Dear Reviewer,

Thanks a lot for your efforts to further improve the manuscript. Please find a point-to-point reply to your comments below.

Peter Bosman and Maarten Krol

p 2, line 35: The justification is too vague and not quantitative enough. It would be more relevant to specify the time scale and the horizontal resolution for which the assumption is valid based on specific case studies.
We have slightly adapted the text to make it more clear:
"The best model performance is during the convective daytime period. Since the CBL-model physics are relatively simple and only include the essential boundary layer processes, the model performs best on what might be called "golden days". Those are days in which advection is either absent or uniform in time and space, deep convection and precipitation are absent, and sufficient incoming shortwave radiation heats the surface allowing for the formation of a prototypical convective boundary layer. When these assumptions are met, the evolution of the budgets of heat, moisture, and gases is to a large extent determined by local land-atmosphere interactions. The aforementioned assumptions should ideally be valid for the whole modelled period. They should ideally hold on a spatial scale large enough that violations of the assumptions in the region do not influence the model simulation location. In practice, days are often not "ideal", e.g. a time-varying advection can be present. This does not necessarily mean the model cannot be applied to that day, but, performance is likely to be worse."

The assumptions underlying mixed-layer theory are rarely (or never) fully met. Placing more specific numbers on the scales over which the assumptions should hold is therefore very hard. Mixed-layer theory is however a powerful theory to understand the essential boundary layer behaviour, even if these assumptions are not fully met. For studies using mixed-layer theory, see e.g. Ouwersloot et al. (2012), Vilà-Guerau De Arellano et al (2012), van Heerwaarden et al. (2010), Pietersen et al. (2015), Pino et al. (2006).
p 3, line 74: Add ..with processes not included..."
It is not fully clear to us where this should be added. In the sentence before we write about ORCHIDEE and JSBACH: "These models have more complex physics not included in the CLASS model, which can be advantageous in accurately simulating land-atmosphere exchange". Therefore we assume the message of CLASS having more simple physics to be clear to the reader.
p 3, line 73: "This enables to include the information" Write instead "This enables the inclusion of information..".
Adapted, we now wrote "This facilitates the inclusion of atmospheric observations…"
p 3, line 74: You can specify that others groups have already coupled a land surface model to a transport model to assimilate both atmospheric observations (e.g., CO2 mixing ratio) and terrestrial observations.See the MPI-CCDAS with Schurmann et al. (2016), the ORCHIDEE-CCDAS with Peylin et al. (2016) and the BETHY-CCDAS (Rayner et al. (2005); Schloze et al. (2007); Ziehn et al. (2012) ; Kaminski (2013).
You could mention the technics used in these systems.

We added some information to the text: “Kaminski et al. (2012) and Schürmann et al. (2016) also assimilate both land-surface-related and atmosphere-related observations. In those studies a land-surface model is coupled to an atmospheric transport model. Meteorology is not simulated in those studies. In ICLASS, meteorology adds an additional set of observation streams, that can be used to optimise land-surface-related parameters that are linked both to gas fluxes and meteorology.”

p 3, line 84: The BETHY Land Surface Model disposes also of an adjoint that is used to optimize the land surface parameters. See Ziehn et al. (2012).

Thanks for the suggestion, We adapted the text and incorporated the reference to Ziehn et al.: “An adjoint has been used in the past to optimise parameters, e.g. for land-surface models (Raoult et al., 2016; Ziehn et al., 2012).”

p28, line 705: When mentioning the CPU time consumed by an experiment with ICLASS, it would be relevant to compare with a Land Surface Model (e.g., SIB4) coupled to a transport model. How much faster is ICLASS compared to a full LSM coupled to a transport model?

We agree that it could be interesting to compare ICLASS to e.g. SIB4 coupled with a chemical transport model (CTM). However, we do not have a coupled SIB4-CTM run available for e.g. the Cabauw case. The result will also strongly depend on the configuration of the coupled model, e.g. which parameters are optimised, resolution etc.

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