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Interactive comment on “Turbulence Kinetic Energy budget during the afternoon transition – Part 1: Observed surface TKE budget and boundary layer description for 10 intensive observation period days” by E. Nilsson et al.

Anonymous Referee #1

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GENERAL COMMENTS

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:

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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.

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.

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.

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

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 surface-layer 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 ???

"SPECIFIC COMMENTS"

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):

389-407.

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.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 15, 29747, 2015.

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