



Early prediction of eruption site using lightning location data: Estimates of accuracy during past eruptions

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Eruption of subglacial volcanoes may lead to catastrophic floods and therefore early determination of the exact eruption site may be critical to civil protection evacuation plans. Poor visibility due to weather or darkness often inhibit positive identification of exact eruption location for many hours. However, because of the proximity and abundance of water in powerful subglacial volcanic eruptions, they are probably always accompanied by early lightning activity in the volcanic column.

Lightning location systems, designed for weather thunderstorm monitoring, based on remote detection of electromagnetic waves from lightning, can provide valuable real-time information on location of eruption site. Important aspect of such remote detection is its independence of weather, apart from thunderstorms close to the volcano. Individual lightning strikes can be 5-10 km in length and are sometimes tilted and to the side of the volcanic column. This adds to the lightning location uncertainty, which is often a few km. Furthermore, the volcanic column may be swayed by the local wind to one side. Therefore, location of a single lightning can be misleading but by calculating average location of many lightning strikes and applying wind correction a more accurate eruption site location can be obtained.

In an effort to assess the expected accuracy, the average lightning locations during the past five volcanic eruptions in Iceland (1998-2011) were compared to the exact site of the eruption vent. Simultaneous weather thunderstorms might have complicated this analysis, but there were no signs of ordinary thunderstorms in Iceland during these eruptions.

To identify a suitable wind correction, the vector wind at the 500 hPa pressure level (5-6 km altitude) was compared to mean lightning locations during the eruptions. The essential elements of a system, which predicts the eruption site during the first hour(s) of an eruption, will be described.