

# 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.

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

Society - 12-10-2018 - 08:56

## 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

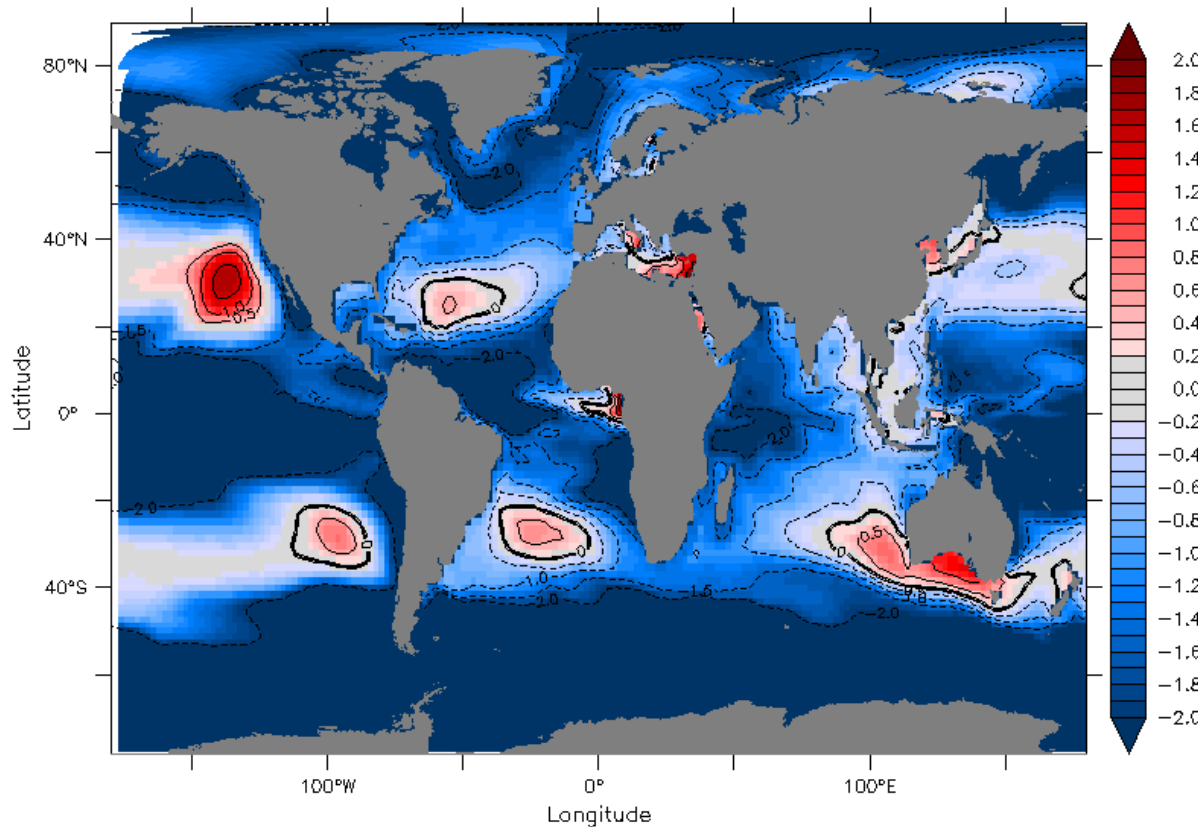
# Model description



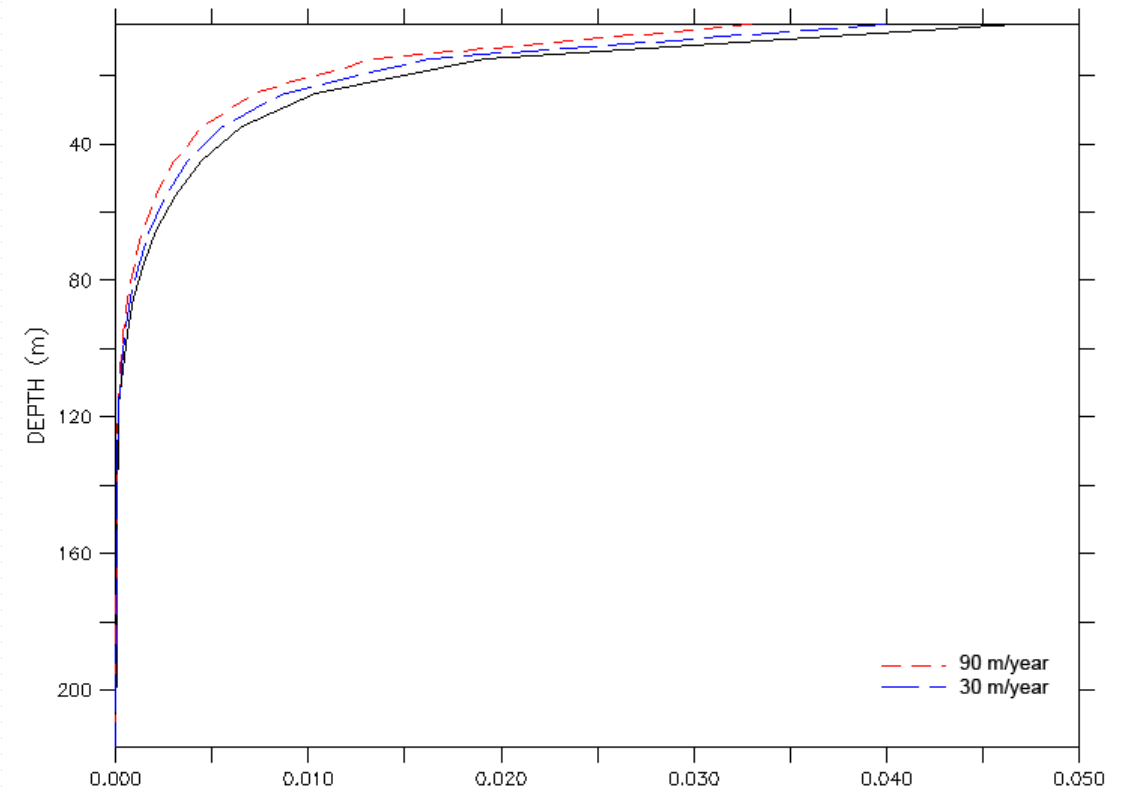
- Nucleus for European Modelling of the Ocean (NEMO) configuration ORCA2\_LIM3 (<https://www.nemo-ocean.eu/>)
- Positively and negatively buoyant plastics
- Plastic inputs along the coastlines – increasing over 50 years
- Control experiment with no plastic removal
- Introduction of ‘sedimentation’ **removal rate** – *90 m year<sup>1</sup>* and *30 m year<sup>1</sup>*



# Positively buoyant plastics

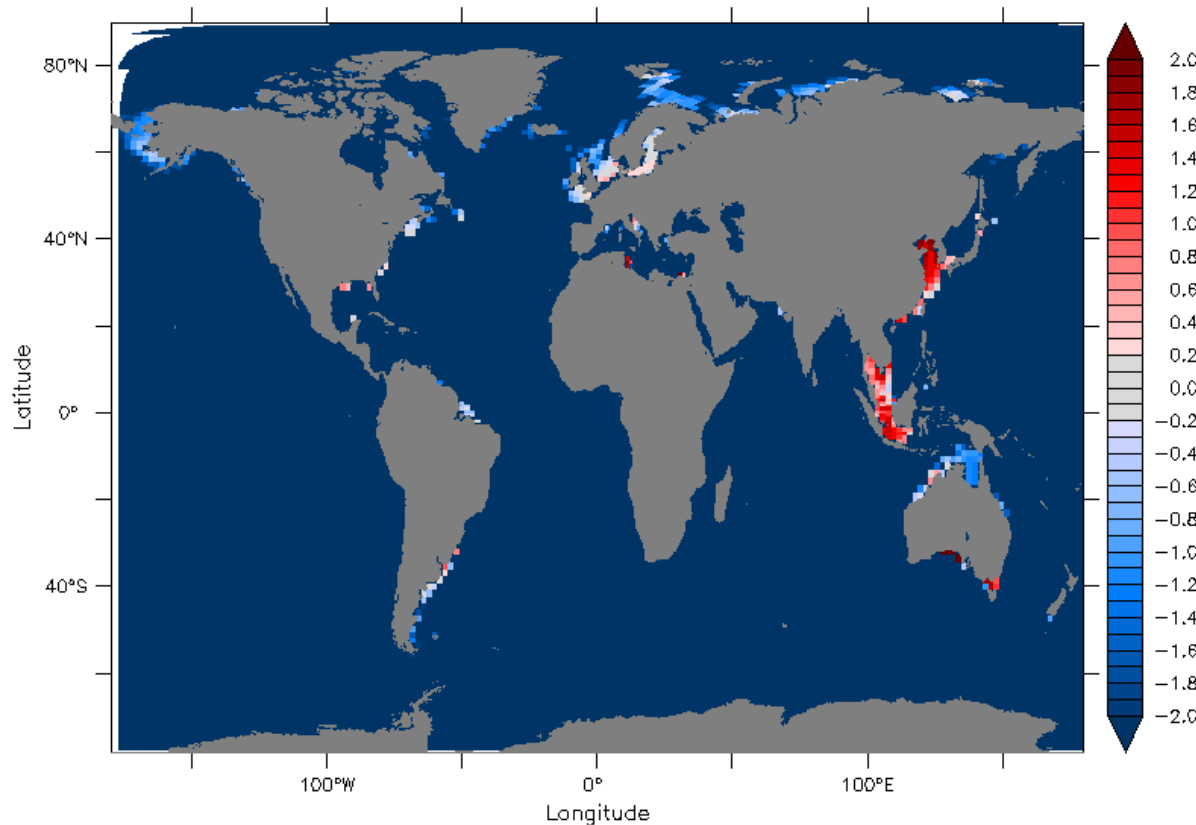


Distribution of positively buoyant plastics  
(normalised by global average concentration per area)

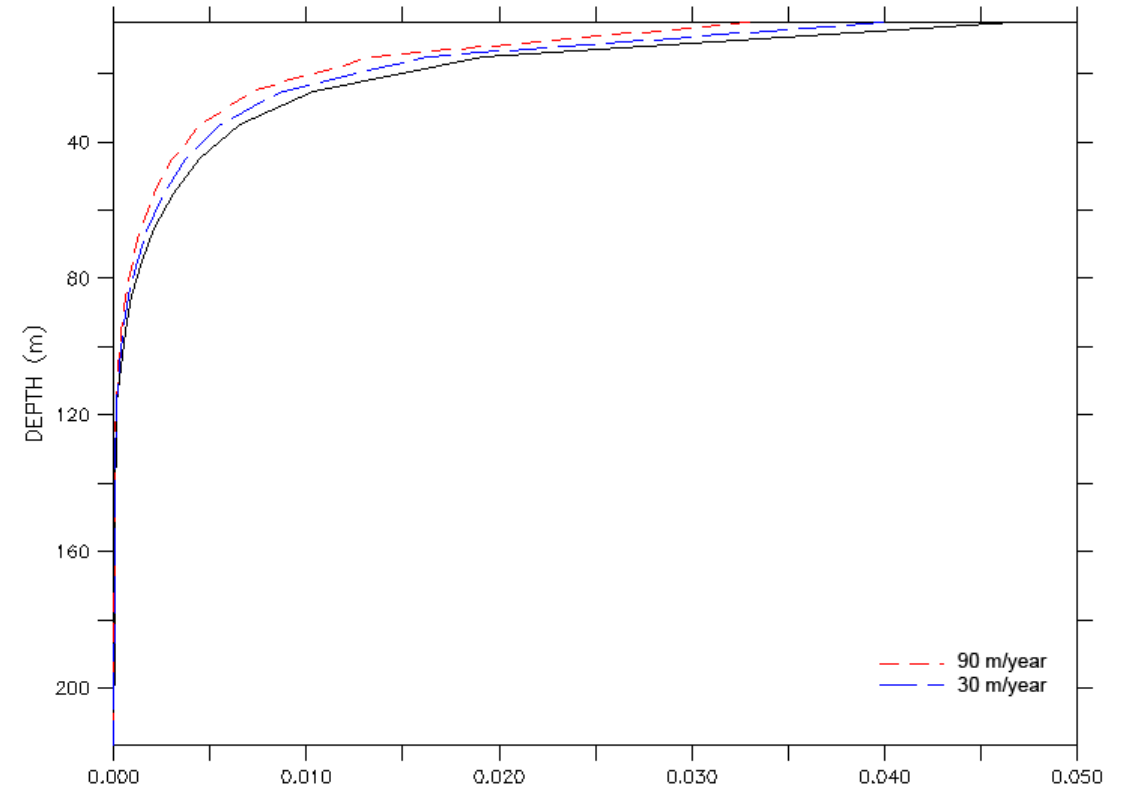


Vertical profile of positively buoyant plastics  
(normalised by total global plastic concentration)

# Positively buoyant plastics

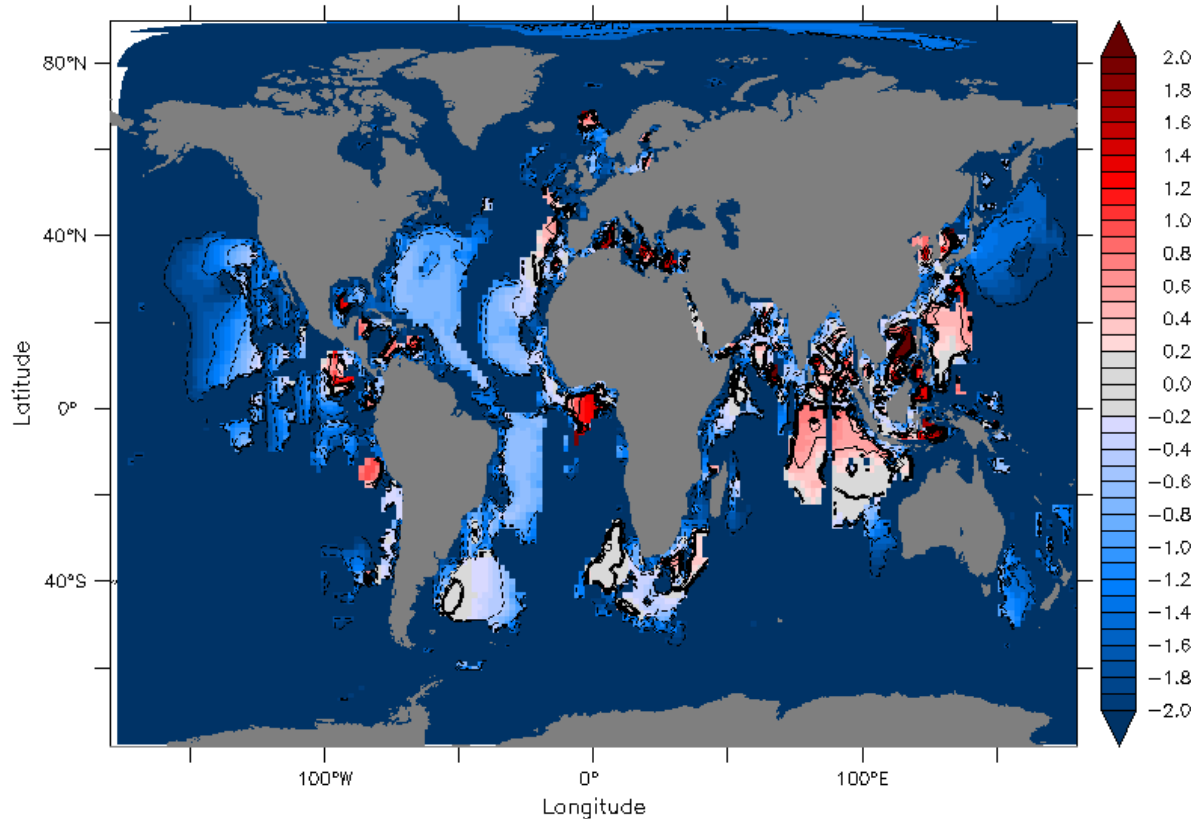


Flux of positively buoyant plastics into the “sediments” (90m year<sup>-1</sup> removal rate, normalised by global average flux into the “sediments”)

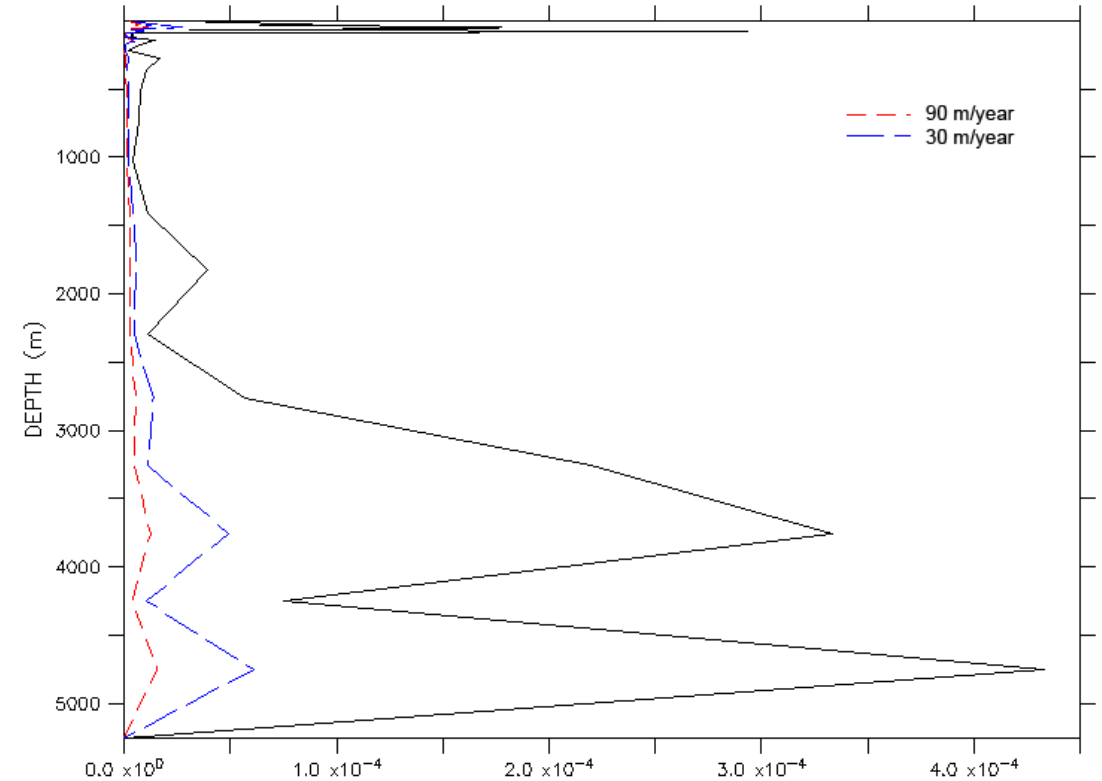


Vertical profile of positively buoyant plastics (normalised by total global plastic concentration)

# Negatively buoyant plastics

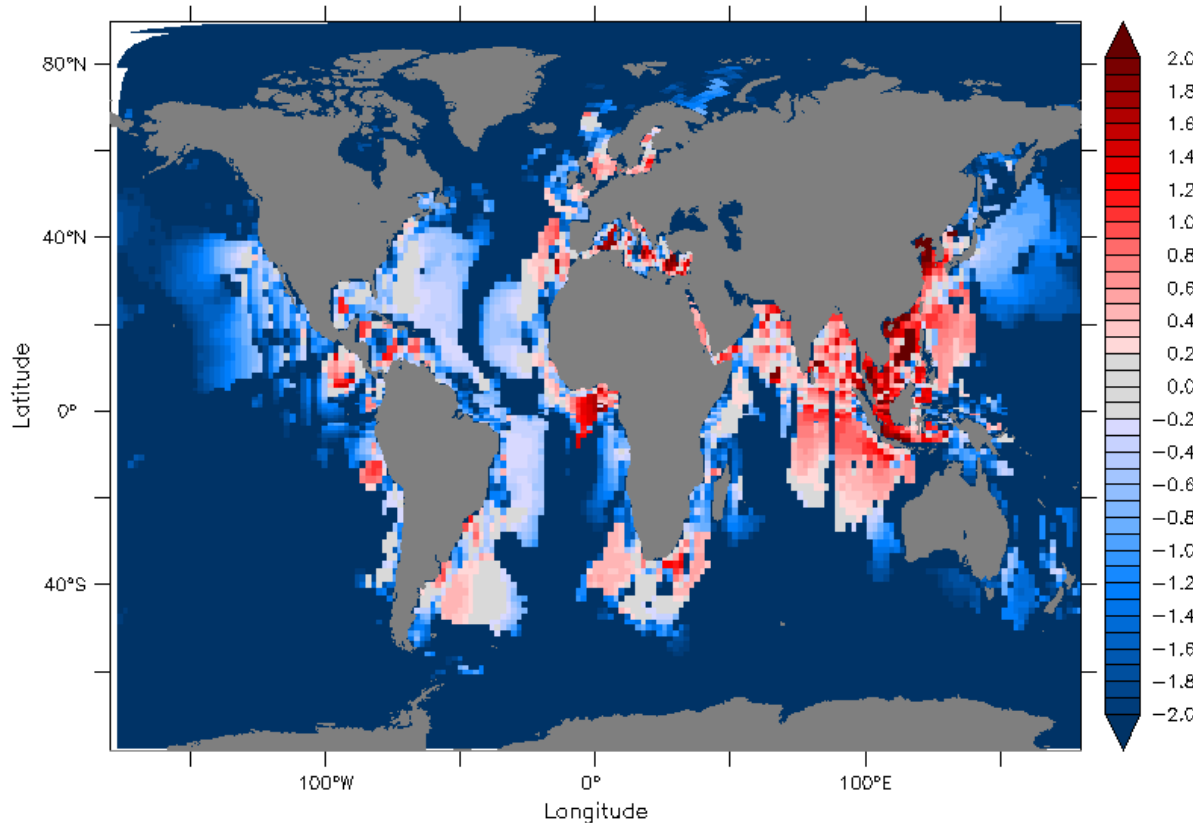


Distribution of negatively buoyant plastics (normalised by global average concentration per area)

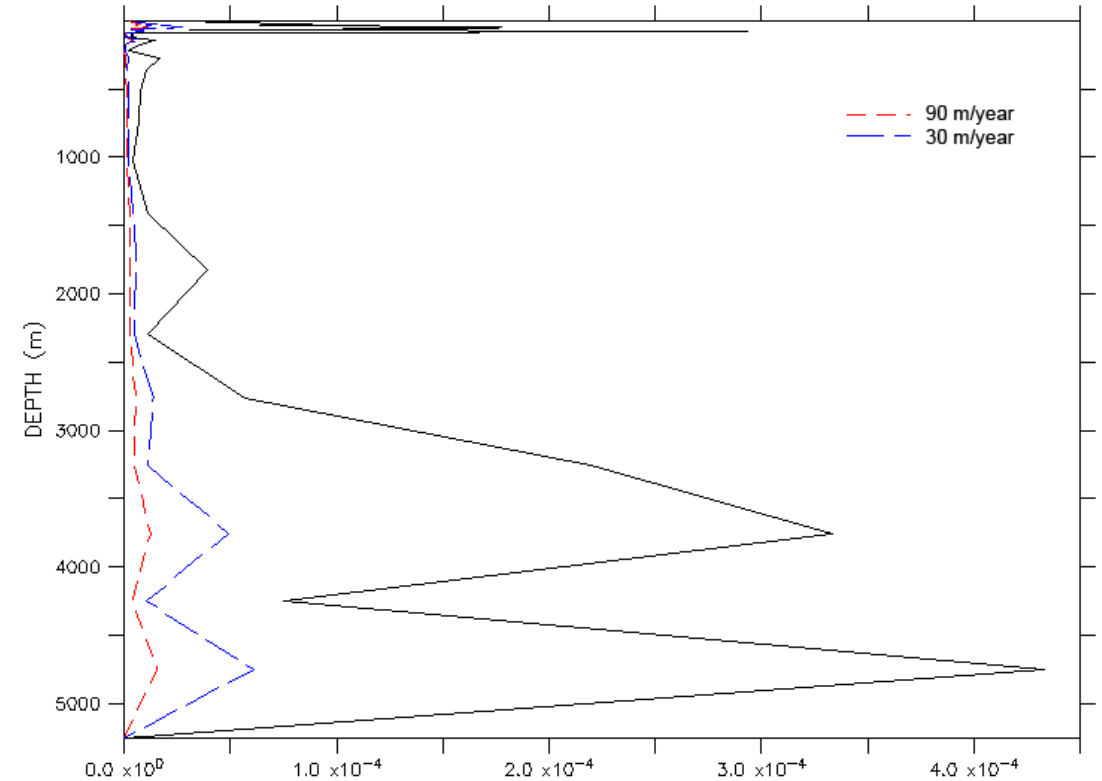


Vertical profile of negatively buoyant plastics (normalised by total global plastic concentration)

# Negatively buoyant plastics



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



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

# Summary & next steps

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Plastics are essentially present at all depths in the oceans  
Modelling allows us to explore possible plastic “hotspots”

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



# Acknowledgements & thanks



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## Questions?

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