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# FuHai Offshore Wind Characteristics during an Extreme class II Typhoon Strike and its Implications on Wind Turbine Selections 路徑 II 颱風在福海離岸的風力特徵與風機選擇

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### 摘要

杜鵑颱風為台灣近年來所遭遇最猛烈的強烈颱風之一，中央氣象局資料顯示颱風近中心最大風速達 51 (m/s) 且侵台路線歸類為 II。為了呈現颱風於風場預定地之風力特徵，本研究藉由福海風力發電股份有限公司設置於彰濱外海的福海氣象塔於警報時間的實測資料進行分析討論，再利用 WRF 模式進行風速資料的預測，以提供相關人員進行風機保護資訊。實際資料明顯看出颱風中心有經過氣象塔附近，風向在颱風影響前期為明顯的北風( $\approx 0^\circ$ )，後期則為明顯南南西風( $\approx 200^\circ$ )，而風速有兩個明顯的高峰與一個低谷。此外，對比於實測資料，發現 WRF 模擬也有相當近似之趨勢，確立模式的預報性。基於風機設計與風場規劃，國際電工技術委員會提出了風機國際設計規範 IEC 61400-1，並以極限風速與垂直風切定義極限風速模型(EWM)，本研究亦利用杜鵑颱風的實測資料、極端風速模型與紊流強度，建議適合福海風場適用的風機種類。

關鍵詞：杜鵑颱風，福海氣象塔，WRF 模式，IEC 61400-1，極限風速模型，紊流強度

### Abstract

Du-Juan typhoon was one of the severest typhoons that stroke Taiwan in recent years. According to the reports of Central Weather Bureau (CWB), the maximum wind speed at near-centered reached up to 51 (m/s) and the route of the Du-Juan typhoon is classified as type II. In order to illustrate the wind characteristics of typhoon at the scheduled wind farm locations, we analyzed the wind data recorded by the Fuhai offshore meteorological mast (constructed by Taiwan Generations Corporation) during the typhoon strike period and applied the WRF model to predict the wind speed, so as to provide the information of wind turbine protection to engineers. From the measured data, it is obvious that the center of Du-Juan passed through nearby the mast. The wind direction was initially north ( $\approx 0^\circ$ ) and then changed to south-south-west ( $\approx 200^\circ$ ). The wind speed recorded in the period had two high-speed peaks and in-between one low peak, which was the evidence of the nearby passing of the typhoon center. Comparing to the measured data, the WRF simulation obtained the similar results. To regulate the wind turbine and wind farm designs, the International Electrotechnical Commission proposed the design standard of wind turbines: IEC 61400-1, wherein the extreme wind speed model (EWM) is defined by using the ultimate wind speed and vertical wind shear. In this study, the type of the wind turbine to adopt for the Fuhai offshore wind farm was suggested according to the measured data, EWM of the Du-Juan typhoon and the turbulence intensity.

**Keywords:** Du-Juan typhoon, Fuhai met mast, WRF model, IEC 61400-1, Extreme wind speed model, Turbulence intensity