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EU-NORSEWIND
Investigation of flow distortion effects on offshore instrumentation
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Abstracts

Data is a key component for all offshore wind projects. However, there remains significant challenges ahead, not least of which is the availability of good quality data to facilitate better project planning and accurate yield prediction. To address this the EU-NORSEWInD project was established in order to create a wind atlas of the North, Baltic and Irish seas by mounting instrumentation on offshore installations to assess the local wind conditions.

Because all offshore installations are large structures it was deemed necessary to assess the interference effect of the structures on the wind data acquired.

Methods

To assess the effects of the platforms on the RS measurements the flow fields over each platform have been simulated by Computational Fluid Dynamics (CFD). CFD allows the flow field around each platform to be calculated and the velocity vector at any point in the flow field to be determined.

Results

Figure 4 shows the distortion of the flow field by the representation of three dimensional streamlines. Figure 5 shows velocity vectors which exhibit recirculation zones where the flow may be found in the opposite direction to the free stream.

Conclusions

It has been shown that, through a combination of CFD and experimental techniques the flow field over an offshore structure can be simulated and the interference on the calculated velocity vector from an RS anemometer determined.

References

3. "Probe Catalogue", Dantec Dynamics

Figure 1: LIDAR wind measurement [1]

Figure 2: Low speed wind tunnel model.

Figure 3; Probe and traverse system

Figure 4; Streamlines over an offshore platform from CFD.

Figure 5: velocity vectors which exhibit recirculation zones

Figure 6; Comparison between CFD and experimental data

A comparison between the wind tunnel data, shown twice to check repeatability, and simulation data may be seen in figure 6. The location of the traverse is shown by the blue line in figure 2

Also, due to the directional ambiguity present in the data analysis it is necessary for the device to know, a priori, the general wind direction. If the device is mounted in a region of reverse flow there is a possibility of a 180° error in the wind direction measurement.

Notation

4 sequential shooting lines of sight on a 6 ~30° ½ angle cone

4 radial wind speeds, \( s_R, s_S, s_G \) & \( s_W \)

Figure 6 shows that the CFD and experimental data agree reasonably well. From the CFD data the velocity at the proposed full scale measurement heights are calculated using the same algorithm as the LIDARs and the effect of the distortion on the measured data assessed.

Objectives

The University of Strathclyde in Glasgow was tasked with assessing the interference effect of the installation platforms on the data measured by the anemometers.

There are several types of anemometers employed on the platforms: LiDAR (LEOPSPHERE and ZephIR), SODAR (AQS AQ500) and the more conventional cup and vane anemometers. There are several types of anemometers used to measure wind speed and direction. The anemometer derives the wind vector by the anemometers

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