Modeling new scenarios of ocean dynamics during deglaciation over Southern European Seas (Mediterranean and Black Seas)

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During quaternary, periodic organic rich layers in the Mediterranean Sea marine sediments also known as sapropels, are not only driven by African monsoon modulation. Superimposed to the main pacing associated with precession cycles (about 21 ka) many sapropels are also impacted by the 100 ka periods associated with the glacial-interglacial cycles. The last occurrence (S1) at the end of the last glacial period and the Early Holocene is an appropriate illustration of this behavior. Recent studies based on long deglaciation simulations with coupled AOGCM pointed out that reaching bottom water anoxia needs a preconditioning, throughout the last deglaciation, driven by North Atlantic Ocean freshening for a few thousand years prior to S1. Here, we investigate another important source of fresh water induced by the melting of Fennoscandian ice sheets (FIS). This runoff freshened the Black Sea, the Marmara Sea and ultimately could have an impact on the stratification and the convection over the Aegean Sea. In order to tackle this issue, we used continental hydrologic perturbation scenarios to drive a high-resolution Mediterranean Sea dynamic circulation model (1/8\textdegree) that correctly captures the convection sites and their intensity. In one hand, we rely on hydrologic reconstruction of FIS melting provided by Peltier et al. (JGR, 2015) and Patton, H. et al. (QSR, 2017) in order to derive freshwater flux since the Last Glacial Maximum - that impacted the Black Sea, and likely the Eastern Mediterranean Sea. In the other hand, we build a complete transient scenario accounting for the later enhancement of the African monsoon and we increase fresh water from Nile river. Prescribing such a scenario: first a freshwater increase from FIS during the deglaciation and second a fresh water increase from Nile river, it leads to the shutdown of the Mediterranean Thermohaline Circulation. Our results are in good agreement with Aegean reconstructions (Grant et al, QSR, 2016; Soulet et al. Proc. Natl. Acad. Sci, 2013). The methodology we developed could also be applied to sapropel S5 and S10.