Reply to Editor

I really appreciate your considerable comments to improve the manuscript. I revised the manuscript with following the point-by-point responses.

Page 2, line 22. Unusual to refer to a "grid mesh". People usually use either mesh or grid. (Either are fine but be consistent)

⇨ “grid” is used

Page 8, line 15. Line 14 says that the Laplacian is on coordinate surfaces. The following lines discuss a horizontal Laplacian but the metric terms are not present. So I assume that you mean Laplacian is on coordinate surfaces. Please do not call this a horizontal Laplacian.

⇨ We revised accordingly.

Page 28, line 28. You use centred differences in the vertical. So if you used non-uniform vertical spacing you would get 1st-order accuracy. The vertical resolution is uniform so these centred differences will certainly contribute to the second-order convergence with resolution.

⇨ We added the sentence for clear description

“Note that it could be theoretically 1st-order accuracy with resolution if non-uniform vertical spacing is used, since the centered difference scheme in the vertical direction is implemented.”

Page 16, line 30. The sentence is not finished.

⇨ We revised accordingly.

The lines for 5th order and 8th order in fig 9 are pretty much on top of each other. I therefore dispute your claim that "The above results suggest that the numerical solution can be converged more rapidly by using a higher order of basis polynomial". I think that your eye was seeing what it wanted to see when comparing figs 7 and 8. Plotting errors instead of/aswell as absolute values would resolve the issue.

⇨ Following your suggestion, we changed the figure as below. Also we revised the related description accordingly.

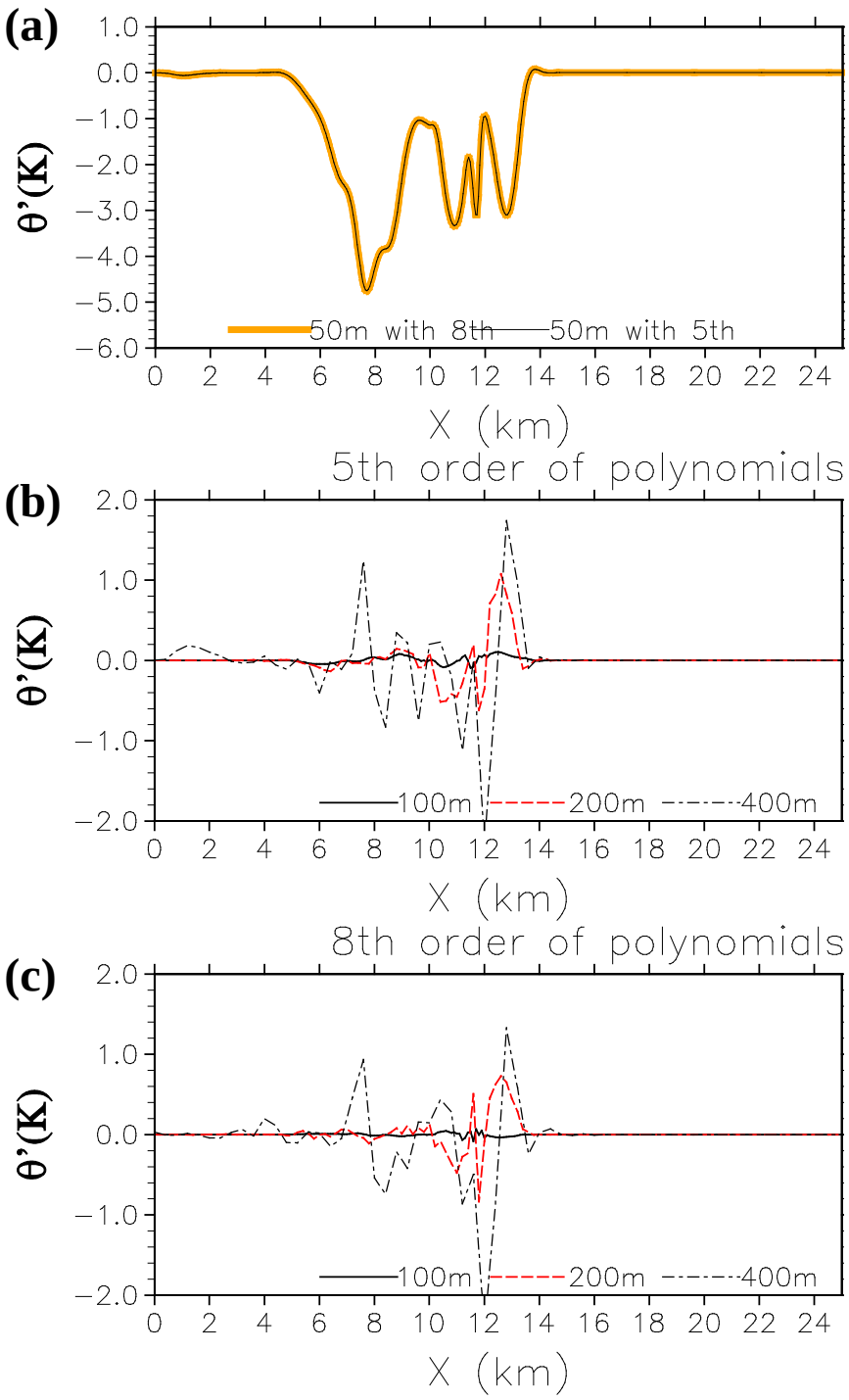

FIG. 9. Profiles of (a) potential temperature perturbation after 900 s along 1200 m height using grid spacing of $\Delta\overline{x} = 50$ m with 5th-order (thin solid line) and 8th-order (thick solid line) basis function, (b) difference between various resolution and $\Delta\overline{x} = 50$ m with 5th-order basis function, (c) difference between various resolution and $\Delta\overline{x} = 50$ m with 8th-order basis function.

Page 19. Based on the statement: "Although this amount of diffusion might seem excessive, it was chosen because it allows the model to remain stable even after the bubble reaches the top boundary." I would change a sentence in the abstract:

"The results from these tests demonstrated that the horizontally spectral element vertically finite difference model is accurate and robust provided sufficient diffusion is applied."

⇨ We changed that.

One of the reviewers also asked if you could report maximum Courant numbers. Do you still have this information? Could you reproduce it?

⇨ We have not analyzed maximum Courant numbers. We are sorry that we cannot provide this information in this time.

Due to a misunderstanding, you did not do a resting atmosphere over orography test case which is a shame. Please note in the manuscript that this will be the subject of future work.

⇨ We conducted the simulation for a resting atmosphere over orography and we added the results in Section 4.2 in which the added figure is as follows. Please see the result.

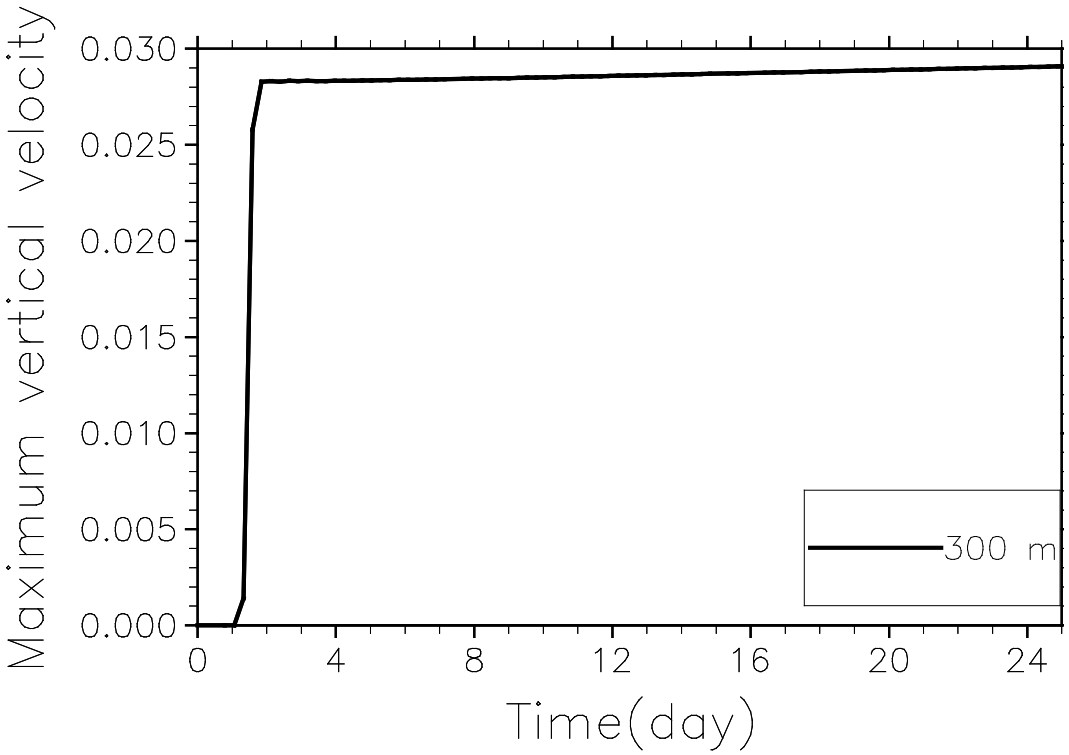

FIG. 5. Time series of the maximum vertical velocity for the resting-atmosphere simulations with a grid resolution of $\Delta\bar{x} = 300$ m using 5th-order basis polynomials per element and $\Delta\bar{z} = 250$ m.