

Modelling Approach in Assessing and Predicting The Trajectory And Spatial Distribution of Floating Plastic Debris in Coastal Water of East Coast Peninsular

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700kg sampah dikutip di Pantai Cempaka, Pantai Sepat

NORAWAZNI YUSOF | 19 September 2021



Kutipan sampah di pantai Kuala Terengganu melonjak 50 peratus



ROZALI SALLEH

Botol plastik, kaca cemari pantai Sepat

Asrol Awang
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SAMPAH yang ditemui di pantai Sepat, Kuantan. FOTO Asrol Awang

>> EDISI > > Kutip 702kg sampah di Pantai Pandak

Kutip 702kg sampah di Pantai Pandak

RAHAYU MUSTAFA | 15 Oktober 2021



Dr Mohamed Ariff Hafzi (dua dari kanan) bersama Zuraida (tiga dari kanan) yang turut hadir ke program gotong royong membersihkan Pantai Pandak.



Lebih 300 Kg Sampah Dikutip Di Pantai Batu Buruk

Study Background

Malaysia is one of the top ten countries responsible for mismanaged plastics that ended in the ocean.

Malaysia is the top plastic consumer in Asia at a rate of 56 kg/capita/ year

East coast of Peninsular Malaysia is expose to the intense wave currents and tides from the South China Sea.

There are no proper study have been conducted to simulate the mismanaged floating marine debris that had been released from rivers.

This study focused on assessing the trajectory of marine debris along East Coast of Peninsular Malaysia.

An effective Lagrangian transport of marine debris may provide an effective mitigation to overcome marine debris problem in Peninsular Malaysia.

Problem Statement

Most of debris found in water body and beach is plastic.

East Coast of Malaysia is greatly affected various mechanism including changes of wind, current and wave magnitude during different monsoonal seasons.

Observations of the source, pathways, distributions and composition of marine plastics are sparse and inaccurate.

Marine debris accumulation can be assessed by field survey sampling, but it could not give better view on its path, trajectory during different seasons.



Lebih 300 Kg Sampah Dikutip Di Pantai Batu Buruk

Main Objectives of the Study

To use numerical modelling method in predicting the trajectory of debris particle and identifying the hotspot of marine debris accumulation for providing effective mitigation plan for reducing marine debris pollution

Study the trajectory and origin of floating marine debris from each State in East Coast of Peninsular Malaysia.

To understand the seasonal differences in floating debris motion and distribution.

METHODOLOGY

Particle Tracking Model

- Develops Parcels (**P**robably A **R**eally **C**omputationally **E**fficient **L**agrangian **S**imulator)
- A set of Python classes to customize the particle simulation using Ocean Circulation Model.

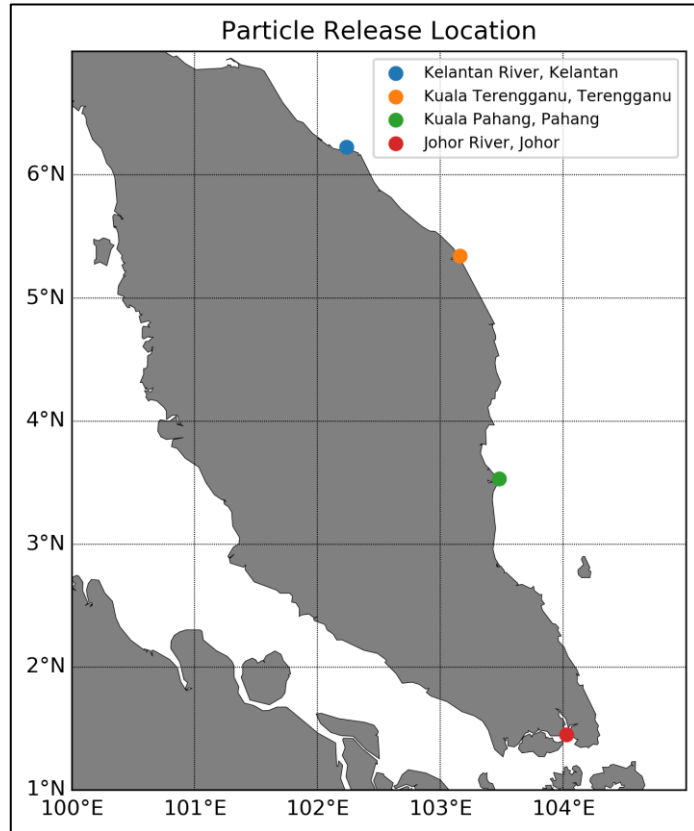
Data Input

Forcing Input

- Parcels compatible with multiple forcing input such as density current, stokes current and tidal residual currents.

- GOFS 3.1 reanalysis HYCOM + NCODA was used with $1/12^\circ$ resolution.
- Current, Stokes drift current and barotropic tidal current were used $u_{total} = u_0 + u_{stokes} + u_{tide}$

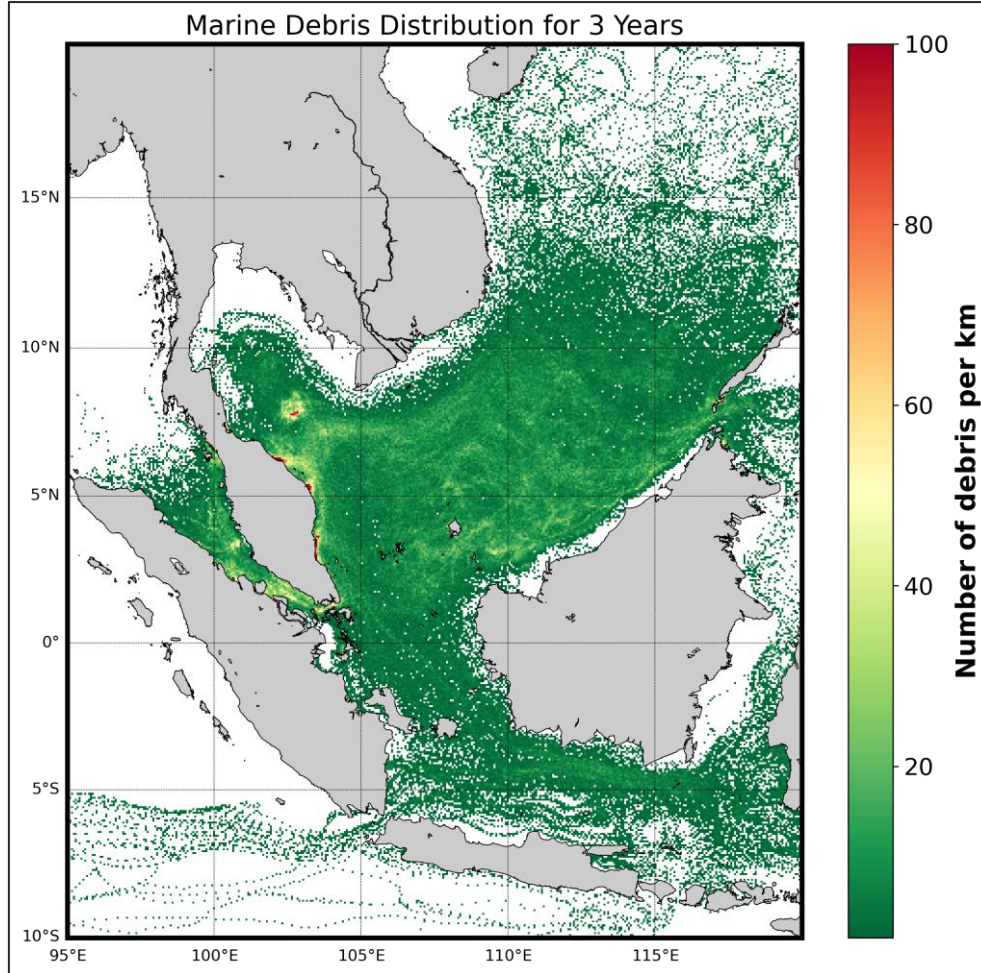
Particle Release Location



- Particle Tracking Model was run for 3 Years
- Particle was set to release on every major river for every state in East Coast of Malaysia.
- Particle was advected using Runge-Kutta 4th particle dynamic.

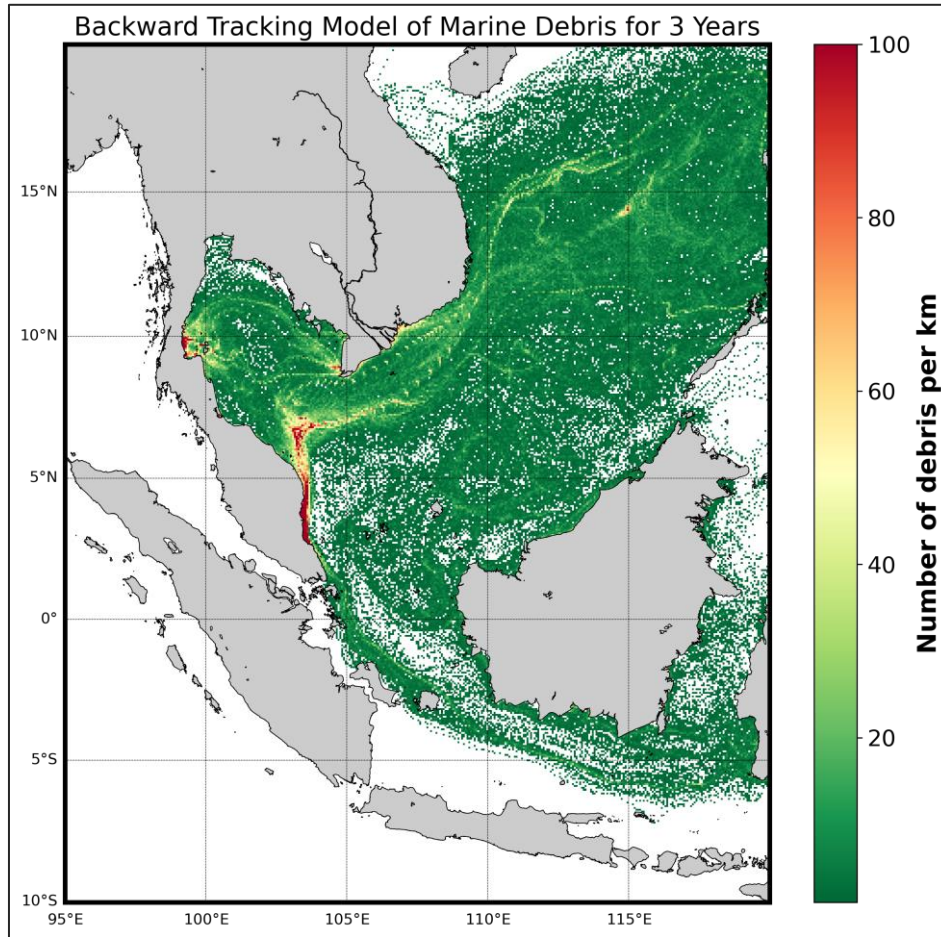
RESULTS AND DISCUSSION

Marine Debris Distribution and Backward Particle Tracking for 3 Years



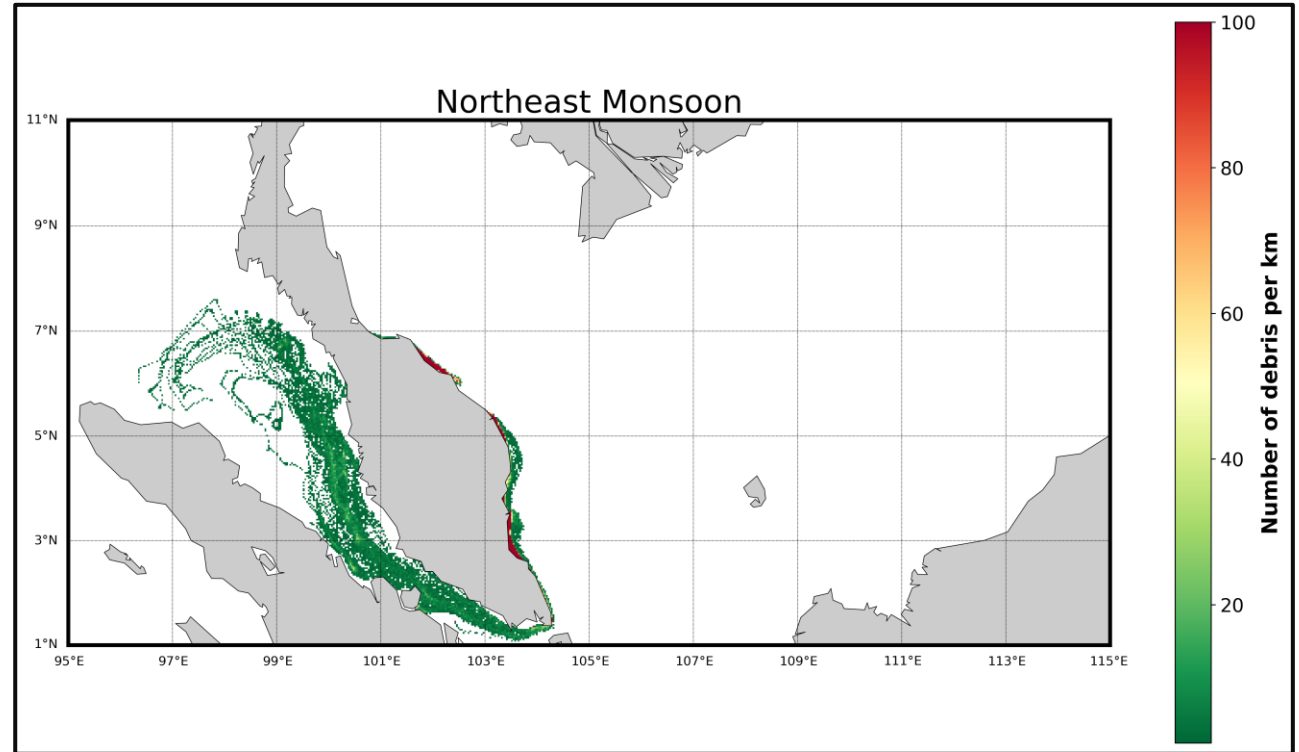
- Most of floating marine debris will settle on east coast States.
- Debris tend to accumulate on Gulf of Thailand.
- Debris from East Coast of Malaysia move towards the South China Sea and accumulate due to occurring eddies.

Floating Marine Debris Backward Particle Tracking for 3 Years



- Most of debris mainly originate from local coastline which are from Pahang and Terengganu Coastline.
- Some of debris originate from East Vietnam Sea, Songkhla and Pattani Coast from Thailand.

- Debris distributed towards Malacca Strait during NEM.
- Most of debris beached on East Coast.
- In NEM, strong winds from the north caused southward current and carried debris to the western Peninsular Malaysia.

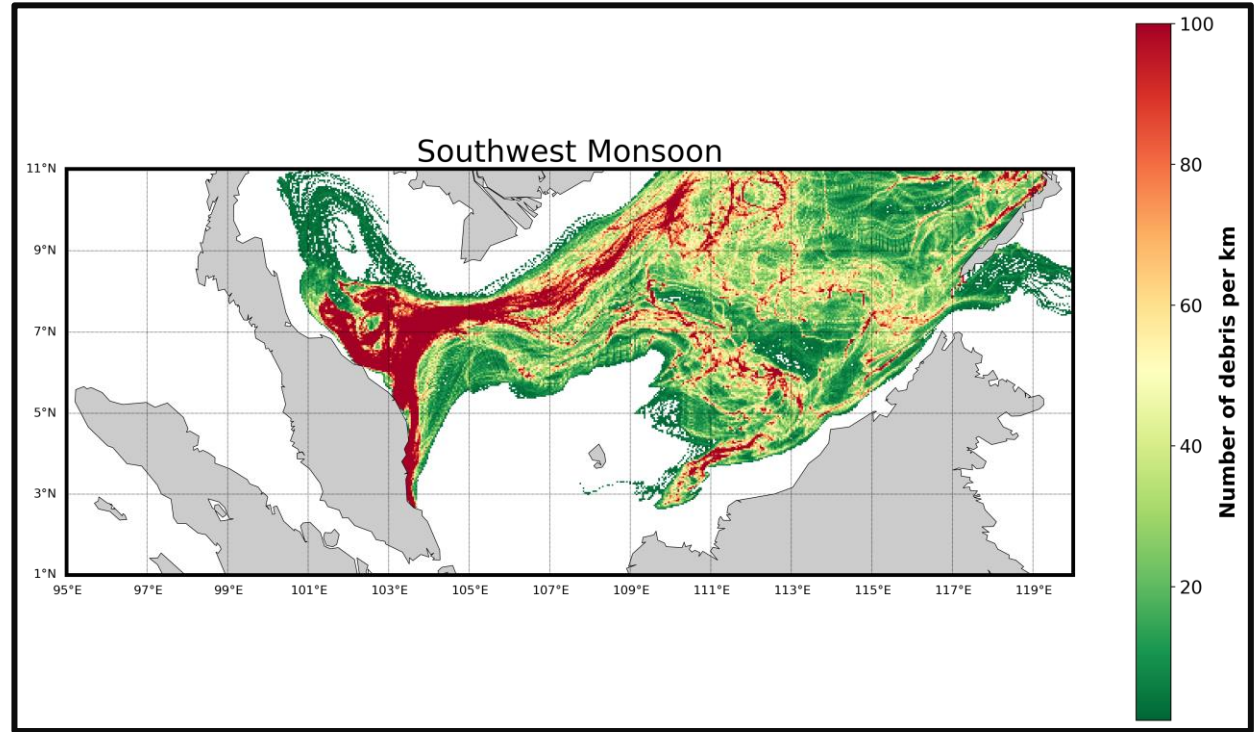


- Most of debris was drifted towards South China Sea during SWM.

- In SWM, the winds from the southeast force water mass and subsequently debris northward.

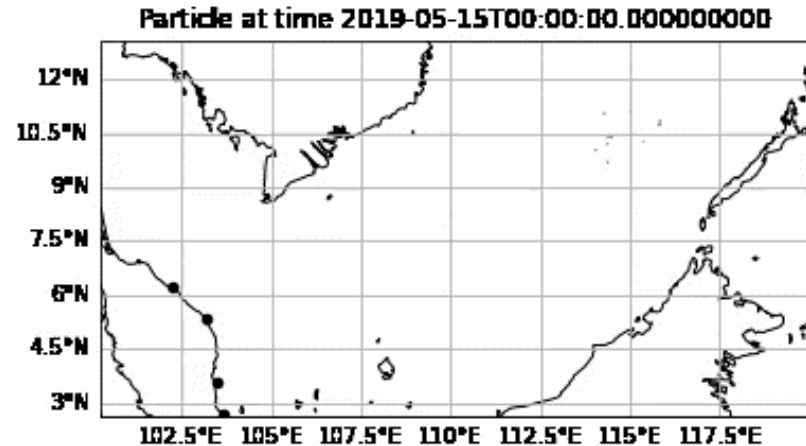
- This pattern can be seen by the higher concentration of debris in the South China Sea and off the coast of Thailand.

- Anticyclonic eddies also occur in this area in which the occurrence of eddies depends on the monsoon (Noir et. al., 2021)



Conclusion

- The virtual particles in this simulation represent highly ideal marine debris floating near the surface
- Marine debris ended up on East Coast of Peninsular Malaysia that mostly originate from local area and some from other regions.
- Marine debris path during different seasons are different due to current changes.



Thank you