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Interactive
comment

Interactive comment on "Improved representation of groundwater at a regional scale – coupling of mesocale Hydrologic Model (mHM) with OpeneGeoSys (OGS)" *by* Miao Jing et al.

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Review on "Improved representation of groundwater at a regional scale – coupling of mesocale Hydrologic Model (mHM) with OpenGeoSys"

General comment:

This paper deals with an effort to couple the regional scale mHM model to a groundwater flow model (i.e. OGS) that can simulate groundwater lateral flow and groundwater head dynamics.

This topic fits very well to the scope of this journal and I consider this study is an im-

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[Discussion paper]

portant contribution for regional or large scale hydrological modelling efforts. Currently, there are a still quite limited number of regional (large) scale hydrological models that include lateral groundwater flow component and can simulate groundwater head dynamics. An extension to groundwater head simulation will greatly strengthen the mHM model capabilities, e.g. for enhancing their groundwater drought studies and groundwater transport modelling.

As a test case, the authors used the Naegelstedt catchment where head observation data are available. They managed to show some convincing validation results of their groundwater modelling result to observation data (e.g. Figure 11). The authors deserved credit for their extensive and successful modelling experiment.

However, this paper is still poorly written and therefore it is difficult to comprehend. English must be improved. I strongly recommend that the revised version is checked by an English native speaker.

Below, I provided a (non-exhaustive) list of some remarks and suggestions that can be used to revise the manuscript.

Details / specific comments:

Page 1, lines 1-2: I suggest to rephrase this sentence. Most hydrological models do include groundwater component, e.g including groundwater (vertical) recharge component and using a linear reservoir concept for groundwater baseflow/discharge. Yet, they hardly include lateral groundwater flow component and simulate groundwater head dynamics.

Page 1, lines 8-9: The sentence (Nested time stepping . . .) does not really flow with the previous ones. Please rephrase. - It will be very informative if the time step lengths used (for both models) are mentioned in the abstract. If I understand correctly, the time step length used for mHM was daily, while OGS used monthly time step. Am I correct?

Page 1, lines 15-16: Please clarify with what you meant by the 'offline coupling method'

in your study.

Page 1, lines 15-16: How much is the 'little surplus' in your computational cost?

Page 2, line 8: . . . ignoring lateral groundwater flow . . .

Page 2, lines 32-35 and page 3, lines 1-10: Please rewrite this paragraph. I found its sentences (e.g. the first until fourth sentences) do not really flow and connect with each other.

Page 3, line 4: LSM? Common Land Model? I guess that you meant CLM (Community Land Model).

Page 3, line 6: For this study, were you using a similar offline coupling strategy as used by Sutanudjaja et al. (2011). Did you first run the mHM model for the entire model simulation period (1970-2005?), then use the mHM output to force the OGS model? Please clarify.

Page 3, line 8: GSFLOW? What does GSFLOW stand for?

Page 3, line 14: What is THMC? I cannot find its long form of this acronym before this line.

Page 3, lines 15-17: Please rephrase this sentence. I am not sure what you meant by 'offline' coupled here.

Page 3, line 17: . . . an offline coupled model ...

Page 4, line 8: So, did you apply MPR for the current study? This is not really clear for me.

Page 4, line 28: . . . first and second regions ...

Page 4, lines 31-32: Could you please elaborate with what you meant by 'sequential boundary condition switching technique'?

Figure 1: I cannot find the explanations for GOCAD, GO20GS and PEST in the

text/paragraph.

Page 5, line GIS2FEM: What does GIS2FEM stand for?

Page 6, lines 7-15: Could you please check this part. I guess that there are some missing lines or sentence here. For example, I cannot find the introduction and explanation for Eq. 2.

Page 7, lines 9-10: Due to this liner reservoir conceptualization, I guess that the current coupled model mHM#OGS cannot simulate infiltration from surface water bodies (rivers) to groundwater?

Page 9, line 24: What is VTU?

Section 2.5: Please rewrite this section, particularly to clarify/confirm the following: - So, you have two scenarios of groundwater modelling: SC1: spatially distributed recharge and SC2: homogeneous recharge - Did you calibrate both scenarios groundwater modelling independently? Or, did you just calibrate SC1 and then using the calibrated SC1 parameters for SC2?

Page 16, line 2: Please provide the unit (m2?) for 8625 and 464.74.

Page 16, lines 2-3: What do you mean by the calibration is robust with totally 114 model runs?

Page 16, lines 3-4: What do you mean by 'convergence criteria relevant to observation'? Please rephrase the sentence.

Page 16, lines 14-16: The sentence does not flow with the previous ones.

Figure 9: I guess this map is for a steady-state condition. Please clarify.

Page 16, line 19-20: What do you mean by the last sentence, i.e. the coincidence with Wechsung (2005)? Is it possible to include/visualize some figures from Wechsung (2005)?

Figure 10: Could you please also provide other performance metrics, e.g. NSE, KGE?

I missed some crucial information, such as the resolution of the forcing data used and the resolution of mHM model used.

Page 19, line 5: . . . each monitoring well ... (singular)

Page 19, lines 15-17, Page 20: Please check the English. An example: Another reason is that we assigned a homogenous storage coefficient (?) in all aquifers, which an over-simplified setting.

Page 21, line 14: Did Kumar et al. (2016) also simulate groundwater heads?

Page 22, lines 9-17: For prediction/application in ungauged basins, I believe that hydrogeological characterization (in ungauged basins) still remains as one of the main challenges.

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