

Transportation Weather Forecasting

Rick Steed, Cliff Mass,
Mark MacIver

Weather is very important to transportation



- In U.S.A. each year:
 - 7,000 people die in weather-related car accidents
 - 800,000 people are injured
 - 1 billion hours of delays

In Washington State

- Snoqualmie Pass
 - 1,000 m elevation
 - 10 m snowfall / year
 - 15,000 cars / day
 - 3,000 trucks / day
 - \$1,500,000 / year



Primary Concern

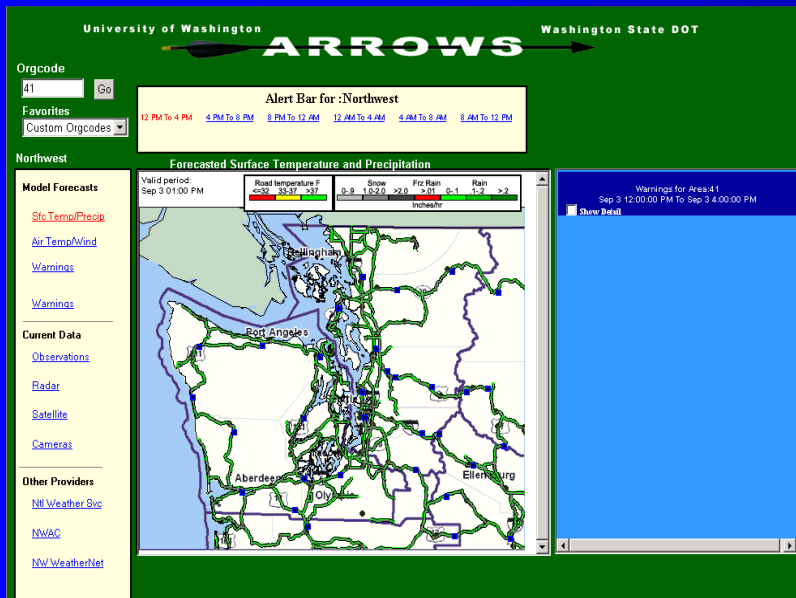


- Snowfall

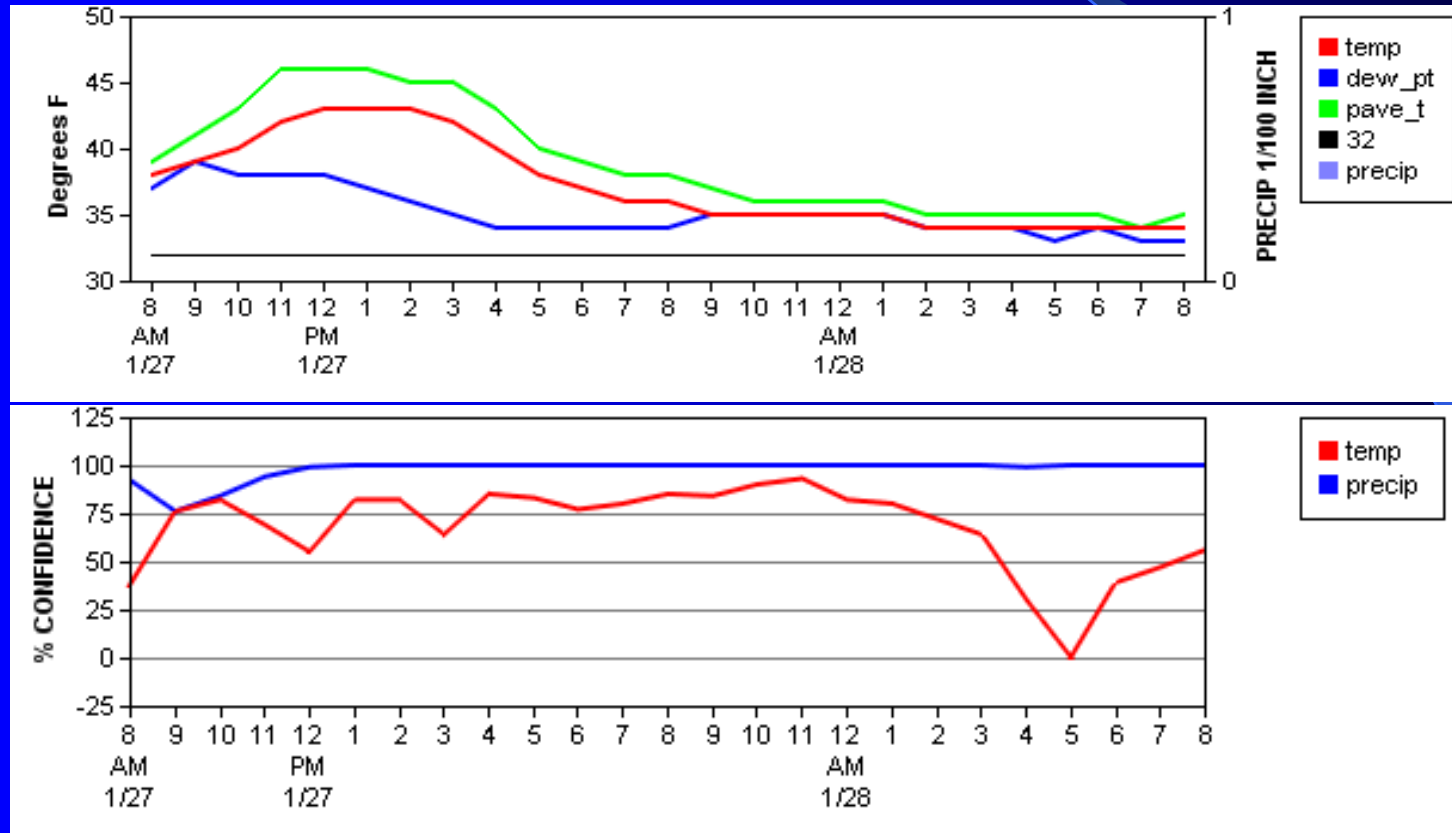
WSDOT Weather Applications

- ARROWS

- First ensemble-based web page for transportation weather in Washington



ARROWS Forecasts



ARROWS Forecasts

- Based on UWME ensemble mean
 - Take 8 ensemble members and average their forecasts over the entire model grid
 - Extract point forecasts and perform simple bias correction to improve systematic errors

ARROWS Uncertainty

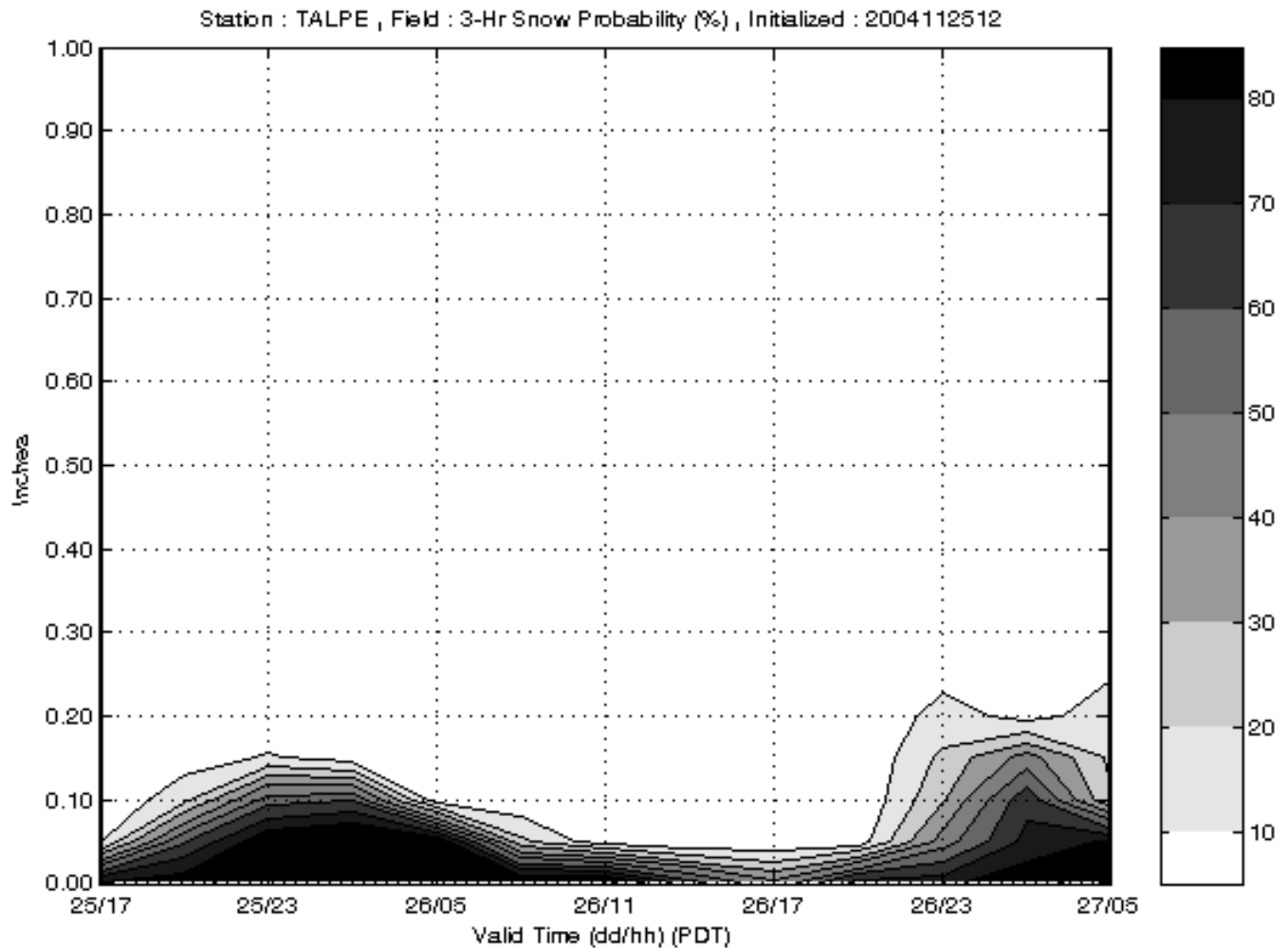
- Based on UWME spread
- 0% confidence if :
 - current spread $>$ 3 month mean spread + 2 SD
- 100% confidence if :
 - Current spread $<$ 3 month mean spread – 2 SD

Problem with ensemble mean forecasts and confidence

- Still deterministic
- Simple ensemble spread not best measure of confidence

What to do now?

- Probabilistic forecast products



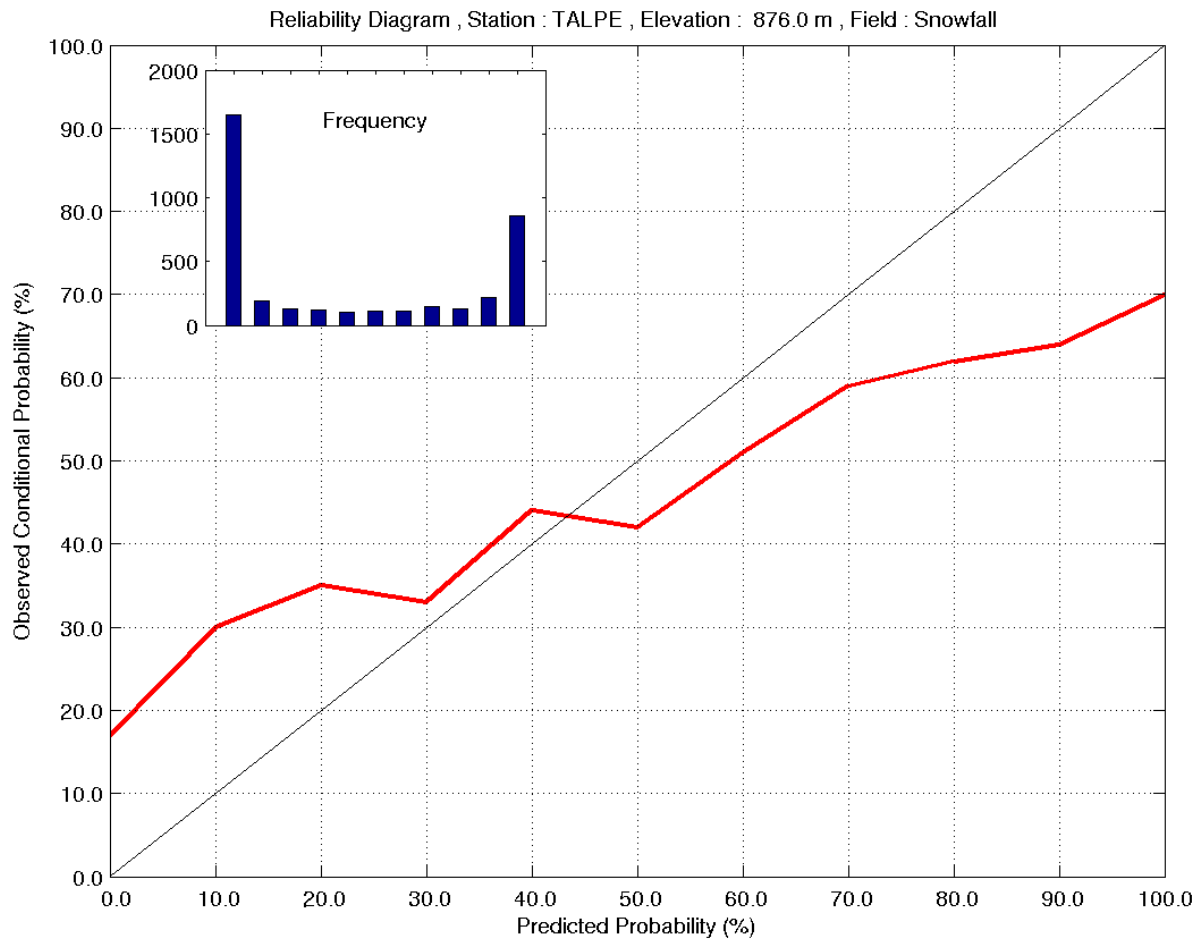
What to do now?

- Probabilistic forecast products
 - Provide users with the range of possibilities
 - Provide users with a measure of uncertainty

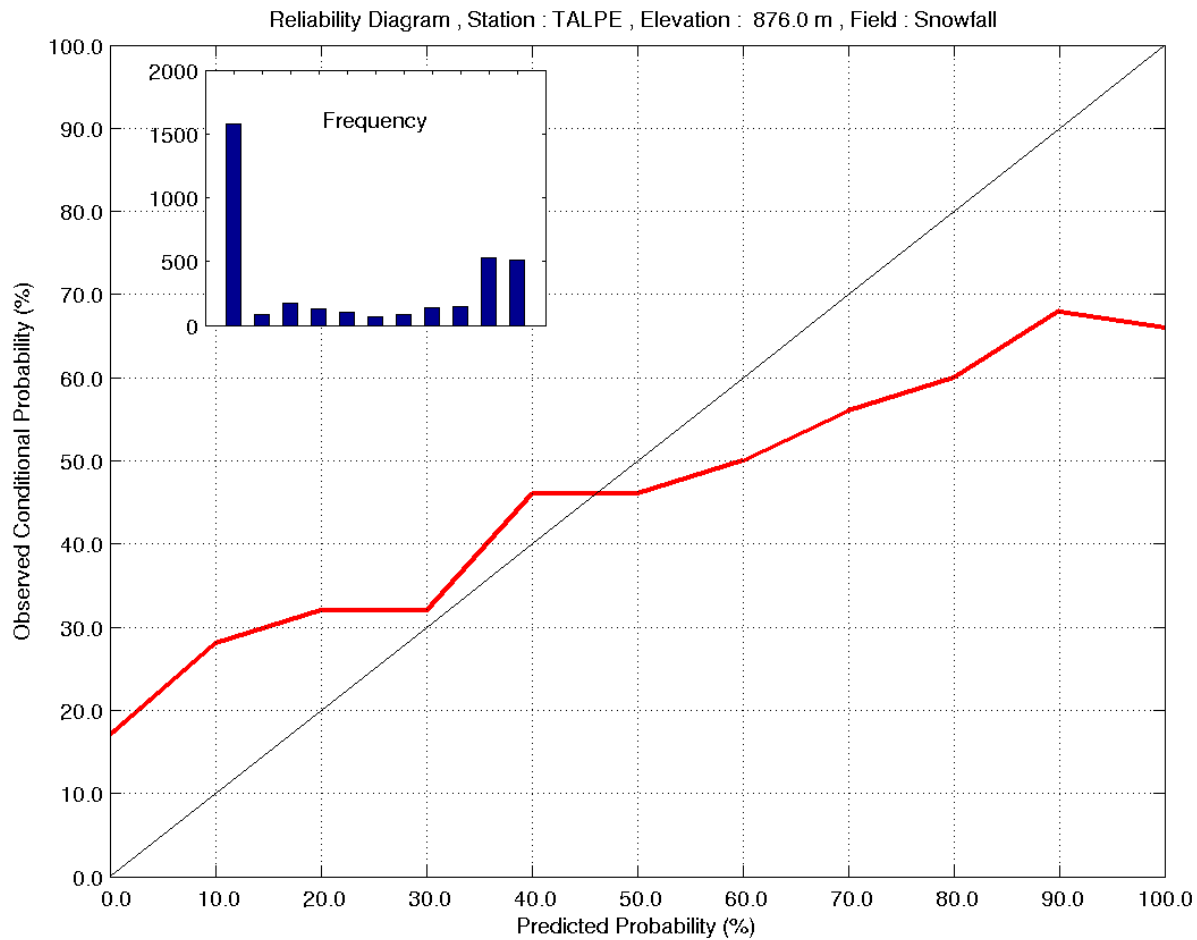
How: probabilistic forecasts

- Combine ensemble member forecasts
 - Democratic Voting
 - Each member votes equally
 - Assumes “truth” captured by ensemble
 - Uniform Ranks
 - Begins to correct for cases when “truth” lies outside ALL ensemble member solutions
 - Assumes Gumbel distribution to account for unrepresented tails (basically extrapolates from the distribution)

Reliability (Demo)



Reliability (Uni)



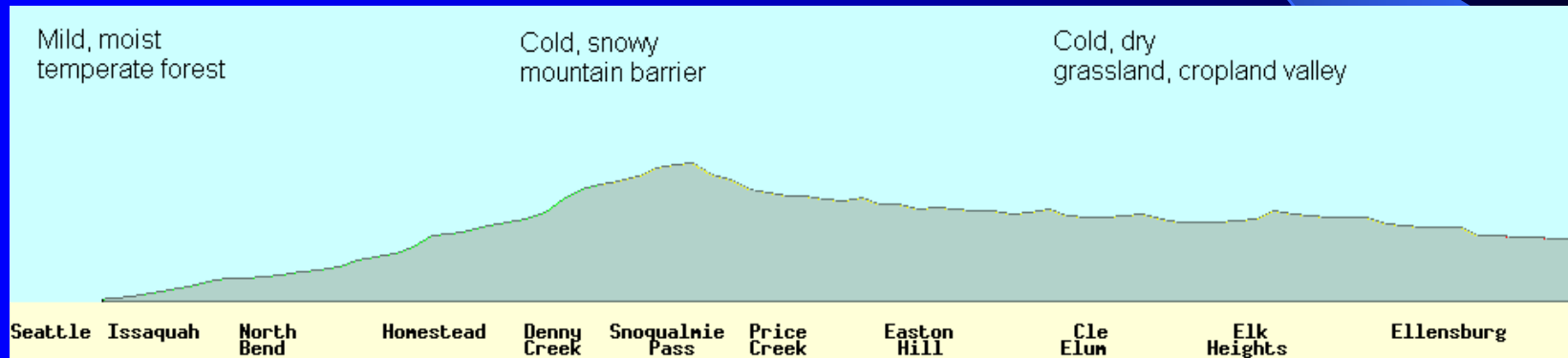
Natural Laboratory: I-90



WSDOT Assets over Snoqualmie Pass

- ~10 RWIS observation sites, ~10 mi. apart
 - Sensors
 - Air temperature
 - Precipitation (Yes/No)
 - Pavement temperature
 - Wind
 - Report every 20 minutes

Three Distinct Climates



Vast Dataset

- Fall 2002 through present
 - Observations
 - Complete ensemble model output

Major work remaining

- Identify optimal method to compute forecasts
- Develop method(s) to deliver probabilistic forecast information effectively and efficiently