Model Evaluation

The WRF-Chem model is used to simulate the emission, formation, mixing, transport, transformation, and removal of aerosols over the most of North America between July 1 and 25, 2012.

- **Domain Configuration**: \( dx = 36 \) and 12 km, 74 vertical levels
- **Aerosol**: SAPRC chemical mechanism, MOSAIC aerosol model with Volatility Basis Set (VBS) approach for SOA
- **Cloud-Aerosol Interactions**: Vertical transport, aqueous chemistry, wet removal in both resolved and parameterized clouds
- **Emissions**: NEI 2005 anthropogenic adjusted to 2012, FINN biomass burning, MEGAN on-line biogenic, on-line sea-salt
- **IC/BC**: Global GFS analyses for meteorology and global MOZART simulation for trace gases and aerosols

### AMF Site on Cape Cod

- **OM**
- **SO\(_4\)**, **NO\(_2\)**, **NH\(_3\)**

**Concentration and multi-day variation** in simulated aerosol composition and AOD qualitatively similar to measurements.

**Observed** increase in AOD on July 17 likely due to layer at 3-4 km. While simulated dry mass is slightly higher than observed, but aerosol water relatively low at this time.

**Simulated**

- **Dry PM2.5**
- **Aerosol water**

**Maximum values** at top of residual layer where RH is higher

**Increase** associated with changing meteorological conditions and transport of more aerosol into TCAP region

### Overarching Goals

**Understand** the processes responsible for producing and maintaining aerosol distributions and associated aerosol and cloud radiative forcings off the East Coast of North America.

**Evaluate** the ability of models to adequately simulate the mass, composition, and size distribution of observed aerosol layers and determine how uncertainties in aerosol microphysical properties affect optical properties when compared to measurements.

### Aircraft Extinction and Composition Profiles

- **July 17, 16:10 – 17:00 UTC**
- **July 22, 15:21 – 16:15 UTC**

**Vertical structure and composition** are simulated well for some layers. Some errors may simply be due to timing of transported layers, while others may be related to emissions (e.g., biomass burning) – both are being investigated.

### Next Steps

While the model qualitatively represents the composition and structure of the aerosol layers, the simulated uptake of water and size distribution still needs to be evaluated. Optical closure studies are being performed to assess the errors due to simulated aerosol microphysical properties and layer structure versus the errors resulting from the model’s treatment of aerosol optical properties (e.g., mixing rules and mixing state).

### Acknowledgements

This research was supported DOE’s ASR Program and the ARM Climate Research Facility.

1. Pacific Northwest National Laboratory
2. NASA Langley Research Center
3. Brookhaven National Laboratory