

Volcanic hazards in Iceland

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Abstract — *Volcanic eruptions are common in Iceland with individual volcanic events occurring on average at a 3–4 year interval, with small eruptions ($<0.1 \text{ km}^3$ Dense Rock Equivalent - DRE) happening about once every 4–5 years while the largest flood-basalt eruptions ($>10 \text{ km}^3$ DRE) occur at a 500–1000 year interval. Despite the dominance of basalts, explosive eruptions are more common than effusive, since frequent eruptions through glaciers give rise to phreatomagmatic activity. The largest explosive eruptions (Volcanic Explosivity Index - VEI 6) occur once or twice per millennium, while VEI 3 eruptions have recurrence times of 10–20 years. No evidence for VEI 7 or larger eruptions has been found in the geological history of Iceland. Jökulhlaups caused by volcanic or geothermal activity under glaciers are the most frequent volcanically related hazard, while fallout of tephra and fluorine poisoning of crops, leading to decimation of livestock and famine, killed several thousand people prior to 1800 AD. The most severe volcanic events to be expected in Iceland are: (1) major flood basalt eruptions similar to the Laki eruption in 1783, (2) VEI 6 plinian eruptions in large central volcanoes close to inhabited areas, similar to the Öraefajökull eruption in 1362, which wiped out a district with some 30 farms, and (3) large eruptions at Katla leading to catastrophic jökulhlaups towards the west, inundating several hundred square kilometres of inhabited agricultural land in south Iceland. With the exception of the 1362 Öraefajökull eruption, fatalities during eruptions have been surprisingly few. Economic impact of volcanic events can be considerable and some towns in Iceland are vulnerable to lava flows. For instance a large part of the town of Vestmannaeyjar was buried by lava and tephra in a moderate-sized eruption in 1973. The prospect of fatalities in moderate explosive eruptions is increasing as frequently active volcanoes, especially Hekla, have become a popular destination for hikers. Automated warning systems, mainly based on seismometers, have proved effective in warning of imminent eruptions and hold great potential for averting danger in future eruptions.*