Global analysis of drought recovery

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The time taken from ecosystems to recover from drought, i.e. drought recovery time, is particularly important for the state of ecosystems. Yet there are some contradictory results about drought recovery time in current literature. Here we try to resolve this controversy and develop a new method to determine drought recovery time. We find that the differences in GPP processing methods and associated "normal recovery level" contribute to the contradictory results. Drought recovery time derived from different time scales of standardized precipitation evapotranspiration index (SPEI) shows large differences, implying large uncertainties. In addition, previous analysis almost used all drought events to determine drought recovery time, although some drought events did not reduce ecosystem productivity. Thus, instead of using traditional drought indices, we firstly use soil moisture to identify the "effect drought events" and "normal recovery level" and then quantify the drought recovery time. Soil moisture is proved to be better than SPEI to quantify drought impacts on ecosystem productivity and subsequent drought recovery. Drought recovery time using multiple scales of SPEI could be subjected to some biases regionally: 1-month, 6-month SPEI may overestimate the drought recovery time, while the 12-month, 24-month SPEI may underestimate the drought recovery time. Our study helps resolve the recent debates about drought recovery and highlights the necessity to account for soil moisture to assess the drought recovery of terrestrial ecosystems.