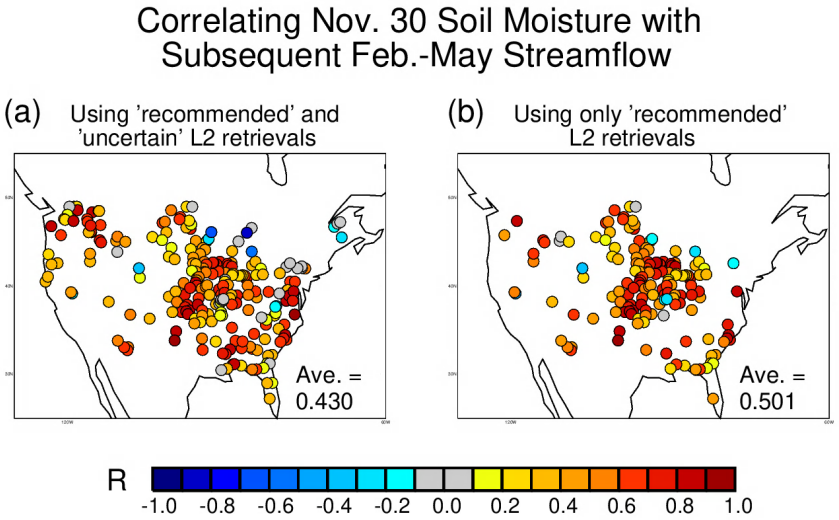
Significant Correlations Found Between Late-Fall SMAP Soil Moisture Retrievals and Subsequent Spring Streamflow

Problem: Given that the generation of surface runoff depends in part on soil moisture content and that this moisture content has some memory – particularly over the quiescent winter season – there is hope that SMAP Level-2 soil moisture retrievals obtained during late fall may be related to streamflow totals during the following spring. How strong, though, is this connection?

Finding: Late fall SMAP Level 2 soil moisture retrievals were processed with an exponential filter to produce estimates of deeper soil moisture, which were subsequently correlated against streamflow in unregulated basins during the subsequent February-May period (2015-2021). Significant correlations were found across CONUS, as indicated in the figure.

Impact: The presence of significant correlations strongly implies that SMAP-based soil moisture estimates can contribute positively to streamflow forecasts at a lead of several months.



(a) Correlation between SMAP-derived profile soil moistures (as estimated from Level 2 [L2] surface moisture retrievals) for Nov. 30 and subsequent spring (February through May) streamflow amounts. For ease in visualization, values are plotted with circles of uniform size at the stream gauge locations.

(b) As in (a), but using only SMAP L2 retrievals flagged as being recommended.

Koster, Liu, Crow, and Reichle (2023), Nature Communications, 14, 3545, https://doi.org/10.1038/s41467-023-39318-3