Abstract

Volcanic Alert warnings to the public; experience from volcanic eruptions in Iceland

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Eruptions in sub-glacial volcanos are a threat to humans and live-stock, not only due to ash emission but also due to glacial outburst. In Iceland a large part of the active volcanos are sub-glacial and the area around Eyjafjallajökull and Mýrdalsjökull, is especially vulnerable as the area, just downhill of the glaciers is habitated by farms and small villages. Hence, early warnings to the public in the area is crucial and evacuations are necessary due to glacial outburst. Ash dispersion is as well dangerous, as ash which is composed of among others fluerosis, can be lethal to live-stock and may cause problems to humans especially those affected by lung and heart diseases. Ash dispersion forecast with fine resolution models, is a tool that might be used to mitigate these effects. In calm periods of the eruption or at its end, ash resuspension can be a great problem.

The Icelandic Meteorological Office (IMO) works closely with the Civil Protection Department of the National Commissioner of the Icelandic Police (CPD), with the aim to alert and inform the public about imminent threat of volcanic eruptions or during erupting phase. IMO is responsible for monitoring and issuing forecast and warnings of natural hazards, such as imminent volcanic eruption to CPD, aviation service provider and the public. Twice per year a common meeting between CPD, IMO and the Earth Science Institute of the University in Iceland (ESI) are held to discuss the seismic activity and possible volcanic eruptions. When the activity rises, with possible imminent eruption and during eruptions meetings are held frequently.

In 1994 the seismic activity in Katla and Eyjafjallajökull rose. This led to a three year project from 2002 to 2005; Risk assessment of volcanic eruptions and glacial outburst form western part of Mýrdalsjökull and Eyjafjallajökull (in Icelandic: Hættumat vegna eldgosa og hlaupa frá vestanverðum Mýrdalsjökli og Eyjafjallajökli – The report as whole is only available in Icelandic). Scientists from IMO and ESI investigated the historical data, modelled glacial outburst flood patterns, discharge and speed, and investigated the return period of volcanic eruptions in the area, and possible correlation between eruption- and glacial outburst strength and eruption return period. The main findings were:

- The past 8000 years large glacial outburst due to volcanic eruptions in western part of Mýrdalsjökull and Eyjafjallajökull has occurred on average every 500-800 years. Catastrophic floods are as large as 200.000-250.000 m^3/s.
- The return period of eruptions in Katla is on average 58 years.

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- Modelling of catastrophic events down Markarfljót show that floods can reach inhabited areas, as well as touristic sites in 2 to 3 hours. The depth of such a flow is as high as 10 to 15 m.
- Volcanic eruptions in Mýrdalsjökull in the western part of the Katla caldera and in Eyjafjallajökull can result in glacial outburst with discharge of 3.000-30.000 m^3/s. Modelling of eruptions from the southerly hills of Eyjafjallajökull (return period 1.000-10.000 years) show that the floods can reach inhabited areas in 15-30 min.

As a result of the report a contingency plan was issued for the area and updated for the neighbouring area in the east where such plan already existed, and information was given to the inhabitants (Fig. 1). An extensive exercise was held in 2006, involving all institutes and rescue teams that take part in real events including as well evacuation of inhabitants. In addition information brochures in several languages are available for tourists and as well posters on touristic sites.

Figure 1: Brochure given to all inhabitants in the area of Eyjafjallajökull and Mýrdalsjökull, with information on how to respond to volcanic eruption in the area.

As mentioned above IMO is responsible for monitoring and issuing forecasts and warnings of natural hazards in Iceland. IMO informs CPD regularly on the status of natural hazards and imminent events. CPD activates its contingency plan accordingly, which contains three phases:

- Uncertainty phase
- Alert phase
- Distress phase

There are four priority phases used to activate rescue teams:

- F1 – Highest priority
- F2 – High priority
- F3 – Low priority
- F4 – No priority

See further in Figure 2.

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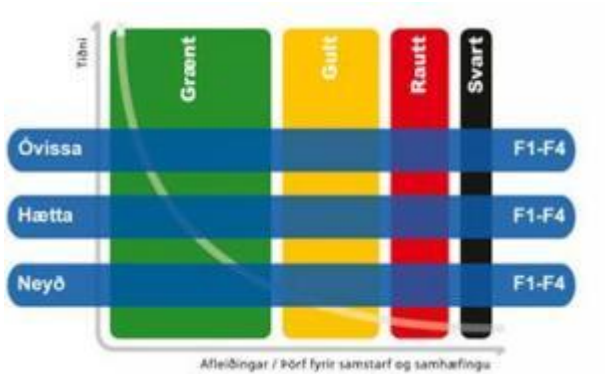

Figure 2: Schematic picture of the danger phases used by CPD. Óvissa = Uncertainty phase; Hætta = Alert phase; Neyð = Distress phase. The colour code identifies the seriousness of the event/accident and the need for coordination of resources. Green (Grænt): Daily work. Accidents or events are taken care of by few personnel/rescue members/institutes, where daily work (business as usual) is sufficient to deal with the matter. Yellow (Gult): Large and complicated events. Serious accidents or events were search over large area might be necessary and many rescuers and institutes are involved. Red (Rautt): Catastrophic accidents and events. Large and/or catastrophic accident or event where search and rescue is needed over large area. Large number of rescue teams and institutes needed with coordination by CPD. Black (Svart): National catastrophe, with large areas involved.

Information to the public on forecasts and warnings on natural hazards are issued through the public radio and television, web, mobile web, and text TV. More work is needed to inform tourists, especially as many popular touristic sites are close to volcanic eruption areas. For example, it is getting increasingly popular to walk on Mt. Hekla, and the main walking path is on one of its eruption rifts. The warning period prior eruption in Mt. Hekla is very short 1-2 hours, and therefore it is important to give warnings immediately. Per today there is a poster on the parking space at Mt. Hekla with information. The tourists can during their walk follow regularly on the mobile web, which issues warnings as soon as earthquakes are in the area. Even though steps have been taken in the right direction improvements are needed.