Supplementary Material for

Global Flash Drought Monitoring using Surface Soil Moisture

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Section S1: Comparing SMS$_{SMAP}$ and SMS$_{PTF}$ for continental-scale drought stress mapping

To highlight the over-sensitivity of SMS$_{PTF}$ vis-à-vis SMS$_{SMAP}$ for SM stress assessment at a continental scale, a comparison between *i*) the weekly average of θ_{RS} from SMAP and *ii*) drought severity assessment from USDM for four select weeks is shown in Figure S1a-d. While both SMS$_{SMAP}$ and SMS$_{PTF}$ capture the overall SM stress conditions over CONUS in comparison to the USDM assessment, SMS$_{PTF}$ consistently overestimates drought severity in the western U.S. Also, several occurrences of mild-to-severe drought conditions in the eastern U.S. are missed by SMS$_{PTF}$ for all selected dates. The relative oversensitivity of SMS$_{PTF}$ compared to SMS$_{SMAP}$ is evident in the severity-area plots shown in Figure S1e-f based on the entire period of the study where SMS$_{PTF}$ consistently overestimates pixels in higher stress categories compared to SMS$_{SMAP}$. It is important to note that the general mismatch between USDM and SMS severity estimates may be observed due to differences in the definition, perception and climatology of the dataset used in the formulation of the indices. However, the overall comparison between USDM and SMS$_{SMAP}$ reveals strong spatial agreement between the two indices in identifying SM stressed regions.
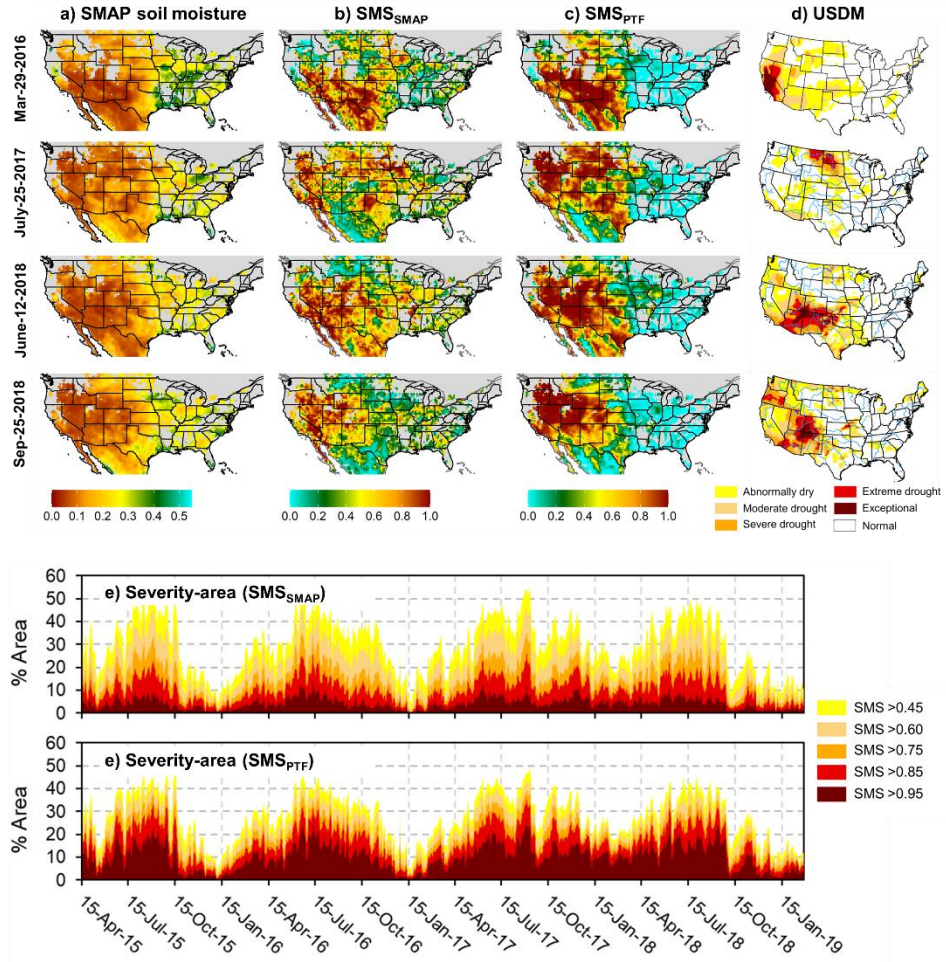
Figure S1*:* Comparison of *a*) weekly averages of SMAP soil moisture, drought severity assessment and a weekly average of the SMS estimates from *b*) SMAP and *c*) PTF-based parameters with *d*) weekly estimates of drought severity by the U.S. drought monitor (USDM, *Svoboda et al., 2002*) for four select dates. *e*) and *f*) show %area of Contiguous U.S. under specific SM stress category from SMS$_{SMAP}$ and SMS$_{PTF,}$ respectively. CONUS-wide weekly drought severity assessment by is used to provide a qualitative comparison of the proposed approach. USDM is a composite index based on diverse county-level information, including groundwater, reservoir levels, snowpack etc. for socio-economic and agricultural decision making.