Anonymous Referee #1 Received and published: 18 March 2019

This manuscript is a product of hard working and written in detail. However, if it is written concisely it will be much better. I think if it is revised a bit with editing and by incorporating some provided information it will be considered for publication.

We thank the reviewer for accepting the correction of this article; we appreciate his/her favorable opinion about the work. We agree with most of the comments and we provide next a point by point answer to the concerns presented.

1- Page 1 Line 26*: Re-write this sentence concisely: "Wave breaking creates a wellmixed region to the lee of the obstacle that induces flow separation; the generation of a dividing streamline between undisturbed flow above and trapped energy and flow analogous to hydraulics in the lower surficial branch (Smith, 1985b)."*

We will now rewrite this sentence more concisely, as follows:

"Wave breaking creates a well-mixed layer to the lee of the obstacle, which generates a dividing streamline separating undisturbed flow aloft and trapped energy and flow analogous to hydraulics in the lower surficial branch (Smith, 1985b)"

2- Page 3-4 Section 1.1 *is a big with repeating same expression time to time. As this is a scientific paper shorten being on a specific on Mountain wave phenomena, hydraulic analog and relation with the Froude number.*

We agree with the reviewer. In this section we aimed to put in context the physics behind the studied phenomena and introduce the hydraulic analog. However, it is true that it could be repetitive in some way and too extensive. In the revised version we reduce this section.

3- Page 4 Line 20*: "Fr in (Eq3)" is it equation 3? If so, there is no relation of Fr. Correct it.*

We apologize for the misunderstanding, we wanted to refer to equation 1. We correct this typo in the revised version.

4- Page 6 Line 20*; Replace "rugosity" by surface roughness (m)*

We will replace the word rugosity by surface roughness (m) in the revised version, as per the reviewer's request.

5- Page 7 Line 6*: "wind episodes". Where is wind? Figure 2a and 2b say they are 850 hPa level temperature and sea level pressure and also there are no any wind arrows. So, include wind.*

In these lines we are referring to the synoptic setting leading to the Tehuantepecer wind event. As discussed in the text, the cold air mass moving south from north America is instrumental for the development of Tehuantepecers, which is why Figure 2 shows 850 hPa and sea level pressure in a very wide domain. Winds are better shown with much more detail, focusing on the Isthmus, in Figure 3.

6- Page 9 Line 4*: "Isthmus (Figure 3d)". There is no caption of Figure 3d. Add this including its exact position (lat./long) so that it will can be compared with aforesaid matters.*

We apologize for our mistake. In the revised version we include the caption for this figure where the lat and lon of the sounding are explicitly mentioned. There is a line from Figure 3d to Figure

3c pointing to the location (NP) where the sounding is performed, but it is barely noticeable. We will mark it more clearly in the revised version.

7- Page 9 Line 5: *"inversion existent at about 800hPa or 2500m". Seems from about 2000 to 2500 m. correct this. Looks sounding has multiple PBL and discontinuous stratification which refers an importance of study of high resolution data sets. So, mention this kind of information to highlight your approach of methodology.*

Another reviewer has noted that more than an inversion it is an isothermal layer, also highly stable, but not really an inversion. We will correct this issue and also include a comment about the need for high resolution for a study of this event. We thank the reviewer for this suggestion.

8- Page 10 Line 10: *"The temperature profile in Fig. 3d evidences that the latter level. . . ".. What does latter level mean as it is hard to understand? If you are referring a presence of stable layer below 2.5km Figure 3d shows there is a presence of static instability, not stability below 2 km. So, regarding this issue rewrite this.*

We meant "the temperature profile in Fig. 3d evidences that the 2500m height level corresponds with the depth of the cold air". The profile is stable above this level, but much less so than in the layers below.

We agree that it can be confusing as written in the original text, we will rewrite this statement in the revised version. We will also add dry adiabats in the sounding in Fig 3 to help identifying stable layers.

9- Page 10 Line 31: *"Figure 6a plots the Froude number (Equation 1)" How did you find "ϑ0" (method) to calculate N for Froude number? Please mention figure nos. in following sentences as it will be easy to follow these criteria:*

We mostly follow [1] [2] and [3] below. As per some other reviewer's request, we will now show the Fr number some distance upstream the obstacle. We calculate Fr using the average Brunt-Väisällä frequency and average wind speed for the layers from the surface to the level of similar elevation as the mountain. We will explain this clearly in the revised manuscript.

[1] Pokharel, B., Geerts, B., Chu, X., and Bergmaier, P.: Profiling radar observations and numerical simulations of a downslopewind storm and rotor on the lee of the Medicine Bow mountains in Wyoming, Atmosphere, 8, https://doi.org/10.3390/atmos8020039, 2017b.

[2] Pokharel, A. K., Kaplan, M. L., and Fiedler, S.: Subtropical Dust Storms and Downslope Wind Events, Journal of Geophysical Research: Atmospheres, 122, 10 191–10 205, https://doi.org/10.1002/2017JD026942, 2017a.

[3] Grubiši´c, V., Serafin, S., Strauss, L., Haimov, S. J., French, J. R., and Oolman, L. D.: Wave-induced boundary-layer separation in the lee of the Medicine Bow Mountains. Part II: Numerical modeling, Journal of the Atmospheric Sciences, p. 150904104933002, https://doi.org/10.1175/JAS-D-14-0376.1, http://journals.ametsoc.org/doi/abs/10.1175/JAS-D-14-0381.1, 2015.

10- Page 10 Line 17-21*: These conditions are: a mountain with steeper lee slope (1) (Figure no. ??) crossed by strong winds (> 15m/s) (2) (Figure no. ??) mostly normal to the barrier (3) (Figure no. ??). A stable layer above the top and less stable above that (4) (Figure no. ??) with cold air advection and large-scale subsidence to maintain the C2 ESDD Interactive comment Printer-*

friendly version Discussion paper stability (5) (Figure no. ??) . Apart from this, reverse wind shear above (6) (Figure no. ??) and no cool pool in the lee (7) (Figure no. ??), is also desirable. These conditions are all perfectly met for both locations analyzed, as discussed previously, and indeed intense downslope windstorms occur in both cases.

These seven conditions were all mentioned at some point in the previous discussions, but we agree with the reviewer in that it will be very informative to summarize here the figures that evidence them as a reminder. We will modify the text accordingly in the revised version of the manuscript.

11- Page 10 Line 31*: Where is Figure 6a as there is no label a, b, c of Figure 6. So, it is hard to follow.*

We totally agree, excuse us for the mistake. This will be corrected in the revised version.

12- Page 14*: Insert figure no. "c" in Figure 7. How about the subcritical flow before the supercritical flow? Did you observe it within your region of interest before the supercritical flow? If so mention them with a value of Froude number so that it could be better to relate how the subcritical flow was converted to supercritical flow as downslope wind.*

We will introduce the subfigure letter (c) in the caption. Concerning the second issue, we will show the Fr number upstream the mountain in the revised manuscript. $Fr \approx 1$ for the highest mountain and $Fr \approx 2$ for the lowest one. In both cases the Fr values are in the range indicating transitional conditions from subcritical to supercritical behavior in the flow, as discussed in section 1.1 in the Introduction. It is difficult to define a Froude number with the same meaning as in shallow water; we nevertheless observe subcritical flow behavior, in the sense that the flow thins and speeds up as it goes upslope in the case of the lower mountain (Fig 5a and 5g), but not so clearly for the higher one.