



Can we use $\delta^{18}\text{O}$ and temperature reconstructions to confidently estimate paleo-density?

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Identical twin experiments with an ocean general circulation model and its adjoint indicate that data sparsity does not appear to be the limiting factor for reconstructing the Atlantic meridional overturning circulation at the Last Glacial Maximum (LGM; see Takasumi et al., EGU2011-7259). Rather, information on paleo-sea surface density is needed. Here we present a new attempt to combine sea-surface $\delta^{18}\text{O}$ measurements on planktic foraminifera with the published MARGO sea-surface temperature reconstruction for the LGM, to “back out” estimates of sea-surface $\delta^{18}\text{O}$ of sea water, salinity and density, including their errors.

We find, for example, higher $\delta^{18}\text{O}_w$ values in the subtropics and lower $\delta^{18}\text{O}_w$ values in the mid-to-high latitudes of the Atlantic Ocean. We discuss the implications for the glacial hydrological cycle, as well as for surface water hydrology.

Furthermore, we address the question whether the large-scale gradients (gradients between large regions over which averages are computed) can be used to confidently infer changes in large-scale ocean circulation.