「だいち 2 号」と「しずく」による南極半島 Larsen-C 棚氷における大規模な氷山分離の観測

阿部隆博[1]、津滝俊[1]、大木真人[1]、田殿武雄[1]、堀雅裕[1]
[1] *宇宙航空研究開発機構 地球観測研究センター*

Large iceberg detachment from Larsen-C Ice Shelf in Antarctic Peninsula observed by ALOS-2 and GCOM-W

Takahiro Abe[1], Shun Tsutaki[1], Masato Ohki[1], Takeo Tadono[1], and Masahiro Hori[1]
[1]*Earth Observation Research Center, Japan Aerospace Exploration Agency*

The western Antarctic ice sheet has been significantly losing mass (Harig and Simons, 2015; Helm et al., 2014). The mass loss occurs mainly from ice shelves by submarine melting and iceberg calving, and affects the mass balance of the grounded ice sheet by influencing the inland ice flow (Hogg and Gudmundsson, 2017). Therefore, monitoring of ice shelves is crucial to assess the ice loss of Antarctica.

Over the last five decades, ice shelves in Antarctic Peninsula have either retreated or almost entirely lost (Cook and Vaughan, 2010). Larsen Ice Shelf is in eastern coast of Antarctic Peninsula and divided into four portions of Larsen-A, -B, -C and -D. Larsen-A and -B has already collapsed in 1995 and 2002, respectively. Larsen-C Ice Shelf has been thinning with a rate of 3.8 m yr^{-1} for the past 18 years (Paolo et al., 2015), and the future stability was discussed by numerical experiments (Kulessa et al., 2014).

On July 12, 2017, a huge iceberg was released from Larsen-C Ice Shelf. A British project team MIDAS reported that the iceberg is the expected weight of approx. one trillion ton, and the surface area is about 5,800 km^2. Due to its size, ALOS-2 ScanSAR mode (observation swath: 350 km, resolution: 100 m) is suitable for capturing the entire portion of the iceberg. Thus, we observe this event with ALOS-2/PALSAR-2 and GCOM-W/AMSR-2 to reveal the whole picture of the event.

PALSAR-2 ScanSAR mode image on July 21, 2017 captured the entire portion of the iceberg, which was completely detached from Larsen-C Ice Shelf. The length and width of the iceberg are about 155 km and 50 km, respectively. The image on August 4 showed that the iceberg moved toward the ice shelf, presumably pushed by sea ice. However, the image on September 1 showed that the iceberg separated again probably due to injection of sea ice into the gap between the iceberg and the ice shelf. We also examined daily behavior of the iceberg by AMSR-2 data (vertical polarization 89 GHz, resolution: 4 km). Although the spatial resolution is quite lower than that of PALSAR-2, AMSR-2 data is available everyday regardless of cloud cover condition and polar night season. Accordingly, we confirmed the iceberg detachment on July 12.

Moreover, ALOS and ALOS-2 ScanSAR mode images acquired from 2007 to 2017 revealed that the front position of the Larsen-C ice shelf had been stable for last 10 years before the calving event. However, cracks are observed near the new calving front of the ice shelf, implying a possibility of further iceberg detachment in the near future.

Satellite microwave sensors with large observation swath are very useful for monitoring hundred-kilometer-scale events in the Antarctic ice sheet in polar night season. The PALSAR-2 high-resolution and AMSR-2 high-frequent images enable us to better understand the dynamics of ice shelves and future drift of a huge iceberg. This can contribute to understand polar environmental changes. We are going to show the observations result by ALOS-2 and GCOM-W just before this conference, and discuss what is going on the ice shelf and the iceberg.

References

Cook A. J. and D. G. Vaughan, Overview of areal changes of the ice shelves on the Antarctic Peninsula over the past 50 years, The Cryosphere, 4(1), 77-98, 2010.

Harig, C. and F. J. Simons, Accelerated West Antarctic ice mass loss continues to outpace East Antarctic gains, Earth Planets. Sci. Lett., 415, 134-141, 2015.

Helm, V., A. Humbert and H. Miller, Elevation and elevation changes of Greenland and Antarctica derived from Cryosat-2, The Cryosphere, 8(4), 1539-1559, 2014.

Hogg, A. E. and G. H. Gudmundsson, Impacts of the Larsen-C Ice Shelf calving event, Nature Climate Change, 7, 540-542, 2017.

Kulessa, B., D. Jansen, A. J. Luckman, E. C. King and P. R. Sammonds, Marine ice regulates the future stability of a large Antarctic ice shelf, Nature Comm., 5, 3707, 2014.

Paolo, F. S., H. A. Fricker and L. Padman, Volume loss from Antarctic ice shelves is accelerating, Science, 348, 327-331, 2015.