Agreement and Availability of Doppler Velocity Measurements from Co-located Doppler Wind Lidar and X-band Weather Radar

Jenna Ritvanen[1,2], Ewan O'Connor[1], Dmitri Moisseev[1,2], Ludovic Thobois[3], Raisa Lehtinen[4], Jani Tyynelä[1]

[1] *Finnish Meteorological Institute, Helsinki, Finland*
[2] *Institute for Atmospheric and Earth System Research / Physics, Faculty of Science, University of Helsinki, Helsinki, Finland*
[3] *Vaisala France SAS, Paris-Saclay, France, E-mail: ludovic.thobois@vaisala.com*
[4] *Vaisala Oyj, Vantaa, Finland, E-mail: raisa.lehtinen@vaisala.com*

Accurate wind measurements are important in aviation for monitoring and providing warnings of hazardous landing and take-off conditions at airports. Ground-based remote sensing instruments, such as scanning Doppler wind lidars and weather radars, are commonly used for this purpose. As the signal in Doppler lidars is from scattering by aerosols and in weather radars from insects, cloud droplets or precipitation, the instruments provide wind measurements in different weather conditions. However, the effect of various weather conditions on the measurement capabilities of these instruments has not been previously extensively quantified.

Here we present results from a measurement campaign that took place in Vantaa, Finland, from May 2021 to November 2021. During the campaign, a co-located Vaisala Windcube400S Doppler lidar and Vaisala WRS400 X-band weather radar were employed continuously to perform wind measurements. Both instruments measured plan-position-indicator (PPI) scans at 2.0 degrees elevation from horizontal. Additionally, vertical profiles of the horizontal wind components were determined using the Doppler-beam-swinging (DBS) technique with the Windcube400S lidar, and the Volume Velocity Processing (VVP) analysis with the WRS400 radar.

We first analyze the Doppler velocity measurements from the PPI measurements and find that the overall agreement between the two instruments is good. Secondly, we study the effect of different weather conditions, such as precipitation, horizontal visibility, and cloud base height, on the measurement availability of both instruments. Finally, we evaluate the agreement of the vertical wind profiles produced from both instruments and the effect of the weather conditions on the availability of the wind profiles.