Comment on essd-2020-370

Anonymous Referee #1

Referee comment on "Rainfall erosivity mapping over mainland China based on high density hourly rainfall records" by Tianyu Yue et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2020-370-RC1, 2021

Dear Editor

The editorial support team

Copernicus Publications

Hello

I am thankful to you for allowing me to review ESSD manuscript. The present MS targeted the calculation of R factor for China using high resolution data. The work was a good and tedious one and I liked it. However, I am against its acceptance for publication thanks to many deficits and ambiguities found in the context and made it unclear in many aspects.

The big issue refers to the rationale of the work.

The formulation of the research setup needs more strong rationale particularly in the viewpoint of agreement with real conditions.

No proper reviewing of literatures with further focuses on the main goals of the study and recent none-Chinese ones has been made.

It has no detailed and documented information on methodology.

It has no comprehensive and integrated discussion.

According to the comments mentioned above and some comments, revisions or suggestions appended in the context, I therefore suggest resubmitting a new and substantially improved MS. My all comments and suggestions have been annotated in the reviewed file as an attachment.

Responses to reviewer #1

Dear Editors and Reviewer

Thank you for your letter and the reviewer's comments concerning our manuscript "Rainfall erosivity mapping over mainland China based on high density hourly rainfall records" (ESSD-2020-370). The comments are valuable and helpful for revising and improving our paper. We have considered and addressed all the comments carefully. We have responded to each of the reviewers' comments in blue:

Line 12: "1-in-10-year". Use common unit?? For instance 10 % probability or 10 years return period!!

Response: "1-in-10-year" is a common term to describe extreme event with an annual exceedance probability of 10%. In fact, in the RUSLE Guideline (Renard et al., 1997), an expression of 10-yr EI was used (p. 31).

Line 15: "1-in-10-year". Why this one??

Response: As mentioned in Line 41, the 1-in-10-year EI_{30} is a required parameter when the support practice factor (P factor) for the contour farming is estimated in the USLE-type model. (Renard et al., 1997)

Line 16: “the R factor”. Is it a "mean value"? Fix it!!

Response: Yes, the rainfall erosivity factor (R factor) in the USLE is the average annual total EI_{30} of all erosive events, which was defined in Line 35-36.

Line 17: “New maps indicated current maps existed an underestimation for most of the southeastern areas and an overestimation for most of the middle and western areas.” How did you assess??

Response: As described in section 2.4, the R factor and the 1-in-10-year EI_{30} maps from Yin et al. (2019) were taken as the reference value for current maps and Section 3.1 assessed the accuracy of new maps developed in this study and those in Yin et al. (2019) by comparing the R factor and 1-in-10-year EI_{30} values with those calculated from 1-min observed rainfall data.

Line 19: “accuracy from 19.4% to 15.9% in the”. It worth of you properly address the former comment!!

Response: Rainfall erovisity values in the current maps from Yin et al. (2019) were overestimated for some regions, while underestimated for others by comparison with the true values from 1-min rainfall data. This sentence focuses on the degree of improvement by comparing the new maps with the old ones from Yin et al. (2019).

Line 21: “the increase of data resolution from daily data to hourly data”. How valuable this approach is for practical purposes and in reality??

Response: There are generally two ways to improve the accuracy of the rainfall erosivity maps: one is to increase the temporal resolution of the data (from daily to hourly); the other is to increase the station density (add more stations, especially in sparse density area). There are usually not many stations with long-term hourly observations (say > 30 years). However, with the installation of automatic weather stations, hourly data are becoming more widely available, and this may be supplemented with satellite-based precipitation data at hourly and sub-hourly intervals. This study presents and shares datasets on the rainfall erosivity based on more than 2000 stations of hourly rainfall observations.

Line 22: “increase of the number of stations from 744 to 2381”. How necessary it is?? Reword it.

Response: As it was pointed out in Section 3.3.2, the improvement from increasing the number of stations from 744 to 2381 occurred mainly in western regions with a station density of 27.3~71.9 stations per million km^2. The station density in the eastern China (90.5~152.5 stations per million km2) has been adequate to describe the spatial variation of the R factor and the 1-in-10-year $EI_{30,}$ which resulted in a small improvement from tripling and quadrupling station density (Table 6). We will revise the sentence in the revision to make it clearer.

Line 24: “$10 \cdot 10^3$ km^2 1 station”. Why you try to use strange presentation and writing??

Response: We will revise this as “1 station every 10,000 km^2”.

Line 26: “Soil erosion has been the major threat to soil health, soil and river ecosystem services in many regions of the world.” Document it!!

Response: References will be added in the revised version to document it.

Line 28: “The reduction of crop production due to erosion has been estimated to be 0.4% per year on a global scale (FAO, 2019b)” Since the erosion rates are not influenced by R factor only, it is not therefore necessary to focus on soil erosion issues and related problems!! So, please remove or shorten it!!

Response: We will remove this sentence in the revised version.

Line 40: “To acquire soil erodibility factor (K factor) and cover-management factor (C factor), the seasonal distribution of EI (monthly, Wischmeier and Smith, 1965; or half-month percentage of EI, Renard, 1997, Wischmeier and Smith, 1978) were needed.” Remove unnecessary materials. The ones who work in this field they know what for R factor is being utilized!!

Response: We generate the R-factor value, its seasonal distribution at half-monthly resolution, and extreme 1-in-10-year storm erosivity so that RUSLE can be applied in a manner that is consistent to RUSLE Guideline (Renard et al., 1997).

Line 41: “The other is the 1-in-10-year storm”. It is not globally accepted!! It is better to provide general results and outputs. However, necessary conversions will be done by end users!!

Response: The 1-in-10-year EI_{30} is an extreme value of event EI_{30}, which is different from the average value of rainfall erosivity (the R factor). Also, it is a requirement in the USLE-type models, therefore, we generate not only R factor but also 1-in-10-year EI_{30} maps. What climate-related factors to be used for erosion prediction is subject to debate. This paper on a data product is all about enabling the application of the RUSLE in a consistent manner.

Line 46-50: The latest literatures would be given!! Even Panagos et al. (2017) would have been cited!!

Response: Panagos et al. (2017) and more latest literatures will be added in the revision.

Line 55: Here, again you have gone back to soil erosion and indispensability of erosivity factor!!

Response: This sentence will be removed in the revision.

Line 65: “which were recorded by simple rain gauges and readily available.” Add “data” at the end.

Response: We will make it more clear in the revision.

Line 67: “Breakpoint data and 1-min data are the best”. Who said so??

Response: The true value of KE should be calculated by the distributions of raindrop sizes measured by distrometers, which are not easy to obtain for long periods. Fortunately, there is a good relationship between kinetic energy KE and the instant intensity I, so KE was estimated based on KE-I relationship using breakpoint data in USLE and RUSLE. One-minute interval data are the finest resolution data measured by automatic tipping bucket rain gauges we can obtain up to now. Therefore, breakpoint data and 1-min data are the best datasets for deriving precipitation intensity and estimating rainfall erosivity given the absence of raindrop sizes observations. We will make it clearer in the revision.

Line 72: “The study of (Yin et al., 2019) was chosen”. Should be “The study of Yin et al. (2019)

was chosen".
Response: We will revise the manuscript accordingly.

Line 73: "New R factor and 1-in-10-year EI_{30} maps were produced in this study may improve the estimation of the soil loss in mainland China." You have worked on R factor and therefore not allowed concluding soil loss or soil erosion rates!!
Response: Quality estimates of the R-factor would allow improved erosion prediction using the RUSLE technology.

Table 1: How these interpolation techniques have been matched??
Response: We agree that these interpolation techniques were not matched. After further confirmation, we will revise the "Contour mapping" into" unknown", the "Kriging" method by Zhang et al. (2003) and Liu et al. (2013) into "Ordinary Kriging".

Line 89: "Observation was suspended in the snowy season". How did you do it??
Response: As mentioned in Line 97-99, if the observations were suspended in cold season, precipitation occurred during this period of time were not included in this study for the following two reasons: (1) Stations with missing observations in cold season were mostly distributed in the northern part of China, where the climate is usually dry in winter due to the monsoon system; (2) Usually the precipitation in cold season was in the form of snow other than rain.

Figure 1: How this gap region was managed??
Response: This region was interpolated with Universal Kriging. We agree that a lack of stations in this region would bring about large uncertainty in the estimation of rainfall erosivity in this region. We will discuss this limitation in the revision.

Figure 2: Same issue!! Lack of station!!
Response: It is true that station densities in Tibetan Plateau and southern Xinjiang are limited, especially for 1-min resolution data. There are large areas without any observation due to its high elevation in Tibetan Plateau and great desert in southern Xinjiang. The evaluation based on 1-min data does not cover these areas without observations in this study. We will discuss this limitation in the revision.

Line 119: "period of >= 6 hours of non-precipitation was regarded as the separation of two rainfall storms". This criterion has to be adjusted for the study region!!
Response: Minimum inter-event time (MIT) is an index used to delineate independent storms from sub-daily rainfall records. An individual storm is defined as a period of rainfall with preceding and succeeding dry periods less than MIT. To be comparable with Wischmeier and Smith (1978), and (Renard et al., 1997), 6 hrs was adopted as the MIT in this study.

Line 120: "amount of >= 12 mm". Do not think it would be too much??
Response: We do not want to be too creative here, just to use ULSE/RUSLE guideline to be consistent. Some storms with total precipitation amount less than 12 mm but with high intensity and short duration may result in soil loss, whereas some storms with total precipitation amount more

than 12 mm but with low intensity may not result in soil loss. As Xie et al. (2002) pointed out, in practice, it is impossible to separate erosive and non–erosive rainfalls completely based on only one or two threshold values because of the complexity of rainfall characteristics and temporal variations in the system response in terms of runoff and soil loss. Xie et al. (2002) identified the erosive rainfall threshold that storms actually caused erosion were omitted from the calculations, while certain storms that do not cause erosion were included in the calculations in order to balance those omitted. In the study, rainfall and runoff data measured for three plots and a small watershed from 1961 to 1969 at the Zizhou experimental station of the Yellow River Basin in China were used. The erosive rainfall amount threshold proposed by Xie et al. (2002) was 12 mm, which was very close to the threshold suggested in the USLE (12.7 mm).

Line 123: "intensity I_{30} (mm h^{-1})". How sure you are that it is the best index??
Response: Wischmeier and Smith (1958) analyzed precipitation and soil loss data from fallow plots at three observation stations in Missouri, Iowa, and Wisconsin and identified that the event EI_{30}, the product value of total storm kinetic energy (E) and its maximum 30-min intensity (I_{30}), estimated the single storm soil erosion best. Wischmeier (1959) analyzed approximately 8000 plot-years of basic runoff, soil loss, and associated precipitation and related data in 21 states in the eastern part of the United States gathered by the National Runoff and Soil Loss Data Center from the erosion stations that were operating at that time. They confirmed the R factor's suitability at these locations, not only for fallow plots but also for continuous row crop plots, and not only for storm-to-storm variation but also for seasonal and yearly variations.

Line 123: "1-hour intensity H_{60} (mm h^{-1})". It is strange!! What for it was??
Response: For hourly data, it cannot calculate I_{30} directly. When there is only hourly precipitation data available, product of the kinetic energy, E, and the maximum 1-hour intensity, H_{60}, in the storm was used to calculate the storm rainfall erosivity, which was then adjusted by multiplying a conversion factor proposed in Yue et al. (2020) to be comparable with EI_{30} based on breakpoint data or 1-min interval data.

Line 132 (equation 5): Still I am not convinced!!
Response: Yue et al. (2020) showed that the R factor calculated by 1-min rainfall data had a good linear relationship with that estimated by 1-hour data based on rainfall data at 1-min intervals from 62 stations over China. The determination coefficient R^2 was 0.994. The slope of the regression model (1.871) can be regarded as a conversion factor to obtain the R factor using hourly data.

Line 150: "The effective years of hourly data were no less than those of daily data (37% of the stations)". On which basis??
Response: We will revise the sentence into ' The effective years of hourly data were less than those of daily data for a majority of stations included in this study (1510 out of 2381 stations)'.

Line 153: "then adjusted by the mean annual rainfall calculated by daily data". How this equation has been attested??
Response: The equation was based on an exponential relationship between the mean annual rainfall

and the R factor, the relationship (the exponent) was calibrated based on the 1-min and daily data at 35 stations in China (Fig. 2 in the manuscript). We will add the accuracy of this method in the revised version.

Line 162 (equation 9): The entire investigation hinges on a set of recessive equations and models developed by formers which certainly leads to an cumulative errors or uncertainties for which no justification has been provided!!!
Response: The model was calibrated using the rainfall data of China. And we will add the efficiency of this method in the revised version.

Line 226: "3.1 Accuracy evaluation on erosivity maps" It seems to be precision rather accuracy!!
Response: Accuracy is how close a measurement/estimation is to the correct value for that measurement. The precision of a measurement system refers to how close the agreement is between repeated measurements (which are repeated under the same conditions). We think it is accuracy here in this study.

Line 230: "particularly noticeable for western China". Where limited stations are available!!
Response: We agree that limited stations were used in western China to estimate and evaluate the rainfall erosivity. More stations have been used for western China in this study compared with previous studies, which improved the accuracy of rainfall erosivity estimation for this region.

Figure 3: It seems to me senseless!!
Response: The scatterplot shows R factor values estimated in this study and those from the previous study (Yin et al., 2019) with those calculated based on 1-min interval data, which was assumed to be the true values of rainfall erosivity. The figure and Table 2 in the manuscript showed for the R factor, the values in the map of Yin et al. (2019) were underestimated where the R factor was relatively high, and overestimated where the R factor was relatively low. R factor values estimated in this study had smaller error comparing with those in Yin et al. (2019).

Figure 4(c): What do you imply from??
Response: Figure 4(c) shows the distribution of the relative errors of the 1-in-10-year EI_{30} for this study and Yin et al. (2019) by comparing them with true values based on 1-min precipitation data. It indicated that the relative errors in this study concentrated in the range of -20%~20%, whereas those in Yin et al. (2019) concentrated in the range of 15%~30% and -20%~40%, which were larger than those in this study. More explanations will be added in the revision to make the implication of the figure clearer.

Figure 5: Any map has to contain important places and localities!!
Response: We will add them in the revised version.

Figure 6: How reliable these differences are??
Response: Figure 6 shows the differences between R factor and the 1-in-10-year EI30 in this study comparing with the previous study (Yin et al., 2019). An independent dataset (62 stations with 1-minute data) was used to evaluate the accuracy of two groups of maps. Figure 3, 4 and Table 2

demonstrated the results of comparison. It is true that most of 62 stations distributed in the eastern part of China, where most water erosion occurs. The uncertainty in western areas with limited observations is large and we will discuss it in the revision.

Figure 7: Firstly, the former comments and inquires have to be addressed!!
Response: We will address them in the revision.

Line 303: "3.3.3 Contribution of the interpolation method" Is it really contribution?? Title it properly!!
Response: We will revise it into "Effect of the interpolation method".

Figure 9: To me they are not comparable, since each has been developed for a particular purpose and with a specific resolution!!
Response: The erosivity map proposed by Panagos et al. (2017) is for a global scale and it has provided a good basis for the comparison of rainfall erosivity among different regions in the world. Mainly due to the number of observation stations obtained, two studies showed some differences. It is suggested to use the R factor map in this study for China since independent 1-min precipitation dataset has been used to show that maps in this study outperform those from Panagos et al. (2017).

Conclusions: Avoid repetition of results and abstract!!
Response: We will revise this section.

References: Cite new literatures and particularly from 2021!!
Response: We submitted this manuscript in 2020 and will add new works of literature in the coming revised version.

References

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