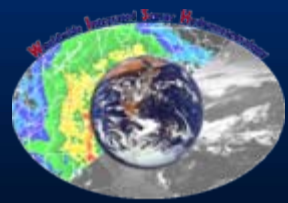
National Mosaic and Quantitative Precipitation Estimation Project (NMQ)

Ken Howard, Dr. Jian Zhang, and Steve Vasiloff

National Severe Storms Laboratory

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.



Strategic Partnerships

Federal Aviation Administration

Convective Weather PDT

Chuck Dempsey, Jason Wilhite and Dr. Robert Maddox

SRP, Salt River Project, Tempe, AZ, USA

Dr. Paul Chiou, Dr. Chia Rong Chen, and Dr. Pao-Liang Chang

Central Weather Bureau, Taipei, Taiwan

Weather Decision Technologies, Norman, Oklahoma, USA

Scientific Collaborators

Mike Smith, George Smith, Feng Ding, Chandra Kondragunta, Jon Roe, and Gary Carter

NWS, Office of Hydrological Development

Dr. Marty Ralph and Dr. Dave Kingsmill

NOAA, Environmental Technology Laboratory

Andy Edman and Kevin Warner

NWS, Western Region Headquarters

Arthur Henkel

California-Nevada RFC

Dr. Thomas Graziano and Mary Mullusky

NWS Office of Climate, Water, and Weather Services

Steve Hunter

USGS, Bureau of Reclamation

Dr. Robert Kuligowski

NOAA National Environmental Satellite, Data and Information Service

Dr. Curtis Marshall

NOAA National Center for Environmental Prediction

What is NMQ?

- The National Mosaic and QPE (NMQ) project is a collaborative initiative between NSSL, FAA, NCEP and the NWS/Office of Hydrologic Development (OHD) and the NWS/Office of Climate, Water, and Weather Services (OCWWS) to address (among others) the pressing need for
  - high-resolution national 3-D radar mosaics for atmospheric data assimilation and severe weather identification and prediction
  - multi sensor QPE and short term QPF for all seasons, regions, and terrains in support of operational hydrometeorological products and distributed hydro modeling
  - facilitating efficient and timely research to operations infusion of hydro meteorological applications and products

Objectives of NMQ

- Maintain a scientifically sound, physically realistic real-time system to develop and test techniques and methodologies for physically realistic high-resolution rendering of hydrometeorological and meteorological processes
- Create the infrastructure for community-wide research and development (R&D) of hydrometeorological applications in support of monitoring and prediction of freshwater resources in the U.S. across a wide range of space-time scales
- Through the NMQ infrastructure, facilitate community-wide collaborative R&D and research-to-operations (RTO) of new applications, techniques and approaches to precipitation estimation (QPE), short-range precipitation forecasting (QPF), and severe weather monitoring and prediction
- Establish a ‘real time’ CONUS 3-D radar data base for model assimilation

NMQ System Network Location

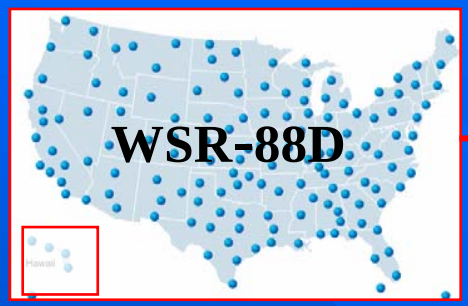
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

NMQ_xrt Processing System

Radar Data Sources

Polar Processing

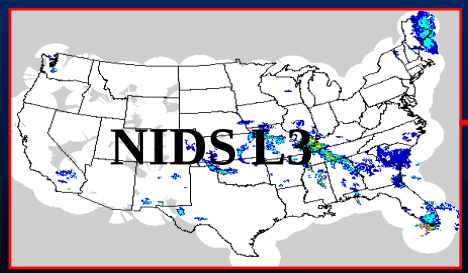
Product Generation



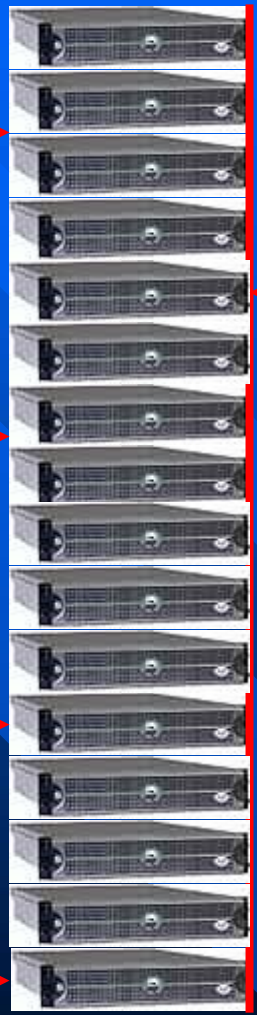
LDM

LDM

LDM



FTP



60 cpu 18 TB

Verification Server

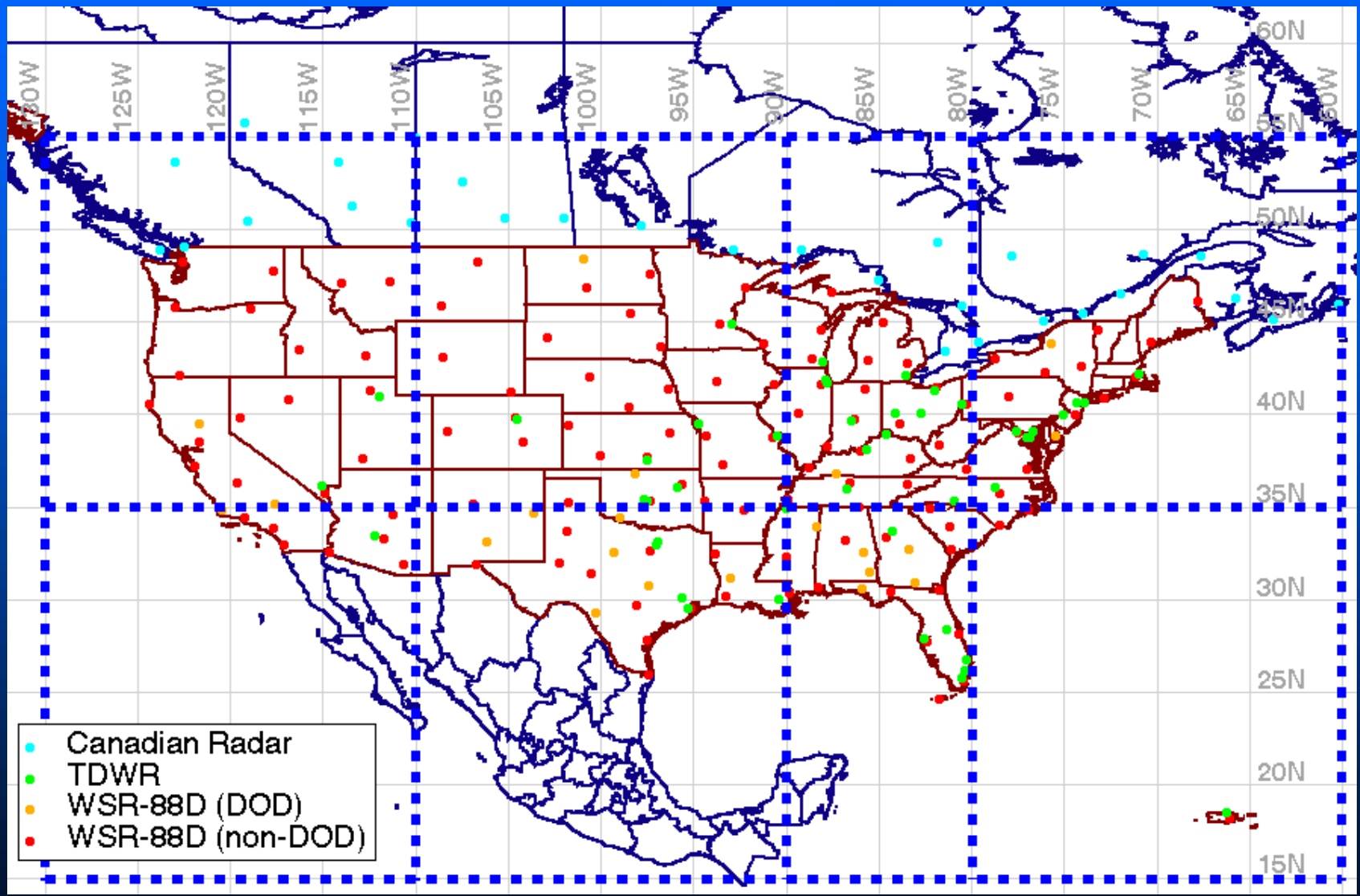
Mosaic Servers

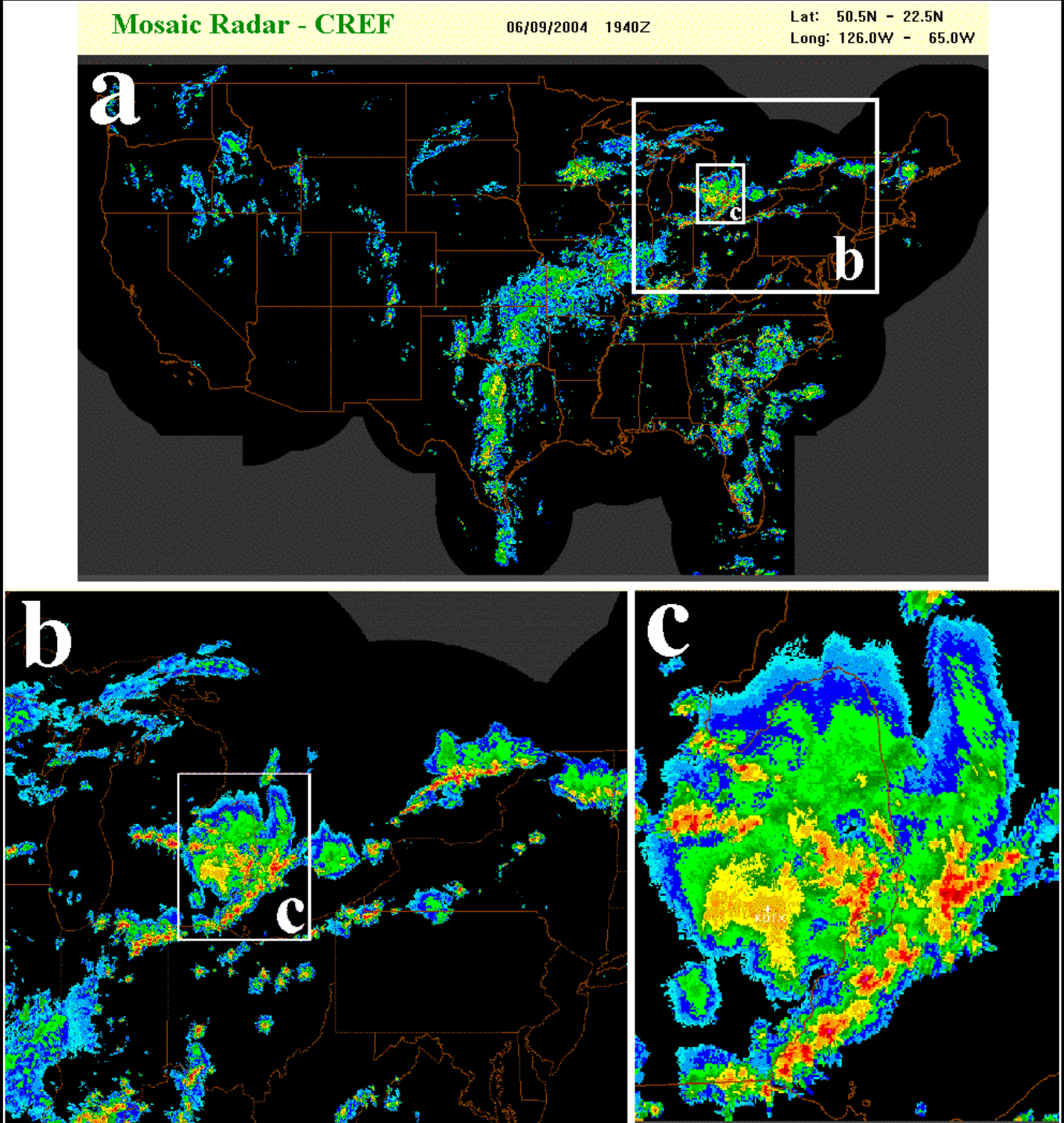
Q2 Servers

NOAA Port

External Data Ingest

NMQ_xrt Computational Tiles





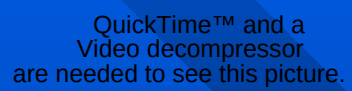
NMQ_XRT
CONUS
3-D Mosaic

Current
124+ Radars
1 km x 1 km x 500m
21 vertical levels
5 min updates cycle

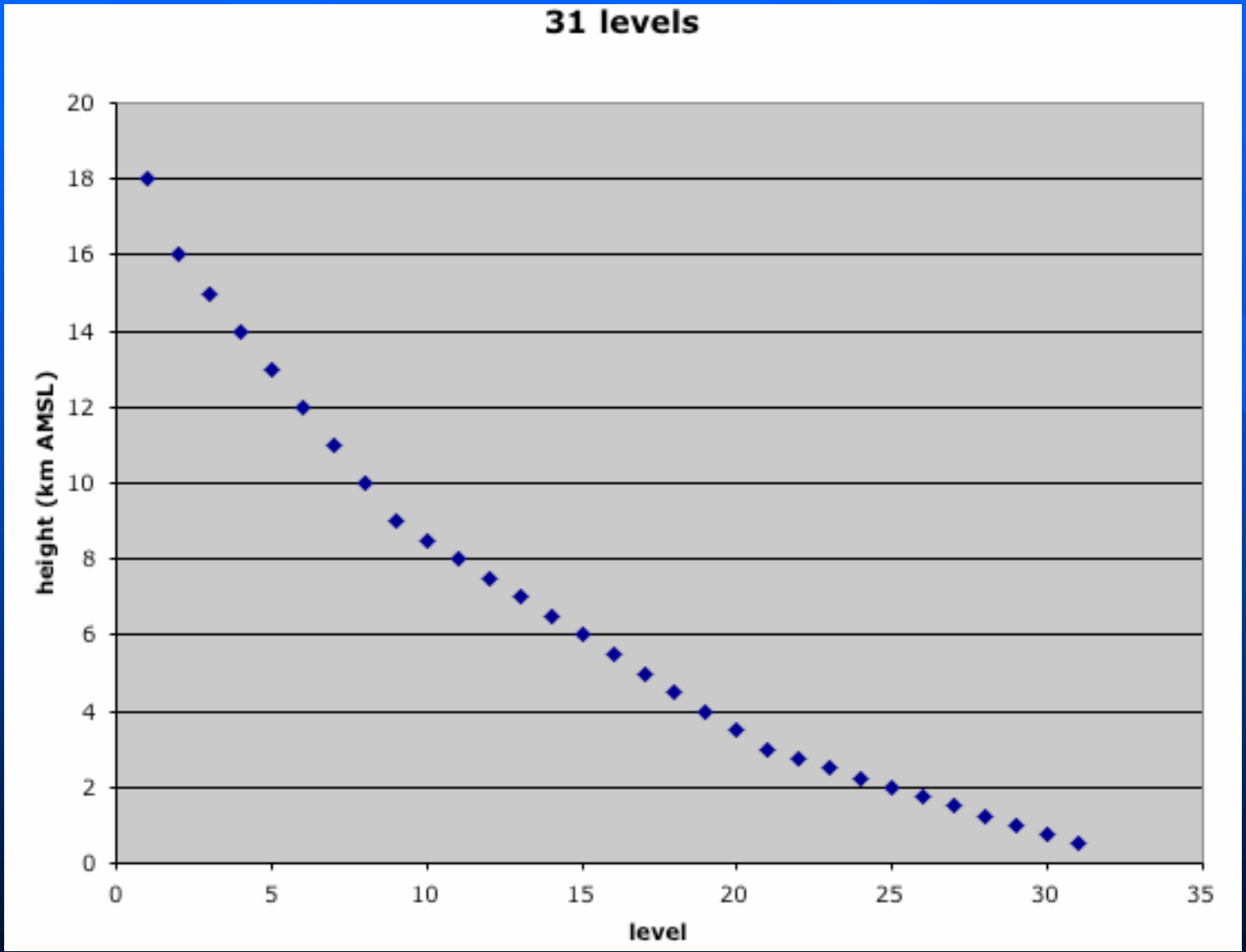
Fall 2005
135+ Radars
1 km x 1 km x 200m
31 vertical levels
<5 min update cycle

Summer 2006
155+ Radars
250x250 meter km x
131 vertical levels
<5 min update cycle

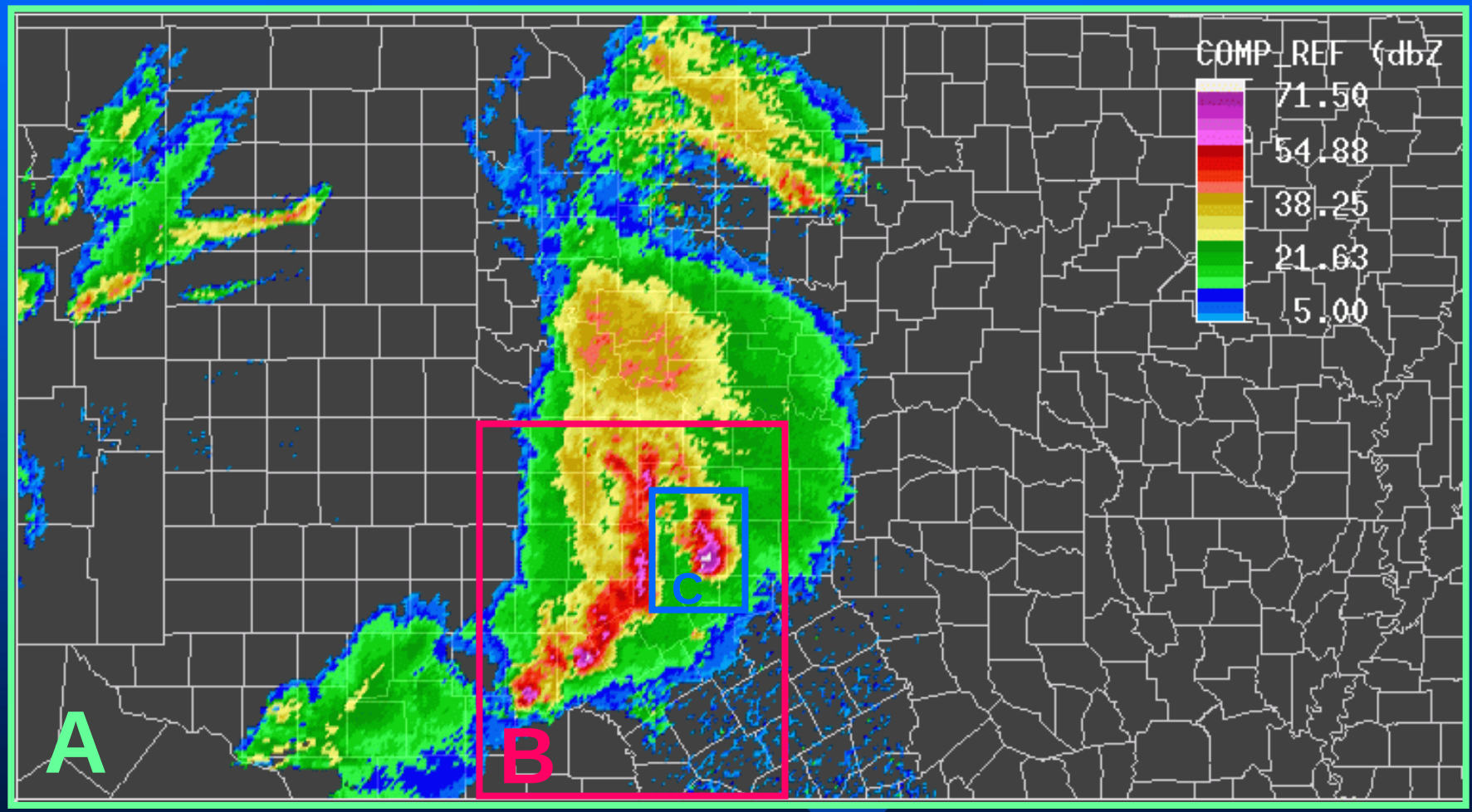
NMQ_xrt Conus CREF



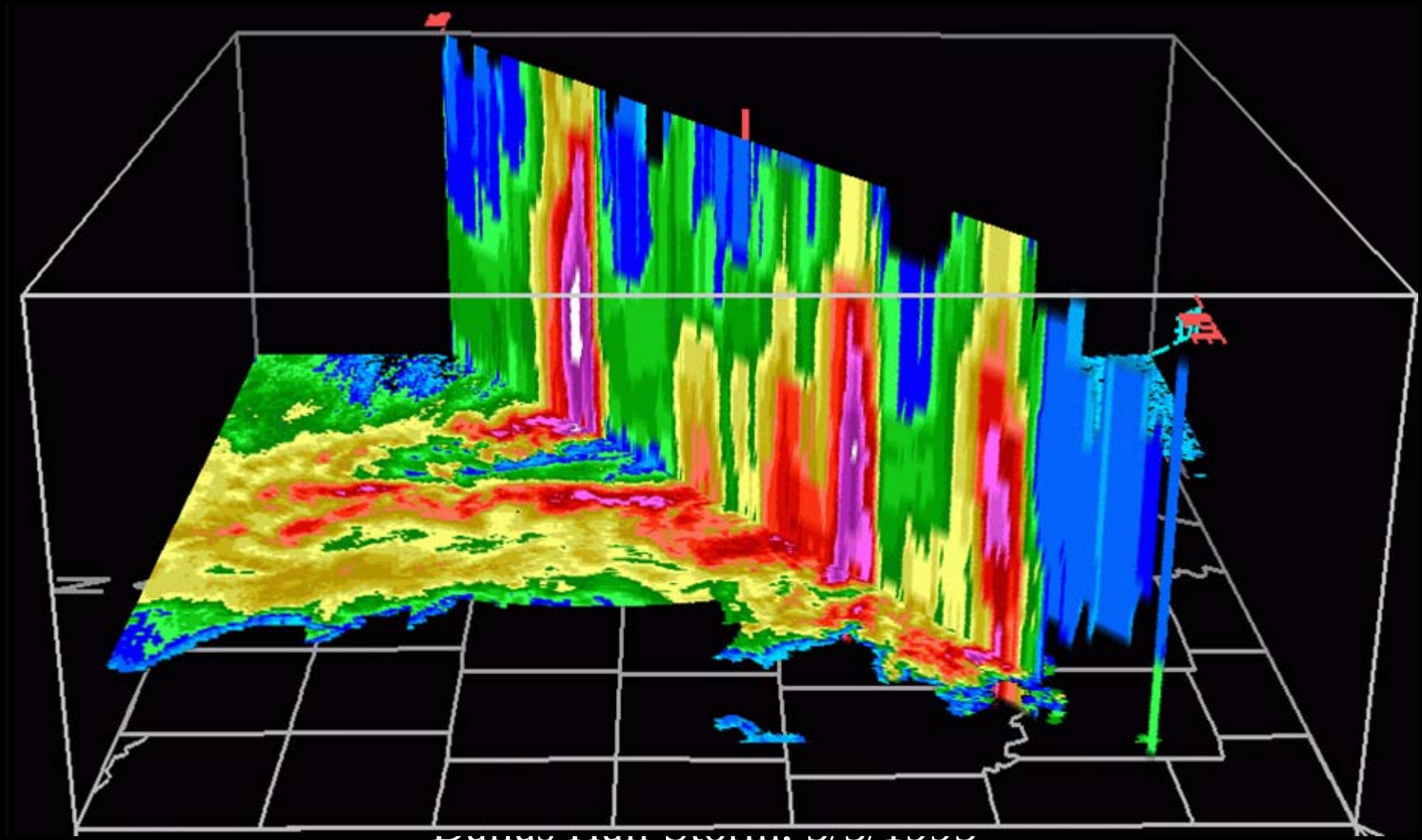
NMQ Vertical Levels



NMQ 2D Mosaic



Cross Sections from NMQ 3-D Mosaic



Dallas Hail Storm, 5/5/1995

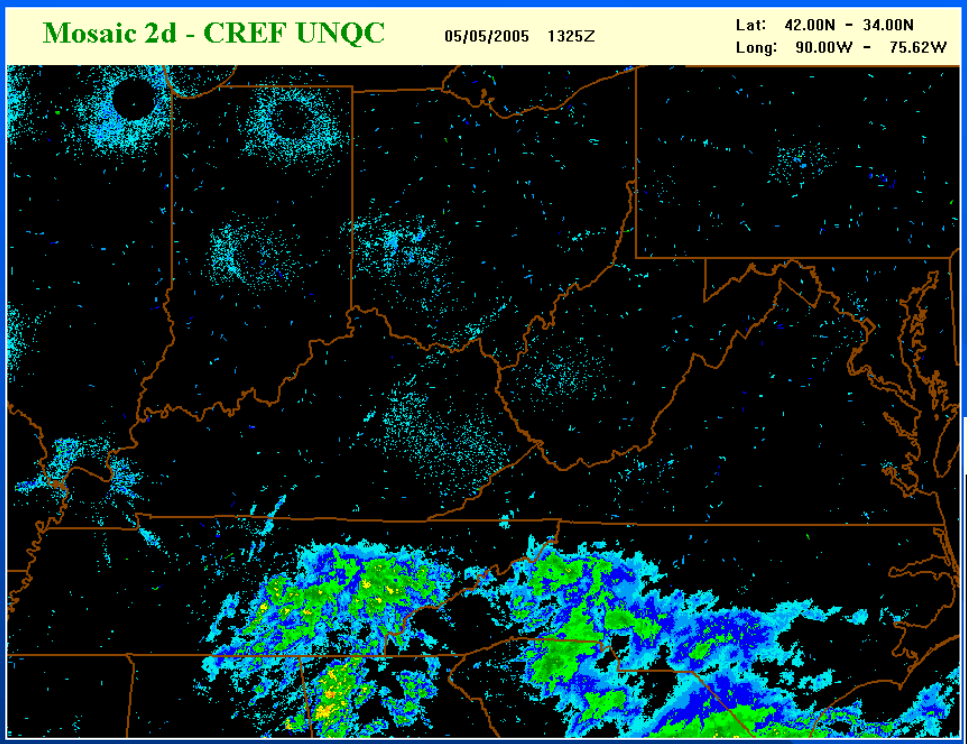
Vertical Cross Section Loop (W-E)

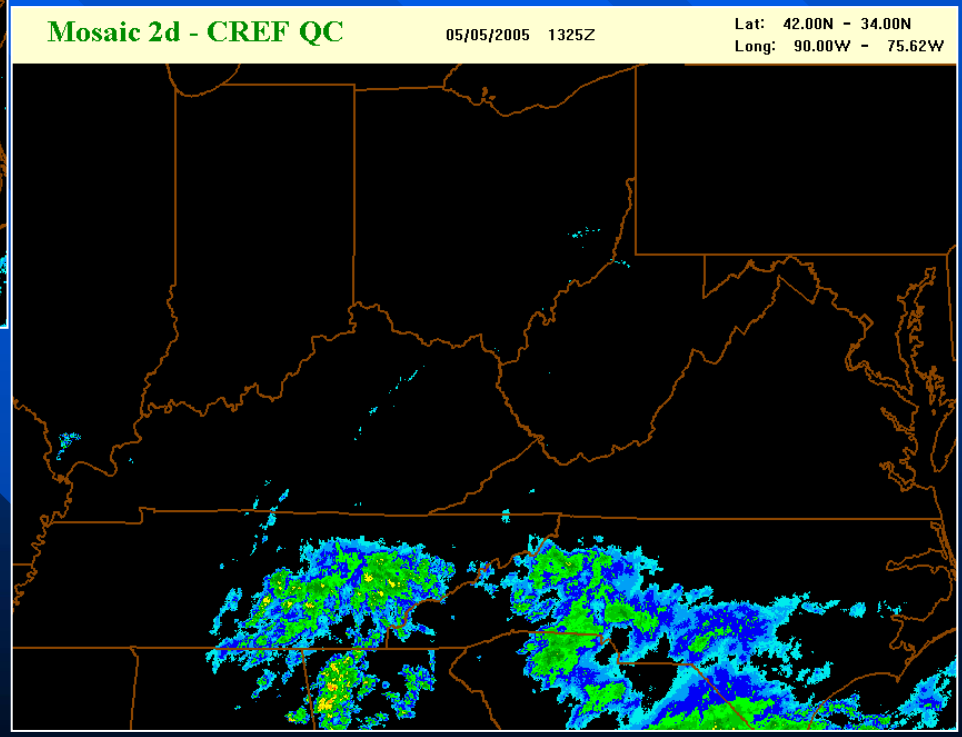
Horizontal Cross Section Loop

Reflectivity QC

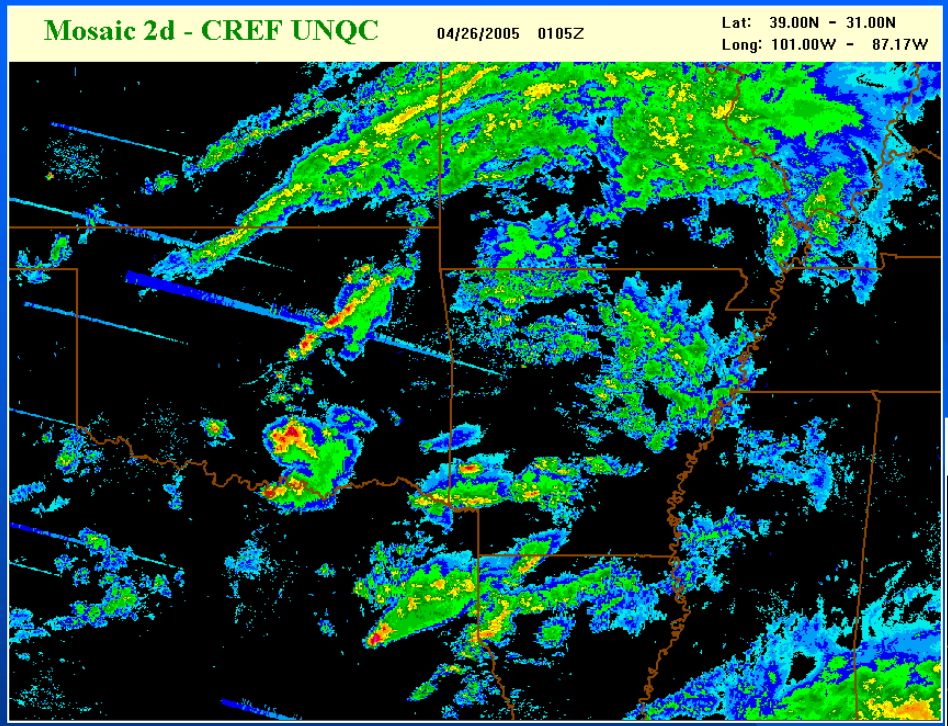
- Noise filter
  - Remove speckles
- Sunbeam filter
  - Remove sun strobe echoes
- Vertical reflectivity gradient check
  - Remove AP and clear air echoes
- Satellite mask
  - Remove AP, deep clear air echoes, and chaff

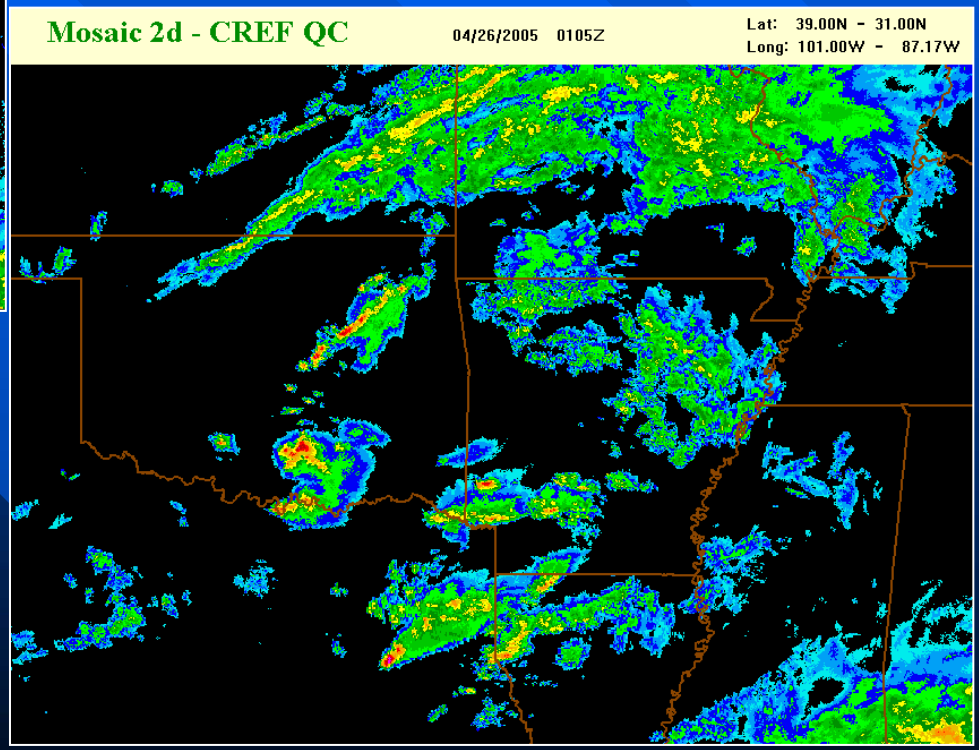
Noise Filter



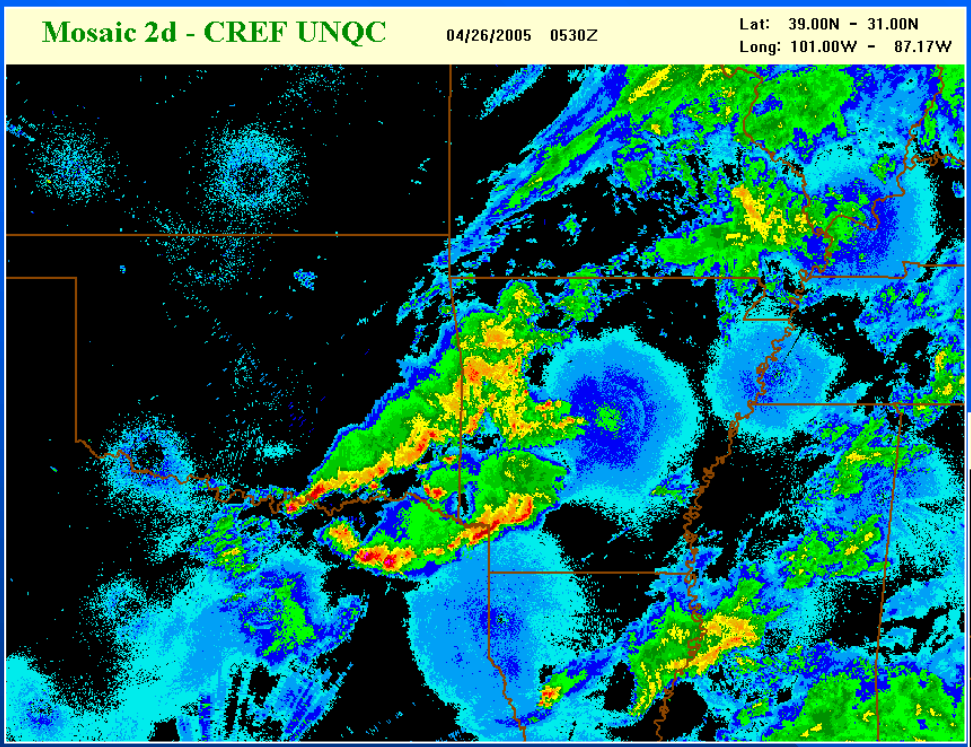


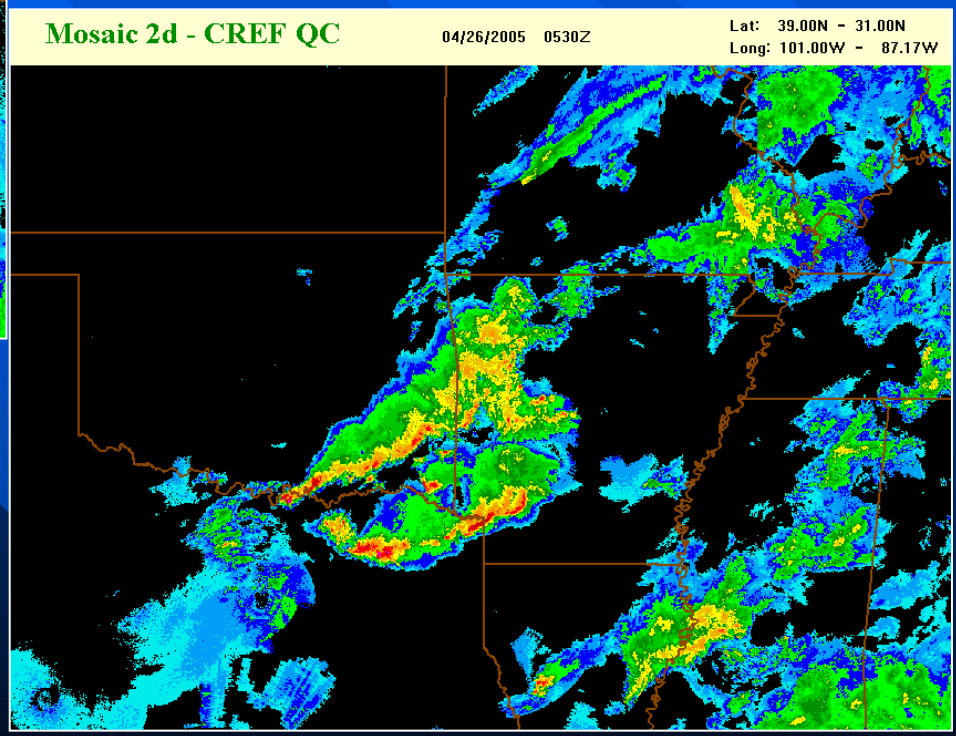
Sunbeam Filter





AP and Clear Air (biological)

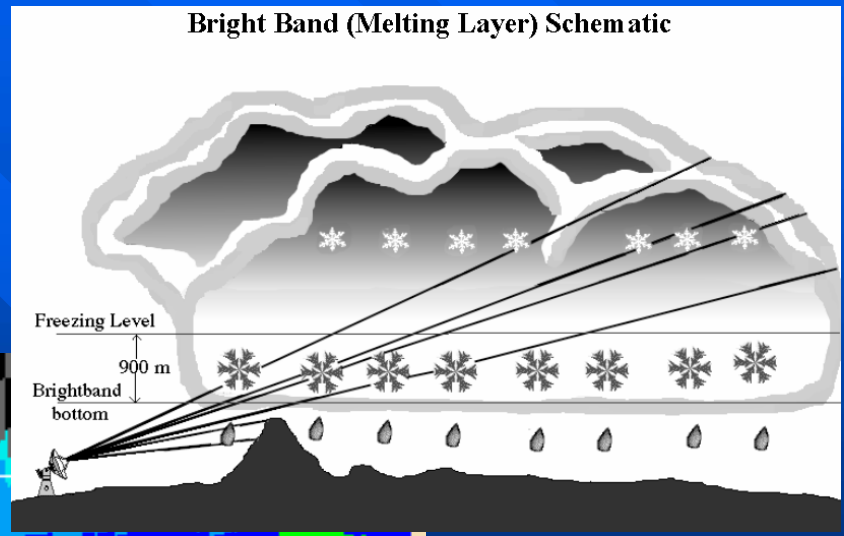


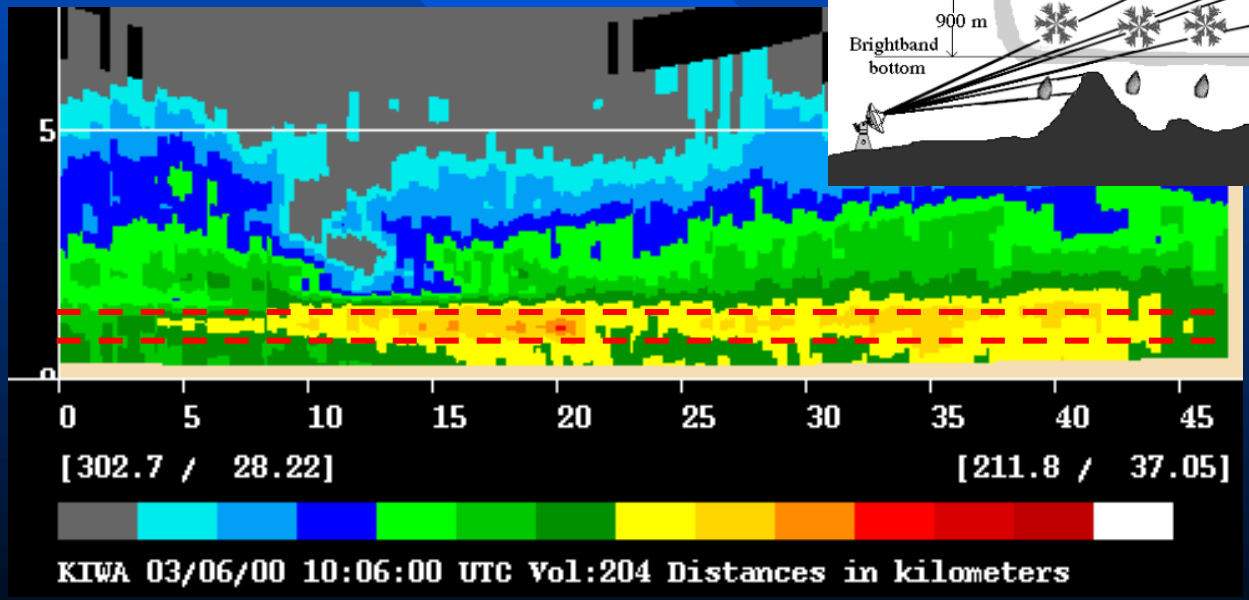


Bright-Band Identification (BBID)

(Gourley and Calvert, 2003)

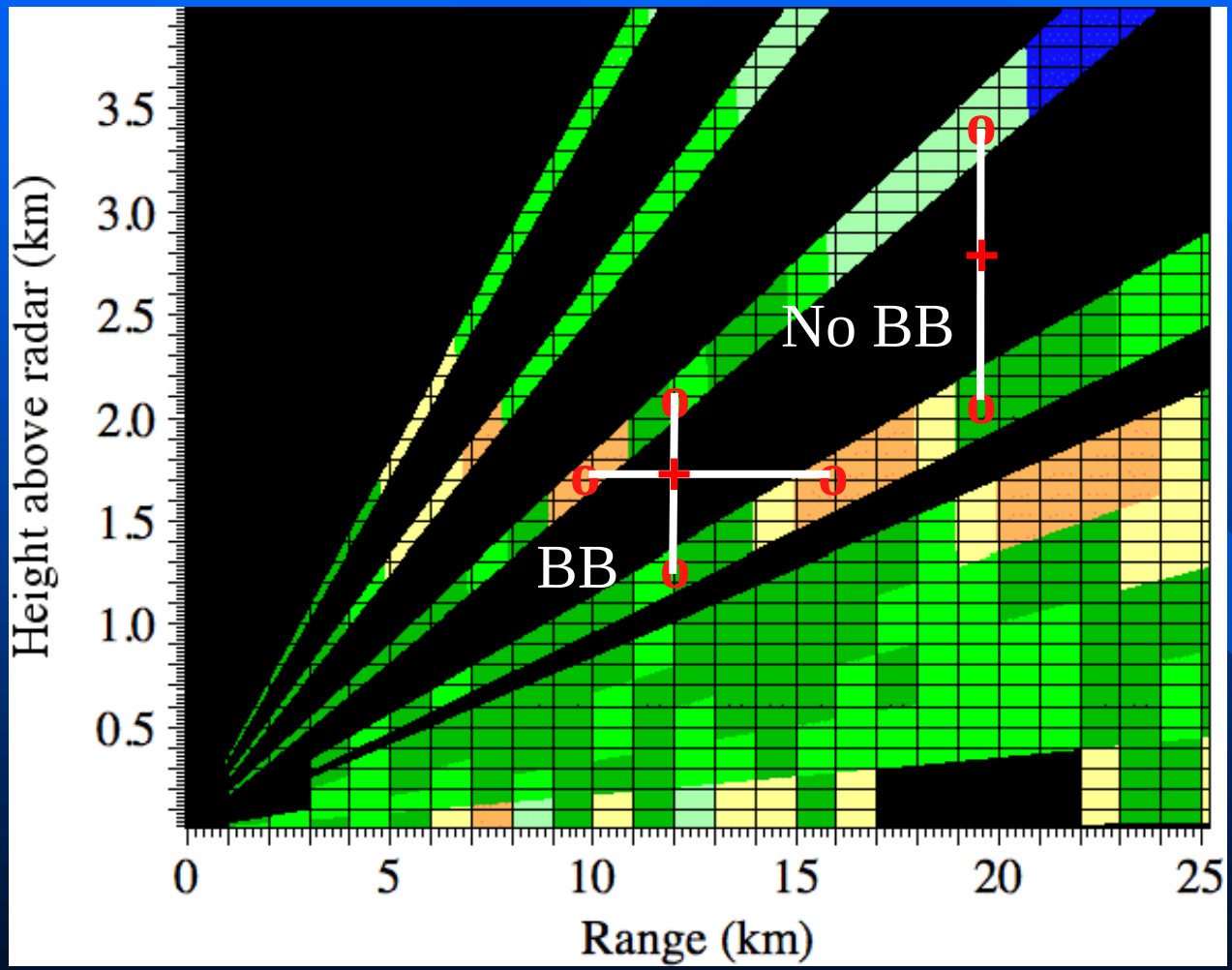
- BB info will impact choice of objective analysis methods
- BBID steps:
  - 3-D Reflectivity Field
  - Find Layer of Higher Reflectivity
  - Vertical Reflectivity Gradient
  - Spatial/Temporal Continuity





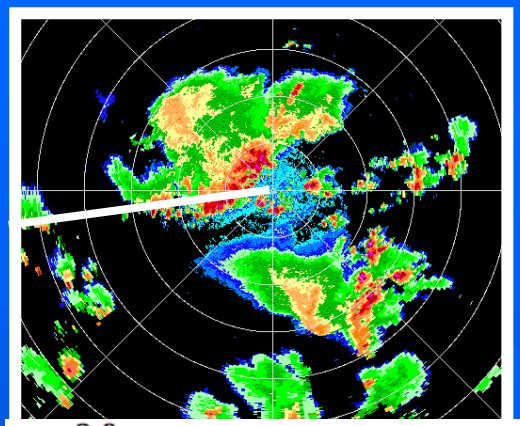
3-D Spherical to Cartesian Transformation

(Zhang et al. 2003)

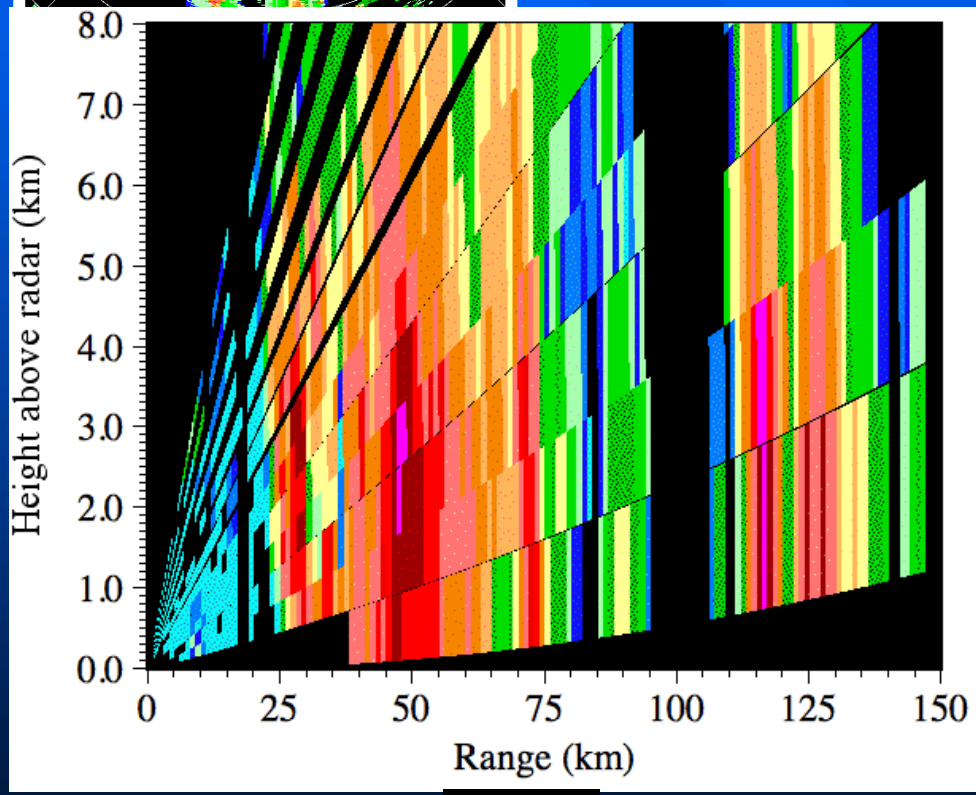


No BB:
Vertical linear interpolation

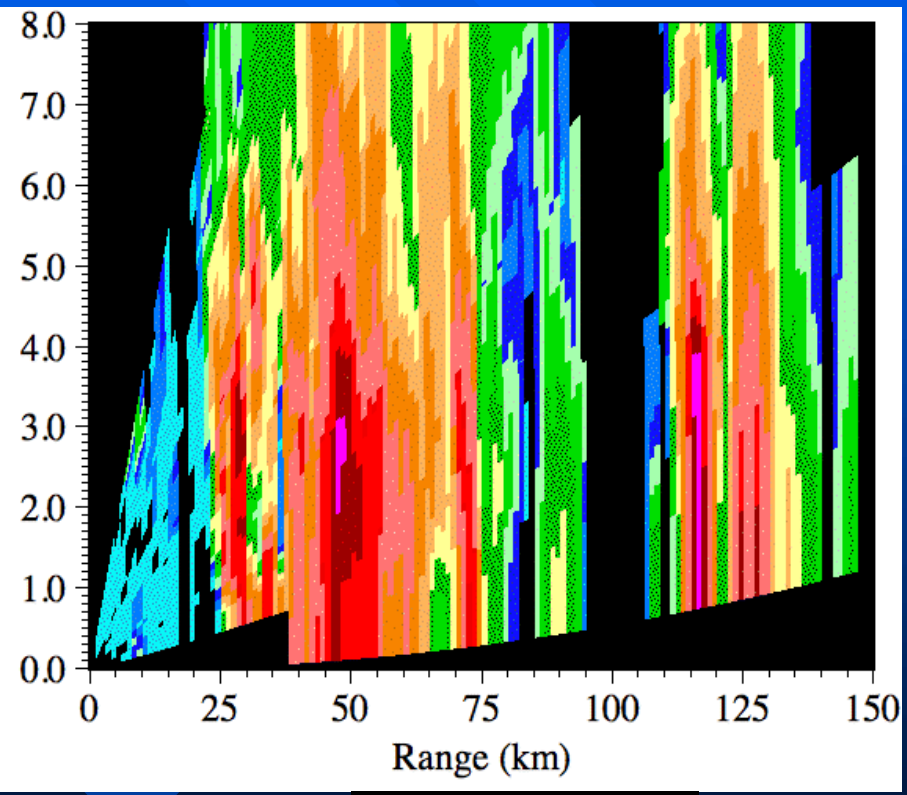
BB exists:
Vertical and horizontal linear interpolation



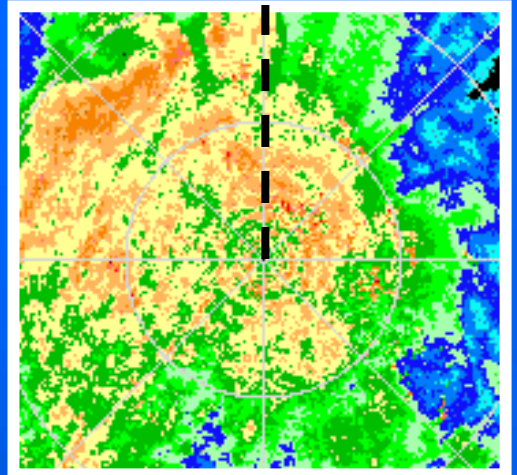
Convective Case1: RHI, 263°



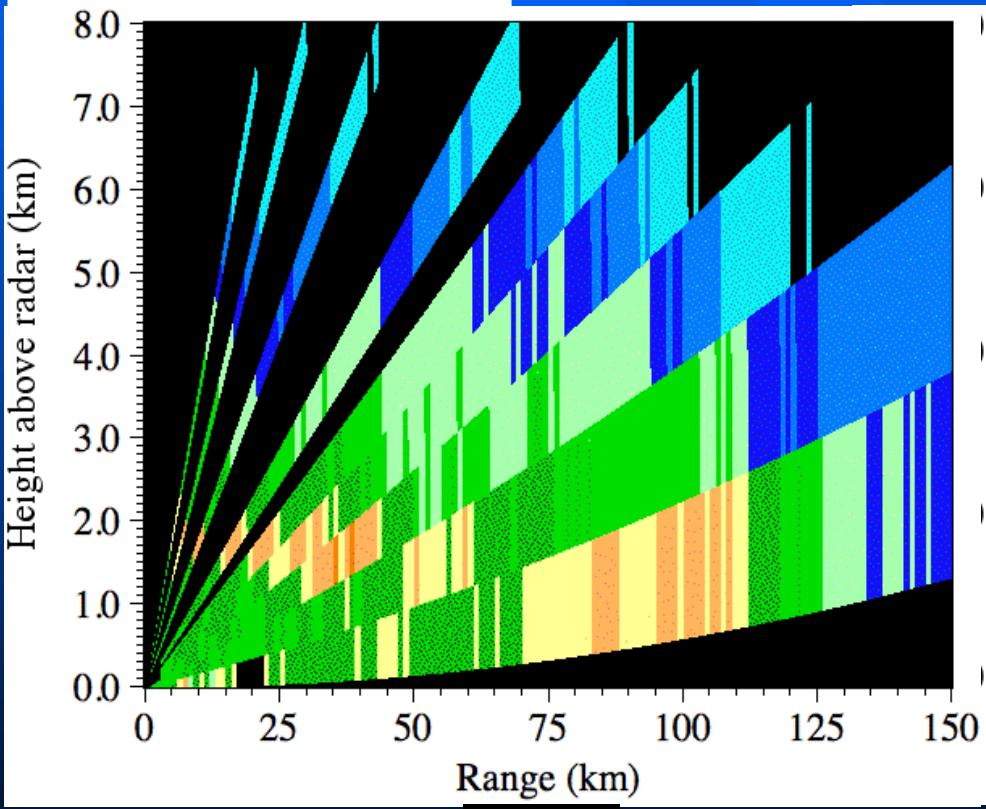
Raw



Interpolated



Stratiform Case 2: RHI, 0°



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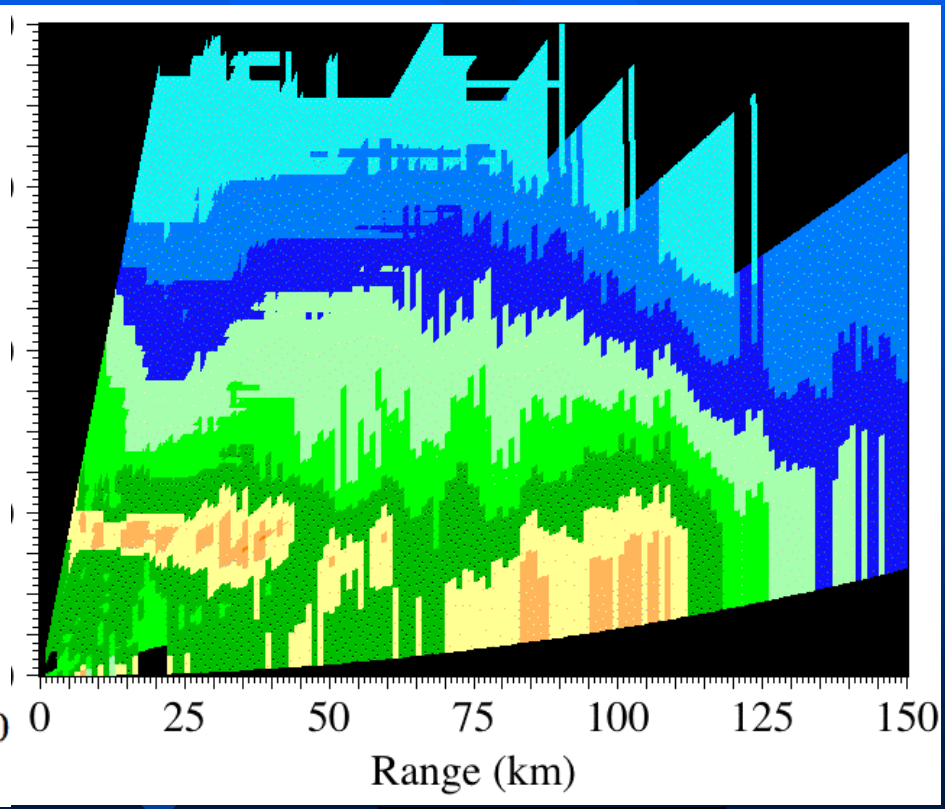
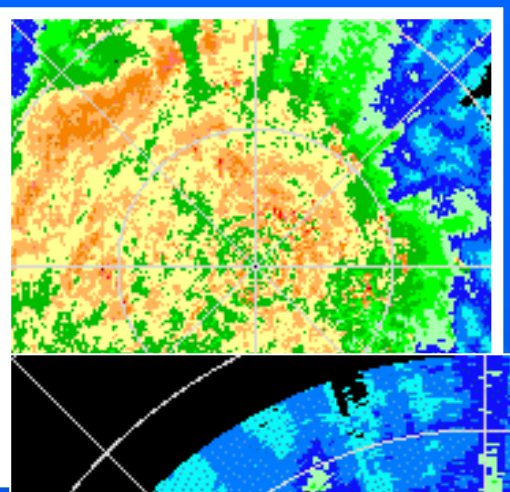
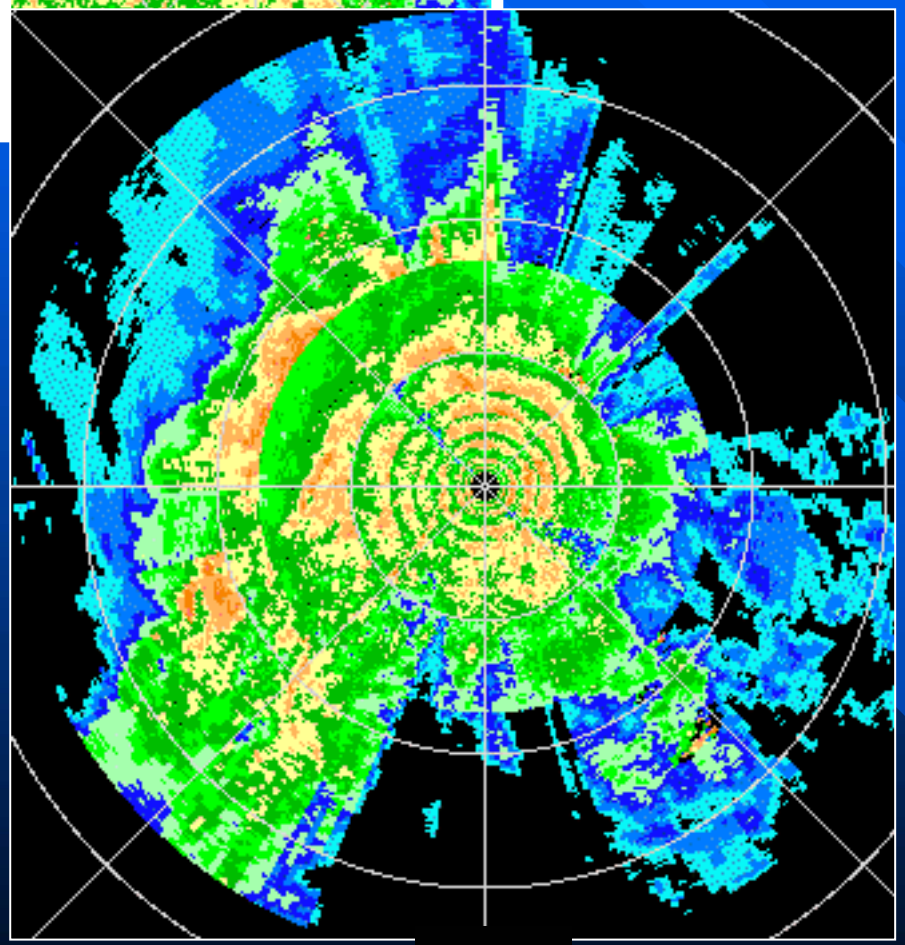


Interpolated

Stratiform Case

CAPPI at 2.3km





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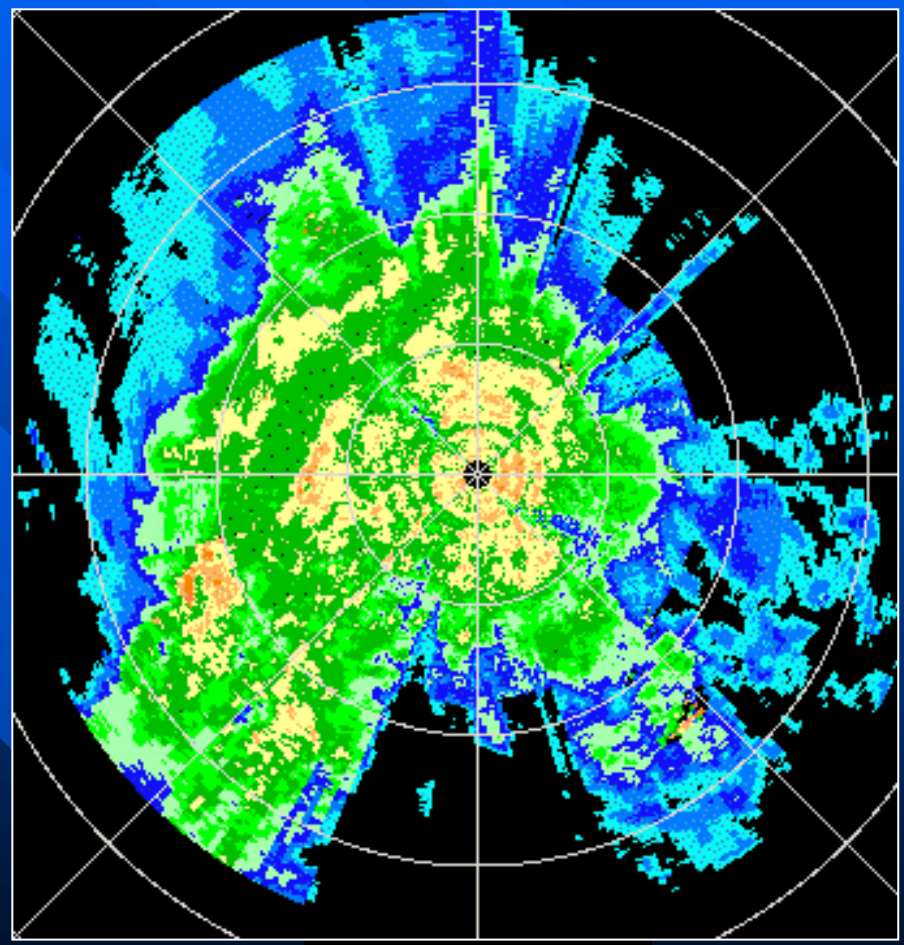
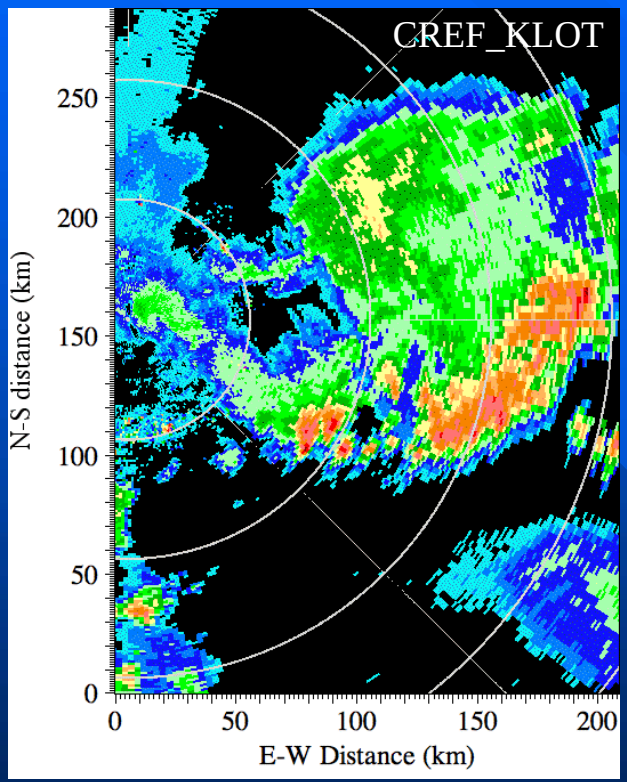
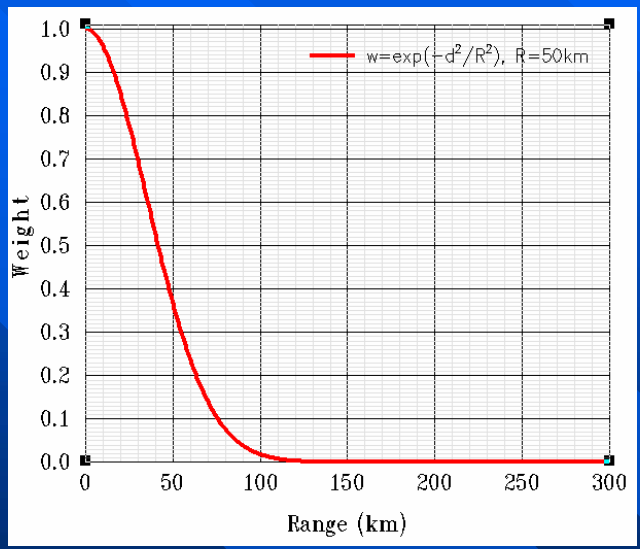
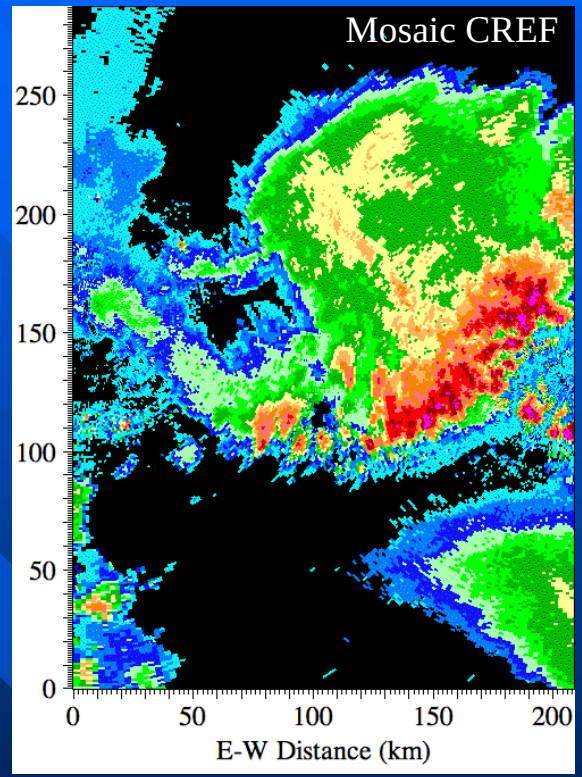


Interpolated

Distance Weighting



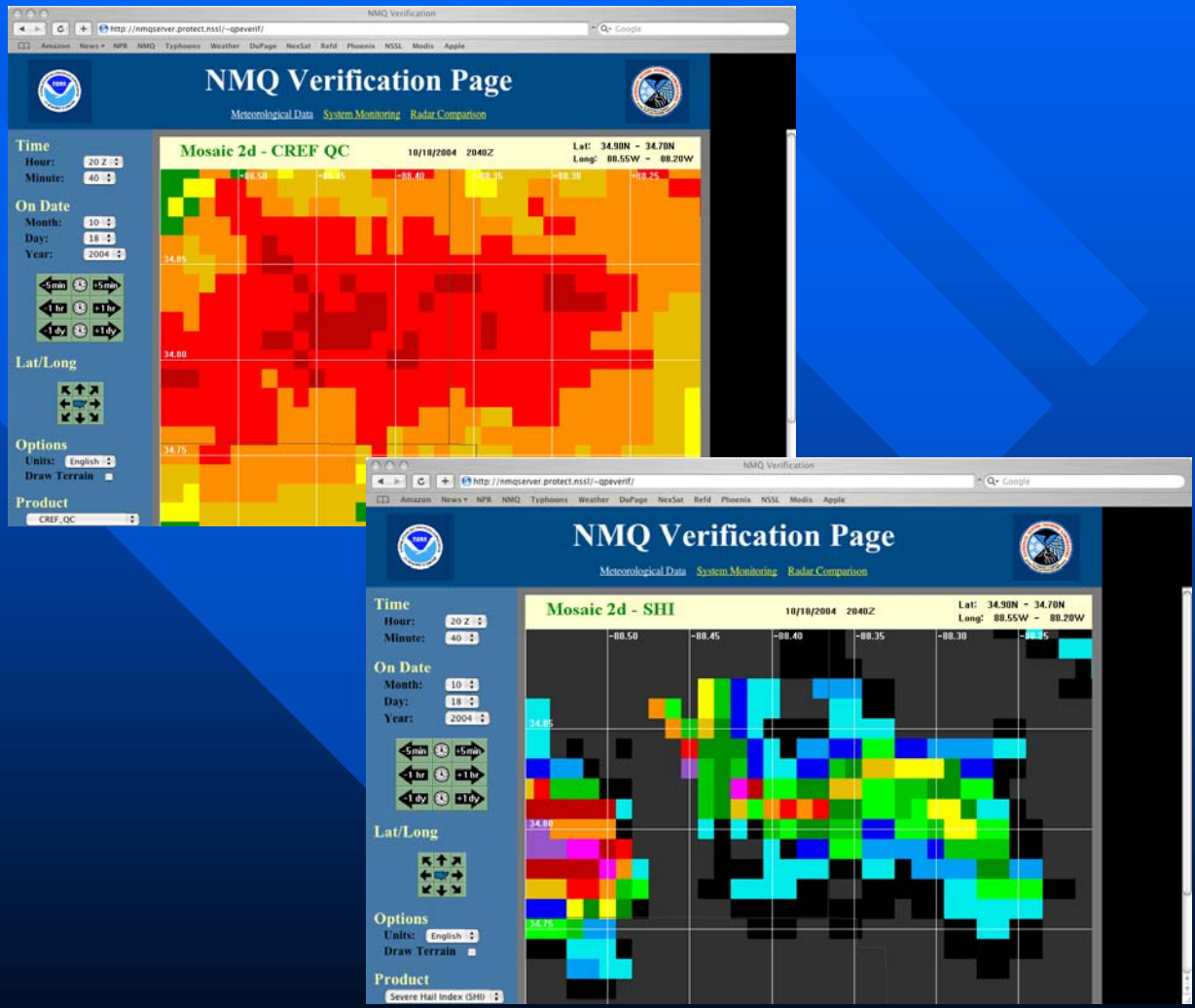




NMQ 2 D Products

(QC'd, UnQc'd, VPR corrected)

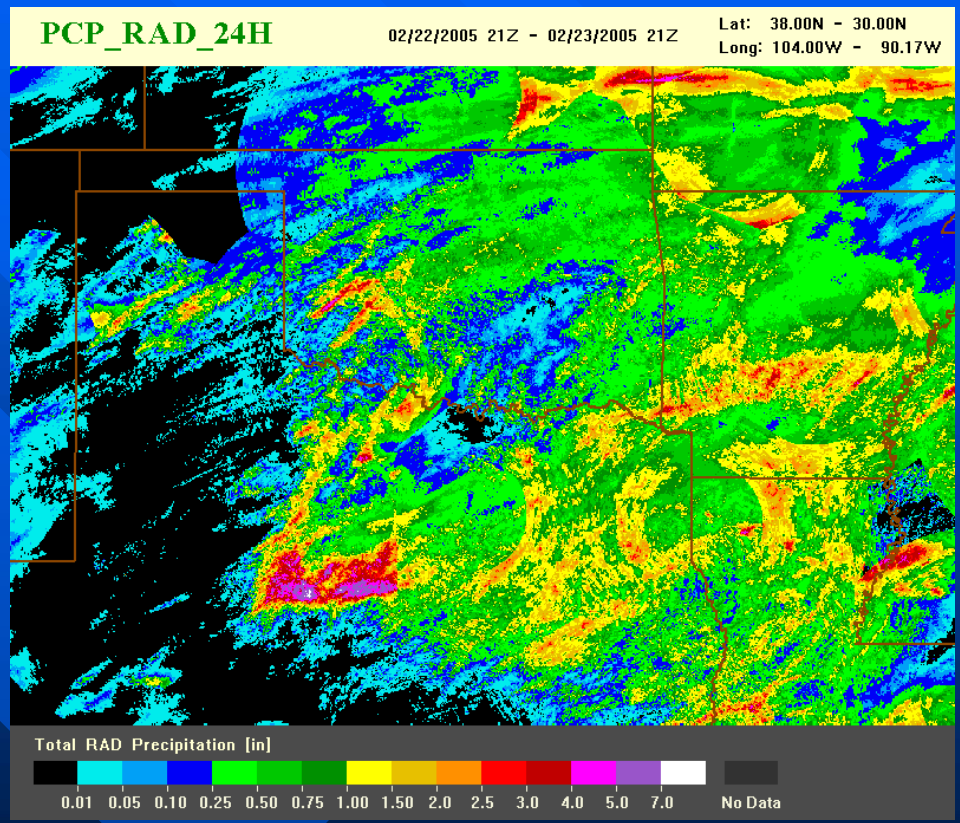
- CREF
- HREF
- VIL
- HIS
- Echo top
- Max hght



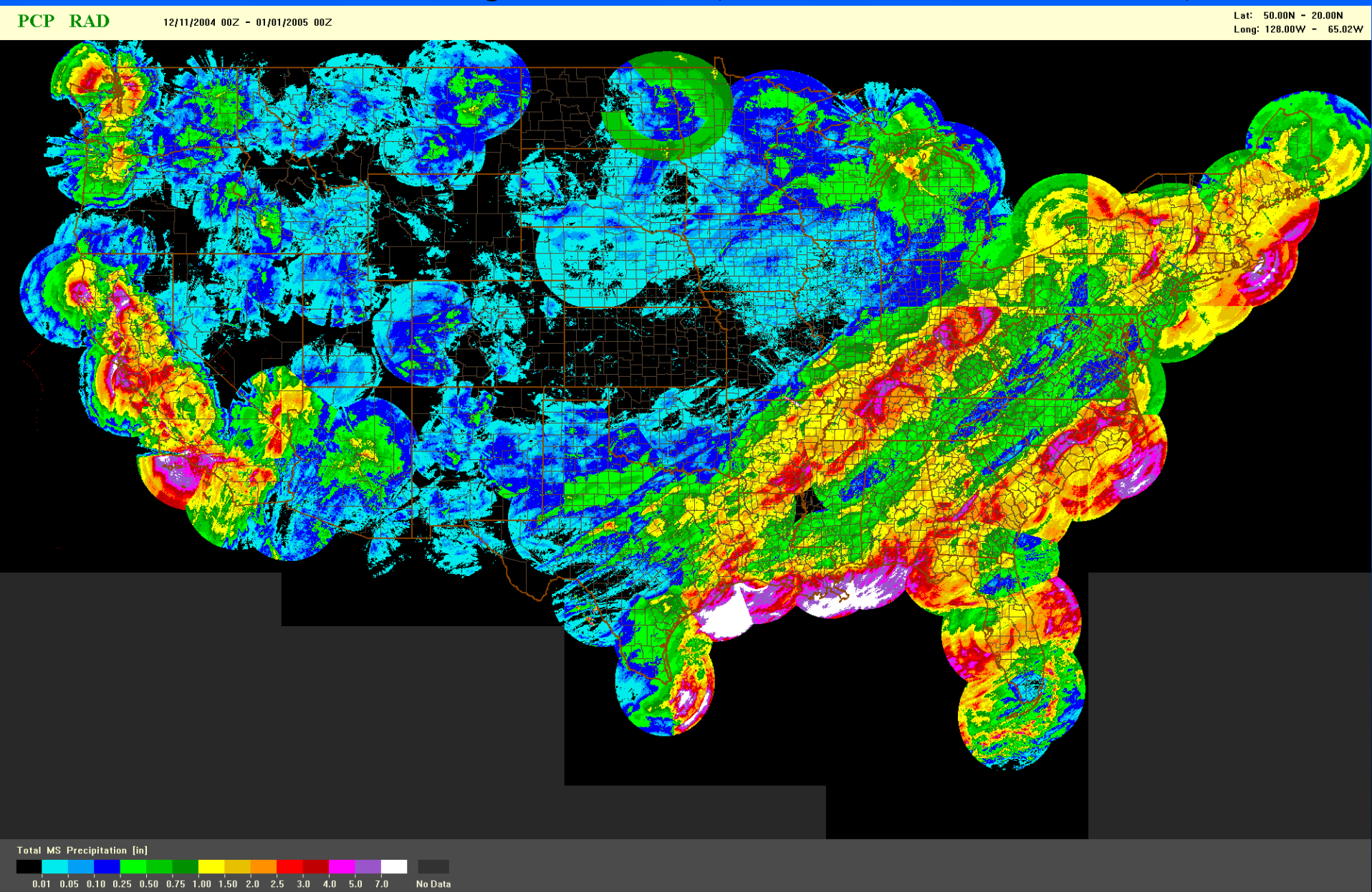
NMQ 3D Products

(QC'd, UnQc'd, VPR corrected)

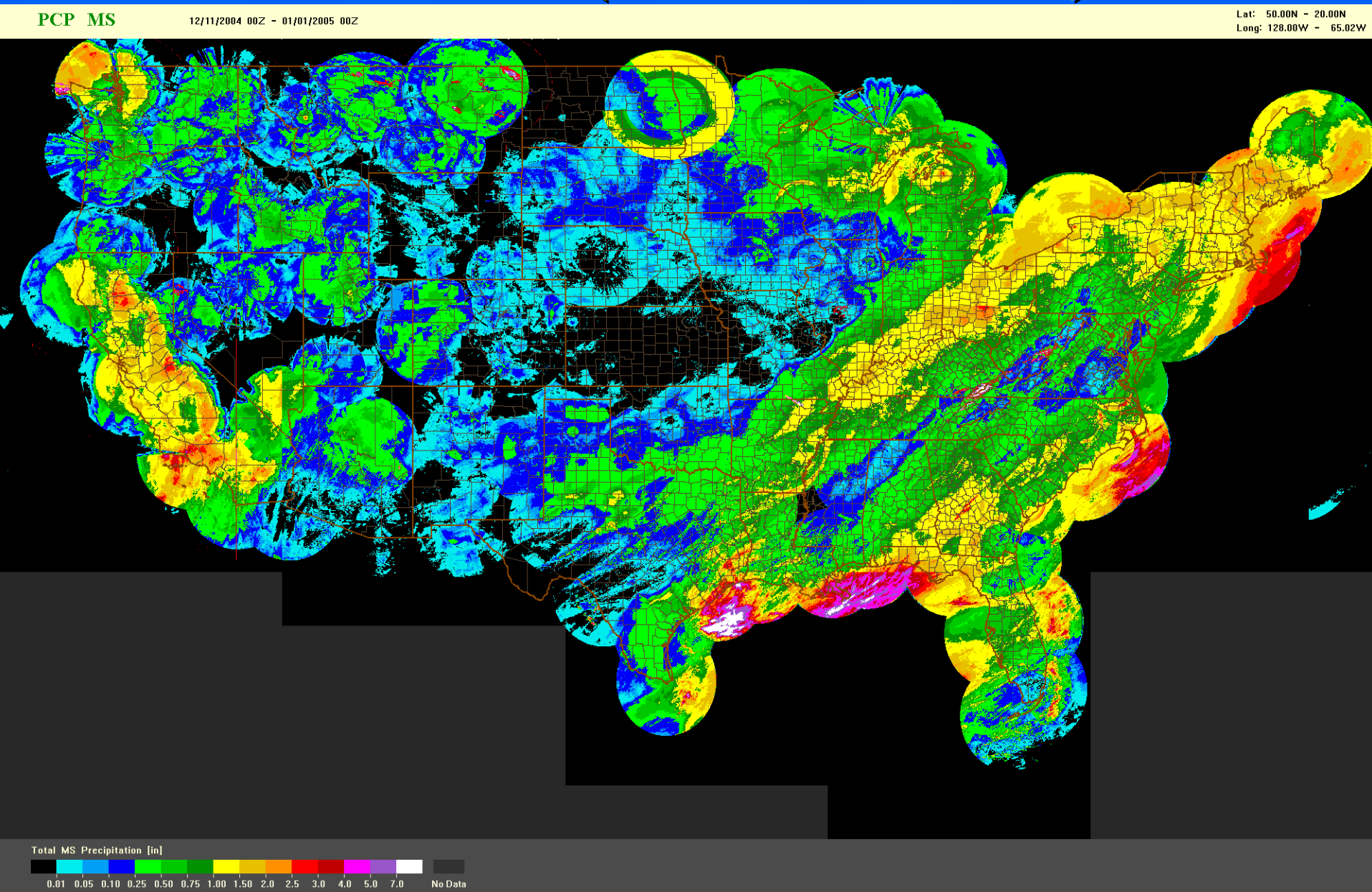
- BREF (31 levels)
- 3D CREF
- Multi Sensor QPE



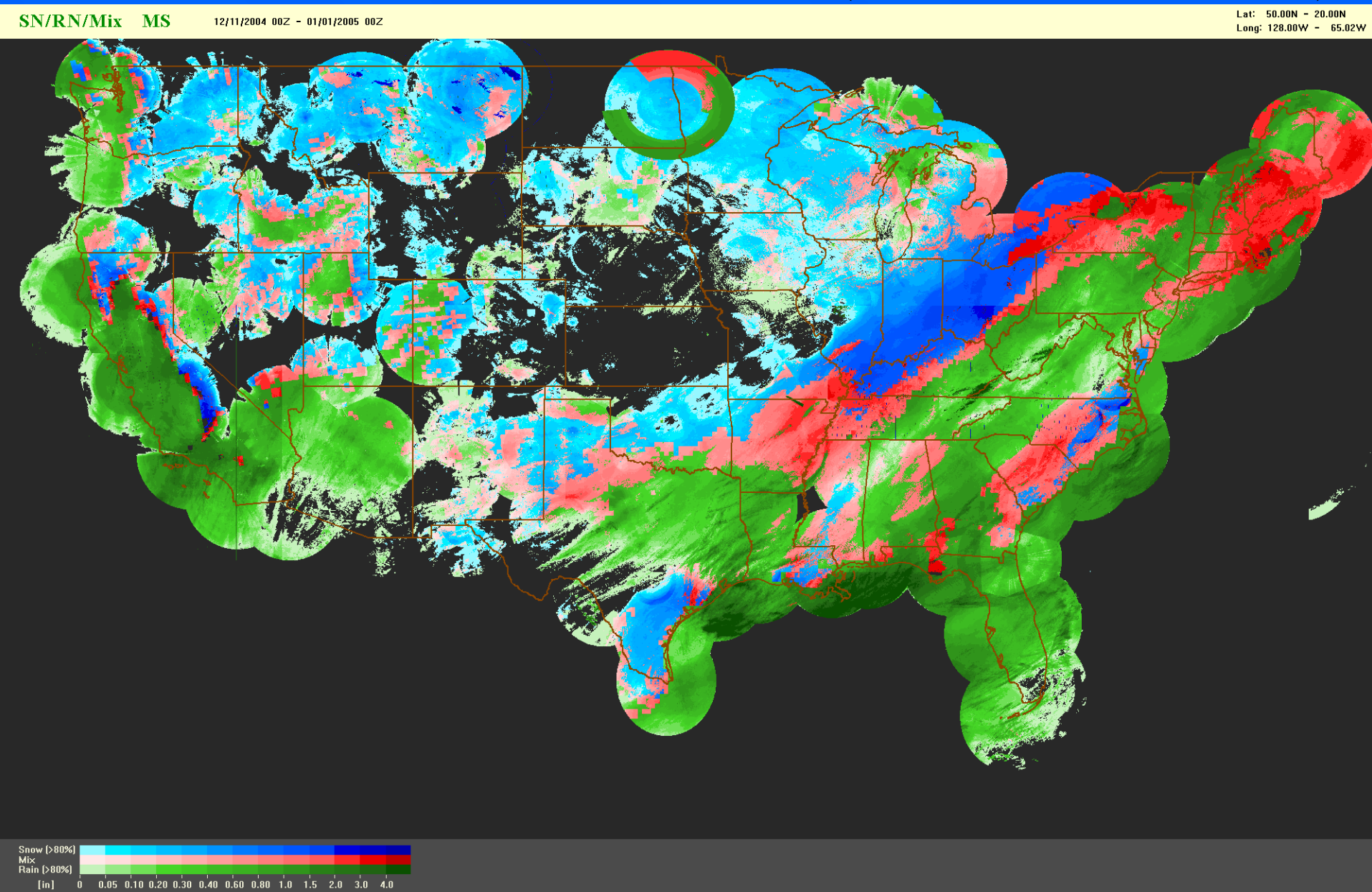
Radar Only PCP (Dec. 11- Jan. 1)



MS PCP (Dec. 11- Jan. 1)



Snow/Rain Mix MS PCP (Dec. 11- Jan. 1)



NMQ Verification Page

Meteorological Data | System Monitoring | Radar Comparison

Time Period

24 hr beginning 0Z

On Date

Month: 10

Day: 18

Year: 2004

-1 dy | +1 dy

Options

Region: CONUS

- tile | + tile

Select/Refresh

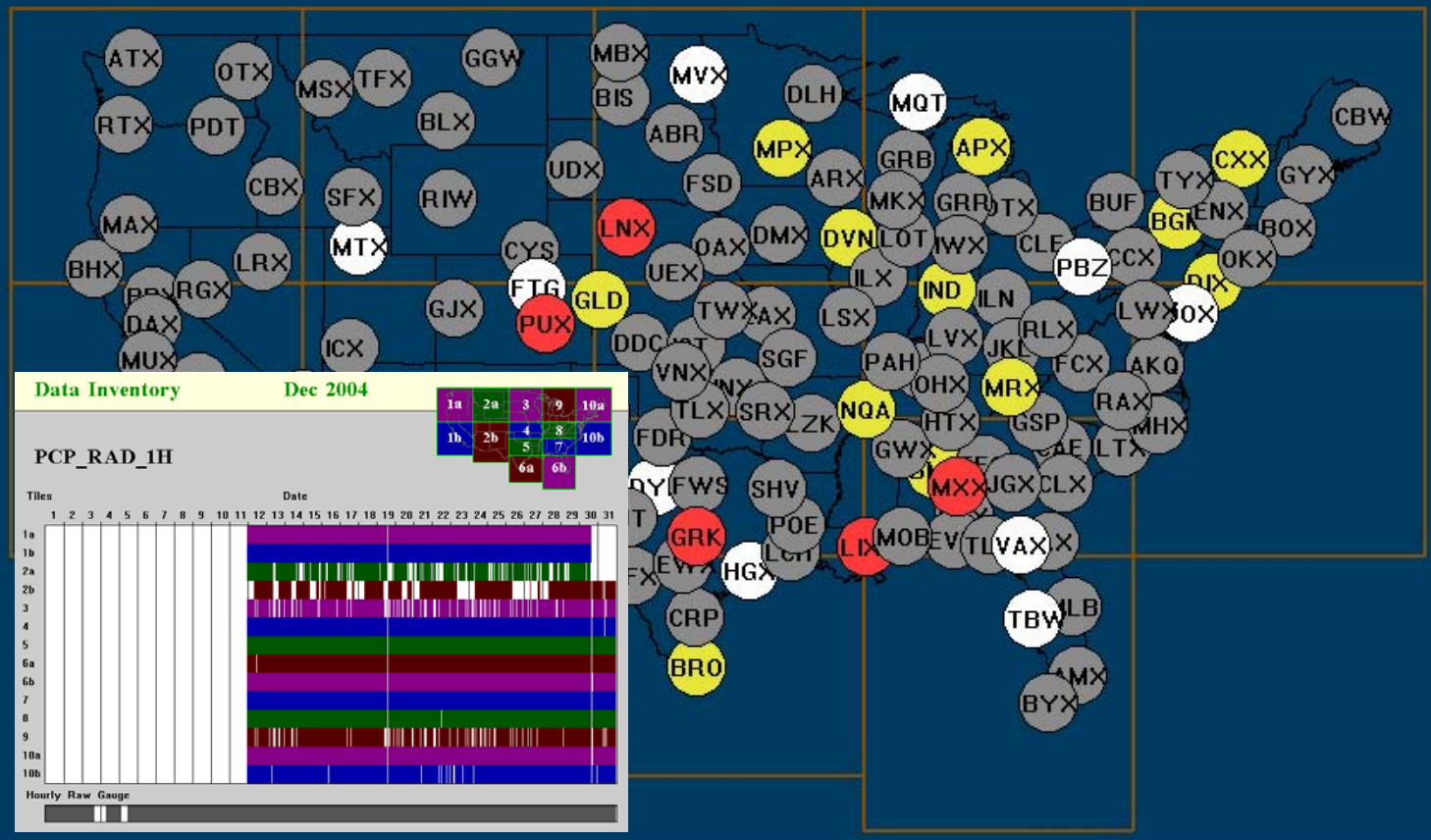
Mosaic File Generation Monitoring

Polar File/Radar Ingest Monitoring

National Radar Status

10/18/2004 00Z - 10/19/2004 00Z
Image Generated: 10/18/2004 21:34Z

Lat: 19N - 51N
Long: 129W - 64W



Longest Data Gap : < 20 min SHV | 20 min - 1 hr BUF | 1 hr - 6 hr GRK | > 6hr VAX

NMQ Verification Page

Meteorological Data | System Monitoring | Radar Comparison

Previous

- 24 Hours
- 10 Days
- 30 Days
- Full Archive

Or Select Range

From:

Month: 10
Day: 28
Year: 2004
Hour: 12

To:

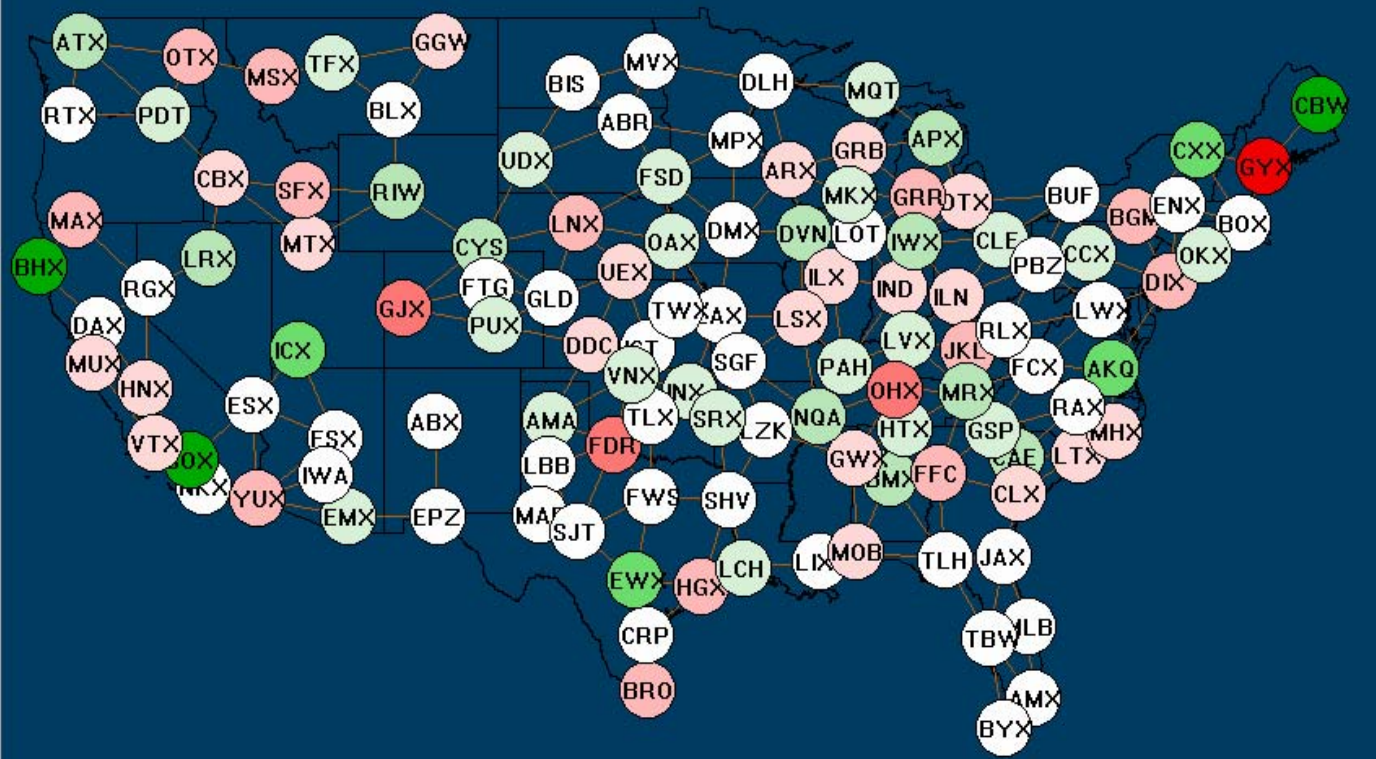
Month: 10
Day: 18
Year: 2004
Hour: 21

Submit

Radar Comparison - Map

04/28/2004 12Z - 10/18/2004 21Z

Lat: 22N - 52N
Long: 126W - 65W



Net dBz diff with nearest neighbors:

No Data

Click Map

NMQ Verification

http://nmqserver.protect.nssl/~qpeverif/

Google

Amazon News NPR NMQ Typhoons Weather DuPage NexSat Refd Phoenix NSSL Modis Apple

NMQ Verification Page

Meteorological Data | System Monitoring | Radar Comparison

Previous

- 24 Hours
- 10 Days
- 30 Days
- Full Archive

Lat/Long

Or Select Range

From:

Month: 4
Day: 28
Year: 2004
Hour: 12

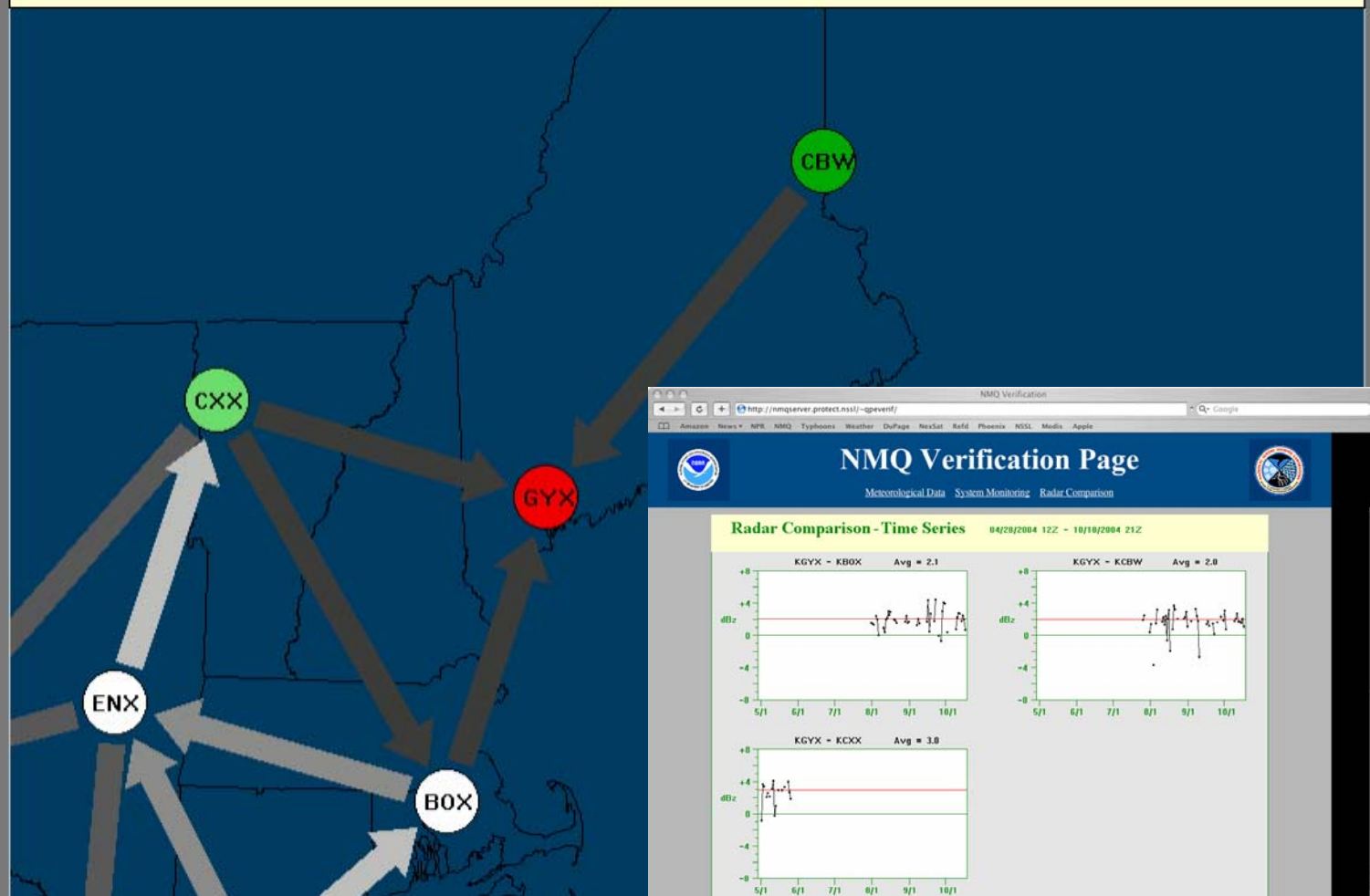
To:

Month: 10

Radar Comparison - Map

04/28/2004 12Z - 10/18/2004 21Z

Lat: 41N - 47N
Long: 75W - 63W



In Closing

- NSSL has assembled the hardware, communication, and software infrastructure for the ‘real time’ creation and dissemination of high resolution 3D radar reflectivity fields and products.
- The NMQ project provides the foundation for the research and development towards high-resolution multisensor quantitative precipitation estimation (QPE) for all seasons, regions and terrains in support of hydrometeorological and hydrologic data assimilation and distributed hydro modeling.
- The NMQ system is being developed as a NATIONAL community test bed for R&D and RTO of QPE, short-range QPF and severe weather science/applications. The NMQ system and products could potentially ‘feed’ LEADS and other Unidata community based applications.
- **NSSL seeks a collaboration with Unidata and Unidata partners towards the utilization and enhancement of the NMQ system as community educational and research/development system including the display and distribution of NMQ products.**

Thank you!


QuickTime™ and a
Video decompressor
are needed to see this picture.