

First validation results of ATLID L2 product using a high-power ground-based lidar in Finland

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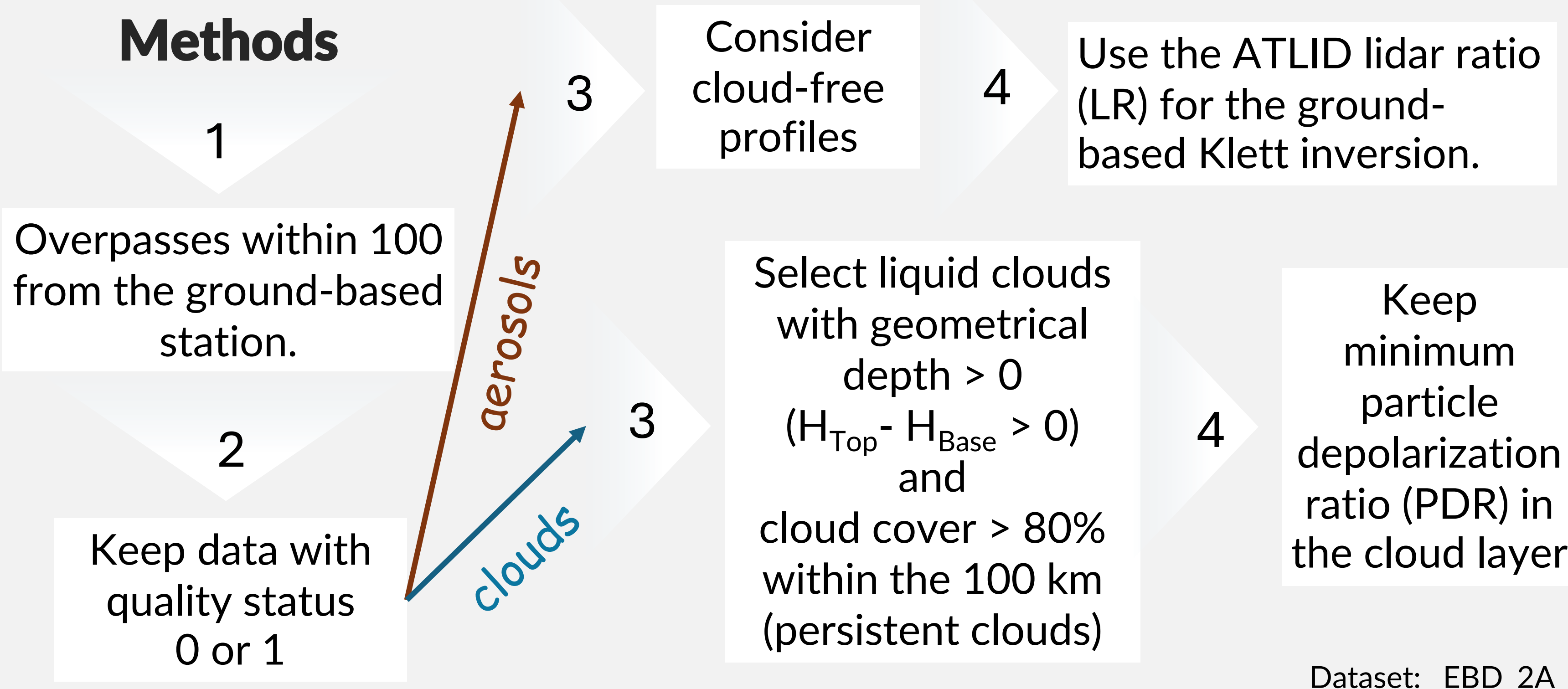


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Abstract

Ground-based lidar measurements at the high-latitude station of Vehmassmäki in Kuopio, Finland (62°44'16.1"N 27°32'35.5"E, 190 m amsl) were used for validating observations from the atmospheric lidar (ATLID) aboard the Earth Clouds, Aerosols and Radiation Explorer (EarthCARE) satellite within the rural sub-arctic environment. In this initial validation, both aerosol and cloud properties are compared against equivalent observations from the high-power PollyXT lidar located on site.

Methods



Measurement site

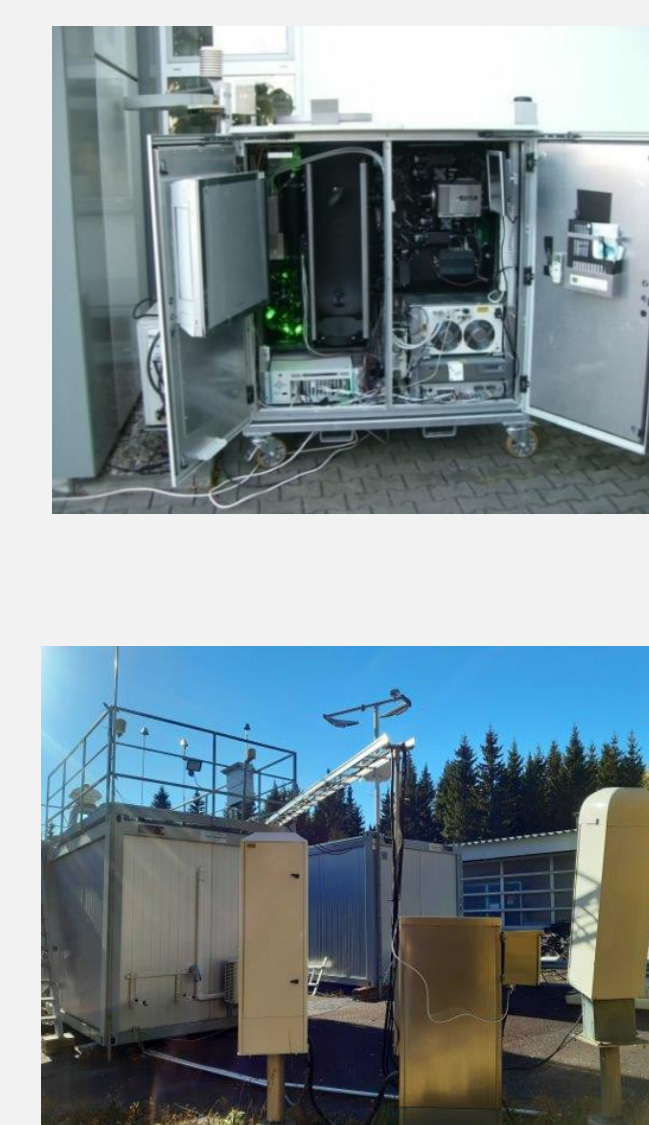
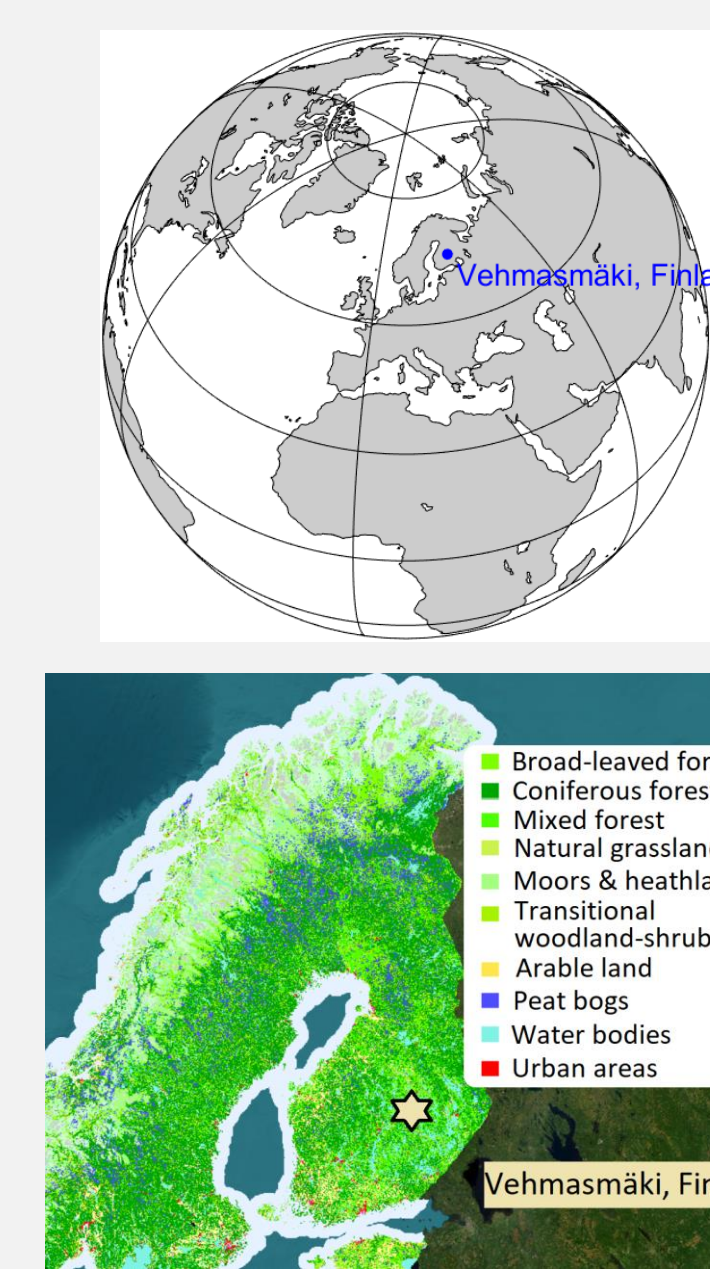
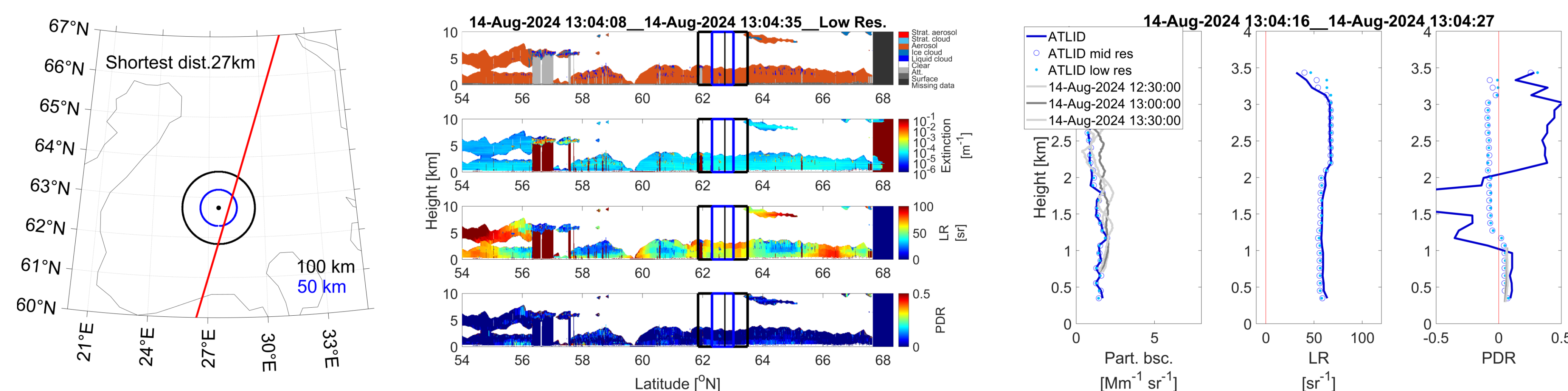


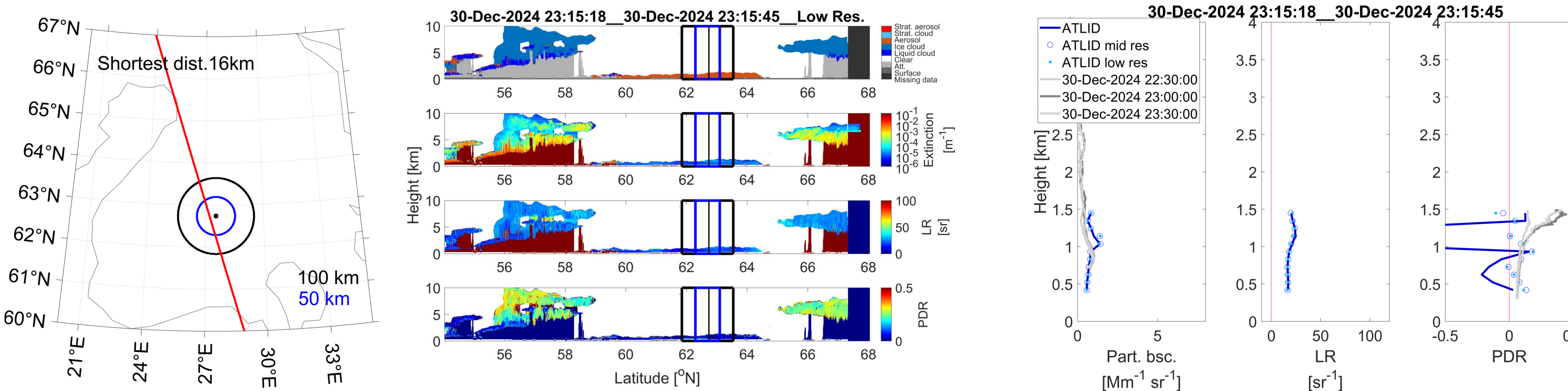
Figure 1. Measurement site location and land cover from the Copernicus CORINE (Coordination of Information on the Environment) Land Cover inventory in 2018. On site, a PollyXT lidar and a Vaisala CL61 ceilometer can be found.

Results

Case 1: 14th of August 2024



Case 2: 30th of December 2024



A total of 52 overpasses between August 2024 and February 2025 over Vehmassmäki station (Kuopio) in Eastern Finland.

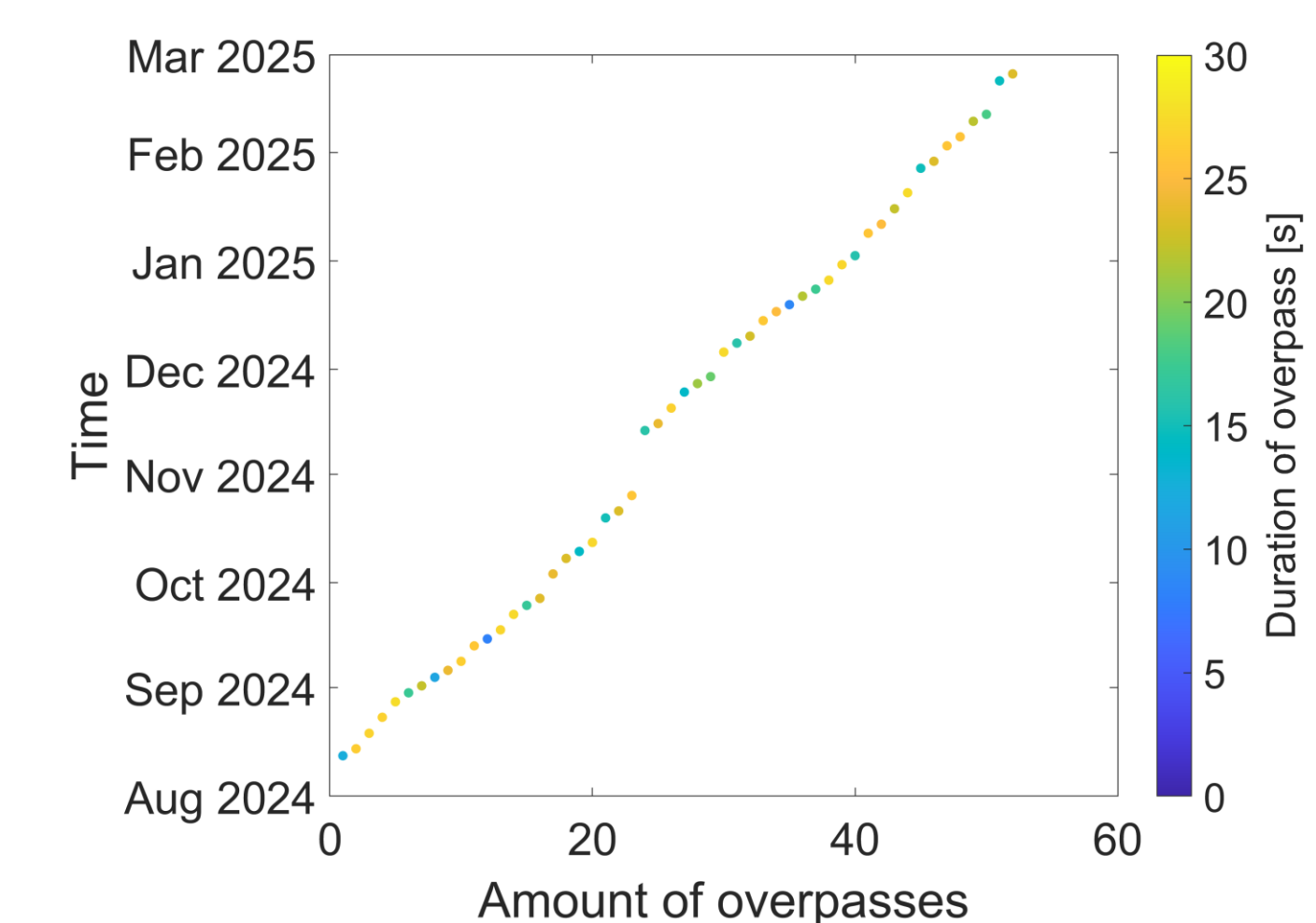


Figure 2. Overview of EarthCARE overpasses over Vehmassmäki station in Kuopio, Finland. The color indicates the duration of the overpass within the 100 km range. The frequency of overpasses over the measurement site is about 6-10 per month.

Figure 3. Case 1: Left panel: EarthCARE overpass over Vehmassmäki station. Middle panel: Simple classification and optical information from ATLID. Low resolution products are shown. Right panel: Comparison between ground-based lidar and ATLID. All three resolutions from ATLID optical products are shown. For the ground-based retrieval, a 30 min temporal averaging was used before, during and after the overpass. A LR of 56 sr was used for the Klett retrieval. Case 2: Equivalent information to Case 1. The LR used is 16 sr.

Liquid cloud statistics

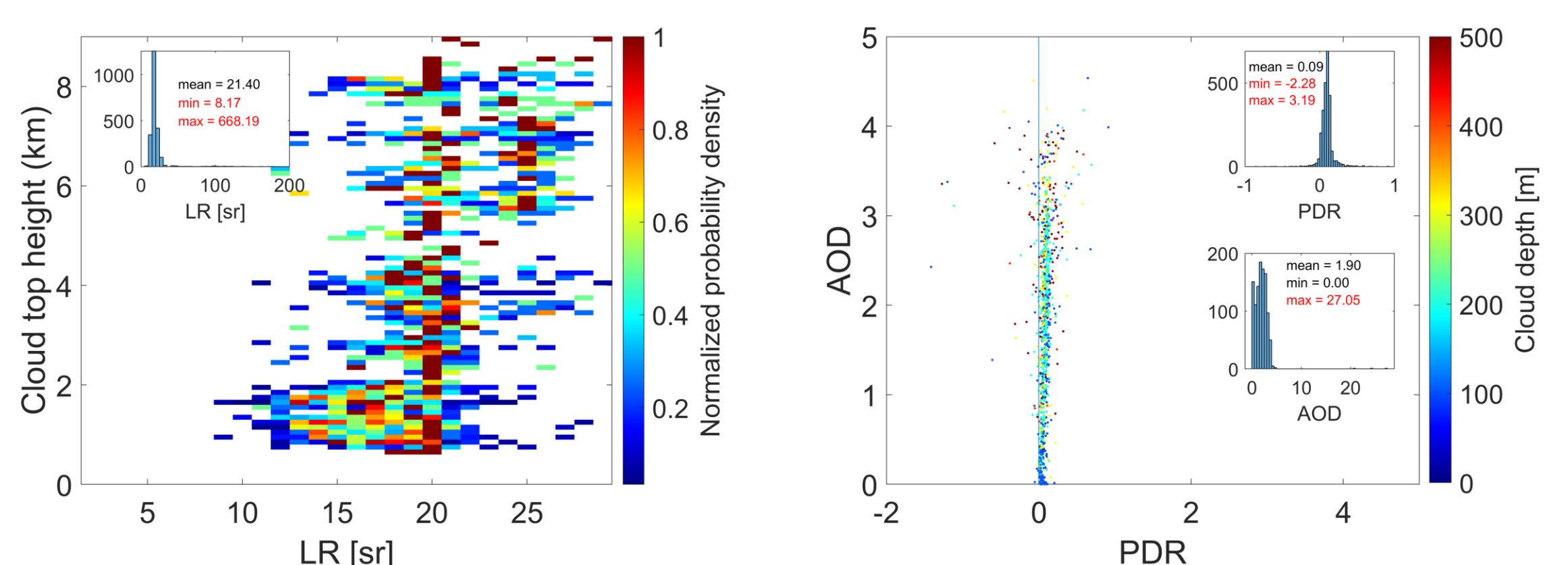


Figure 4. Left: Observed values of the lidar ratio (LR) plotted as histograms of their distribution at each height (every 100 m) and normalized by the number of values that fall within the largest interval. Right: Relationship between Aerosol Optical Depth (AOD) and minimum particle depolarization ratio (PDR) in the cloud. The color scale indicates the geometrical depth of the liquid cloud. Superimposed histograms demonstrate the mean/min/max values of AOD and PDR.

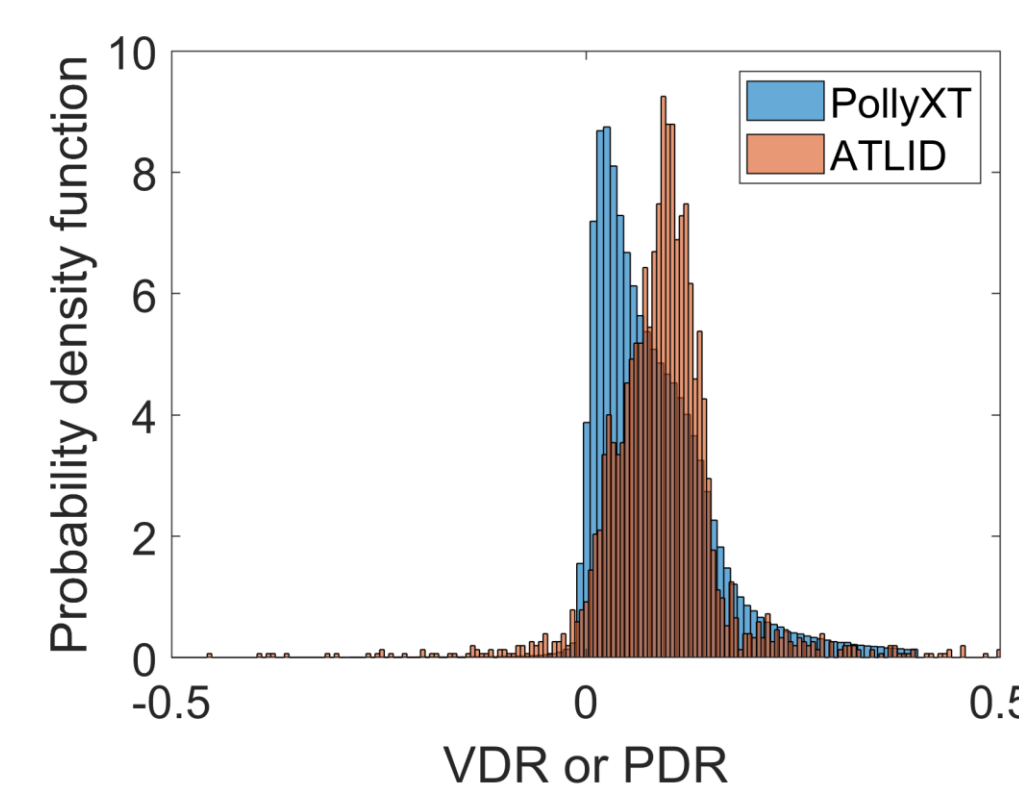


Figure 5. Histogram of the liquid cloud depolarization ratio from PollyXT and ATLID.

The peak value of the liquid cloud volume depolarization ratio (VDR) corresponds to ~2 % in PollyXT observations. For ATLID, the peak value of the particle depolarization ratio (PDR) amounts to 9 %. Mean values amount to 8 % and 9 % for PollyXT and ATLID, respectively.

See poster 34 using ceilometers for validation!

Misclassification case?

