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Assimilation of satellite altimetry data in hydrological models for improved inland surface water information: Case studies from the ”Sentinel-3 Hydrologic Altimetry Processor prototypE” project (SHAPE)

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This communication is about the Sentinel-3 Hydrologic Altimetry Processor prototypE (SHAPE) project, with a focus on the components dealing with assimilation of satellite altimetry data into hydrological models.
The SHAPE research and development project started in September 2015, within the Scientific Exploitation of Operational Missions (SEOM) programme of the European Space Agency. The objectives of the project are to further develop and assess recent improvement in altimetry data, processing algorithms and methods for assimilation in hydrological models, with the overarching goal to support improved scientific use of altimetry data and improved inland water information. The objective is also to take scientific steps towards a future Inland Water dedicated processor on the Sentinel-3 ground segment. The study focuses on three main variables of interest in hydrology: river stage, river discharge and lake level.
The improved altimetry data from the project is used to estimate river stage, river discharge and lake level information in a data assimilation framework using the hydrological dynamic and semi-distributed model HYPE (Hydrological Predictions for the Environment). This model has been developed by SMHI and includes data assimilation module based on the Ensemble Kalman filter method. The method will be developed and assessed for a number of case studies with available in situ reference data and satellite altimetry data based on mainly the CryoSat-2 mission on which the new processor will be run; Results will be presented from case studies on the Amazon and Danube rivers and Lake Vänern (Sweden).
The production of alti-hydro products (water level time series) are improved thanks to the use of water masks. This eases the geo-selection of the CryoSat-2 altimetric measurements since there are acquired from a geodetic orbit and are thus spread along the river course in space and and time. The specific processing of data from this geodetic orbit space-time pattern will be discussed as well as the subsequent possible strategies for data assimilation into models (and eventually highlight a generalized approach toward multi-mission data processing). Notably, in case of data assimilation along the course of rivers, the river slope might be estimated and compensated for, in order to produce local water level "pseudo time series" at arbitrary locations, and specifically at model’s inlets.