German Aerospace Center

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TerraSAR-X Image of the Month: The Wadden Sea in North Frisia

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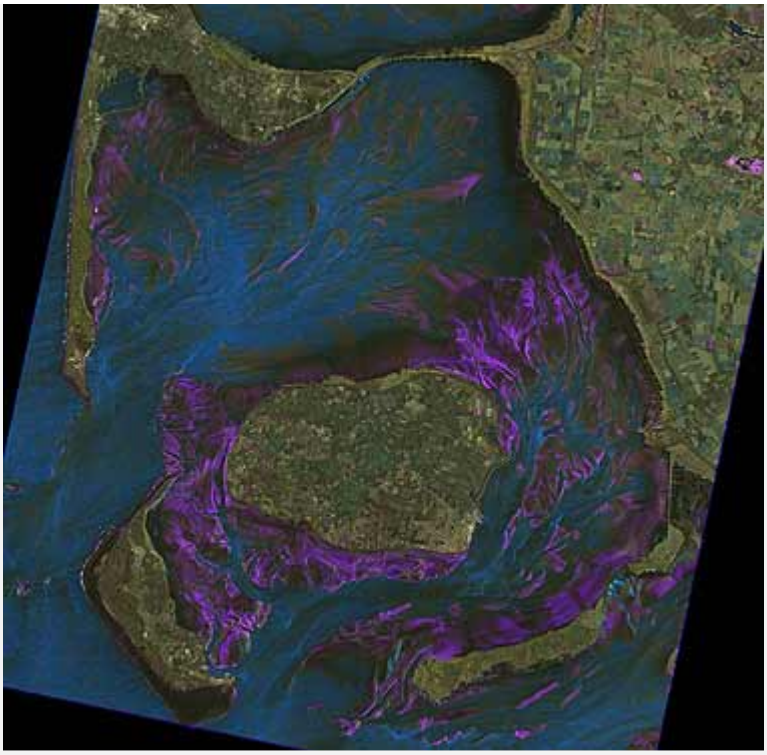

Mudflats near the island of Sylt

The image shows the mudflats near the island of Sylt. It was compiled from two satellite images that were taken by the German radar satellite TerraSAR-X in April and May 2008. The individual pictures are coloured red and green respectively. The difference in the reflected radar signals is especially large over the areas of water, as it is here that there were the most changes between when the first picture was taken in April and the second in May. The blue coloured strip has been used to highlight this. The resulting image can be used to extensively study the morphology, sediments and habitats in the Wadden Sea. Structures such as tidal creek courses (recognisable in the blue area) and mussel beds (light areas near the coast) are clearly shown.

Smooth mudflat surfaces, in this case the intertidal estuarine mudflats, reflect the incident radar beam that comes from the satellite and thus appear dark. Rough surfaces, for example areas that are covered with mussels, appear light in the image. Images such as this are especially interesting to mussel fishermen because, much to their chagrin, the shellfish migrate and do not always inhabit the tidal flats that are so suited to harvesting blue mussels. The satellite images can be used to map the current dimensions of the mussel beds. Small tidal creeks can also be easily detected. The locations of these creeks are difficult to predict as they are in constant flux.

An uncertain future for the Wadden Sea

In addition to the biomass, the distribution and the size of the habitats in the mudflats are important indicators of the condition of the Wadden Sea and also of changes in the ecosystem. The sheer size of the Wadden Sea (around 7 000 square kilometres) makes it necessary to employ remote sensing

techniques. Against the background of a rise in sea level and the expected climatic changes, the future of the Wadden Sea is uncertain. If there is a moderate rise in sea level and sufficient deposit of sediment, the mudflats and salt meadows can be expected to rise as well. If the rise is more pronounced, but still definitely within the range forecast by the Intergovernmental Panel on Climate Change (IPCC), erosion will probably lead to a decrease in the area of the tidal flats in the long-term and the Wadden Sea will become more and more like a lagoon, with all of the associated consequences for habitats, functions and species.

These developments will play out on a large scale, with the tidal pools being the smallest unit. In order to be able to identify these trends at an early stage, it is necessary to regularly record the change in the surface, the water levels and the sediments and habitats on a large-scale. New developments in the area of satellite technology, and in particular new high-resolution radar techniques, are making significant contributions to regular and large-scale mapping.

The special suitability of TerraSAR-X data to mapping the mudflats is, on the one hand, due to the general fact that radar sensors (wavelengths in the centimetre range) are very sensitive to surface roughness and structure. On the other hand, TerraSAR-X is particularly suitable due to its high degree of spatial resolution (one metre per pixel), which also enables small-scale mapping. Added to that is the well-timed repetition rate of TerraSAR-X radar images, which are taken regardless of the time of day.

The TerraSAR-X mission

TerraSAR-X is the first German satellite that has been manufactured under what is known as a Public-Private Partnership (PPP) between the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and Astrium GmbH in Friedrichshafen. The satellite travels around the Earth in a polar orbit and records unique, high-quality X-band radar data about the entire planet using its active antenna. TerraSAR-X works regardless of weather conditions, cloud cover or absence of daylight, and is able to provide radar data with a resolution of down to one metre.

DLR is responsible for using TerraSAR-X data for scientific purposes. It is also responsible for planning and implementing the mission as well as controlling the satellite. Astrium built the satellite and shares the costs of developing and using it. Infoterra GmbH, a subsidiary company founded specifically for this purpose by Astrium, is responsible for marketing the data commercially.

Contact

Elke Heinemann
German Aerospace Center (DLR)
Corporate Communications, Online Communication - DLR Web Portal
Tel: +49 2203 601-2867
Fax: +49 2203 601-3249
E-Mail: elke.heinemann@dlr.de

Dr.rer.nat. Susanne Lehner
German Aerospace Center (DLR)
Remote Sensing Technology Institute, Photogrammetry and Image Analysis
Tel: +49 8153 28-1507
Fax: +49 8153 28-1077
E-Mail: Susanne.Lehner@dlr.de

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