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Sediment yield assessment in different geographic contest: implementation of EPM Model in GIS environment

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Soil erosion is considered to be as one of the major threats to land degradation and environmental sustainability linked to natural disasters, and yet, its quantification is still problematic, especially in data-scarce environments. One of the available GIS-based methods for estimating the sediments yield and erosion intensity at basin scale, is the Erosion Potential Method (EPM). The EPM is a model used for estimating the average (annual) soil loss obtained through the integration of several factors: meteo-climatc factors (based on average temperature and rainfall), erodibility factors (based on land use, lithology, and morphology of the basin) and physical basin factors (based on surface area, average slope, perimeter, average elevation, and hydrographic network). In the present study, the EPM method has been applied in different geographic contest (Apennine, Alpine and Andean basins). All parameters were calculated using specific analysis. This was necessary to reduce the subjectivity of the input data. The meteo-climatic factors were calculated on the basis of a correlation function between the altitude and the mean annual rainfall/average temperature. For the erodibility factors calculation, several geo-mechanical analysis and analysis of weathering grade of rocky mass were performed. The physical basin factors were determined by using the best resolution data input (cells size of DEM 5/10 m).
The results were compared to long-term sediment yield data from two permanent monitoring station located in the Rio Cordon (Alpine Basin) and Estero Morales (Chilean Basin), and with estimates of silting of dams, located in the Alpine Arc and along the Southern Apennines. Overall, results from various semi-quantitative models used to estimate sediment loss, are known for their tendency to overestimate the output data. For this reason, a connectivity GIS-based index has been applied, which describes the connection between the sediment along the slopes and the hydrographic network (Connectivity Index). In this way, the basin is divided into: 1) areas capable of producing sediment and, 2) areas where the sediment is deposited, thus identifying the real quantity of sediment that reaches the closing section of the basin.
The sediment yield values provided by the calibrated EPM model are in line with the real estimates of the sediment production measured in the field. The correlation coefficient (R2) between the sediment yield (EPM Model) and the real estimation is equal to 0,92. This demonstrated the efficiency of our revised model.