Dear Shuiqing Yin,

Thank you very much for your helpful comment and your interest in our study. Below, we answer to the points you raised one by one, marked in blue.

Best regards,

Magdalena Uber on behalf of all co-authors

The study proposed the advantage of Convection-Permitting Simulations (CPS) in simulating extreme convective precipitation, which plays an critical role in the soil erosion process. Uber et al. compared rainfall erosivity for the past (1971-2000), present (2001-2019), near future (2031-2060), and far future (2071-2100) periods in the Central European region based on CPS data as well as soil erosion in the Elbe River basin. The study follows in the scope of HESS and the use of CPS data for the estimation and projection of future erosivity is the novelty of the study. Following are the main concerned issues:

- Uber et al. used "CMIP5 driven CPS" to compare with "ERA5 driven CPS" for the evaluation simulation, which can not demonstrate the benefit of CPS in simulating extreme precipitation. High spatial-temporal resolutions of precipitation observations should be used for the purpose.

Apparently, we did not describe the purpose of the ERA5/ERA40 driven evaluation runs sufficiently. The comparison of the CMIP5 driven projection run with the ERA5/ERA40 driven evaluation run was not undertaken to demonstrate the benefit of CPS. Instead, the evaluation run serves as a reference that can be used for different applications: comparisons with other model simulations, with precipitation observations, driving data set for impact models.

We fully agree that CPS model results have to be compared to high resolution precipitation observations. This was done in a quality check routine before data publication and, in more detail, by Rybka et al. (2022). For rainfall erosivity, we compared our results to rainfall erosivity calculated by Auerswald et al., 2019 from high resolution radar precipitation data (Section 3.1.2).

In order to clarify the purpose of the evaluation run, we added the following sentences in the manuscript: "*The evaluation simulation driven with reanalysis data serves as a reference for the historical simulation driven by a global climate model. It quantifies how well the historical climate can be reproduced by the historical simulation and how large the differences of specific climate variables are between both simulations. In addition, Rybka et al. (2022) used the evaluation simulation for a comparison with high resolution observational precipitation data sets to analyze the model performance for extreme precipitation.*" (line 183-187).

- Regression equation based on mean annual precipitation sums can not be used to project future rainfall erosivity for it can not fully reflect the change of daily and hourly precipitation intensity along with the warming climate.

We certainly agree. This was also criticized by reviewer 2 so our answer is the same:

We argue that one of the main advances of using CPS for erosion modelling is that we don't have to rely on regression equations such as Equation 3 anymore. Nonetheless, we think that using Equation 3 also has advantages over using CPS, the main one being that it can easily be applied to (projected) climate data of basically any temporal resolution. In our case, it enables an estimate of changes in rainfall erosivity due to changes in mean annual precipitation from an ensemble of climate models. Thus, variability between climate models can be assessed which is not yet the case for CPS.

Apparently, we did not point this out clear enough in the manuscript. Thus, we changed Figure 6 so that it now includes results showing the bandwidth of the climate model ensemble. Furthermore, we added the following paragraph (line 377-392):

"Furthermore, the changes in rainfall erosivity calculated from convection-permitting climate model output are considerably higher than the ones calculated with the low-resolution approach using mean annual precipitation from model output of conventional regional climate model ensembles (Fig. 6). *This is the case not only when future MAP is obtained from the median of the model ensemble but also for the entire plausible bandwidth of models. Figure 6 shows changes in rainfall erosivity estimated with the 15th and the 85th percentile of the model ensemble. Even though this approach only considers changes in MAP and not changes in rainfall intensity, it allows an estimate of model uncertainty due to the differences between the ensemble members. The results obtained with CPS are outside of the bandwidth of the model ensemble because they also represent changes in extreme precipitation in addition to changes in MAP*."

- This reviewer agrees with the RC2 that the temporal scaling factor of 1.9 is reasonable (Yue et al. (2020) as a reference, Effect of time resolution of rainfall measurements on the erosivity factor in the USLE in China) . Nearing et al. (2017, Rainfall erosivity: An historical review) reported the differences among three KE-I equations in USLE and its revisions, which may be useful for you to discuss differences between your study and Panagos et al. (2015c). Breakpoint or less than 5-min interval observation data are suggested to be obtained for the determination of the scaling factor of the study area.

Thank you very much for the useful references. We included them in the revised manuscript. The temporal scaling factor of 1.9 was obtained for Germany (i.e. the center of the study area) by Fischer et al., 2018 using 1 min resolution rain gauge data.

Of course, differences in KE-I equations are important. Besides Nearing et al., (2017), also Hanel et al. 2016 presented an interesting comparison of 14 different equations.

Following your comment and the one of reviewer 2, we added a paragraph that discusses these issues in the revised manuscript (line 323-347).

- This reviewer agrees with the RC2 that the chapter on future erosion rates for the Elbe River basin is strongly shorten or even deleted. Instead, the study focuses on the projection of rainfall erosivity and fully demonstrates the advantage of CPS data to highlight the novelty.

The parts on soil erosion modelling was deleted as suggested by you and reviewer 2.

References:

Hanel, M., Máca, P., Bašta, P., Vlnas, R., and Pech, P.: The rainfall erosivity factor in the Czech Republic and its uncertainty, HYDROL EARTH SYST SC, 20, 4307-4322, https://doi.org/10.5194/hess-20-4307-2016, 2016b.

Nearing, M. A., Yin, S.-q., Borrelli, P., and Polyakov, V. O.: Rainfall erosivity: An historical review, CATENA, 157, 357-362, https://doi.org/10.1016/j.catena.2017.06.004, 2017.

Rybka, H., Haller, M., Brienen, S., Brauch, J., Früh, B., Junghänel, T., Lengfeld, K., Walter, A., and Winterrath, T.: Convection-permitting climate simulations with COSMO-CLM for Germany: Analysis of present and future daily and sub-daily extreme precipitation, development, METEOROL Z 64, 65, https://doi.org/10.1127/metz/2022/1147, 2022.