An AeroCom intercomparison exercise on state-of-the-art organic aerosol global modeling

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+68 more authors from 44 institutions
with 31 models and >1000 measurement locations
Aim

• **Document** global organic aerosol modeling
• **Quantify** robustness of model parameterizations

• Why models **differ**
• Why models are **the same**

• How do models compare with measurements
• How we can use measurements to improve models
Status of the paper – Sep 18

• 87 pages (1.5 spaced)
• 5 tables
• 19 figures (more to come)
• 7 supplementary figures (more to come)

Manuscript almost ready for distribution!

One month reading time will be provided
31 models

# of OA tracers: 1 - 62
# of SOA tracers: 0 - 22
AeroCom I $\rightarrow$ AeroCom II: higher complexity + higher model diversity due to SOA
Organic Carbon observations

μgC/m$^3$
Organic Aerosol observations
LAD: Least Absolute Deviation
US urban stations

- Arizona (AZ, -112.10, 33.50)
- Georgia (GA, -83.64, 32.78)
- Colorado (CO, -104.83, 38.83)
- Ohio (OH, -81.68, 41.49)

Graphs showing seasonal variations in OC urban concentrations with overlaid error bars and line graphs for each location.
US urban stations

SOA production +50%
US urban stations

Bond et al., 2007
US urban stations

Bond et al., 2007
US urban stations

GISS-modelE-G (lon: −111.25, lat: 33.00)

GISS-modelE-G (lon: −83.75, lat: 33.00)

GISS-modelE-G (lon: −103.75, lat: 39.00)

GISS-modelE-G (lon: −81.25, lat: 41.00)
US urban stations

GISS-modelE-I (lon: -111.25, lat: 33.00)

GISS-modelE-I (lon: -83.75, lat: 33.00)

GISS-modelE-I (lon: -103.75, lat: 39.00)

GISS-modelE-I (lon: -81.25, lat: 41.00)
US urban stations

GMI (lon: -112.50, lat: 34.00)

GMI (lon: -82.50, lat: 32.00)

GMI (lon: -105.00, lat: 38.00)

GMI (lon: -82.50, lat: 42.00)
US urban stations

HadGEM2-ES (lon: -112.50, lat: 33.75)

HadGEM2-ES (lon: -84.38, lat: 32.50)

HadGEM2-ES (lon: -105.00, lat: 38.75)

HadGEM2-ES (lon: -82.50, lat: 41.25)
US urban stations

Graphs showing OC urban (ugC m$^{-2}$) for different locations:

a) MPIHAM-v2 (lon: -112.50, lat: 32.64)

b) MPIHAM-v2 (lon: -84.38, lat: 32.64)

c) MPIHAM-v2 (lon: -105.00, lat: 38.24)

d) MPIHAM-v2 (lon: -82.50, lat: 41.97)
US urban stations

OsloCTM2 (lon: -112.50, lat: 32.34)

OsloCTM2 (lon: -84.38, lat: 32.34)

OsloCTM2 (lon: -104.06, lat: 37.97)

OsloCTM2 (lon: -81.56, lat: 40.78)
US urban stations

**SPRINTARS (lon: -112.50, lat: 33.08)**

**SPRINTARS (lon: -83.25, lat: 33.08)**

**SPRINTARS (lon: -104.62, lat: 38.69)**

**SPRINTARS (lon: -82.12, lat: 40.93)**

- **OC urban (µgC m⁻²)**
- **J F M A M J J A S O N D**
- **J F M A M J J A S O N D**
- **J F M A M J J A S O N D**
- **J F M A M J J A S O N D**
US urban stations

GISS-CMU-VBS (lon: -112.50, lat: 34.00)

a) OC urban (µgC m⁻²)

b) OC urban (µgC m⁻²)

c) OC urban (µgC m⁻²)

d) OC urban (µgC m⁻²)

volatility-basis set
US urban stations

Images (lon: \(-111.25\), lat: 33.00)

Images (lon: \(-83.75\), lat: 33.00)

Images (lon: \(-103.75\), lat: 39.00)

Images (lon: \(-81.25\), lat: 41.00)

multiphase
US urban stations

- IMPACT (lon: -110.00, lat: 34.00)
- IMPACT (lon: -85.00, lat: 34.00)
- IMPACT (lon: -105.00, lat: 38.00)
- IMPACT (lon: -80.00, lat: 42.00)

Multiphase epoxides
US urban stations

- **TM4-ECPL-F (lon: -112.50, lat: 33.00)**
- **TM4-ECPL-F (lon: -82.50, lat: 33.00)**
- **TM4-ECPL-F (lon: -103.50, lat: 39.00)**
- **TM4-ECPL-F (lon: -82.50, lat: 41.00)**

**Multiphase**
US urban stations

- Multiphase
- Primary biological particles
US remote stations

Urban: 6

AZ (-114.07, 36.02)

GA (-82.13, 30.74)

CO (-107.80, 37.66)

OH (-81.34, 39.94)

Urban: 4
Conclusions

• Diversity increased since AeroCom phase I.
• Missing OA source can be either anthropogenic or biogenic.
• OA/OC assumption affects model skill; OA appears to be better compared with measurements.

• More data are needed, spatial coverage still poor.

• more to come in ‘future plans’ presentation