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Geochemical composition of surface sediments from the fjords of Northern Chilean Patagonia (44-47°S): Spatial variability and implications for paleoclimate reconstructions

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High-resolution paleoclimate records from the Southern Hemisphere are essential to improve our understanding of the interhemispheric pattern of paleoclimate changes. Due to their intermediate location between the terrestrial and marine realms of southern South America, the sediments deposited in the fjords of Southern Chile contain a high resolution (i.e., sub-decadal) record of paleoclimate changes that occurred in the area since the last deglaciation. Here we investigate the geochemical and mineralogical composition of surface sediment samples collected in the fjords of Northern Chilean Patagonia (44-47˚S) in order to better understand the processes that are responsible for changes in sediment composition. PCA analysis of multi-proxy geochemical and mineralogical variables demonstrates that the sediment composition in the fjords primarily reflects the distance from/to the main tributaries, and therefore mirrors the nature and degree of terrestrial sediment discharge. Proximal locations are characterized by high contents in dense minerals such as amphibole, and high Zr/Ti, Ti/Fe, Zr/Al, Fe/Al and C/N ratios, while more distal locations are enriched in biogenic particles and have high Na/Al, Sr/Al and low C/N ratios. These proxies are therefore well suited for estimating changes in terrestrial supply into the fjords through time. The application of these proxies to a 2-m long sediment core from the Quitralco fjord (PC29A, 46˚S, 1400 years) shows an increased terrestrial supply between ∼1400 and 1900 AD, clearly marked by an increase in the Fe/Al ratio, as well as by a strong increase in total Ti and Fe concentrations. These results are interpreted as an increased river runoff, most likely linked to an increase in precipitation intensity and/or wetter climate conditions between ∼1400 AD and the beginning of the 20^{th} century. This wet period is coeval with a 1˚C decrease in SST, and is therefore believed to represent a northward shift of the Southern Westerlies over Northern Patagonia during the Little Ice Age. Finally, a similar approach is now being applied to long sedimentary records from the fjords of Northern and Southern Patagonia (45-55˚S, ∼15,000 years), from which preliminary results will be presented (Palmer 0505 cores).