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Bipartite response in the Black Sea sediment record to Greenland-Interstadial 10

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High-latitude climate variations during Greenland Interstadials (GI) are expected to transfer globally in a complex way through interactions of fast atmospheric as well as slower cryospheric and oceanic processes. Prerequisite for an investigation of the evolution of GI is a climate independent synchronization of the considered paleoenvironmental archives. Measuring and aligning globally common production rate variations of the cosmogenic radionuclide ^{10}Be in different archives provides a tool for such synchronizations and the investigation of environmental gradients in space and time, with minimized uncertainties in the relative timing.

A ^{10}Be time-series at < 40-year resolution was measured along with new proxy records down to sub-mm step size from Black Sea sediment core M72/5-22-GC8 around GI-10 (~41 ka BP). We synchronized our ^{10}Be time-series to that from Central Greenland ice cores based on the globally common production rate variations using the globally optimal fit.

Comparing the synchronized environmental proxy records points to a bipartite response of the Black Sea sediment record at the onset of GI-10. First, synchronous with the abrupt temperature increase in Greenland, costal sea ice decreases on the Black Sea, reflected by reduced sedimentary ice rafted debris contents. Second and with a lag of ~190 years, abrupt increases in the K/Ti proxy point to enhanced regional precipitation causing higher riverine sediment supply into the basin.

This bipartite structure might be connected to both differential thresholds of proxy responses in Black Sea sediments to locally abrupt environmental forcing and/or a bipartite climate transition in the region in response to GI-10. The latter could possibly be explained by an initial fast atmospheric-transmitted warming in the Black Sea region synchronous to the onset of GI-10, followed by a shift from predominantly continental to Mediterranean weather systems ~190 years later, after regional oceanic adjustments. However, further investigations during more GIs are necessary to test the robustness of these results.