



Regional scale analysis of human and biophysical control of sediment yield variability in the Ethiopian Highlands

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Data on sediment transport in rivers enables us to study the spatial variability of land degradation at the hydrological basin scale. By measuring sediment deposition in reservoirs or sediment load in rivers, we are able to relate a quantitative proxy of soil erosion to upstream land characteristics. In reality, the quantity of sediment exported from a catchment may be controlled by its drainage area, topography, climate but also by the soil erodibility which is itself a function of soil characteristics, vegetation cover and human activity. Various authors have indicated that the analysis of spatial variability in sediment load is more appropriate to study erosion problems than traditional upscaling of USLE-type plot measurements.

However, even if the analysis of sediment yields is likely to provide reliable data on catchment-wide soil erosion, the fact remains that there are many uncertainties about the factors controlling land degradation at the regional scale. While some authors insist on the importance of natural physical controls (such as climate, topography...), others rather focus on the anthropogenic acceleration of erosion by demographic pressure, and agricultural practices. Therefore, it is important to explore if it is possible to detect the relative importance of these natural vs. anthropogenic driving forces of soil erosion at the regional scale.

The purpose of this work is to study the spatial variability of sediment fluxes in some major tributaries of the Nile River. More precisely, our efforts will be concentrated on rivers which take their origins in the Ethiopian Highlands. This region is characterized by important biophysical and anthropogenic constraints, which are presumably acting together to accelerate land degradation. Heavy and intense precipitation (qualified as erosive rains) falling on intensively used soils for agricultural production are at the origin of important water erosion problems. Water erosion increasingly deteriorates the chemical and physical soil properties to the point that a quarter of the land belonging to the Ethiopian Highlands is considered to be severely degraded.

In this study, the spatial variability in sediment yield variability and its controlling factors will be analysed on a regional scale using data for the Upper Blue Nile and Tekeze River basin (an Atbara affluent). We integrate in our analysis hydrological catchments for which the average drainage area is around 8000 km². Therefore, this study clearly differentiates itself from previous ones that mainly focused at small-scale variations in erosion and sediment yield for catchments generally smaller than 50 km².