Geophysical Research Abstracts
Vol. 20, EGU2018-4558, 2018
EGU General Assembly 2018

How much water is used for irrigation? A new approach exploiting satellite soil moisture observations

Luca Brocca (1), Angelica Tarpanelli (1), Paolo Filippucci (1), Wouter Dorigo (2), Felix Zaussinger (2), Alexander Gruber (2,3), and Diego Fernandez Prieto (4)

(1) National Research Council, Research Institute for Geo-Hydrological Protection, Perugia, Italy (luca.brocca@irpi.cnr.it), (2) CLIMERS – Research Group Climate and Environmental Remote Sensing, Department of Geodesy and Geoinfomation, Vienna University of Technology, Vienna, Austria, (3) Department of Earth and Environmental Sciences, KU Leuven, Heverlee, B-3001, Belgium, (4) European Space Agency, ESA-ESRIN, Frascati, Italy

Irrigation is the greatest human intervention in the water cycle. In a changing climate and with the growing of population, the use of irrigation water is expected to significantly increase worldwide. Notwithstanding its huge importance, nowadays we do not have any method for obtaining information on the amount of water used for irrigation over large areas. Indeed, through remote sensing, we are able to detect areas in which irrigation occurs (e.g., through optical and thermal sensors), but not to quantify irrigation water.
Under the WACMOS-Irrigation ESA (European Space Agency) project, we developed a new approach exploiting satellite soil moisture observations for assessing the amount of water applied for irrigation. Specifically, through the exploitation of SM2RAIN algorithm (Brocca et al., 2014), which is based on the inversion of the soil water balance equation, and by using satellite soil moisture data as input, the amount of water entering into the soil, and hence irrigation, is determined.
Firstly, through synthetic experiments, we assessed the impact of soil moisture measurements accuracy and temporal resolution, also as a function of climatic conditions, on the accuracy of the method. Secondly, we applied the proposed approach to the currently available coarse resolution satellite soil moisture products: Soil Moisture Active and Passive, SMAP, mission; Soil Moisture and Ocean Salinity, SMOS, mission; Advanced SCATterometer, ASCAT; Advanced Microwave Scanning Radiometer 2, AMSR2. Nine pilot areas in Europe, USA, Australia and Africa are used as case study to test the method reliability in a real-world application.
Results revealed that satellite products accuracy and climate conditions play the major role for determining our capability of quantifying irrigation. Specifically, at semi-humid sites in which irrigation is applied to increase yield, the proposed method fails in obtaining reliable performances. Similarly, low performances are obtained in areas in which satellite products are not accurate, or their spatial resolution is too coarse with respect to the size of irrigated fields. However, over semi-arid regions in which satellite soil moisture products perform good, and in which long period of absent rainfall is observed, the method shows reliable results in quantifying irrigation. Therefore, in these regions we expect that the proposed approach might be highly useful for water management and food applications.

REFERENCES

Brocca, L., Ciabatta, L., Massari, C., Moramarco, T., Hahn, S., Hasenauer, S., Kidd, R., Dorigo, W., Wagner, W., Levizzani, V. (2014). Soil as a natural rain gauge: estimating global rainfall from satellite soil moisture data. Journal of Geophysical Research, 119(9), 5128-5141, doi:10.1002/2014JD021489.