**Problem:** How much do gauge-based precipitation data and SMAP brightness temperature (Tb) observations contribute to L4_SM skill?

**Finding:** SMAP’s contribution to L4_SM skill is greater in otherwise in poorly instrumented regions, incl. portions of South America, Africa, & central Australia. Both data sources contribute about equally to L4_SM root-zone soil moisture skill; L4_SM runoff skill largely stems from gauge-based precipitation data (not shown).

**Impact:** Results demonstrate the importance of SMAP Tb for global soil moisture estimation and will guide future algorithm improvements.


Surface soil moisture skill difference between L4_SM and simulations (a) without SMAP Tb and gauge-based precipitation, (b) without SMAP Tb, and (c) without gauge-based precipitation. Skill is anomaly time series correlation, estimated using independent ASCAT retrievals as Instrumental Variable.