04-Mar-2023  
  
Dear Joe:  
  
Manuscript ID GWAT-2022-11-0213 entitled "FloPy Workflows for Creating and Constructing Structured and Unstructured MODFLOW 6 Models" which you submitted to Groundwater, has been reviewed.  The comments of the reviewer(s) and the Guest Editor are included at the bottom of this letter.  
  
The reviewer(s) have recommended some minor revisions to your manuscript.  Therefore, I invite you to respond to the reviewer(s)' comments and revise your manuscript. Also please consider the following **Minor**Issues:

Insert paper type, followed by a backslash, on first line, above title (i.e., “Research Paper/”).

*Done*

In author information, clearly indicate who is the Corresponding Author, and include their email address.

*Done*

Remove hyphenation from words at line endings—this can lead to uncertainty & errors during typesetting. This might be easily accomplished by changing paragraph justification from full to left.

*Done*

References: Fienen et al (L. 661): insert "U.S. Geological Survey" before “Scientific Investigations Report 2022-5046”.   “Gillies, S.. 2022” (& in multiple following refs): delete double period.  L. 713 Mehl: change “US” to “U.S.” in title.

*Done*

Add a list of figure captions at the end—after References.

*A list of figure captions has been added at the end of the manuscript.*

It is also highly recommended that you submit (upload) separate individual files for each figure in acceptable resolution and format (not in a Word document), with the figure number included in the filename; the figure file should not include the caption; this generally yields a better reproduction/printing of figures than using figures embedded in the Word, Latex, or pdf document.  Also upload a copy of the main document in an editable text format, such as Word or Latex. Thanks for submitting this excellent manuscript.  
  
  
  
Executive Editor  
Comments to the Author:  
Thank you for the article, which was well received by all reviewers. All three reviewers recommended some minor revisions or additions to the article, and considered that it would be acceptable for publication following consideration of those revisions/additions. The article is indeed well put together, and I recommend that after the minor revisions/additions proposed by the reviewers have been considered and incorporated, as appropriate, the article be accepted. Thank you.  
  
  
Reviewer(s)' Comments to Author:  
  
Reviewer: 1  
  
Comments to the Author  
First of all, as a frequent FloPy user, I'd like to express my deepest gratitude for the FloPy developers for providing this wonderful tool.  
This paper describes the recent development of FloPy for pre- and post-processing MODFLOW 6 models. The paper is well written. Specific new features/functions are explained with demonstrations by plots and code snippet.

My main comment is whether these new features are included in the older MODFLOW version? As I believe, most models are still in the older versions of MODFLOW. Is it possible to unify the FloPy methods/functions between new and old MODFLOWs?

*All of the FloPy capabilities demonstrated in the manuscript except for the output.methods() can be used to develop input datasets for previous versions of MODFLOW and post-process simulated results. We believe that it clear that the output.methods() only apply to MODFLOW 6 models (first paragraph of the “Processing MODFLOW 6 output” section.*

For the example code snippets, adding some comments can be very helpful for those readers who want to learn the code. And are the full version notebooks for these examples provided?

*The Jupyter Notebooks for the watershed and Synthetic Valley examples will be available when the paper is published. The web addresses for these examples are given in the Summary and Conclusions section.*

Figure 1: I understand it is to show the different grids supported by FloPy. Nevertheless, a colorbar may be added to explain the color grid.

*We are not sure that we understand this comment…there was a colorbar on Figure 1E. To make it clear that the colorbar applies to all the panels, the colorbar has been moved to the Explanation on Figure 1.*

Figure 2A: I suggest remove “0.001 m/d” at the top and explain it in the caption. Or change to “Specific discharge = 0.001 m/d”.

*The arrow and associated text at the top of Figure 3A and 6B. Specific discharge vector has been added to the Explanations for Figure 3A and 6B.*

Figure 2B: For discharge type, red is discharge or cyan is discharge?

*The two colors represent the what the discharge represents. Red would be aquifer discharge to a river and blue would be areas where the groundwater is above land surface away from a river and discharging to the land surface (groundwater seepage).*

Figure 2D: The first column is close to 100 m as yellow but it does not reflect the same color in Fig 2A.

*We are not sure that we understand this comment. There are no elevations shown on Figure 2. If this comment refers to Figure 1, elevations were geo-processed for all the grids from a high-resolution digital elevation model. There are differences between elevations in individual grid cells but the elevation contours show the consistency of elevations in all of the grids.*

Figure 8. Maybe use a stronger color or thicker line for the contours. They are difficult to read.

*We have increased the line width of the concentration contours on Figure 8.*

Overall, I enjoy reading the paper.  
  
Thanks,  
Michael Ou  
SSP&A  
  
  
Reviewer: 2  
  
Comments to the Author  
The authors present an overview of the most recent additions to FloPy, especially those that are associated with MODFLOW 6. It is impressive what is possible with these new features and I think that many existing FloPy users will find it useful to see them presented in a journal paper. I only have a few suggestions, but they're all very minor:  
  
- line 303: it might be worthwhile explaining what and advanced stress package is for modellers not yet too familiar with MODFLOW 6

*Added the following “…Some individual GWF and GWT Model advanced stress packages can also write simulated output during a simulation. Advanced packages are packages that solve their own continuity equation and include the Lake (LAK), StreamFlow Routing (SFR), Multi-Aquifer Well (MAW), Unsaturated Zone Flow (UZF), and Mover (MVR) packages. For example, the LAK Package…”*

- rainfall and evaporation are quoted separately for the model as a whole (line 538) and Blue Lake (line 529) but they are numerically the same. Does this mean that they are uniform across the entire model?

*Modified line 538 to “Uniform recharge and potential evapotranspiration rates were specified using the recharge (RCH) and evapotranspiration (EVT) packages, respectively, and are equal to the rates specified in the SFR and LAK packages (0.0025 and 0.0019 m/d).”*

- it might be worthwhile labeling the wells in Figure 8.

*We modified Figure 8 to include well labels. We also restricted the wells symbol to layer 6 (Figure 8F) since this is the layer containing the wells.*

Reviewer: 3  
  
Comments to the Author  
This paper provides a valuable demonstration of new capabilities in Flopy, especially support for unstructured grids and many other powerful capabilities of MODFLOW 6, which seems to have been underutilized by the groundwater modeling community, perhaps due to an initial lack of or lagging GUI support. I think this will be of interest to many readers.  
  
I only have a few minor general comments:

Decide on regular/irregular or structured/unstructured terminology and stick with it (using both might be confusing, especially to non-native English speakers).

*Regular grid has been changed to structured grid in the revised manuscript.*

Citation and figure references are highlighted throughout the paper, which makes it seem like they should link to what they are referencing, but the links don't seem to be working in this PDF. Maybe this will be fixed in layout.

*The hyperlinks work in the pdf generated by LaTeX. Maybe the submission process removed the hyperlinks. This should be fixed as part of journal layout.*

The triple carrots (>>>) and continuation dots (…) in the code snippets are at little distracting in the longer code blocks that don't include output (for example, the blocks beginning on 161, 193, 208, etc). Consider only including these to differentiate between output and input in the shorter snippets that include output.

*Modified code blocks so that only code that produces output use the triple carrots (>>>) and continuation dots (…).*

Line-specific comments:

49: Consider adding a sentence here about applications of Flopy to facilitate rapid and repeatable automation of groundwater model development. For example "FloPy is also being used in other software and workflows to improve repeatability and robustness through automated model construction (Larsen et al 2022; Leaf and Fienen 2022; Fienen et al 2022a; White et al 2020).

*Added the suggested sentence.*

116: The Summary and Conclusions hyperlink isn't working for me. Might be simpler/easier to just link straight to the hypothetical problem here (same for line 465)

*The hyperlinks work in the pdf generated by LaTeX. Maybe the submission process removed the hyperlinks. This should be fixed as part of journal layout.*

150: You might consider referencing Fienen et al 2022b as an example application of LGR with MODFLOW 6, especially since this application demonstrated the computational efficiency of the LGR approach in MODFLOW 6, in contrast to past work such as Vilhelmsen et al 2012, which showed less computational benefit to using LGR in MODFLOW-2005.

*Added the suggested reference. Did not add any text about the computational efficiency of LGR in MODFLOW 6 since it is out of scope for the manuscript.*

Figure 1: Consider replacing "common refinement area" with "local grid refinement area". "Common area" makes it seem like this area is simulated by both (parent and child) models, but if I'm understanding this right that this area represents LGR, it is inactive in the parent (only simulated in the child).

*Modified to “grid refinement area”. Local grid refinement only applies to Figures 1C and 2C, which use two model grids. The other model grids are single grids.*

218: 'nodes' here is a little confusing. The courier font and lower case make it seem like a code object, but no other description is given. Consider either capitalizing in the main body font to refer generally to nodes, or if it is a code object, add more description (i.e. "node objects")

*Changed nodes to refinement\_verts. There is a description of what to refinement\_verts is in the sentence after the code block.*

231: it would be helpful to define what is meant by "local" and "global" coordinates here. Or you could reword to something like "converting x, y locations from model coordinates to a coordinate reference system." (a more standard term)

*Added “Local coordinates are model-based coordinates and global coordinates are coordinates generated after transforming local model coordinates using user-specified x-offset, y-offset, and rotation angle values; global coordinates are equal to local coordinates if the x-offset, y-offset, and rotation angle are all zero.” after the list of grid properties and methods.*

237: I know it's more typing and would require an API change, but consider renaming "thick" to "thickness" to be more descriptive (or at least grammatically correct). Same with "saturated\_thick" Better to do it now before the paper comes out!

*Good suggestion. Will create a cell\_thickness property and saturated\_thickness function and deprecate the thick property and saturated\_thick function before the paper is published.*

244: This statement about Fienen et al 2022(b) is a little misleading. A better way to put it would be something like  "Fienen et al. (2022) used local grid refinement models tightly coupled to inset models that were in turn loosely coupled to a coarse regional model, to better represent lakes and quantify the effects of distant pumping on lake/groundwater interactions in the Central Sands region in Wisconsin, USA."

*Made the suggested change.*

269: I think you should cite the rasterstats package somewhere, since it looks like this is what's being used for the "median", "mean", "min", "max", "mode" options

*Modified sentence to “…however, the method also supports “nearest”, “cubic” and other options (“mean”, “median”, “mode”, “min”, and “max”) available in the rasterstats Python package (Perry 2013) for geostatistical resampling.*”

Figure 5: consider changing "River cells" to "SFR cells" in the legend to be more precise

*Made the suggested change.*

Cited references:  
  
Fienen, M.N., Corson-Dosch, N.T., White, J.T., Leaf, A.T. and Hunt, R.J. (2022a), Risk-Based Wellhead Protection Decision Support: A Repeatable Workflow Approach. Groundwater, 60: 71-86.  https://doi.org/10.1111/gwat.13129  
  
Fienen, M.N., Haserodt, M.J., Leaf, A.T., and Westenbroek, S.M., 2022b, Simulation of regional groundwater flow and groundwater/lake interactions in the Central Sands, Wisconsin: U.S. Geological Survey Scientific Investigations Report 2022–5046, 111 p., https://doi.org/10.3133/sir20225046.  
  
Larsen JD, Alzraiee AH, Martin D and Niswonger RG (2022) Rapid Model Development for GSFLOW With Python and pyGSFLOW. Front. Earth Sci. 10:907533. doi: 10.3389/feart.2022.907533  
  
Vilhelmsen, T. N., Christensen, S., and Mehl, S. W. (2012). Evaluation of MODFLOW-LGR in connection with a synthetic regional-scale model. Ground Water 50, 118–132. doi:10.1111/j.1745-6584.2011.00826.x  
  
White JT, Foster LK, Fienen MN, Knowling MJ, Hemmings B and Winterle JR (2020) Toward Reproducible Environmental Modeling for Decision Support: A Worked Example. Front. Earth Sci. 8:50. doi: 10.3389/feart.2020.00050