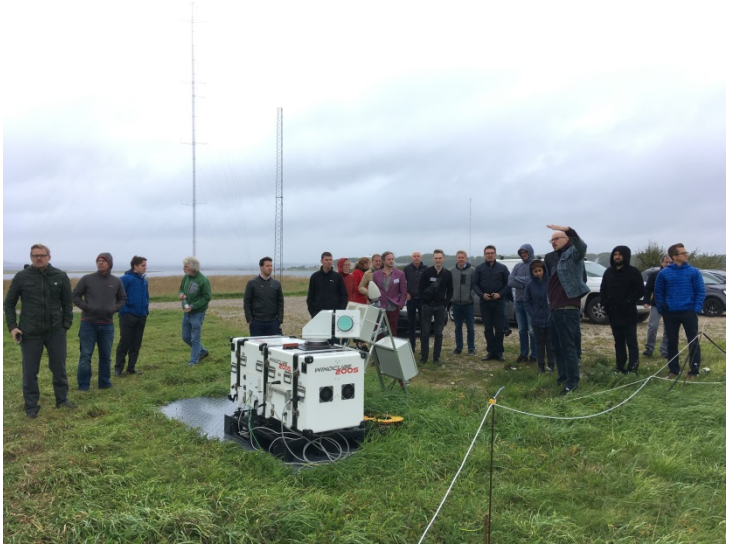
RECAST Workshop: Scanning lidars for AEP

Minutes – Rozenn 10-10-2018

The "RECAST workshop – Scanning lidars for AEPs" took place at DTU Risø campus on the 2nd of October. The purpose of the workshop was to identify and discuss the main barriers to using scanning lidars/Windscanners for wind resource and site assessment. 30 participants took part in the discussions with various perspectives: wind farm developers, wind turbine OEMs, independent advisors, lidar OEMs, and academics.



During the lunch break, all the participants went to see the long range Windscanners deployed on DTU Risø campus. This was followed by a of online demo of measurements from Alaiz, Spain (NEWA measurement campaign)

WindScanners is the combination of 2 or 3 scanning lidars through a master computer using the DTU WindScanner software enabling to make the lidars steer their beams and measure in a synchronous manner. This can provide 2D or 3D measurements of the wind vector at various locations around a given site. The difference with profiler lidar or single scanning lidar is that the homogeneous wind field assumption is not required thanks to the multiple beams measuring simultaneously at the same location. This enables more accurate measurements in complex terrain.

Measurements at multiple locations within a site considered to build a wind farm offer the possibility to reduce the uncertainty of wind map generated by microscale flow modelling. Wind farm projects presented with a more accurate and more certain AEP estimate are more attractive to investors, and contribute to lower the cost of wind energy. What is needed to get there is to get WindScanner measurements accepted by all the stakeholders with the same level of confidence as met mast data today.

The RECAST project is a research project aiming at developing a holistic methodology to use WindScanner for wind resource and site assessment. The DTU WindScanner software will be upgraded in order to be more user-friendly so that the configuration and monitoring can be handled by non-experts in the same

way as wind lidar profilers today. In addition to this, several tools will be developed to make the use of Windscanners as practical as possible:

1. WAsP will be upgraded in order to accommodate multiple point measurements;
2. A software will be developed to help designing the measurement campaign layout. E.g decide where the WindScanners – hardware- should be placed in order to measure at chosen positions and accounting for all constraints such as topography, obstacle to the lidars line of sight and access to power.
3. In order to compensate for the high cost of a WindScanner campaign, a software will be designed to estimate how long the campaign should last as a minimum in order to capture the main characteristics of the wind climate at this site – thus bringing the measurement duration down from 12 months to 3 to 6 months.

The purpose of this workshop was to understand and align with the stakeholder needs. Acceptance of a new resource assessment method and especially of a new type of measurement is a key parameter to the success of the project. Contrary to the offshore wind energy community which is relatively well identified – which helped drafting the roadmap for floating lidars, the "onshore/complex terrain community" is very broad. It is important to remember that this topic also concerns microscale flow modelling. It is necessary to consider the measurements and the models together. Such multi point measurements could contribute to assessing the uncertainty of CFD modelling and move towards consensus on this matter. Priority should be given to convincing the site assessment community rather than approaching the investors directly. Acceptance requires evidence, guidelines (road map and/or best practice). We must also recognise that new technology brings new challenges as well as new opportunities. Justifying the cost of a WindScanner measurement campaign remains a major challenge. A business case should be worked out in order to show the gain brought by multi-point measurements and lower micro flow modelling uncertainty against the cost of the campaign, also for the common case where there are no measurements at all.

The workshop was organised around several presentations and group discussions.

Presentations:

The slides of the presentations are available on the RECAST project website:

- Presentation of the RECAST project by Rozenn Wagner, DTU Wind Energy
- Presentation of Dublin Bay experiment by Peter Stuart, RES
- Many years of experience and lessons learned using WindScanners by Nikola Vasiljevic, DTU Wind Energy
- Results of the survey about the gaps for using Lidars for AEP by Andreas Bechmann, DTU Wind Energy
- Technology Road map – the floating lidar example by Eloise Burnett, CarbonTrust

- Demo of real time, long-range WindScanner measurements from Alaiz, Pedro Alvim De Azevedo Santos, DTU Wind Energy

Discussions:

The survey pointed out to three main barriers to using WindScanners for AEP estimates:

- cost
- complexity
- acceptance/bankability

Those barriers as well as main benefits expected from using WindScanner for resource and site assessment and wanted changes were discussed in groups. A summary of the discussions outcomes is given below.

1. Benefits of using scanning lidar for site assessment:

Scanning lidars can (from bigger benefit to smaller benefit)

- Provide better spatial coverage (horizontal and vertical) leading to better flow model and lower uncertainty
- Make measurement possible in area with no access
- Provide measurements of complex flow
- Require less permits required for deployment than met mast and accelerate deployment time
- Provide measurement in icing conditions

2. What could reduce the cost of scanning lidar campaign?

- Better lidar hardware: lower weight, lower power consumption, more reliable, interchangeable components
- Better lidar software: simpler, more reliable
- Easier data handling: standard data format, data analysis tools, industry consensus
- Easier operation: Easier/automatic alignment, best practice
- Short measurement campaign
- Economy of scales
- Provided by external measurement provider

3. What could reduce the complexity of scanning lidar campaign?

- Evidence base, experience, Best practice, standards
- Define clear and simple objectives for the campaign (well defined use cases)
- Easier data handling
- Easier operation (e.g turn on key solutions), less dependence on OEM

4. Acceptance and bankability

From higher impact to lower impact:

- Stakeholder acceptance
- Stakeholders/investors involvement
- workshops
- Reference cases, many experiences
- Standards
- Good data quality, proven uncertainty, evidence the measurements are correct

5. What would you like to change?

From easier changer to more difficult changes:

- Turn key data
- Turn key system, no need for experts
- Probe volume
- Validation
- Proof it works consistently
- Robust diagnostic check
- Use case specific
- Simpler procurement
- Need to measure at least as many things as a mast with similar uncertainty
- 3D printed (low cost off the shelf, open source laser)
- acceptance
- everything

The outcome for those discussions will be used to refine the RECAST project scope and steer the developments of the various tools to answer the identified needs. Of course all the gaps cannot be solved within one project, but RECAST aims at closing the most urgent ones.

- An easy user interface will be created for the WindScanner software primarily for the resource and site assessment application (e.g. automatic beam trajectory generator to measure at predefined position, real time data quality control);
- Minimising the duration of the measurement campaign will be addressed through an analysis of the uncertainty of Long Term Correction (LTC) methods to measurements time series shorter than 12 months and the development of a software to estimate how long one should measure at a given site.
- A full scale demonstration campaign will be executed in the RECAST project. Dual Doppler measurements will be carried out and used as primary basis for resource and site assessment for one of RES wind farm project.
- A “Decision tool” will be developed to compare the uncertainty and costs of various measurement campaign designs (e.g. 12 months of measurements with one met mast vs 4 months of measurements with multipoint measurements using a Windscanner system).

Link to IEA Wind Task 32 on lidar for wind energy will be established. The IEA Wind Task 37, new IEA Task on data digitalisation and the FAIR data project https://www.ieawindtask32.org/workshop-12/ could also be relevant regarding standardisation of lidar data.