

SANDY SUPPLEMENTAL BLEND OF GLOBAL MODELS

Leveraging European Models
also known as National Model Blender

Overview for NCEP Ensemble Workshop
March 26, 2014

Team Leads: Stephen Lord, Dave Novak, Tom Hamill, Jeff Craven, David Ruth, Kathryn Gilbert
and at last count 60 additional team members, advisors, contributors

Project Goals & Requirements

Objective:

- Improve quality and consistency of the NWS National Digital Forecast

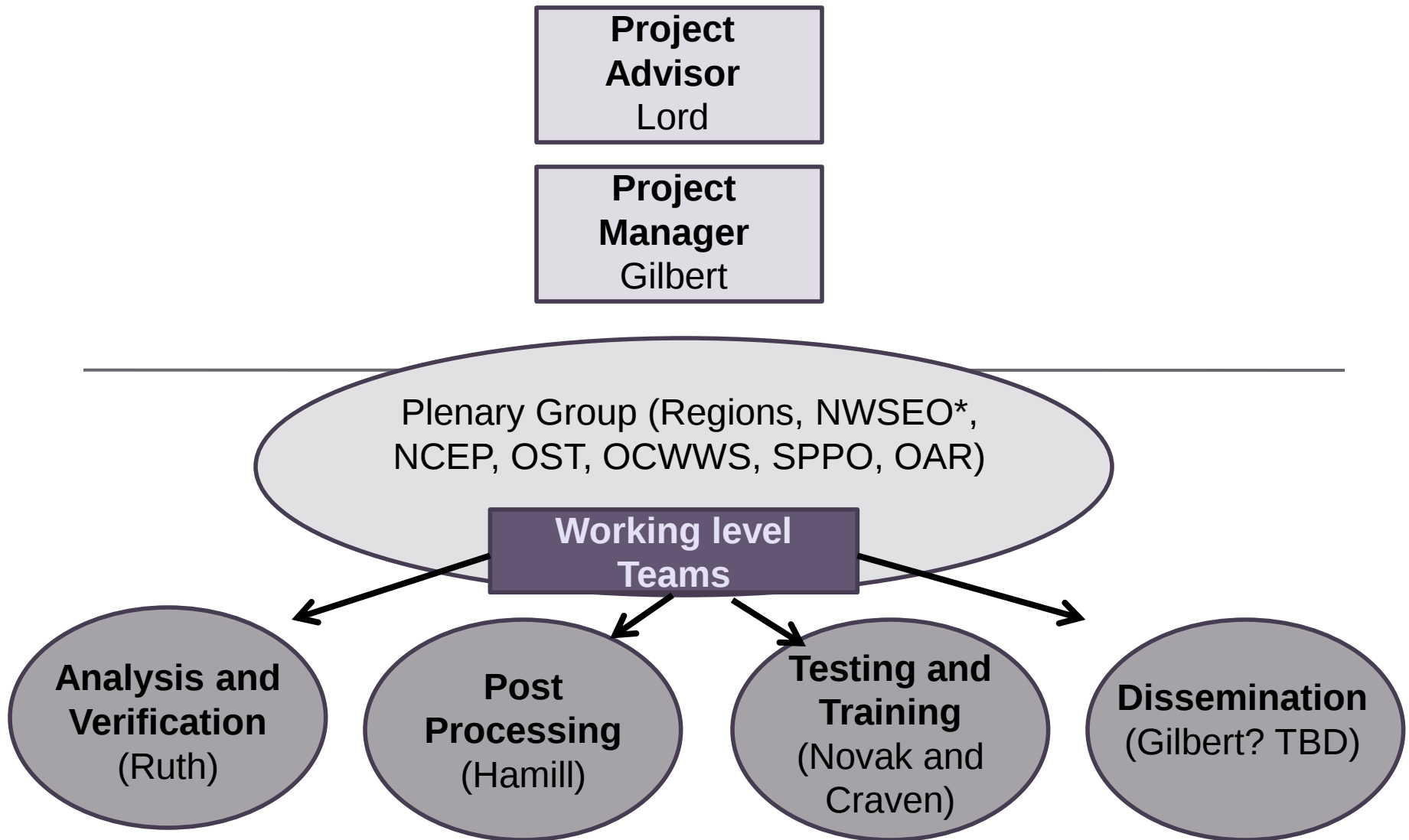
Project Goals

- Through an integrated and structured approach:
 - Develop a set of next-generation foundational gridded guidance products for NDFD weather elements based on NWS and non-NWS model information
 - Create a NWS methodology for a national blend (“best”) product, beginning with the Day 3 - 8 time frame and extensible to a full set of NWS deterministic and probabilistic products covering days 1-10

Project Requirements:

- NWS Enterprise Solution
 - Nationally uniform product, with spatial and temporal consistency
 - Extensible methodologies (models, elements, days...)
- Meet R2O criteria
 - Forecast benefits (product quality)
 - Implementable and Sustainable
- No degradation of service

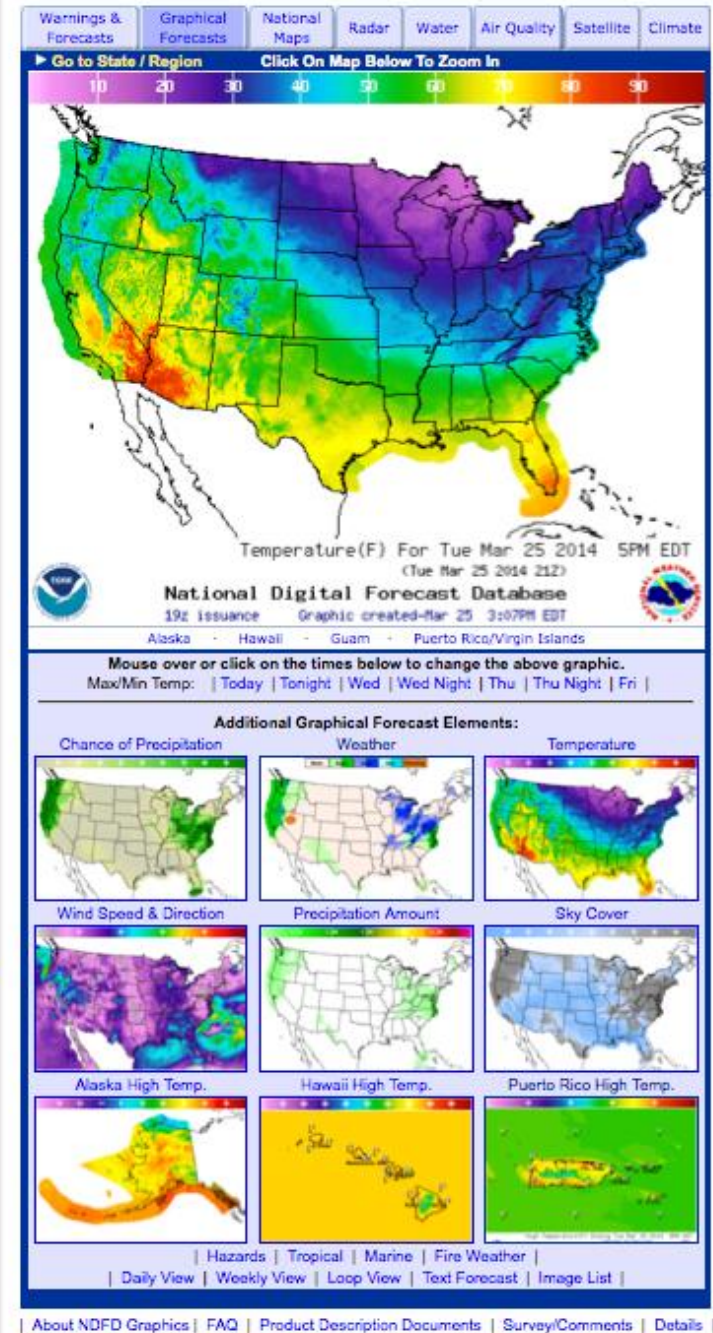
Project Management



* NWSEO Rep: Jim Sieveking

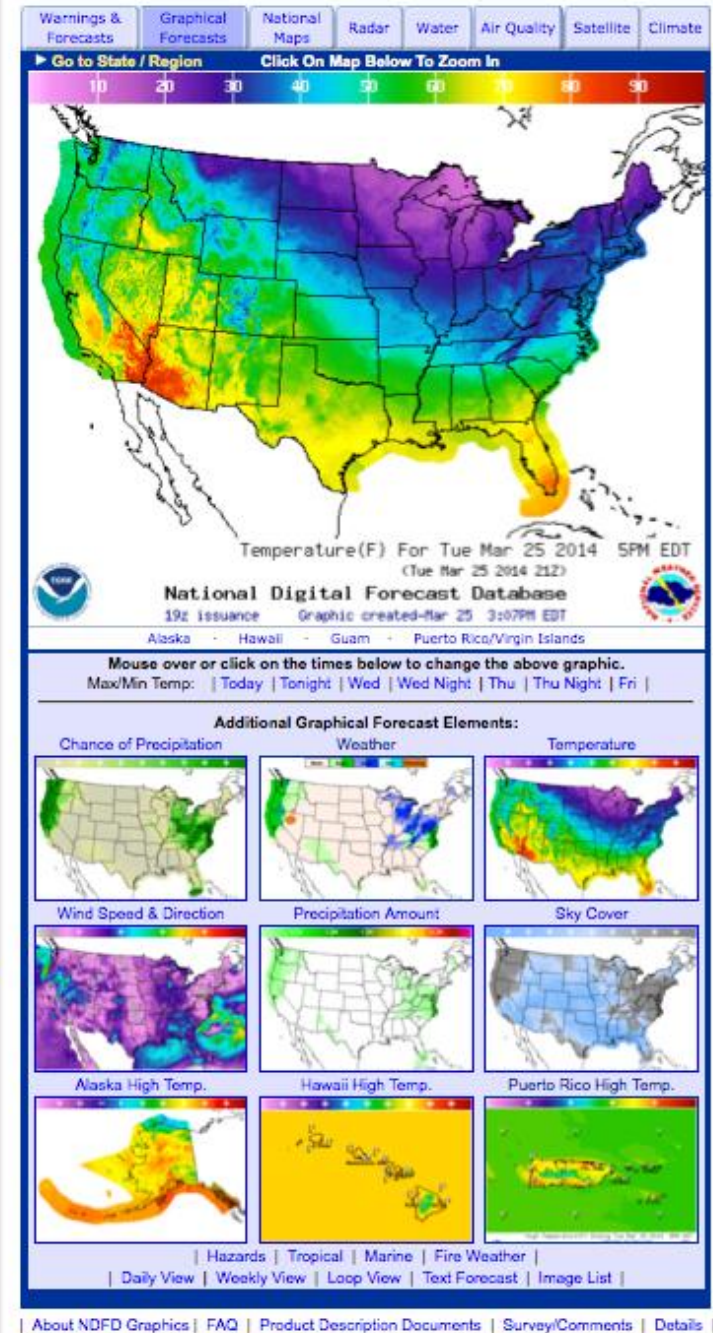
Project Development Scope

- National Digital Forecast Database (NDFD) elements will be part of the new blender package
- Initial weather elements:
 - Temperature, Dewpoint, Daytime max T, Nighttime min T, Sky Cover, Wind speed/direction, Precipitation Type, PoP/QPF
 - 2nd phase: Snowfall Amount, Wind Gusts, Apparent Temperature, Predominant Weather, others as needed
 - Derive where it makes sense to ensure consistency, efficiency: i.e. Relative Humidity, Apparent Temperature
- Domains:
 - CONUS, Alaska, Hawaii, Puerto Rico
 - Guam?, Oceanic (winds)



Project Development Scope

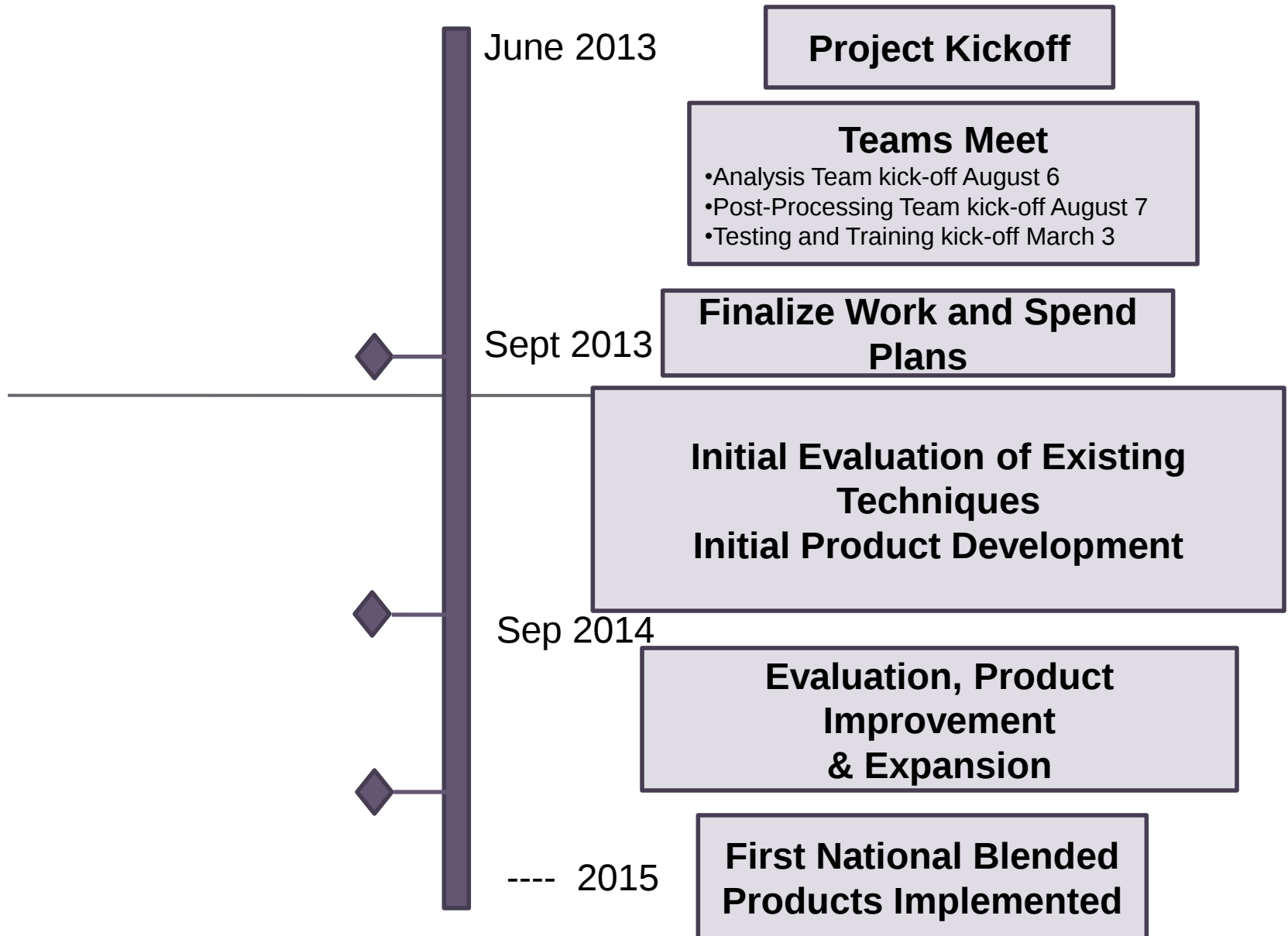
- National Digital Forecast Database (NDFD) elements will be part of the new blender package
- 1-10 day products will be generated on NOAA's Weather and Climate Operational Supercomputer System (WCOS)
- Performance measures for 3-8 day guidance
- Initial efforts focused on blending global models
 - ECMWF, ECMWF Ensembles
 - GFS, GFS Ensembles
 - CMC, CMC Ensembles
 - FNMOC



Project Development Scope (cont.)

- All elements verified against Analysis of Record (AOR, grid-based) and observations (point-based)
- **The scope of this project explicitly does NOT test or propose any changes in staffing, workforce neutral**
- Project is not complete until blended guidance is available for all NDFD domains on the AWIPS-II system in the NCEP perspective; and the WFO Graphical Forecast Editor (GFE) and 2-Dimensional Data Display (D2D) applications
- Required features of candidate techniques
 - Mature enough to begin specific product development now
 - Framework capable of expansion to complete set of gridded guidance products
 - Models, analysis(es), and statistical post-processing techniques demonstrate they are implementable and available on the NOAA production supercomputer

Project Timeline



Concept of Operations in latest draft of Project Plan

Objective blended products generated from calibrated post-processed model output produced centrally on WCOSS

- Two cycles per day, lead times through Day 10
 - Limited to Deterministic and Ensemble **Global** models during period of Sandy Supplemental funding
 - Disseminated to NCEP Centers and WFOs
- WPC will provide “forecaster-over-the-loop*” oversight of the National Blend for Days 3-8, eventually extending to Day 10
 - ensuring meteorological consistency and validity
 - WFOs will receive both objective (WCOSS generated) and WPC (edited) grids
 - WFOs retain the final gridded forecast responsibility for the full Day 1 – 8 period.
 - Days 2-3 WFOs will provide “forecaster-over-the-loop” oversight of the National Blend using local Smart Tools and other techniques.
 - The final modified National Blend is used to populate NDFD

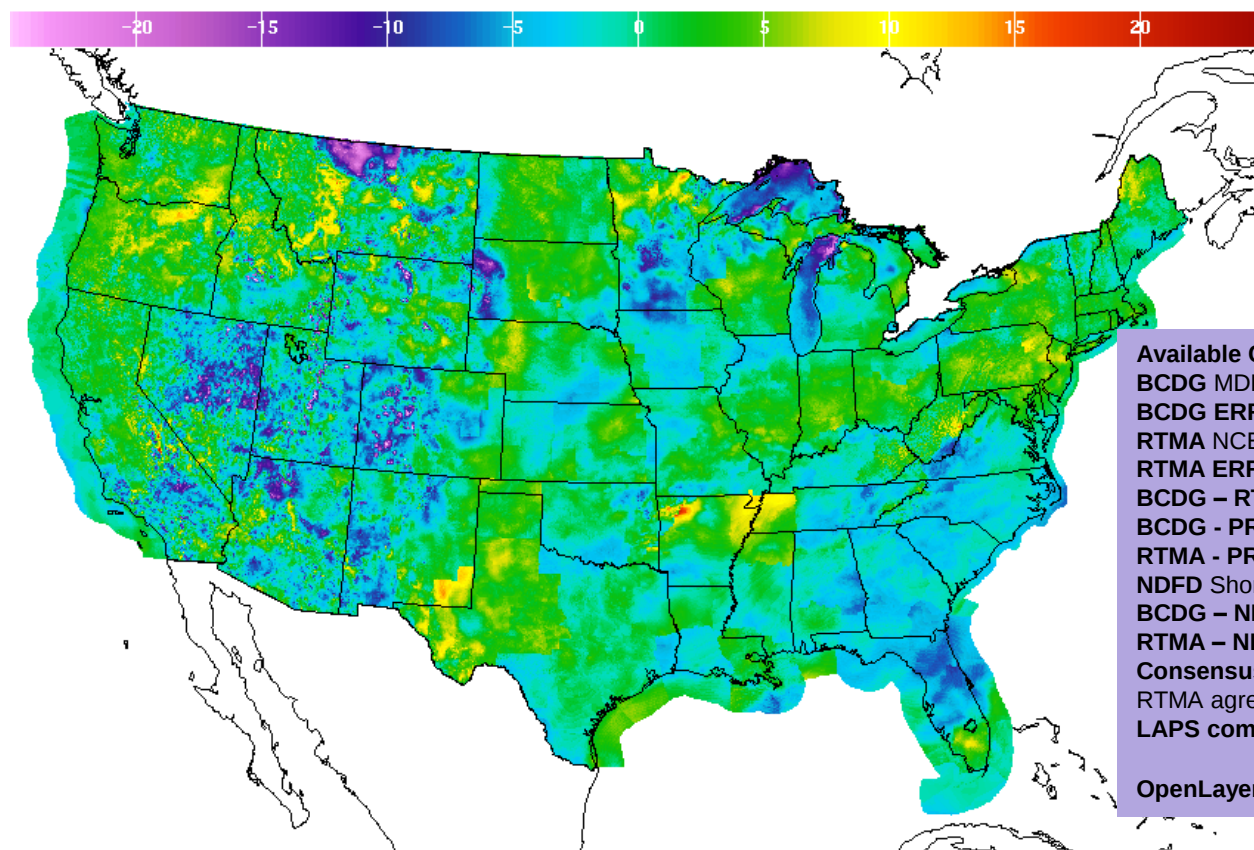
*Forecaster-over-the-loop: forecaster remains in the forecast process at a higher decision level. Human focus on new model analytical tools to more scientifically identify characteristics of storms and communicate IDSS impacts, providing intervention and mitigating risk when national blender does not yield desired IDSS message. Facilitates increase in lead time messaging for significant events.

Supported sub-projects funded from Sandy Supplemental ~\$1.8 million

- a. Perform grid-to-grid and grid-to-point verifications (Ruth; OST/MDL)
- b. Lead efforts of post-processing team, contribute GEFS Reforecast data sets, contribute to PoP/QPF development and new blending approaches, participate in evaluation (Hamill; OAR/ESRL/PSD)
- c. Accelerate URMA/RTMA improvements for use as “Analysis of Record” in model blender (DiMego/Pondeca; NCEP/EMC)
- d. Advanced MOS statistical post-processing techniques for calibration of NDFD variables and blending of model output (Gilbert; OST/MDL)
- e. Expand NAEFS post-processing (Zhu; NCEP/EMC)
- f. Data management and visualization tools to improve collaboration (Gilbert; OST/MDL)
- g. Transition NCEP’s WPC blending and ensemble visualization capability to AWIPS II for the NCEP Perspective (Mainelli; NCEP/NCO)
- h. Training (Spayd/Bua; COMET)

Analysis Comparison Page

RTMA-NDFD Example



Available Comparisons:

BCDG MDL's GMOS analysis run on hourly observations
 BCDG ERR Estimation of the BCDG analysis error
 RTMA NCEP's Real-Time Mesoscale Analysis
 RTMA ERR Estimation of the RTMA error
 BCDG - RTMA Difference between two analyses
 BCDG - PREV_HR Change in BCDG from previous hour
 RTMA - PREV_HR Change in RTMA from previous hour
 NDFD Shortest-range forecast in NDFD (nowcast)
 BCDG - NDFD Difference between BCDG and NDFD nowcast
 RTMA - NDFD Difference between RTMA and NDFD nowcast
 Consensus Plot Shows where NDFD nowcast, BCDG, and RTMA agree and disagree
 LAPS comparisons just added

OpenLayers coming soon!



Experimental (Wed Mar 05 2014 14Z)
 RTMA-NDFD (AVG: 2.910)
 Graphic created-Mar 05 9:53AM EST



http://www.mdl.nws.noaa.gov/~lamp/gobs_analysis.php
 (use ndgd, iluvndgd)

Issues & Challenges

• Issues

- Clarify dissemination restrictions on products developed relying on ECMWF model output; latest meeting March 7 with ECMWF, DoC General Counsel, NWS International Activities, NCEP, OST. Cooperative Agreement drafted.
- Post-processing team will mitigate risk by developing blending techniques which will have a backup capability when a model is unavailable at cycle run time, individual models will be calibrated
- Need nationally consistent foundational datasets: terrain, land/water masks, observation analyses. Inconsistent terrain files in use by AWIPS applications, NCEP downscaling applications, MDL gridded guidance...

• Challenges

- Lack of High Performance Computing and human resources to generate sufficient reanalysis and reforecast samples from newest version of numerical models needed to provide representative samples for statistical calibration
- Lack of an established Analysis of Record of sufficient length and quality for downscaling, calibration, blending, and verification for all NDFD elements over all NDFD domains
- Initial delivery is limited. It will not meet all temporal requirements of NDFD.

Summary

• Successes

- Reached agreement to support a common analysis, likely to be RTMA/URMA with improvements.
- Proposal process was open to all (NOAA, external groups applied)
 - Review team was able to reach agreement on major thrusts
- Project scope has been vetted
 - Compromises were reached, project scope has been finalized and prototype development is underway
 - Plenary sessions have broad attendance and have been instrumental in defining project
- NWSEO Engagement

• Ongoing items

- Complete allocation of funds – hope to finalize remaining award executions in April
- Possible dissemination restrictions on products developed using ECMWF model output

• Challenges

- Lack of HPC and human resources to generate sufficient samples of:
 - Input models and analyses for statistical post-processing
 - Analyses for verification
- Inconsistent National foundational datasets
 - Topography, Land/water masks
- Dissemination of probabilistic output
- National Model Blender Google Drive folder – open to staff with NOAA e-mail accounts
<https://drive.google.com/a/noaa.gov/folderview?id=0Bw8bxLLiwYqsWVUtdcm9RVzNmZkk&usp=sharing>