Cosmogenic Nuclides, River Geochemistry, and Lanforms Reconstruction methods comparison to study the coopling between chemical weahering and mechanical erosion in a steep Reunion Island Basins.

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Understanding the mechanisms that modify landscapes is essential for identifying feedbacks between climate, tectonic and topography. Because measurements of erosion rates are critical for quantifying landform evolution, the coupling of different techniques has often been used. However, different methods often estimate erosion rates over different time scales, and are sensitive to different erosion processes.

In this study we estimate erosion rates of highly eroding drainage areas of Reunion Island. We compare and combine the results of three methods: i) from cosmogenic ^{3}He concentrations, ii) from river geochemistry and iii) from landforms reconstruction. Our aim is to derive, from this new approach, the message provided by each method in terms of chemical weathering, mechanical erosion and erosion processes.

Helium concentrations and isotopic ratios were measured in olivine-rich sands from rivers and landslides products. Digital elevation model and K-Ar geochronological data were used to reconstruct basins initial topographies and to calculate the volumes of material eroded over the past ~65Ka. Finally, dissolved and suspended loads and river sediments were analyzed for their major and trace elements contents, and a geochemical mass balance was built in order to quantify both chemical and mechanical erosion rates. Results show a good agreement between long-term erosion rates derived from topography reconstructions and so called short-term erosion rates from the geochemical mass balance. The cosmogenic method underestimates erosion rates, but comparison with the geochemical mass balance helps to show that episodic landslides dominates erosion of the basins. Finally a new approach of the geochemical mass balance with a systematic study along the range of river sediment grain size shows an anti-correlation between weathering and grain size allowing to depict weathering vs genesis and transport of sediments.