Response to Reviewer # 1

Authors would like to thank the anonymous reviewer for thorough evaluation of our manuscript and constructive comments. Point-by-point responses to the reviewer's comments are given below in bold fonts and corresponding changes in the manuscript have been highlighted in red color.

General comment: This article delineates the effects of spatial resolution on the model performance over the central Himalaya. Ground and radiosonde profiles were used to assess the performance of WRF at different spatial resolution. The temporal evolution of meteorological profiles in WRF is seen to be in agreement with the measurements with stronger correlations for upper troposphere than those in the lower troposphere. To use the profiles to assess the model result for mountain region is new in my review. However, I find that this paper does not really reach to main question for mountain meteorology studies. The authors should review the frontier of this area. Only do evaluations is not qualified for GMDD publication.

Response: We agree with the reviewer and following the suggestion more literature survey has been included in the revised version (Page: 4-5, Lines: 85-104). We would like to mention that our study is not limited to evaluation only and we show that high-resolution set ups, with existing terrains in the model preprocessor, could reduce the model biases only to some extent. We therefore implemented a very high-resolution topography into the preprocessor to improve the model performance. Some biases particularly in the dynamics suggests uncertainties associated with other factors e.g. interaction between local circulation due to slope winds and synoptic-scale flow, or the representation of highly complex topography of the Himalaya, as correctly pointed out by the reviewer. This study is therefore first step and would be followed up with testing of individual physics schemes as new field measurements

become available. These aspects and outlook have been discussed in the revised version (Page: 20-21 Lines 373-406; Page: 25-27 Lines: 503-505, 509-514). It must be however stressed that a model evaluation does qualify for GMD(D) publications as mentioned in the journal's policy.

Comment 1: An issue is that when they compare model grid values with that of AWS, they might use two temperature at different height. Please compare the AWS elevation and the grid elevation where AWS located. Use the elevation difference to adjust the model temperature. The same problem also happens to wind speed. There are many evaluation papers for the mountain numerical simulation. The authors should review these papers, try to improve the wind speed performance.

Response 1: Thanks for the valuable suggestion. The difference between actual elevation of the observation site with model grid is 588 m in d01, 480 m in d02, and 270 m in d03 respectively. As the objective here is to describe the improvements in the model output over finer resolutions, we have analyzed model output without adjustments first. Nevertheless, following reviewer's suggestion and following other mountain modelling papers (e.g. Mues et al., 2018), meteorological data adjusted for elevation has also been analyzed in the revised manuscript (Page: 20, Lines: 371-390 and revised Table 1).

Comment 2: Figure 3, add their difference between d01 and Radiosonde and give some introduction on the difference. Line 261, it‘s better to add a figure which shows the correlation coefficient r, mean bias etc. result for all the height, not only say model captures variations at 500 hPa better than 50 hPa. It is also possible to compare the r and mean bias profiles with the three spatial resolution simulation.

Response 2: As suggested, difference between d01 and radiosonde are analyzed and discussed (revised Figure 3; and Page: 13-14, Lines: 269-282). Correlations at different altitudes are presented in form of Taylors diagram (Figure 7a). Following reviewer's suggestion, results summarizing the mean bias, root mean square error, correlation of profiles at different resolution have also been included in the revised version (new Figure 5, and Page: 15-16, Lines: 307-331).

Comment 3: Figure 4, many things are not clear in the figure, which year? It also repeat with figure 3. Again, the difference is more interesting to us.

Response 3: Following reviewer's suggestions, Figure 4 (as well as Figure 3) have been modified for clarity. Year (2011) has been mentioned on the revised figure. As suggested, differences are presented in both the figures in revised version.

Comment 4: Figure 6 the figure legend is not clear at all. Replot the figure with a colored marker.

Response 4: As suggested, Figure 6 (Figure 7 in the revised version) has been replotted with proper color marker and legend.

Comment 5: Figure 7 where is (a) and (b) letters? what does "0-6-12-.30" mean in the first wind-rose diagram? then why 0-2, 2-4, 4-6.....legend appears on the right of the fourth diagram?

Response 5: Figure 7 (Figure 8 in the revised version) has been revised to address reviewer's comment. Frequency of the occurrence and detailed legends are included now. Previously,

the “0-6-12-..30” **was percentage frequency and legend** “0-2, 2-4, 4-6.....” **at the right of the figure was showing the wind speed (ms^{-1}).**

Comment 6: Figure 8, the simulation does not show the diurnal variation in wind speed at all. What‘s the explanation for it? This is really interesting for mountain numerical simulation.

Response 6: We agree that the model does not capture the diurnal variation in the wind speed, as also seen over another complex terrain – such as the Tibetan Plateau (Zhou et al., 2019). The daytime reduction in the wind speed was observed by Solanki et al. (2019) over the same mountain peak attributed to the evolution of mountain circulation due to the heating of the slopes and its interaction with the synoptic scale flow, resulting in increased intensity of turbulences and vertical exchange of the momentum fluxes within the surface layer of atmosphere which inhibit the synoptic scale flow up to a certain extent during the daytime. Such competing effect between the thermal and mechanical driven processes could remain unresolved in the model even at higher grid resolution. In addition, mountain winds show sensitivity to boundary layer schemes Yver et al. (2013). Here, we analysed first the impacts of improved representation of the topographical features which would be followed up with testing of different physics schemes in the future. The interpretations with references as well as the limitations and outlook is added in the revised version of the manuscript (Page: 20-21; Lines: 371-406).