Geophysical Research Abstracts
Vol. 19, EGU2017-15922-1, 2017
EGU General Assembly 2017

On the exploitation of optical and thermal band for river discharge estimation: synergy with radar altimetry

Angelica Tarpanelli, Paolo Filippucci, and Luca Brocca
National Research Council, Institute for Geohydrological Protection, Perugia, Italy (a.tarpanelli@irpi.cnr.it)

River discharge is recognized as a fundamental physical variable and it is included among the Essential Climate Variables by GCOS (Global Climate Observing System). Notwithstanding river discharge is one of the most measured components of the hydrological cycle, its monitoring is still an open issue. Collection, archiving and distribution of river discharge data globally is limited, and the currently operating network is inadequate in many parts of the Earth and is still declining.
Remote sensing, especially satellite sensors, have great potential in offering new ways to monitor river discharge. Remote sensing guarantees regular, uniform and global measurements for long period thanks to the large number of satellites launched during the last twenty years. Because of its nature, river discharge cannot be measured directly and both satellite and traditional monitoring are referred to measurements of other hydraulic variables, e.g. water level, flow velocity, water extent and slope.
In this study, we illustrate the potential of different satellite sensors for river discharge estimation. The recent advances in radar altimetry technology offered important information for water levels monitoring of rivers even if the spatio-temporal sampling is still a limitation. The multi-mission approach, i.e. interpolating different altimetry tracks, has potential to cope with the spatial and temporal resolution, but so far few studies were dedicated to deal with this issue. Alternatively, optical sensors, thanks to their frequent revisit time and large spatial coverage, could give a better support for the evaluation of river discharge variations. In this study, we focus on the optical (Near InfraRed) and thermal bands of different satellite sensors (MODIS, MERIS, AATSR, Landsat, Sentinel-2) and particularly, on the derived products such as reflectance, emissivity and land surface temperature. The performances are compared with respect to the well-known altimetry (Envisat/Ra-2, Jason-2/Poseidon-3 and Saral/Altika) for estimating the river discharge variation in Nigeria and Italy.
For optical and thermal bands, results are more affected by the temporal resolution than the spatial resolution. Indeed, even if affected by cloud cover that limits the number of available images, thermal bands from MODIS (spatial resolution of 1 km) can be conveniently used for the estimation of the variation in the river discharge, whereas optical sensors as Landsat or Sentinel-2, characterized by 10 – 30 m of spatial resolution, fail in the estimation of extreme events, missing most of the peak values, because of the long revisit time ($\sim$14-16 days). The best performances are obtained with the Near InfraRed bands from MODIS and MERIS that give similar results in river discharge estimation, even though with some underestimation of the flood peak values.
Moreover, the multi-mission approach applied to radar altimetry data is found to be the most reliable tool to estimate river discharge in large rivers but its success is constrained both spatially (number of satellite tracks) and temporally (revisit time of the satellites).
Therefore, it is expected that the multi-mission approach, merging also sensors of different characteristics (radar altimetry, and optical/thermal sensors), could improve the performances, if a consistent and comparable methodology is used for reducing the inter-satellite biases.