Geophysical Research Abstracts
Vol. 15, EGU2013-3233, 2013
EGU General Assembly 2013

Mapping connectivity for modelling catchment scale runoff and sediment yield

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Recent developments in hydrology and geomorphology include the connectivity principle, which describes how different elements in a landscape are connected and how water and matter moves between these elements. So far, studies on connectivity have been mainly of a conceptual nature, while studies that map, quantitatively establish relations, and model water and sediment transport in connectivity are rare.

This study aimed at developing a new method for mapping connectivity within agricultural catchments. The method, which is a combination of traditional geomorphological field mapping and GIS was applied to two agricultural catchments in Navarre, Spain. The areas were divided into compartments which have a certain degree of connectivity to the river, which can either be diffuse e.g. into the riparian zone, or direct by e.g. man-made ditches and divers, or a combination of the two. These compartments were identified by mapping individual parcels and other land use units and then subdividing these according to the topography within the units. In addition, sediment sources and sinks were mapped, as well as connectivity inhibiting and promoting features such as changes in slope, changes in vegetation cover, ploughing direction and depressions.

In further studies, graph theory will be used to convert the developed maps into graphs containing the different compartments and pathways, where graph edges represent the compartments and nodes(vertices) represent the pathways. These graphs will be used in a connectivity model that is able to predict locations of sediment sources and sinks and sediment quantities for events with different antecedent conditions, e.g. soil moisture and vegetation cover as well as different event magnitudes. The main model input will consists of the graph containing the compartments and pathways and their corresponding properties.

We will present the method and results of the mapping methods in the two agricultural catchments as well as outlining the methods for graph creation and model development.