Neural Network Bias Correction for SMAP Soil Moisture Assimilation

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Statistical techniques permit the retrieval of soil moisture estimates in a model space while retaining the spatial and temporal signatures of the satellite observations. As a consequence, they can be used to implement an alternative bias correction to the local cumulative distribution function matching typically used in soil moisture data assimilation (DA) systems. Here, we calibrate a statistical neural network (NN) retrieval algorithm with SMAP brightness temperature observations and modeled soil moisture used to calibrate the SMAP Level 4 DA system. Daily values of surface soil moisture are estimated using the NN and then assimilated into the NASA Catchment model. Several observation error formulations are tested to maximize the amount of independent satellite information extracted during the assimilation. We assess the skill of the NN assimilation estimates through a comprehensive comparison to in situ measurements from the SMAP core and sparse network sites. The NN method compares well against more traditional bias correction approaches and yields consistent improvements over the model skill.