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Identifying erosive periods by using RUSLE factors in mountain fields of the Central Spanish Pyrenees

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Abstract. The Mediterranean environment is characterized by strong temporal variations in rainfall volume and intensity, soil moisture and vegetation cover along the year. These factors play a key role on soil erosion. The aim of this work is to identify different erosive periods in function of the temporal changes in rainfall and runoff characteristics (erosivity, maximum intensity and number of erosive events), soil properties (soil erodibility in relation to freeze-thaw processes and soil moisture content) and current tillage practices in a set of agricultural fields in a mountainous area of the Central Pyrenees in NE Spain. To this purpose the rainfall and runoff erosivity (*R*), the soil erodibility (*K*) and the cover-management (*C*) factors of the empirical RUSLE soil loss model were used. The *R*, *K* and *C* factors were calculated at monthly scale. The first erosive period extends from July to October and presents the highest values of erosivity (87.8 MJ mm ha^{-1} h^{-1}), maximum rainfall intensity (22.3 mm h^{-1}) and monthly soil erosion (0.25 Mg ha^{-1} $month^{-1}$) with the minimum values of duration of erosive storms, freeze-thaw cycles, soil moisture content and soil erodibility (0.007 Mg h MJ^{-1} mm^{-1}). This period includes the harvesting and the plowing tillage practices. The second erosive period has a duration of two months, from May to June, and presents the lowest total and monthly soil losses (0.10 Mg ha^{-1} $month^{-1}$) that correspond to the maximum protection of the soil by the crop-cover (C factor = 0.05) due to the maximum stage of the growing season and intermediate values of rainfall and runoff erosivity, maximum rainfall intensity and soil erodibility. The third erosive period extends from November to April and has the minimum values of rainfall erosivity (17.5 MJ mm ha^{-1} h^{-1}) and maximum rainfall intensity (6.0 mm h^{-1}) with the highest number of freeze-thaw cycles, soil moisture content and soil erodibility (0.021 Mg h MJ^{-1} mm^{-1}) that explain the high value of monthly soil loss (0.24 Mg ha^{-1} $month^{-1}$). The interactions between the rainfall erosivity, soil erodibility, and cover-management factors explain the similar predicted soil losses for the first and the third erosive periods in spite of the strong temporal differences in the values of the three RUSLE factors. The estimated value of annual soil loss with the RUSLE model (3.34 Mg ha^{-1} yr^{-1}) was lower than the measured value with ^{137}Cs (5.38 Mg ha^{-1} yr^{-1}) due to the low values of precipitation recorded during the studied period. To optimize agricultural practices and to promote sustainable strategies for the preservation of fragile Mediterranean agrosystems it is necessary to delay plowing till October, especially in dryland agriculture regions. Thus, the protective role of the crop residues will extend until

September when the greatest rainfall occurs together with the highest runoff erosivity and soil losses.

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