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Cyclone Xaver seen by SARAL/AltiKa

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During the first week of December 2013, Cyclone Xaver pounded the coasts and the North Sea. On 6 December, all along the Wadden Sea, the barrier islands along the north of the Netherlands and the northwest of Germany experienced record storm surges.

We show a comparison of the storm surge measured by the radar altimeter AltiKa on-board the SARAL satellite and various types of in-situ data and models.

Two tide gauges along the German North Sea coast, one in the southern harbour of the island of Helgoland and one on an offshore lighthouse Alte Weser, confirmed that the storm drove sea level to about three meters above the normal tide level. Loading effects during the storm are also detected by the GPS measurements at several tide gauge stations. The altimeter in the mean time shows that the storm surge was noticeable as far as 400 km from the coast.

The altimeter measured wind speeds of 20 m/s nearly monotonically throughout the North Sea. An offshore anemometer near the island of Borkum corroborated this value. A buoy near the FINO1 offshore platform measured wave heights of 8 m, matching quite well the measurements from the altimeter, ranging from 6 m near the German coast to 12 m further out into the North Sea.

Furthermore we compare the altimeter-derived and in-situ sea level, wave height and wind speed products with outputs from the Operation Circulation and Forecast model of the Bundesamt für Seeschifffahrt und Hydrographie (BSH) and with a global storm surge forecast and inundation model of the Joint Research Centre (JRC) of the European Commission.

The Operational circulation model of BSH (BSHcmod) and its component, the surge model (BSHsmod), perform daily predictions for the next 72 hours based on the meteorological model of the Deutsche Wetterdienst (DWD).

The JRC Storm Surge Calculation System is a new development that has been established at the JRC in the framework of the Global Disasters Alerts and Coordination System (GDACS). The system uses meteorological forecasts produced by the European Centre for Medium-Range Weather Forecasts (ECMWF) to estimate (with a 2-day lead time) potential storm surges due to cyclone or general storm events.

Departure between model and altimeter-derived values, in particularly wind, are investigated and discussed. The qualitative agreement is satisfactory; the maximum storm surge peak is correctly estimated by BSH but underestimated by JRC due to insufficient wind forcing. The wind speed of SARAL/AltiKa agrees well with the ECMWF model wind speed but is lower than the DWD model estimate.

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