On the trail of ocean plastic

Plastic owes its commercial success to its durability. But this quality becomes a flaw when it comes to plastics in the environment, where they pose toxicity problems, among others.

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Masked booby surrounded by plastic waste, Clipperton.

The story begins like a holiday anecdote, with a researcher finding two plastic bottles on a beach in New Caledonia. According to their labels, one came from the Solomon Islands, the other from Papua New Guinea. How strange... Because according to ocean circulation models, neither should have been on that beach - no known surface current could have carried them there.

This inconsistency led a research team to model the movement of plastics in the region. They began by using surface geostrophic currents, tracked over the last 30 years by satellite altimetry, to show that these bottles should have ended up in Australia - which is not what happened. To get them to New Caledonia, the scientists had to factor in the influence of wind and oceanic mesoscale eddies (10-100 km), the maritime equivalent of depressions and anticyclones in the atmosphere.

This allowed them to reconstruct the journey the bottles took over 60-90 days travelling from the Solomon Islands and Papua New Guinea to New Caledonia. They were able to highlight the role of winds, waves, currents, tides and eddies in transporting plastics across the open sea. Thanks to these cumulative factors, scientists were able

"Research around the dispersal of marine pollution in Indonesia and Southeast Asia has mainly focused on the distribution of plastics at the ocean surface, while the behaviour and fate of plastics in the water column have not yet been sufficiently studied. To fill this gap, I am seeking to understand the dynamics of plastic dispersal at different ocean depths, using a digital model and Lagrangian methods. The results should offer new insights into plastic distribution pathways, support Indonesia's efforts to mitigate marine pollution, and ultimately, strengthen international collaboration for sustainable ocean management."

Dava Amrina, University of Western Brittany, France

••• Ocean currents alone do not explain the trajectory of floating plastics in the ocean •••

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Plastic waste on the surface of the ocean.

to simulate large ocean gyres in subtropical regions, which accumulate and trap plastics that have been floating on the surface, sometimes for more than 20 years.

This work was then adapted to simulate the flow of plastics across Indonesia's 17,000 islands. The country is aiming to reduce its plastic waste emissions by 70%. Furthermore, it is trying to improve the way it tracks this pollution, to identify landing areas and organise clean-up campaigns. Analysis of models has confirmed the importance of sources of pollution coming from rivers. It has also highlighted the key role of landing areas not only as waste sinks, but also as sources of pollution when rubbish is recaptured by the sea. 60% of waste washes up less than 1,000 km from its point of entry into the ocean. A significant level of connectivity on a larger scale, towards the Indian Ocean, has also been demonstrated.

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