Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10386, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10386
EGU General Assembly 2008

Temporal dynamics of runoff and erosion risk in a cultivated catchment of the loess belt: temporal patterns of rainfall and evolution of soil surface state

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Erosion susceptibility is a function of the overlap of two distributions, the driving force of erosion (rainfall and induced runoff) and the system resistance (erodibility). This study investigated the seasonality of erosion susceptibility of a small catchment (94 ha) representative of the intensely cultivated loess areas of the European Loess belt. The temporal distribution of erosivity was analysed based on the rainfall data collected over 14 years (March 1992 - February 2006). The rainfall events identified by 4 parameters (rainfall amount, rainfall duration, 48-h antecendent rainfall amount, rainfall maximum 5 min intensity) were first classified in three groups using a clustering tool. The three groups included a group of ordinary events characterized by low values of all parameters, a group of events occurring in wet conditions and a group of major thunderstorms. The distribution of the three groups of rainfall events throughout the year and the distribution of the recurrence periods of the rainfall events throughout the year were examined. We could delineate four statistically independent periods with different erosivity. The temporal distribution of the erodibility of the catchment was subsequently considered using the data on the soil surface state measured during the period from September 1993 to June 1995. The temporal evolution of the soil surface crusting, soil roughness, and vegetation cover along with the cumulative precipitation were used to define five periods with different erodibility. These periods did not match the periods identified for rainfall erosivity and the periods of maximum erosivity and

erodibility did not coincide. To evaluate the relevance of these observations and analyses, erosion susceptibility was finally addressed based on the storm-flow coefficients measured in the catchment over the period from September 1993 to June 1995. Runoff and erosion risk was maximum in October and January and minimum in summer. It was clearly shown that significant runoff events only occurred during the periods when both erosivity and erodibility were maximum, which represent about 15% of the year. These results will help to target when the implementation of conservation measures will be most effective throughout the year. This study also offers interesting perspectives for continuous modelling of past periods. Based on the seasonality of erosion sensibility that was defined it makes possible to simulate representative storms during representative periods of different erosion susceptibility.