Geophysical Research Abstracts
Vol. 15, EGU2013-9995, 2013
EGU General Assembly 2013

Effects of present day deglaciation in Iceland on the mantle melt production rate

Peter Schmidt (1), Björn Lund (1), Christoph Hieronymus (1), John Maclennan (2), Thora Árnadóttir (3), and Carolina Pagli (4)

(1) Dept. of Earth Sciences, Uppsala University, Uppsala, Sweden (bjorn.lund@geo.uu.se), (2) Dept. of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, UK, (3) Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland, Sturlugata 7, IS-101 Reykjavik, Iceland, (4) School of Earth and Environment, University of Leeds, Leeds, UK

The ongoing deglaciation in Iceland not only causes uplift at the surface but also decompression of the mantle below, leading to increased magma production. Here we study glacially induced decompressional melting using 3D models of glacial isostatic adjustment in Iceland since 1890. We find that the mean glacially induced pressure rate of change in the mantle increases the melt production rate by 100-140%, or an additional 0.21-0.23 km^3 of magma per year across Iceland. The greatest volumetric increase is found directly beneath the largest ice cap Vatnajökull, co-located with the most productive Icelandic volcanoes, where approximately 20% of the melt associated with glacial unloading is generated. If, in addition, melts are being channeled from the flanks of the melting region towards the central rift, up to 50% of the additional magma might reach the base of the elastic lithosphere beneath or close to the Vatnajökull ice cap, equivalent to more than half of the magma volume extruded during the 2010 Eyjafjallajökull summit eruption per year. Our results are significantly larger than previous estimates which considered only the effect of deglaciation of Vatnajökull and mantle melting directly beneath. Although the ongoing deglaciation in Iceland significantly increases the melt production rate in the mantle, the increase in melt supply rate (MSR) at the base of the lithosphere is delayed. If the melt ascent velocity is lower than 1,000 m/yr, the additional MSR caused by the last 120 years of deglaciation will continue to increase.