Motion of David Glacier in East Antarctica Observed by COSMO-SkyMed Differential SAR Interferometry

Hyangsun Han and Hoonyol Lee
Dept. of Geophysics, Kangwon National University, Chuncheon, Kangwon 200-701, Republic of Korea
Tel: +82-33-250-8587
E-mail: hyangsun@kangwon.ac.kr

David glacier, located in Victoria Land, East Antarctica (75°20′S, 161°15′E), is an outlet glacier of 13 km width near the grounding line and 50 km long from the source to the grounding line. David glacier flows into Ross Sea forming Drygalski Ice Tongue, 100 km long and 23 km wide. In this study, we extracted a surface displacement map of David by applying differential SAR interferometry (DInSAR) to one-day tandem pairs obtained from COSMO-SkyMed satellites on April 28-29 (descending orbit) and May 5-6 (ascending orbit), 2011, respectively. Terra ASTER global digital elevation model (GDEM) is used to remove the topographic effect from the COSMO-SkyMed interferograms.

David glacier showed maximum displacement of 35 cm during April 28-29 and 20 cm during May 5-6 in the direction of radar line of sight. The glacier can be divided into several blocks by the disparities of displacement between the different sliding zone.

Surface displacement map contains errors originated from orbit data, atmospheric conditions, DEM error. GDEM is generated from the ASTER optical images acquired from 2000 to 2008. It has the vertical accuracy of about 20 m at 95% confidence with the 30 m of horizontal posting. The accuracy of GDEM reduces when cloud cover is included in the ASTER image. Particularly in the snow and ice area, GDEM is inaccurate due to whiteout effect during stereo matching. The inaccuracy of GDEM could be a reason of the observed glacier motion in the opposite direction of gravity. This problem can be solved by using TanDEM-X DEM. Bistatic acquisition of SAR images from the constellation of TerraSAR-X and TanDEM-X will generate a global DEM with the vertical accuracy better than 2 m and the horizontal posting of 12 m. We plan to perform DInSAR of COSMO-SkyMed one-day tandem pairs again when the high-accuracy TanDEM-X DEM is available in the near future.

As a conclusion, we could analyze the displacement of David glacier in East Antarctica. The glacier showed very fast motion forming a block of streamlines with different flow velocity. For more accurate analysis, we will use TanDEM-X DEM to perform the DInSAR. The flow characteristics, ice mass balance, ice discharge rate of David glacier remains as an ongoing research.