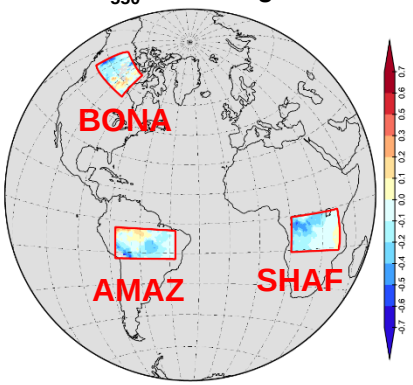
Framework

AEROCOM model ensemble
- Biomass burning experiment (11 models)
- CTRL2016 (12 models)
- CTRL2019 (10 models)

Observation ensemble
- Satellite
- AERONET
- In situ

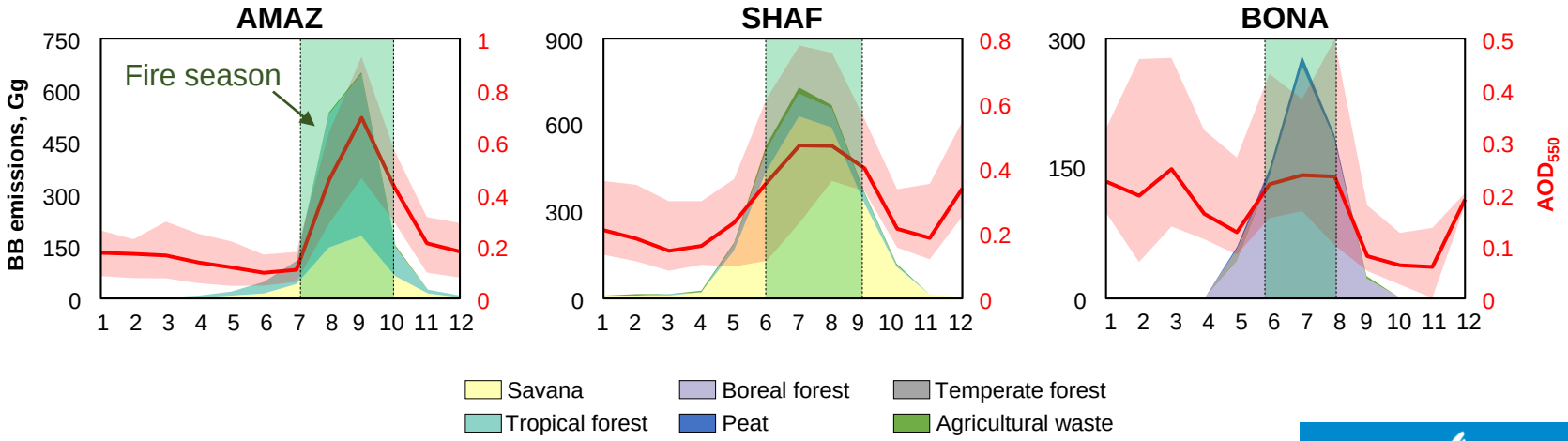
Observation uncertainties

AOD_{550} modelling bias



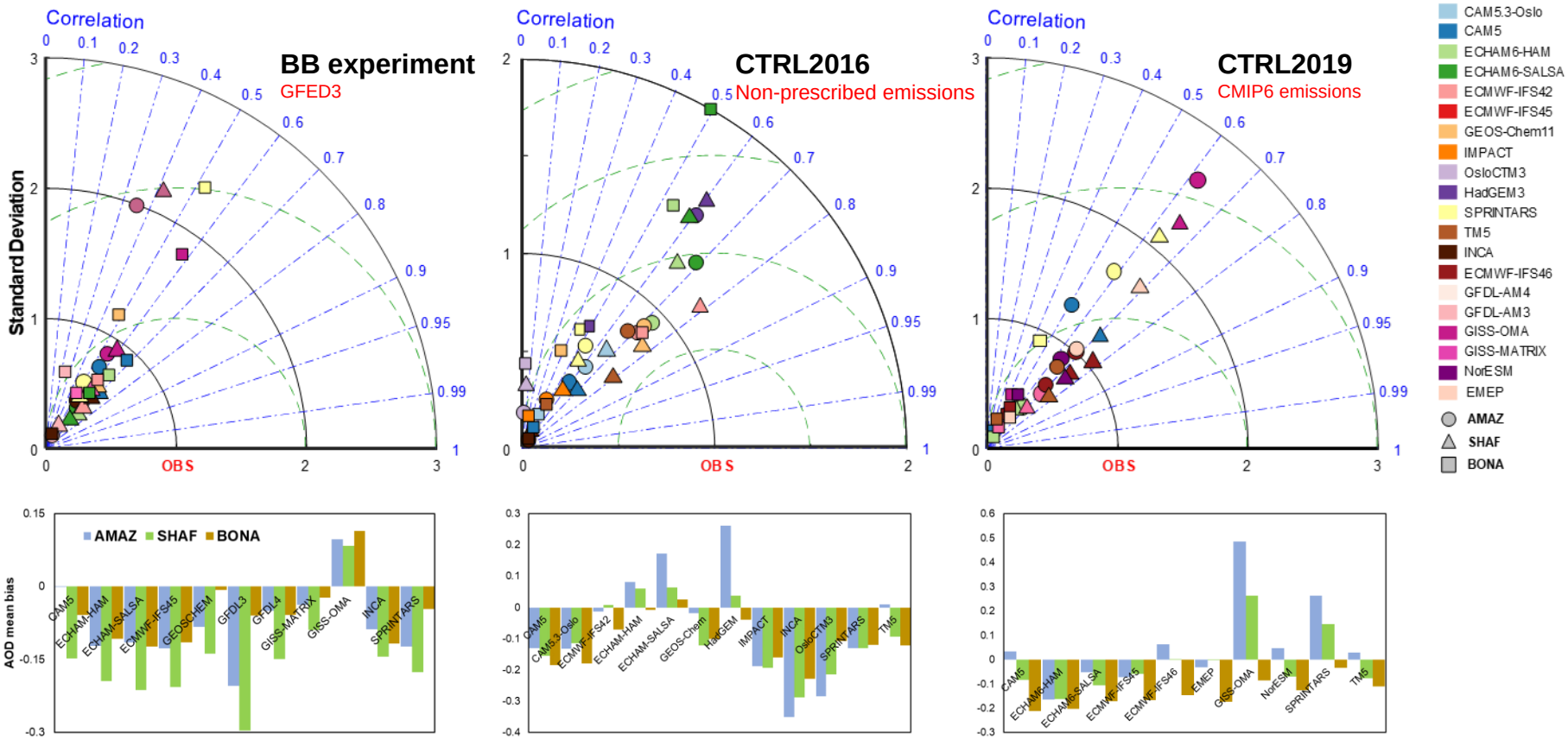
Understanding modelling bias
- Emissions
- Lifetime
- Optical properties (MEC, AE, SSA)

Modelling ensembles
- ECHAM-HAM
- WRF-Chem



Model-satellite comparisons

Compared with an ensemble-mean satellite product, BB aerosols are usually underestimated by models



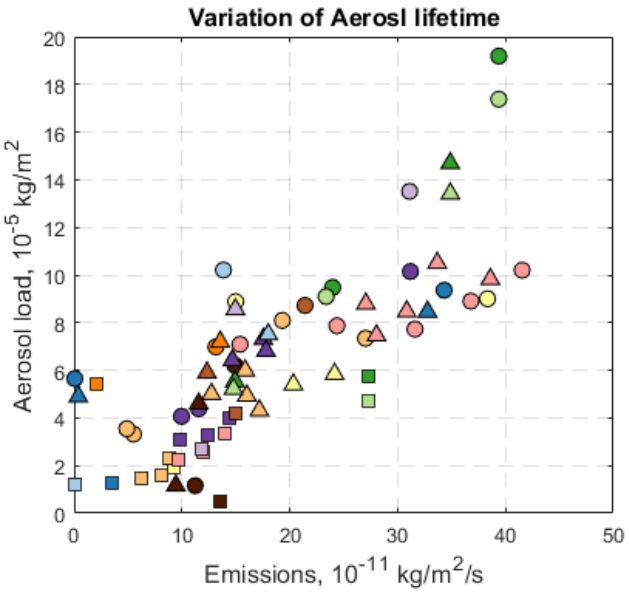
Model bias interpretation

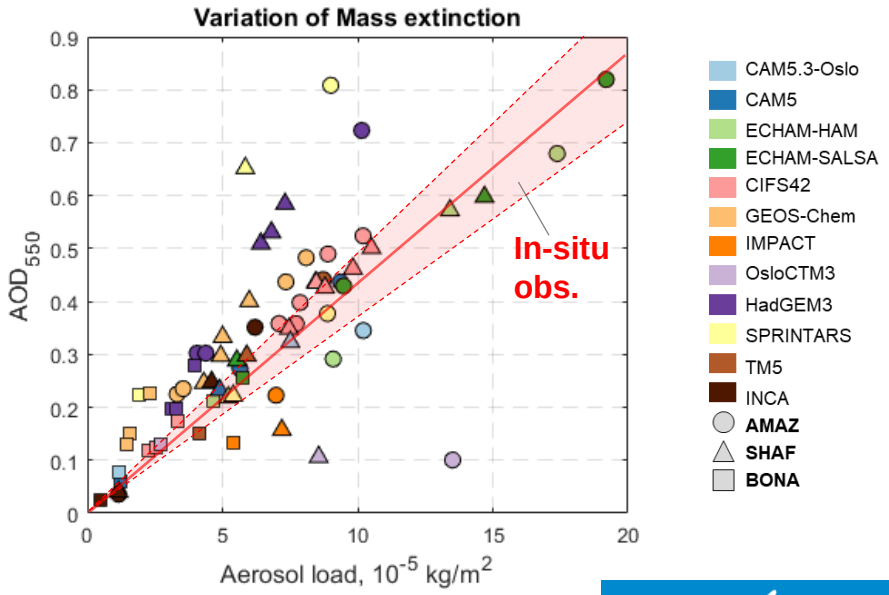
$$\mathbf{AOD} = \mathbf{Emission} \times \boldsymbol{k} \times \mathbf{MEC}$$

$\mathbf{MEC} = \frac{\mathbf{AOD}}{\mathbf{Load}}$

$\boldsymbol{k} = \frac{\mathbf{Load}}{\mathbf{Emission}}$

Model bias/differences are mostly affected by emissions, followed by mass extinction. The variation in lifetime contributes less to the AOD variability





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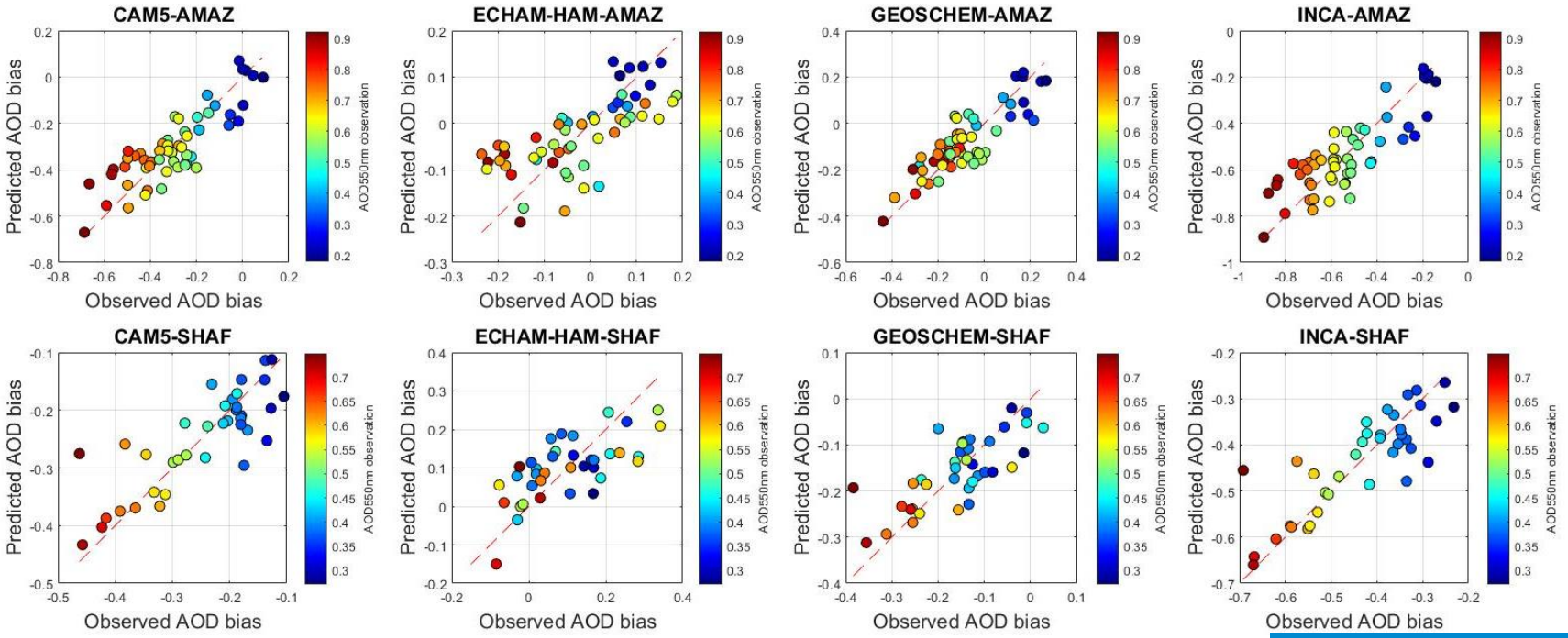
Understanding the daily modelling errors

Using observation of indicators to understand the daily AOD modeling errors via linear regression:

$$\varepsilon_{AOD} = b + \sum a_i p_i$$

Observed parameters →

Observed indicators	Indicated target	Data source
CH_2O column	SOA formation	OMI
Precipitation	Deposition	GPCP
Relative humidity	Hygroscopic growth	ERA-interim
Angstrom exponent	Aerosol particle size	POLDER
Single scattering albedo	Optical property	POLDER



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Conclusions

- Most global models tend to underestimate BB aerosols
- Variabilities in emissions and mass extinction coefficients are mostly responsible for the model bias
- Possibility of using the observation to understand random modeling errors of aerosols

To be continued …