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The sensitivity of convective precipitation to soil texture distribution and soil hydraulic characteristics

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The formation of convective clouds is regulated by both the characteristics of the atmosphere and the land surface. The effect of land-surface properties can be significant via the thermal and hydraulic exchange between the soil-vegetation system and the atmosphere. In this study the sensitivity of convective precipitation to soil texture distribution and to soil hydraulic characteristics is analyzed.

Case studies were performed by Version 3 of the Penn State - NCAR MM5 (Fifth-generation Mesoscale Model) modeling system. Its land-surface model is the Noah Land Surface Model. It consists of a multilayer soil model and a single-layer snow and canopy model. The ten case studies include storm events, mostly with heavy rain, without any preference on the synoptic features.
In simulations the effect of soil texture distribution was investigated by replacing the original distribution in Hungary according to measurements given by the RISSAC (Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences). All of the USA soil hydraulic properties were also replaced by mostly recalculating them from Hungarian field measurements. 24 hours accumulated precipitation fields were analyzed using skill score analysis and significance tests. Results indicate that the aforementioned characteristics have a not negligible effect on precipitation intensity and distribution in heavy precipitation events without disturbing the large scale pattern of the atmospheric circulation.