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Volcanomagnetic monitoring in El Hierro (Canary Islands, Spain): preliminary analysis of the 2011-2017 IGN dataset

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During July 2011 El Hierro Island experienced the beginning of the first volcanic unrest episode after two centuries of quiescence. Seismic activity and ground deformation escalated during the following months, with more than 10 000 located earthquakes and up to 5 cm of island-scale ground deformation, until a submarine volcanic eruption started on 10^{th} October 2011, ∼2km to the south of the southernmost El Hierro shoreline. This eruption, accompanied by a second seismicity pulse, lasted until mid-February 2012 and was followed by six additional episodes of magma intrusion within the uppermost mantle under the island which did not triggered any eruption but that were characterized by even stronger seismicity and ground deformation pulses. The last one of these intrusion episodes occurred during March 2014, after which the island seems to have reentered a relatively quiet phase. Since the first phases of the volcanic unrest, the Instituto Geográfico Nacional (IGN) started the deployment of a network of several magnetometers at El Hierro Island, in order to complement the multiparametric geophysical, geodetical and geochemical IGN monitoring network, and also to test the effectiveness of volcanomagnetic monitoring in this volcanic context, characterized mainly by monogenetic, basaltic to intermediate volcanism. Due to logistical reasons, this volcanomagnetic network has not been static, but has evolved with different spatial configurations, with a maximum number of 4 absolute magnetometers (Proton and Overhauser) functioning simultaneously at 1 min resolution, until a final stable configuration of two magnetometers was stablished and has continued to operate until now. One of these two permanent stations has been operating since 1^{st} September 2011, through all the intrusion episodes and the subsequent quiet phase, allowing us to obtain a long baseline of observations. Here we present a preliminary analysis of the complete 2011-2017 El Hierro volcanomagnetic dataset, using Güímar Geomagnetic Observatory (Tenerife Island; IGN-INTERMAGNET) as a reference station to reduce external ionospheric-magnetospheric variations. To analyze the data we have followed a classical approach similar to the one described by Zlotnicki and Le Mouel (1988) and Zlotnicki (1995), calculating daily averages of total geomagnetic field intensity differences (ΔF) between the network stations and the reference station. The temporal evolution of these daily averages is compared both with volcanic unrest proxies (released seismic energy, ground deformation) and with external geomagnetic indexes (e.g. planetary A index) in order to discriminate possible genuine volcanomagnetic signals from spurious geomagnetic external variations. We have also calculated ΔF nightly averages (00 to 05 h), as well as pre-dawn 1 hour averages, in order to compare periods with minimum ionospheric external effects. We are also performing a moving window Fourier spectral analysis for ΔF and F (S_q corrected) data at full resolution (1 min) for the most relevant periods in the dataset, trying to test for the presence of local transient magnetic perturbations potentially associated with volcanic effects.