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Impact of oceanic circulation changes on the CO_2 concentration during past interglacials

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Interglacials before the Mid-Bruhnes Event (around 430 kyrs BP) were characterized by colder temperature in Antarctica, lower sea level and lower atmospheric CO_2 compared to the more recent interglacials. Recent climate simulations have shown that the climate of the interglacials before and after the MBE can only be reproduced when taking into account changes in orbital parameters and atmospheric CO_2 concentrations (Yin and Berger, 2010; Yin and Berger, 2012). Indeed, interglacial atmospheric CO_2 concentrations were $\sim$250 ppm and $\sim$280 ppm prior and after the MBE, respectively. Yet, the cause for this change in atmospheric CO_2 remains mainly unknown. climate simulations suggest that oceanic circulation was different during the interglacials due to the different climate states (Yin, 2013). The changes of oceanic circulation could have modified the carbon cycle: a more sluggish circulation would lead to greater carbon sequestration in the deep ocean and, subsequently, a decrease of atmospheric CO_2. However, the impact of oceanic circulation changes on the carbon cycle during the interglacials of the last 800 kyrs has never been tested in coupled carbon-climate models.
Here, we evaluate the role of ocean circulation changes on the carbon cycle during interglacials by using the intermediate complexity model iLOVECLIM (Goosse et al., 2010 ; Bouttes et al., 2015). This model includes a carbon cycle module on land and in the ocean and simulates carbon isotopes. The interglacial simulations are forced with orbital parameters, ice sheets and CO_2 concentrations from data reconstructions. The model computes carbon fluxes between the reservoirs and an atmospheric CO_2 that is distinct from the one used as a forcing. We will present simulations from this climate model for different interglacial periods of the last 800 000 years and use model-data comparison to analyse and evaluate the changes in the carbon cycle, including CO_2.

References

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