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Reconstructing the upper water column structure along 35°N-20°S in the Atlantic: a tool to reconstruct past thermocline circulation.

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Sub-surface circulation within the thermocline impacts a range of climate processes, from upper ocean heat capacity and transport to decadal variability. In the subtropical and tropical regions, this sub-surface circulation, often refers as Subtropical Cells, imprints the temperature and salinity water column structure of the upper ocean. We show that this structure can be reconstruct using deep-dwelling planktonic foraminifera.
We performed oxygen isotope and trace element ratio measurements on one surface-dwelling (G. ruber) and six deep-dwelling planktonic foraminifera species (N. dutertrei, G. inflata, G. tumida, G. truncatulinoides, G. hirsuta and G. crassaformis) on 60 coretops spanning from 35°N to 20°S in the Atlantic Ocean. In a first step, we used Bayesian statistical analysis between foraminifera data and modern oceanographic data to determine the calcification habitat of the different species. Our results are in agreement with previous works when they are available. For G. crassaformis and G. hirsuta, for which very little ecological information has been acquired, we find a very deep and consistent average calcification depth along the latitudinal transect. The calcification depth distributions for these two species are bi-modal. In a second step, we established the relationships between temperature and salinity from oxygen isotope and Mg/Ca ratio measurement for each species using a multivariate regression. Using selected species, we can accurately reconstruct the density structure of the upper 600 meters depth. This study lays the foundation for past upper water column structure reconstruction along a latitudinal transect in the Atlantic.