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Geoscientific Model Development Discussions

Interactive comment on "Sensitivity of the Mediterranean sea level to atmospheric pressure and free surface elevation numerical formulation in NEMO" *by* P. Oddo et al.

Anonymous Referee #2

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The manuscript examines whether using different numerical schemes and accounting for the effect of atmospheric pressure in numerical ocean models can improve the model performance.

By comparison of model results with tide gauge data from selected stations, it is clearly shown that including atmospheric pressure improves reproduction of sea level. It is not that obvious that changing numerical scheme from the filtered one to the time splitting one improves the model performance.

There are several issues authors should resolve before this manuscript is suitable for publication:

(1) The model runs are from 7 January 2004 to 31 December 2012, yet all comparisons are done with tide gauge data from July 2010 to July 2012. Comparison should be done with tide gauge data covering the whole of studied interval. There is not much point in discussing spectral energy at periods longer than ∼200 days, when there are only 2-3.5 oscillations of these period in the modeled time series. These tide gauge data (at least at a hourly sampling interval) are certainly available for a number of the Mediterranean stations. If there is a problem with using longer time series because of model spin up time (but is it 6.5 years?), I either suggest starting model earlier, or refraining from discussing too much these long periods.

(2) I fully agree with reviewer 1 that periods shorter than 12 hours should not be analyzed due to aliasing problems; and would also, to be on a safe side, suggest cutting analysis at least at the 24 hours period. In any case, I suggest the authors to create spectra for the modeled time series at three selected stations for the whole modeling time interval for periods shorter than 48 hours, and to check whether or not they get some spurious spikes which could be due to aliasing. E.g. all of your spectra of model time series have strong peaks at 4 hours, likely at ∼2.5 hours also, and at some other periods as well. Also whatever you reproduce at the Adriatic has a spectral peak centered at 23-24 hours, and not at 21 hours.

(3) Analysis of water mass transport through Gibraltar is interesting. But this should be compared with some measurements, or, if these are not available, at least with existing literature. What is real amplitude of seasonal oscillations of transport through the Gibraltar strait?

(4) Finally, if you are to discuss influence of including air pressure effect into numerical model, you should include tide gauge stations which are influenced by the largest horizontal pressure gradients into analysis - like Genoa (but here it's important to use periods shorter than 15 days), and then stations for which there are largest pressure differences between model runs (as seen from Figure 2).

More specific comments:

Figure 3. Is this data from all tide gauge stations? Authors should smooth their spectral estimates (using window averaging); all these peaks in the middle left figure are distressing. Also, level of confidence should be added to all spectral plots.

Figure 4. Authors should add levels of confidence, and when crossing from left to right column in plots, authors should continue their plots where they've stopped them (at 72 hours period). X-label should be given (or written in Figure caption).

Figure 5. What is black line in middle plot, i.e. from which experiment is it originating from?

Figure 6-8. Restrict to periods longer than 24 hours (you can filter short periods out from tide gauge time series), estimate spectra for whole modeling interval, add confidence levels. I would even do spectral analysis for periods of 1 - 360 days for selected stations.

Interactive comment on Geosci. Model Dev. Discuss., 7, 3985, 2014.