NOAA-EPAs U.S. National Air Quality Forecast Capability

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National Air Quality Forecast Capability

- Background and Current Capability
- Transitioning capabilities to operations
- Progress toward expanded capabilities
US National Air Quality Forecast Capability

Background: Timing and Partners

Constituent Interest

- Health and economic impacts of poor AQ enormous
- AQ managers, public health officials, private weather sector partners urge NOAA to provide AQ forecasts

Science of Quantitative AQ Predictions Maturing

- Ozone forecast models in use -- others in development. NOAA-EPA deployed initial operational capability in September, 2004
- PM forecast models in work. Current capabilities qualitative; R&D ongoing
- Other nations with AQ forecast capability beginning in late 1990s

Congressional Interest

- H.R. 4 Energy Policy Act of 2002 (Senate Amendment); Directed appropriations to NOAA beginning in FY 02

NOAA-EPA Agreements

- DOC Deputy Secretary and EPA Administrator signed MOU/MOA for AQ forecasting May 6, 2003
US National AQ Prediction: 
**EPA + NOAA + State/Local Links**

EPA Data Management Center

NOAA National Center for Environmental Prediction

Commercial Weather Providers

Predicted Pollutant Concentration Fields

Weather Obs

Data “pull” — — —> Data “push” — — —>

AQ Data from S/L Agencies

EPA Emissions Inventory

City-specific AQI forecasts

State/Local Air Agencies
National Air Quality Forecast Capability: Phased Growth

Early Implementations: 1-day forecast guidance for ozone
- Developed and deployed initially for Northeastern US, September 2004
- Expanded over Eastern US, Aug 2005

Near-Term
- Convert driving met model from Eta to WRF: Spring 2006
- Experimental test of ozone guidance over CONUS: Summer 2006
- Deploy Nationwide (AK & HI) by 2009

Longer range (within 10 years):
- Develop and implement capability to forecast particulate matter (PM)
  - Particulate size ≤ 2.5 microns
- Data assimilation for air quality
- Extend air quality forecast range to 48-72 hours
- Include broader range of significant pollutants
**National Air Quality Forecast Capability**

**End-to-End Operational Capability**

**Model Components: Linked numerical prediction system**

Operationally integrated on NCEP’s supercomputer
- NCEP mesoscale NWP: Eta-12
- NOAA/EPA community model for AQ: CMAQ

**Observational Input:**
- NWS weather observations
- EPA emissions inventory

**Gridded forecast guidance products**

Delivered to NWS Telecommunications Gateway and EPA for users to pull 2x daily

**Verification basis**

EPA ground-level ozone observations

**Customer outreach/feedback**

NCEP mesoscale NWP: Eta-12
State & Local AQ forecasters coordinated with EPA
Public and Private Sector AQ constituents
National Air Quality Forecast Capability

Major Model Components

- NWP Model
  - NAM/Eta-12
  - NOAA/NWS

- NWP Post-processors for AQ Modules

- AQ Module: Emissions Preprocessor
  - PREMAQ
  - NOAA/OAR and EPA/ORD

- AQ Module: Air Quality Reactive Transport
  - CMAQ
  - NOAA/OAR and EPA/ORD

- Weather Observations

- EPA’s National Emissions Inventory:
  - EPA/OAQPS

- IT/Comms
  - NOAA/NWS and EPA/OAQPS
Transition to Operations

**Phased Testing**

Research

Does the science work?

Developmental Testing

Does it work with operational systems?

Experimental Testing

Does it meet deployment readiness criteria?

Deploy into Operations

**Key S & T Tests, Summer 2005**

More advanced vertical mixing in CMAQ: ACM test

Convective mixing improved in CMAQ, Cloud/radiation impacts, Boundary conditions (ozone)

Eta-X improves NAM; Updated emissions data in CMAQ

Does the science work?

More advanced vertical mixing in CMAQ: ACM test

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Eta-X improves NAM; Updated emissions data in CMAQ


NOAA Air Quality Forecasting Research Priorities

• Addressing key issues with forecast models (e.g., vertical mixing/ species distribution, sulfate bias aloft identified with ICARTT data)

• Improving boundary conditions for regional model

• Developing prototype PM forecast system for future operational capability

• Developing advanced approaches for biomass burning and windblown dust

• Developing chemical data assimilation approaches

• Ensemble forecast approaches
Experimental Test Domain: Summer 2006

Experimental: CONUS “5X”
Operational: EUS “3x”

CONUS “5x” Domain
EUS “3X”
IOC “1x”

268 grid cells
265 grid cells
259 grid cells

442 grid cells
## Expansion of Initial Capability:

### Summary Operational Readiness Criteria

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Metric</th>
<th>Dates</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective Evaluation: Accuracy</strong></td>
<td>&gt; 90 %</td>
<td>6/1/05 – 8/1/05</td>
<td>C</td>
</tr>
<tr>
<td><strong>Subjective Feedback</strong></td>
<td>Positive on balance</td>
<td>6/1/05 – 8/1/05</td>
<td>C</td>
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<tr>
<td><strong>Production Readiness</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>On-time delivery</td>
<td>&gt; 95 %</td>
<td>6/1/05 – 8/1/05</td>
<td>C</td>
</tr>
<tr>
<td>Back-up</td>
<td>In place</td>
<td>6/1/05</td>
<td>C</td>
</tr>
<tr>
<td>Data retention</td>
<td>In place</td>
<td>6/1/05</td>
<td>C</td>
</tr>
<tr>
<td>Near-real time verification</td>
<td>In place</td>
<td>6/1/05</td>
<td>C</td>
</tr>
<tr>
<td><strong>Final go/no go decision</strong></td>
<td></td>
<td>8/17/05</td>
<td>C</td>
</tr>
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**Key**
- **Complete**
- **On schedule**
- **At risk**
- **Remedial Action Required**
Ozone forecast guidance produced operationally:

- Expanded, August 2005 to Eastern US. 2X daily, 12km grid resolution, hourly predictions, through midnight next day.
  - Ground-level ozone concentrations (ppb) on NOAA/NWS servers: weather.gov/aq
  - As AQI: On EPA’s AIRNow website cfpub.epa.gov/airnow/index.cfm?action=static.noaa_today
  - Achieving performance targets for accuracy, reliability

Expanded products being tested in FY06:

- Ozone:
  CONUS domain, experimentally available, beginning June, 2006

- Particulate matter components:
  Smoke from large fires, experimentally available, weather.gov/aq-expr
  In development: Aerosols produced/transported; sources from anthropogenic emissions in climatologic inventories
Sample AQ forecast guidance

www.weather.gov/aq

Further information

www.nws.noaa.gov/ost/air_quality
Sample smoke forecast guidance


- Experimental Testing: beginning March, 2006
- Fire Locations and verification based on satellite observations
- Fire emissions estimates from USFS (BlueSky)
- HYSPLIT/NAM transport
Preview of Experimental Testing:
Ozone Predictions during Summer 2006
US National Air Quality Forecast Capability:
- Improving the Basis for AQ Alerts
- AQ Information for People at Risk

<table>
<thead>
<tr>
<th>Current AQ Alerts</th>
<th>NOAA’s Operational Capability</th>
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<tbody>
<tr>
<td><strong>Purpose:</strong>&lt;br&gt;Limit adverse effects from poor AQ, by providing:</td>
<td><strong>Current (3/06)</strong>&lt;br&gt;State-of-the-science ozone forecast guidance</td>
</tr>
<tr>
<td><strong>Products for Public</strong>&lt;br&gt;Daily AQ alerts; predicted interpretive AQ Index category</td>
<td>Hour-by-hour predictions of air pollutant concentrations in digital &amp; graphical formats</td>
</tr>
<tr>
<td><strong>Coverage</strong>&lt;br&gt;Approx 300 cities</td>
<td>Eastern United States</td>
</tr>
<tr>
<td><strong>Pollutants Forecasted</strong>&lt;br&gt;AQ Index for ozone; some cities include particulate matter</td>
<td>Ground-level ozone</td>
</tr>
<tr>
<td><strong>Forecast Period</strong>&lt;br&gt;Next-day; also through weekends</td>
<td>Forecast guidance through midnight next day</td>
</tr>
<tr>
<td><strong>Spatial Resolution</strong>&lt;br&gt;Alerts are community-wide; little/no other spatial information</td>
<td>12 kilometer grid</td>
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<tr>
<td><strong>Temporal Resolution</strong></td>
<td>Daily</td>
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