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Oxygen and Hydrogen stable isotopes as climate tracers in the Laclavere Plateau, Antarctic Peninsula

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In the last decades the western side of the Antarctic Peninsula has presented the highest temperature increase of the southern hemisphere. The lack of instrumental meteorological records in this region has hindered the study of regional climatic trends. In this context the study of ice cores has became a powerful source of information because they contain records of greater temporal extension and from areas where meteorological information hasn′t been retrieved. Ice cores from high-accumulation regions can significantly contribute to understand the undergoing climate variability and expand short meteorological time-series to the past.

Laclavere Plateau (63°27′15”S / 57°41’53”W / 1130 m.a.s.l.) is situated in the northern tip of the Antarctic Peninsula and is the northern area in the Peninsula which has a height above 1000 m.a.s.l. The climatological regime in the north of the Peninsula presents a complex interaction between the different elements that form the climatic system. Meteorological conditions in this area are strongly controlled by the variation in the sea ice extension, the position of the Antarctic Circumpolar Current and the differences in the lapse rate throughout the year.

The air parcels that precipitate over the Laclavere Plateau are strongly related with the conditions that prevail on the Southern Seas at the west of the Antarctic Peninsula and in particular with the conditions present near coastal areas of the Bellingshausen Sea. Since 2008, we have studied the northern part of the Antarctic Peninsula, where several surface firn cores (<20m depth) have been collected from sea level to the divide between west and east coast at the Plateau Laclavere. The isotope signature of the cores shows a complicated signal to interpret. No clear seasonality is observed from δ18O (δD). Here we show the statistical treatment that allow us to conclude that the deuterium excess (dexcess = δD - 8 δ18O), oxygen and deuterium ratios can be potentially used as a seasonal marker. We propose that variations observed in the stable isotope signal and in meteorological conditions are related with the development of an inversion layer in the lower troposphere (below 1000 m.a.s.l.) during the winter because of the formation of sea ice in the western coast of the Peninsula.

We estimate that the Laclavere Plateau present appropriate conditions for the conservation of the isotopic signal recorded in the snow that accumulates on its surface (mean value of 1,700 kg m2 a-1). Therefore, we conclude that isotopic signal recovered from Laclavere’s Plateau ice show that ice is a strong indicator of actual meteorological parameters, which make them capable of being proxy of local variability in atmospheric circulation, snow accumulation and temperatures above surface. The well preserved isotope signal, along with the thick ice cover over the Laclavere Plateau (surveyed by geophysical methods), project this place as a favorable spot to recorver a medium depth ice core (>250m), from which it could be developed a paleoclimatic reconstruction covering at least half century at a high temporal resolution.