Geophysical Research Abstracts
Vol. 17, EGU2015-3613-3, 2015
EGU General Assembly 2015

Deciphering influences of temperature, moisture sources, post-deposition effects and stratospheric inputs in records of stable isotopes in East Antarctic snow

Alexandra Touzeau (1), Elise Fourré (1), Mélanie Baroni (2), Mark Curran (3), Alexey Ekaykin (4), Olivier Magand (5), Andrew Moy (3), Joe McConnell (6), and Amaelle Landais (1)

(1) Laboratoire des Sciences du Climat et de l'Environnement-CNRS, Université de Versailles Saint-Quentin-en-Yvelines, Gif-sur-Yvette, France (alexandra.touzeau@lsce.ipsl.fr), (2) CEREGE, Université d'Aix-Marseille, Aix en Provence, France (baroni@cerege.fr), (3) Australian Antarctic Division and ACE ERC, Hobart, Autralia (mark.curran@aad.gov.au), (4) Arctic and Antarctic Research Institute, St. Petersburg, Russia (ekaykin@aari.ru), (5) Laboratoire de Glaciologie et Géophysique de l'Environnement-CNRS, Université Joseph Fourier Grenoble, Grenoble, France (omagand@lgge.obs.ujf-grenoble.fr), (6) Division of Hydrologic Science, Desert Research Institute, Reno, USA (joe.McConnell@dri.edu)

The oxygen and deuterium isotopic composition of ice represent a prodigal source of information for the reconstruction of past climate. Their widespread use relies upon the straightforward relationship between the oxygen or deuterium isotopic composition in the snow precipitated and the inversion temperature (or the local temperature). However, between the precipitation of the snow and the solidification of ice, several mechanisms may affect the initial composition of the snow, thereby rendering the climatic signal less perceptible. During deposition or shortly after deposition, the wind may blow away and redeposit the uncompact snow, and therefore affect the chronology of the record. Various origins of the moisture source, including possible stratospheric inputs in very low accumulation sites, may also affect water isotopic composition. Finally, after deposition, the isotopic signal is also modified by diffusion of isotopes in the solid phase, local sublimation and condensation with associated fractionation, and water vapor transport between snow layers.

In order to assess the effect of these mechanisms on the snow isotopic composition, we compare the results of the analysis of five snow pits from the East Antarctica plateau: two from Vostok, one from Dome C, one from S2 and one from Aurora Basin (ABN). For each snow pit, snow was sampled every three cm over a depth of about three meters. The ratios of $^{18}O/^{16}O$, $^{17}O/^{16}O$ and D/H were determined for each sample and additional ^{10}Be profiles were obtained for some profiles. Because the different water isotopes are affected differently by equilibrium and diffusive processes and because stratospheric inputs are expected to leave a significant signature in ^{10}Be and ^{17}Oexcess, the combination of the different isotopic profiles is a useful tool for inferring the origin of $\delta^{18}O$ or δD variations in the top 3 m of the ice sheet. Using the relationships observed between $\delta^{18}O$, d-excess, ^{17}O-excess and ^{10}Be, we are able to show that stratospheric input can only be significant at the Vostok station and that the water isotopic records at Dome C are mainly driven by temperature and post-deposition effect.