

First of all we want to thank the three reviewers for the helpful comments. We have already answered the main problems of the reviewers in a letter to the editor on January 24, which was distributed to all reviewers: <https://www.biogeosciences-discuss.net/bg-2017-450/bg-2017-450-AC1-supplement.pdf>. Therefore, in the following we will answer only the specific problems. In accordance with these general comments we have made large additions to the Introduction and deleted parts about the ACASA-model that were repetitions from earlier publications. Comments from referees are presented in black and these are followed by the authors' responses in blue.

### **Reviewer #3**

#### **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?

P1L14:

Text was re-formulated and supplemented with additional text.

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

P1L19: The paper is an overview paper.

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

P2L2: Text was reformulated.

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

P2L25:

Text was re-formulated and supplemented with additional text.

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.

P3L9: We believe that with Fig. 1a and 1b, the heights of the relevant hills in the surrounding, and the slope in the text, all necessary information is given.

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

P3L12: was re-formulated.

P3 L12 “where  $z$  is the measurement height normalized by the stand height  $h_c$ ” Comment:  $z$  is just a measurement height

P3L12: was corrected.

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

P4, Table 1: Table 1 includes the necessary data for the tile approach of the clearing. The modeling for the forest was done with the assumption of a homogeneous forest and the information is now also provided in Table 1.

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?

P5L12: The sentence was reformulated. It works for the clearing and the forest.

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?

P5L19: was corrected.

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

P5L20: This is now clarified in the text.

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

P5L21: was corrected.

P5 L25 How tall is "taller vegetation"?

P5L25: was corrected.

P5 L26 What are the "diffusive approaches"?

P5L26: Reference was included and the sentence was reformulated, with a reference to the one-dimensional diffusion equation.

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?

P6Table 2: The Table was corrected: pressure AB60; CM14, CG2: both components were used; CNR4: all four components were used; the “N” was deleted; soil heat flux was added; PAR see P7L18

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.

P6L4-5, P7L7, P7L13-14: This part was deleted because this was already published.

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.

P7L18: This part was deleted, because this was already published, PAR was not measured but calculated/parametrized from global radiation.

P7L27: was deleted.

P9L3-7: The Bowen ratio correction can only be applied when both fluxes (sensible and latent) are affected in a similar way by measuring errors or energy balance closure.

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?

P9L10: The correction for the latent heat flux can only be applied to the carbon dioxide flux if both fluxes are affected in a similar way by the energy balance closure problem. Ruppert et al. (2006) have shown that this required scalar similarity is not always valid, see Fig. 3 in this reference. An additional remark was included.

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

P10 L22 “between the different stratification” – singular or plural?

P9L20, P10L22, was corrected.

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

P10L24: The forest is within the footprint effect levels 80 and 95.

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?

P11Fig. 2: We have added some words for clarification.

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?

P11L7-8: was corrected.

P11 L11-13“...difference...is more dominant” – please reformulate.

P11L11-13: was corrected.

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?

P12L2-3: Sentence has been corrected.

P12 L3: Which “land use characteristics”?

P12L3: was corrected.

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?

P12L4-5: Further was deleted.

P12L3 Fig. 3. What about uncorrected fluxes?

P12L3, Fig 3: Uncorrected fluxes were not included because they are always smaller than modeled fluxes (Eq. 3).

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

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

P13L3: Both were corrected

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

P14L1-2: The corrections in Table 2 should now make this clear, and a reference for ground heat flux has been included.

P14 L18 – “sensors” – which sensors?

P14L18: Has been added in Table 2.

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?

P18: We have made a small change in the sentence; we believe that the conclusions would be stronger if other models and data sets were to be analyzed in the same way.

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.

P19L2: We have corrected this.

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.

P20L4: We have added some words for clarification.

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

P20L7-12: We have added again the reference Falge et al (2017) for a better understanding.

Reference:

Ruppert J, Thomas C and Foken T (2006) Scalar similarity for relaxed eddy accumulation methods. *Boundary-Layer Meteorol.* 120:39-63.