



The effect of interactive gas-phase chemistry and aerosols on climate simulations over the last millennium

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Significant computational resources are required for long transient simulations using coupled atmosphere-ocean general circulation models. The additional requirements of the full chemistry module would increase this requirement by a factor of ~ 3 . And yet, it is well known that chemistry and aerosols are very important on climate, both regional and global. Therefore, we have designed a set of experiments where the ocean and sea ice boundary conditions of the coupled model, paired with the land surface, greenhouse gases, insolation, and total solar irradiance (TSI) forcing from the PMIP3 protocol are applied to a series of full-chemistry GISS ModelE snap-shots each 50-years through the last millennium.

We will present results from atmosphere-only model simulations with the GISS ModelE, which includes interactive gas-phase chemistry and aerosols at decadal-scale time slices, driven by millennial-length simulations performed with the same model when coupled with an ocean model. The impact of the presence of short-lived gases and aerosols on the simulated climate is studied. The role of previously omitted forcing mechanisms will be performed during the whole simulated period.

The results presented are the initial runs from a larger set of experiments that will assess the climate impact of changes to dust, sea-salt, and ocean-derived sulfate, biomass burning ozone-precursors and aerosols, organic carbon, wetland methane emissions, and a final set with all components. These species are standard components in the GISS model's 20th century simulations, so that we may compare millennial variability characteristics with those better constrained from more recent climate periods. Comparison of model and proxy records will test model-simulated mechanisms while the model provides insight into factors contributing to proxy variability. The addition of potentially important forcing mechanisms will enable a more comprehensive evaluation of the climate sensitivity.