



Active deformation at Grímsvötn subglacial volcano: a composite evolution to be deciphered

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The sub-glacial Grímsvötn volcano, Iceland's currently most frequently erupting volcano, is located under Vatnajökull, the largest ice cap in Europe. This volcano has experienced 20 eruptions the last 200 years, with the most recent in 1998 and 2004. Since the 1998 eruption, annual campaign GPS measurements have been conducted at the only available nunatak, located on the south caldera rim. The recent eruption in Gímsvötn had its vent along the southern caldera rim fault about 3.5 km due west from the GPS benchmark, which makes it insensitive to the deformation to an east-west orientated dike and only sensitive to the shallow magma chamber

In addition to the magmatic processes the Grímsvötn station is affected by glacio-isostatic uplift due to thinning of the ice, and an annual cycle in land movements due to variable ice load. Glacial rebound due to present-day thinning of the Vatnajökull ice cap is inferred to cause relatively steady uplift of approximately 3 cm/yr at Grímsvötn, added to the uplift signal caused by increasing magma pressure. In the late 2004 a continuous GPS was installed near the campaign GPS at Grímsvötn, and was complemented by a tiltmeter. The GPS and tilt observation can give a better constrain on the location of the shallow magma chamber. The mid and long term deformation observed there can be attributed to magma inflow/outflow, but dominantly of uplift due to glacial thinning, and plate movements. Annual cycles due to winter snow loading also modulate the time series with a peak to peak amplitude of about 4 cm. The displacements measured now continuously at Grímsvötn have been compared to time series collected at other places around the ice cap, at 50-100 km distance. This enables us to evaluate the contribution of the different sources of the deformation at Grímsvötn, and to evaluate climate-induced thinning of the Vatnajökull ice cap, with GPS studies on and around Vatnajökull.