Oxygen isotopes improve weather predictability in Niger

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For the African nation of Niger, the effect of seasonal atmospheric variability on the weather is poorly understood. Because most residents rely on local agriculture, improving the predictability of seasonal weather and precipitation availability is crucial.

In the summer of 2006, researchers measured the oxygen isotope ratio of rainwater collected in the nation's capital, Niamey, to determine the connection between intraseasonal atmospheric variability and precipitation. Water containing the heavier oxygen-18 isotope rains preferentially over the lighter oxygen-16 version, lighter water evaporates preferentially over the heavier molecule, and the oxygen isotope ratio decreases from the equator to the poles. Thus, the oxygen isotope ratio found in a water sample can indicate the water's history. Previous research found that precipitation oxygen isotope ratios could be used to understand convective processes, but to develop a more nuanced and continuous interpretation researchers need to understand the seasonal shifts in the background atmospheric water vapor ratio.

From July 2010 to May 2011, Tremoy et al. measured the atmospheric water vapor and precipitation oxygen isotope ratios in Niamey. They find that the water vapor ratio varied regularly throughout the year, with minima during both the summer monsoon and the winter dry season and maxima in between. The authors suggest that the summer decline is driven by convection associated with the monsoon and that the dry season decrease is due to both atmospheric subsidence and air arrivals from midlatitudes. The fall maxima are caused by weakening

convection, and the spring peak is associated with oxygen-18 enriched air moving in from the south. The authors also detect a number of shorter-period shifts in water vapor isotopic composition, which they suggest are driven by convective processes, like evaporation and subsidence, and daily atmospheric mixing, potentially opening the door for oxygen isotope measurements to be used to study atmospheric variability and dynamics and thus the origin of Niger's moisture.

More information: A 1-year long delta-O-18 record of water vapor in Niamey (Niger) reveals insightful atmospheric processes at different timescales, *Geophysical Research Letters*, doi:10.1029/2012GL051298 , 2012

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