Mapping regional soil water erosion risk in the Brittany-Loire basin for water management agency

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Soil water erosion is one of the main degradation processes that affect soils through the removal of soil particles from the surface. The impacts for environment and agricultural areas are diverse, such as water pollution, crop yield depression, organic matter loss and reduction in water storage capacity. There is therefore a strong need to produce maps at the regional scale to help environmental policy makers and soil and water management bodies to mitigate the effect of water and soil pollution.

Our approach aims to model and map soil erosion risk at regional scale (155 000 km^2) and high spatial resolution (50 m) in the Brittany – Loire basin. The factors responsible for soil erosion are different according to the spatial and time scales considered. The regional scale entails challenges about homogeneous data sets availability, spatial resolution of results, various erosion processes and agricultural practices. We chose to improve the MESALES model (Le Bissonnais et al., 2002) to map soil erosion risk, because it was developed specifically for water erosion in agricultural fields in temperate areas. The MESALES model consists in a decision tree which gives for each combination of factors the corresponding class of soil erosion risk. Four factors that determine soil erosion risk are considered: soils, land cover, climate and topography. The first main improvement of the model consists in using newly available datasets that are more accurate than the initial ones. The datasets used cover all the study area homogeneously. Soil dataset has a 1/1 000 000 scale and attributes such as texture, soil type, rock fragment and parent material are used. The climate dataset has a spatial resolution of 8 km and a temporal resolution of mm/day for 12 years. Elevation dataset has a spatial resolution of 50 m. Three different land cover datasets are used where the finest spatial resolution is 50 m over three years. Using these datasets, four erosion factors are characterized and quantified: the soil factors (soil sealing, erodibility and runoff), the rate of land cover over three years for each season and for 77 land use classes, the topographic factor (slope and drainage area) and the climate hazard (seasonal amount and rainfall erosivity). These modifications of the original MESALES model allow to better represent erosion risk for arable and bare land. We validated model results by stakeholder consultations and meetings over all the study area. The model has finally been modified taking into account validation results.

Results are provided with a spatial resolution of 1 km, and then integrated into 2121 catchments. An erosion risk map for each season and an annual erosion risk map are produced. These new maps allow to organize in hierarchy 2121 catchments into three erosion risk classes. In the annual erosion risk map, 347 catchments have the highest erosion risk, which corresponds to 16 % of total Brittany-Loire basin area. Water management agency now uses these maps to identify priority areas and to plan specific preservation practices.