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Transient climate simulations of the Mid-Holocene to present: temperature trends and meridional moisture transport

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Several simulations covering different periods of the past millennia with the coupled atmosphere-ocean model ECHO-G driven by different configurations of external forcings have been analysed to identify the role of solar variations, greenhouse gases and orbital configurations. Some important results of these simulations would be presented. These comprise the causes of the millennial temperature trends and of the centennial episodes like the Medieval Climate Anomaly (MCA), millennial trends in the hydrological cycle and the related meridional transport of heat and moisture.
The climate simulations display millennial cooling trends in the Northern and Southern Hemisphere and a slight warming trend in the Tropics, consistent with alkenone-based temperature sea-surface reconstructions. Comparison between a simulation driven by orbital forcing and a simulations additionally driven by solar variations and greenhouse gases indicates that these two later forcing factors did have an influence on the simulated Holocene temperature trends. The generation of a MCA requires a maximum in the solar forcing, internal variations alone do not seem able to produce any noticeable temperatures anomalies at the global scale.
The evolution of precipitation in both Hemispheres and in the Tropics is coupled to their corresponding mean temperatures. Precipitation-minus-evaporation also displays clear millennial trends consistent with an increasing meridional transport of moisture from the Tropics to the high latitudes as the Holocene advances. Although the climate model does not include interactive land glaciers, this transport would imply either an increase run-off from land at high latitudes or the build-up of solid water storage. This trends are suddenly reversed in the past few centuries of the simulation driven by orbital, solar and greenhouse fas forcings, but not in the the simulations driven by orbital forcing alone.