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Sources of moisture for four ice cores in the Antarctica

I. Taboada (1), R. Nieto (1,2), L. Gimeno (1,2), R. Trigo (2,3), L. de la Torre (1,4) and J. Añel (1)

(1) Universidad de Vigo, Departamento de Física Aplicada, Facultad de Ciencias de Ourense, Ourense, Spain (rnieto@uvigo.es), (2) University of Lisbon, CGUL, IDL, Lisbon, Portugal, (3) Universidade Lusófona, Departamento de Engenharias, Lisbon, Portugal, (4) University of Aveiro, CESAM, Aveiro, Portugal.

An ice core is a cylindrical section of a naturally occurring medium consistent enough to hold a layered structure resulting from the accumulation of snow and ice over many years that have recrystallized and have trapped air bubbles from previous time periods. The composition of these ice cores, especially the presence of hydrogen and oxygen isotopes has been shown to be invaluable as it can provide a continuous picture of the climate over hundreds of thousands of years, i.e. including several Glacial-Interglacial periods. Typical ice cores are removed from an ice sheet, most commonly from the polar ice caps, confined to Antarctica and Greenland, or from high mountain glaciers elsewhere. When handled properly and with the correct instrumentation Ice cores may provide an abundance of climate information. Inclusions in the snow of each year remain in the ice, such as wind-blown dust, ash, bubbles of atmospheric gas and radioactive substances. It would be of undeniable interest to evaluate the origin of the air that is trapped annually in these ice cores with all the climate information associated.

Therefore, the main objective of this study is to locate the main sources of moisture over the Antarctica using a Lagrangian method (STOHL and JAMES, 2004, 2005). The method computes budgets of evaporation minus precipitation (E-P) by calculating changes in the specific humidity along 3-D back-trajectories. The trajectories were calculated for the previous 10 days, which is the average time that water vapour resides in the atmosphere. The areas analyzed (final point of the moisture) were four known stations of extracting ice cores [Vostok (-78.5ºS, 106.8ºE), EPICA Dome C (-73ºS, 120ºE), Byrd (-80ºS, 119.6ºW) and EPICA DML (-75ºS, 0.04ºE)]. We tracked the

origin of air-masses residing over these ice cores during a period of five years (2000–2004). The analysis of (E-P) values tells us where and when the moisture over the ice cores was received.

The 10 days averages of the back-trajectories for the Vostok and EPICA Dome C ice cores show that the main source area of moisture is located over the Pacific Ocean between 30ºS and 50ºS in latitude. Similarly, the main source area of moisture for the Bird ice core is located over the Indic Ocean at roughly the same latitudinal band, and for EPICA DML ice core the most important source of moisture is located over the Atlantic Ocean between 30ºS and 45ºS and towards the American continent. These results show that, for these selected ice core stations located over the same continent but at different longitudes, the main sources of moisture can vary considerably.