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Implementing Offshore Remote Wind Sensing Technologies Including Protocols for Evaluation, Selection, and Validation (Extended Abstract)

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1. Introduction

The use of LIDAR in onshore wind resource assessment is regarded as an acceptable technology, with a solid body of results, e.g., [1,2,3]. Such systems detect wind speed and direction based on the time delay of the laser beam reflected by airborne aerosols. The use of offshore LIDAR, does not have a similar body of work. Investigations by Grand Valley State University are underway to establish this technology as an acceptable tool for wind resource assessment. This Michigan Alternative and Renewable Energy Center (MAREC) project will demonstrate the use of LIDAR-type sensors in an offshore environment.

MAREC is developing a protocol that can be utilized for the validation of data from a buoy-mounted lidar to include parameters that can impact the quality of received data. The protocol will detail the practical issues and solutions for making offshore wind resource assessments at several sites on Lake Michigan.

2. Current Solutions

The current solutions to these issues are summarized below:

- Floating met mast – standard met mast with 60m and 90m options, based on a 35m spar buoy, a total of up to 125m. Designed for 50m plus depths. Anchor size not known
- Spar buoy and first generation LIDAR – LIDAR and standard met sensors on a spar buoy of up to 30m. Designed to be deployed in 18m depths and deeper. Anchor size – 40 tons and higher
- NOMAD buoy and Laser Wind Sensor – LWS, standard met sensors and specialist sensors – waves, currents, bat and bird etc. Designed for 15m depths and deeper. 6 ton anchor.

3. Selection Criteria

- Data accuracy
- Providers track record
- Deployment depth
- Reliability
- Ease of deployment
- Ease of redeployment

4. Validation Protocol

- LIDAR manufacturer's certification
- LIDAR onshore against certified mast
- LIDAR offshore in close proximity to mast
- LIDAR at final deployment site

5. Implementation Issues

- Lack of 100m onshore masts
- Lack of 100m onshore masts in close proximity to lake
- Lack of 100m offshore masts
- Mooring approvals
- Deployment assets

6. Conclusions

The use of the WindSentinel provides a more cost-effective method than the installation of offshore meteorological towers using traditional anemometers. In addition, it provides mobility to collect data at various locations as scientists and engineers evaluate future offshore wind farm locations on the Great Lakes. A live-study commenced on October 7, 2011.

7. References

[1] Zuev, V.E., 1982: Laser beams in the atmosphere. Consultants Bureau, N.Y. A. Div of Plenum Publ. Corpor., 504.
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[3] Weitkamp, C. (Ed.) 2005. Lidar: Range resolved observation of the atmosphere, Berlin: Springer