New!

AeroCom aircraft comparison experiment

Duncan Watson-Parris and Philip Stier

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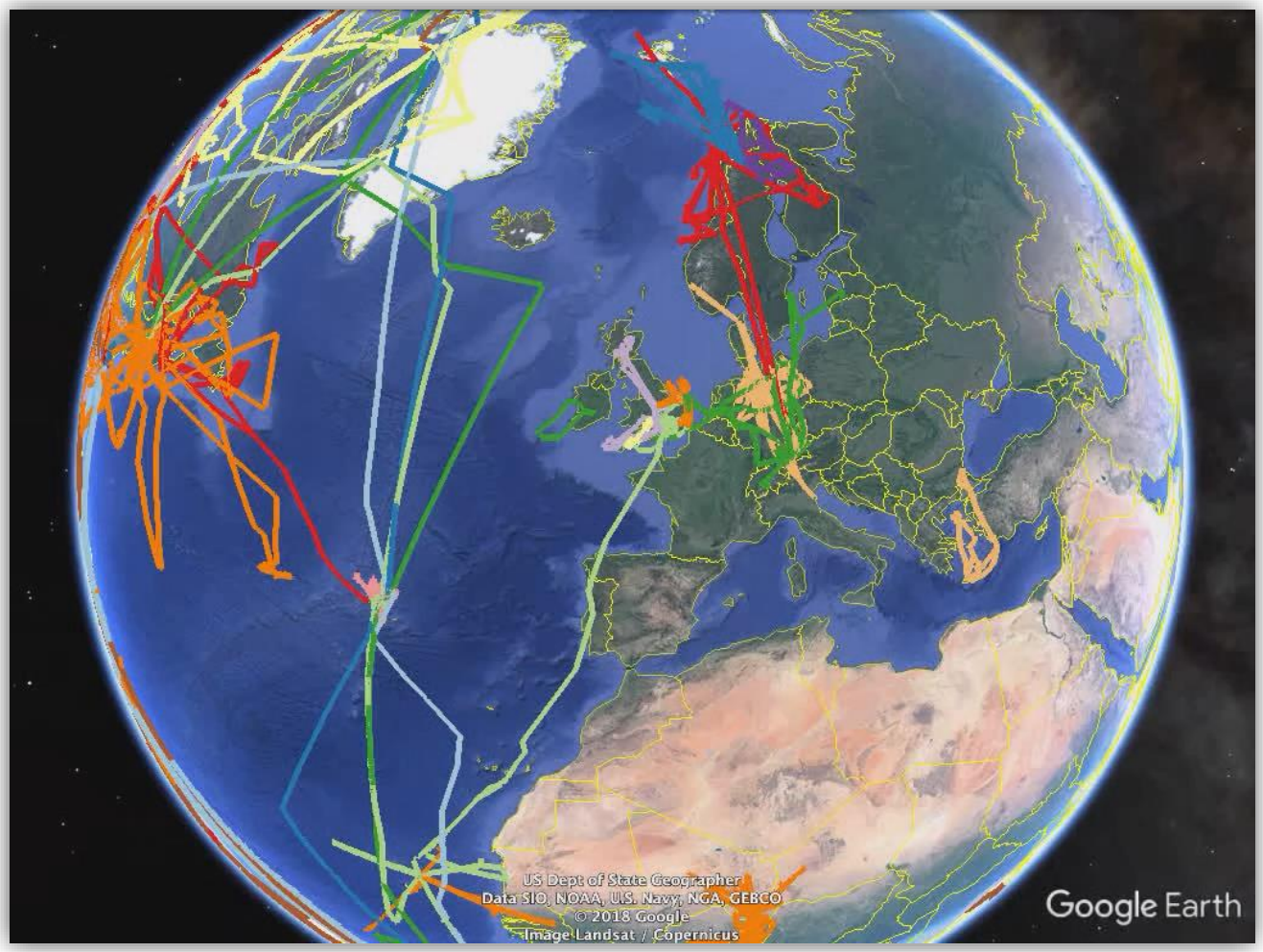
GASSP The Global Aerosol Synthesis & Science Project

Community Intercomparison Suite

Climate Processes Group

UNIVERSITY OF OXFORD

Outline



E.g. C. L. Reddington et al., BAMS 2017

Setup

Tier 1 – 2017 only

- This one-year experiment will support the main analyses. The requested model setup is identical to the Phase III control experiment

Tier 2 – Pre-Industrial (optional)

- We also request a pre-industrial run (1850) to investigate natural aerosol and how representative remote campaigns are of ‘pristine’ conditions.

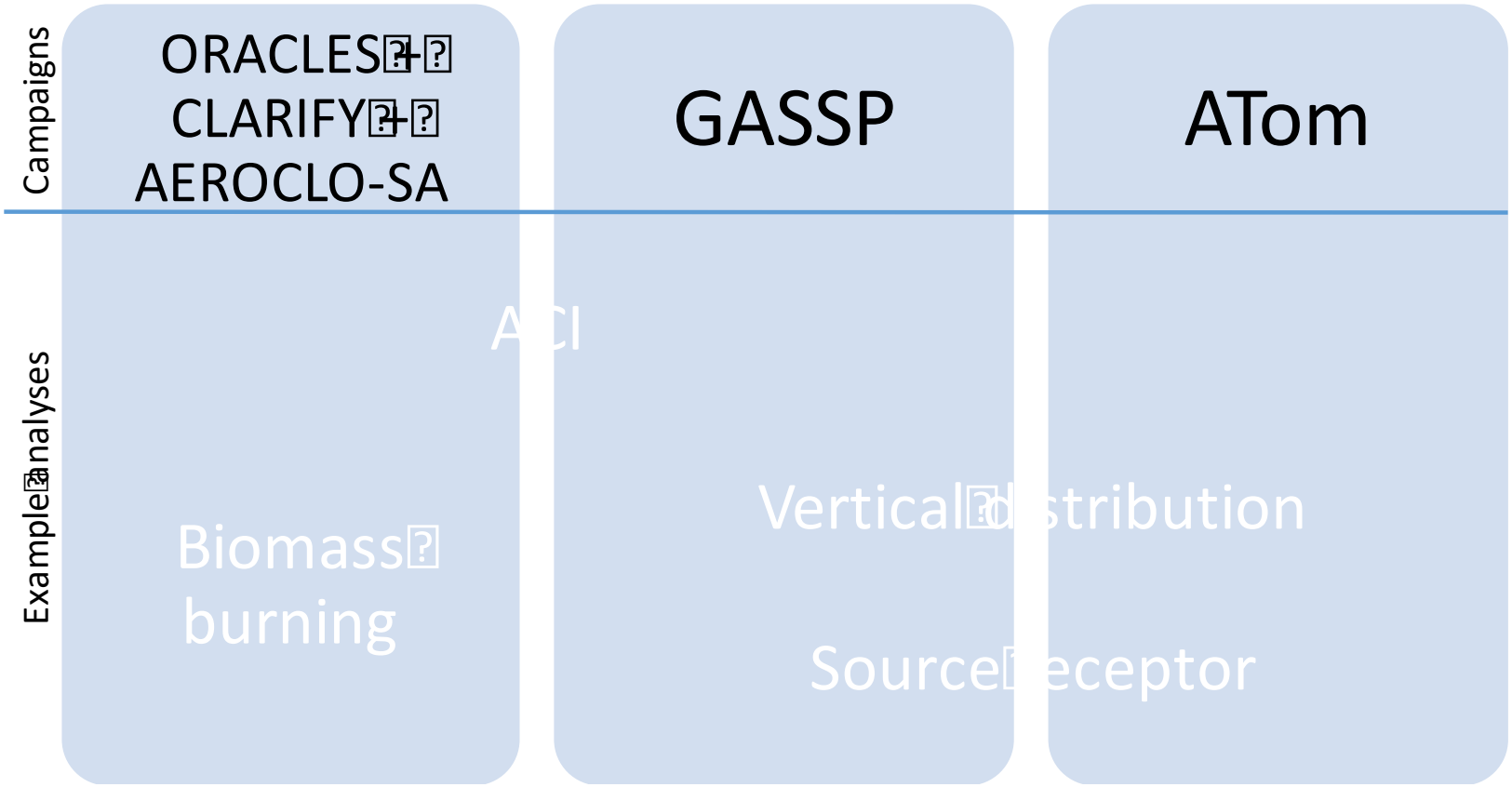
Tier 2 – Hindcast (optional)

- A full hindcast is requested to run for 2008 through to 2018 to explore the inter-annual variability of remote aerosol and assumptions made in Tier 1.

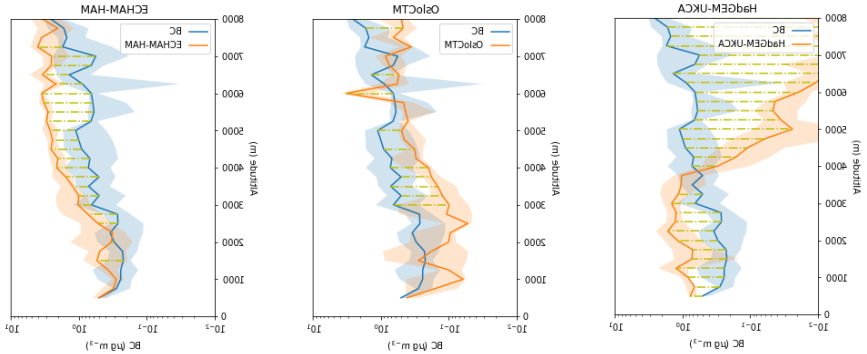
Diagnostics

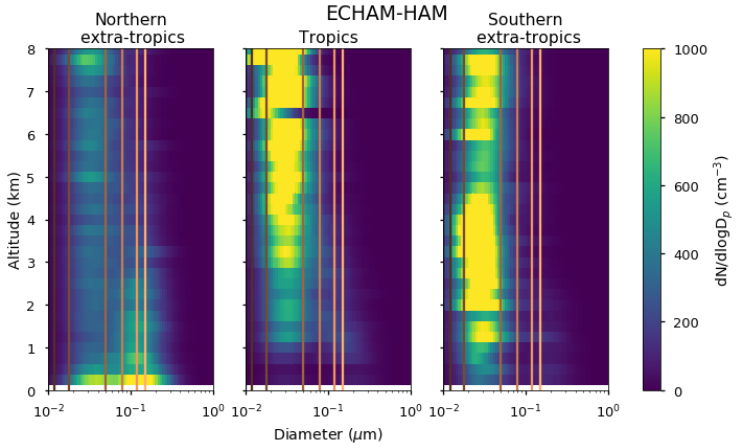
Aerosol	Cloud	Thermodynamics	Radiation
CCN at: 0.05%, 0.08%, 0.12%, 0.16%, 0.20%, 0.25%, 0.3%, 0.35%, 0.45%, 0.55%, 0.60%, 0.75%, 1.0%	Cloud droplet effective radius	Air temperature	Ambient aerosol scattering coefficient at 550nm
	Cloud droplet number concentration	Air density	Ambient aerosol absorption coefficient at 550nm
	Liquid water path	Specific humidity	Single scattering albedo at 550nm
N4, N10, N18, N50, N80, N120, N150		Relative humidity	Dry aerosol Scattering coefficient at 550nm
Concentrations of BC, OC, Sea Salt, DMS, MSA, NO3, …		Omega (dp/dt)	Dry aerosol absorption coefficient at 550nm

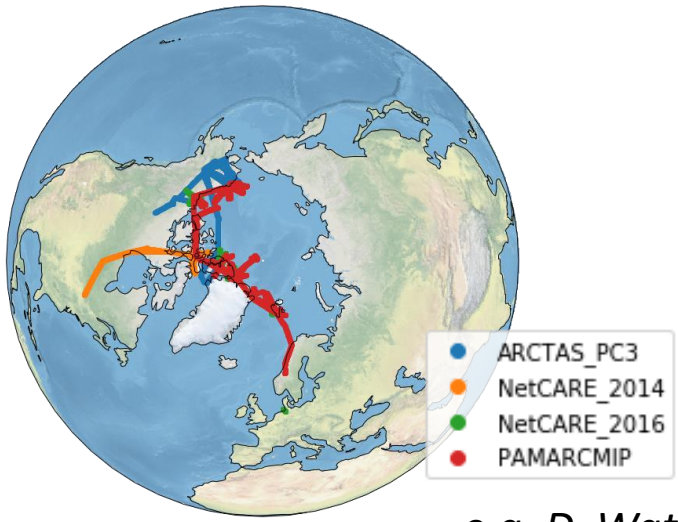
Example analyses

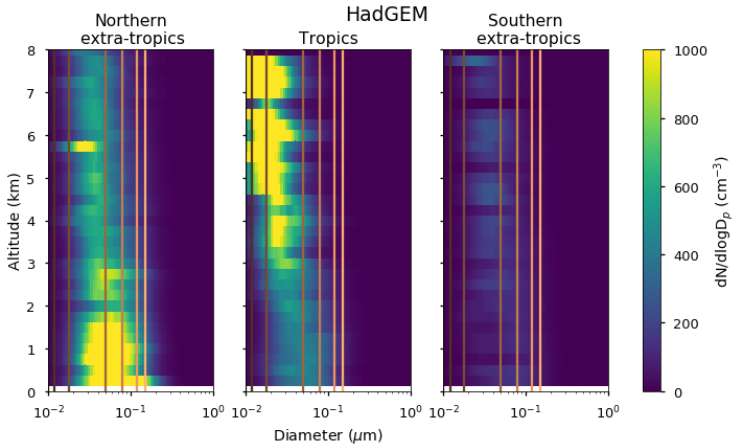


Example analyses









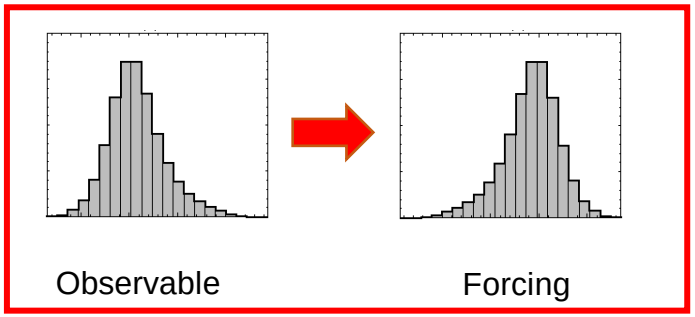
e.g. D. Watson-Parris et al., Atmos. Chem. Phys. 2019

BC multi-model perturbed physics ensemble (MMPPE)

Duncan Watson-Parris, Lucia Deaconu, Lindsay Lee, Andrew Gettelman, Ken Carslaw and Philip Stier

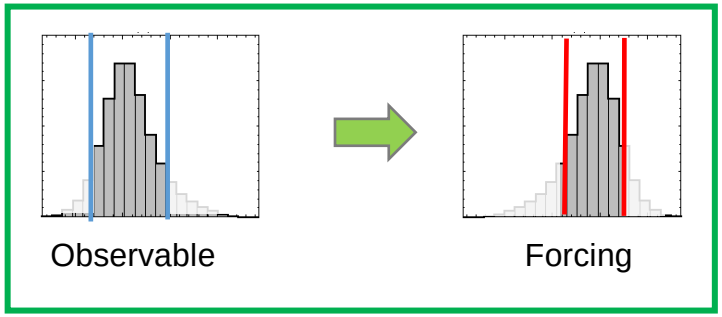
Black Carbon experiment (PPE)

Initial model variant and aerosol forcing



constrain

Constrained model variant and aerosol forcing



1. Constrain models using observations

PPE

2. Compare (constrained) models to each other

MMPPE

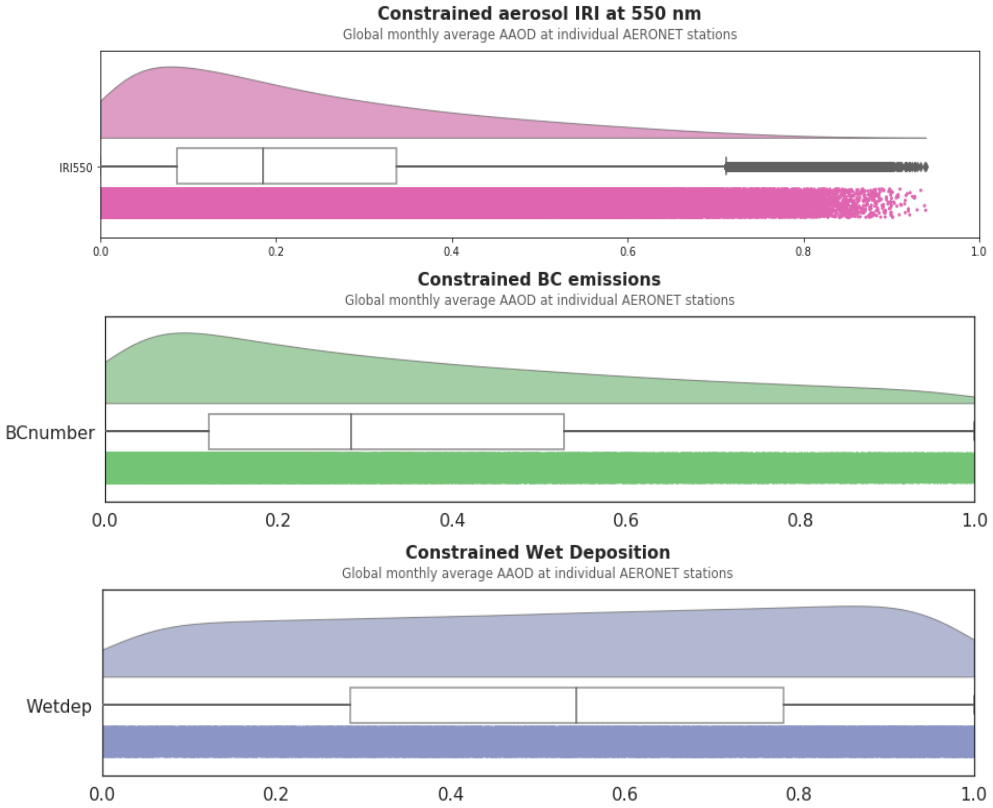
Perturbed parameters for BC PPE

- Implementation test -

Atmospheric burden	**Aerosol number**: Scale mass flux of BC carbonaceous emission	[X*0.5, X*2]
	Wet deposition: Scale removal tendencies/change in droplet number	[Y*0.3, Y*3]
Radiative properties	**BC optical properties:** Scale the imaginary part of refractive index	[0.0, 0.2, 0.8]

1. Constrain models using observations

AERONET AAOD constraints ASO 2017

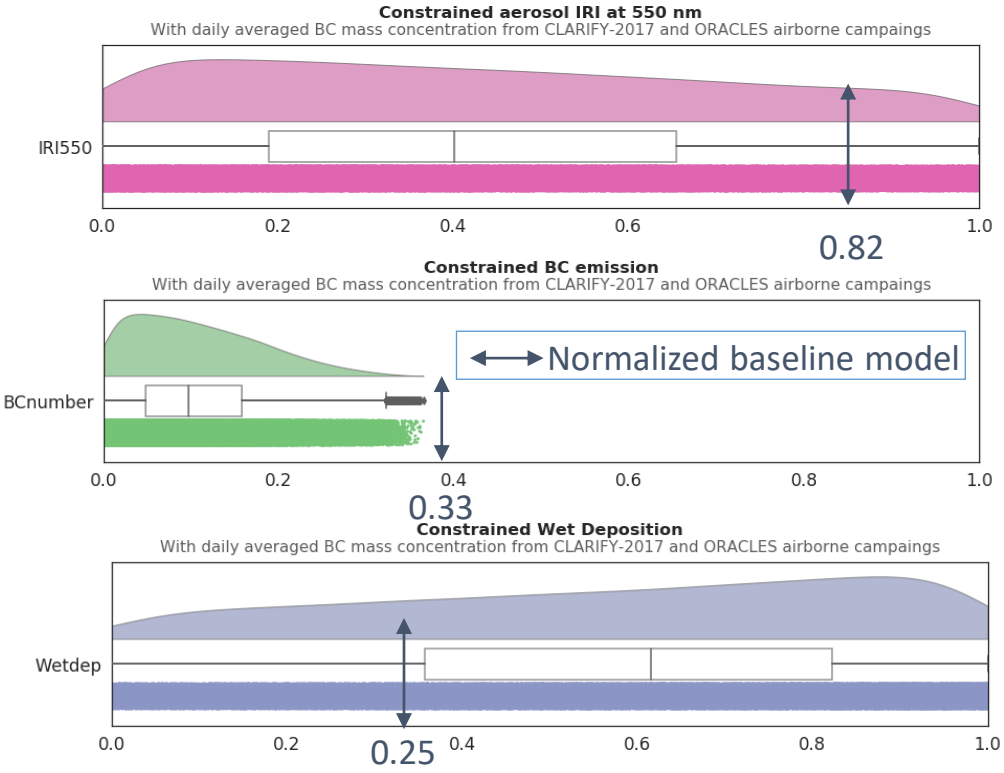


- Large values of IRI correspond to low values of BC number and higher values of Wet Dep
- AeroNet rules our combinations of high emissions and high IRI

(Deaconu et al., in preparation)

1. Constrain models using observations

ORACLES & CLARIFY
BC mass concentration 2-4km



- Constrains strongly the BC emissions towards the lower end of the parameter space (towards small values).
- The Wet Deposition is also quite well constrained (which was expected).
- Different observations are consistent on their constrained result, which is encouraging for applying a combined constraint

(Deaconu et al., in preparation)

2. Compare models to each other

Multi-model experiments

- Time period
  - 2017 and some pre-industrial year (1850)
- Simulations
  - 39 simulations + AeroCom baseline

To be consistent between models

- Emissions
  - Current emissions
- Nudging
  - Nudging such that radiation effects can be determined
- Chemistry
  - Offline but not CTM

Model dependent