EGU General Assembly 2022

State Key Lab of Estuarine & Coastal Research
EAST CHINA NORMAL UNIVERSITY

Plastic Marine Debris Research Center
East China Normal University

Atmospheric microplastics over ocean: abundance, distribution and transport

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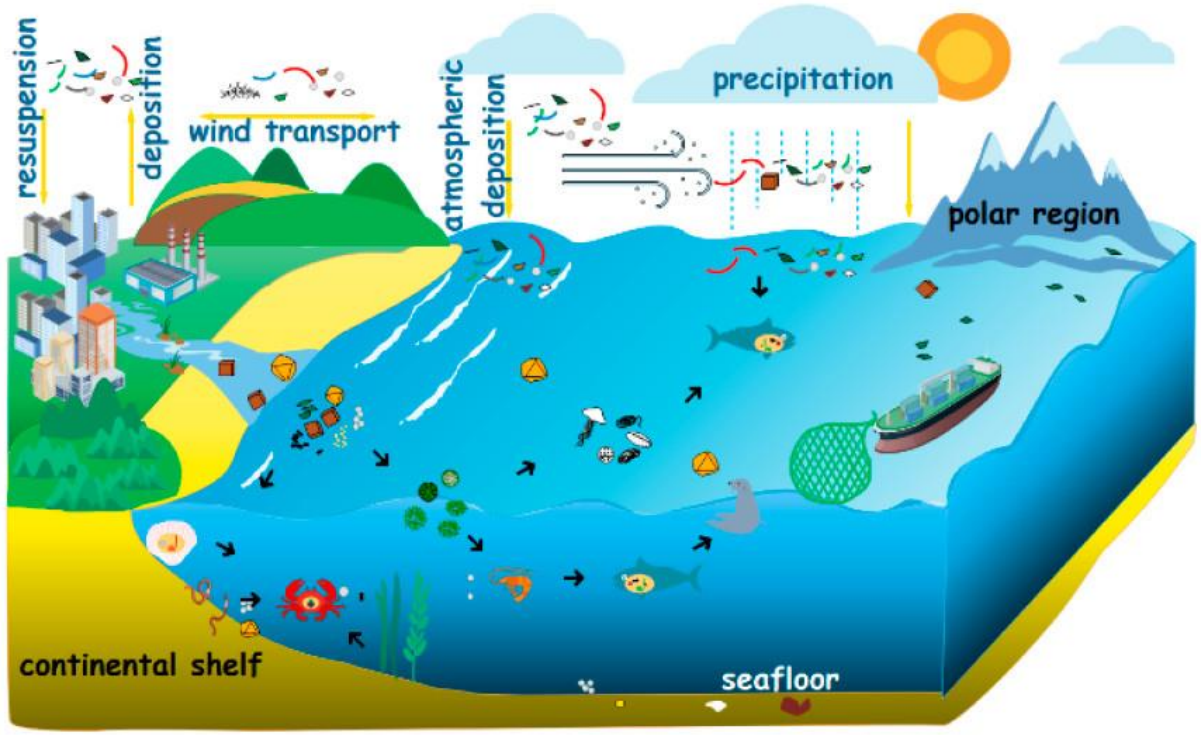
26 May, 2022. Online Meeting

Content

1. Background
2. Materials and Methods
3. Results

1. Background

At present, the characteristic distribution of atmospheric microplastic over land has been reported; however, the connection between continental atmospheric microplastic emissions and impacts over the ocean is less known.



Conceptual diagram of transport of microplastics in marine and terrestrial environments

Scientific question

- Characteristics and Potential source of atmospheric MPs over the ocean
- Atmospheric MPs transport flux to sea/land during monsoon
- Distribution of atmospheric MPs from megacity to open ocean

Liu et al., EST, 2019

2. Materials and Methods

1.NSFC voyage:

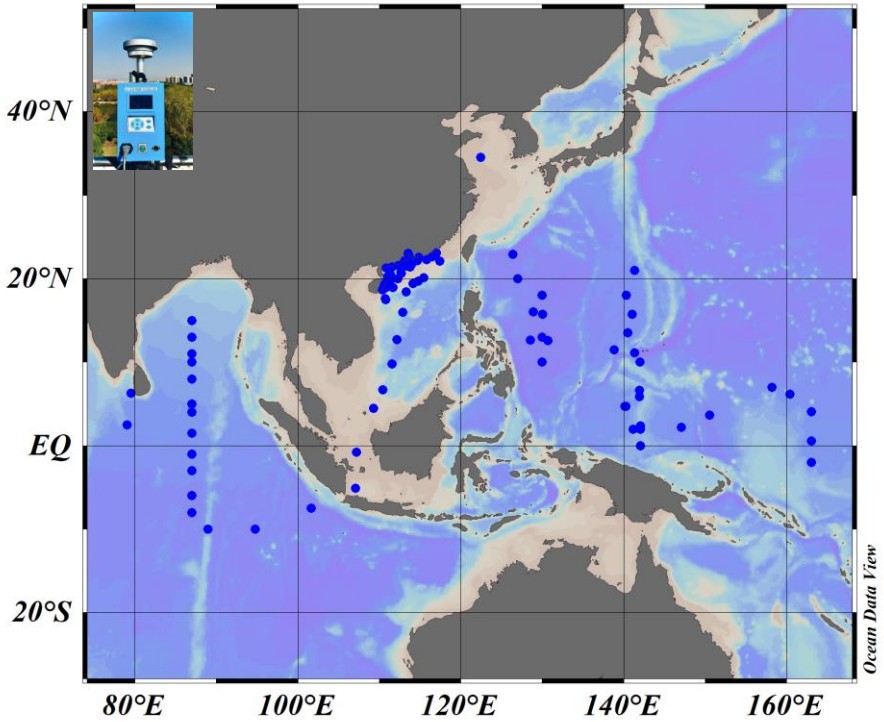
- ✓ West Pacific Ocean voyage (R/V *Kexue*);
- ✓ East Indian ocean voyage (R/V *Shiyan* No. 3);
- ✓ South China Sea - Pearl River Estuary (R/V *Haike68*);

2.Sampling instrument：

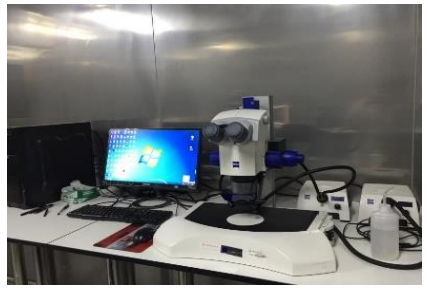
- ✓ TSP sampler (KB-120F, 100 ± 0.1 L/min，Jinshida, Qingdao);
- ✓ Automatic meteorological station (Aanderaa) and so on;

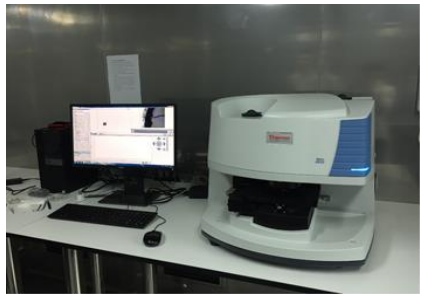
3.Analytical instrument：

- ✓ Stereomicroscope (Leica M165 FC, Germany) ;
- ✓ u-FTIR (Thermo Nicolet iN10, USA) and so on ;



Study region and sampling stations

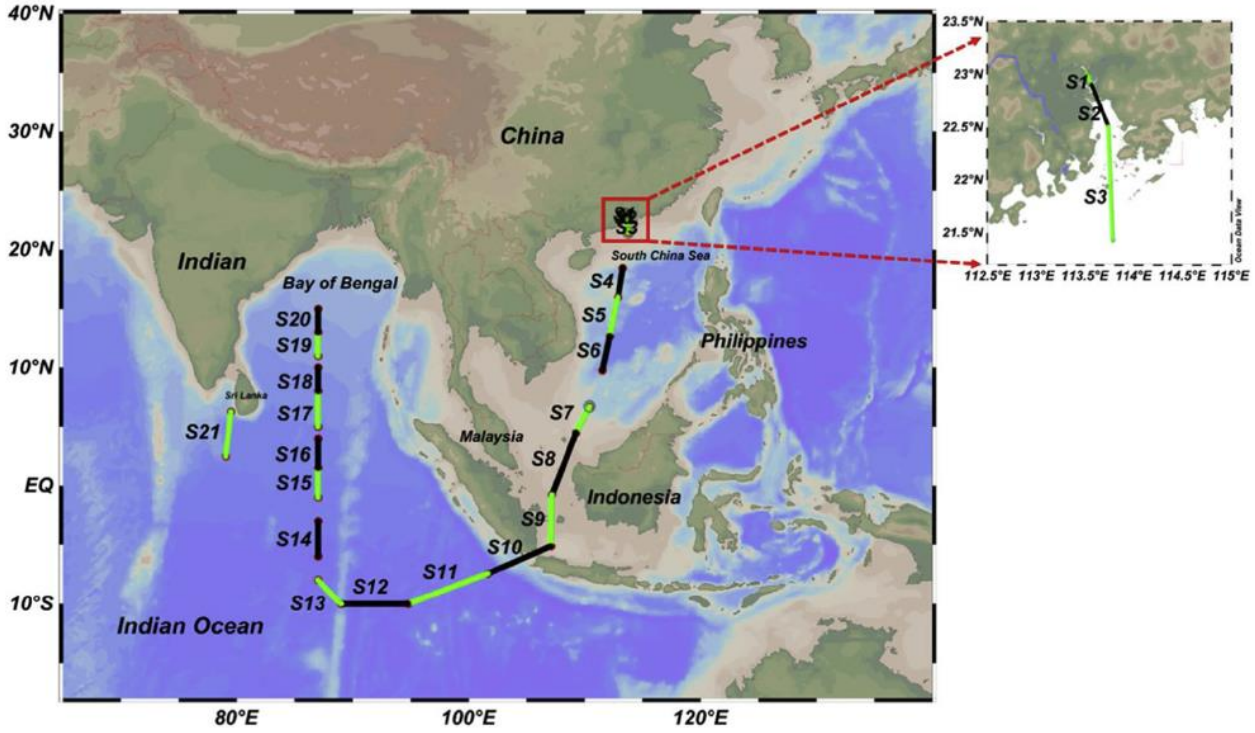


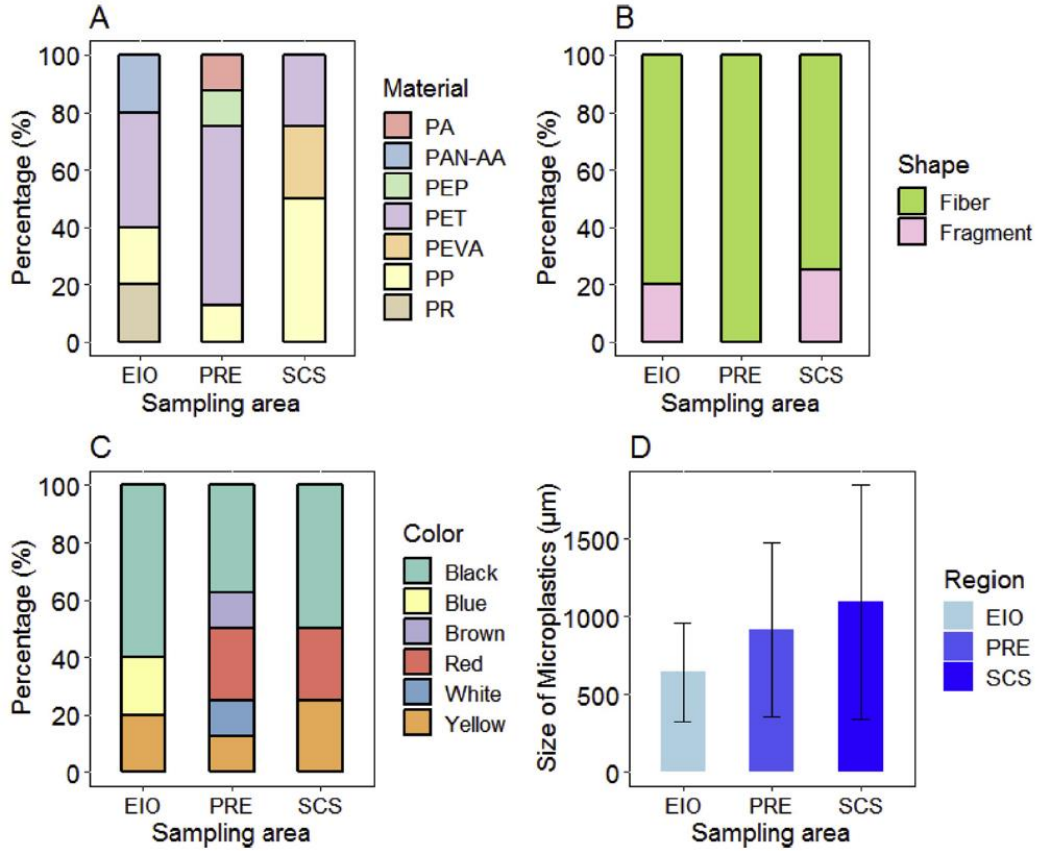


3. Results

1. Atmospheric microplastic over the South China Sea and East Indian Ocean: abundance, distribution and source

21 monitoring transects from Pearl River Estuary to South China Sea and further to Eastern Indian Ocean



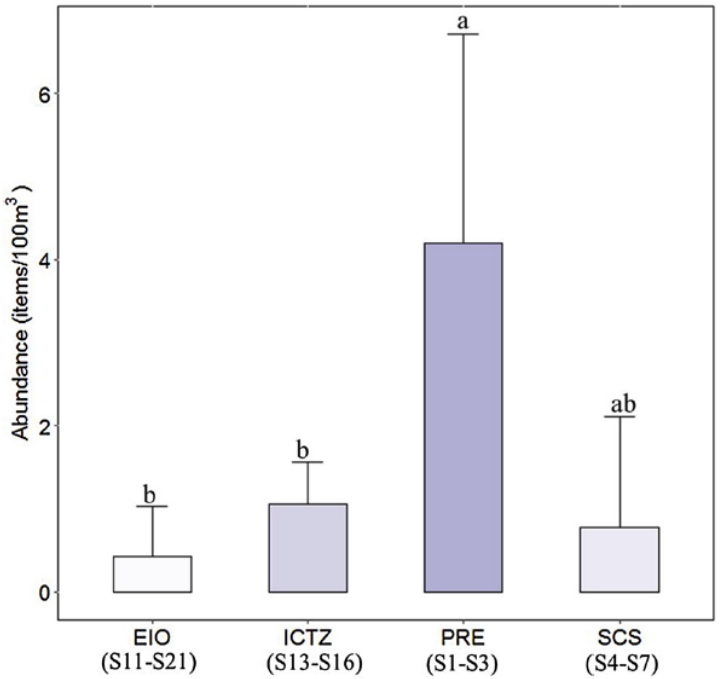


Polymer types (A), shape (B), color (C) and size (D) of atmospheric MP particles in different sampling areas.

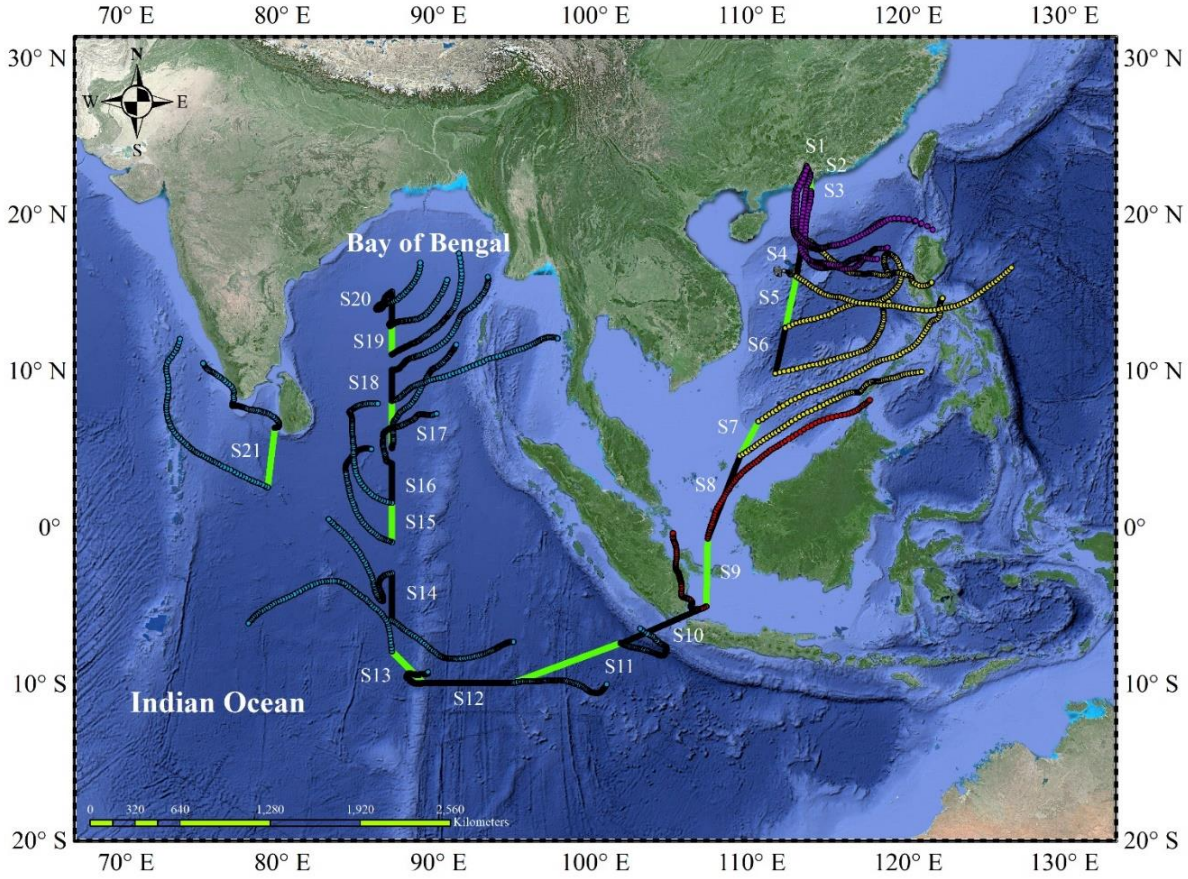
Wang et al, JHM,2020

3. Results

1. Atmospheric microplastic over the South China Sea and East Indian Ocean: abundance, distribution and source



Atmospheric MP abundance in different sampling areas. Bars that do not share the same letters are significantly different ($p < 0.05$).



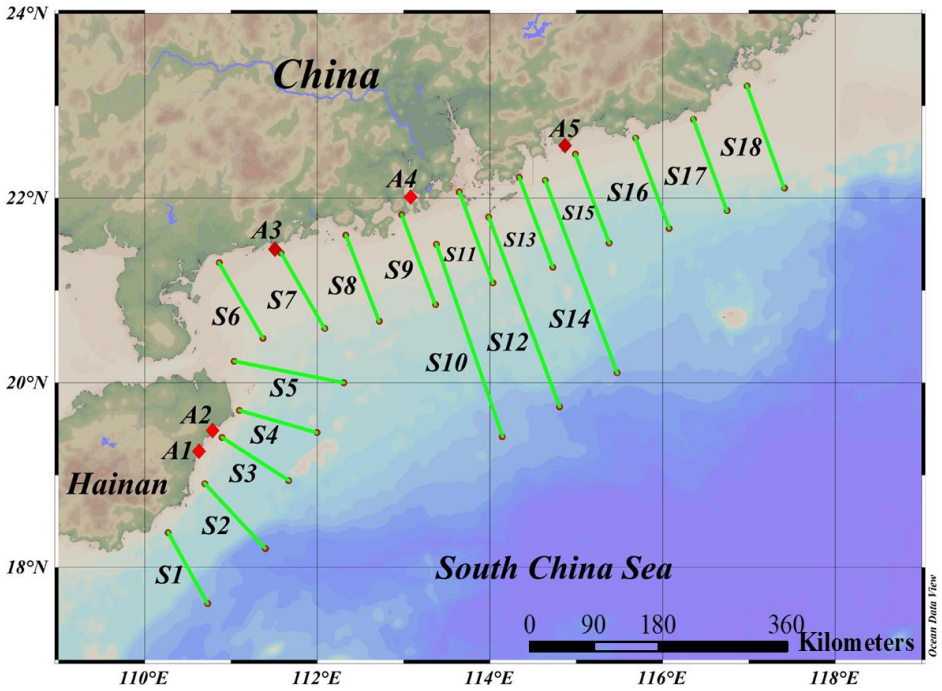
The backward trajectory of the air parcel along all sampling transects.

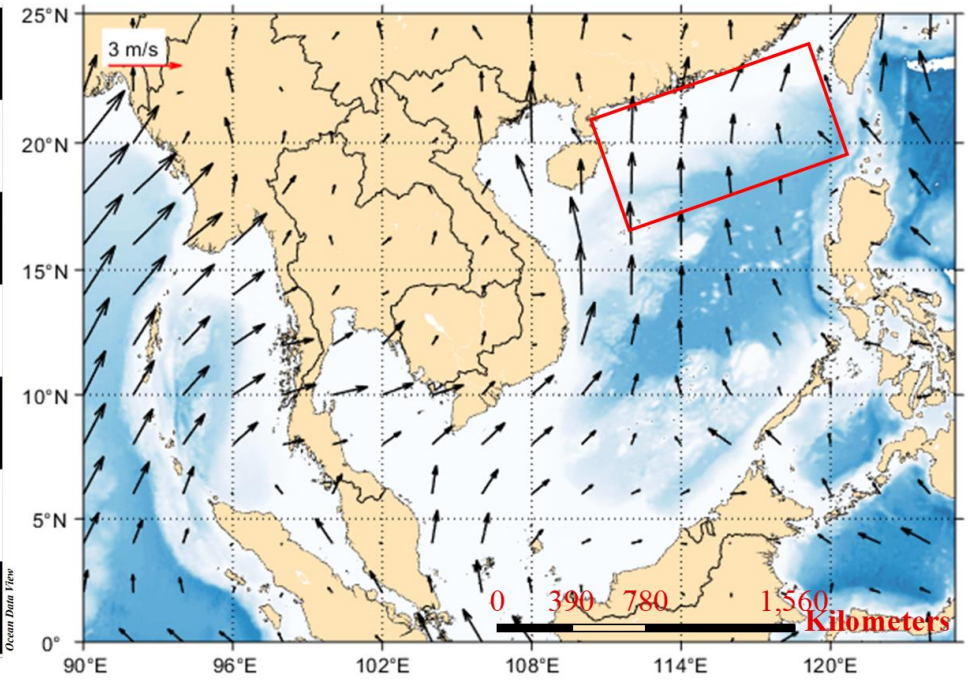
Wang et al, JHM,2020

3. Results

2. Efficient transport of atmospheric microplastics onto the continent via the East Asian summer monsoon

- ✓ Sampling time: 2020.5.31-2020.7.10 (East Asian summer monsoon);
- ✓ Sampling method: Underway-pumping sampling and in-situ sampling;





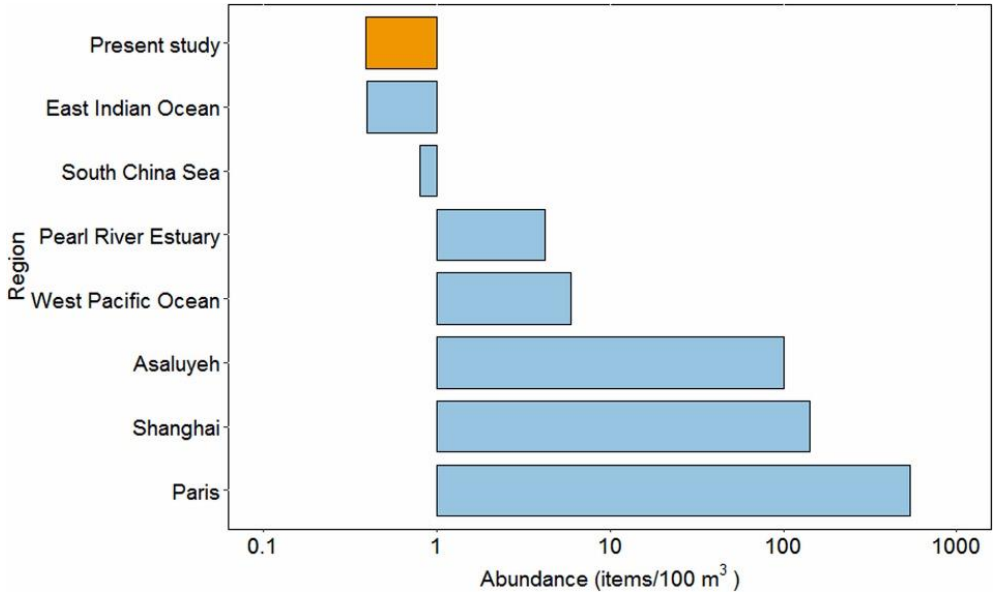
Map showing the sampling information (left). S represents the sampling transect, and A represents the in-situ sampling. Monthly (June) average 10 m surface wind field during the sampling period (right).

Wang et al, JHM, 2021

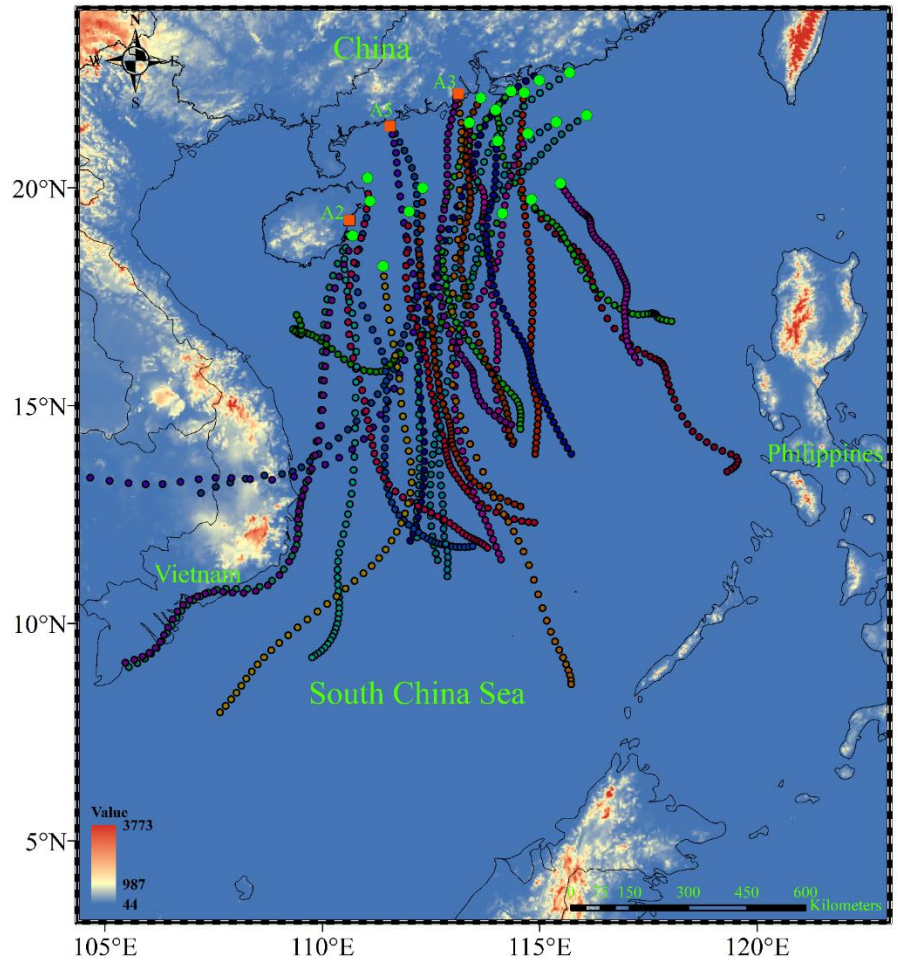
3. Results

2. Efficient transport of atmospheric microplastics onto the continent via the East Asian summer monsoon

- The average abundance of atmospheric MP was 0.39 items/100 m^3 during the East Asian summer monsoon.
- EASM transport flux of atmospheric MP was 212.977-213.433 kg /EASM/year;
- Backward trajectory and wind field revealed the potential source of atmospheric MPs;



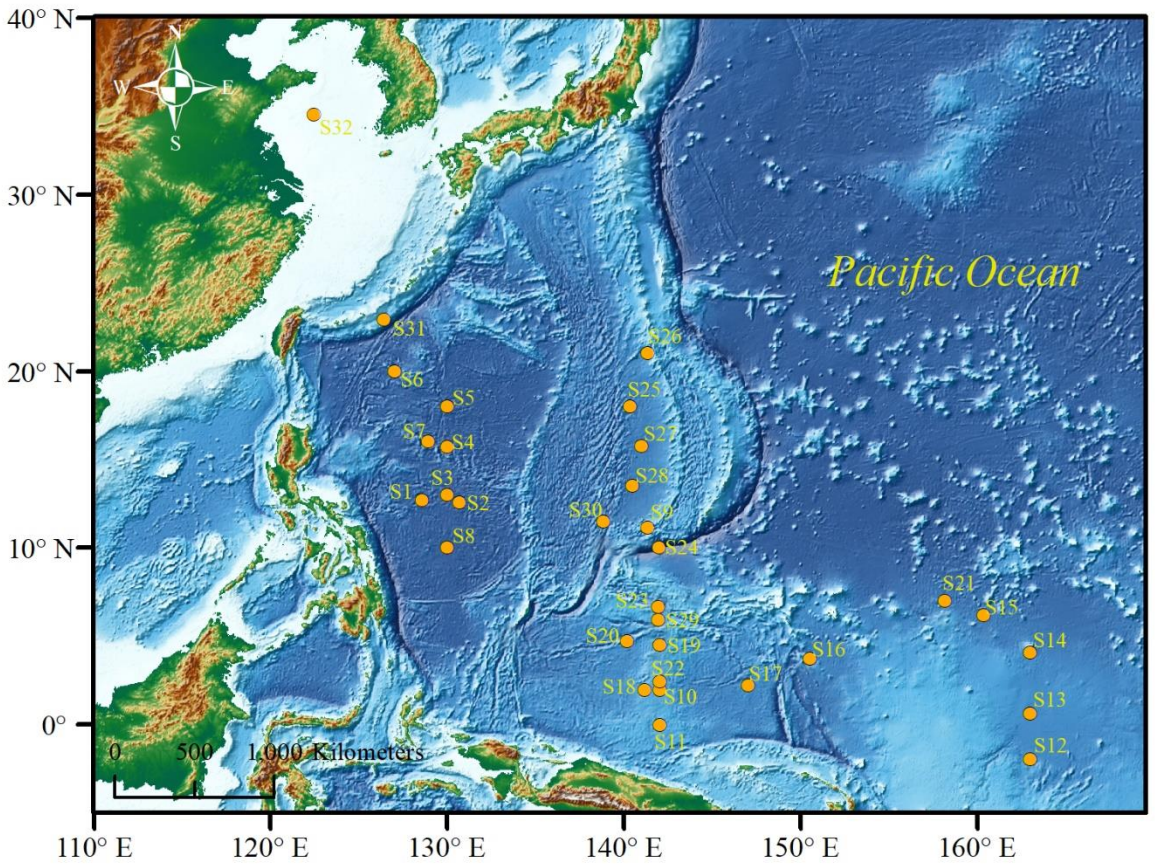
Comparison of the average plastic abundance in the atmosphere



Two-day backward trajectories of the sampling stations

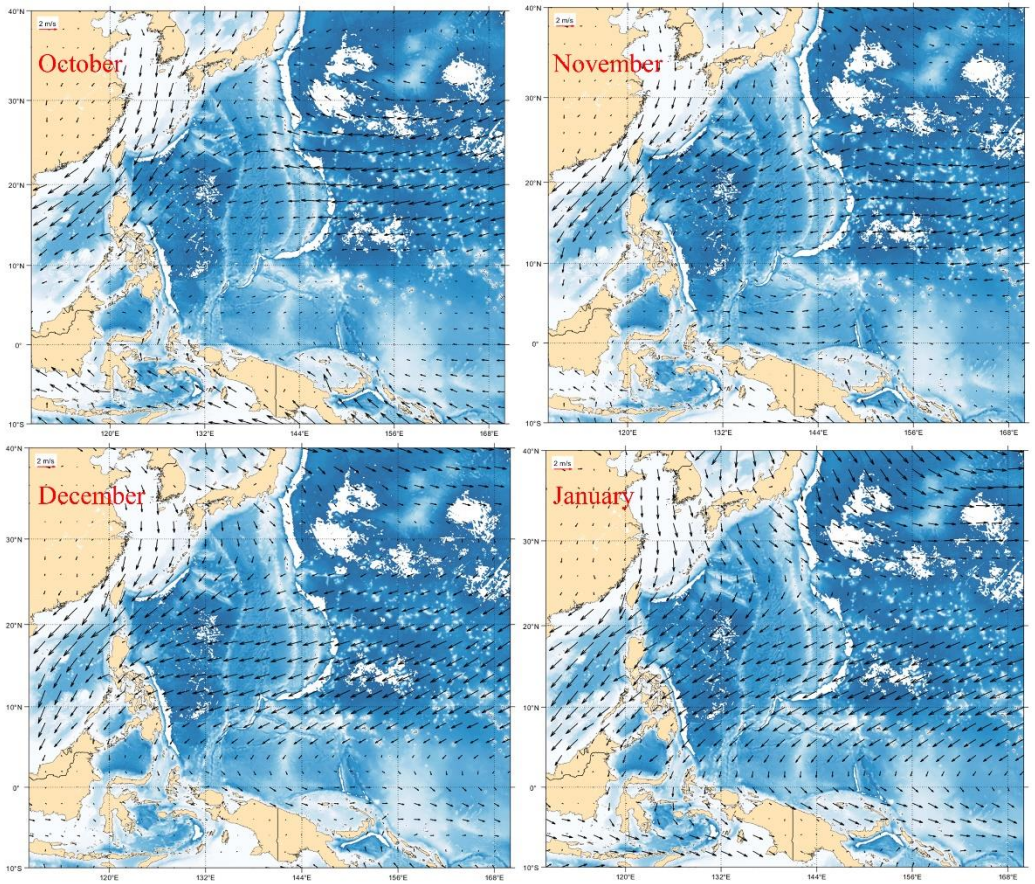
3. Results

3. Atmospheric microplastic over the western Pacific Ocean: abundance, distribution and source



Location of samples sites in the western Pacific Ocean. The 32 orange dots represent the active sampling start points.

Wind field during sampling



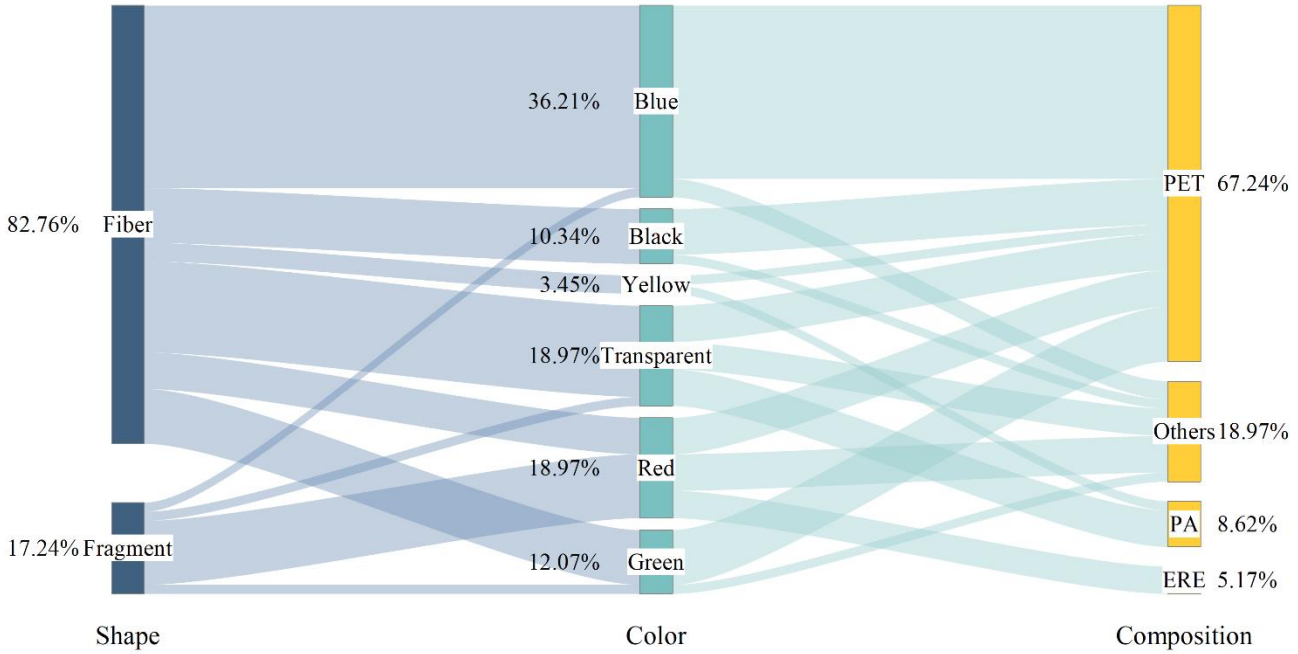
Wang et al, Articles in Press

3. Results

3. Atmospheric microplastic over the western Pacific Ocean: abundance, distribution and source

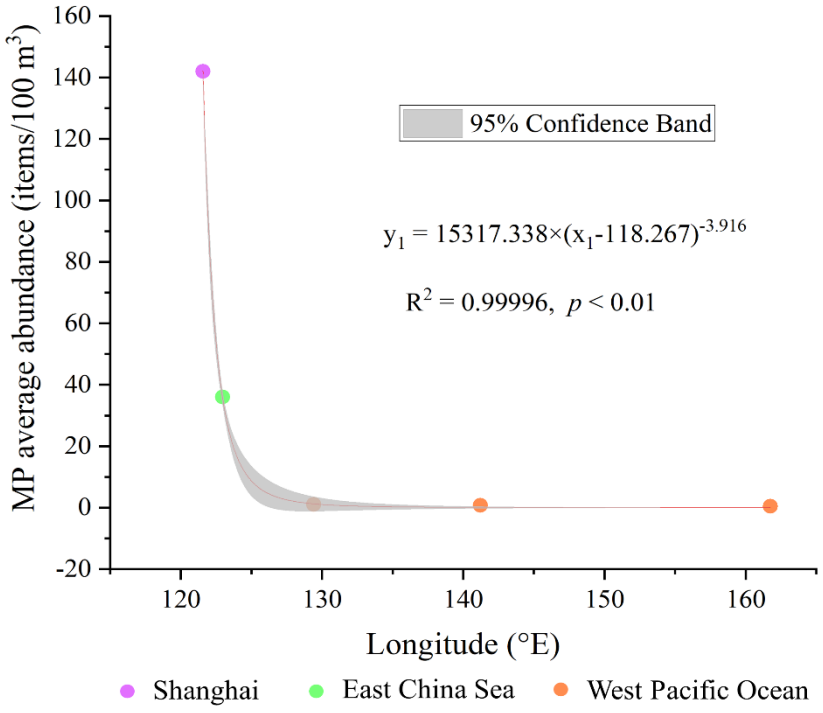
Results & Findings:

- Study suggested that synthetic MPs comprised 25.89% of total atmospheric particles;
- Atmospheric MPs abundance is decreased exponentially from megacity to open ocean;



Microplastic composition, color, and shape in atmospheric samples

Relationship of atmospheric MP average abundance and average longitude



Wang et al, Articles in Press

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THANK YOU FOR YOUR ATTENTION

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