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OFCM Sponsored Session – Federal R&D Needs and Priorities for Atmospheric T&D Modeling

DoD/DTRA Perspective

DEFENSE THREAT REDUCTION AGENCY | JOINT SCIENCE AND TECHNOLOGY OFFICE | CHEMICAL AND BIOLOGICAL DEFENSE

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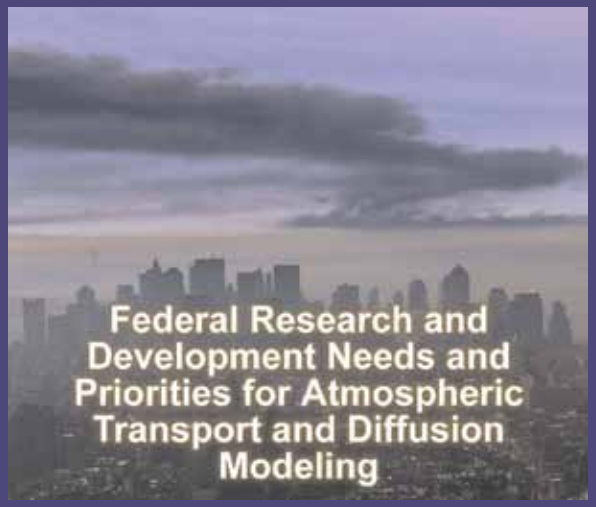
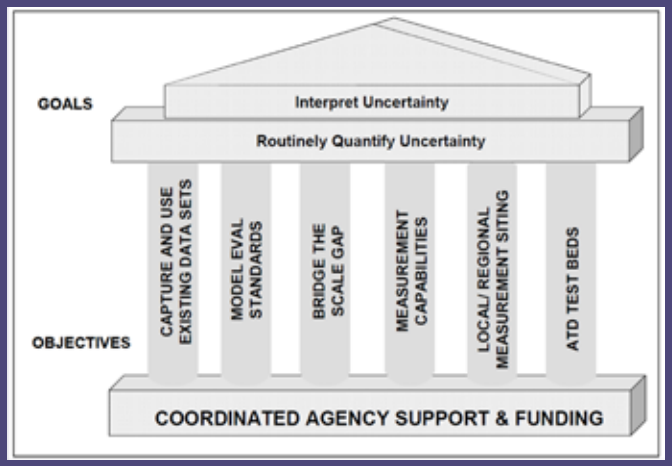
Outline

- 2004 OFCM Report Findings & Recommendations
- Progress by DoD
  - JEM/HPAC ATD Systems
  - Meteorological Modeling
- Emerging Systems for Test & Evaluation
- Remaining Gaps

2004 OFCM Report Recommendations

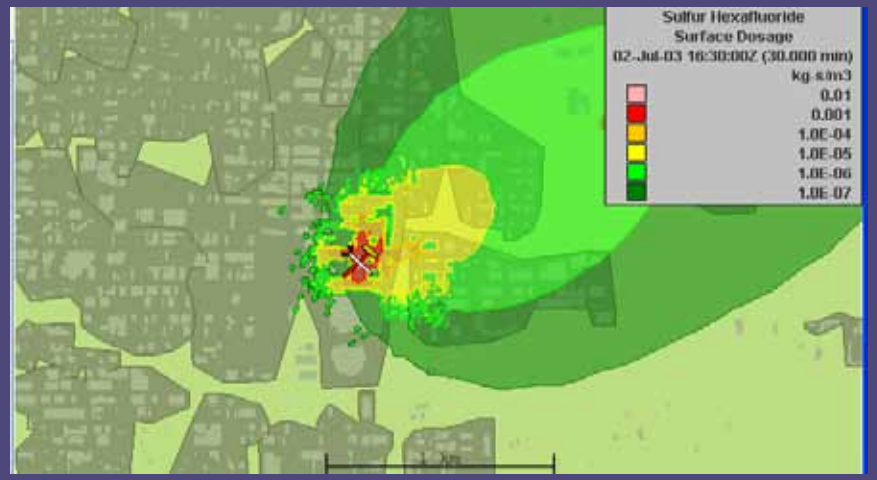
- Quantify model *uncertainties* and interpret their implications to users
- Capture and use *existing data sets*
- Implement *ATD test beds*
- Develop *standards for evaluating* modeling system performance
- Improve the spatial and temporal scale *interactions between meteorological and ATD models*
- Improve *measurement* capabilities
- Design and conduct special studies and *experiments*

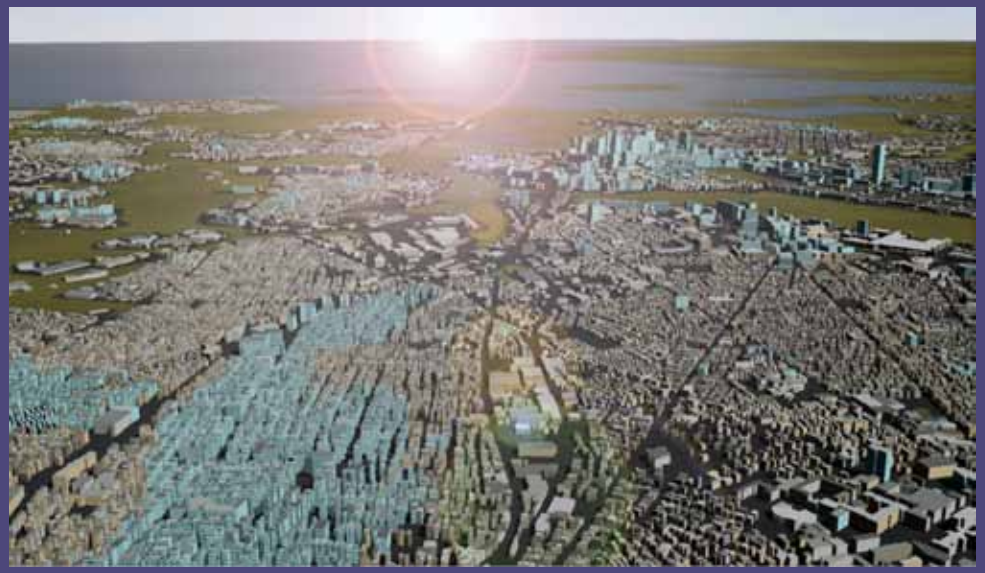




Major R&D Efforts (1) – Urban Modeling

- City database expansion and improvements
- Urban Dispersion Model (UDM) improvements
- Microswift/SPRAY (MSS) – wind solver and Lagrangian dispersion model for short range (100s of meters) within the urban canopy

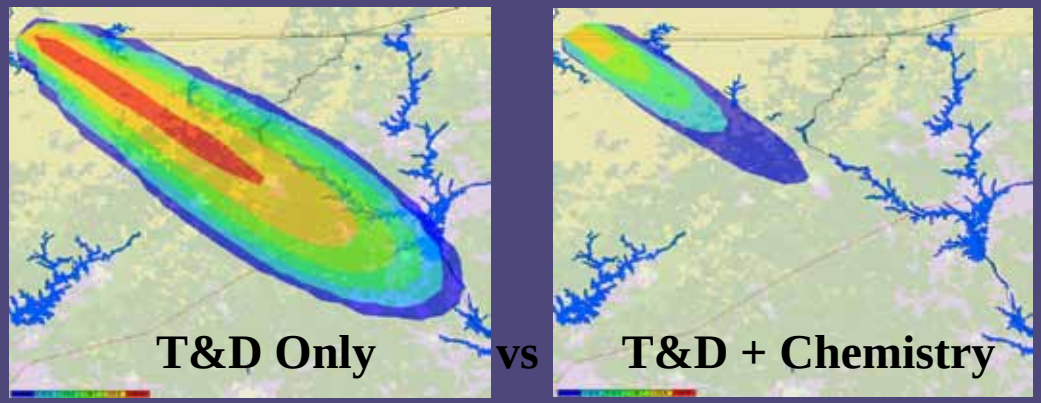




Acknowledgement – Dstl, RiskAware, SAIC, NGA

Major R&D Efforts (2) – Atmospheric Chemistry

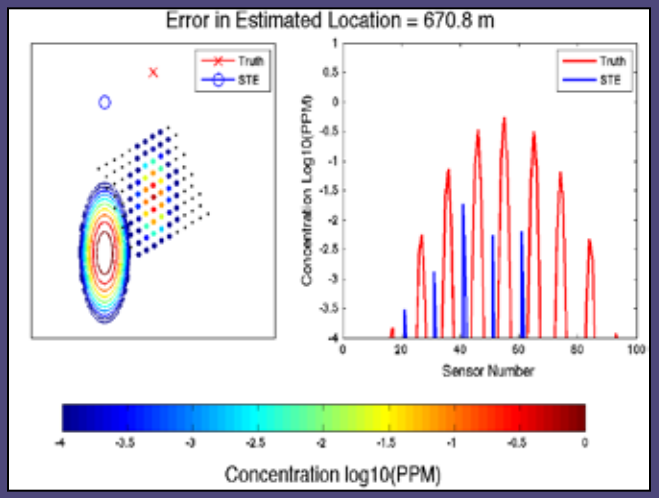
- Development of the “Degrade” model for a limited set of Toxic Industrial Chemicals (TICs)
- SCIPUFF empolys the TIC degradation rate from the Degrade module.
- Degradation rate is then be used to simulate atmospheric chemistry within the ATD prediction
- Results in less over-prediction errors



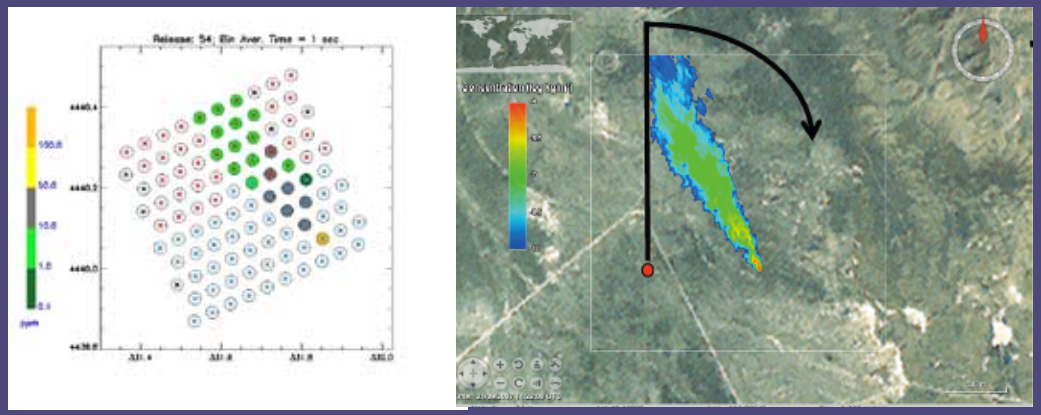
Acknowledgement – AFRL, ENSCO

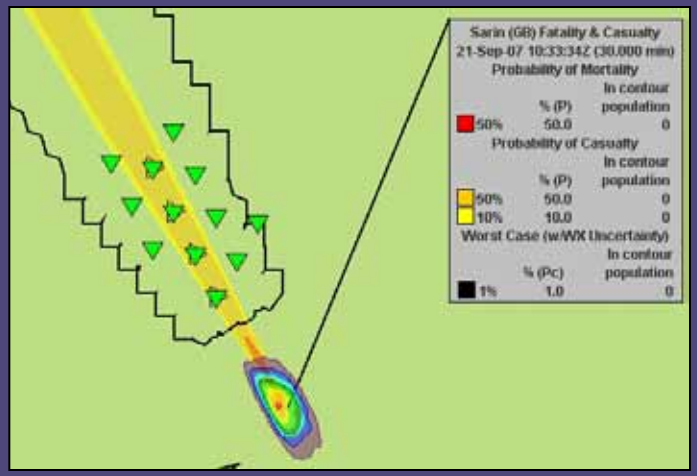
Major R&D Efforts (3) – Source Term Estimation & Hazard Refinement

- Adjoint SCIPUFF variational data assimilation
- Allows for near real-time estimation of source parameters and refined estimate of downwind hazards
- Extensive V&V efforts based on the 2007 DTRA-sponsored FUSION Field Trial data set and additional synthetic data



Variational Source Term Estimation and Hazard Refinement

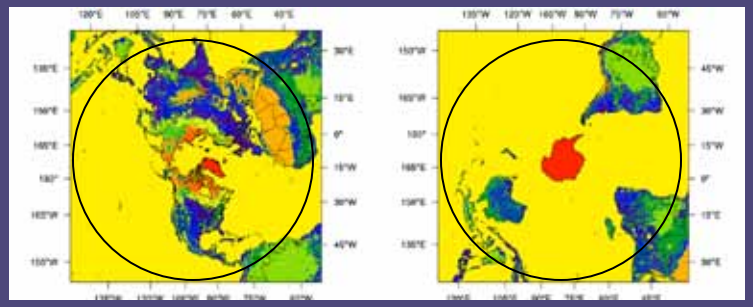


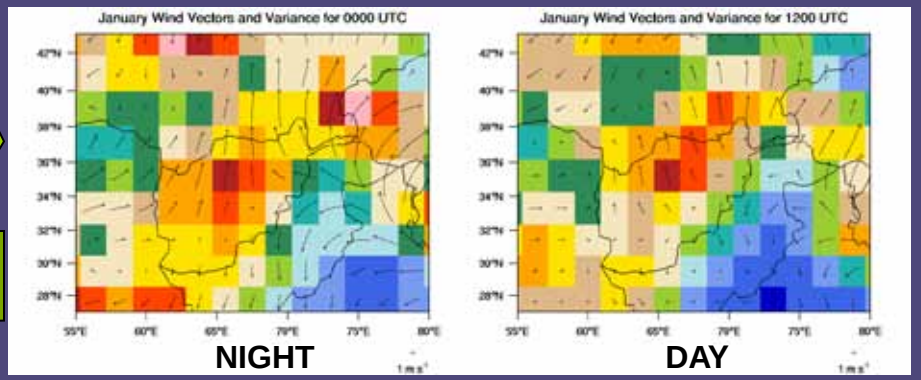


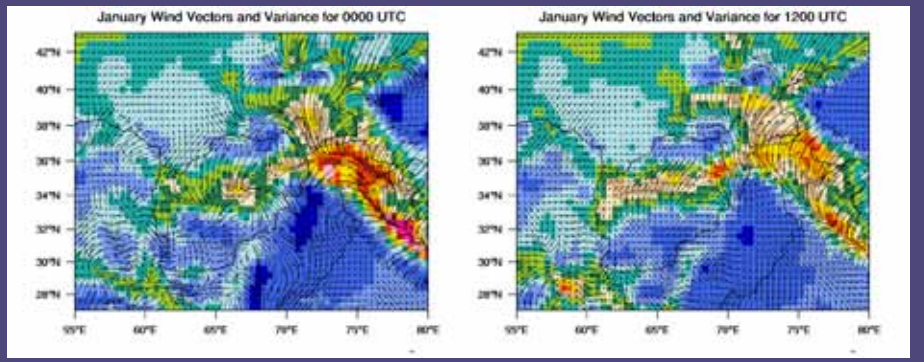
Acknowledgement - NCAR

Major R&D Efforts (4) – Meso-beta Scale Climatology

- Improved climatology database
  - 21-year set of hourly dynamically downscaled re-analyses on a global 40 km grid (1985-2005).
  - Use fully compressible, nonhydrostatic mesoscale model (MM5).
  - Incorporates high-quality observation datasets.
  - Faithful representation of mean structure and statistical behavior of atmosphere within PBL



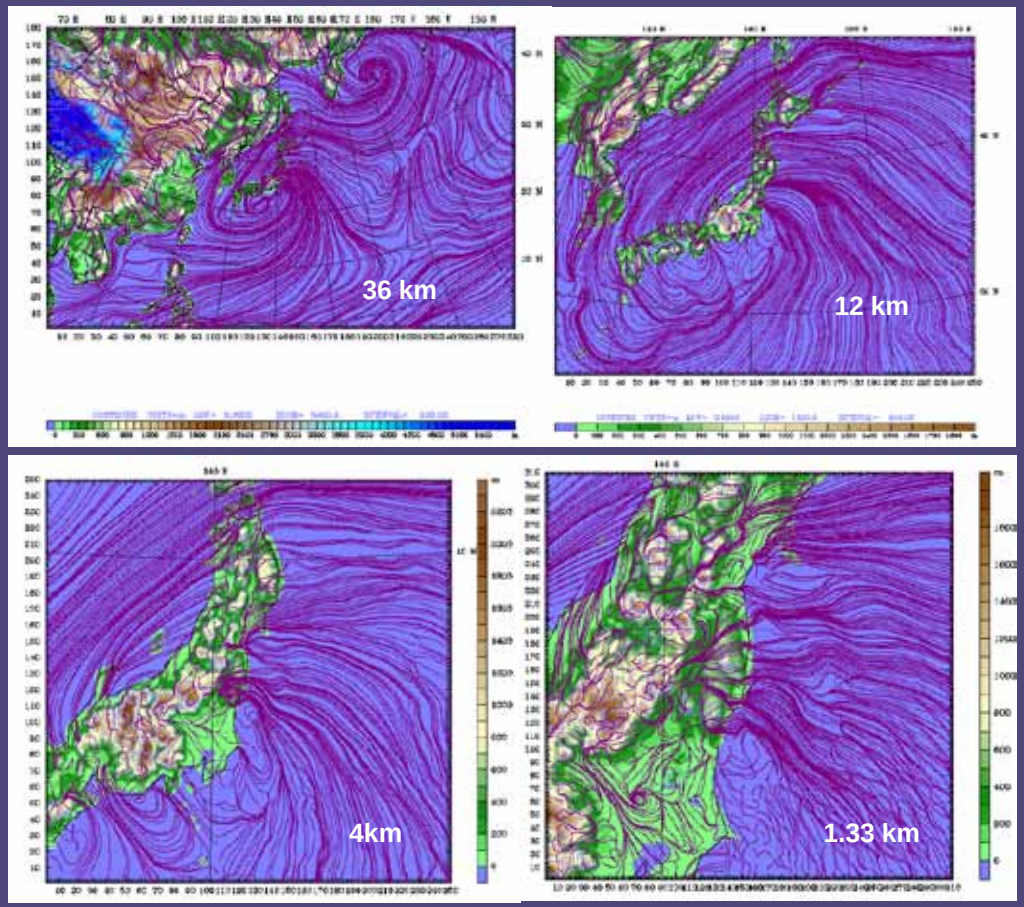




Acknowledgement - NCAR

Major R&D Efforts (5) – Mesoscale Modeling and Coupling w/ATD Systems

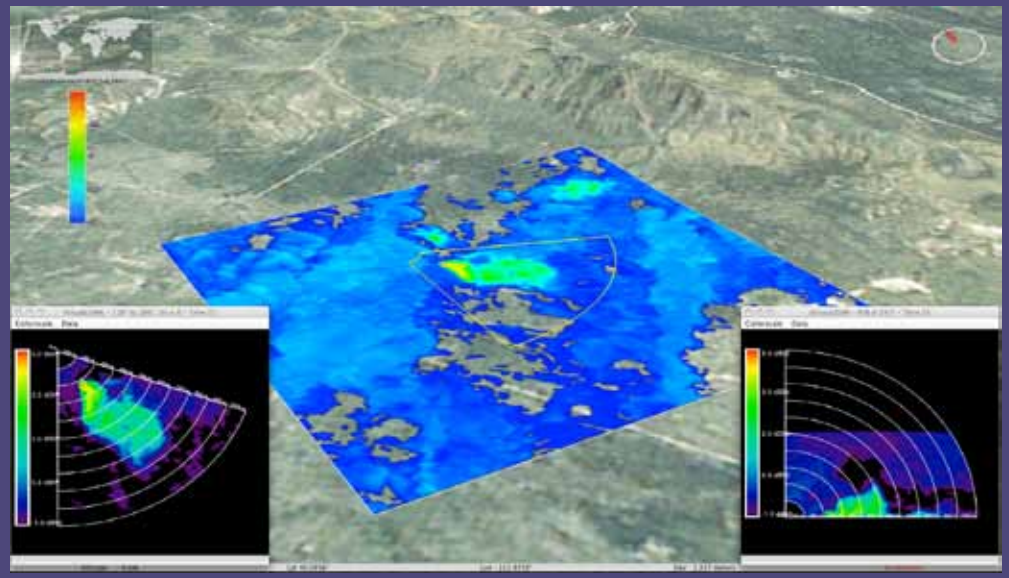
- Stable boundary layer R&D – model parameterizations
- Coupling NWP output directly with ATD codes
  - TKE or other PBL mixing parameters for the parameterization of turbulent diffusion rates
- Operational support
  - Fukushima - run in continuous four-dimensional data assimilation (FDDA) mode for the entire model period
  - Olympic Games
  - Military operations

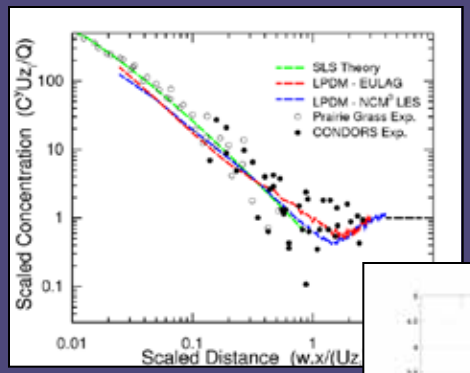


Acknowledgement - PSU

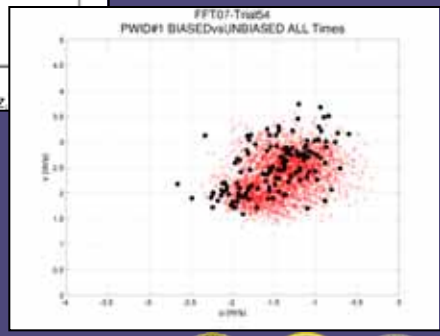
Major R&D Efforts (6) – LES and Synthetic Environments

- Beyond traditional operational modeling
- Support to acquisition decisions, trade-off studies and virtual testing of CB equipment
  - Design and augmentation of field trials
  - System specification design
- LES, environmental background models, CB & met sensor (point and standoff) models, etc.





LES component validation



Acknowledgement - NCAR

Current Efforts & Existing Gaps

- TIC/TIM
  - Material Data (Public & paid for physical property resources)
  - Health effects data
- Chemical Weapon Agents
  - Agent fate data
- Non-traditional Agents
  - Physical properties data
  - Health effects data
  - Agent fate data
  - Atmospheric exposure behavior data
- High Altitude and Missile Intercept
  - Rarified atmosphere liquid dispersion
  - Small scale testing
- Urban Dispersion
  - CONUS City building data
  - OCONUS City building data
- Health Effects
  - Population data (Landscan, Day/Night Pop & Dynamic Population)
- Source Term Models
  - Two-phase flow test data
  - Varying tank burst/failure scenario data
  - Dry particulate dispersion

- Under Way
- Planned Work
- Gap