The coupling between chemical weathering and mechanical erosion in volcanic islands : Example of the steep Reunion Island basins.

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The quantification of landform evolution and the understanding of the processes involved are essential to consider their implications for global biogeochemical cycles and climate-tectonic feedbacks. Althought the comparison between different techniques has been used to adress the coupling between mechanical erosion and chemical weathering, different methods generally estimate erosion rates over different time scales, and are sensitive to different erosion processes.

In this study we estimate rates of erosion and sediment transport of highly eroding landscapes of Reunion Island. We compare and combine the results of five methods: i) from cosmogenic ^{3}He concentrations, ii) from river geochemistry (geochemical balance on river water and river sediment, iii) from landforms reconstruction, iv) from U-series and v) from aerial images analysis. Our aim is to derive, from this comparative approach, the message provided by each method in terms of chemical weathering, mechanical erosion and erosion processes.

A good agreement is observed between long-term erosion rates derived from topography reconstructions and so called short-term erosion rates from the geochemical mass balance. The prominent role of episodic landslides in the erosion of the island is shown by a) the comparison between cosmogenic analysis and the geochemical mass balance and b) by a new approach of the geochemical mass balance with a systematic study along the range of river sediment grain size showing an anti-correlation between weathering and grain size. In addition, the later approach enables to track the source of sediment in the drainage areas (high erosion sites of the basin). Finally U-series on soils and river sediments are expected to track river sediment sources (from soils or regoliths), while initial results on aerial image analysis allows us to estimates landslide scars surfaces available for weathering as well as transport rates of the sediment produced thereby.