OFCM Special Session on Research Needs

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Two Research Areas of Particular Interest

- Urban winds, turbulence, and dispersion
- Integration of agent sensor data with dispersion models

Urban Winds, Turbulence, and Dispersion

- Increasing awareness of importance of urban dispersion for emergency response, military operations, and others

- Previous urban dispersion studies: helpful, incomplete
  - Some old studies, but these lack comprehensive data
  - Some recent studies, but these don't answer all the relevant questions
  - Planned studies will approach needs in various ways

- The primary requirement is to obtain data to improve *model performance* and *scientific understanding* in urban situations

DTRA

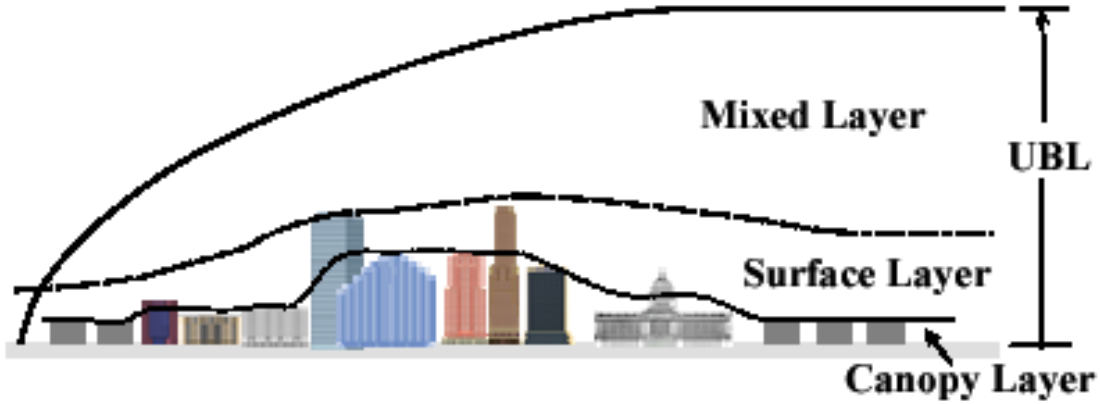
Model Development and Validation

- Many models for urban effects are available

- Wide range of approaches and applications
  - Parameterization of urban effects in mesoscale models
  - Fast-response urban dispersion models
  - Quick-response urban wind models
  - CFD wind and dispersion models

- Requirement: Acquire data suitable for validation and evaluation of all types of models
- Requires variety of experiments

Scientific Understanding of Urban Boundary Layer



- Study urban boundary layer structure and development
  - Both daytime and nighttime studies
  - Range of wind conditions
  - Interaction between scales
  - Long-term statistics for model parameterizations

Future Urban Studies

- Joint Urban 2003 in Oklahoma City
  - Limited-duration (one month)
  - Abundant equipment to study scale interactions, detailed flow and dispersion in various parts of city
- DCNet in Washington DC
  - Long-term (plan for several years)
  - Multiple sensors across DC region
- Urban Atmospheric Observatory in New York City
  - Long-term (plan for several years)
  - Dense network in limited area of downtown NYC
- UMPIRE on Penn State campus (proposed)
  - Study wind flow around buildings

Sensor Data Integration

- Becoming an actively discussed topic

- Several approaches have been proposed
  - It's usually possible to think of reasons they won't work in certain situations
  - This is NOT a reason not to proceed—optimists needed

Sensor Data Integration

- Variety of objectives
  - Look *backward* to determine source characteristics (particularly location)
  - Look *forward* to predict what happens to observed material—use sensor reading as source term
  - Combine sensor data with dispersion calculations
    - My favorite analogy is with weather observations combined with weather model output as first guess—resulting blended analysis is better (more accurate, more complete) than either alone
    - Help identify false positives or calibration errors
    - *Get the most complete depiction of situation*

Sensor Data Integration Research

- Mathematical consideration of problem
  - Fuzzy logic?
  - Other approaches?
  - Incorporate false positives, false negatives, multiple releases at different times, moving releases…

- Lab and field studies
  - Probably need very dense network of samplers, high resolution models to give detailed picture of releases
    - Need to know ground truth (remote sensing?)
  - See if selected special observations can reveal true pattern

Sensor Data Integration Research

- Tech Panels 9 and 10 of The Technical Cooperation Program will host a combined meeting to discuss sensor data integration in Sep 03 in Salt Lake City

- Propose lab or field studies then