Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11658, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11658
EGU General Assembly 2008

Climatic impacts of greenhouse gas concentration changes under glacial and interglacial conditions: Polar amplification, land/sea warming ratio, atmospheric circulation anomalies

A. Laîné (1), M. Kageyama (1), R. Alkama (1), P. Braconnot (1)

(1) LSCE/IPSL, UMR CEA-CNRS-UVSQ 1572, CE Saclay, L'Orme des Merisiers, bât. 701, 91191 Gif-sur-Yvette CEDEX, France

We study the temperature response of a glacial and an interglacial climate to a greenhouse gas (GHG) concentration change in an ocean-atmosphere coupled model, IPSL-CM4. Except for the GHG concentrations which are imposed to different values, the glacial climate is defined from the boundary conditions of the Last Glacial Maximum (LGM) as defined in the second phase of the Paleoclimate Modelling Intercomparasion Project (PMIP2). The interglacial climate consists of modern boundary conditions.

The response to a GHG concentration varying from LGM to pre-industrial values is similar for both boundary conditions, but enhanced under modern ones. The model simulates the classical amplification of the temperature response in the northern high latitudes compared to lower latitudes and over the land surfaces compared to the oceanic ones. The physical reasons for the different temperature warmings according to the latitude and to the surface type are studied through an analysis of the energy fluxes anomalies. The high latitudes warm more due to strong sea-ice and snow albedo feedbacks, along with cloud cover increases that result in a radiative warming. Concerning the land-sea warming ratio, our study highlights the role played by the evaporation differential response between the two types of surface. The latitudinal variations of the land/sea warming ratio are due to variations in the anomalies in albedo changes, evaporation, cloud cover change and water vapour air content. The lo-

cal amplifications or attenuations of the zonally-averaged warming are enhanced under modern boundary conditions compared to glacial ones, due to a greater land albedo feedback, water vapour increase and enhanced air/sea sensible heat fluxes changes in the northern hemisphere and mostly due to oceanic advection processes in the southern hemisphere.

The consequences in terms of atmospheric circulation are anomalous stationary waves in the northern hemisphere with lower pressures over lands and higher over central oceanic basins, especially over the North Atlantic. These latter correspond to a general poleward displacement of the storm-tracks.