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Modelling oxygen isotopes in the Pliocene using a fully coupled atmosphere-ocean GCM: applications for model-data comparison.

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One of the most widely used palaeoproxies for temperature reconstruction of past climates is the ratio of different isotopes of oxygen in archives such as tree rings and ocean dwelling foraminifera. Palaeotemperatures are reflected in these archives because, as the organisms incorporated water throughout their lifecycle, a temperature dependent isotope fractionation process occurred. However, to accurately utilize these archives, knowledge of the oxygen isotope ratio of the water which these organisms incorporated is needed. The oxygen isotope ratio of the palaeo oceans is needed to interpret foraminifera, while the oxygen isotope ratio of meteoric waters are needed to interpret tree rings. Unfortunately there is very little independent evidence of the oxygen isotope ratio of these waters for the past.

Isotope enabled General Circulation Models (GCMs) can be used to estimate oxygen isotope ratios throughout the hydrological cycle in a way that is consistent with GCM physics and prescribed climate forcings. Here we present simulations of the late Pliocene ($\sim$3.2ma) using the isotope enabled version of the Hadley Centre GCM (HadCM3). We show how modeled water isotope ratios in the ocean, and in precipitation have changed between the Late Pliocene and the preindustrial. These results are used to help interpret Pliocene palaeodata and facilitate a more accurate data-model comparison for the Pliocene climate.