



Maintenance Decision Support System (MDSS)

Transportation Weather Needs

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MDSS Weather Challenges

Optimal performance requires **accurate weather information on very small scales (city block/minutes)**. Almost all products (road and weather) are dependent on accurate weather data input.

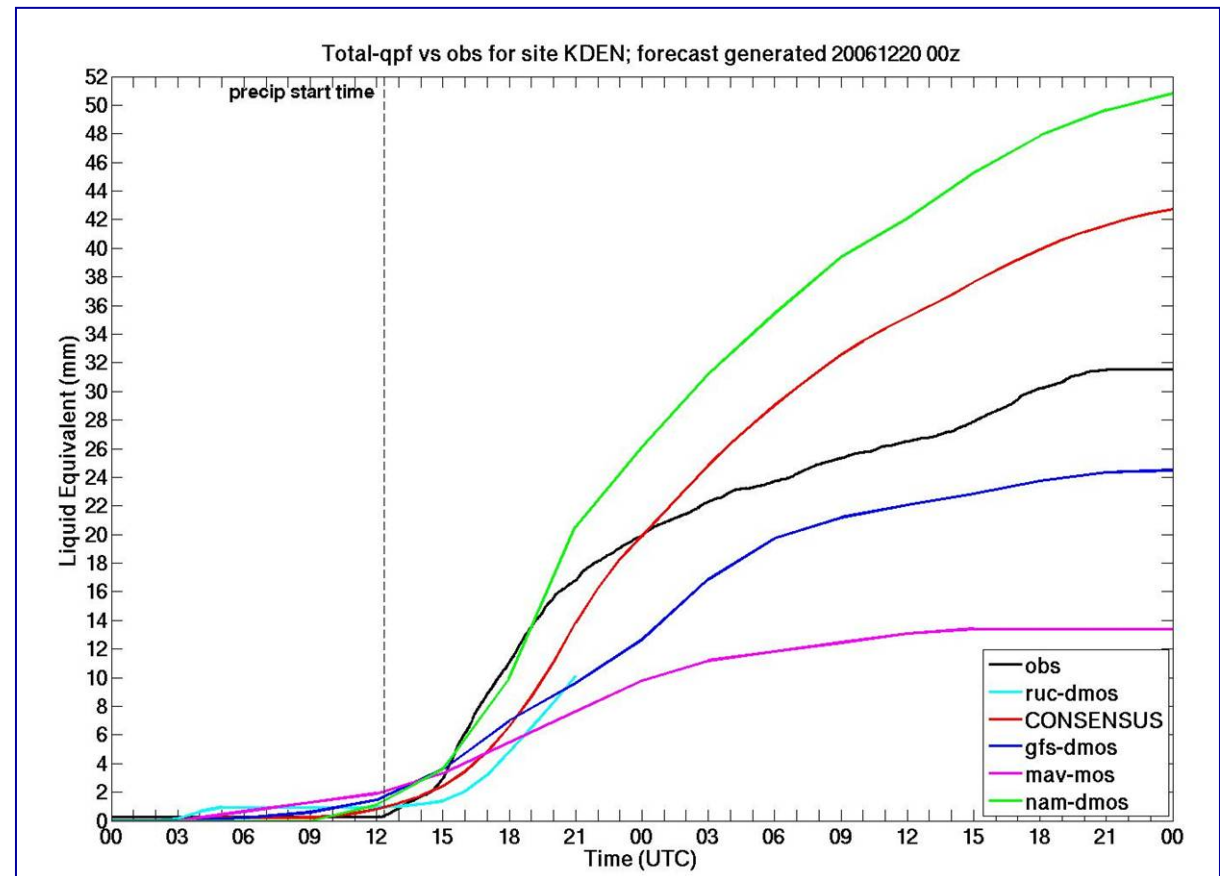
Given this dependency and the knowledge that weather prediction is still imprecise at these scales, what research and development is required to improve future skill.





Primary Limitations (Prediction)

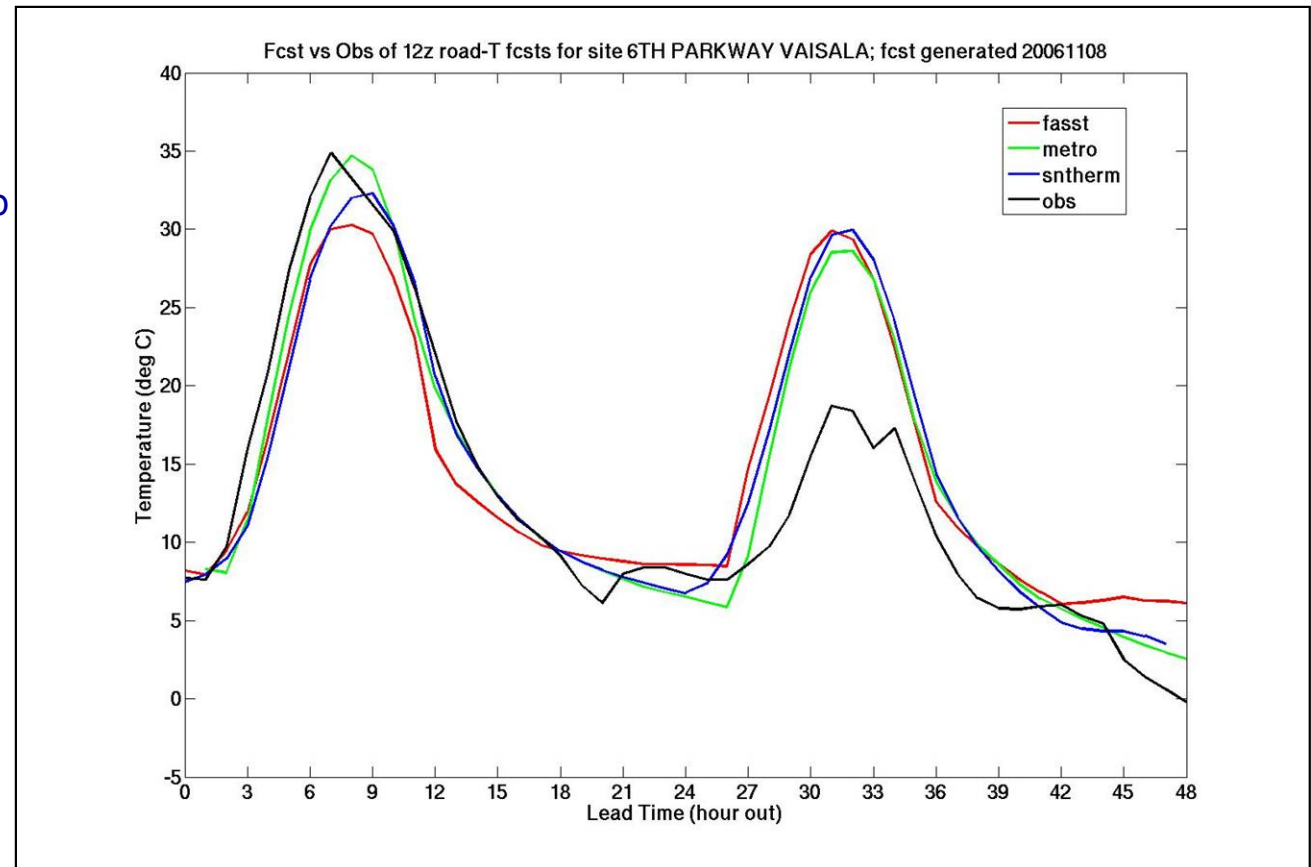
- Lack of consistently accurate weather predictions
 - **Precipitation start and stop times**
 - **Precipitation amounts (particularly for light events)**
 - Cloud cover (solar radiation)
 - Water vapor (fog, frost, dew, etc.)





Primary Limitations (Prediction)

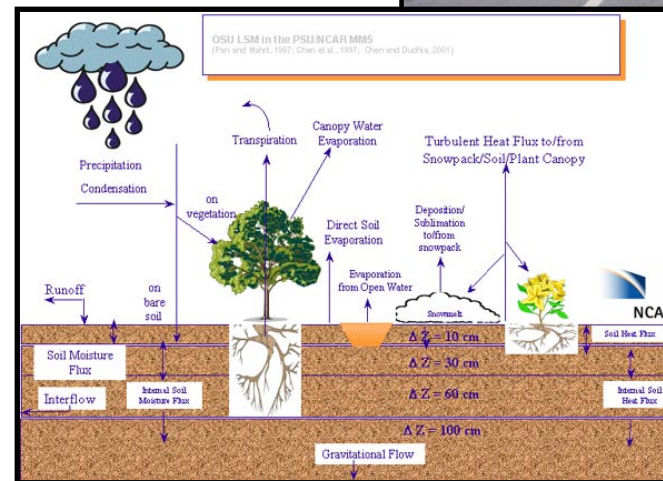
- Lack of timely, consistently accurate weather predictions
 - Precipitation start and stop times
 - Precipitation amounts (particularly for light events)
 - **Cloud cover (solar radiation)**
 - Water vapor (fog, frost, dew, etc.)





Research Needs and Investments (Predictions)

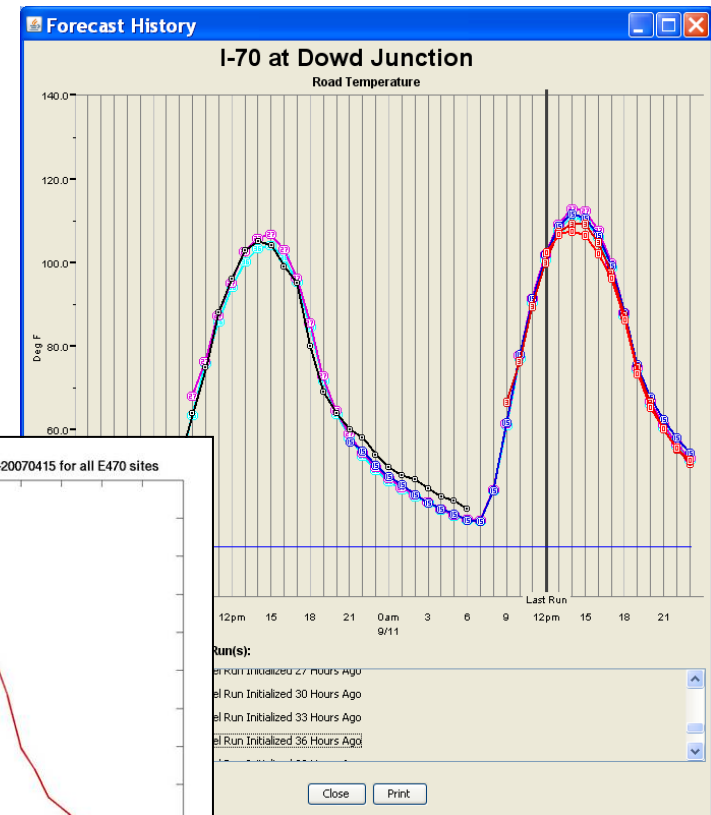
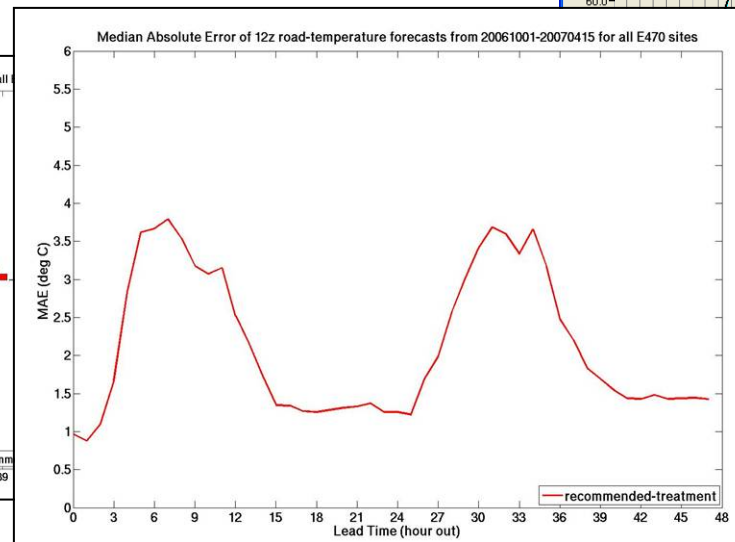
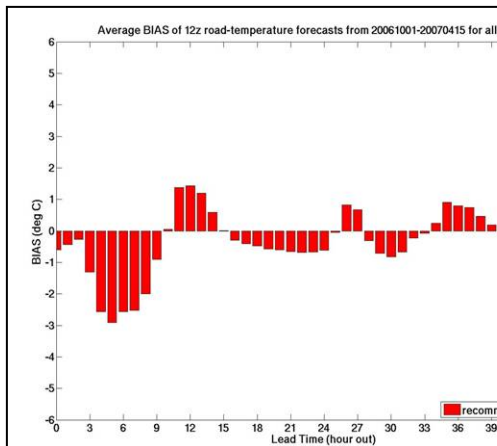
- Improvements in global, mesoscale, and land surface model capabilities
 - Data assimilation
 - Satellite
 - Radar data
 - GPS data
 - Mobile data (AVL, VII, etc.)
 - Boundary layer physics
 - Surface/atmosphere interface
 - Soil moisture
 - Snow cover
 - Temperature
 - Albedo
 - Vegetation type
 - Greenness fraction
 - Soil type
 - Others...
 - Update rates/efficiency
 - Spatial and temporal resolution





Research Needs and Investments (Predictions)

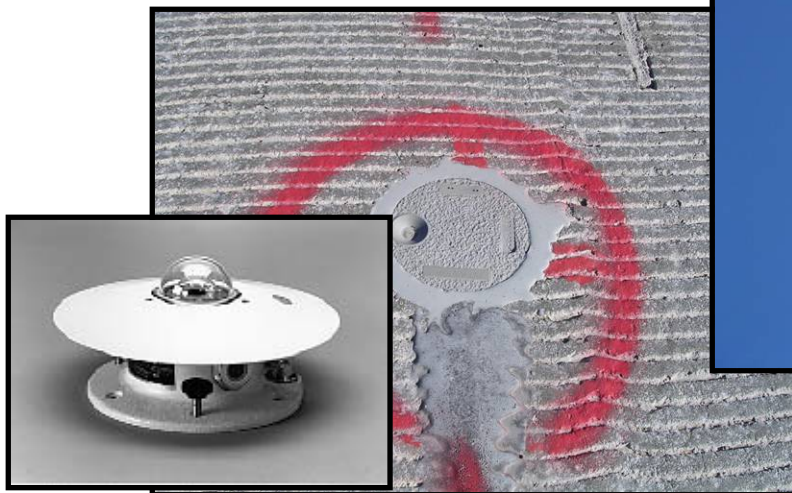
- Improvements in surface (road) energy balance models
 - Sensitivity studies
 - Parameterizations (e.g., vehicle heat)
 - Efficiency (e.g., METRo)
 - Forecasting road temperatures in city canyons and complex terrain





Primary Limitations (Observations)

- Lack of accurate, widespread observational weather and road condition data and a full understanding of how to effectively use these data.
 - Snow amounts (depth and liquid water equivalent)
 - Freezing rain and drizzle
 - Clouds and solar radiation
 - Road temperature
 - Road condition information
 - Treatment application





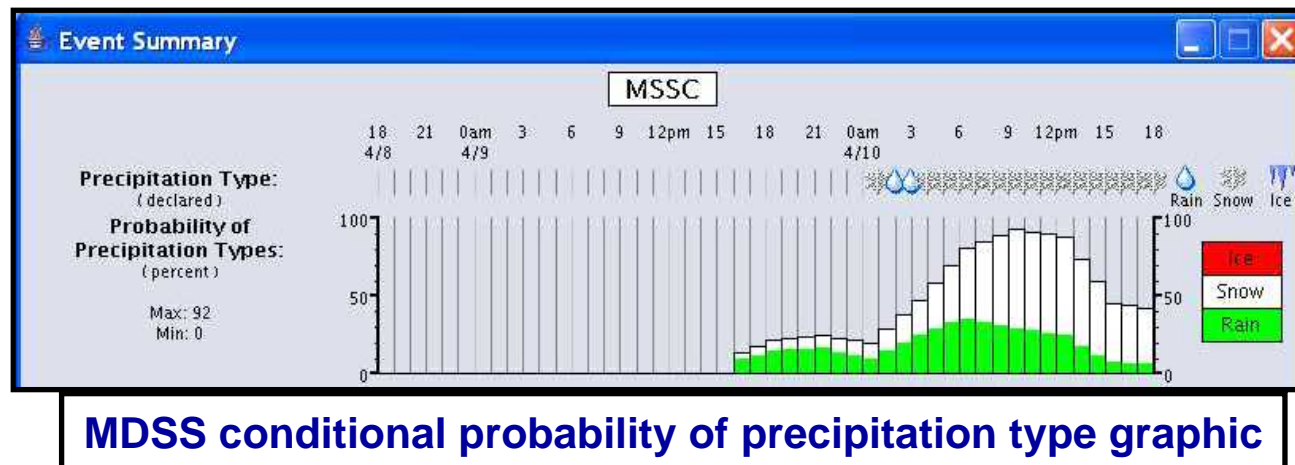
Research Needs and Investments (Observations)

- Expand the number of snow observations (amount and LWE) and solar radiation measurements made at ESS sites.
- **Develop statistical techniques to adjust model insolation output based on observed solar radiation measurements**
- Develop national testbed(s) that would facilitate key road weather investigations
 - Examine pavement temperature and condition accuracy from disparate devices
 - Explore pavement temperature behavior under varying conditions
 - Determine optimal ESS sensor placement (single platform)
 - Investigate treatment applications (impacts on pavement conditions)
 - Conduct freezing rain and drizzle studies (sensor, algorithms, etc.)
 - Evaluate new and emerging technologies (Optical, Laser, etc.)
 - Others...
- **Investigate and develop methods for using AVL data as feedback in the MDSS treatment recommendation process**
- Continue the development of video imagery techniques for road weather applications



Communicating Uncertainty

- Given that weather and road condition prediction is not precise, we need to develop methods to convey uncertainty to decision makers.
- Need user working group to help define product concepts (text and graphics) for multiple variables.





Summary

In terms of the MDSS and other potential road weather applications and products, a considerable amount of the low-hanging fruit has been consumed.

Next Steps??

1. Proactive R&D
2. Reactive use of new products and services as they become available.

As a community, it is important that we invest in applied R&D that will advance the state of the science and enhance current road weather analysis and forecast capabilities.

