Modelling the three-dimensional distribution of plastics in the global ocean

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Our motivations

Environment | PLANET OR PLASTIC?

The world agrees there's a plastic waste crisis—can it agree on a solution?

Many countries are disappointed the UN didn't reach a more definitive agreement on plastic pollution in Kenya, yet efforts continue at national and international levels.

Plastic horror: Horrific pictures show crisis in marine pollution

These are the shocking images being used to help fight plastic pollution in the world’s oceans.

Plastics 'leading to reproductive problems for wildlife'

Scientists say some marine animals with high levels of pollutants are failing to calve

Plastic pollution: Could we have solved the problem nearly 50 years ago?

What if we’d listened to the researchers who first warned us about plastic pollution in the 1970s?

Study Suggests Deep-Sea Creatures Are Eating Plastic

Recent research suggests that no marine ecosystem is spared from the impacts of plastic pollution.

Dead whale found with 40 kilograms of plastic in its stomach

Plastic in the ocean: the facts, effects and new EU rules

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Model description

- Nucleus for European Modelling of the Ocean (NEMO) configuration ORCA2_LIM3 (https://www.nemo-ocean.eu/)
- Positively and negatively buoyant plastics
- Plastic inputs along the coastlines – increasing over 50 years
- Control experiment with no plastic removal
- Introduction of ‘sedimentation’ removal rate – $90 \text{ m year}^{-1}$ and $30 \text{ m year}^{-1}$
Positively buoyant plastics

Distribution of positively buoyant plastics (normalised by global average concentration per area)

Vertical profile of positively buoyant plastics (normalised by total global plastic concentration)
Positively buoyant plastics

Flux of positively buoyant plastics into the “sediments” (90 m year\(^{-1}\) removal rate, normalised by global average flux into the “sediments”)

Vertical profile of positively buoyant plastics (normalised by total global plastic concentration)
Negatively buoyant plastics

Distribution of negatively buoyant plastics (normalised by global average concentration per area)

Vertical profile of negatively buoyant plastics (normalised by total global plastic concentration)
Negatively buoyant plastics

Flux of negatively buoyant plastics into the “sediments” (90m year$^{-1}$ removal rate, normalised by global average flux into the “sediments”)

Vertical profile of negatively buoyant plastics (normalised by total global plastic concentration)
Plastics are essentially present at all depths in the oceans. Modelling allows us to explore possible plastic “hotspots”:

- Higher resolution simulations
- Degradation as a function of age – tendency towards neutral buoyancy
- Inclusion of biological interactions – biofouling
- Removal of plastics into sea ice
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Questions?

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