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Title: A Study of the Dependence between Soil Moisture and Precipitation in different Ecoregions of the Northern Hemisphere

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We highly appreciate the editor for the very helpful and insightful comments that lead to the significant improvement this manuscript. We have checked our work carefully according to these comments and made the requested changes. In this revised version, we emphasized the novelty of this study, and clearly explained how it contributes the new insights.

Below we indicate the comments and use blue font for our responses. The corresponding revised texts are also used blue font in the revised version of our manuscript.

Comments from Editor

Your revised manuscript received substantially good feedbacks from the Referees. Although, could be further improved by taking into account the comments raised by the Reviewers, according to the statements in your reply. Please proceed according to your response and submit a final revised version of your work.

Response: Thank you for your recommendation and comments. We emphasized the novelty of this study, and clearly explained how it contributes the new insights, based on the version of “egosphere-2025-762-manuscript-version4”. Some writing typos were also corrected.

Lines 18-20:

The relationship between soil moisture and precipitation was found to be nonlinear and negative in Northern Hemisphere ecosystems.

Lines 22-24:

This study quantified the spatiotemporal distribution of the nonlinear dependence of soil moisture to precipitation, and identify the dominant factors in different ecoregions to explore the driving mechanisms and regional patterns.

Lines 78-81:

Existing studies have not fully addressed some issues in the nonlinear dependence of soil moisture to precipitation, including the heterogeneity in different ecoregions and soil layers, as well as inadequate identification of tail dependence.

Lines 108-110:

In particular, although the negative dependence has been reported, its dominant drivers and their relative contributions across different timescales and soil layers still remain unclear.

Lines 118-129:

This study targets the nonlinear dependence of soil moisture to precipitation across Northern Hemisphere at monthly and annual scales from 2000 to 2019. A copula function was applied to describe the joint distribution of precipitation and soil moisture. It can capture the asymmetric and tail-dependent relationship, as well as the varying influences of precipitation volume, frequency, and evapotranspiration on soil moisture at monthly and seasonal scales. A Bayesian attribution framework involved gross primary productivity (GPP), land surface temperature (LST), and near-surface air temperature (T_a) were selected to identify the key driving factors, since the dependence between precipitation and soil moisture is influenced by factors such as vegetation growth, temperature, and soil properties. The driving factors and regional characteristics of the negative correlation observed between precipitation and soil moisture in different ecoregions were also compared.

Lines 629-631:

Bayesian models were used to analyze the driving factors and relative contribution in the dependence of soil moisture to precipitation in different time scales and ecoregions of the Northern Hemisphere.

Again, we thanks for your recommendation and comments.