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.

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.

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.

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.

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).

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.

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.

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).

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 their 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.

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.

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

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).

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

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

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

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.

Line 248: Mention all of the representative variables included in Figs. 4 and 6 here, not just SFCRNOFF and TV.

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.

Line 262: Is the figure reference referring to both Figures 4 and 5?

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

Line 279: Does NSE refer to Nash-Sutcliffe Efficiency or something else? Please define in the text.

Figure 6 caption: Should the units of vegetation temperature be deg C and not K?
Figure 8: Please add units to the axes of all subfigures.

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.

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.

I agree with another reviewer's comment that the authors should consider renaming NMP-Hydro to something more distinct from WRF-Hydro and Noah-MP to avoid confusion.

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.

Technical comments

Line 16 (abstract) and lines 176-177: For clarity, change "the most part of North China" to "most of North China"

Line 235: Change "percentive" to "percent"