



## **Role of anthropogenic aerosols in the 20th century surface solar radiation, temperature, and meridional heat transport in the Max Planck Earth System Model**

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It is still debated, to what degree anthropogenic aerosols were affected surface temperatures – especially over sea surfaces – through alteration of surface solar radiation (SSR). Previous work using mixed-layer ocean equilibria corroborated the relevance of anthropogenic aerosols for surface temperature response patterns obtained. Here we complement these studies by fully coupled simulations with the Max Planck Earth System Model (MPI-ESM) in its CMIP5 version. Experiments comprise preindustrial control and historical as in CMIP5, as well as transient experiments 1850 – 2000 with either anthropogenic aerosols or well-mixed greenhouse gases (WMGHG) kept at 1850 levels.

With this suite of experiments, we analyse the impact of anthropogenic aerosols and WMGHG on the global energy balance and provide estimates of atmospheric and oceanic meridional heat transport changes in our modeling setup. We find that Global mean surface temperature responses to single forcings are additive. Furthermore, spatial surface temperature response patterns in the WMGHG only experiment are more strongly correlated with the historical experiment than the aerosol only case.

We compare transient and equilibrium responses and discuss potential implications of not allowing for cloud-aerosol interactions in the transient modeling set-up.