Geophysical Research Abstracts
Vol. 20, EGU2018-692, 2018
EGU General Assembly 2018

Estimating drainage rate using satellite soil moisture drydowns

Ehsan Jalilvand (1), Masoud Tajrishy (1), Luca Brocca (2), Christian Massari (2), and SedighehAlsadat Ghazi Zadeh Hashmi (1)

(1) Sharif University of Technology, Tehran, Iran, Islamic Republic Of (ehsan.jalilvand@gmail.com), (2) Research Institute for Geo-Hydrological Protection, National Research Council, Perugia, Italy

Valuable information regarding the processes involved in the soil drying is encoded in the soil moisture (SM) drydowns. Many studies have investigated the total losses including evapotranspiration (ET), drainage and runoff by analyzing SM drydowns, but none has yet attempted to decouple these processes. Knowledge of drainage is essential for modelling the interaction between land and atmosphere and, hence, it represents an important input in land surface and hydrological models. In this study, a data-driven approach for estimating drainage from soil moisture drydowns (DfD) is introduced. In this method, drying events after rainfall when evapotranspiration and runoff are negligible compared to drainage are selected, then by employing surface water balance model (SWBM) and assuming a power law relation between drainage and soil moisture the drainage coefficients are estimated.
The main input for DfD is the SM time series that is now available from different satellite missions (Soil Moisture Active Passive (SMAP), Soil Moisture Ocean Salinity (SMOS), Advanced Scatterometer (ASCAT) and . . .). Previous application of DfD to in situ data revealed that adequate number of drainage active drying events should be involved to better estimate drainage parameters. A study by McColl et al. (2017) suggested that during a drydown event, drainage active drying period are usually less than 3 days and not more than 5 days (depending on climate and soil type). Therefore, in this study the ASCAT SM data with nominal revisiting time of one day is used as the input. Nine pixels with different combination of climate and soil type are chosen across the world as the case studies. To validate the result, a physically based SWBM developed by Brocca et al. (2014b) is employed that estimate drainage parameters using precipitation and temperature data by applying a semi-analytical approach. Moreover, DfD is also validated indirectly by using the obtained drainage coefficients into SM2RAIN algorithm (Brocca et al., 2014a) for rainfall estimation.
The results indicate that model has a better performance in regions with humid climate where ET is not a significant term in drying of the soil. With respect to soil type, results are better in moderate permeable soil. Indeed, if the sand fraction is high, the drainage occurs quickly and it cannot be captured by satellite overpasses. If the clay fraction is high, drainage has a small share in the drying process which is difficult to be identified.

References:
Brocca, L., Ciabatta, L., Massari, C., Moramarco, T., Hahn, S., Hasenauer, S., Kidd, R., Dorigo, W., Wagner, W., Levizzani, V., 2014a. Soil as a natural rain gauge: Estimating global rainfall from satellite soil moisture data. J. Geophys. Res. 119, 5128–5141. doi:10.1002/2014JD021489

Brocca, L., Camici, S., Melone, F., Moramarco, T., Martínez-Fernández, J., Didon-Lescot, J.-F., Morbidelli, R., 2014b. Improving the representation of soil moisture by using a semi-analytical infiltration model. Hydrol. Process. 28, 2103–2115. doi:10.1002/hyp.9766

McColl, K.A., Wang, W., Peng, B., Akbar, R., Gianotti, D., Lu, H., Pan, M., Entekhabi, D., 2017. Global characterization of surface soil moisture drydowns. Geophys. Res. Lett. doi:10.1002/2017GL072819