

We thank the reviewer for many interesting and useful questions and comments (C) which we respond (R) to below and also give our suggested modifications (M) to our manuscript when needed. Reviewer 1 and 2 had some questions in common and because reviewer 2 had more questions we sometimes here refer back to our author response given to reviewer 2.

Reviewer 1:

C1: *"The paper deals with the problem of the Turbulent Kinetic Energy budget during the afternoon transition. The BL description is based upon experimental profiles while the TKE budget is calculated from surface observations that are acquired during the BLLAST field experiment. The results show some interesting and new aspects that merit to be published.*

Besides that, I have the following questions:

It would be interesting to calculate the TKE budget at upper levels, for example in the tall tower (30-60 m). This may be useful to understand the role of the mixed layer on surface layer dynamics, during the decay."

R1: As stated already in the paper we consider the uncertainty involved too large to estimate the TKE budget at the 60 m tower. The high-frequency range of the wind spectra was also noted in the manuscript to be more noisy at the 60m tower than at the Divergence site preventing in our opinion a regular reliable estimation of dissipation at an hourly time-scale. It may be possible that in a more careful analysis or case study some specific hours during some afternoons could be investigated further in the proposed way. It should also be said that the 60 m tower is located about 400 m away from the Divergence Site tower which can also limit the possibility to conclude directly upon mixed layer effect on surface layer dynamics.

As the comments of reviewer 2 imply that we may already have discussed too many details when it comes to the TKE budget description on individual afternoons and hourly basis (in section 4.1) we refrain from including more analysis and new results in this manuscript for some specifically chosen time period.

C2: *"The turbulent and pressure transport terms of the TKE budget is calculated as a residual term. The turbulent transport term (T_t , pag.29758, line 10) have been incorporated in the total transport term T (pag.29758, line 20) assuming that the "uncertainty introduced by taking the vertical gradient, led to large scatter : : :.." I wonder if using upper levels in calculating the vertical gradient could resolve this issue. In this way the turbulent transport term (T_t) enters in the budget directly and not as a residual term."*

R2: See our response to comment **C14 by reviewer 2** where we show the turbulent transport term estimates for the Divergence site. We consider these estimates very uncertain and suggest not to include them in the revised manuscript.

C3: *"Figure 5, that seems related to the most important aspect of this paper is difficult to understand clearly. There are 10 sub-panels and in each panel are represented all terms of the TKE budget at 4 different levels."*

R3: We suggest to change Figure 5 into a landscape format with subpanels as large as possible and remove some information from some of the axes when this does not limit the interpretation of the figure.

M3: A new improved Figure 5 will be in our revised manuscript.

C4: *"In the legend of figures 8/9/10 please report only the description of the figure itself and put comments in the text."*

R4: Thank you for this comment we rewrite the figure texts.

M4: For figure 8 the following is removed: "also indicating that in the free convection limit the buoyancy production is balanced by dissipation and transport".

For figure 9 the following is removed: " (including also other data outside the afternoon period)"

For figure 10 the following is removed: " to distinguish between different days"

C5: *"In the conclusion (pag.29774, lines 11-13) it is written "The TKE tendency term was found to be much smaller than all the other budget terms suggesting that the surfacelayer turbulence evolves in a quasi-stationary way during the afternoon transition" But, if you consider the bulk-TKE (Nieuwstadt and Brost, 1986), this is true for more or less the first ten-eddy turnover time (since solar zenith), then the bulk-TKE start to decay with a similarity law t^{-n} , in which the exponent n at the later stage of decay is close to six. So, I wonder if the surface quasi-stationarity does it hold for the whole afternoon transition ???"*

R5: Thank you for this comment which gives us an opportunity to clarify that we believe similarity laws on the form t^{-n} have limited use near the surface. This is explained in more detail in our companion paper "Turbulence Kinetic Energy budget during the afternoon transition – Part 2: A simple TKE model". We think it is very important not to interpret the decay rate directly from only the exponent value n because this can be disinformative. Even in the simple situation of a constant TKE decay rate in terms of m^2s^{-3} we can obtain larger negative exponents n at the end of the afternoon in comparison to in the early afternoon. Please also note that in the case of shear production TKE decay rates can be reduced or TKE even increase. Reduced decay rates has also been shown for boundary-layer averaged TKE in Pino et al. (2006).

C6: *"There are recent works that should be mentioned, among the others: Taylor, Alexander C., Robert J. Beare, and David J. Thomson. "Simulating Dispersion in the Evening-Transition Boundary Layer." *Boundary-Layer Meteorology* 153.3 (2014):*

*Puhales, Franciano Scremin, et al. "A simple parameterization for the turbulent kinetic energy transport terms in the convective boundary layer derived from large eddy simulation." *Physica A: Statistical Mechanics and its Applications* 392.4 (2013): 583-595."*

R6: We now include these references in the paper.

M6: The reference to Taylor et al. (2014) was included as part of our response to reviewer 2 comment C5. For the other reference we suggest to include it in the introduction.