

EGU22-11471

<https://doi.org/10.5194/egusphere-egu22-11471>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Retrieving wind profiles over the Paris (France) urban area from a single Doppler Lidar measurements

Jonnathan Cespedes¹, Simone Kotthaus², Ludovic Thobois³, and Martial Haeffelin²

¹Laboratoire de Météorologie Dynamique (LMD-IPSL), CNRS, École Polytechnique, Institut Polytechnique de Paris, 91128 Palaiseau Cedex, France (jonnathan.cespedes@lmd.ipsl.fr)

²Institut Pierre Simon Laplace (IPSL), CNRS, École Polytechnique, Institut Polytechnique de Paris, 91128 Palaiseau Cedex, France

³Vaisala France SAS

Air quality and meteorology in urban environments are strongly affected by dynamical and turbulent processes occurring in the atmospheric boundary layer. These are largely driven by the interaction between the surface and the atmosphere, including the exchange of momentum, heat, moisture, and various gases and aerosols. Vertical ventilation, horizontal advection, and atmospheric stratification are key processes.

To improve the understanding of the exchange processes in the urban atmosphere and to assess the implications of spatial variations in surface roughness, spatially resolved vertical profiles of the horizontal wind are required. In this work, we are implementing a novel “volume wind processing” approach to retrieve horizontal wind information on a 3D spatial grid from observations of a scanning Doppler wind lidar (Vaisala Windcube 400s). Deployed on the rooftop of a tall building in downtown Paris, France, the Doppler lidar is operated with a series of scan strategies to monitor the vertical and horizontal variations of the mean wind field across the city center.

In order to quantify the performance of the volume wind processing, an evaluation measurement campaign was performed combining measurements at the Vaisala measurement site and the SIRTA atmospheric observatory (Paris-Saclay) located 3.5 km from each other. The Windcube 400s, located on the Vaisala site, gathered measurements based on different scan patterns (full or sector (>30°) Plan-position Indicator (PPI)), from which wind profiles were retrieved using the volume wind processing. These retrievals were then compared to vertical wind profiles obtained from a previously validated and calibrated Doppler lidar (WLS70) running in a vertical profiling mode located at SIRTA. The comparison is performed over a 30-days period. We found a mean difference (Volume Wind – Vertical Stare) of -0.69 m/s and a standard deviation of 1.32 m/s for 10-min averaged profiles.

The ongoing work consists of identifying the sources of uncertainty in the volume wind processing and improving the quality of the retrievals by improving quality control procedures. High-quality wind profile products will then be available for research on the spatial variability of the wind speed profiles, in order to determine the influence of the surface roughness on exchange processes in

the Paris urban atmosphere.