

Interactive comment on “Hydrodynamic modeling of coastal seas: the role of tidal dynamics in the Messina Strait, Western Mediterranean Sea” by A. Cucco et al.

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Dear Editor

The paper has been modified following the reviewers suggestions and comments. Several modifications were made to improve the clarity of the text. The English grammar was revised. The general structure of the paper was slightly changed following the recommendations of the reviewers. The quality of the figures was improved and figure 2 was deleted as requested by reviewer #2.

In the following we pointed out the answers to the main comments and questions of the reviewer #1.

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ANSWERS TO REVIEWER #1

Reviewer #1 main comment: “Given the different vertical discretization schemes of TSCRM and SHYFEM (sigma levels vs zeta levels, respectively), it would be worth commenting on how any eventual discrepancies during the model nesting were overcome.”

The nesting procedure, already tested in previous works (Cucco et al., 2012a; 2012b; Melaku et al., 2015), allowed to force the SHYFEM model domain, based on unstructured mesh, with Open Boundary Conditions (OBC) provided by the TSCRM model, based on structured mesh. The OBC was built for T, S and Eta at all the nodes of the two Open Boundaries (OB). As an example, for each node of the OB, the T was derived at each z-layer of the SHYFEM model mesh. A linear interpolation was used to derive, for each node of the TSCRM, the vertical distribution of the T values at each z-layer of the SHYFEM model domain. Subsequently, by means of Lagrange interpolation procedure, the T was computed for each node of the SHYFEM model mesh starting from the new horizontal distribution of the TSCRM T calculated at each SHYFEM model z-layer. The obtained interpolated 3D fields was used both as OBC and for the nudging procedure. The adopted interpolated data was not generating any distortion in the computed SHYFEM hydrodynamic fields being the OB located off-shore and with the same geometrical and bathymetrical features of the TSCRM raw mesh. We avoided to describe the adopted method in the text being it already described in Cucco et al., (2012a; 2012b) and Canu et al., 2014.

Reviewer #1 main comment: “The authors could elaborate a bit more on the “linear combination” (mentioned in Page 7 / Line 30) that resulted into the water level open boundary conditions.”

It was a mistake, the TTC water levels were derived by simple summation of the tidal and THO water level signals. Sorry for the inattention.

In the text, page 7 at lines 1-4: “Similarly, for the TTC scenario, the same ocean and

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meteorological data were used as open boundary conditions with the exception of the water levels which, in this case, were derived for each point of the mesh by the sum of the tidal elevations (adopted in TDO scenario) and the sea surface elevations computed by TSCRM (adopted in THO scenario).”

Reviewer #1 main comment: “Is there any suggestion as to why Station 10 - Messina appears to give the highest relative discrepancies in observed and computed harmonics’ amplitudes?”

The differences between modelled and measured semidiurnal amplitudes at Messina station are mainly due to the discrepancies between the simulated and the observed positions of the Anphidromic Point (AP). In particular, considering the values obtained for stations 4 and 7 (Ganzirri and Faro), north of the supposed AP position, an underestimation of the observed semidiurnal amplitudes are found (see table 2). On the contrary, at station 10 (Messina), south of the AP position, the modelled data overestimate the observed amplitudes (see table 2). It follows that the modelled iso amplitudes and the AP position of the main semidiurnal waves are slightly shifted to the north with respect to their supposed locations. Therefore, the model inaccuracy is not properly on the reproduction of the amplitudes of the semidiurnal tidal waves but on reproducing the exact position of the AP. This, of course, is not particularly affecting the reproduction of the tidal dynamic the Strait.

Reviewer #1 main comment: “General remark: . . .”

We followed all indications provided by the reviewer: the stations numbers have been included into the figures, “in correspondence of” has been substituted with proper propositions, Figures and Tables have been edited without capital letters and the figures have been uploaded with high details and resolution.

Smaller comments have been integrated silently into the manuscript

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