German Aerospace Center

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TerraSAR-X Image of the Month: The Drygalski Glacier in Antarctica

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Once a month, starting from March 2009, the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) will publish the 'TerraSAR-X Image of the Month'. The German TerraSAR-X radar satellite was launched in June 2007. DLR is responsible for using TerraSAR-X data for scientific purposes, for planning and implementing the mission, and for controlling the satellite.

The Drygalski Glacier – time-lapse video

The animation shows the Drygalski Glacier on the Antarctic Peninsula. This time-lapse video shows how the glacier is pushed out into the area formerly occupied by the Larsen A Ice Sheet at a speed of up to two kilometres per year. Thirty images recorded by the German TerraSAR-X radar satellite between October 2007 and October 2008 were combined to create this video sequence.

Melting ice shelves and surging glaciers

The Drygalski Glacier is the largest outlet glacier in the area around the former Larsen A Ice Shelf. It carries ice from the Antarctic Peninsula out towards the sea. In the past, Drygalski thus provided a substantial part of the ice inflow into the Larsen A Ice Shelf, but now is calving directly into the sea. Since the Larsen A Ice Shelf disintegrated in January 1995, the speed at which the glacier ice flows out towards the coast and into the sea has increased from one to about six metres per day. The ice shelf – a large ice sheet floating on the sea and forming an extension of the glacier, which itself rests on solid ground – can therefore be said to act as a natural barrier. Without the stabilising presence of the ice shelf, the glacial outflow speed increases.

The Larsen Ice Shelf extends along the east coast of the Antarctic Peninsula. It is divided into three distinct shelves (Larsen A, B and C). Larsen A, which used to be about 200 metres thick, disintegrated in January 1995, followed by Larsen B in 2002. Larsen C is still present. Ice shelves typically become smaller as their underside melts and icebergs break off into the sea, a process known as calving. Around the Antarctic Peninsula, ice melting from the top of the ice shelves also plays a role. The breakup of the Larsen Ice Shelf is linked to the fact that this region is warming up particularly quickly. The rising temperatures lead to increased melting at the upper surface of the ice shelf and weakening of the ice. A regional temperature rise of 2.5 degrees Celsius has been observed over the past five decades.

New insights into the stability of polar ice

Floating ice shelves do not contribute directly to rising sea levels, but increased ice discharge by outlet glaciers does. The glaciers flowing down to Larsen A and B are of limited relevance for the sea level, as their total mass, spread over the total ocean area of the world, is rather small and only amounts to a rise in the sea level of about two centimetres. Studies into the dynamics of outlet glaciers are nonetheless important, as they enable us to estimate the possible effects of a retreat of the large West Antarctic ice shelves (the Filchner-Ronne Ice Shelf and the Ross Ice Shelf) as a consequence of continued global warming. If the ice of West Antarctica were to melt away, this would cause sea levels to rise by six metres. Research into the Drygalski Glacier and the other outlet glaciers flowing down to the Larsen Ice Shelf indicates that the ice reacts more strongly to climate change than previously thought.

The Drygalski Glacier was named after Erich von Drygalski (1865-1949). Drygalski was a German geographer and geophysicist who specialised in the theory of glaciers and ice shields. From 1901 to 1903, he led the first German South Polar expedition, exploring new territory in Eastern Antarctica.

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.

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