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SARAL/Altika for inland water: current and potential applications

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Although representing less than 1% of the total amount of water on Earth the freshwater is essential for terrestrial life and human needs. Over one third of the world's population is not served by adequate supplies of clean water and for this reason freshwater wars are becoming one of the most pressing environmental issues exacerbating the already difficult tensions between the riparian nations. Notwithstanding the foregoing, we have surprisingly poor knowledge of the spatial and temporal dynamics of surface discharge. In-situ gauging networks quantify the instantaneous water volume in the main river channels but provide few information about the spatial dynamics of surface water extent, such as floodplain flows and the dynamics of wetlands. The growing reduction of hydrometric monitoring networks over the world, along with the inaccessibility of many remote areas and the difficulties for data sharing among developing countries feed the need to develop new procedures for river discharge estimation based on remote sensing technology. The major challenge in this case is the possibility of using Earth Observation data without ground measurements.
Radar altimeters are a valuable tool to retrieve hydrological information from space such as water level of inland water. More than a decade of research on the application of radar altimetry has demonstrated its advantages also for monitoring continental water, providing global coverage and regular temporal sampling. The high accuracy of altimetry data provided by the latest spatial missions and the convincing results obtained in the previous applications suggest that these data may be employed for hydraulic/hydrological applications as well. If used in synergy with the modeling, the potential benefits of the altimetry measurements can grow significantly. The new SARAL French-Indian mission, providing improvements in terms of vertical accuracy and spatial resolution of the onboard altimeter Altika, can offer a great contribute for monitoring inland water and especially for the assessment of the discharge. Expressed in terms of water level variations using mathematical formulas or calibrated relationships, the discharge can be estimated by different methods. In the last years, empirical formulae relating the flow to the hydraulic variables (width, flow depth, slope) along with more complex methods that use hydrological modelling and assimilation techniques were applied to this end. Recently, a simplified approach based on relationship between the discharge and the hydraulic conditions and a method using MODIS images for the river flow velocity estimation were successful applied to altimetry data derived from the previous satellite missions (ERS-2, ENVISAT) for different case studies. With the aim to investigate the benefits that can be achieved by SARAL mission, the same two procedures are here applied by using Altika altimetry data for some pilot rivers. Results are analyzed and discussed in terms of performance measures in discharge estimation.