

# Use of the METRo Model in the National Weather Service

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# Outline

- Motivation
- METRo details
- RWIS stations
- Output and Google Earth interface
- Sensitivity Analysis
- Verification
- Comments

# Winter Weather Impacts

- Annual toll taken in life, property, and economic loss due to severe winter driving conditions
  - 1,300 fatalities and over 100,000 injuries are due to vehicle crashes on snowy, slushy, or icy roads
  - State and local agencies spend 2.3 billion dollars on snow and ice control
  - Commutes slowed due to poor road conditions (estimates of economic impacts vary)



Data obtained from the U.S.  
Federal Highway  
Administration (FHA)

# Road Surface Model

- METRo: *Model of the Environment and Temperature of Roads*
- Open Source – Distributed under the **GNU GENERAL PUBLIC LICENSE**
- Originally developed by scientists at Environment Canada
  - Goal: dependable and reliable forecasts of road surface conditions
  - Produces forecasts at a point based on:
    - Site-specific metadata
    - Past observations
    - Atmospheric forecast
  - Crevier, L.-P. and Y. Delage, 2001: METRo: A New Model for Road-Condition Forecasting in Canada. *J. Appl. Meteor.*, 40, 2026-2037.

# Road Weather Information Systems



RWIS Station  
Bearmouth, MT



## Road surface condition sensor

- Dry, moist, wet, ice, snow
- Road Temperature
- Salinity of moisture

# METRo Model

## Recent Observations

- Air Temp
- Dew Point
- Wind Speed
- Precip. present? Yes/No
- Road Condition (Dry/Wet/Snow)
- Road Surface T
- Road Sub-surface T

## Output

- Road Sfc T
- Sub-surface temp
- Surface conditions
- Fluxes

## Atmos. Forecast

- Wind
- T
- Td
- Sky
- QPF

Inputs

METRo Model

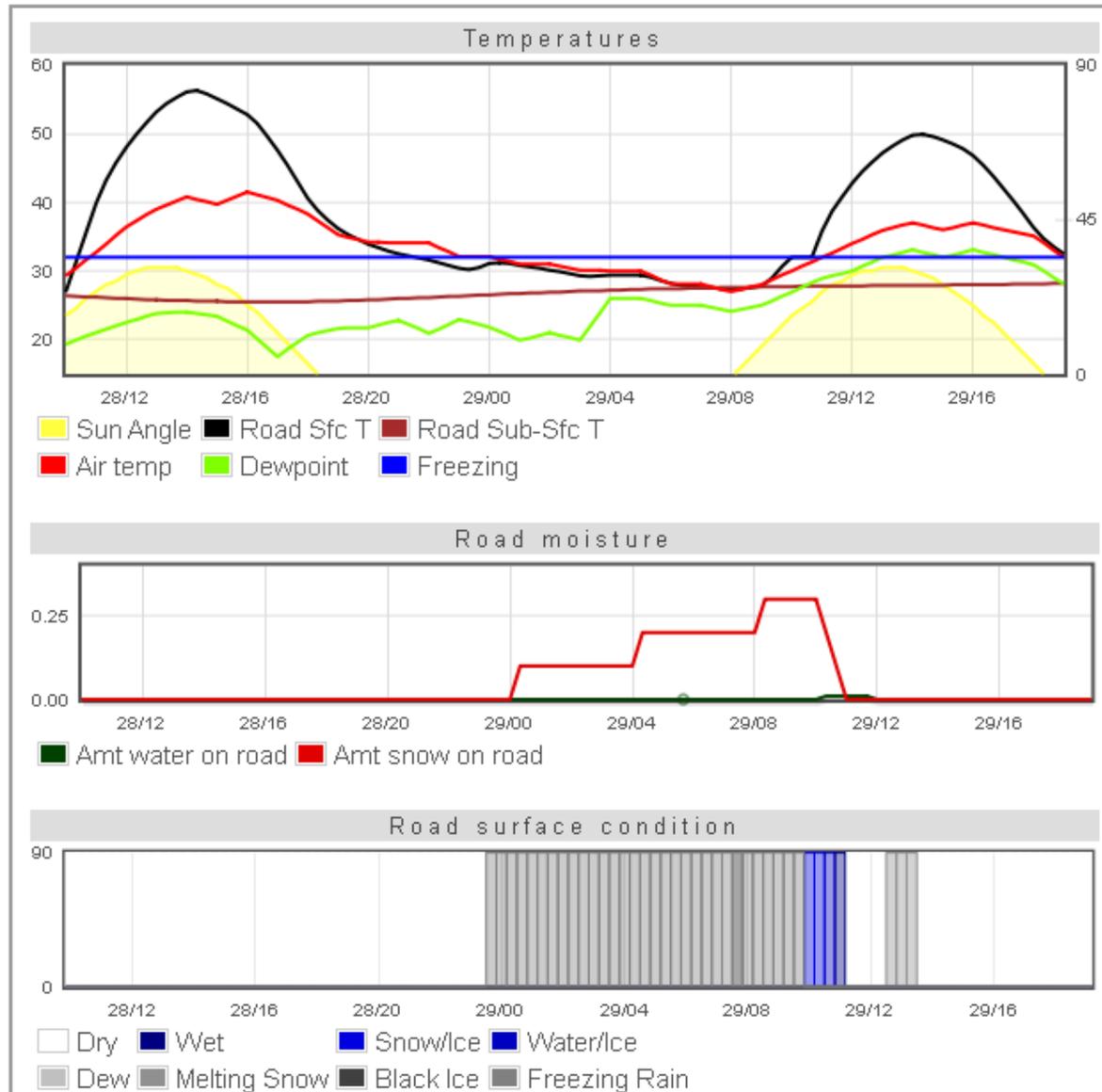
# Output Example

-----  
Display developed  
by Don Britton  
of  
Glasgow, MT

## Metro Forecast: Lost Trail Pass

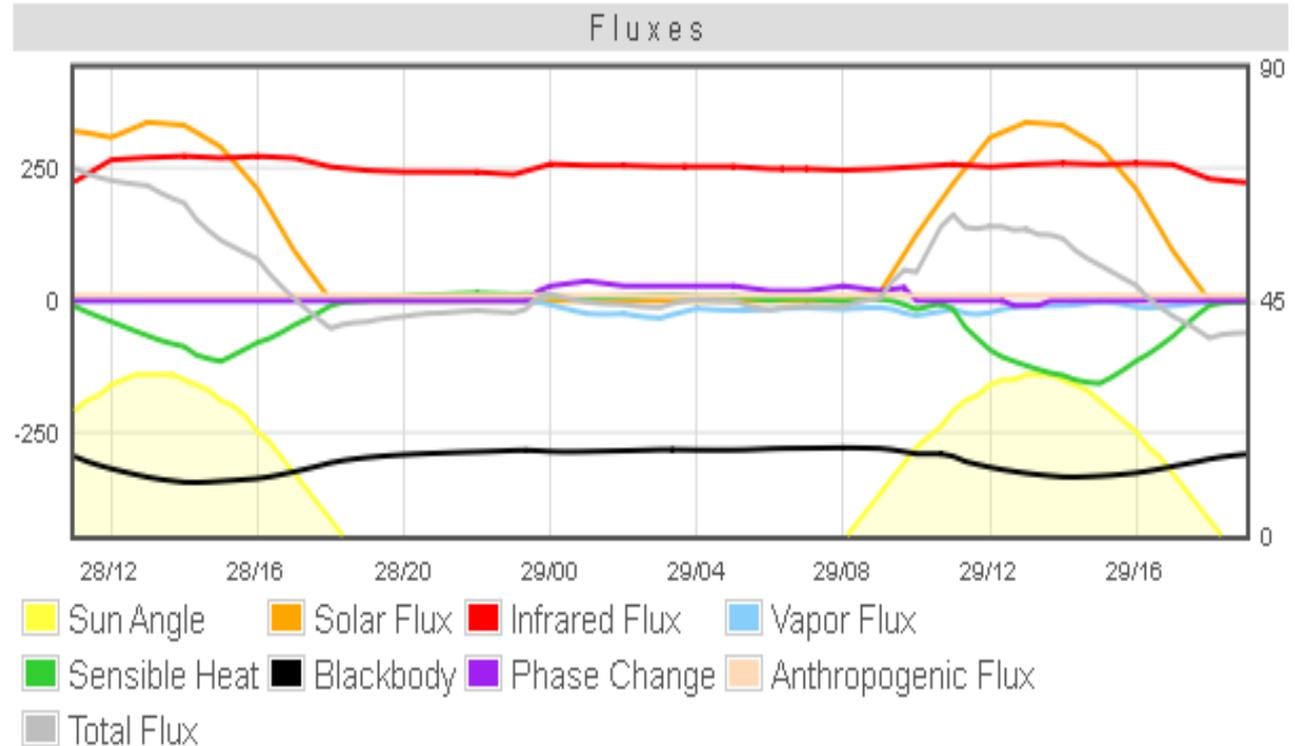
[Right click and copy for raw link](#)

Fri 10/28/11 1720Z (Creation Time)



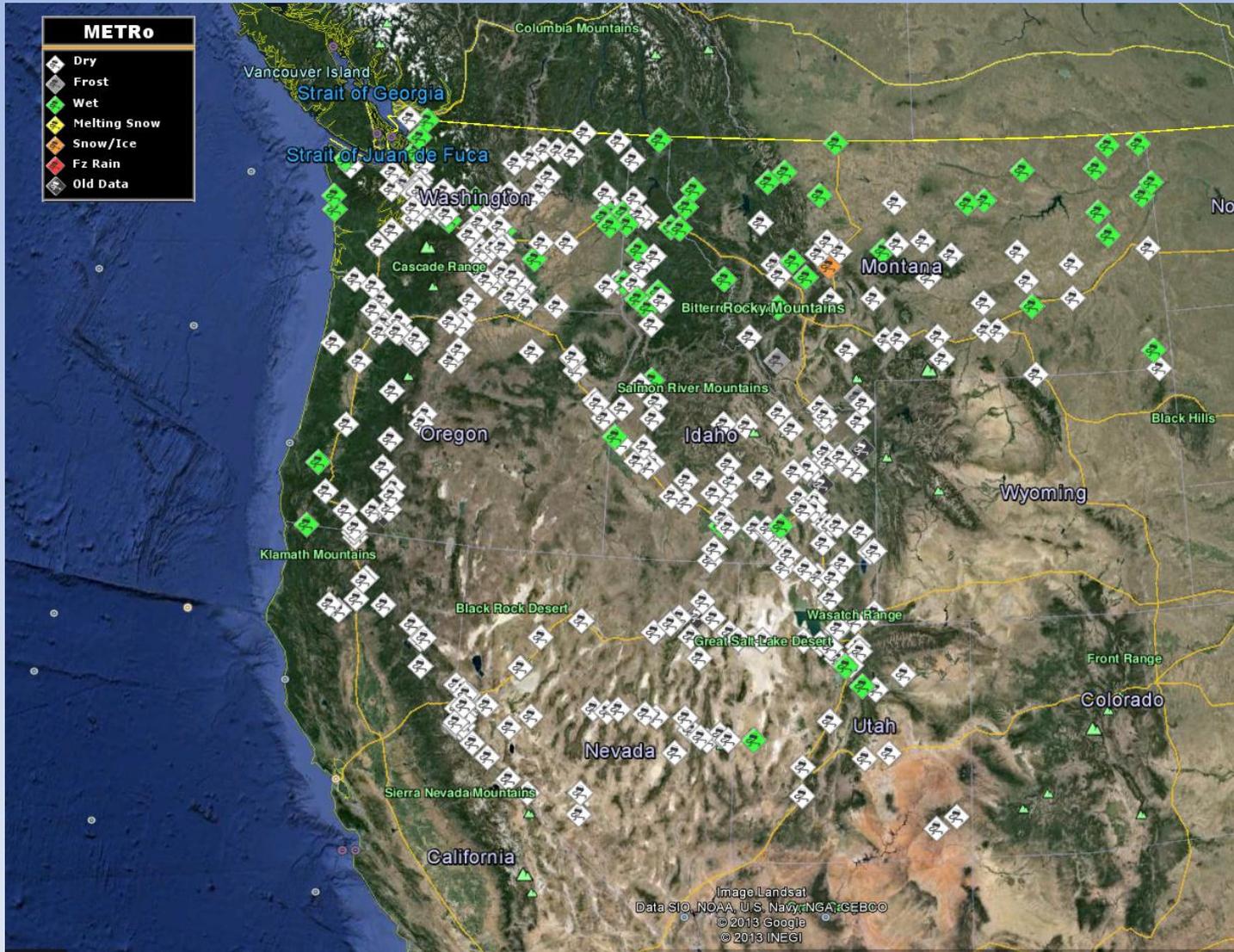
# Output Example

-----  
Display developed  
by Don Britton

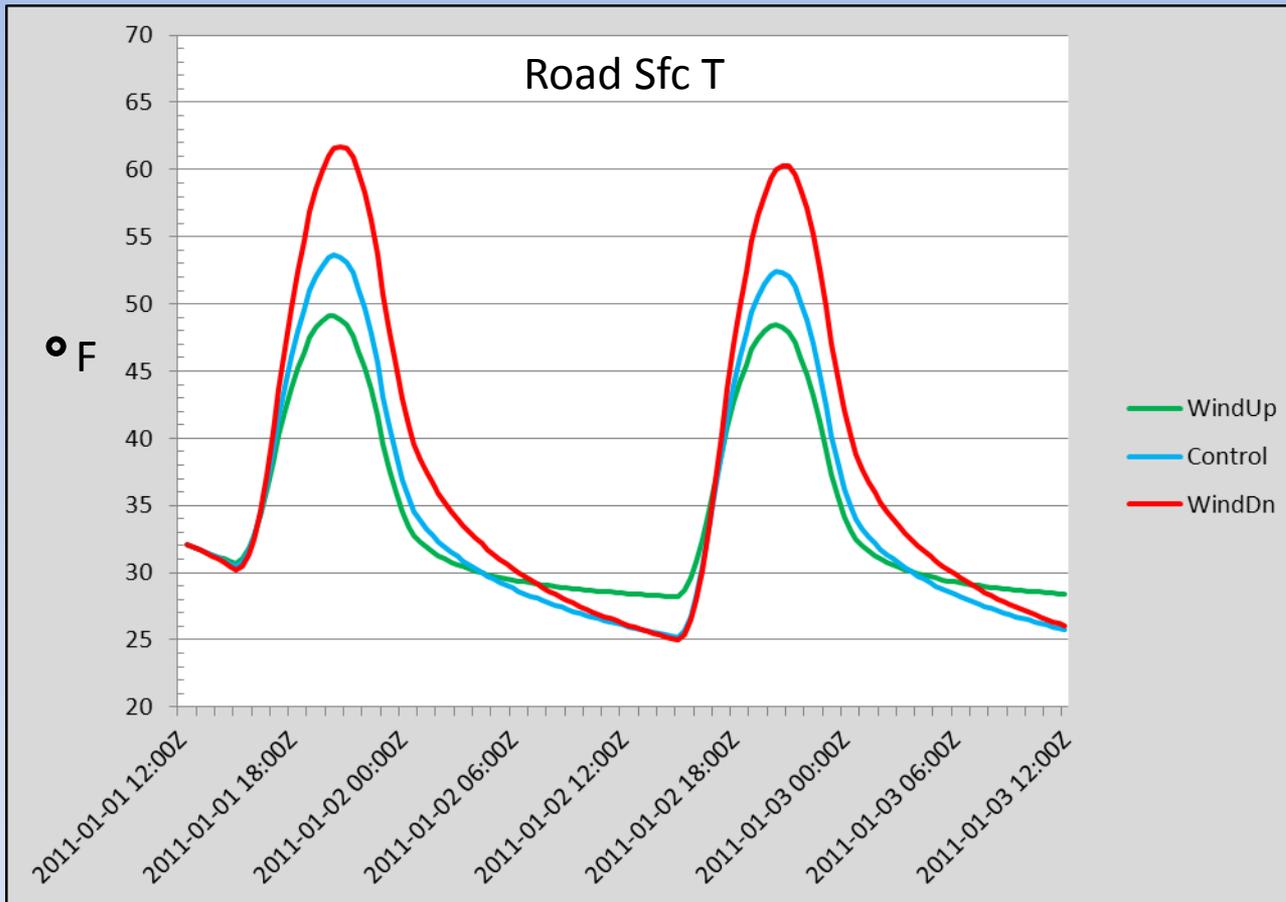




# Regional METRo Model Output

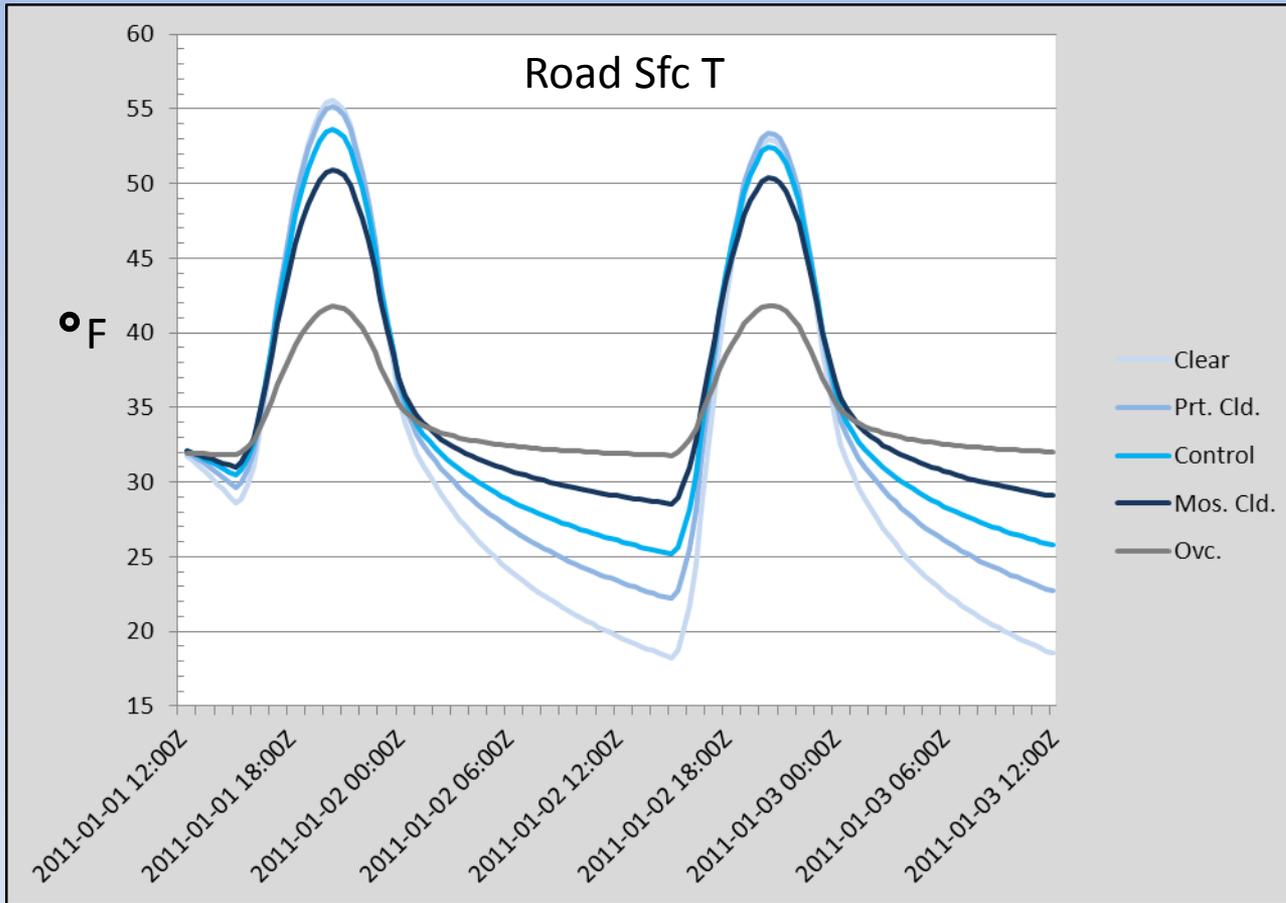


# Test Case – Winds



The model seems to confirm intuition – all else equal, windy days are cooler and windy nights are warmer

# Test Case – Clouds



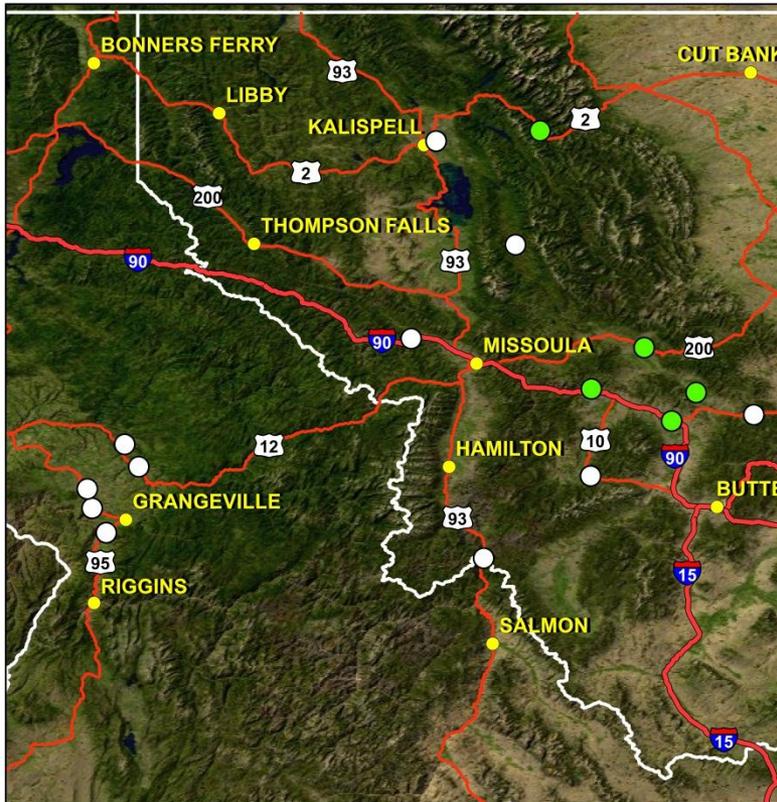
- Clear      ↑ (0 oktas)
- Prt. Cl.    □ (2 oktas)
- Control    □ (4 oktas)
- Mos. Cl.    ■ (6 oktas)
- Ovc.        ↓ (8 oktas)

- Clear
- Prt. Cl.
- Control
- Mos. Cl.
- Ovc.

Slightly more complicated scenario – the effect of cloud cover is linear at night, but much more complex during the day

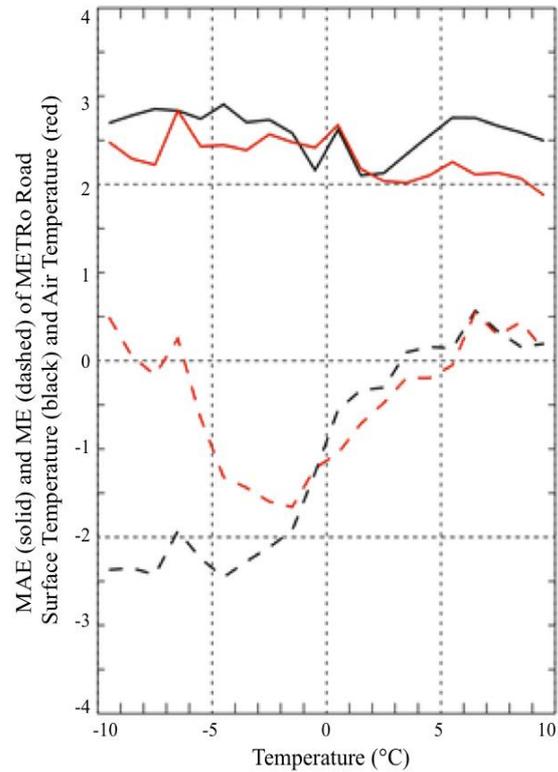
# Verification Points

● Points Verified



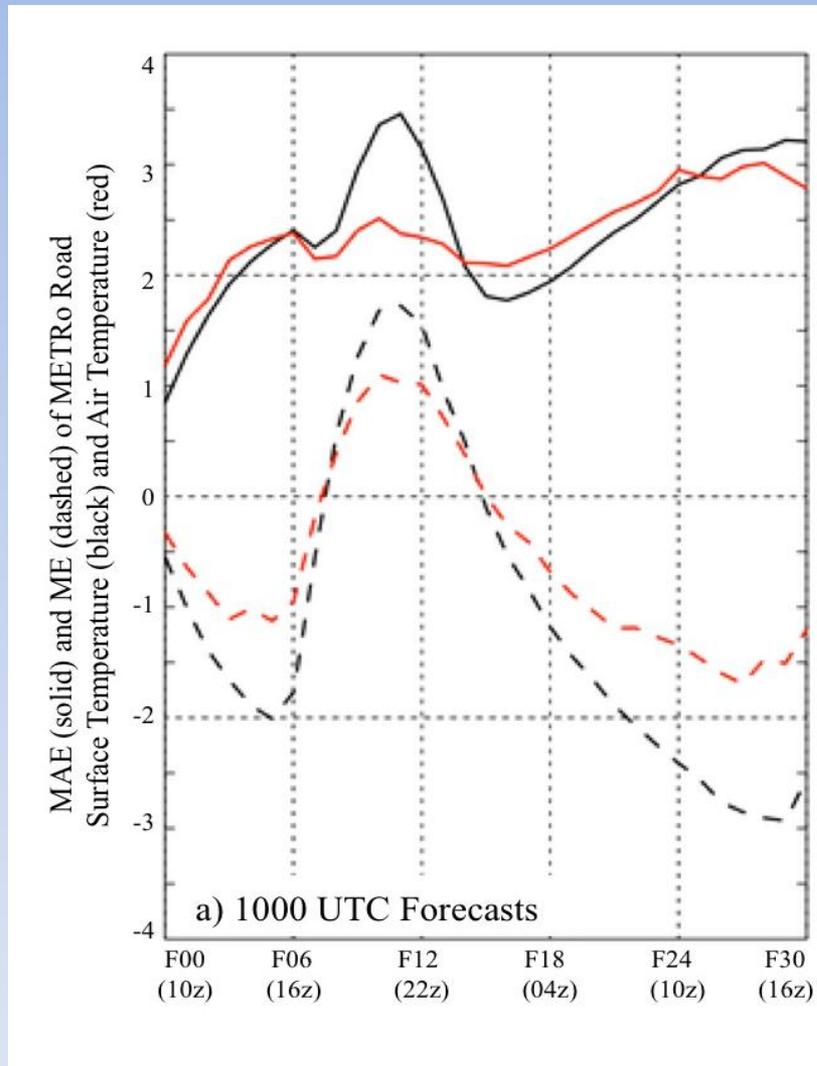
Bulk Verification  
Completed for  
5 RWIS locations  
mid-November 2011  
through  
March 2012

# Verification Results



Relatively small negative bias near 0C

# Verification Results



MAE and Bias highly correlated with the Solar cycle

# METRo Usefulness at Missoula

- Most useful in the transition seasons (Fall and Spring)
- Very helpful for assessing the timing of impacts:
  - Beginning of travel impacts due to ice/snow
  - Ending of impacts as roads warm and melt
- Overall better situational awareness of road conditions for forecasters



# METRo Notes

- Can be used for bridge decks
  - Where Sub-Sfc T is set to Air Temperature
  - Can show when bridges are freezing before nearby roads
- Could be used for runways
  - Provided you have real time runway surface temperature and some estimate of sub-sfc temperature
  - Use airport weather station for atmospheric observations
- Accurate engineering information regarding road layers and thickness is ideal

# Thank You!

## Questions or Comments?

### Credits

Dave Bernhardt, SOO, WFO Great Falls

Ron Miller, SOO, WFO Spokane

Don Britton, MIC, WFO Glasgow

Ahmad Gorabi, Web Development, WRH

Andy Edman, SSD, WRH

Mark Loeffelbein, STID, WRH

