National Mosaic and Quantitative Precipitation Estimation Project (NMQ)

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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_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
QuickTime™ and a Video decompressor are needed to see this picture.
NMQ Vertical Levels

31 levels

height (km AMSL)

level

0 5 10 15 20 25 30 35
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

![Bright Band (Melting Layer) Schematic](image-url)
3-D Spherical to Cartesian Transformation

(Zhang et al. 2003)

No BB:
Vertical linear interpolation

BB exists:
Vertical and horizontal linear interpolation
Convective Case 1: RHI, 263°
Stratiform Case 2: RHI, 0°
Stratiform Case
CAPPI at 2.3km

Raw
Interpolated
Distance Weighting

- CREF_KLOT
- Mosaic CREF

[Graph showing exponential weight function with range and weight axes, and distance weighting radar maps.]

\[ w = \exp\left(-\frac{d^2}{R^2}\right), \quad R = 50\text{km} \]
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)
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!

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