Geophysical Research Abstracts
Vol. 21, EGU2019-14569-1, 2019
EGU General Assembly 2019


# Effects of different rescaling and error characterization schemes in an extensive data assimilation experiment over Europe

Domenico De Santis (1), Christian Massari (2), Wade T. Crow (3), Luca Brocca (2), Stefania Camici (2), and Daniela Biondi (1)

(1) Department of Informatics, Modelling, Electronics and System Engineering, University of Calabria, Arcavacata di Rende, Italy (d.desantis@dimes.unical.it), (2) Research Institute for Geo-Hydrological Protection, National Research Council, Perugia, Italy, (3) Hydrology and Remote Sensing Laboratory, USDA ARS, Beltsville, Maryland, USA

In this study, the effects of remotely-sensed soil moisture (SM) data assimilation (DA) on rainfall-runoff model performances have been extensively explored, through a large experiment involving numerous catchments located across Europe (>700), and the use of different observations preprocessing and error characterization approaches. ESA-CCI SM products, that merged several available active and passive observations datasets, are employed, also in order to evaluate the role of the type of sensors on DA performances. Daily discharge time series and basin characteristics are obtained from the Global Runoff Data Centre, while daily rainfall and mean temperature data are collected from the European Climate Assessment & Dataset E-OBS. The MISDc-2L model (Brocca et al., 2012) is used for hydrological simulations.
In the preprocessing phase, the exponential filter is adopted to address the depth mismatch between model estimates and observations. Two alternative approaches are considered for satellite data rescaling between reference and rescaled datasets, namely CDF-matching and Triple Collocation analysis (TC), which imply the matching of the total variance and of the signal component, respectively. Then, TC is used for observation error characterization by using different triplet configurations in order to test the impact of different observation weights in DA performances. Finally, the Ensemble Kalman Filter is employed to assimilate the rescaled satellite-based observations into MISDc-2L model.
The model performance in open-loop (OL) can be considered generally good, while the effects of remotely-sensed SM assimilation are contrasting. The improvements due to DA are substantially limited to catchments in Mediterranean area, while a degradation of model results is almost systematically observed at northern latitudes. Spatial patterns in DA performances are inversely related with both those of model OL performances and of provided rainfall accuracies; in this sense the assimilation of satellite SM shows skills where model does not work so well and/or higher errors in precipitation data could be expected. No remarkable differences in performances attributable to the different ESA-CCI products or rescaling procedures are observed. However, adopting TC for rescaling appears to be more effective in limiting multiplicative bias (i.e. state-dependent systematic errors) evidences in simulated discharges. The use of lagged model as third variable in error variance characterization, that in this case implies higher uncertainties attributed to satellite-based observations, lead to better DA performances with respect to the integration of two satellite-based datasets in the triplet configuration.
In conclusion, this study confirms in some way the contrasting results available in literature on satellite SM data assimilation in hydrological models (e.g., Massari et al., 2015). Here, the integration of remotely-sensed data seems suitable for specific areas, and shows a high potential to correct for uncertainties associated with rainfall estimates.

REFERENCES

Brocca, L.; Moramarco, T.; Melone, F.; Wagner, W.; Hasenauer, S.; Hahn, S. Assimilation of surface- and root-zone ASCAT soil moisture products into rainfall–runoff modeling. IEEE Trans. Geosci. Remote Sens. 2012, 50, 2542–2555.
Massari, C.; Brocca, L.; Tarpanelli, A.; Moramarco, T. Data assimilation of satellite soil moisture into rainfall-runoff modelling: a complex recipe? Remote Sens. 2015, 7, 11403–11433.