

Geosci. Model Dev. Discuss., referee comment RC2
<https://doi.org/10.5194/gmd-2020-385-RC2>, 2021
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Comment on gmd-2020-385

Anonymous Referee #2

Referee comment on "Ocean Plastic Assimilator v0.2: assimilation of plastic concentration data into Lagrangian dispersion models" by Axel Peytavin et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-385-RC2>, 2021

Peytavin et al. describe a numerical assimilation scheme which allows to assimilate observed plastics concentration data into a Lagrangian dispersion model with the aim to improve the prediction of plastic waste distribution over the ocean. This assimilation scheme, called Ocean Plastic Assimilator, uses an ensemble Kalman filter to assimilate observations into gridded concentrations values, which are then mapped to the Lagrangian particles to forecast the distribution of plastics in a double gyre analytical flow field.

General comments: The paper describes an interesting topic with a relevance for present day clean-up of plastics waste distributed in the oceans and is well written. This study is only a proof-of-concept and the main focus of the work is the assimilation of observations into a LG dispersion model to improve the forecast of plastics distribution in the ocean. Although the authors study the sensitivity of the total plastics mass to certain parameters of the flow field and the values of the initial plastics mass in detail, the sensitivity of the results to location and the number of observational points is, however, not considered.

This paper is recommended for publication after some corrections.

Specific comments:

Page 1, line 7: What is meant by "more suitable"? Can you describe what you mean more specifically?

Page 1, line 8: "can effectively be approached": do you mean: can effectively be improved by this simple assimilation scheme?

Page 1, line 13 and 19: Please cite the publication of Lebreton et al. correctly, see also the references chapter:

Lebreton, L., Slat, B., Ferrari, F. et al.: Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. *Sci Rep* 8, 4666 (2018).
<https://doi.org/10.1038/s41598-018-22939-w>

Page 2, line 37: Please clarify which of the following sub-sections belong to the Plastic Assimilator v0.1 method by summarizing it under the respective section with that name.

Page 2, line 38: Instead of "This" I would suggest "It".

Page 2, line 39 (see also line 54): Replace "how we go back and forth" by "... transformation between Eulerian and Lagrangian space ..."

Page 2, line 40: I would delete the last sentence of this paragraph.

Page 3, line 57: ..gridded domain, with a grid size (m,n), and indices i,j to ...

Page 4, line 73: I would suggest to write out "ensemble Kalman filter (EnKF)" in the section heading.

Page 5, line 112: "then"? This sounds as if the initial weight is a consequence of eq 8! Please comment.

Page 6, line 120: "Advection scheme of the dispersion model"? Do you mean "advection in the dispersion model"?

Page 6, line 121: what do you mean by "regenerate the particle trajectories"?

Page 7, line 156: "use these possibilities"? Do you mean "modify the flow field parameters and the particle positions seeds to create..."

Page 7, line 157: Please rephrase the sentence: "By using plastics concentrations sampled from the reference simulation and assimilated into the forecast simulation, we can mimic assimilating observational plastics data ... errors."

Page 8, line 167: Please be more specific and describe the "metrics".

Page 8, line 172: How sensitive are your results to the choice of the observation points with respect to number and location in your analysis?

Page 9, Figure caption 4: "assimilation simulations" = "forecast simulation"? I would suggest to modify the text of the figure caption to: "Evolution of mass over time for five different forecast simulations with five different values of initial total mass ... The mass evolution of the reference simulation is indicated by a solid line."

Results section: In several places (Fig.4, Sec. heading 4.1, text) you use the term "forecast/reference mass". This sounds odd to me. What you actually mean is the evolution of plastics mass in the forecast/reference simulation. Would you please change the wording where appropriate? Is there a difference in meaning when you use "total mass" instead of "mass"?

Page 10, Table 1: "Final total mass (FTM) relative to M_ref and the concentration field RMSE for 5 different forecast simulations ... with and without assimilation of observations."

Page 10, line 197ff: How do you calculate the concentration errors? You describe a decrease in the mean absolute error and reference to figure 5. Figure 5, however, displays a percentage error (what does this mean?). Please rephrase this paragraph and the description of the figure 5 caption.

Page 14, line 250ff: Could you please explain how the ensemble member particles are coupled when they use the same dispersion simulation? Please, elaborate on this.

Page 14, line 265: "...method to assimilate observations of plastics concentration data into..."

Page 14, line 271: Thus, it? the Ocean Plastic Assimilator?

Page 14, line273: "on real-world"... do you mean: using real-world observations. ?