

# National Effort to Develop a Real-Time Mesoscale Analysis System

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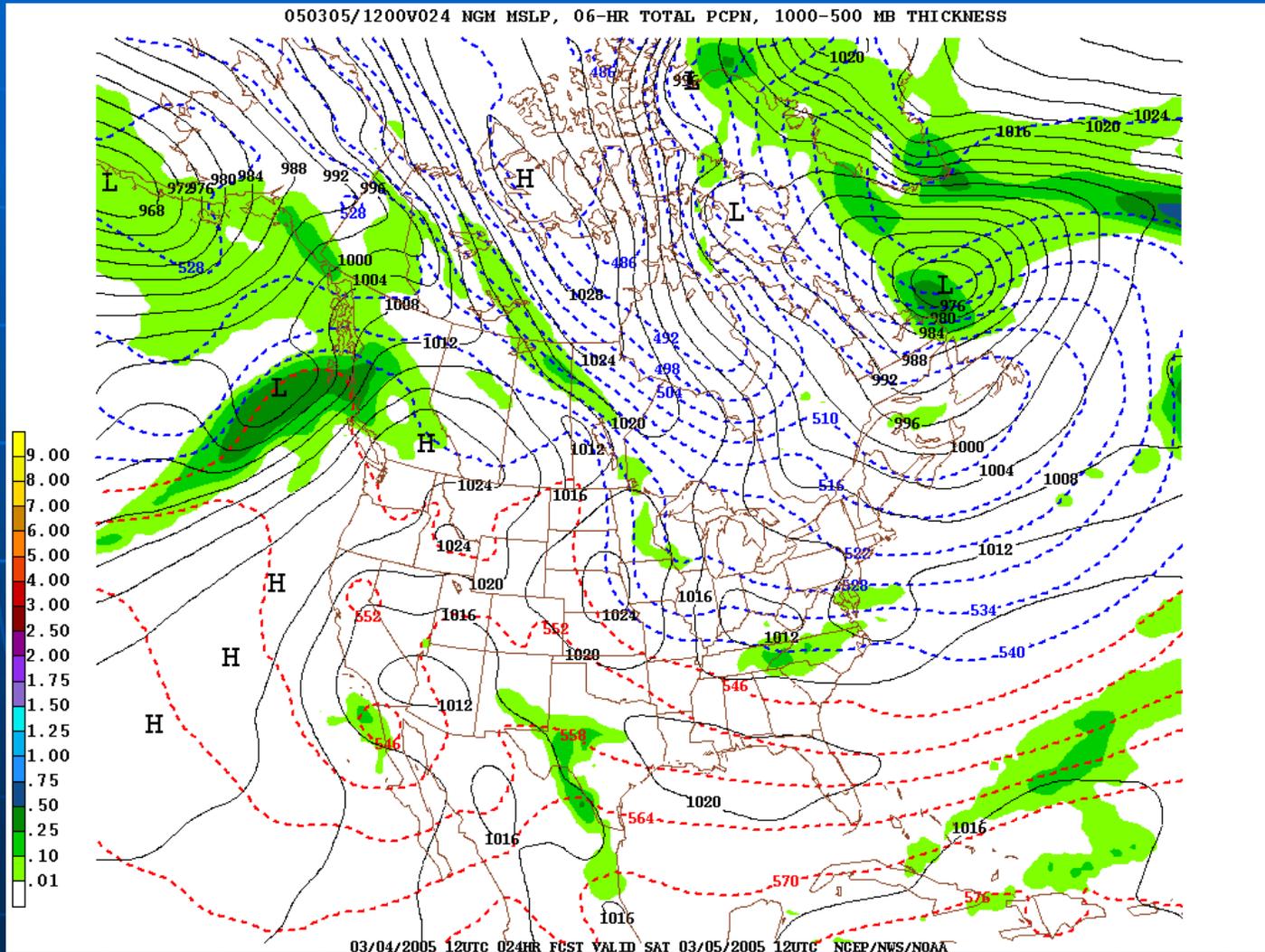
(Co-Chairs Mesoscale Analysis Committee, NWS Office of Science and Technology)

# Historical, established practices; for years...

- Public forecasts have been presented (and verified) with a broad brush, and a few specific point forecasts.
- NWP forecasts have been presented (and verified) with a synoptic UA and surface observing network.

**But, the ways we view weather have changed...**

# NWP Forecast from Yesteryear



# NWP Forecast for Today

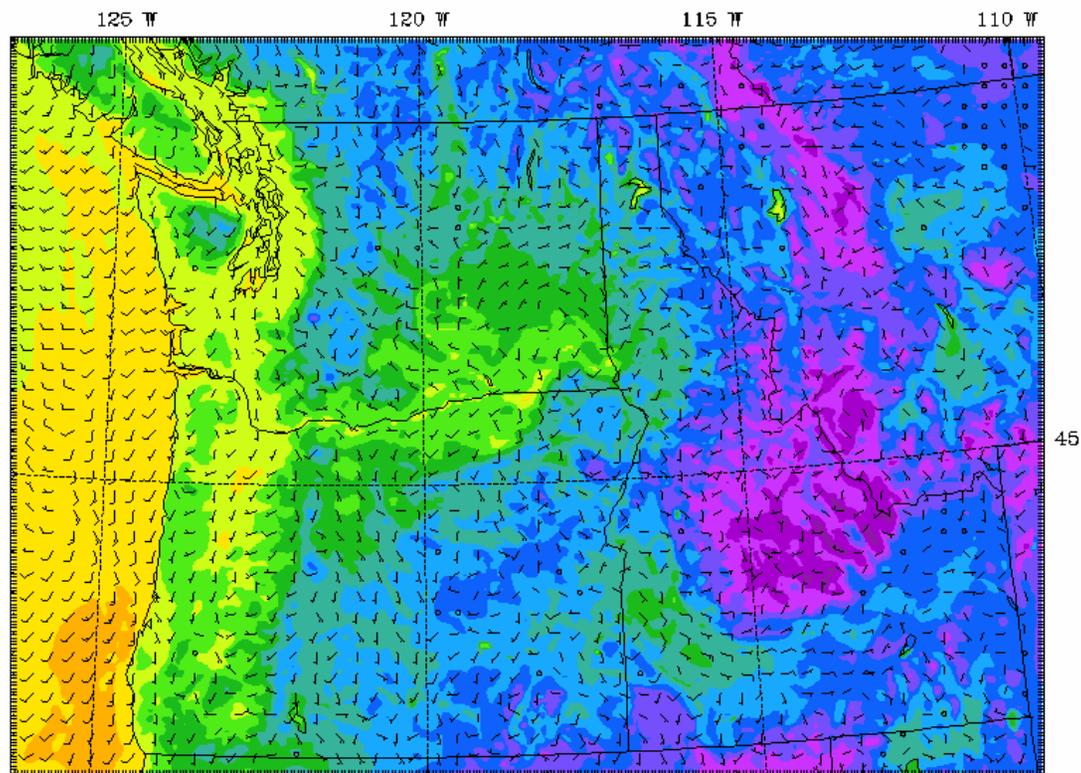
UW MM5-GFS 4km Domain

Init: 12 UTC Wed 02 Mar 05

Fcst: 48 h

Valid: 12 UTC Fri 04 Mar 05 (04 PST Fri 04 Mar 05)

2m Temperature (°F) ----- 10m Wind (full barb = 10kts)



BARB VECTORS: FULL BARB = 10 kts



Model info: V3.6.3 Kain-Frisch MRF PBL Reisner 2 4 km, 37 levels, 1 sec

# Public Forecast from Yesteryear

ZONE FORECAST PRODUCT FOR WASHINGTON  
NATIONAL WEATHER SERVICE SEATTLE WA  
415 AM PST FRI MAR 4 2005

EVERETT AND VICINITY-SEATTLE METROPOLITAN AREA-TACOMA AREA-  
415 AM PST FRI MAR 4 2005

.TODAY...PARTLY SUNNY. HIGHS IN THE 50S. SOUTH WIND AROUND 10 MPH  
SHIFTING TO THE SOUTHWEST THIS AFTERNOON.

.TONIGHT...PARTLY CLOUDY. LOWS IN THE MID 30S TO LOWER 40S. SOUTHWEST  
WIND TO 10 MPH.

.SATURDAY...PARTLY SUNNY. HIGHS IN THE MID 50S TO LOWER 60S. SOUTH  
WIND TO 10 MPH.

.SATURDAY NIGHT...MOSTLY CLOUDY. LOWS IN THE UPPER 30S TO MID 40S.  
SOUTH WIND TO 10 MPH.

.SUNDAY...MOSTLY SUNNY. HIGHS IN THE MID 50S TO LOWER 60S. SOUTHWEST  
WIND TO 10 MPH.

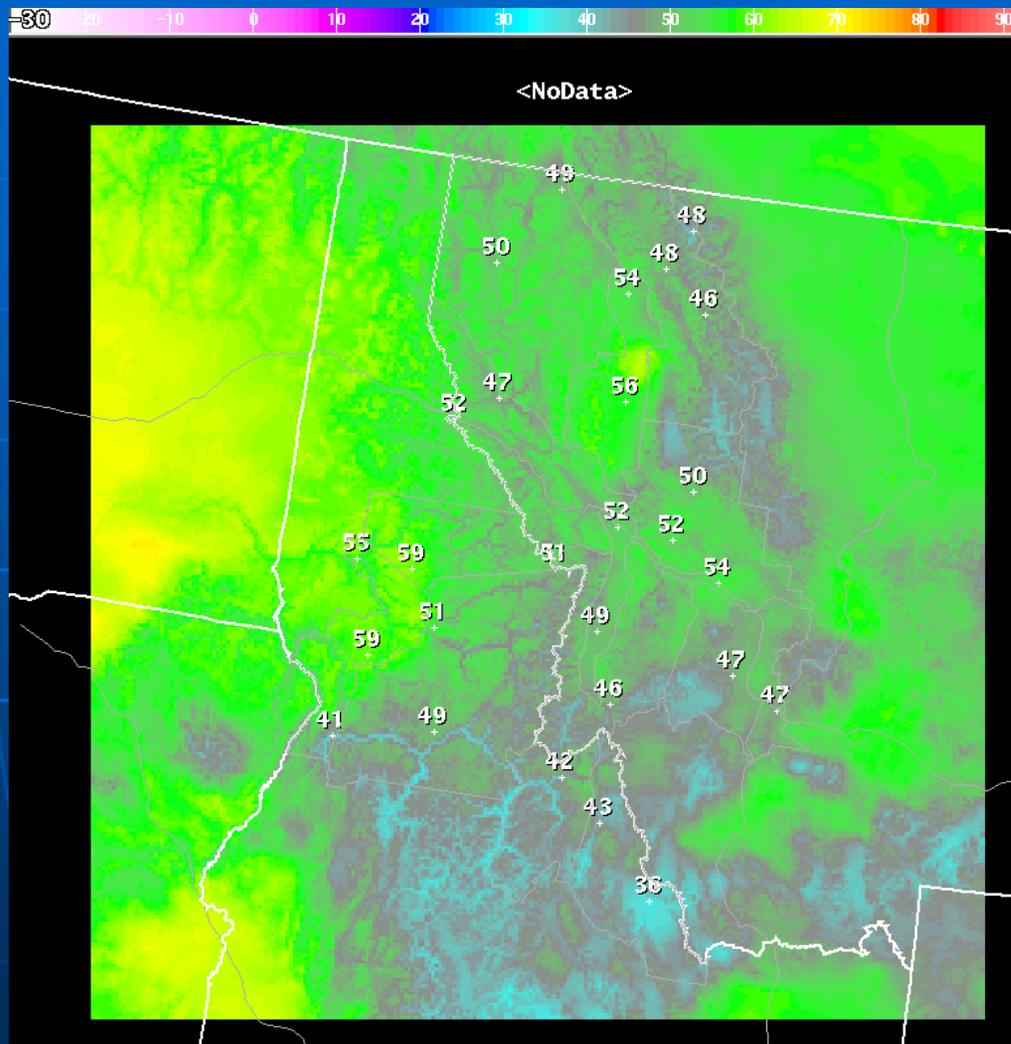
.SUNDAY NIGHT...MOSTLY CLEAR. LOWS NEAR 40.

.MONDAY AND MONDAY NIGHT...PARTLY CLOUDY. HIGHS NEAR 60. LOWS NEAR  
40.

.TUESDAY THROUGH THURSDAY...MOSTLY CLEAR. HIGHS IN THE 50S TO LOWER  
60S. LOWS IN THE MID 30S TO LOWER 40S.

	TEMPERATURE			/	PRECIPITATION		
EVERETT	54	42	55	/	10	10	10
SEATTLE	54	41	57	/	10	10	10
TACOMA	55	36	58	/	10	10	10

# Public Forecast for Today



MINIMUM TEMPERATURE FORECAST ON A 5-KM GRID

28  
SVNW1

26 26  
TSTEN STP40

23  
STG48

23  
STD43

22  
STB49

19  
ST552

20  
STT54

# Stevens Pass “Mesonet” -- an area equivalent to an MM5 4-km grid box or the NWS NDFD

- 2 Jan 2005, 0000 UTC (Mark Albright)
- The sites are:
  - svnw1 - snotel north of highway 4100 ft
  - RWIS along highway 4000 ft
  - NWAC near highway 4000 ft
  - NWAC Grace Lakes 4800 ft
  - NWAC Brooks Chair 4900 ft
  - NWAC Skyline Express Chair 5200 ft
  - NWAC Daisy Chair 4300 ft
  - NWAC Tye Mill Chair 5400 ft

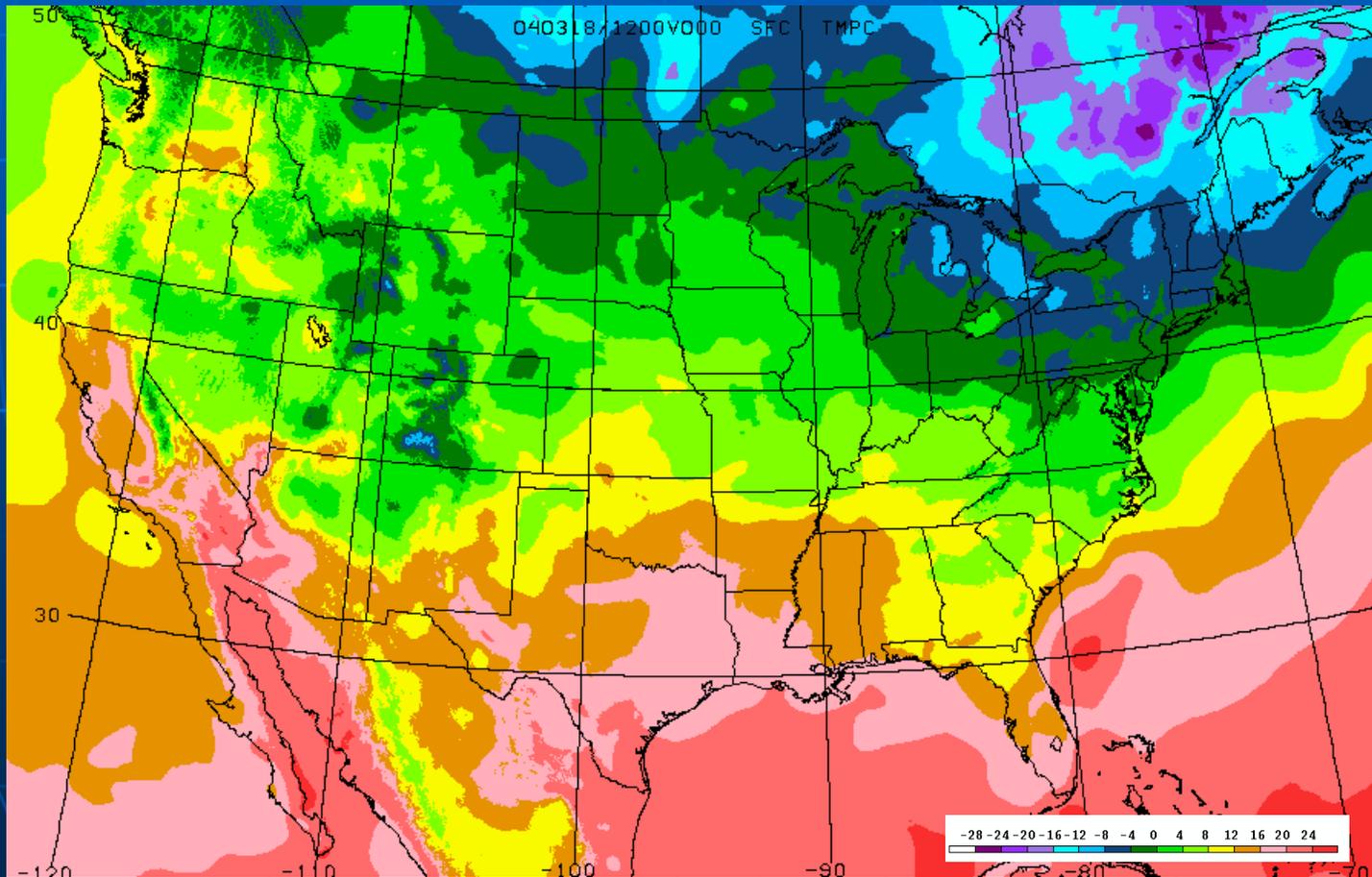
# How Can we Assess the NDFD Without a System-Compatible Analysis?

- What does a forecast on a 5-km grid represent? (MM5 or NDFD)
- What temporal and spatial scales are realistically captured?
- How do we verify gridded forecasts?
- How do we assess the quality of gridded analyses?

# Context -- What is truth?

- The NWS has a critical and immediate need to produce real-time and retrospective analyses at high resolution to help create and verify gridded forecasts
- Admiral Lautenbacher *"Observations alone are often meaningless without the actions that provide economic and societal benefit."*
- A comprehensive weather and climate observing and modeling system requires the integration and synthesis of observations into gridded analyses

**Analysis of Record (AOR):** The best possible, state-of-the-science analysis of the atmosphere at high spatial and temporal resolution with particular attention placed on weather and climate conditions near the surface. Including spatially and temporally varying estimates of uncertainty.



# Needs for AOR

- NWS gridded forecasts (preparation and verification)
- Mesoscale modeling
- Dispersion modeling for transport of hazardous materials and pollutants
- Homeland defense
- Aviation and surface transportation
- Environmental issues from coastal zone to fire management
- Impacts of climate change on regional scale

# A Community Meeting on Real-time and Retrospective Mesoscale Objective Analysis: An Analysis of Record Summit

June 2004

Co-chairs: Brad Colman and John Horel

- Can research and operations work together to define approaches for an AOR?
- Are there clearly definable requirements and objectives?
- Can we make a compelling business case to fund the R&D, testing, and implementation?

# Issues

- Real time vs. retrospective needs
- How can AOR resolve detailed microclimates, synoptic and mesoscale weather & localized severe weather
- NDFD verification needs vs. other needs
- 2-dimensional surface analysis approaches, statistical & dynamical downscaling vs. 3-dimensional data assimilation strategies
- How can the biases of underlying modeling system be minimized
- How can uncertainty be quantified and expressed to the end user
- What is possible now vs. what might be possible in a few years

# Recommendations from Summit

- **Proceed rapidly to foster AOR program that meets diverse needs for high spatial and temporal resolution mesoscale analyses**
- **AOR program should lead to suite of consistent products:**
  - Provisional mesoscale analyses available within roughly 30 minutes of the valid time
  - Mesoscale analyses completed a day or so after the valid time
  - “Gold standard” AOR would be an archive-quality analysis/reanalysis
- **Community support for an AOR project must be broadened**
- **Ongoing research and development efforts supported by other programs are critical to the future success of the AOR program:**
  - WRF R&D
  - COOP modernization
- **Mesoscale Analysis Committee (MAC) should be formed that reports to the Director of the NWS Office of Science and Technology**

## Prototype Real Time Mesoscale Analysis (RTMA):

- Available hourly, within 30 min of valid time
- T, Td, wind, precipitation, and sky
- Prototype products on NDFD 5-km grid (available for testing by WFOs and others within 6 months)
- GFS/Eta model used for initial and lateral boundary conditions for hourly 13 km RUC
- FSL will modify RUC postprocessing to downscale RUC to 5 km grid
- EMC will continue development and implementation of 2DVAR for temperature, moisture, and wind
- Quality assurance efforts will include cross validation and estimate of analysis uncertainty
- Separate univariate analyses for QPE and sky cover; OHD and NESDIS leading efforts

# GOES Effective Cloud Amount (ECA)

