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Hydrology and Earth System Sciences Discussions

Interactive comment on "Impact of climate change on sediment yield in the Mekong River Basin: a case study of the Nam Ou Basin, Lao PDR" *by* B. Shrestha et al.

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Responses to the comments by Reviewers and Editor Title: "Impact of climate change on sediment yield in the Mekong River Basin: a case study of the Nam Ou Basin, Lao PDR"

We are thankful to the Anonymous Reviewers and the Editor for their valuable comments and suggestions on the paper. Below we provide the responses to the comments and questions raised.

Reviewer # 3

Comment 1: The authors present the study area, mainly sandy clay loam, must inform how spatial heterogeneities are distributed across the basin to encompass hydrological behaviors for model's characterization.

Response 1: We thank reviewer for pointing this out. More than 50% of the soil in the basin has sandy clay loam texture. In order to inform the spatial heterogeneity of soil across the basin we will include soil distribution map of the basin in the revised manuscript.

Comment 2: About the database used, a short discussion about the uncertainties carried out to the global scale mapping is very welcome.

Response 2: The use of only one RCM and two emission scenarios is a limitation of the study, which does not address uncertainties in future climate. This has also been pointed out by the other two reviewers. Therefore, we have decided to add a number of other GCMs in the revision. We are considering two or more from CCMA_CGCM3, CNRM_CM3, NCAR_CCSM3, MIROC3.2Hires, GISS_AOM, MPI_ECHAM5. We will update the manuscript accordingly.

Comment 3: From results of Figure 3, calibration period has a total variance explained of 64% and validation period with total variance explained of 74%. The observed and modelled time series approximate well related to total runoff volumes. Some observed flow extremes are not well modeled between year 1994 until year 1997. In this period, seven observed floods are not well modeled. These behaviors could demonstrate some floodplain features not well characterized, i.e. consecutive floodprone areas activated, oxbows or even local occupations which accelerate flows. Some discussions about these regional aspects are appropriate. These local situations are difficult to encompass at the scale of the model used, but they can explain that nested experiments, or multi-scale model approaches, are strongly recommended. Thus R2 and PBIAS can be used at different gauging stations and their inherent uncertainties. All these uncertainty carry into model behaviors which affect modeled sediment transport.

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Interactive Comment

Model's results are good according to the scale used. Thereafter intrinsic uncertainty from rating curves has consequences into (adopted) observed values.

Response 3: The observed flow extremes are not well captured. We attributed this to precipitation data and also errors in the observed streamflow data, especially during high flows which was also noted by Rossi et al. (2009). At the same time, we agree to the reviewer that this might also be due to some floodplain features which are not well characterized by the model. We will certainly discuss these possible causes of poor-match of extreme flows in the revised paper. Calibration of model at different scale can help understand the actual behavior of model as well as basin characteristics and improve the model results for sediment yield. But we were not able to conduct multi-scale model approach because of non-availability of gauging stations in other parts of basin at the scale of the interest. However, we will bring in the nested experiments, or multi-scale model approaches in discussion in the revised paper.

Comment 4: Authors are very encouraged to incorporate a brief discussion on the comparison between the uncertainty of observed values compared to the uncertainty of model outputs.

Response 4: Thanks for the comment. For addressing the uncertainty of model outputs we conducted uncertainty of SWAT model using SUFI-2. Besides uncertainty of model outputs uncertainty of observed data also exists especially in basins like Mekong, where in some part of the basin the observed data is contains erroneous, which might be due to human as well as instrumental errors. Hence we agree to the reviewer to incorporate a brief discussion on the comparison between the uncertainties of observed values compared to model outputs. We will include this discussion in updated version of paper.

Comment 5: To discuss differences in calibration and validation periods, cumulative plots of both observed and modeled discharges can be useful.

Response 5: This is a very good suggestion. We agree that cumulative plots of both

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observed and modeled discharges can be useful in explaining the low as well as high flows variation between the simulated and observed data. We will plot the cumulative discharges and discuss the results in the revised version.

Comment 6: Otherwise, Mannings's "n" value for main channel, with initial value of 0.014, but with fitted parameter value of 0.19 must be better explained. This comment serves for other most sensitive parameters. Not only as a spatially mean value (among all channel reaches) but also in comparison for every channel reach across the basin modeled. Local roughness and spatial discretization in the model can "upscale" local roughness into a broader-scaled effective parameter.

Response 6: We will discuss/explain the fitted parameters, especially most sensitive ones, with respect to initial values and their consequences.

Comment 7: Because variance of future sedimentological outputs and estimated flows derived from climate change runs are not discussed, authors should recommend an heuristic approach for new papers in this research topic. For instance, a new generation of vulnerability index or criteria, related to downscaled regional values, through quantile mapping of empirical downscaling methods, from global models which better explain the variance's transfer related to scale, in order to perform robust hydrological modeling related to river basin resiliency.

Response 7: This was also pointed out by reviewer # 2. Please kindly refer to response 3 for Reviewer # 2. We will also include this point as recommendation for future research.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 3339, 2012.