



River sedimentation and channel bed characteristics in northern Ethiopia

Biadgilgn Demissie (1,2), Paolo Billi (3), Amaury Frankl (2), Mitiku Haile (4), Sil Lanckriet (2), and Jan Nyssen (2)

(1) Department of Geography and Environmental Studies, Mekelle University, Ethiopia, (2) Department of Geography, Ghent University, Belgium, (3) Department of Physics and Earth Sciences, University of Ferrara, Italy, (4) Department of LaRMEP, Mekelle University, Ethiopia

Excessive sedimentation and flood hazard are common in ephemeral streams which are characterized by flashy floods. The purposes of this study was to investigate the temporal variability of bio-climatic factors in controlling sediment supply to downstream channel reaches and the effect of bridges on local hydro-geomorphic conditions in causing the excess sedimentation and flood hazard in ephemeral rivers of the Raya graben (northern Ethiopia). Normalized Difference Vegetation Index (NDVI) was analyzed for the study area using Landsat imageries of 1972, 1986, 2000, 2005, 2010, and 2012). Middle term, 1993-2011, daily rainfall data of three meteorological stations, namely, Alamata, Korem and Maychew, were considered to analyse the temporal trends and to calculate the return time intervals of rainfall intensity in 24 hours for 2, 5, 10 and 20 years using the log-normal and the Gumbel extreme events method. Streambed gradient and bed material grain size were measured in 22 river reaches (at bridges and upstream). In the study catchments, the maximum NDVI values were recorded in the time interval from 2000 to 2010, i.e. the decade during which the study bridges experienced the most severe excess sedimentation problems. The time series analysis for a few rainfall parameters do not show any evidence of rainfall pattern accountable for an increase in sediment delivery from the headwaters nor for the generation of higher floods with larger bedload transport capacities. Stream bed gradient and bed material grain size data were measured in order to investigate the effect of the marked decrease in width from the wide upstream channels to the narrow recently constructed bridges. The study found the narrowing of the channels due to the bridges as the main cause of the thick sedimentation that has been clogging the study bridges and increasing the frequency of overbank flows during the last 15 years.

Key terms: sedimentation, ephemeral streams, sediment size, bridge clogging