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Modelling erosion and catchment's sediment exports based on erosion plot's measurements using the STREAM model. Application to the Rheraya catchment, High Atlas, Morocco.

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The Rheraya watershed (225 km2) is located in a semi-arid climat, in the High Atlas of Morocco. The land cover includes mainly degraded rangelands on the slopes, and some irrigated crops in the valleys. The average annual rainfall ranges between 300 and 500 mm depending on the site location. Six erosion plots of about 150 m2, located on various soil and land cover conditions were measured during four years. The observations showed very rare runoff events in the main part of the watershed, and producing a low sediment load (between 0.015 and 2.5 t/ha/year). Conversely, runoff was much more frequent on silty badlands, producing about 95% of the watershed sediment (350 t/ha/year) despite their area was only 1% of the watershed. The resulting average erosion over the watershed was about 3-4 t/ha/year, which is of the same order than the mean sediment exportation at the outlet, indicating a sediment delivery ratio around 1.

STREAM is a semi empirical distributed erosion model initially designed for agricultural landscapes, taking into account as the main drivers of erosion, the vegetation cover, the soil surface states and the soil roughness. These surface characteristics are input by the user for each pixel, allowing the computing of the infiltration capacity and the runoff turbidity. STREAM works for single rain events, and uses a simple hortonian hypothesis for runoff generation for each pixel, which is subsequently routed down slope using a DEM.

The adaptation of this model to the very different context of the Rheraya catchment, with mostly rangelands instead of crops, led us to identify three new drivers of soil infiltration and turbidity, namely the soil type, the soil protection by vegetation or stones, and the soil conservation practices. Infiltration and turbidity for each landscape unit were quantified based on the in situ erosion plot measurements. The results of STREAM simulations for single events were compared to measurements at the catchment's outlet. Despite an overall agreement for the cumulated values over one year, strong discrepancies appears for individual events, due mainly to the fact that STREAM doesn't manage the river bed processes, deposition and erosion, which delay and buffer the sediment delivery.