Estimating suspended sediment yield based on reservoir hydrographic survey, rating relationships and distributed hydrological modeling

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Acheloos River, located in Western Greece, is discharging at Kremasta Reservoir (catchment 1760 km2). The sediment deposits in the reservoir were measured during the year 1998 and the mean annual sediment discharge was calculated equal to 68 kg/s. The Avlaki gauging station, run by the Public Power Corporation (PPC) of Greece, is located a few kilometers upstream of the reservoir's entrance (catchment 1358 km2). Sediment discharge measurements were taken during 1966-1970 whereas daily river stages were recorded with frequent intervals without measurements. A distributed hydrologic model (the MIKE SHE model) was applied to fill in the periods with missing mean daily discharges from 1966 to 1998. Two alternative rating curves were deduced from the sediment discharge measurements, the first one with a unique power law expression for the whole set of discharges and the second with different power relations for two discharge classes above and below a threshold roughly corresponding to the bankfull discharge. It is assumed that the rating relationships are valid for the whole time span of the simulation since the catchment has undergone insignificant land use changes. The application of the first rating curve to the mean daily discharge yields mean annual sediment discharge equal to 13.5 kg/s, whereas the application of the different power relations for two discharge classes yields a corresponding value of 73.3 kg/s. The first equation seriously underestimates the sediment discharge whereas the second one results in an estimate close to that of hydrographic survey. This indicates that sediment rating curves can give good estimates if applied carefully, otherwise can result in serious inaccuracies.