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Crustal deformation associated with the 1996 Gjálp subglacial eruption, Iceland: InSAR studies in the affected areas adjacent to the Vatnajökull ice cap

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Deformation signals associated with the Gjálp eruption that took place under the Vatnajökull ice cap, Iceland, from September 30 to October 13, 1996 have been measured using interferometric analysis of Synthetic Aperture Radar images (InSAR). The eruption caused crustal deformation extending outside the border of the ice cap, in areas that remain coherent over years for InSAR. On September 29 intense seismic activity occurred on the northwestern part of Bárdarbunga, including a Mw=5.4 earthquake. On September 30 seismicity started migrating southwards and a N-S trending, 7 km long eruptive fissure opened midway between Bárdarbunga and Grímsvötn volcanoes. We analyzed a series of over 200 interferograms, from ERS track 281, 009 and 238. Good temporal resolution of the InSAR dataset allows for distinctions between discrete deformation events occurring during the course of the eruption. Co-eruptive interferograms, spanning only the first few days of eruption, show a consistent deformation signal of one fringe arranged in two different lobes over a small area on the western part of Bárdarbunga. The deformation pattern suggests a fault movement and correlates with intensive seismic activity recorded in the area on September 29. Co-eruptive interferograms, spanning the last week of eruption and the following nine months, show a subsidence signal of up to three fringes on the flank of the Bárdarbunga volcano at the NW border of Vatnajökull. This suggests significant subsidence at Bárdarbunga, but only after October 6 when most of the magma had erupted from Gjálp. Fault slip was triggered by the eruption in distant areas, as three deformation signals consistent with small fault movements are observed up to 50 km from the

eruptive site. Two of these signals correlate with earthquake swarms on October 13.