Dear editor and reviewers,

Thank you for your thorough review of our manuscript. We sincerely appreciate your comments and constructive suggestions, which helped us improve the quality of our study. We have carefully considered all of your comments and revised the manuscript. The following are point-to-point response to each comment including all relevant changes made in the manuscript.

In addition to these revisions, we have added a funding source that supported our research to the Acknowledgments section.

Editor

Comment 1: The manuscript still lacks insights into the physical processes modeled which should intrinsically linked to the specific characteristics and limitations of the model itself. Specifically, Figure 2 should be revised to clearly explain and link the different modules of the hydrological model.

Response: Thanks for your suggestion. Based on the original discussion, and incorporating your and the reviewers' suggestions, we have added explanations for the limited benefit of increasing data imposed by other driving data (such as evapotranspiration) and model's structure. Furthermore, we reorganized these potential causes and explanations from the perspectives of data-driven factors and model structure, providing evidence from the results of this study and other literature to better reveal how data at different resolutions influence the simulation of hydrological processes.

Figure 2 has been revised and designed as a block diagram that clearly explains and links the different modules of the hydrological model.

Comment 2: The authors clarify, based on the findings of this study, which of these potential reasons might be the most significant and whether there is supporting evidence within this study for these explanations.

Response: Based on the results of this study, among the potential causes listed, the spatial and temporal autocorrelation of the data (as discussed in the first point of the discussion section) could be the primary factor limiting further improvements in model performance. The fundamental value of high-resolution data lies in its ability to provide novel, accurate, and valuable information. The GOUE metric we employed effectively quantifies the additional information contained in actual hourly resolution data compared to data obtained by uniformly resampling daily resolution data to an hourly scale. Among various basin characteristics, GOUE showed the strongest correlation with IMP, indicating that in basins with greater streamflow variability, increased data resolution introduced more detailed and novel information, leading to greater improvements in model performance. The case studies of three representative basins also vividly demonstrate that the ability to enhance model performance critically depends on the introduction of additional effective information through higher-resolution data.

We have revised the wording in the discussion section to highlight this primary cause and its supporting evidence.

Comment 3: In addition, the authors should provide further justification for selecting these three catchments and the corresponding flood events, elaborating on their representativeness.

Response: We have revised the sections in the manuscript related to the selection of representative catchments to more clearly explain the rationale behind their selection and their representativeness. The revised content is as follows:

To better understand how rainfall and streamflow data at different resolutions specifically influence the hydrological simulation results, we selected three representative catchments based on the Hourly Test results (IMP_H) and sensitive factors such as DRA, GOUE and RGA, which were identified as having a significant impact on IMP_H. These catchments were chosen as representative examples specifically due to their following typical characteristics and the distinct patterns they exhibit in hydrological simulation results, providing valuable insights into the influence of data resolution on model performance.

Catchment 1 (Tiantangyan): This catchment, characterized by relatively small DRA, GOUE, and RGA values, showed a significant improvement in simulation results with increased data resolution, as reflected by a large IMP.

Catchment 2 (Saitang): With medium values for DRA, GOUE, and RGA, this catchment demonstrated a gradual improvement in KGE as resolution increased, though the gains were less substantial.

Catchment 3 (Gaoan): As one of the largest catchments in terms of DRA, with relatively large GOUE and RGA, Gaoan exhibited limited improvement in performance with higher-resolution data, as indicated by a smaller IMP.

Reviewer #1

Comment 1: The manuscript still lacks insights into the physical processes modeled. Two examples include snow/glacier dynamics and evapotranspiration. Both processes exhibit significant diurnal and seasonal variations that influence streamflow, depending on factors such as basin size, the presence (or absence) of glaciers, and the distance to outlet points. These factors can affect the choice of the appropriate time step for simulations. For instance, if the model only accounts for daily evapotranspiration while the actual process varies hourly, it becomes clear that the results are limited by the model's inability to capture small temporal-scale variations in evapotranspiration accurately. A similar limitation could apply to snow processes, where finer temporal scales might be critical for realistic simulations.

Response: Thank you sincerely for your valuable advice and the examples you provided. In this study, we focused on the value of rainfall and streamflow data, while the resolution of other auxiliary data used in the model is fixed and relatively coarse. The resolution of other driving data could indeed be one of the factors limiting the further improvement of model performance. Our study catchments are located in southern China, where snowfall is rare, and glaciers are absent. As you pointed out, processes with significant diurnal variations, such as evapotranspiration (currently at a daily resolution), could be a factor constraining the model's ability to improve its performance at finer temporal scales.

Additionally, from a physical process's perspective, the re-infiltration process might also constrain the model's ability to achieve better performance with higher-resolution data. A real watershed acts as a low-pass filter, while hydrological models are simplified representations of actual runoff processes. Localized short-duration heavy rainfall may cause infiltration-excess runoff, but during the surface flow routing process over the hillslope, re-infiltration can occur, leading to slower runoff variations. Although the hydrological model does not explicitly account for re-infiltration, the use of coarse-resolution data effectively performs a "low-pass filtering" function, which can result in comparable or even better performance than when using high-resolution data. Similarly, other hydrological processes that have a smoothing effect on runoff but are not yet accounted for in the model, such as variations in water surface width during channel routing, could also be factors limiting the model's performance when using high-resolution data.

This study focuses on the value of high-resolution rainfall and streamflow data for semi-distributed hydrological models. The influence of above processes may require validation and quantification through a more physically-based hydrological model with higher resolution.

We have reorganized potential reasons from the perspectives of driving data and hydrological processes, and incorporated the above discussion into the revised manuscript's discussion and limitations section.

Comment 2: This observation is closely tied to the following suggestion regarding the figure representing the model. In other words, part of the discussion is, in my view, intrinsically linked to the specific characteristics and limitations of the model itself. I suggest revising Figure 2. The figure should be designed as a block diagram that clearly explains and links the different modules of the hydrological model. The current figure is of poor quality, with some arrows that are not even explained.

Response: Thanks for your suggestion. We have replaced the original Figure 2 with the following diagram to better explain the hydrological processes in the model.

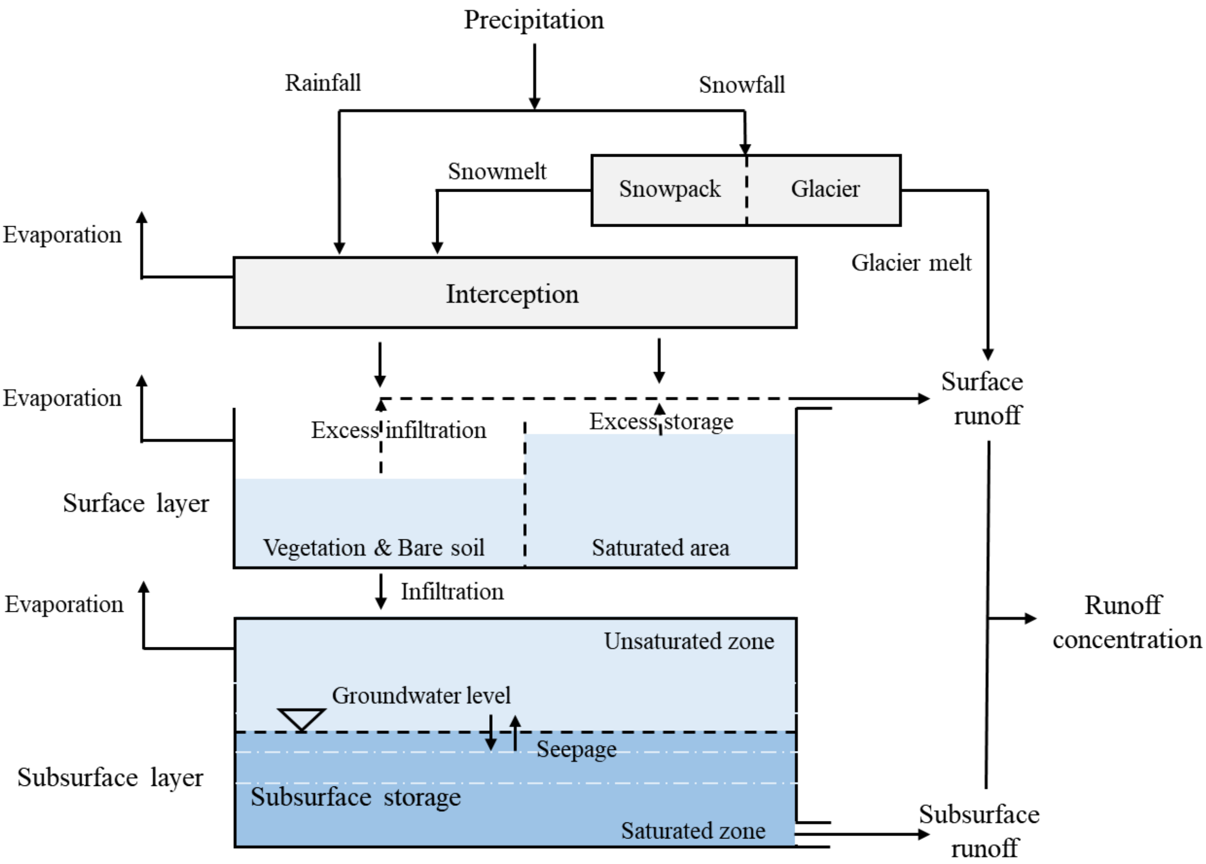

Figure 2. Structural diagram of runoff generation processes in the THREW model

Comment 3: Finally, please update the captions for all tables to clarify the meaning of the * and ** symbols.

Response: Thank you for your suggestion. We have updated the captions for all tables to clarify the meaning of the * and ** symbols.

Reviewer #2

Comment 1: In the discussion section, the authors have presented several potential reasons and explanations for the limited impact of further increasing data resolution on the enhancement of simulation accuracy. Some of these appear to be summaries of findings from existing literature, without providing evidence from the current study. I suggest that the authors clarify, based on the findings of this study, which of these potential reasons might be the most significant and whether there is supporting evidence within this study for these explanations.

Response: Thank you for your suggestion. Based on the results of this study, among the potential causes listed, the spatial and temporal autocorrelation of the data (as discussed in the first point of the discussion section) could be the primary factor limiting further improvements in model performance. The fundamental value of high-resolution data lies in its ability to provide novel, accurate, and valuable information. The GOUE metric we employed effectively quantifies the additional information contained in actual hourly resolution data compared to data obtained by uniformly resampling daily resolution data to an hourly scale. Among various basin characteristics, GOUE showed the strongest correlation with IMP, indicating that in basins with greater streamflow variability, increased data resolution introduced more detailed and novel information, leading to greater improvements in model performance. The case studies of three representative basins also vividly demonstrate that the ability to enhance model performance critically depends on the introduction of additional effective information through higher-resolution data.

We have revised the wording in the discussion section to highlight this primary cause and its supporting evidence.

Comment 2: The paper selected three representative catchments from the total of 63 study catchments to illustrate how data of different resolutions specifically affect simulation accuracy. I recommend that the authors provide further justification for selecting these three catchments and the corresponding flood events, elaborating on their representativeness.

Response: Thank you for your suggestion. We have revised the sections in the manuscript related to the selection of representative catchments to more clearly explain the rationale behind their selection and their representativeness. The revised content is as follows:

To better understand how rainfall and streamflow data at different resolutions specifically influence the hydrological simulation results, we selected three representative catchments based on the Hourly Test results (IMP_H) and sensitive factors such as DRA, GOUE and RGA, which were identified as having a significant impact on IMP_H. These catchments were chosen as representative examples specifically due to their following typical characteristics and the distinct patterns they exhibit in hydrological simulation results, providing valuable insights into the influence of data resolution on model performance.

Catchment 1 (Tiantangyan): This catchment, characterized by relatively small DRA, GOUE, and RGA values, showed a significant improvement in simulation results with increased data resolution, as reflected by a large IMP.

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