Thank you for your insightful points. We address each of these below, and a copy of the revised manuscript is included in the supplement.

1) In the last paragraph of section 4.3, the authors state that "Unfortunately, evaluation of soil moisture drought propagation timescales is inhibited by the lack of root-zone soil moisture data at global scale. While satellite soil moisture products are available, these are limited to the upper few centimeters of the soil (Owe et al., 2008), which is not representative of root-zone soil moisture." However, satellite observations of total water storage (TWS) from the Gravity Recovery and Climate Change (GRACE) include soil moisture variations in the root-zone. It also has been used to investigate drought propagation timescale in combination with SPEI and other satellite records at the global scale (Zhao et al. 2017 https://doi.org/10.1175/JHM-D-16-0182.1). Therefore, the authors should phrase their statement more carefully here.

Indeed, we failed to mention that GRACE is also sensitive to changes in soil moisture. Unfortunately, GRACE data is also unsuitable for validating the results in our study because it also reflects changes in other terrestrial water stores. We have added a statement summarizing this to our revised manuscript (P21 L3-6).

2) Does the magnitude and duration of a specific meteorological drought affect the timescale of drought propagation in the terrestrial hydrologic cycle? For example, in a region a meteorological drought might happen very quickly and intense (such as flash drought), it might quickly deplete soil moisture and streamflow therefore may better agree with short time-scale SPI. But in the same region, a meteorological drought can form slowly and gradually propagate into the terrestrial hydrological cycle therefore may better agree with long time-scale SPI. Can the authors explain how this would affect the interpolation of a" temporally averaged" SPI-n presented in the paper?

SPI-n is indeed the accumulation period that best matches soil moisture and runoff droughts over the entire time period. For specific droughts, differing initial conditions or conditions during the event may result in drought propagation that is slower or quicker than the overall result. Very short (flash) droughts may not even be adequately represented at the monthly time scale used in this study.

We performed an additional experiment to investigate how the overall SPI-n is affected by the occurrence of short and long drought propagation time scales. In this experiment, we selected pixels where summer soil moisture droughts are best represented by the shortest SPI-n (1 or 2 months) and pixels where they are best represented by long time scales (24 or 36 months). As an additional criteria we used only pixels where the correlations between SSMI and SPI-n are very high (> 0.9). This resulted in 33 pixels with short SPI-n and 68 pixels with long SPI-n. We made 100 random combinations of these pixels and combined their SSMI and SPI time series into 60-year time series. Finally, SPI-n were calculated for each of these synthetic time series. Results of this analysis show that combining the short and long drought propagation time scales largely results in intermediate SPI-n (Figure R1). Shorter SPI-n appear to have a slightly larger impact on the overall SPI-n, as the

shortest time scales are still represented in the combined time series, while the original longer SPI-n are not.

In the revised verison of the manuscript, we have added a statement indicating that the SPI-n represents the overall drought propagation timescale for a pixel, though drought propagation may be quicker or slower for individual events (P5, L3-6).

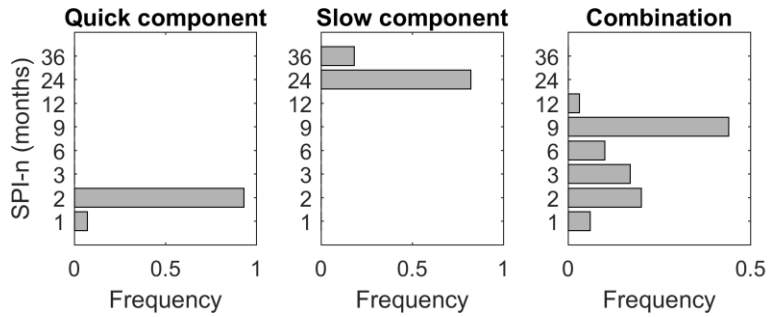

Figure R1. Histograms of SPI-n used for the quick and slow components, and the SPI-n resulting from combining their underlying SPI and SSMI time series.