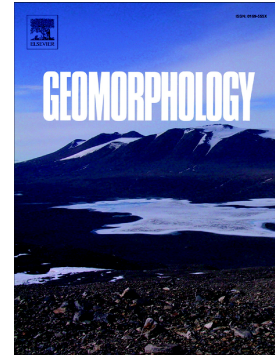


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Inferring mean rates of sediment yield and catchment erosion from reservoir siltation in the Kruger National Park, South Africa: an uncertainty assessment

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Abstract

Reservoir siltation surveys facilitate the quantification of the mean area-specific sediment yield (SSY) of catchments for decadal and longer time spans. This requires information on the volume (V_S) and dry bulk density ($dB D$) of reservoir deposits, the period of time (T_R) during which they were accumulated, the reservoir sediment trap efficiency (TE) and the catchment area (A). For the calculation of the catchment-wide average rate of erosion by water (E), the sediment delivery ratio (SDR) of the catchment needs to be estimated. Each step in this workflow represents a potential source of uncertainty. Here, we explore the extent to which individual error sources contribute to uncertainties in SSY and E values. Mean SSY and E values are inferred for small to medium-sized catchments ($\leq 100 \text{ km}^2$) of 15 small ($\leq 350 \times 10^3 \text{ m}^3$) intermittently dry reservoirs located in the southern Kruger National Park and observation periods of 30 to 65 yr. Mean relative uncertainties of resulting SSY and E values amount to $\pm 21\%$ and $\pm 46\%$ at the 95% confidence level, respectively. Uncertainties in SSY values arise mainly from the TE estimation (mean fractional uncertainty contribution of 64%), while the SDR estimation is the major cause (79%) for uncertain E values. Uncertainties in the determination of V_S and $dB D$ values are rather unimportant, contributing

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