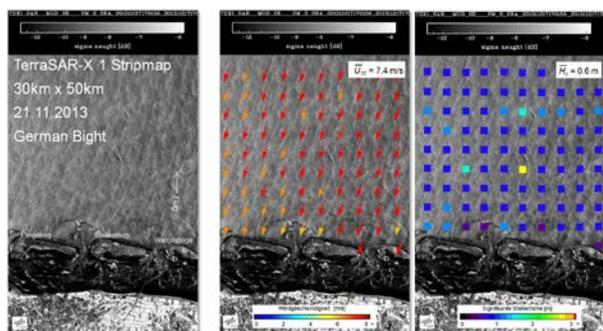


Satellite-based applications for maritime safety and security

Satellite observations for maritime applications provide a powerful tool to monitor both environment and security and safety concerns. Security comprises a broad set of policy concerns, e.g. border surveillance and piracy. Safety topics are traffic safety, environmental protection, fisheries control and Search and Rescue. High-resolution Synthetic Aperture Radar (SAR) such as the German TerraSAR-X satellite or the ESA's Sentinel-1, offer the advantage to observe events in remote regions covering large areas as well at night and in almost all weather conditions. SAR image allow maritime users to estimate a large spectrum of parameters and features.

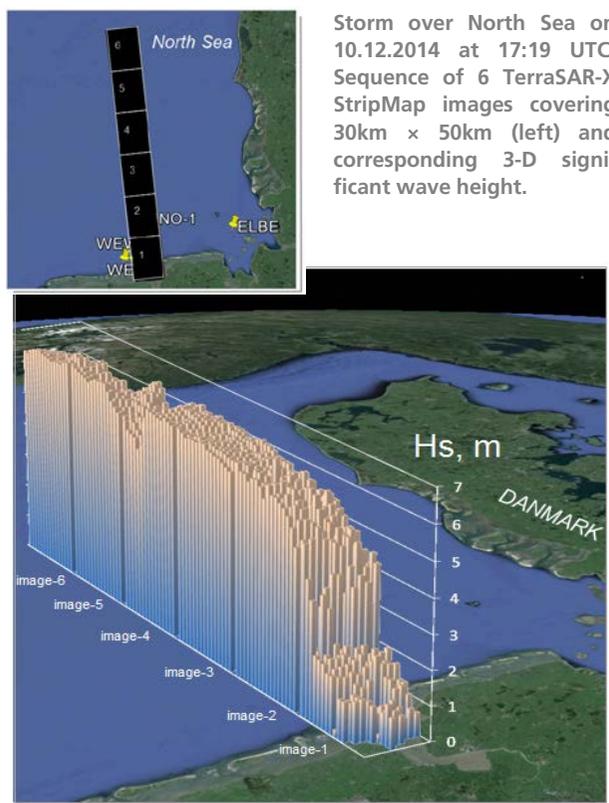


Example of a TerraSAR-X Stripmap image taken over in German Bight (on the left), estimated wind field (middle) and significant wave height (right)

The validation of sea state and surface wind fields using remote sensing data improve forecast services and help to explain natural phenomena such as storm front propagation, wind gusts and emergence of wave group with extreme wave height. The improved accuracy of marine and meteorological parameters help to reduce the frequency and severity of shipping accidents.

Meteo-marine parameters

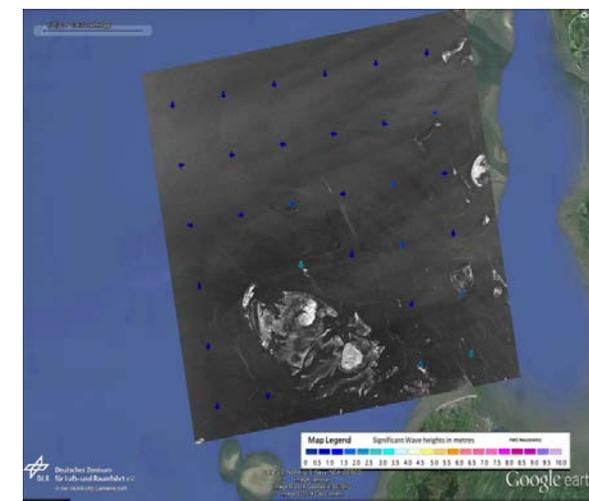
Meteo-marine parameters observed by high-resolution radar satellite images. Wind fields and sea state: Synthetic aperture radar can provide wind information over the ocean by measuring sea surface roughness and the corresponding sea state parameters can be estimated from the same image. Recent development of meteo-marine parameter assessment with X-band SAR Images allows obtaining wind and sea-state information over large areas at high resolution and thus represents a valuable complement to in-situ measurements and model results.



Near real time sea state processor

The Sea State Processor (SSP) was developed for automated NRT services. A core of SSP is an empirical algorithm XWAVE for obtaining integrated sea state parameters. XWAVE has been developed for X-band data and based on analysis sub-scenes and uses parameters fitted with collocated buoy point-measurements and spatial data from forecast wave models.

SSP is installed at the Ground Station Neustrelitz to provide an operational service and is currently being tested. The delivery of NRT products from Neustrelitz to the user (e.g. German Weather Services DWD) occurs by E-mail. The attachment includes a text file (.txt) with the data (lon, lat, wave height Hs), the Google Earth file (.kmz) for an illustration of an image file (.jpg).

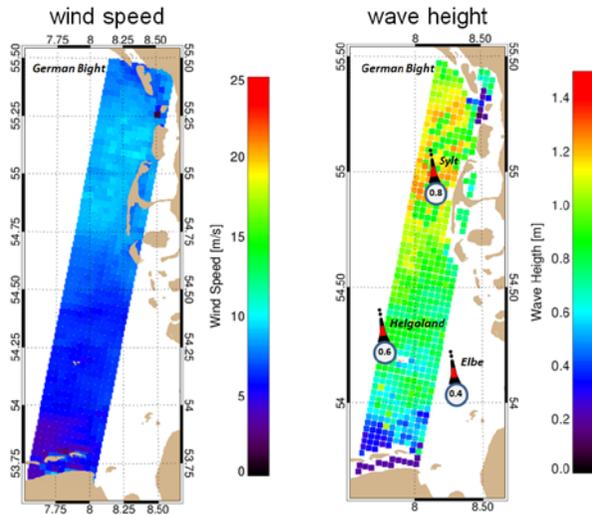


Example of an NRT delivery product of sea state (significant wave height)

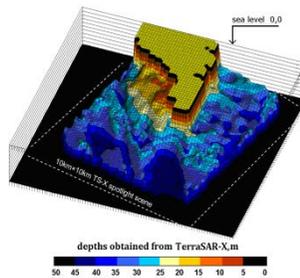
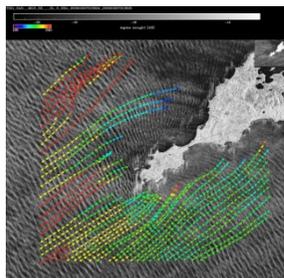
Maritime security applications

High-resolution satellite synthetic aperture radar (SAR) give a large benefit to serve maritime users' demands on a wide array of processes. Typical applications are:

- Monitoring of ship traffic and secure navigation
- Disaster monitoring, oil spill detection
- Information on sea ice conditions and trends
- Estimation of ocean wave parameters and wind fields
- Estimation of underwater topography



Wind and sea state form sequences of 4 TS-X StripMap images on 07.04.2015 at 05:50 UTC with buoy measurements (German Bight)



Application: Sea state analysis to derive underwater topography from detected wavelength

DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 7700 employees at 16 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Goettingen, Hamburg, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.



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Sea State Retrieval using TerraSAR-X Data

DLR Maritime Security Lab Bremen

