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Evaluating the soil moisture feedback on convective and stratiform precipitation

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Land-atmosphere coupling in midlatitude continental regions is particularly active during the warm season. It is still unclear whether this coupling generates a positive or negative feedback between soil moisture conditions and rainfall occurrence. Assessing such feedback is crucially important for a better understanding of the role of land surface conditions on the regional dynamics of the water cycle, which in turn would improve short-term weather forecasting and flood risk prediction. This study investigates the relationship between soil moisture and subsequent precipitation in midlatitude continental regions. Sounding data from sixteen locations across the midwestern US are used to calculate two indices of atmospheric instability – namely, the convective available potential energy (*CAPE*) and the convective inhibition (*CIN*). Daily rainfall time series for each station are classified as convective or stratiform rainfall on the basis of these two indices. We carried out a linear correlation analyses to these two rainfall categories to assess the dependence of rainfall occurrence on antecedent soil moisture conditions. It is found that most of the positive correlation observed between soil moisture and subsequent precipitation is due to the autocorrelation of precipitation during long stratiform events.

Uniformity analyses of the probability distributions of precipitation depending on soil moisture are also carried out to provide a more powerful assessment of their dependence, in that these analyses do not resort to the linearity assumption and to data binning. The existence in the same region of both areas with positive and negative feedback on convective precipitation is found. This behavior is likely due to the con-

trasting effects of soil moisture conditions on convective phenomena through changes in surface temperature and the supply of water vapor to the overlying air column. The analysis of the warm-season data from the midwestern US allows us to identify three main regions with similar feedback characteristics. No significant correlation is found between daily rainfall depth and antecedent soil moisture conditions either for convective or stratiform rainfall.