Integrating Weather Forecasts into Transportation Decision Making

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Outline

- Common concern and goal
- National Weather Service
- Partnerships & DOT Support
- Resources
Our Common Concern

Extreme Weather

• Includes…
  – severe and unseasonable weather
  – heavy precipitation
  – hurricanes
  – storm surges
  – tornadoes, other windstorms (including derechos)
  – extreme heat, extreme cold
  – and many other qualifying weather events…
Our Common Goal
A Weather Ready Nation
*It's about better decisions!*

[Image: Weather-Ready Nation]

[Link: http://www.nws.noaa.gov/com/weatherreadynation/]

[Traffic Operations Center. Photo courtesy UDOT]
Your National Weather Service
Protecting Lives and Property

Mission
Protect life and property and enhance the national economy

What we do!
Create a suite of data and products (forecasts, analysis, maps, outlooks, tools…)

Enable decisions of other governmental agencies, the private sector, the public, and the global community

We issue the warnings you hear on radio and TV
Severe Weather Possible Across Parts of Northern Plains, Southern Plains, Southeast

The NWS Storm Prediction Center is forecasting a possibility of severe thunderstorms Friday afternoon and evening for parts of northeast Wyoming, western South Dakota and northwestern Nebraska, parts of west-central Texas, as well as parts of northern Mississippi and Alabama and southern middle Tennessee. The primary threats will be damaging wind and large hail.

Read More...
NWS Seamless Suite
Products and Services
Spanning Climate, Water and Weather Scales
Seamless Suite
National Outlooks for Hazardous Weather

Severe Weather
www.spc.ncep.noaa.gov

3–7 and 8-14 Day Hazards
www.cpc.ncep.noaa.gov

Winter Weather and Heavy Precipitation
www.hpc.ncep.noaa.gov
NWS Seamless Suite
Non-Routine Products and Services

Watch/warning/advisory

- Convective Weather
- Tropical Weather
- Winter Weather
- Hydrology
- Coastal Flood
- Marine Weather
- Non-Precipitation
- Fire Weather
- Statements
- Storm Data
- Other Non-Routine Products
- Information Requests

- Extreme Weather Wording
- Verification and Performance Goals
- Impact-Based Decision Support Services
- Requesting a Spot Fire Weather Forecast
- Hazardous Materials Emergency Support
- Interactive Warning Team
- HazCollect
- Damage Surveys
NWS Seamless Suite
Routine Products and Services

• Public Forecasts
• Data
• Radar Services
• Hydrologic Services
• Marine Services
• Fire Weather Services
• Aviation Services
• Climate Services
NWS Support for State DOTs

Partnership Policy

• **What we do!** NWS provides weather information through standard dissemination mechanisms

• **What we don’t do!** NWS does *not* provide specialized forecasts or comprehensive services

*NOTE:*

*NWS partners with the America’s Weather Industry to provide specialized weather support to DOTs*
Collaboration across **all extreme weather concerns**…

- NWS Centers and Offices may respond to questions from (or initiate contact with) state DOTs for the purpose of ensuring motorist safety, and for protecting life and property.

- NWS/DOT interaction will occur in certain **non-routine situations** that may be critical to public safety, such as fires, hazardous material incidents, heavy fog, and dangerous conditions that fall outside standard products.
NWS Support for State DOTs
Messaging and Forecasting

• **Coordinated** DOT and NWS products
  – Variable-message signs
  – Common **wording**

• **Collaborative forecasting**
  – DOT participation in NWSChat
  – Evaluation of road model (e.g. METRo) output based on NWS grids and products
  – Forecasts from NWS grids available on some
    – DOT public websites
    – DOT 511 travel information systems
    – DOT internal webpages for each mile post
NWS Support to State DOTs
Enabling Decision Support

- **NWS CHAT** Community
  - Live 2-way communication with NWS, emergency managers, media… including access to DOT data and products
- **At least 91 identified DOT registered today**

DOTs and their “agents” register at: [nwschat.weather.gov](http://nwschat.weather.gov)

Friend Us, We are on Social Media too!
NWS Support for State DOTs
Graphics, Training & Education

- **Graphical Weather Summaries**
  - Graphical Travel Pages
  - *Single Slide Graphics*

- **NWS Outreach and Education**
  - Seasonal Training and Workshops (visits to Forecast Offices and Traffic Ops Centers)
  - COMET workforce/training modules
  - Social-sciences impact studies

Billings MT.  

Pocatello, ID  
NWS Support for State DOTs
Graphics, Training & Education

Single-slide IDSS Graphics
“A picture is worth a thousand words”

Partners then re-distribute the single-slide graphics that they receive via email, which helps us get the word out about the impending weather hazards. Here’s an example of one of our graphics being posted on the NCDOT webpage.

Each graphic is manually created using PowerPoint and is uniquely based on the particular weather situation at hand. The finished graphics are then emailed to partners via our partner email lists.

Courtesy of WFO Raleigh
Enterprise Support to State DOTs
Enterprise Partnership Study

Project Description and Goals

• **NWS with FHWA to Evaluate Current DOT/Weather Enterprise Practices**

• Document Effective Interactions
Provide Guidance

But, Who Ya Gonna to Call?
No One Organization has all the Solutions
Enterprise Supporting to State DOTs

Case Studies

1. State Dot Meteorologist/NWS
   • Private Sector in-situ
   • Private Sector off site

2. Private Sector/NWS
   • Private Sector in-situ
   • Private Sector off site

3. NWS Only
   • No Private Sector
Enterprise Support to State DOTs
What Does Success Look Like?

• Clearly Defined Roles
• Coordination of *Decision Support Services*
• *Consistent* Messaging
• An Engaged and Communicative
NWS Public Services
Evolution and Timing of Hazards

• Winter Weather
  • Forecast weather conditions including freezing drizzle and black ice, which makes the road slippery but is invisible to drivers.
  • Predict Icing, Snow accumulation
  • Winter and melt-related flooding
  • Data from ploughs and other equipment

Probability of Freezing Near Surface

http://www.hpc.ncep.noaa.gov/wwd/winter_wx.shtml
Winter Weather
Evolution and Timing of Local Impact

- Sensors in the traffic areas with high temporal and spatial resolution (1/2mi)
- Mobile Observing Networks
- Winter weather Advisories
- 7-Day Zone Forecasts
Wildfires
Regional Extremes

2012: destructive wildfires impact more than 9,000,000 acres across 37 States

http://www.noaawatch.gov/themes/fire.php

- Daily fire weather forecasts, fire weather warning products, and forecasts
- Most NWS Weather Forecast Offices provide fire forecasts twice a day and provide warnings in close partnership with local, state and Federal fire control agencies.
  - **Red Flag Warnings and Fire Weather Watches** for protection of the public and safety of officials on the ground
  - Weather Forecast Staff provide vital, **site-specific spot forecasts** for wildfire (>19,000/yr), prescribed fire projects, all-hazards incidents
Low Visibility Events
Can also be Extreme!

- High winds and dust
- Volcanic ash
- Fog
  - Dense fog advisory
  - Fog warning
Heat
Extreme Impact on Lives and Infrastructure

- July 2012 was the warmest month on record for the contiguous United States and more than 9,600 daily high temperature records broken during June, July, and August.
Climate Services
Data Services and Trend Analysis

• **NOAA’s Online Weather Data** (NOWData) is a data query system providing basic climate statistics
  – Downscaled National Outlooks to local climate information

• Other online data products:
  – Last 3 month daily data
  – Last 5 year monthly/daily
  – This year record events
  – Last year monthly site, regional and state summaries

[http://www.weather.gov/climate](http://www.weather.gov/climate)
Developmental Climate Services
Local Climate Analysis Tool (LCAT)

• Pre-Operational - Online Interactive Tool for regional, local studies and analysis

• Future Plans
  – Weather and Climate Extremes
  – Local information and projections
Marine and Coastal Weather

High Impact Events

• Coastal flooding
• Storm surge
• Hurricane
• Tsunami
Extreme Extremes
Superstorm Sandy

- 100 deaths,
- 100,000’s of evacuations,
- 8,500,000 homes without power
- Massive flooding
- Gasoline shortages,
- Crippled regional energy and transportation infrastructure.
Ways to Stay Informed

Current Storm Information
- National Weather Service: www.weather.gov
- National Hurricane Center: www.nhc.noaa.gov
- Central Pacific Hurricane Center: www.prh.noaa.gov/cphc

Historical Storm Information
- National Climatic Data Center: www.ncdc.noaa.gov
- NOAA Coastal Services Center: www.csc.noaa.gov

Emergency/Preparedness Information
- American Red Cross: www.redcross.org
- FEMA: www.fema.gov

Mobile NHC and NWS Information
- Mobile NHC website in basic HTML: www.nhc.noaa.gov/mobile
- Mobile NWS website for smartphones: mobile.weather.gov
- Mobile NWS website in basic HTML: cell.weather.gov

Other Information
- Geographic Information System Data: www.nhc.noaa.gov/gis/
- NOAA Weather Radio All Hazards: www.weather.gov/nwr
- Hurricane Tracking Charts: www.weather.gov/os/hurricane/

Facebook
- NHC Facebook Page: www.facebook.com/US.NOAA.NationalHurricaneCenter.gov

Twitter
- Atlantic: @NHC_Atlantic
- Eastern North Pacific: @NHC_Pacific
- Central Pacific: @NWSHonolulu
- Storm Surge: @NHC_Surge
Observation and Data Services - MADIS

Shared Weather Data Collection
Regional (Mesonet) Sensors (DOT and NWS, other partners)
Travel corridors
Local/traffic Cams

Provides access to
• Real-time and archived data;
• Real-time gridded surface analyses;
• User documentation and help desk
**Enhanced Clarus Capabilities**

**Transition to Operations - MADIS**

**FHWA Clarus Initiative**
Shares local and regional road and rail weather observations

**MADIS, Meteorological Assimilation Data Ingest System** running operationally within NWS

- MADIS
- Operational System
- Research System
- Weather Data Environment (WxDE)

15 km grid, updated every 15 min
MADIS

http://www.nws.noaa.gov/ops2/ops24/madis.htm

• Data:
  – Enhanced further by RWIS + Clarus
• Advanced data query and web services
  – MADIS Website - http://madis.noaa.gov/
  – Google displays
The *Clarus* transition consists of three delivery dates of MADIS enhancements:

<table>
<thead>
<tr>
<th>Enhancements to MADIS</th>
<th>Delivery Date</th>
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</thead>
<tbody>
<tr>
<td>RWIS observations</td>
<td>June 15, 2013</td>
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<tr>
<td>RWIS contributors</td>
<td></td>
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<tr>
<td>RWIS data displays</td>
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<tr>
<td>RWIS metadata displays &amp; dissemination</td>
<td></td>
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<tr>
<td>RWIS multiple observations of the same type.</td>
<td>December 31, 2013</td>
</tr>
<tr>
<td><em>Clarus</em> background fields required for QC.</td>
<td></td>
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<tr>
<td>Enhanced subscription service capabilities.</td>
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<tr>
<td>Display enhancements for RWIS data/metadata.</td>
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<tr>
<td>RWIS QC implemented.</td>
<td>December 31, 2014</td>
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<tr>
<td>Contributor constraints.</td>
<td></td>
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<tr>
<td>Display enhancements for QC additions.</td>
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</tbody>
</table>
Water

- Data and information relevant to condition of roads and culverts
  - Precipitation Frequency
  - Runoff
  - Melts
- Signage
  - Warning and implications
- Atlas 14-9 17

CO. Alert of wet roads.

CO. RWIS Snowmass Canyon
Water

• Advanced Hydrologic Prediction Service (AHPS)
  – Flash-flood to seasonal freshwater forecasts
  – Quantification of forecast certainty
  – Accurate and timely forecasts and warnings
  – Partnered flood-forecast area mapping
  – Visually-oriented products
  – Consistent access to standardized graphics via web interface http://weather.gov
Water

Currently provide probabilistic river forecasts at over 2500 locations.

“click on” the forecast location to access local hydrograph.

“click on” tabs for probabilistic forecasts.
Water

- **AHAPs Precipitation**
  - Multi-sensor Observed Precipitation
    - Daily
    - Past 7, 14, 30 and 60 days
    - Year and Water Year-to-date
    - Historical Monthly totals
  - Analysis:
    - Period Normal
    - Departure from Normal
    - Percent of Normal

http://water.weather.gov/precip/
Water

• NOAA Atlas 14 Precipitation
  
  • Updates precipitation frequency (PF) estimates for various areas of the U.S. as Volumes of NOAA Atlas 14.
  
  • PF Data Server (PFDS) provides access to data and information in many formats.
  
  • Publications for states not covered by Atlas 14 are also available
  
  • Partially funded by State Departments of Transportation

http://www.nws.noaa.gov/oh/hdsc/
Signage and Education
NWS Area Forecast discussion

Decision support

- Forecaster’s scientific rationale (i.e., thinking) behind the forecast
- Conveys level of confidence
- Factors which could change forecast
- Updated 2-4 times daily
Mobile Alerts

NOAA Weather Radio
weather.gov/nwr

WEA - cell broadcast alerts
weather.gov/wirelessalerts

iNWS – text message alerts
inws.wrh.noaa.gov
NWS- DOT Shared Outcomes

- **Protecting life and property:**
  - Situational awareness (sensors, high spatial/temporal resolution, real time and retrospective)
  - Integrated decision support (health and safety)
  - Evacuations and response
  - Consistent actionable messaging/communications
  - Continuity of operations (Secure/maintained infrastructure)

- **Promoting the economy:** (minimized delays, increased mobility, enhanced productivity, ensured safety)
  - Non-recurring congestion (weather and accidents)
  - Recurring congestion (commuting)
  - Energy and fuel usage
  - Emergency response and logistics