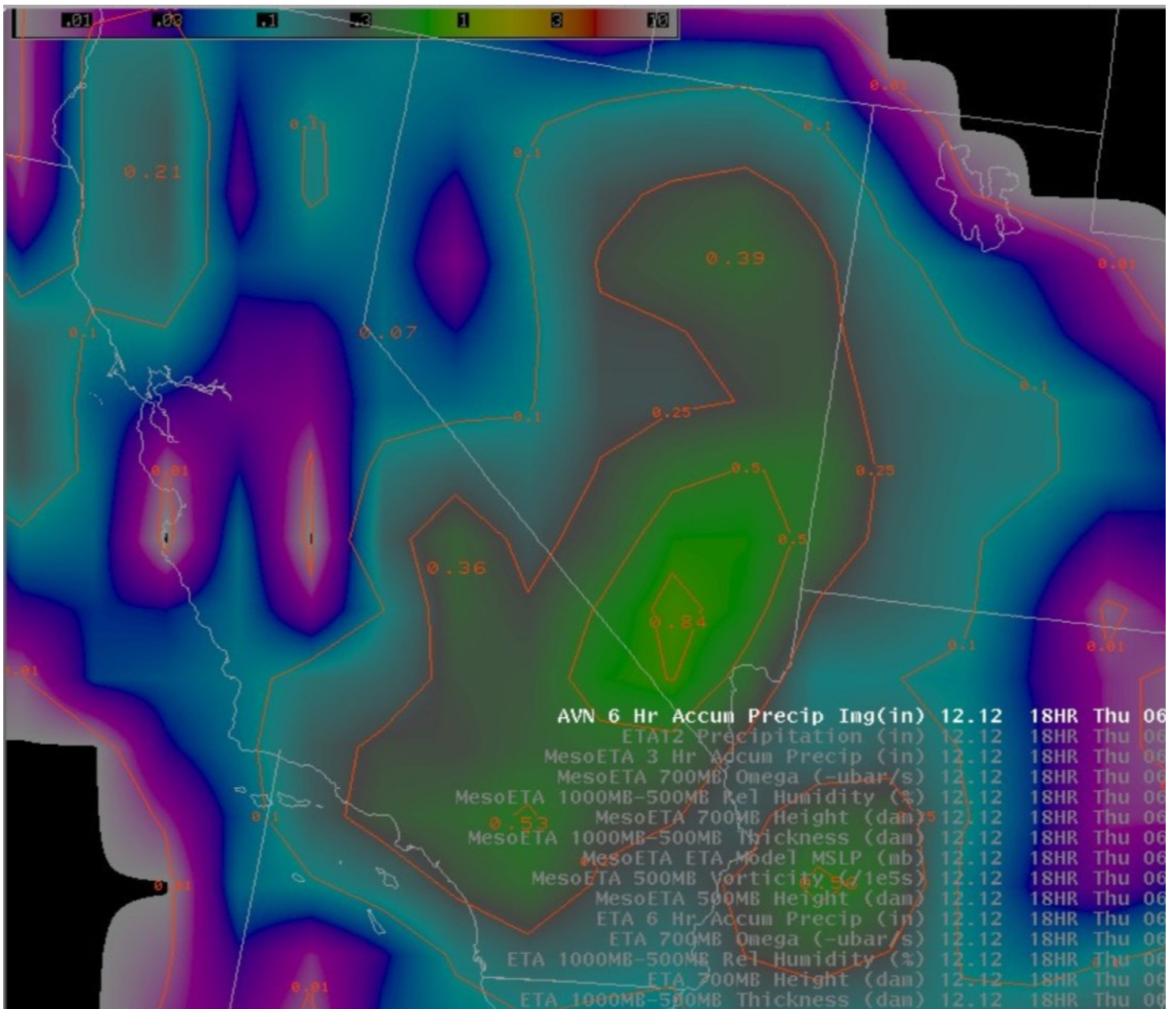


Figure 4. AVN 18-hr forecast at 13/06Z of 6-hr Accumulative Precipitation

Figure 5

