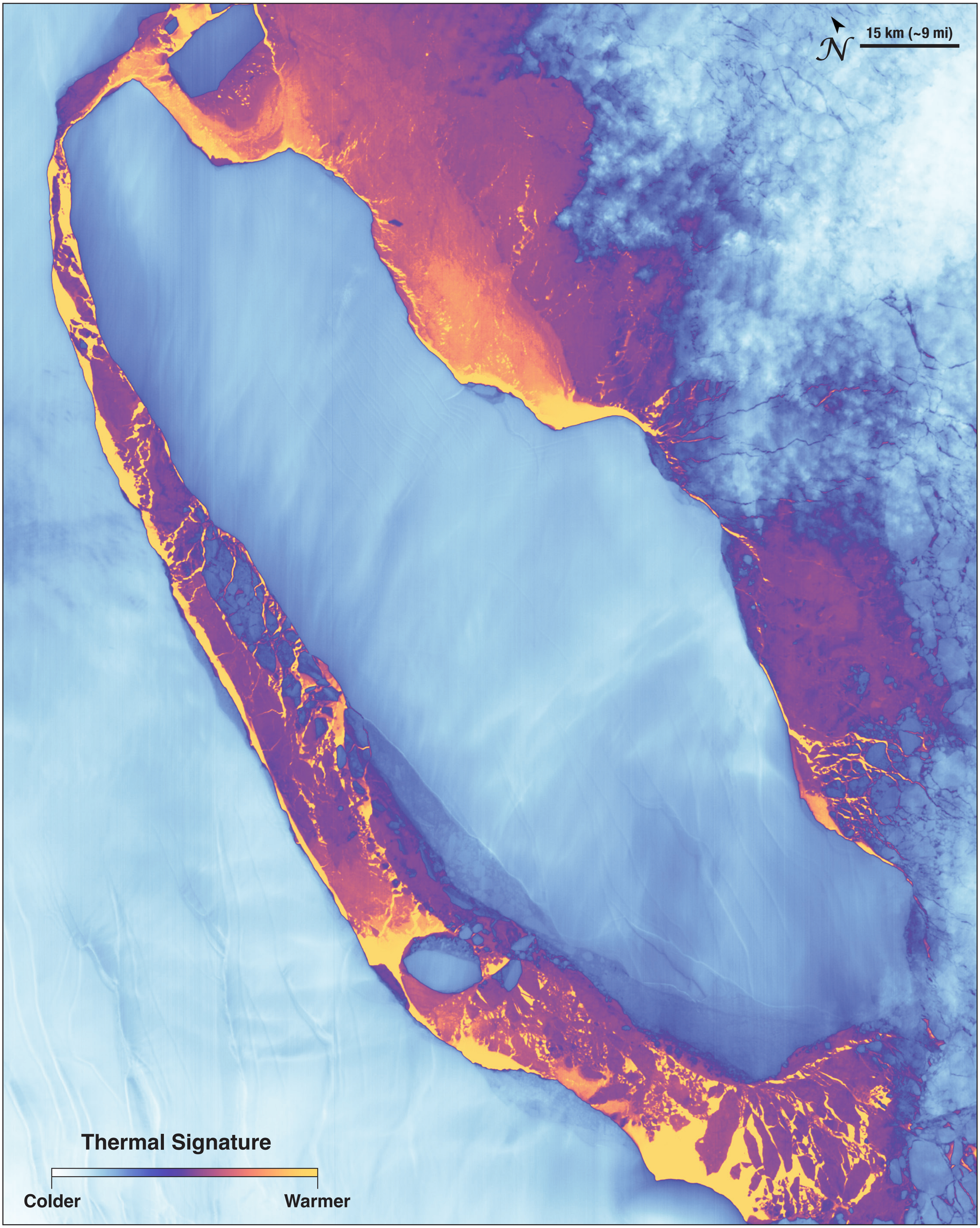
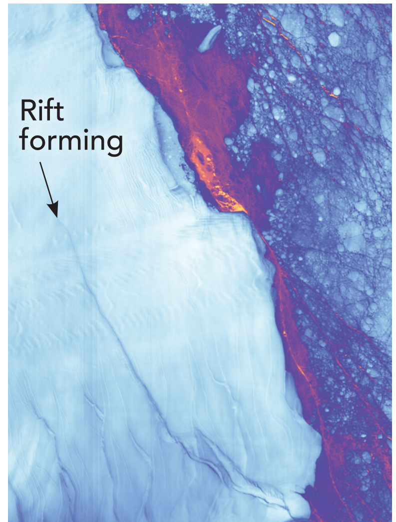
Seeing in the Dark: Calving at Larsen C Ice Shelf

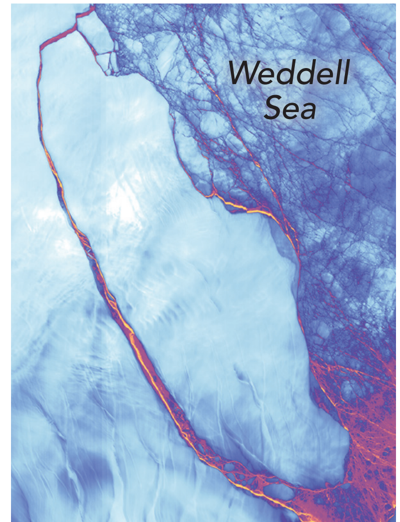


Landsat Tracks Calving of Iceberg A-68

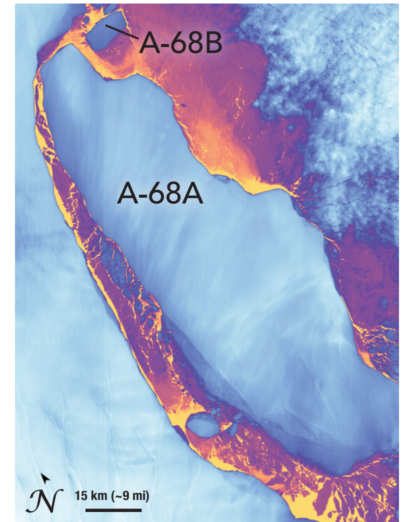
Evolving over many years, a massive rift in Antarctica's Larsen C ice shelf created Iceberg A-68 with an area larger than the State of Delaware. Observed by Landsat 8's visible and thermal bands, the crack could be seen gradually extending at first and then more rapidly in 2016 and early 2017. Due to the onset of Antarctica's winter darkness, visible sensors could no longer track the position of the rift as it grew closer to the Larsen C's northern ice front. Landsat 8's Thermal Infrared Sensor (TIRS) could 'see' by capturing the thermal energy emitted by the cold ice shelf and the relatively warmer water and mélange in the narrow rift and the surrounding water of the Weddell Sea. By July 12, 2017, both Landsat 8 TIRS thermal and Sentinel-1 radar imagery confirmed the calving of the ~5800 km^2 iceberg. Landsat continued to track this huge iceberg as a piece of A-68 broke off to form the main iceberg, A-68A, and a smaller piece, A-68B.



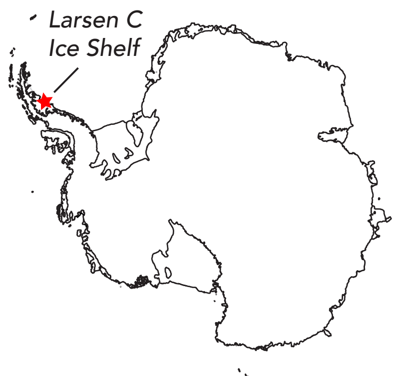
July 11, 2016



July 30, 2017



Sept. 16, 2017



Cryospheric scientists had been tracking a crack spreading across the Larsen C's floating ice since 2011 using Landsat and other imagery. In July 2016, data from Landsat 8's TIRS showed the extent of the rift at that time. About one year later, despite the lack of sunlight in Antarctica, TIRS data captured the complete ~200 km (~125 mile) long rift between the new iceberg, now dubbed A-68, and the ice shelf about three weeks after the main calving event. About six weeks later, the main iceberg and a smaller piece that broke off soon after the main calving event, named A-68B, began moving further away from the ice shelf. Both slowly made their way out of the new embayment at the front of the Larsen C ice shelf and moved northward under the influence of the Weddell Sea currents, tides, and storms.

Using Landsat to Monitor the Antarctic

Since the first Landsat satellite was launched in 1972, the orbit of these satellites (covering ~83°N to ~83°S latitudes) and their evolving sensors have enabled the tracking of large iceberg calving events in considerable spatial and temporal detail. The two largest icebergs observed in the satellite era were B-15, which calved in March 2000 and was nearly the area of Connecticut; and A-20 which calved from the Larsen C Ice Shelf in early 1986 and was estimated to be about the area of Delaware and Rhode Island combined.

However, Antarctica experiences months of polar darkness when no sunlight reaches the vast majority of the continent. Instead of relying on reflected solar energy, the TIRS instrument on Landsat 8, like previous thermal bands since Landsat 4 in 1982, is able to capture imagery in the dark by measuring the differences in surface temperature. This allows Landsat to find rifts that form in ice shelves by 'seeing' the distinct thermal contrast between the cold ice shelf surface and the relatively warm ocean water that fills the rift. Even when the rift is filled with frozen seawater or mélange (a composite of sea ice, ice blocks that have fallen from the rift edges, and wind-blown snow), TIRS can observe a rift as it evolves despite the lack of sunlight.

When sunlight is available, Landsat 8's Operational Land Imager (OLI) can show additional details of Antarctica's icy coastline and interior. OLI's highest resolution channel, Band 8, can more clearly observe the narrow rifts in ice shelves. OLI's multi-spectral channels can reveal melt ponds on ice shelf surfaces in natural color band composites. Scientists have continued to use Landsat 8's visible and infrared images to observe the evolving Larsen Ice Shelf and other parts of Antarctica's margins to understand the evolution of these vast floating glacial ice masses.

About Landsat

Landsat satellites provide an unparalleled record of Earth's varying landscapes to help us understand how Earth is changing and what those changes mean for life on our planet. Landsat sensors make observations of Earth's land surface and surrounding coastal regions in wavelengths of light both visible and invisible to human eyes. The consistency of Landsat's data from sensor to sensor and year to year, makes it possible to trace changes of individual areas of land from 1972 to the present. As a joint initiative between the U.S. Geological Survey (USGS) and NASA, the Landsat Project and the data it collects support government, commercial, industrial, civilian, military, and educational communities throughout the United States and worldwide.

More Information

Earth Observatory article: https://earthobservatory.nasa.gov/images/91052/a-68-adrift
NASA Landsat Science: https://landsat.gsfc.nasa.gov/
USGS Landsat Science: https://www.usgs.gov/land-resources/nli/landsat