

“ENSURF: multi-model sea level forecast – implementation and validation results for the IBIROOS and Western Mediterranean regions” by B. Pérez et al.

Final Author Comments:

RC C647: Referee 1: H.Dahlin (received and published: 16 September 2011)

I have read the paper and it needs to be language checked. Content is OK with one question. The authors should reconsider line 9-10 on page 4. The statement can be removed without harming the paper. "it would be immediate and easy to do it for any other parameter such as waves or currents."

Answer:

We thank Dr. Dahlin for the comments and really agree on the need of a language check. This is something that has already been done by one of the native english authors and a new version of the paper with language corrections is now available.

We also understand the referee suggestion to remove the sentence "it would be immediate and easy to do it for any other parameter such as waves or currents". We will remove that statement, since it is not founded.

RC C794: Referee 2: K. Horsburgh (received and published 22 Nov 2011)

We thank Dr. Horsburgh comments. We understand most of them. We answer below to each one:

Abstract: Please re-write the abstract to describe the project in terms that make sense to readers outside of the ECOOP/GOOS/NOOS/IBIROOS community. There are far too many acronyms there. An abstract is meant to summarise the science not the funding mechanism or the partnership arrangements.

Answer: We have done so in the new version of the paper.

Introduction, objectives and general description: The weakest part of the paper is the introduction and then description of numerical modelling, yet this is put forward as the main rationale for the work. The introduction (p763, line 25) gives a false impression of how mature operational surge modelling systems function.

Answer: line 25: we interpret here the referee means that we emphasize too much the need of real time tide gauge data for bias correction in near-real time. We understand the comment and it is true it is not well explained at all in the paper. We should have clarified that this is the case where the magnitude of storm surges is relatively small in comparison with steric sea level variations not considered by barotropic models and this is particularly needed in the South of Europe and Mediterranean. On the other hand, the reason for this bias is diverse, so we propose just deleting the whole paragraph as we agree it does introduce confusion at this point. On the other hand we have modified the introduction to point basically to the fact that there are several approaches to operational surge forecasting out there, including 2D and 3D models and statistical methods. The power of ENSURF is that they could be seen together in real time and make an overall probabilistic forecast through BMA.

It is stated (p765, line 1) that the system was implemented in the NOOS region yet it does not involve the UK, Dutch, Danish or German operational models - which are amongst the best developed in the world.

Answer: We do not understand this comment completely: one of the components of ENSURF system is in operation at Deltares (<http://noos.deltares.nl>), where sources from the NOOS community are included (UK, DMI, BSH...)...We only mention this but the paper is not about the NOOS region. We have modified the text to make this clear. On the other hand, these sources are not included in the rest of the paper which is about the implementation for the Atlantic and South of Europe (IBIROOS), and the Western Mediterranean, and that we have in operation at Puertos del Estado. In this particular case we did in fact contact the UK by email a couple of times for including UK forecast for the British Isles, as we of course considered this would be the better contributor due to its history and experience on storm surge forecast. Nevertheless, unfortunately for us we did not get an answer. So the work was performed with the existing operational systems of the participants of the project. Other institutions have been invited to contribute in the future, with positive answer, from France and Italy. If we are able to maintain the activity, and this is the idea, we would really appreciate and need UK contribution.

There is a muddled description of the differences between 3D and 2D depth-averaged models, yet no serious attempt is made to challenge the well-known fact that 3D models do not perform any better for storm surge simulation. As it stands, to imply that the merged approach described in the paper somehow improves upon current operational forecasting practices is totally misleading..

Answer: although it is not really the objective of the paper to go in detail into the origin of the differences between 2D and 3D models, but just to confirm these differences for the operational systems in the region of study, we suggest adding this sentence in page 763, line 25 (replacing previous deleted paragraph):

"However, it is well known that these 3D circulation models do not generally perform better for storm surge simulations, although they include a more complete description of the physical processes that produce sea level variations, something we confirm within the ENSURF application for the IBIROOS region. Nevertheless, they do provide a sea level forecast that could be considered as an additional source of information and validated with observations.". This links well with the immediate next paragraph.

I recommend modifying sections 1 and 2 to describe in a more accurate way that the project is offering a technique that may be valuable to operational systems, without giving the impression that ENSURF has all the answers

Answer: Of course, we don't think ENSURF has all the answers for storm surge forecast, this is not possible as we of course are not considering many of the aspects of well developed storm surge forecasting systems, especially in the North Sea. We can introduce slight modifications in the text that clarifies this point, as this message was not really deliberate. For example a slight modification in this line would be, at the end of the introduction (p764, line 12...):

"ENSURF.....as it represents a perfect example of this integration, not only because it involves and compares different forecasting systems but also because it makes use of observations and new statistical techniques that may improve the final independent forecasts. In the particular case of IBIROOS (European Atlantic Coast) and Western Mediterranean, the overall best estimate forecast from BMA is found to perform generally better than any of the individual forecasts at the locations of interest."

and at the beginning of section 2, just to make clear that not all the available systems are included in the work we could write: "ENSURF is a multi-model application for sea level forecast that makes use of several storm surge/circulation models currently operational in Europe" ("several" instead of "existing", it is more precise).

Numerical modelling: Please ask the modellers to check that their respective model descriptions are complete and properly referenced. Also, seek consistency between the descriptions so that the reader can tell the similarities and differences between the models. In fact, if the paper is trying to comment on aspects of model performance due to differences in dimensions or parameters then please consider introducing more detail into Table 1.

Answer: we completely agree also with this comment and have made a review of the descriptions for more consistency and a new version of Table 1.

In 2.1.2 Charnock is spelled Charnok. Henry would turn in his grave.

Answer: Thank you for the comment. We have changed this.

Section 2.1.4 is the worst description of a numerical model that I have ever seen: what is the (unreferenced) "C. Fairall COARE method"? The relevant (not first) author should do this properly and this time devote sufficient time to it.

Answer: we completely agree also with this comment. This section has been already completely re-written by the relevant author:

"IMI system:

The circulation model used by the Marine Institute is the Regional Ocean Modelling System (ROMS) which is a free-surface, hydrostatic, primitive equation ocean model described in Shchepetkin and McWilliams, 2005. ROMS uses orthogonal curvilinear coordinates on an Arakawa-C grid in the horizontal while utilizing a terrain-following (sigma) coordinate in the vertical. The model domain (NE_Atlantic) covers a significant portion of the North-West European continental shelf at a variable horizontal resolution between 1.2 and 2.5 km and with 40 sigma levels. The model bathymetry utilizes data from a number of sources (e.g. Irish National Seabed Survey multibeam dataset) to produce the best possible bathymetry for the area. Surface forcing (at three-hourly intervals) is taken from the half-degree Global Forecasting System (GFS) forecast while tide forcing is proscribed at the model boundaries by applying elevations and barotropic velocities for ten major tide constituents which are taken from the TPX07.2 global inverse barotropic tide model (Egbert and Erofeeva, 2002). The NE_Atlantic model is nested within the high resolution (1/12°) Mercator Ocean PSY2V4R2 operational model of the North Atlantic whereby daily values for potential, temperature, sea surface height and velocity are linearly interpolated from the parent model onto the NE_Atlantic model grid at the boundaries. Bottom stress is applied using the logarithmic "law of the wall" with a roughness coefficient of 0.01m. Surface stress is calculated using the COARE algorithm (Fairall et al., 1996). The output consists of 10 min total sea level at tide gauge locations. No data assimilation of tide gauges is performed."

The English needs thoroughly checking throughout It would greatly assist the paper if a native English speaker provided a final edit. Many examples of phrases needing correction are evident in just the first few pages P762, line 23. ..differences between, not "on" P763, line 8. Prone not "prompt" P763, line 21. "although not always considered with the importance it has,". This is not English or even close.

Answer: as already answered to the first referee, one of the native english speaker authors has checked the manuscript and a new version of the paper with language corrections is available and will be used when sending the final manuscript, including the bad English examples shown by the referee.