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A marine perspective of EPICA ice records: links between atmospheric circulation, marine productivity, sea ice and CO_2 over the last 1.1 Myrs

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The paleoclimatic reconstruction generated by the EPICA community provided a valuable record, not only of atmospheric CO_2, but also to assess the relative importance of key climate processes involved in the regulation of atmospheric CO_2 concentrations through time (e.g. Fe supply, sea-ice extent and wind intensity). However, ice records only allow indirect inference of these processes in the marine realm. Here we present independent estimates of Fe supply, marine productivity, sea surface temperature (SST), and atmospheric circulation from the deep sea sediment record ODP Site 1090 (42º55'S, 8º54'E) extending back to 1.1Ma. Our alkenone sea SST profile varies closely to the δD temperature reconstruction from the EPICA ice cores over the entire span of the record (i.e. 800kyrs). This implies that Antarctic atmospheric and southern ocean temperatures are closely linked, and hence that such linkage may be extended beyond the span of the ice record back to 1.1Ma. The pattern of variation of the marine Fe flux estimates agree well with those of the EPICA ice cores, and present a good correlation to changes in marine biological productivity reconstructed using several biomarkers. We conclude from this, that the process of iron fertilization of marine biota, driven by increased dust supply during glacial times, has been operating in the subantarctic region over the last 1.1Ma. This may have occurred in parallel to other key processes potentially involved in the regulation of atmospheric CO_2 concentra-

tions, such as the movements of the westerly winds and changes in sea-ice extent and surface water stratification. In addition, we also provide ^{230}Th-corrected dust and Fe fluxes, as well as an estimation of the variation of the % of Fe in dust for the last 350ka, which are variables of great interest for climate modelers. Currently, our record is being extended at high resolution back to 3Ma, providing new insights into the Plio-Pleistocene evolution of this region that would be of great interest for future long-term ice-drilling projects in Antarctica.