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## TerraSAR-X image of the month – Kiritimati atoll

*16 December 2013*

Kiritimati atoll is a unique place – here, major European cities or entire countries become tiny hamlets, and where you might find that Paris is abandoned, 235 people live in Poland and London has about 1829 inhabitants. This remote Pacific island, where the seafarer James Cook and his crew celebrated Christmas back in 1777, is quite literally in deep waters. It has a land area of 321 square kilometres, and a lagoon roughly 324 square kilometres. If current forecasts prove accurate, climate change and the consequent rise in sea levels in the Pacific could mean the disappearance of the island state of Kiribati and the island of Kiritimati by around 2070. Viewed through the 'eyes' of the German Aerospace Center's (Deutsches Zentrum für Luft- und Raumfahrt; DLR) TerraSAR-X radar satellite, orbiting at an altitude of over 500 kilometres, the atoll looks like a porous, fragile structure.

When James Cook anchored there in 1777 and named the atoll 'Christmas Island', it was still uninhabited. Today, about 5100 people live on Kiritimati – out of a population of roughly 102,000 in the entire island state of Kiribati with its more than 30 atolls and archipelagos. If one takes its expanse as the basis of calculation, the Republic of Kiribati is among the largest countries in terms of the area it occupies. However, its actual land area of just 811 square kilometres places it firmly in the group of microstates.

### **A view from space**

The radar satellite TerraSAR-X is particularly capable of imaging this type of location from space: "The areas located above water are particularly good at reflecting the radar signals back to the satellite," explains Stefan Buckreiß, Mission Manager at the DLR Microwaves and Radar Institute. In the radar images shown here – acquired on 30 November 2013 – these areas are discernible as a light-coloured frame stretching round the lagoon of St Stanislas Bay on the Kiritimati atoll. The differing green and yellow colours indicate differences in the roughness of the land surface. "The areas in yellow are particularly rough – so they could be rock formations, trees or even man-made structures."

In contrast, the calm waters of the lagoon are visible in dark green – a sign that the ocean is particularly smooth, as the signals are mainly reflected away from the satellite with only weak returns being received. Such surfaces appear dark in radar images; however, the slightly smudged lines along the coast clearly show that the Pacific is anything but quiet around the outer reaches of the atoll. The motion of the spray flying through the air as the breakers pound the coast prevents TerraSAR-X from imaging this area.

### **Seafarers, fish and satellite missions**

Besides selling fishing rights, the Germans, who set up a seafaring college in the capital city of South Tarawa back in 1967, represent the island state of Kiribati's primary source of foreign exchange. German shipping corporations provide the teachers and also run an agency for Kiribati sailors. More than 1000 islanders currently work on German merchant ships and remit part of their wages back home. Apart from copra – dried coconut kernels – Kiribati exports fish, shark fins and seaweed, but its location close to the equator also makes it interesting for space missions. The Sea Launch service launches satellites for customers such as Eutelsat and Intelsat from the region around Christmas Island – from a converted ocean drilling rig.

The inhabitants of Kiritimati are among the first each year to celebrate Christmas Day – the island state of Kiribati is closest to the International Date Line. The chain of islands, which

stretch over 5000 kilometres, introduced a diversion into the date line when it was adjusted on 1 January 1995 to ensure that the islands do not straddle it.

### **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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### **Atoll in the Pacific – Kiritimati**



The coral atoll of Kiritimati has a land area of 321 square kilometres, but also 324 square kilometres of lagoon surface. It is part of the island nation of Kiribati. In 1777, navigator James Cook and his crew celebrated Christmas here and named the island 'Christmas Island'. Viewed through the 'eyes' of the German Aerospace Center's (Deutsches Zentrum für Luft- und Raumfahrt; DLR) radar satellite TerraSAR-X at a height of over 500 kilometres, the atoll looks like a porous, fragile structure. North is to the left in the image.

Credit: DLR.

## A view from space



The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) radar satellite TerraSAR-X orbits more than 500 kilometres above the Earth, scanning its surface using radar. Shown here is the island of Kiritimati, part of the island nation of Kiribati.

Credit: DLR.

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