WINTWEX-W

Wind Turbine Wake Experiment - Wieringermeer
ECN test site Wieringermeer

- Available data from
  - 5 Nordex research turbines
  - 80 m hub & rotor diameter
  - 6 upstream met masts
ECN test site Wieringermeer

+ Met mast 3
  + 3 sonic anemometers at 52 m, 80 m and 109 m

- Top mounted at 109.1m: Gill 3D Sonic anemometer

- 80m: Three booms (0, 120, 240 deg)
  One boom (N) with 3D sonic (60.0m)
  Two booms with cups (80.0m)
  Two booms with wind vanes (79.2m)
  Air temperature, humidity and pressure (78.4m)

- 52m: Three booms (0, 120, 240 deg)
  One boom (N) with 3D sonic (52.0m)
  Two booms with cups (52.0m)
  Two booms with wind vanes (51.2m)

- Air temperature difference measurement
  10.0m – 37.0m:
  Stable/unstable/neutral atmosphere
  (Together with sonic anemometer data:
  Monin-Obukhov length scale)
Analysis of 2 years met mast data (met mast 1&3)

- Main wind direction at 71.6 m: SW

- Most frequent wind speed at 71.6 m: 7 m/s

- Maximum turbulence intensity at 80 m: NE
Campaign setup

- Additional measurement equipment aligned in the main wind direction (210°)
  + 1x Windcube 100s
  + 3x Windcube v1
  + 1x Windcube v2
  + 1x Zephyr DM
  + 1x SUMO
Scan patterns WLS100S

- Rotor diameter (D): 80 m
- Distance: 961 m
- Area of interest: 2D x 10D

<table>
<thead>
<tr>
<th>Type</th>
<th>Azimuth</th>
<th>Elevation</th>
<th>Speed</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>PPI</td>
<td>180°-240°</td>
<td>2.4°</td>
<td>6°/sec</td>
<td>10 sec</td>
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<td>PPI</td>
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<td>6°/sec</td>
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<td>PPI</td>
<td>180°-240°</td>
<td>7.2°</td>
<td>6°/sec</td>
<td>10 sec</td>
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<tr>
<td>RHI</td>
<td>210°</td>
<td>0°-63°</td>
<td>6°/sec</td>
<td>10.5 sec</td>
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<tr>
<td>RHI</td>
<td>210°</td>
<td>63°-0°</td>
<td>6°/sec</td>
<td>10.5 sec</td>
</tr>
</tbody>
</table>

Total duration: 51 sec
Scan patterns WLS100S
**First picture**

- 60° PPI at 3° elevation with a scan speed of 6°/sec
- 1st row wakes of 3 Nordex research turbines
- 2nd row wakes of prototypes
Outlook

- Planed duration of the campaign
  - November 2013 – April 2014

- Research aims
  - Test of WLS100S performance for wake measurements
  - Tests of different scan patterns for wake studies
  - Investigations of wake characteristics
    - Extension and persistency for different weather conditions
    - Meandering
  - Model validation studies