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Quantitative evolution of volcanic surfaces affected by erosional processes

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Variations through time of erosion dynamics, a key point to investigate correlation between climates and landform evolution, still remains poorly documented. One of the main issue in this type of study is the difficulty in determining for how long the erosion has operated. For this purpose, volcanic contexts are particularly suitable for defining the temporal dynamics governing erosion since the age of volcanic activity also constrains the age of emplacement of the surface today eroded, and thus the erosion duration. Furthermore, quantitative analysis of river profiles offers the opportunity to discriminate, among the wide variety of geological phenomena influencing erosion, their respective influence. Quantification of erosion processes and constrain of their signature on reliefs can be addressed by a morphometric approach of river profiles in volcanic environment through the analysis of digital topography (DEM). Break in slope zones, the so-called knickpoints, are usually related to a retreat of the point between the relict channel, upstream, and the adjusted channel, downstream. They are induced by either a lithological contrast, a change in the base level, uplift or eustatism, or a rejuvenation of the age of the volcanic surface. The stream long-profile and its watershed is also investigated by their concavity and hypsometric indexes to determine for how long the complexity and its heterogeneity along the valley incision remain visible.
The present study focusses on the erosion of volcanoes in the Lesser Antilles, Reunion Island and Lombok Island (Indonesia). All located in tropical environments, these volcanoes offer a wide diversity of age (30 – 0 Ma) and lithology for investigating the respective influence of geological processes that have induced a large variety of shapes and volcanic history that we try to correlate to geometry of river profiles.