



Comparison of simulated oxygen isotopes from an ice sheet-climate model to proxy data: a Middle Miocene example

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By implementing oxygen-isotopic ratios in an ice sheet-climate model, the simulated isotopic composition of sea water can be directly compared to high-resolution isotopic records from deep-sea sediment cores. In the Middle Miocene these records show an abrupt isotopic depletion of approximately 0.5 per mil. Around 90% of this transition can be explained by a simulated ice-sheet expansion on Antarctica induced by a decrease in $p\text{CO}_2$ and favorable orbital parameters. We also investigate the relationship between sea level (or global ice volume) and the isotopic composition of sea water. Our experiments confirm that there is approximately 1 per mil isotopic enrichment per 100 m sea-level lowering. This relationship is restricted by the mean ocean depth and oxygen-isotopic composition of the ice sheet. Small deviations from this relation occur depending on the size of the ice sheet. Large (small) continental ice sheets are more (less) depleted in heavy oxygen isotopes and have therefore a slightly larger (smaller) effect on the isotopic composition of the ocean.