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Geoscientific Model Development Discussions

# *Interactive comment on* "GSFLOW-GRASS v1.0.0: GIS-enabled hydrologic modeling of coupled groundwater–surface-water systems" *by* G.-H. Crystal Ng et al.

**Anonymous Referee #2**

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**General comments:**

Ng et al. present a GIS-based tool, GSFLOW-GRASS, that prepares input and runs the USGS hydrologic model GSFLOW. The authors provide comprehensive description of the GIS-based software, as well as the USGS hydrologic model. The paper is well-organized and well-written. As a modeler, I highly appreciate the authors' efforts in developing such tools, because "developing inputs to these models is usually time-consuming and requires extensive knowledge of software engineering, often prohibiting their use by many researchers and water managers". However, I do feel that GSFLOW-GRASS has limited capability in handling spatially-distributed, realistic input data (see



specific comments #2). All examples are shown without any measured discharge data. I acknowledge that model calibration is beyond the scope of this study, but it would be helpful if measured data could be shown, to demonstrate that the generated input can yield reasonable, if not accurate predictions. The authors also need to do a better job describing what are the "substantial new/novel concepts, ideas, or methods" in developing GSFLOW-GRASS, as required by GMD.

**Specific comments:**

1. Besides GSFLOW-GRASS and Gardner et al. (2017), there is another for-free software by Earthfx that can generate the inputs for GSFLOW. It is surprising that the authors did not review or describe this software. What are the differences between GSFLOW-GRASS and Earthfx software?

2. The GSFLOW-GRASS tool has limited capability in handling spatially-distributed, realistic input data. For example, P10, L24 "In its current form, v.gsflow.segments . . . allows the user to set a single channel width and Manning's n (in-channel roughness coefficient for flow resistance) across the whole domain;" P13, L29 "we do provide a script for uniformly applying a single climate data series over all HRUs to create climate_hru files;" and P14, L24 "most parameter values in printPRMSparamfile.py are preset. . .. This includes various soil and land-cover inputs, such as soil_type, cov_type, transp_end, and pt_alpha." There are GIS-based hydrologic model input tools that can take all different types of GIS input to generate spatially-distributed input data from national data-base or in situ measurements. For example, PIHMgis (Bhatt, G., Kumar, M. and Duffy, C. J., 2014: A tightly coupled GIS and distributed hydrologic modeling framework, *Environmental Modelling & Software*. **62**, 70—84.). The spatially-uniform approach and the preset default parameter values may prohibit GSFLOW from generating accurate predictions.

3. Page 3, L10 The authors state that triangulated irregular networks have better water balance performance. Why is that?

4. I am interested in the spin-up process described between L6 and L11 on Page 9. The authors describe the initial conditions as preliminary steady-state initial conditions. Usually the spin-up process is aimed to bring models to steady-state. If so, what is the difference between the before- and after-spin-up initial conditions?

5. Some of the parameters are shown without their definitions, for example pref_flow_den and sat_threshold. It would be add definitions.

**Technical comments:**

1. Figure 2 caption “Duncan runoff and fast interflow occurs in the preferential-flow reservoir.” Should be “occur.”

2. P10 L4 “This approach is complementary to the grid-cell HRU approach of (Gardner et al., 2017).” \citet command should be used instead of \citep.

3. P22 L8 “This allow users . . ..” Should be “allows.”

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