

Aerosol evaluation using a global synthesis of aircraft measurements

AeroCom 2017

D Watson-Parris¹, C Reddington², N Schutgens¹, K Carslaw², P Stier¹

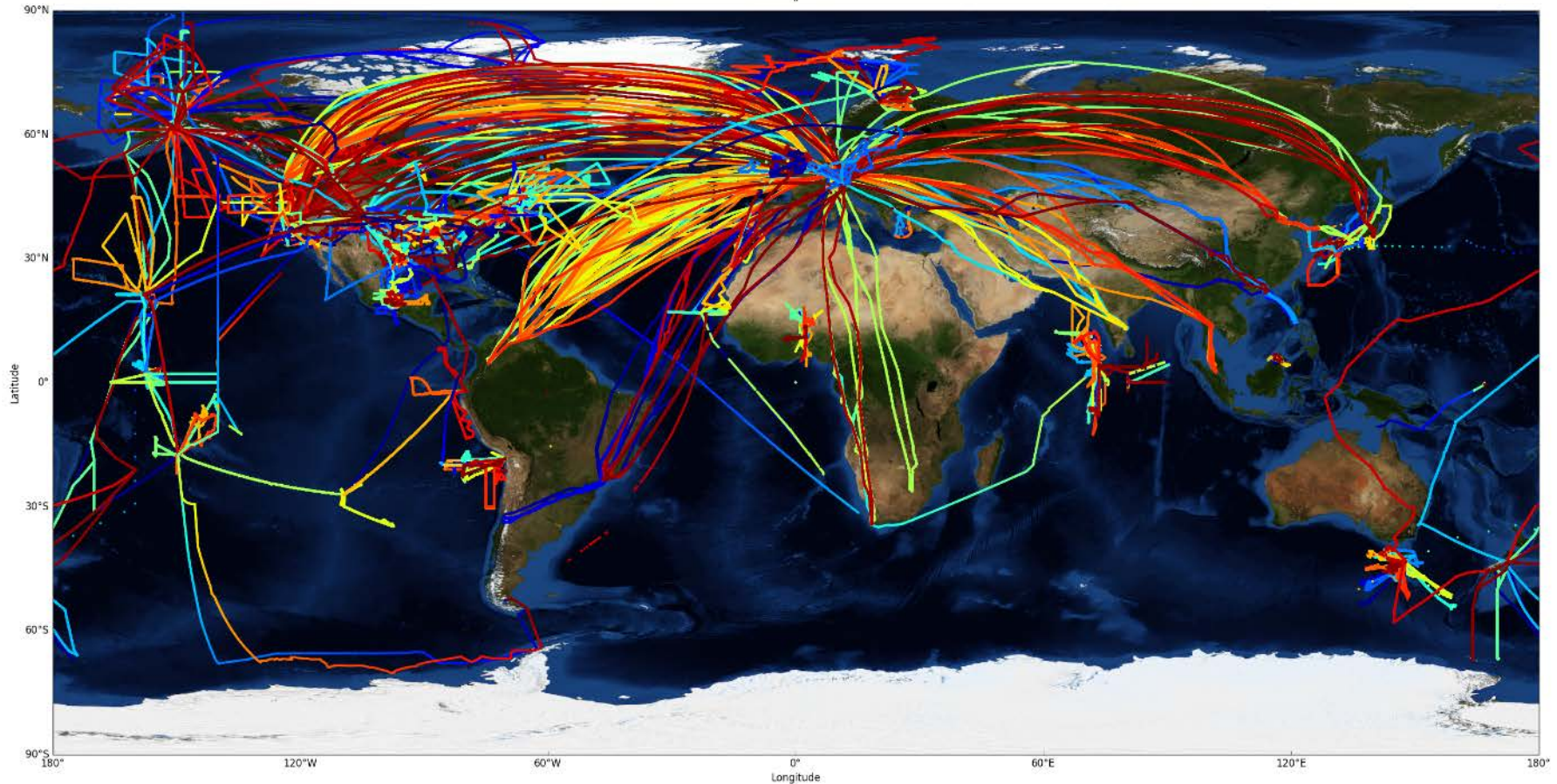
¹Department of Physics, University of Oxford, UK

²School of Earth and Environment, University of Leeds, Leeds, UK

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The Global Aerosol Synthesis and Science Project (GASSP)



Reddington, C.L., et al. *Bull. Amer. Meteor. Soc.* 2017

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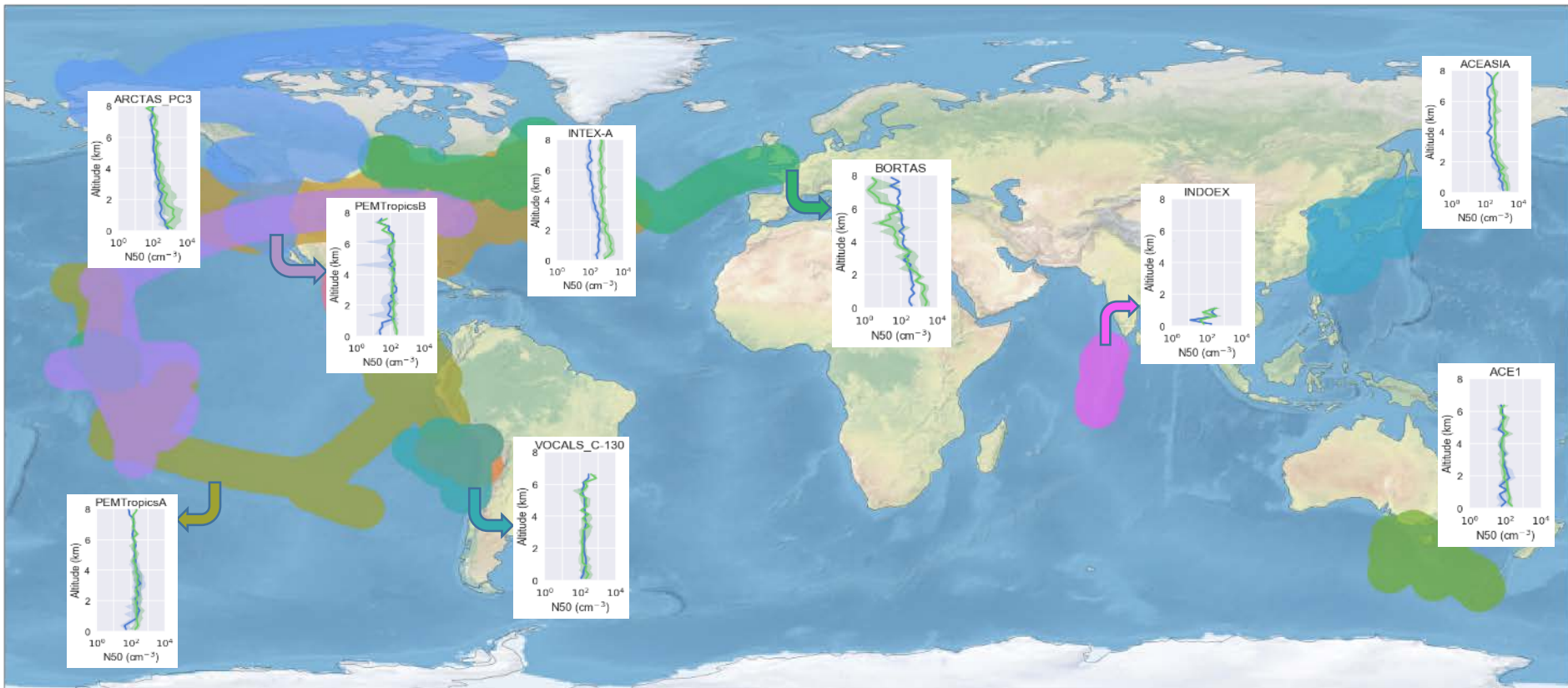
Size distribution

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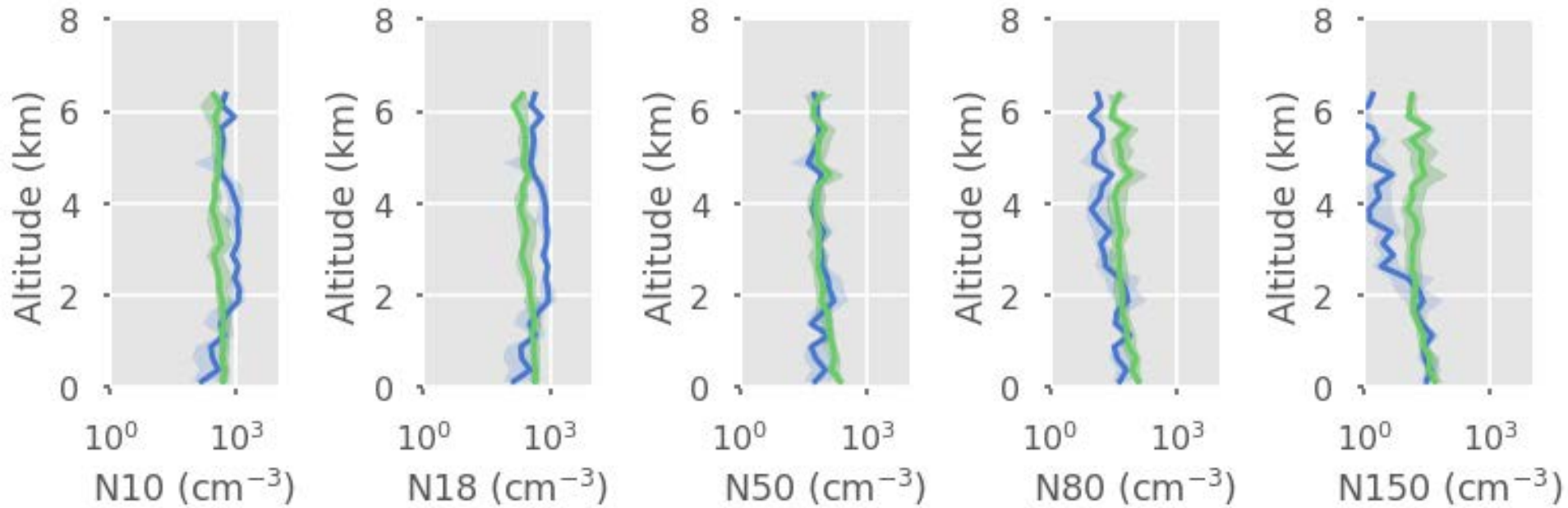


Size distributions by campaign

- MIRAGE
- VOCALS_FAAM
- INTEX-A
- PEMTropicsA
- ACE1
- BORTAS
- PASE
- VOCALS_C-130
- ACEASIA
- ARCTAS_PC3
- PEMTropicsB
- INDOEX
- ACEAN-GAME

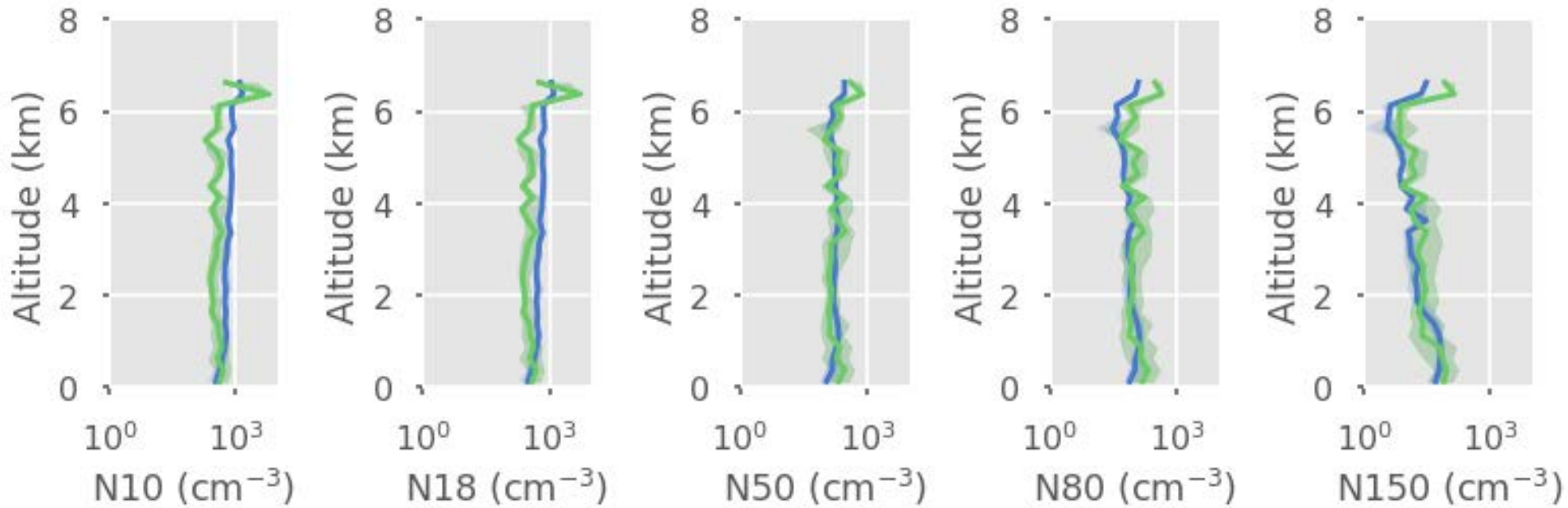


Size distributions – ACE1



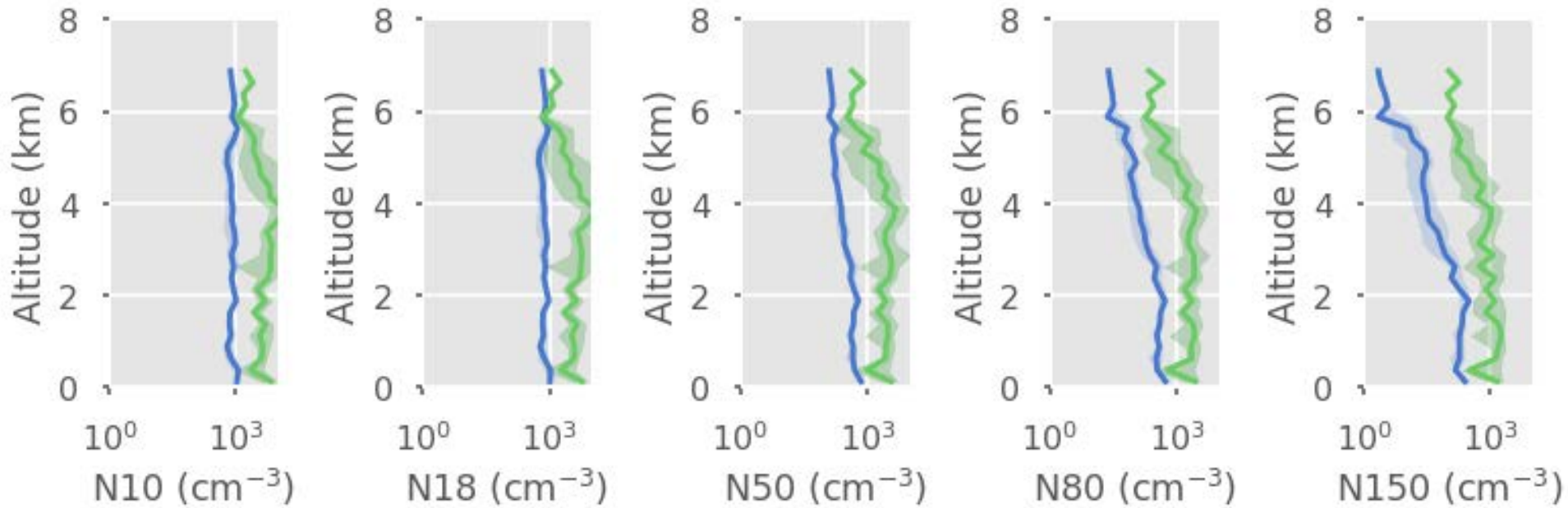
— Model
— Observations

Size distributions – VOCALS



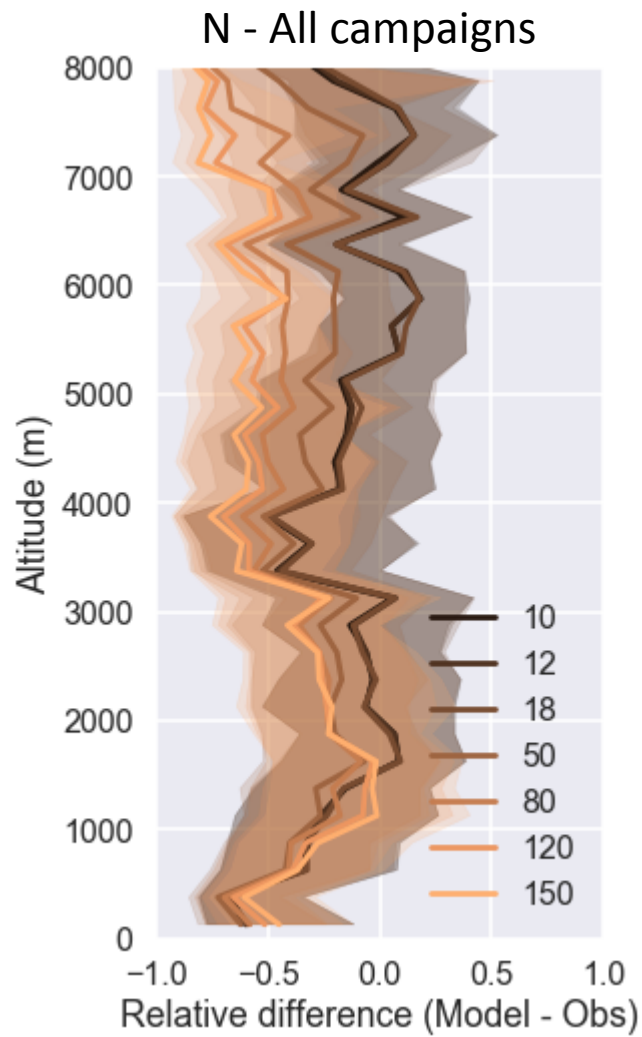
— Model
— Observations

Size distributions – MIRAGE



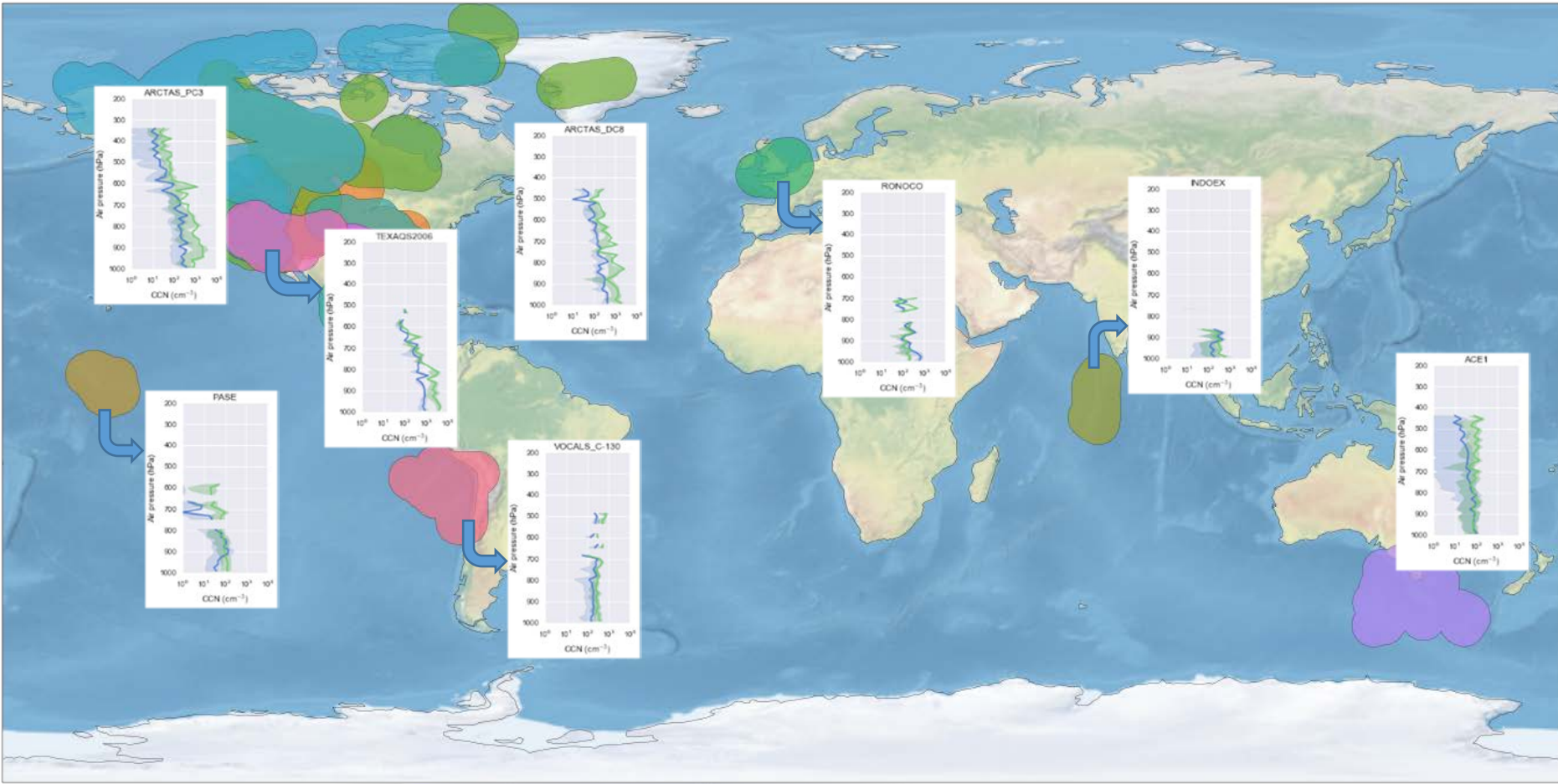
— Model
— Observations

Size distributions – All campaigns

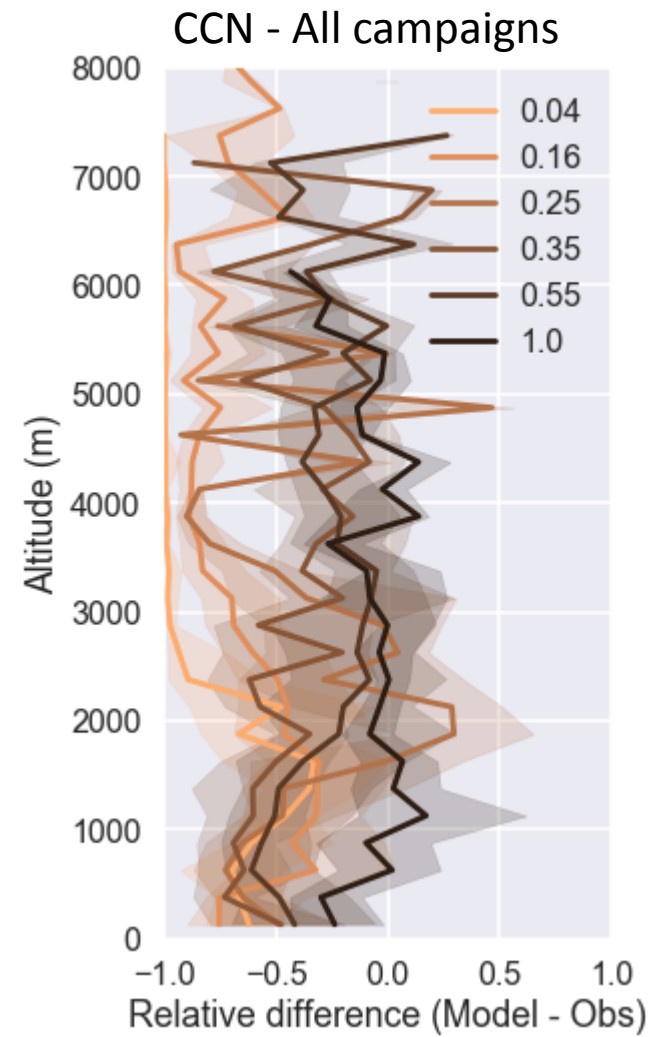
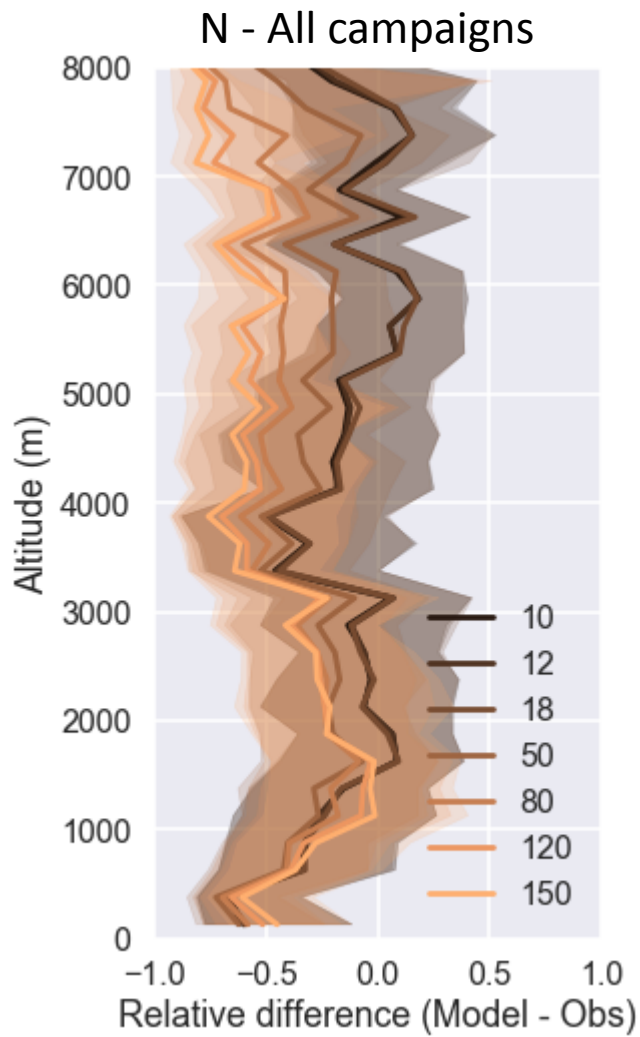


CCN distributions

- VOCALS_C-130
- PASE
- ARCTAS_DC8
- INTX-B
- ARCTAS_PC3
- ACE1
- SEAC4RS
- INDOEX
- RONOCO
- DC3
- MRAGE
- TEXAQS2006
- CALNEX



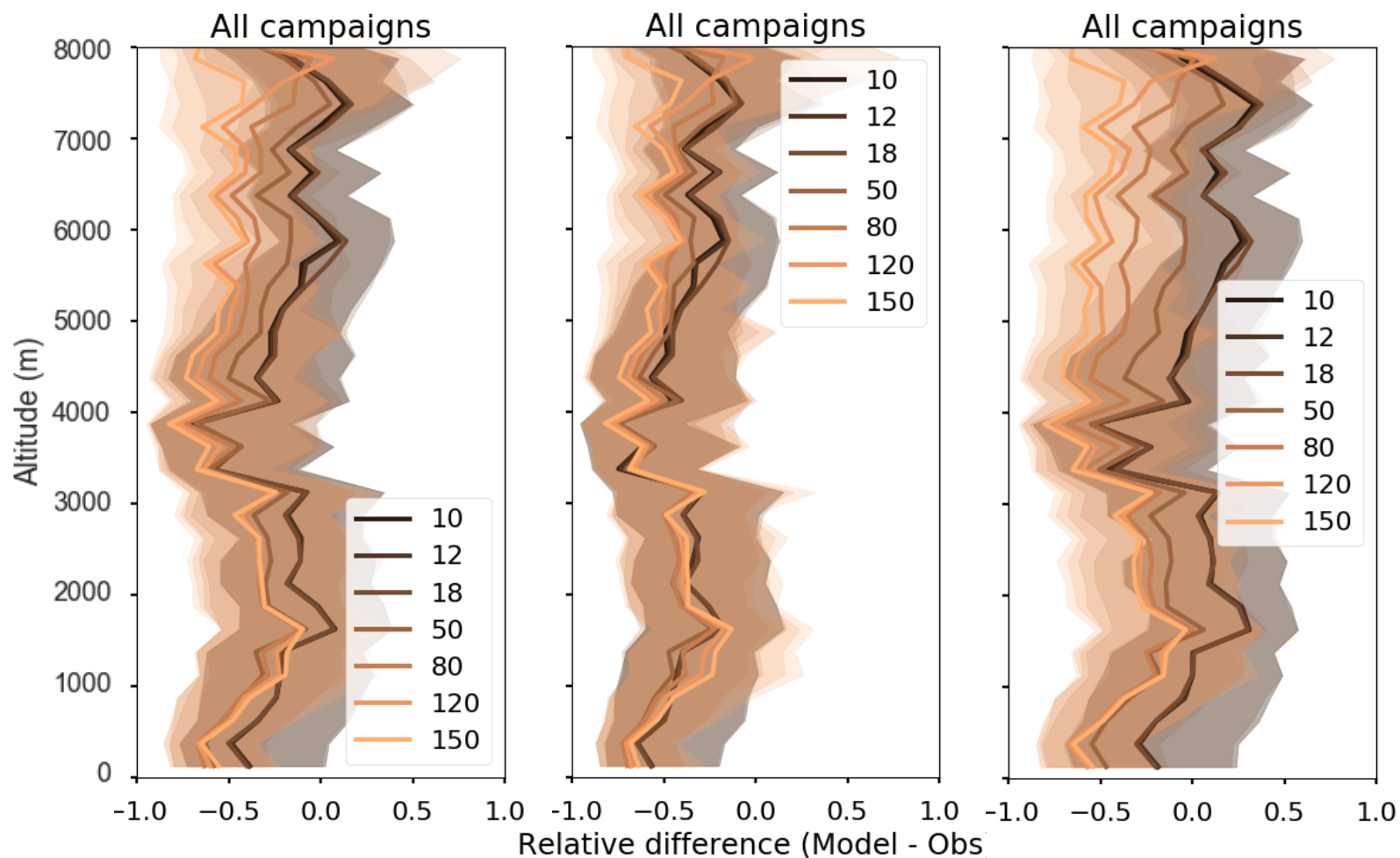
Size distributions – All campaigns



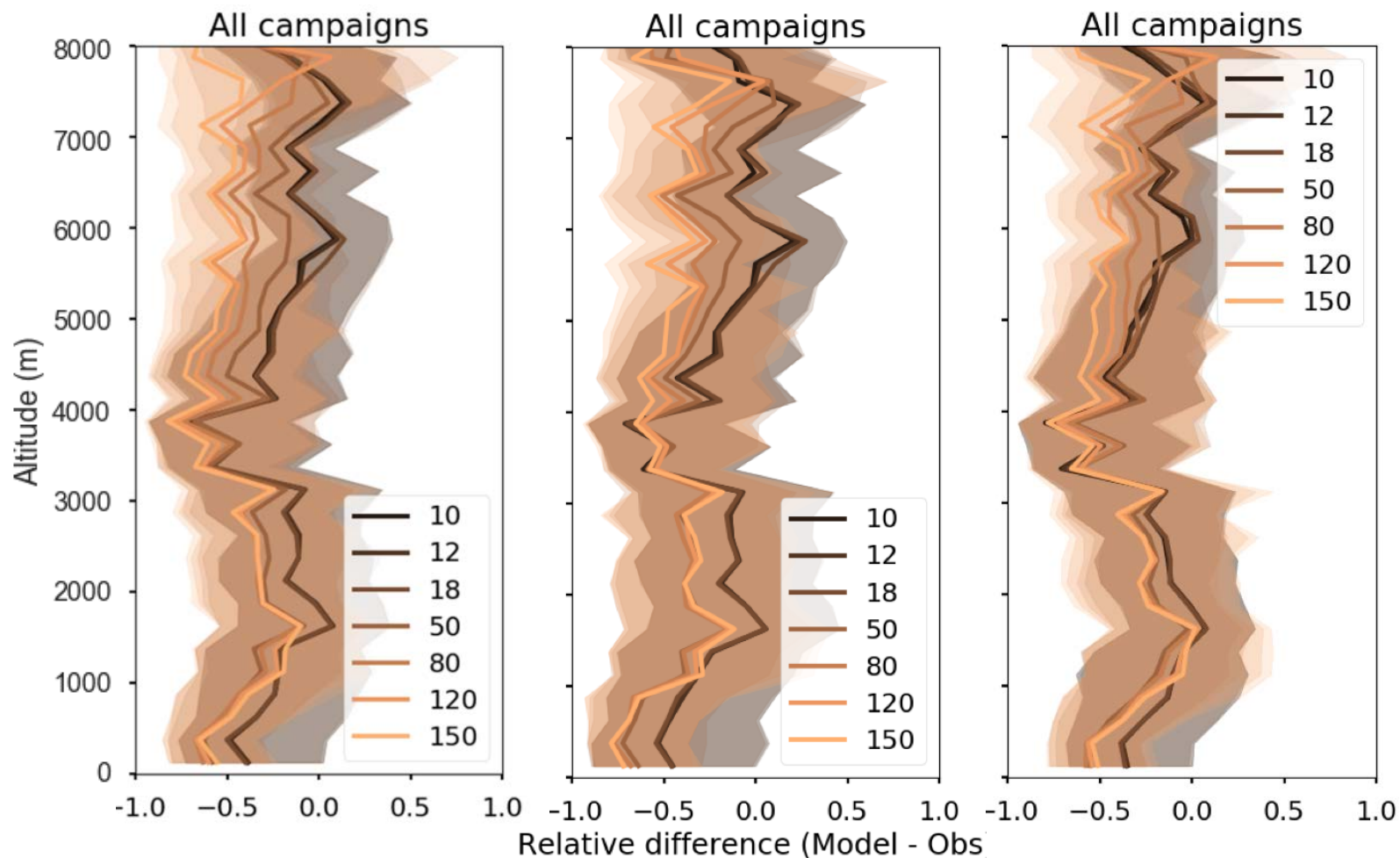
Perturbed Physics Ensemble (PPE)

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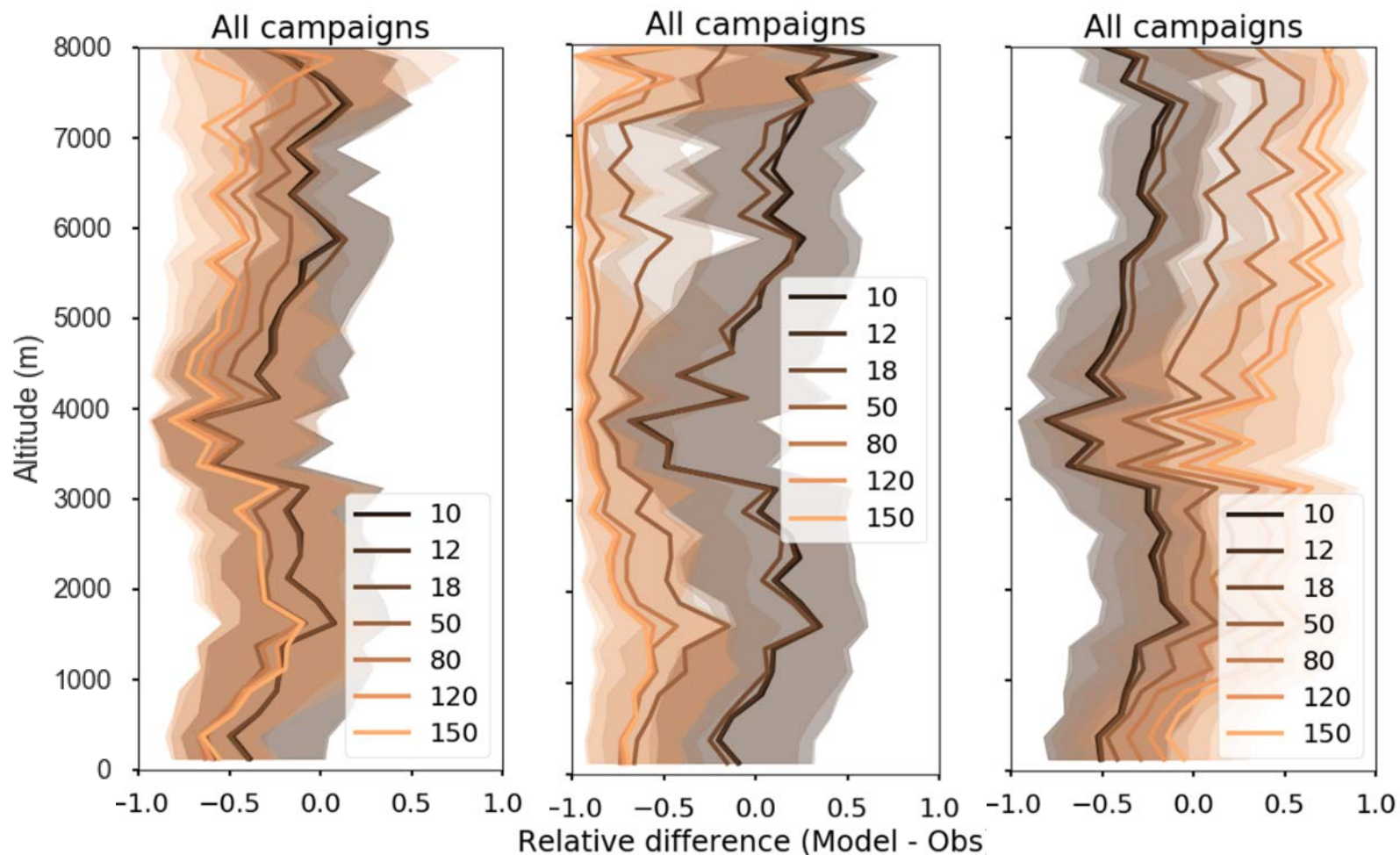
Perturbing coagulation



Perturbing tracer entrainment



Perturbing wet deposition



CALIOP backscatter

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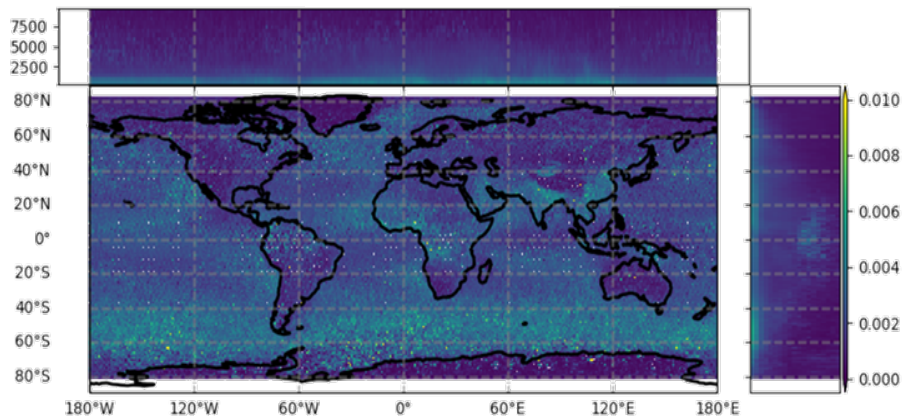
Calculating aerosol backscatter in ECHAM-HAM: LIDAR simulator

	COSP (clouds)	In-house (aerosol)
Wavelength	532nm (hardcoded)	Flexible, multiple
POV	From space	From space or Earth
Observables	attenuated total backscatter	attenuated total backscatter total backscatter aerosol extinction Rayleigh extinction LIDAR ratio (colour ratio)
Profile	model levels	model levels
Scatterers	1 fixed particle mode (effectively)	Flexible (model dependent)

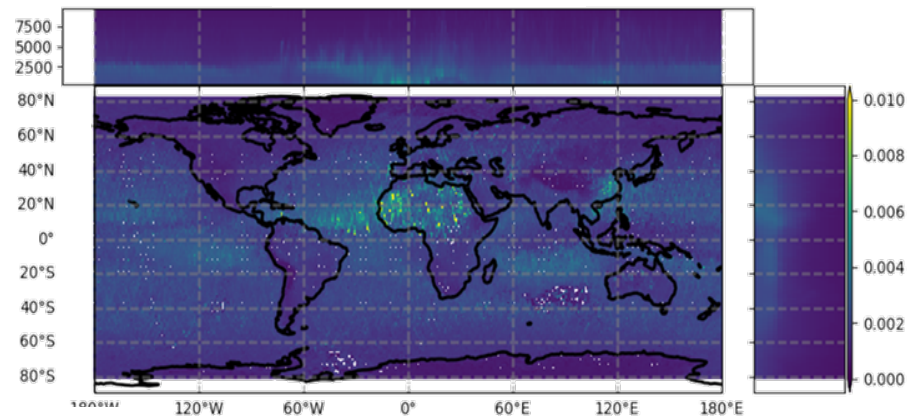
Required input: profiles of extinction and backscatter

Global backscatter comparison

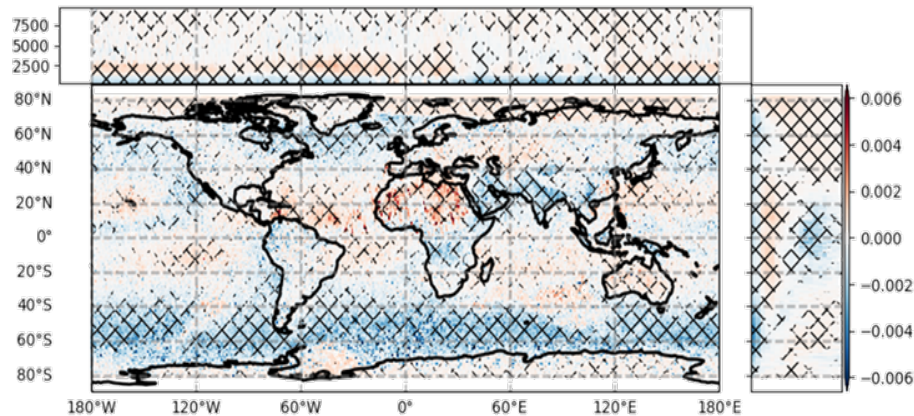
CALIOP L2



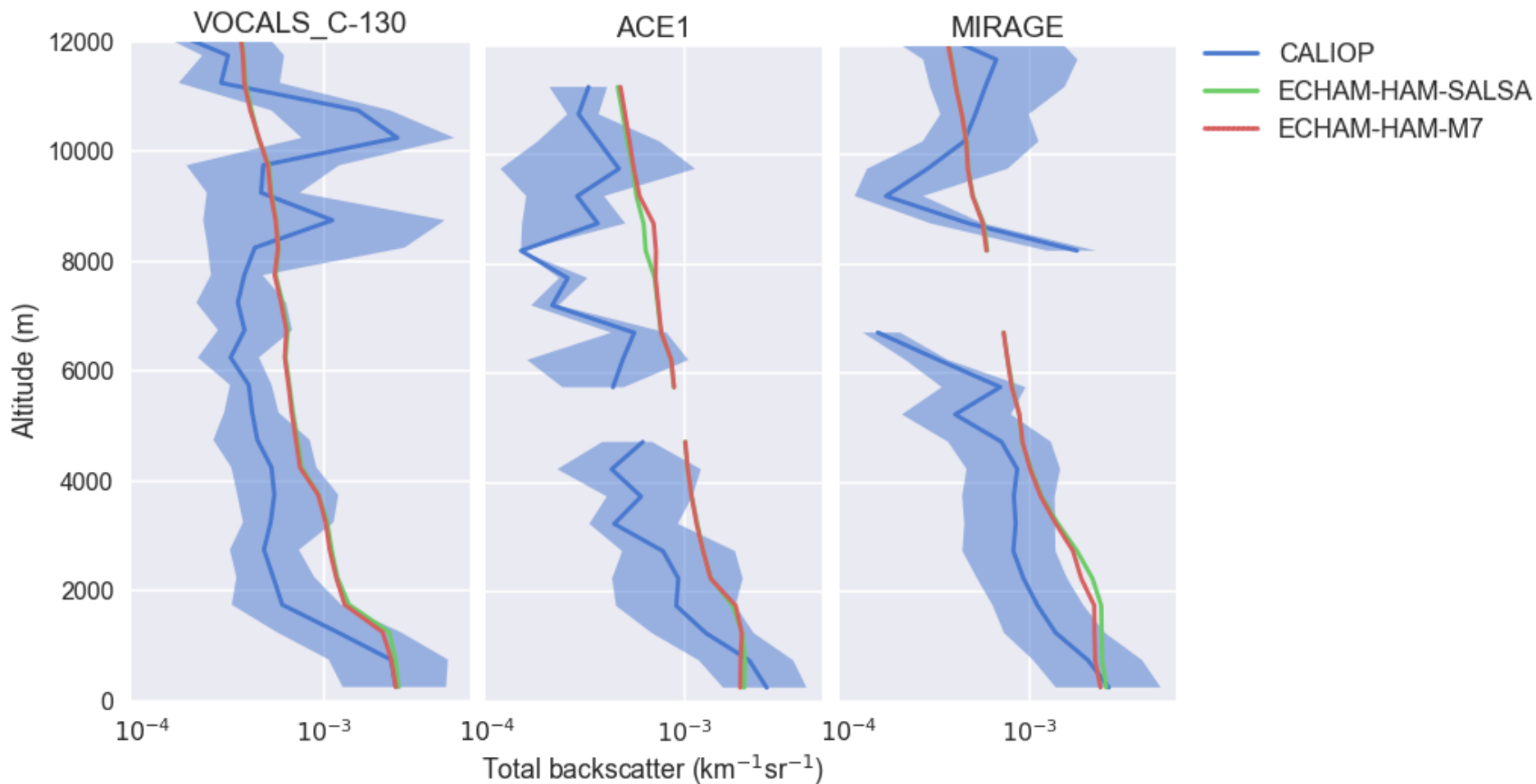
ECHAM-HAM-M7



Abs. diff



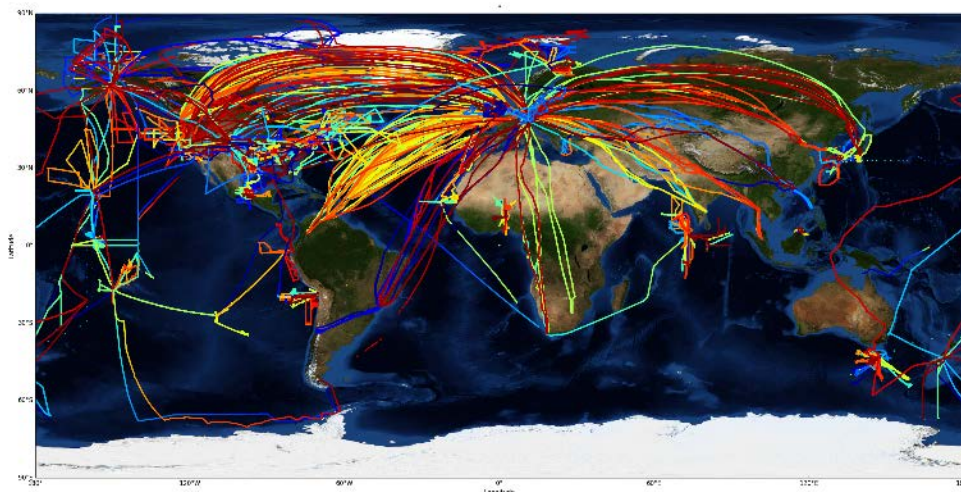
Regional backscatter comparison



Proposed Phase-III experiment

Building on Phase II experiments to perform detailed comparisons

- Same setup as P3-CTRL, 2008 and 2010
- Points will be provided as merged CF-compliant NetCDF file(s)
- Use online interpolation or post-processing using CIS



D. Watson-Parris et al., Geosci. Model Dev. 2016

Summary

- Used the GASSP dataset to investigate the vertical distribution of aerosols in ECHAM6.3-HAM2.3
- Larger particles ($>100\text{nm}$) appear to be consistently under-estimated at high altitude with a corresponding underestimation in low-supersaturation CCN
- This is due to insufficient coagulation, excessive wet deposition or a combination of both
- Regional back-scatter comparisons with CALIOP show good agreement throughout the vertical profile
- A new P3 experiment will explore inter-model differences and enable a myriad other comparisons

