Geo-statistical model of Rainfall erosivity by using high temporal resolution precipitation data in Europe

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Rainfall erosivity (R-factor) is among the 6 input factors in estimating soil erosion risk by using the empirical Revised Universal Soil Loss Equation (RUSLE). R-factor is a driving force for soil erosion modelling and potentially can be used in flood risk assessments, landslides susceptibility, post-fire damage assessment, application of agricultural management practices and climate change modelling. The rainfall erosivity is extremely difficult to model at large scale (national, European) due to lack of high temporal resolution precipitation data which cover long-time series. In most cases, R-factor is estimated based on empirical equations which take into account precipitation volume.

The Rainfall Erosivity Database on the European Scale (REDES) is the output of an extensive data collection of high resolution precipitation data in the 28 Member States of the European Union plus Switzerland taking place during 2013-2014 in collaboration with national meteorological/environmental services. Due to different temporal resolutions of the data (5, 10, 15, 30, 60 minutes), conversion equations have been applied in order to homogenise the database at 30-minutes interval. The 1,541 stations included in REDES have been interpolated using the Gaussian Process Regression (GPR) model using as covariates the climatic data (monthly precipitation, monthly temperature, wettest/driest month) from WorldClim Database, Digital Elevation Model and latitude/longitude. GPR has been selected among other candidate models (GAM, Regression Kriging) due the best performance both in cross validation (R^2=0.63) and in fitting dataset (R^2=0.72). The highest uncertainty has been noticed in Northwestern Scotland, North Sweden and Finland due to limited number of stations in REDES. Also, in highlands such as Alpine arch and Pyrenees the diversity of environmental features forced relatively high uncertainty.

The rainfall erosivity map of Europe available at 500m resolution plus the standard error and the erosivity density (Rainfall erosivity per mm of precipitation) are available in the European Soil Data Centre (ESDAC). The highest erosivity has been found in the mediterrean countries (Italy, Western Greece, Spain, Northern Portugal), South Austria, Slovenia, Croatia and Western United Kingdom.