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On the simulation of mid-20th century global and regional dimming trends in CMIP5 models and CESM 1.2

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Measurements of surface shortwave radiation from the global GEBA dataset show strong global dimming in the 1960s and 1970s, which has been attributed to increased economic activity and associated increases in anthropogenic aerosol emissions during this period. Testing the ability of climate models to reproduce this dimming trend provides an opportunity to evaluate the sensitivity to, and accurate representation of, aerosol forcing in climate models, which, in turn, have consequences for accurate representation of total anthropogenic forcing of the climate system.

We will present the results of a comparison between the GEBA and CRU observational datasets, and corresponding surface radiation and temperature variables extracted from historical simulations of 32 climate models and a total of 107 ensemble members participating in CMIP5, in order to evaluate the extent to which CMIP5 models are able to reproduce dimming trends on global and regional basis. Furthermore, sensitivity studies using the CESM 1.2 community model with altered aerosol parameters and emission data will be presented and discussed with the aim of identifying which factors may improve representation of anthropogenic aerosol forcing in climate models in general. Overall, our results indicate inadequate anthropogenic aerosol sensitivity in CMIP5 models and suggests ways to address this.