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

Anonymous Referee #2

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Since there are not so many research papers dedicated to the directional aspects of the sea surface roughness, the subject of the manuscript was interesting and promising. Unfortunately the handling of the subject was rather superficial.

The manuscript is a straightforward attempt to parameterise all kind of cases into a mean behaviour taking into account the wave age and difference in dominant wave and wind directions. The parameterisation might work as a practical solution to include all situations but I am not convinced that it will improve e.g. the estimates of the vertical wind profiles, given the observed different wind profile during swell. The benefit of the study is to stress the importance of the directional information, but that alone is not really a new result as it has been brought up in the literature cited in the manuscript. In this manuscript, though, the amount of data is considerable. Unfortunately the study in

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Discussion paper

its present form does not contribute much to our understanding of the complex interplay between the waves and atmosphere. It is regrettable, since the authors have good material to do a more detailed analysis of the momentum flux and the impact of the directional aspects.

Some specific comments:

1. There was not much analysis of the two datasets used in the study: the only criteria was that there was not shadowing of the mast structures on the atmospheric side. No consideration was given

- to the impact of the water depth to the wave field: changes in wave steepness, depth induced breaking, refraction etc, all contributing to the sea surface roughness. Especially the ASIT wave data is from shallow water, but the 30 m depth at FINO1 is not free from these additional factors either.

- to other reasons for the differences in wind and dominant wave directions than swell due to possible refraction or slanting fetch cases, especially at the location of ASIT.

- and most importantly, to the structure of the MABL during swell. The difference between the wind and dominant wave direction was mainly attributed to the swell cases/mixed seas with a dominant swell. There are several papers about the changes in the MABL when a swell is present, see for example the series of papers by Smedman et al. and Högström et al. and the references within. The validity of Monin-Obukhov scaling, and the existence of the logarithmic profile is questionable when there is a swell present. There is no discussion about the different characteristics caused by a swell in the manuscript, or if the presented analysis is suitable of handling the subject in the first place.

2. The Drennan et al. 2003 parameterisation is for pure wind-sea cases: the swell and mixed sea cases where carefully excluded. There is not really reason to expect that the parameterisation would be valid in all kind of situations. This is clear also from the

comparison paper by Drennan et al. 2005. The latter paper even recommended to use Smith (1980) parameterisation for swell cases. The results were not compared to the model calculations of Patton et al. 2015 which would have been closer to the way of handling the subject in this manuscript.

3. Smaller comments

P.4, Equations 5 and 6: why the full equation for phase speed was not used to cover the intermediate depths?

P. 5, Lines 24-25: Drennan et al. 2005 discussed how the swell direction affected the sea surface roughness, but they did not present a parameterisation that accounts for the swell and its direction.

P. 6, Section 3. Methods. There is no mention who runs FINO1 and ASIT.

P.7. Lines 11-12. The location of the wave buoy is not mentioned.

P.9, Line 13. What does wind-wave equilibrium mean? Same directions? There are some other loosely used terms in the manuscript as well, e.g. wave direction -> mean wave direction at the spectral peak.

P. 15 Fig. 8. The scatter is still large. There probably are other reasons as well, not just the wave age and difference in wind and wave directions.

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