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The use of coastal altimetry to support storm surge studies in project eSurge

P. Cipollini (1), P. Harwood (2), H. Snaith (1), S. Vignudelli (3), L. West (1), S. Zecchetto (4), and C. Donlon (5)

(1) National Oceanography Centre, Southampton, UK (cipo@noc.ac.uk, +44-(0)23-80596404), (2) Logica UK Ltd, Leatherhead, UK, (3) Istituto di Biofisica, Consiglio Nazionale delle Ricerche, Pisa, Italy, (4) Istituto di Scienze dell'Atmosfera e del Clima, Consiglio Nazionale delle Ricerche, Padova, Italy, (5) European Space Agency/ESTEC, Noordwijk, The Netherlands

One of the most promising applications of the new field of coastal altimetry, i.e. the discipline aiming to recover meaningful estimates of geophysical parameters (sea level, significant wave height and wind speed) from satellite altimeter data in the coastal zone, is the study of storm surges. The understanding and realistic modelling of surges supports both preparation and mitigation activities and should eventually bring enormous societal benefits, especially to some of the world's poorest countries (like Bangladesh). Earth Observation data have an important role to play in storm surge monitoring and forecasting, but the full uptake of these data by users (such as environmental agencies and tidal prediction centres) must first be encouraged by showcasing their usefulness, and then supported by providing easy access.

Having recognized the above needs, The European Space Agency has recently launched a Data User Element (DUE) project called eSurge. The main purposes of eSurge are a) to contribute to an integrated approach to storm surge, wave, sea-level and flood forecasting through Earth Observation, as part of a wider optimal strategy for building an improved forecast and early warning capability for coastal inundation; and b) to increase the use of the advanced capabilities of ESA and other satellite data for storm surge applications. The project is led by Logica UK, with NOC (UK), DMI (Denmark), CMRC (Ireland) and KNMI (Netherlands) as scientific partners.

A very important component of eSurge is the development, validation and provision of dedicated coastal altimetry products, which is the focus of the present contribution. Coastal altimetry has a prominent role to play as it measures the total water level envelope directly, and this is one of the key quantities required by storm surge applications and services. But it can also provide important information on the wave field in the coastal strip, which helps the development of more realistic wave models that in turn can be used to improve the forecast of wave setup and overtopping processes. We will present examples of how altimetry has captured a few significant surge events in European Seas, and we will describe how a multi-mission coastal altimetry processor is going to be integrated in the eSurge system. The delayed-time reprocessed coastal altimetry data will be blended with tide gauge data to extract the main modes of variability in the coastal regions. Then data from the tide gauges can be used to estimate water level in real time, based on the modes of variability found.
In a later phase of the project, the eSurge coastal altimetry processor will be extended to be able to ingest Near-Real-time (NRT) raw altimetric waveforms and generate the relevant NRT products, a definite first for coastal altimetry. The pilot regions for this application will be the European Seas (where an area of specific interest is the Northern Adriatic, which is being investigated within a related initiative called eSurge-Venice) and the North Indian Ocean.

In summary, we expect eSurge to be one of the first pre-operational applications of coastal altimetry and a proof of the benefits to society that can be brought by this relatively new branch of marine remote sensing.