Manuscript Number: **gmd-2018-112**

Article Title: **FESOM-C v.2: coastal dynamics on hybrid unstructured meshes**.

GMD

Dear Editor,

We made the required corrections in the manuscript and answered some of the reviewer's questions.

Referee #2: I would like to thank the authors for the additional information given in the answers. The manuscript is an interesting description of the model mathematical background and gives insights and possible solutions to common numerical problems of unstructured mesh models. But still the results do not convince me with respect to the validation in the realistic cases of the Sylt-Romo and South-East North Sea circulation experiments. The results seem to depend stronger on the applied forcing (sensitivity to open boundary, river input, etc) than on the numerical mesh (see differences in Fig 7 compared to over- respectively underestimation of the tidal amplitude maybe due to the different open boundary forcing in the two experiments?). The velocity differences between the meshes do not exceed 5 cm/s (mostly less than 1 cm/s). So the question is, what is absolute velocity and the natural variability of the currents in these areas and how does this difference compare to velocity changes due to uncertainties in the forcing, parametrizations and bathymetry. Are there still improvements in the numerical schemes required? The salinity and temperature comparison with observation could be more detailed, because a RMSD of 1.24 °C is quite common for ocean models in this region. The gradients seem to be stronger than observed. So I recommend setting up the model with better meteorology and open boundary forcing (including a surge model), tune it and then perform a more detailed validation with observation. Especially the storm surge heights have not been analyzed at all. (The sea surface height average for one tidal period could be zero, although there is atmospheric influence, e.g. during permanent easterly winds lowering the sea level in the German Bight). The question is, what the models purpose is, so what are the important variables to analyse. The article has improved with the corrections and I would suggest accepting the manuscript as is (maybe do typo corrections: p.9 l.2 trough -> through and p.16 l.5 A, phi_star -> A, phi). Thanks for making code available in open source.

Answer: We thank the reviewer for his efforts in reading carefully our manuscript and summing up the manuscript and appreciating our efforts.

Referee: The results seem to depend stronger on the applied forcing (sensitivity to open boundary, river input, etc) than on the numerical mesh (see differences in Fig 7 compared to over- respectively underestimation of the tidal amplitude maybe due to the different open boundary forcing in the two experiments?).

> *Answer:* In coastal models, the result is strongly dependent on boundary information and less from the mesh. On all tested meshes, for the *Sylt-Römö* experiment, we set identical boundary information. The conclusions of our analysis suggest that the solution on triangular meshes is more dissipative (*effectiveness of the filtering procedure on triangular grids was lower, Danilov and Androsov, 2015.)* and, if possible, it is desirable to use a meshes consisting of quads.

Referee: The velocity differences between the meshes do not exceed 5 cm/s (mostly less than 1 cm/s). So the question is, what is absolute velocity and the natural variability of the currents in these areas and how does this difference compare to velocity changes due to uncertainties in the forcing, parametrizations and bathymetry.

Answer: Variability in velocity fields is of interest to us only in terms of the convergence of solutions on meshes of various configurations.

Referee: Are there still improvements in the numerical schemes required?

Answer: Of course, the numerical scheme will have some changes in the future. The main ones will be associated with vertical approximation of the area and wetting and drying parametrization.

Referee: The salinity and temperature comparison with observation could be more detailed, because a RMSD of 1.24 °C is quite common for ocean models in this region. The gradients seem to be stronger than observed. So I recommend setting up the model with better meteorology and open boundary forcing (including a surge model), tune it and then perform a more detailed validation with observation. Especially the storm surge heights have not been analyzed at all. (The sea surface height average for one tidal period could be zero, although there is atmospheric influence, e.g. during permanent easterly winds lowering the sea level in the German Bight).

Answer: We work on the next manuscript with more detailed validation of similar experiment and reduced uncertainty in current simulations.

Technical corrections:

1) p.9, l.2: *trough* → **through**. *Thanks, corrected.*

2) p.16, l.5: $A, \varphi_* \rightarrow \boldsymbol{A}, \boldsymbol{\varphi}$. *Thanks, corrected.*

With our best regards,

The authors