Atmos. Chem. Phys. Discuss., 10, C9446–C9448, 2010
www.atmos-chem-phys-discuss.net/10/C9446/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of urban surface parameterizations in the WRF model using measurements during the Texas Air Quality Study 2006 field campaign" *by* S.-H. Lee et al.

Anonymous Referee #1

Received and published: 4 November 2010

A very complete set of observations at the surface and upper air are used to evaluate three different land-surface parameterizations implemented in the mesoscale model WRF in the urban area around Houston. The intercomparison is very complete and well written, but it fails short in provide clear explanations and potential improvements in the parameterization performance. In my opinion, these are the three main aspects that require further elaboration and clarifications:

a) Nocturnal boundary layer. At different parts of the manuscript (abstract, section 4.3, conclusion) is found that the modeled night conditions are characterized by excessive turbulent mixing. This is a key aspect of the research since it involves the interaction be-

tween the land surface representation with the boundary layer scheme. In my opinion, this research needs to include how to improve this fundamental aspect in WRF. There has been already previous research on this subject and I will encourage the authors to implement it and discuss if it improves their results and the model performance at night (see for instance Steeneveld et al., 2008, Journal of Applied Meteorology, 869-887).

b) Interaction mesoscale phenomena and boundary layer dynamics. In section 4.3 it is mentioned that the model is able to reproduce well the influence of the sea breeze. The influence of the sea breeze on the development of the boundary layer is very vaguely described. I have the following question related to this issue: What is the impact of the sea breeze on the different land-surface schemes understudy? Do all react in a similar way? Is the boundary layer still growing? I believe that in addition of the sea breeze, there is a urban breeze driven by the different thermal capacities. What is the influence of the breeze on the boundary layer dynamics? In that respect, it will be very interesting to determine the impact of horizontal resolution (for instance by doing an extra numerical experiment imposing 2 x 2 km2) in their results (see also point 6 in the specific comments).

c) Aerosols. There is hardly any discussion on the effects of aerosols in the development of the boundary layer. I should expect that in urban areas they exert an influence on the radiation an therefore on surface forcing, but also in stabilizing the upper part of the boundary layer by absorption and scattering (see for instance Yu et al., 2002, Journal of Geophysical Research 107, D12,4142). How is the interaction between the radiation schemes and the land-surface model understudy? Does it influence the boundary layer characteristics in the studied situation?

Specific comments

1- What are the assumptions behind equations (4) and (5)?

2- How is the entrainment flux estimated in equation (6)? Is this term included in all the thermodynamic variables?

3- Shear is a very local process. In equation (8), it is only included the shear at the surface. What about the contribution of shear in the inversion?

4- In equation (8), why the convective scale is multiplied by the von Karman constant?

5- In equation (9), I think they should use the virtual potential temperature

6- In the majority of the figures, they are comparing a single point measurement with the 4 x 4 km2 grid. The urban are is highly heterogeneous and I think they need to justify the assumptions in comparing observations and WRF model results.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 25033, 2010.