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# Estimation of event rainfall erosivity from weather radar data in a burnt area

Qinggaozi Zhu (1) and Xihua Yang (2)

(1) University of Technology Sydney, School of Life Sciences, Australia (qinggaozi.zhu@uts.edu.au), (2) New South Wales Office of Environment and Heritage, PO Box A290 Sydney South, NSW 1232, Australia

Rainfall characteristics drive water erosion processes, change in runoff flow paths and impact all stages of hillslope erosion processes: detachment, transport and deposition. Rainfall erosivity is an important factor (R factor) in the revised universal soil loss equation (RUSLE). It is estimated as the sum of the product of all rainfall kinetic energies (E) and the maximum 30-min intensity (I30) of rainfall events, or in combination EI30 during a one-year period. Previous studies mainly focused on the estimation of the R factor for prediction of the mean annual or long-term soil losses. However, many applications require EI30 values at a much higher temporal resolution, such as post-fire soil erosion monitoring, which requires a time step at storm events or on a daily basis immediately after wildfire.

Severe wildfires are recognized as an inducement that potentially increases the rainfall erosivity due to the canopy loss. In this study, we explored the use of radar rainfall data to estimate the storm event-based and daily EI30 after a catastrophic wildfire in Warrumbungle National Park in eastern Australia. The radar-derived rainfall data were calibrated against twelve tipping bucket rain gauges across an area of 239 km2 and the time series rainfall erosivity maps were produced at a daily step since the wildfire ravaged in Jan 2013. The radar-derived daily rainfall shows good agreement with the gauge measurements (R2 = 0.75, RMSE = 8.05, Ec = 0.66). Daily EI30 derived from adjusted radar rainfall has a good to strong correlation (coefficient = 1.10, R2 = 0.69, Ec = 0.63) with that based on gauge measurements. The maximum EI30 from rain gauges was estimated as high as 827 MJ mm ha-1 hr-1 for a single storm event. The 1st February 2013 storm event was predicted with a peak EI30 value of 728 MJ mm ha-1 hr-1 from radar data in the burnt area, which accounts for 37.6% of the total rainfall erosivity. In contrast, less than 5% of annul total rainfall occurring during such storm event (45.1 mm). Meanwhile, rainfall erosivity is highly seasonal with 43.7% of the total erosivity occurring in three summer months (December, January and February).

Weather radar rainfall data can be used to derive timely EI30, monitor the high-risk areas and erosion information for fire incident management and erosion control. Nevertheless, comparing to the radar-based EI30, The performance of daily gauge-based EI30 is apparently better when considering the soil plots measurement. The methodology developed in this study is general, thus readily applicable to other areas as long as the weather radar data are available.

Keywords: weather radar, rainfall erosivity, EI30, storm events, post-fire erosion