Validation and use of operational coastal satellite altimetry observations for storm surges

Kristine S. Madsen1, Jacob L. Høyer1, Paolo Cipollini2, and Luke West6
1 Centre for Ocean and Ice, Danish Meteorological institute, Denmark, contact: kma@dmi.dk and jlh@dmi.dk
NOC Southampton, UK

Abstract
The North Sea – Baltic Sea area is an ideal region for validation of coastal altimetry due to the dense network of tide gauge data, varied coastline and high natural sea level variability. Within the ESA DUE eSurge project, we have prepared for data assimilation of coastal sea level into the DMI hydrodynamic model for the North Sea – Baltic Sea area, focusing on storm surge situations (See poster 2-P-190 by W. Fu et al.).

Standard along-track altimetry products have reduced quality closer than approximately 50 km from the coast, and are not available within approximately 10 km of the coast. Envisat data from the coastal zone has now been processed for a selected track in the North Sea/Baltic Sea. Here, we investigate how to construct the high resolution sea level anomaly for coastal applications and validate the coastal altimetry products from the CoastAlt and eSurge projects against tide gauge data.

The coastal altimetry data will be used to develop a revised and operationalized version of our statistical sea level model (Madsen et. al. 2007) within eSurge.

Data sources, processing and example

Our construction of sea level anomaly:

- Envisat pass 829.
- CoastAlt (Brown) and ALES retrackers with 18 Hz data, RADS 1 Hz data.
- Corrections as recommended for each product, except no ocean tidal correction or inverse barometer correction, and ECMWF wet tropospheric correction for RADS.
- Mean sea surface: CLS11 for ALES & RADS, interpolated GDR standard for CoastAlt.

When examining the noise level of the altimetry data as a function of distance to the coast, we see that:

- The standard deviation is approximately 0.2 m more than 5 km from the coast and is slightly improved with alongtrack smoothing.
- The standard deviation increases dramatically within 3-5 km of the coast, but with spike removal and alongtrack smoothing, data may be used until 3 km of the coast.

Distances to coast statistics

When examining the noise level of the altimetry data as a function of distance to the coast, we see that:

- The standard deviation increases dramatically within 3-5 km of the coast, but with spike removal and alongtrack smoothing, data may be used until 3 km of the coast.

Future work

- We will validate Jason 2 data for the study area using Pistach and eSurge 20 Hz products.
- The coastal altimetry products will be used with the post processing methods developed here to improve our statistical sea level model, blending satellite and tide gauge observations. The model results will be available within the eSurge project for selected storm surges.

Acknowledgements
Satellite data were obtained from the eSurge and CoastAlt projects and the RADS data base. In situ data were obtained from DMI and Statens Kartverk / met.no.