Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2018-94-AC3, 2019

Earth Surface Dynamics Discussions

Interactive comment on "Rainfall intensity bursts and the erosion of soils: an analysis highlighting the need for high temporal resolution rainfall data for research under current and future climates" *by* David L. Dunkerley

David Dunkerley

david.dunkerley@monash.edu

Received and published: 11 March 2019

I sincerely thank both anonymous referees for undertaking reviews of my manuscript and for their insightful comments. I hope that I have been able to improve the paper in light of these comments. In the following, I have attempted to identify the principal comments in order, and provide a response to each.

Comments from Referee 2

C: spatial intermittency should be considered as well as temporal intermittency R: I

thank the referee for this comment. I had not neglected spatial issues, but eliminated any discussion of this (apart from the section discussing post-fire erosion, where the spatial extent of intense rain is highlighted) as being beyond the scope of the paper. However, I have inserted some additional text to highlight this issue in a new Section 4.4 in the Discussion of the revised paper.

C: Comparing ITTs with buckets of differing capacity. R: It would certainly be preferable had both tipping buckets had the same capacity. However, the FG site was set up more than 17 years ago, and the rain gauge installed at that site, which has been retained since its installation, had a 0.5 mm bucket capacity. I have tried to make the difference in data resolution clear in the discussion of ITTs, in which shorter ITTs can sensibly be analysed for the MM site (0.2 mm bucket capacity) than at the FG site. The different sensitivities at the two field sites is certainly not ideal.

C: Modified Julian dates (MJDs) are unhelpful to read in Figures etc. R: It is very difficult to represent intensity variations using Gregorian calendar dates with the resolution that can easily be achieved using MJDs. Gregorian dates would need to specify separately year, month, day, hour, minute, and second at tick marks along the time axis of Figures, which is difficult to achieve. Appreciating that MJDs are difficult to interpret, I have modified all of the Figures to show the start and end dates of each rainfall event in the Gregorian system. There are online conversion tools that can also assist here, such as the MDJ to Gregorian converter at http://www.csgnetwork.com/julianmodifdateconv.html.

C: Tables 2 and 3 are difficult to understand. R: As noted above in the response to Referee #1, these Tables have been removed and replaced by Figures.

C: Regarding the threshold of 'extreme' rainfall R: This has been corrected to show the 20 mm h-1 criterion of Tokay & Short (1996).

C: what is the goal of increasing the temporal resolution? R: The argument presented in the paper is that hourly data, for instance, sacrifice too much intensity resolution for studying the influence of intensity on many landsurface processes. My view is that

since event data loggers can readily store unaggregated tip event data, that this should be more widely collected and retained, rather than data that have been temporally aggregated. The sensitivity of tipping-bucket gauges is of course itself limited owing to the time required to fill the buckets, but this provides a good reason for wishing to avoid an additional loss of temporal resolution. The point about the need to also consider spatial resolution is very pertinent, though collecting the required data will be difficult. For specialised field research sites, at least, such as those involving soil runoff and erosion plots, or small fields, a 'point' where the character of the rainfall is known from high-resolution rainfall data, in sufficient detail to resolve intensity bursts, may often be sufficient. For whole catchment studies, the challenge of acquiring adequate spatio-temporal data resolution is a daunting one.

C: minor errors: Missing Peters & Chistensen (2002) reference etc. R: all of the minor errors listed have been corrected; the Peters and Christensen reference has been added.

C: Can the three graphs of original Fig. 2 be combined into a single Figure? R: This seems an excellent suggestion, but having attempted to do this, I found that it was not really achievable. The three intensity peaks are coincident in time, and this causes the curves to lie closely on top of each other. Additionally, the intensity of the data aggregated to 1 h are very small (commonly less than 2 mm h-1) and on the vertical scale required to show the unaggregated data (which extends to > 200 mm h-1) the 1 h data become unreadable. Using a log scale for the intensity axis radically alters the apparent character of the intensity brusts. I have therefore retained the layout of the original Figure, but with the Gregorian dates added to the time access (in addition to the Modified Julian Day numbers) as an aid to readability.

Interactive comment on Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2018-94, 2019.