

Subglacial crustal deformation associated with the 2014-2015 Bardarbunga rifting episode inferred from SAR pixel tracking

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Iceland is located along a subglacial divergent plate boundary between North American and Eurasian plate. We can observe high geothermal activities and volcanic activities along the tectonic boundaries. Because some volcanoes in Iceland are covered with glaciers and/or ice, subglacial eruptions sometimes cause not only pyroclastic flow but also lahars or floods by meltwaters. Bardarbunga is also one of the subglacial active volcanoes beneath Vatnajökull icecap, the largest icecap in Europe. The 2014-2015 Bardarbunga rifting episode occurred on August 2014. Interferograms and pixel tracking data in previous studies revealed graben forming with 6 m of subsidence and 2m of WNW-ESE extending displacement at ice-free region (Sigmundsson et al., 2014, Nature; Ruch et al., 2016, Nat. Comm.). Measurement of airborne altimetry and DEM difference in previous studies revealed over 60 m of collapse at Bardarbunga caldera and icecap surface movement during the episode. However, subglacial crustal deformation due to the dike intrusion has not been identified so far because of decorrelation problem in interferograms. We aim to identify the subglacial crustal deformation associated with the dike intrusion using satellite synthetic aperture radar (SAR) pixel tracking data, and to improve dike opening model using these data. We applied pixel tracking approach to Cosmo-SkyMed, Terra-SAR and RADARSAT-2 data. Our pixel tracking results during the co-diking period indicate both steady-state of icecap surface motion and icecap deformation due to the subglacial crustal deformation. In order to isolate only the subglacial crustal deformation, we subtract the pre-diking signal multiplied by an arbitrary number from the co-diking signal. The arbitrary numbers were determined so that the signal at the edge of icecap is smooth. The inferred subglacial crustal deformation signal will contribute to improve our previous opening model.

Keywords: Satellite synthetic aperture radar, Divergent plate boundaries, Dike intrusion episode