Reply on RC2

Nicolas Azaña Schnedler-Meyer et al.

Author comment on "Water Ecosystems Tool (WET) 1.0 – a new generation of flexible aquatic ecosystem model" by Nicolas Azaña Schnedler-Meyer et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-366-AC2, 2022

Dear Referee #2

Thank you for your very valid and constructive criticisms and suggestions. We have considered your questions and will reply to these individually below. With regards to smaller comments not specifically mentioned below, we have generally followed your suggestions.

First major comment:

- My major concern is a lack of sufficient validation for the new functions to the model in the current manuscript. Clearly these new features, such as vertical migration and N fixation of cyanobacteria, are crucial for modeling the food web interaction and ecosystem dynamics, which jointly improve the applicability of the WET model. However, the test case of Lake Bryrup and the available dataset are insufficient to explicitly test the adequacy of the new functions. The lake is also a bit too shallow to reflect the features of the deep lakes with pronounced vertical migration of organisms. More importantly, the main advance of the 'flexible food web' is also not addressed in the test case. Nevertheless, I can understand that field data to validate these new features are rare, particularly the spatial distributions of the organism along the vertical dimension. Therefore, I recommend to use the case of Lake Bryrup, but rather than validating the model, the main focus here should be on providing a more detailed evaluation of the new features. In additional to the existing analyses, the authors may consider the following (but not limited to): 1) compare the modeled cyanobacteria with and without N fixing function (ideally with two types of cyanobacteria), and illustrate how the N limitation regulates the growth of the cyanobacteria and potentially other algae groups; 2) design a gradient of the vertical migration parameters for zooplankton, as shown currently in Fig. 5 as an nice example (but now only with one parameter set). Such additional evaluations will help readers to better understand the importance of the new features for modeling and unravel the sensitivity of the key parameters, thereby opening up the opportunities to test the new model in other lake cases with more comprehensive datasets in the future.

Our reply:

We appreciate that the reviewer recognizes the challenges involved, but agree that the model tests can be improved. We are thankful for the excellent suggestions and recommendations on how to improve this aspect of the manuscript. We have gone with the suggestion of the reviewer and provided a more thorough presentation of the new features, in accordance with suggestion 1) and 2) of the reviewer's comment.

- As suggested by the reviewer, we have added a second, N-fixing cyanobacteria to the model, and compare the dynamics of these in Lake Bryrup in a new figure (attached to this reply). As Lake Bryrup is mainly P-limited during the growth season (as are most temperate lakes), we have also run scenarios with N-inflow to the lake disabled, and report on the dynamics observed.
- We interpret this suggestion to mean that the reviewer would like us to compare the dynamics of the different vertical migration options in the model. To this end, we have introduced two new panels in figure 5 (now 6, attached to this reply), illustrating the dynamics of passive transport, and hypoxia avoidance by zooplankton, and comment on the results in the results and discussion.

Second major comment:

- I found that some details of the new features are not clearly described. This could be fine for current users but may puzzle the new users in the future, thus obscure the application and further development of the model. The authors may consider using more Tables to list the new features of some modules with the explanation of the related parameters and meaning of the values in the configuration files. Below I list some specific points in the minor comments, but overall I would appreciate taking advantages of Tables in such model description papers as the key document.

Our reply:

We have done as suggested, and added a table detailing the parameters and options related to each new feature.

Third major comment:

- It remains unclear how to practically change the structure of the model by adding or deleting organism components. Likely it will be done in the configuration file, but it is not described (if I did not miss anything). Tutorial cases and/or a detailed manual for such configuration procedure should be provided because such flexible feature is one of the major advantages of the new WET over the previous version and also many other aquatic ecosystem models. Besides, I recommend to briefly discuss the possibility to implement the flexible food web in a more user-friendly way (such as the GUI of ECOPATH or AQUATOX), if such function would be envisioned for further model development.

Our reply:

This comment is in line with reviewer #1, who also requested more documentation on model setup and configuration. Although we failed to adequately cover this in the manuscript, there is in fact extensive documentation on how to setup and configure the model on the WET homepage. We have emphazised this more clearly in the manuscript. We have also included a short description on how to add or remove food web modules to the manuscript.

With regards to the possibility of running the model with a more user-friendly interface, the QWET plugin for the (freeware) GIS software QGIS does exactly this. There is also extensive documentation in the QWET section of the WET homepage on how to set up QWET. We have further emphasized these facts in the manuscript.

Fourth major comment:

- It is uncommon to number the first version of the WET by '0.1.0'. The first release of software or model is usually numbered as '1.0' or '1.00' etc. Current version of '0.1.0' gives the impression that the model is still at the very beginning stage and far from completed for first release. Please consider changing the version numbering, if appropriate.

Our reply:

In this case, we simply followed the examples of some other model software, but upon reflection, we agree with your comment. We will make another release of the model under the version number 1.0, when and if our manuscript reaches the accepted status.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2021-366/gmd-2021-366-AC2-supplement.zip