

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-300

Anonymous Referee #1

Referee comment on "Impacts of a revised surface roughness parameterization in the Community Land Model 5.1" by Ronny Meier et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-300-RC1>, 2021

General comments:

This study intends to modify the roughness of the land surface (z_0) in the CLM5.0 over various land types, in particular, bare soil and vegetation, and then examine the effects of those modifications on the land surface temperature (LST) in offline CLM5.0 and CESM. z_0 is one of the important parameters in computation of the surface fluxes and LST, but it cannot directly observe in the ground base. In LSMs, z_0 is usually defined as constant (e.g., bare soil and snow) or is parameterized as the vegetation height or urban canyon height. In current CLM5.0, the parametrization of z_0 was developed decades ago and has been proved to misrepresent when it is compared to the recent derived datasets (e.g., Figure 2). I personally think that the current study makes the important contribution toward the land surface model development. Previous studies have been showed that the CLM4.0 underestimates the LST over sparse vegetated regions (e.g., Wang et al. 2014). Compared the CESM-Z0 simulations with CESM-CTL (Figure 10), the LST increases over vast regions in NH. This may lead to the reduction of LST cold biases over those regions.

Specific comments:

In order to fully understand the methods technically, I have several comments and suggestions below.

- CLM does not explicitly compute and output the LST. It is necessary to give the equation for the LST computation in text.

- The processing MODIS LST in section 4.1 is stated in texts and is not easy to be captured. It suggests giving the bullet-point of each procedure as these in section 4.2.
- In both L488-489 and L491-493, the relationships between incoming shortwave radiation and LST seems oppositely. From the computation equation of LST (e.g., Yang et al. 2008 in reference list; Wang et al. 2014), the long-wave radiations (both incoming and outgoing) directly determine the LST magnitude. The incoming longwave radiation may change due to the cloud cover. The incoming shortwave radiation does not directly influence LST. Therefore, it is necessary to explain the possible mechanisms behind the relationship between incoming shortwave radiation and LST/cloud cover.

Technical corrections:

L684 (Fig. A2) should be (Fig. A3)

Reference: Wang, A., M. Barlage, X. Zeng, and C. S. Draper (2014), Comparison of land skin temperature from a land model, remote sensing, and in situ measurement, *J. Geophys. Res. Atmos.*, 119, 3093–3106, doi:10.1002/2013JD021026.