Geoscientific
Model Development
Discussions

Interactive comment on "A simplified atmospheric boundary layer model for an improved representation of air-sea interactions in eddying oceanic models: implementation and first evaluation in NEMO (4.0)" *by* Florian Lemarié et al.

Anonymous Referee #2

Received and published: 29 September 2020

First, I would like to commend the authors for tackling this much-needed task. When forced by prescribed atmospheric fields via bulk formula, ocean-ice only models can only modify the atmospheric forcing via the drag coefficient. In a fully coupled system, the atmosphere is, in turn, expected to respond the ocean SST and currents. There is therefore a strong need for intermediate models like the proposed ABL1d by allowing part of the near surface atmospheric field to vary as a function of ocean variables.

Second, while the authors provide a thorough description of their approach, it is often dense and not always easy to extract the main information. It is also lacking an

overview of what is the current practice in planetary boundary layer models and how the particular approach chosen for ABL1d stacks against them.

Major comment #1: While I appreciate the fact that this approach emphasize over water conditions, the paper would benefit from a brief overview of current PBL and parameterizations (Baklanov et al., BAMS, 2011, DOI:10.1175/2010BAMS2797.1) and why the authors decided to use their own approach. In particular, there are already existing standalone PBL models such as the one from the University of Washington. Important differences between the planetary boundary layer over land and ocean surfaces arise because the ocean thermodynamic and dynamic characteristics, especially its temperature and this should be contrasted with existing models. This would set the stage for section 2.3

Major comment #2: It is somewhat related to #1, but when stating that the turbulent mixing by the air-sea feedback is thought to be the main coupling mechanism and that this mechanism is expected to explain most of the eddy-scale wind-SST and wind-currents interactions, this needs to be further substantiated or be made clear that this is one of your assumptions.

Major comment #3: The series of validation experiments in sections 4 and 5 are not easy to ready and would benefit from a clearer introduction clearly stating which aspect of the ABL1d model is being tested and which limitations are emphasized. A thorough discussion of the choices in relaxation time scales and lack of advection are key elements to the validation discussion. Section 5.2 is the main achievement with an application of global NEMO, but what are we learning here besides the fact that it has impact on the circulation? For each of the applications/validations sections, the manuscript would benefit from an introductory statement describing the intent of each section, what is being tested, and their outcome.

Minor comment: I suggest moving the code performance section to an appendix.

Recommendation: Accept after revisions – minor in the sense that they do not require

new experiments, major in the sense that the paper would benefit from a substantial rewrite with a stronger introduction with a discussion of current PBL practices and another one clearly describing the motivations for the validation/applications.

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