EGU24-5200, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-5200
EGU General Assembly 2024


# Anthropogenic aerosol forcing in CMIP from prescribed optical and cloud microphysical properties

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Anthropogenic aerosol forcing is quantitatively uncertain affecting the ability to constrain the climate response to anthropogenic perturbations. Climate models participating in the Coupled Model Intercomparison Project (CMIP) use different methods to incorporate direct and cloud-mediated aerosol effects. Some models in CMIP6 used prescribed anthropogenic aerosol optical properties and associated effects on cloud droplet number concentrations from the Simple Plumes parameterization fitted to the Max-Planck-Institute for Meteorology's Aerosol Climatology version 2 (MACv2-SP). MACv2-SP was originally designed for the use in a subset of experiments for the Radiative Forcing Model Intercomparison Project to better understand the model diversity in aerosol forcing (Fiedler et al., 2023). The final uptake of MACv2-SP for research was, however, much broader. In the context of CMIP, the implementation of MACv2-SP in several climate models led to the request for new MACv2-SP input data that are consistent with updated emissions, e.g., in the framework of CovidMIP (Fiedler et al., 2021) and now in preparation for CMIP7 via the CMIP Climate Forcings Task Team. Moreover, MACv2-SP also serves in creating seasonal and decadal predictions, and satellite products.

We will therefore derive and freely provide new data for the anthropogenic aerosol optical properties and their cloud-mediated effects based on newly available emissions. The next data version of MACv2-SP is currently in preparation for interests in using CMIP6plus compliant boundary data. It will use the historical emission data for aerosols and their precursors from the new release of the Community Emission Data System (CEDS), which will be published at the beginning of 2024. The new emissions will allow us to revise and extent the historical data for MACv2-SP to include years after 2014. Expected changes compared to the MACv2-SP data used in CMIP6 are improved aerosol optical depth over some land regions in recent years, where the observations developed differently compared to assumptions in the scenarios. We will further translate uncertainty in the emission data to expected differences in the aerosol forcing. In addition to the new data for CMIP6plus, a new development of the simple plumes approach will be made for an assessment of the radiative forcing and climate response to aerosols from severe wild fires in recent years that are not represented by CMIP6 models.

Fiedler, S., Wyser, K., Rogelj, J. and van Noije, T. (2021) *Radiative effects of reduced aerosol emissions during the COVID-19 pandemic and the future recovery*. Atmospheric Research, 264 . Art.Nr. 105866. DOI 10.1016/j.atmosres.2021.105866.

Fiedler, S., van Noije, T., Smith, C. J., Boucher, O., Dufresne, J., Kirkevåg, A., Olivié, D., Pinto, R., Reerink, T., Sima, A. and Schulz, M. (2023) *Historical Changes and Reasons for Model Differences in Anthropogenic Aerosol Forcing in CMIP6.* Geophysical Research Letters, 50 (15). Art.Nr. e2023GL104848. DOI 10.1029/2023GL104848.