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Observing shallow atmospheric boundary layers over Helsinki

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Given Helsinki's poleward latitude and climatology, we expect a large occurrence of shallow atmospheric boundary layers (ABL). Observing the height, profile and frequency of these are important for predictions of air quality and NWP. Measurements were thus carried out as part of Helsinki UrBAN (Urban Boundary-layer Atmosphere Network, http://urban.fmi.fi): a dedicated research-grade observational network for the study of the physical processes in the atmosphere above the city.

We focus first on providing automated estimates of shallow ABL depth from (i) lidar, and (ii) sodar.
(i) Vertically pointing lidars typically cannot diagnose shallow ABLs, so custom low-level scanning routines (RHI scans) were implemented to observe vertical profiles of the variance of velocity. We used data from a scanning doppler lidar (HALO Photonics, Streamline), running since August 2011.
(ii) Furthermore, sodar is an ideal tool, given its low first sampling region (range 20–400m and resolution of 10m): we used a Latan-3 1D sodar (3400Hz) operated from August 2009 onwards. The algorithm is based on finding the height of the greatest reduction in acoustic backscatter intensity within the sensing range.

Preliminary analysis suggests that around quarter of occasions (hourly periods) have ABL depths below 105m. Since these would certainly not be detectable using most lidars' vertical stare routines, this corroborates and motivates the use of the scanning and doppler capabilities of the lidar. Furthermore, using these data we expect to compare with and improve modelled ABL estimates.