Geophysical Research Abstracts,
Vol. 11, EGU2009-11880, 2009
EGU General Assembly 2009

Sediment budgets across different scales

O. Cerdan (1), M. Delmas (1,2), and LT. Pak (3)

(1) Bureau de Recherches Géologiques et Minières, ARN MSO, Orleans, France (o.cerdan@brgm.fr), (2) UPM, Paris VI, France, (3) INRA, LISAH, Montpellier, france

Processes controlling sediment redistribution, and particularly surface runoff and soil erosion, are mainly described and known from local scale studies. When studying larger scales as catchments that constitute the natural hydrological unit, the question on how processes at one scale can be linked to processes operating at other scales remains open. No cross-scale investigation has already permitted to transfer from a scale to another the physical processes describing the sediment redistribution. At the global scale, the sediment budgets have been developed to predict the sediment exports to the oceans and to allow an estimation of current flux importance at continental scale, based on elementary units corresponding to large river basins. The scale effect is often expressed by the fact that only a part of the eroded materials within the landscape reaches the outlet of the considered river basin. In a given context, it is indeed generally reported that SSY (specific sediment yield) declines as the catchment area increases. Runoff coefficients, which correspond to the ratio of surface runoff to rainfall, also dramatically decrease with scale. In temperate cultivated environments, observed variations can range from 30-50% for experimental plots to less than 1% for a large river basin. Therefore, a catchment surface runoff budget cannot be considered as the sum of individual field budgets. Processes can emerge with scale such as water drainage in karst areas and transmission losses in stream channel. In addition to the fact that new processes can occur, decreasing trend of runoff coefficients and sediment delivery ratios from the field or hillslope to the catchment scale can also be explained by the spatial configuration of hydrological response units and their connection to the flow network system. The relative positioning and the connectivity between areas producing surface runoff/erosion and the infiltrating/deposition areas can represent the link between field and catchment scales. Concerning erosion, one explanation is that erosion rates variation is due to the emergence of new processes of water and sediment production and transfer when moving from an homogeneous hydrological/topographical unit (erosion rates ca. 10^2-103 t.ha-1.yr-1) to an heterogeneous catchment (erosion rates less than 100 t.ha-1.yr-1). For example, at the local scale in upstream areas, only the splash effect, i.e. the raindrop impact, causes soil particles detachment whereas at the catchment scale, overland flow dynamic is also responsible for detachment of sediments leading to rill and interrill, and eventually gully erosion. During this talk, we will try to illustrate observed differences between sediment budgets carried out at different scales on the basis of different experiments and database gathered in an European context.