

## ***Interactive comment on “Can wave coupling improve operational regional ocean forecasts for the North-West European Shelf?” by Huw W. Lewis et al.***

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We thank the reviewer for their constructive and considered review, and note the positive comments on the structure and quality of the submitted manuscript.

The reviewer summarizes that “I would be much more comfortable if some limitations (not all) pointed by the authors as future topics of investigations (part 5) were a little investigated when feasible”. This results from two substantive concerns:

1) “Looking at the results of the DA assimilation system doesn’t seem fair, even if it makes sense in the context of Copernicus. . .there is little to learn from this, apart from

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a demonstration that the current DA system is very efficient, but should be modified when adding different physics”

2) Some wave forcing terms are missing: a. Are Stokes velocities included in tracer advection? b. Vortex force, taking into account interactions between Stokes and Eulerian velocities (neglected in previous studies with NEMO).

Author Response to comment 1)

The authors consider it important that both free running and assimilative simulations are presented with and without wave coupling in this paper. This approach is explicitly supported by RC1 in his summary comments also. The impact of wave coupling is most clearly demonstrated by comparing the free runs with and without coupling. However, as RC2 notes, also assessing the performance of the assimilative runs with and without wave coupling does make sense and is considered to be highly relevant in the context of Copernicus evolution, and thereby in the context of the CMEMS Special Issue to which this manuscript was submitted. These simulations are also a necessary first step to being able to conduct the further tuning to the assimilation system with wave coupling discussed in the Conclusions. It is not clear to the authors how to modify the manuscript in light of this comment, given the premise that we consider both assimilative and non-assimilative results to be of interest and value to the community.

Author Response to comment 2)

The modifications to NEMO implemented to support this study were discussed in more depth by Lewis et al., 2019 (<https://www.geosci-model-dev-discuss.net/gmd-2018-245/>), including a link to the NEMO code branch developed, and now implemented within NEMO v4. Specifically, we have updated the manuscript to note that the Stokes drift is accounted for in the tracer advection equation (code TRA/traadv.F90) when NEMO flags In\_wave and In\_sdw are active. Line 17 of p6 has been amended to reflect this. As the reviewer supposes, the Vortex Force formulation has not been considered here, rather building from the implementation of surface wave effects in NEMO de-

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scribed by Breivik et al. (2015), and also by Staneva et al. (2017). Section 2.3 has been briefly expanded in the revised manuscript to make the absence of the vortex force representation more explicit when referencing Langmuir circulations. It may be of interest to note that further development to the NEMO wave coupling physics are proposed by the NEMO Wave Working Group (e.g. <http://forge.ipsl.jussieu.fr/nemo/ticket/2155>), but we considered it to be too soon to reference this explicitly in the current manuscript beyond the discussion from line 12 of page 17 in the Conclusions.

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