Kennis voor Klimaat

Knowledge for Climate

WindVisions
Wind and Visibility Monitoring System at Mainport Schiphol

HSMS 01

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Mainly due to its location near the sea, operations at Mainport Schiphol are very sensitive to changes in weather conditions. Given the anticipated climate change this sensitivity to local weather will increase, as extreme weather events are expected to occur more frequently and with increased intensity.
The operations at Mainport Schiphol are especially sensitive to the local wind field and visibility.
Adverse wind and visibility conditions represent a safety hazard as well as economic losses due to additional delays, diversions and holdings.
In order to maintain its position as a Mainport Schiphol will have to anticipate a climate change with more frequent adverse/extreme weather conditions to become more 'climate proof'.

1. Objective

Climate change happens right now.
This clear conclusion comes from the quintannual KNMI report of 2008 (KNMI (2008)) on the state of the current climate in the Netherlands.

To better understand and anticipate the implications of climate change for Mainport Schiphol it is essential to improve local monitoring of wind and visibility as soon as possible.

Photo: P. de Vries KNMI: Strong cross-wind conditions

Photo: P. de Vries KNMI: Poor visibility conditions

Objective

The objective is to develop a Wind and Visibility Monitoring System (WindVisions) better fit to the requirements of the mainport Schiphol.

WindVisions will provide continuous measurements of the 3D-wind field and visibility which will lead to better safety and efficiency of the operations at Mainport Schiphol.

2. Methods

The proposed development will consist of a vertically scanning remote sensing instrument, a so-called light or sound detecting and ranging instrument (LIDAR or SODAR), complemented by a horizontal long range wind sensor, a so-called cross-wind scintillometer.
The area of interest to monitor is the landing and take-off course of airplanes ranging from the surface to a height of about 300m.

Scintillometers

SODAR

3. Technology

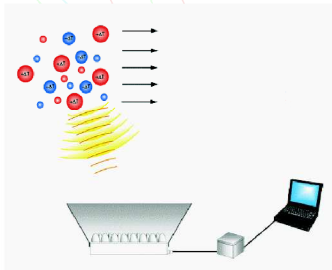

Figure: SODAR principle

- A SODAR emits short acoustic pulses into the atmosphere.
- The acoustic waves are backscattered at temperature inhomogeneities (turbulent eddies) in the air .
- The Doppler frequency shift of the backscattered signal contains information on the wind speed.
- The amplitude of the backscattered signal contains information on turbulence intensity.

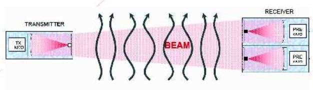

Figure: Crosswind Scintillometer principle

- A scintillometer consists of a transmitter and receiver.
- The transmitter emits a light beam over a horizontal path upto several km.
- The received intensity exhibits intensity fluctuations or 'scintillations' due to turbulent eddies in the path.
- The delay between the two received signals contains information on the cross-wind.
- The average received signal contains information on visibility.

4. Project phases

The project is split in two phases.

First Phase (actual research proposal):

- Definition study to find out which combination of sensors (SODARs/LIDARs and cross-wind scintillometers) suits best to the proposed objectives of WindVisions.
- Conduct a first test with a cross-wind scintillometer together with a compact SODAR system at the KNMI tower of Cabauw.
- Develop novel aspects of cross-wind scintillometry.

Follow-on Phase:

- Development of an operational system, based on the results of the first phase, which will then be fully tested at Schiphol airport.
- Embedment of WindVisions in IMPACT.
- PhD thesis.

HOTSPOT SCHIPHOL