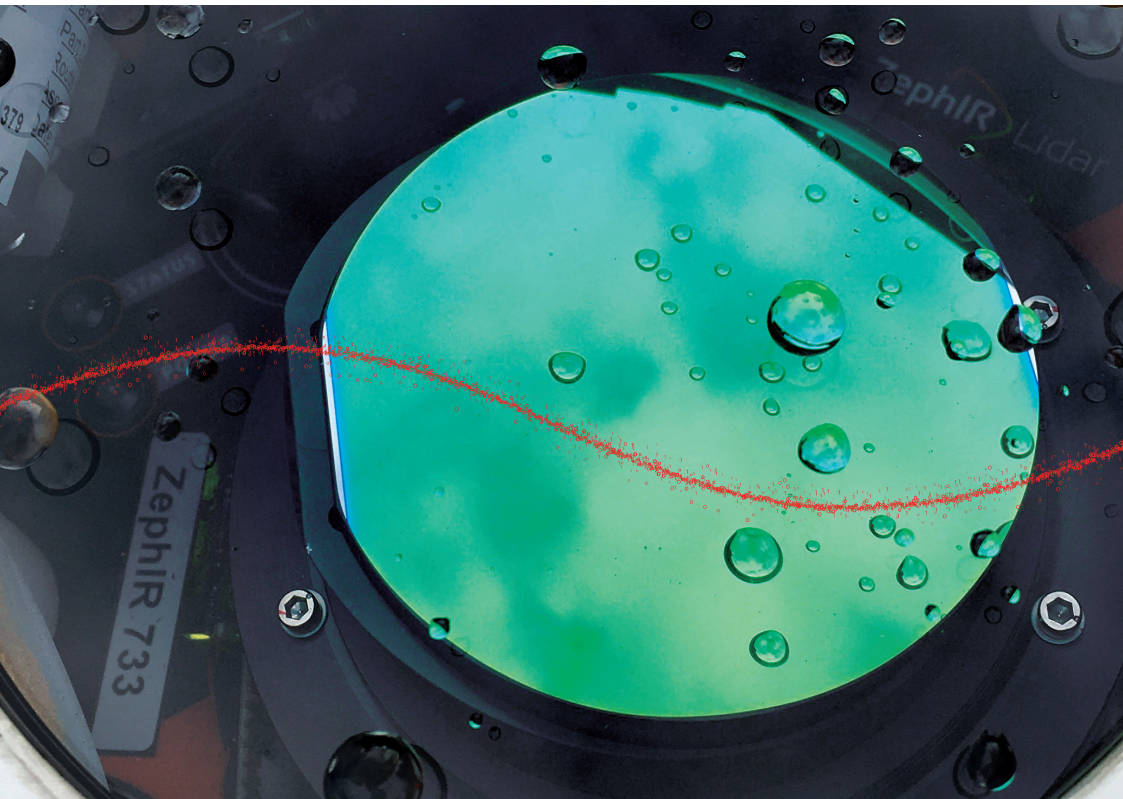




# Wind lidars for operational wind profile measurements and model validation

Ground-based Doppler wind lidars are laser-based remote sensing instruments that measure wind speed and wind direction up by measuring the Doppler-shift of the backscattered laser light, typically by aerosols in the moving air. The growing number of wind farms in the Dutch North Sea provides both the opportunity and the need to measure the wind conditions at those locations. With the increasing size of wind turbines, wind profiles up to a few hundred meters or higher, are of relevance. Wind lidars are well suitable for measuring in this range. The data can be used for nowcasting and improve weather forecasting, as well as for wind climatology purposes. Within this project KNMI gains experience with operational use of wind lidars, onshore and offshore, which is interesting for future directions in our meteorological observation network.



Within the wind energy industry, wind lidar measurement campaigns have become a standard tool for wind resource assessment, resulting in data sets from different locations in the Netherlands, both onshore and offshore. When made available to KNMI, these can be used for model validation or intercomparisons with other sources of wind information. In the coming years wind lidars will be installed by the MIVSP project on substations within the upcoming offshore wind farms in the Dutch part of the North Sea. Their main purpose is to monitor the wind conditions at hub height. These wind lidars will provide near real time wind profile data up to almost 300 m above sea level and will be made available as open data via KNMI.

#### MARITIEM IV SERVICE PUNT (MIVSP)

In the coming years, the MIVSP project will realize new sensor locations on windfarm substations. In cooperation between Rijkswaterstaat and the KNMI, these locations will be connected to their existing systems for collecting and distributing weather and sea state data.

#### MIVSP MEASUREMENT CAMPAIGN

In order to assess data availability and quality of the wind profiles under various weather conditions, KNMI has completed a two-year measurement campaign of this instrument at the CESAR Observatory in Cabauw, The Netherlands [1], commissioned by Rijkswaterstaat/MIVSP. A comparison between the wind lidar and cup anemometers at several levels in the 213 meter high meteorological mast is made, while monitoring the meteorological conditions with several of in situ and remote sensing instruments.



ZephIR 300M wind lidar at CESAR Observatory in Cabauw, the Netherlands

#### LIDAR RELATED R&D AT THE KNMI

Promising new applications of those wind lidar instruments for KNMI are real-time wind profile monitoring for operational weather forecasters and comparison with weather model data. Also long range versions for measuring wind above the influence of the wind turbine.

Our R&D activities are aiming at a thorough understanding of the instruments (including their measurement characteristics and operational issues), their added value for our nationwide meteorological observation network and atmospheric research at Cabauw, and application of wind lidar data sets (measured by KNMI or third parties) for model validation.

[1] S. Knoop, W. Koetse, and F. Bosveld, *Wind lidar measurement campaign at CESAR Observatory in Cabauw: preliminary results*, CIMO TECO-2018, 2018.

#### MORE INFORMATION

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