Geophysical Research Abstracts
Vol. 15, EGU2013-11759, 2013
EGU General Assembly 2013

Modeling atmosphere-ocean circulation in the South Atlantic during the Pliocene

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Paleo-simulations of atmosphere-ocean circulation are not only an indispensable tool for understanding former climate conditions. It also impacts on other research areas, such as the investigation of the development of shelf areas or the reconstruction of topography. We model the dynamical state of atmosphere and oceans both separately and in a coupled mode for the Pliocene and pre-industrial times, using the atmosphere model ECHAM5 and the ocean model MPIOM.

In comparison, the Pliocene has a globally warmer ($\sim$2.2°C) and slightly drier ($\sim$ 1.4 cm/yr) climate than today. South America and Africa are both colder (4°C) and drier (6 cm/yr), evoked mainly by changes in vegetation type and density. This explanation is supported by the fact that the composition of the atmosphere, the solar radiance and the land-sea distribution are similar in both time-slices for these regions.

Changes in oceanic currents are strongly influenced by the opening of the Straight of Panama and a decreased meridional temperature gradient. This leads to a weakening of the Atlantic Meridional Overturning Circulation (AMOC) and the Antarctic Circumpolar Current (ACC) during the Pliocene in comparison to nowadays.