

The Recent “Additional Factor” Snow Event

PNW Weather Workshop, 1 March 2008

Brad Colman and Kirby Cook
NOAA/NWS Seattle

- 
- **Rather insignificant snow event**
 - **Snow reports (inches):**
 - **Lake City - .5**
 - **Brier - .5**
 - **Downtown Seattle - 1.5**
 - **Bellevue - 2.2**
 - **Redmond Highlands - 2.6**
 - **Most of the snow fell between 00Z and 04Z**

Photo: Steven Cavallo

“The Perfect Commuting Storm”

- Skies cleared
- Hundreds of accidents in the morning commute
- Forecasts were good – not perfect
 - Rain changing to scattered showers; showers mixing then changing to snow mainly north of Seattle in the evening
 - Location and timing issues
- My experience

Photo: Steven Cavallo

The UW WX listserv

"I just walked outside in the U District and all of the slushy snow has frozen into a nice sheet of ice. I've already seen a few early morning commuters sliding around. In my experience, when a **convergence zone** produces snow in the Seattle area we usually don't have a freeze afterward. **What was different this time?**" -Steve Robinson

A few of the processes discussed...

- Maritime polar air in its wake (i.e. 850mb temperatures at around -8C) (Terry Kubar)
- Ideal combination (Mark Stoelinga)
 - Timing of frontal band passage in mid afternoon, to set up CZ in late afternoon and early evening.
 - Temperatures at time of CZ precipitation a few degrees above freezing, to produce wet slushy snow.
 - Not too much precipitation so cars can make compact slush tracks on roads, instead of full snow cover.
 - Clear out of CZ around 9 pm, just in time to maximize overnight
 - radiational cooling and freezing of thin slush layers on roadways.
- Very dry post frontal air mass (Nick Bond)
- "One of the strongest cold fronts I've seen..." (Justin Sharp)

What if we look at another level?

Taxonomy

The use of conceptual models

- I. We all desire an analysis of the current situation and the forming of an hypothesis about how the current weather came to be, or is expected to be.
- II. This really requires a set of physical models with which to build the hypothesis. These are phenomenological conceptual models, which are:
 - a. concepts of atmospheric features, and how they are manifest in the observations and models, and
 - b. physical models formed through a mixture of theory, experience, and climatology.
- III. Maximize human capacity for perception of processes, and minimize incorrect judgment.

Forecast Benefits of Conceptual Models

- A known climatology
- Valuable information in specific dynamics
- Physical basis for forecast adjustments
- Define sensitive predictors
- Are particularly useful in nowcasting
- Great communication tool

Puget Sound Convergence Zone

- A classic conceptual model
- Safford (1967); Mass (1981); etc.
- Cokelet (1992)
- Excellent communication tool

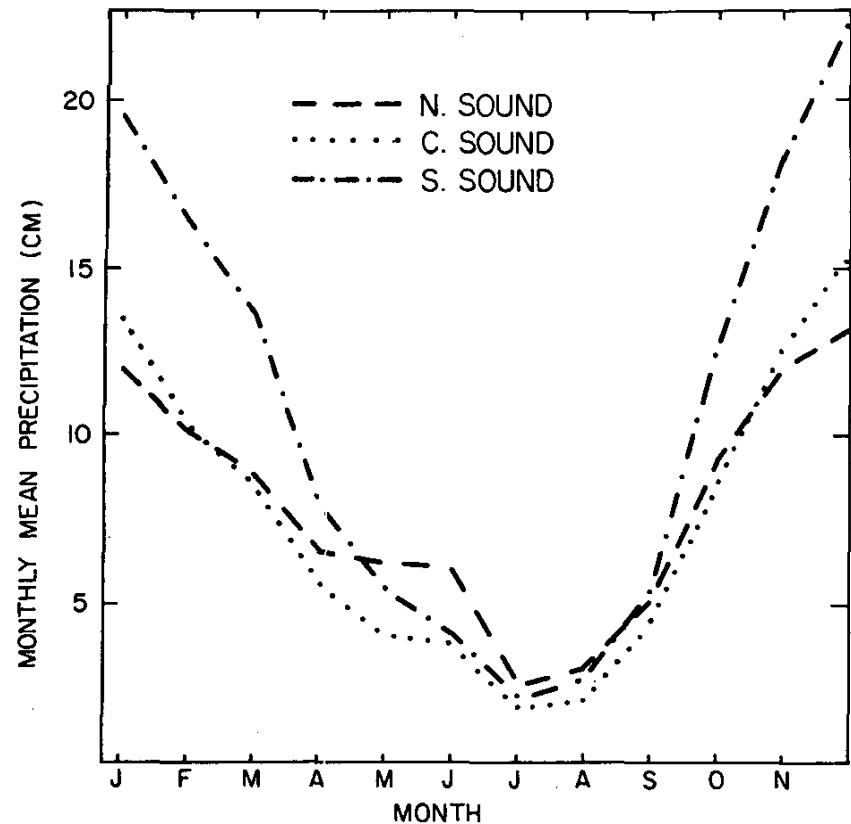
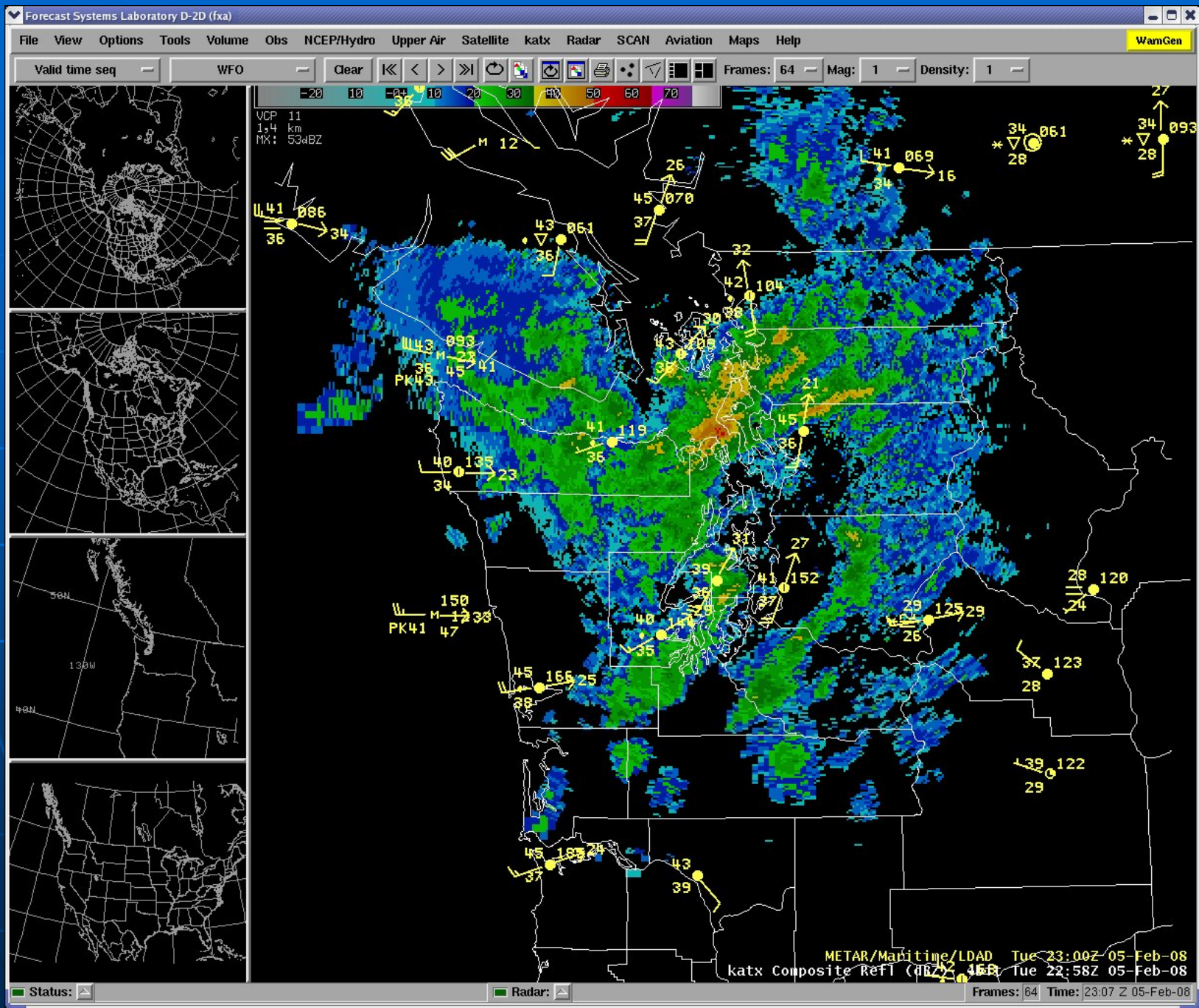


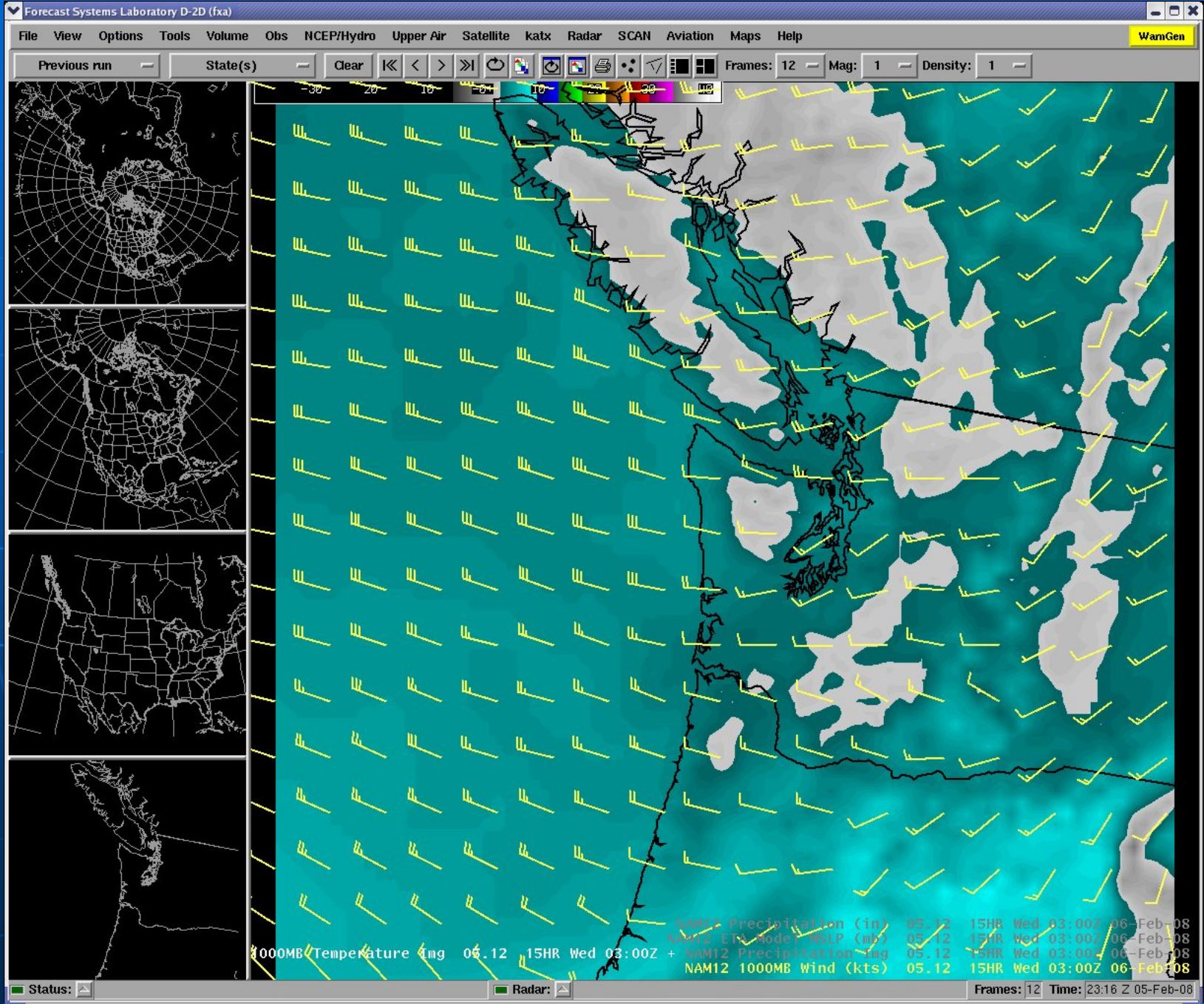
FIG. 15. Annual variation of precipitation for the northern, central and southern Puget Sound regions.

Mass (1981)

A Canonical Case

5 February 2008

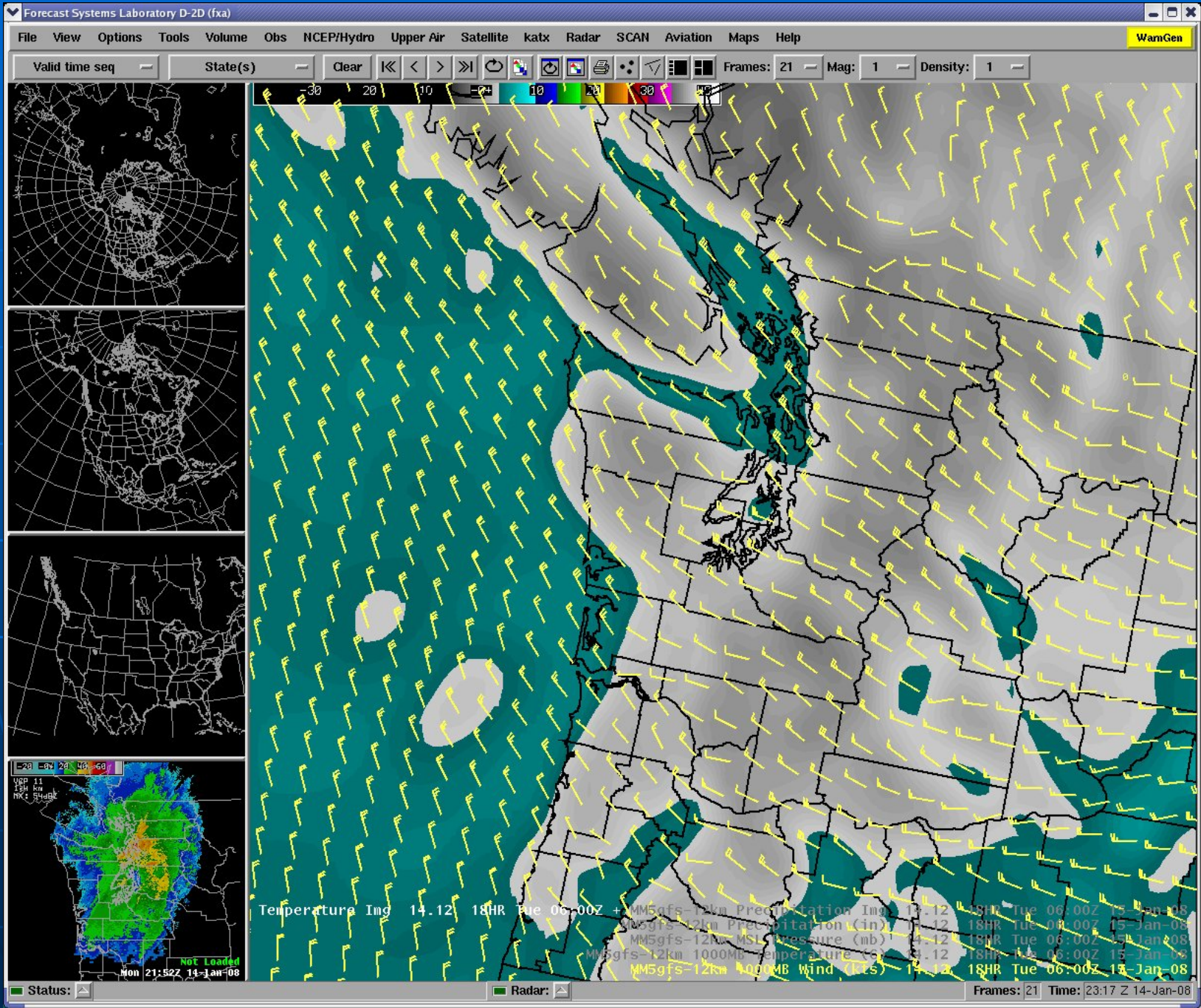


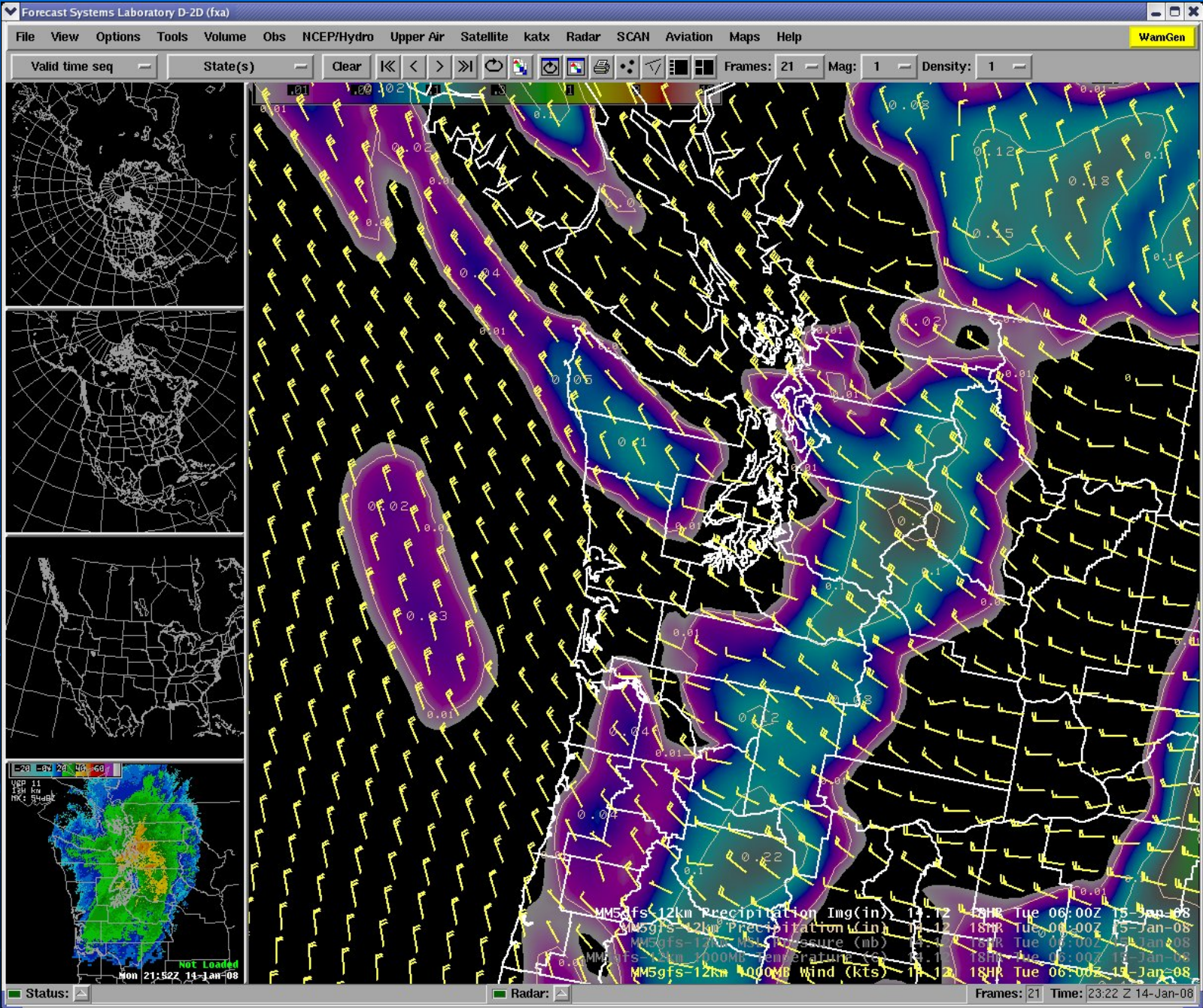


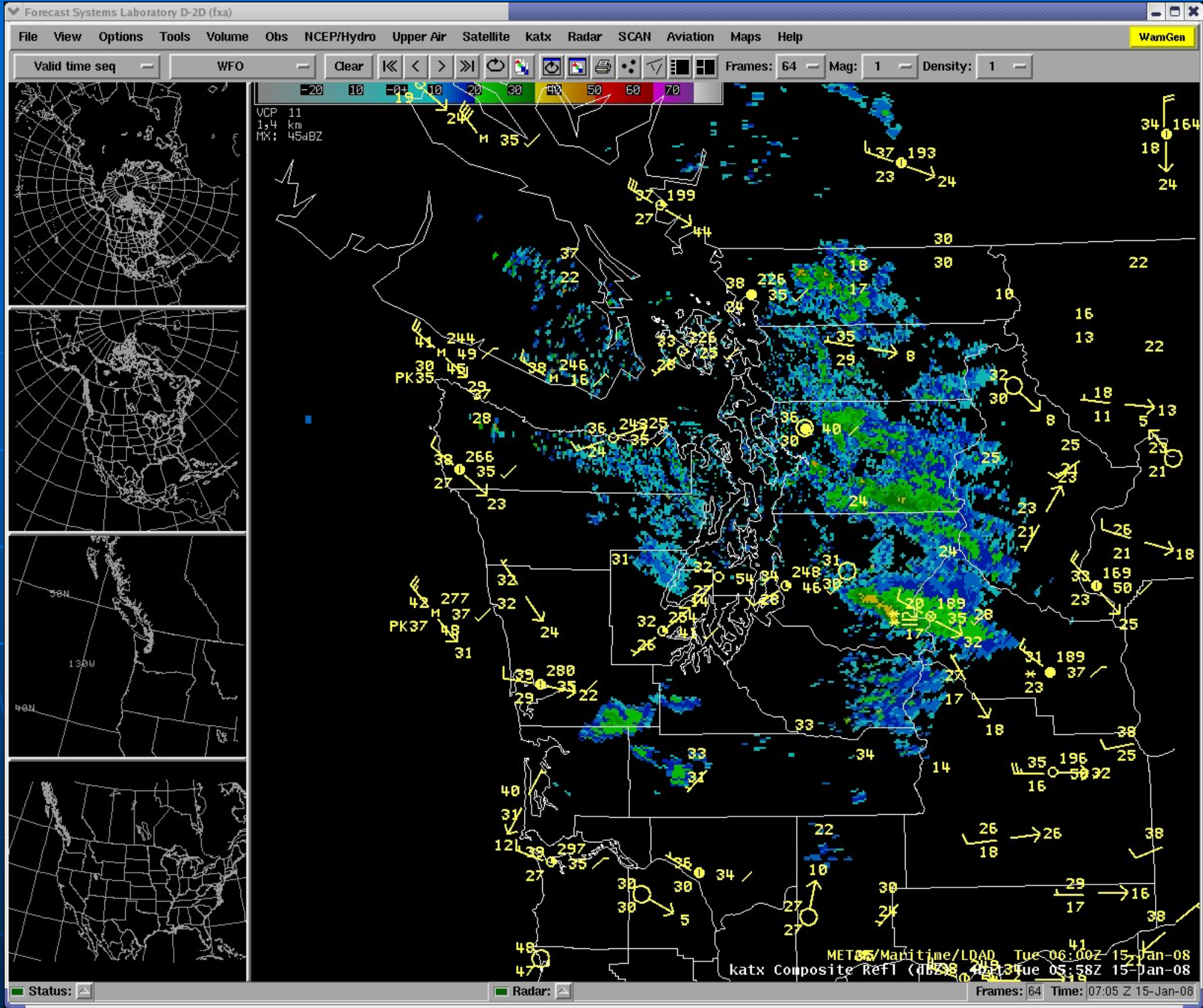
Puget Sound Convergence Zone

- A terrain-induced, convergence band that typically forms north of Seattle
- Channeled flow and lee-side mesolow
- Typically Lags a CFP by 6-9 hours
- Sets up in the terrain wake that remains anomalously warm following a CF (which is typically sheared apart)

Now let's look at the 14 January case...

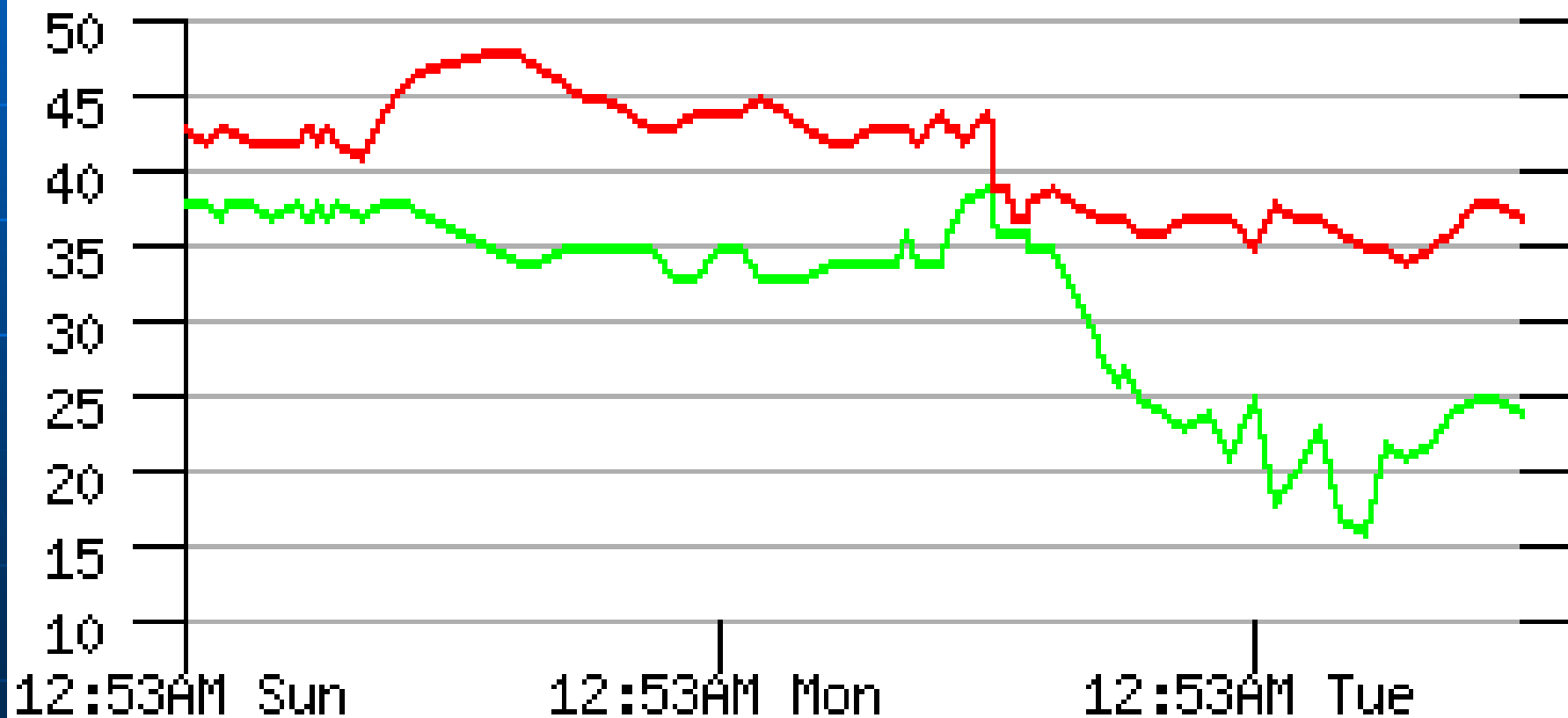






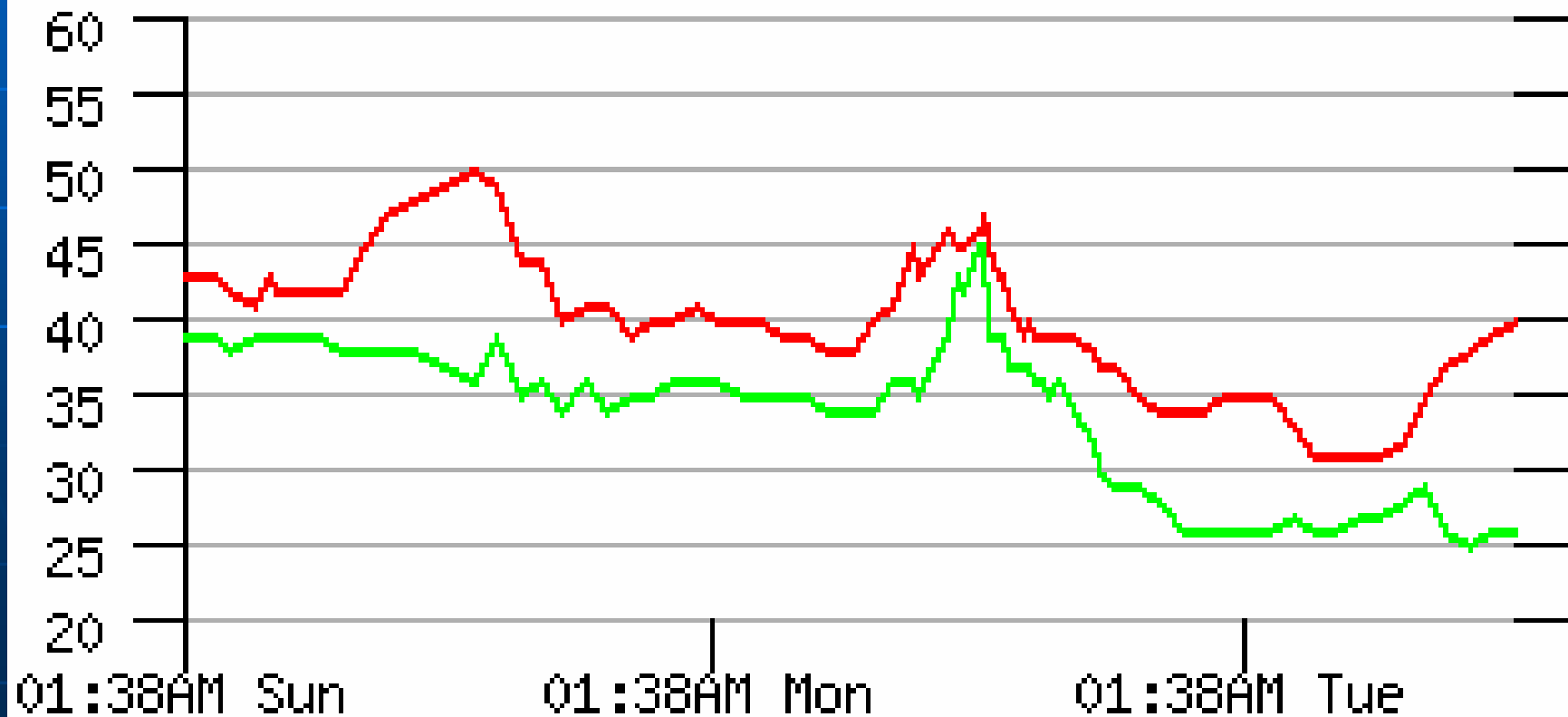
Paine Field - T, Td

Everett, Snohomish County Airport - NWS/FAA
Temperature and Dewpoint (Degrees F)



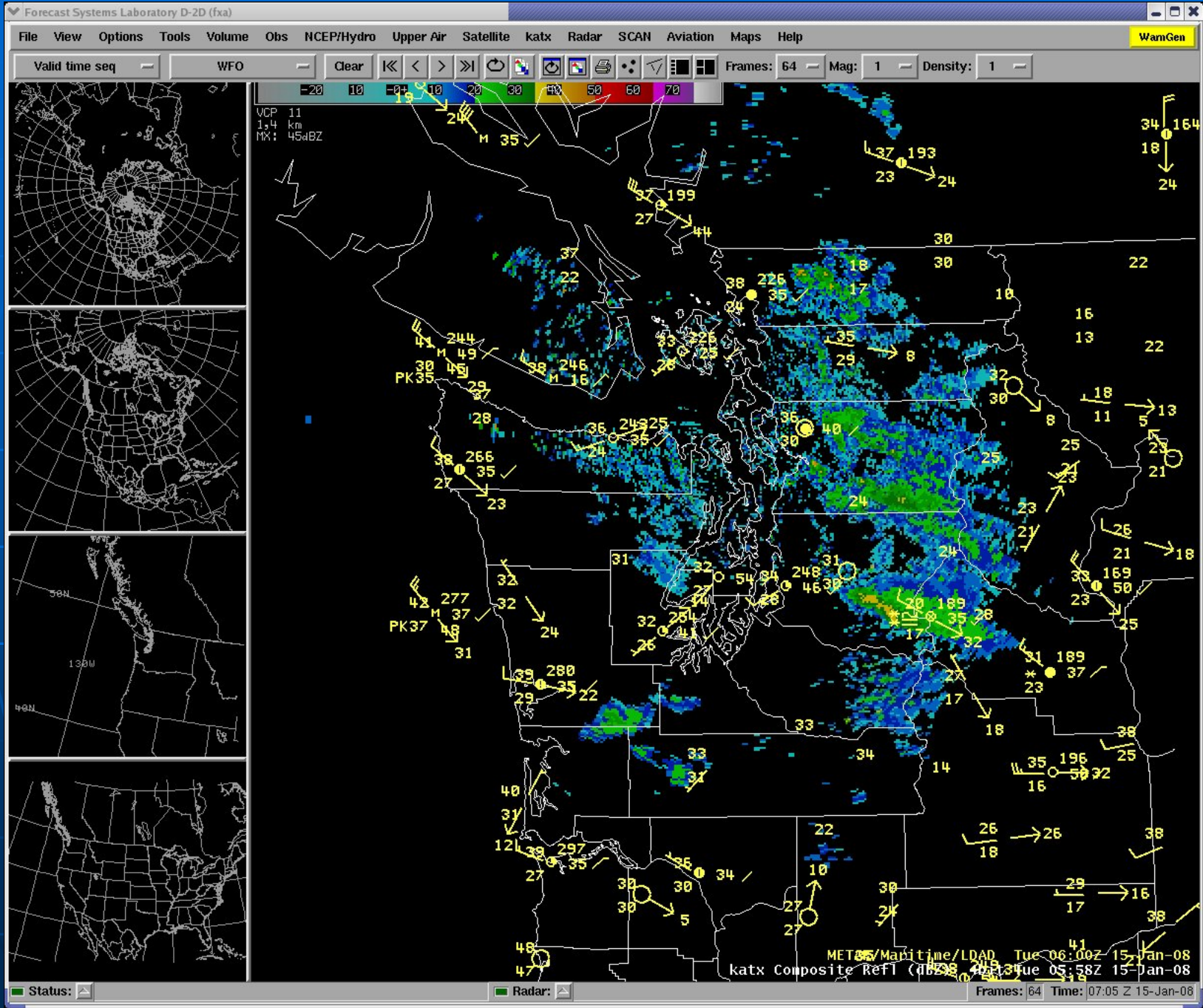
SeaTac - T, Td

Seattle, Seattle-Tacoma International Airpo - NWS/FAA
Temperature and Dewpoint (Degrees F)



So what was different?

- Rapid transition in central Puget Sound to northerly surface flow with the front; a true surface CFP
- Timing error...several hours earlier than PSCZ model
- Snow was Seattle and eastward (farther south than PSCZ model)



*If it walks like a duck and quacks
like a duck,is it a duck?*

**Are all convergence zones that
form in Puget Sound, Puget Sound
Convergence Zones?**

The “Additional Factor”

- Much of the precipitation was associated with the surface cold front
- The CF was coherent and did not shear apart
- CF temporarily stalled across Puget Sound
- Drier air aided clearing and freezing
- It was more than an outlier...

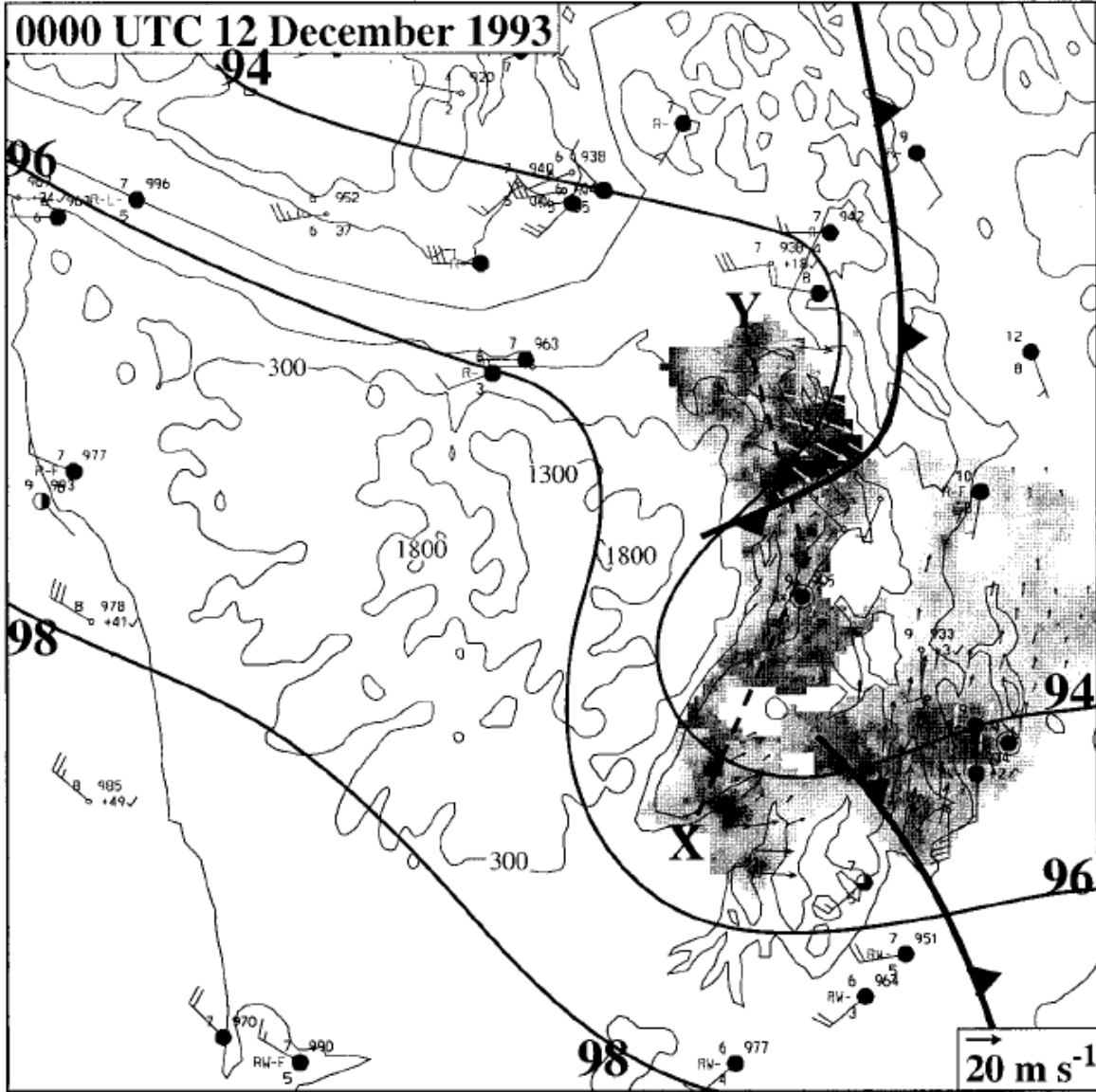
Summary

- Conceptual models give meteorologists an efficient way to communicate
- Humans tend to adhere to them even when models and observations suggest otherwise

BEWARE: Not all convergence zones that form in Puget Sound are Puget Sound Convergence Zones

Excerpt from Colle et al. (1999)

There are some subtle and important differences between this PSCZ and a late Spring event described in Chien and Mass (1997). In their case (as well as many other PSCZ events), the development of the PSCZ occurred 3-9 h after frontal passage since it took a while for the winds at crest level and along the Washington coast to veer to west-northwesterly behind the frontal zone. For the IOP5 case, **the front developed PSCZ characteristics as it progressed southward (postfrontal flow splitting around the Olympics resulting in an east-west band of precipitation across central Puget Sound).**



2 6 10 14 18 22 26 30 34 38
dBZ

Colle et al. (1999)