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Water level and discharge retrieval from the new altimeter missions

Luciana Fenoglio-Marc, Jürgen Kusche, and Anne Springer
Germany (fenoglio@geod.uni-bonn.de)

The advent of synthetic aperture radar (SAR) altimetry with its improved along-track spatial resolution has enabled the measurement of inland water levels with a better accuracy and an increased spatial resolution.
This study presents Sentinel-3A results in European rivers where tide gauge data are available for validations and in other ungauged rivers . The performances of products available within Copernicus and the GPOD ESA products (OCOG, Samosa2 and SAMOSA+) are evaluated and compared to alternative data processing.

We first consider the Elbe, Rhine and Po rivers. Time series of water levels are retrieved. The results show good agreement with in situ measurements. with a root-mean-square errors (RMSEs) between 0.10 m and 0.30 m in the Rhine and the Po (width 300 meters). For the Elbe the correct accounting for the ocean tide is challenging.

We then consider the Niger river (West Africa) which represents a challenging target for deriving discharge from spaceborne radar altimeter measurements, in particular since most terrestrial gauges ceased to provide data during the 2000s. We show that altimetry (Jason-1 and-2, Envisat, Saral/Altika) subsequently produce sea level height. Sentinel-3 data products allow to extend the time series and produce data of higher accuracy with less outlayers (width 700 meters). Here we propose to derive altimetric rating curves by 'bridging' time series between gauge and altimeter using hydrological model simulations.. However, this necessitates a careful choice of model forcing data, model calibration, radar retracking, and fitting empirical stage-discharge relation which may need to allow for breakpoints, depending on the used hydrological model.

We conclude that results with the new satellites are promising. ryoSat-2 and Sentinel-3. At the end of the decade the evolution of the technology up to the future SWOT mission will open up many new hydrology-related opportunities.