EGU21-16134, updated on 19 Jan 2022
https://doi.org/10.5194/egusphere-egu21-16134
EGU General Assembly 2021

Volcano-seismic 2020 unrest in Reykjanes Iceland: The MAGIC multi-parametric rapid response during Covid-19 lockdown

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The plate boundary between the American and Eurasian plates runs in southwest Iceland along a 5-10 km wide seismicity zone on the Reykjanes Peninsula. There, tectonic spreading events take place as continuous seismic release and seismic episodes (swarms and individual large events) with recurrence interval of about 40 years and volcanic episodes at intervals of 800-1000 years. The crust in Reykjanes is, therefore, particularly thin and hot and geothermal energy is currently harnesses in two areas on the western part of the peninsula in Reykjanes and Svartsengi.

Since January 2020, earthquake swarms with larger events up to M5.6 have been occurring frequently over the entire Reykjanes Peninsula, accompanied by unusual uplift (up to 12 cm) and subsidence cycles in the Svartsengi-Eldvörp fissure swarm. This raises the question whether we might be at the beginning of a new volcanic episode. In order to classify such processes at an early stage, multidisciplinary geophysical measurements are particularly valuable.

The Icelandic Meteorological Office (IMO), University of Iceland as well as ISOR and several partners responded immediately after the unrest began. As soon as January 2020, GFZ proposed a rapid response field campaign (MAGIC: MultidisciplinAry imaGIng and Characterization of the magma/fluid reservoir beneath Svartsengi). Only one week after the uplift start and first earthquake swarm, we connected a Distributed Acoustic Sensing interrogator to a 21 km long telecommunication fibre optic cable which crosses the uplift and swarm area. In addition, while we complied to strict constraints due to the Covid-19 pandemic, the rapid response activities comprised deployment of several additional sensors including broadband seismology, rotational seismology and we performed repeated surveys including gas-, gravity-, electromagnetic-, airborne and ground magnetic- measurements.

We present preliminary results from various techniques and discuss their role in discriminating different scenarios aiming at explaining the magma-tectonic unrest phase. In particular, we analyze how the combination of airborne snapshots of ground morphology can be combined with the high temporal and spatial resolution deformation fields along the fibre optic cable.