Responses to the comment on *"DWM model calibration using nacelle mounted lidar systems" by Inga Reinwardt et al., manuscript number: wes-2019-89*

Iteration: correction

Comments to the Author:

Dear authors,
Both referees are satisfied with your revised manuscript and your answers to their questions.
Referee 2 has a last request of modification (see report).
Could you please proceed with this modification and upload again the manuscript?
Best regards
Sandrine Aubrun

The authors write in lines 61-64 :"Furthermore, the collected LiDAR measurements are used to recalibrate the DWM model, which enables a more precise modelling of the wake degradation. As a consequence, the calculation of loads and energy yield of the wind farm can be."

The impact of the recalibration on loads and power is of great importance which would have been valuable to in the same paper as the recalibration. However, it´s mentioned to be ongoing work to be published soon. Maybe in the present paper the authors could write a few lines about what the impact on power and loads qualitatively will be.
A key issue is that in the DWM-Egmond model the calibration of the coupling of the eddy viscosity to ambient turbulence was carried out on basis of turbine power measurements at different spacings and turbulence intensities whereas now it is on basis of wake flow measurements. Apparently, the two calibration methods give different results.

Response: An example of DWM-Model load and power simulations for different inflow conditions are given in Figures 1 to 9. Simulations with a wind direction of -30° to 30° in 2° steps were carried out, whereby a wind direction of 0° means full wake. The simulations are valid for an ambient wind speed of 8 m/s and a distance between the upstream and downstream turbine of 3.61D (D=117 m). Results of the normalized damage equivalent load (DEL) of the flapwise moment for an ambient turbulence intensity of 4 %, 8 % and 12 % are given in Figures 1 to 3. The corresponding tower bottom fore-aft moment and the power are shown in Figures 4 to 9. The recalibration significantly affects the lower turbulence intensity simulations, especially at partial wake conditions. The influence of the recalibration on the power output is considerably lower than the influence in the flapwise and tower fore-aft loads. This could also be seen in the mean DEL respectively power over all simulated wind directions, which are summarized in Tables 1 to 3. The mean value is taken with respect to the woehler coefficient, which are given in the Figure captions. The difference between the original DWM-Keck model and the recalibrated DWM-Keck-c model regarding loads is about 13 % for a turbulence intensity of 4 %, whereas the difference in power is less than 1 %. Even the power difference between the DWM-Egmond model and the DWM-Keck-c model is only 7 %, which could explain the difference in the calibration results presented here and the calibration of the DWM-Egmond model.

To give a brief overview of the influence of the recalibration into turbine power and loads following phrase has been added in the conclusion of the paper: *"Simulations have shown that the recalibration of the DWM-Keck model can lead up to 13 % lower loads in the turbulent depending components in cases with small turbine distances and low turbulence intensities, whereas for higher turbulence intensities (>12 %) the difference between the original DWM-Keck model and the recalibrated model is less than 5 %. The overall influence of the recalibration on the power output is low (<2 % for all turbulence intensities)."*

Table 1: Accumulated normalized DELs and power over all inflow conditions for an ambient wind speed of 8 m/s and for an ambient turbulence intensity of 4 %

Model	Flapwise DEL [-]	Tower bottom DEL [-]	Power [-]
DWM-Keck	2.626	2.303	0.764
DWM-Egmond	2.851	2.583	0.726
DWM-Keck-c	2.292	2.015	0.775

Table 2: Accumulated normalized DELs and power over all inflow conditions for an ambient wind speed of 8m/s and for an ambient turbulence intensity of 8 %

Model	Flapwise DEL [-]	Tower bottom DEL [-]	Power [-]
DWM-Keck	1.973	2.024	0.772
DWM-Egmond	2.175	2.305	0.735
DWM-Keck-c	1.816	1.840	0.784

Table 3: Accumulated normalized DELs and power over all inflow conditions for an ambient wind speed of 8 m/s and for an ambient turbulence intensity of 12 %

Model	Flapwise DEL [-]	Tower bottom DEL [-]	Power [-]
DWM-Keck	1.617	1.673	0.786
DWM-Egmond	1.816	1.951	0.746
DWM-Keck-c	1.547	1.586	0.795

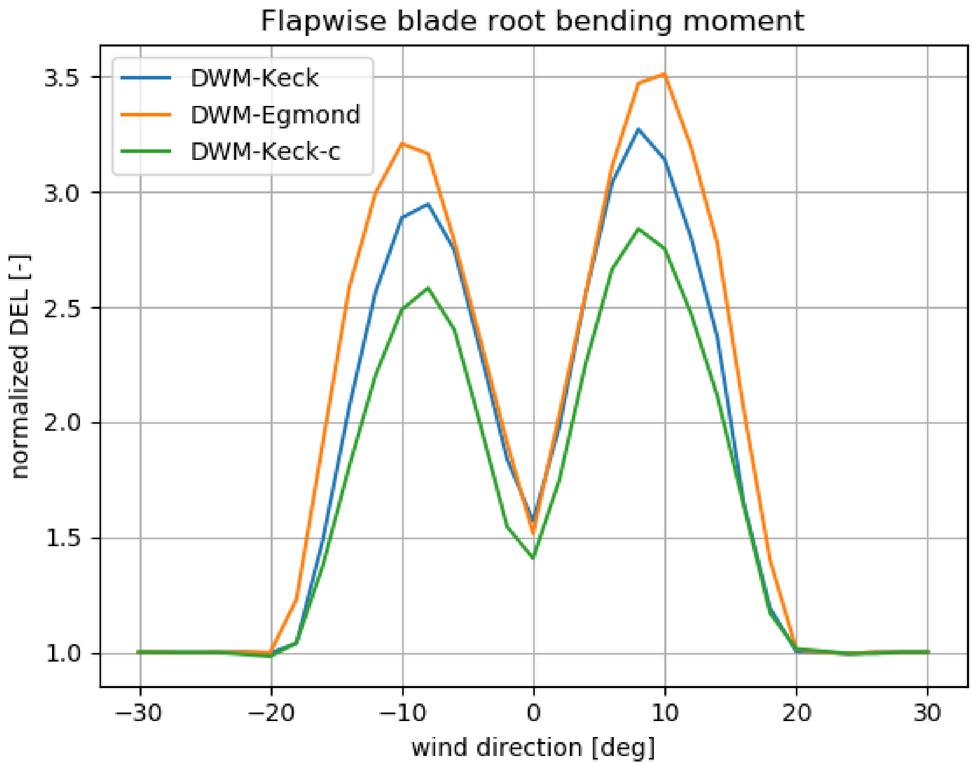

Figure 1: Normalized flapwise blade root DEL over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 4% and a downstream distance of 3.61D. The DELs have been calculated with a wöhler coefficient of 10.

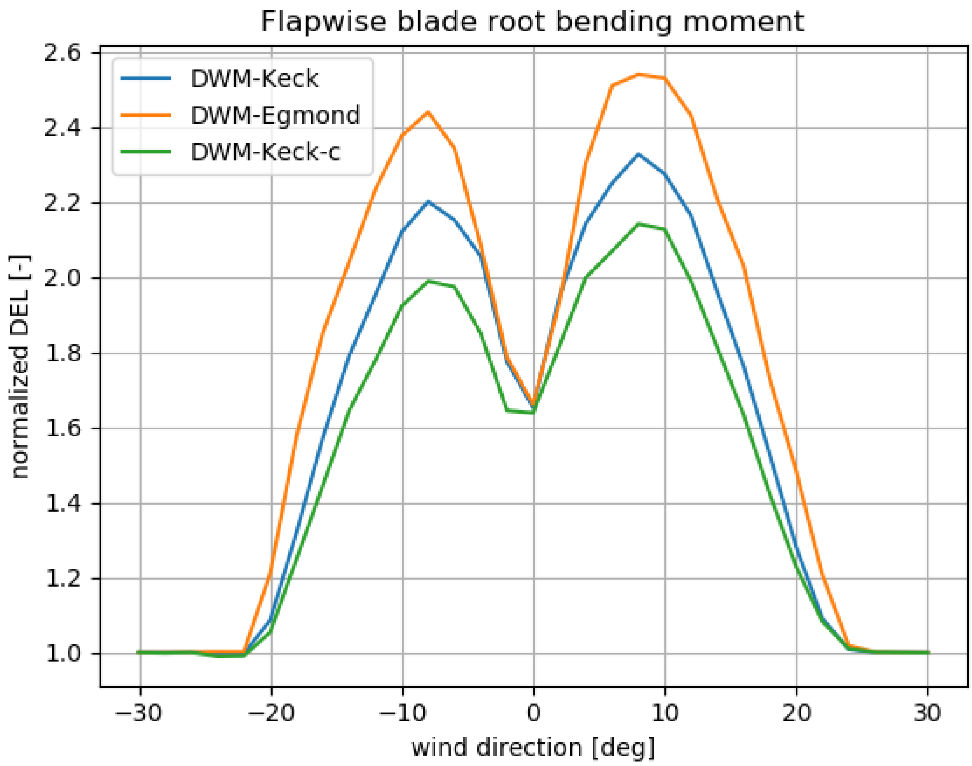

Figure 2: Normalized flapwise blade root DEL over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 8 % and a downstream distance of 3.61D. The DELs have been calculated with a wöhler coefficient of 10.

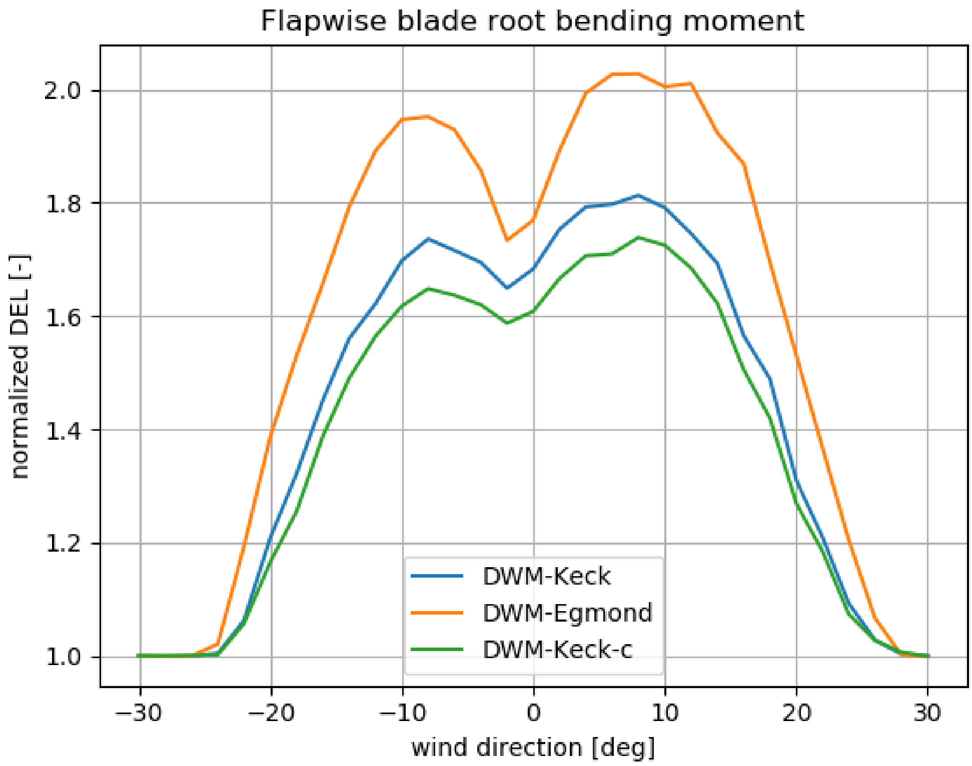

Figure 3: Normalized flapwise blade root DEL over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 12 % and a downstream distance of 3.61D. The DELs have been calculated with a wöhler coefficient of 10.

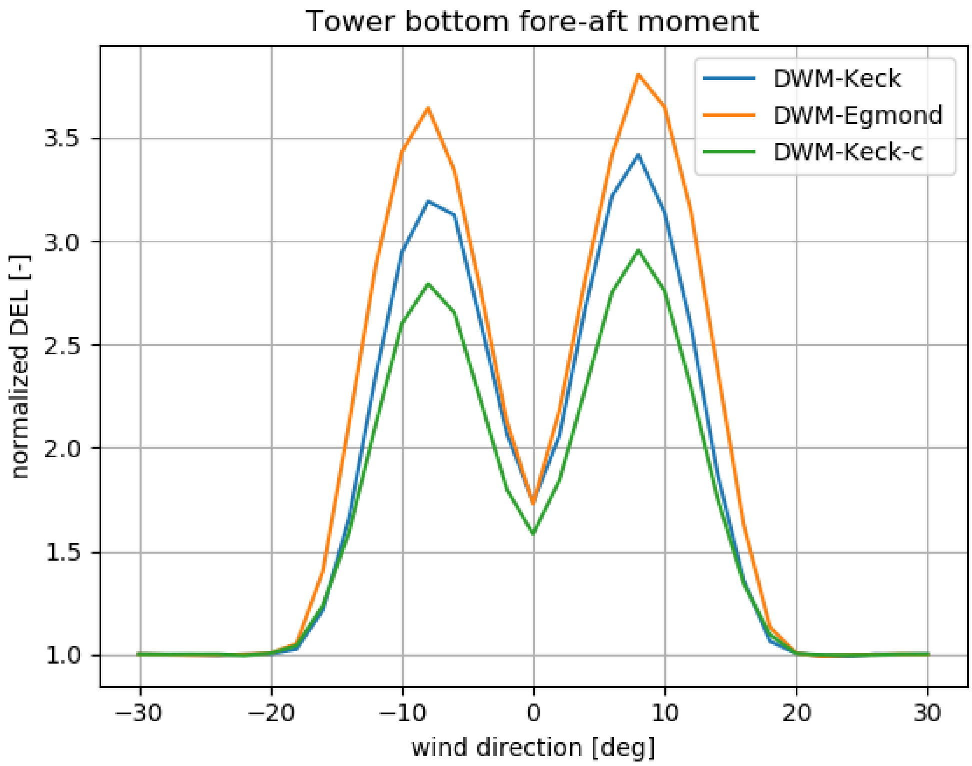

Figure 4: Normalized tower bottom fore-aft DEL over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 4 % and a downstream distance of 3.61D. The DELs have been calculated with a wöhler coefficient of 4.

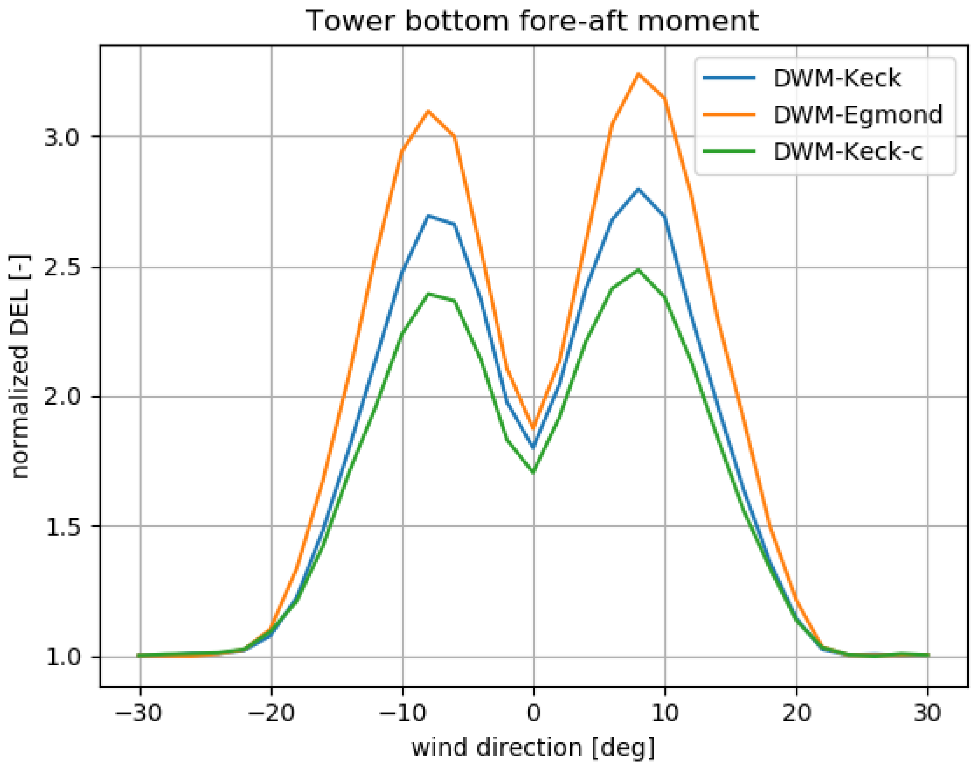

Figure 5: Normalized tower bottom fore-aft DEL over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 8 % and a downstream distance of 3.61D. The DELs have been calculated with a wöhler coefficient of 4.

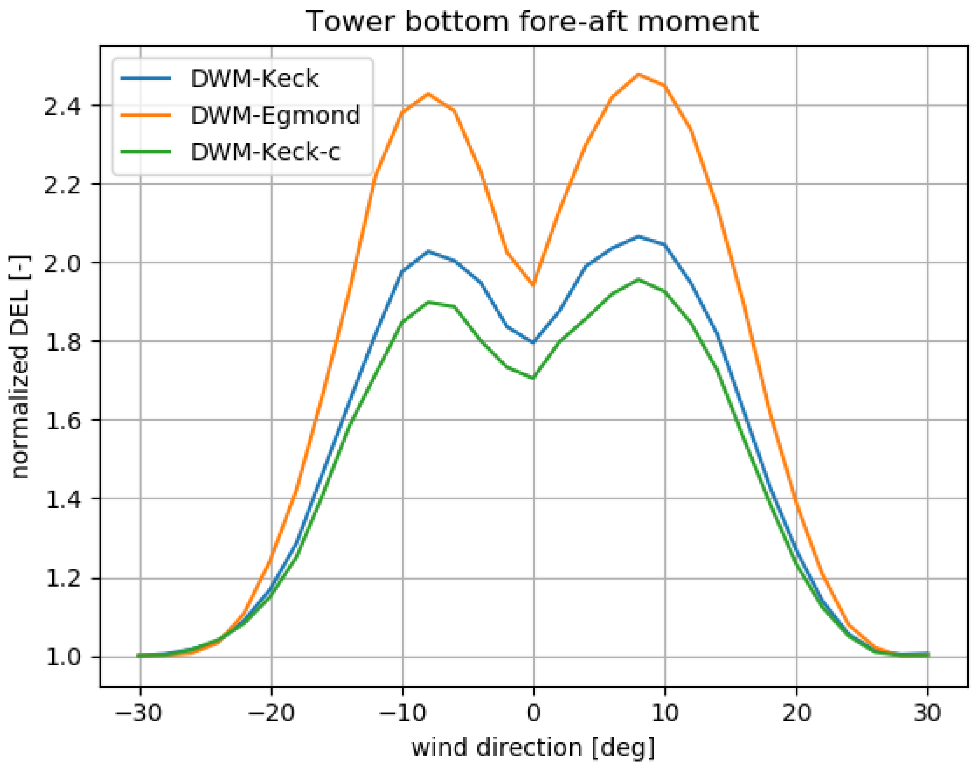

Figure 6: Normalized tower bottom fore-aft DEL over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 12 % and a downstream distance of 3.61D. The DELs have been calculated with a wöhler coefficient of 4.

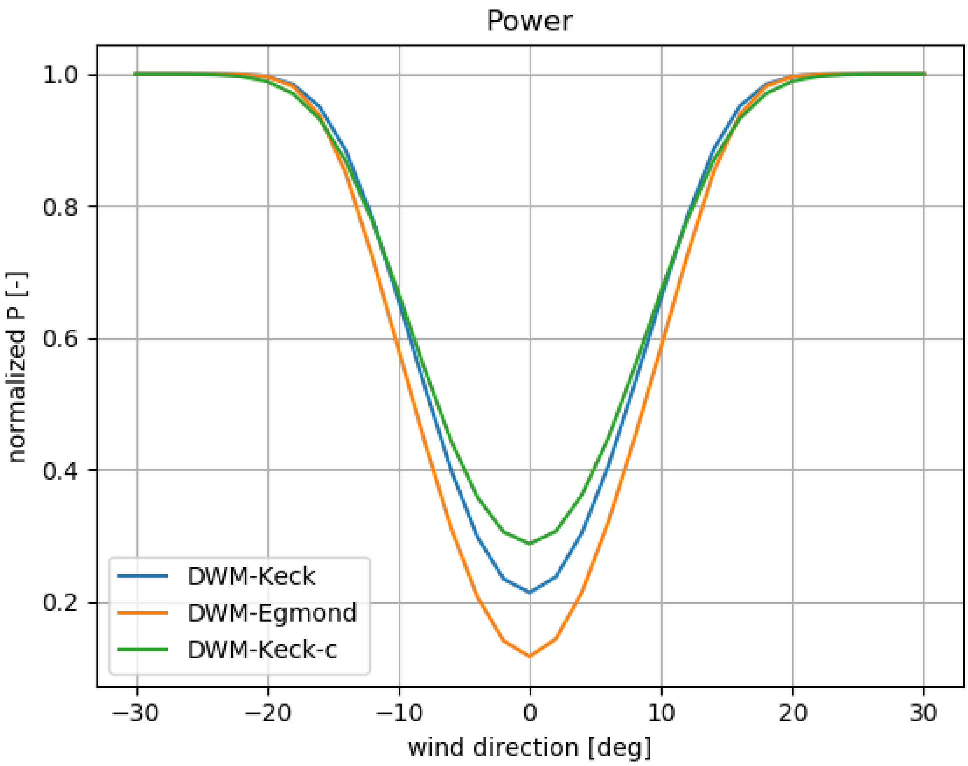

Figure 7: Normalized power over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 4 % and a downstream distance of 3.61D.

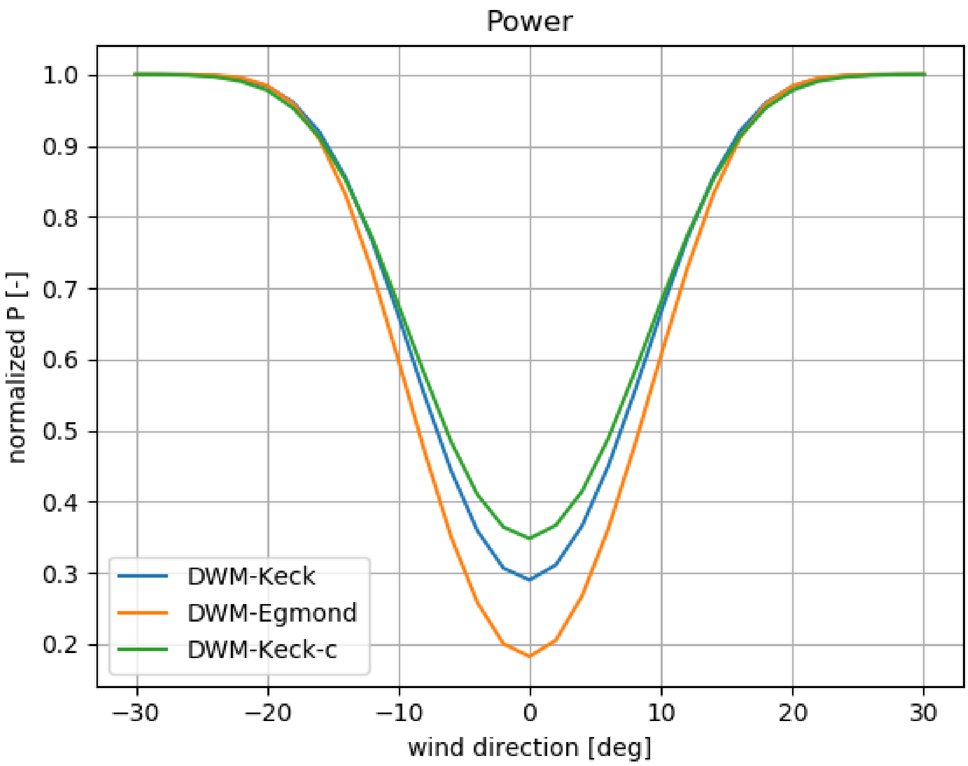

Figure 8: Normalized power over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 8 % and a downstream distance of 3.61D.

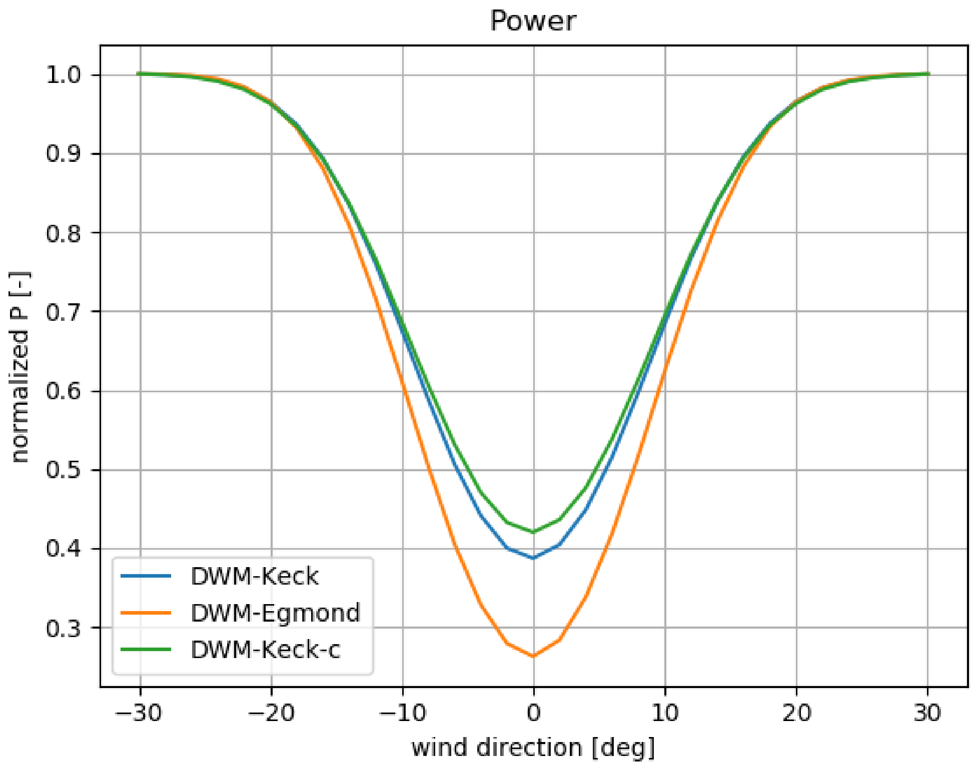

Figure 9: Normalized power over different wind directions for an ambient wind speed of 8 m/s, an ambient turbulence intensity of 12 % and a downstream distance of 3.61D.