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Evolution of the biological productivity during the last deglaciations using the triple isotopic composition of oxygen

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The last deglaciation is probably the best documented large climatic changes of the Quaternary. It is associated with global temperature increases of ∼4-5°C, significant increase of the sea level by ∼120 m and an increase in atmospheric CO_2 concentration by 80 ppm. Understanding the combination of biochemical and physical factors responsible for this 80 ppm increase and the link with climate change is essential in the current evolution of greenhouse gases concentration. Biological productivity plays a role in the change of CO_2 concentration during the last deglaciation. However, the lack of direct and global tracers of biological productivity makes it difficult to quantify and date the global change of productivity over the last deglaciation.

Here, we use the triple isotopic composition of oxygen (δ17O of O_2) over the last deglaciation obtained with a 300 years resolution on the NEEM ice core to depict the change of global productivity on this period. δ17O of O_2 is indeed responding to the variations of O_2 flux from the biosphere albeit in a complex manner. To help its interpretation, we thus combine these measurements with O_2 fluxes obtained from the coupled climate model of IPSL over the last deglaciation.

Finally, we compare the dynamic and amplitude of the δ17O of O_2 change over the last deglaciation with variations obtained on previous deglaciations using new δ17O of O_2 data obtained from the Dome C ice core.