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Evaluation of SMAP, SMOS and AMSR2 soil moisture retrievals against observations from two networks on the Tibetan Plateau

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Two soil moisture and temperature monitoring networks were established in the Tibetan Plateau (TP) during recent years. One is located in a semi-humid area of central TP and consists of 56 soil moisture and temperature measurement (SMTM) stations, the other is located in a semi-arid area of southern TP and consists of 21 SMTM stations. In this study, the station data are used to evaluate soil moisture retrievals from three microwave satellites, i.e. the SMAP of NASA, the SMOS of ESA, and the AMSR2 of JAXA. It is found that the SMAP retrievals tend to underestimate soil moisture in the two TP networks, mainly due to the negative biases in the effective soil temperature that is derived from a climate model. However, the SMAP product well captures the amplitude and temporal variation of the soil moisture. The SMOS product performs well in Naqu network with acceptable error metrics, but fails to capture the temporal variation of soil moisture in Pali network. The uncertainties in the SMOS retrievals arise from errors in both the effective soil temperature but also other aspects (e.g. ancillary parameters). The AMSR2 products evidently exaggerate the temporal variation of soil moisture in Naqu network, but dampen it in Pali network, suggesting the retrieval algorithm needs further improvements for the TP.