Response to the comments of reviewer #2.

Authors thank to the referee for the careful evaluation of the manuscript, providing the valuable suggestions and comments that helped us to improve the manuscript significantly. We have cautiously gone through the comments and implemented accordingly. Reviewer's comments are in regular font and our replies are in bold font characters.

Major question: the local (Himalayas Mountains) is a very dry. You can also see this looking to your profile of specific humidity. In this case, the SNR should be very weak, shouldn´t? Could you comment this point?
Response: **It is worth mentioning here that wind profiler basically detects the subtle fluctuations in the radio refractive index gradients, which in turn depend upon temperature and humidity gradients. Humidity gradients in the few hundred meters above surface will always be dominating due to orographic effects. We agree that SNR will not be that strong particularly in the absence of solar radiation, but as a result of mixing due to orographic influences and slope winds the SNR will always be positive (in our case) in the nocturnal local boundary layer over a mountain peak.**

Minor questions: Page 1, Line 16: I think that the precision of the instrument did not permit an estimation of the BL with 1 decimal (for instance 439.6 m).Use the closest integer for the average (440 m) and the standard deviation (197 m).
Response: **We agree with your suggestion, and the BL height values have now been reported to the closest integer in meters only.**

Page 2, line 10: I would suggest using potential temperature profile (not virtual potential temperature profile) as you are also using specific humidity.
Response: **Thank you for your suggestion, the potential temperature profiles have been presented in the revised manuscript throughout.**

Page 3, line 2: use the word missing instead of lacking.
Response: **Correction incorporated as per suggestion.**

Page 3, line 10: contrasting periods: winter and spring? How contrasting are these seasons?! Do you have data at summer period (or stopped at March 2012)?
Response: **The contrasting periods, referring to winter and spring (March only) have seasonal averaged sensible heat flux (SHF) of 50 Wm^{-2} and 17 Wm^{-2} respectively i.e. the SHF in spring is almost three times of that in the winter (Solanki et al., 2016).**

Page 4, line 15: between 0.1 and 6 km.
Response: **Correction incorporated.**

Figure 1: the vertical scale is height (not altitude since there is 2000 m of amsl plus the vertical profile). Also, it is better to use March 15, 2012 as label for the date. What are the daytime

hours?! What are the time zone differences for 06, 08 and 10 UTC? How have the authors computed the height of BL?! (described at page 5)
Response: **Altitude changed to height throughout the manuscript. Date format has also been changed. For the site, local time is UTC +5.5 Hours (i.e. 5 hours and 30 minutes ahead of UTC), and this is also mentioned on page 7 in line 8. We have quoted about BL height on page 5, this height has only been speculated from the RWP and radiosonde profiles.**

Page 5, lines 1-6: what are the relations between the description of the entrainment zone and the a typical SNR profile?! I did not completely understand the point raised at those lines. Could the authors clarify this point?!
Response: **We have speculated about the characteristics of entrainment zone over complex mountainous terrain in these lines. It has been stated that, over flat homogeneous terrain, a peak in the SNR profile implies the entrainment zone or inversion layer; however such a feature was non-existent in the profiles measured at the site under consideration.**

Page 5, line 7-8: what are the times of the radiosondes?! It was written 4 times per day, but I did not find the times (also some description of the radiosonde model used)? Clarify this point.
Response: **The general times of radiosonde launches were (0600, 1200, 1800 and 0000 UTC), however the exact launching times of radiosonde ascents illustrated in the plots have been mention in the figures itself. The radiosonde model being used ("Vaisala RS92-SGP"), has now been mentioned in the revised manuscript.**

Page 5, lines 10-12: what is the difference between LBL and PBL? Also, there is ML. All of them are refered to the boundary layer height. Clarify this point.
Response: **LBL basically refers to the inhomogeneity in the PBL over inhomogeneous terrain; these inhomogeneities can arise as a result of variation in topography, moisture content, etc. Through boundary layer height we refer to the height to which the influence of the underlying surface is discernible, being referred to as ML during daytime and stable boundary layer during nighttime. More precisely, the extent of mixing in the day time as a result of solar heating is termed as ML which may be called PBL and LBL for flat and complex terrain respectively.**

Page 5, lines 24-25: FNL from GFS? Both are datasets used for WRF initialization, but they have different structures between them. Clarify this point.
Response: **Description of NCEP data is provided in the manuscript.**

Figure 2: I would suggest making a sign/arrow at sunrise and sunset at the top panel for better visualization of the convective/daytime conditions. Also, Kelvin should be written with capital letter. Why the profiles for virtual potential temperatures were shifted by 2 K? Explain this.
Response: **Arrow has now been drawn in the upper panel (RTI plots) of figure 3 and 4 marking the sunrise and sunset times. 'Kelvin' is now written with capital 'K' in the revised manuscript and figures. The reason behind shifting virtual potential Temperature Profiles by 2K was to make the profiles in the figure distinct; however, in the new figures of potential temperature profiles, this shifting has been removed.**

The thetav and specific humidity profiles at 622 UTC shows clearly a shallow BL around 200 m. However, for the profile at 1148 (still daytime), the both profile has a stable pattern. Explain this.
Response: **Yes, for 0622 UTC profile that is indeed the case, however, on December 17, 2011, the sunset time is 11:47 UTC. Thus the 1148 UTC profile reflects post sunset (dusk) conditions over site, wherein a rapid decrease in the moisture content is observed, with a minor bump in the profile at 200 m. Hence, it can be speculated that the downslope flows just triggering before sunset (due to rapid cooling of the mountain peak) might result in such a transition in humidity profiles. These downslope flows grow in depth after sunset that probably reach up to 200 m above surface with weaker magnitudes and results in an overall reduction with a minor bump at 200 m, as seen in the humidity profile.**

Page 7, line 4: what are the differences (besides the months) for the chosen of these 2 contrasting days?! The authors should described them these difference as earlier as possible. Described in terms of sensible heat fluxes (or radiation energy budget values)
Response: **The contrasting days have been taken from spring and winter season for which the seasonal averaged sensible heat flux is 50 Wm^{-2} and 17 Wm^{-2} respectively, same has been clarified in the revised manuscript.**

Page 7, line 7: the profile at 1148 UTC should be convective / daytime instead of stable. Explain why this happen!
Response: **The 1148 UTC is not convective daytime, since the sunset time is 11:47 UTC on December 17, 2011, and due to rapid cooling of the ridges and mountain peaks during sunset, the profile represents a stable atmosphere over the site.**

Page 7, line 20-21: how a BL value around 800-1000 m (derived from the wind profiler) is consistent with an observations of 400-500 m derived from radiosondes?!Explain this point
Response: **From the RTI plot and 6 dB criterion the BL height value is found to be 562 m at 0608 UTC and 750 m at 1139 UTC, which is nearly consistent (considering the resolution of 62.6 m for RWP measurements) with the radiosonde inversion height of 500 and 540 m respectively.**

Page 8, Line 6: it is incorrect to say ML height at nighttime period. The authors should say nocturnal or stable boundary layer, not mixed layer (ML).
Response: **We agree with the reviewer, and the term nocturnal boundary layer is now being used in the manuscript for nighttime period.**

Page 8, lines 20-21: " …ML decreases in depth, but this could be attributed 20 to the rapid cooling of the surface". At this time (end of the night and near to the sunrise), there is no rapid cooling of the surface, as the NBL is very stable. Clarify this point.
Response: **The section has been rephrased along with the inclusion of one important reference in the revised manuscript.**

Page 8, line 27: It is missing a final point (between …mixing depth. Errors …).
Response: **Thank you for pointing out the mistake. The sentences have been re-written for clarity.**

Page 9, lines 6-7: ".. Overall the model and observations are in reasonable agreement during the study period (r2 = 0.5)." Is 0.5 a reasonable agreement? What is the physical meaning of a negative value for intercept showed at Figure 7?
Response: **We agree that r^2 values of 0.5 do not represent, in general, a very good agreement; however, over the complex terrains such as Himalayas, models generally fail to resolve the topography and reproduce the meteorology affected by local winds and convection. Therefore, in this specific context of model performance over Himalayas, we said that r^2 value of 0.5 is reasonable. Intercept basically represents the difference in the detection limit of RWP measurements and model simulations, negative value might be due to the highly complex topography around the peak.**

Also, for Table 2, I suggest to use the integer values for height of BL! There are so many assumptions on the determination of the BL either by RWP or radiosondes that the integer values are a better representation of BL heights.
Response: **Correction incorporated, integer values are being used for BL height throughout the revised manuscript.**

Figure 3: upper panel: the authors should not draw a continuous line amongst the data as there are gaps (no data collected). See the example from end of December and beginning of March.
Response: **The line has been removed. However, there is no data gap but a 15 min mean is taken and a little lower SNR than 6dB in the nocturnal measurements at few occasions.**

Lower panel: the both scales should be the same, plot the line 1:1 and explain the physical meaning of a negative value for intercept.
Response: **Both scales have been made same now and 1:1 line has also been added. Negative Intercept is explained in one of the comments above, however, this is also perceptible that model is resolving the local boundary from the valley and not from the top in the night time.**

Page 10, line 4: potential temperature?! It was used virtual potential temperature for the entire text. I agree to use potential temperature (instead of virtual potential temperature), but it should be along the entire document.
Response: **We agree with the reviewer, and in the revised manuscript potential temperature has been used instead of virtual potential temperature.**

Page 12, Lines 9-12: it is very strong the sentence saying that RWP gives the best temporal estimates. If you have a ceilometer and/or a microwave radiometer, you also have very good estimates of the BL heights. By the other hand, these instruments (ceilometer and radiometer) are much more simple to use thank a wind profiler. So, I suggest to re-write this sentence.
Response: **The sentence has been re-written as suggested.**

Page 12: Line 29: torrential downpour. Can it be replaced by torrential rain? The line below, I think that it is year long (not yearlong).
Response: **Correction incorporated.**

<u>References used in the response to referee 2:</u>

Solanki, R., Singh, N., Kiran Kumar, N.V.P., Rajeev, K., and Dhaka, S.K.: Time variability of surface-layer characteristics over a mountain ridge in the central Himalayas during the spring season. Bound.-Lay. Meteorol., 158, 453-471, doi: 10.1007/s10546-015-0098-5, 2016.