Supplementary Information for

Global continental and oceanic emissions of atmospheric microplastics inferred from pattern-restricted Bayesian inversion

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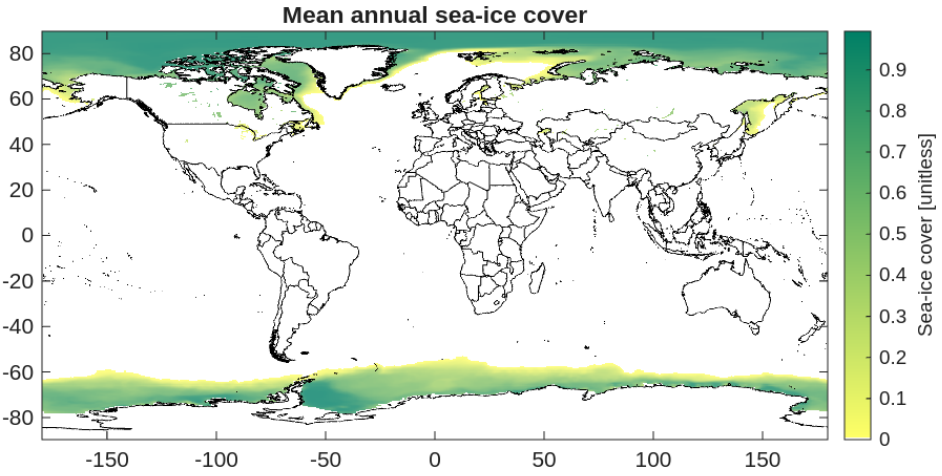

Figure S1. Mean annual sea-ice cover used in the study.

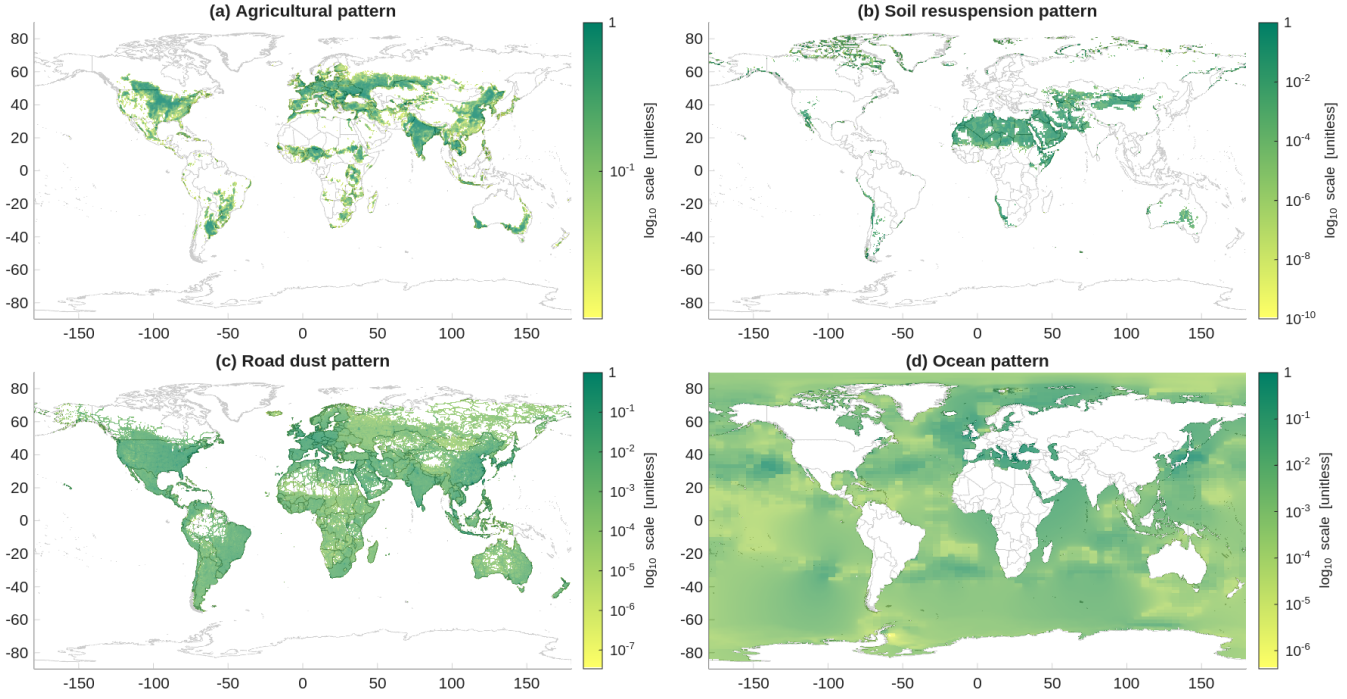

Figure S2. Four patterns considered as sources of MPs are displayed here: agriculture, soil resuspension, road dust, and ocean. Data that are available in monthly resolution are averaged here.

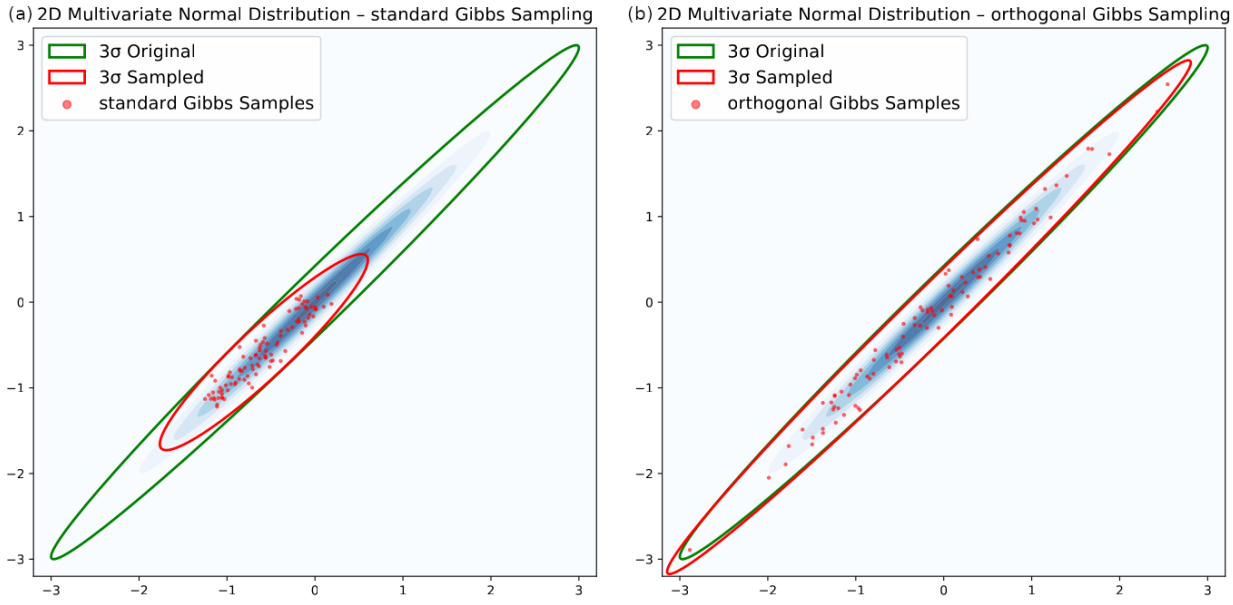

Figure S3. Standard vs. orthogonal Gibbs sampling in a highly correlated 2D Normal distribution. 100 samples from both methods are plotted as well as 3 sigma ellipses of both the distribution and the samples.

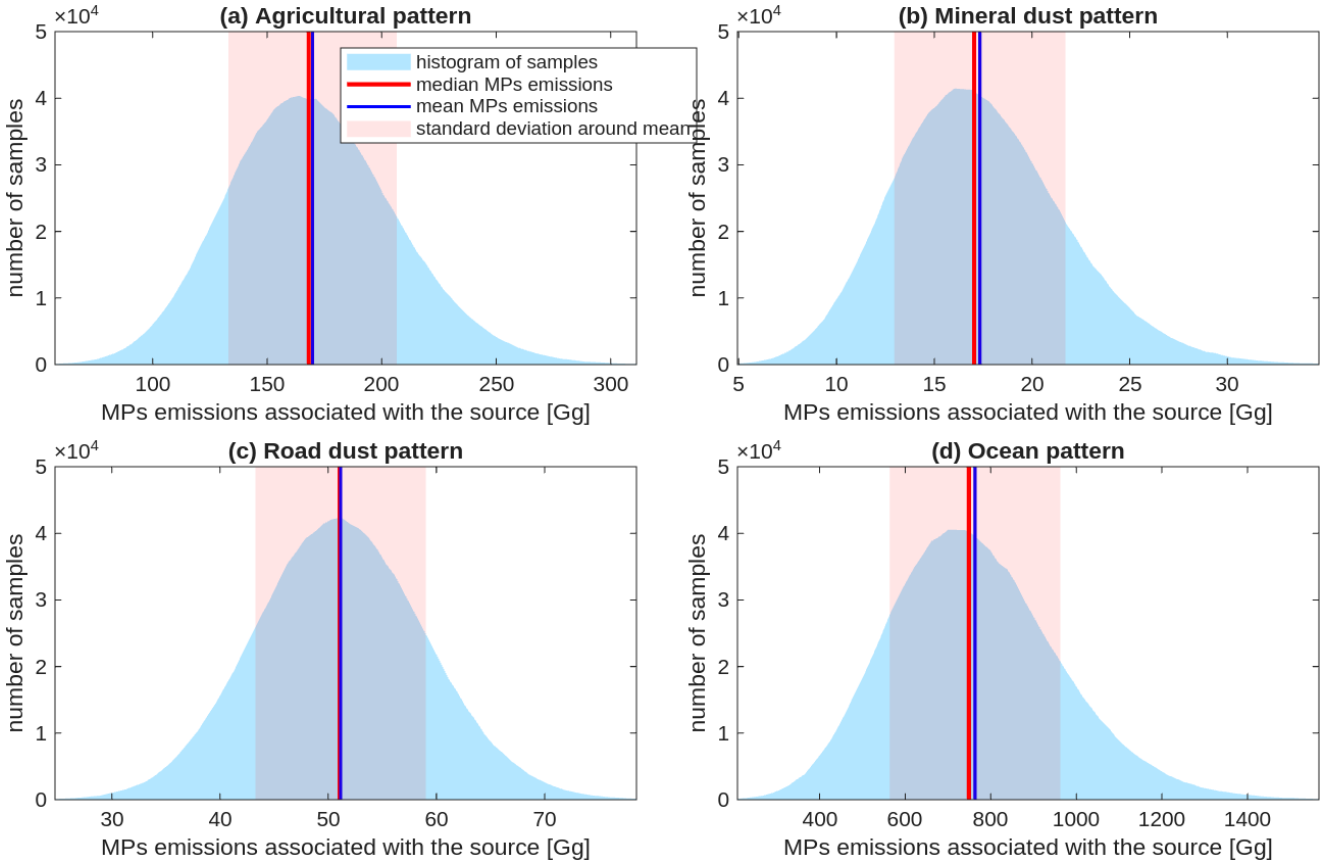

Figure S4. For each pattern (given in the title of each plot), histogram of Gibbs 1 million samples is given recalculated to respective associated MPs emissions. Median and mean of samples are given using red and blue lines, respectively, while full red area indicate one standard deviation around the mean.

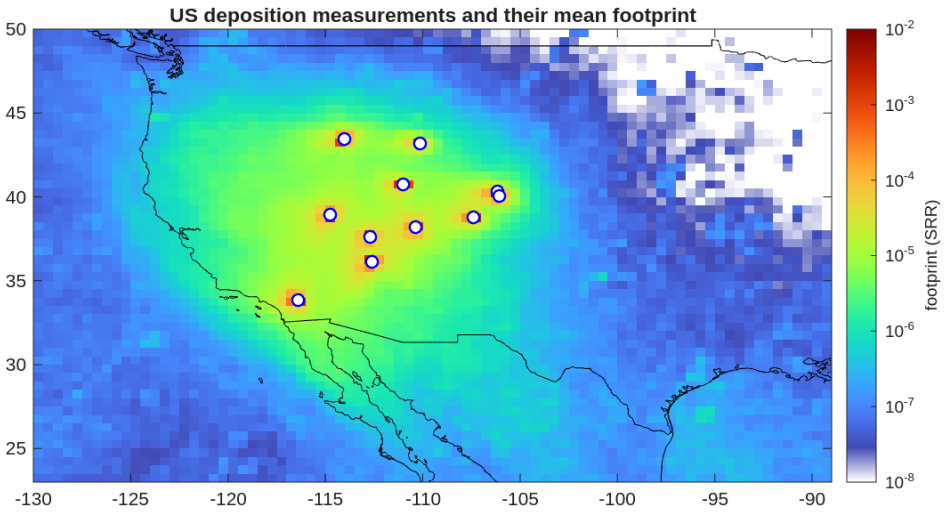

Figure S5. US deposition measurements used in this study (white circles) together with their corresponding averaged model footprints.

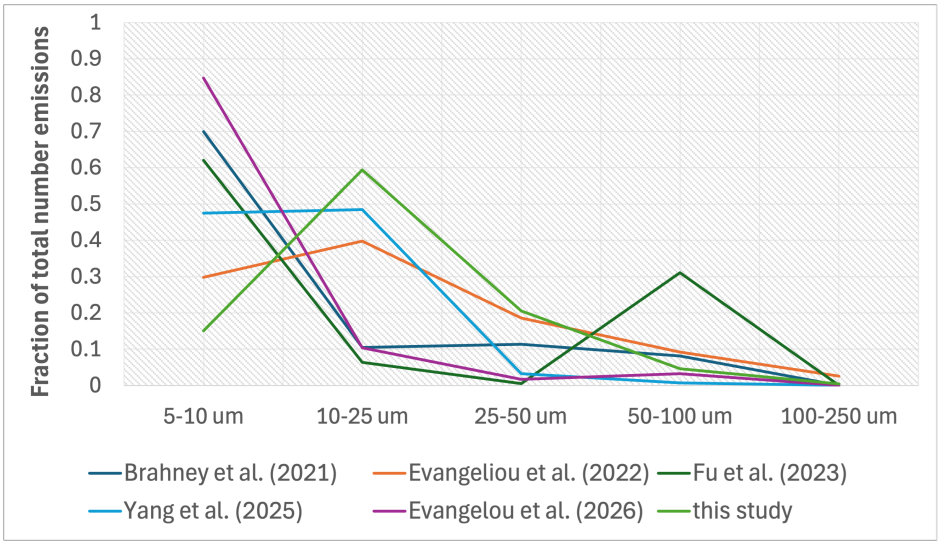

Figure S6. Fractions of emitted particles.

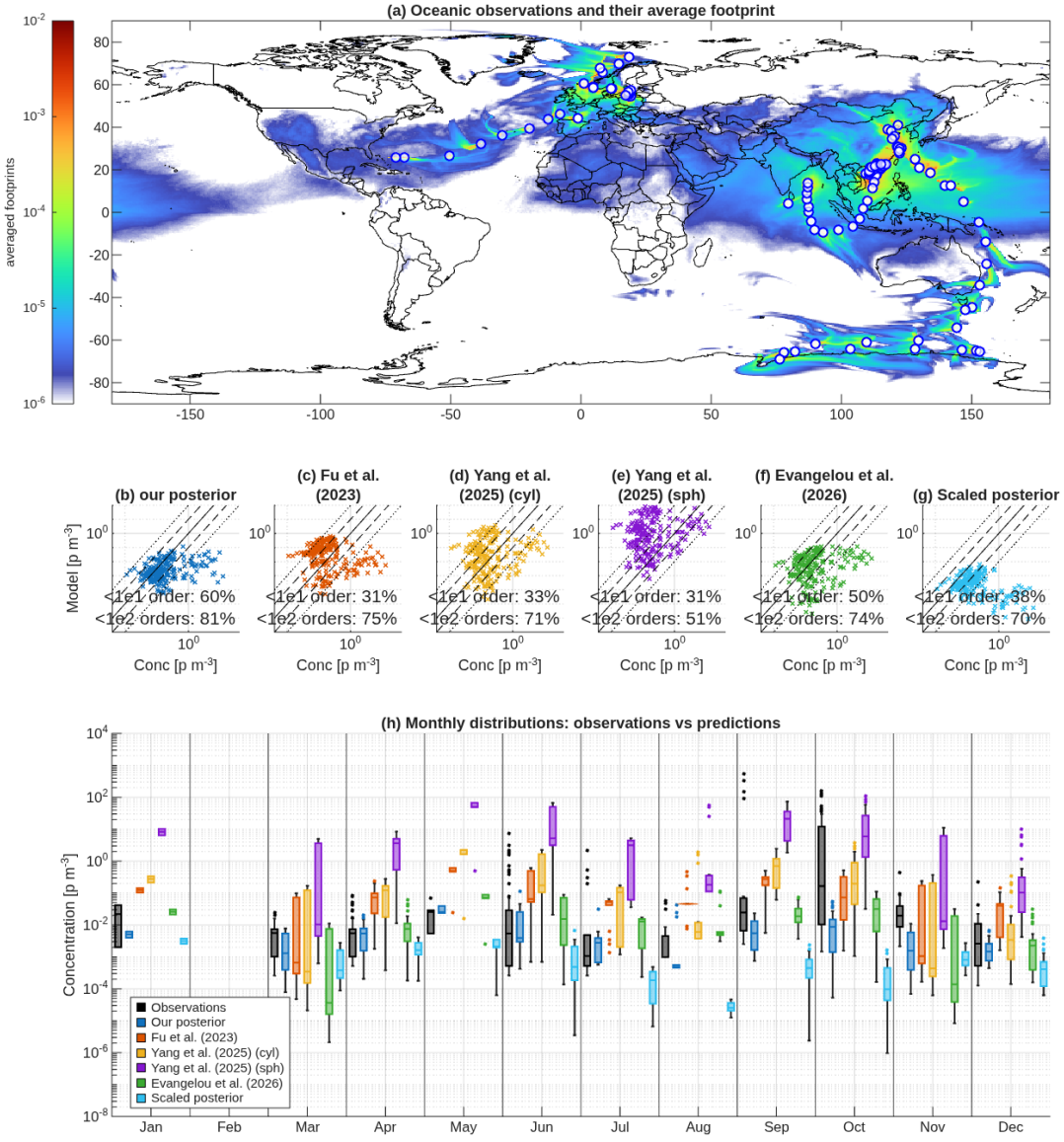

Figure S7. (a) Global distribution of ocean concentration measurements used in this study (white circles) together with their corresponding averaged model footprints. (b–g) Comparison between observed and reconstructed MPs concentrations over the ocean for (b) our posterior estimate, (c) Fu et al. (2023), (d) Yang et al. (2025) assuming cylindrical particles, (e) Yang et al. (2025) assuming spherical particles, (f) Evangelou et al. (2026), and (g) our scaled posterior, accompanied by the fraction of predictions within one and two orders of magnitude of the observations. (h) Associated monthly distributions of observed and modeled concentrations.

References

Evangelou, I., Bucci, S., and Stohl, A.: Atmospheric microplastic emissions from land and ocean, Nature, pp. 1–4, https://doi.org/10.1038/s41586-025-09998-6, 2026.

Fu, Y., Pang, Q., Ga, S. L. Z., Wu, P., Wang, Y., Mao, M., Yuan, Z., Xu, X., Liu, K., Wang, X., et al.: Modeling atmospheric microplastic cycle by GEOS-Chem: An optimized estimation by a global dataset suggests likely 50 times lower ocean emissions, One Earth, 6, 705–714, https://doi.org/10.1016/j.oneear.2023.05.012, 2023.

Yang, S., Brasseur, G., Walters, S., Lichtig, P., and Li, C. W.: Global atmospheric distribution of microplastics with evidence of low oceanic emissions, npj Climate and Atmospheric Science, 8, 81, https://doi.org/10.1038/s41612-025-00914-3, 2025.