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Assimilation of SMAP-enhanced and SMAP/Sentinel-1A/B soil moisture data into land surface models

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Prediction of water-related natural disasters such as droughts, floods, wildfires, landslides, and dust outbreaks on a regional-scale can benefit from the high-spatial-resolution soil moisture (SM) data of both satellite and modeled products. The reason is that the amount of surface SM controls in the partitioning of outgoing energy fluxes into latent and sensible heat fluxes.

Recently, NASA's SMAP mission has been implemented, in order to provide 3-km and 1-km SM data from a combination of SMAP and Sentinel-1A/B observations along with 9- and 36-km SM data retrieved from an L-band radiometer brightness temperature (TB). The 3-km and 1-km SM products were produced by combining the Sentinel-1A/B C-band radar backscatter and SMAP radiometer TB observations.

In the present study, we assimilated SMAP-enhanced (9-km) and SMAP/Sentinel-1A/B SM (3-km and 1-km) products into a land surface model (LSM): SMAP-enhanced and SMAP/Sentinel-1A/B SM data were assimilated into Noah-MP3.6 LSM. Then, these products were evaluated against ground observations in the United States. Three DA products' error characteristics were intercompared: (1) SMAP-enhanced 9-km DA, (2) SMAP/Sentinel-1A/B 3-km DA and (3) SMAP/Sentinel-1A/B 1-km DA.

When SMAP and SMAP/Sentinel SM data sets were assimilated into LSM, the R- and ubRMSE values for 9-, 3-, and 1-km SM data were greatly improved.