

Detection of both icecap and crustal deformation associated with the 2014-2015 Bárðarbunga rifting episode

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The 2014-2015 Bárðarbunga rifting episode is one of the largest event in Iceland. Previous studies have already reported that the earthquake swarm migrated from Bárðarbunga to Holhraun where the fissure eruptions occurred at northern edge of Vatnajökull icecap. There were few ground-based GPS observation points near the epicenters of the swarm. While the nearby crustal deformation associated with the episode have also been detected by using satellite InSAR-data, phase decorrelation problems have hampered detecting the icecap deformation during the rifting episode. Although the icecap has been known to flow steadily, one of our motivations is to see if the rifting episode affected the flow speed of ice in light of the well-known Jökulhlaups event by subglacial eruption. Moreover, phase-based InSAR measurement does not allow for the detailed measurement of the subsidence over the graben, which is indispensable to constrain the volume and geometry of intruded dike.

In this study, we processed COSMO-SkyMed images to simultaneously detect both the flow signals on the icecap and the crustal deformation associated with the rifting event. The offset tracking data derived from COSMO-SkyMed images showed the displacement signals that consist of both the crustal deformation over land and the icecap flow. Two displacement discontinuities were detected not only on the land but also on the icecap, while we could not capture the entire image of the both deformations due to the limited SAR image coverage. The 3D displacements revealed a graben structure with over 8 m subsidence at the graben floor. At the graben floor, approximately 1 m of the rift-parallel motion which caused by the dog-bone seismicity was detected. Using these observation results, we will estimate the dike intrusion model and discuss the possible interaction between the ice and the crustal deformation during the 2014-2015 Bárðarbunga rifting episode.

Keywords: Dike intrusion episode, Divergent plate boundary, Synthetic Aperture Radar, Iceland, Pixel offset technique