Organic Aerosol Volatility Parameterizations and their Impact on Atmospheric Composition and Climate

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OA volatility in global models

	Volatility		Emissions		Chemistry	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
noSOA	Non-volatile	Non-volatile	BB+Anthro	0.15*(Terp)	Aging	Aged

Dentener et al., 2006

To take into account the intermediate volatility organic compounds (IVOCs); Shrivastava et al., 2008.

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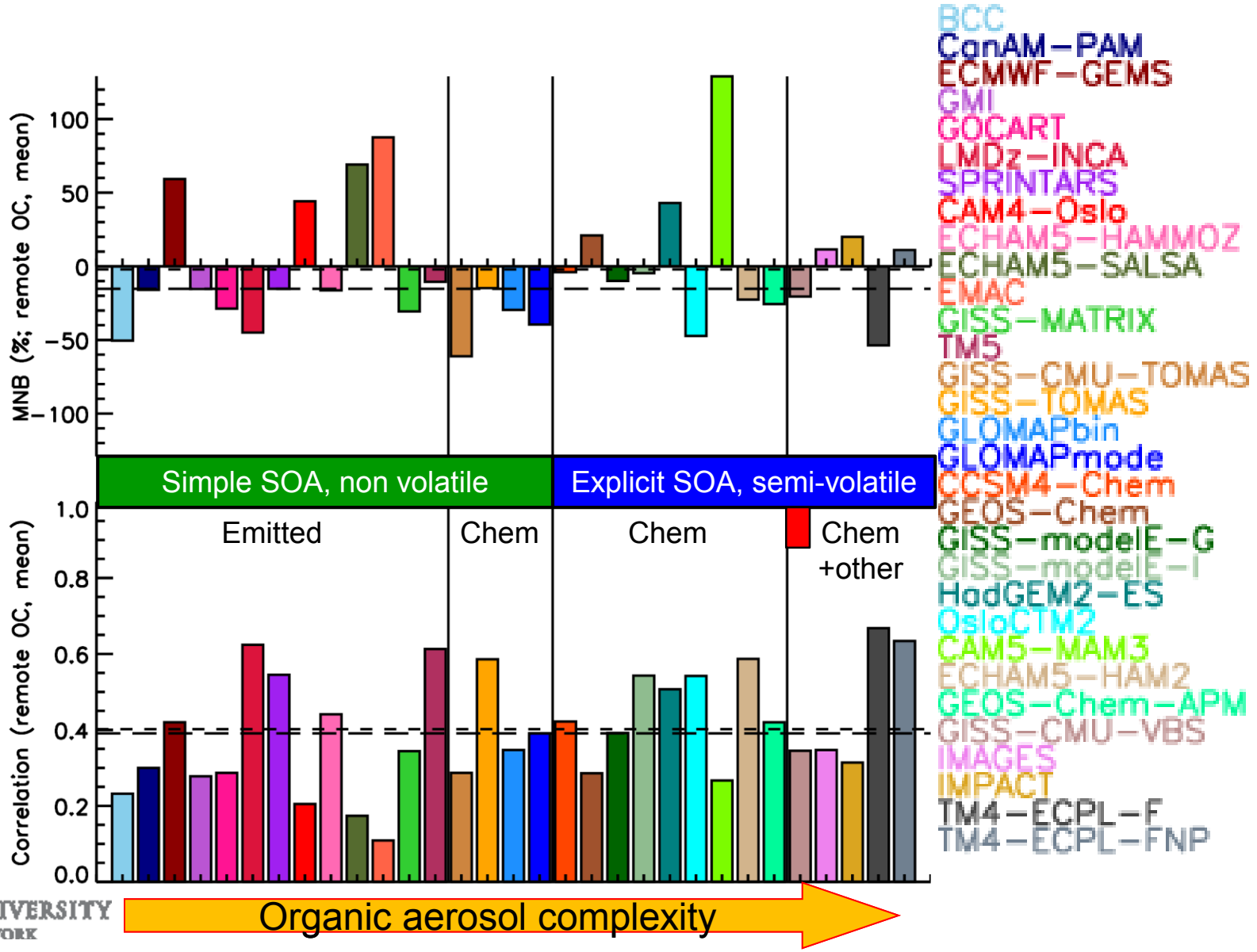
Global model skill against OA measurements



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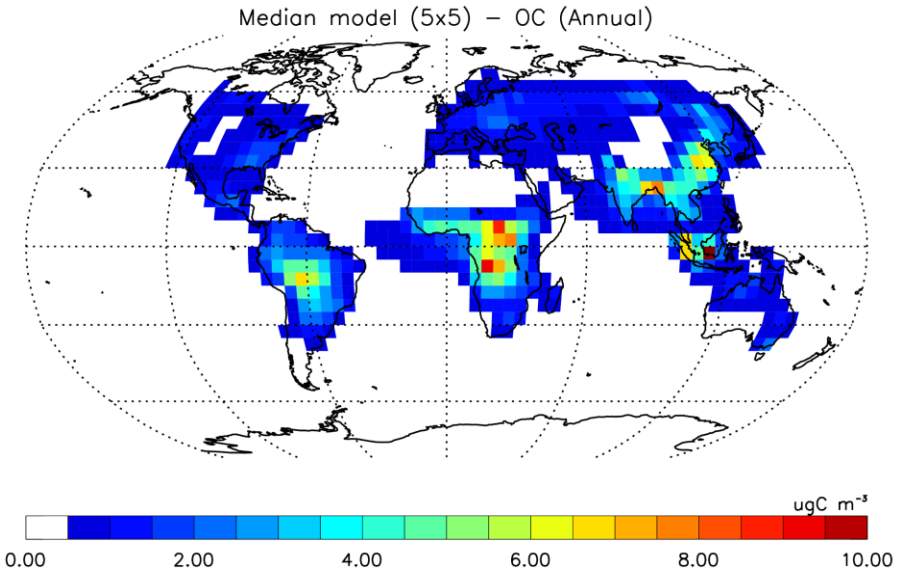
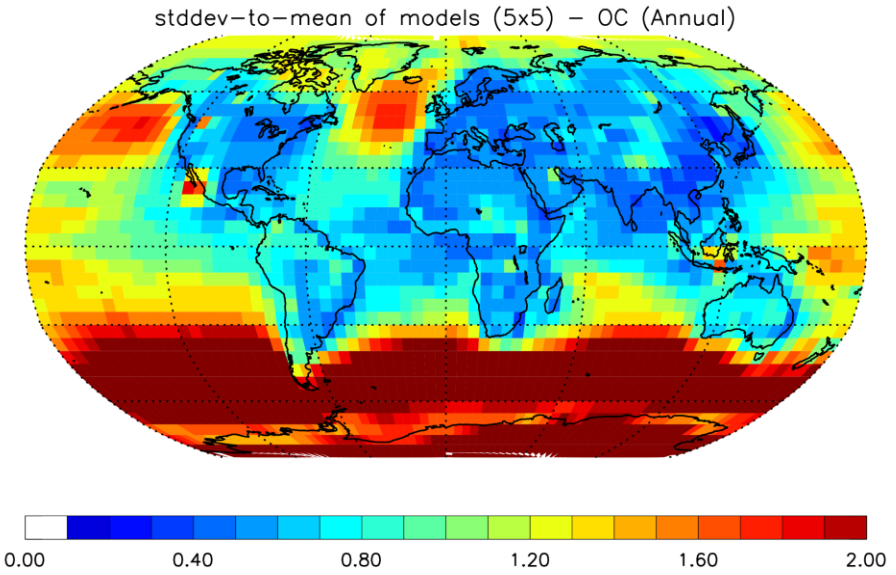
Tsigaridis et al., 2014

Median model – surface





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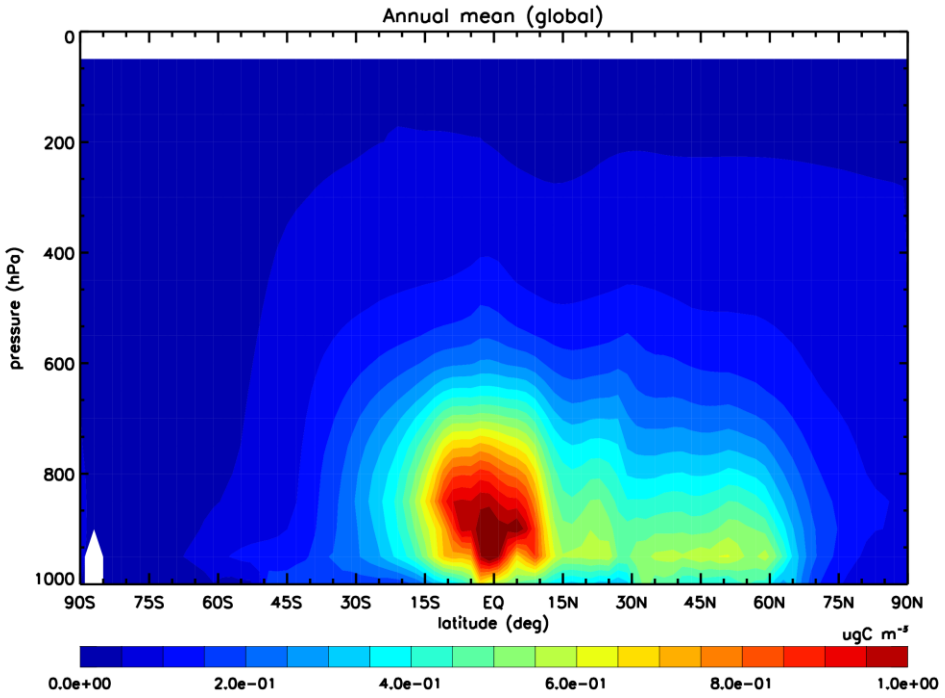
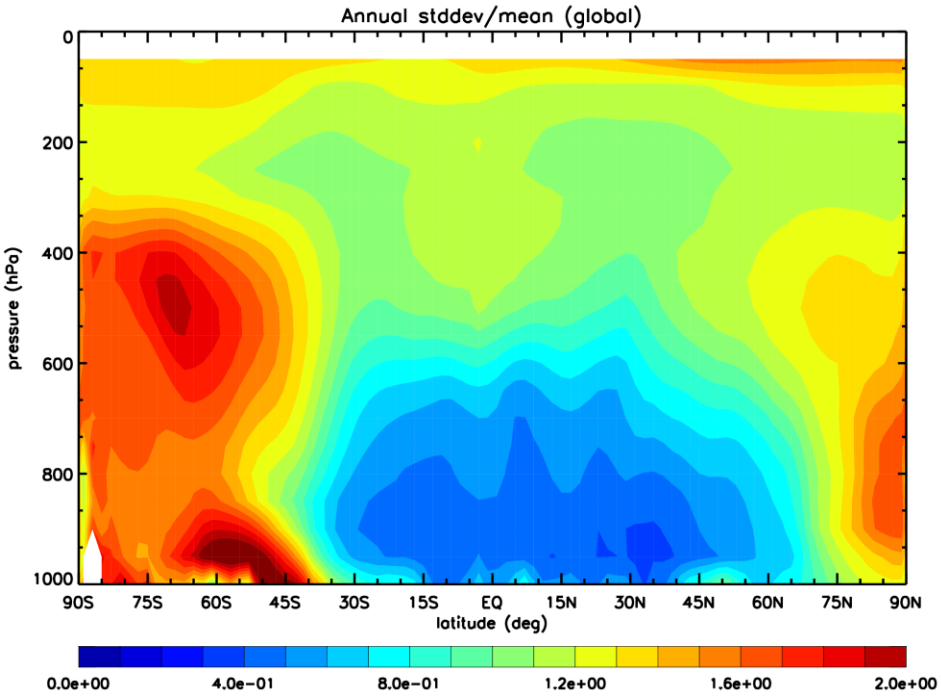
Tsigaridis et al., 2014

Median model – vertical

Model median



Model diversity



1 μgC m^{-3}

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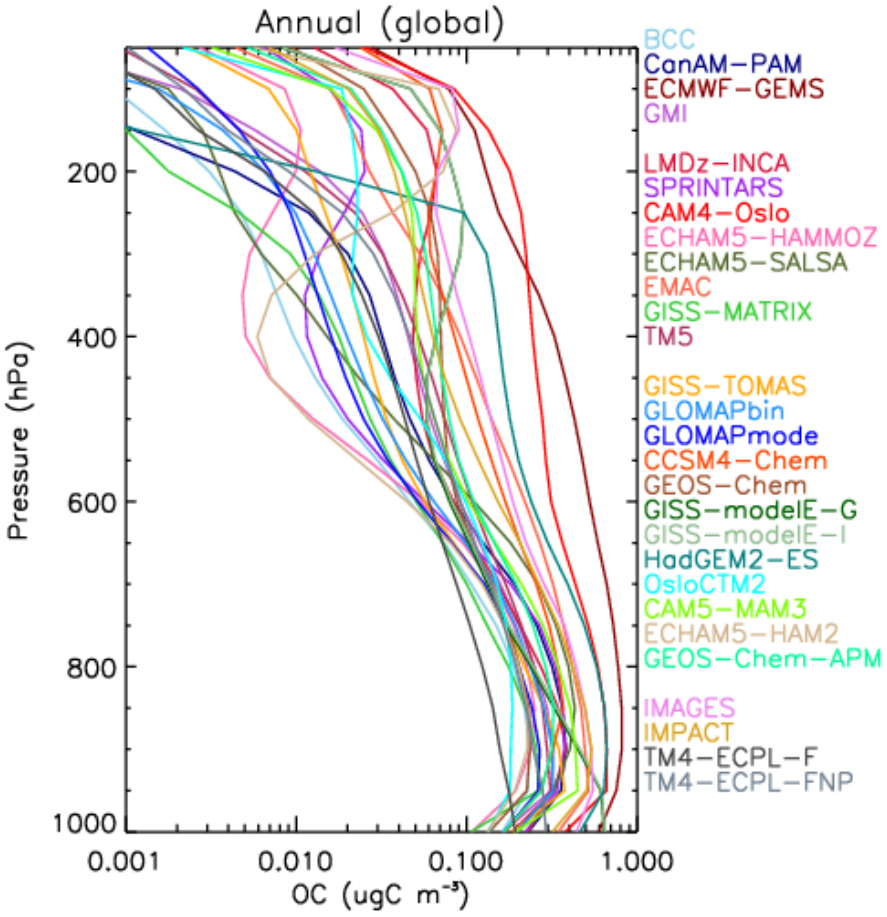
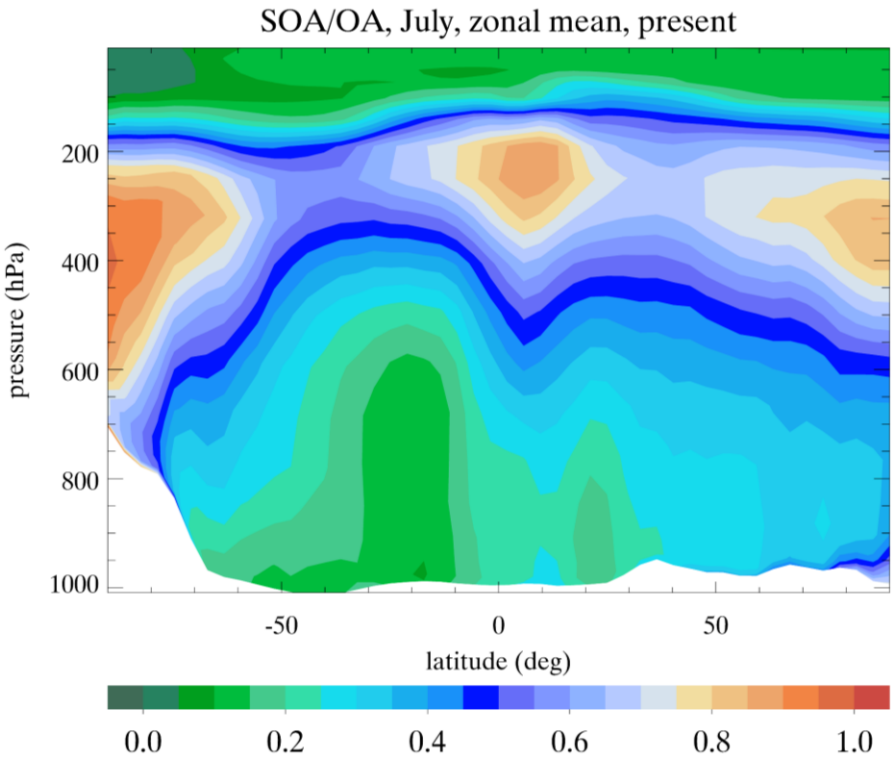
Tsigaridis et al., 2014

Vertical profile

Tsigaridis et al., 2014



Kanakidou et al., 2005



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OA volatility in global models

	Volatility		Emissions		Chemistry	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
noSOA	Non-volatile	Non-volatile	BB+Anthro	0.15*(Terp)	Aging	Aged
SOA	Non-volatile	Semi-volatile	BB+Anthro	Terp+Isop	Aging	Oxidation
VBS	Semi-volatile	Semi-volatile	2.5*(BB+Anthro)	Terp+Isop	Oxidation	Oxidation

	Aerosol parameterization
OMA	One-moment aerosols (bulk)
MATRIX	Aerosol microphysics

Dentener et al., 2006

To take into account the intermediate volatility organic compounds (IVOCs); Shrivastava et al., 2008.

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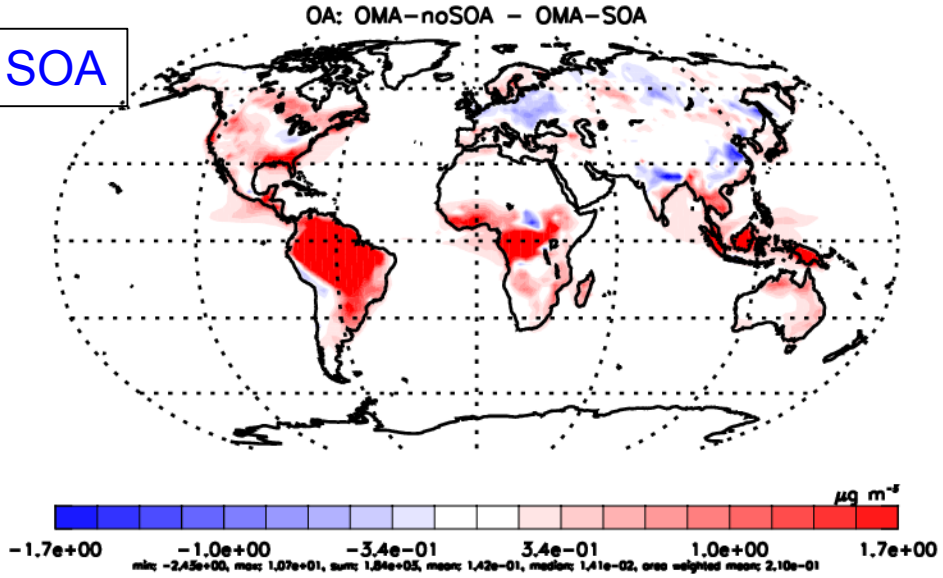
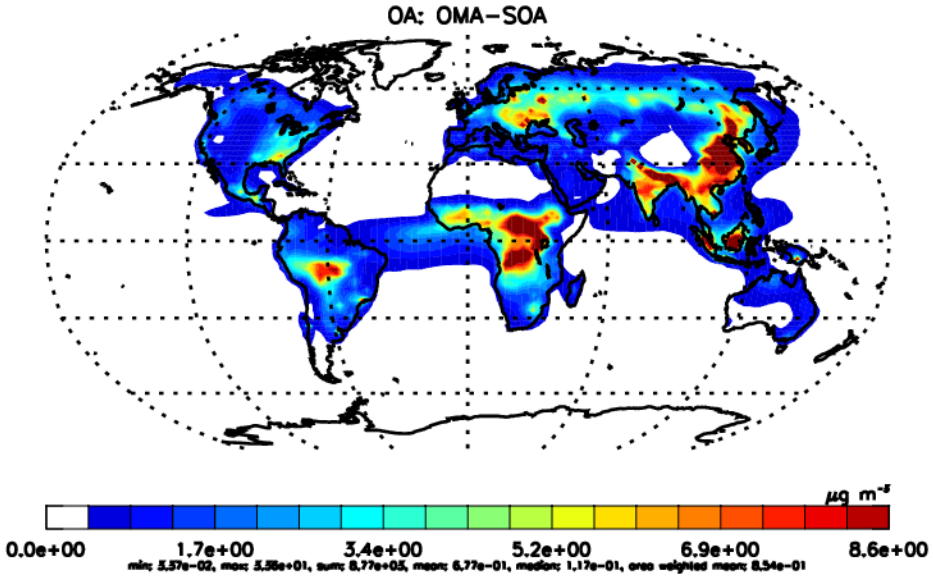
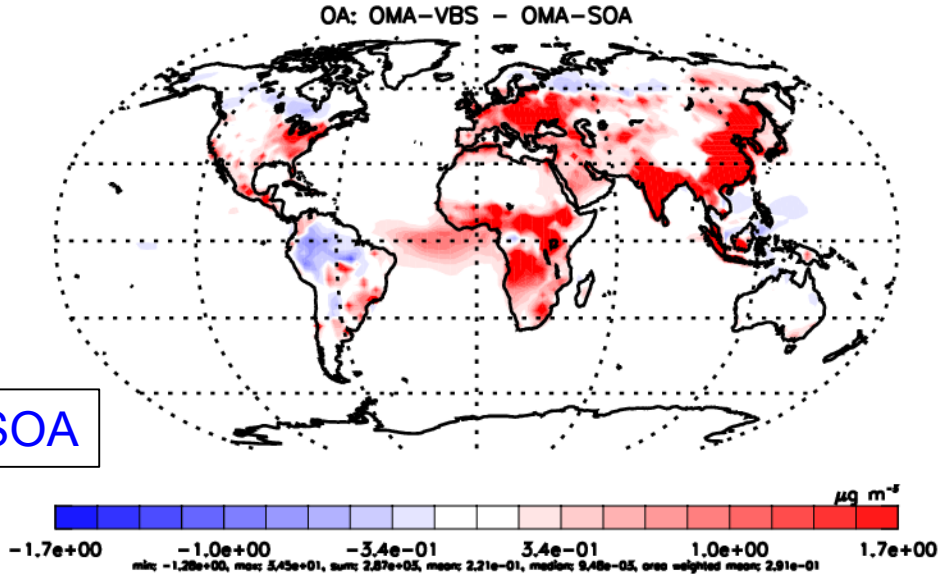
OA at surface

noSOA - SOA



SOA





VBS - SOA

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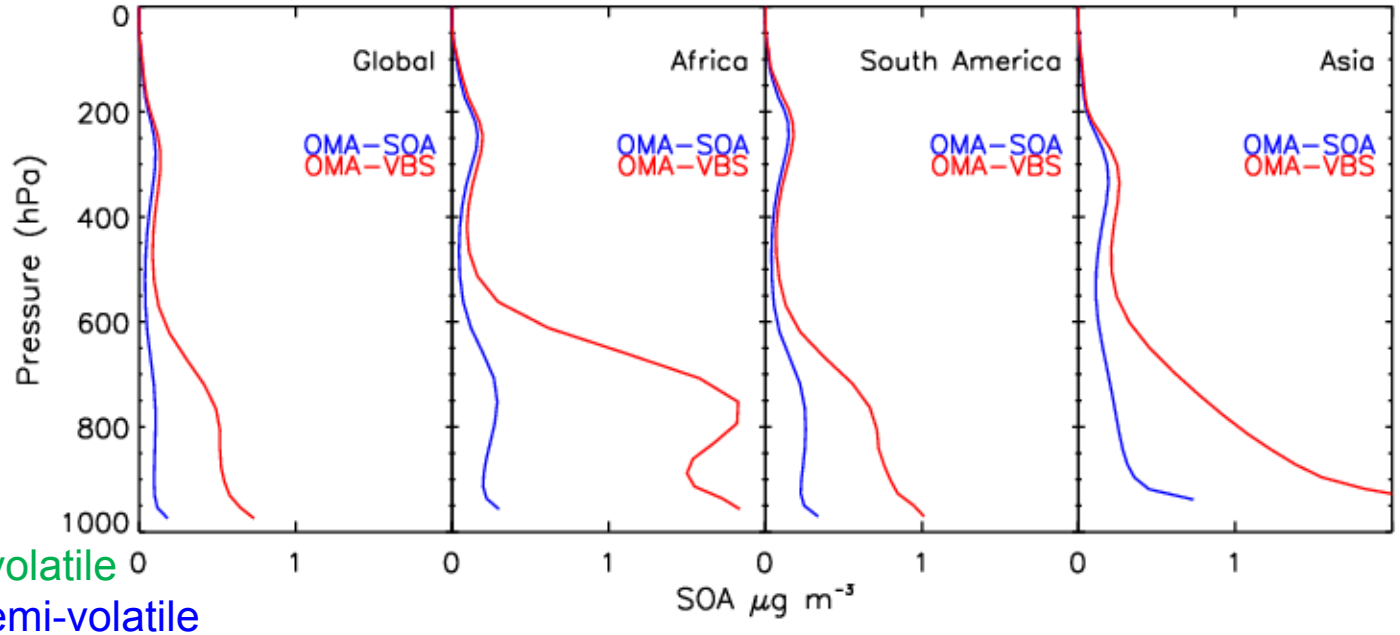
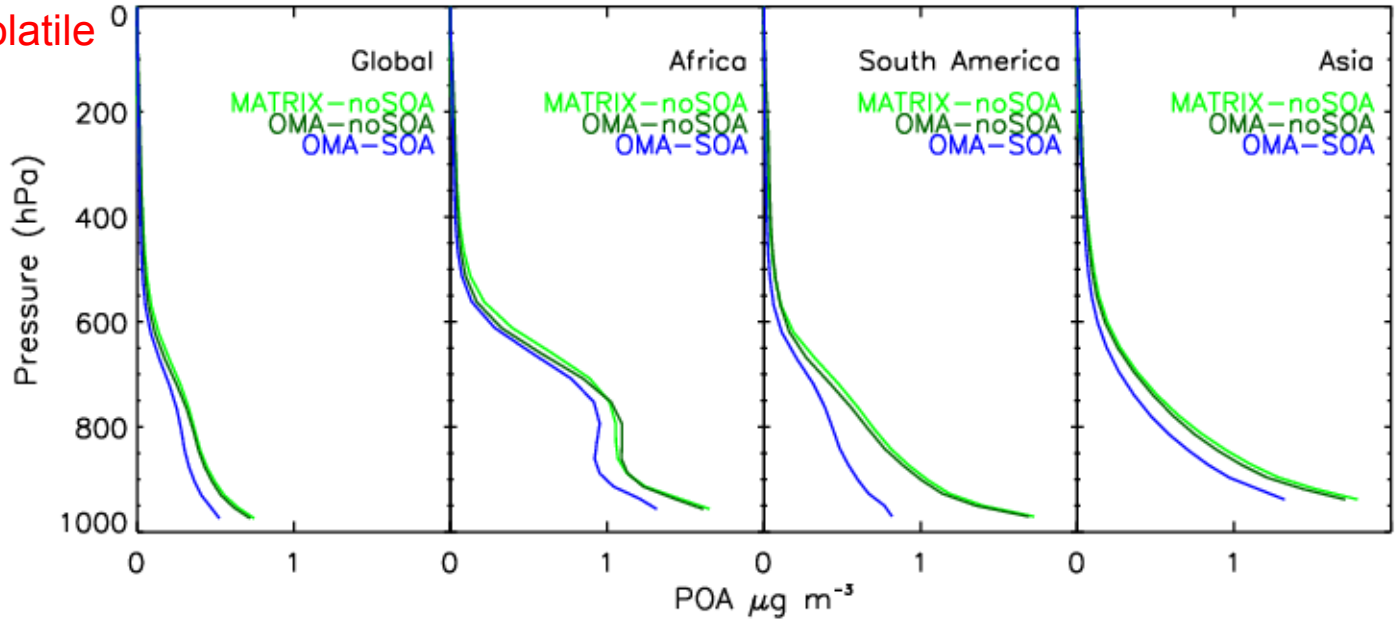
POA/SOA vertical distribution

Secondary



Green: All organics non-volatile
Blue: All biogenic SOA semi-volatile
Red: All organics semi-volatile

Primary



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OA vertical distribution

Green: All organics non-volatile
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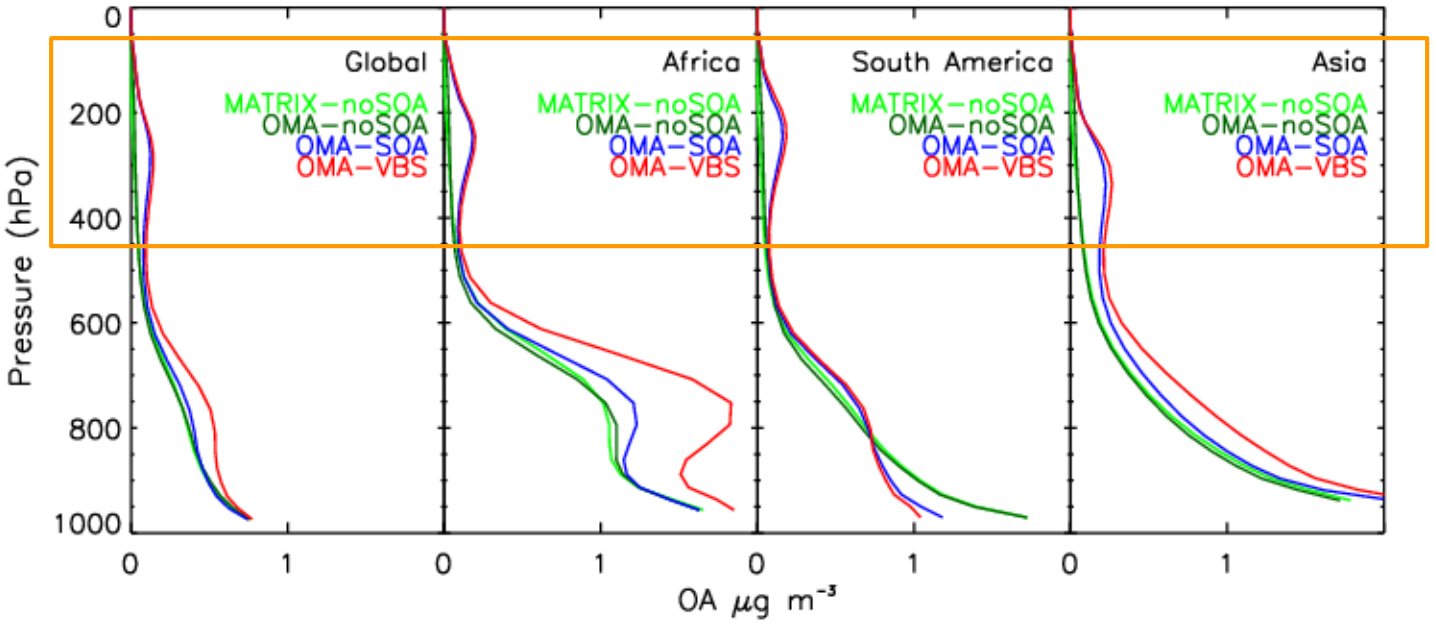

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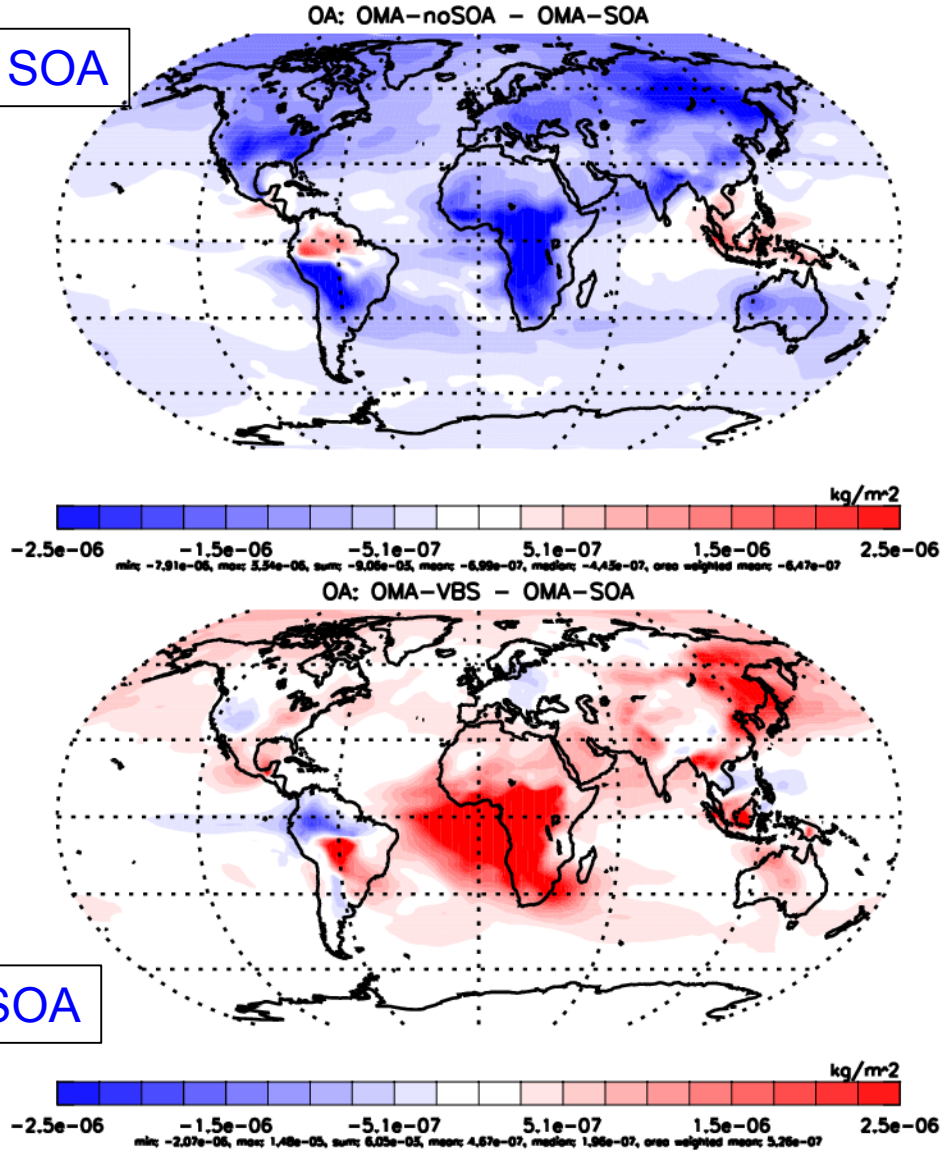
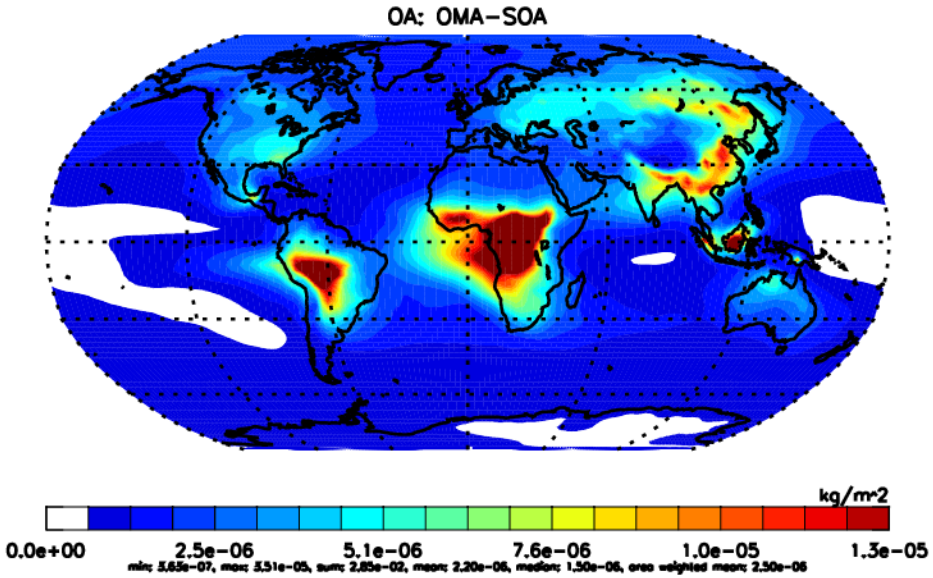
OA column burden

noSOA - SOA



SOA



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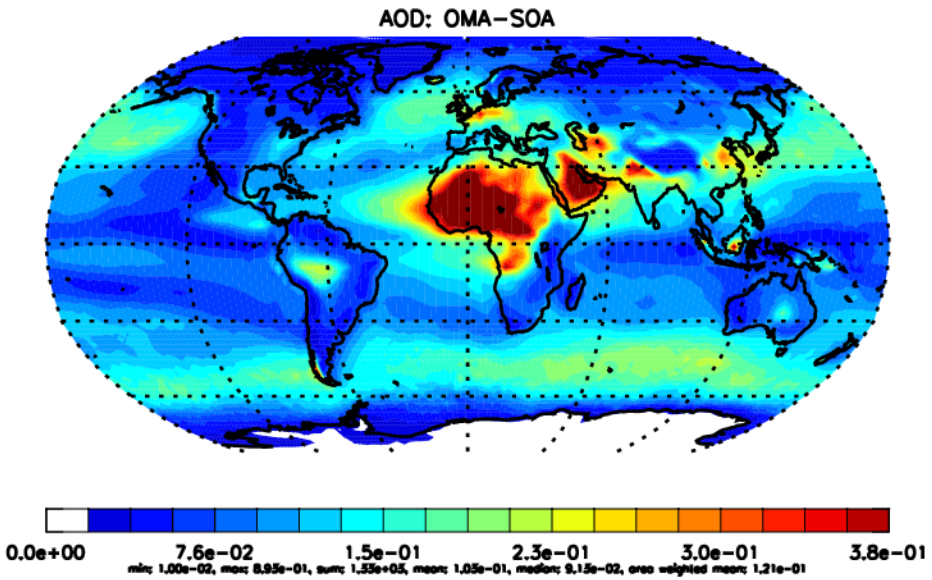
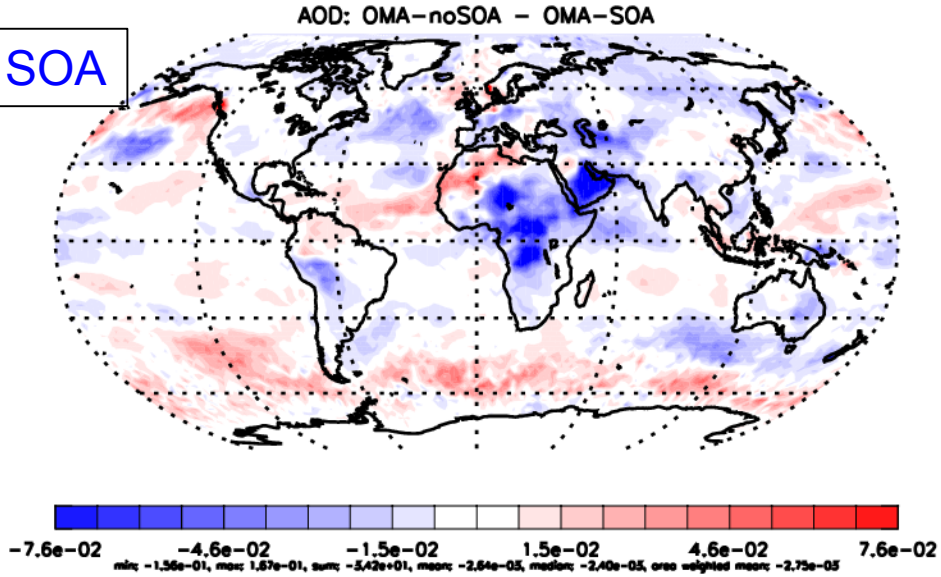
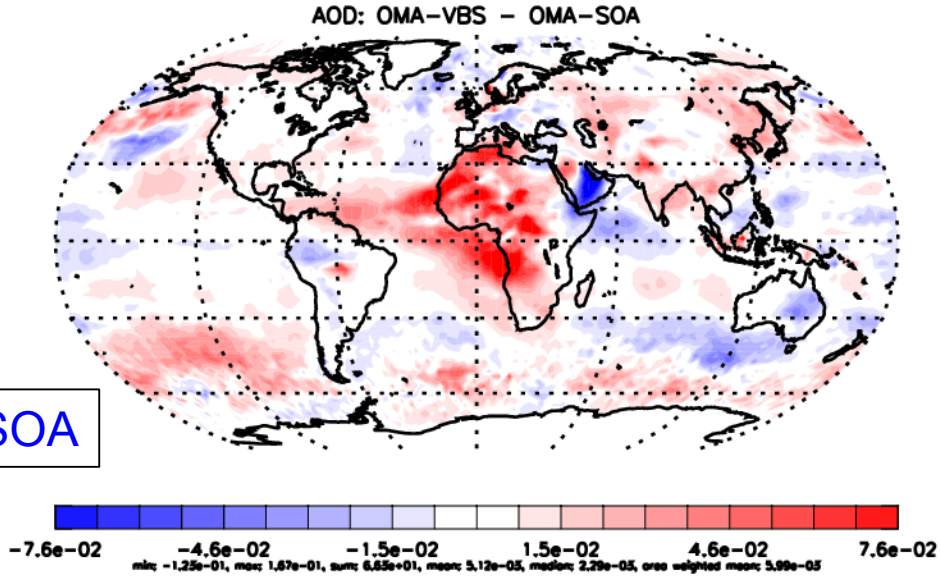
Aerosol Optical Depth @ 550 nm

noSOA - SOA

SOA







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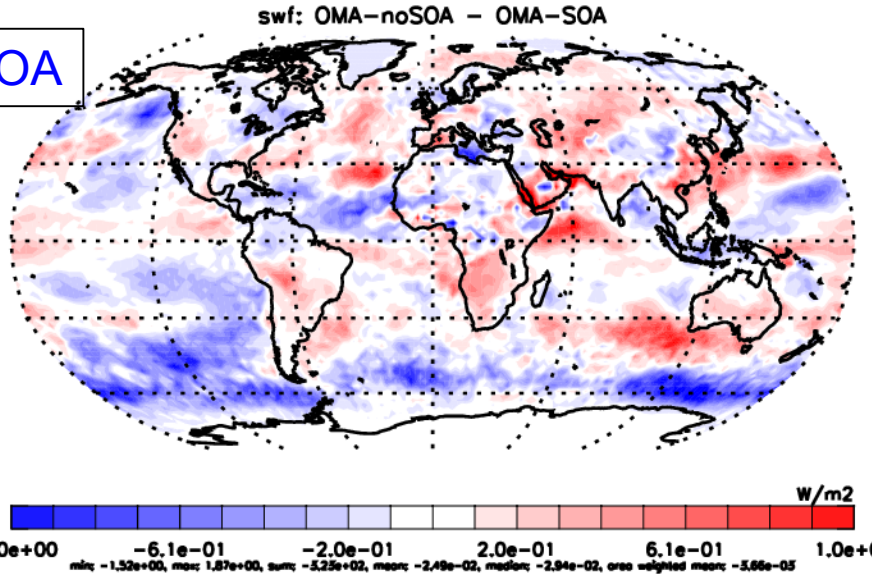
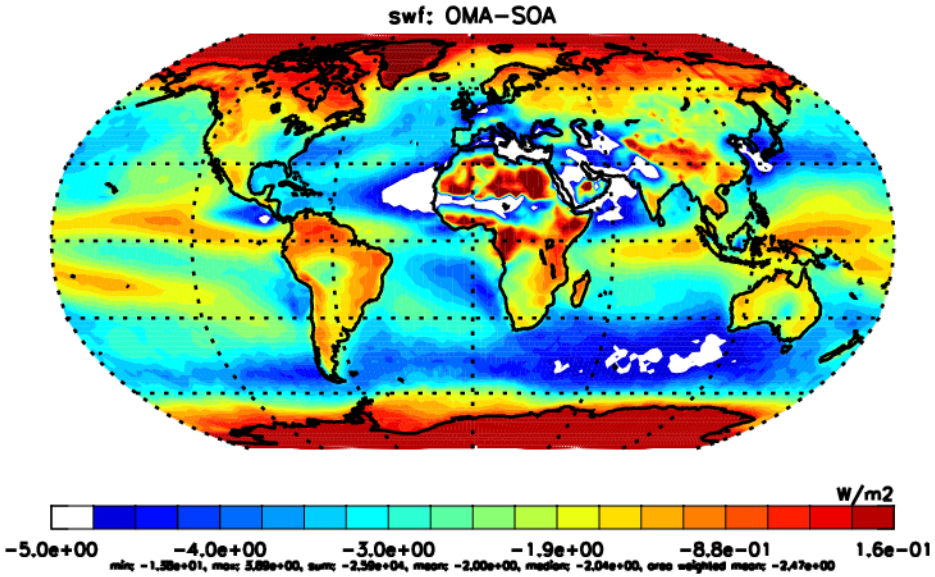
Shortwave aerosol forcing

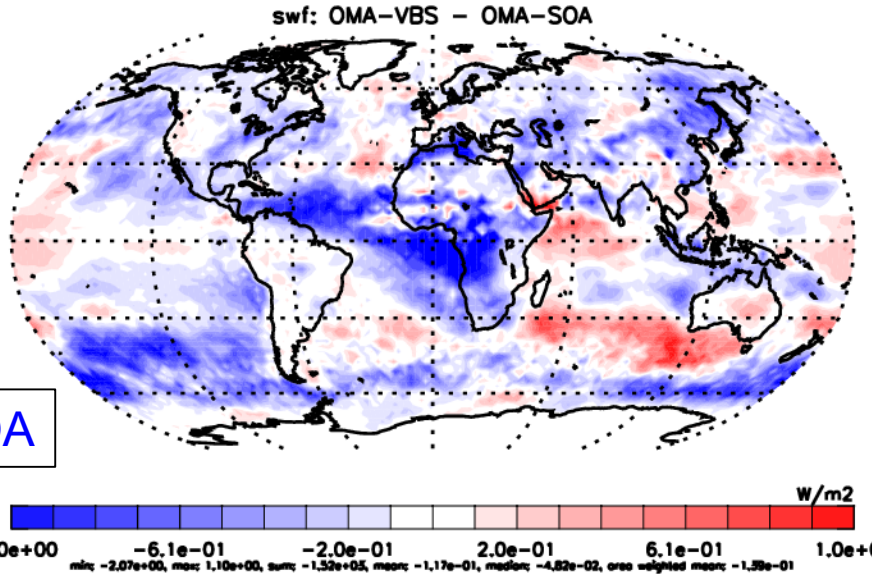
noSOA - SOA

~0 W m^{-2}



SOA





VBS - SOA

-0.14 W m^{-2}

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Conclusions

- Aerosol microphysics do not significantly alter the mean OA vertical profile or comparison with surface measurements. This might not be the case for semi-volatile OA with microphysics.

- The inclusion of some (or all) of OA as semi-volatile strongly impacts their vertical profile, with climate implications.

Application against high altitude measurements:
Bauer (A51N-0269)

VBS with microphysics:
Gao, Tsigaridis and Bauer (A43G-0371)

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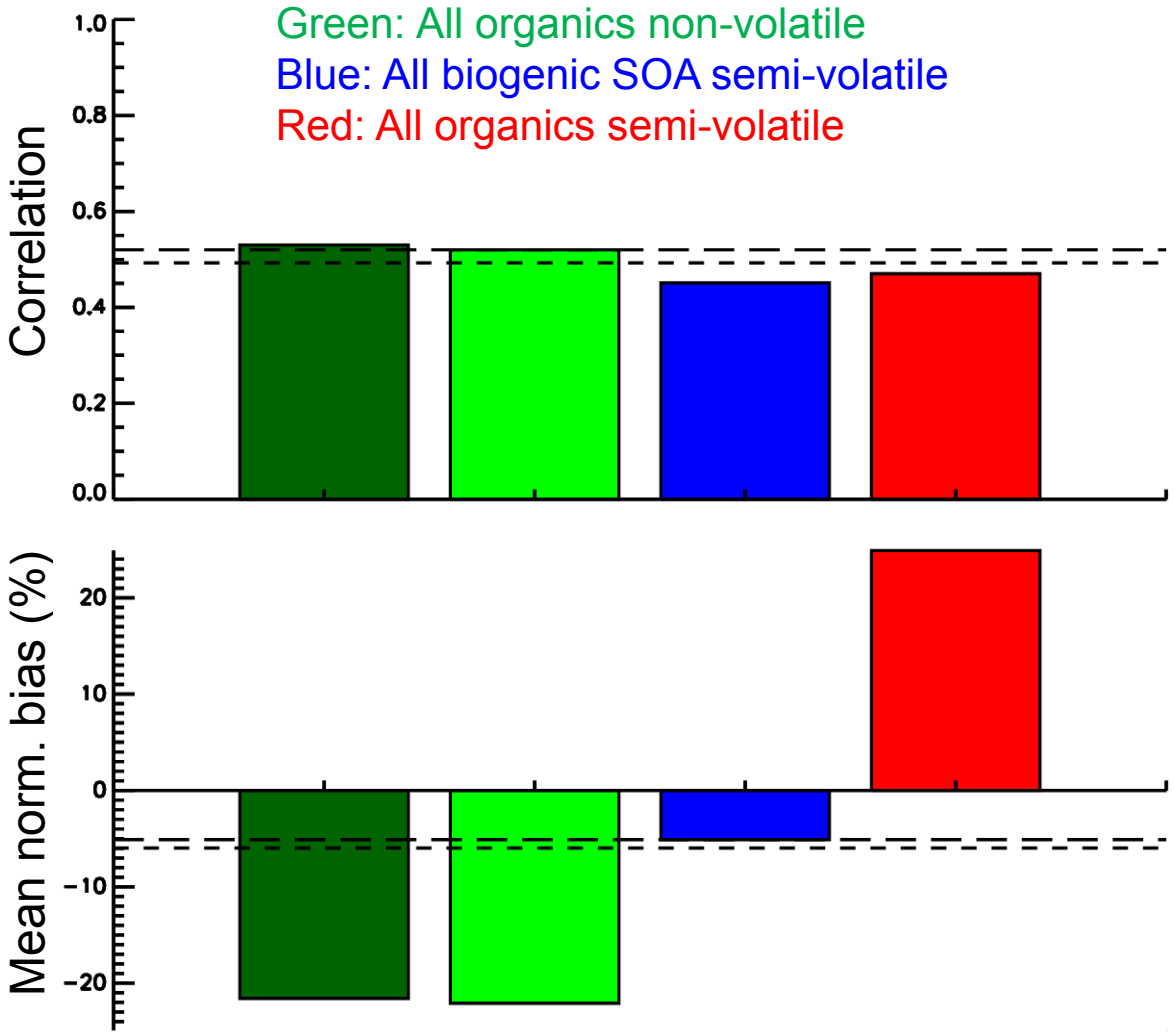
Comparison with surface measurements



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