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Evidence of two-way feedback mechanisms between precipitation and soil moisture at annual and interannual timescales in tropical South America

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Land and atmosphere interactions represent a critical component in the climate system, since soil moisture may influence the atmospheric boundary layer dynamics through its impact on evapotranspiration and surface energy fluxes partitioning. This study explores the spatio-temporal dynamics between precipitation and soil moisture in six regions of tropical South America (TroSA): Central Amazon (CA), West Amazon (WA), East Amazon (EA), South Amazon (SA), Colombia (CO) and Venezuela (VE), using monthly precipitation data from the Tropical Rainfall Measuring Mission (TRMM) 3B43 available at a spatial resolution of 0.25°x0.25°, and monthly water content data from the Gravity Recovery and Climate Experiment (GRACE) satellite mission (1°x1°, 2002-2017), as well as soil moisture data from the Soil Moisture and Ocean Salinity (SMOS) L3 product (0,25ºx0,25°, 2010-2017). Our results indicate that simultaneous and lagged monthly cross-correlation analysis show statistically significant correlations (P>0.95) when precipitation leads soil moisture at 3 to 1 month-lags, whereas, statistically significant negative correlations when soil moisture leads precipitation from 3 to 5 month-lags. Our results provide evidence about the existence of two-way feedback mechanisms between precipitation and soil moisture in TroSA. Similar results were obtained using the series of monthly standardized data, removing the annual cycle, to examine the relation between precipitation and soil moisture at interannual timescales.

KEY WORDS: precipitation, soil moisture, Tropical South America, cross-correlation, Amazonia