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Comment on gmd-2022-208

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Community 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-CC2>, 2022

This is an interesting contribution that I think it would be a nice read if made shorter and more focused, by mainly:

- (1)** reorganising the methodology to ensure that the interesting parts appear first, or are at least introduced. For example, it would help to introduce the concept of SERGHEI here, and narrow down the scope to the SWE module.
- (2)** cutting the verification and validation section, significantly, to only focus on the analysis of performance and scaling for selected test cases. The 2D dam-break is a keeper because its symmetricity is important to ensure that the code re-implementation is valid (i.e., illustrating the 1D radial profile for the 2D dam-break test will provide stronger evidence of code validity). Many the test cases can either removed or put in an Appendix.

Other comments:

The abstract: It can be made more personalised to just reflect on the content of this contribution. For example, the first 10 lines can be cut to a sentence or two to just introduce the concept of SERGHEI and its relevance to portability.

The Introduction: What does ESM stand for? Earth System Modelling? Line 89-90. The trend to address "rainfall-runoff problems in both natural and urban environments, fluvial problems, and other flows" seems to be the case with many of existing models in Table 1. That may not be the novelty here, as also shown later by the type of test cases reported.

The organisation of the methodology: Section 2 and Section 3.1 seem to be overviewed from past published works. They are useful for completeness, but their presence at the start is confusing without any introductory text saying about what is where, and why, with reference to the novel aim and scope of this work. Could Section 3, or the methodology, be titled more specifically? For example, SERGHEI-SWE?

Verification and validation: The mathematical and the numerical formulations are already valid on existing platform. From this stand, verification should be brief to just confirm that the new implementation, using kokkos, remains valid too. Therefore, there is no need to have the main body of the results for the detailed verification of accuracy and error convergence. This could go into an appendix for the basic test cases. This will keep room for the interesting part to be the center of the main discussion: that is, **Section 7 of the performance and scaling**.

Vision and future work: Couldn't this part be repositioned, re-edited higher up to be **integrated at start the methodology** to better scope this paper and set the expectation earlier/clearer on the novelty?

I hope the authors find my comments useful.