

Modelling of sedimentation processes inside Roseires Reservoir (Sudan)

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1. Introduction

Roseires Reservoir is located on the Blue Nile River, in Sudan (figure 1). It is the first trap to the sediments coming from the upper catchment in Ethiopia, which suffers from high erosion and desertification problems. The reservoir lost already more than one third of its storage capacity due to sedimentation in the last four decades. This is a big economical loss to Sudan, in addition to the high maintenance costs of sediment clearance in front of the turbines to facilitate hydropower production.

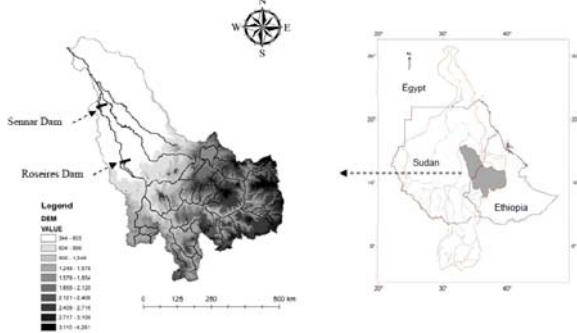


Figure 1: Blue Nile basin and location of Roseires Dam.

2. Objectives

The problem of siltation in Roseires reservoir could be mitigated by appropriate management of the upper catchment, where sediment is coming from. In order to do that, the areas providing the highest sediment volumes to the river have to be identified. This requires studying the sedimentation record inside Roseires Reservoir, with the aim of identifying the most promising coring locations to investigate deposit stratification (to derive the time of sedimentation) and sediment origin (from the mineralogy of deposited fine material) of the reservoir soil.

3. Methods

A physics-based morphodynamic model was developed to simulate graded sediment processes and keep record of vertical soil development to obtain vertical and horizontal sediment sorting inside the reservoir. The morphodynamic model included two sediment granulometries, silt and sand, according to the two types of sediment transported by the Blue Nile River. It was calibrated and validated on the observed bed level changes during the periods; 1985-1992 and 1992-2007.

4. Results

The model allowed studying the contribution of two sediment types, coarse sand and fine cohesive material, both transported by the Blue Nile into the reservoir.

Two promising places were selected as possible coring locations, as shown in Figure 2. The selection of these two locations is based on the tendency of sediment to always deposit there and to the apparent absence of bar migration, based on both measured data analysis and model results

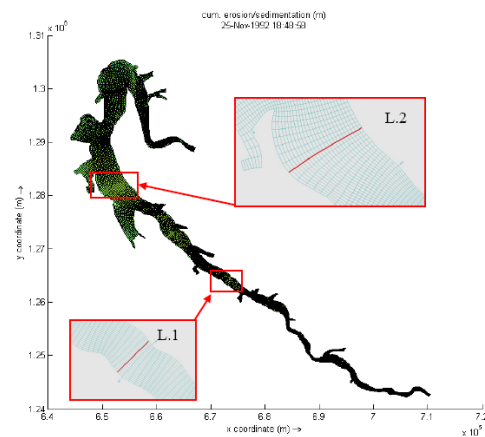


Figure 2. Selected coring locations (L1 and L2).

5. Conclusions

To study the sedimentation history inside Roseires Reservoir, we selected the most promising coring locations by combining bathymetric data analysis with the results of a quasi 3D morphodynamic modelling including horizontal and vertical sorting.

6. What is next

Mineralogy analysis will be carried out for the soils from the coring location and from the eroded areas in the catchment.

Acknowledgments

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