



Moisture sources and synoptic to seasonal variability of North Atlantic water vapor isotopic composition

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The isotopic composition of surface water vapor on the south coast of Iceland (63.83°N, 21.47°W) has been monitored in situ between November 2011 and April 2013. The calibrated dataset documents seasonal variations in the relationship between $\delta^{18}\text{O}$ and local specific humidity, and in the relationship between deuterium excess and $\delta^{18}\text{O}$. These seasonal variations are attributed to seasonal changes in atmospheric transport. A strong linear relationship is observed between deuterium excess and atmospheric relative humidity calculated at regional sea surface temperature, surprisingly similar to the relationship observed in Bermuda Islands. During days with minimum isotopic depletion, our data significantly deviate from the global meteoric water line. This feature can be explained by a supply of an evaporative flux into a simple box model above the ocean surface. Based on the close relationship identified between moisture origin and deuterium excess, we combine deuterium excess measurements performed in Iceland and south Greenland with moisture source diagnostic based on back-trajectory calculations to establish the distribution of d-excess moisture uptake values across the North Atlantic. We map high deuterium excess in the Arctic, and low deuterium excess for vapor in the subtropics and mid-latitudes. These findings provide a new benchmark for the evaluation of isotopically enabled atmospheric models, and confirm the role of North Atlantic water vapor isotopes as moisture origin tracers.