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The resistivity structures around and beneath the Eyjafjallajökull volcano, Southern Iceland: first insides from electromagnetic investigations

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Due to the recent eruptive and highly disruptive volcanic events in 2010 in Iceland, scientific and societal interest is overwhelming in gaining as much information as possible about the volcanic structures and processes to enhance the understanding of the partially glacier-covered Eyjafjallajökull and Katla volcanic systems. Due to their ice-caps the eruptions of these volcanoes are phreato-magmatic in type and are capable of producing jökulhlaups (or glacier bursts), i.e., sudden glacial outburst floods. Numerous petrological, geochemical and geophysical investigations of these systems have already been published. However, to date no electrical or electromagnetic data have been aquired on these two volcanoes to attempt to image the resistivity structure beneath and around them, although electromagnetic methods are far more sensitive to fluid distribution (in this case partial melt) than any other geophysical method.

In July 2011, broadband magnetotelluric (MT) data were collected at 26 sites around the Eyjafjallajökull and the southern part of Mýrdalsjökull (i.e., the glacier covering Katla). Both horizontal electric field components were recorded using 100 m dipoles, and the vertical and both horizontal magnetic field components were measured using induction coils. At most sites the recording time was approximately 40 hours, and a distant remote reference site (about 150 km away) was recording during the whole survey. The obtained period range of good quality data is about 300 Hz to 1,000 – 2,000 s. In addition, at each MT site central loop transient electromagnetic (TEM) data were obtained using a transmitter loop of 200 m x 200 m and a 1 m^2 receiver loop with 100 windings (effective area 100 m^2). The TEM data are used to correct the MT data for static shift effects.

State of the art data processing and analysis methods have been applied to the data and dimensionality and distortion analyses have been conducted. Induction arrow and phase tensor maps as well as preliminary inversion models will be shown and provide a first idea of the resistivity structure present around and beneath these two volcanoes.