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Model – data integration with ^{18}O water isotope: results for pre-industrial and Last Glacial Maximum climates

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Amongst the different proxies used in palaeoclimate studies, few are as routinely measured since years in the different realms of the Earth system as are water isotopes. They form the base for our understanding of marine sediment cores (marine carbonate δ^{18}O) and ice cores but are as well measured in lake sediments, corals, speleothems or tree rings. Since the processes involved in building all these archives are quite complex, it is often difficult to link the changes in one particular location to another distant one if few reliable time markers are present. Since the δ^{18}O is ultimately controlled by the hydrological cycle in the atmosphere together with long term response of the cryosphere – oceanic system, there is potential to use the physical processes of δ^{18}O to link the climate archives together. Our aim is to achieve such a goal using a model-based approach, the model being a test bed for ideas of climate evolution.

We present here the first part of our work that concerns the validation of the model under pre-industrial conditions and Last Glacial Maximum simulation, after development of the ^{18}O cycle within the *i*LOVECLIM coupled climate model (Roche and Caley, in preparation).

For the pre-industrial climate, we present a proxy based evaluation of the model that arise from a compilation of Late Holocene ^{18}O data from the different Earth components. We show that using a model with low resolution complicates certain aspects of the data – model comparison on land, while we are able to fairly well represent the observed distribution of ^{18}O within the oceans. We discuss some of the caveats in the view of what is (expected to be) recorded in each archive.

Moving to the Last Glacial Maximum (21000 yrs), we analyse the simulated evolution as compared to compiled databases (speleothems, ice cores and marine sediments, Caley and Roche, in preparation) and existing simulations with isotope enabled models. We focus our analysis on the detection of major front systems changes in the ocean and on the link between oceanic circulation changes and its detection in land δ^{18}O change.