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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assessing the sources of uncertainty associated with the calculation of rainfall kinetic energy and the erosivity $\vec{R}$ factor. Application to the Upper Llobregat Basin, NE Spain" *by* G. Catari et al.

Anonymous Referee #1

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General remarks

The aim of the paper is to analyse the diverse sources of uncertainty in the estimation of the rainfall erosivity and the USLE R factor for a mountainous river basin. Five sources of uncertainty are investigated: i) uncertainty on the rainfall intensity measured by the typing-bucket rain gauge

ii) the efficiency of the exponential kinetic energy-intensity relationship (Kinnell; 1981) to estimate kinetic energy

iii) the efficiency of the regressions between daily rainfall erosivity and daily rainfall depth used to upscale rainfall erosivity from sub hourly to daily values

iv) the temporal variability of annual rainfall erosivity values

v) the spatial variability of annual rainfall erosivity values

This research topic is certainly of interest to the readers of Hydrology & Earth System Sciences. This paper provides valuable information on the uncertainty associated to the USLE R factor and would be helpful for incorporating uncertainties of USLE outputs when applied to the Upper Llobregat basin.

Nevertheless, I provide below some additional technical remarks that merit further attention and that suggest some minor revisions.

Specific remarks

P. 3454, line 6: "updates of the Kinnel (1981) equation". For the clarity of the abstract I suggest that the updates (i.e. Mc Gregor et al. (1985)) should be mentioned in the abstract.

P. 3454, line 10: Rainfall erosivity maps were estimated from the stations values using Thiessen polygons. The choice of such spatial interpolation should be motivated. How the interpolation differs if we consider the inverse distance or the squared of the inverse distance for estimating distribution of the spatial rainfall erosivity ?

P. 3455, line 12: The R factor is derived from I30 and the total kinetic energy of the storm. In this study which criteria is considered to define and to separate rain events?

P. 3455, line 19: " . . . continuous electromechanical, optical or microwave disdrometers (Joss and Waldvogel, 1967)". The reference cited refers to electromechanical devices but not to optical or microwave disdrometers.

P. 3457, lines 23-25: The location of the Vallcebre station is such that during winter, solid precipitation (snow, hail) would be observed. How such events are considered in your analysis ? Is the typing bucket rain gauge equipped with an heating system to accelerate the melting of the snow ?

P. 3458, eq. (2): Brackets are missing. The denominator should be (t – (to. n))

P. 3459, lines 1-2. Possible and relevant errors on the daily precipitation provided by the INM stations are mentioned but not taken into account. For a complete uncertainty approach, it is needed that those errors are considered or at least estimated.

P. 3459, line 10. " . . . specific kinetic energy per unit time . . . and may be analytically derived from the classic ones" The specific kinetic energy per unit time is not derived analytically from the classic one. The two KE-forms are related each other through the rain intensity. And it was shown that when establishing empirical relationships between rain kinetic energy and rain intensity from measured drop size distribution kinetic energy per unit of time is more appropriated (see Salles et al., 2002 cited in the manuscript).

P. 3459, line 25. It is not clear to me the meaning of this sentence : " Diverse published graphs of the relationships observed between Ekd and intensity, from diverse sites around the world, were examined." Which kind of examination did you perform ? You should develop on this point. Hence, do the sites (location, climate, level, . . .) cited in table 2 are close to the conditions in the llobregat basin ?

P. 3460, line 9. The assumption of log-normal distribution of the point measurement of kinetic energy has to be justified.

P. 3463, line 19. The value of 519 mm/h for the rain intensity seems unrealistic. From table 2, the range of observed intensities does not exceed 228.6 mm/h. Attend to extrapolate to higher intensity is quite "risky".

P. 3463, line 21. "relative dispersion is minimal for high-intenity . . .". This is the con-

sequence of equation (3); Ekd is approaching an asymptote, emax, at high intensities. If one considers the various relationshiphs between Ke and I from the literature, the dispersion is not minimal at high intensities (e.g. Salles et al., fig 2a).

P. 3465, line 6. The fitted relationships between daily rainfall depth and daily rainfall erosivity (eqs. (6) and (7))were obtained from the scatterplot reported figs. 5a and 5b. The daily rainfall erosivity is known with a given uncertainty as this is the daily values of storm erosivity. Does this uncertainty is taken into account for the dertermiantion of eqs. (6) and (7) parameters . If not, how the uncertainties on the daily rainfall erosivity could be taken into account?

P. 3466, line 20. Better estimates of the event rainfall erosivity could also be obtained from direct measurement of the rain kinetic energy. See as example the promising impactometer of Licznar et al. (2008)

References cited :

P. Licznar, J. Lomotowski, S. Blonski, G.J. Ciach, 2008 :Microprocessor Field Impactometer Calibration: Do We Measure Drops' Momentum or Their Kinetic Energy?, Journal of Atmospheric and Oceanic Technology, 25(5), pp. 742 – 753

Salles, C., Poesen, J., and Sempere-Torres, D., 2002: Kinetic energy of rain and its functional relationship with intensity, J. Hydrol., 257(1–4), 256–270

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