Analysis of Record: An Opportunity for Community Cooperation

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The U.S. Model of Data Sharing

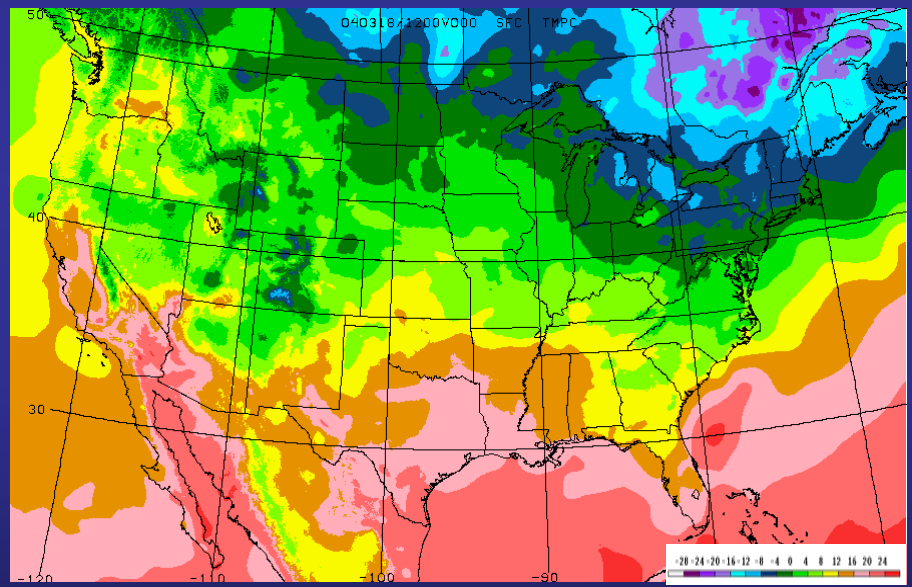
- A success story!
- Free and open exchange of data
- Increasing number of mesonets, RWIS, etc.
- Some collaboration in packaging and QC (e.g., MADIS, MesoWest, and others)
- Plans to modernize NWS COOP program

But, is this the best we can do?

What if we were to add to this a community, state-of-the-science analysis process that blends these heterogeneous data into a single gridded analysis?

A comprehensive set of the best possible analyses of the atmosphere at high spatial and temporal resolution with particular attention placed on weather and climate conditions near the surface.

Analysis of Record



Analysis of Record

The value of an accepted “truth analysis” would be tremendous:

- Data assimilation process is expensive; this effort would concentrate our limited resources
- The process would provide weather information uniformally and not just at *in situ* observation points
- It could be the foundation for a diverse set of enhanced weather information and forecast services

Analysis of Record – A Few Metrics

- Parameters: temperature (max, min, current), dew-point temperature, wind, sky, and precipitation (type, amount) to start, but eventually expanding to contain full complement of environmental variables and three dimensions.
- Resolution:
  - Nominally 5-km grid over contiguous 48 states
  - Future expansion to remainder of the U.S. and its territories
  - Hourly
- Three step process:
  - 30-m latency to meet real-time needs
  - ~1-day delay for improved analysis for verification, etc.
  - ~1-month delay for final “Analysis of Record” for archive
- Spatially and temporally varying error statistics
- Geo-referenced, GIS compatible digital gridded data

- Re-analysis once state-of-the-science system is obtained
  - Likely matching the time period of the North American Regional Reanalysis (1979 start, 32-km grid, 3-h)

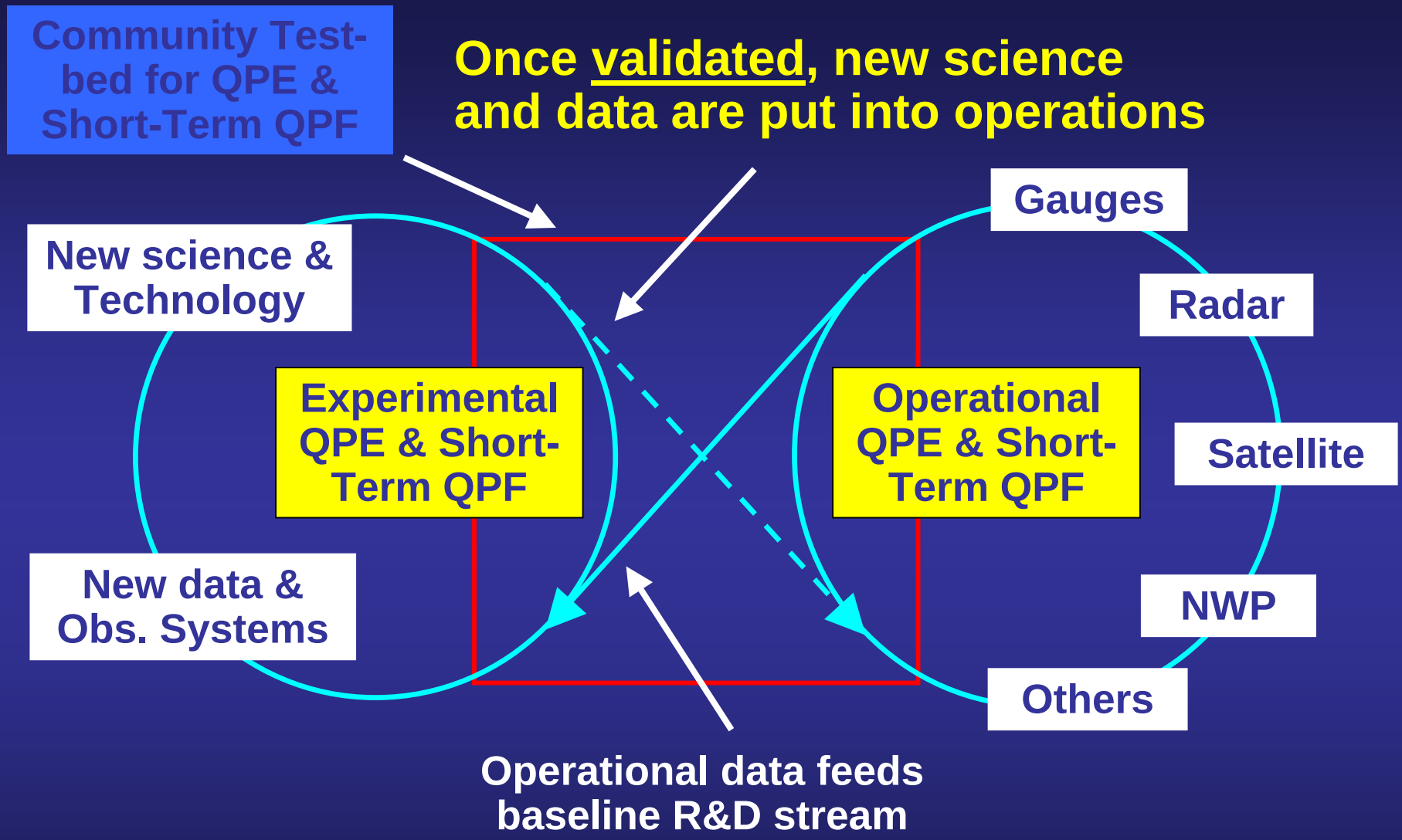
NRC: "Crossing the Valley of Death"

The potential forecast skill based on current research understanding, state-of-the-art sensors, and computers is **expected** to be higher than that of the operational system. **Verification of forecast skill** and ongoing dialogue about performance should guide operational practices toward improvement.

From *Research to Operations in Weather Satellites and Numerical Weather Prediction: Crossing the Valley of Death (2000).* National Research Council, Board on Atmospheric Sciences and Climate.

The absence of an accepted (and broadly used) 'truth' analysis prevents an efficient transfer from research to operations. For example it:

- Complicates model development
- Compromises operationally-necessary model inter-comparisons (no single verification database)
- Prevents the optimal use of data assets
- Promotes inconsistent interpretations



(From Q2 Workshop, June 2005; adapted from NWS Integrated Water Science Plan, 2004)

AOR Context – Weather Enterprise

- Admiral Lautenbacher

  "*Observations alone are often meaningless without the actions that provide economic and societal benefit.*"
- A comprehensive weather and climate observing system requires integration and synthesis of observations into gridded analyses of current and past states of the atmosphere
- Such a process allows us to optimally benefit from our open exchange of data and leverage the growing set of private and public surface mesonets

GEOSS --- Creating a "System of Systems"

Global Earth Observing System of Systems

Proposed Ongoing Analysis of the Climate System/Analysis of Record

Climate Variability and Change | Disasters | Health | Ecosystem

Ocean Resources | Energy | Agriculture | Water Resources

Societal Benefits

P. Arkin

Diverse needs for an AOR

- Private sector and public need for current weather conditions
- NWS gridded forecast preparation and verification
- NWP (model development, validation, intercomparison)
- Dispersion modeling for transport of hazardous materials and pollutants
- Homeland defense
- Aviation and surface transportation
- Environmental issues from the coastal zone to fire management
- Climate and impacts of climate change on a regional scale

“The truth is rarely pure and never simple.” Oscar Wilde

First Steps Toward an AOR

- A Community Meeting on Real-time and Retrospective Mesoscale Objective Analysis, June 2004
  - Co-sponsored NOAA/NWS OS&T and USWRP
  - About 70 attendees from all sectors
  - Prepared recommendations on how to proceed
  - Recommendation to develop prototype system
  - Meeting report was just published in BAMS
- Mesoscale Analysis Committee established August 2004 by Director, NWS Office of Science and Technology
- Committee meeting in October 2004 to define needs and development strategy for prototype AOR, the Real Time Mesoscale Analysis (RTMA)

Mesoscale Analysis Committee (MAC)

- Robert Aune, NOAA/NESDIS University of Wisconsin Space Sciences and Engineering Center
- Stanley Benjamin, Forecast Systems Laboratory
- Craig Bishop, Naval Research Laboratory
- Keith A. Brewster, Center for Analysis and Prediction of Storms The University of Oklahoma
- Brad Colman (Committee Co-chair), NOAA/National Weather Service -- Seattle
- Christopher Daly, Spatial Climate Analysis Climate Service Oregon State University
- Geoff DiMego, NOAA/ National Weather Service National Centers for Environmental Prediction
- Joshua P. Hacker, National Center for Atmospheric Research
- John Horel (Committee Co-chair), Department of Meteorology, University of Utah
- Dongsoo Kim, National Climatic Data Center
- Steven Koch, Forecast Systems Laboratory
- Steven Lazarus, Florida Institute of Technology
- Jennifer Mahoney, Aviation Division Forecast Systems Laboratory
- Tim Owen, National Climatic Data Center
- John Roads, Scripps Institution of Oceanography
- David Sharp, NOAA/National Weather Service -- Melbourne

Ex Officio:

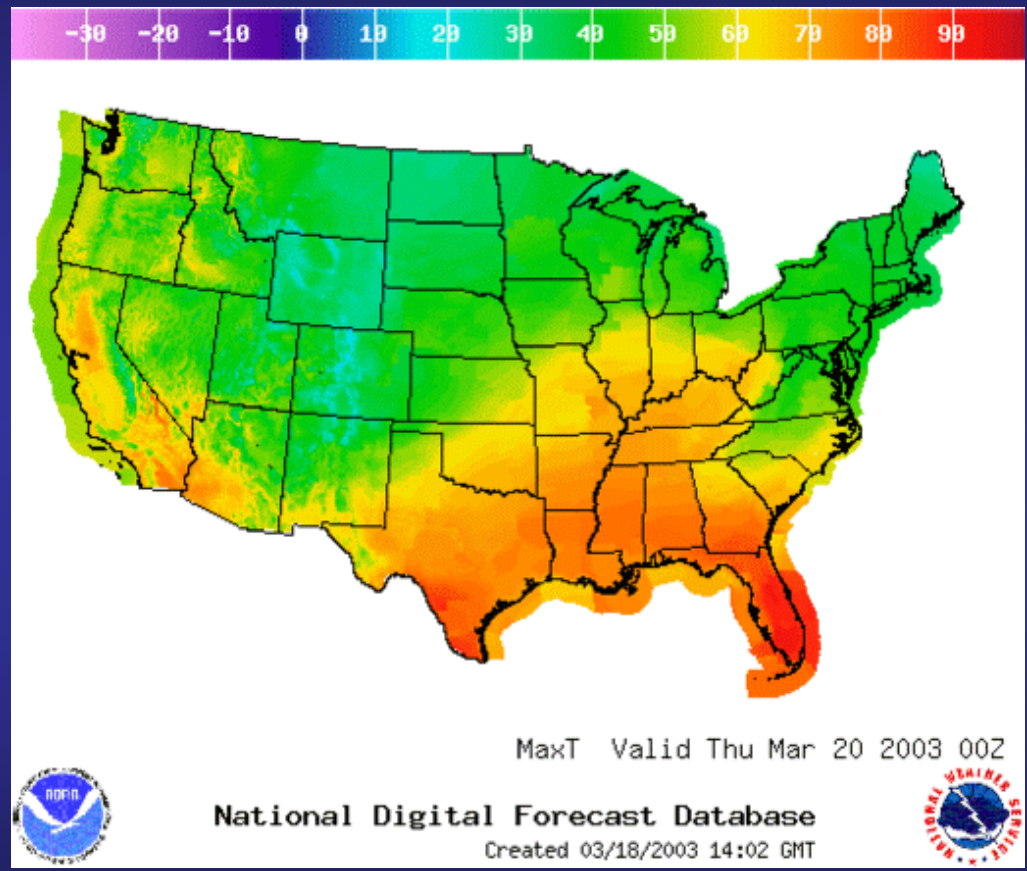
- Andy Edman, Science & Technology Committee representative
- LeRoy Spayd, Meteorological Services Division representative
- Gary Carter, Office of Hydrology representative
- Kenneth Crawford, COOP/ISOS representative

Context – NOAA/NWS

NOAA/NWS has a critical need to produce real-time and retrospective analyses at high resolution to help create and validate gridded forecasts as part of NWS Digital Services Program

National Digital Forecast Database (NDFD)

- A national database of digital weather forecast information
- 3 hour to 7 day lead time, but ***no analysis grids***
- Ongoing program development and concept of operations requires a comprehensive verification program. Necessary enhanced forecast tools require a matching analysis (e.g., bias removal and now-casting tools).



Real-Time Mesoscale Analysis (RTMA)

Initial developers (among others):

- –Stan Benjamin, FSL
- –Geoff Dimego, NCEP/EMC
- –Bob Aune, NESDIS

The RTMA is a fast-track, proof-of-concept effort intended to:

- leverage and enhance existing analysis capabilities in order to generate experimental CONUS-scale hourly NDFD-matching analyses
- create a real-time process that delivers a sub-set of fields to allow preliminary comparisons to NDFD forecast grids
- begin to establish analysis uncertainty estimates and identify deficiencies with RTMA methodology – essentially establish a benchmark for future efforts
- FSL, NCEP/EMC, NESDIS partnership
- deliver a baseline product to partners and customers
- build a diverse constituency for subsequent AOR development activities

Analysis of Record:
Moving Beyond the Prototype RTMA

- Tremendous community benefit would be derived from a consistent suite of high-resolution analysis products
- Initial RTMA will serve as a benchmark; but AOR development will be intellectually and scientifically challenging
- Support for this suite of mesoscale analyses needs to be strong and compelling – it needs to be a high enterprise priority
- Initial steps underway to address NWS AOR funding requirements for FY 2008 and beyond (Lee Anderson)
- Additional funding sources for broader community efforts to develop next-generation AOR are also needed

Summary comments

- Fundamentally, a multiple sector challenge
- All sectors stand to benefit; none can do it alone
- Better enables us to move forward efficiently and effectively
- Helps to establish a paradigm of constructive cooperation
- Extreme value; but requires all to accept and use as state-of-the-science analysis

“It is amazing what you can accomplish if you do not care who gets the credit.” Harry S Truman

The End