



## **Properties of ash-infused hail during the Grímsvötn 2011 eruption and implications for radar detection of volcanic columns**

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The latest Grímsvötn volcanic eruption in Iceland lasted for a week, 21-28 May 2011, while most of the tephra was erupted in the first 24 hours. During the early hours the volcanic column rose to about 20-25 km altitude. The Grímsvötn caldera is within the Vatnajökull glacier and most of the tephra was deposited on the glacier. Fortunately, for our study of ash-infused hail deposited from the column, the surface air temperatures on the glacier were below freezing level during the first few weeks after the eruption.

In early June 2011 the ash deposits around the eruption site were studied, with special focus on thick distinct intermittent layers of ash-infused hail. Close-up photographs of the in-situ hail layers were taken and hail samples collected, some were kept frozen while others were allowed to melt. Most of the hail had grain sizes between 1 and 2 mm with various visual grades of ash density, from almost clear hail to ice-glaced spherical balls of packed fine ash.

Both the ash and hail grain size distributions of the samples were analyzed as well as their water content. The much larger grain size of the hail than of the ash has important implications for some effective physical properties and remote detection of ash in volcanic columns. These changes in effective grain size lead to increased precipitation of ash, and affect radar reflectivity. The influence of hail formation in volcanic columns on mass flux estimates based on radar measurements will be discussed.