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Toward creating a global map of drainage rate using satellite soil moisture data as the only input

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The parameterization of hydrological processes over large areas is extremely difficult. The large heterogeneities in soil surface conditions makes impracticable to obtain reliable estimates of soil hydraulic parameters for areas larger than few squared kilometers. However, the knowledge of these parameters on a global scale is essential for a number of hydrological and climatic applications. For instance, their use within SM2RAIN algorithm (Brocca et al., 2014) would allow to obtain a self-calibrated precipitation product based on soil moisture data and independent from any other data sources.
In this study, a new approach is suggested to estimate the coefficients of the drainage rate at satellite footprint scale ($\sim$25 km) by using only satellite soil moisture data. To this end, discrete dry down events after rainfall are selected during the periods in which surface runoff and evapotranspiration rates are negligible compared to the drainage rate. Then, by exploiting the water balance equation, soil moisture recession curves are analyzed to derive the coefficients of a power law model of drainage rate. Scientific challenge here is the selection of dry down intervals, mainly because no ancillary data, like precipitation, is used to identify the drying periods.
In-situ soil moisture data from 10 sites across the world characterized by different soils, land uses and climatic regimes, and three satellite soil moisture datasets from the Advanced SCATterometer (ASCAT), the Soil Moisture Active Passive (SMAP) mission and the Soil moisture Ocean Salinity (SMOS) mission are considered as the soil moisture datasets. Finally, to validate the model results at satellite footprint, an indirect method is used to determine the correlation between model outputs and some relating parameters (e.g., soil texture, vegetation cover).
The preliminary results show that the model can capture the dynamic of drying process at point and satellite footprint scale. However, the drainage rates derived from satellite datasets are found to be higher than the ones from in-situ data and it can be attributed to soil moisture measurement depth.

REFERENCES

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