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Sediment yield in human-induced degraded catchments of the Northern Ethiopian Highlands: magnitude and dynamics

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The Northern Ethiopian Highlands are a fragile environment, characterised by steep slopes, intense rainfall and a sparse vegetation cover. The extreme poverty, stagnating technology and high population and livestock densities induce serious soil erosion problems. This not only leads to lower crop yields but also reduces the life expectancy of many dams and reservoirs (used for power generation or water supply in the dry season) as a result of massive sedimentation. Although these problems demand for a thorough solution, little is known about the magnitude and dynamics of sediment transport in the Northern Ethiopian Highlands. Therefore an intensive measuring campaign was conducted during the rainy season of 2006 in 10 subcatchments of the Geba (drainage area: 5180 km^2), a tributary of the Tekeze (Atbara) river. These subcatchments range in size from 120 km^2 to 4330 km^2 and represent contrasting environments typical for the Northern Ethiopian Highlands. In this paper, the results of this measuring campaign are discussed. The sediment yield for the 10 subcatchments range between 400 and 2500 t km^{-2} a^{-1}, with an average value of 1400 t km^{-2} a^{-1}. The uncertainties on these sediment yields were assessed by Monte Carlo simulations. Important spatial and temporal variations in suspended sediment export were noted. A few flash floods were recorded in detail for which clear positive hysteresis effects in sediment concentration were found. The environmental factors, causing the large differences in sediment yield between the studied catchments were assessed by means of a semi-quantitative model.