Biogeosciences
Discussions

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Interactive comment on "Application of the ACASA model for a spruce forest and a nearby patchy clearing" *by* Kathrin Gatzsche et al.

Anonymous Referee #3

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The paper investigates the possibilities to apply the ACASA Model for the calculation of turbulent fluxes over heterogeneous landscape consisting of forest and clearing. The paper clearly presents the results of a model development study. That's why the title of the article is slightly misleading in my option – the "application of the model" usually means that we use a model as an instrument to study something, e.g. turbulent fluxes. In such case the model is a tool not the goal. In present article the "overall aim" is to "to analyze whether ACASA can simulate the fluxes over tall and low vegetation in an appropriate way", i.e. the model itself is the aim. Therefore, I think it would be better to resubmit the article to some journal focused on model development like "Ecological modelling".

However, whether the publication will take place in this or in a modelling journal, it

should be clearly defined what is the main aim of the proposed model development. What do you plan to use the model for? If you want to study the processes in a spatially heterogeneous landscape than it would be better to use a 3D model as an instrument. We cannot learn much about the 3D effects in the spatially heterogeneous landscape using the 1D model. The authors write that the model "has been utilized for the simulation of the turbulent transfer for a forest-clearing transition." It is not true in my opinion - what was described are the forest AND the clearing, but not the transition. The authors stated themselves that for such studies a 3D approach like LES modelling is better. Or is the aim of the model to use it as an enhanced land surface submodel for climate modelling?

Other questions are: what are the main improvements of the corrected model and whether they are sufficient for publication? The authors state that the present paper is "an updated investigation" of the Falge et al (2017), so what is their new and original contribution? For the model improvement several already published methods were implemented and the share of "we suggested" seems to be relatively small. Please highlight clearly the new and original achievements of the study.

Besides, the text should be thoroughly checked - there are many mixings between singular and plural, and the formulations in the text are not really clear (s. also the special remarks below).

Special remarks:

P1 L14 "models must be applied for different surface types" Comment: It is not quite clear why it is a MUST to apply any model at all and for different surfaces in particular?

P1 L19 "not closed by an amount of up to 30%" Comment: 30% of unclosure is not an absolute maximum, is it?

P2 L2 "Measurement data must be corrected..." Comment: again – is it always a MUST?

P2 L25 "the footprint of different plant classes." Comment: What do you mean?

P3 L9 "more detailed description of the surrounding topography is provided by Foken…" Comment: It is an important information for a study dealing with heterogeneous surface and should be provided in a manuscript.

P3 L12 "The main foliage is located" Comment: What is the main foliage? Do you mean a leaf area or mass or what?

P3 L12 "where z is the measurement height normalized by the stand height hc" Comment: z is just a measurement height.

P4 Table 1. Why clearing is described in the table 1 and forest – in the text?

P3 L12 "This method allows the calculation of the temperatures of these components without also making substantial errors in the case of significant deviations from the ambient temperature" Comment: 1) Why "also"? 2) Does it work for the components in a forest-clearing transition zone?

P5 L19 "Direct as well as diffuse radiation can be absorbed, transmitted, emitted or reflected by the canopy, whereby these processes are dependent on the leaf distribution of the plants." Comments: 1) The terms "direct" and "diffuse" are usually applied for shortwave solar (or diffuse sky) radiation fluxes which, therefore, cannot be emitted by the canopy under normal conditions. The canopy can emit a longwave radiation. 2) Why only the leaf distribution? What about stems, branches and soil?

P5 L20 "the vegetation is distributed in 10 different leaf angle classes" Comments: the whole vegetation or just leaves/needles?

P5 L21 "allocation of the incoming energy" Comments: or of the available? The emitted/reflected parts of incoming energy are lost for the canopy.

P5 L25 How tall is "taller vegetation"?

P5 L26 What are the "diffusive approaches"?

P6. Table 2: The measured parameters and instrumentation are not presented adequately: - What is the instrument for the air pressure? - CM14 is an albedometer and can measure both incoming and reflected shortwave radiation. Did you use the incoming component only? - CG2 – is the net radiometer, thus, the same question as for the CM14 - CNRN4 is probably the CNR4 net radiometer – the same questions about upward and downward fluxes. If you measured the downward fluxes only – how did you calculate the radiative balance? What is the instrument for the soil heat flux? Is there any instrument for PAR-measurements?

P6 L4-5 "The soil respiration is separately calculated for 5 roots and microbes according to Eq. (1)" Comment: using the same R0 and Q10?

P7 L7 "the relation" – which relation?

P7 L13-14: As the information is important, I suggest to provide both parameter sets – clearing and forest for the better comparison and visualization of differences.

P7 L18 – PAR, measured or modelled? P7 L27 – Second reference of Haverd and Lindroth is not necessary P9 L3-4 "…but requires their scalar similarity. Henceforth, this method is abbreviated with EBC-Bo." Comment: The formulation is unclear – why scalar similarity produces this abbreviation? The same question is about EBC-HB.

P9 L10 "Therefore, we propose a new correction method on the basis of the good scalar similarity between the humidity and the carbon dioxide concentration (Ruppert et al., 2006). Comment: Again, the formulation is unclear – is it your original suggestion or the one of the Ruppert et al?

P9 L20 "of surface characteristics (roughness length)" – characteristic or characteristics?

P10 L22 "between the different stratification" – singular or plural?

P10 L24 " forest has additional influence" – how is it visible in Fig.2?

P11 Fig. 2: Consider placing the four (a) panels (upper row) below the four (b) panels (lower row) for a direct comparison of footprints. What is the "all" case?

P11 L7-8. The sentence is not clearly formulated please rewrite. What is the "land-use distribution of the whole clearing"? Do you mean different land covers or vegetation types?

P11 L11-13"…difference… is more dominant" – please reformulate.

P12L2-3 "Obviously, the integrated fluxes of the tile approaches for the whole clearing and the footprint of the turbulence mast for 5.5m height do not differ significantly" – what do you compare with what?

P12 L3: Which "land use characteristics"?

P12 L4-5 "This can be seen by the high measured latent heat fluxes in the first Golden Day 5 Period (see Fig. 3). Further regression analyses…" Comment: Why "further" – there is no regression analysis on Fig.3?

P12L3 Fig. 3. What about uncorrected fluxes?

P13 L3 "regression has been achieved" – can you achieve a regression?

P13 L3 "regression analysis is calculated for" – can you calculate an analysis?

P14 L1-2 "difference between net radiation and the ground heat flux" – how they were measured?

P14 L18 – "sensors" – which sensors?

P18 "Further research is necessary with other well parametrized models that close the energy balance very well, and data sets for lower Bowen ratios." Comment: does it mean that the present model is not adequate for the goal?

P19 L2 "The comparison of the modeled and the measured (ground truth)" Comment: in previous section the ground truth was the model, wasn't it? P19 L5-6 "the buoyancy

corrected fluxes show better results in comparison with the model. This offers the possibility of modeling fluxes over larger heterogeneous areas…" Comment: This does not look like a logical consequence for me.

P20 L4 "can also be used with high accuracy for low vegetation if the plant specific parameters are appropriately implemented in the model" Comment: What in this case is the "high accuracy" and "low vegetation"? The conclusion does not follow from the results in my opinion.

P20 L7-12. The paragraph is not really clear. Try to reformulate it.