Dear Referee #3,

Thank you for providing good comments to improve the manuscript. We are now preparing the revision of the manuscript based on your comments.

Review of *NMP-Hydro 1.0: a C# language and Windows System based Ecohydrological Model Derived from Noah-MP* (https://doi.org/10.5194/gmd-2024-168)

This manuscript describes a version of Noah-MP that has been ported to C# for the purpose of increased user friendliness and efficiency in model development and testing. This version of Noah-MP is consistent with that used in WRF-Hydro 3.0. The authors refer to this new C# version of Noah-MP as NMP-Hydro. In addition to Noah-MP, NMP-Hydro includes a river routing module. The authors present results from NMP-Hydro and WRF-Hydro and determine there are numerical differences between them, though the two frameworks have identical physics. The authors say that the source of these differences may be floating-point errors. Additionally, the authors provide a comparison of NMP-Hydro discharge and observations from a station within the domain. In this comparison, the authors include many configurations of NMP-Hydro with different physics options activated.

I believe this study addresses an important need for more accessible land surface modeling infrastructures, and I would like to see a revised version that addresses the comments below and those from other reviewers. I think there are some major points that need to be addressed before the manuscript is ready for publication.

Reply: Thank you for acknowledging our work.

Specific comments

Lines 43-44: To provide more context, could the authors expand on the ways in which C# is widely used? Also, who is the intended community of users for NMP-Hydro? I ask because many existing users of Noah-MP/WRF-Hydro are comfortable with using these models in Unix/Linux operating systems. Do the authors anticipate that some existing users of Noah-MP/WRF-Hydro will take advantage of the portability and convenience of NMP-Hydro? Do they expect that NMP-Hydro will allow a new community of users to use tools that have traditionally been used by hydrologists and atmospheric scientists? I think widening the accessibility of modeling tools is an important motivation for this work and should be highlighted more in the Introduction.

Reply: This comment is interesting. As a modern programming language, C# is extensively utilized by numerous commercial enterprises in industrial software development and scientific research. According to the TIOBE Programming Community Index for October 2024, C# ranks fifth among major programming languages with a user base of 5.6%, while Fortran ranks ninth with 1.8% of users. It is important to note that the languages preceding C# in popularity are Python, C++, Java, and C.

I believe that some existing users of Noah-MP may be reluctant to transition their working environment to the Windows system. However, many new hydrological researchers, primarily postgraduate students, are not proficient with Linux. They are currently compelled to use Linux because the existing Noah-MP is developed in Fortran under this operating system. If a Windows-based version of Noah-MP were available, it would likely be more appealing to these new researchers. For existing users who are already familiar with Linux, a C#-based Noah-MP could also be attractive. As a modern programming language, C# offers greater user-friendliness, ease of

use, and access to more powerful development tools compared to Fortran. We will present some description in the introduction, according to your comment.

Lines 53-54: Consider replacing "simulation" in these sentences with "component". Using "simulation" is a bit confusing to me. It implies the authors are talking about two different models, but I understand that you are referring to the different components of NMP-Hydro.
Reply: Modified now.

Lines 70-72: The sentence "Additionally, Noah-MP plays a pivotal role in the National Water Model…" can be omitted, since there is a similar sentence in the previous paragraph.
Reply: Corrected.

Table 1 caption: I suggest including information here on how the reader can access the Noah-MP user document (or referring them to another part of the manuscript with these details).
Reply: Now cited to "Gochis, D.J., W. Yu, D.N. Yates, 2015: The WRF-Hydro model technical description and user's guide, version 3.0. NCAR Technical Document. 123 pages."

Table 1: As was suggested by another reviewer, please clarify that Table 1 does not reflect the options currently available in HRLDAS Noah-MP, which many readers will likely be familiar with.
Reply: A sentence is added in the caption: ***Note that these options may not be applicable to other versions of Noah-MP, such as that used in HRLDAS.***

Table 1: I suggest elaborating on the scheme options somewhat, as simply "SIMGM", "SIMTOP", "Koren99", "NYO6", "BATS", etc. may not be very informative for a reader who does not have extensive experience with Noah-MP. The authors don't have to completely explain them, but maybe at least say what the acronyms are referring to and include citations for relevant papers, e.g. "Koren's iteration (Koren et al. 1999)". See Table 1 in He et al. (2023) (also published in GMD) for an example of what I mean.
Reply: We think elaborating these marks is unnecessary here, because these marks/acronyms are used in the namelist file of the original Noah-MP, and why the earlier developers use them is not very clear to us. Most existing Noah-MP users are familiar with these options. If the users want to know the actual meaning of these acronyms, they should read the document of the original Noah-MP other than the description of this study. In other word, we are not responsible for explaining the initial details of Noah-MP.

Line 89: If possible, can the authors include the version number of the Noah-MP version that was ported to C#? This will help the reader understand how it compares to the current community version (5.0).
Reply: Based on your comments, we have changed the version of NMP-Hydro from 1.0 to 3.0, in order to maintain consistency with the original WRF-Hydro 3.0.

Section 3.2: I think this section lacks technical detail of the river routing module. In particular, the four contributions from the authors listed in lines 132-135 need elaboration. What are the scientific bases behind these techniques? What is the motivation for them development? Also, can the authors include a figure to summarize the physics of the river routing module? Please add these details to the text or point the reader to the relevant references.

Reply: The original description here is not very clear, now some small modification has been made. The river routing module is actually a previously published study (Liu et al., 2023), where the details of the module can be found. There is no much physics in the Muskingum-method river routing. The principle is very simple, because the Muskingum method is a traditionally widely used and known one. The main innovation of this module is the new parallelization method other than the physics.

Section 3.3: I think this section could also use more detail. How long were the simulations used to check for bugs in the code? Was debugging done based on output from one grid cell within the larger domain? Please add these details to the text.

Reply: Now the total paragraph is rewritten and more details are described.

Line 198: Should Fig. 3 be referenced here instead of Fig. 2?

Reply: Yes, Fig.3 is correct. Modified.

Line 210: As was also pointed out by another reviewer, I ask the authors to address the difference in spatial resolution between the GLDAS-1 product (1 degree, quite coarse) and the model simulations (6 km).

Reply: More details are added now : the data extraction include spatial clipping and regridding using bilinear interpolation.

Line 239: Why were these grid boxes selected for analysis? Please add to the text.

Reply: More details are added now. The selection of these grid points is an arbitrary determination by roughly considering different climate zones, without strict considerations. In fact, in this study, more grid points have been tested, but the results are mostly similar. Here, only analyzes and discusses the results based on these three grid points.

Table 2: Please provide a description for CHLEAF in the table.

Reply: Added.

Line 246: Should Table 2 be referenced here instead of Table 3?

Reply: Yes, corrected.

Lines 246-247: I ask the authors to elaborate on why output for 10 June of different years was chosen for analysis. Why 10 June, and why these particular years? Please consider adding this to the text.

Reply: The time slices are arbitrarily selected without special consideration. After all, the amount of data is very large, and it is impossible to display the results of all time data. Only a few dates can

be selected. I think it is unnecessary to describe every reason for the selection. If no special reason is given in the text, then it must be that this reason is not important.

Line 248: Mention all of the representative variables included in Figs. 4 and 6 here, not just SFCRNOFF and TV.
Reply: Has been rewritten:" *The maps for all the sate variables in Table 2 reflect high consistence between NMP-Hydro and WRF-Hydro, but here only the maps for two representative variables (SFCRNOFF and TV) are shown in Fig.4 and Fig.6.*"
There are numerous variables are compared in our study, it is difficult to present all the results in such figures, considering that the length of the paper for publication must be limited. The figures in Figs.4-6 are enough and representative, because other variables are highly interrelated with SFCRNOFF and TV. If there are inconsistencies in other variable, it is impossible get such inconsistent SFCRNOFF and TV maps.

Discussion of Fig. 4, lines 248-253: I find Fig. 4 to be somewhat misleading. From 4a, 4b, 4e, and 4f, it would seem that there are no visual differences between WRF-Hydro and NMP-Hydro. However, 4c, 4d, 4g, and 4h suggest that there are relative differences of up to 40%, which suggests considerable differences between the two models. Why are such large differences not suggested by 4a, 4b, 4e, and 4f?
I also recommend rearranging the figures such that they are referenced in numerical order, i.e. move Fig. 6 to Fig. 5, move Fig. 8 to Fig. 6, etc. Also move the corresponding discussions as necessary.
Reply: Thank you for pointing out the problem. We will rewrite this discussion during the submission of this revision.

Line 262: Is the figure reference referring to both Figures 4 and 5?
Reply: The original description is ambiguous. We need rewrite the description in the total paragraph, because the result is now changed a lot.

Figure 5: Please revise 5b so the right y-axis labels are fully visible.
Reply: Revised the figure.

Line 279: Does NSE refer to Nash-Sutcliffe Efficiency or something else? Please define in the text.
Reply: During this revision, the metrics such as R and NSE will no longer be used in the paper, because the variables are more highly consistent now.

Figure 6 caption: Should the units of vegetation temperature be deg C and not K?
Reply: During this revision, All K will be changed to deg C. the figures will be redrawn.

Figure 8: Please add units to the axes of all subfigures.
Reply: Now units are added. The figures will be reproduced.

Line 311: Does this section analyze results from NMP-Hydro and WRF-Hydro, or only NMP-

Hydro?
It seems Figs. 9 and 10 only include results from NMP-Hydro, but perhaps I am mistaken.
Reply: No results of WRF-Hydro is presented here (some description is wrong in the previous submission). The purpose of this section is to test the effectiveness of NMP-Hydro, other than compare the two of them. Due to the many physical scheme combinations, conducting both the two models with all those scheme combinations are difficult and also is not very necessary.

Lines 385-386: I don't yet agree that the NMP-Hydro and WRF-Hydro results are consistent. They may be scientifically consistent, but not numerically consistent. I ask that the authors include this distinction in the text.
Reply: The sentence has been changed to " The NMP-Hydro code has been subjected to rigorous testing to ensure that it produces results that are as consistent as possible with those of the original WRF-Hydro."

I agree with another reviewer's comment that the authors should consider renaming NMPHydro to something more distinct from WRF-Hydro and Noah-MP to avoid confusion.
Reply: I have considered your suggestion, and I also think the current name is not ideally good. However, in this revision, I have not come up with a more suitable name for it. Meanwhile, renaming it now poses some difficulties as it involves changing the names on several websites. If multiple reviewers agree that a name change is necessary, I will decide to do so in the next upload of the manuscript.
Actually, I don't think NMP-Hydro would be confused with WRF-Hydro or Noah-MP, as they are different spells. The reason I choose such a name because this model does come from WRF-Hydro or Noah-MP.

Revised supplementary material: Perhaps this has already been done in the revised manuscript, but if not, I ask that the authors discuss the supplementary figures in the main text where appropriate.
Reply: I would discuss those figures as far as possible.

Technical comments
Line 16 (abstract) and lines 176-177: For clarity, change "the most part of North China" to "most of North China"
Reply: Corrected.
Line 235: Change "percentive" to "percent"
Reply: Corrected.

Your suggestions are very valuable. We feel very appreciated for your hard working.

The authors: Yong-He and Zong-Liang

References:

Liu, Y., Yang, Z. and Lin, P., 2023. Parallel river channel routing computation based on a straightforward domain decomposition of river networks. JOURNAL OF HYDROLOGY, 625.