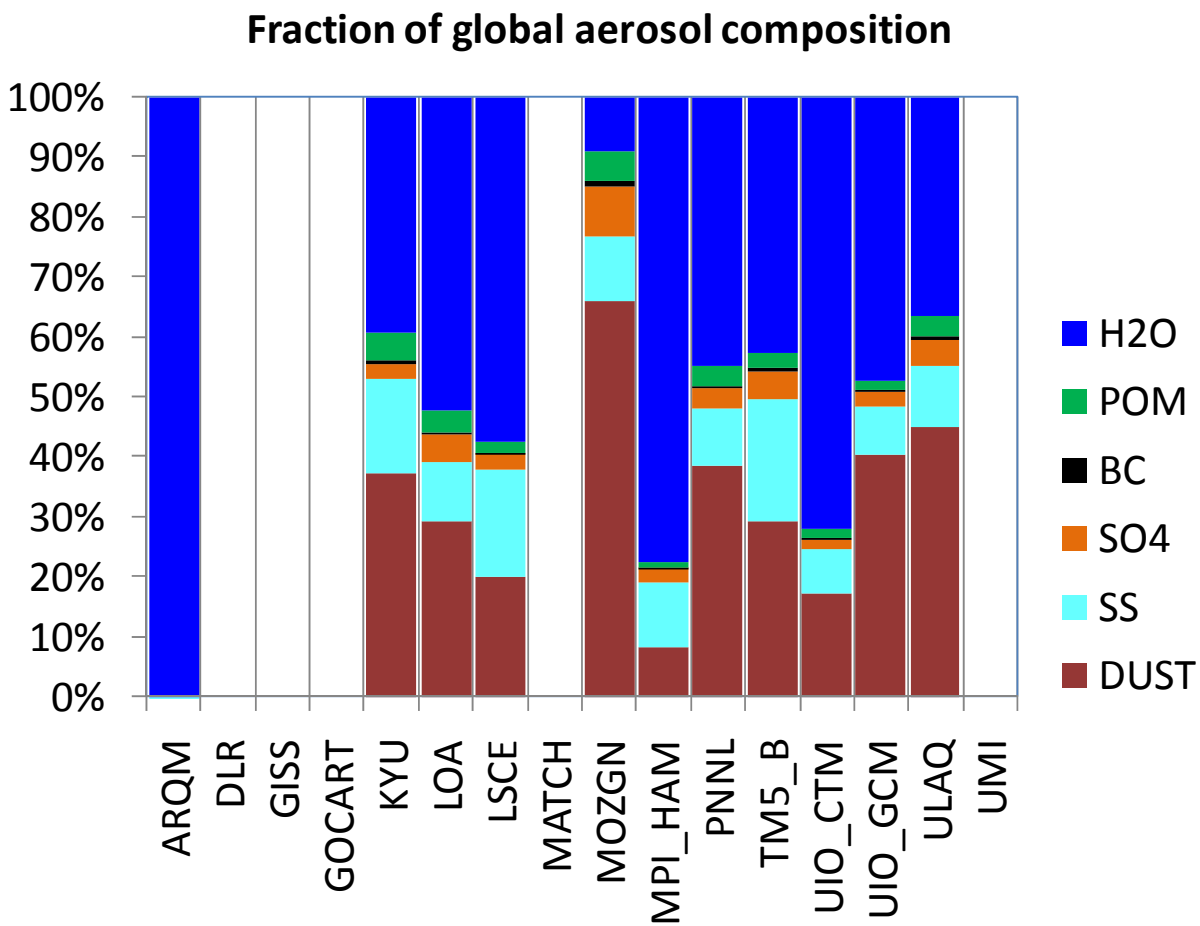
Kostas Tsigaridis
Maria Kanakidou

Organic aerosols: time to compare different approaches

OA within AEROCOM



Modified from Textor et al., 2006

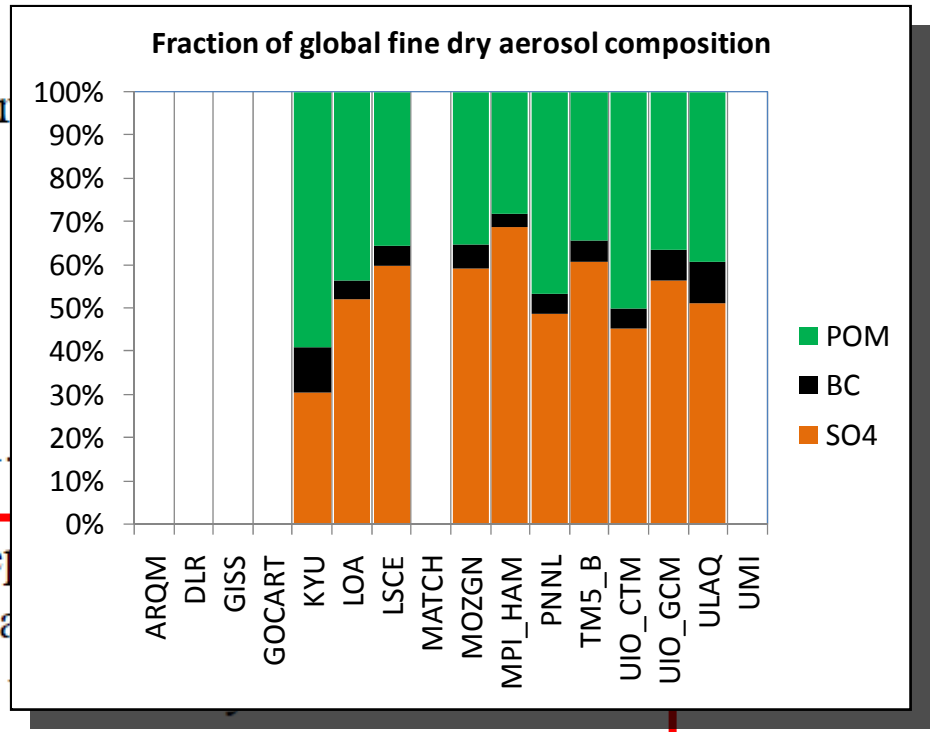
AEROCOM conclusion

Several processes and parameters, which are particularly relevant for aerosol radiative forcing calculations, with high diversities are:

- masses of aerosol in the r
- dry aerosol composition
- aerosol water content
- vertical aerosol dispersal.

Consequently the improved re
and parameters in large-scale a
priority in order to reduce the
pact attributed to aerosol.

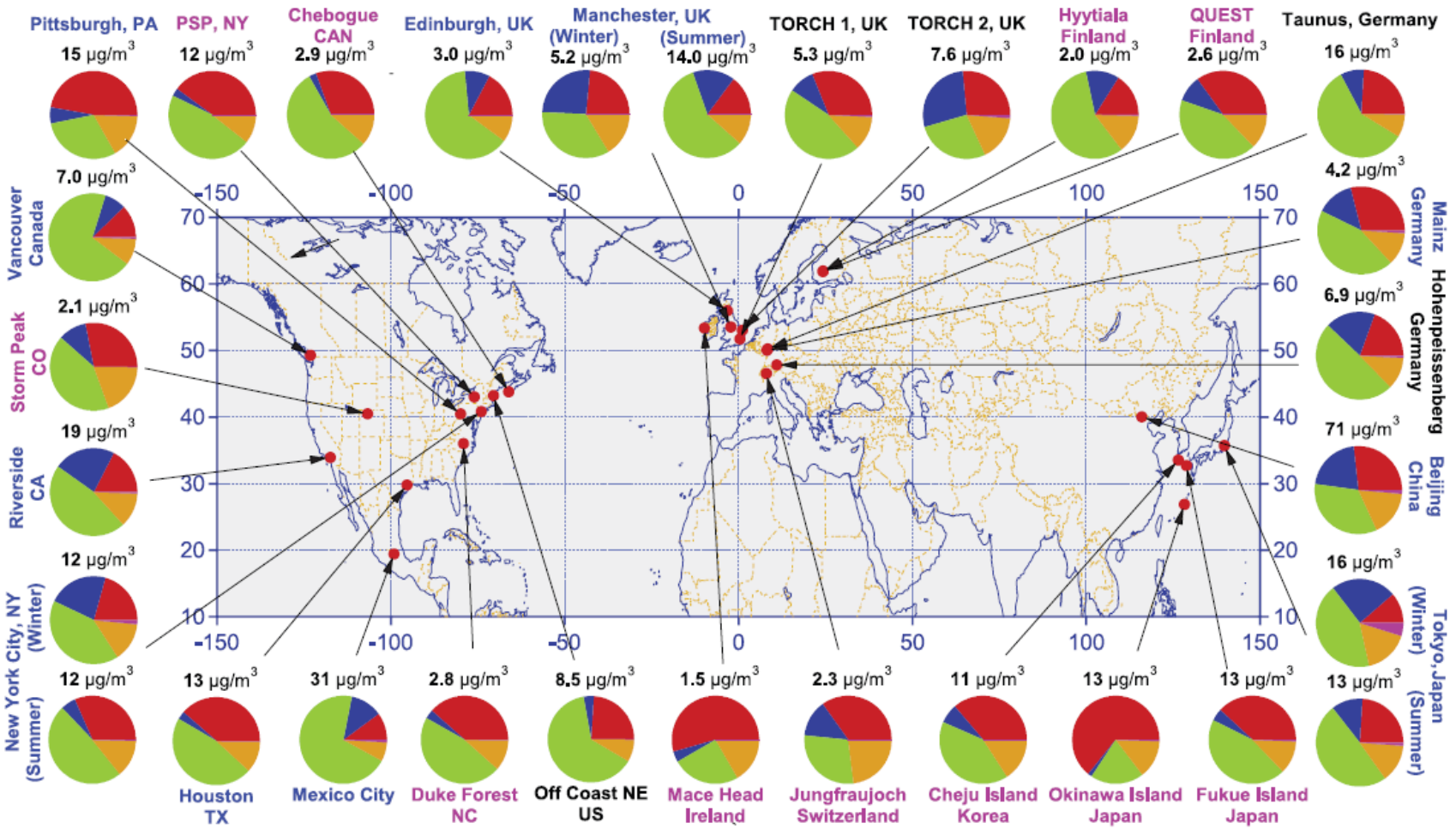
No fine SS, DU



Textor et al., 2006

OA at surface

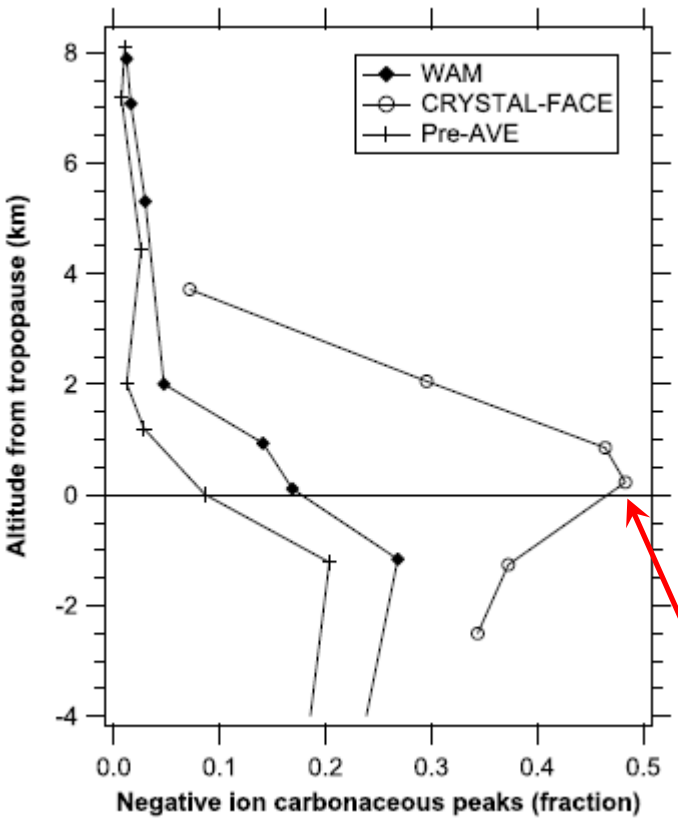
Urban
Urban downwind
Rural/remote

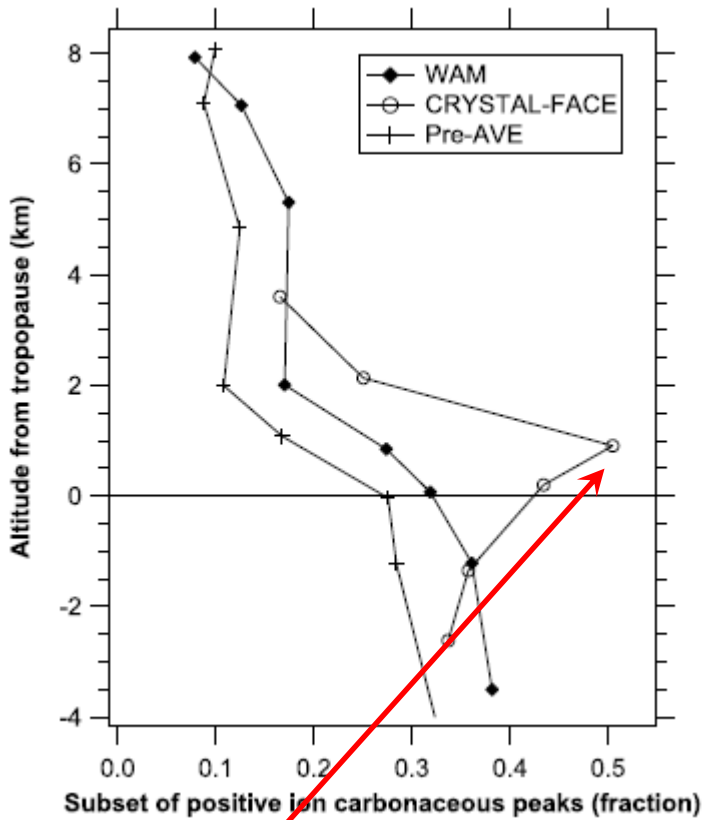


Zhang et al., 2007 (GRL)

organics (green), sulfate (red), nitrate (blue), ammonium (orange), and chloride (purple), of NR-PM_1

OA at high altitude



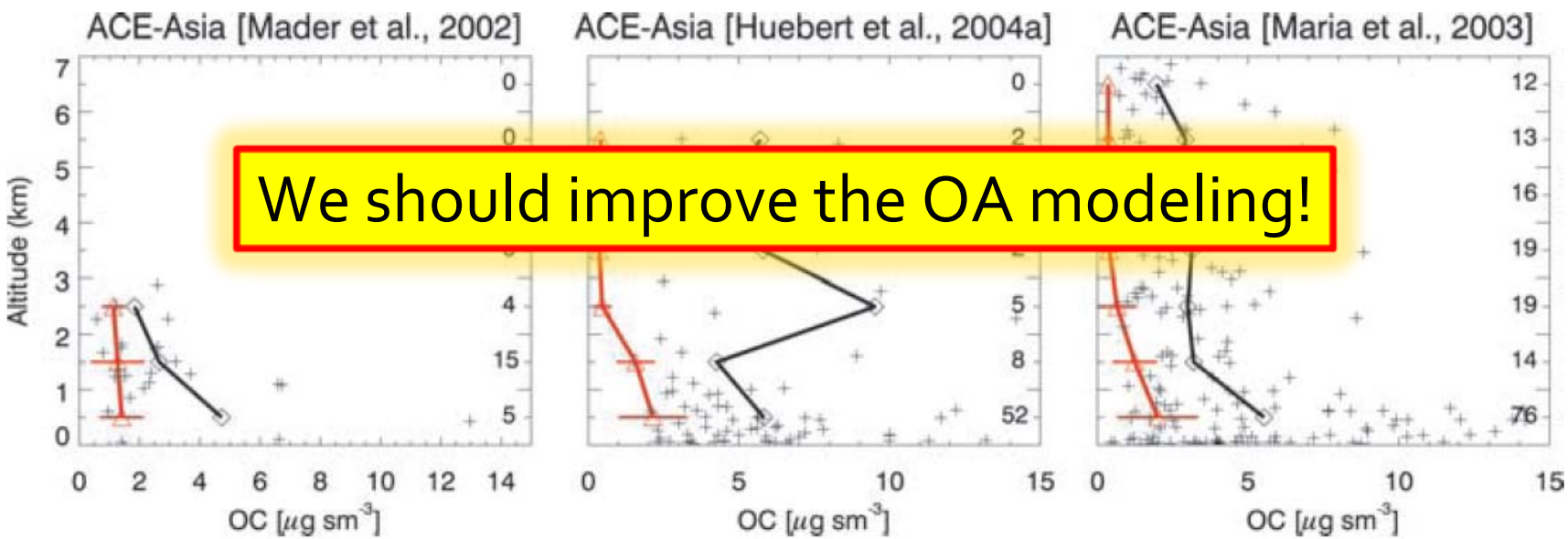


Biomass burning particles

Murphy et al., 2007

OA at high altitude

Black: measurements
Red: model



We should improve the OA modeling!

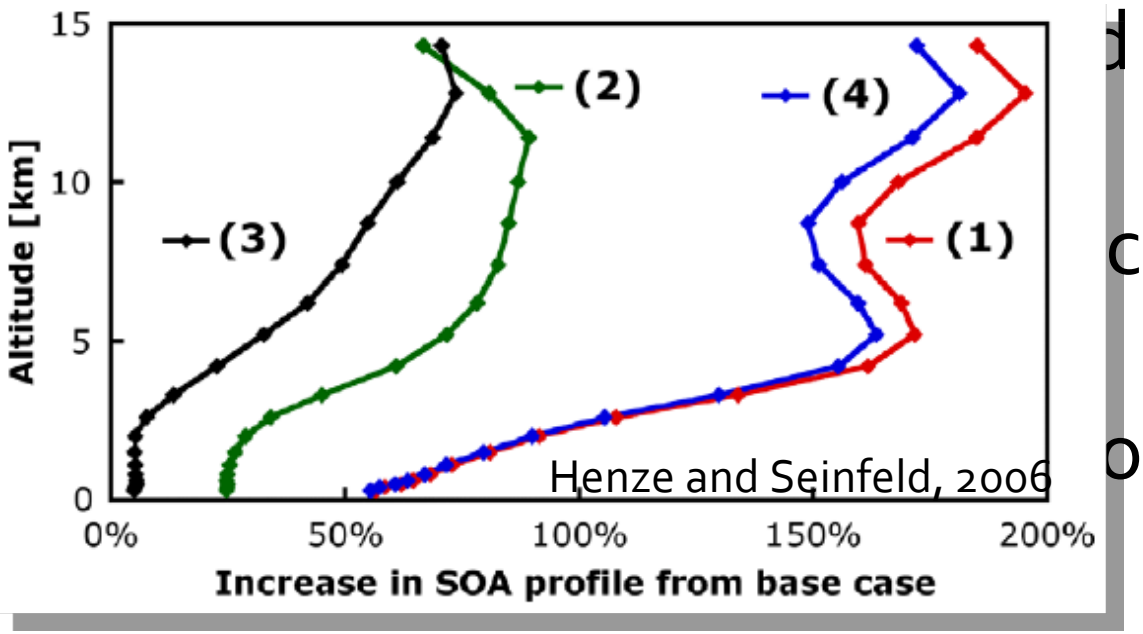
Heald et al., 2005

OA limitations within AEROCOM

- Accurate SOA source missing
- Marine POA/SOA source missing
- Semi-volatile POA missing
- No comparison with observations

Accurate SOA source

- "Inclu
- Many
- New



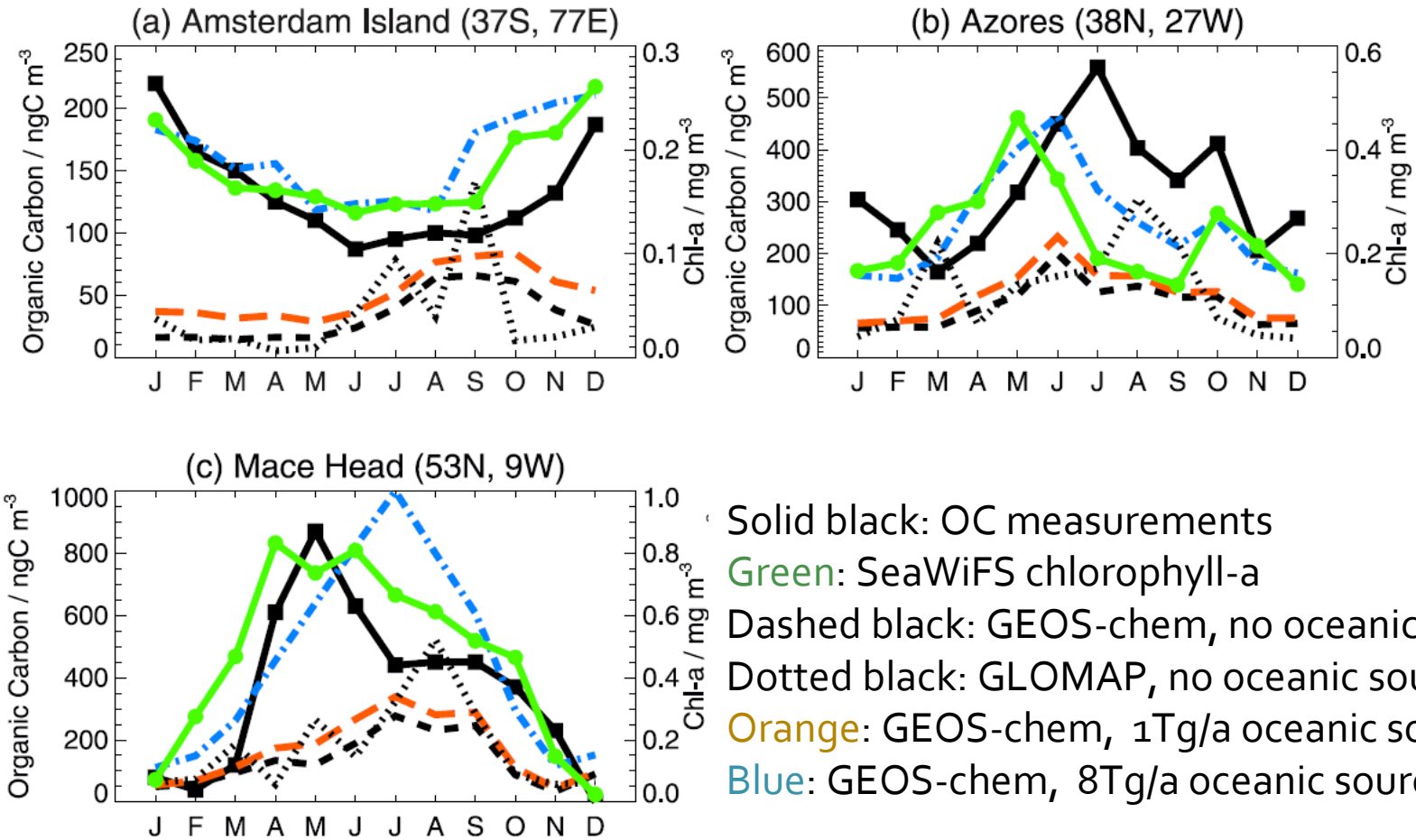
come

oprene)

Could isoprene be the missing high altitude source?

(1) Isoprene, ΔH=42kJ/mol, H=10^5M/atm
(2) Non-isoprene, ΔH=50kJ/mol, H=10^5M/atm
(3) Non-isoprene, ΔH=42kJ/mol, H=10^4M/atm
(4) Isoprene, ΔH=42kJ/mol, H=10^6M/atm

Marine POA/SOA source



Solid black: OC measurements

Green: SeaWiFS chlorophyll-a

Dashed black: GEOS-chem, no oceanic source

Dotted black: GLOMAP, no oceanic source

Orange: GEOS-chem, 1Tg/a oceanic source

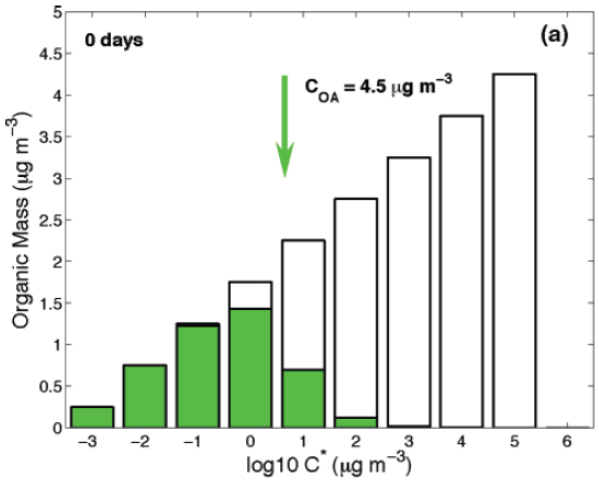
Blue: GEOS-chem, 8Tg/a oceanic source

POA: Spracklen et al., 2008; SOA: Arnold et al., 2008

Semi-volatile POA

Gas

Aerosol



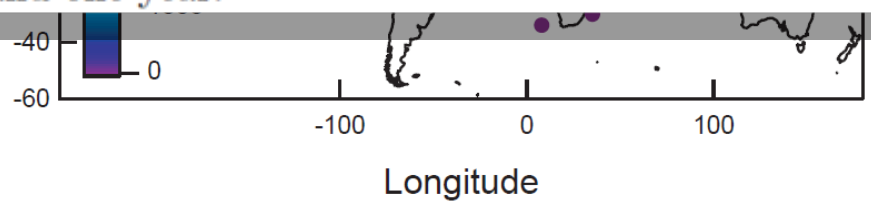
Donahue et al., 2006; Robinson et al., 2007

Comparison with observations

Sampling frequency	World	N. America	Europe	Africa	China	Japan	Other Asia
Hourly	151493	149396	0	0	0	2097	0
Daily	288470	283927	2547	0	1658	272	56
Weekly	147	0	0	0	143	0	4
Monthly	551	2					
Seasonal	174	75	8	0	79	4	8
Annual	77	26	8	0	37	1	5
Total	440912	433640	2563	29	2094	2482	104

+ AMS measurements (Zhang et al., 2007)

Table 1
Global inventory of individual organic carbon measurements. Sampling durations range between one hour and one year.



Bahadur et al., 2008 (submitted, available at http://aerosol.ucsd.edu/publications.html)

What do we want to know?

- Primary/secondary (chemically processed)
- Anthropogenic/natural
- HOA/OOA (AMS)
- CCN/solubility
- Optical properties
- Mixing state

- Seasonal/interannual variability
- Base year?

Description of the OA model

- Emissions (hydrophilic/hydrophobic fraction)
- OA species (POA, SOA, MSA)
- OM/OC ratio
- Aerosol microphysics (especially mixing state, size distribution and their evolution)
- Treatment of SOA
- Optical calculations (especially AOD)
- Dry and wet removal (Henry?)
- Direct and/or indirect effect included?

What model output do we need?*

* Per species, per month (or per day?), 3D. At selected stations, daily output vs. height

- Concentration and burden, ratio OM/OC
- Positive fluxes (emissions (per source), chem. production)
- Negative fluxes (dry/wet deposition, chem. destruction)
- Ratio of soluble to insoluble
- Hydrophobic-to-hydrophilic conversion rate
- Lifetime
- AOD
- Oxidants (OH, O_3, NO_3), BC

Feedback:

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Thank you!