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Interactive comment on "A new roughness parameterization accounting for wind-wave (mis)alignment" *by* Sara Porchetta et al.

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Dear authors,

This paper is very interesting, just there are few things which I have not understood. See my comments below.

It is a nice paper overall, very interesting topic. Well done so.

Section1:

- "The wind-wave interaction is located within the Marine Atmospheric Boundary Layer (MABL), which is the lowest part of the atmosphere directly influenced by the sea surface.": could you please clarify/differentiate between the influence of the

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Discussion paper

seastate (wave spectrum) and the influence of the surface water temperature ? I could imagine that the waves only affect the very lower part of the MABL, see slide 20 of http://www.pcwg.org/proceedings/2014-10-06/06-Turbulence-Intensity-measmnts-offshore-4-PC-verification-wind-res-assmt-R-RiveraLamatA-D-Pollack-Dong.pptx.

- "Contrary to the atmospheric boundary layer (ABL) over land, the effect of the diurnal cycle of the atmospheric stability is negligible due to the high heat capacity of the ocean": could you clarify what you mean by "the effect" ? The influence of stability is still present on the wind profile, though the stability itself varies less (see for instance Figure 4 of http://lr.home.tudelft.nl/fileadmin/Faculteit/LR/Organisatie/Afdelingen_en_Leerstoelen/Afdeling_AEWE/Wind_Energy/Rese
_torque_2010.pdf).

- "In addition, higher wind speeds with lower turbulence intensities": lowe than... on-shore ?

Section2:

- "The viscous shear stress is assumed to be negligible because of the large scales involved": it is negligible when considering the Reynolds number, right ?

Section3:

- General comment: FINO1 and ASIT are two very different locations with two very different bathymetry and wave climates. Furthermore, the wind and wave datasets are very different too. Could you, in this paper, present the results for both datasets separately ?

- have you considered shoaling and wave height limitation (bottom friction) at the ASIT ? The wave height is depth-limited, and therefore cant grow above a certain threshold at ASIT.

- can you explain more clearly what data have been used, for what directions and in what periods, for what parameters ? maybe in a table... ?

- There are high-quality LiDAR data available at the ASIT, did you know ? https://www.masscec.com/masscec-metocean-data-initiative

- "The histogram of the angle between the wind and wave direction is shown in Fig. 4". Please make clear that you are using the Peak Wave Direction (see caption of Figure 4). As I understand it, misalignement between WD and Dp does not necessarily mean that the largest waves in the spectrum are swell waves, but instead that swell waves have the most pronounced peak in the spectrum, while the waves can still be wind-driven. In the North Sea especially, there can be 1m swell from North and the rest in Wind-Sea from SW, see https://www.researchgate.net/publication/261834850_Wind_Sea_and_Swell_Waves_in_the_Nordic_Seas.

When you write misalignement, it therefore means most likely "dual seastate", with waves coming from two directions.

- "This behavior is seen for both FINO1 and ASIT measurements.": maybe provide a plot for each ASIT and FINO1 datasets, as the swell conditions are different at both sites. Have you considered wave shoaling at the ASIT ? You can check the offshore waveconditions using https://www.ndbc.noaa.gov/station_page.php?station=44097 and http://cdip.ucsd.edu/?nav=recent&xitem=sfile&stn=154&stream=p1.

- "A first step required is the calculation of the friction velocity" have you tried to correlate u_star with the Turbulence Intensity (std/mean) to check the plausibility of the u_star values ? These should correlate well, see Figure 3 of https://onlinelibrary.wiley.com/doi/full/10.1002/we.1863.

- Using the LiDAR measurement (ASIT) and the mast (FINO1), you could also make a plausibility check of the MOL calculation as in Figure 6 of http://orbit.dtu.dk/files/7872609/2008_01_paper.pdf.

Section4:

- How is cp calculated ? Is it constant for ASIT (shallow water) ? How is L calculated

for FINO1 ?

- Can you just show u* vs z0 and Charnock relationship, to see what the data look like in this dataset ?

- Figure 7: can you make the same plot for 2-3 wind speed ranges and also for 2.3 Hs ranges so we are sure that using non-dimensional analysis works across all speed and scale ranges ?

- General: it is a bit difficult to relate z_0/H_s and u_{star}/c_p to what really happens at the site (since the 4 parameters can vary). Maybe some time series plots for selected cases would help understand what happens.

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Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-726, 2018.