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Low-frequency variability of an Aquaplanet with a coupled atmosphere-ocean general circulation model

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A long-term aquaplanet simulation is conducted with a global spectral atmospheric general circulation model (the Planet Simulator AGCM) coupled to the Hamburg Large Scale Geostrophic ocean circulation model (LSG-OGCM). In an aquaplanet set-up the entire surface of the earth is covered by one ocean. In this idealized environment no continents break the zonal symmetry in the atmosphere and the ocean is also completely zonally symmetric due to a flat bottom topography. Furthermore, all external forcings are symmetric about the equator to eliminate seasonality and to create a symmetry between the northern and southern hemisphere.

A low-frequency variability develops in the climate of the aquaplanet. The meridional overturning circulation (MOC) oscillates with a period of approximately 700 years. Similar oscillations can be seen in other climate variables, like the sea surface temperature (SST) and the polar sea ice cover. The mean state of the different climate phases (strong and weak MOC) are analyzed and compared. The variability of the coupled climate system and the mechanisms behind the low-frequency oscillation of the MOC are investigated.