Project: **1051**

Project title: **Contribution to AerChemMIP with ECHAM-HAMMOZ simulations**

Principal investigator: Ina Tegen,

David Neubauer, Ulrike Lohmann

Report period: **2018-07-01 to 2019-04-30**

The aim of this project s the preparation of the contribution of the ECHAM-HAMMOZ community to the next assessment report of the Intergovernmental Panel on Climate Change (IPCC/AR6) with a focus on atmospheric aerosol processes. It comprises the ECHAM-HAMMOZ contribution to the Aerosol Chemistry Model Intercomparison Project (AerChemMIP) that is designed to quantify the climate and air quality impacts of aerosols and reactive gases (https://wiki.met.no/aerocom/aerchemmip/start).

During the previous project phase from 07/2018 to 04/2019 a further parameter fine-tuning was attempted to improve a low bias in historical warming. To this end, parameters known to impact climate sensitivity (related to shallow clouds) were varied. However, the historical warming did not increase significantly while worsening the geographical distribution of atmospheric aerosol, in particular in tropical biomass burning regions. The preliminary evaluation of MPI-ESM1.2-HAM was continued with a local installation of ESMValTool (Eyring et al., 2016). Many aspects of the modelled climate are as well represented as in many CMIP5 models. Therefore the parameter fine-tuning was finalized and the piControl-spinup simulation was run for 200 years more.

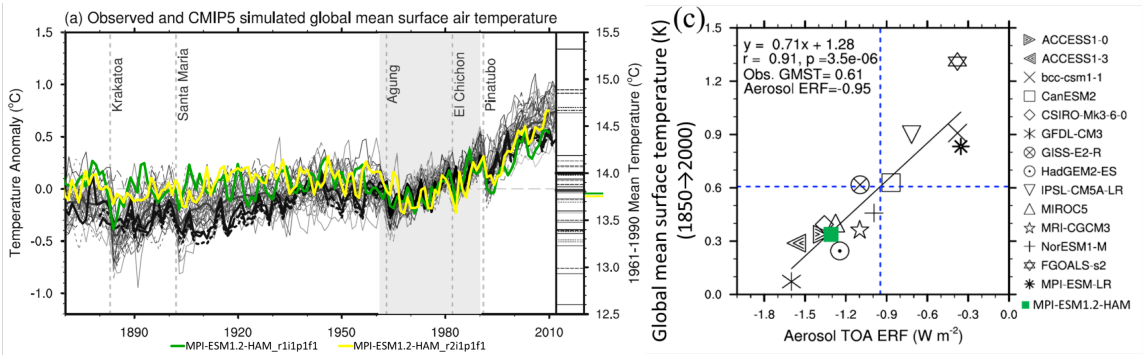

Figure: Surface temperature results of historical runs with MPI-ESM1.2-HAM in the context of CMIP5 model results.

Trends of nutrients and carbon in ocean basins of the piControl-spinup simulation were analysed and the weathering rates in the ocean biogeochemistry module HAMOCC6 adapted. No relevant trends were found and the adjustment of the weathering rates had no significant impact. Also the storage of carbon and nitrogen in the land biosphere in the piControl-spinup simulation was analysed and no significant trends were found. Given the short spinup time of MPI-ESM1.2-HAM, this is remarkable and probably due to our strategy to tune MPI-ESM1.2-HAM from a spun-up MPI-ESM1.2-LR simulation while keeping certain variables like global mean surface temperature close to the values of MPI-ESM1.2-LR during tuning. Next to model evaluation, the diagnostic variables unique to AerChemMIP were implemented and tested. The implementation of the full diagnostics for CMIP6/AerChemMIP has been delayed due to a delay in the release of the final MPI-ESM1.2-LR version and because the implementation and testing of the extensive diagnostics for CMIP6/AerChemMIP takes longer than expected.

Preparation of the forcing data for the future scenarios has only just started because some of the forcing data only recently became available (e.g. future ozone or nitrogen deposition).