



# **Focus Area Summaries**

Fire Weather	Observations
Hydrology	Data Assimilation+ Forecast Modeling
Aviation	Post Processing
Severe Weather	Forecaster Applications
Winter Weather	Decision Support Services I: Tiers 1-2
Marine	Decision Support ServicesII: Tiers 3-5
Tropical Weather	Verification / Metrics
Climate	Dissemination
Air Quality	Customer Outreach & Feedback Tech
Space Weather	Social Sciences
Tsunami	IT Segment Architecture
Emerging Areas	



# Focus Area Team Summary: **Observations**

Deploy Dual Pol Radar,

NPP, NPOESS, GOES R

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#### **R&D Needs & Opportunities** Optimize observing (obs) architecture for cost-effective service-based outcomes: investigate multi-sensor platforms, gap-filling observations Develop adaptive observing capabilities to support downscaled and probabilistic warnings: e.g. Warn on Forecast for severe weather, hurricanes Characterize and incorporate observational uncertainty in probabilistic forecast generation Near-Term: **Current Status:** Inventory and assess obs architecture, identify gap- Individual Systems: filling systems for end-state public, private, universities Assess impact of planned Radar architecture (including OSEs, OSSEs) Satellite Initial capabilities for 4-D Surface; in-situ national mesonet

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• Upper Air

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• Etc

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system, providing accurate, complete and well characterized information of the Earth system; when, where and how needed

Vision

An integrated observing

Long-Term

Network of networks

Integrated Radar

- Observations & metadata accessible through dynamic push-pull, triggering, data mining
- Obs architecture integral to model assimilation supporting risk/ valuebased adaptive obs, analysis and predictions

▶25 **Observations** 

Increasing Impact



# Focus Area Team Summary: **Data Assimilation and Modeling**



and Modeling

#### **R&D Needs & Opportunities**

- 4-D data assimilation (4DDA) development
- Common global/regional coupled system with globally consistent arid resolution
- 4DDA based on global ensemble prediction system
- Physics/DA methods for convection resolving models:

#### Vision

A transformed integrated environmental forecast system, serving all customers requirements

supporting WoF Current Status: • 3-D Var DA in GSI • GFS, NAM, at 27km, 12km respectively	for severe wx Near-Term: • 4D DA: IOC • 4DVar in testing • Fully coupled global modeling system; NUOPC	Long-Term: • Hybrid 4DVar implemented • Grid-based coupled global and regional modeling system with DA • Convection-resolving
NOMADS	• R2O < 6 mos	<ul> <li>Convection-resolving physics and DA upgrades to support WoF</li> </ul>
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# Increasing Impact



# Focus Area Team Summary: Post-Processing



#### **R&D Needs & Opportunities**

- Improved bias correction methods/processes
- Optimal methods for fusing information from multiple sources
- Optimal ensemble generation

Vision

Reliable/skillful ensemble of possible environmental scenarios on all spatial/temporal scales

+25

**Processing** 

Current Status:

- Limited forecast variables/formats
- Redundancy in operations

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#### Near-Term:

- Forecast uncertainty estimates
- Tools to create additional format
- Fully engaged forecasters via training

Long-Term:

- All environmental information available
- Single source for all forecast needs
- Easy access for internal & external users

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Increasing Impact

June 11, 2009

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Post-



# Focus Area Team Summary: **Forecaster Applications**



#### **R&D Needs & Opportunities** Enhanced data visualization/ integration tools Social science studies/assessments Approach to acculturate staff to new tools/techniques Social networking tools Increasing Impact Neural networks/fuzzy logic Virtual data visualization Near-**Current Status:** Incol Workstation scier upgrades Auto GIS integration assis Streamlined S&T Test infusion process Impr Improved situational Stream awareness

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"Smart Systems" that maximize forecaster effectiveness with focus on forecast challenges and high impact events.

adon		
lear-Term:	Multi-disciplinary decision	
Incorporate social	support services	
science principles	3-D visualization	
assistance	Virtual collaboration	
Test beds	Automated knowledge	
Improved coordination	transfer	
Streamline process to enhance gridded data	<ul> <li>Forecaster modification and control on inputs</li> </ul>	

earlier in forecast process

**Forecaster Applications** 

+ 25

July 15, 2009

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# Focus Area Team Summary: Dissemination



▶ 25

**Dissemination** 6

#### Vision **R&D Needs & Opportunities** Provide information to Investigate, exploit, pursue, and leverage users what/when/where emerging technologies and standards they want to fully enable Investigate and analyze alternative system decision support service architectures Increasing Impact Long-Term Near-Term: Two-way interactive, real **Current Status:** Smart push-pull time, standard-based, capability both wired Consolidate access-friendly, and roleand wireless services into based driven dissemination integrated system service in an "any-place, Common standard any-time, any-key-medium" Integrate SBN, formats, protocols and fashion web services NOAANet, Internet Farm toward Decision support enterprise solution service (Tier 1-5)

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July 10, 2009

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# Focus Area Team Summary: DSS Tiers 1-2



#### **R&D Needs & Opportunities**

- Advanced graphics, animation
- Methods for effective communication of forecast uncertainty
- Interactive communication tools with customers

Near-Term:

Service Deliverv

- User needs/thresholds database
- "Intelligent" information sharing tools

technology that enables easily accessible, wellarticulated interaction with government agencies (federal, state, local) resulting in appropriate actions to mitigate loss of life and property.

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Infusion of science &

#### Long-Term:

• "Intelligent" Information Sharing (e.g., web 2.0/3.0)

# Increasing Impact

**Current Status:** 

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<ul> <li>Integrate science</li> </ul>	social		commu impact	inicatio s	n of		
• DSS me	rics		• Trainin	g of un	certaint	у,	collaboration tools
database	2	$\neg$	• NWS-v	vide CF	RM sys		Advanced remote
Custome	r thresho	Id	• AWIPS	-II alert	t sys		<ul> <li>National/Regional Command Center</li> </ul>
<ul> <li>2-way m informati</li> </ul>	obile devi on	ce	Provin	g Grour	nd	1	Shanng (e.g., web 2.0/3.0)

**DSS Tiers 1-2** 



# Focus Area Team Summary: DSS 3–5



#### Vision **R&D Needs & Opportunities** Good decisions empowered Blended Guidance with essential environmental Rapid Updating information, forecasts, and warnings, for protection of life Improved Resolution and property and promotion of Quantification of Uncertainty economic prosperity Sector-specific services with thresholding Increasing Impact Integration of weather & environmental data Long-Term Near-Term: Highly-accessible **Current Status:** Timely, accurate, comprehensive and consistent High-resolution environmental data for Single Authoritative (spatial and decision making Source within 4D temporal) NDFD datacube Availability of uncertainty More robust and information Automated refresh complete NDFD Thresholds fully integrated 09 11 12 13 15 10 14 16 ▶ 25

July 28, 2009



# Focus Area Team Summary: Verification



#### **R&D Needs & Opportunities**

- Improve Verification of Human Generated Forecasts
- Expand Tools, Analyses, and Guidance
- Real-Time Customer and Service Assessments

Vision Improve verification capabilities, expanding guidance, and providing real-time feedback to **customers** 



July 9, 2009



# Focus Area Team Summary: Customer Outreach and Feedback Technologies



#### **R&D Needs & Opportunities**

- Analyze sociologic/economic factors
- Seek interoperable push/pull technologies
- Investigate simulation and VR technologies
- Investigate opportunities for automation

Vision

Technology empowers collaboration between NWS and customers, continually improving service

#### Long-Term Near-Term: Outreach & Feedback on **Current Status:** Nationwide CRM aids demand using advance Customer relationship DSS & drives future communication technology information fragmented services Traditional outreach Next generation Call to Social networking tools used. Action Simulation credited GoToMeeting, webexpands & enhances with saving lives, property, outreach & feedback based training and economy NWS educates on how • CAS helps people best to use, respond to better respond to NWS **NWS** information 12 13 15 + 25 09 10 16 11 14

Outreach and Feedback

Increasing Impact

July 14, 2009



# Focus Area Team Summary: IT Segment Architecture



#### R&D Needs & Opportunities

- Information Technology as a Service
- Master Database Management for environmental data
- Interactive Collaborative Services
- Continuous Innovation

Vision

Enterprise IT Infrastructure, unified data, Customer collaboration

#### Long-Tern

Increasing Impact

Near-Term: Architecture for **Current Status:**  Cloud computing collaboration, decision Infrastructure & Data support Consolidated **Standards Databases**  Continuous Innovation Service/Product Boundaryless Ontology Security Infrastructure COOP via cloud Virtualization Initial Cloud 09 12 13 15 16 + 25 10 11 14

Architecture



# Focus Area Team Summary: Social Science



#### **R&D Needs & Opportunities**

- Social Science Assessments to quantify impact of NWS information
- Advanced decision support system tools addressing
  - user needs & social science aspects
- Determination/integration of effective uncertainty/ probabilistic information into DSS
   Long

Vision Integrate social science methodologies into NOAA's information services to evoke the most appropriate societal responses and guide investments in service improvements to maximize their value to the Nation

Long-Term:

	<ul> <li>Current Status:</li> <li>Initial integration of social science into overall operations and mitigation activities to enhance DSS</li> <li>Improvement of situational awareness</li> <li>Initial social science performance metrics</li> </ul>	<ul> <li>Near-Term:</li> <li>Operational Proving Ground testing social science principles</li> <li>More training in R2O; sociological impact</li> <li>Social networking expands, enhanced outreach &amp; feedback</li> <li>Training on uncertainty and communication of impacts</li> </ul>	<ul> <li>Products &amp; services that better convey risk and uncertainty</li> <li>Increased economic productivity and efficiency</li> <li>Improved preparation/risk mitigation, response, and recovery during high impact events</li> <li>Increased trust/credibility with general public, key partners, and decision makers</li> </ul>
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**Social Science** 

Increasing Impact



# Focus Area Team Summary: Fire Weather



#### **R&D Needs & Opportunities**

 On-demand, movable, high-res integrated fire and smoke behavior model

- On-demand, indexed Red Flag WWA DSS
- Long range fire weather outlooks
- Tools for fire detection and tracking
- Analysis of social science for fire weather support

Vision

High-resolution fire weather information/services providing impact-oriented, integrated improvements of fire predictions that save lives and reduce impact to property

ł		Near-Term:	• 90-day Red Elag W/W/A	`
	Current Status:	• 14 day Red Flag WWA	• 500m fully coupled smoke	
)	• 1-3 day Red Flag	• Fire scale 1km hourly	behavior forecast	
	vvarning	fire/smoke forecasts	10m res fire/behavior	
	• 12-km Smoke Forecasts	• 100mres_30-min.	forecast	
	• 20-km wx models	coupled fire wx &	Mobile WFO	
	Wx-centric data	behavior forecast	Hazardous Wx observing	
	analysis	GIS, mobile system	system	
I	• RAWS, balloon,	• UAS, radar, RAWS	• GOES-R VIIRS, Rapid Scan	
	satellite obs		ISI fire weather outlooks	•
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Increasing Impact

Fire Wx 13



# Focus Area Team Summary: Hydrology



#### **R&D Needs & Opportunities**

- Develop hydrologic ensemble-based forecasting
- Coupling of hydrologic and estuary and ocean models
- Integrate dual-pol radars and satellite techniques
- Distributed models with uncertainty analyses

Production of accurate, relevant, and actionable water information and forecasts that reduces loss of life & property and enhances economic prosperity

**Hydrology** 

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Current Status: • Forecasts at 4000+ locations • Limited probabilistic forecasts • Coastal points don't have river forecasts • Short term precip/temp forecasts	<ul> <li>Near-Term:</li> <li>River forecasts with 12 hr lead time at the skill of today's 6 hr lead.</li> <li>10% of coastal communities receive hydrologic forecasts</li> <li>Distributed modeling at LTE 4km scale</li> <li>Ensembles</li> <li>Varification info</li> </ul>
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October 6, 2009



# Focus Area Team Summary: **Aviation**

Needo 9 Opportunition



# Increasing Impact

<ul> <li>Probabilistic fore</li> <li>NWP models su</li> <li>Optimal generate</li> <li>Methods enhance</li> <li>Enhanced grour</li> <li>Enhanced predition</li> <li>Convection, onset</li> </ul>	ecasts for aviation informatio porting WIDB spatial resolu- ion of SAS for current wx information cing wx integration into Nextu- nd, airborne, space-based with ction of initiation/evolution of cof turbulence/icing	n ution ormation Gen DSS x sensors Long-Term:
Current Status: Competing NOAA aviation wx products; FAA NextGen requirements not met NOAA products not fully integrated into FAA/aviation ops/DSS	Near-Term: • IOC WIDB • Increasing MOTL • Integrate new satellite/radar obs • Integrate GPS-Met	<ul> <li>WIDB for NextGen FOC</li> <li>WIDB includes Single Authoritative Source (SAS)</li> <li>New sensor data into models</li> <li>NEVS Implementation</li> </ul>
09 10 11 1	2 13 14 15 <sup>·</sup>	16 25

**Aviation** 



### Focus Area Team Summary: **Severe Weather** ٨



R • Predictability limit • Phased array we • Boundary layer s • Cloud-scale mod • Advanced radar	<b>&amp;D Needs &amp; Opportunities</b> its eather radar campling leling data assimilation and mining	Vision Warn-on-Forecast severe weather at cloud-scale coupled with decision support services to save lives and property
Current Status: • Evaluation of X/K- band radars • Evaluation of phased array radars • Advanced radar data assimilation • WoF R&D	<ul> <li>Near-Term:</li> <li>Mesoscale models with rapid radar data assimilation</li> <li>Mesoscale ensembles</li> <li>Testing of phased array radars</li> <li>WoF Demos</li> </ul>	<ul> <li>• 1-hour tornado and severe TS lead times</li> <li>• 4-hour flash flood lead time</li> <li>• Cloud-scale numerical models and probabilistic warnings</li> <li>• Adaptive data integration</li> </ul>
16, 2009		Severe Wx

July 16, 2009



# Focus Area Team Summary: Winter Weather



#### **R&D Needs & Opportunities**

- Advanced decision support system tools
- Specified winter wx forecasts with universal access
- Concentration on CSI and snow band formations
- Integration of multi-phase radar data

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 Improved modeling to address precip types and weather/climate patterns

#### Vision

NWS forecasts minimize impact of winter weather on decision makers & public: saving lives, property & enhancing the nation's economy

▶ 25

Winter<sub>17</sub>

Current Status:

- County based WWA
- Staff has strong science background/ experience
- Standardized products, Internet and media-filtered dissemination

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#### Near-Term:

- Storm-based WWA
- Additional training in research to operations, and sociological impact
- Push relevant information to users who have need.
- User-defined criteria

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#### Long-Term:

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- No watches or warningsdetailed forecast data available
- All meteorologists have detailed understanding of winter weather impact
- Universal and customized information to all partners and customers (push/ pull)

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# Focus Area Team Summary: **Marine Services**



#### **R&D Needs & Opportunities**

New obs sensors

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Vision Improve wave model physics from shelf to shore **On-demand accurate &** timely weather information including inundation and coupled wave-surge modeling. from coast to high seas, Include global and regional modeling at all spatial and needed to ensure temporal scales in coupled Earth System Modeling prosperity, livelihood, & resilience Social science studies/assessments of coastal communities New observation technologies Long-Term Near-Term: Multi disciplinary emerging **Current Status:**  Incorporate social products with maritime science Improved model focus physics and Coastal wave model – Fully coupled modeling of resolution workstation atmos/ocean/land/ice New obs sensors More model coupling Leverage emerging S&T advances to deliver NWS Improved • Storm surge & inundation test bed

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marine products for DSS

New observation sensors

+ 25

Marine

Increasing Impact

awareness

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# Focus Area Team Summary: Tropical Weather





June 28, 2009



## Focus Area Team Summary: Climate



#### **Research Needs and Opportunities**

- Sustained climate observation system with data continuity
- ESMF with high resolution and MMF.
- Coupled data assimilation, initialization, reanalysis and reforecast
- NWS weather-climate-hydro multi-model EPS
- Alternative downscaling for various regional applications
- Incorporating uncertainty information into DSS

Vision A national capability to anticipate, plan for and respond to risks and opportunities re seasonal/ interannual climate variability

Long-Term Near-Term: Routine integrated Earth **Current Status:**  Data continuity mandate Consolidate seasonal system analysis OSSE expansion outlook with GPRA near Real-time attribution • CFS advancement in key 24 in US temp forecast model aspects capability • Operational ocean. • MME & CTB MTF monsoon, drought Reliable local user-centric monitoring & hazard Improved ENSO,MJO climate products for decision assessment simulations for CFS reanalysis/ support quantifiable skill increase reforecast Weather-climate-hydro Climate portal; formalized Continuity studies not extreme event alert system user requirement and performed in routine observation feedback process 12 ► 25 09 11 13 15 16 10 14

August 28, 2009

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Climate







# Focus Area Team Summary: Tsunami



#### **R&D Needs & Opportunities**

- Deliver high resolution and advance physics for near-shore high impact tsunami events
- Improve forecast accuracy/speed through enhanced observations, model development and data assimilation
- Employ community modeling to advance R&D
- Social Science Studies/Assessments

Vision

Provide timely warnings and forecasts, and promote development of tsunami-resilient communities

Long-Term Near-Term: Implementation of Next **Current Status:**  TWC IT Modernization Gen Modeling capability Enhanced seismic array Improved model processing physics and resolution Improved observations and Improved tsunami Improved obs & detection capability detection situational awareness Forecasts for non- Leverage emerging social Incorporate social tectonic sources science technology to science principles • Web interfaces improve forecasts process Use of NCEP SC for Tsunami Test Bed and decision support tools DSS Tools model forecasts Community Modeling 12 13 09 10 11 15 16 > 25 14

Tsunami

