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Eruption precursor or business as usual? Evaluating volcanic unrest on Tenerife, Canary Islands, via ground deformation and gravimetric studies

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Increased onshore seismic activity in April 2004 marked the first documented renewal of crustal unrest on Tenerife, Canary Islands, Spain, since the island's last volcanic eruption in 1909. Effects included tremors, felt earthquakes as well as an increase in diffuse CO2 emission along the NW volcanic rift-zone and increased fumarolic activity at the summit of the central 3718 m high Teide volcano. Here, we present results from time-lapse ground deformation and micro-gravity investigations performed between May 2004 and July 2005 as part of the TEGETEIDE multi-disciplinary investigation program funded by the Spanish Ministry of Science, in order to shed light on the causative sub-surface processes for the unrest and the current state of the volcanic system on Tenerife. We show that the recent reactivation after almost a century of inactivity was accompanied by the addition of approximately 1E11 kg of material in the sub-surface, yet we did not detect significant surface deformation. We find that the causative source was migrating with time and infer on fluid migration at depth as the most likely cause for mass and density increase. Arrival of a small batch of magma at depth and the release and upward migration of hot fluids may be a common trigger of reactivation after long repose periods and may not be accompanied by ground displacement, but quantifiable perturbations in the gravity field.