Focus Area Summaries

Updated 17 September 2009
Focus Area Team Summary: Observations

Current Status:
- Individual Systems: public, private, universities
  - Radar
  - Satellite
  - Surface; in-situ
  - Upper Air
  - Etc

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:
- Inventory and assess obs architecture, identify gap-filling systems for end-state
- Assess impact of planned architecture (including OSEs, OSSEs)
- Initial capabilities for 4-D national mesonet
- Deploy Dual Pol Radar, NPP, NPOESS, GOES R

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/ value-based adaptive obs, analysis and predictions

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

Observations
**Focus Area Team Summary:**

**Data Assimilation and Modeling**

**R&D Needs & Opportunities**
- 4-D data assimilation (4DDA) development
- Common global/regional coupled system with globally consistent grid resolution
- 4DDA based on global ensemble prediction system
- Physics/DA methods for convection resolving models; supporting WoF for severe wx

**Vision**
A transformed integrated environmental forecast system, serving all customers requirements

**Current Status:**
- 3-D Var DA in GSI
- GFS, NAM, at 27km, 12km respectively
- NOMADS

**Near-Term:**
- 4D DA: IOC
- 4DVar in testing
- Fully coupled global modeling system; NUOPC
- R2O < 6 mos

**Long-Term:**
- Hybrid 4DVar implemented
- Grid-based coupled global and regional modeling system with DA
- Convection-resolving physics and DA upgrades to support WoF
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

Current Status:
- Limited forecast variables/formats
- Redundancy in operations

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

June 11, 2009
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
- Neural networks/fuzzy logic
- Virtual data visualization

Current Status:
- Workstation upgrades
- GIS integration
- Streamlined S&T infusion process
- Improved situational awareness

Near-Term:
- Incorporate social science principles
- Automated decision assistance
- Test beds
- Improved coordination
- Streamline process to enhance gridded data

Long-Term:
- Multi-disciplinary decision support services
- 3-D visualization
- Virtual collaboration
- Automated knowledge transfer
- Forecaster modification and control on inputs earlier in forecast process

Vision

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

July 15, 2009
**Focus Area Team Summary: Dissemination**

**R&D Needs & Opportunities**
- Investigate, exploit, pursue, and leverage emerging technologies and standards
- Investigate and analyze alternative system architectures

**Current Status:**
- Consolidate services into integrated system
- Integrate SBN, NOAA Net, Internet Farm toward enterprise solution

**Near-Term:**
- Smart push-pull capability both wired and wireless
- Common standard formats, protocols and web services
- Decision support service (Tier 1-5)

**Long-Term:**
- Two-way interactive, real time, standard-based, access-friendly, and role-based driven dissemination service in an “any-place, any-time, any-key-medium” fashion

**Vision**
- Provide information to users what/when/where they want to fully enable decision support service
Focus Area Team Summary: DSS Tiers 1-2

Vision
User-specific, real-time interactions with NWS customers leading to enhanced situational awareness for improved decision-making and risk mitigation

R&D Needs & Opportunities
- Advanced graphics, animation
- Training for uncertainty forecasting, DSS tools
- Interactive communication tools with customers
- User needs/thresholds database
- “Intelligent” information sharing tools

Current Status:
- 2-way mobile device information
- Customer threshold database
- DSS metrics
- Integrate social science

Near-Term:
- Service Delivery Proving Ground
- AWIPS-II alert sys
- NWS-wide CRM sys
- Training of uncertainty, communication of impacts

Long-Term:
- “Intelligent” Information Sharing (e.g., web 2.0/3.0)
- National/Regional Command Center
- Advanced remote collaboration tools
Focus Area Team Summary: DSS 3–5

R&D Needs & Opportunities
- Blended Guidance
- Rapid Updating
- Improved Resolution
- Quantification of Uncertainty
- Sector-specific services with thresholding
- Integration of weather & environmental data

Vision
Good decisions empowered with essential environmental information, forecasts, and warnings, for protection of life and property and promotion of economic prosperity

Current Status:
- High-resolution (spatial and temporal) NDFD
- More robust and complete NDFD

Near-Term:
- Timely, accurate, and consistent Single Authoritative Source within 4D datacube
- Automated refresh

Long-Term:
- Highly-accessible comprehensive environmental data for decision making
- Availability of uncertainty information
- Thresholds fully integrated

DSS Tiers 3-5

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

**Current Status:**
- Real Time Feedback on Gridded Forecasts
- Rapid Response Service Assessments
- RTMA (2.5 km) & Analysis of Record (AOR) for NextGen
- Local assessment of Customer Satisfaction

**Near-Term:**
- Object-oriented & regime-based verification/feedback
- NEVS for NextGen
- AOR Phase II
- Investigate impact of weather & climate variability on skill
- Assess Customer Satisfaction for uncertainty & WoF

**Long-Term:**
- Develop methodologies for verification scores based on user defined thresholds
- AOR Phase III
- Value of Verification
- Assess efficiency gains from use of decision support tools

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

July 9, 2009
**Focus Area Team Summary: Outreach and Feedback**

**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

**Current Status:**
- Customer relationship information fragmented
- Traditional outreach tools used. GoToMeeting, web-based training
- NWS educates on how best to use, respond to NWS information

**Near-Term:**
- Nationwide CRM aids DSS & drives future services
- Social networking expands & enhances outreach & feedback
- CAS helps people better respond to NWS

**Long-Term:**
- Outreach & Feedback on demand using advance communication technology
- Next generation Call to Action Simulation credited with saving lives, property, and economy
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
- Infrastructure & Data Standards
- Service/Product Ontology
- Infrastructure Virtualization
- Initial Cloud
- Cloud computing
- Consolidated Databases
- Boundaryless Security
- COOP via cloud

Vision

Enterprise IT Infrastructure, unified data, Customer collaboration

Current Status:

- Infrastructure & Data Standards
- Service/Product Ontology
- Infrastructure Virtualization
- Initial Cloud

Near-Term:

- Cloud computing
- Consolidated Databases
- Boundaryless Security
- COOP via cloud

Long-Term:

- Architecture for collaboration, decision support
- Continuous Innovation

July 2, 2009
Focus Area Team Summary: Social Science

R&D Needs & Opportunities
- Social Science Assessments/Studies
- Advanced decision support system tools addressing user needs & social science aspects
- Determination/integration of efficient uncertainty/probabilistic information into DSS

Current Status:
- Initial integration of social science into overall operations and mitigation activities to enhance DSS
- Improvement of situational awareness
- Initial social science performance metrics

Near-Term:
- Operational Proving Ground testing social science principles
- More training in R2O; sociological impact
- Social networking expands, enhanced outreach & feedback
- Training on uncertainty and communication of impacts

Long-Term:
- Products & services that better convey risk and uncertainty
- Increased economic productivity and efficiency
- Improved preparation/risk mitigation, response, and recovery during high impact events
- Increased trust/credibility with general public, key partners, and decision makers

Vision
Integrate social science methods to elicit most appropriate action to NWS products and services and to quantify their economic value to the Nation.

Sept 14, 2009
Focus Area Team Summary: Fire Weather

R&D Needs & Opportunities

Current Status:
- 1-3 day Red Flag Warning
- 12-km Smoke Forecasts
- 20-km wx models
- Wx-centric data analysis
- RAWS, balloon, satellite obs

Near-Term:
- 14 day Red Flag WWA
- Fire scale, 1km, hourly fire/smoke forecasts
- 100mres 30-min, coupled fire wx & behavior forecast
- GIS, mobile system
- UAS, radar, RAWS

Long-Term:
- 90-day Red Flag WWA
- 500m fully coupled smoke behavior forecast
- 10m res fire/behavior forecast
- Mobile WFO
- Hazardous Wx observing system
- GOES-R VIIRS, Rapid Scan
- ISI fire weather outlooks

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

June 26, 2009
Focus Area Team Summary: Hydrology

R&D Needs & Opportunities
- Develop hydrologic ensemble-based forecasting
- Coupling of hydraulic and ocean models
- Integrate dual-pol radars and satellite techniques
- Distributed models with uncertainty analyses

Current Status:
- Forecasts at 4000+ locations
- Limited probabilistic forecasts
- Coastal points don’t have river forecasts
- Short term precip/temp forecasts
- Very limited verification

Near-Term:
- Hydrologic forecasts with 6 hr lead time
- 10% of coastal communities receive hydrologic forecasts
- Distributed modeling at LTE 4km scale
- Ensembles
- Verification info

Long-Term:
- Distributed modeling for river and flash floods at 1km scale; fine-scale products
- Multi-scale, multi-model ensemble data assimilation; prediction of water resources variables
- Comprehensive verification of end-to-end hydrologic forecasting

Vision
Production of accurate, relevant, and actionable information that reduces loss of life & property and enhances economic prosperity
**Focus Area Team Summary: Aviation**

**R&D Needs & Opportunities**
- Probabilistic forecasts for aviation information
- NWP models supporting WIDB spatial resolution
- Optimal generation of SAS for current wx information
- Methods enhancing wx integration into NextGen DSS
- Enhanced ground, airborne, space-based wx sensors
- Enhanced prediction of initiation/evolution of convection, onset of turbulence/icing

**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

**Long-Term:**
- WIDB for NextGen FOC
- WIDB includes Single Authoritative Source (SAS)
- New sensor data into models
- NEVS Implementation

**Vision**
Provide accurate, timely and consistent wx information for integration into NextGen, enabling effective management of nation’s airspace.
Focus Area Team Summary: Severe Weather

R&D Needs & Opportunities
- Predictability limits
- Phased array weather radar
- Boundary layer sampling
- Cloud-scale modeling
- Advanced radar 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

Near-Term:
- Mesoscale models with rapid radar data assimilation
- Mesoscale ensembles
- Testing of phased array radars
- WoF Demos

Long-Term:
- 1-hour tornado and severe TS lead times
- 4-hour flash flood lead time
- Cloud-scale numerical models and probabilistic warnings
- Adaptive data integration
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
- 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

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

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

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

July 28, 2009
Focus Area Team Summary: Marine Services

R&D Needs & Opportunities:
- Improve wave model physics from shelf to shore including inundation and coupled wave-surge modeling.
- Include global and regional modeling at all spatial and temporal scales in coupled Earth System Modeling.
- Social science studies/assessments.
- New observation technologies.

Current Status:
- Improved model physics and resolution.
- New obs sensors.
- Improved awareness.

Near-Term:
- Incorporate social science.
- Coastal wave model – workstation.
- More model coupling.
- Storm surge & inundation test bed.
- New obs sensors.

Long-Term:
- Multi disciplinary emerging products with maritime focus.
- Fully coupled modeling of atmos/ocean/land/ice.
- Leverage emerging S&T advances to deliver NWS marine products for DSS.
- New observation sensors.

Vision:
On-demand accurate & timely weather information from coast to high seas, needed to ensure prosperity, livelihood, & resilience of coastal communities.

July 6, 2009
**Focus Area Team Summary: Tropical Weather**

**R&D Needs & Opportunities**
- Cause of rapid intensity changes
- Key observations needed for improved forecasting
- Air-sea fluxes under quiet and disturbed conditions
- Predictability limits
- Vortex-convection-environment interactions
- Microphysics of convection at high-resolution
- Social Science

**Current Status:**
- Track forecast to 7 days
- Detailed storm-surge warnings
- Improved tropical cyclone QPE

**Near-Term:**
- Wind radii forecasts to 5 days
- Wind and surge impact guidance to 36-hr
- Improved rapid intensity change POD and FAR

**Long-Term:**
- Halved track & intensity forecast errors
- Warnings and forecasts prior to cyclogenesis
- Communication of accurate, high-resolution evacuation information

**Vision**
Finer scale & highly accurate track, intensity & inundation forecasts that trigger appropriate responses resulting in reduced loss of life & economic impacts

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

Current Status:
- Consolidate seasonal outlook with GPRA near 24 in US temp forecast
- Operational ocean, monsoon, drought monitoring & hazard assessment
- CFS reanalysis/reforecast
- Continuity studies not performed in routine observation

Near-Term:
- Data continuity mandate
- OSSE expansion
- CFS advancement in key model aspects
- MME & CTB MTF
- Improved ENSO,MJO simulations for quantifiable skill increase
- Climate portal; formalized user requirement and feedback process

Long-Term:
- Routine integrated Earth system analysis
- Real-time attribution capability
- Reliable local user-centric climate products for decision support
- Weather-climate-hydro extreme event alert system

Vision
A national capability to anticipate, plan for and respond to the risks and opportunities related to climate variability

August 28, 2009
Focus Area Team Summary: Air Quality Forecasting:

Vision
Protect lives and property by providing accurate and timely AQ predictions to the nation

R&D Needs & Opportunities
- Modeling of PM 2.5
- Chemical data assimilation
- Modeling of additional pollutants

Current Status:
CONUS:
- Ozone prediction
- Smoke prediction
- Increasing resolution

Nationwide:
- Ozone prediction
- Smoke prediction
- Dust prediction
- Increasing resolution

Near-Term:
- Increasing resolution

Long-Term:
- Longer lead-time, higher accuracy for ozone and smoke prediction
- Total PM2.5 prediction
- Prediction of additional pollutants
- Increasing resolution; increasing forecast period, out to day 5

August 5, 2009
Focus Area Team Summary: Space Weather

R&D Needs & Opportunities
- Earth-Space System Model
- Solar Wind and Solar Disturbance Model
- Data Assimilation: Ionosphere, Magnetosphere, and Solar Wind
- Solar Flare and Solar Energetic Particle Prediction Model

Current Status:
- < 1-hour lead time
- Ionospheric services only in CONUS
- Empirical forecasts
- Stand-alone products

Near-Term:
- 3-day lead time
- Global ionospheric forecasts
- Regional forecasts, horizontal resolution
- Physics-based forecasts
- Integrated products

Long-Term:
- Long lead time, higher accuracy
- Improved horizontal resolution
- Optimize interoperability of space and terrestrial weather services
- Effective international and interagency partners

Vision
To mitigate the impacts of space weather with actionable forecasts, warnings, and data

July 7, 2009
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

Current Status:
- Improved model physics and resolution
- Improved obs & situational awareness
- Incorporate social science principles
- Use of NCEP SC for model forecasts

Near-Term:
- TWC IT Modernization
- Enhanced seismic array processing
- Improved tsunami detection
- Forecasts for non-tectonic sources
- Web interfaces
- Tsunami Test Bed
- DSS Tools
- Community Modeling

Long-Term:
- Implementation of Next Gen Modeling capability
- Improved observations and detection capability
- Leverage emerging social science technology to improve forecasts process and decision support tools

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

Tsunami