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Interglacial carbon cycle dynamics

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We are investigating the natural dynamics of the carbon cycle during interglacials. Our main focus is the Holocene, but Marine Isotope Stages 5 and 11 are considered as well.
Using the coupled climate carbon cycle model CLIMBER2-LPJ, the natural factors influencing the atmospheric CO2 concentration are considered. CLIMBER2 is a climate model of intermediate complexity, containing a dynamic atmosphere and ocean, as well as sea ice and land surface modules. Its coarse spatial resolution leads to a high computational efficiency, which allows long-term transient integrations of the coupled model.
Land carbon dynamics are computed using the dynamic global vegetation model LPJ. LPJ is run at a high spatial resolution of 0.5° and coupled to CLIMBER2 using the climate anomalies approach. Changes in land carbon storage as a response to changes in climate or atmospheric CO2 are therefore taken into account interactively at high spatial resolution.
Further elements of the carbon cycle included in the modelling system are the oceanic inorganic carbon cycle and marine biology in the oceanic biogeochemistry module, while carbonate compensation and coral reef growth are considered in a sedimentation model. At the land surface, a weathering module determines weathering rates and corresponding changes to the riverine bicarbonate flux, while peat accumulation in the high Northern latitudes is included as an external forcing scenario.
The coupled model is driven by changes in orbital forcing. For the Holocene, the timeframe 8kyr BP to preindustrial is considered. Here we compare the contributions of different forcing factors: Changes in carbon storage on land, changes in oceanic temperature and circulation and corresponding changes in the marine carbon cycle, as well as changes in carbonate sedimentation.
During the Holocene, coral reef growth appears to be the most important factor contributing to the rise in CO2 after 7kyr BP. The land surface appears to be an overall sink for CO2, due to carbon accumulation in the soil, as well as peat accumulation. Oceanic contributions due to temperature and circulation changes are quite small.
These investigations of the Holocene climate will be complemented by a similar analysis of previous interglacials MIS 5 and 11.