Author response to Reviewers of Earth Surface Dynamics Manuscript egusphere-2023-62:

Past anthropogenic land use change caused a regime shift of the fluvial response to Holocene climate change in the Chinese Loess Plateau

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Summary:

The authors would like to thank the Reviewer, Dr. Weimingliu, for the constructive and insightful comments on our manuscript, which were very useful for us to improve the manuscript and its readability.

We carefully revised the manuscript based on the Reviewer's suggestions. The modifications include the information about the KK10 model and the explanations about the evaluation criterion in the calibration processes. In the new version of the manuscript, the comments and suggestions raised by Reviewer are fully considered. We think the modified manuscript can meet reviewer's expectations.

In the following, we discuss in detail all Reviewer's comments and show how we have addressed them in the revised manuscript. Please note that the Reviewer's comments

are in black, our responses are in blue, and the content of the revised manuscript is depicted in a frame.

Legend

RC: Reviewer Comment; AR: Author Response; □: Modified manuscript content

Response to the Referee Weimingliu #2:

RC 1: Line 85: What is KK10? I think authors should add more information about it in the supporting information since it's maybe one of reasons for the sources of sensitivity.

AR 1: Thanks for your comments and suggestions. We have added a brief description about the KK10 scenarios in the Introduction (line 84-87). More information about KK10 model scenarios has been included in the Section 3.1.3 (line 245-257).

(line 84-87) The changes of anthropogenic land use are taken from Kaplan et al. (2010). Their KK10 database provides the anthropogenic land cover change from 8000 years ago to AD 1850, based on a model that relates changes of global population to past land use (Kaplan et al., 2009).

(line 245-257) The changes of anthropogenic land use since the mid-Holocene (Fig. S3) is obtained from the KK10 database, which in turn is calculated from a global ALCC model that is driven by population density and the land suitability (Kaplan et al., 2009, 2011). The land suitability takes into account that agriculture develops first on the most productive crop lands (Kaplan et al., 2009). The used time series of the KK10 model is from 6000 BCE to AD 1850. Because only the provincial data from 221 BCE to AD 1850 (Zhao and Xie, 1988) were available to calibrate the spatial patterns of population changes in China used by Kaplan et al. (2009), there is an uncertainty in the land-use changes in our study region prior to 221 BC. In previous simulations focusing on a tributary, the Beiluo River catchment, Chen et al. (2021) applied a variation of 25% for the ALCC from 6000 BCE to 221 BCE to estimate the impact of this uncertainty. It showed the uncertainty of ALCC had a limited effect on

the simulation results for discharges and sediment loads.

RC 2: Line 184: “model development” seems to be inaccurate in here, and I think “model summary” better sums up Sect 3.1.

AR 2: Thanks for your suggestion. We have changed the title of Sect.3.1 from the “Model development” to the “Model summary”.

RC 3: Line 271: Is there any reason why the authors think that a 10% error is acceptable? In my image it is usually 5%.

AR 3: Thanks for your comment. We chose the 10% error based on our previous simulation work in the Beiluo River (Chen et al., 2021), which is a tributary of Wei River. This also applied in a SPACE model to study the effect of vegetation on soil erosion (Carriere et al., 2019). The predicted errors in the hydrological stations in the Beiluo River are all around 10% (Chen et al., 2021). In the simulation works of Carriere et al. (2019), they used a “leave-one-out” calibration method based on a 23-year dataset. The satisfactory value of predicted error shown in their works is also around 10%. We have added the statement about why the evaluation criterion was chosen in the main text (line 292-295).

(Line 292-295) The calibration results are accepted when the mismatch between the simulated and observed discharges and sediment loads is less than 10%. This evaluation criterion was chosen based on the previous simulation works (Carriere et al., 2019; Chen et al., 2021).