



Supplement of

Operational performance of the Vaisala CL61 ceilometer for atmospheric profiling

Viet Le et al.

Correspondence to: Viet Le (viet.le@fmi.fi)

The copyright of individual parts of the supplement might differ from the article licence.

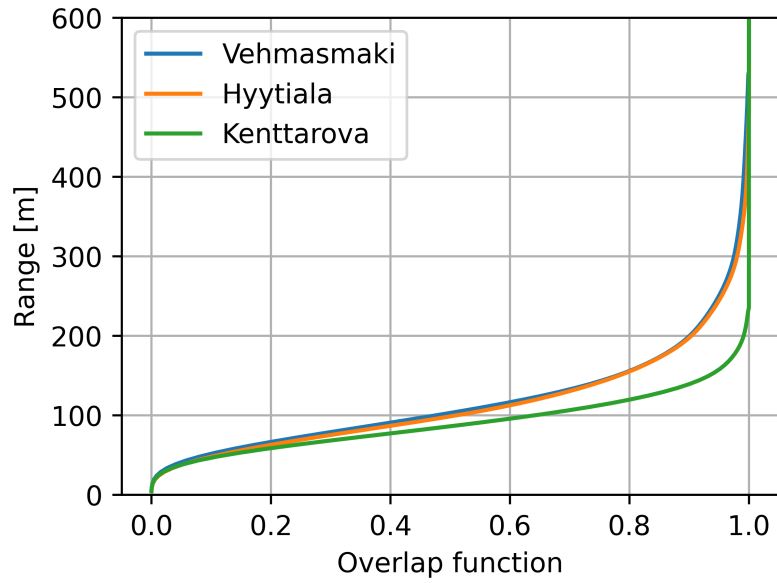


Figure S1. Overlap function of CL61 in Vehmasmäki, Hyytiälä and Kenttäröva.

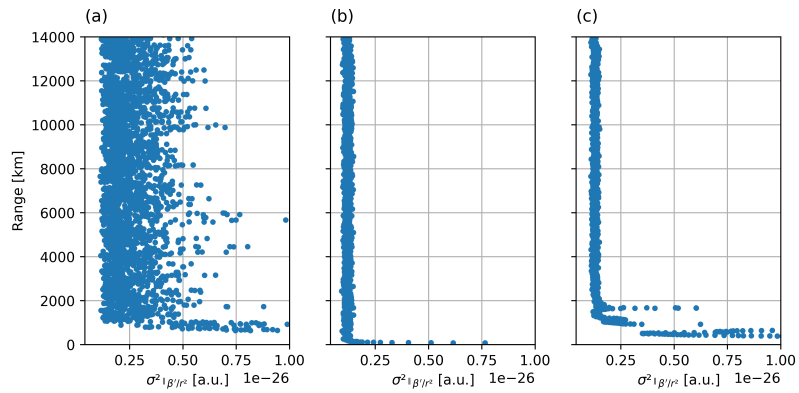


Figure S2. Background noise in Kenttäröva measured during (a) daytime conditions (5 March 2024 from 00:00 to 02:00 UTC), (b) termination hood measurements (5 March 2024 from 14:00 to 15:00 UTC), and (c) nighttime conditions (6 March 2024 from 20:00 to 22:00 UTC).

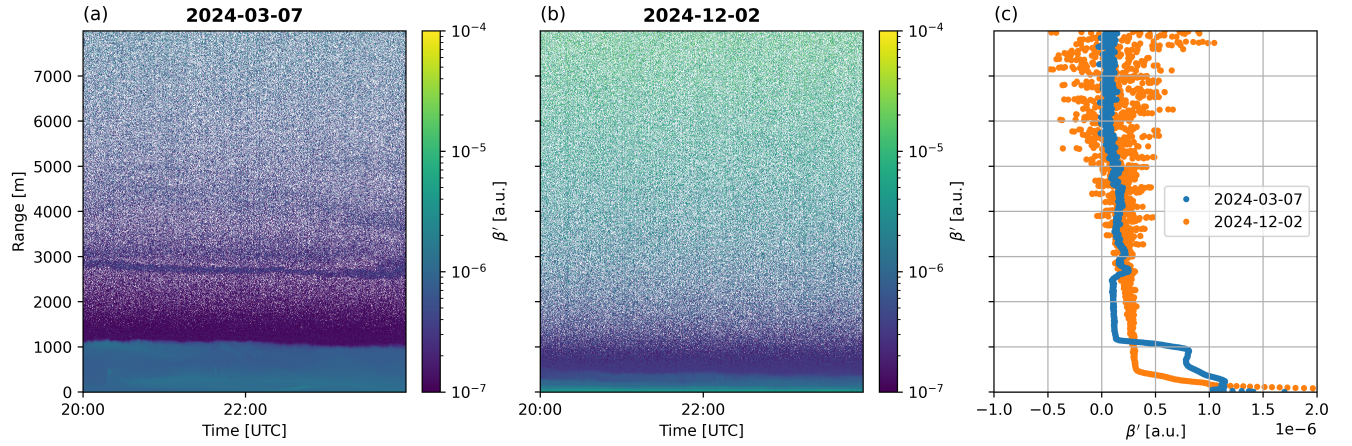


Figure S3. Study case on the effect of laser power percentage on the β' in Lindenberg. (a) on 7 March 2024 20:00 to 23:00 UTC with laser power percentage at 80 %, (b) on 2 December 2024 20:00 to 23:00 UTC with laser power percentage at 10 % and (c) Their average profiles from 20:00 to 23:00 UTC.

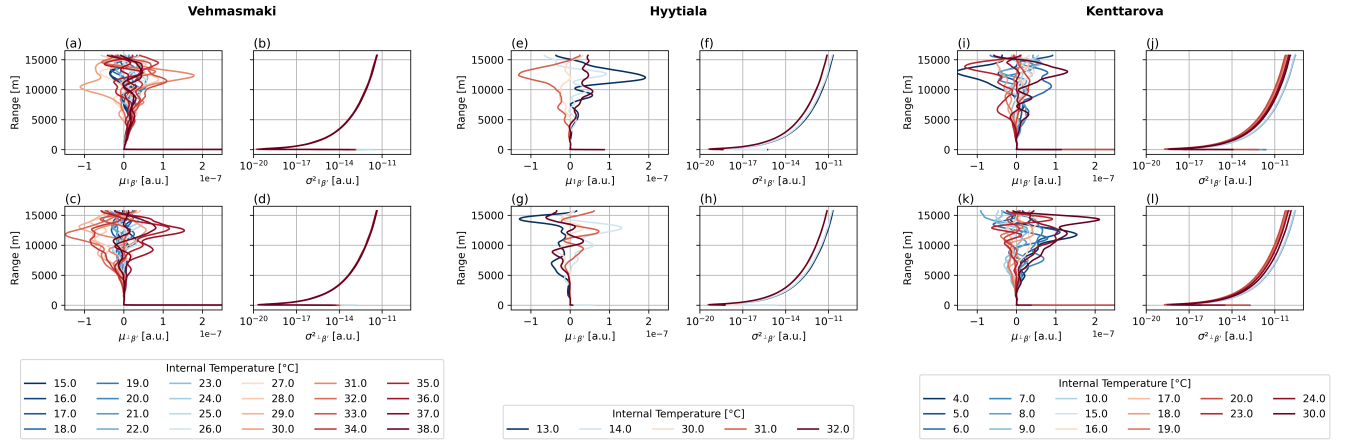


Figure S4. Termination hood profiles at various internal temperatures (color-coded) across different sites. In Vehmasmäki: (a) $\mu_{\parallel \beta'}$, (b) $\sigma_{\parallel \beta'}^2$, (c) $\mu_{\perp \beta'}$, and (d) $\sigma_{\perp \beta'}^2$. In Hyttialä: (e) $\mu_{\parallel \beta'}$, (f) $\sigma_{\parallel \beta'}^2$, (g) $\mu_{\perp \beta'}$, and (h) $\sigma_{\perp \beta'}^2$. In Kenttäröva: (i) $\mu_{\parallel \beta'}$, (j) $\sigma_{\parallel \beta'}^2$, (k) $\mu_{\perp \beta'}$, and (l) $\sigma_{\perp \beta'}^2$.

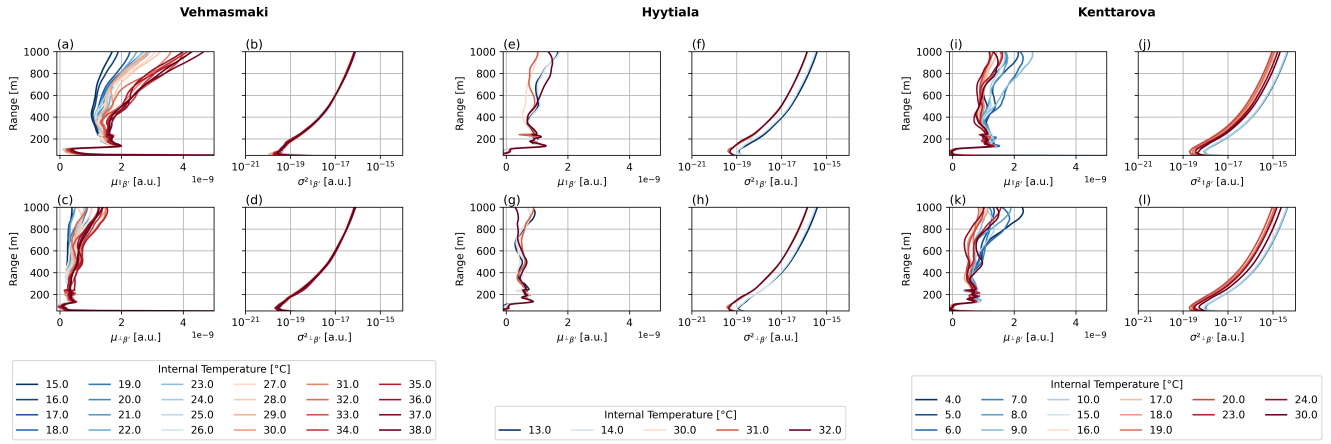


Figure S5. Termination hood profiles at various internal temperatures (color-coded) across different sites only up to 1000 m range. In Vehmasmäki: (a) $\mu_{\parallel \beta'}$, (b) $\sigma_{\parallel \beta'}^2$, (c) $\mu_{\perp \beta'}$, and (d) $\sigma_{\perp \beta'}^2$. In Hyytiälä: (e) $\mu_{\parallel \beta'}$, (f) $\sigma_{\parallel \beta'}^2$, (g) $\mu_{\perp \beta'}$, and (h) $\sigma_{\perp \beta'}^2$. In Kenttäröva: (i) $\mu_{\parallel \beta'}$, (j) $\sigma_{\parallel \beta'}^2$, (k) $\mu_{\perp \beta'}$, and (l) $\sigma_{\perp \beta'}^2$.

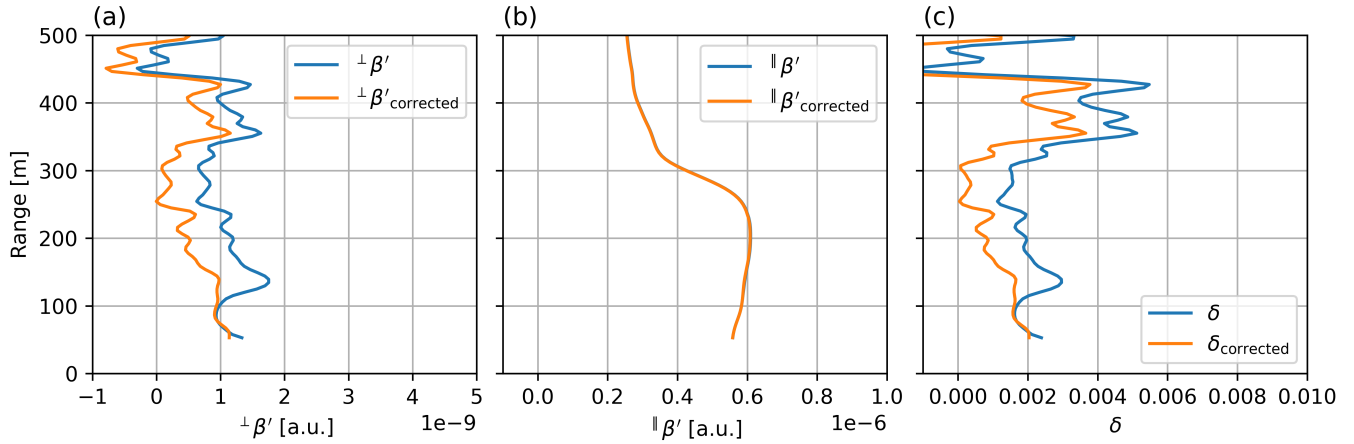


Figure S6. Data from Kenttäröva 3 October 2023, averaged from 11:00 to 15:00 UTC showing (a) $\perp \beta'$, (b) $\parallel \beta'$ (c) δ .

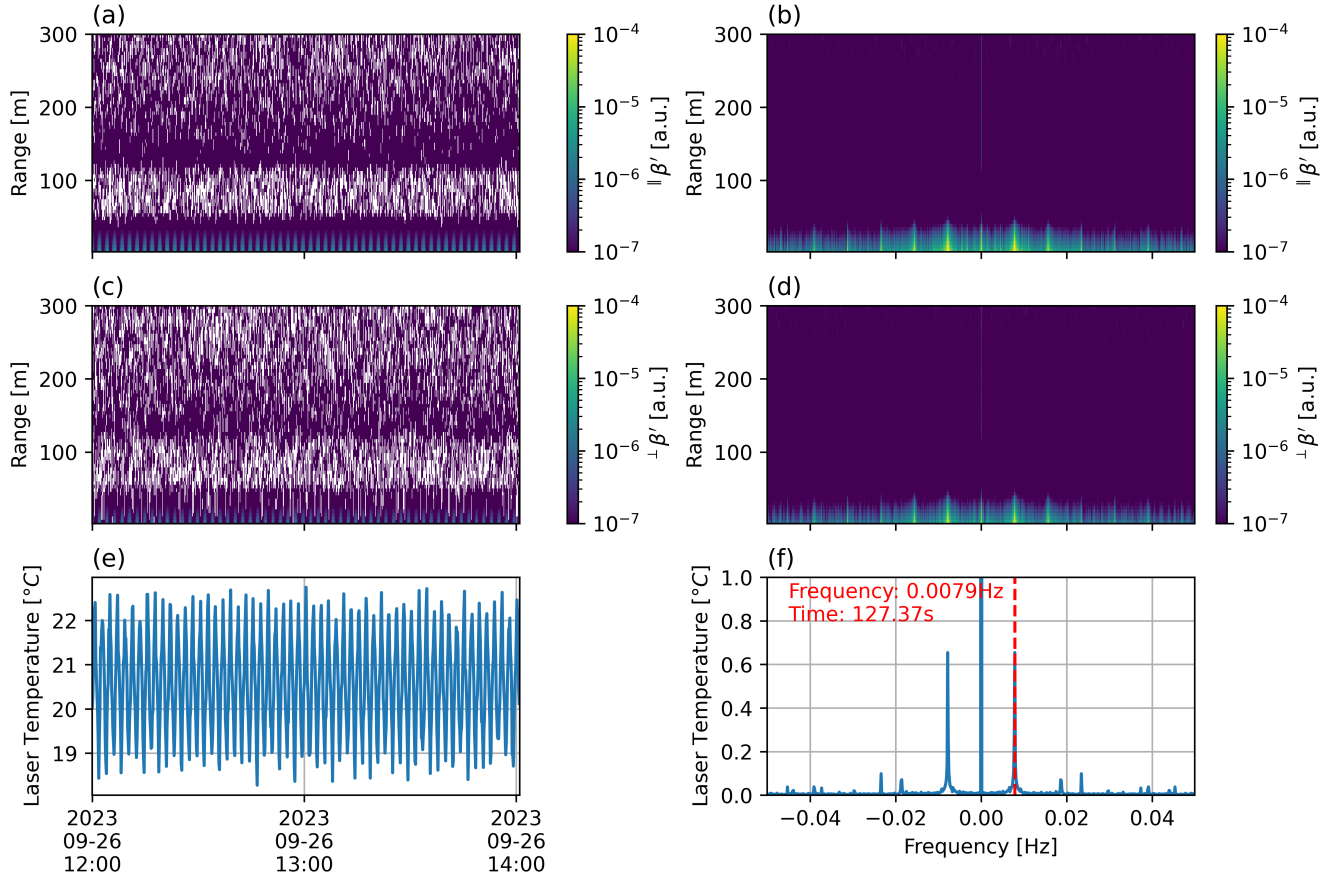


Figure S7. Data from Kentärova 26 September 2023 (a) $\parallel \beta'$, (b) Fourier transform in the time domain of $\parallel \beta'$ (c) $\perp \beta'$, (d) Fourier transform in the time domain of $\perp \beta'$, (e) laser temperature, (f) Fourier transform in the time domain of laser temperature.

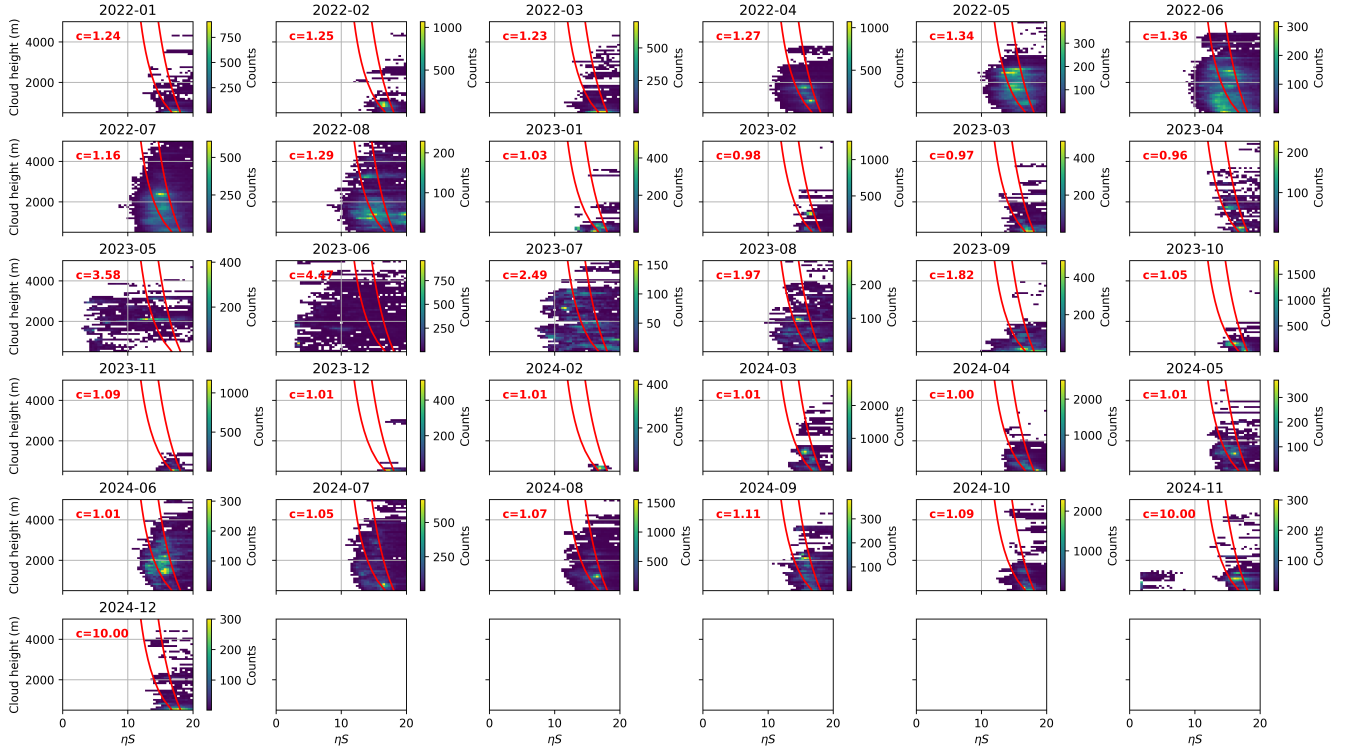


Figure S8. Monthly calibration factor C (in red) obtained from the cloud calibration method on Vehmasmäki CL61 data. The red line represent the theoretical values of ηS for droplet effective diameters 8-20 μm . The shown calibration factor value was applied.

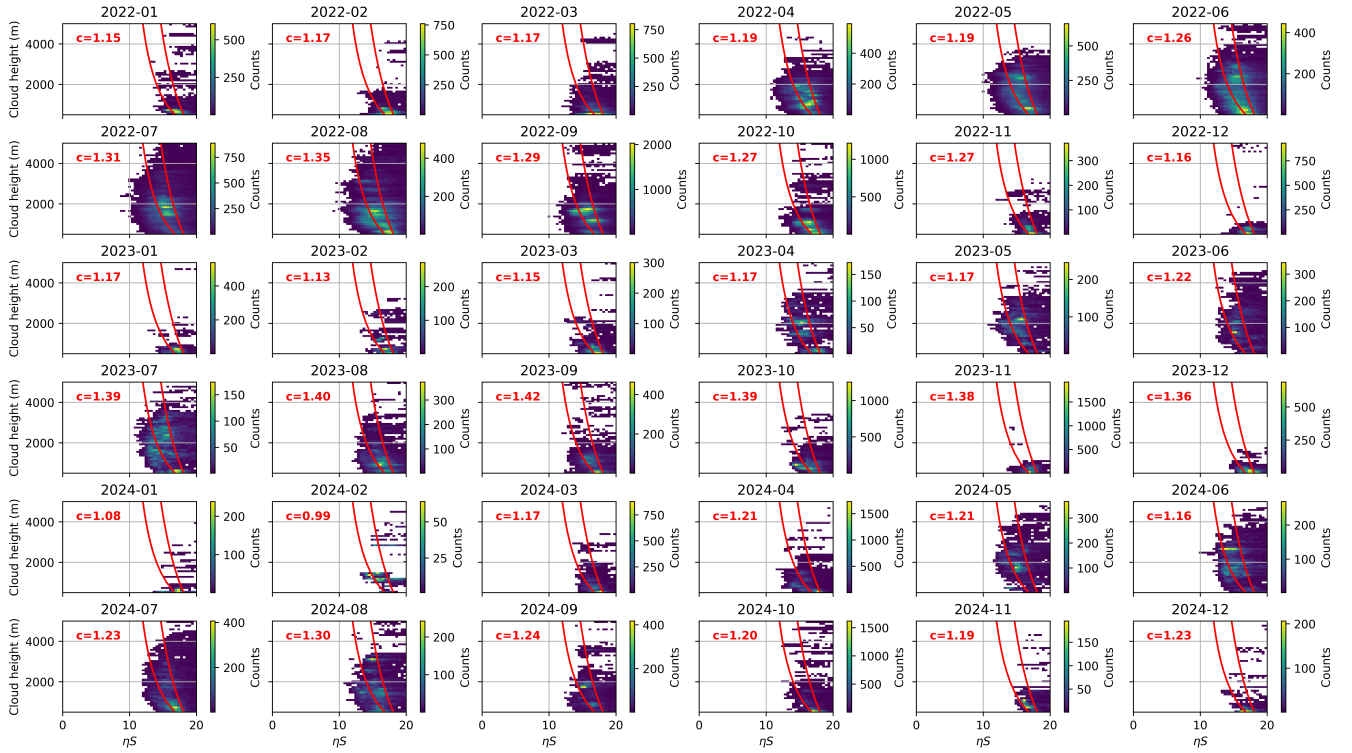


Figure S9. Monthly calibration factor C (in red) obtained from the cloud calibration method on Hyytiälä CL61 data. The red line represent the theoretical values of ηS for droplet effective diameters 8-20 μm . The shown calibration factor value was applied.

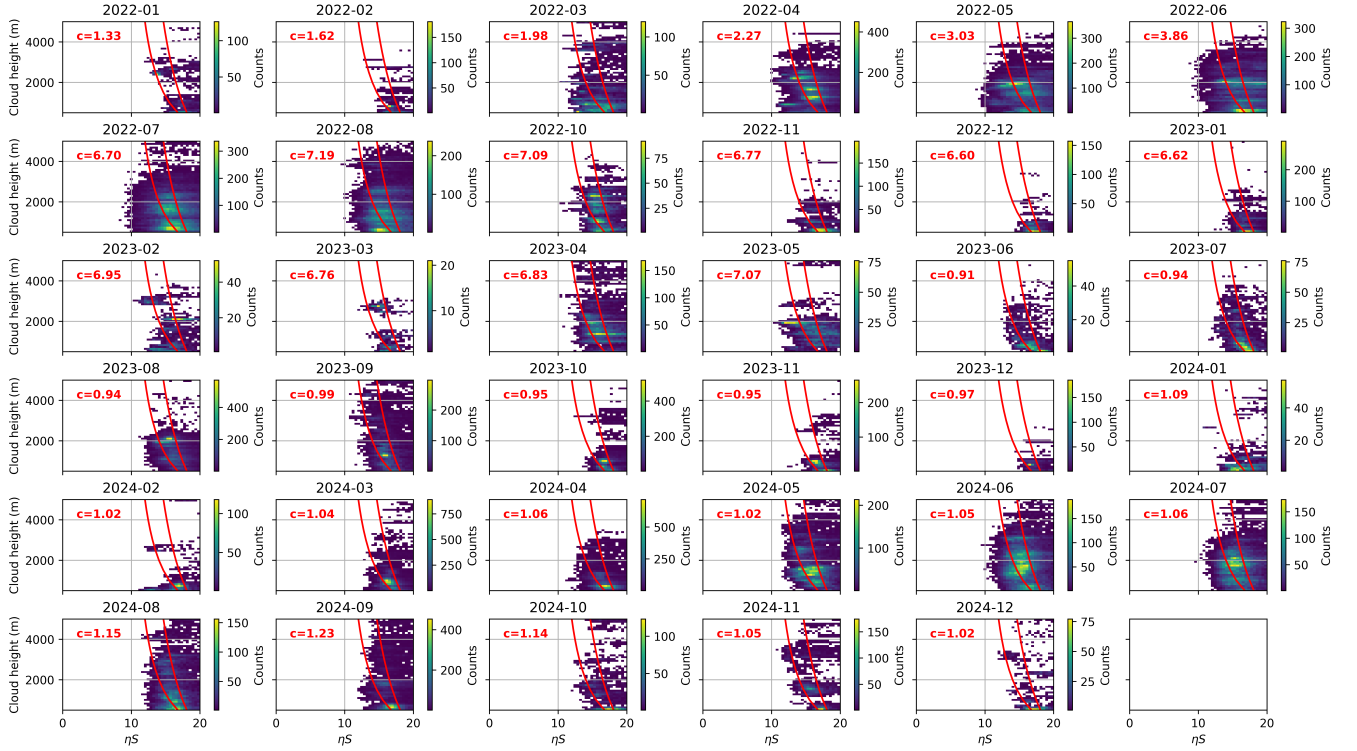


Figure S10. Monthly calibration factor C (in red) obtained from the cloud calibration method on Kenttäröva CL61 data. The red line represent the theoretical values of ηS for droplet effective diameters 8-20 μm . The shown calibration factor value was applied.

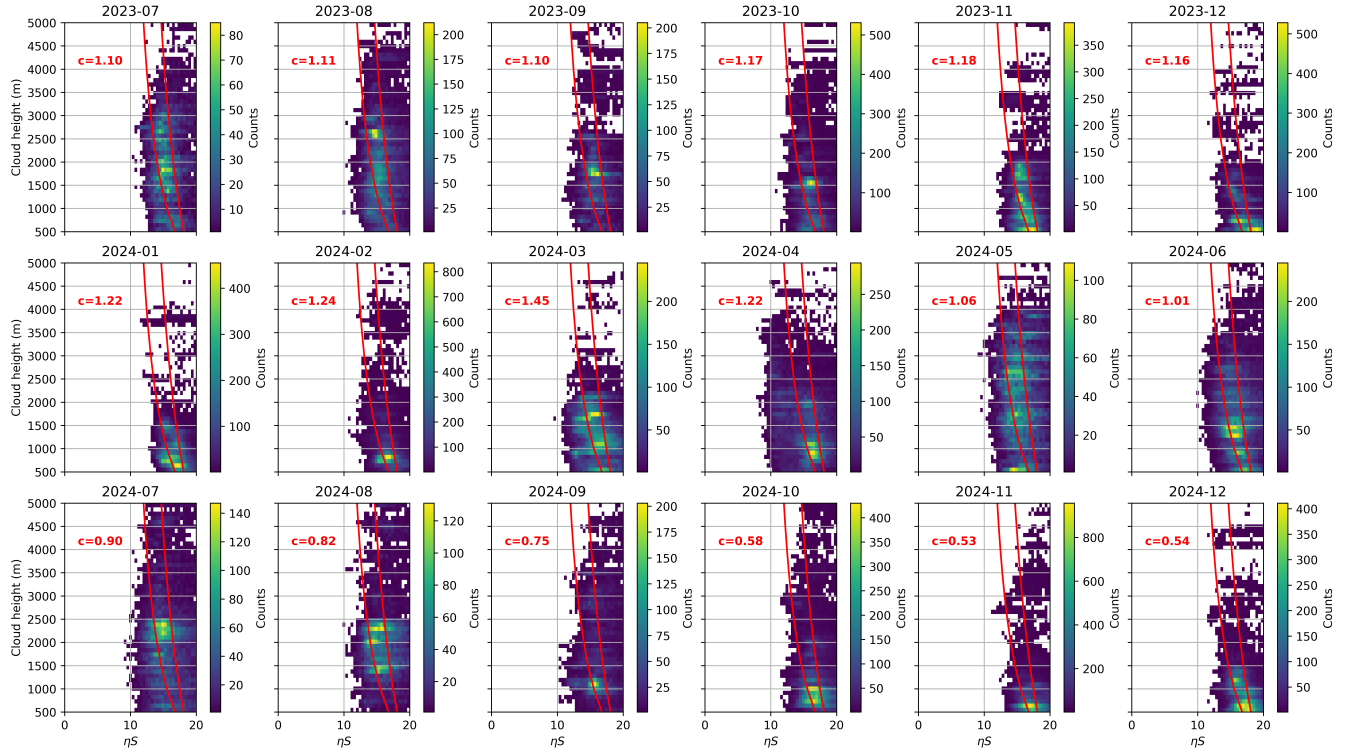


Figure S11. Monthly calibration factor C (in red) obtained from the cloud calibration method on Lindenberg CL61 data. The red line represent the theoretical values of ηS for droplet effective diameters 8-20 μm . The shown calibration factor value was applied.

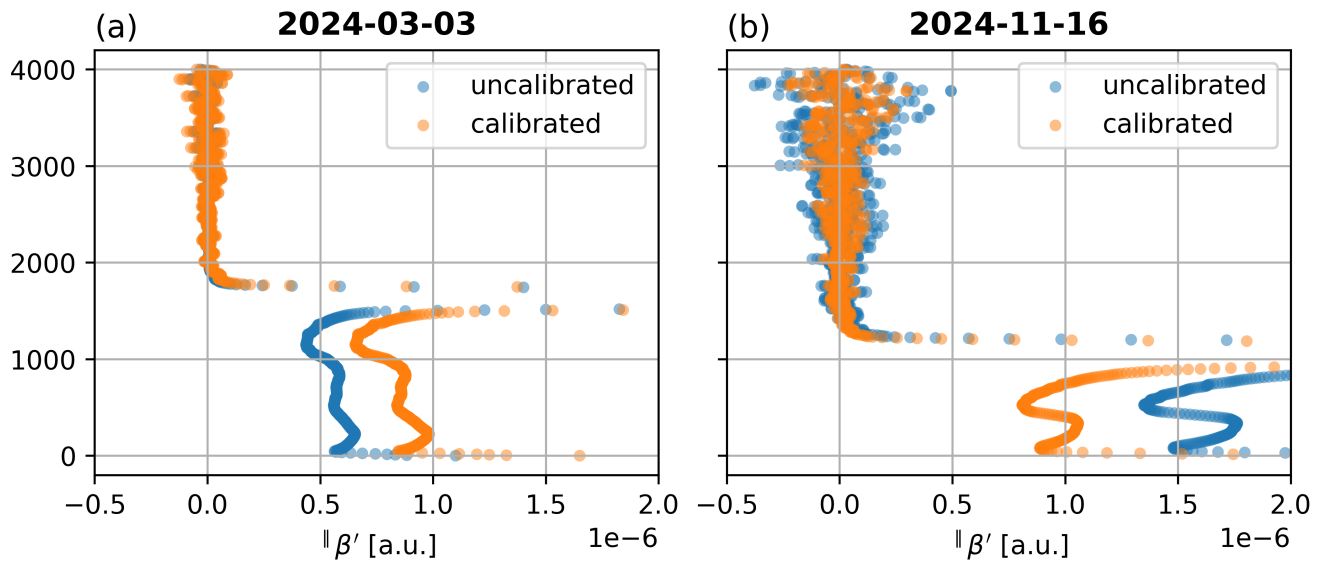


Figure S12. Averaged backscatter profile from Lindenberg (a) 3 March 2024 16:30 to 17:00 UTC at laser power 80 %, (b) 16 November 2024 16:30 to 17:00 UTC at laser power 10 %.

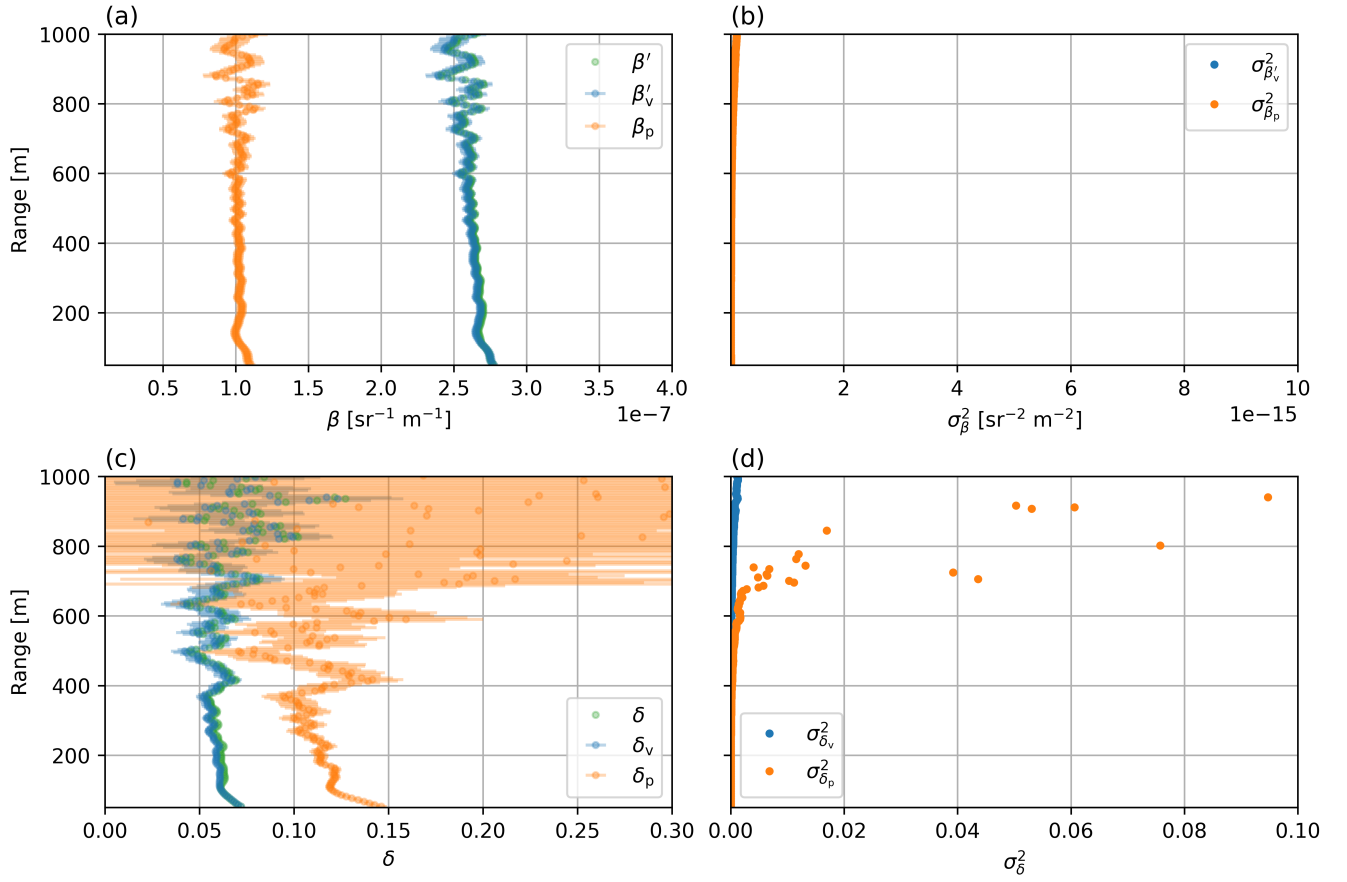


Figure S13. Example of uncorrected and corrected profiles in Kenttäröva, averaged from 4 June 2024 13:00 to 13:10 UTC. (a) β' (instrument provided), β'_v (bias corrected and calibrated), β_p , (b) $\sigma_{\beta'_v}^2$, $\sigma_{\beta_p}^2$, (c) δ (instrument provided), δ_v (bias corrected and calibrated), δ_p , (d) $\sigma_{\delta'_v}^2$, $\sigma_{\delta_p}^2$.

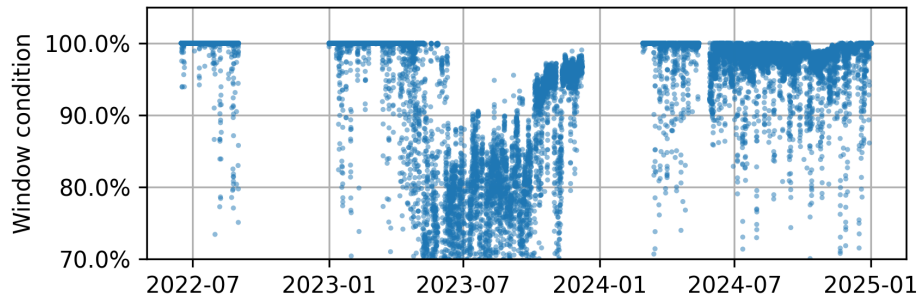


Figure S14. Window condition in Vehmasmäki.