Road Weather Roadshow

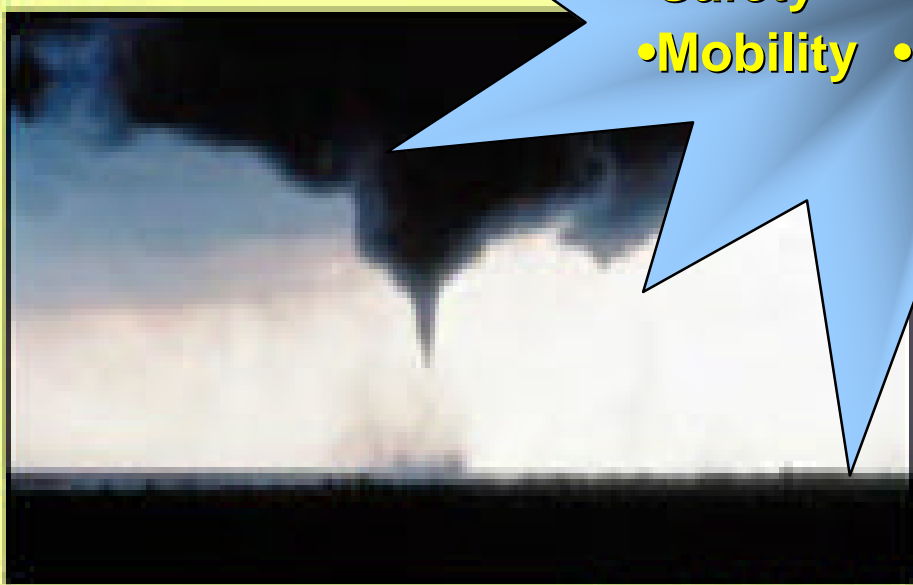## Advancing the Presentation of Road Weather Information for Improved Decision Making

FHWA Weather Team and
the Aurora Program

Weather

Affects transportation outcomes of:

- Safety
- Productivity
- Mobility
- Environmental quality

Every year in the United States...

- Nearly 7,000 fatal highway crashes and over 450,000 injury crashes occur annually
- Over $2 billion is spent for snow and ice control
- About $5 billion is spent on weather related infrastructure damage
- Billions of dollars are lost in delay and disruption to trips and production

…because of weather

Many decision makers affect the quality of the transportation system…

Transit Operator

Traffic Manager

Maintainer

Commercial Operator

Transportation System

Personal Traveler

Planner

Emergency Manager

Winter Maintenance Decisions

Winter Maintenance in North America

- A $2.5 billion/year activity of state and local highway authorities
- Involves
  - stocking of materials
  - purchase of equipment
  - scheduling of crews
  - dispatching for pretreatment, snow/ice removal and salting/sanding
- Maintenance operators use weather information of several kinds and scales -- from long range forecasts to data from roadside sensors

The media report general weather conditions and forecasts, regionally and nationally, when it fits their program schedule, based on National Weather Service and private sources.

What's missing?
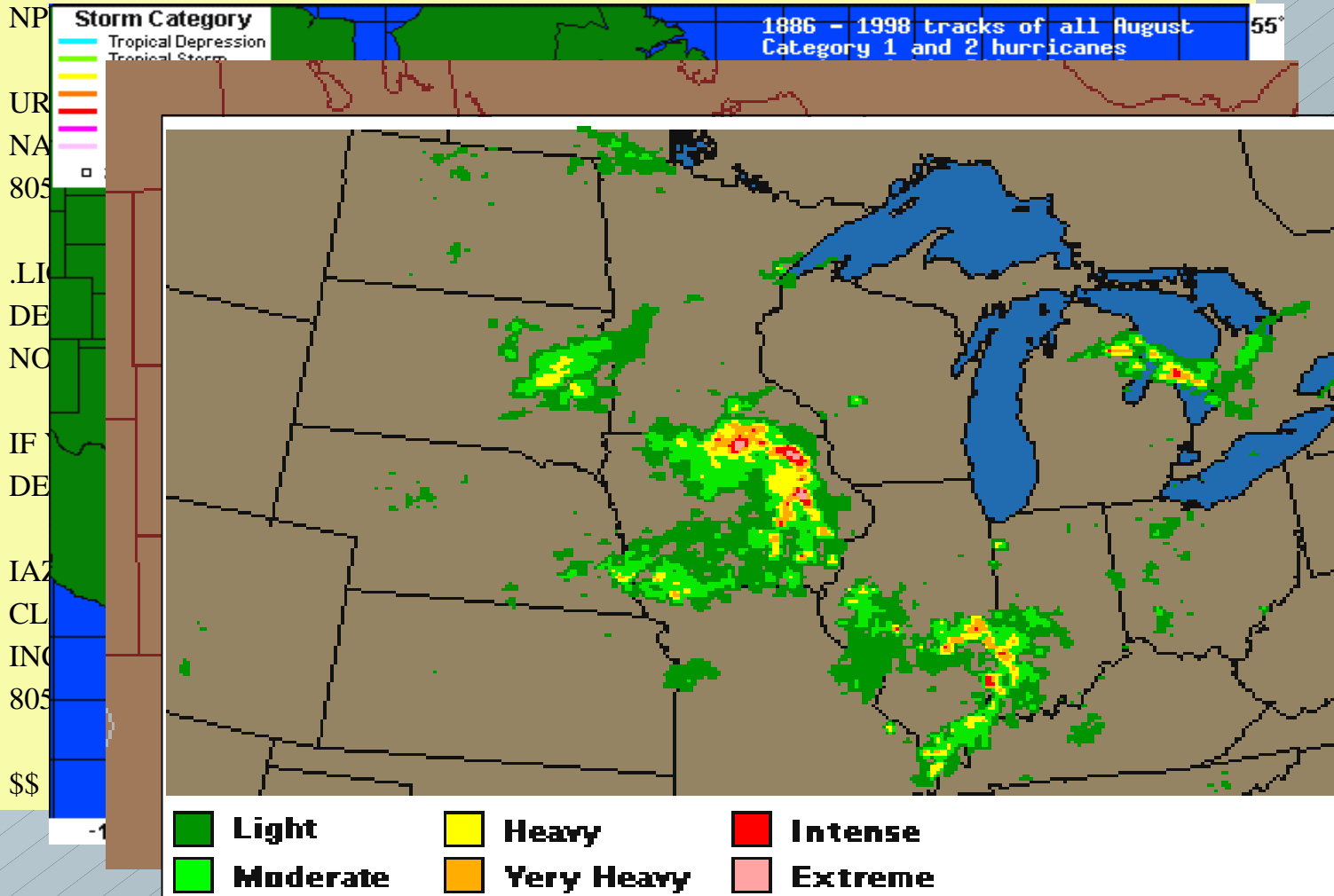
Is it possible to have too much information that still does not support decisions well?

The Question

How do we make the best use of all of this weather and road condition information?

Information Must Fit the Decision

micro (current-minutes)	meso (1-12 hrs.)	synoptic (12 hrs.-week)	climatic (weeks+)

micro (current-minutes)

use caution
route/diversion
go/no-go
protect work/stock
set signals
set & issue warnings
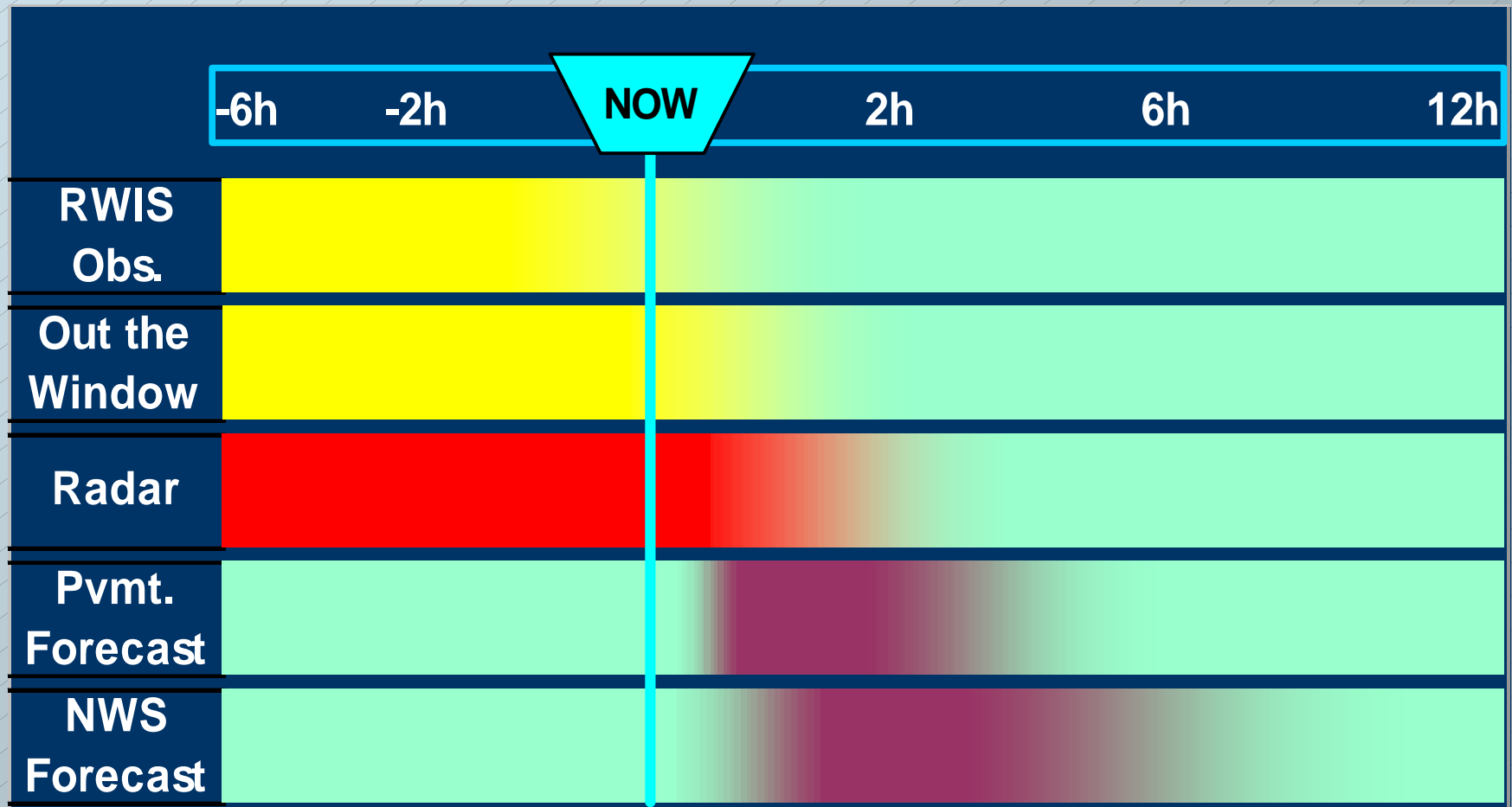close/restrict routes

"Warning"

meso (1-12 hrs.)

trip mode
vehicle equipage/prep
trip route/time
dispatching
schedule jobs
bring assets online
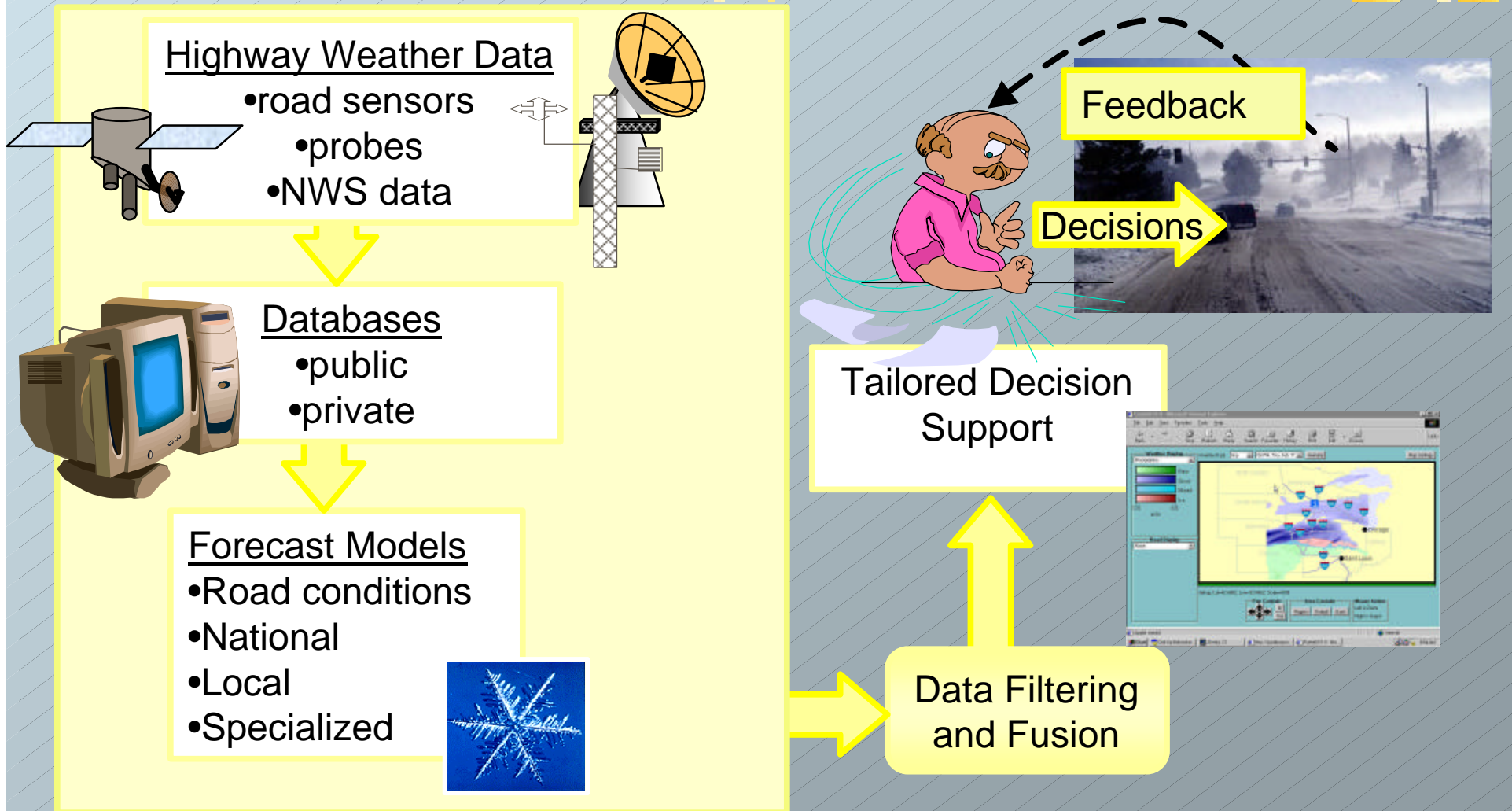plow/salt/drain
suppress emissions

"Operations"

synoptic (12 hrs.-week)

work schedules
store/ship
design facilities
provide capacity
provide backup
allocate land uses

"Planning"

Observations vs. Forecasts

	-6h	-2h	NOW	2h	6h	12h
RWIS Obs.						
Out the Window						
Radar						
Pvmt. Forecast						
NWS Forecast						

WIST-ful Thinking: A Vision of Weather Information for Transportation Systems (WIST)

Highway Weather Data
- road sensors
- probes
- NWS data

Databases
- public
- private

Forecast Models
- Road conditions
- National
- Local
- Specialized

Feedback

Decisions

Tailored Decision Support
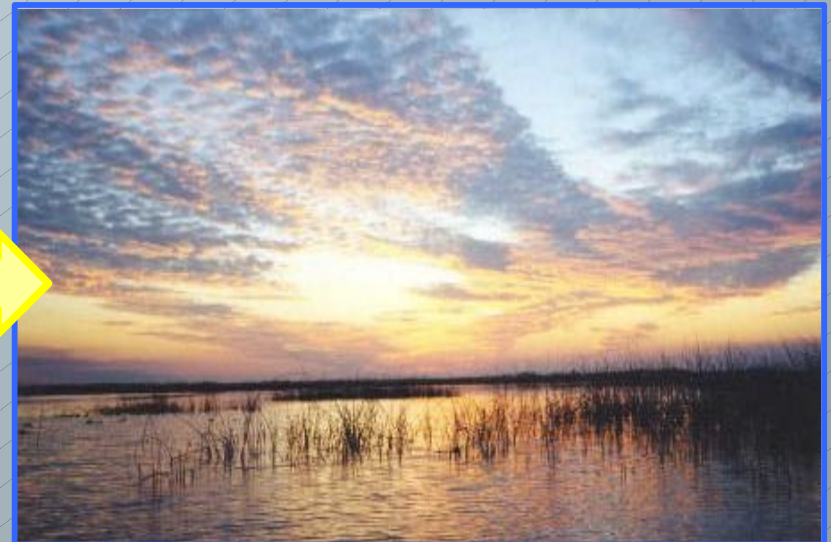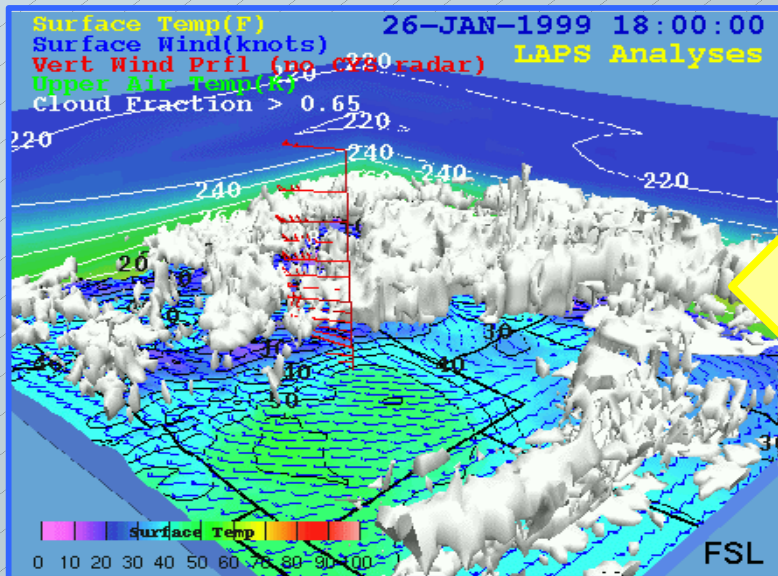
Data Filtering and Fusion

The Model Decision Support System Incorporates...

- ⌘ Visualization
- ⌘ Interpretation
- ⌘ Association
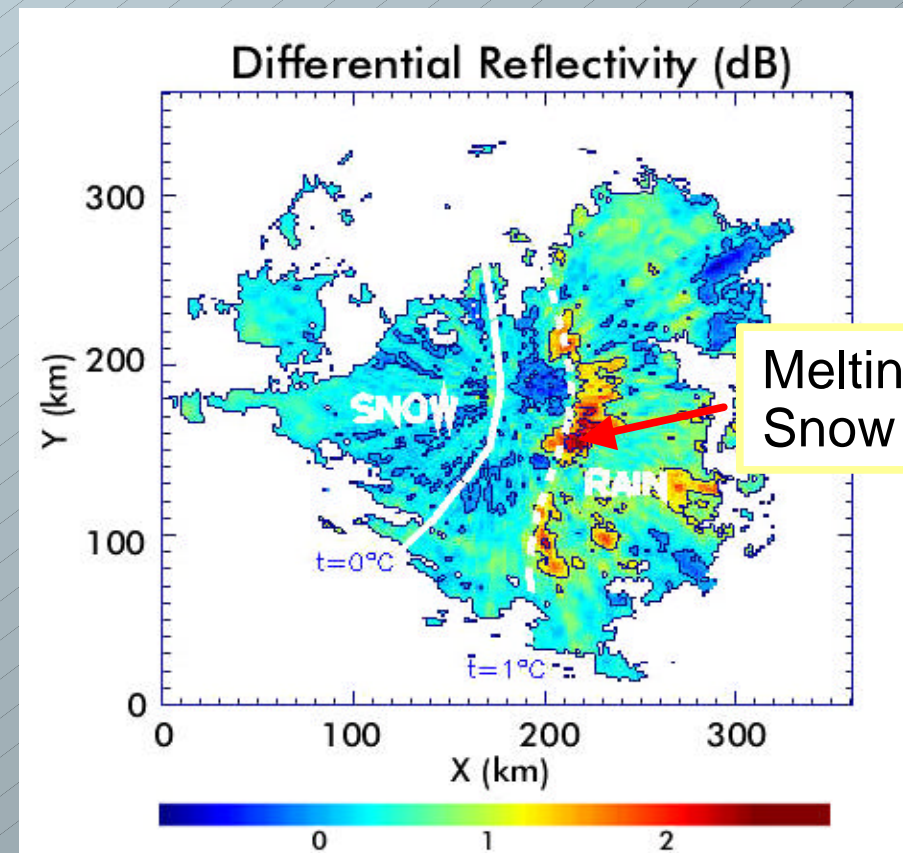
Weather Decision Support System - Visualization

Weather Decision Support System - Interpretation

Displays can discriminate between Snow, Melting Snow, and Rain

Differential Reflectivity
- Large values indicate melting snow
- Moderate values indicate rain
- Small values indicate dry snow

Differential Reflectivity (dB)

Weather Decision Support System - Association

Model: a system that converts 11 million bits of Doppler radar data every 5 minutes into key information for forecasters to make warning decisions
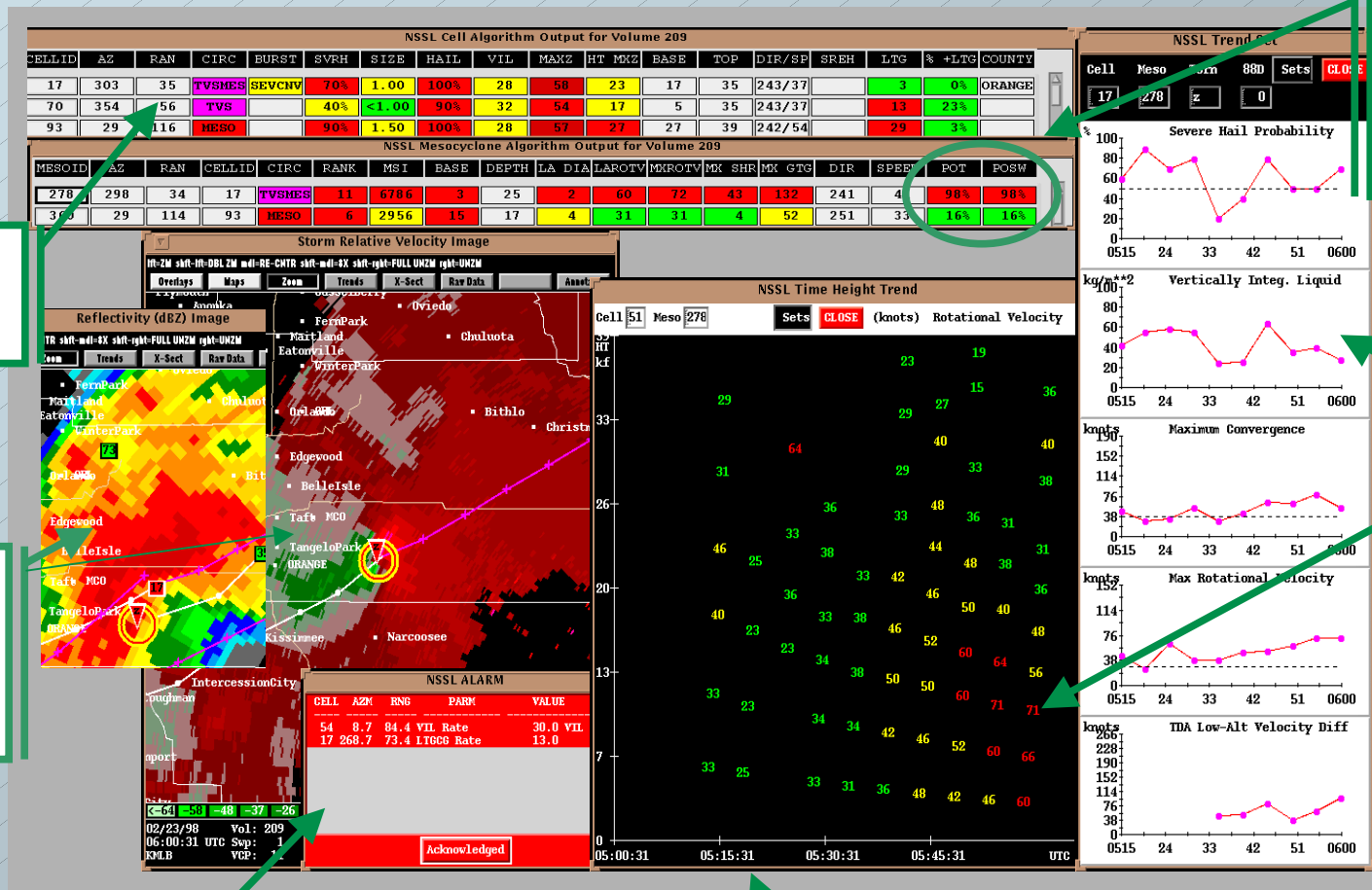
Probability of tornado and damaging winds from neural network

Table ranking the most severe storms

Detects storms and vortices and forecasts their movement.

One hour trend of storm parameters

Pop-up table alerting of rapidly growing storms
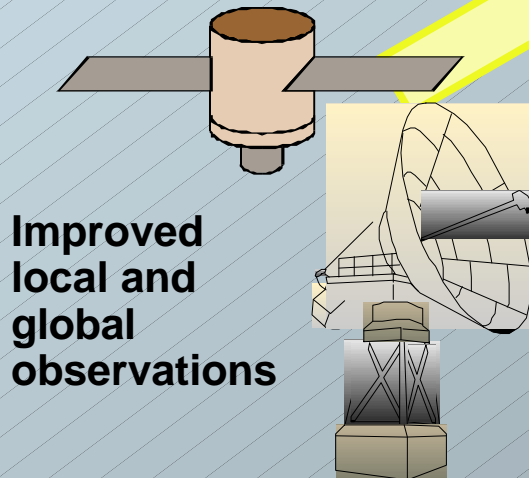
Time-height trend information from 130 million data points

Key Aspects & Components

- National Weather Service
- Transportation Agencies
  - Federal, State and Local
- The Environmental Sensor System
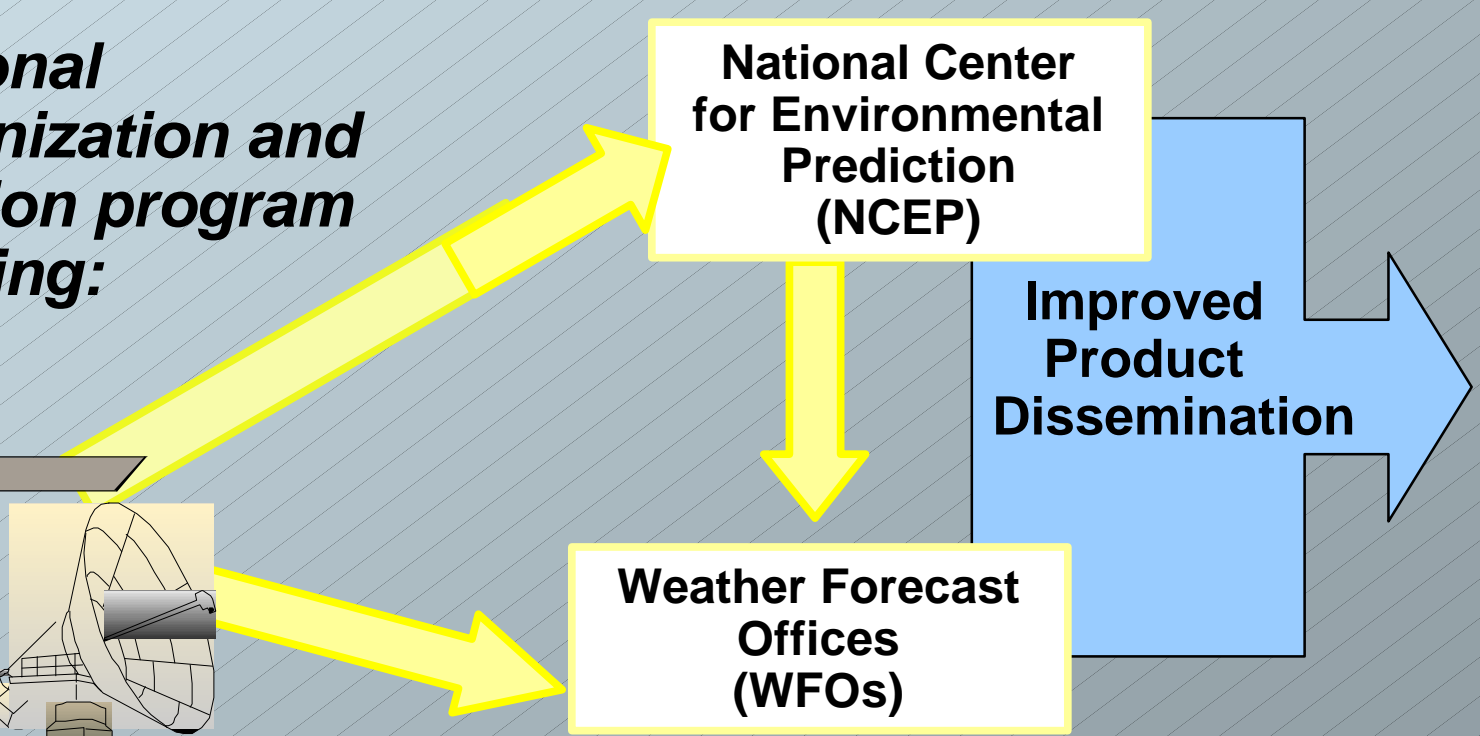- Definition of Public & Private Roles

The National Weather Service

A national modernization and evolution program providing:

National Center for Environmental Prediction (NCEP)

Improved Product Dissemination

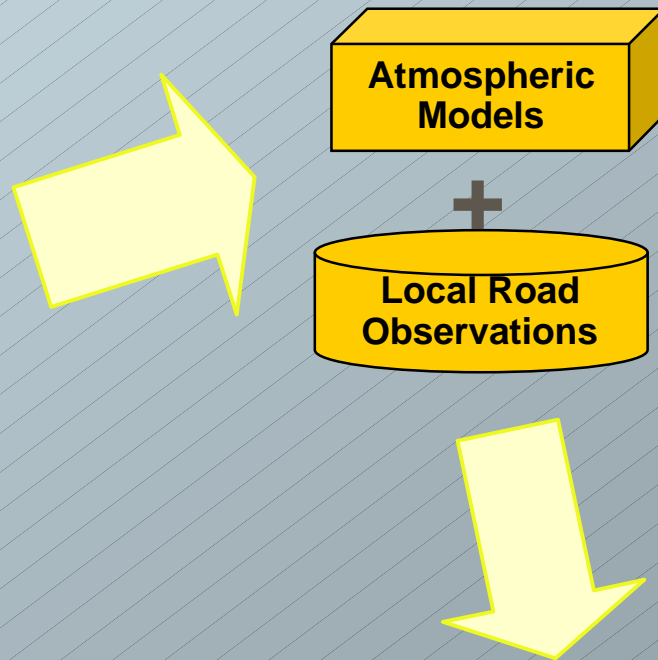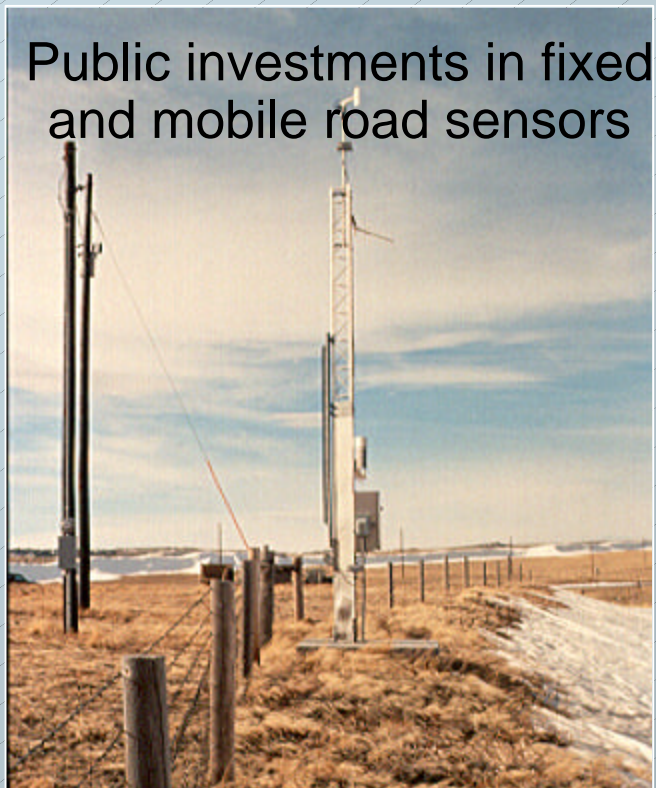**Weather Forecast Offices (WFOs)**

Improved local and global observations

Transportation Agencies

- Federal Highway Administration
- State and Local Agencies

The Environmental Sensor Station (ESS)

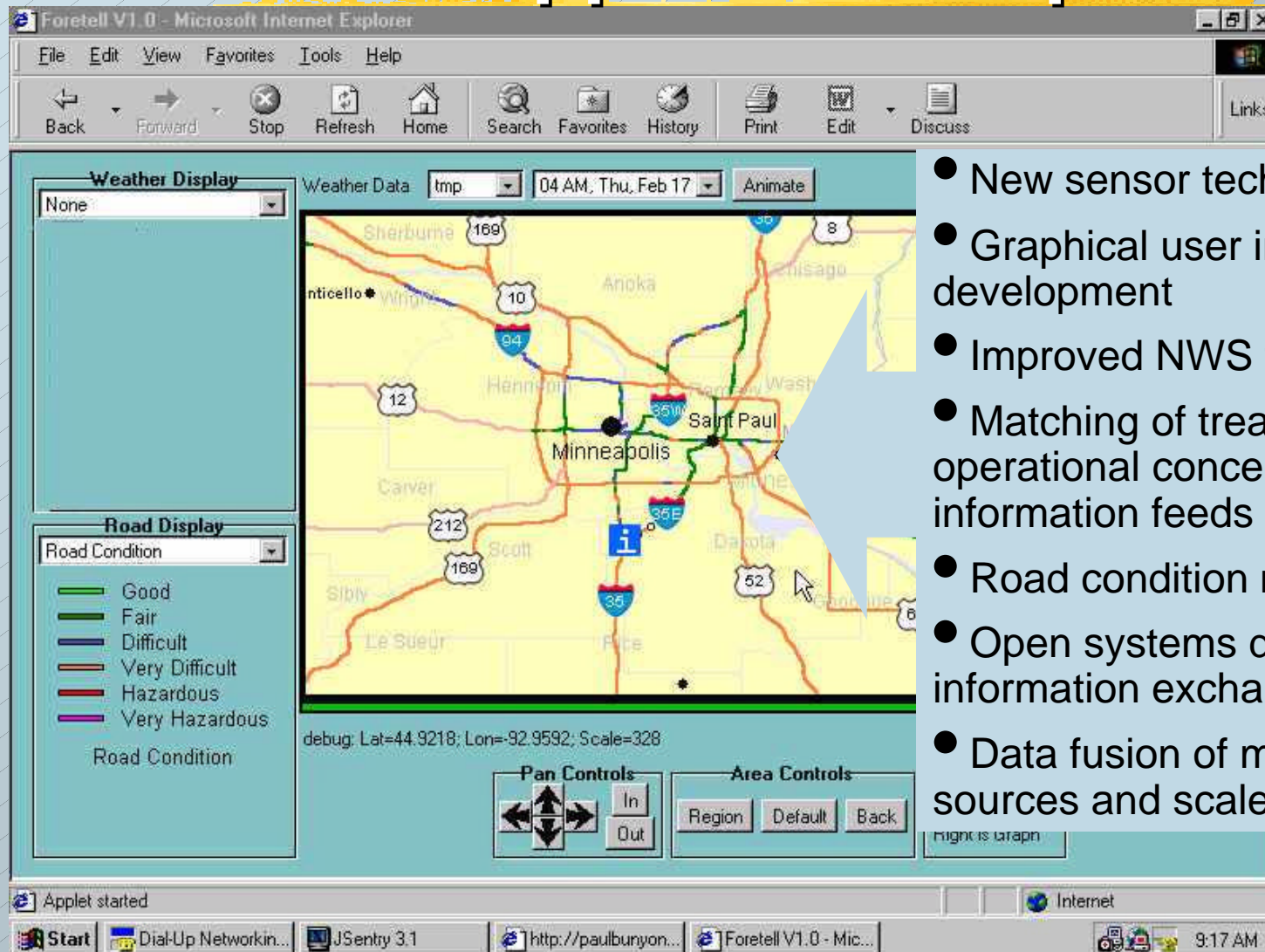Public investments in fixed and mobile road sensors

Atmospheric Models
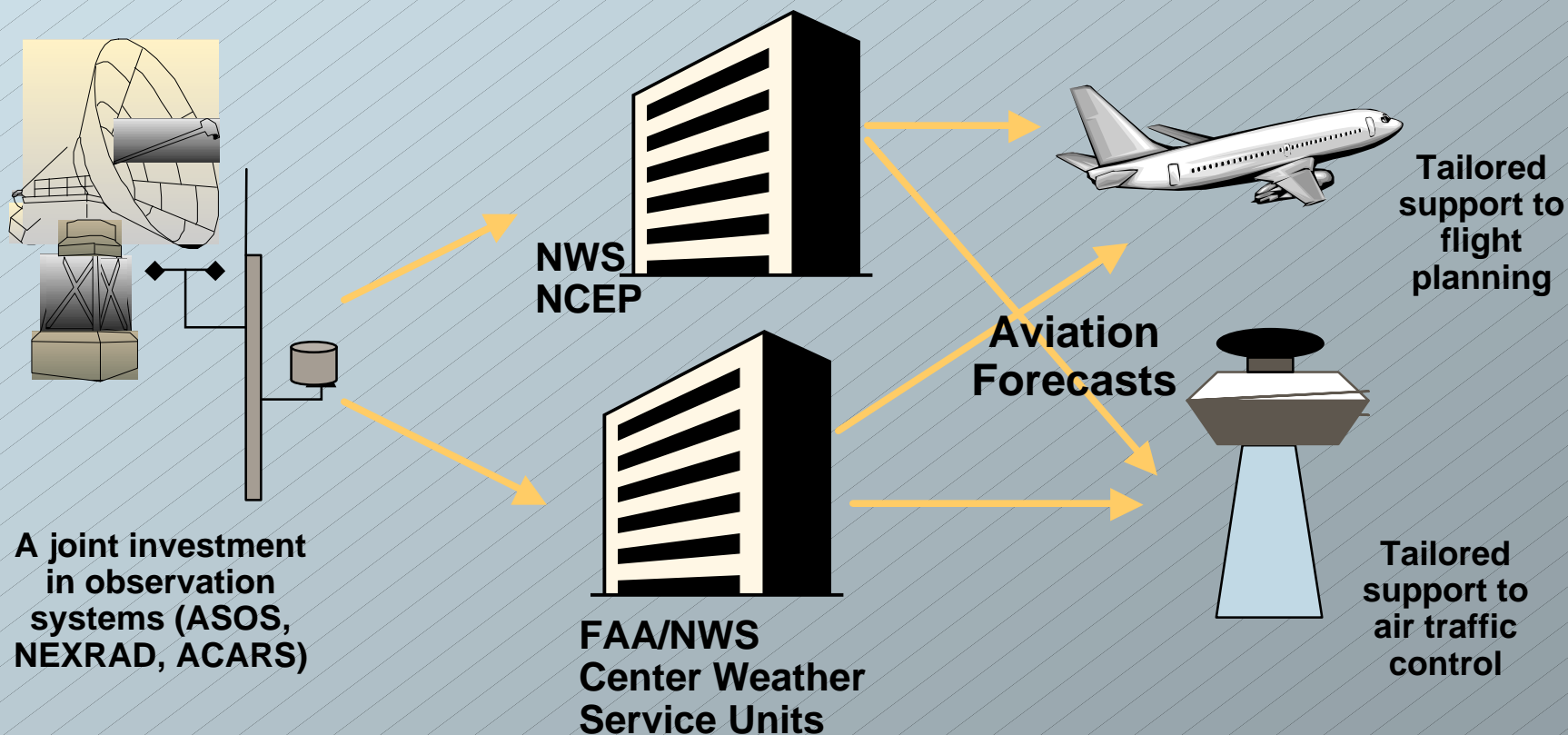
+

Local Road Observations

The ability to monitor individual road segments directly and to predict treatment needs.

The Public/Private Decision Support Development

- New sensor technologies
- Graphical user interface (GUI) development
- Improved NWS feeds
- Matching of treatment operational concepts with information feeds
- Road condition models
- Open systems development for information exchange
- Data fusion of multiple data sources and scales

The Example of Aviation Weather Information

NWS NCEP

FAA/NWS Center Weather Service Units

A joint investment in observation systems (ASOS, NEXRAD, ACARS)

Aviation Forecasts

Tailored support to flight planning

Tailored support to air traffic control

This should be done for surface transportation!

What Needs to Be Done...

- Document surface transportation weather requirements and operational scenarios (i.e., describe how weather affects road users and operators)

- Apply surface transportation requirements to the NWS information infrastructure

- Develop the decision support systems to the operational scenarios

- Invest in cooperative observations of road and surface atmospheric conditions.

… and By Whom

- The federal program for Operations, including Intelligent Transportation Systems (ITS)
- Federal agencies concerned with weather information (USDOT, NOAA, DOD, USDA…)
- State and local highway operators, capital investment and pooled-fund research
- Public and Private system developers and private vendors of information services
- Academic community

For Further Information...

- **Paul Pisano**
  Federal Highway Administration
  202-366-1301, paul.pisano@fhwa.dot.gov

- **Curt Pape**
  Aurora Program Chair
  651-297-1798, curt.pape@dot.state.mn.us

- http://www.aurora-program.org