EGU24-8690, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-8690
EGU General Assembly 2024

How your aerosol implementation choices affect your model's climate system response

Estela Monteiro and Nadine Mengis
GEOMAR Helmholtz Centre for Ocean Research Kiel, Biogeochemical Modelling Department, Germany
(emonteiro@geomar.de)

Anthropogenic activities have disrupted the energy balance of the planet since preindustrial era through, among other drivers, the emission of various greenhouse gases and aerosols. The largest uncertainty to current climate forcing and future projections relates to the effect of aerosols. Their different impacts on the planet's radiative balance, that is, with direct radiative and indirect cloud interaction forcing, need to be considered accurately in simple policy-informing climate models. Especially in the context of high ambition mitigation scenarios, variability in the future development of spatiotemporal aerosol forcing will have a relatively large impact on climate projections. Accordingly, an accurate inclusion of the relevant processes onto the modeling scheme, such as the spatiotemporal level of detail chosen when accounting for aerosol forcing in simple(r) climate models must be carefully considered.

Here we explore the impact of different aerosols implementation schemes in an intermediate complexity Earth system model configuration with an energy moisture balance model (UVic ESCM, version 2.10). While the global mean forcing is the same for all scenarios, we vary spatial and temporal resolution of optical depth maps or implement aerosol forcing as direct radiative forcing to the Earth system. These schemes are applied to relevant ambitious mitigation scenarios aiming at temperature stabilization, which will become especially relevant in the upcoming CMIP exercises. Using a newly developed assessment framework, we will provide insights into the impacts of this model implementation choice onto future temperature development, the carbon cycle and heat uptake processes. Ultimately these insights aim to improve, constrain and design better scenario simulations that are both applicable and relevant to the scientific and decision-making communities.