Interactive comment on “Temporal and spatial scale and positional effects on rain erosivity derived from contiguous rain data” by F. K. Fischer et al.

Anonymous Referee #1
Excellent paper on very interesting and actual topic. There is wide discussion about application of various rain data sources for determination of rain erosivity for application within USLE, but there are very few papers, dealing with this topic on relevant level. And even less information about possible corrections and expected errors and problems. What I appreciate a lot is data set size – number of stations, area included and duration of the study (number of events recorded and included). I have no comments or requests to change or add anything from scientific point of view – on this point I strongly recommend for publication.

We appreciate the encouraging comments

I only have several minor comments to formal presentation of the paper – to be possibly more clear to the readers or/and easily understandable – as such statistic studies are always difficult to interpret to someone, who did not study the certain problem deeply.

Introduction: potential recent data sources are well discussed – (gauging stations networks and meteo-radars) also including their accuracy.

To be fair, I would appreciate also short discussion of accuracy and potential errors occurring on gauging stations. There are for sure errors in records, especially during extreme stormy events given by tipping bucket, by capacity of drainage pipe (if this type of gauging station is used), etc. It also depends a lot on type of device used. Also, there is modern recent method now for rainfall parameters estimation using commercial microwave links. I fully understand that these data are not analyzed within this paper, but they should at least be mentioned in Introduction part.

We added reference to commercial microwave links in the discussion (not in the introduction).

“…The same is true for using data of commercial microwave links, which recently have been identified as additional source for retrieving precipitation (Chwala et al., 2012; Overeem et al., 2013) and which will require the method effect to be adapted for this particular approach. The approach is based on analysing the signal attenuation that depends on rain intensity. These data are especially valuable in regions with sparse coverage by conventional measurement devices like, e.g., in parts of the African continent, but may also improve high resolution precipitation estimates and forecasts in hydrometeorological applications (Chwala et al., 2016).”

Regarding accuracy and potential errors at gauging stations we added to the new Chapter 2.1 Data sets:

“Precipitation measurements of the DWD station network were conducted with Pluvio Ott weighing rain gauges (OTT Hydromet GmbH, Kempten, Germany) with a collector area of 200 cm^2, a measurement range of 0-1800 mm/h, and a 1-minute resolution of 0.1 mm/h. The precipitation data passed a quality control system testing for completeness, carrying out climatological tests, checking consistency over time as well as internal and spatial consistency (Spengler, 2002; Kaspar, 2013). The data were neither corrected for wind drift effects nor homogenized. A thorough overview of the precision of rain gauge measurements

is given in Monesi et al (2009). Information on the stations' meta data can be found in the Climate Data Center (ftp://ftp-cdc.dwd.de/pub/CDC/observations_germany/climate/hourly/precipitation/historical/) of DWD."

We also expanded the description of the radar data by adding:

"The DWD radar network underwent several upgrades during the analysis period. In the beginning of the considered time period five single-polarization systems (DWSR-88C, AeroBase Group Inc., Manassas, USA) operated without Doppler filter the latter being added between 2001 and 2004. Between 2009 and today, DWD exchanged the network of C-band single-polarization systems of the next generation of type METEOR 360 AC (Gematronik, Neuss, Germany) and DWSR-2501 (Enterprise Electronics Corporation, Enterprise, USA) by modern dual-polarization C-band systems of type DWSR-5001C/SDP-CE (Enterprise Electronics Corporation), all equipped with Doppler filter. During the time of exchange, a portable interim radar system of type DWSR-5001C was installed at some of sites.
Radar data underwent an operational quality control system. They were adjusted to gauge data within a reprocessing suite applying a consistent software version (version 2017.002) and optimized quality control algorithms (Winterrath et al., 2017)."

Hypothesis formulation are relevant and clear. They are relatively trivial – and expectable – therefore I would appreciate possibly to more clearly state if those are research questions, which shall be answered in Conclusions and Discussion.

We added at the bottom of the Introduction:
"We will quantify these effects and discuss their implications."

Chapter 2 – to be clearer, I would recommend to characterize at least briefly goal and basic scheme of analyses planned (done) of the research in the beginning of the chapter. It is then described later – but reader is a bit confused by overview of methodology, but not knowing, which data will then be used and why actually.

We added at the beginning of chapter 2 a sup-chapter "2.1 Data sets" in which we describe the data and for which question we will use the data. We removed the respective information from the following chapters in order to avoid repetition and increase in manuscript length.

Chapter 2.2, section 15 – there is a bit confusing for me discrepancy between 16 years (duration of whole experiment = data record ?) and four years for 12 rainfall gauging stations within 1 km2. Can be explained better ?

Due to the rearrangement of information in a sub-chapter "2.1 Data sets" it should be clearer now that these are independent data sets. The long-term data were taken from a long-term observation network while the 4-yr data of high spatial resolution (12 recording rain gauges within 1 km^2) stem from a research project that did not last longer. Globally, there are hardly any other rain gauge data of similar density available.

Basic description of gauging stations (equipment) and analyzed data shall be performed to clarify number of rising associated questions – from both of gauging stations and from radars. Were rainfall data from gauging stations treated, corrected, filled gaps,…. ? Time resolution and other data characteristics, …basic statistics of the data set should be performed (really all the stations measured all the time for whole 16 years ?). Is there consistency in equipment ? (=all the stations had same equipment during whole period ?)

We added an extensive description to the new Chapter 2.1 Data sets (see above)

Figure 1 – relation between sections B and C is not really clearly described. Why Thiessen polygons were used and not some smooth interpolation polygons ?

We added:
"A previous geostatistical analysis of the spatial pattern had shown that erosive rains recorded by the dense network followed near-linear trends between neighboring rain gauges (Fiener and Auerswald 2009; see also Fig. 1b for an example). From this follows that the spatial pattern can be retrieved best by linear interpolation between the rain gauge sites. The spatial average of a linear interpolation is mathematically identical to the well-known Thiessen polygons. We thus used Thiessen polygons for calculation of the spatial average because they are mathematically simpler as they lead to a constant weighting for the different stations irrespective of the recorded amount of rain. They also can easily be illustrated (Fig. 1c)."

Generally – all my recommendations are just minor in importance and formal to clarify the analyses performed and I appreciate the paper as a whole a lot.