

Interactive comment on “Salinity changes in the Agulhas leakage area recorded by stable hydrogen isotopes of C₃₇ alkenones during Termination I and II” by S. Kasper et al.

Anonymous Referee #3

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The study “salinity changes in the Agulhas leakage area recorded by stable hydrogen isotopes of C₃₇ alkenones during Termination I and II” aims to validate the use of alkenone δD values to infer salinity changes. For this, the authors use different cores from the Agulhas leakage where previous studies showed an effect of salinity on the Mg/Ca and $\delta^{18}O$ records of planktonic foraminifera (Matinez-Mendez et al., 2008, 2012). Based on their alkenone δD values, they could estimate a decrease of salinity from ca. 1.5 to 2 during the Termination I and II, which was in good agreement with previous foraminifera records.

General comments:

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Schouten et al. (2006) demonstrated, by culturing *E. huxleyi* and *G. Oceanica* in water with different δD values, temperatures and salinities that, besides source water δD values, the hydrogen isotope compositions of alkenones are additionally affected by salinity, growth rate and alkenone producers.

Based on ca. 1‰ ¹³C-depleted alkenones in interglacial relative to glacial periods, the authors argue that growth rate change did not significantly affect alkenone δD values. Also refer to Wolhowe et al. (2009). Even if I agree with this interpretation, this statement has to be strengthened, for instance, by estimating the effects of CO₂ and growth rate changes on the alkenone δD values.

However, haptophyte community changes likely have a stronger control on the alkenones δD values. Because the fractionation difference between *G. Oceanica* and *E. huxleyi* is by 27‰ (Schouten et al., 2006), even small changes of their relative contribution may potentially affect the integrated alkenone δD values in sediments. See Schwab and Sachs (2011). Flores et al., (1999) shown that during MIS1, *E. huxleyi* (ca. 50%) predominate over *G. Oceanica* (ca. 10%), whereas during MIS5 absolute abundances of both algae were at ca. 20%. As changes of their relative abundance were significant, this effect on the integrated alkenone δD values should be discussed more precisely and if possibly quantified. As noted by the authors, higher abundance of *E. huxleyi* relatively to *G. Oceanica* during MIS1 likely bias the results toward more positive alkenone δD values leading to an underestimation of the salinity changes during the MIS1. This effect should be estimated on the integrated alkenone δD values. Are then the salinity changes still realistic and in agreement with the foraminifera records?

As different proxies have to be combined for paleo-environmental interpretations, it is necessary to consider the SST proxies. However, these proxies and the alkenone δD values have to be discussed in more details and together. For instance, how are the salinity and the temperature changes affecting the Mg/Ca records? Could different growth seasons or growth depths of forams and haptophyte explain some of the observed differences? Having discussed the proxies in more details, the authors should

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better consider the oceanographic and climatic implications on their results.

In summary, I recommend major revision of the manuscript. The authors should better estimate the effects of growth rate and haptophyte community changes on their alkenone δD values and thus on the salinity proxy. They should better consider these new data sets together with other proxies, especially with the foraminifera records, if they want to state that "(line 27) alkenone δD values is a potentially suitable tool to reconstruct salinity changes independent of planktonic foraminifera $\delta^{18}O$ ".

References

Schwab, V.F., Sachs, J.P., 2011. Hydrogen isotopes in individual alkenones from the Chesapeake Bay estuary. *Geochimica et Cosmochimica Acta*. Wolhowe, M.D., Prah, F.G., Probert, I., Maldonado, M., 2009. Growth phase dependent hydrogen isotopic fractionation in alkenone-producing haptophytes. *Biogeosciences* 6, 1681-1694.

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