Geoscientific

Model Development

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Interactive comment on "Modeling the diurnal cycle of conserved and reactive species in the convective boundary layer" *by* D. H. Lenschow et al.

Anonymous Referee #1

Received and published: 24 November 2015

The manuscript 'Modeling the diurnal cycle of conserved and reactive species in the convective boundary layer' by Lenschow et al. describes the development of a model that describes the influence of vertical turbulent transport on concentrations, fluxes and (co)variances of scalars and chemical species. They expand the Kristensen et al. (2010) model to account for diurnal variations in boundary layer depth, and the effects thereof on conserved and reactive species. The model combines the advantage of a LES model, i.e. that it can be used to calculate second order moments and intensity of segregation, with the advantage of a mixed-layer model, i.e. that its computational demands are low. The model is described in detail, and a series of systematic test cases is presented for inert and reactive species, as well as a comparison with LES and

eddy diffusivity theory results. The manuscript is written well and the model description and analysis are well-structured. I have only some very minor remarks on the MS, and think it can be published in GMD after the authors have addressed these.

Specific comments:

Title: in the title of a GMD paper, the name and version of the model should be indicated

A section on the availability of the model code is missing

p. 9336, line 6: is there a specific reason why a value of 0.993h was chosen?

Technical comments:

p. 9325, line 4: the acronym 'CBL' is already explained in the abstract

p. 9329, line 11: I think '$S_i(z)$' should read '$S_i(z,t)$'

p. 9333, line 4: here the acronym 'PBL' is used without further description. Since all PBLs discussed in this manuscript are CBLs, I would suggest using the latter term consistently throughout the manuscript.

p. 9337, line 13: pls change 'In' into 'in'

p. 9340, line 7: add a comma after 'case B'

p. 9341, line 16-17: remove one of the two occurrences of 'directly' from this sentence

p. 9342, line 4: change 'whose the reactive' into 'whose reactive'

p. 9342, line 16: remove 'that'

p. 9343, line 2: remove 'for O_3,'

p. 9349, line 9: add 'it is' between 'and' and 'easy', and 'to; between 'and' and 'quickly' to make the sentence grammatically correct

p. 9349, line 11: remove 'adding'

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p. 9349, line 12: change 'incorporating' in 'to incorporate'

p. 9350, line 7: do you mean 'numerically', instead of 'numerally'?

figure 10, caption: the figure shows the species variances at 10:00, 12:00 and 14:00, while the caption only mentions 12:00 LT. Further, the last sentence of the caption does not seem to apply to the figure.

A list of abbreviations in the appendix would be a great help for the reader

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