Strategies for Ensuring Optimal Guidance in Decision Support Systems for Winter Maintenance Operations

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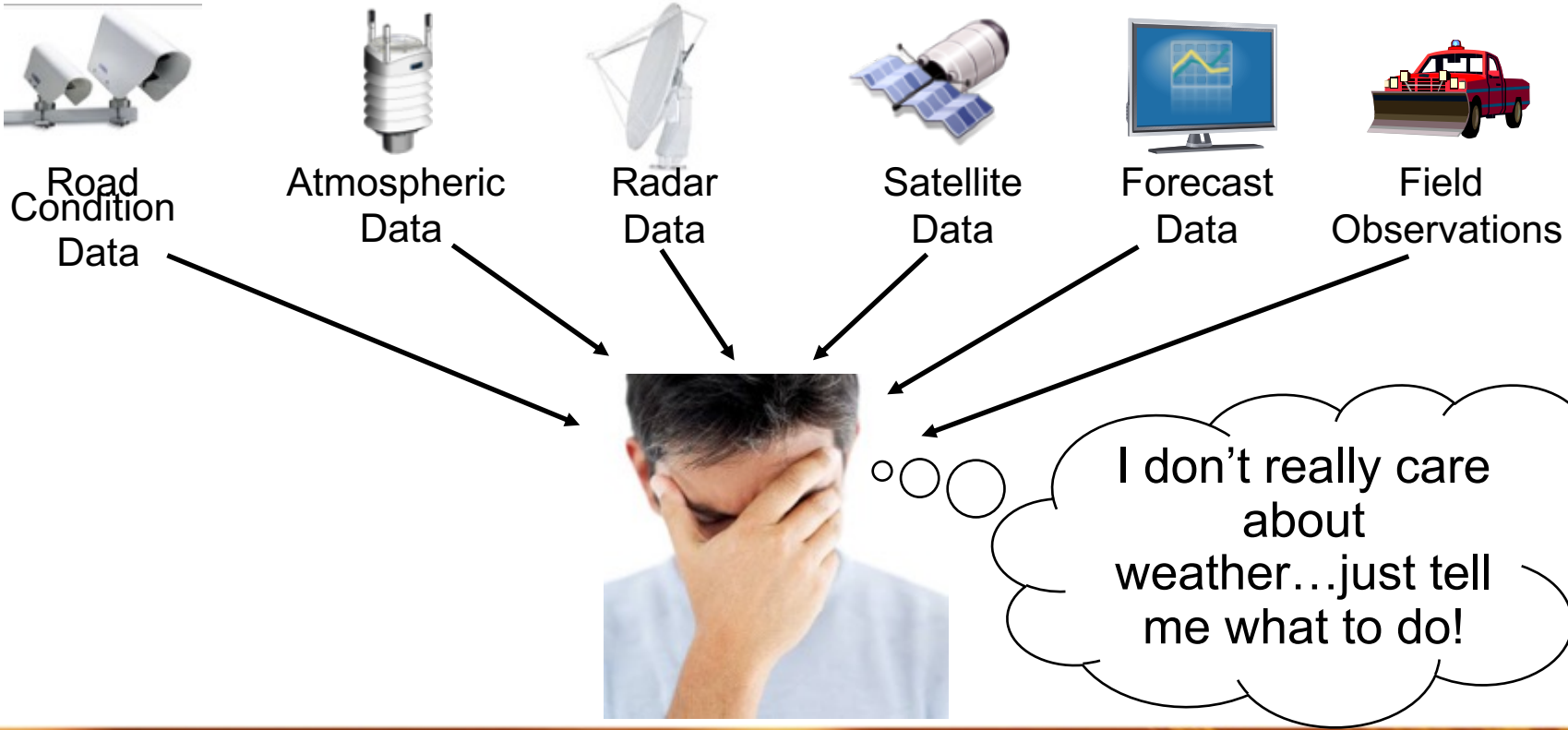
VAISALA

A Common Challenge

- How to use disparate road weather data and information to make critical decisions concerning roadway operations



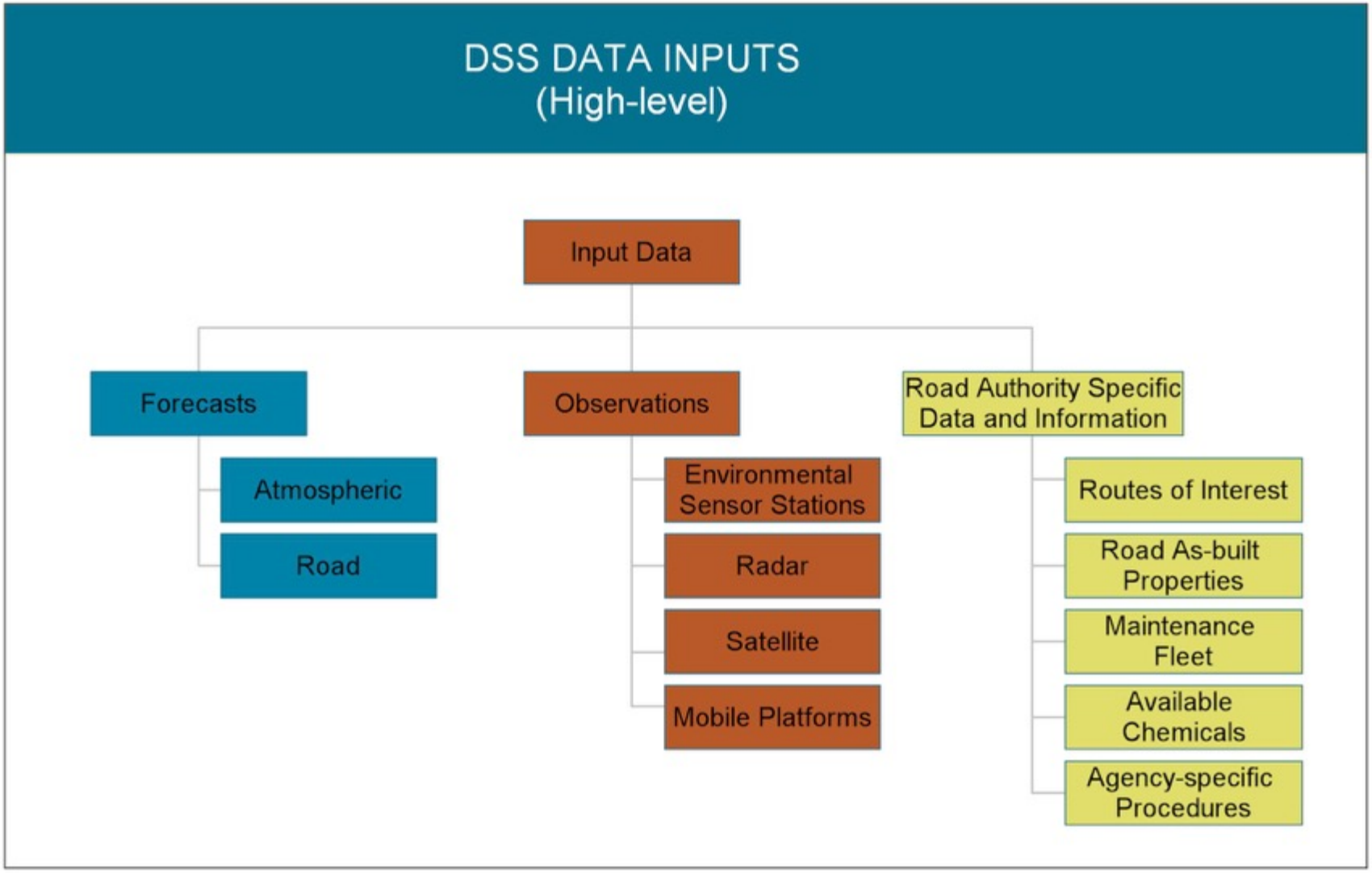
Decision Support System: One Perspective

- An information system that uses an interactive analytical modeling process to recommend an action (or no action). System is based upon
  - decision models (e.g., industry best practices)
  - a database
  - a decision maker's own insights

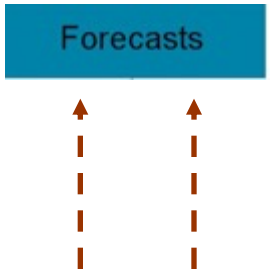
- Road Weather Decision Support System
  - Fully automated
  - Objective, repeatable guidance
  - Targeted guidance (weather and road)
- If properly constructed, can serve as a single repository of road weather information and guidance

Essential Elements of a DSS for Winter Maintenance

Data Inputs


DSS DATA INPUTS
(High-level)
Input Data
Forecasts
Atmospheric
Road
Observations
Environmental Sensor Stations
Radar
Satellite
Mobile Platforms
Road Authority Specific Data and Information
Routes of Interest
Road As-built Properties
Maintenance Fleet
Available Chemicals
Agency-specific Procedures

Quality Forecasts



- A DSS is only as good as the forecasts (weather and road) that drive it!
  - Provides tactical (0 – 3 hrs) and strategic (beyond 3 hours) weather and road condition information
  - Di[Observations]ct the treatment recommendation process
- Forecasts should be optimized through the use of observations
  - Model initialization
    - Weather
    - Road
  - Post-processing routines

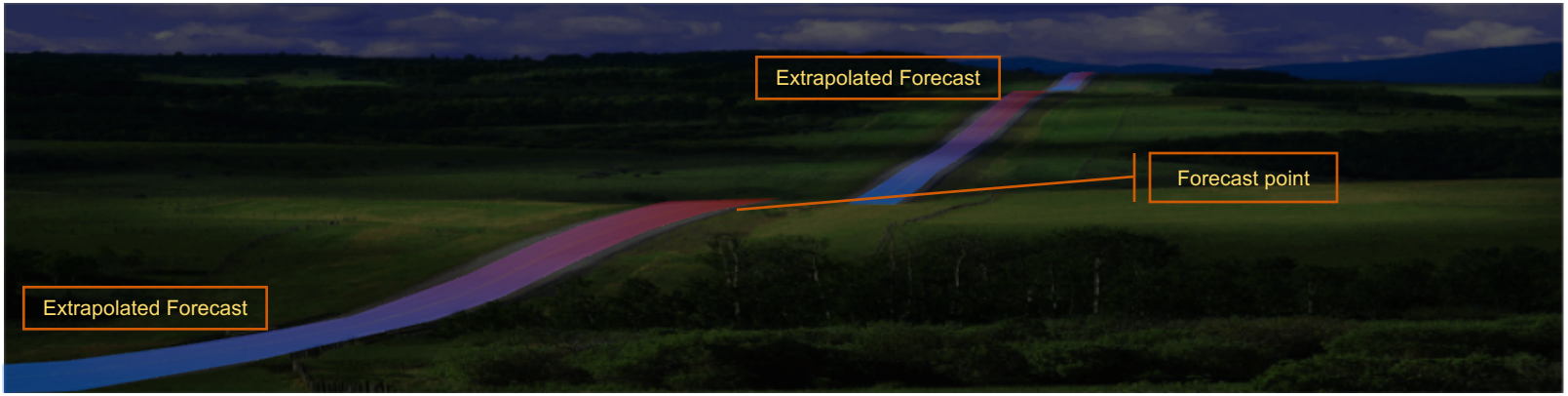
Road Condition Assessment and Prediction

- Proper assessment of road conditions is fundamental in a DSS's ability to provide tactical guidance.
- Road Weather Information System (RWIS) Environmental Sensor Stations have become the backbone of the road weather community.

- The future of road weather observations
  - Non-invasive instruments with the capacity to deliver supplemental road condition observations
  - Mobile observations (similar to marine and aviation operations)
    - Weather and road condition data
    - Maintenance operations data
      - Plow up/down
      - Treatment type
      - Treatment rate
      - Treatment location
  - Traffic Data
- DSS for winter maintenance operations should have the capacity to leverage both conventional and non-conventional observations

Road Condition Assessment and Prediction

- Optimal predictions are made at observing sites along a roadway.
- Any attempt to make road condition forecasts at non-observing site can result in low quality predictions, thus, inaccurate guidance
  - Lack of accurate initialization
  - No opportunity to do post-processing
- In cases where roads have been thermally mapped, forecasts can be extrapolated to other sections of the roadway to provide an understanding of what is occurring between stations or forecast points*
- Mobile observations will also serve as way to derive more accurate forecast between traditional observing sites

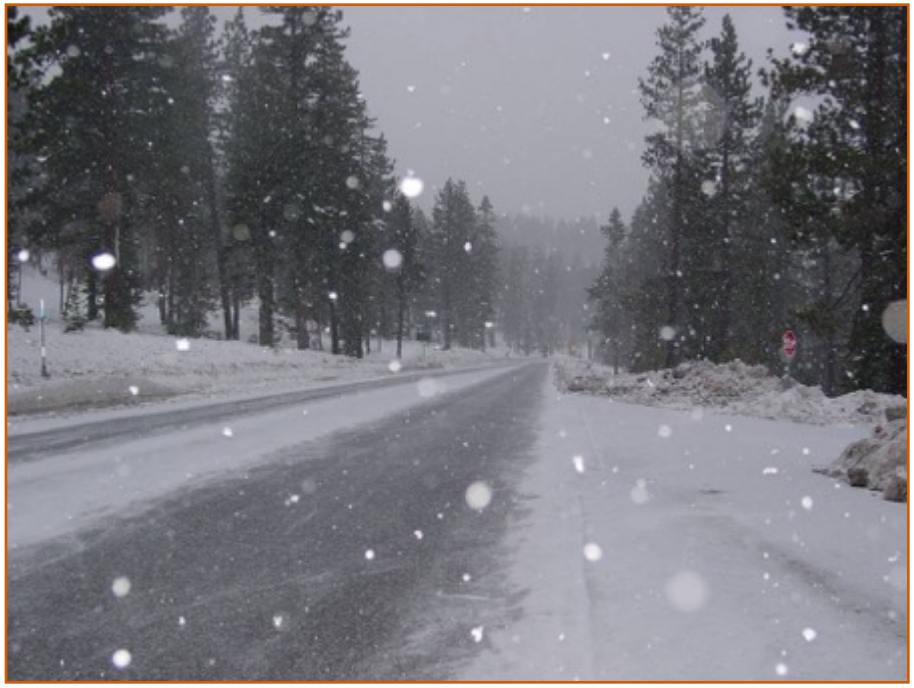


*This can be done in none-precipitation situations during nighttime hours

Event Characterization and Decision Models

- Need to construct the evolution of an event over the time period of interest (24 hrs, 48 hrs., etc.), utilizing road weather forecasts

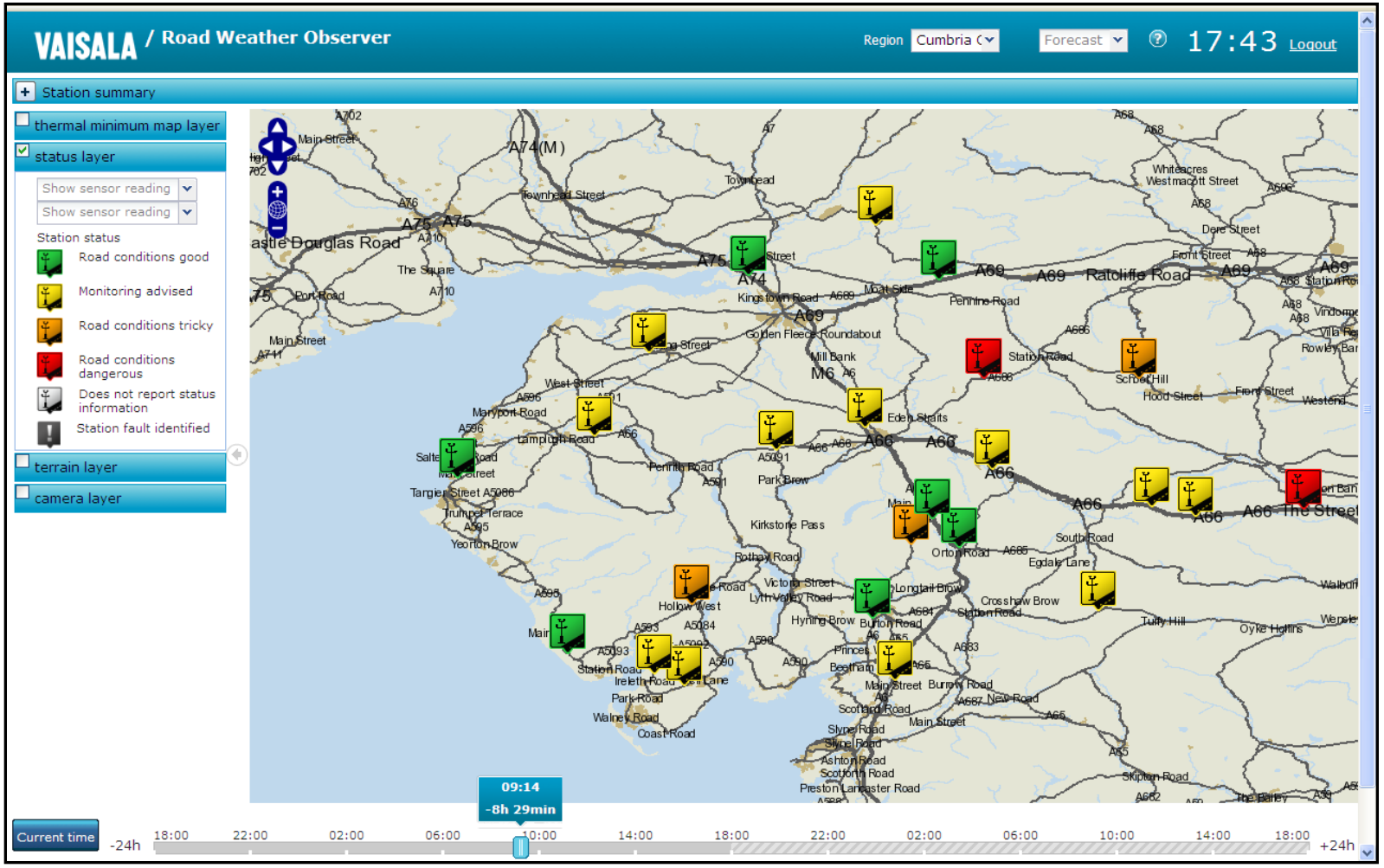
- Serves as the foundation for the decision model
  - Best practices for winter maintenance operations
  - Eutectic properties of the materials used in operations.
  - Integrate understanding of an end user's operations
    - Types of materials used
    - Operational philosophy
    - Maintenance fleet



Characteristics of an Effective DSS

CHARACTERISTIC	USABILITY DESCRIPTION
Effective	A DSS should allow winter maintenance practitioners to fully achieve their goals and objectives, with an acceptable level of accuracy.
Efficient	The application should enable users to meet their goals and objectives in a timely fashion, maintaining the desired level of accuracy.
Engaging	A DSS should employ an interesting, appealing interface.
Error tolerant	A DSS should be designed in a way that errors are minimized and error recovery is supported.
Easy to learn	A DSS should promote rapid, trouble-free adoption and high-level use, but should also enable more complex analysis and investigation.

Novel Visualization



Consultation

- Provides an added level of support (human interface opportunity)
  - Forecast clarification
  - Ascertain forecast confidence
  - System monitoring
- Consultants should
  - Be trained in weather and experienced
  - Be familiar with the region (e.g., microclimates)
  - Understand/speak winter maintenance operations
  - Understand specific end user perspective
  - Be Available 24 hours/day, 7 days per week

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