Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
https://doi.org/10.5194/gmd-2022-208-RC1, 2022

Comment on gmd-2022-208

Anonymous Referee #1

Referee comment on "SERGHEI (SERGHEI-SWE) v1.0: a performance-portable high-performance parallel-computing shallow-water solver for hydrology and environmental hydraulics" by Daniel Caviedes-Voullième et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-208-RC1, 2022

The authors present a very timely and interesting topic introducing an open source modelling framework which in the perspective should be capable of simulating hydrodynamics, transport, morphodynamics, ecohydrology including feedbacks and interactions on large spatial and temporal scales using modern computational toolboxes and a broad range of high performance computing capabilities.The approach follows the tendency to also use hydrodynamic models for catchment scale cases where in the past hydrological models have been used which however cannot resolve the high resolution information on elevation etc. The paper can be published from my side after major revision.

Major:

- Title: environmental hydraulics is mentioned; the reader may expect more than 2D hydraulics and rainfall runoff -> rethink
- Abstract: it describes to a large extent the overall aim of the whole project where of course only parts are included in this paper -> reduce this a bit and therefore comment more on the results you obtained here
- There are many abbreviations in the text which are not all well known to the readers -> introduce a list of abbreviations
- P. 4: as you are also addressing urban environments, I suggest to also comment on the linkage to sewer systems – although this might not be planned here
- 5: your framework is quite fundamental; why are viscous / turbulent terms not included, e.g. to also in the perspective include eg turbulence models (eg algebraic, k-epsilon); this also might be relevant in the view of environmental hydraulics (title); this

might be extended later (include in chap. 7) ?

- p. 5: there are also friction laws for small water depths; as rainfall runoff has an important role, should 1 or 2 be mentioned ? Ilhan knows
- p. 5: a comment that there are also many 2nd order schemes and unstructured grids
- p. 12, Fig 5: add axis description specific discharge, why is discharge 0 ? or do you show the error or a relative error, unit ? in case it is a (relative) error, add description how it is computed in the text; supercritical flow: is this elevation or water depth ? the water depth goes down to 0 ? add a comment if it becomes very small and is no more visible
- p. 13, Tab 2: I suggest to explain the computation of the norms in the text add a, b, c, d also in Fig 5; I do not understand the numbers in Tab 2, they are far away from machine accuracy?
- chap. 4.3.1: a bit more description here
- p. 17, Fig. 9: the legends must be larger, add [m] for the axis
- p. 18, chap. 4.4: please comment a bit more on this rainfall; otherwise the results cannot be understood
- p. 22, Fig 15: legend text a bit larger here
- p. 25, chap. 5.7: in the previous case 1cm, what resolution here ?
- p. 26: add 1 or 2 sentences to the agreement of model and field results; Fig 20: explain these 3 terms in the text
- otherwise the reader cannot understand
- chap 4+5: there is a large number of test cases which of course is very impressive; I would include all these test cases in a validation document, however I suggest to reduce this number in a journal paper and possibly shift some cases in the appendix, for example: 4.1: 2 instead of 4 hydraulic cases; 4.2 show only 4.2.2; 4.3 show only 4.3.2; 5.3 show only 1 case; 5.6+5.7: show only 1; please rethink, this does not mean that all should be shifted to the appendix or removed from the paper
- chap. 6: from small scale to large scale: show 6.2 as 6.1 ?
- 4, 5 + 6: I understand and it is good that the cases descriptions are very short as most cases have been widely used in the literature; however not every reader know every cases; to avoid that the reader has to search for several other papers to understand the systems and results in the test cases I suggest to add core information to each test case in an appendix, eg: figure of system, initial and boundary condition, core parameters; it is not a must, but would be helpful for the reader
- chap. 7.2+3: you had that many cases before, therefore I am wondering why not one of the previous cases was chosen or the cases of 7.2+3 should be included earlier -> rethink
- p. 32, close to end: add referenes to Ecosys, EcH20
- chap. 8: is further (substantial) performance improvement possible using domain decomposition with MPI ?

Further minor comments are in the commented pdf.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2022-208/gmd-2022-208-RC1-supplement.pdf