NAWIPS Status and Plans

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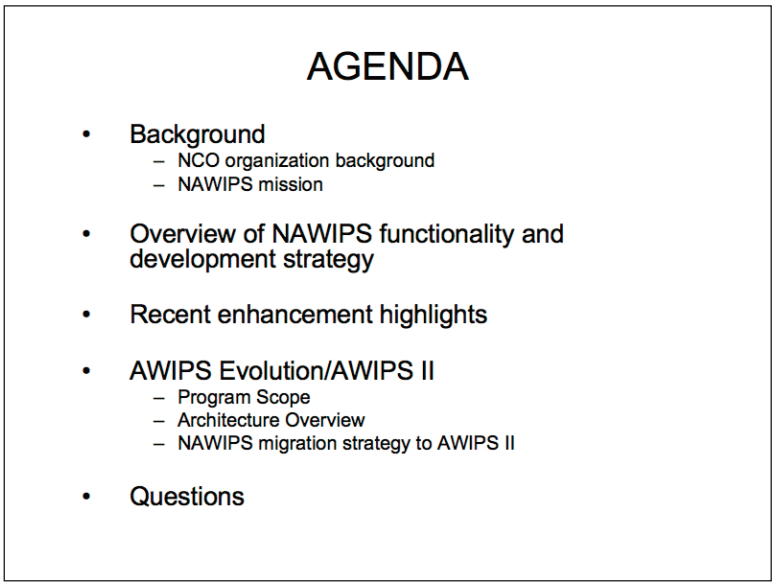
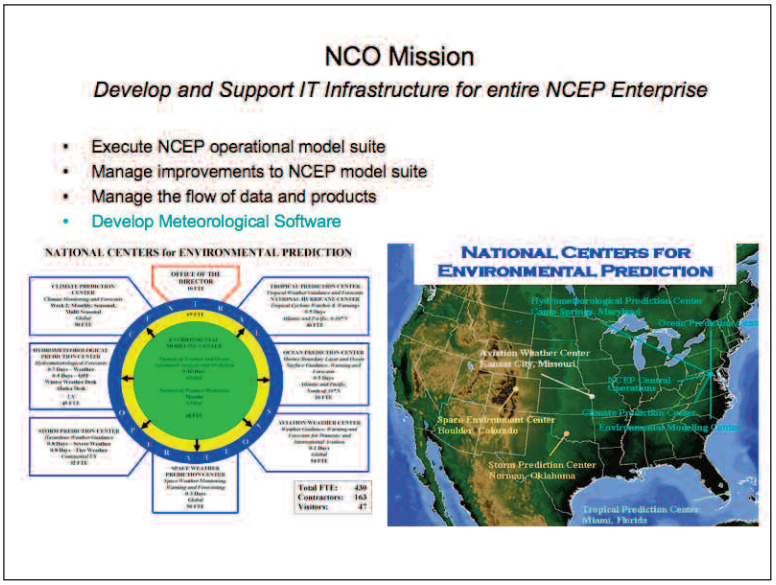
Abstract

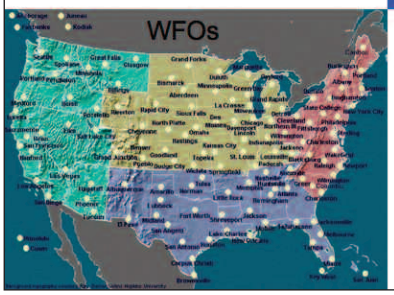
The National Centers for Environmental Prediction, National Centers Advanced Weather Interactive Processing System (NAWIPS) is the primary forecaster tool used at the NCEP centers. The purpose of this talk is to summarize NAWIPS functionality and development strategy and to discuss recent functionality additions. In addition, the AWIPS-2 program will be discussed along with the NAWIPS migration strategy to the AWIPS-2 environment.

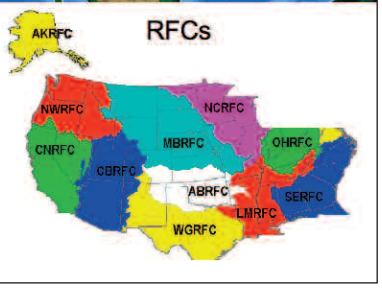




NAWIPS Mission

- Develop meteorological application software to meet NCEP requirements, NCEP-AWIPS (NAWIPS)
  - National Centers given responsibility to meet their mission requirements occurred in early phase of AWIPS program – Late 1980's
    - Recognition of significant mission differences between National Centers and Local Forecast offices and River Forecast Centers
    - Decision primarily cost-driven

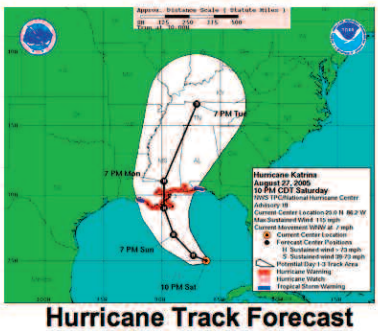




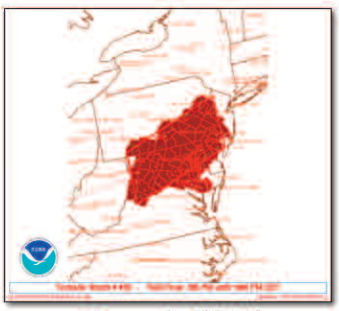
NAWIPS Key Attributes

- NAWIPS Software:
  Ingests, performs calculations on and displays meteorological observational and model data
  - Operates on the full spectrum of geographic and temporal scales
  - Is adaptable, allowing for the introduction of new data, products and functional improvements
  - Has the flexibility to support a diverse user base
    - **NCEP Centers (AWC, CPC, HPC, NHC, OPC, SPC)**
    - **Automated products on the NCEP super computer**
    - NWS Alaska, Pacific, & River Forecast Centers
    - UCAR-Unidata (~200 universities)
    - Government labs
  - Is used to create a diverse set of forecast products

NAWIPS Product Samples

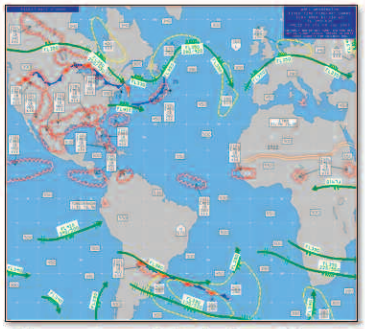


Hurricane Track Forecast
From the Tropical Prediction Center's National Hurricane Center



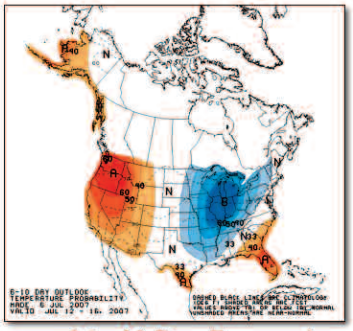
Tornado Watch
From the Storm Prediction Center

NAWIPS Product Samples



Upper Level Aviation Chart

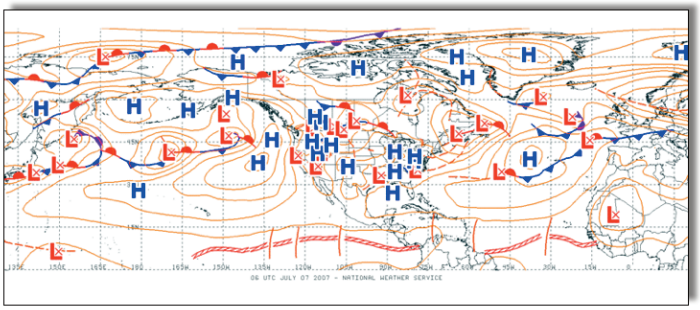
From the Aviation Weather Center



6 to 10 Day Forecast

From the Climate Prediction Center

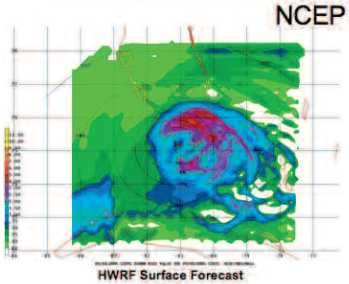
NAWIPS Product Sample



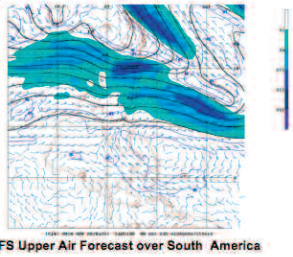
Unified Surface Analysis

Collaboration of the Hydrometeorological Prediction Center, Ocean Prediction Center, Tropical Prediction Center and Pacific Region

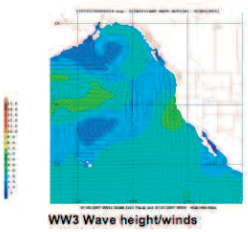
Automated Model Product Samples Created on the NCEP CCS



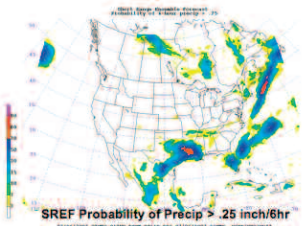
HWRF Surface Forecast



GFS Upper Air Forecast over South America



WW3 Wave height/winds

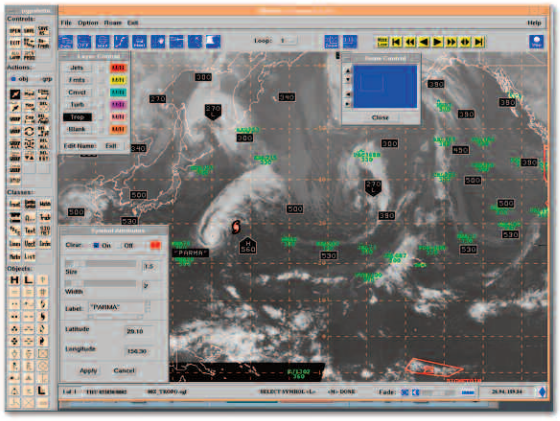


SREF Probability of Precip > .25 inch/6hr

NAWIPS Key Attributes- Continued

- Integrated Product Generation
  - Creation/Editing of graphical products overlaid on meteorological data displays
- Critical requirements:
  - Drawing and editing tools using meteorological objects, e.g., fronts, weather symbols, etc.
  - Graphical objects navigated to account for multiple product sectors and projections, wind rotation, …
  - Facility to import first guess fields, e.g., model fields and other centers' graphical products
  - Product formatting to support GIF, TIFF, PostScript, GRIB, BUFR, text …
  - Product layering to support multi-component or multi-time concurrent editing
  - Object grouping

NMAP2 Integrated Product Generation GUI



NAWIPS Development Strategy

- Address multiple requirements with generic functionality
- Support multiple platforms: Unix (HPUX, AIX), Linux, single or multi-monitor workstations
- Use an evolutionary development strategy
  - Build in small frequent increments, quarterly release cycle
  - Refine requirements based upon forecaster feedback

NAWIPS Enhancement Motivations

- Products – new/enhanced/more consistent
- Forecast process
  - New science
    - New data types
    - New or enhanced techniques
  - Increase efficiency
    - Add or enhance interactive display and product generation tools
    - Automate process components

Automate Creation of Categorical Severe Weather Outlooks

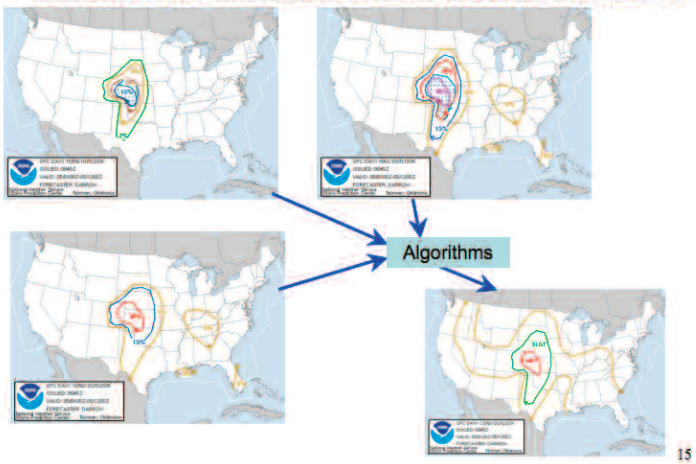
Description:

- Automatically create categorical outlook from probabilistic products

Motivations:

- Improve consistency among related outlook products
- Increase forecaster efficiency to allow forecaster more time to create new products

Automate Creation of Categorical Severe Weather Outlooks from Probabilistic Weather Outlooks for the SPC



Outlook Probabilistic to Categorical Process

- Forecaster uses NMAP2 tools for graphical creation/editing and text product creation
- Post processing – Creates categorical outlooks
  - Polygon combine
  - Polygon clipping
  - Application of rule set that relates outlook types

Day 1 Probability to Categorical Outlook Conversion

(SIGNIFICANT SEVERE area needed where denoted by hatching - otherwise default to next lower category)

Outlook Probability	TORN	WIND	HAIL
2%	SEE TEXT	NO SIG	NO SIG
5%	SLGT	SEE TEXT	SEE TEXT
10%	SLGT		
15%	MDT	SLGT	SLGT
30%	HIGH	SLGT	SLGT
45%	HIGH	MDT	MDT
60%	HIGH	HIGH	MDT

- Public product creation
  - Graphics: object to graphic encoding
  - Grids : object to grid using graph-to grid techniques

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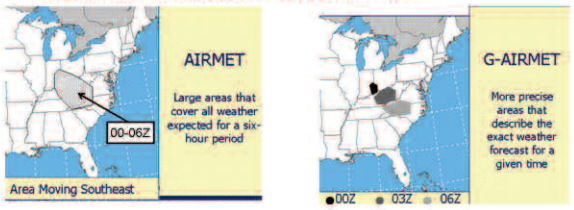
Graphical AIRMET (G-AIRMET) Production For AWC

Motivations: Improve domestic forecast aviation hazard product

- Greater spatial and temporal resolution than current AIRMET
  - 3 hour snap shot as opposed to 6 hour time smear



- Increase product issuance
- Creating graphical product that is geo-referenced form (BUFR) to allow product to be displayed in end user systems
- Standardize AIRMET text product by deriving it from graphical product in a automated fashion

G-AIRMET Creation Process

- Create G-AIRMET hazard snap shot object using NMAP2 tools
- NMAP2 generates AIRMET text product using a suite of algorithms:
  - Polygon combine – for 6 hour time smear
  - Polygon snapping to aviation relative geographic points
  - Polygon clipping to forecast boundaries
  - Polygon point reduction and splitting to ensure that generated text product complies with AIRMET text length specification
- Post processing to create BUFR and web products with required attributes from NMAP2 generated objects

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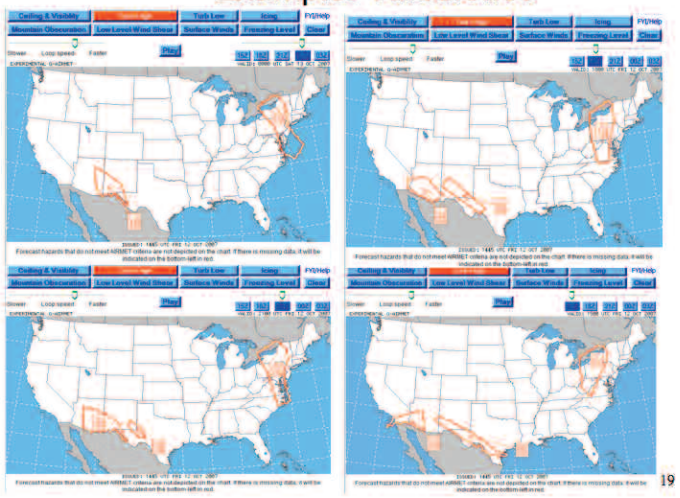
Example: Turbulence



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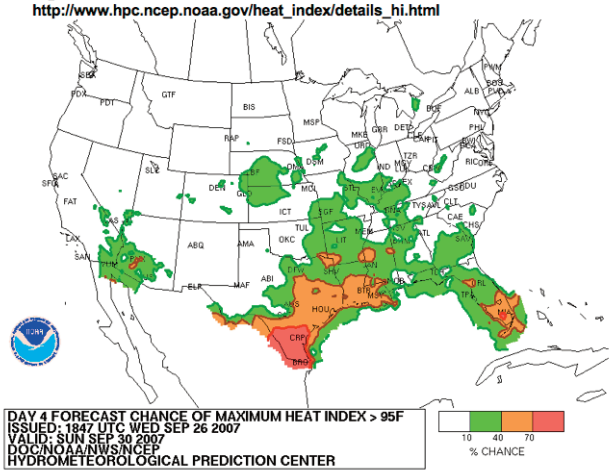
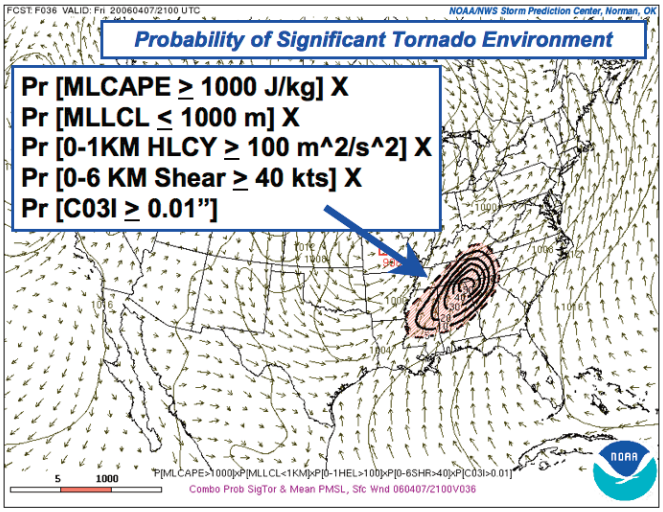
NAWIPS Ensemble Calculation Capabilities

- Motivation
  - Improve use of ensemble derived products to support forecast process
  - Requirements for probabilistic based products
- Key Attributes
  - Ensemble calculations can operate on any of available grid diagnostics
  - User specified ensemble members and/or deterministic models can be used in calculations
  - Calculations can be performed on **super-computer or workstation environment**
- Current ensemble functions
  - Average, weighted average, spread of scalar and vector diagnostics
  - Min/max/mode/percentile/range of scalar diagnostic
  - Multivariate probability function of scalar diagnostics

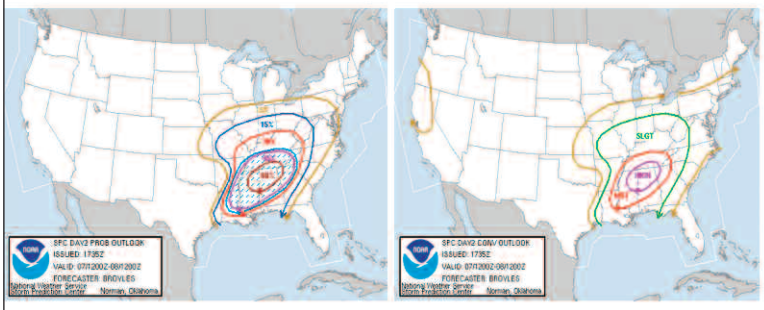
Ensemble spread combined with forecaster input to create a probabilistic heat index forecast. For details see:
http://www.hpc.ncep.noaa.gov/heat_index/details_hi.html



SREF Probability- Used For Day 2 Severe Outlook



Day 2 Severe Weather Outlooks Using Ensemble Guidance



Probability of severe weather within 25 miles of a point.
Hatched Area: 10% or greater probability of significant severe within 25 miles of a point.

Ensemble IT Challenges

- Meteorology community desires access to entire suite of ensembles and derived products in a timely fashion
- Volume of ensemble data is large and will continue to grow rapidly thus applying stress on entire IT infrastructure: networks, data flow, local server processing and local data storage
  - Currently produced - 850GB per day on CCS
  - Currently operationally distributed
    - 65 GB/day to remote centers NCEP Centers
    - 120 GB/day to FTP server
    - 45GB/day to NWS Telecommunications Operations Center
  - The future holds more expansions
    - Additional members
    - Higher resolutions
    - More individual ensemble output products

Ensemble IT Potential Options

- Centrally created products versus locally created products
  - Advantage – Alleviates distribution issues by not distributing all data
  - Disadvantage – less flexibility for center and end-users to create event based ensemble products
- Develop "smart push - smart pull" data delivery systems
  - "Smart" – Capability to subset and distribute by parameter, space, time, ensemble member
  - NOAA Operational Model Archive and Distribution System (NOMADS)
    - Advantage will partially satisfy end -user requirements in near term – Initial Operational Capability FY08
    - Disadvantage – Internal data flows, and server capacity limitations; Timeliness currently not sufficient to meet NCEP center forecaster requirements
  - Develop NWS enterprise solution – AWIPS II evolution initiative
    - Implements a discovery service within the AWIPS II Service Orientated Architecture (SOA)
    - Allows access to data not available locally
    - Schedule – Final Operational Capability – FY 2012

AWIPS Evolution Scope

- AWIPS Evolution (FY2005 – FY2014)
  - A long-term project which delivers a modern, robust software infrastructure that provides the foundation for future system level enhancements for the **entire NWS enterprise**
- AWIPS II – Migration of WFO/RFC AWIPS (FY2007-FY2009)
  - Implements a modern Services Oriented Architecture (SOA) infrastructure
  - First output of AWIPS Evolution and provides the foundation for all subsequent improvements
- AWIPS II Extended - Creation of a seamless weather enterprise spanning NWS operations (FY2009-FY2010)
  - **Migration of NAWIPS into the AWIPS II SOA**
  - Delivery of thin client
    - Support to the Weather Service Offices and Center Weather Support Units
  - Integration of "orphan" systems (e.g., Weather Event Simulator)
- AWIPS II enterprise enhancements (FY2009 – FY2014)
  - Data delivery enhancements
    - "Smart push-smart pull" data access
  - Integrated visual collaboration
  - Visualization enhancements
  - Information generation enhancements

AWIPS II Architecture Overview

- Created by Raytheon
- Consists of AWIPS Development Environment (ADE) and the Common AWIPS Visualization Environment (CAVE)
- Service Oriented Architecture (SOA)
- Primarily Java based
- Integrates many Open Source Projects

ANT	ADE build scripting
JAVA	ADE Java virtual machine
postgresSQL	RDBMS for metadata
Jibx	Java Object to XML mapping
Jython	Python scripting in Java
Jhdf5	Java API to HDF5
Hibernate 3	Relational to object mapping
Geotools	GIS libraries and tools
Antlr	Language grammar parser
Xfire	Collaborator server
Eclipse RCP	Visualization framework
Jogl	Open GL Java API for CAVE
Batik	SVG tool library
Activemq	ADE Java Messaging Service
Mule ESB	ADE Enterprise Service Bus

NAWIPS Migration Strategy

- FY-08
  - Familiarize NAWIPS staff with AWIPS II Technology
    - SOA and Java Training
    - Participation in AWIPS II SOA testing
    - Develop prototype applications in AWIPS II environment
  - Develop NAWIPS migration plan
- FY-09 and FY-10
  - Migrate NAWIPS functionality to AWIPS II SOA