River incision on volcanoes: Case study of La Réunion, Mauritius and Rodrigues islands, Indian Ocean

Loraine Gourbet [*1], Sean F. Gallen [2], Vincent Famin [1], Laurent Michon [1], Anne Replumaz [3]

[1] Université de la Réunion - IPGP - France
[2] Colorado State University - USA
[3] Institut des Sciences de la Terre - France

Volcanic islands are geological and biological hotspots. The evolution of volcanic islands landscapes depends on the age of volcanism, the history of subsidence and uplift, and climatic variations. In these environments, erosion is characterized by frequent landslides, large-scale collapses, and landscape dissection by bedrock river incision. Case studies of La Réunion [1] and Tahiti-Nui [2] showed that present-day island landscapes can preserve an imprint of volcano structures. On Mauritius, alternating quiescence and volcanic activity periods affect river development [3]. Despite their importance, few studies address the links between volcanic architecture and erosion.

Here, we focus on La Réunion, Mauritius and Rodrigues islands to study the relative influence of structural inheritance and precipitation on river evolution. Topographic and river profile analysis of Mauritius Island suggests that its relief is largely inherited from volcanic structures. In contrast, most rivers on Rodrigues Island show concave-up profiles, with knickpoints at high elevation that are characteristic of headward erosion.

We assess the bedrock erodibility and its potential link with climate gradients by modelling river incision through time. First, we reconstruct the pre-incision topography by interpolating relict volcanic surfaces [4]. Then, using a Bayesian approach applied to the stream power law [5] and taking into account the precipitation distribution, we invert river profiles in order to obtain three parameters: the erodibility K, the drainage area exponent m, and the slope exponent n. This method could potentially be used as an indirect dating tool for volcanic surfaces. We will discuss our results and their implications on the geodynamical relationships between the three islands and the Réunion hotspot.

References
[1] Gillot et al. (1994)
[2] Hildenbrand et al. (2008)
[3] Saddul (1995)
[4] Gayer et al. (2019)
[5] Gallen and Fernández-Blanco (2021)

Mots-Clés : Erosion, volcanic islands, climate

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.