



Investigating the Propagation of Regional Droughts and Floods Within the Soil Profile in Illinois

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In this study we investigate the patterns of hydroclimatic droughts and floods at the regional scale with an emphasis on the mechanisms of amplification/dissipation of dry and wet anomalies at monthly, seasonal and interannual timescales. This analysis is based on a comprehensive data set of Illinois describing relevant hydrological variables, including 25-year (1981-2005) monthly time series of precipitation, soil moisture, groundwater depth, and streamflow. The characteristics of persistence and downward propagation of droughts and floods with increasing depth within the soil profile (i.e., eleven 10-20 cm soil layers and the shallow unconfined aquifers) are analyzed by using analytical crossing theory. Crossing theory deals with the properties of excursions of random processes above and below certain threshold values, and is well suited for studying droughts and floods. The role of deep-layer soil moisture and shallow groundwater in affecting land surface-atmospheric feedback on longer timescales is also investigated.