

The contribution of altimetry to storm surge modelling in the eSurge project

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A **storm surge** is an unexpectedly high water level brought on by unusual atmospheric conditions. Much of the world's coastline is at risk of storm surges, which are among the most devastating of natural catastrophes.



The ability to model and forecast storm surges can support preparation and mitigation activities, bringing enormous benefits, including to some of the world's poorest countries.

Earth Observation data from satellites has an important role to play in surge monitoring and forecasting, but the full uptake of these data by users such as environmental agencies and tidal prediction centres has not been as high as it might be. This is especially true for newer data types such as coastal altimetry and high resolution scatterometry.

Recognising this, the European Space Agency is funding the eSurge project, which will make access to such data easier than it has been, including providing new data types (see below). The project will also run demonstration experiments, as well as providing training for users and doing outreach activities to advertise the data and to encourage people to make full use of them.

The project is led by CGI (UK), with NOC (UK), DMI (Denmark), CMRC (Ireland) and KNMI (Netherlands) as scientific partners.



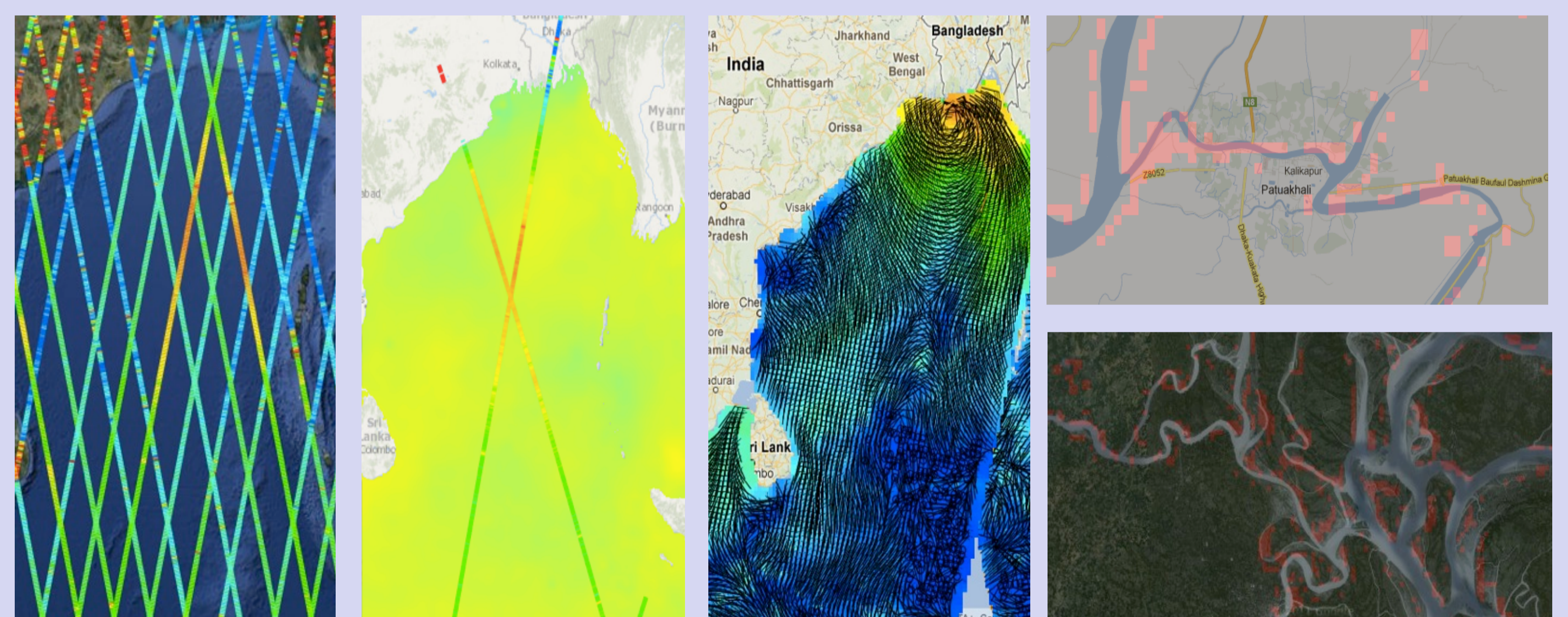
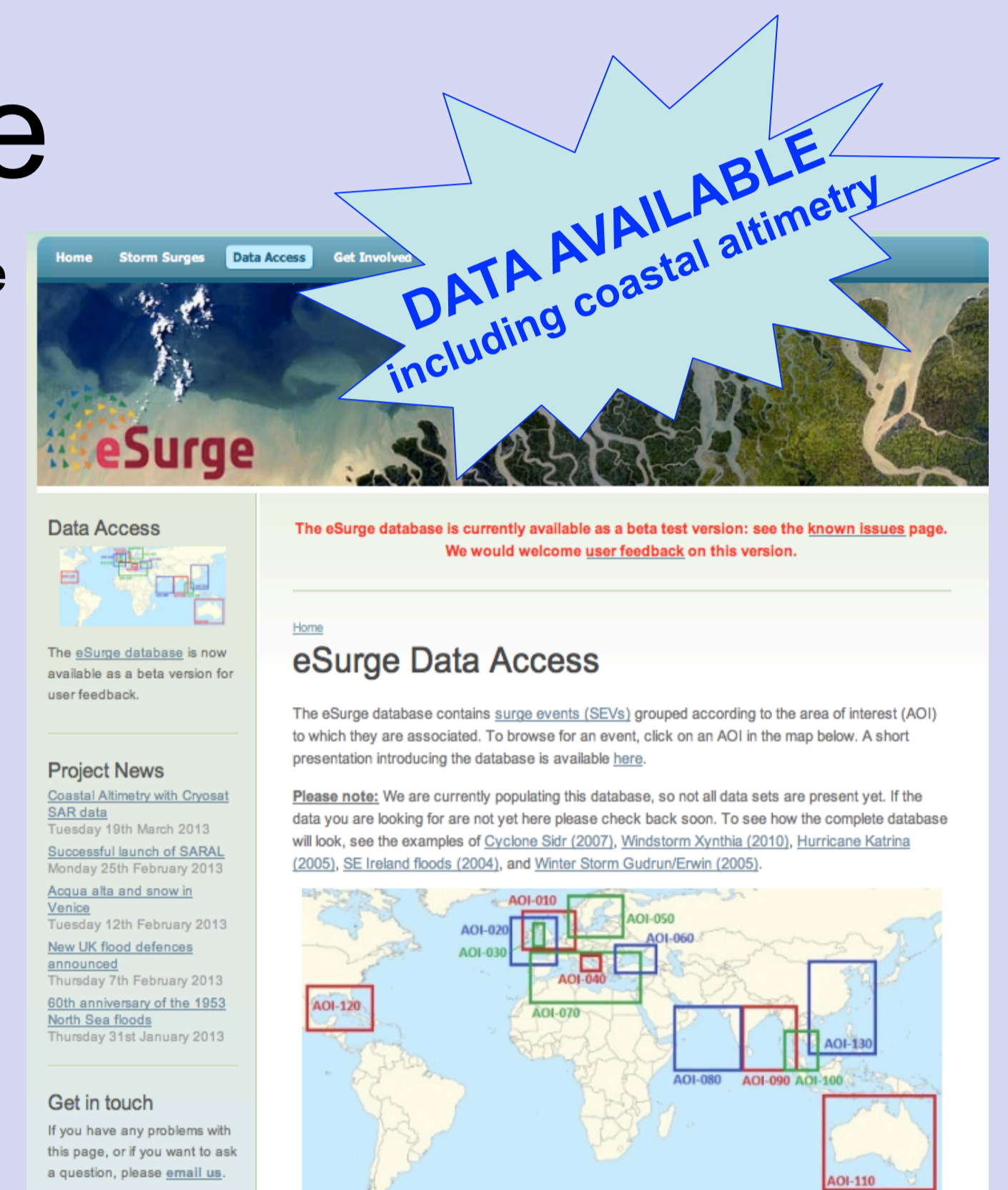
The eSurge Database

The eSurge Database contains a wide range of satellite and other data for more than 100 storm surge events across a range of areas of interest.

This includes coastal altimetry, scatterometry, waves, tide gauge measurements, and many more, as well as tools for visualisation and data manipulation.

All data are freely available and can be accessed at www.storm-surge.info/data-access.

We are currently expanding the number of surge events in the database, so please contact us if there are any additional events that you would like to see data for.

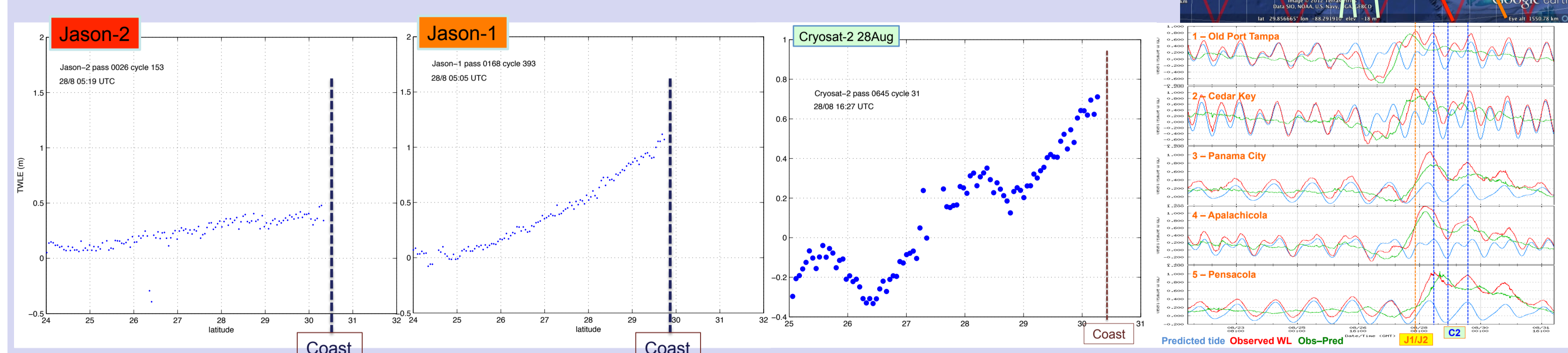


Coastal altimetry within eSurge

In recent years there has been a strong focus on retrieving altimetry measurements in the coastal zone, previously considered unusable: see for example www.coastalt.eu

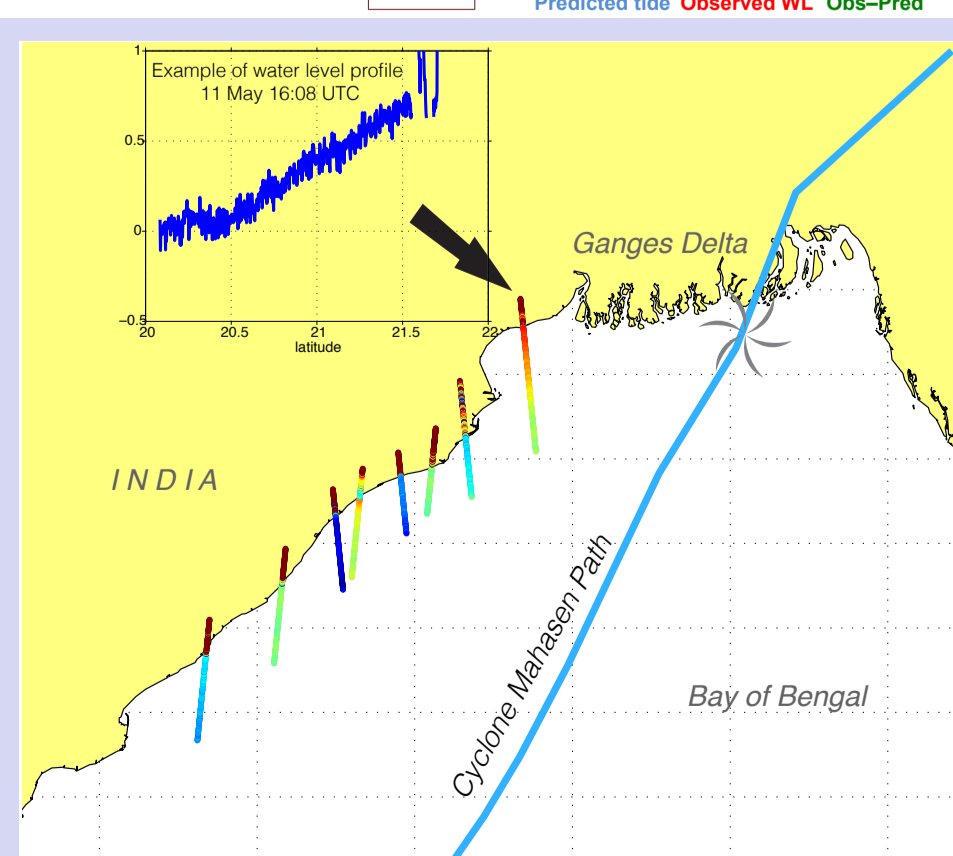
Coastal altimetry provides a direct measurement of the total water level, and so is an ideal tool for looking at storm surges. eSurge is demonstrating the practical application of coastal altimetry techniques to a real life application, using a dedicated processor implementing the ALES retracker (see talk and OSTST poster by Passaro et al.)

Example 1: TWLE measurements by Jason-1 Jason-2 and Cryosat during Hurricane Isaac (Gulf of Mexico, August 2012).



Example 2: the first example of NRT coastal altimetry from Cryosat SAR, for Cyclone Mahasen in the bay of Bengal during May 2013.

Unfortunately the Cryosat SAR tracks did not give a direct overpass of the cyclone, but even so such data can be useful for validating surge models.

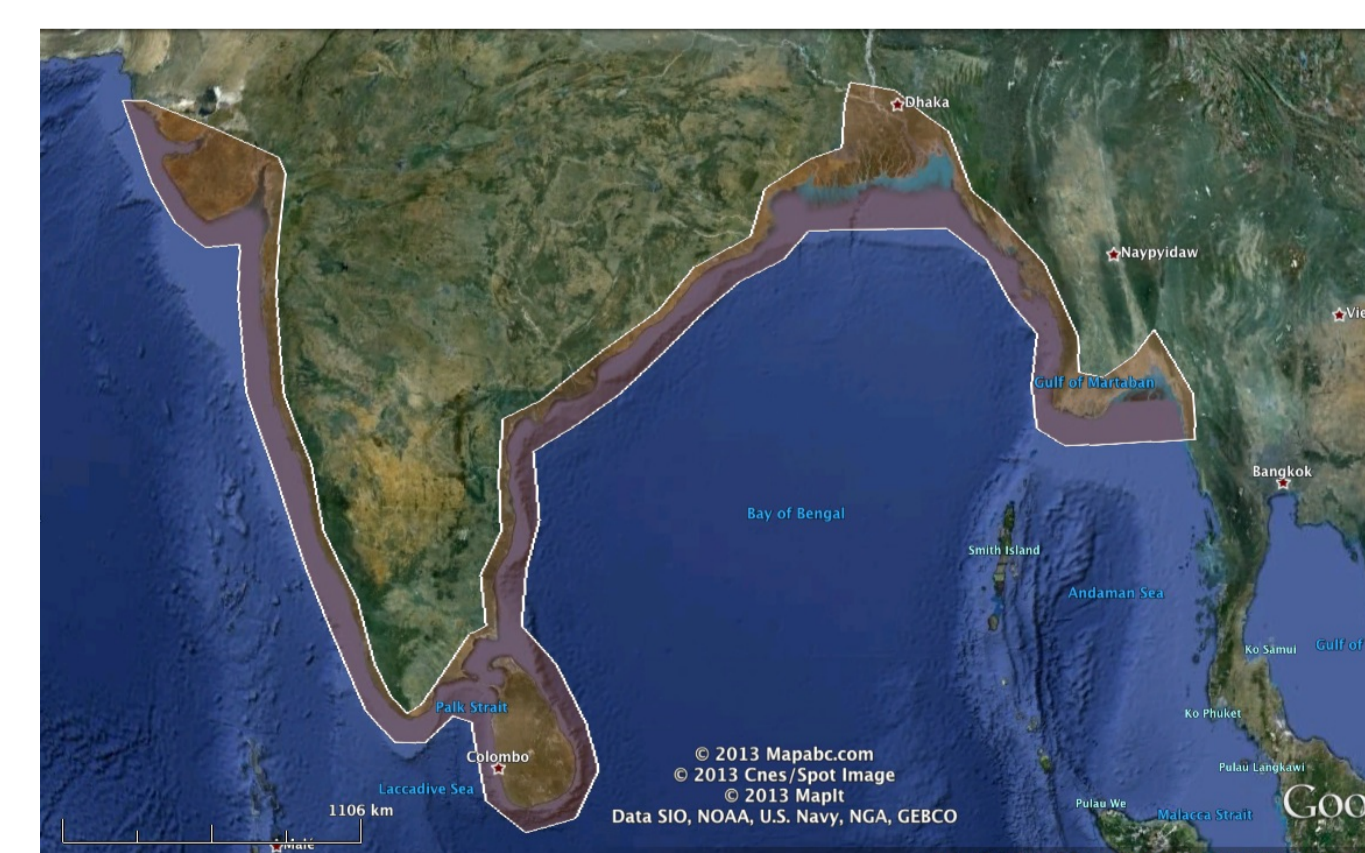


The **eSurge Live** service provides available data when a storm surge is predicted, to demonstrate the feasibility of using such data in future operational storm surge forecasting services. This demonstration service mainly operates in the European coasts and North Indian Ocean.

A particularly challenging aspect is to provide **coastal altimetry data in NRT**, and spatial and temporal sampling are an obvious issue (a constellation of altimeters would reduce this problem). Nevertheless, we expect coastal altimetry to have a number of NRT uses:

- verification of model runs
- pruning of model ensembles, i.e. identifying unrealistic ensemble members that can be discarded

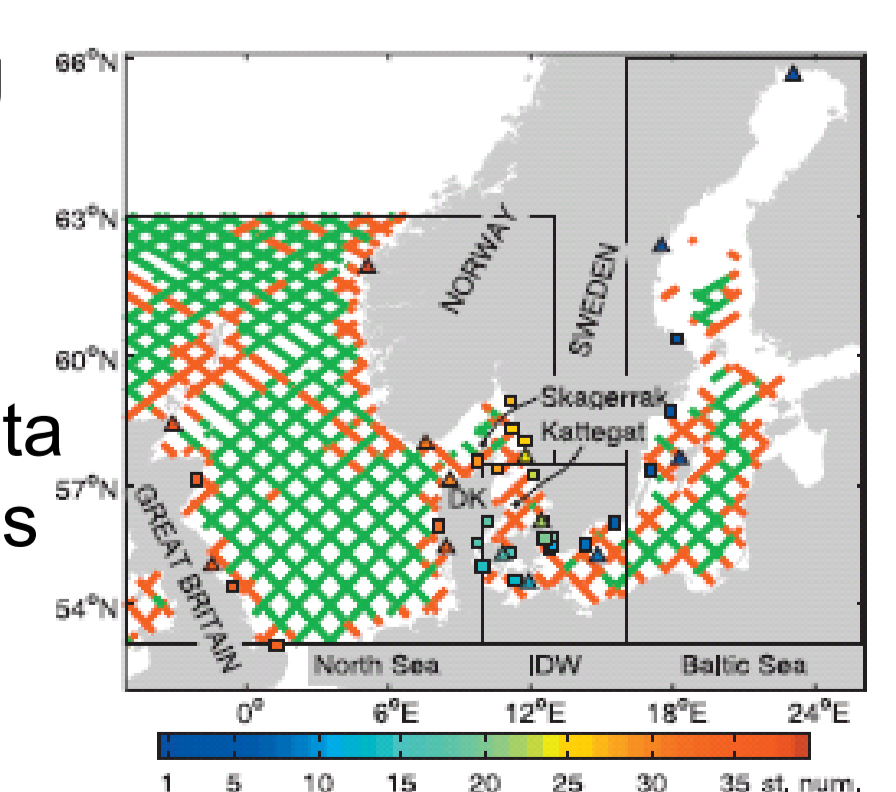
There may be circumstances where even a relative height profile is useful, such as for determining seiche phases in the Adriatic sea.



In the latest Cryosat mode mask (3.4) includes a SAR mode area around the Indian ocean coastline to provide SAR altimeter data to eSurge. Data for the first few live events (including cyclone Mahasen, see Example 2) are available online.

The project will perform a series of hindcasting experiments to see how best to assimilate the data into existing storm surge models, and quantify the improvements. Coastal altimetry measurements are blended with tide gauge data for assimilation in ocean hydro-dynamic models and for real time processing, using a method already demonstrated by DMI for non-coastal altimetry.

The blended data are most naturally used for assimilation into models, hindcasts and forecasts – see poster by Madsen et al.



For more information, to access data and to contact us, visit the project website at

www.storm-surge.info