

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

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

GMD

Dear Editor,

Thank you for the opportunity to answer to the issues raised by the reviewer and improve the manuscript.

In the following we will answer the comments in detail:

Referee #1: This paper is a description of the coastal component of global ocean model FESOM2. I appreciate authors' honest account of aspects of model details, and think it'd be a great contribution to GMDD. I give some minor comments and suggestions below.

Answer: We thank the reviewer for summing up the manuscript and appreciating our efforts. We try to address the remaining issues in a satisfactory manner.

Referee: Eq. (7): the advection part seems missing; why?

Answer: This is a simplified form assuming horizontal homogeneity, so that the change of kinetic energy db/dt can be written without advection terms (see for example: Monin, Jaglom, "Statistical Fluid Mechanics" v.1, 1965; Kaimal and Finnigan, "Atmospheric boundary Layer Flows", 1994). This simplification is widely used in turbulent models (see GOTM). Of course, a more general form can be used if needed.

Referee: Pg. 5, the formula for C_d should have an exponent of '-2'. More importantly, why is H used instead of the bottom cell size? This is inconsistent with the bottom B.C. on line 25.

Answer: It our typo. It is corrected, many thanks!

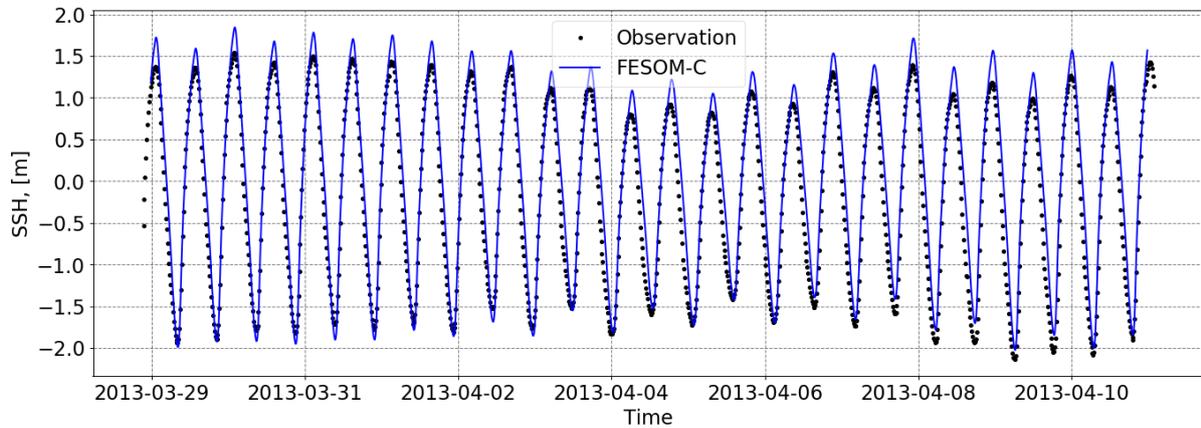
Referee: Eq. (10): if $S_w=0$ in most cases, this becomes no flux condition, and is independent of E/P values, so the model will not see their effects.

Answer: We added additional comments to the new version of the article. The impact of the evaporation/precipitation has been included as a volume source in the salinity and continuity equations (additional water volume provided by evaporation/precipitation).

Referee: Section 5: all tests use only a few tidal constituents. Why not use the full tides so the model results can be compared easily with observation? Without this, I don't see how tracers can be compared for the Elbe station.

Answer: The current manuscript represents the state of our model approximately 1 year ago (we submitted it to GMD at the beginning of this year). We used mainly M2 constituent to show the model ability to represent the main features of tidal dynamics, keeping the design as simple as possible to be able to diagnose possible errors. Main

dynamics in this area defined by the M2 wave, as can be seen from our comparison. We now work on a manuscript analyzing longer simulations with more constituents. To show the ability of FESOM-C to work with multiple constituents we include a figure plotting the SSH at station Helgoland (Fig. 11 in our manuscript) based on results of FESOM-C for same region with 9 constituents.



As an additional analysis it would be of interest to compare dynamics of tracers in two setups with M2 only and with several constituent. However, it is beyond the scope of present manuscript were we only describe the new model and its abilities.

Referee: Fig. 11: indicate tides are not filtered out in (b)? Fig. 13: show legend for each color.

Answer: We modified the caption as follows (in the new version of the article this is Fig.12):

Fig. 12. Modeled (blue line) and observed (gray dots and dashed black lines) sea surface salinity (SSS) at the Cuxhaven station. The station is positioned at the mouth of the Elbe River between stations 9 and 13 in Fig. 11. The top panel shows 9 months of simulations. The bottom panel shows results from 2 selected days in May. The blue (modeled with the Miura advection scheme) and thick dashed black (observation) lines in the top panel show running mean SSS with time window of 10 periods of M2 tidal wave. Thin dashed black lines are one standard deviation bounds of running mean observed SSS on the top panel.

Referee: Pg. 17, ln 5: what's 'antiphase'?

Answer: "antiphase" means that two opposite open boundaries are shifted by 180° (by a half period) with respect to each other.

Technical corrections:

Editorial corrections: 'ofexisting' (pg 2, ln 25); → *Many thanks. Corrected.*

Eq. (4) did not use the flux form (but the latter is used later in numerical method); → *Thanks. Of course, equation (4) must be written in the flux form. Corrected.*

Eq. (8): i should be 'j'; → *Thanks, it is our typo. Corrected.*

divergence operator should have a ‘.’
(pg 9 ln 30), similarly on ln 25, pg. 10; → *Thanks, corrected.*

Pg.12, ln. 5: far-reaching; → *Corrected.*

Pg.12, ln.25: what’s ‘bathymetric land height’? → *Replaced by “topography”.*

Pg.13, ln.10: where-> were. → *Thanks, corrected.*

Fig.5: does ‘1/h’ mean hour⁻¹? → *Yes. We redraw the labels on the x-axis. Now it is hour⁻¹.*

Pg.15, ln.10: daily; → *Thanks, corrected.*

Pg.16, ln.20: ‘13% larger on ’-> ‘than’? → *Thanks, corrected. It is now: ...despite the fact that the number of vertices is 13% larger than on MESH-2.*

We hope our answers are satisfactory and the corrected manuscript is now adequate for publication.

With our best regards,

The authors