



EGUsphere, referee comment RC2  
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## **Comment on egusphere-2022-657**

Anonymous Referee #2

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Referee comment on "Hydrologic implications of projected changes in rain-on-snow melt for Great Lakes Basin watersheds" by Daniel T. Myers et al., EGU sphere,  
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A representative simulation of ROS melt events is important for improving hydrological modeling practice in snow dominated region. It is valuable to look into the future impact of ROS melt events under climate change. This is exactly what this work intends to address. However, the current manuscript is not yet ready for publication, due to two points :

1. This work utilized a calibrated SWAT ROS model to simulate the hydrological process using CMIP5 climate projections. All analyses are based on the assumption that this calibrated model is representative. However, as described "The SWAT ROS model for the Great Lakes Basin simulated historic streamflow at the daily time step with an NSE of 0.38 (with 29% of stations greater than 0.5) and a dr of 0.62 (Myers et al., 2021b). The model simulated historic snowpack SWE at the daily time step with an MAE of 26 mm", the model cannot be well considered well-calibrated with a low NSE of 0.38 for discharge simulation. Moreover, 26 mm MAE for daily SWE is a considerable high bias in comparison to the SWE value of the study area (e.g. Figure 4). The median SWE value of many months is around 50 mm or lower. GCM climate projections are highly uncertain already. A hydrological model with high bias will make the combination much worse. As a consequence, it is not reasonable to trust the analyses of this work about future climate change impact, even the analysis strategy is comprehensive. Therefore, the authors should implement the climate change investigation based on a reasonably well-calibrated SWAT ROS model. Moreover, detailed information about the rationality of the calibrated SWAT model is necessary but missing. Such information should be properly added to this paper or its supplementary material for its readers. The authors simply cited the paper that developed and evaluated the SWAT ROS model (reference below). But it is not open-access.

Myers, D. T., Ficklin, D. L., and Robeson, S. M.: Incorporating rain-on-snow into the SWAT model results in more accurate simulations of hydrologic extremes, *J. Hydrol.*, 603, 126972, <https://doi.org/10.1016/J.JHYDROL.2021.126972>, 2021b.

2. Future climate projects have large uncertainty. When evaluating climate change impacts, it is more reasonable to discuss the trend or relative changes rather than absolute quantities. The authors should shorten such contents and keep the necessary ones only. Besides, Figure 2 shows different behaviors of climate driving force during different future periods. It would be interesting to investigate the corresponding hydrological signatures of different future periods. Although, as described in section 2.4, the analyses of future period include mid-21st century and late-21st century. Throughout the paper, the result and analysis of late-21st century is almost none. Please complete such missing parts.