Atmos. Chem. Phys. Discuss., 10, C8764–C8766, 2010
www.atmos-chem-phys-discuss.net/10/C8764/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Surface heterogeneity impacts on boundary layer dynamics via energy balance partitioning" *by* N. A. Brunsell et al.

N. A. Brunsell et al.

brunsell@ku.edu

Received and published: 15 October 2010

We thank the reviewer for thoughtful comments concerning our manuscript and feel that the manuscript has been considerably improved.

1. The reviewer is absolutely correct that we set the v-component of the geostrophic wind to zero. The simulations are fully three-dimensional. The text has been altered in places to make this more apparent. In addition, as the reviewer requested, we have added the spatial variance of the resolved transverse velocity. This addition required that we split the old Figure 13 into two figures: the new Figure 13 which consists of the three components of the velocity and a new Figure 14 which consists of the resolved temperature and humidity variances across all of the simulations. We have also altered the text to reflect that we were altering the geostrophic velocity (not simply adding 3

or 6 m/s to the output fields) for those simulations examining the impacts of changing wind speed. With regard to the inclusion of the equations, note that ARPS employs a fully compressible framework and a curvilinear coordinate system that renders the equation set far more cluttered (and frankly, inelegant) than that of a typical LES (see Xue 2000, equations 1-7). However, as a middle ground, we follow Vinkovic et al. 2006, and present the momentum and pressure equations. In addition we have added the equation for conservation of humidity as an example of a scalar as requested. We have also altered the notation throughout the text (added tildes when referring to resolved fields and angle brackets for spatial averaging) to make our nomenclature more in line with the tradition within LES studies. We did not however alter the nomenclature for the surface fields as these fields are to not be filtered in the sense of the turbulent fluctuations.

2. This sentence has been removed from the manuscript.

3. The wording surrounding this sentence in the abstract has been altered to (hopefully) make it more clear.

4. These values were chosen from experience to select a variation in wind speed, but still have values that are physically plausible. The text has been altered to make this more clear.

5. The plots are now shown as a function of latitude and longitude rather than grid cell.

6. The figure axes and labels have been increased in size to aid readability.

7. We've added a paragraph to discuss the role of filter size on the spatial variance of the surface fields and how this related to the spatial variance under the observed scenarios. Section 2.1 was amended as the reviewer requested to employ the traditional LES (tilde) nomenclature consistently.

8. Most of the figures are now normalized by appropriate values. However, we chose not to alter the discussion about Figure 2 due to the fact that these length scales are

derived from the surface fields and thus are independent of the turbulent boundary layer flow. Also, employing dimensional length keeps the discussion about the nature of these scales more similar to what would appear in remote sensing studies of surface variability. The atmospheric fields are all normalized and the units have been added to Table 1.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 17815, 2010.