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# Assessing the vegetation feedbacks at 6 kyr BP with ECBilt-CLIO-VECODE.

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Within the EU project MOTIF, the Earth system Model of Intermediate Complexity, ECBilt-CLIO-VECODE, is used to investigate the importance of the vegetation on the mid-Holocene (6 ka BP) climate. ECBilt-CLIO-VECODE is made up of three components: a T21, three-level quasi-geostrophic atmospheric model and an ice-ocean general circulation model (3° x 3°, L20) and a dynamical vegetation model. The atmospheric component has the big advantage that it has been simplified to a level that makes runs on a multi-century time-scale computationally feasible, while at the same time, producing results that, on the whole, are comparable to those of atmospheric general circulation models.

The purpose of this study is to assess the role of the vegetation feedbacks in determining the characteristics of the mean seasonal cycle of climate at 6 kyr BP and to investigate how vegetation feedbacks impact on the mid-Holocene climate changes in regions affected by the African monsoons. Therefore several sensitivity experiments are conducted. The baseline simulation differs from the pre-industrial climate (control simulation) by the orbital configuration, and thus the distribution of solar energy at the top of the atmosphere, and by the atmospheric CH4 concentration.

The contribution of vegetation to the climate at 6 kyr BP is quantified through a sensitivity experiment for which vegetation is kept to its pre-industrial distribution. The major difference in vegetation distribution between the two epochs is the greening of the Sahara and the presence of a large boreal forest at 6 kyr BP. Consequently, the increase of the boreal winter temperature is amplified by the vegetation feedback. Be-

sides, the sensitivity experiment shows that the greening of Sahara is responsible for a warming of this region (instead of a cooling if Sahara is a desert).

All the simulations performed are equilibrium simulations. However, it is clear that the climate evolution is transient and that climate needs time to adjust to changing forcings. A further experiment is designed to compare the climate simulated at 6 kyr BP for the baseline equilibrium simulation and for a transient simulation. The transient simulation is started at 9 kyr BP. ECBilt-CLIO-VECODE model is forced by seasonally varying insolation and long-term trend in atmospheric CO2 and CH4 concentrations over the last 9 kyr BP. The initial conditions are obtained from an experiment that was run until equilibrium with 9 kyr BP insolation, trace gas concentration and present-day ice sheets. First analyses do not show major differences.

Experiments with simple models show that they may display several equilibrium states for a given epoch. It is therefore important to test the role of the initial conditions. Therefore, the baseline experiment is compared with a simulation for 6 kyr BP starting with 9 kyr BP initial conditions. Both simulations converge towards the same equilibrium climate.