OFCM Special Session

Atmospheric Transport and Dispersion Modeling Support for Homeland Security

Panel 3: Developing a Common Framework for Model Evaluation

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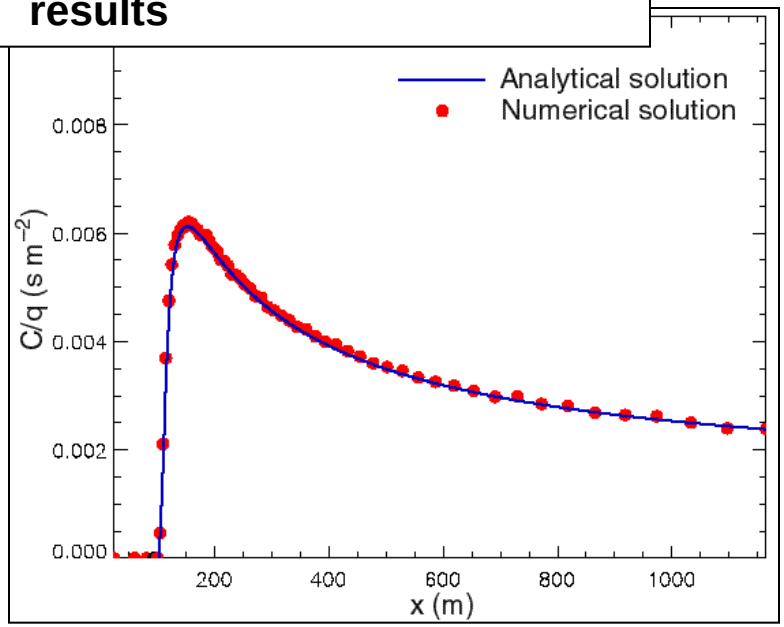
Model Evaluation Methodologies

- Apply analytic solutions to check numerical methods against known solutions
- Use tracer field experiments to evaluate validity of models for real-world cases
  - Limitations:
    - Limited number of processes included (e.g., only transport and diffusion of trace gas)
    - Limited range of source, meteorological and geographical conditions studied
- Test operational system for ease of use, efficiency and robustness
- Open literature publication and public availability of the model to allow for scrutiny by the scientific and user communities
- Evaluate in operational mode or environment
- Evaluate for unknown source term with tracer material measurements

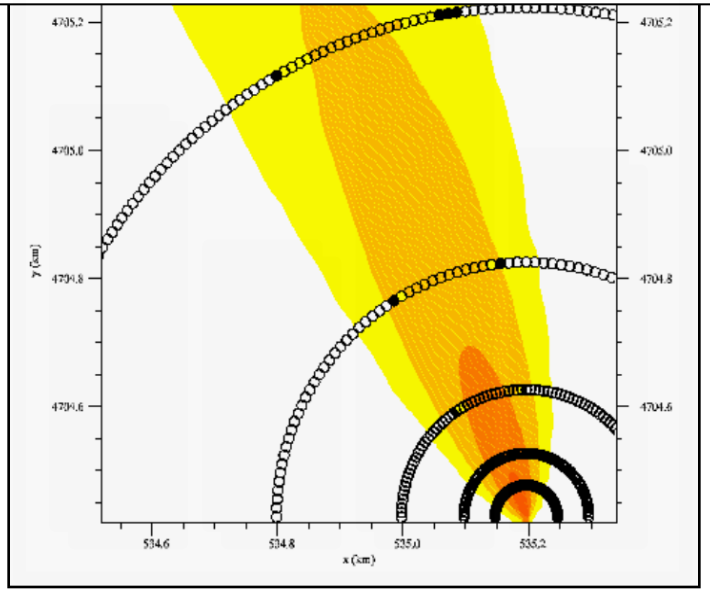
NARAC Model Testing

- **Analytic solutions** test models versus known, exact results



- **Field experiments** test models in real-world cases

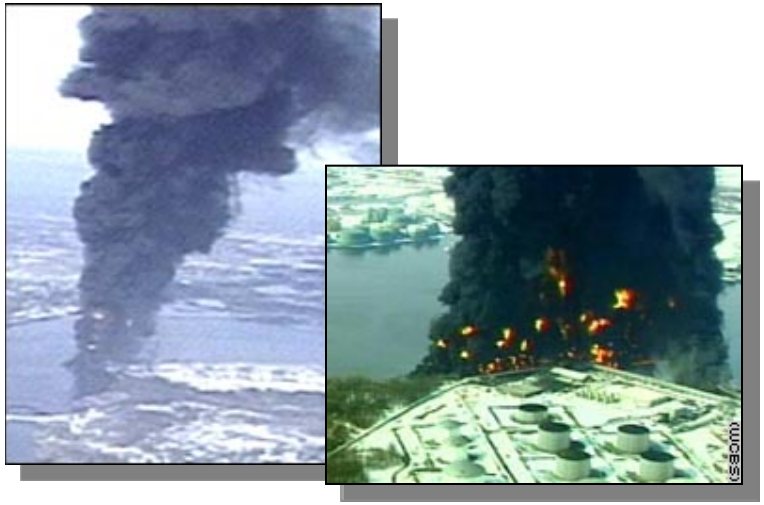
Examples: Project Prairie Grass, Savannah River Mesoscale Atmospheric Tracer Studies, Diablo Canyon Tracer Study, URBAN

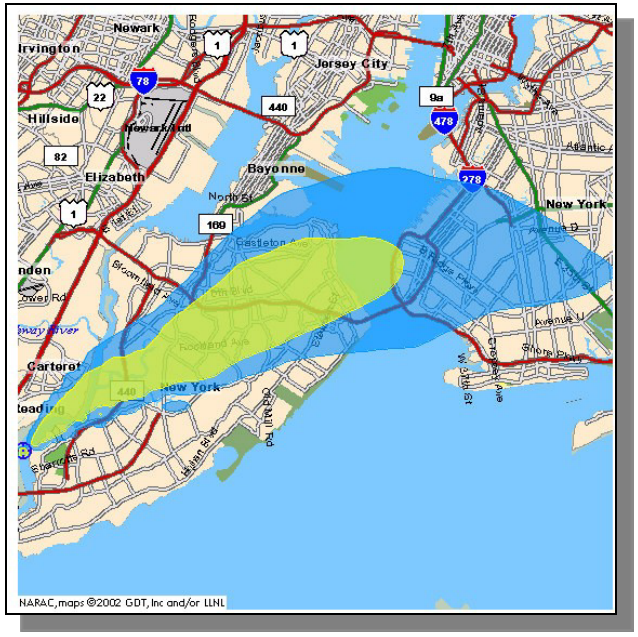


- **Operational testing** evaluates the usability, efficiency, consistency and robustness of models for operational conditions

Examples: Chernobyl, Kuwait oil fires, tire fires, industrial accidents, Algeciras Spain Cesium release, Tokaimura criticality accident

Staten Island, NY Fire
Feb. 21, 2003

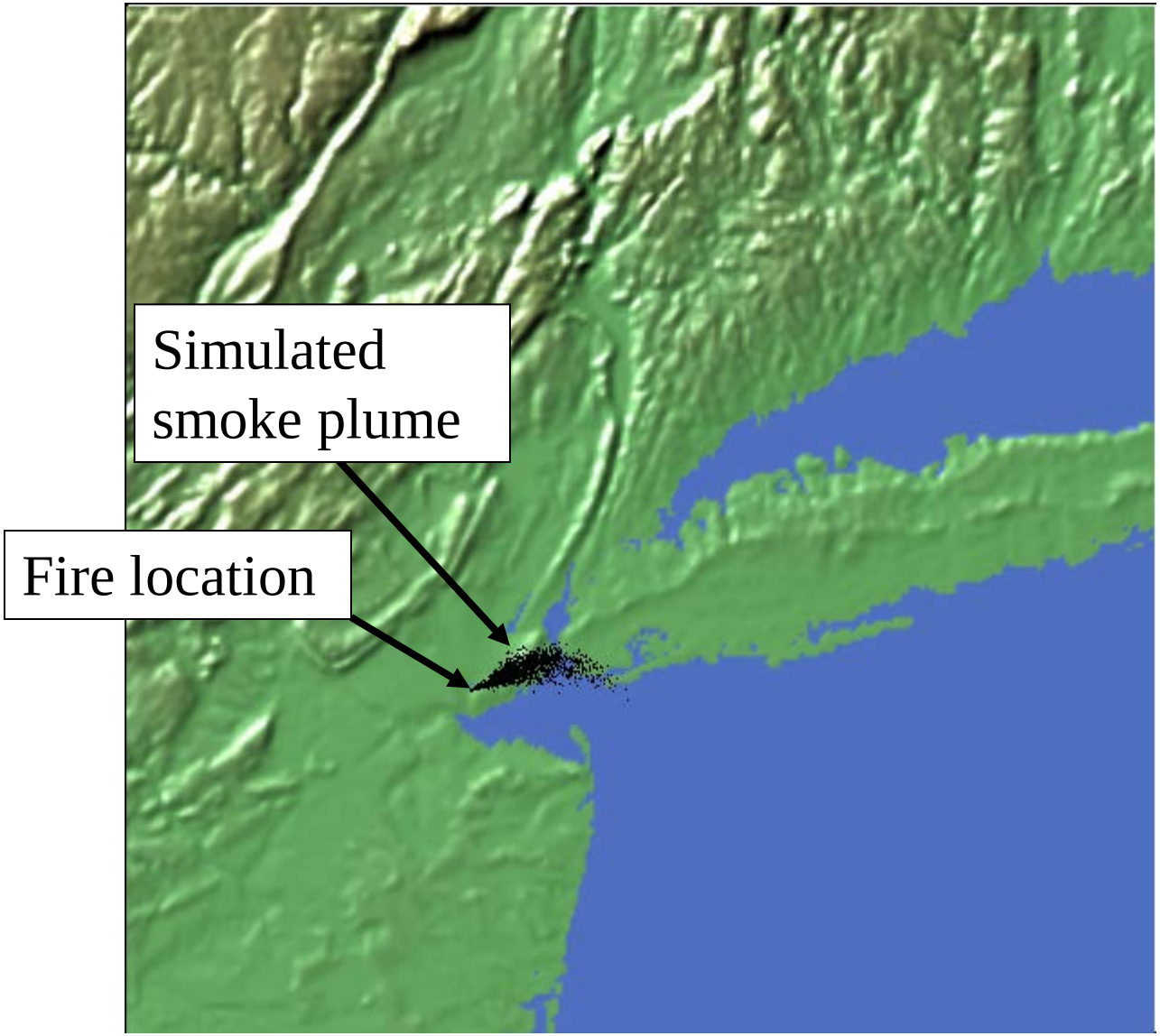




Through the NYC Office of Emergency Management, LINC/NARAC provided the following operational assistance:

- Real-time 3-D plume prediction of affected areas and population
- Guidance for deployment of emergency responders and field monitoring teams
- Health risk levels for 1-hr and 24-hr exposure (in consultation with NOAA Hazardous Material Response and Assessment Division, Seattle, team)
- Forecasts of plume spread over next 24 hours
- NARAC Plumes exported to NYC OEM GIS

NARAC Simulation of Smoke Dispersion From Staten Island Fire



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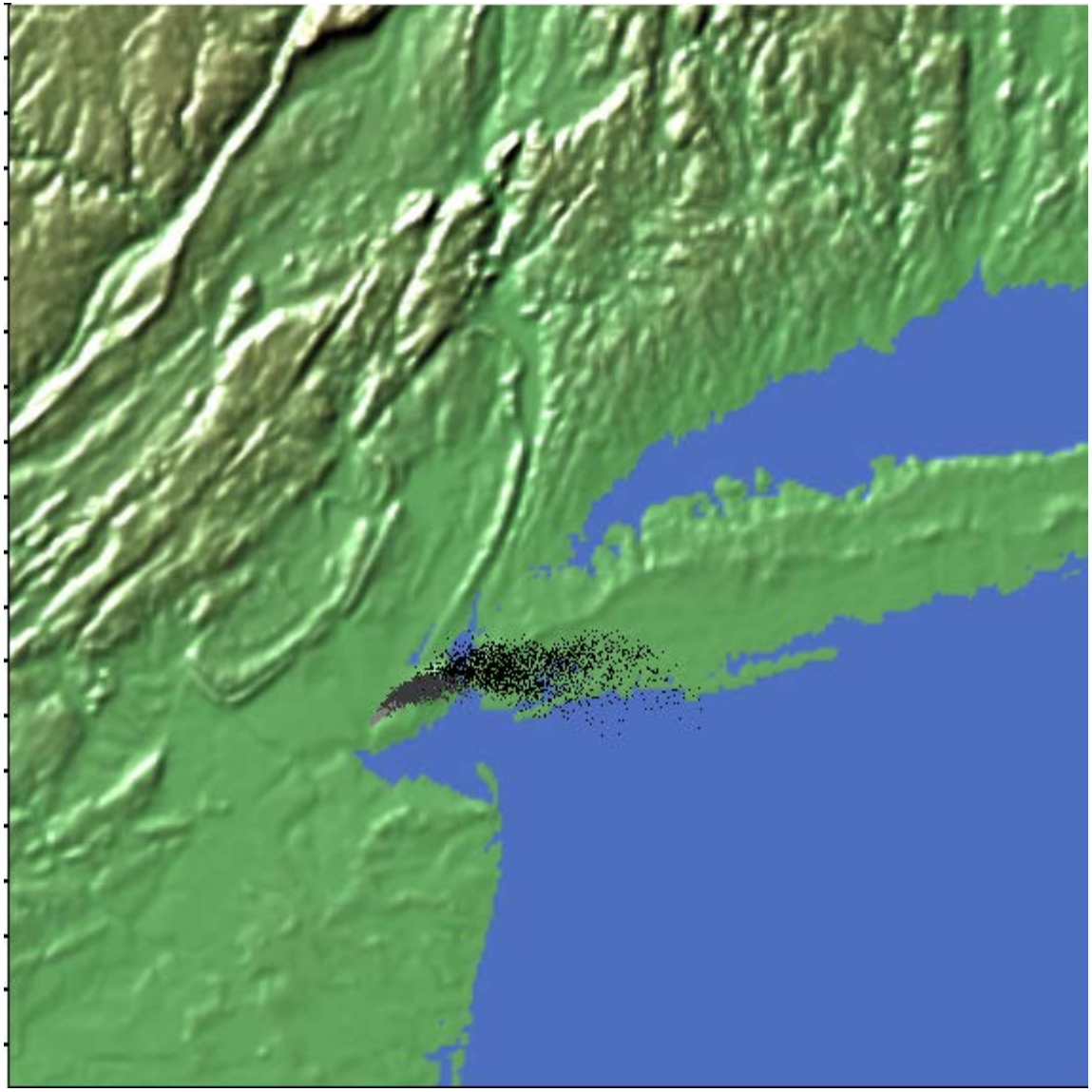


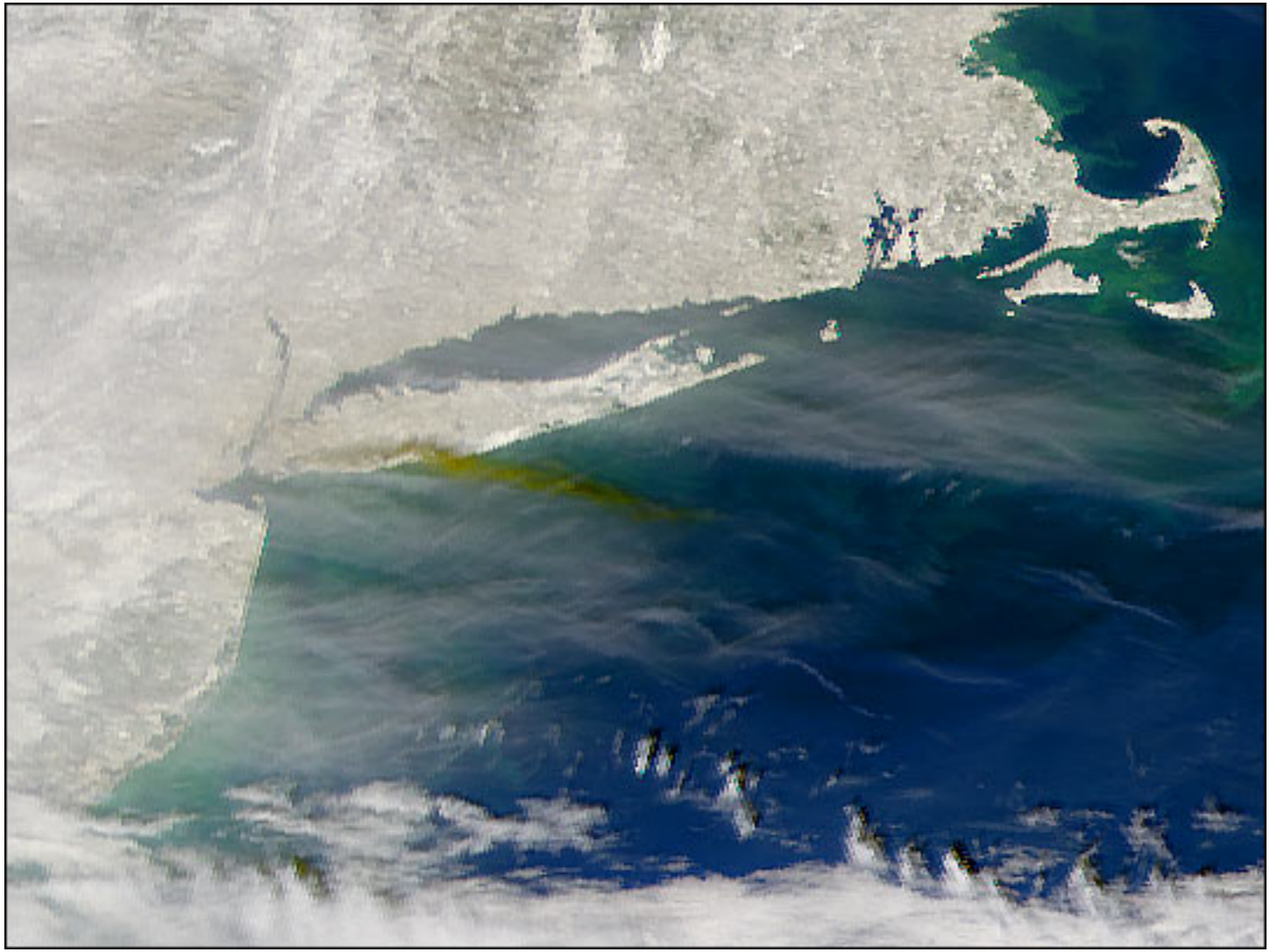
NARAC Simulation of Smoke Dispersion From Staten Island Fire

Staten Island, New York, Smoke Plume: Feb. 21, 2003

Satellite image showing smoke plume

Photograph of smoke plume looking South from Manhattan

Staten Island, Fire Smoke Plume: Satellite Image (1130-1300)



Evaluate in Operational Mode or Environment

- User wants to know performance in real-world events
- Establish a number of baseline sites (e.g., city, coastal, mountain, plains)
- Sites would have advanced observational instrumentation to “well” characterize the atmosphere on an ongoing basis
- Occasional tracer releases at various times and locations within site area
- Evaluate plume modeling system with full, subsets and predicted data sets
- Evaluate for multiple time and spatial scales and resolutions, scenarios, and atmospheric conditions
- Evaluate observational data needs

Evaluate for unknown source term with tracer material measurements

- In real-world WMD event source term is usually not known
- Use meteorological and tracer measurement data sets from sites to evaluate plume modeling system's ability to reconstruct event
- Evaluate for accuracy and speed
- Evaluate effects of uncertainties in data
- Evaluate sensitivity to various users (reproducibility)