Soil Water Estimates from SMAP, SMOS and GRACE Assimilation as Landslide Predictor

Problem: Can SMAP, SMOS, or GRACE soil water estimates be used for the probabilistic modeling of hydrologically-triggered landslides?

Finding: Soil water estimates from NASA Catchment model simulations can distinguish between "stable slope" (no landslide) conditions and landslide-inducing conditions in a probabilistic way.

Unlike GRACE and SMOS assimilation, SMAP assimilation generally increases the landslide probability estimates based on soil water percentiles for reported landslides, relative to model-only estimates.

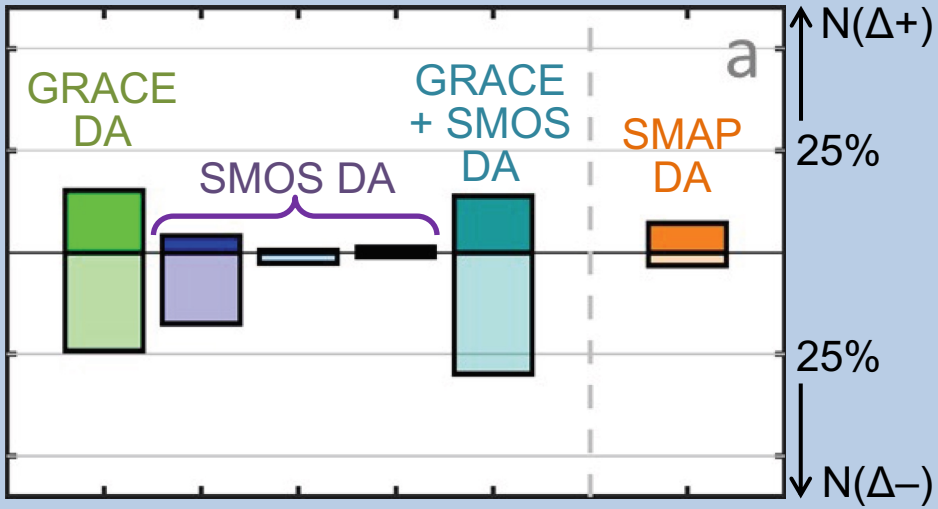

Fig. 1. Effect of GRACE, SMOS, and SMAP data assimilation (DA) on root-zone soil moisture (RZSM), conditioned on reported landslide events (LSEs). Ordinate shows the relative number N of RZSM updates from DA for (upper half) wetting (Δ+) and (lower half) drying (Δ–) corrections w.r.t. model-only estimates. Number is relative to reported LSEs. The preponderance of wetting increments seen (only) in SMAP DA is consistent with the reported, hydrologically-triggered LSEs.

Impact: SMAP observations may be helpful for probabilistic modeling of hydrologically-triggered landslides.

Felsberg, De Lannoy, Girotto, Poesen, Reichle, and Stanley, 2021: Global soil water estimates as landslide predictor: the effectiveness of SMOS, SMAP and GRACE observations, land surface simulations and data assimilation, *Journal of Hydrometeorology.*