Regional Modeling

WRF-Chem is used by PNNL scientists to simulate the regional-scale evolution of aerosols and their impact on radiation and clouds

- MOSAIC, sectional aerosol model
- MOSAIC coupled with SAPRC99 and volatility basis set approach (*Shrivastava et al.*, 2008, 2011) for SOA
- MAM (3 mode and 7 mode versions) ported to WRF
- Aerosol-radiation-cloud interactions
- ASR-developed modules made available to the public via WRF web site

Campaigns:

- SOA, mixing state, optical properties: MILAGRO, CARES
- Cloud-aerosol interactions: CHAPS, VOCALS (NOAA project), ISDAC (ESM project)

Aerosol Modeling Testbed: Systematic and objective method of testing and evaluating aerosol process modules across spatial scales

BAMS March Issue

Pacific Northwest
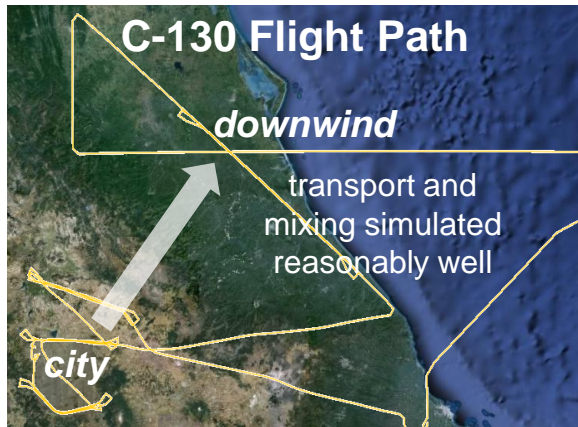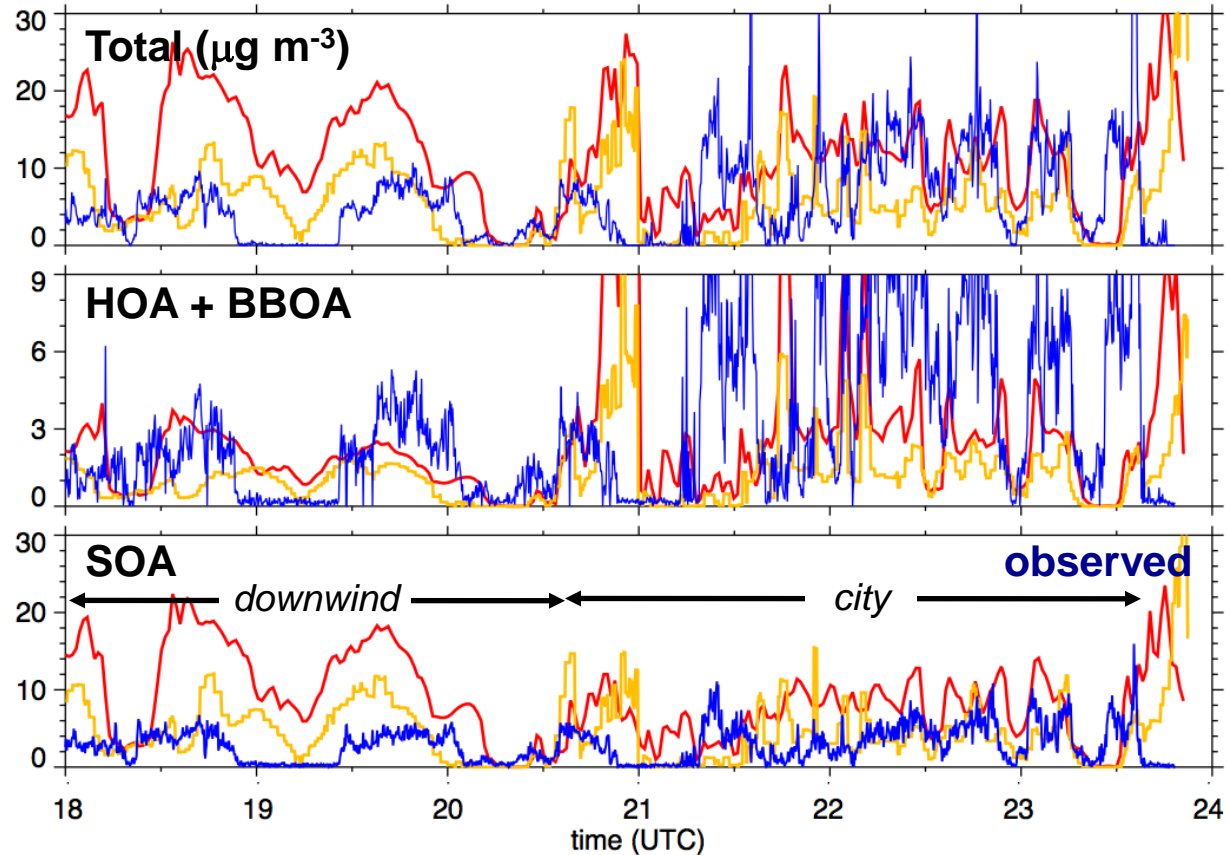NATIONAL LABORATORY

Organic Matter Predictions in the AMT

AMT Methodology:

Identical emissions, boundary conditions, meteorology, trace gas chemistry, dry deposition

C-130 Flight Path

downwind

transport and mixing simulated reasonably well

city

Volatility Basis Set (VBS) from *Shrivastava et al.*, ACP, 2011

MAM (from CAM5)
modal – 3 modes, 11 species
'simple'

1 simulation day ~ 21 min
(128 processors)

MADE/SORGAM
modal – 3 modes, 38 species
15 times more species

~ 24 min

MOSAIC +VBS
sectional – 4 bins, 164 species
'complex'

~ 60 min

Science Questions
For Integrated Observational and Modeling Studies

Secondary Organic Aerosols:

- What are the major gas-to-particle partitioning processes that contribute to SOA? How do those processes evolve downwind of emission sources?

- What are the chemical compositions, volatility spectra, and hygroscopicity of SOA as a function of atmospheric processing time and photochemistry?

- How do chemical interactions among anthropogenic, biogenic, and biomass burning sources affect SOA?

- What is the dependence of SOA chemistry on boundary-layer and recirculation processes that mix aged air masses with fresh emissions?

Mixing State:

- How does the mixing state evolve through chemical and physical transformation processes, and how should the range of mixing states be represented in global and regional models?

- What are the temporal and spatial scales for changes to the hygroscopic and CCN properties of black carbon, organic, and mineral dust particles through condensation, heterogeneous chemistry, and coagulation?

Optical Properties:

- How does the morphology and mixing state of aerosols alter the ensemble optical properties of aerosols and consequently direct radiative forcing?

- What are the scattering and absorbing properties, as a function of wavelength, of different types of organic matter and organic matter mixed with other components?

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