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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Sea waves impact on turbulent heat fluxes in the Barents Sea according to numerical modeling" *by* Stanislav Myslenkov et al.

**Anonymous Referee #2**

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The paper describes the impact of the ocean surface waves in the calculation of the heat fluxes over the Barents Sea. Notably it aims to investigate the impact over the long term especially during storm waves events and cold-air outbreaks. A specific methodology is design to identify those events over the period of interest, 1979-2017. The Authors analyzed first the storm activity in the region and showed the correlation between the numbers of cold-air outbreaks days and the increase of heat fluxes. Then they studied the impact of waves on those heat fluxes by doing a comparison between several fluxes' parametrization using the COARE algorithm. They compared their results against ship measurements obtained during the NABOS campaigns over different years. The showed that over the long term the impact of waves on heat fluxes appears



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Discussion paper

to be small in average (1-3%). However, the difference during one single event could be significant. They conclude on the fact that in a climatic aspect taking into account waves in the parametrization of heat fluxes could be neglected.

Overall, the paper is generally written to a good standard, is relevant and has scientific merit. The methodology is well explained and the numerical set of simulation and experiments is appropriate to answer the scientific questions. The Authors bring valuable content for the scientific community and for the understanding of the air-sea processes over the Barents Sea region. The Authors should emphasis in their conclusion that the results are especially true in this region, according to their study. It might vary depending on the region and/or atmospheric conditions during other extreme events. I am content that the paper should be published following minor revision detailed below.

Wave modeling:

-What are the waves boundaries conditions used for the wave simulation? And so, as a related question how good does your wave simulation performed against observations and then if you have a bias could it also be a source of error when comparing the output of COARE against observations?

COARE input:

-If I understood correctly the wind seen by the waves in the simulation is the same as the one input in COARE, could you confirm that? Because if not it might include some inconsistency between the wind and waves parameters.

Heat fluxes difference:

-I found it interesting that on a single case you could have such a significant difference in heat fluxes between parametrizations, over 700 W/m2 which is quite large compared to the maximum value. And especially between parametrization which include waves. However, I would have liked a bit more explanation about this and what is causing this difference in the parametrization in your case, i.e. particular wind regime or sea state. I





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think it would be worthy to explaine a bit further those differences since you mentioned them.

-Also, you recommend in the conclusion that it is better to use parametrization including wave parameters and I tend to be agreed with that. However, it is not clear for me according to your study because in one hand you showed quite small differences over the long-term average even during storm waves and CAO and on the other hand you showed large differences between parametrization over a case by case analysis. Can you be more precise on which parametrization we should use, or not use, especially for the Barents Sea region and/or during storm waves/CAO? Did you compare the parametrization against observations on a case by case analysis, for example the event showed on Fig 19?

Surface stress differences:

Did you look at the momentum fluxes differences between the parametrization in the long term and for CAO and storm waves? Since those are occurring during strong wind regime one could expect impacts on the roughness length and so the drag coefficient and surface stress. It might be worth mentioning it in the discussion or perspective since the stress is also an important factor in the air-sea processes and of COARE calculation.

Technical corrections:

Line 147 : “a development”

Line 315 : do you mean “ and their detailed analysis would require an additional research” ?

Line 354 : ‘ is significant and represents up to 16%’

Fig 9: it would be better to show that it is a discontinuous data, that the gap between observations can be easily seen on the figure.





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Line 411: “and difference between experiments are shown on”

Fig 10,11 : Do you mean “ sea ice represents more than half of the grid nodes” ?

Line 424: fix typo ‘within -3 $\sim$ 2’

Line 483:” Experiments T1 and O2 increase everywhere the magnitude of”

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