TerraSAR-X image of the month – the coastal cliffs of Christmas Island

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Captain William Mynors was not particularly creative as he sailed past a remote island in the Indian Ocean on the 'Royal Mary', a ship belonging to the British East India Company, on 25 December 1643. He named the 135-square-kilometre island, which he could not even disembark on, 'Christmas Island'. In the image acquired with the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) TerraSAR-X radar satellite, one thing is clear – even today, tropical rainforest proliferates on the island and the coastal cliffs continue to make life difficult for mariners.

The island is surrounded by some 80 kilometres of cliffs. The choppy waters of the surf on the south coast are not easy to image clearly for the radar on TerraSAR-X – the waves reflect the radar signals back to the satellite very irregularly. It looks different in the bay between the only harbour on the island, Flying Fish Cove in the northeast, and West White Beach in the northwest: "When the image was acquired on 26 November 2012, the water there was apparently calm," explains mission manager Stefan Buckreuss from the DLR Microwaves and Radar Institute. "The smooth surface reflects the signals away from the satellite, so it appears as a dark surface."

Radar view of manmade structures

The fact that the small villages on the island are detectable even from space, at an altitude of over 500 kilometres, is down to the numerous right angles and corners on the buildings. The radar signals from TerraSAR-X encounter the walls, are partly reflected onto the street, and only travel back towards the satellite's receiving antenna after being deflected a number of times. A retroreflector, such as the reflector on a bicycle, works in a similar way, consisting of numerous mirrors arranged at right angles to one another so that a large part of the incident light is always reflected back towards the source, almost independent of its position. When analysing radar images, DLR scientists can use this to determine where TerraSAR-X has imaged manmade structures, as the existence of right angles is primarily a characteristic of artificial objects. In the image of Christmas Island, the small communities appear magenta.

Anyone wanting to celebrate Christmas 350 kilometres south of Java and over 2600 kilometres northwest of Perth will have little company. Of the 1400 inhabitants, the majority are Buddhists, then Islamists and finally Christians. The island, which belongs to Australia, has principally been of interest in the past for its phosphate deposits – hence, its ownership has shifted from Britain to Japan, then back to Britain and finally to Australia. The inhabitants today include Chinese, Australians, Europeans and Malays.

Crab migrations in the impenetrable forest

However, the most unusual inhabitants live in a place where the radar signals from the TerraSAR-X satellite are largely absorbed – in the thick tropical rainforest, which has been protected since 1980 as the Christmas Island National Park. Since early December 2012, the start of the rainy season, millions of red Christmas Island crabs have been on a journey to the shore in order to breed there. In doing so, they abandon their habitat in the forest and travel miles to the water. However, the thickly forested island remains largely impenetrable to TerraSAR-X. "The forest canopy reflects radar signals in only very limited amounts," explains Buckreuss. Only routes through the forest that people have created are apparent from space, appearing as just indentations. It is easier to reach Christmas Island nowadays than it was for

Captain Mynors – there is a small airport in the northeast of the island, with flights from Kuala Lumpur and Perth.

The TerraSAR-X mission

TerraSAR-X is the first German satellite manufactured under what is known as a Public-Private Partnership 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 the absence of daylight and is able to provide radar data with a resolution 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.

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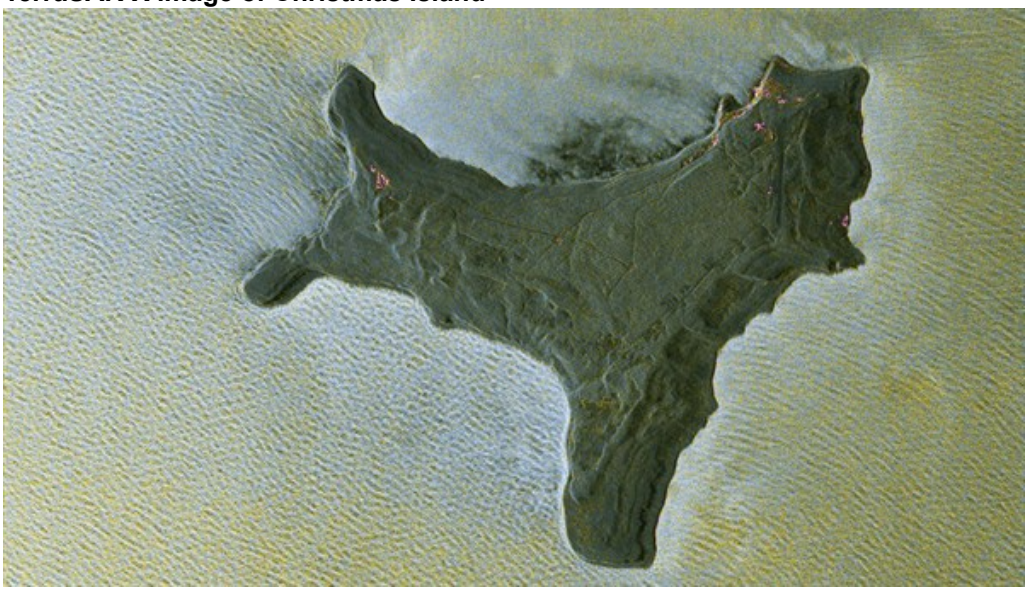
TerraSAR-X image of Christmas Island



Christmas Island is a 135-square-kilometre island in the Indian Ocean. In the image acquired with the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) TerraSAR-X radar satellite, one thing is clear – even today, tropical rainforest proliferates on the island and the coastal cliffs continue to make life difficult for mariners.

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