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An evolution volume balance approach to determine relevant discharge threshold for bed load transport

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ABSTRACT

The aim of this study is to investigate discharge rates at which a flow hydrograph becomes relevant for bed load transport on the example of the alpine river Saalach. Two characteristic flow hydrographs of the river Saalach are selected and reduced to discharges above pre-specified values. With each set of reduced hydrographs, a 2D morphological simulation is conducted. Two important morphological parameters namely total river bed evolution (i) and sorting effects of the active layer (ii) are analyzed and evaluated. Moreover, an additional simulation is conducted with a linearly increasing flow hydrograph as boundary condition to analyze the initiation of bed load transport as function of discharge (iii). The results are analyzed and evaluated with respect to the total sediment output at the downstream boundary of the model to validate the findings for (i) and (ii). The model results show: (i) For regions with fine bed materials, discharge thresholds between 100 m^3/s and 130 m^3/s and for regions with mainly coarse bed materials discharge thresholds in the range between 150 m^3/s and 180 m^3/s can be identified as relevant discharges for bed load transport and may be used for reducing hydrographs without affecting the accuracy of the model results; (ii) The active layer shows no obvious changes in the mean diameter of sediments for all tested hydrographs. (iii) The investigations with a linearly increasing flow hydrograph show that the sediment output from the investigated river reach increases significantly for discharges exceeding 150 m^3/s.