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Soil moisture-precipitation coupling: observations question an impact on precipitation occurrence in North America

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The coupling between soil moisture and convective precipitation through indirect mechanisms (e.g. boundary-layer growth and convection triggering) remains a key challenge out of numerous aspects on the interactions between the land surface and precipitation. In particular, how surface turbulent fluxes (sensible, latent heat fluxes and their partitioning) impact the occurrence of rainfall is poorly understood, due to the number and diversity of the processes involved.

Here we explore the relationship between Evaporative Fraction (EF) and precipitation occurrence on the daily time scale. We apply a recently developed method (Findell et al., 2011) to observational data in North America: EF derived from FLUXNET sites and from GLEAM (satellite-based estimates), and radar precipitation data from NEXRAD. We then compare the resulting estimate of land-precipitation coupling to the NARR reanalysis (North American Regional Reanalysis).

While a strong relationship is found in NARR, observations do not confirm a strong impact of EF on precipitation occurrence (i.e. no significant coupling is found). Further analyses show that, while precipitation data from NARR and NEXRAD agree well, EF data from the different sources differ widely and lead to different coupling. This questions the existence of a positive coupling between EF and precipitation occurrence in North America and highlights the need for more reliable datasets of high spatial and temporal resolution to fully quantify the strength of such land-surface atmosphere coupling.

References:

Findell, K. L., P. Gentine, B. R. Lintner, and C. Kerr. 2011. Probability of afternoon precipitation in eastern United States and Mexico enhanced by high evaporation. Nature Geosci, 4, 434-439.