

AWEA Wind Resource & Project Energy Assessment Workshop

Addressing NRG #40 Dry Friction Whip

Rob Istchenko, P.Eng.

GENIVAR Consultants LP

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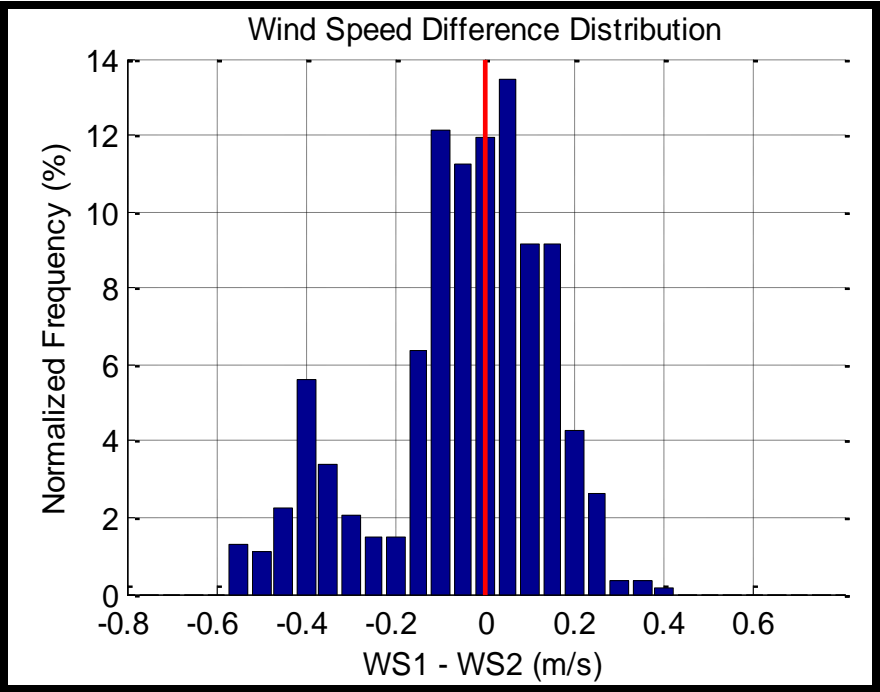
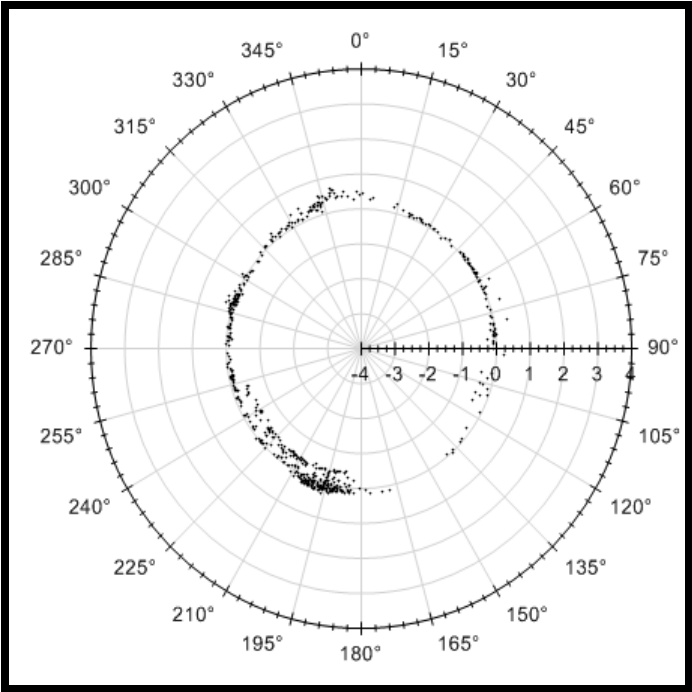


Understanding Dry Friction Whip

- With NRG #40 sensor DFW is manifested as an intermittent bimodal output
- Modes consist of calibrated “true” mode and slowed secondary mode
- Magnitude of slowdown -0.2 m/s to -0.6 m/s
- Preferentially occurs in the 4 m/s to 10 m/s wind speed range for decreasing wind speeds
- Detection largely contingent on redundant sensors or wind tunnel testing
- Intensity and frequency vary both temporally and from sensor to sensor
- Distinct from other causes of discrepancies between sensor readings:
 - Response to wind conditions (inflow, turbulence)
 - Degradation - although DFW may be a contributor
 - Calibration procedure



Example



1 month of data, WS > 4m/s, Temp > 5°C



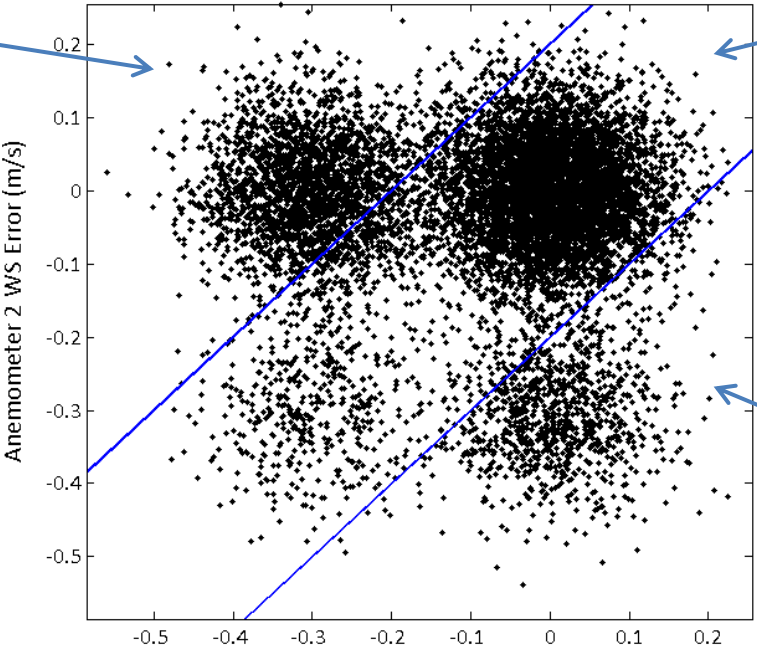
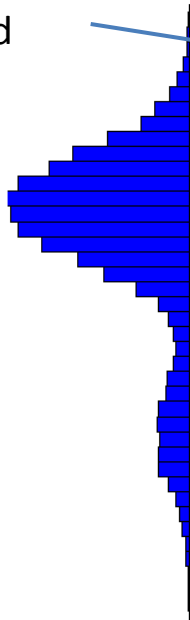
Addressing DFW in WRA

- Create a valid unified wind speed for a given height based on a comparison of the redundant measurements
 - If $\Delta WS > 0.2$ m/s, then $WS = \text{Max}(WS_1, WS_2)$
 - If $\Delta WS \leq 0.2$ m/s, then $WS = \text{Avg}(WS_1, WS_2)$
- For sites with frequent detectable DFW, the frequency of selecting the maximum will be higher - takes into consideration site-specific frequency of detectable DFW
- When both sensors are dragging, portion of DFW will go undetected
- Reflect frequency of identified DFW in the assignment of uncertainty
- Post calibration may serve to help identify affected sensors, however, poor consistency/reproducibility of DFW restricts benefit
- Removal of DFW-induced bias is a worthwhile objective
- Difficult to isolate the impact of DFW in a generic correction – evaluation and discussion regarding other sources of bias warranted
- Sensitivity to potential pre-construction over-prediction justifies scrutiny of a generic positive correction



Bimodal Distribution Example

WS_2 selected



$Avg(WS_1, WS_2)$

WS_1 selected

