

Review of “The CO5 configuration of the 7 km Atlantic Margin Model: Large scale biases and sensitivity to forcing, physics options and vertical resolution” by Enda O’Dea et al.

General comments:

This Model Development paper describes a new configuration of the NEMO code – called CO5 – applied to the European Northwest Shelf area, with the aim of producing an upgrade of the CMEMS multi-year model product for that region. The description focuses on updated model components with respect to the previous version – call CO4 – which is documented in O’Dea et al 2012. A 30-year hindcast simulation (no assimilation) is carried out with CO5 and the results are compared with the current CMEMS multi-year product, which is also a hindcast (no assimilation) produced using the POLCOMS code. The two hindcasts are also compared with observations and climatologies in order to show that the new one gives improved large-scale biases. Returning to the CO4-to-CO5 changes, a number of sensitivity runs are made to demonstrate the impact of the individual component changes; in these cases, bias and rmse for temperature and salinity, as well as tidal analyses, are presented.

The paper is well-written in very good English. The topic and material are very relevant for the development of operational oceanography in the NWS region. The sensitivity tests of NEMO component upgrades are in particular of interest to the coastal modeling community. The paper should definitely be published in GMD.

The paper really has two topics: the CO4-to-CO5 model upgrades and the CO5 – POLCOMS hindcast comparison. They are tied together by the use of 30-year hindcasts for the model sensitivity and the CMEMS product upgrade aspects, respectively. I think this is acceptable, but it demands considerable care in organising the material. I found it all a bit confusing on first read. My main recommendation is that the authors should put some effort into simplifying the terms used and explaining more carefully (repeating) what the purpose of each (sub-)section is. I also suggest adding a table with the relevant features of the 3 models: POLCOMS, CO4, CO5; it would make the similarities and differences clearer in the discussions in Section 5.

Specific comments:

1. The term AMM is used in the title and in the 1st para of the Introduction, and nowhere else. There should be an explicit connection to CO4 and CO5. Better yet, reduce the terminology to one term for the bulk of the paper.
2. Introduction p.2: Make clear the connection between AMM and CO5
3. p2.l6-8 and p2.l17-18: These two sentences say the same thing. Move the latter to the former’s place?
4. p2.l14-17: This list of changes should include the atmospheric fluxes.
5. Section 3: Add sub-section numbers 3.1 – 3.4 at the appropriate places, e.g., p4.l17, p4.l28, ...
6. p5.l1: Add url for E-HYPE data
7. p6.l13: Add a referral to fig. 11
8. p7.l5-...: Give a reason for why the surface bdry condition was changed.
9. p8.l14: “...amphidrome in southern Norway ... better represented” needs to be substantiated. Add a reference.
10. p8.l15-16: “It is found that...” without further explanation means “unsubstantiated claim” in my book. Was a sensitivity test done? Are the CO4 and CO5 bathymetries otherwise identical?
11. p12.l15-18: Is this meant as an explanation for why the bottom profiles in fig. 7 look different? If so, say so.

12. P18.Figure 11: Add “The figure shows CNTL minus S30_1. Grey area in Kattegat indicates interface to Baltic NSBS model data.”
13. p19.l5: should be “slightly less saline” if the Figure 12 caption is correct.
14. p13.l13: to me “near bed” means right at the bottom, but Figure 13a shows that the PDWL scheme reduces bias over more than half the water column. Reformulate.
15. p25.l11: same as previous
16. p22.l21-23: Give a reference for the cold/fresh bias in ORCA025.
17. p22.l25-30: There appear to be two differences at play here: different sources (Met Office NWP and ERAI) and how they are applied (as direct fluxes or via CORE bulk formulae). “ERAI fluxes” is a bit misleading; use “ERAI-derived fluxes” or similar instead. Is data availability the reason for doing this sensitivity test?
18. p22-24 Section 5.42: Why not show the SST/SSS biases in the two runs in Figure 15? I would imagine the discussion would be easier.
19. p23.l1-p24.l2 and p26.l2-7: This is interesting and could be substantiated more. What is the actual impact on the circulation? “Significant impacts” is not very useful.
20. P24.l22-24: Needs some explaining, as mentioned above.
21. P24.l29-31: CO5’s SSS bias in the German Bight is also affected by E-HYPE.

Technical comments:

1. “data” is a plural and should be treated grammatically as such. Many occurrences of this error.
2. “intercompare”. (A pet peeve, admittedly) Defined to mean to “compare each member of a group against all other members” (Collins Dictionary). In this paper “compare” is more appropriate, since there is only comparison of 2 members. BTW: “intercompare” is not found in the online Oxford Dictionary.
3. There are a surprising number of “is-are” errors that a technical editor should pick up.
4. p1.l4: “seamless”
5. p12.l34: Replace “However” with “On the other hand”
6. p18.l8: “CO5 and may be” → “CO5, which may be”
7. p21.l5: “...the 30 year experiments (Section 5.3)”