Supplementary Material for “Attribution of Plastic Sources Using Bayesian Inference: Application to River-Sourced Floating Plastic in the South Atlantic Ocean”

1 SIMULATION WITH RESUSPENSION PARAMETER $\lambda_R = 171$ DAYS.

We performed a simulation with the same parameters as explained in Section 3.2, except for the resuspension parameter, which was selected to be $\lambda_r = 171$ days. This value falls between the validity range of the resuspension parameter (Onink et al., 2019) and is larger than the one used in the main simulation, which had a value of $\lambda_r = 69$ days. For this new simulation, we used the same release locations and time of release as in the main simulation. The other parameters where also the same as in the main simulation. After performing the simulations, we computed the same Bayesian framework to compute the same analysis as shown in Section 4, to understand how sensitive is the simulation to the resuspension parameter.

Figure S2 shows the likelihood maps for the simulation with $\lambda_r = 171$ days. Compared to the simulation with $\lambda_r = 69$ days (Figure 2), we observe that Figure S1 has similar patterns of dispersion of the particles per cluster. The slight difference is that the proportion of particles is reduced, for instance, it is fairly perceptible for most of them, but it’s very clear for Rio de la Plata. These results match with the idea that by having a larger resuspension timescale, there are fewer particles drifting at sea.

Figure S2 shows the oceanic posterior probability maps with $\lambda_r = 171$ days. We don’t see any significant difference, compared to the simulation with with $\lambda_r = 69$ days parameter (Figure 3). The increased resuspension parameter didn’t affect the posterior probabilities maps compared to Figure 3.

Figure S3 shows the posterior age distribution for $\lambda_r = 171$ days at the same location A, B, C shown in Figure 4. In general, we don’t see a significant change in the posterior age distributions with the new resuspension parameter. The times in which particles reach these locations match with the times in Figure 4 (simulation with $\lambda_r = 69$ days). We observe that the clusters with the largest posterior probabilities are still Rio de Janeiro, Porto Alegre and Unclustered America, which behave in a similar fashion as with Figure 4. The average number of particles is far less with $\lambda_r = 171$ days.

Figure S4 shows the beaching posterior probability for $\lambda_r = 171$ days. The main conclusion remains unchanged: the largest probability corresponds to the nearest cluster, with the exception of Santos and Cape Town. Over the African Coast, we see the predominance of the South American clusters, while Cape Town’s probability stays below 10%. Even though by changing the resuspension time scales, which makes beached particles remain beached for longer, we see that the conclusion drawn from Figure 5 still holds.

2 BOOTSTRAPPING AND STANDARD DEVIATION.

We computed the standard deviation, as a measure of the dispersion of the posterior probabilities. For this, we performed a Bootstrapping using the outputs of the simulations that contained the trajectories of the particles. The Boostrapping consists of resampling with replacement randomly the trajectories to create new data sets that emulated new simulations. We did the Bootstrapping with 100000 particles per cluster, and we did this 100 times. From these 100 new data sets, we computed the posterior probability as explained in section Section 3.3 for all the locations S_{loc}. From the 100 new posterior probabilities obtained at each location, we computed the standard deviation. Figure S5 shows the standard deviation at each location in the South Atlantic. In general, we observe that the standard deviation for all clusters is below 3%, except for the Southernmost part of the domain where the standard deviation is larger than 4%.

2.1 Figures

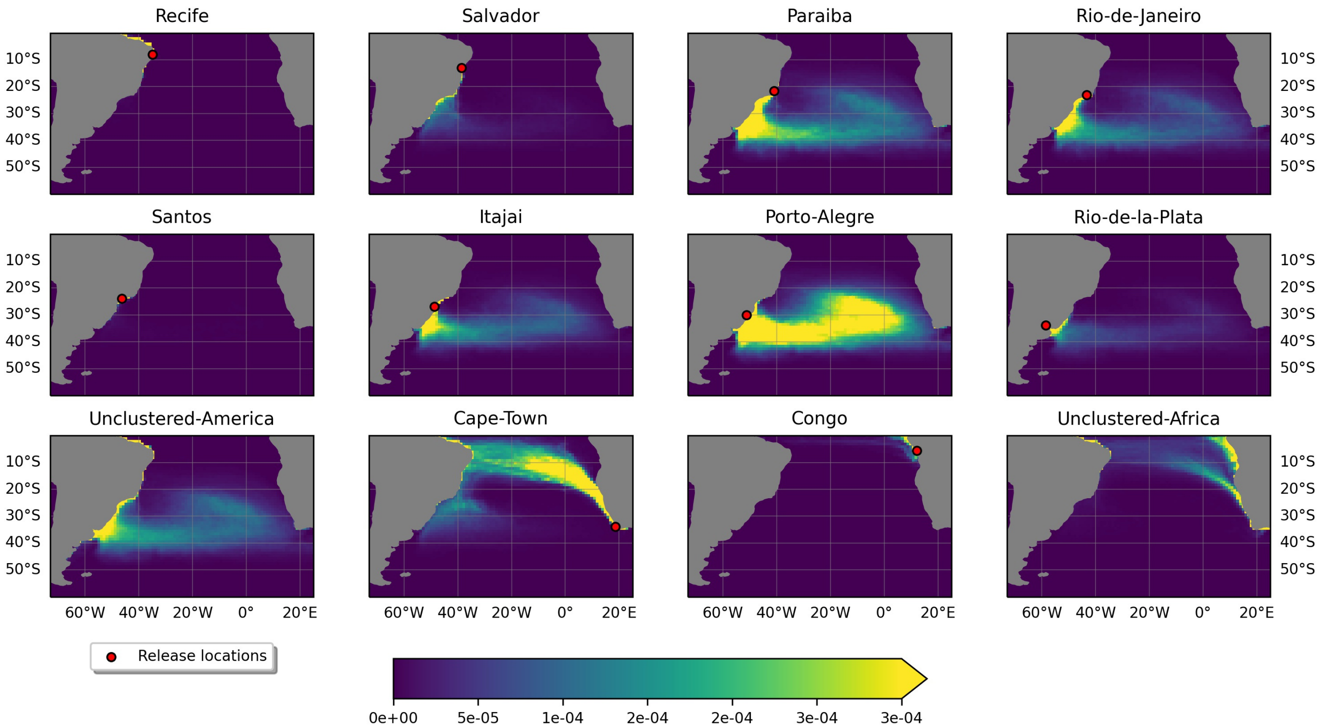

Figure S1. Likelihood maps of the spatially binned $p(S_{loc}|R_i)$ for the simulation with the resuspension parameter $\lambda_r = 171$ days. The color scale indicates the probability of finding a plastic particle coming from the source (indicated as a red point).

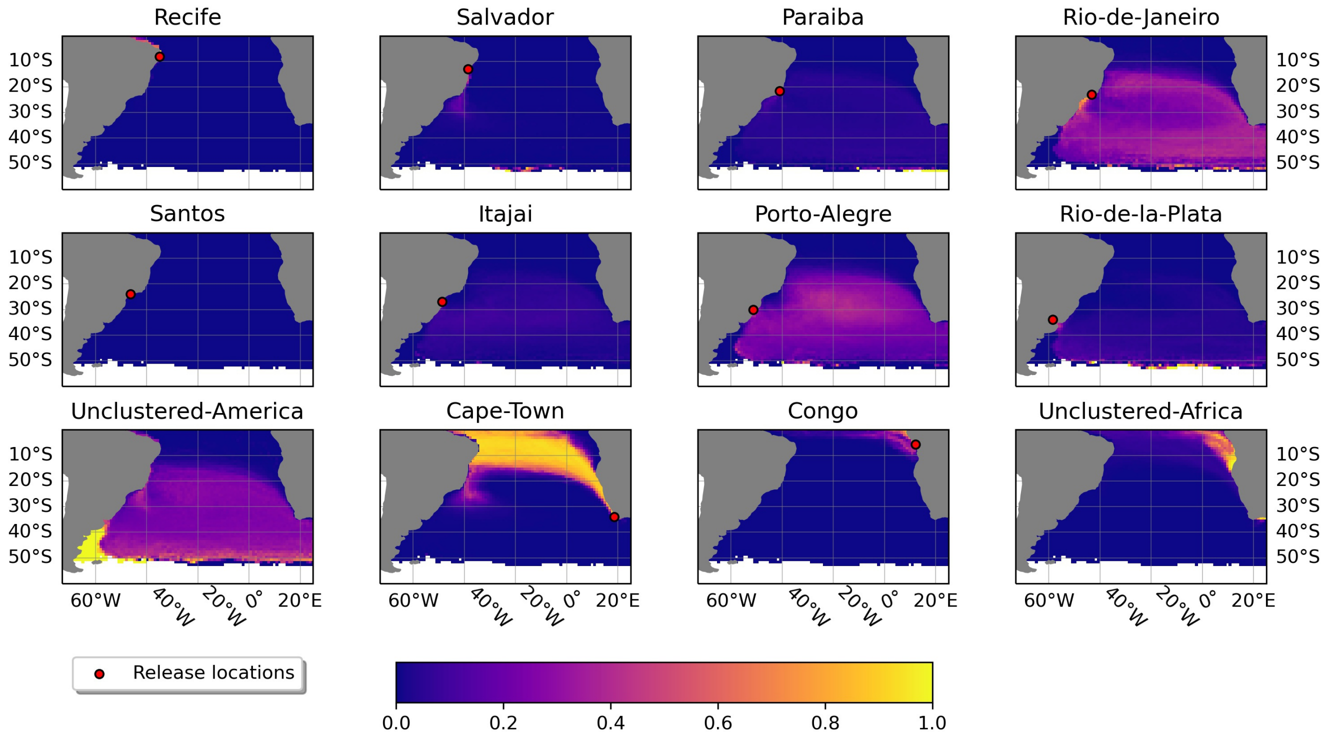

Figure S2. Posterior probability maps of the spatially binned $p(R_i|S_{loc})$ for the simulation with the resuspension parameter $\lambda_r = 171$ days

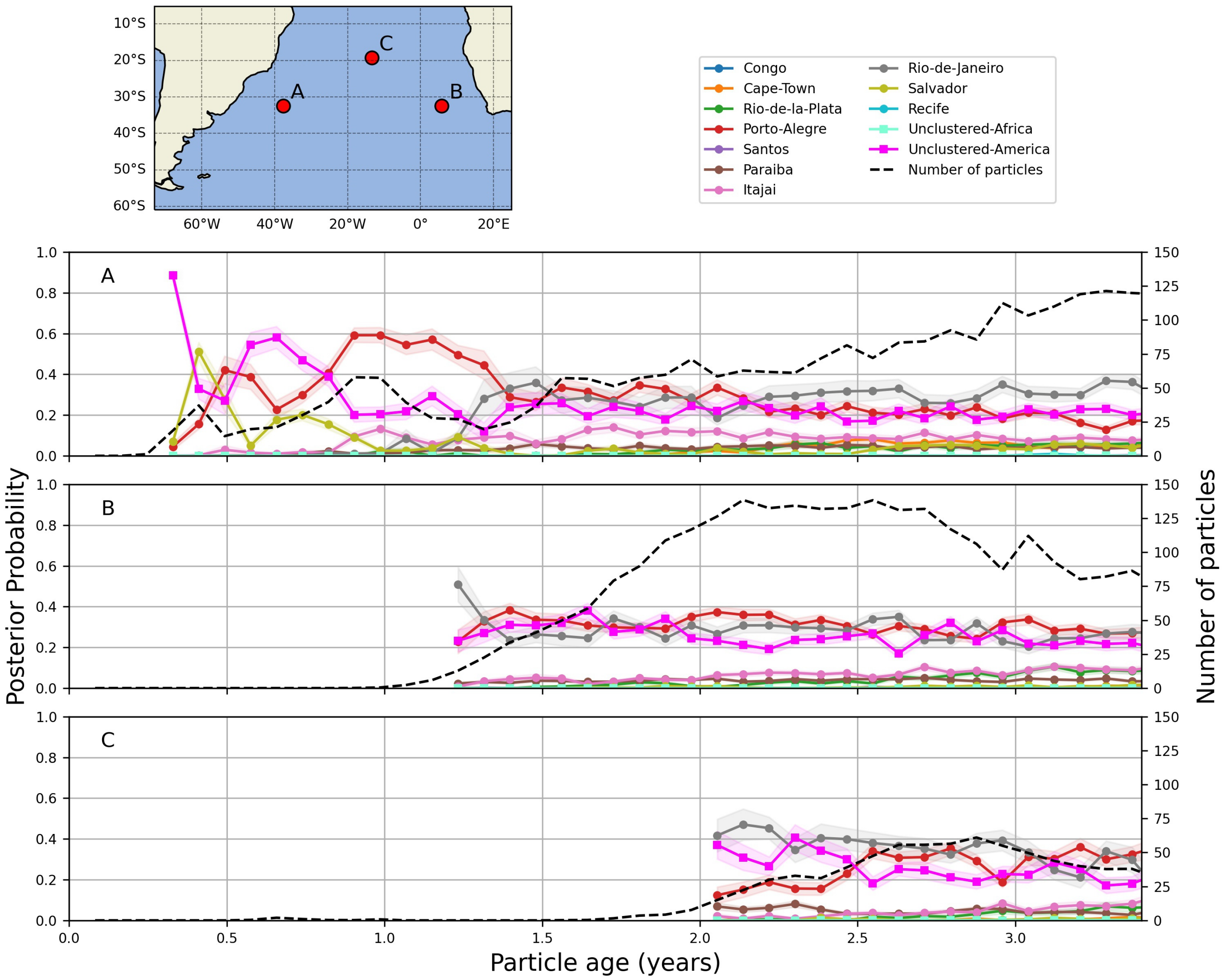

Figure S3. Local posterior age distributions at three different locations for the simulation with the resuspension parameter $\lambda_r = 171$ days. The map on the top right marks the locations A, B, and C, that correspond to the time series shown in the plots A, B, and C. Each color in A, B and C, represents the probability $p(R_i|S_{loc})$ for a particular cluster. The color shadow shows the standard deviation associated with the probabilities. The black dashed line represents the number of particles (N) at the respective location.

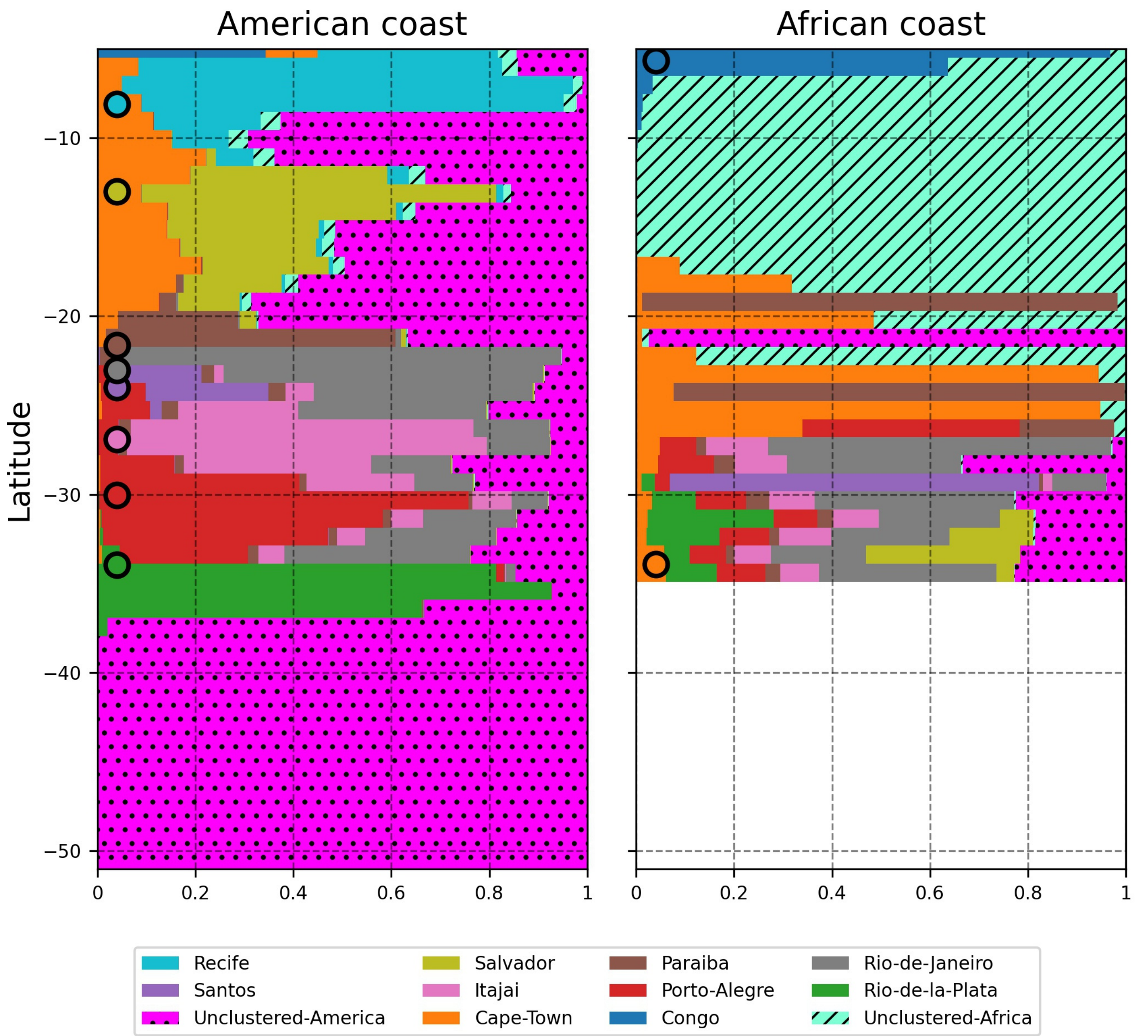

Figure S4. Horizontal bar plot for the posterior probabilities of beached particles (x-axis) at a specific latitude (y-axis) for the simulation with the resuspension parameter $\lambda_r = 171$ days. The panel on the left shows the probabilities at the American Coast and the panel on the right the probabilities at the African coasts. Each color is associated with a cluster, shown in the legend at the bottom. Each latitude has a corresponding horizontal bar summing the probabilities from the clusters at that latitude to 1. The round markers on the left of each plot represent the latitudes of the clusters. If the marker is on the left panel, the cluster is at the American coast, and if the marker is in the right panel, the cluster is located at the African coast.

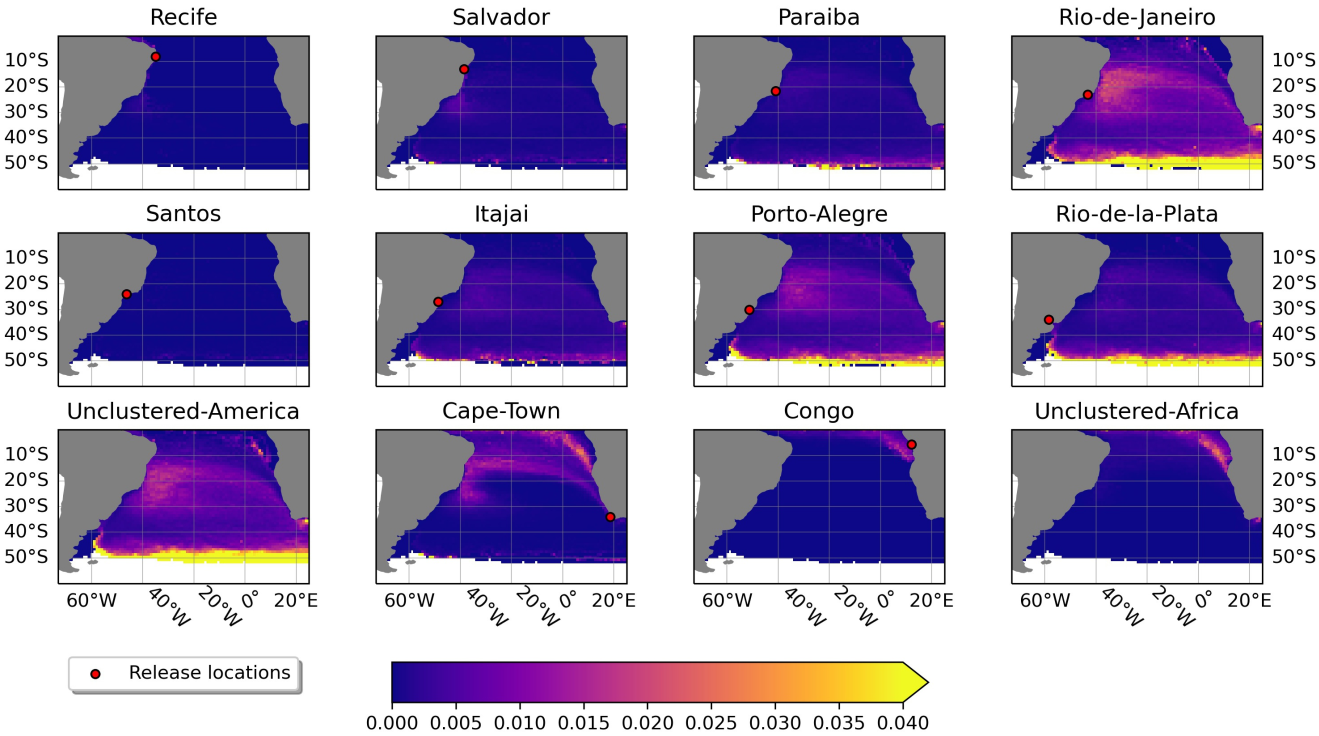

Figure S5. Standard deviation map of the posterior probability obtained from 100 samples. The units of the colorbar represent the fraction of the posterior probability.