Comment on hess-2022-51

Anonymous Referee #2

Referee comment on "A snow and glacier hydrological model for large catchments – case study for the Naryn River, central Asia" by Sarah Shannon et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-51-RC2, 2022

The paper is dedicated to an acute problem of development of glacio-hydrological models for the prediction of future changes in river runoff due to deglaciation. The presented study aims to develop a computationally efficient hydrological model that can be applied to large glaciated and snow-fed catchments. The paper is overall well-written and provides interesting results. However, there are few major and several minor recommendations to the authors, stated bellow:

- The description of the DECIPHeR model needs to be extended: what hydrological processes are taken into account, how the water is routed, number of conceptual storages etc.
- A clearer parameters calibration scheme should be added to the methods section. What is the initial and resulting range of the parameters? It is mentioned that degree day factor varies daily in the introduction – it gives the first impression that the values are calibrated for each day separately.
- The 3.1 section provides information on the evaluation and validation period. It seems that for the evaluation the same period as for the calibration was used? It is not quite common. Authors should comment on that.
- It is mentioned on P16 L 337 that the Nash–Sutcliffe efficiency (NSE) is used to evaluate high flows and the timing of peak discharge. Just below that a formula for mean monthly discharges evaluation using NSE metric is given
- Analysis of model performance using the MSC method compared to ISC method for other sub-catchments should be included as well in 3.2.2
- Compare the range in glaciated area prediction with the observed glaciated area
- The positive trend in snow melt and negative trend in rainfall component seems to be consistent over the territory that could be better emphasized in the text
- Discussion should be extended covering following aspects: 1) the 95th percentile simulations in all cases show an asymmetrically larger contribution of the rainfall compared to 5th and 50th percentile, 2)analysis of the importance of including new calibration parameters in the DECIPHeR model. As the model performance seems to be not very sensitive to most of the calibration parameters values (FigS15), 3) comparison of derived contributions of snow melt, glacier melt, rainfall with previous studies

Other minor suggestions and technical corrections are given in the attached pdf file

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2022-51/hess-2022-51-RC2-supplement.pdf