Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-141, a study optimizing minimal K in ACM2

Anonymous Referee #2

Referee comment on "Influence on the temperature estimation of the planetary boundary layer scheme with different minimum eddy diffusivity in WRF v3.9.1.1" by Hongyi Ding et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-141-RC2, 2021

This study tries to optimize the minimal vertical mixing coefficient in the ACM2 PBL scheme to alleviate the cold bias during nighttime at one urban site in Beijing. It is concluded that increasing the minimal vertical mixing coefficient is beneficial to reproduce nighttime surface temperature. While it is important for models to accurately simulate near-surface boundary layer structure, including surface temperature (T2), I have a few concerns for this manuscript before it could be published.

1. This study only focuses on surface temperature (T2). How about water vapor and winds? You may improve temperature performance at the cost of worse performance for other variables.

One cannot simply focus on one variable but ignore other variables during model calibration/optimization.

2. Only data at one urban site are used in model evaluation in this study. The cold bias at this site may not be representative. Normally, regular soundings are used for PBL scheme calibration. Why don't use soundings?

3. Cold bias seen at the urban site in this study may be due to model errors associated with urban scheme and anthropogenic heat, as well as errors in initial model states particularly soil moisture. So, this study may be attributing other model errors to PBL scheme

Other minor comments:

LN27-30 These are old PBL schemes, not including modern PBL schemes, for example scale-aware schemes and mass flux schemes

LN128-130

Aerosol effect may impact temperature, which is not considered by the model simulation in this study. So, this study ascribes the potential bias of not considering aerosol effects to vertical mixing.

LN166, what is the Landusef value used in the simulation

LN255

I don't think Kzmin would affect daytime prediction. It must be the residual effects from the nighttime impact

In Figure 6.

actually K=0.01 gives better temperature variation/cooling rate during nighttime. This simulation just has some systematic bias, which may not be due to PBL schemes, but due to other model/inputs bias/errors, for example, the systematic bias from urban scheme and uncertainties in initial land properties especially soil moisture.

ACM2_CMAQ should be identical as K=1 since urban fraction is 1.

Fig. 7, there is only one profile. Is this a profile averaged over several days or just at a specific time of a day? Please be explicit.