Plastic Skies: How Microplastics Are Shaping Our Weather and Climate

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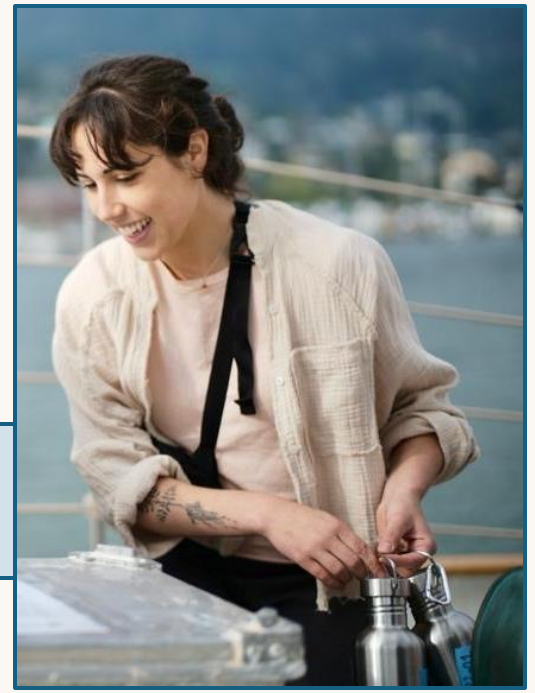
One Ocean Youth Panel

Canada

About me

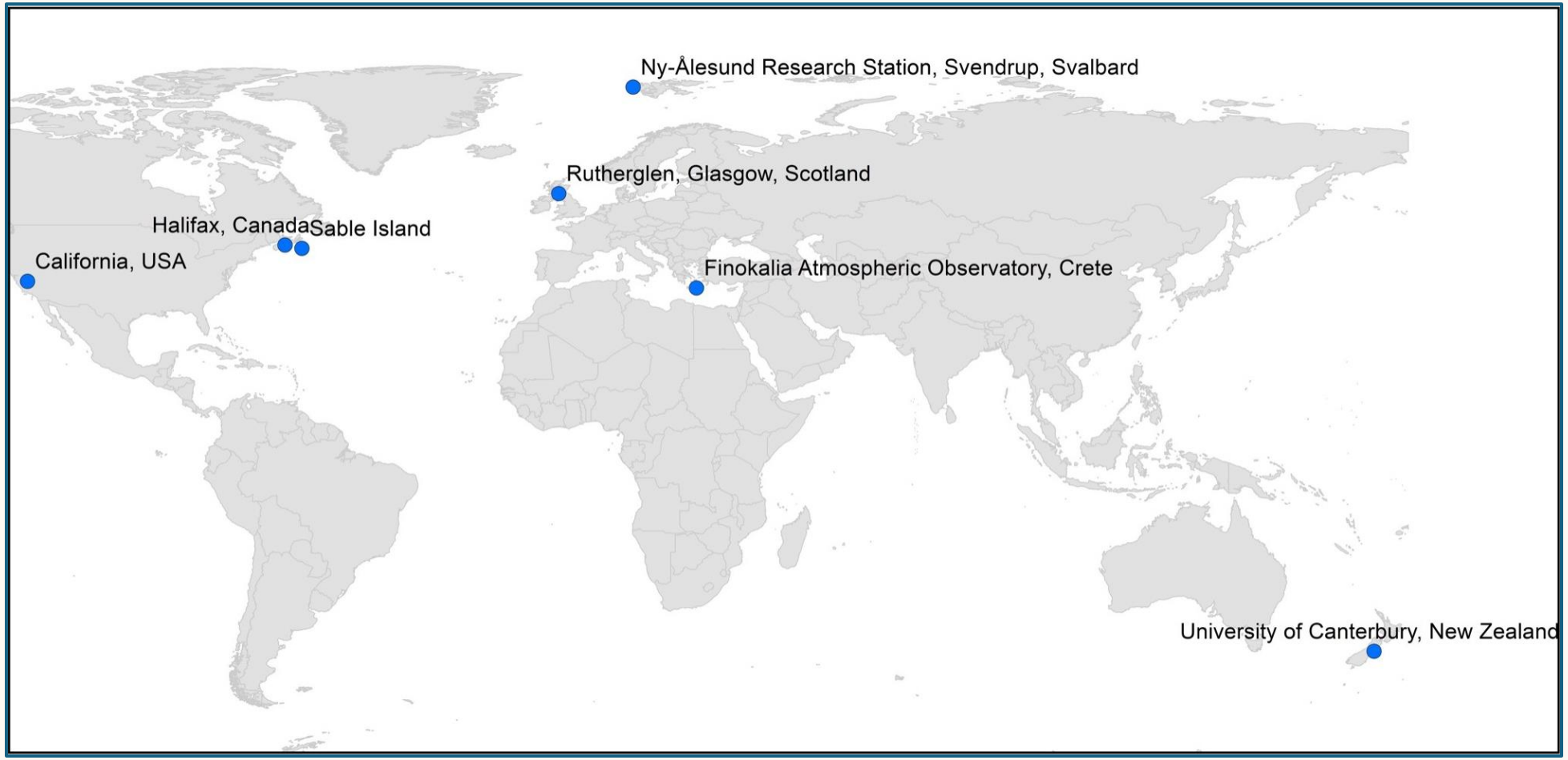


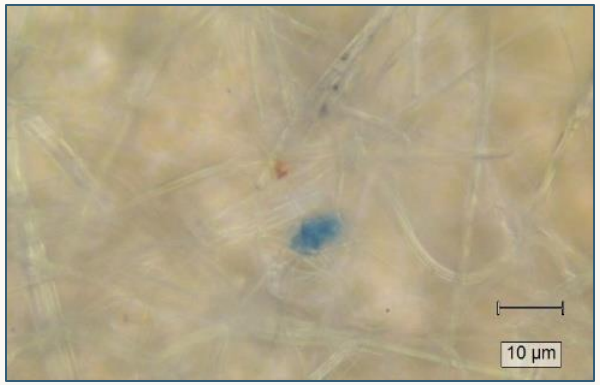
Master of Environmental Studies (MES)

Dalhousie University

- Microplastics (MPs) in lobster tail muscle tissue
- Airborne MPs in San Francisco Bay
  (LeBlanc et al., 2025; LeBlanc et al., (*in prep*))
- Transport of MPs by hurricane Larry, post-tropical storm Fiona
  (Ammendolia et al. (*in prep*); Ryan et al., 2023)

A global effort to map airborne MPs

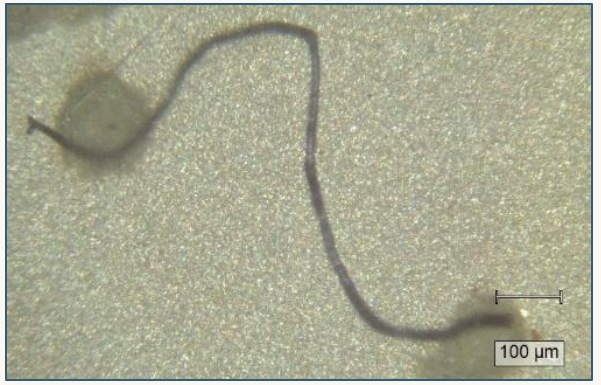



10 µm


100 µm


10 µm


50 µm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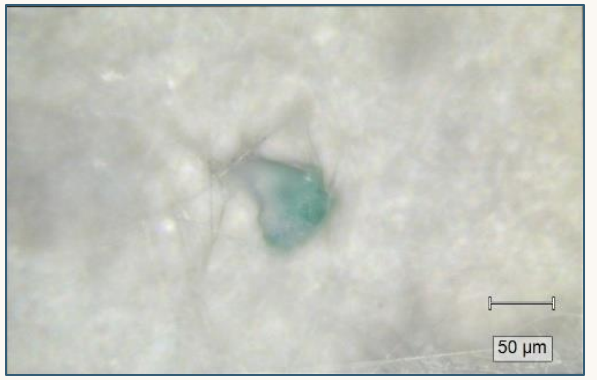
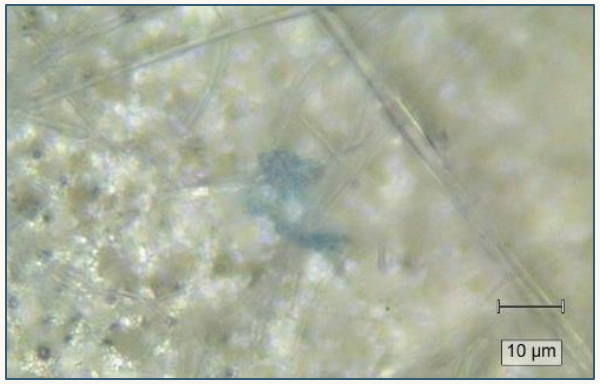

50 µm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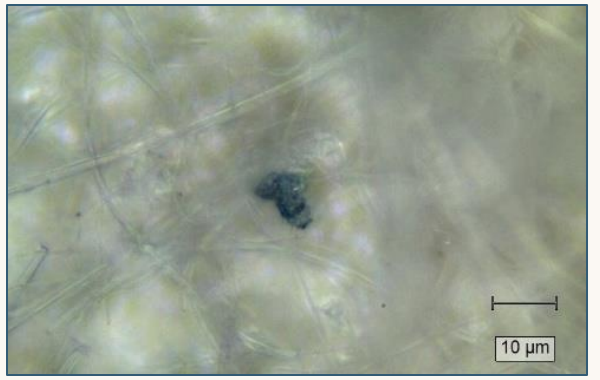

10 µm

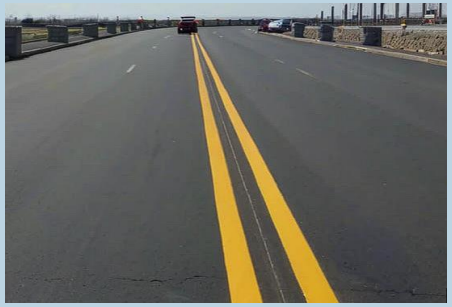
Sources and Transport

Sources

Road dust

Tire and brake wear, polymer-modified bitumen, painted road markings, vehicle components

~28% of fine particulate matter in urban air



Up to 84% of MPs in urban air

Tire wear: ~2.9 million tonnes/year

(O'Brien et al., 2023)

Sources

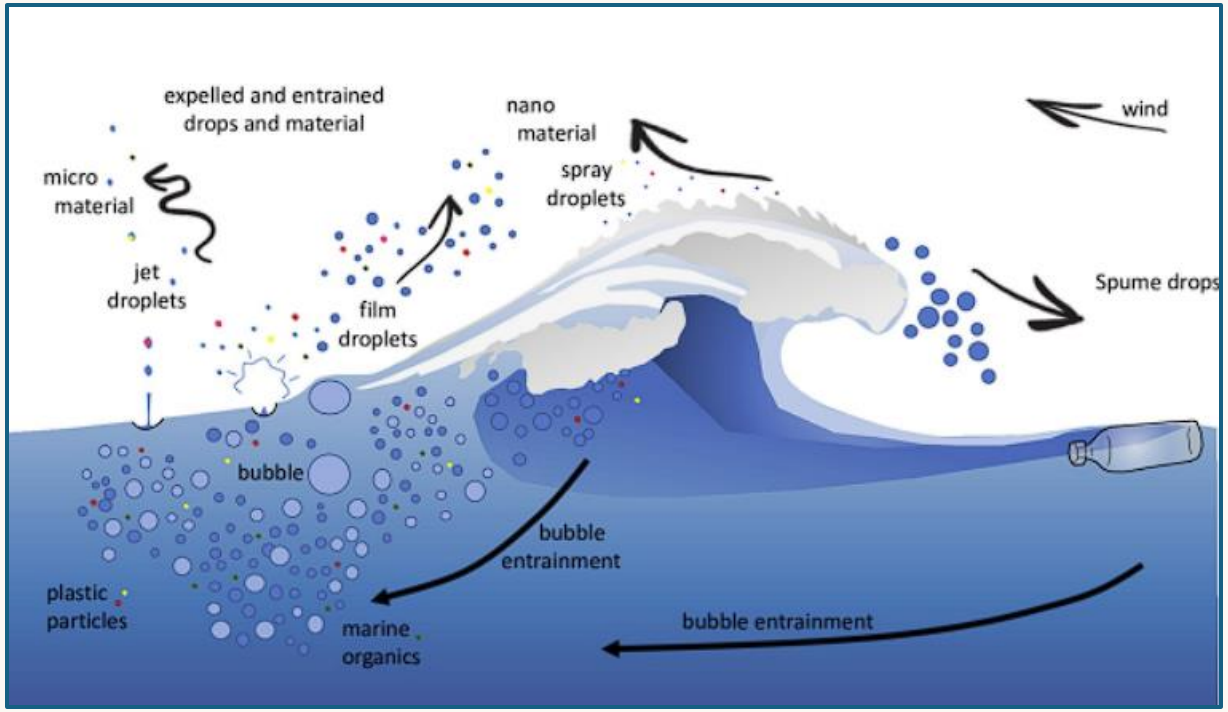
Textile fibres

- Fleece, nylon, polyester
- Machine drying of synthetic textiles releases thousands of MPs
- 8 - 47 million airborne fibres week/laundromat

(Erdle et al., 2025; Napper et al., 2023)

Ocean spray

- Bubbles burst from breaking waves
- Continuous source emitting ~136,000 tonnes/year



(Allen et al., 2020)

Sources

Industrial and urban emissions

Waste incineration

Handling and processing in factories

Simple abrasion of plastic products

(Zhang et al., 2024)

Where are they?

Svalbard

Antarctic snow

The French Pyrenees

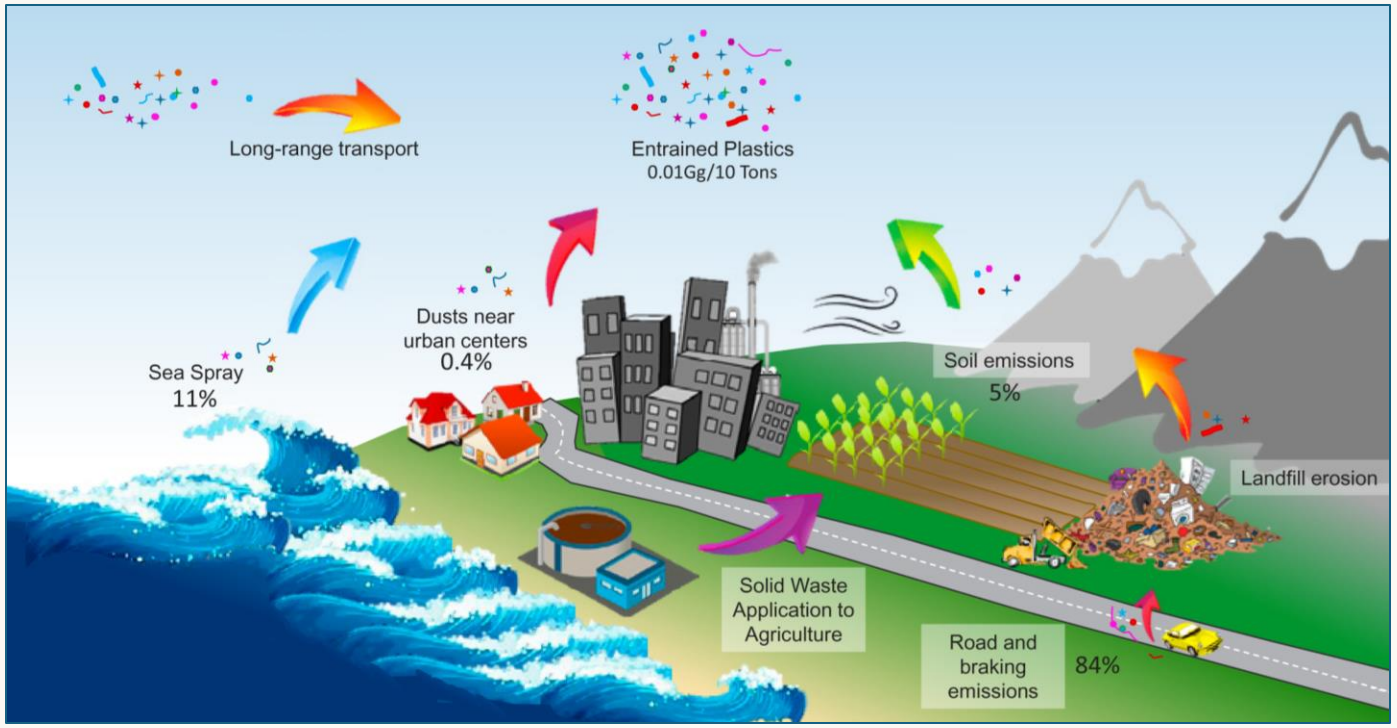
The troposphere

(Allen et al., 2019; Aves et al., 2022; MacDonald et al., 2025)

How do they travel?

Shape matters:

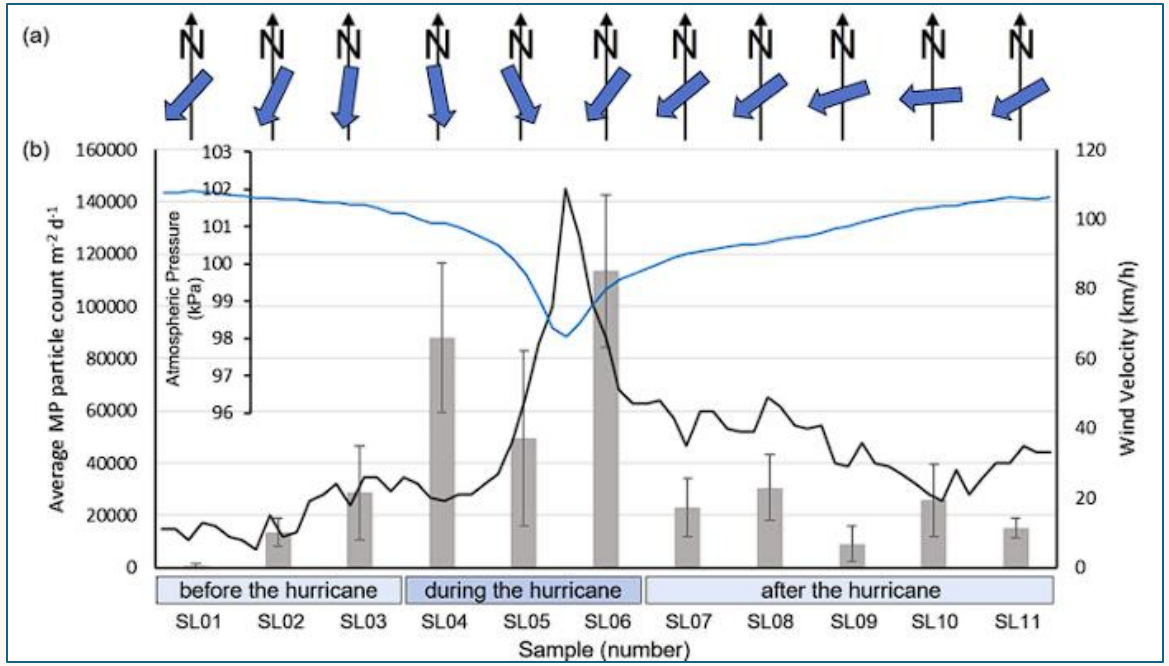
- Fibres and smaller particles (>6 µm) travel longer distances
- Flat fibres can remain airborne over 450% longer vs round fibres



(Brahney et al., 2021; Ward et al., 2024; Xiao et al., 2023)

Storms: Hurricane Larry

- North Atlantic Gyre garbage patch
- Deposition rates:
  - increased before storm
  - peaked at 113,000 MPs / m^2
  - dropped to background levels after storm
- Polyvinyl chloride and polyeurethane

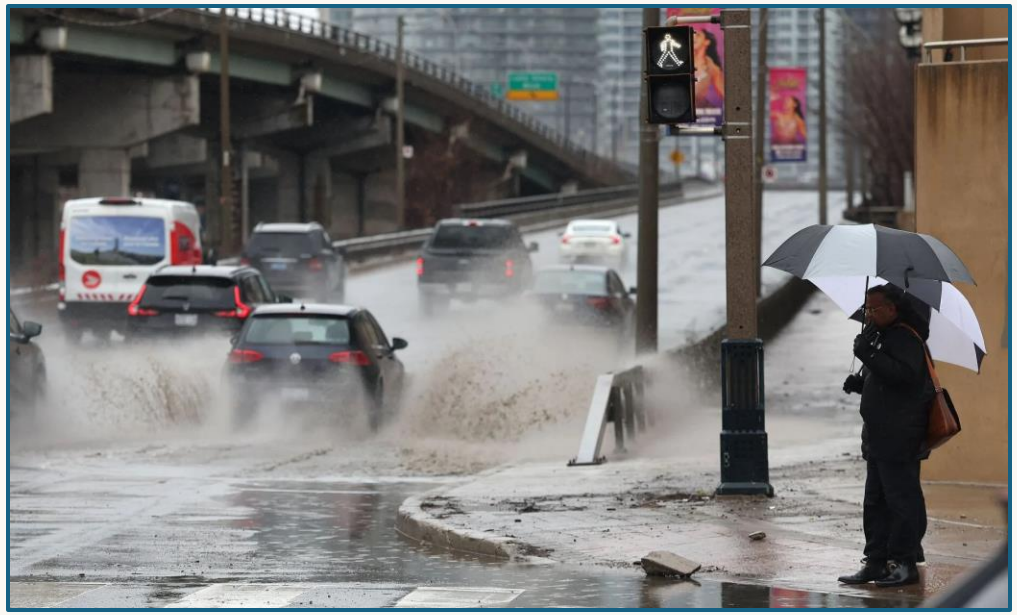


(Ryan et al., 2023)

Rainfall

Increases MP deposition:

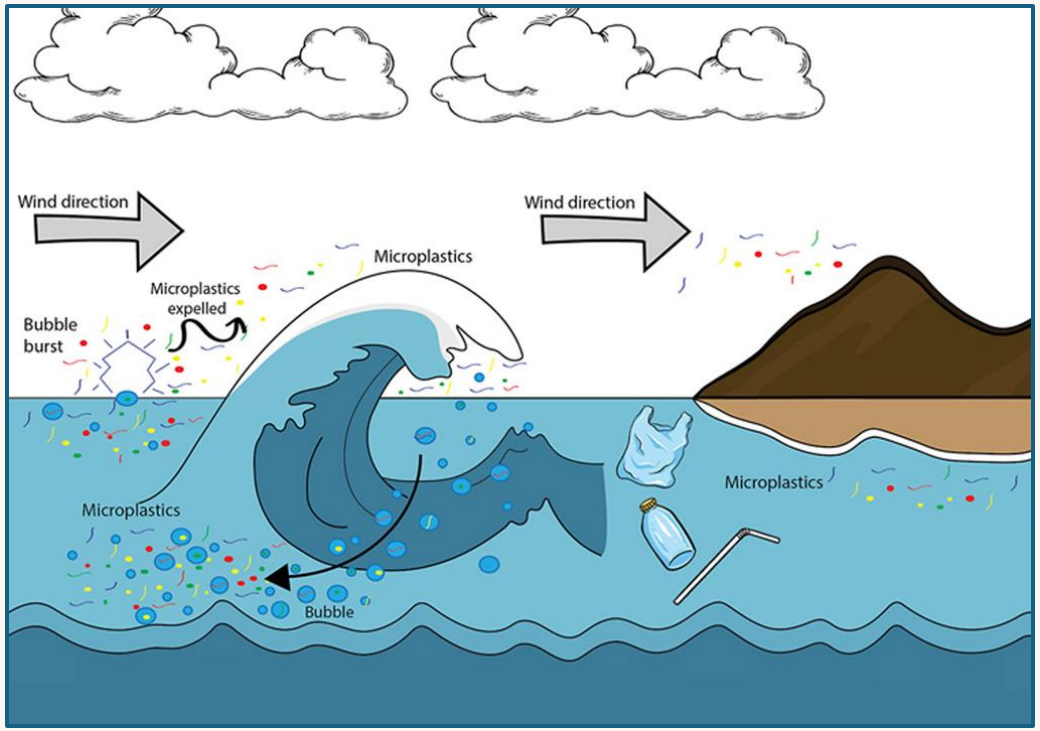
- 5-11x higher rates in urban areas
- 2-50x higher rates in tropical and subtropical regions
- Removal through direct capture and in-cloud scavenging



(Dris et al., 2015; Xu et al., 2025)

Sea Breeze

- Land heats faster than ocean
- Warm air over land rises, cooler air from ocean rushes inland to replace it = sea breeze
- Pattern reverses at night = land breeze
- Sea breeze can transport MPs from ocean surface inland

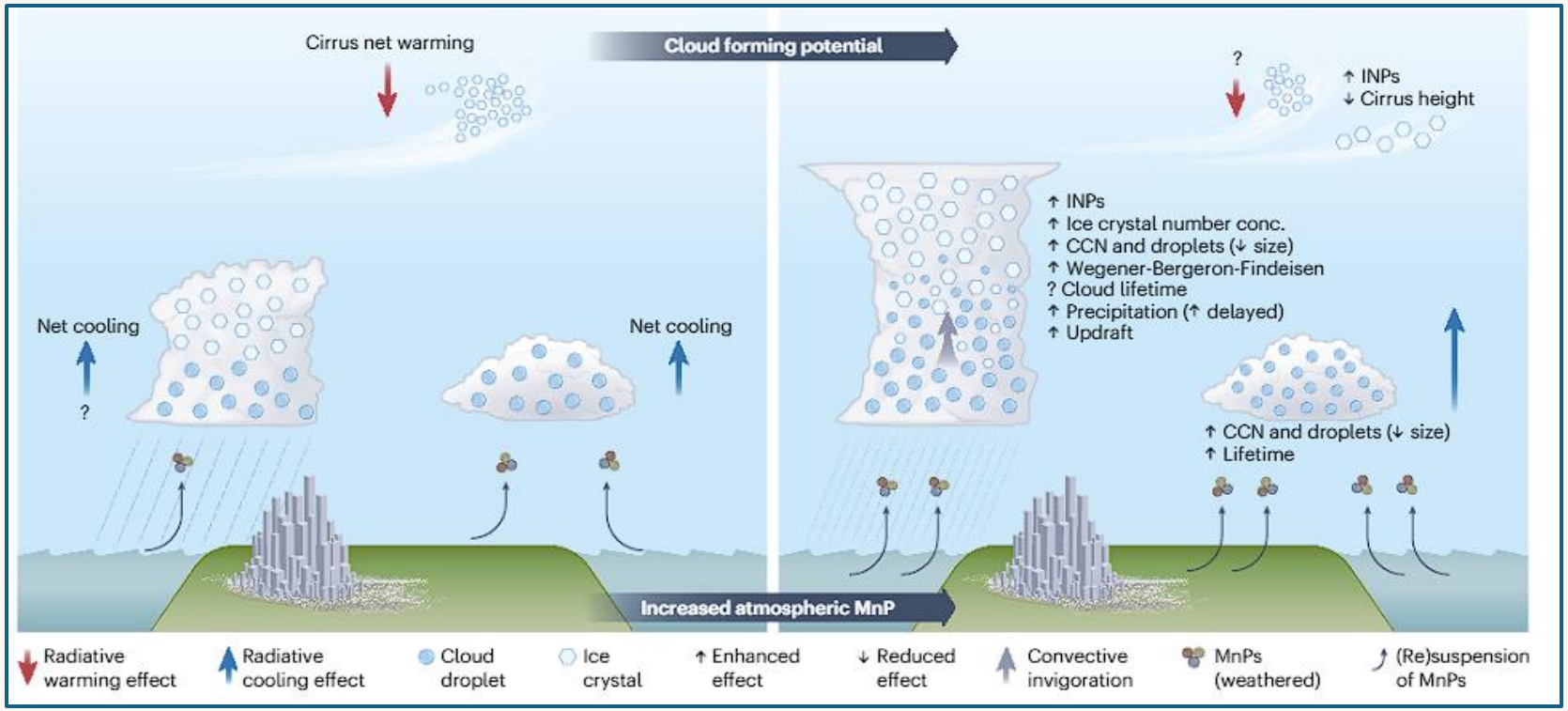


(Ghosh et al., 2025; Reynoso-Cruces et al., 2025)

The Troposphere

Cloud formation

- Cloud condensation nuclei + ice nuclei (storm clouds)
- Could impact cloud lifetime, precipitation efficiency, storm intensity

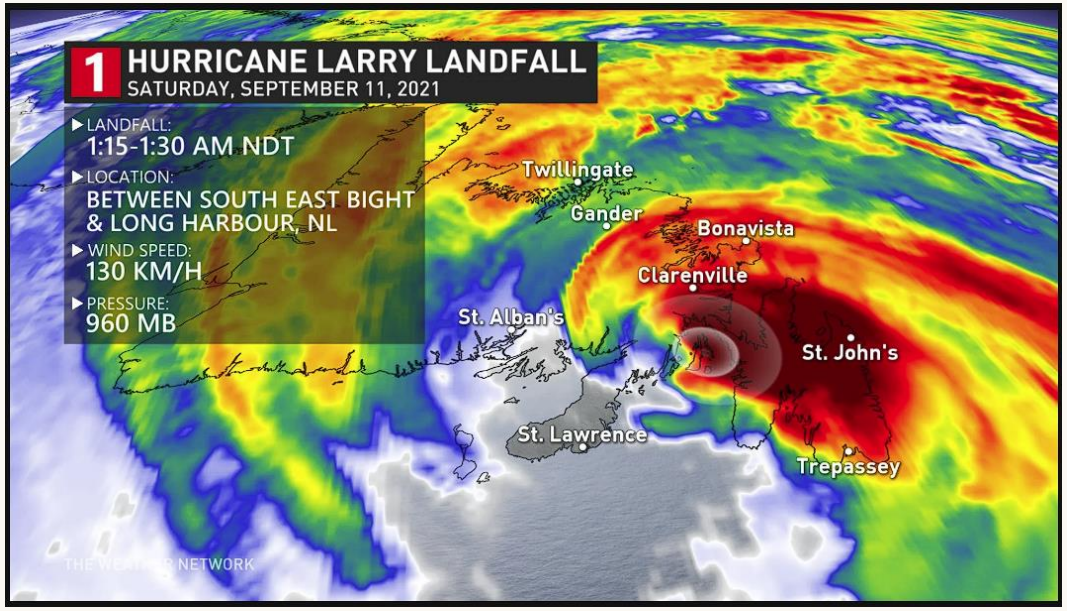


(Aeschlimann et al., 2022; Wang et al., 2023)

Climate Change

Extreme weather

- Increased storm intensity = more extreme wind and rainfall
- 10-15% increase in severity by end of century



(IPCC, 2023)

Radiative effects

- MPs absorb / reflect solar radiation
  - 1000x less impactful than typical aerosols
- alteration of cloud formation, effect uncertain
- deposition onto snow and ice

(Revell et al., 2021; Zhang et al., 2022)

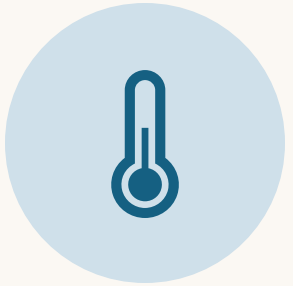
Conclusion

Summary

Airborne MPs are everywhere

Weather and storm events integral to the mobilization and deposition of MPs

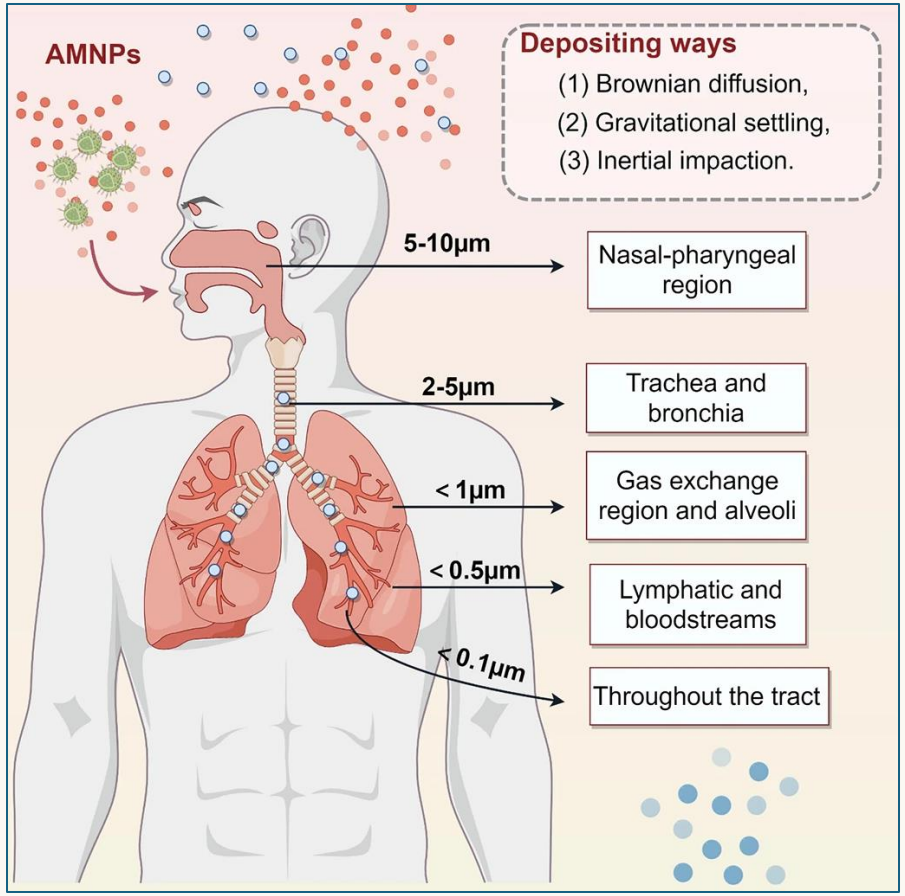
MPs are meteorologically active, impacting cloud processes



MPs are part of the climate feedback loop

Human health

- MPs can lodge in delicate lung tissue
- Enter the bloodstream
- Physical irritation
- Chemical exposure
- Can lead to chronic inflammation, cancer, asthma, etc.



(Ahmad et al., 2023; Gou et al., 2024; Nawab et al., 2024)

Major questions

How many MPs are in the atmosphere?

How does composition and shape impact cloud formation?

How much impact do MPs have currently / in the future on net warming and cooling?

Can we measure change in hurricane intensity, rainfall patterns, cloud properties that we can directly attribute to MPs?

Thank you! Takk!

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