Geophysical Research Abstracts
Vol. 12, EGU2010-7084, 2010
EGU General Assembly 2010

Estimating rainfall erosivity from daily precipitation records in Campania region (Southern Italy)

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The assessment of rainfall erosivity, as defined by the RUSLE R-factor, depends on availability of sub-hourly rainfall intensity time-series which are seldom available for a significant temporal extent. Even in areas where significant sub-hourly time-series have been recorded, their spatial distribution is too coarse to be interpolated with an acceptable level of uncertainty.

We present a four-parameter model for estimating monthly values of the R-factor (R_i) from mean values of the maximum daily rainfall (d_i) and accumulated rainfall (m_i) in each *i-th* month of the year. The model has been calibrated and validated by using sub-hourly rainfall data from a set of 110 automatic raingauges which have been operating for more than 8 years in Campania Region (Southern Italy).

R_i values are estimated by power functions of d_i and m_i, scaled by a two-parameter periodic function. This periodic function has been specifically designed to account for the meteorological conditions affecting the temporal variability of R_i across the year in Mediterranean regions.

R_i is mainly controlled by the occurrence of single rainfall events of high intensity and short duration within each month and is highly correlated with the average value of the maximum hourly rainfall of the month (h_i). Both R_i and h_i exhibit marked peak values in September, while d_i and m_i are relatively more uniformly distributed across the rainy season, from September to April.

Meteorological conditions in late summer and early autumn enhance the occurrence of convective storms, characterized by high intensity and short duration, which drop almost the entire rainfall depth observed in one month. In the rest of the rainy season rainfall events are characterized by longer duration and lower average rainfall intensity. Thus the functional relation between R_i and (d_i, m_i) changes from one month to the other. The model simulates this inter-monthly variability by the periodic scaling function.

Tests have been performed in the calibration and validation stages, to verify the model efficiency not only at monthly scale, but also at seasonal and annual scales.