# Recent and Emerging Improvements to the NWS Hydrologic Services Program

Illinois Association for Floodplain and Stormwater Management Annual Conference March 15, 2012

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### **President Obama Announcement**

- January 13 Announcement
  - Seeking Congressional authorization to reinstate power to reorganize government
  - First reorganization proposal would be to move DOC and other business related departments/agencies into a new department.
- What does it mean to NWS?
  - If authority granted President would request moving NOAA to DOI as part of the first proposal

### 14 U.S. Weather & Climate Disasters JAN-NOV 2011



### A Changing World Society Increasingly Vulnerable

- Extreme impacts from weather, water, climate events
- Population growth and demographic changes
- Technological dependence
- Water Availability—too much, too little, quality

# Weather Ready Nation

### Weather-Ready Nation Web Site www.noaa.gov/wrn



#### **Recently Updated Content**

Miss America hopeful shares compassionate lightning safety story at national pageant

To 2011: Goodbye and good riddance



#### **WRN Social Media**



### **NWS Actions** What is the weather service doing?

- Improved precision of weather and water forecasts
- Effective communication of risk
- Improved decision support services
- Innovative science and technological solutions
- Strengthened partnerships

Meeting the Nation's Needs Building a Weather-Ready Nation

**GOAL 2:** Deliver a broad suite of improved water forecasting services to support management of the Nation's water supply

- Develop Integrated Water Resources Science and Services with partners
  - Establish National Water Center
- Deploy Community Hydrological Prediction System



Meeting the Nation's Needs Building a Weather-Ready Nation

**GOAL 5:** Enable integrated environmental forecast services supporting healthy communities and ecosystems

- Establish enhanced weather-dependent health decision support services
  - Partnerships: other NOAA offices, federal agencies, and private sector
- Develop new weather and water forecast capabilities to enhance NOAA ecological prediction and ecosystem decision support services



### Engaging the Challenge The Extreme Impacts

- Threat: The Extreme Impacts
  - Extreme impact events across the country in 2011
    - Blizzards affecting up to 100 million people
    - Weeks of tornado outbreaks
    - Months of floods
    - Months of heat, drought, and wildfires
    - Deepwater Horizon requiring 400 NWS staff deployments
- Goals: Improved forecasts and adaptable community presence
- What We're Doing:
  - New Science and Technology
    - Unmanned Aircraft Observation
    - Dual polarization radar
  - Focusing on Collaboration
    - Deployable Emergency Response Specialists
    - Improving quantitative precipitation forecasts
    - Community Hydrologic Prediction System (CHPS)
  - Improve Service Delivery
    - Inundation Forecast
    - Uncertainty Quantification
    - Economic/Environmental Forecasts

# **New Technology**

## **Unmanned Aircraft Systems**



- Inundation
- Levee Breach
- Ice/Debris Jam
- Impoundment Integrity

### **UAS Operations**

### **Aircraft In Hangar**

### **Operations Control Room**



OPERATION: Flood Watch-ND-FY11-SAR TARGET: Road Bridge/Railroad Bridge SNSR/RES/Mode: Lynx SAR/6 " Dwell Spot/SOS overlay on EO image AREA: Oslo, MN TOT: 30 Mar 2011

Oslo, MN



Ice

1



U.S. Customs and Border Protection EO image Jun 23, 2009

AND MARI



# **UAS Capabilities**



# **Radar Upgrade**



- What Changed?
- New Capabilities





### • What do you mean "Dual Polarity"?



# **Monitor the Playground**

What games are they playing?

Doppler



Where are the 1<sup>st</sup> graders?

### **Dual-Pol**

# **Improved Detection of Rain & Hail**

Size distribution analysis = Better quantity estimate









Discriminate between heavy rain and hailPredict hail size

### **Precipitation Data Access**



### **Real-Time Precipitation**



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### **Storm Analysis**



## **Dual-Pol Installation Schedule**



## **Collaboration & Partnership**



24 Federal Agencies have roles in fresh water, including NOAA:

Monitoring

- Prediction
  - Protection
  - Regulation

- Management
- Section Mitigation
  - Conservation
- Science

- Response
- Recovery
- Restoration
- Seducation

### **IWRSS Roadmap and MOU**

Framework to align agencies with complementary water-related missions to accomplish operational goals.

#### Integrated Water Resources Science and Services (IWRSS)

An Integrated and Adaptive Roadmap for Operational Implementation

Don Cline, NOAA (Compilation) IWRSS Workshop Participants (NOAA, USACE, USGS) Cross-cutting Theme Teams for Human Dimensions and Technical Information Services

Regional Case Study Contributors



February 2009

MOU Signed May 11, 2011

• "Collaborative Science, Services and Tools to Support Integrated and Adaptive Water Resources Management"

#### **Signatories**

- Dr. Jane Lubchenco, Director of NOAA
- Rock Salt for the Honorable Jo-Ellen Darcy, Assistant Secretary of the Army for Civil Works
- Dr. Marcia McNutt, Director of the U.S. Geological Survey

#### **Initial Focus Areas**

- High-Resolution Water Resource Forecasts and Flood Inundation Maps
- System Interoperability and Data Synchronization



February, 2009

# **Real World Actions**

#### Integrated Water Resources Science and Services (IWRSS) Design Principles:

- Embody "good government" to leverage existing resources
- ✓ Share technology, information, models and best practices
- Be comprehensive, systematic and scalable

National Water Center (NWC) – Catalyst for enhanced water forecasting operations, applied research and inter-agency collaboration Objectives:

- ✓ Leverage multi-disciplinary skills to formulate effective solutions
- ✓ Deliver interoperability of key systems and data synchronization
- Implement new products and services based on enhanced geospatial information and visualization
- Address stakeholder needs and recommendations for new and enhanced water resources information





















### **Seamless Data Access Prototype**



28

## **National Water Center**



### University of Alabama

### **Community Hydrologic Prediction System**



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### **Community Hydrologic Prediction System**

#### **Old Way - Propriety System**



#### **Open System - CHPS**



# **Decision Support Services**

Joplin Tornado 2011 Marion EOC Flood 2011 Harrisburg EOC Tornado 2012 Michigan Oil Spill 2010 Minot, ND Flood 2011 Deepwater Horizon 2010



# **Products for the Digital Age**

# **Evolution of Hydrologic Forecasts**

### 1800s – Early 1900s

**Observe Flood** 



Send Telegram



Downstream folks get a better viewing position



### Mid 1930s - 1997

- Limited forecast
- No future rainfall
- Levee breaks
- Rainfall distribution issues

#### <MSPRVFMIN

+ÇTTAA00 KMSR 171605

JUNE 17 1993 11:05AM

|                    | 2    | NORTH CEN | NTRAL RFC STAGE FORECASTS   |
|--------------------|------|-----------|---|
| FOR                | INTE | RNAL NWS  | USE NOT FOR PUBLIC RELEASE  |
| STREAM AND STATION | FS   | TODAY     | FORECASTS   |
|                    |      |           |   |
| COTTONWOOD R       |      |           |   |
| NEW ULM MN         | 11   | 8.9       | CREST 16.0 6/19   |
| MINNESOTA          |      |           | Sa S (C),   |
| MONTEVIDEO MN      | 14   | 9.0       | MINOR RISE  |
| MANKATO MN         | 19   | 16.6      | CREST 24.0 6/22RISE ABV FS 6/18A  |
| HENDERSON MN       | 729  | 731.5     | CREST 734.5 6/24  |
| JORDAN MN          | 20   | 23.2      | CREST 27.5 6/25   |
|                    |      |           | New Add Server (1997) Server (199 |

NOTE.. FORECASTS BASED ON PCPN UP TO 7AM TODAY. .. FORECAST FOR REDWOOD R SENT EARLIER THIS AM. ..PN..

### 1997

### Advanced Hydrologic Prediction Service Is Launched For The Des Moines River



### **Bread & Butter**



## Water Forecasting Challenges



### **Complete the Continuum**

### Probabilistic information to support risk-based decisions

Seamless short- to long-term Hydrologic Ensemble Forecast Service

Incorporates both atmospheric and hydrologic uncertainties

Latest observation: 40.05 ft at 2:33 PM CDT 26-Mar-2008 56' 54' 52' 50' > 48.5 48' River Measure axis: Stage; (ft) 46' 44 42' 42' 40' 38' 37 36' 34' 32" 32' 30' 28 1 pm 1 pm 1 pm 1 pm Thur Wed 1 pm Tue 1 pm Sat 1 pm Mon 1 pm Mon Wed Mar 27 Mar 29 Sun Mar 31 Tue Thur Mar 24 Mar 26 Mar 28 Mar 01 Apr 03 **Time Interval axis:** CDT; Weekly

## **Multiple Rainfall Forecasts**

#### **THE Rainfall Forecast**

### "Reasonable" Maximum



### **Multiple River Predictions**



Graph Creation Date: Tue, 24 May 2011 12:19:39-0500

\*\*(3) DPF maximum (Max) and minimum (Man) are determined through Confidence Interval statistics (95% Max/95% Man)

## **Digital Information Age** Static Flood Inundation Mapping



### **Digital Information Age**





**Conventional Flood Forecast** 

#### **Dynamic Flood Inundation Forecast**







# **Runoff Risk Advisory Forecast**

### Wisconsin Manure Management Advisory System



# **Recipe For Success**



# **Thank You**

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