United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Virginia-West Virginia Water Science Center

1730 E Parham Rd

Richmond, VA 23192

**MEMORANDUM** January 11, 2023

**To:** Joseph D. Hughes, Hydrologist, USGS Integrated Modeling and Prediction Division

**From:**  Jason Pope, Hydrologist, USGS VA-WV WSC, Richmond, Virginia

**Subject:** Colleague Review of Journal Article – “FloPy Workflows for Creating and Constructing Structured and Unstructured MODFLOW 6 Models”

I appreciate the opportunity to provide a review of the subject article. I was very interested in the details, which are relevant to my ongoing work, so it was useful for me to get a preview. Given the very specific and technical content, I found the text to be extraordinarily clear, well organized, and comprehensible. The technical work reported in the article regarding FloPy represents a remarkable and impressive advancement in the capability and ease of use for the FloPy package, and MODFLOW groundwater modeling in general, which I was able to witness personally in recent tutorials given by some of the authors.

Aside from the technical content of the text and figures, I checked the embedded hyperlinks, which all appear to go to the intended locations. I did not check the individual hyperlinks for each of the References, though I noted that some are not included, and I suggest including those for completeness. I did not attempt to run any of the individual code snippets, and I am not a Python or FloPy expert, but I noted no apparent errors or discrepancies. I used a “sticky note” in the document PDF to highlight what appears to be a single small typographic error. Otherwise, I offer only a few more detailed comments and suggestions below on the technical content of the article.

* The placement of some of the figures in reference to the text discussion could be improved, but I suspect this issue will be entirely resolved in the journal layout.  
   *The journal will modify figure placement as part of the layout process.*
* In the second paragraph of the text in the “MODFLOW 6 Model Setup” section, I suggest explicitly stating that layer 3 represents the confining unit, and (more importantly) that the simulated confining unit layer is relatively thin. This information can be discerned indirectly from the text and from the unit elevations provided, but was not initially apparent. This caused some initial confusion for me in viewing the cross-section figures, because the layer is so thin that it is not readily visible in the cross sections at this scale, and it is difficult to discern where it is present.  
    
  *Modified to “…Confining units have to be explicitly simulated in MODFLOW 6, therefore, a total of six layers are simulated. The bottom of layers 1, 2, 3, and 4 were set to constant values of -1.53, -15.24, -15.55 and -30.48 m, respectively. Model layer 3 represents the confining unit and is relatively thin (0.3 m). The IDOMAIN concept…”*
* The two section lines shown in figure 6 are of different lengths, but the cross sections are shown in figure 7 with the same vertical scale but different horizontal scales. These scales are clearly marked, but I think the figure could be improved by expanding figure 7A so that the horizontal scale matches that of 7B.  
    
  *Figure has been designed to fit in a single column. Have modified 7B so that it has the same scale as 7A. The same modifications have also been made to figure 3C and 3D.*
* I suggest adding a flow-vector symbol to the Explanation in figure 6. It was not initially apparent what those are, though they are clearly discussed in the text. Even at full size on a high-resolution monitor, the vectors are quite small, but I think they are sufficient to convey the idea discussed.  
    
  *The flow-vector symbol has been added to the explanation. Also added additional text to the vector scale arrow at the top-left of figure 6B. The same modifications have also been made to figure 3.*