Mapping and quantifying the morphometry of volcanic features using high resolution Tandem-X DEM: the Virunga Volcanic Field, DR. Congo

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Detailed morpho-structural mapping of volcanoes is essential to understand the structure of a volcanic system and the spatial distribution of eruption probability. Quantifying the volume of pyroclasts and lava emitted by a given eruption further enable to constrain the eruption dynamics, the volcano long term magma production rate and to constrain hazard models. Here we present a new volcano-structural map of the Virunga Volcanic Province (VVP) based on high-resolution topographic and multispectral remote sensing data. The VVP located within the Western branch of the East African Rift system at the boundary of D.R.Congo, Rwanda and Uganda, hosts 8 volcanoes, including two active ones, Nyiragongo and Nyamulagira. The latter one, with one eruption every 1-4 year requires frequent update of the geological map. Panchromatic and multispectral images from sensors of SPOT and Pléiade constellations were used to systematically map the hundreds of volcanic spatter-and-scoria cones, lava flows, eruptive fissures and other lineaments in the VVP. Using bistatic images from the Tandem-X mission, a high-resolution DEM at 5 m resolution was produced by radar interferometry. This DEM, which is 6 times more accurate than the so-far available DEM of the area, enables us to systematically quantify the morphometry of volcanic cones and to constrain the volume of lava flow lobes. From difference between two Tandem DEM's taken before and after the last eruption at Nyamuragira,the extension and volume of the lava flows have been estimated with a higher accuracy than preliminary field estimation. The new map and GIS database will serve as a basis for modelling the spatial distribution of volcanic hazard in the VVP. This research highlights the added value of newly available remote sensing data to study hazardous or inaccessible volcanic regions.