

Wind Farm Zone LES-simulations

(part of the DOWA-download manual)

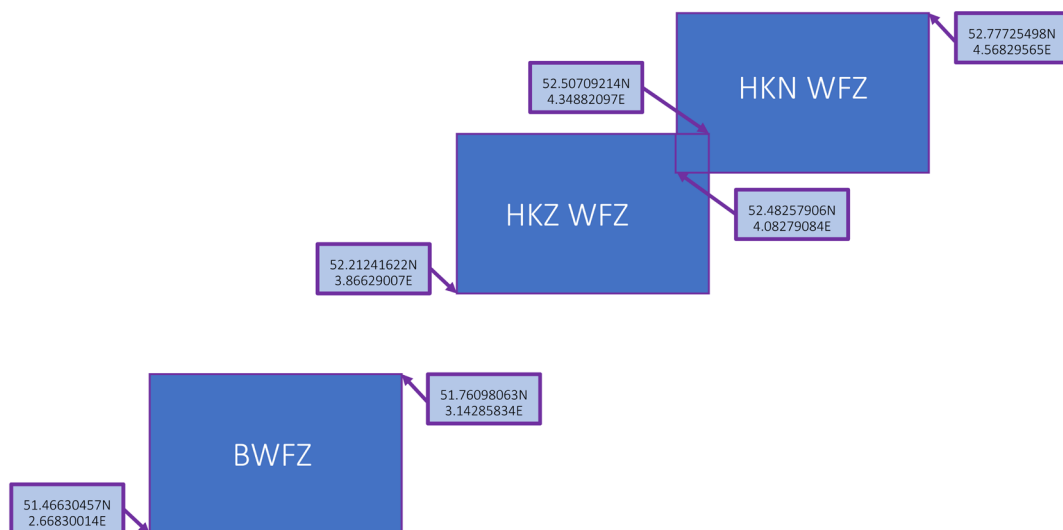
1. General information

The information (NetCDF-files) can be downloaded from the KNMI Data Centre (KDC). The wind turbines operational at the time are included in the LES-simulations.

Overview LES-experiments:

LES simulations are performed for 3 sites:

- Borssele Wind Farm Zone BWFZ: SW-corner [51.46630457N 2.66830014E] and NE-corner [51.76098063N 3.14285834E]
- Hollandse Kust Noord Wind Farm Zone HKN WFZ: SW-corner [52.48257906N 4.08279084E] and NE-corner [52.77725498N 4.56829565E]
- Hollandse Kust Zuid Wind Farm Zone HKZ WFZ: SW-corner [52.21241622N 3.86629007E] and NE-corner [52.50709214N 4.34882097E]



LES-results are made available for 18 heights: 10, 30, 51, 72, 93, 115, 137, 159, 182, 205, 229, 277, 328, 380, 434, 490, 548 and 608m. So roughly every 20 m for heights up to 225m and every 40 m for heights above 225m and up to 600m.

Every LES-experiment (for every WFZ) is done on 512 by 512 grid points (64m distance between grid points), but information is available on 460x460 grid points (outer “nudging” zone excluded). So [0,0] is in the nudging zone. For more information on the LES-experiments, we refer to the “GRASP model description & validation report” by E. Wiegant and R. Verzijlbergh on the DOWA website

(<https://www.dutchoffshorewindatlas.nl/publications/reports/2019/12/05/whiffle-report---grasp-model-description-and-validation-report>) and to Whiffle (<https://www.weatherfinerecasting.com/contact/>).

2. Daily files

https://data.knmi.nl/datasets/dowa_grasp_slices/1

Dutch Offshore Wind Atlas - hourly wind speed from LES runs on an area around Dutch wind farms.

Dutch Offshore Wind Atlas (DOWA) project - daily files with LES hourly-averaged wind speeds for three Dutch wind parks. Dissemination of high-resolution (time: 10mins; space: 64x64m) information for Dutch OWFZs (offshore wind farm zones) is a deliverable of the DOWA project. This dataset contains daily files with hourly-averaged wind speed (and standard deviation) for OWFZs Borssele (exp006), Hollandse Kust Noord (exp101) and Hollandse Kust Zuid (exp205).

More information is available on the DOWA website: www.dutchoffshorewindatlas.nl

For every day 24 hourly average wind speed values are given for:

- 18 heights: 10, 30, 51, 72, 93, 115, 137, 159, 182, 205, 229, 277, 328, 380, 434, 490, 548, 608m.
- 3 sites: BWFZ, HKN WFZ and HKZ WFZ.

2.1 How to download the LES daily files

- Go to: https://data.knmi.nl/datasets/dowa_grasp_slices/1
- The total file size is 1.7 TB (which cannot be downloaded in one go). Therefore you need to select which files you want to download:
- Click on “files” (“bestanden”)
- Select the file (733,0 MB per file) you want to download (e.g. file *graspslices_exp205_20180725.nc* contains 24 hourly average wind speed files (+standard deviation) for HKZ WFZ (exp205) for 25-7-2018 (=2018-07-25 01:00 until 2018-07-26 00:00). Overview experiments in chapter 1 of this manual.

The daily files contain hourly averaged information (not instantaneous values): the value with label 01:00 is e.g. the average of 30sec¹ samples between 00:00 and 01:00. Every daily file contains values from 01:00 on that day (representing the average of 30 second samples between 00:00 and 01:00) to 00:00 on the next day (representing the average of 30 second samples between 23:00 and 00:00). For 30-7-2017 e.g. the daily file contains 24 hourly averages: 01:00 on 30-7-2017 (average from 00:00-01:00 on 30-7-2017), 02:00 (average from 01:00-02:00 on 30-7-2017), ... and 00:00 (average from 23:00 on 30-7-2017 to 00:00 on 31-7-2017).

¹ Time step in LES is a few seconds, depending on the wind speed (CFL criterium). The sampling rate is manually set to 1/30 sec.

In the file names the experiment numbers (exp006, exp101 and exp205) refer to the area for which the daily files are available:

Experiment number and name of the OWFZ:	Period with daily files:	Measurements	Data missing for:
Exp006 (BWFZ)	1-1-2015 until 31-12-2017	Floating lidar measurements from 11-6-2015 until 27-2-2017 (site I) and from 12-2-2016 until 07-07-2016 (site II)	28-08-2016 12-05-2017
Exp101 (HKN WFZ)	1-1-2009 until 31-12-2010 and 1-1-2017 until 31-12-2017	OWEZ measurements from 1-7-2005 until 31-12-2010. 2 floating lidar measurements from 10-4-2017 until 31-10-2017.	01-01-2009 28-02-2010 02-03-2010 03-03-2010 04-03-2010 05-03-2010 08-03-2010 09-03-2010 10-03-2010 11-03-2010 12-03-2010 14-03-2010 15-03-2010 17-03-2010 18-03-2010 19-03-2010 20-03-2010 24-03-2010 26-03-2010 01-04-2010 03-04-2010 05-04-2010 07-04-2010 22-04-2010 24-04-2010
Exp205 (HKZ WFZ)	1-1-2016 until 30-7-2018	2 floating lidar measurements from 5-6-2016 until 28-2-2018	no missing days

3. Time series

https://data.knmi.nl/datasets/dowa_grasp_tower/1

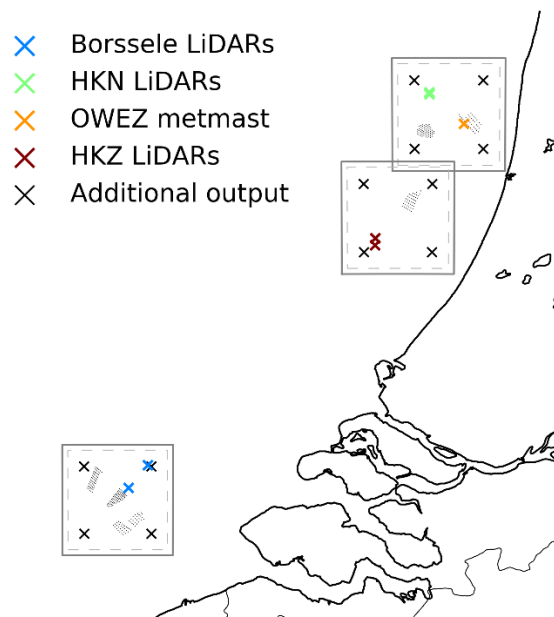
Dutch Offshore Wind Atlas - time series for individual points from an LES run on an area around Dutch offshore wind farms

Dutch Offshore Wind Atlas (DOWA) project - LES-time series at locations in Dutch offshore wind parks. Dissemination of high-resolution (time: 10mins; space: 64x64m) information for Dutch OWFZs (offshore wind farm zones) is a deliverable of the DOWA project. This dataset contains time series with 10-minute averaged wind speed, wind direction, air pressure, relative humidity and temperature from Whiffle's Large Eddy Simulation model GRASP using tendencies constructed from the ECMWF reanalysis ERA5. Wind parks have been included in the LES model for the periods they have been operational. The files with *_fs_* in the file name contain free-stream fields, i.e. without wind parks. The time series contain values at heights from 10 to ca. 600m. The attribute experiment in the NetCDF files indicates the wind park: Borssele (006), Hollandse Kust Noord (101) or Hollandse Kust Zuid (205).

More information is available on the DOWA website: www.dutchoffshorewindatlas.nl

10 min average wind speed, wind direction, air pressure, relative humidity and temperature are given for:

- 18 heights: 10, 30, 51, 72, 93, 115, 137, 159, 182, 205, 229, 277, 328, 380, 434, 490, 548, 608m.
- BWFZ (6 grid points: the 4 corner locations and 2 lidar-locations).
- HKN WFZ (7 grid points: the 4 corner locations, 2 lidar-locations and OWEZ).
- HKZ WFZ (6 grid points: the 4 corner locations and 2 lidar-locations)



The time series contain 10min averaged information (not instantaneous values): the value with label 10:10 is e.g. the average of 30sec samples between 10:00 and 10:10.

3.1 How to download the LES time series

- Go to https://data.knmi.nl/datasets/dowa_grasp_tower/1
- The total file size is 1.1 GB.
- Click on "files" ("bestanden")
- Select the file you want to download (e.g. file *grasptower_52.270N_4.253E.nc* is a file for location 52.270N, 4.253E in HKZ WFZ for 18 heights (10, 30, 51, 72, 93, 115, 137, 159, 182, 205, 229, 277, 328, 380, 434, 490, 548 and 608m).
- Downloads via ftp: see DOWA download manual