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Lava flow risk maps at Mount Cameroon volcano

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Mount Cameroon, in the southwest Cameroon, is one of the most active volcanoes in Africa. Rising 4095 m asl, it has erupted nine times since the beginning of the past century, more recently in 1999 and 2000. Mount Cameroon documented eruptions are represented by moderate explosive and effusive eruptions occurred from both summit and flank vents. A 1922 SW-flank eruption produced a lava flow that reached the Atlantic coast near the village of Biboundi, and a lava flow from a 1999 south-flank eruption stopped only 200 m from the sea, threatening the villages of Bakingili and Dibunscha. More than 450,000 people live or work around the volcano, making the risk from lava flow invasion a great concern.

In this work we propose both conventional hazard and risk maps and novel quantitative risk maps which relate vent locations to the expected total damage on existing buildings. These maps are based on lava flow simulations starting from 70,000 different vent locations, a probability distribution of vent opening, a law for the maximum length of lava flows, and a database of buildings. The simulations were run over the SRTM Digital Elevation Model (DEM) using DOWNFLOW, a fast DEM-driven model that is able to compute detailed invasion areas of lava flows from each vent.

We present three different types of risk maps (90-m-pixel) for buildings around Mount Cameroon volcano: (1) a conventional risk map that assigns a probability of devastation by lava flows to each pixel representing buildings; (2) a reversed risk map where each pixel expresses the total damage expected as a consequence of vent opening in that pixel (the damage is expressed as the total surface of urbanized areas invaded); (3) maps of the lava catchments of the main towns around the volcano, within every catchment the pixels are classified according to the expected impact they might produce on the relative town in the case of a vent opening in that pixel.

Maps of type (1) and (3) are useful for long term planning. Maps of type (2) and (3) are useful at the onset of a new eruption, when a vent forms. The combined use of these maps provides an efficient tool for lava flow risk assessment at Mount Cameroon.