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A Self Potential study of the summit geothermal system of the Krafla volcano (Iceland).

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The Krafla central volcano is located on the North Iceland Rift Zone. The Krafla geothermal field is located in a large (8 km) collapse caldera that formed approximately 110 000 years ago. Rhyolite formations border the caldera and an extensive geothermal system occurs within it. A 100 km long and 5-10 km wide fissure swarm transects the volcano. These and the central constitute together the Krafla volcanic system.
The caldera has been the site of extensive drilling for geothermal development. Drilling started in 1974 and a total of 43 wells have been drilled and at least two wells hit rhyolitic magma, at the depth of 1.5 and 2.1 km respectively. The subsurface structure of Krafla has been investigated by seismic, gravimetric, electromagnetic, and geodetic techniques. Good geophysical evidence confirms the presence of a shallow magma chamber under the central part of the caldera at about 3 km depth. The resistivity structure of the Krafla volcano has also been investigated, first by DC methods but later by joint application of MT and TEM.
In the framework of the Krafla Magma Drilling Project (KMDP), a Self Potential (SP) survey has been realized in order to characterize the background flow pattern in the area. SP method measures the distribution of the electric potential at Earth surface generated in rocks because of various physical and chemical processes. The SP is the only method that is directly sensitive to the pattern of groundwater flow and to changes in the seepage velocity. At first, a NS profile crossing the IDDP-1 borehole site has been realized. A secondary profile, in a roughly EW direction orthogonal to the first one has been also performed. Both profiles have an approximate length of 4 km, which should be enough to characterize the flow pattern in the crust overlying the magma chamber. After the completion of the profiles, a first analysis through a probabilistic algorithm has been attempted. The findings has been used as starting constrain for a quantitative inversion of the data.