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# Combining precipitation and soil moisture observations: a way for improved estimates of land surface water fluxes?

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Simulations of the Earth water and energy fluxes are highly dependent on the reliability of model input data. Uncertainties of simulations of terrestrial water fluxes are hereby directly related to the accuracy of available precipitation data. As precipitation is characterized by small temporal and spatial correlation lengths, the uncertainties in precipitation data increase with decreasing density of available precipitation gauges.

Active and passive satellite sensor systems allow for the derivation of quantitative precipitation information from space. However, these precipitation estimates are prone to large uncertainties, especially over land, as the measured signal is also influenced by the underlying land surface.

However, as soil moisture directly depends on precipitation dynamics, its variation is likely to be used as a proxy for precipitation variability. Remote sensing techniques have been proven to allow for the monitoring of surface soil moisture dynamics at different spatio-temporal scales. Especially low frequency microwave data are most sensitive to soil moisture dynamics.

The present paper investigates the potential of combining microwave soil moisture information with (uncertain) precipitation estimates to partly compensate for uncertainties in precipitation data sets. The combined use of soil moisture and precipitation information within a data assimilation framework should therefore be favourable for an estimation of surface water fluxes.

The present paper investigates the general potential of a such combined approach by integrating L-band (1-2 GHz) microwave radiometer data into a simple model for soil wetness to compensate for uncertainties in a priori information of precipitation. A high correlation between the microwave signature and surface soil moisture was found which is consistent with previous findings. An analytical data assimilation scheme for the integration of that information into a soil wetness model, based on an antecedent precipitation index (API), was developed.

The results reveal that the data assimilation filter adds or removes an amount of water partially compensating for the actual precipitation error. The correlation coefficient between the filter update and actual precipitation error was found to be $0.6 < r < 0.8$ and the model simulations did show a better coincidence with in situ soil moisture records, by integrating the microwave data. The results indicate a high potential to use L-band microwave data to compensate for uncertainties in precipitation measurements in the absence of detailed ground based measurements.