Ocean Science

Discussions

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Interactive comment on "Revisiting the DeepWater Horizon spill: High resolution model simulations of effects of oil droplet size distribution and river fronts" *by* Lars R. Hole et al.

Anonymous Referee #1

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Hole and the coworkers present a simulation study of surface oil spreading during the DeepWater Horizon oil spill. The authors use an open source oil trajectory model to test the surface spreading with two different oil droplet size distributions, and the cases with/without the Mississippi River fresh water plume. With their modeling results, the authors conclude that the surface oil spreading and the final size distribution are almost independent of the selection of the initial oil size distributions as a long-term process. The model shows the impact of MR plume on the surface transport of oil slicks.

This study is generally useful; however, it lacks the description of the model initiation on droplet sizes and the discussion of the oil transport in the water column. Particularly,

the authors did not mention how different oil size distributions were set in the model and what are driving forces that were used to calculate the oil sizes, which I believe is the key to any transport processes in the oil spill modeling. This is a No. 1 weakness of the paper because the authors are trying to understand the impact of initial oil sizes on the model results. One important question is that whether the oil droplets were released from the oil wellhead or were just released at the water surface (although the authors mentioned this in the end of the paper). The author mentioned in the end of Section 2.1 that shapefiles were used for initialization of the oil drift simulation, which makes me wonder if the oil were released at the surface, not at the wellhead. In Page 2, line 24, the authors claimed that the simulation was initialized from satellite observations and point sources. So, it is not clear how oils with different size distributions were put in the simulation and how they were calculated. If two different oil size distributions were used at the wellhead, it is hard to believe the surface oil slick would have no (or negligible) difference according to the authors' conclusion.

Another weakness of the paper is that the discussion is descriptive, not quantitative. Apparently the usefulness of the qualitative discussion on helping oil spill response is limited. The authors compare the spreading area of the oil slick on the surface, but it is not clear the masses of oils were transported in the spatial domain. Also, in the discussion of the oil droplet sizes in Fig. 5, it is mentioned these are all particles at the surface and submerged. Can you quantify the percentage of the oil at the surface and in the water column? Both sizes, numbers, and volume are important parameters, which should be discussed. A 3D plot might be useful. See a previous work:

North et al. (2011) Simulating Oil Droplet Dispersal From the Deepwater Horizon Spill With a Lagrangian Approach.

About the oil droplet sizes: the authors claim that the oil droplet sizes are similar after 1 hour (Fig. 4). First, it is not clear what does this 1 hour mean, from the initial condition? What is the initial condition (oils were released at the surface)? If the oil were released at the wellhead, how long it would take for the oil surfacing? How is the surface time

related to oil droplet sizes? Second, the two distributions in the lower panel are very different from the upper panel in my opinion. The lower-left panel has much more larger oil droplets in the system. If you integrate all of these larger droplets, the total volume of the oil is significant, at least on the same order of magnitude as in the smaller spectrum of the oil size distribution. Hence, I don't agree that the two distributions give the similar results. Again, the author must clarify whether the oils were released from wellhead or the surface. If at the surface, what is the total volume? What driving forces are used to calculate the size distribution? If the oils were released at the wellhead, because small oil droplets have much longer lifetime in the water column (they rise slower) than large ones, loss of the oil mass will be so different with different initial wellhead size distributions. Hence, the resulting sizes of surfacing oils at the water surface will need to be calculated with a fate and transport model. Do you include these processes in the model?

The paper also has many vague statements and topographic errors (see below). Some minor comments are also included here.

Page 1, line 9: in Abstract, "The oil droplet sizes are also relevant for the biological impact." Page 2, line 1: "significant quantities" Page 2, line 22, "all important factors", I would use "major factors" Page 2, line 26, "significant effect" Page 3, line 11, "Bleck (2002)" -> (Bleck, 2002) Page 3, line 15, "USG" -> "USGS" Page 3, line 17, missing ")" Page 4, line 16, "model physics", be specific. Page 5, line 14, "state-of-the-art" Page 6, line 4, "Fig. 7"? Page 6, line 5, "former"? Page 6, line 7, ms-3 -> ms-1 Page 6, line 7, define "super particles" Page 6, line 10, "very similar volume distribution". I do not agree. Page 6, line 11, "more particles", particle numbers or volume? Page 6, line 15, it will be interesting to check how different sizes of oils move with wind, especially those submerged in the water. Page 8, line 3, "realistic spill rate", be quantitative. Page 8, line 11-14. Not sure what the authors wanted to deliver here. Discussion of the oil droplet sizes is not adequate. The discussion is very qualitative. Page 8, line 30, "large surface" -> large surface area? Page 9, line 3-5, a few hyperlinks seem not

working. Page 9, line 10-11, be accurate describing coordinate. I would delete the last paragraph.

Towards the end of the paper, the author finally mentioned the oil particles were evenly distributed at the surface, and at the point source at the sea floor. Do you release same oil sizes at both surface and seafloor? How do you calculate these oil size distributions? Why do you just release oil particles at the seafloor? Without the information of how oil sizes were calculated and what oil fate and transport model was used, I think this manuscript is lack of fundamental information to justify the rational of the simulation. Hence, I do not recommend publication of this manuscript.