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Comparison of magnetotelluric and soil gas geochemistry data for geothermal exploration at Gran Canaria, Canary Islands

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Gran Canaria is the central and the third-largest island (1560 km^2) of the Canarian archipelago, after Tenerife and Fuerteventura. The island is circular in shape, approximately 45 km in diameter, and rises to an altitude of 1949 meters above sea level (masl). The main geomorphological features of Gran Canaria are related to the volcanic evolution of the island, and are divided in two equal parts by a northwest-southeast line that coincides with a Pliocene rift zone. The southwest older part (Paleocanaria) is formed by the Miocene volcanics, whereas the younger northeast portion (Neocanaria) concentrates the rejuvenation and recent volcanism (Plio-Quaternary).

With the aim of studying the geothermal resource in Gran Canaria Island, a geochemistry survey was carried out from June 2017 to November 2017 with 3000 observations sites in the Neocanaria part. The sampling distribution was subject to accessibility constrains, with an average distance between sites of $\approx$ 250 m. Radon (^{222}Rn) and thoron (^{220}Rn) activities, soil H_2S and Hg gas concentrations and CO_2 diffuse efflux were measured in situ at each sampling site. Additionally, soil gas samples were collected at a depth of 40 cm using a stainless steel probe and stored in glass vials for a later analysis in the laboratory.

A 3D electrical resistivity model of the possible Gran Canaria geothermal system has been determined using the magnetotelluric (MT) method. A dataset consisting of 100 broadband magnetotelluric soundings distributed around the whole island has been acquired from July 2017 to September 2017. For the acquisition of the new data the instrumentation consisted of Metronix ADU06 and Metronix ADU07 magnetometers. The x-axis was oriented magnetic N and y-axis was oriented to magnetic E. At each site, the four horizontal components of the electromagnetic field (Ex, Ey, Hx and Hy) were recorded at periods of 10^{-4}–10^2s.

At this area where there is a lack of visible geothermal manifestations in the surface environment, electrical resistivity model will be correlated with the geochemical prospecting of soil gases distribution, since the bulk resistivity is sensitive to factors as fluids content and/or temperature at the surface. This correlation can provide useful information on the location of areas where deep-seated fluids can reach the surface along active tectonic structures.