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Geoscientific Model Development Discussions

Interactive comment on "Implementation of a roughness sublayer parameterization in the Weather Research and Forecasting model (WRF version 3.7.1) and its validation for regional climate simulations" *by* Junhong Lee et al.

Anonymous Referee #1

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This paper describes the implementation of a roughness sublayer approach into the WRF surface layer physics. The paper describes the method of implementation well and it involves several iterative calculations due to implicit dependencies. Results are shown both for offline and real-data tests. The offline simulations vary the stability, while the real-data simulations show the impact of a wider range of regional variations in surface types for a one-month winter period. The results demonstrate important differences in the wind speed due to the added effective roughness of the new scheme that treats the canopy including forests in a more physically based way following the

methods suggested by Harman and Finnigan (2007,2008).

The paper introduces a useful representation of the roughness sublayer to WRF and is therefore a fitting publication for this journal. It is generally well written, but I will include some technical points that need better description and this could lead to minor revision of the text to improve some explanations.

Technical Points

1. With various z definitions, and d0 and dt, it is easy to be confused about what reference height is being used. The authors should try to ensure consistency, such as when z is referenced and then dt is introduced. Is z still relative to d0 in that case when seen in later equations such as (4)-(5)?

2. Eq. (2). Using an infinite upper bound implies that the length scale in (3) is still below the lowest model level? If so, this needs to be made clear because it is not obvious what length scale (3) has.

3. Eq. (4). This introduces f and does not define it as far as I can tell.

4. The positions of d0, dt and h relative to each other may be helpful to visualize with a schematic, along with how z is defined.

5. line 106. I believe this references Eq. (8) not (7).

6. line 109. ga is introduced without being defined as far as I can tell. This is referred to as aerodynamic conductance but some may be more familiar with it as a surface exchange coefficient for temperature. Is it simply the heat flux divided by the temperature difference? This should be explained.

7. Table 1 shows a z0, but this is probably only in the control experiment as z0 is calculated by the new scheme.

8. With the iterations required, does this add much to the cost of the scheme in computer time.

9. Figure 3. In the idealized case, the control z0 is 0.25 m. Here the figure shows a ratio of z0/z0N. What is z0N so that we can compare it with 0.25 m?

10. Figure 5 is another place where it would have helped to know that the original displacement height is less than the canopy height because we see the CTL values end there.

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