Geoscientific
Model Development
Discussions

Interactive comment on "Modeling of land-surface interactions in the PALM model system 6.0: Land surface model description, first evaluation, and sensitivity to model parameters" *by* Katrin Frieda Gehrke et al.

Anonymous Referee #1

Received and published: 9 November 2020

Within this study, the authors introduce the land-surface model (LSM) implemented in PALM model, and evaluate the performance using two-day in-situ observations. They conduct a series of sensitivity experiments to explore the impacts of model parameters on simulating the boundary-layer profiles, the surface energy balance, and near-surface meteorological variables.

Despite the detailed description about the LSM and useful information for PALM users, the results are very preliminary. As the manuscript reads now, the authors touched some subjects only briefly without really adding any scientific merit. It is more like a

graduate's project essay than a scientific paper.

Specific comments:

The manuscript needs significant restructuring in order to establish a better focus within this paper. I suggest the authors seriously consider the sensitivity experiment design first. Of course every parameter in a model would have more or less impacts on the simulations. To fit this study, no need to take the radiation scheme (RRTMG & CLEARSKY), large-scale forcing (ADV_tq), or resolution (Dz_2) into account. Other case like EMIS_95 and EMIS_100, even not being mentioned in the manuscript. These unnecessary results make the paper more difficult to follow and do not have much scientific merit being covered so briefly. Removing the relevant content would be better, in my opinion.

Second, the results section seems poorly phrased. I see a little conjecture and repetition in Section 5. For example in L430-445, this portion could be removed (at least be shortened), as it does not provide much "facts" to convince readers. If I correctly understand, the point is the observed H and LE might be underestimated due to the limitation of eddy-covariance method, which partially explains the overestimated H and LE by model. Fig. 7 can be removed as well because we've already got those information from Figs. 3-6. The black line of RES term just indicates the measurements are of bad quality. Plus, a repeated statement about Bowen ratio in the end; authors have mentioned that in L396-400. For L472-489, after going through this paragraph, I still have no idea why the model is not able to reproduce the nocturnal boundary layer, even feel a big unsolved issue existed in the LSM or the atmospheric model. Authors should not do like give a hypothesis, reject it, and then say we in actual don't have much confidence in the rejection. This discussion won't help raise one's interest in the model.

The third point is to be correct. Like L355, I assume ALBE_24 is the sensitivity experiment featuring a decreased albedo in comparison to the REF. But following L232, the

shortwave albedo is set to 0.14 in REF. Please double check the setup of your experiments. L398: I doubt the discussion "cases HUMID_sat and LAI_05 show significantly lower Bowen ratios compared to observations". From Figs 4&5, I see larger H and lower LE which means a larger Bowen ratio (H/LE) than observations. In L509, it is the low temperature leading to stable boundary layer, not "stable layer, hence the low temperature". Likewise later in L513, the convective boundary layer started developing because of the surface heating in the morning than "the stable layer is eroded and temperature can rapidly increase".

Lastly, seriously improve the English writing.

Technical comments

L1: PALM is an acronym?

L2: "For this" -> "To this end"

L4: Add "with observations" after "agree well"

L8 & L47: "By this" -> "In this way"

L235: What is CESAR?

L263-264: Rephrase the sentence to "The CESAR site is well equipped with the vegetation and soil information which provides a good opportunity to evaluate the land-surface parameterization proposed in the present study. "

L267-271: Change to "The land surface scheme configuration is given in Table 4" and then add the information you don't have in Table 4.

L314: "One the one hand" -> "On one hand"

Fig.2: Crowded figure. May be plotted as Fig. 9, one time in one panel.

L326, L334 & L337: Add "with observations" after "agree well"

L377: "Moreover, the simulated H ..., respectively" -> "The model overestimates H

during the daytime while the maximum bias is at noon."

L394: "Compared with ... in Cabauw" -> "However, the observed LH is non-negative which suggests the dew formation does not occur in Cabauw."

L550: "at vegetated ... water surfaces" -> "at vegetated surface"