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Reconstruction of Global and Regional Drought in the Second Half of the 20th Century

J. Sheffield, L. Luo, and E. F. Wood

Princeton University, Civil Engineering, Princeton, United States (justin@princeton.edu)

Off-line simulation of the global terrestrial hydrologic cycle has the potential to provide retrospective estimates of global and regional drought, including its characteristics and variability. We show results based on soil moisture data from the VIC land surface model forced by a bias corrected meteorological dataset at 1.0 degree spatial resolution for 1948-2006. The model is calibrated to large basin streamflow and accounts for within basin variation in runoff generation and has been evaluated against soil moisture from observational networks, remote sensing based snow products and evaporation derived from atmospheric reanalysis and remote sensing. Drought is defined in terms of runs of soil moisture anomalies relative to the 50+ year climatology for given deficit thresholds. The dataset is able to identify well-known regional drought events, and other less documented ones. These events are analyzed in terms of their concurrent severity-area-duration characteristics, enabling the identification of the most severe regional events over the past 50 years for different area and duration thresholds. Comparison with large scale climate variability indicates strong ties between global soil moisture variability and ENSO that is also seen in the variation in the number of large scale drought events. This dataset forms the basis for real-time drought monitoring in which current conditions can be assessed relative to the long-term climatology. In turn, the real-time monitoring provides initial conditions for seasonal hydrologic prediction based on downscaled dynamical atmospheric forecasts. The dataset has also been used to evaluate coupled climate model simulations of 20th century drought and their future projections. Current work is looking at identifying mechanisms for drought initiation, persistence and recovery through analysis of atmospheric forcing and land-atmosphere feedbacks with a view to assessing skill in atmospheric seasonal forecast models.