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Improving tidal open boundary conditions for the Adriatic Sea numerical model

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Tides in the Adriatic Sea are among the strongest one in the whole Mediterranean Sea, implying that numerical models with aspiration to represent realistic dynamics, particularly for real-time applications, need to include correct tidal forcing. There are many strategies to determine open boundary tidal forcing from simple one using intuitive sea level data from closest gauge station to using advanced assimilation techniques. In this work we are improving tidal open boundary conditions (obc) for advanced finite different ROMS model by using simpler assimilative part of finite element model TRUXTON in an iterative way. To accomplish the task we have made carefully triangulation of finite difference ROMS grid taking particular attention to preserve the same domain representation in both meshes, e.g. bathymetry, channels, etc. Complications arise when one triangulate finite difference staggered C-grid to obtain finite element A-grid. We had to use information from staggered C-grid at both "rho" and "psi" points in order to prevent opening and closing straits of one cell width, along with imposing unrealistic flows. Furthermore, we extended assimilation domain to embed inside ROMS grid in order to suppress possible unrealistic open boundary effects, found before in previous studies. In a similar way as before, we have used iterations to reduce discrepancy between physics in assimilative part with more advanced one found in a forward ROMS model. Numerical simulations of ROMS model using obtained open boundary conditions exhibit better match to tidal gauge sea levels, as well as to the ADCP current observations. Namely, ROMS model was run for 200 days, after which we performed tidal analysis of sea level and calculated RMS against available 31 tide gauge station data. Improvement between base solution (model forced with baseline obc) and one with optimal one (obc from assimilation) is in range from 15% up to 194 % depending on tidal constituent. Further more, by using assimilation of higher

values of sea level in the Northern Adriatic we have provided obc for 3 more tidal constituents, ending with 7 most important ones. Applied procedure is shown to be applicable to different range of numerical models no matter finite difference or finite elements/volumes.