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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "The BLLAST field experiment: Boundary-Layer Late Afternoon and Sunset Turbulence" *by* M. Lothon et al.

Anonymous Referee #1

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The paper provides a description of the BBLAST campaign. The aims of the BBLAST campaign were to study the afternoon transition, '... the period of the day that connects the daytime and stable boundary layer ...'. The paper outlines the issues connected to the afternoon transition that will be addressed by BBLAST, describes the instrumentation and presents some observations to illustrate the potential of the BBLAST dataset. As a description of the BBLAST the paper is generally acceptable and should be accepted after some minor revisions.

Comments.

The authors should consider combining Sections 2 and 4. The observations provide a way of illustrating the various transition periods that are defined in Section 2 and I

found it difficult to comment on Section 2 without referring to the plots described in the figures accompanying section 4. The Section on the sites and instruments would not be affected by combining these two sections.

Section 2 The addressed issues.

This section introduces the definitions of the Afternoon Transition (AT), Late Afternoon Transition (LAT) and the Evening Transition (ET), The idea of transitions sets the framework for the rest of the paper. The definitions and significance of these periods were, I felt, unclear and needed to be made more precise.

1. Figure 8 shows that the afternoon transition lasts from 5 to 8 hours. This is a large proportion of the daylight hours and so it is not clear that it is appropriate to consider this a transition period, it should probably be considered as being the convective boundary layer, albeit with a decreasing heat flux. Figure 12 shows the TKE decreases gradually (after 1500 UTC). An important question is whether this decrease can be considered to be a quasi-steady response to the decreasing surface buoyancy flux, i.e does the TKE continue to scale with the convective velocity scale after 1500 UTC. If it does this period can be considered as a convective boundary layer that is evolving quasi-steadily rather than a transition period.
2. The late afternoon transition is defined to be when the '... vertical structure starts to decouple ...'. This definition comes from remote sensing and is illustrated in Fig 10. for three days. However, from the plots I wasn't certain when the decoupling took place. My guess is that the LAT starts around 1600 UTC. However it is difficult to be sure what the significance of the decrease in the depth of the darker colours actually means. A simple quasi-steady reduction in the TKE might also look like this. A more precise definition of the LAT as shown by Figs 10a-c should be given.

Comments on Section 4. Potential of the BBLAST dataset.

1. Page 10812 line 13 : It would be useful to say something more about the heat fluxes on the warm days. Figure 7c suggests that there is a substantial flux into the ground (particularly noticeable over night) which reduces the available energy and therefore the sensible heat flux.
2. Page 10813 line 1 : The paper says that the boundary layer was particularly shallow on the warm days. However, Fig 7e suggests that the maximum depth of the boundary layer during the warm period were generally similar to those on the other days (maybe shallower on 25th). The statement needs to be clarified.
3. Section 4.1.2 : Figure 8 shows that the length of the AT is generally very long, and occupies a significant fraction of the daylight hours. Is it really correct to term such a period a transition period. Should it really be taken to be the convective boundary layer in the afternoon. It needs to be shown that the properties of the boundary layer are significantly different to what might be expected for a convective boundary layer through this period.
4. Page 10815 line 10-15 : I don't understand what decoupling refers to. There do not appear to be any particular changes in behaviour of the dissipation rate in Figs 10a and b between 1400 and 1600. The period between 1600 and 1800 could be interpreted in terms of a reduction in dissipation which the colour scale turns into an apparent decoupling between the turbulent layer and the inversion. The significance of these changes needs to be discussed in more detail.
5. Page 10815 Para starting line 17. The profiles in Fig 11b for the 1 July look like a convective boundary layer exists until 1800 UTC when the evening transition starts. There doesn't seem to be anything strange occurring during the LAT apart apart from a small decrease in the height of the inversion.

However, this is probably could just be a consequence of the reduced entrainment due to the reduced surface flux. How the evolution of these profiles differs from this quasi-steady view should be made clear.

6. Page 10816 Para starting line 3. I don't understand how the boundary layer depth could be estimated at 1km (Figure 10c) from the profiles in Fig 11c. I would say it was around 500m for most of the time. The structure on this day and the estimates of boundary layer depth need more discussion since the structure is very different from that of the classic convective boundary layer.
7. Page 10816 Para starting line 9. The difference between groups 1 and 2 is the stratification of the residual layer. Since the difference in the growth of the boundary layer seems to be simply explained by this stratification a more interesting question is where does this stratification come from. The profiles for 24/06 show some stratification in the early evening profiles, is this the origin of the difference. Grant (1997) also found stratification developed during the LAT/ET.
8. Page 10817 Para starting line 11. During the initial slow decay does the TKE scale with the convective velocity scale. If so the first part of the AT can be simply described in terms of the quasi-steady evolution of the boundary layer in response to the decreasing surface heat flux. This would reduce the significance of the AT.
9. Page 10817 Para starting line 22. It would be useful to see the average time variation of the heat flux from at least one of the sites to see whether the onset of the rapid decrease of TKE corresponds to anything in the heat flux. It might also be worth marking the approximate times of the start of the LAT and ET on the plot.
10. Figure 10c. It would be useful to alter the colour scale to show the evolution of the turbulence more clearly.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 10789, 2014.