Response to the Referee #1

This paper investigates the possibility of correlations between the integral scale of stratified turbulent flows in the boundary layer and parameters characterizing topological features of the wind velocity field, such as the fractal dimension, and its stability properties studied through the Richardson number. Using data of the SABLES-98 campaign, at moderate temporal resolution, authors present here a series of results which provide interesting insights on the dynamics of the atmospheric flow in the site understudy. The outcome of the paper is relevant for the audience of Nonlin.Processes in along the lines detailed in the following.

We thank the referee for his positive reviews and constructive comments for our paper. We greatly appreciate the fact that our work is deemed acceptable for publication in NPGD with some revisions. In the following, we respond point by point to the referee 1 remarks (in blue).

1 line 5-6 page 2. The text says: "The aim of this paper is to bridge the considerablegap that exists between the fractal dimension and the integral scale"

We agree with referee #1 toclarify this sentence, and have it replaced by the following in this paper:

The aim of this paper is to investigate the possible correlations between the integral scale of the turbulent stratified flows in the Boundary Layer and parameters charactering topological features of the wind velocity field, such as fractal dimension and its stability properties studied through the BulkRichardson number. We are aware that there is a lack of investigations between the integral scale and fractal dimension.

2 line 22-23 page 2. The text is not clear, is it a 5 minutes running average used toremovethe mean field? This point needs to be better explicated in the text.

We decided to change the sentence line 23-24 page 2 " In this paper we have carried out the necessary transformation to get the mean wind series in short intervals, namely 5 minutes ". It is not a 5 minutes running average.

In this work, the series of wind velocities in the three directions x, y and z recorded by the anemometer are divided in series of five minutes length. Each of these series applies the necessary transformation to get the mean wind series (u horizontal component) and vertical velocity (w vertical component)(Kaimal and Finningan, 1994).During 5 minutes the average values of the magnitudes in study remain constant.

3 line 11-14 page 3. The sentence within these lines is not at all clear, please rephrase it.

We rephrased the sentence line 11-14 page 3 by:

Turbulent motion of the atmospheric fluxes occurs through a broad range of scales from the smallest scales that are usually defined as the scales at which the motion dissipates into heat due to the viscosity of the fluid until the larger scales corresponding to the integral scale.

4 line 2 page 4. The Richardson number provides a measure of how a turbulent flowis prone to develop instabilities. I thus disagree with referring to this parameter as a number that characterize the degree of stratification in the atmosphere. This definition (used in many places in the paper) is misleading and it is very important to modify it in the text not to drive the wrong message that stratified flows cannot be unstable. Indeed the Richardson number is used to identify unstable regimes also in strongly stratified flows and strong instabilities (and turbulence) can develop in the direction of the gravity, characterized a vertical Froude number

of order _ 1 as described in Billant&Chomaz,"Self-similarity of strongly stratified inviscid flows," Phys. Fluids 13, 1645–1651 (2001).

We replaced the sentence line 2 page 4 by:

As well as the relationship between the integral scale with the Bulk Richardson number, this number provides a measure of the intensity mixing, and of how a turbulent flow is prone to develop instabilities. It is also used as a criterion for the existence or nonexistence of turbulence in a stably stratified environment (a large positive value of Ri> 0.25 is indicative of a decaying turbulence or a completely nonturbulent) (Arya, 2001).

5 line 22 page 4. The text says: "..the integral scale of the mean wind direction u'". Here the authors probably means the horizontal direction but the way this is writtensounds wrong. Please rephrase it.

We change the sentence line 22 23 page 4 by:

In this paper we focus on calculating the integral scales for horizontal and vertical component fluctuations u' and w'.

7 line 1-2 page 6. See comment ## 2 and please specify better the way the datahave been processed. This is important for the readers to be able to reproduce (andtherefore validate) the results presented in the paper.

We change the sentence line 1-2 page 6 by:

During the period of study the series are obtained in a consecutive period along the day every 30 minutes by a sonic anemometer and these series have been divided into five minutes series and over them the mean wind velocity of the horizontal and vertical components is calculated

8 line 3-4 page 6. Authors claim they resolve vertical integral scales from 1m to1000m, which puzzles me a bit. Indeed, I am wondering how is it possible to detect(using the Taylor hypothesis) vertical scales larger than the hight(s) at which the sonicanemometer are placed? An answer to this point should be included in the report andand a compelling explanation integrated in the text.

We have included the following explanation in line 5 of how vertical integral scales are possible to detect larger than the heights at which the anemometer are placed

We detect vertical scales over a broad range of scales from 1 m to 1000 m. The integral scales here are calculated based on the autocorrelation function, the mean wind velocity and integral time scale and each of them can be expected to vary significantly. As the integral scale are larger scales of turbulent flows is it possible to detect vertical scales larger than heights at which the sonic anemometer are located.

9 line 20 page 6. Details on how the potential temperature has been estimatedshould be included in the text.

We have included in the line 21 how the potential temperature has been estimated.

The potential temperature has been estimated as relative to ground level byusing the following formula: $\Delta\theta=\Delta T+\Gamma\Delta z$, $\Gamma=0.0098\ K\ m^{-1}$(Arya 2001)

10 line 12 page 7. The text says: "Thus, stable stratification decreases the fractaldimension."Authors acknowledge they cannot provide rigorous arguments to explain the variationof the fractal dimension with the height. As a consequence the statement above soundsa bit too strong, unless they propose some solid argument to support it.

As we cannot provide rigorous arguments to explain the variation of the fractal dimension with the height. We removed from the text the statement"Thus, stable stratification decreases the fractal dimension."

11 line 14-27 page 7. The text within these lines is poorly written and its meaning isa bit confusing. I suggest to re-written it from scratch and perhaps make it a bit moreconcise.

We will clarify the text within the line 14-27 page 6 by:

In Fig 4 it is observed how the integral scale varies versus time at the three heights. There are some questions that have not been clarified yet. For example: How doesthe diurnal and night cycle influence on the integral scale? Which is the mechanism responsible for the growth of the integral scale?It has been observed in the previous works that under certain conditions the turbulent flows self – organize and develop large-scale structures take place through an inverse cascade that occurs in stably stratified anisotropic flows (with or without rotation)(Marino et al., 2014, Smith and Waleffe, 2002). The inverse cascade mechanism might also be responsible for the growth of the integral scale in the stratified atmosphere. It is a fundamental issue that we should clarify in a future research. As it is indicated in Fig 4 the integral scale for u` component varies between around 100 m on their minor scales, until above 1500 m for its major scales. The integral scales for w` component are slightly lower than u` component. It is shown that these vertical scales can reach sizes between a few tens of meters until 1000 m in some occasions. It is observed in each of the components that the greater is the height at which is located the anemometer, greater is the integral scale in turbulent flow. Usually, at 32 m these scales are, on average, greater than those of the 13 m and the latter higher than at 5.8 m height.

12 There is a long standing debate in literature on whether an inverse cascade occursin stably stratified anisotropic flows (with or without rotation). The inverse cascademechanism, if any, might also be responsible for the growth of the integral scale in thestratified atmosphere. I thus suggest the authors to address this point,

perhaps whenthey re-arrange the text (line 14-27) as indicated in the previous comment (## 11). Onthis note/topic I suggest to cite these two papers:
L. Smith and F. Waleffe, “Generation of slow large scales in forced rotating stratifiedturbulence,” J. Fluid Mech. 451, 145–168 (2002).
R. Marino, P.D. Mininni, D. Rosenberg, and A. Pouquet, “Large-scale anisotropy instably stratified rotating flows”. Phys. Rev. E 90, 023018 (2014).

This comment is appreciatedand the suggestions and the references of the two papers have been incorporated in the point (## 11)

13 Conclusions should definitely be rearranged from line 16-24 to achieve a betterclarity of the text.

We clarify the text within the line 16-24 page 10 by:

We have calculated the fractal dimension and the integral scale of the horizontal and vertical components using wind velocity data at three different heights: 5.8 m, 13 m and 32 m. The numerical results show light significant differences on the diurnal and night cycle when the variation of the integral scale is analyzed versusthe fractal dimension. Atmospheric stratification is analyzed in the three heights through the Bulk Richardson number, finding thethree types of stratification during diurnal hours and at night hours the stable stratification. It would be interesting for future works to study the growth of the integral scale in stratified flows and if it could be due to the inverse cascade on both diurnal and nighttime cycles. The main conclusions of this study are as follows.

14 Units are missed in some plots, for instance in figure 2 "tau" is indicated but it isnot clear whether the lag is given in seconds, minutes or hours. Please double-checkall the figures and add the units (on the axes/legend) when it feels needed.

Thank you for reminding the units in some plots.

Correct units in the following figures: Fig 2, tau(s), Fig 5, 6, 7, 8, 9 y 10 Integral scale (m).