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Combining water and gas isotopes measurements from the NEEM ice core to reconstruct abrupt temperature changes and reorganization of the hydrological cycle over a series of Dansgaard-Oeschger events

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Ice cores from Greenland have revealed the occurrence of 25 rapid climatic events (Dansgaard-Oeschger events, hereafter DO events) during the last glacial period. These DO events have a very strong temperature signal in Greenland (more than 15°C temperature increase in less than a century) with an imprint of almost global extent. Open questions exist on the regional fingerprints of DO events in Greenland. The exact reorganization of the northern hemisphere water cycle and the sequence of events between low and high latitudes remain uncertain. In this study, we combine new measurements of water stable isotopes (δD, δ^{18}O, δ^{17}O) and air isotopes (δ^{15}N of N_2, δ^{40}Ar of Ar) every 50 years on a sequence of three DO events (8-10) on the NEEM ice core (North Greenland Eemian Ice Drilling, North West Greenland). The isotopic composition of water, through the second order parameters deuterium excess and ^{17}O-excess, allow to document changes in sea surface temperature and humidity at the evaporative regions at low latitudes. The comparison of δ^{18}O with d-excess and ^{17}O-excess therefore allows to quantify the time lags between changes in Greenland temperature and changes in low latitudes evaporative conditions. The magnitude of temperature changes is quantified based on gas isotopes. The isotope and temperature patterns observed during DO 8-10 at NEEM are compared with results obtained from GRIP, GISP2 and NorthGRIP ice cores to discuss the regional signature of DO events in Greenland. Finally, the gas and water isotope signals are compared with the methane records to characterize the sequence of events between low latitude methane production and polar climate.