

Interactive comment on “Parameterization of vertical diffusion and the atmospheric boundary layer height determination in the EMEP model” by A. Jeričević et al.

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Dear all,

I am pleased to see that the formulation of the PBL height and vertical diffusion in the stable boundary layer is indeed of extreme relevance for air quality. After having read the paper I have some suggestions and comments:

1. What was the motivation to start with a new parameterization for $K(z)$ and the ABL height. It has not been mentioned in the paper that one was unhappy with the EMEP results under the old schemes. If this was the case, please mention.

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2. P9605: At which height as ϕ been evaluated?
3. P9605: Note that Eq 6b is only valid for $z/L < 1$
4. Equation 10: Can you provide some physical background on the formulation of Eq. 10. It appears it is an interpolation, but why in this way?
5. P9606: Can you provide also the uncertainty of the coefficients in Eq. 11 and 12.
6. P9607, Eqs 13,14,15: Perhaps it is interesting to check the paper of Voegelezang and Holtslag (1996). They use the same method (also at Cabauw), but they find much better results if u_s and v_s in eq. 14 and 15 are not taken at the surface, but at the 20, 40 or 80 m level. Voegelezang, D.H.P., and A.A.M. Holtslag, 1996: Evaluation and model impacts of alternative boundary-layer height formulations. *Boundary-Layer Meteorol.*, 81, 245-269.
7. A question on DATABASE64. First, does, in your opinion, a 64 cubed LES have sufficient resolution to provide reliable results for the turbulent fields? Second, in the DATABASE64 dataset, the surface sensible heat flux has been prescribed at the surface. However, in the paper below, we show based on theoretical arguments that using a surface heat flux is not a proper boundary conditions for stable conditions (not for LES, no for 1D models). With this information, can you comment on the reliability of the DATABASE64? Basu, S., A.A.M. Holtslag, B.J.H. van de Wiel, A.F. Moene, and G.J. Steeneveld, 2008: An inconvenient 'truth' about using the sensible heatflux as a surface boundary condition in models under stably stratified regimes, *Acta Geophys.*, 56, 88-99.
8. P9608: Has the PBL depth in DATABASE64 been determined with the same method as in the newly developed scheme? This should be true for an honest comparison.
9. P9610: Perhaps the paper can be strengthened if the systematic part of the RMSE is used, and the index of agreement instead of correlation coefficient (Willmott, 1981).
10. P9611: It is mentioned that Grisogono is less diffusive than Obrien. However, in

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Fig 2 I see the opposite.

11. P9615: Can you comment on the quality of radiosounding data. My experience is that wind speed is limited available, and only at coarse resolution. This will impact on RiB.

12. P9618: Which % of data has a PBL height of more than 200 m? In the paper below, a substantial amount of the Cabauw data has $H > 200\text{m}$? So how representative is your evaluation?

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