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## Scanning Doppler wind lidar at Ruisdael Observatory

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The Ruisdael Observatory [1] is a national initiative, a nationwide observatory for measurements of the atmosphere. It is set up to enable more concrete, detailed forecasts of the weather and air quality. The Ruisdael Observatory, named after the 17th century painter Jacob van Ruisdael, famous for his cloudy skies, will be modelling the entire Dutch atmosphere with a high resolution of only 100m. At the Cabauw site, which fulfils the role of main station within the Ruisdael Observatory, a large set of instruments is operated to study the atmosphere and its interaction with the land surface. Doppler wind lidars, which are laser-based remote sensing instruments, will provide detailed measurements of the wind field, aerosols and clouds around the Cabauw site.

We have installed a scanning long-range Doppler lidar Windcube 200S (Leosphere/Vaisala) at the Cabauw site at April 6<sup>th</sup>, 2021. This instrument operates at a laser wavelength of 1.5  $\mu\text{m}$  and retrieves return signals mainly from aerosol backscatter. Therefore the wind measurements are typically limited to the boundary layer, although higher lying clouds up to 14km can also provide data. The instrument has full semi-hemisphere scanning capabilities and the principle measurands are the radial wind speed, i. e. the wind component along the line-of-sight, and the relative attenuated backscatter coefficient. Wind profiles of horizontal wind speed and wind direction are retrieved from specific scan modes.

During its first year at Cabauw the Doppler lidar has operated continuously, alternating between different scan modes and instrument parameters, This included all standard Windcube scan modes: RHI (Range Height Indicator) for elevation scans at fixed azimuth angle, PPI (Plan Position Indicator) for azimuth scans at a fixed elevation angle, DBS (Digital Beam Swing) to retrieve wind profiles, and vertical staring. In addition, the six-beam method for retrieving wind and turbulence profiles [2] have been applied. During two campaign periods the Doppler lidar was co-located with Doppler cloud radars to investigate possible synergy between the retrieved wind profiles. Also a co-located ceilometer (Lufft CHM15K) is present, being part of the automatic weather station at Cabauw, which can be helpful in interpreting the Doppler lidar data.

Among the topics that are investigated:

- intercomparison with the *in situ* wind measurements in the tall meteorological tower at 200m
- comparison DBS and six-beam wind profiling scan modes
- presence of range ambiguity and its consequences on the chosen resolution
- vertical velocity information from DBS and continuous vertical staring scan modes

- PPI and RHI scans for (LES-)model evaluation

Here we will present some results of those studies, and our plans towards a long-term operational measuring program.

[1] <https://ruisdael-observatory.nl/>

[2] *A six-beam method to measure turbulence statistics using ground-based wind lidars*, Sathe, Mann, Vasiljevic, and Lea, *Atmos. Meas. Tech.*, 8, 729 (2015)