Geophysical Research Abstracts
Vol. 14, EGU2012-7932, 2012
EGU General Assembly 2012

Low-frequency climate variability of an aquaplanet

E. Dahms (1,2), F. Lunkeit (2), K. Fraedrich (1,2)

(1) Max Planck Institute for Meteorology, Hamburg, Germany (eileen.dahms@zmaw.de), (2) KlimaCampus, Meteorological Institute, University of Hamburg, Germany

The long-term variability of an aquaplanet climate is analyzed with a coupled atmosphere–ocean–sea ice general circulation model. The Planet Simulator, a model of intermediate complexity of the atmosphere, is coupled to the Hamburg Large Scale Geostrophic (LSG) ocean model. The coupled model includes a thermodynamic sea ice model. The main result of the 20,000 years of simulation is a very dominant internal low-frequency oscillation. All compartments of the aquaplanet (atmosphere, ocean, and sea ice) are involved as the climate alternates between warmer and colder states. The period of the oscillation is approximately 700 years.

The Meridional Overturning Circulation (MOC) is used as a representative to analyze the long-periodic variability. Comprehensive time series analyses give a detailed picture of the life cycle of the low-frequency oscillation. The warm phases are characterized by ice-free polar waters, which are more salty than in the climatological average, and a weaker meridional overturning circulation in the ocean as well as weaker winds in the atmosphere. During cold phases, the poles are completely covered by sea ice (down to 65°N/S), which goes along with fresher polar oceans. Furthermore, the oceanic and atmospheric overturning cells are stronger. The climate state changes throughout atmosphere and ocean, however, surface areas in high latitudes are especially affected due to the changing sea ice cover. The meridional energy transport in atmosphere and ocean also alternates with the climate regime, since the ocean is more efficient in transporting heat poleward when the poles are ice-free.