

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-325

Anonymous Referee #3

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Referee comment on "Large eddy simulation of boundary-layer turbulence over the heterogeneous surface in the source region of the Yellow River" by Yunshuai Zhang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-325-RC2>, 2021

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Comments on "Large eddy simulation of boundary-layer turbulence over the heterogeneous surface in the Source Region of the Yellow River" by Zhang et al.

### General comments

This research investigates the effects of circulations induced by strip like heterogeneity on the boundary-layer turbulence by using a Large Eddy Model which is initialized by the radiosonde profiles based on a field campaign Ngoring in the summer of 2012. The effects of surface anomaly heating and background wind on the TKE were studied carefully. The contributions to the turbulent intensity and heat flux from the patch-induced circulations and background turbulence were compared through the phase-averaged method. The effects of heterogeneity on boundary-layer turbulence in the surface and entrainment layer are investigated as well. As is noted in the paper, other simulation about the effects of heterogeneity on the boundary-layer turbulence have been reported already in other papers, but I think it is interesting to have this LES study on the Tibetan Plateau where the few observations on the turbulence intensity and turbulence flux have been performed. In any case the paper provides the insights and comment that I have not seen elsewhere, in particular a description of detailed turbulence characteristics in the source region of the Yellow River.

My overall recommendation is that this ms is acceptable for publication on the Atmospheric Chemistry and Physics after minor revision.

### Specific comments

(1). The authors use the quasi-three-dimensional large eddy simulations (LES) in this

study. The horizontal model domain of 135 km x 30 km with the mesh grid of 200 m. My question is why did not the author use the higher LES resolutions in this study? I wonder if the resolution of 200 m is appropriate for a LES study? In addition, what is the timestep in the simulations?

(2). The thermal internal boundary layer (TIBL) would form when cold air passes over the warm surface. It has been reported that a large scale convective TIBL could form due to the surface heterogeneity. If there exists a TIBL when the air flows from the cold lake-patch to the warm grass land in your study? How does the TIBL affect the turbulence interaction over the heterogeneous surfaces in your simulations?

#### Detailed comments

1) p8, line 164-165, here 'various ambient wind' refers to the initial wind or the geostrophic wind?

2) p11, Fig 2d, Is the unit (km) of the height in Fig. 2d correct?

3) p13, line 239-240, sentence does not read well. You use three times 'induced' -> reword it.

4) p13, line 251, 254, please unified 'fig' and 'Fig', and check all through the paper

5) p15, line 290, 'with at a 3 h interval' should be "with a 3 h interval"

6) p17, line 325-327, Sentence does not read well, reword it.

7) p28, line 502, 'confirms' should be 'confirm'

8) p30, fig. 13, I suggest plotting the joint distribution for cases of HOM, A1L and A2L in a panel instead of two.

9) I suggest the authors polishing the English proficiency of this ms again.