There is large diversity in the simulated aerosol forcing in CMIP5 models, particularly related to aerosol-cloud interactions. There is also large diversity in the global load and spatial distribution of sulphate aerosol. We use simple models to quantify the main sources of uncertainty in the magnitude of the cloud albedo effect.

**Diversity in aerosol load and distribution**

![Image of aerosol load and distribution](image)

**Relationship between PI values and historical changes**

![Image of relationship between PI values and historical changes](image)

**Simple models of effective radius**

![Image of simple models of effective radius](image)

**Sources of diversity in sulphate load**

- Considerable diversity in load and distribution, despite standardised anthropogenic emission
- Diversity is present in both pre-industrial (PI) and present-day periods
- Use the relationships given in [2] to calculate radiative forcing, assuming that all cloud is low
- Differences in model climatology result in different relative sensitivities of the models to sulphate load for different metrics

**Sources of diversity in sulphate load**

- Perturbing cloud fraction within the range of 11 CMIP5 models shows this sensitivity in the HadGEM2-ES simple model, when the model sulphate is lower than would be expected from parameterisations alone
- Perturbing the absolute change in sulphate load results in a range -39% and +48% about the baseline estimate
- The use of different parameterisation schemes for the relationship between cloud-top effective radius and CDNC is the largest potential source of inter-model diversity
- Actual inter-model differences are less than would be expected from parameterisation alone
- Driving the simple models with 9 CMIP5 pre-industrial loads results in radiative forcing estimates between -15% and +61% about the baseline estimate
- The use of different parameterisation schemes for the relationship between cloud-top effective radius and CDNC is the largest potential source of inter-model diversity
- The largest contribution to sulphate load changes in the HadGEM2-ES parameterisation is the use of different parameterisation schemes for the relationship between cloud-top effective radius and CDNC.

**PL load and historical temporal structure**

![Image of PL load and historical temporal structure](image)

**Sources of inter-model diversity in the cloud albedo effect**

Laura Wilcox1,2 | Ellie Highwood2 | Ben Booth3 | Ken Carslaw4

---

1. NCAS-Climate, University of Reading  
2. Department of Meteorology, University of Reading  
3. Met Office Hadley Centre  
4. School of Earth and Environment, University of Leeds

---


---

www.met.reading.ac.uk/~laura