Geophysical Research Abstracts
Vol. 13, EGU2011-10344, 2011
EGU General Assembly 2011


# Influence of a dynamic background albedo scheme on mid-Holocene North African rainfall

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Precipitation in North Africa during the mid-Holocene was significantly increased compared to today, presumably due to a change in orbital forcing. It has been hypothesised that a vegetation-precipitation feedback acted to increase the response of precipitation to this forcing. The key parameter for the strength and sign of this feedback is the surface albedo. Thus, to correctly asses the importance of this feedback, the change in surface albedo must be modelled in an appropriate way. Albedo schemes in general circulation models tend to simulate the dynamic behaviour of the canopy, but not of the surface below it, which may lead to a misrepresentation of the albedo change. Here we present a new albedo scheme, that takes the dynamic behaviour of the surface below the canopy into account. Using the MPI Earth System Model (MPI-ESM) we investigate the effect of using this dynamic scheme versus the static version that is usually used. The dynamic scheme represents the seasonal cycle of albedo and the correspondence between annual mean albedo and vegetation cover in a more consistent way than the static scheme. It thus gives a better estimate of albedo change between the two time periods. The present-day dry bias in the Sahel of the standard MPI-ESM is reduced and the sensitivity of precipitation to mid-Holocene external forcing is increased by around one third. The dynamic albedo scheme leads to increased vegetation variability in the remaining desert region, indicating a higher frequency of green spells, thus reaching a better agreement with the vegetation distribution as derived from pollen records. We also show that without the dynamic albedo scheme, the vegetation-precipitation feedback in the MPI-ESM is very weak.