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An analogue based forecasting system for Mediterranean marine litter concentration

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The pollution of the seas and oceans due to plastic waste has become one of the environmental problems that generate the most concern, both for the scientific community and for society as a whole. In that framework, marine litter (ML) forecasting systems are potentially a powerful tool for an efficient management of ML, to optimize the removal strategies and/or to better characterize the ML distribution. ML forecasting systems are typically based on explicit numerical models which simulate ocean currents and, afterwards, the advection and diffusion of passive particles in the ocean that mimic the evolution of ML. This approach is considered to be the most accurate one, at least as accurate as the quality of the forcing and the initial conditions are. However the downside is that this approach involves a high technical complexity and computational cost. In order to overcome those limitations we propose to explore a new approach implementing a fast and light forecasting system based on the analogue downscaling method. The main idea is to use statistical properties of the ML concentration fields, and the relationship between those fields and the state of the atmosphere to produce ML forecasts from atmospheric forecasts, which are readily available by several meteorological services. As this is a new approach never tested before for ML concentration forecasts, the first step will be to run several tests to fine-tune the methodology and to characterize its limits of validity.

Our results show that the analog-based forecast method presented here has potential to become a suitable cost effective forecasting method for ML concentration. The quality of the forecasts depends on the region of application: the larger the region of application the better, as we get better results for the whole Mediterranean or for the East/West basins than in smaller local areas. The method struggles to capture the extreme values as it produces smooth spatio-temporal patterns of ML concentration. Therefore, in locations or regions where short intense events or small scale features dominate the variability, the method performs worse. On the other hand, if instead of the time variability, what are aimed at are the spatial structures, the method shows high skills.