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Spatial-temporal variability in the snow chemistry along the Brazilian Antarctic traverses 2004–2015

Content

Between 2004 and 2015, the Centro Polar Climático/UFRGS team, in cooperation with Chilean and American colleagues, carried out two traverses of the Antarctic ice sheet covering more than 2900 km, sampling surface snow every 10 km from the Geographic South Pole to the upper part (79°07.4' S, 96°22.5' W) of the Pine Island Glacier drainage basin. In total, 191 surface samples and more than 4000 thousand from 14 shallow cores (5 to 45 m deep) of snow and firn were analysed. This work reviews the results of these two traverses, exploring the spatial variability of the major ionic content (Ca, CL, Ka, Mg, Na, NO2, methysulfonate) and stable isotopic ratios (delta D, delta Oxygen-18 and excess deuterium) in the surface samples. Comparing the isotopic signal with 2014 mean temperature profiles of the lower troposphere, obtained by the ERA5 reanalysis data, it became evident that the isotopic signal along the path in the West Antarctic ice sheet reflects the influence of two air masses from distinct nature: a colder air mass (continental) that exerts greater influence on the Weddell Sea sector and a warmer one (maritime), acting on the drainage divide and in the Amundsen-Bellingshausen Sea sector. In one of the cores obtained near the divide between the Pine Island Glacier and Institute Ice Stream drainage basins, the concentrations and mass size distribution of refractory black carbon (rBC) were determined for 47 years. Using HYSPLIT back trajectory modelling, it is found that Australia and New Zealand as the most probable BC source areas. The spectral analysis identified common cycles between the Antarctic Oscillation and rBC and the ENSO phenomenon.

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