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How does vegetation impact the erosion by modelling landscape evolution of marly catchments in the Southern Alps of France?

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The Southern Alps of France have been identified as a hot-spot in a global climate change context where the rainfall intensity increase may exacerbate the erosion of already badly erodible lands: Badlands. Vegetalization methods are a promising area of research for erosion control and slope and riverbed stabilization. Nevertheless the impact of vegetation on erosive dynamics is still poorly understood. We own data collected over the last thirty years on marly catchments in the Southern Alps of France from the Draix-Bleone Observatory, part of the Network of Drainage Basins RBV. These are temporal data of sedimentary flux at the scale of the precipitation event but also more recent topographic data on watersheds with areas ranging from 10-3 square kilometers to twenty square kilometers. We simulate the topographic evolution of the catchments over a few decades with the landscape evolution model Landlab using our data to calibrate and explicitly validate the model over two catchments, one highly vegetated and the other one poorly vegetated. We want to see how the erosion laws parameters depend on the vegetation cover. We implement the calibration of parameters of a non-linear diffusion module coupled with a stream power with alluvium conservation and entrainment law. This stream power law is designed in cases where the study area has both cohesive material but also non-consolidated sedimentary material that can be transported and deposited using a two-layer model. We add the catchment-river bed coupling. Diffusion process creates the potential source of sediment and brings the sedimentary supply into the riverbed which will then be mobilized for erosion using the stream power law. By operating only on slopes we calibrate the parameters of the non-linear diffusion law according to the vegetation cover. We observe that the values of the erosion laws parameters are strongly affected by the percentage of vegetation cover. The vegetation in this study seems to act mostly on soil cohesion and especially diffusion processes rather than hydrology.