Geoscientific Model Development Discussions

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# Comment on gmd-2020-385

Anonymous Referee #1

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-RC1, 2021

Review of “Ocean Plastic Assimilator v0.1 : Assimilation of Plastics Concentration Data Into Lagrangian Dispersion Models” by Peytavin et al

In this manuscript, the authors introduce what they named the Ocean Plastic Assimilator v0.1, which is an implementation of an Ensemble Kalman Filter for estimating weights of virtual particles in Lagrangian simulations to fit particle densities at the surface of the ocean. They show the skill of this method in an idealised double-gyre simulation

This is an interesting and novel project, that I'm sure will be very relevant to both TOC and the scientific community if it matures a bit more. As it stands now, it is very early-stage; not much more than a proof-of-concept. I leave it to the editor to decide whether the 'delta' in scientific understanding is sufficient to warrant publication in GMD

I do nevertheless have the following comments:

1) The implementation of EnKF focusses on estimating the weights of individual particles, yet as far as I understood the trajectories of these particles are not data-assimilated. I would argue that most uncertainty in Lagrangian simulations of floating plastic is on the processes affecting their pathways (windage, mixing, etc), so would a EnKF implementation that also adapts the parameters of the particle properties beyond weight not be much more relevant? The authors do mention this briefly in the outlook, but this could certainly be discussed further (especially to what extent the method has to be adapted then).

2) The project could fairly easily be advanced a level beyond this proof-of-concept by also including a slightly more realistic test case on for example a simulation of the North Pacific. Does the code still perform well then? In particular, the double gyre is an incompressible flow so the particle density is (roughly) uniform in space (see also Fig 2). This is very different from the North pacific gyre, where plastic concentrations vary by orders of magnitude because of Ekman convergence. How good is the method in such a more complicated system?

3) I wonder how sensitive the results are to the choice of the two 'observation' points. Why have they been chosen where they are? Are these particularly 'good' or 'bad' locations for the EnKF? This should be discussed

4) The implementation of EnKF by the authors requires constant regridding of the particle locations to a Field. This is an expensive step, that I'm not entirely sure is needed. Would it not be possible to do the EnKF directly on the particle positions themselves and work entirely in the Lagrangian framework?