Reviewer #1

Responses from the authors and the revised manuscript have indicated that considerable effort was made to address the reviewers' concerns. The fundamental issue with record length (9 years) leads to question whether the mean annual erosivity should really be called the R-factor for erosion prediction especially for areas of high interannual climate variability. I would therefore suggest that authors should not state that a new R-factor map is created for China using 1-min rainfall data, instead just say that this is a data product of mean annual rainfall erosivity using 1-min data from 60,000+ stations for a period of 9 years (2014-2022).

Response: Thank you for your advice.

The title has been revised to: "Gridded Rainfall Erosivity (2014-2022) in Mainland China Using 1-Minute Precipitation Data from Densely Distributed Weather Stations." The corresponding sections in the text have also been updated accordingly. Please refer to Lines 1, 81-84, 117, 123, 125, 155, 156, 169, 163, 164, 167, 169, 170, 178, 192, 193, 197, 201, 211, 215, 226, 231, 232, 272, 273 in the revised manuscript.

Reviewer#2

Dear editor,

Thank your for inviting me to review this manuscript. After checking the response letter and the revised manuscript, I conclude that the authors has addressed most concerns of the two referees. Thus, the manuscript can basically be accepted for publication.

Nonetheless, I would suggest the authors 1) provide the information about the source of the rainfall data used in this study (which organization or data center) and how to get this rainfall database; 2) upload the calculated site-level rainfall erosivity to an open-accessed data hub.

Response: Thanks for your advises.

1) The 1-miniute precipitation data were provided by the National Meteorological Information Center (NMIC) for the China Meteorological Administration (http://data.cma.cn/) (Lines 290-291). You can contact the NMIC to inquire about the specific process for obtaining relevant materials.

2) We have released two sets of mean annual rainfall erosivity data for mainland China (https://doi.org/10.11888/Terre.tpdc.301206). One set is generated directly from station-based rainfall erosivity values in China, although it contains some missing values in certain regions. The other set is generated using multi-source precipitation data and spatial interpolation method. In the Dawang–Chayu area of the southern Tibetan Plateau, the mean annual rainfall erosivity value are derived from hourly ERA5 reanalysis data (Chen et al., 2022). For other regions in China, the mean annual rainfall erosivity values are calculated from ground-based observations and then interpolated using the Kriging method to produce a national dataset. Users can select the type of rainfall erosivity data they need based on their specific requirements.

Revewer#3

The authors have provided reasonable responses. However, they only refer to the line numbers in the revised manuscript instead of copy/pasting the text updates verbatim into the response report. As such, it was rather inconvenient having to go back and forth between the revised manuscript and their responses just to check the updated/revised text.

Response: Apologies for the inconvenience caused.

•The authors added r^2 and RMSE metrics in their cross-comparisons. Add the Bias/Mean Error as this will give a quantitative idea on the overall over- or under-estimation (visually/qualitatively, it appears that Yue et al. (2022) overestimates the R-factor compared to your estimates while Panagos et al.'s (2017) estimates are more or less in line with yours).

Response: We have added the Bias in Figure 5 in the revised manuscript (Line 210). The details are as follows:

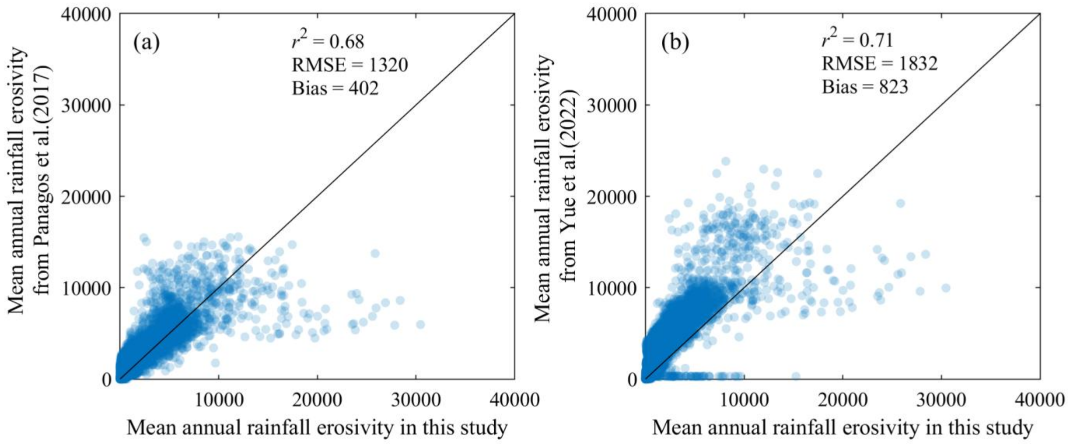
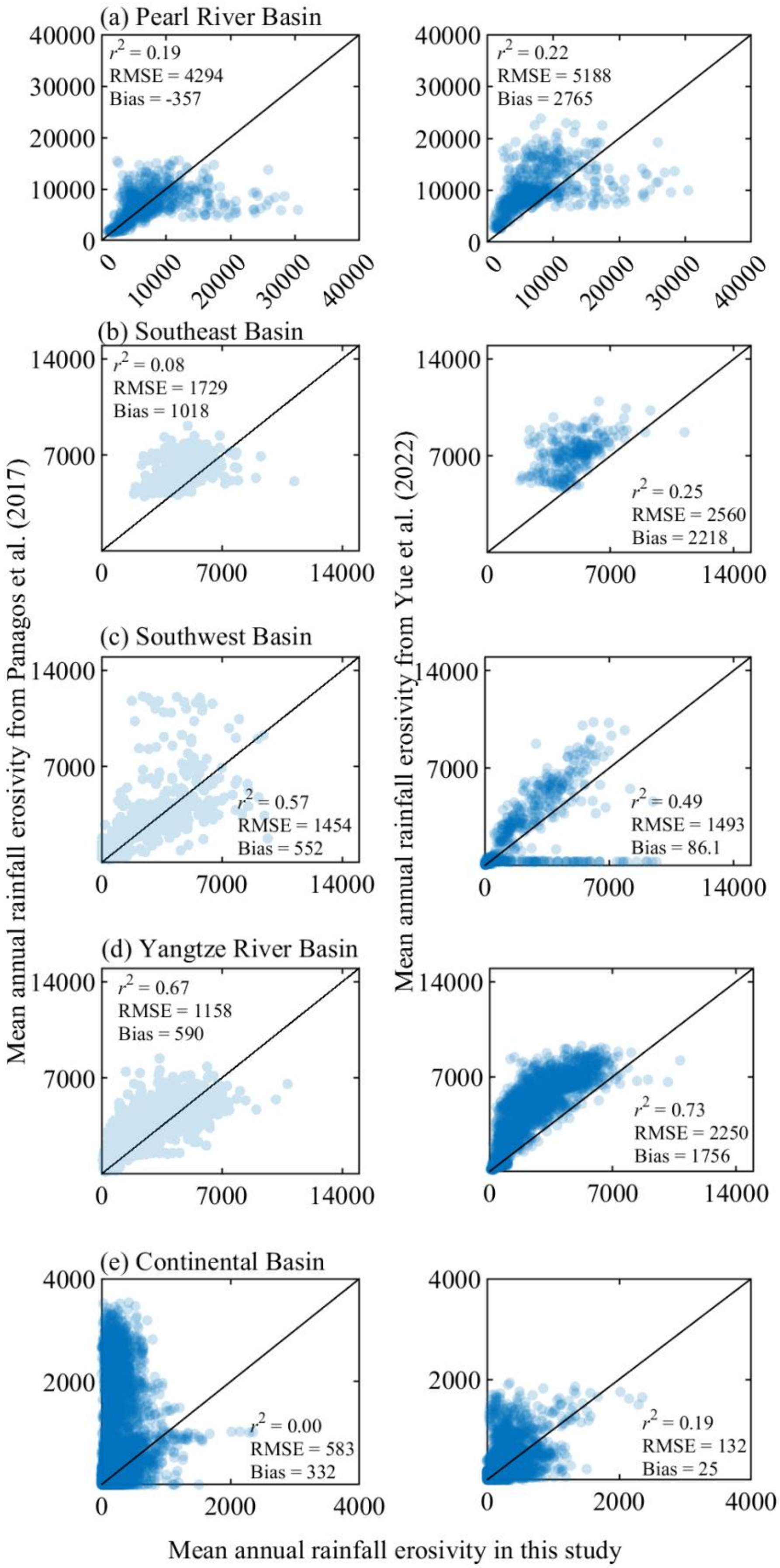


Figure 5: Comparisons between the newly developed mean annual rainfall erosivity map and existing maps (Panagos et al., 2017; Yue et al., 2022) (Unit: $MJ \cdot mm \cdot ha^{-1} \cdot h^{-1} \cdot yr^{-1}$).

•In addition, either add: 1) separate plots (similar to Figure5) for each of the 9 basins delineated in Figure6a, OR 2) a table compiling the cross-comparison performance metrics (r^2, rmse, bias) over the 9 basins.

Response: We have compared the performances of different rainfall erosivity maps by basin in Figure S1 of the Supplementary materials. The details are as follows:



(a) Pearl River Basin
r2 = 0.19
RMSE = 4294
Bias = -357
r2 = 0.22
RMSE = 5188
Bias = 2765
(b) Southeast Basin
r2 = 0.08
RMSE = 1729
Bias = 1018
r2 = 0.25
RMSE = 2560
Bias = 2218
(c) Southwest Basin
r2 = 0.57
RMSE = 1454
Bias = 552
r2 = 0.49
RMSE = 1493
Bias = 86.1
(d) Yangtze River Basin
r2 = 0.67
RMSE = 1158
Bias = 590
r2 = 0.73
RMSE = 2250
Bias = 1756
(e) Continental Basin
r2 = 0.00
RMSE = 583
Bias = 332
r2 = 0.19
RMSE = 132
Bias = 25
Mean annual rainfall erosivity from Panagos et al. (2017)
Mean annual rainfall erosivity from Yue et al. (2022)
Mean annual rainfall erosivity in this study

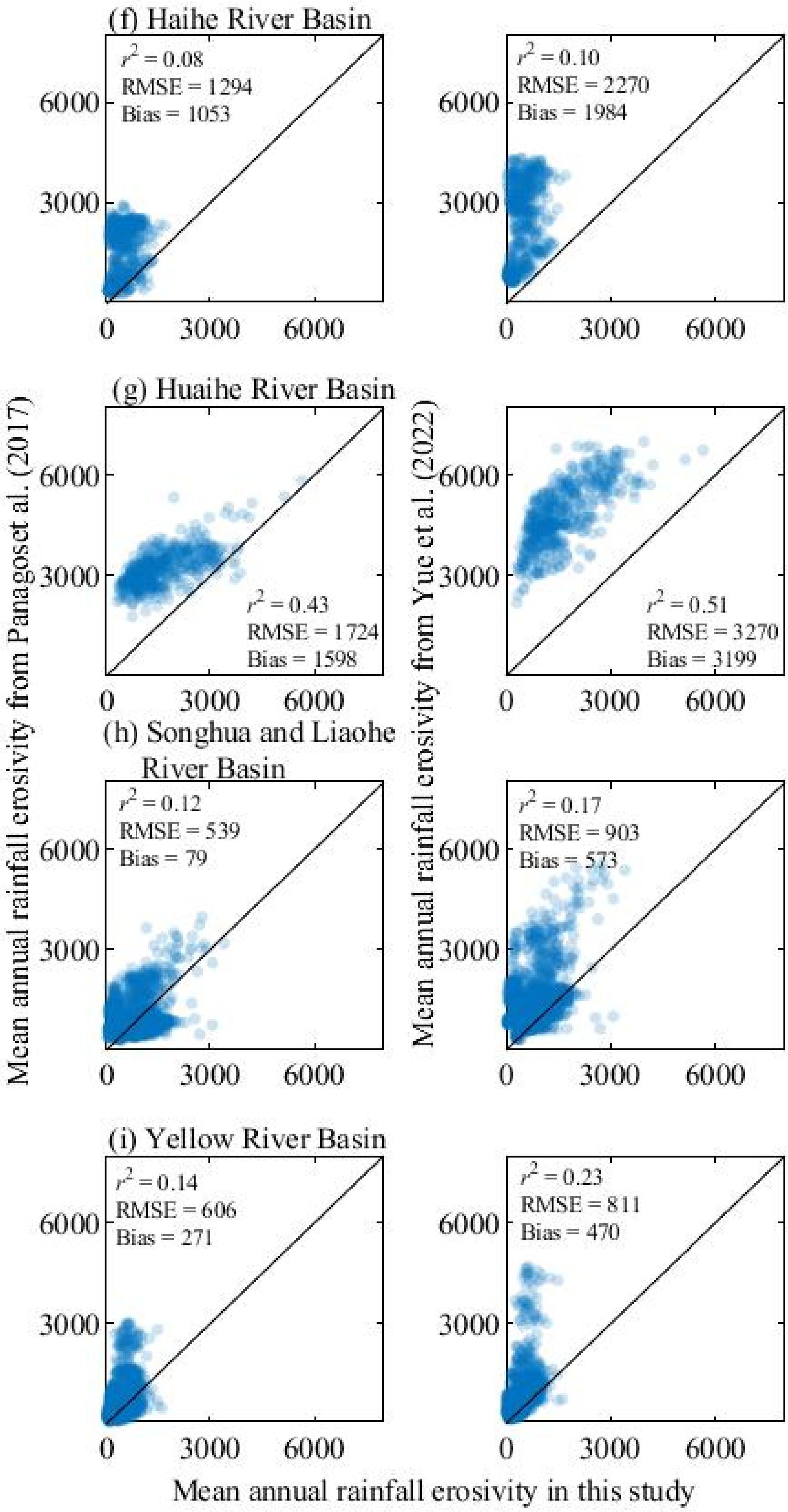


Figure S1. Comparisons between the newly developed mean annual rainfall erosivity map and existing maps (Panagos et al., 2017; Yue et al., 2022) by basin (Unit: MJ • mm • ha^{-1} • h^{-1} • yr^{-1}).

• Ensure that **units** are included where relevant. For example, in Figure 5, the R-factor units [MJ.mm/ha/hr/yr] are missing in the plot labels as well as in the performance metrics (RMSE, Bias(to be added)); Figure 6b … also some double closing brackets appear in the y_labels in Figure5, i.e. ~(2017)), ~(2022)).

Response: Given that the unit is somewhat long, we have included the unit in the caption of figure 5 in the revised manuscript. The labels of Figure 5 has also been revised (Line 210). The figure5 has shown in the response for Question 1.

• I could not find the figure with the *R* factor maps generated using the different spatial interpolation methods (Spline, IDW, Kriging) in the revised manuscript. Add it somewhere (say, in the appendix or in a supplementary document).

Response: This figure has been added in the supplementary document (Line 410). The details are as follows:

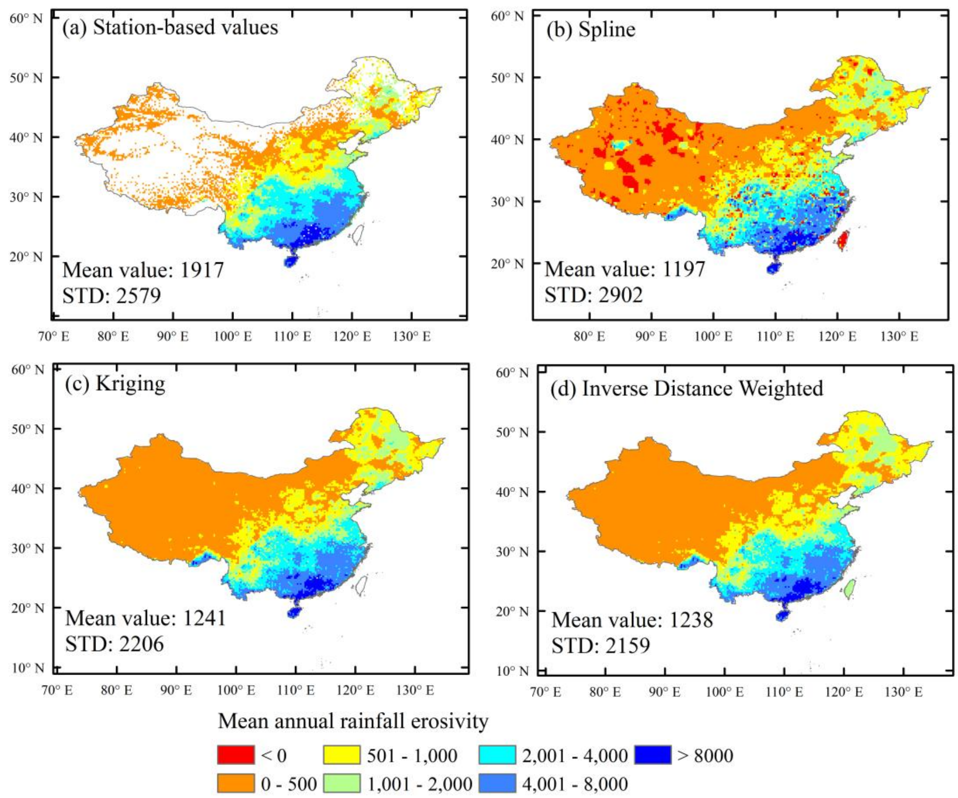


Figure S2. (a) Station-based mean annual rainfall erosivity map for mainland China; mean annual rainfall erosivity map generated using the Spline interpolation method (b), the Kriging interpolation method (c) and the Inverse Distance Weighted interpolation method (d) (Unit: $MJ \cdot mm \cdot ha^{-1} \cdot h^{-1} \cdot yr^{-1}$). STD represents the standard deviation.

It is interesting to see that Spline has a larger spatial spread (as quantified by the standard deviation-STD, i.e. 2902) compared to IDW [2159] and Kriging [2206]. Spline also appears to provide more variability/non-homogeneity, especially in the northwest region where 1-minute data are missing. Could the authors comment on this?

Response: Kriging interpolation is a geostatistical method that uses spatial autocorrelation to estimate values at unknown locations. The IDW method assigns different weights to nearby data points based on the inverse of their distances. Spline interpolation is a method that uses smooth polynomial functions to generate smooth curves or surfaces.

Compared to the first two interpolation methods, the density and distribution of data points significantly affect the performance of Spline interpolation. If the distance between data points is large, the Spline method may “stretch” the curve or surface, resulting in interpolation values that do not match the actual data (such as negative values). Therefore, Spline interpolation performs well when the distances between data points are small and the changes are relatively smooth. However, it is less effective when point data are sparse.

Remember to add the *R* factor units to the mean and STD values presented within the plots. Also, add the ‘Mean value’ and ‘STD’ for map “(a) Station-based R factor” with the missing data pixels/grids ignored.
Response: The mean value and standard deviation (STD) are shown in Figure S2a. The unit has explained in the figure caption.

• Again, not sure why the newly added “Table 1 Comparison of *data and methods* used to generate R factor maps” is placed in the “Results” section instead of the “Data and methods” section where it is better suited. Move it to section 2.1.2.
Response: Table 1 has been removed to Section 2.1.1 in the revised manuscript (Line 131).

• Since they possibly missed it, could the authors comment on: “Also, how did the authors reconcile the 0.25deg resolution of your grids (see section 2.1.1) with the 0.5deg CMA grid in your comparative analyses?”
Response: Although approximately 57% of all grids in mainland China have in-situ precipitation observations on a national scale, we remain concerned about the potential presence of high annual rainfall erosivity values in areas with limited 1-minute data.
Since annual rainfall erosivity has a strong positive correlation with annual precipitation, we used the CMA gridded precipitation data to identify regions with high mean annual precipitation but no 1-minute records, rather than using it to calculate rainfall erosivity. Therefore, in this study, we directly used this dataset without altering its spatial resolution.