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Depth to Curie temperature or magnetic sources bottom in the Lesser Antilles Arc volcanic area

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In the continuation of the innovative study carried out at the scale of La Réunion Island to generalize Curie Point Depth (CPD) determinations at the scale of oceanic volcanic islands, we present here a similar work at the scale of the Lesser Antilles Arc. Assuming that magnetic anomalies are concentrated within the oceanic crust and using the growing assumption of a magnetized upper mantle, the Curie depth should become deeper as the oceanic lithosphere becomes older (i.e. thicker). We use the magnetic anomaly map computed by Gailler et al. (2013), completed and extended with the global Earth Magnetic Anomaly Grid (EMAG2) (Maus et al., 2007). The calculated magnetic sources bottom lies at depths between 18 and 32 km and exhibits a complex topography, presumably caused by the combination of various magmatic and tectonic crustal structures in this complex subduction context. The correlations between our depth to magnetic sources bottom and the large scale bathymetric and geophysical studies provide an interesting overview of the Lesser Antilles Arc structuring. The Inner Arc is mainly associated with a deepening of the depth to magnetic sources bottom. On the contrary, a huge doming appears along the central Lesser Antilles Arc, consistent with the seismic imaging (Kopp et al., 2011). This uprise of our calculated magnetic surface extents southeastern to the Guadeloupe Island in the direction of the Tiburon Ridge following the abnormal transverse component of the subduction in the N130°E direction defined by Gailler et al. (2013). A strong lateral narrowing of this doming is evidenced southern of Dominique Island where the two arcs converge. In this central area, the averaged depth of the magnetic sources bottom is also larger than expected in the case of classical oceanic crust. This is in agreement with previous interpretation of an original oceanic crust thickened by deep magmatic processes and underplating prior to the evolution of the Lesser Antilles Arc (Diebold, 2009). To the NE, the five main axis of deformation imaged from geophysical and bathymetric studies are well correlated with the larger bulged area of the magnetic sources bottom which also seems to underline the large scale deformation and faulting of the Outer arc. Along this latter, our map is correlated with the accretionary prism, the subduction trench, and the large scale gravity scheme. We also perform 2D thermo-mechanical simulations of the Lesser Antilles subduction zone to model the thermal structure of the fore-arc/arc domain at steady-state. Water transfers associated to slab dehydration and overlying rock hydration are modeled, including a simple hydrous strength weakening law. Simulations show that asthenospheric flows are strongly enhanced in the hydrated mantle wedge, yielding a significant reheating of the fore-arc domain, consistent with what is suggested by magnetic data.