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Automatic detection of atmospheric boundary layer heights at European scale (ABL testbed)

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A detailed understanding of atmospheric boundary layer (ABL) processes is key to improve forecasting of pollution dispersion and cloud dynamics in the context of future climate scenarios. International networks of automatic lidars and ceilometers (ALC) are gathering valuable data that allow for ABL layers to be derived in near real time. A new generation of advanced methods to automatically detect the ABL heights now exist. However, diversity in ALC models means these algorithms need to be tailored to instrument-specific capabilities. Initial evaluation of the advanced algorithms STRATfinder (for application to high signal-to-noise ratio (SNR) ALC observations) and CABAM (low-SNR measurements) to automatically derive ABL heights indicates promising performances (Kotthaus et al. 2020).

In the framework of the ABL testbed project (funded by ICOS, ACTRIS and E-PROFILE) the two algorithms are now being assessed for application in an operational network setting, such as EUMETNET E-PROFILE. A subset of 11 E-PROFILE sites in a range of geographical and land cover settings across Europe are selected where data from low-SNR and/or high-SNR ALC are available for multiple years. Automatic layer detection is implemented, including instrument-specific corrections and calibrations. Algorithm performance for layer height detection is being evaluated via comparison of results from different ALC and by including reference data from thermodynamic- and turbulence derived layer heights from radiosondes and other ground-based profiling sensors where available. Recommendations are formulated for implementation of automatic ABL height retrievals across a diverse sensor network. A prime example of collaborations within the EU COST action PROBE on profiling the atmospheric boundary layer, the ABL testbed is a crucial step towards harmonised ABL height products at the European scale.

References

Kotthaus, S, M Haeffelin, MA Drouin, JC Dupont, S Grimmond, A Haefele, M Hervo, Y Poltera, M Wiegner, 2020: Tailored Algorithms for the Detection of the Atmospheric Boundary Layer Height from Common Automatic Lidars and Ceilometers (ALC). ***Remote Sens*****, 12, 3259, DOI: 10.3390/rs12193259.**

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