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Reconstructing Pan-Tropical Precipitation Recycling Based on Stable Isotopes

Kurt Solander[1*], Brent Newman[1], Nicolette Gonzales[1], Scott Jasechko[2], and Chonggang Xu[1]

[1] Earth and Environmental Sciences, Los Alamos National Laboratory, Los Alamos, NM;
[2] University of California, Santa Barbara, Santa Barbara, CA

Contact: ksolander@lanl.gov

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We used the IAEA Global Network of Isotopes in Precipitation (GNIP) database to assess the characteristics of stable isotopes (d^2H and $d^{18}O$) in precipitation at the pan-tropical scale. These data relate to tropical ecohydrology in a number of ways including moisture sources, characteristics of climate zones including seasonality and moisture recycling (e.g. local re- precipitation of water vapor derived from ET). In this study, we used monthly precipitation isotope data from 395 sites within $+/-30^0$ North Latitude. We focus our efforts on investigating spatial patterns of d-excess calculated from this data due to its strong sensitivity to precipitation recycling. We employed a geospatial interpolation method to get a spatially continuous estimate of mean monthly d-excess across this latitudinal range and further classified these estimates into the three main groups of Köppen-Geiger climate zones that occur within the tropics (e.g. tropical, temperate and arid) based on differences in d-excess values. Our results show the spatial distribution of derived major Köppen-Geiger climate zones match reality in greater than 60% of the land surface at 1^0 resolution. Spatial matching was highest over larger continental land masses and lower where data was too sparse to appropriately resolve the interpolation as well as in regions where precipitation was more seasonally controlled. We aim to improve upon these estimates by investigating the role of specific climate and geospatial variables on d-excess values that include distance from ocean, precipitation, temperature and evapotranspiration as well as how these relationships vary seasonally. Such an effort will be useful to integrate precipitation recycling into Earth System Models (ESMs) to determine how the spatial variability of moisture sources might be changing under a warming climate.