1 Reply to Editor

We received the remaining two reviewer comments forwarded to us by the editor and we tried to do our best to follow the suggestions.

Editor:
Thank you for your revised manuscript. Reviewer #2 has expressed concern that you have not adequately addressed their major comments. In particular I am asking you to revisit their initial review and address two comments:

(1) 'I think it will be good if you plot the phase diagrams of surface winds to understand any local circulations. There are many papers on such a phenomenon, so not going to mention here. Please look at papers that probe the land-sea breezes. Probing this will make your article much stronger.'

As already written in our former reply to this comment we tried some other representations than the velocity azimuth display with vectors and color shading as shown in figure 3, but we found nothing which brought a clearer representation and gave more insight. The editor agreed that our former reply to reviewer #2 and the discussion of the land-sea breeze covers this point sufficiently.

(2) 'Last major thing I will mention is the lack of information on profiles of turbulence. The Doppler Lidar was pointing vertically, so you can derive estimates of variance and skewness of vertical velocity. These are also used for PBL classification. I suggest you show the diurnal cycle of these quantities same as you have done for cloud properties.'

We added two further figures presenting means of vertical velocity standard deviation and skewness at the begin of section 3.7 "Turbulence". They have numbers 11 and 12, follwing figures are shifted backwards. We discuss these figures in the text as follows:

Mean standard deviation of vertical velocity (σ_w, Fig.11) remains most of the time below 0.5 m/s. Only during daytime higher values develop from the ground and reach up to 300 m in summer and autumn and 750 m in winter and spring. During night time the upper half of the MBL shows especially in winter and spring slightly higher values.

The mean diurnal course of the skewness (Fig.12) shows distinct night and day patterns: During night skewness is mostly negative with lowest values in the upper half of the MBL, while during daytime skewness in the lower 2/3 of the MBL is clearly positive. Nighttime skewness is most negative in winter and spring. Daytime positive skewness reaches higher up in winter and spring than in summer and autumn. Most positive skewness occurs at heights in the range 200-300 m.

Vertical velocity in rising, as well as subsiding plumes is typically concentrated in narrow chimneys with high speeds surrounded by larger regions with only small velocities compensating for the mass transport in the plume cores. As a result regions with rising plumes show positive skewness and regions with subsiding plumes show negative skewness. Accordingly night time turbulence is driven mainly by subsiding plumes, and day time turbulence is driven by plumes rising from the surface. Nighttime as well as day time turbulence in winter and spring is more intense and reaches further down and further up, respectively, when compared to the other half of the year.

To further investigate how frequent which type of turbulences occurs and how far its influence reaches we use the boundary layer classification scheme of Manninen et al. (2018). ...