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Trace the sea surface salinity on the Iberian Margin by oxygen and hydrogen isotopes during the abrupt climate changes

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The ice melting events and freshening of North Atlantic surface water have been proposed to be the main trigger of slowing down of Atlantic meridional overturning circulation (AMOC) and abrupt climate changes during the glacial periods. However, direct reconstructions of seawater salinity are still lacking in the North Atlantic. To fill this gap, we performed proxies comparisons based on three different proxies on the Iberian Margin, including the percentage of tetra-saturated alkenone ($C_{37:4}$%); seawater oxygen isotope estimated from foraminifera and hydrogen isotope ratio of alkenones. Moreover, we calibrate the alkenone hydrogen isotope by using lab culture. Here are the main findings:

First, the C37:4% represents cold temperature, instead of salinity, on the Iberian Margin. Second, the freshening of surface water reconstructed by foraminifera lag behind the cooling on the Iberian Margin. Third, the variations of alkenone hydrogen isotope ratios is significantly different from the pattern of seawater oxygen isotope by foraminifera. Some non-salinity effects, such as CO2 and temperature, on the fractionation of alkenone to water are detected in our culture works. After removing these non-salinity effects, the alkenone hydrogen isotope matches better with the foraminifera oxygen isotope ratios.

In conclusion, based on our records on the Iberian Margin, the surface freshening did not always trigger the weakening of AMOC and significant freshening occurred during the middle of a cooling events. Thus, ice melting events may play a potential role as an amplifier in these abrupt climate events.