

Interactive comment on “Usefulness of high resolution coastal models for operational oil spill forecast: the Full City accident” by G. Broström et al.

Anonymous Referee #2

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The paper reflects quite an interesting attempt to compare the ability of three different ocean and oil spill models to reconstruct the properties of propagation of the oil spill after the major accident of *Full City* in 2009 in terms of the reproduction of the location and timing of beaching of parts of the oil spill. The results are interesting in several aspects. Additionally to the description of the sequence of events and explanation how it was reproduced by different models, the authors highlight the general problem of the treatment of the coastline in such efforts with both operational and scientific models.

The body of the paper provides a sound description of what happened and how adequately the location and timing of coastal pollution can be reconstructed using a selec-

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tion of models for the area in question. The conclusions mostly follow the presented material. Although some claims of Section 4.3 are almost trivial, they still point the reader to some generic deficiencies of even the best modelling systems.

The quality of the entire paper suffers to some extent from the absence of a clearly defined scientific focus of the study. I admit that mostly descriptive papers carry at times good value for science but even then it is necessary to formulate what we learn from the particular data set or analysis. In this context, a description of similar modelling efforts, both in terms of comparative studies of the performance of different oil spill models and comparisons of modelled and observed beaching of oil pollution would help both the authors and the reader. I have in mind not a comprehensive overview of such efforts but a selection of the most advanced cases, their basic outcome and, most importantly, a list of identified bottlenecks (low resolution of the circulation model? bad quality or resolution of metocean forcing data? problems with the physics of surface-layer transport?, etc.) that need more detailed analysis.

The history of efforts towards understanding the ability of models to reproduce the beaching of oil extends back to several decades. Among these are almost forgotten studies of the 1991 oil spill in the Arabian Gulf (Venkatesh and Murty, *Water Air and Soil Pollution*, 1994), numerous papers addressing more closely located events, such as coastal pollution after accidents with *Sea Empress* or *Prestige*, and recent hindcasts of oil beaching (e.g., during the Lebanon crisis in 2006, Coppini et al., *Marine Pollution Bulletin*, 2011). A comparable number of studies of hypothetical cases of the fate and potential beaching of oil (and related computational problems) exist for the North Sea and Baltic Sea regions (e.g. Viikmäe et al., *Estonian Journal of Engineering*, 2010 or Soomere et al., *Ocean Dynamics*, available online, 2011). A selection of the relevant information would put the entire study into proper context of the pool of similar efforts and would make much easier to formulate new challenges for the scientific community.

Discussion of the role of wave-driven nearshore flow on p. 1487 should be better connected with the existing structure of the coasts in the neighbourhood of the accident

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site. This sort of flow effectively exists in the surf zone of more or less straight sections of the coast. Usually it is blocked or considerably weakened by even small capes or headlands, or entrances to fjords. As the coastline in the vicinity of the accident site is quite far from being straight, the wave-driven longshore transport apparently was only effective within small coastal sections. A description of the physics of this transport on lines 5-8 is not necessary.

In the light of the interesting message it is a pity that the language of the paper needs essential improvement. It contains numerous typos and obvious grammatical errors. In many places the message can be made much clearer by splitting long sentences into shorter ones. A selection of items that probably need correction is given below.

Therefore, I recommend moderate to major revision of the manuscript along the above comments and accounting for the list of minor items. The text should be definitely checked by a native speaker before final acceptance.

Page 1468, line 2: perhaps "an important part of decision support systems ..."

Line 5: consider saying "areas where low resolution ... models are ..."

Line 16: "affect" is basically a verb in both UK and US English and "their" should obviously be attached to "oil spills". Thus, consider saying, for example: "Numerical models are important tools for the prediction of movement of oil spills and for evaluating their impact affect on the environment. An accurate prediction of an oil spill is ..."

Line 17: the use of "on standby" is questionable (although it does express some interesting aspect in this context); consider using "in charge" or "responsible"

Line 19: consider replacing "by necessity" by, for example, "intrinsically"

Line 20: probably it is meant that numerical reproduction of many fields is necessary for "an adequate description of the advection of the oil spill"

Line 25: "wave-induced mixing" would be more exact.

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Page 1469, line 1: consider saying "spill event" or using a similar expression associated with a proper time interval.

Line 2: should be "is"

Line 3: "guiding" is redundant.

Line 7: "see" is redundant.

Line 9: using "wind" would perhaps make the point more clear.

Line 12: keeping the geographical position in the text, perhaps in simple brackets, would make the text easier to read.

Line 12: "at about", although often used in scientific texts, is internally controversial; notice the use of the same combination also below, e.g., line 25; moreover, it is said on p.1479 that the grounding time was 22:23.

Line 13: consider saying simply "hull damage"

Line 14: "shorelines" in plural is inadequate here; consider saying "extensive sections of the shore" or similar.

Line 15: should be "diesel" (singular) or "diesel fuel", whichever is more exact.

Line 16: obviously "during the first hours" is meant.

Line 19: "foreseen" seems inadequate in this context as the model runs were probably not performed at the early stage of the event; perhaps "understood" or "recognised" would be better.

Page 1470, line 10: consider starting new sentence with "The total cost ..."

line 11: use capital M to denote millions of Euros.

Line 20: evidently "wind direction parallel ..." is meant.

Line 22 and a few following lines: consider rephrasing the sentence so that it would not

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start with "met.no" and would not contain so many repetitions; for example, "Data from a met.no observation station at Jomfruland (about 30 km southwest from Såstein, Fig. 1) show that the wind speed was about 18 m/s and wind direction about 210 degrees at the time of the accident. The wind speed remained constant for about 5 h, and then (about 6 h after the accident) it decreased to about 7 m/s and the wind direction turned to 235 degrees."

Line 27: consider saying: "the wind direction turned further to ..."

Page 1471, lines 1-2: consider saying "the wind properties (speed about 9 m/s, direction 220 degrees) were constant"

Line 6: probably it is meant that "the use of observed wind data produced..."

Line 9: consider saying "wind blowing along..."

Line 13: The essence, ways of estimate of the magnitude of the Stokes drift as well as problems with the accuracy of such estimates are so widely addressed in scientific literature that there is definitely no need to refer to simplified versions of its treatment. Instead, it would be much more instructive to the reader to provide either confidence intervals for the approximation of the magnitude of the drift and/or a comparison with the state-of-the-art estimates of its magnitude based, for example, on references provided in the interactive comment by Fabrice Ardhuin.

Line 14: "the wave conditions depend..."

Line 20: consider saying "on the match of the wind direction and the orientation of the coastline"

Line 21-22: please rephrase the sentence as currently the point is unclear.

Page 1472, line 1: probably "ocean currents for the period..." or "current patterns ... " is meant.

Line 8: consider saying "The model hindcast a strong cyclonic current system in the

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Skagerrak for this period with inflow..."

Lines 10-11: "this was" is probably redundant.

Line 13: consider saying "the arrows visualising the currents closest ..."

Line 15: consider replacing "distinguish" by "clearly visible"

Line 16: should be "expect that ..."

Line 17: consider replacing "normal" by "often" or "typical"

Line 20: replace "and is an stable" by "which is a stable"

Line 21: should be "coastline" (singular).

Lines 23, 24: I doubt whether "northeastwardly" or "southwestwardly" are acceptable English words.

Line 26: replace "wind speed" by "wind impact"; also start a new sentence from "The currents ..."

Page 1473, Line 12: should be "discretisation"; also "in the vertical direction"

Line 14: the use of "are" implies saying, for example, "The values of the linearised..."

Line 19: Tijm and Lenderink, 2003 is not in the reference list.

Lines 21-24: for these details, the reader could be simply referred to a relevant publication and the entire last sentence of this page could be left out.

Page 1474, Line 1: the name of WAM comes from WAve Modeling project.

Line 3: "models"

Lines 6-7: consider saying, more adequately "the contribution from high-frequency waves that are not resolved by the model is calculated using a self-similar shape of this part of the spectrum"

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Lines 7-10: please account for the interactive comment by Fabrice Ardhuin.

Line 14: delete "has the name"

Line 20: delete "and described"

Line 22: it seems that there are two models, one of which apparently is global (covering at least a part of North Atlantic and is not described in this paper at all), and the other probably is the MI-POM model. Please make clear which model does which job.

Page 1475 Line 5: use either "waves" or "wave fields"

Line 6: The use of stratification as a part of forcing is very much a jargon (albeit not directly wrong); more likely is that stratification is simply accounted for as a background physical field.

Line 8: consider saying simply: "The model time step is 30 min and thus the numerical ..."

Line 16: should be "models ... do"

Line 17: use "in the vicinity of rugged sections of the coastline or/and in archipelago areas."

Lines 19-20: the comment in brackets is irrelevant here.

Page 1476, line 6: say simply "a part"

Line 7: say simply "The system"

Page 1478, line 4: consider saying "from a 4 m thick surface layer to a 60 m thick bottom layer at the deepest parts"; also, use "The Stokes drift" as in the previous text.

Line 17: delete "with"

Line 20: delete article "a"

Page 1479, line 13: consider saying simply " its subsequent later release is not ..."

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Line 21: consider making the point more clear by saying: "Therefore, there might be ..."

Page 1480, line 1: consider separation of "a little further east" by commas.

Line 9: should be "where stranded..."

Lines 21-23: consider rephrasing, for example, as follows: "Only the data from visible-light cameras and IR/UV-sensors, obtained during airborne over-flights, made it possible to establish the nature of the numerous dark features"

Page 1481, line 16: "simulations"

Line 17: consider replacing "one" by "another"

Line 21: "coastal"

Line 23: "simulation"; also "does not"

Line 24: consider saying: "The wind direction changes from southwest to a more northern one after a ..."

Page 1482, line 2: it is a good place to split the sentence into to: "Accordingly, ..."

Line 8: replace "that" by "why"

Line 9: consider splitting the sentence into two.

Line 10: "does"

Line 12: consider splitting the sentence into two.

Line 16: "Eulerian" is redundant here

Line 19: "during the following"; consider starting a new sentence from "At model hour..."

Line 20: consider saying simply: "in strength and starts to blow towards the Norwegian coast"

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Line 22: perhaps "at" is not necessary.

Page 1483, line 5: "strand"

Line 10: "reduces"

Line 22: "a distance"

Page 1484, line 22: "similarly"

Page 1485, line 21: "come" and "do not"

Page 1486, line 8: use either "the shore that is" or "(the) shores that are"

Line 12: "blows"

Line 13: consider starting a new sentence from here.

Line 18: ρ_0 and $\Delta\rho$ should have different values.

Line 25: say simply "resembles this coastal jet; however ..."

Line 27: "does not"

Line 1487, line 2: "wave-forced"

Line 10: "changed"

Line 21: once more "at about"; consider rephrasing.

Page 1488, line 24: "inappropriate" is perhaps too narrow here; consider "unfortunate" or similar
Line 25: "does"

Page 1489, line 8: "are"

Line 16: probably the classical circulation models are meant here.

Caption to Figure 8: "The figure shows ..."

Caption to Figure 10: "The figure shows ..."

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The captions to Figs. 11 and 12 are probably interchanged; if so, please indicate which panel in (the current) Fig. 11 corresponds to which mode.

General remark: please check whether all the locations mentioned in the text are reflected in figures.

Interactive comment on Ocean Sci. Discuss., 8, 1467, 2011.

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