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Estimation of specific climate sensitivities from reconstructions of climate forcing and global temperature

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We obtain an empirical assessment of the relative importance of the ultraviolet (UV) part of the solar spectrum compared to the total solar irradiance (TSI), forcing from volcanic aerosols and anthropogenic forcing.

The research strategy is to utilize available data on radiative forcing over the last millennium and data on global and hemispheric climate variability in the same period. The main uncertainties in these data are the relative weights between solar, volcanic and anthropogenic forcing, and for solar forcing; the relative weight between the forcing from UV variability and TSI variability. We denote these weights the specific climate sensitivity parameters.

The first step is to decompose the forcing signals into deterministic and stochastic components. Unknown weight parameters are assigned to the various components (UV, TSI, volcanic and anthropogenic) of the forcing. The main product here is a stochastic model of the total forcing signal parametrized by the specific climate sensitivity coefficients.

It has been shown that global surface temperatures exhibit a long-range memory response on time scales from months to several centuries. This justifies to feed the forcing signals and the climate response records into a dynamic-stochastic model for the global temperature with long-range memory response, and a maximum-likelihood statistical method is employed to determine the Hurst exponent of the long-range memory response as well as the specific climate sensitivity parameters. Estimates of these climate sensitivity parameters, and their confidence limits, are the main deliverables of this project.