Supplemental Material

In this section, observations from the instruments used in the case studies presented in Section 3.3 are shown. Observations for the case study Aug 19, 2019 are presented in Figs. S1, S2, S3, S4, and S5 for the RWP, CL51, AERI, MWR, and HSRL, respectively.
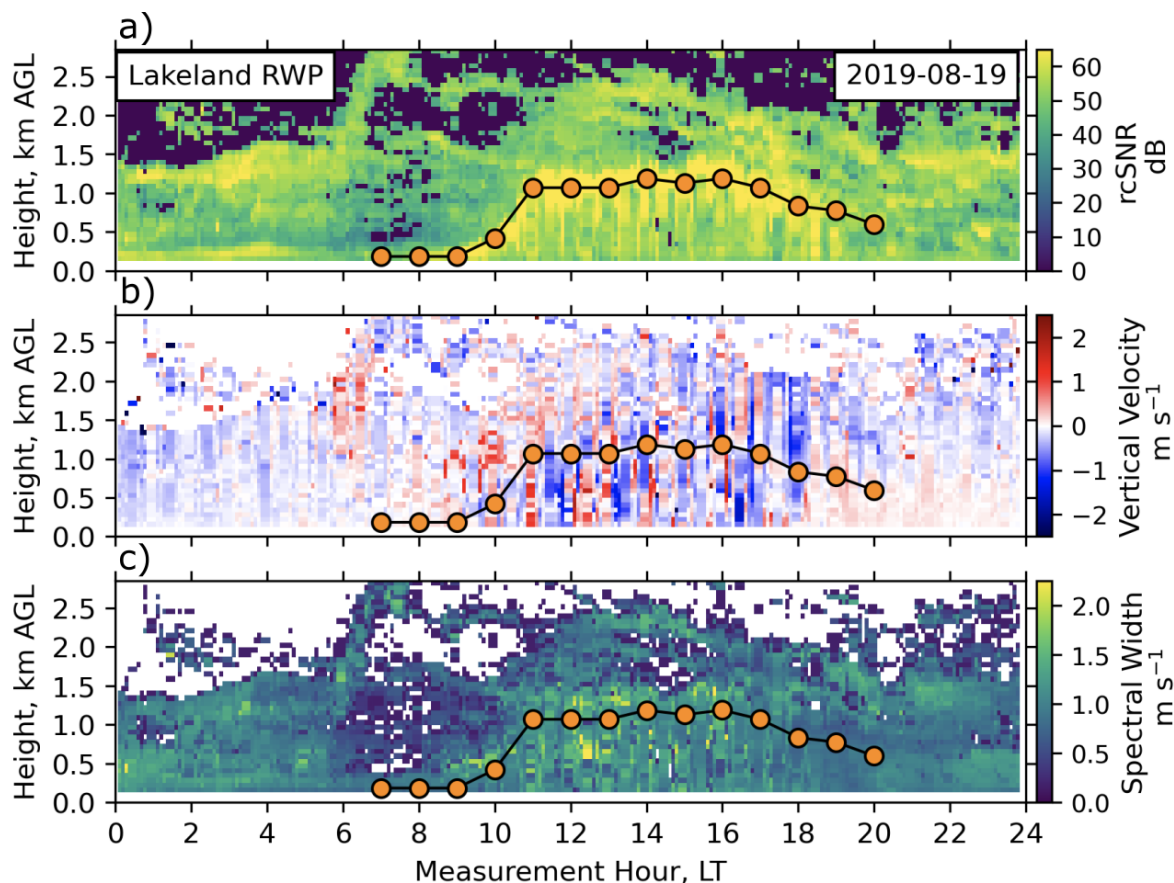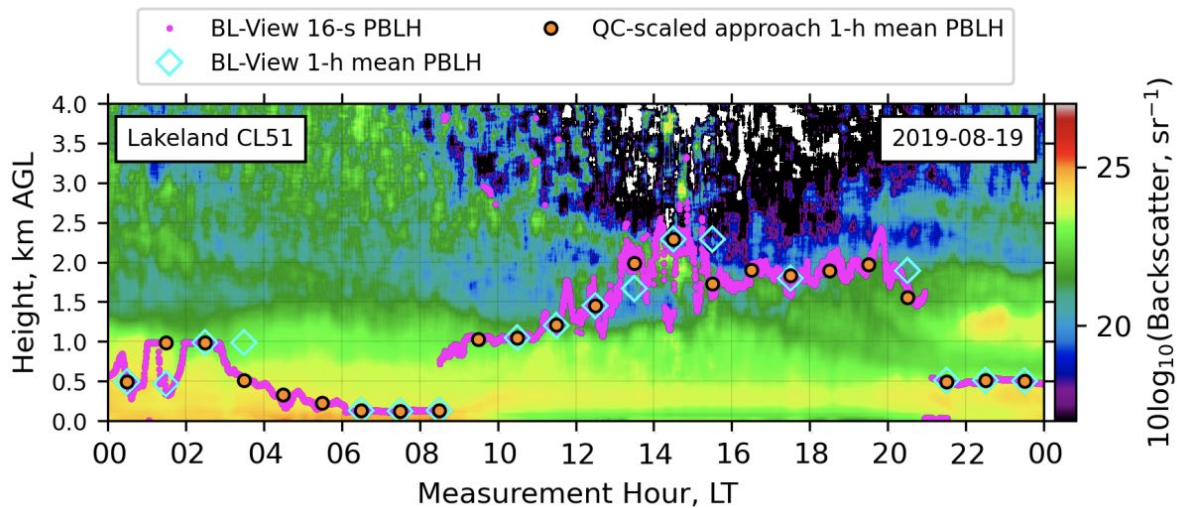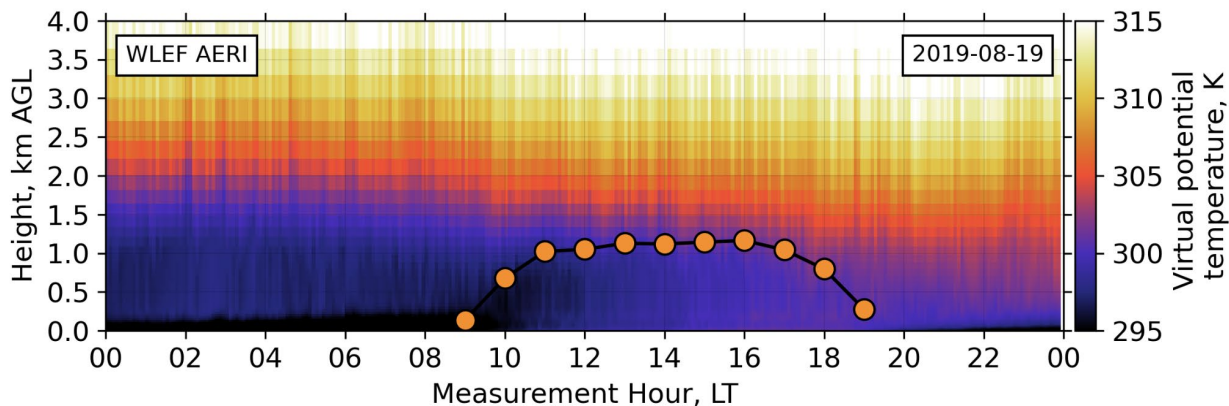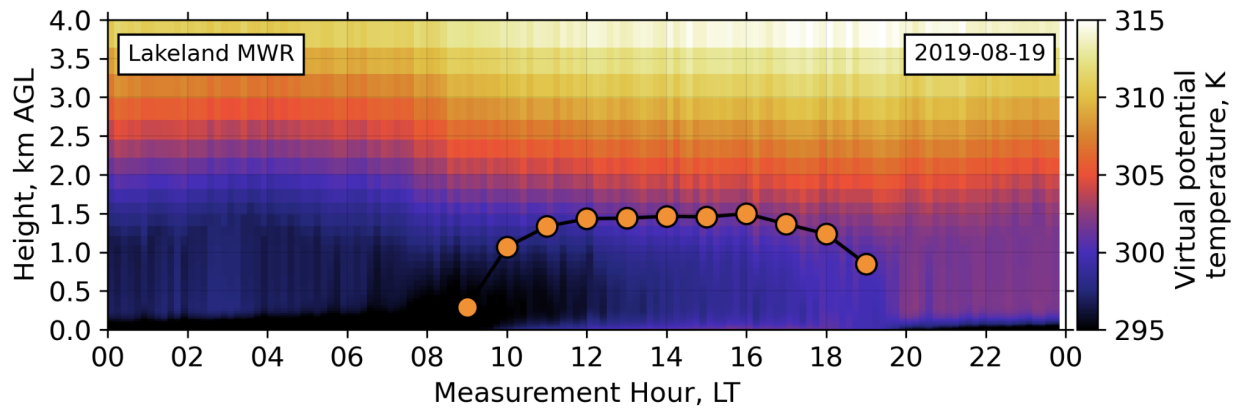

Figure S1: Time–height cross-section of the RWP measurements used to determine the PBLH estimates at Lakeland, for day Aug 19, 2019. a) range-corrected SNR; b) vertical velocity; c) spectral width of the vertical velocity. Overlaid on each of these subplots are the hourly-mean PBLH estimates (orange dots) during the daytime.
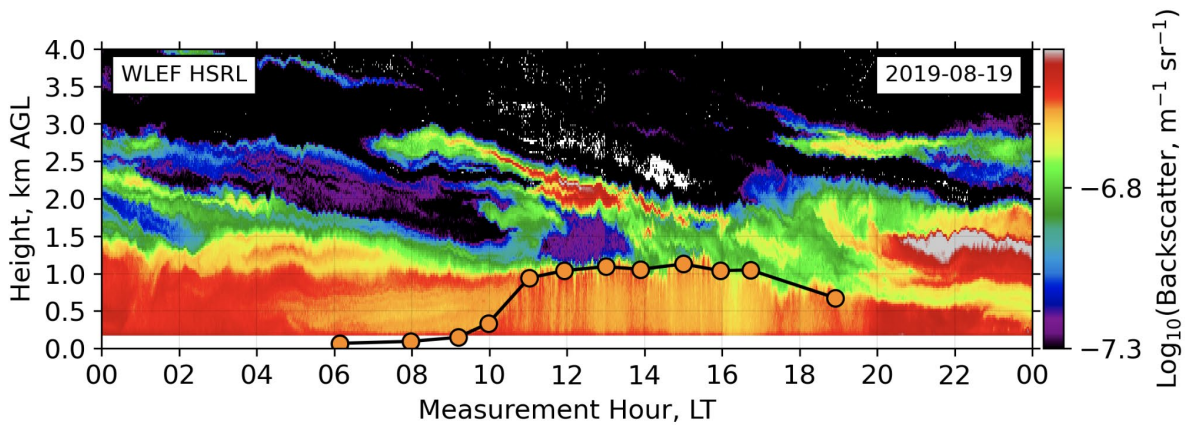
Figure S2. Time–height cross-section of backscatter profiles at the Lakeland site, for day Aug 19, 2019. The magenta dots are the 16-s temporal resolution PBLH estimates by the BL-View software, the cyan diamonds are the correspondent hourly mean estimates from the BL-View software, and the orange dots are the PBLH estimates obtained using the QC-scaled approach.

Figure S3: Time–height cross-section of retrieved virtual potential temperatures for the AERI at the WLEF site, for day Aug 19, 2019. Over-imposed are PBLHs (orange dots) estimated applying the parcel method to the corresponding hourly-averaged profiles between sunrise and sunset.

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Figure S4: Time–height cross-section of retrieved virtual potential temperatures for the MWR at the Lakeland site, for day Aug 19, 2019. Over-imposed are PBLHs (orange dots) estimated applying the parcel method to the corresponding hourly-averaged profiles between sunrise and sunset.

Figure S5: Time–height cross-section of the HSRL aerosol backscatter measurements at the WLEF site, used to determine the PBLH estimates for day Aug 19, 2019. Overlaid are the hourly-mean PBLH estimates (orange dots) during the daytime.

Observations for the case study Sep 23, 2019 are presented in Figs. S6, S7, S8, S9, and S10, and S11 for the RWP, CL51, AERI, MWR, HSRL, and CLAMPS multi-instrument respectively.
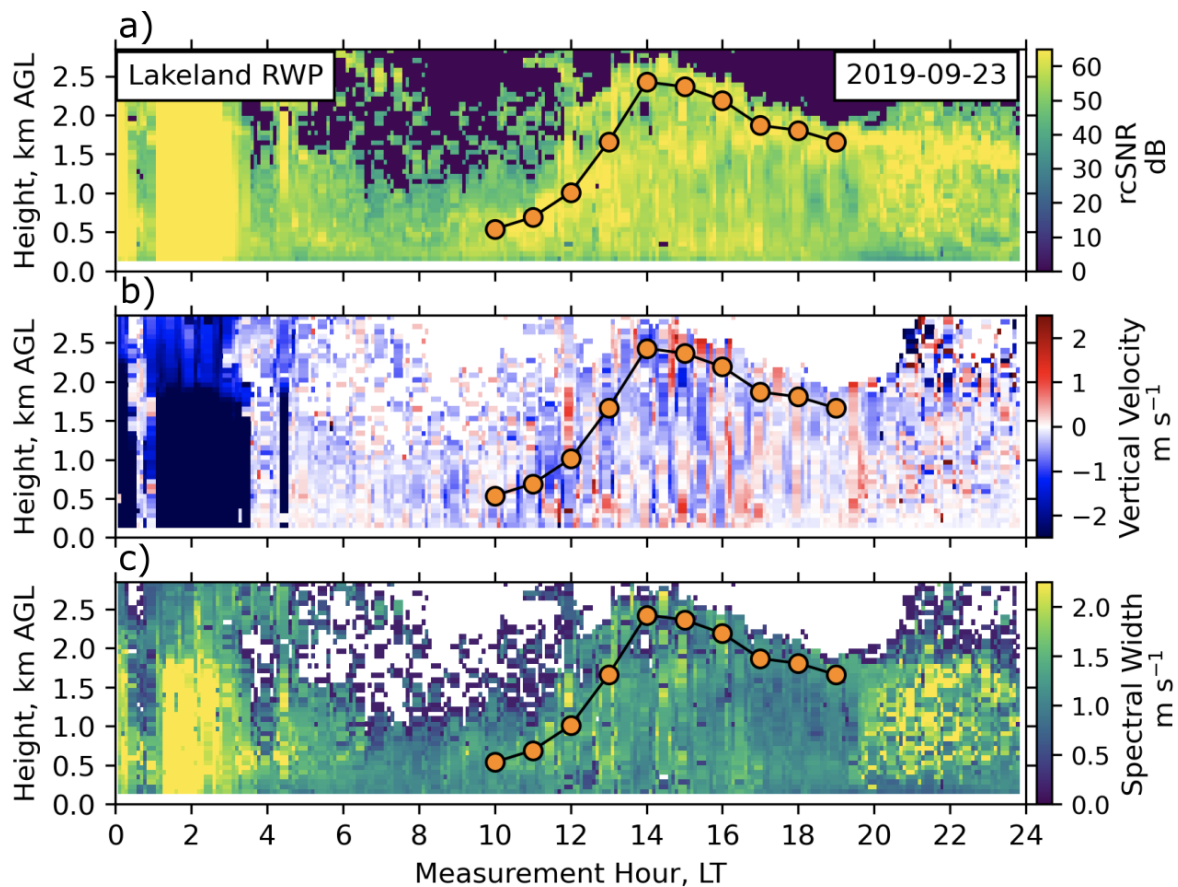
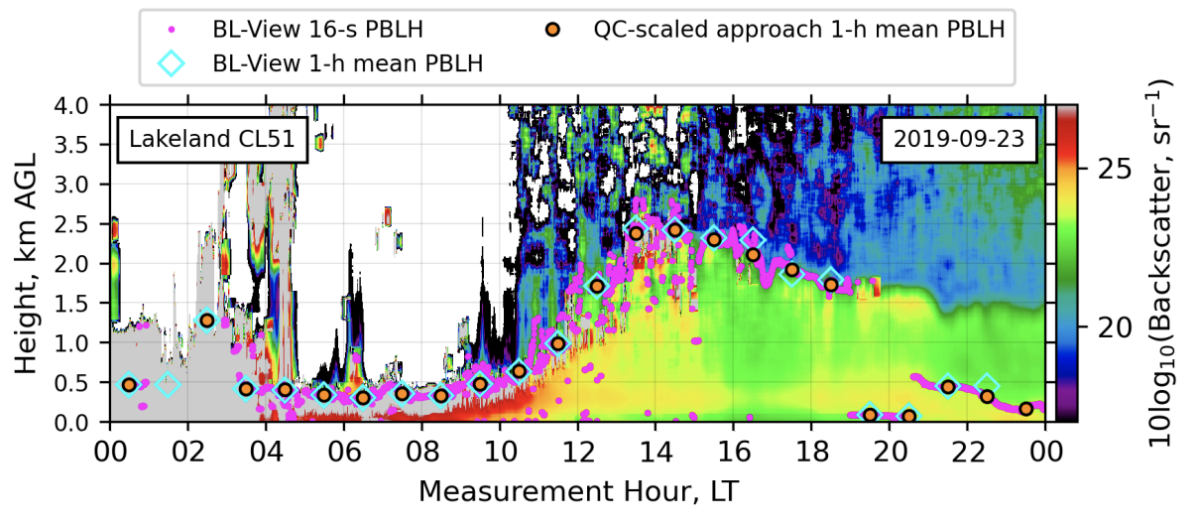**Figure S6: As in Fig. S1, but for the case study Sep 23, 2019.**

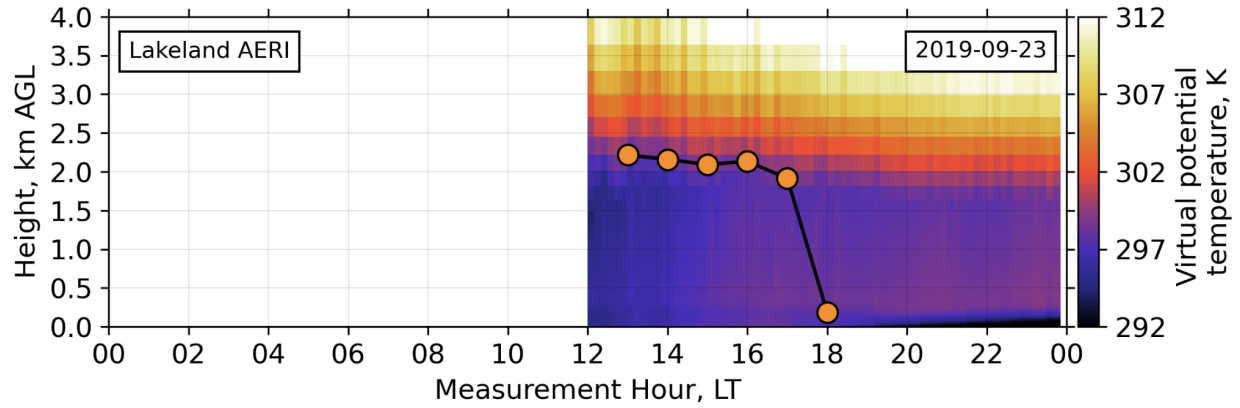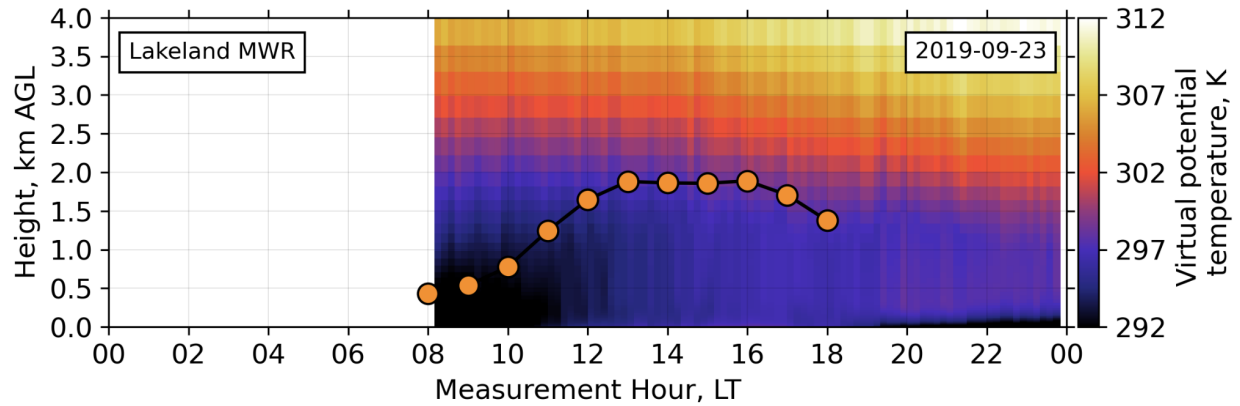**Figure S7: As in Fig. S2, but for the case study Sep 23, 2019.**

Figure S8: As in Fig. S3, but for the case study Sep 23, 2019.

Figure S9: As in Fig. S4, but for the case study Sep 23, 2019.
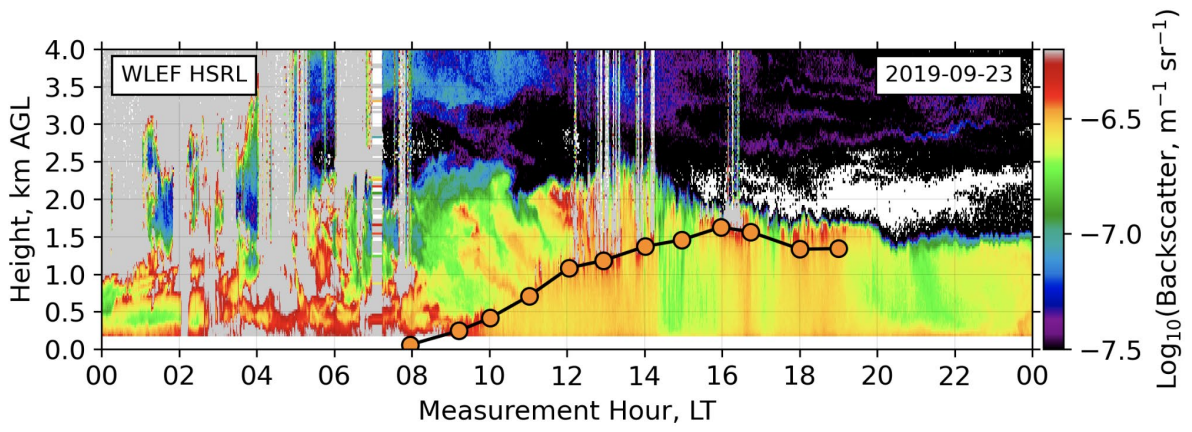
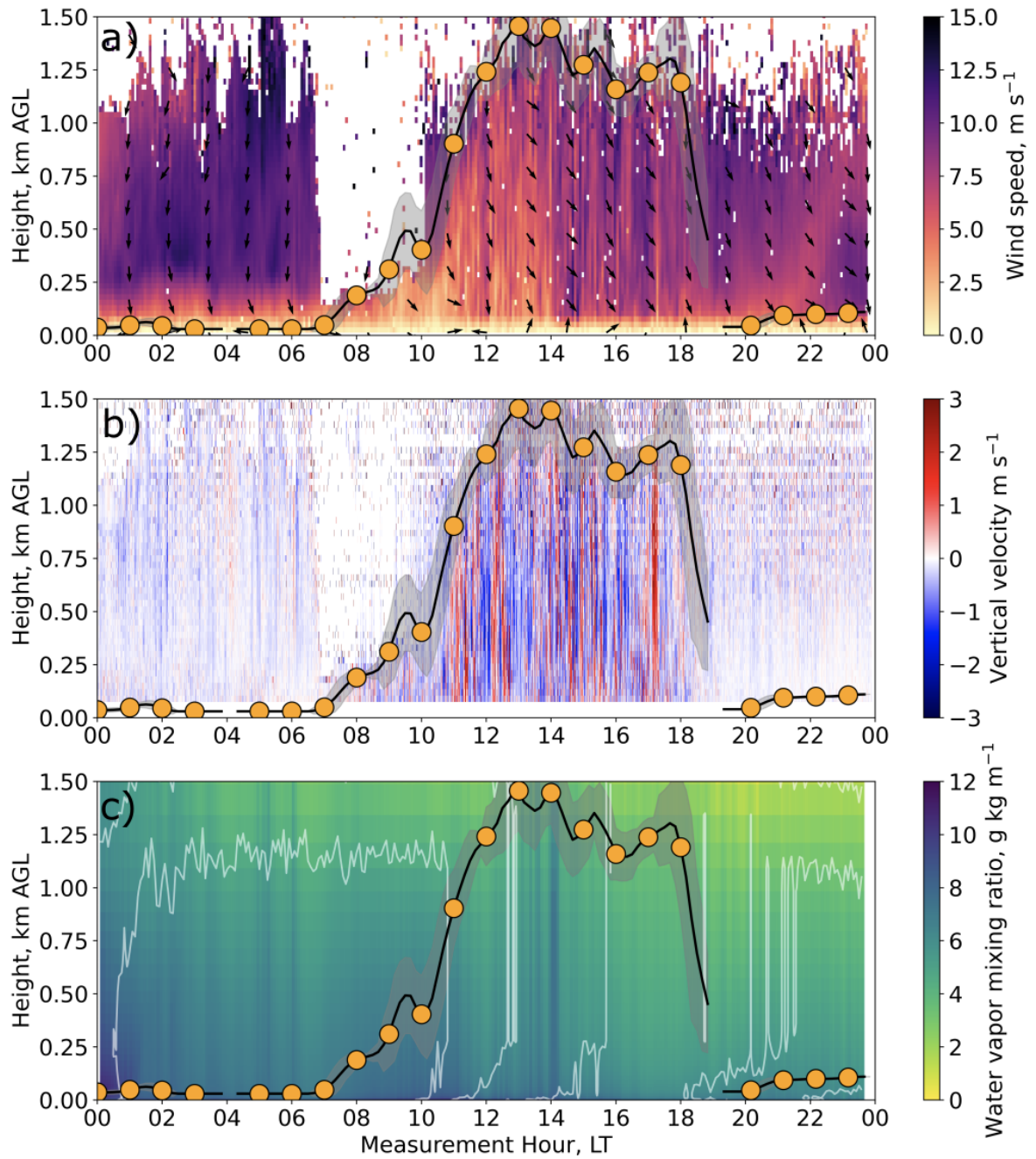**Figure S10: As in Fig. S5, but for the case study Sep 23, 2019.**

Figure S11: As in Fig. 4, but for the case study Sep 23, 2019.

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