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Discussions

Interactive comment on "Lagrangian Trajectory Modelling for a Person lost at Sea during Adriatic Scirocco Storm of 29 October 2018" *by* Matjaž Ličer et al.

Anonymous Referee #2

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General Comments

In this work the potential trajectory followed by a windsurfer lost at sea in the surroundings of the Gulf of Trieste during a storm that took place in October 2018 is simulated through a Lagrangian approach.

To this end, high resolution oceanic and atmospheric models are used as input for two Lagrangian tools: OpenDrift and FlowTrack. Despite using the same numerical integration scheme (Runge-Kutta 2nd order) they present some differences. Likely the most important is that Open Drift offers pre-calibrated coefficients for downwind and crosswind components more suitable to simulate the drift of a person at sea, specially if the wind drift is dominant. As a result, the final distribution of particles simulated by OpenDrift match better the (tentative) inferred trajectory reconstructed by the authors from an interview with the windsurfer.

My impression is that this paper is based on a compelling idea and that results can be potentially useful at regional and operational level. English is good and one key strength is that model data (especially ocean currents) have very high resolution. However, I feel that this version of the manuscript needs some reorganization, a more accurate description of methods, a more elaborated assessment of the different contributions of wind/ocean currents/(waves?) terms to the simulated trajectories, and an improved treatment of uncertainties and search and rescue areas, before being considered suitable for publication.

In the below lines I elaborate further my above overall impression.

Major Comments

A- It is rather weird (and a bit confusing) to describe wave data from ECWAM model when it is not used later in the Lagrangian simulations. Indeed I think it is more logic to start in Section 2 with the quite general equations of Lagrangian particle tracking (current Section 4), and later describe in Section 3 observations and model data. In this way the fact that you neglect the Stokes drift is clearly stated and there is no need to include a description of the wave model in Section 3. Then in Section 4 you could show the results on the validation of model data with observations, and so on.

B- You say that you do not consider the Stokes drift for your simulation because wavelengths are significantly larger than the size of a person/windsurf table. However, as far as I understand in the case of microplastics, wavelengths are proportionally even larger but the Stokes drift has an important role on their distribution (e.g. van den Bremer and Breivik; Onink et al., 2019). Am I wrong? I think that it is likely simpler to say that the Stokes drift is generally a second (or third) order term in the Adriatic Sea in terms of magnitude (e.g. see Fig. 1d within Onink et al., 2019) . Indeed it would be a good exercise to verify this point with an in-situ wave buoy or with your wave model data.

C- It is not explained which expression you use to simulate turbulent effects (random numbers) at each time step. Is it based on a uniform or a normal distribution? Is it different for each direction? Is the maximum number of 0.02 m/s based on observations or a model assessment? Indeed in coastal regions where strong gradients in ocean currents exist the magnitude of diffusivity can change significantly between relatively close grid cells depending on the ocean features. Please clarify this point.

D- With respect to the validation of the model data with observations, why do not show a comparison between the ADCP data (Figure 6, violet arrows) and the closest grid cell ocean model velocity? This would help to provide some numbers on the discussed underestimation of modeled currents. Also, do you have any reference in which HF radar velocities have been validated? Add it (them) to Section 2.2.

E- Other unclear points are:

- How do you estimate the light red circles in Fig. 8-10?

- Why particles are initially deployed in a rectangular shape?

- You deploy initially 480 particles, one for each value of Lp(theta), however in this way the uncertainty introduced by their different initial location is not assessed. What is the impact of the uncertainty in the initial position on the final search and rescue area for each Lp(theta)? Is it significant?

F – I find that would be interesting to show also the distribution of simulated particles with only wind drift/only ocean currents, and to estimate how large is the dispersion of particles (final area of search and rescue) for both cases. It would show graphically how predominant is the wind drift in the advection of particles and the lag with only ocean currents.

G- My major criticism to this work is the approach you follow to show your results. Considering that it is aimed to be useful for search and rescue (SAR) tasks and, therefore,

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Discussion paper

time is critical, I think that to show trajectories is far less useful than to show areas (or contours) of accumulated probability constructed with suitable mathematical functions. In terms of accumulated probability the areas for search and rescue tasks can be more easily prioritized. Your estimated areas after just few hours of simulation look pretty large to be useful for search and rescue tasks. Additionally, the probabilistic approach naturally includes the fact that there are uncertainties everywhere. Even more, probability contours can have a bimodal distribution, while your polygon seems to include all particles inside irrespective of the spatial holes among them. For example, this approach can be found in Abascal et al., (2010).

You need to convince me that for SAR tasks your current approach is reasonable enough, otherwise I suggest to redo your Fig. 8-10 with a probabilistic perspective (showing e.g. contours of 50%/70%/90% of accumulated probability estimated from the distribution of your particles), which is relatively easy to implement. In the latter case I suggest to remove the word "trajectory" from the title.

Other Comments

Title. Change "for" by "of".

Ln 2. Suggest to change "He was drifting" by "He drifted".

Ln 6. We "modeled".

Ln 52. Unclear how you estimate the +/- 500 m of error.

Ln 65. "By the time he is entering" . . .

Ln. 218. Remove point after "day"

Ln. 218. "all directions..."

Ln. 224. "generates a westward initial current".

References

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