Geophysical Research Abstracts
Vol. 16, EGU2014-14393, 2014
EGU General Assembly 2014

Climatic controls on water vapor deuterium excess in the marine boundary layer of the North Atlantic based on 500 days of in situ, continuous measurements

Hans Christian Steen-Larsen (1,2), Arny Sveinbjörnsdottir (3), Andrew Peters (4), Valerie Masson-Delmotte (1), Mark Guishard (4), Gregor Hsiao (5), Jean Jouzel (1), David Noone (2), Joseph Warren (4), and James White (6)

(1) Laboratoire des Sciences du Climat et de l'Environnement, UMR CEA-CNRS-UVSQ/IPSL 8212, Gif-sur-Yvette, France (hanschr@gfy.ku.dk), (2) Department of Atmospheric and Oceanic Sciences, and Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado, USA, (3) Institute of Earth Sciences, University of Iceland, Reykjavik, Iceland, (4) Bermuda Institute of Ocean Sciences, St. George's GE 01, Bermuda, (5) Picarro Inc., Santa Clara, California, USA, (6) Institute of Arctic and Alpine Research, Campus Box 450, University of Colorado, Boulder, Colorado, USA

Continuous, in situ measurements of water vapor isotopic composition have been conducted in the North Atlantic, Bermuda Islands (32.26°N 64.88°W) between November 2011 and June 2013, using a cavity-ringdown-spectrometer water vapor isotope analyzer and an autonomous self-designed calibration system. Meticulous calibration allows us to reach an accuracy and precision on 10 minute average of δ18O, δD, and d-excess of respectively 0.14‰ 0.85‰ and 1.1‰ verified using two parallel instruments with independent calibration. As a result of more than 500 days with 6-hourly data the relationships between deuterium excess, relative humidity (rh), sea surface temperature (SST), wind speed and direction are assessed. From the whole dataset, 84% of d-excess variance is explained by a strong linear relationship with relative humidity. The slope of this relationship (-42.6 $\pm$ 0.4 ‰ per % (rh)) is similar to the theoretical prediction of Merlivat and Jouzel (1979) for SST between 20ºC and 30ºC. However, in contrast with theory, no effect of wind speed could be detected on the relationship between d-excess and relative humidity. Separating the dataset into winter, spring, summer, and autumn seasons reveals different linear relationships between d-excess and humidity. Changes in wind directions are observed to affect the relationships between d-excess and humidity. The observed seasonal variability in the relationship between d-excess and relative humidity underlines the importance of long-term monitoring to accurately separate signals of local evaporation from signals associated with moisture advection.