Geophysical Research Abstracts
Vol. 14, EGU2012-11106, 2012
EGU General Assembly 2012

Raster based modelling of watershed erosion and sedimentation in an Alpine basin of Northern Italy

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Soil erosion and sedimentation assessment is fundamental in both engineering practice and hydrologic research. A wide range of mathematical models have been developed during years; they can be classified in two categories: a) models mainly oriented to hillslope surface erosion that concentrate attention to rill and interrill processes, and b) models developed for simulating in-stream phenomena mainly related to bed-load transport. In order to predict erosion and sedimentation at the river basin scale, all sediment related processes on hillslope and river channel need to be simulated in an integrated model. Moreover, in poorly gauged mountainous river basins, where available measurements and data are generally limited, models need to be kept as simple as possible in order to limit the number of parameters.

The erosion and sedimentation model (ERODE) developed in this study combines raster USLE parameters to the spatially distributed physically based hydrological model FEST-WB processes with minimal data requirement. In particular, the model takes in account rain splash detachment in overland areas and shear stress erosion in channel areas. Sediment transport and sedimentation are evaluated along the river network by calculating the transport capacity trough the unit stream power theory.

The model was applied to an Alpine river basin in Northern Italy and it was validated against measurements of suspended solids and total sediment transport at the basin scale. The results show that the model is able to correctly simulate storm and within-storm erosion and deposition.