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THE IMPACT OF PLASTIC POLLUTION ON CLIMATE CHANGE

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Abstract

Almost all plastic is derived from materials (like ethylene and propylene) made from fossil fuels (mostly oil and gas). The process of extracting and transporting those fuels, then manufacturing plastic creates billions of tonnes of greenhouse gases. Plastic dumped in landfills can take hundreds of years to break down using a process called photodegradation. Over time, plastic breaks down into methane and ethylene which also contribute to climate change, albeit slowly. Other toxins are also released into the local ecosystems causing ground pollution. The waste management of plastic products has long been a problem. Burning plastic waste is a source of air pollution that is harmful to human health but also releases toxins and carbon dioxide into the atmosphere that impacts global warming. In our oceans, plastics directly chokes and smothers a host of marine animals and habitats and can take hundreds of years to break down. As our climate changes, the planet gets hotter, the plastic breaks down into more methane and ethylene, increasing the rate of climate change, and so perpetuating the cycle. The tiny powerhouses (microplastics) play a critical role in taking carbon dioxide from the atmosphere and water and sequestering it in deep ocean sinks. Our studies show that plastic can affect the water-holding capacity of drains, river channels and reservoirs. This leads to flooding of adjacent lands and loss of biological diversity and livelihoods. To combact plastic pollution some steps needs to be taken such as government should levy a high fee on each plastic bag that shoppers get at mall and markets because it will discourage people from discarding them after single use; the people should be educated on the three Rs: reduce, recycle and reuse plastic material; the dangers imposed by discarding water satchet and bottles in the environment. Paper bags should be encouraged; government should launch a campaign to crack down on plastic bags and bottles in the country; government should pass the "plastic pollution bill" into law to serve as a guide for the citizens.

Keywords: photodegradation, microplastic, greenhouse gases, landfill, global warming

Introduction

An extreme by meaning is significantly different from the average or usual pattern. According to (Hijioka et al. 2014; IPCC 2012), the region of Southeast Asia is the hotspot of global warming. In Malaysia, extreme weather has increased the number of extreme events lately (AFP 2022; MMD 2019) and this country is prone to any climate change impacts due to its geographical location such as drought, land slides, heatwaves, storm surges and flash flood. The number of rainfalls received in this country is influenced by monsoonal seasons, topography areas, climate variabilities and urban heat islands (Asmat et al. 2018; Salimun et al. 2014; Tan et al. 2021; Tangang et al. 2017; Tangang et al. 2008).

Detrimental events have affected various sectors such as socioeconomic development, politics, and disruption to normal services (Tan et al 2018). The extensive flooding in southern peninsular Malaysia from December 2006 to January 2007 forced over 200,000 evacuations, caused 16 fatalities, and incurred economic losses exceeding $500 million (Tangang et al. 2008). Recently, Malaysia has lost

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USD1.46 billion due to flooding that hit during December 2021, according to a statement by the Department of Statistics (DOSM) (Bernama 2022). The amount of rain fell in Klang on a day (18th December 2021) was equivalent to the national monthly average rainfall. The event has claimed 54 lives and more than 120000 peoples were evacuated. Warmer climate may alter the atmospheric condition (IPCC 2012; Viceto et al. 2017) and intensified rainfall is expected to be occurred within a short period of time in the future (Fowler et al. 2021).

The High Resolution Model Intercomparison Project (HighResMIP) was a MIP endorsed by CMIP6. It pioneered a multi-model approach to systematically study the effects of horizontal resolution, marking the first instance of such an application (Gutjahr et al. 2019; Kodama et al. 2021; Roberts et al. 2019). Some studies were using General Circulation Models (GCM) to investigate the characteristic and magnitude of extreme precipitation over Southeast Asia (Hariadi et al. 2022; Liang et al. 2022; Liang et al. 2021) which agreed an exponential increase in trend of both precipitation and temperature. The using of higher resolution model helps analysing extreme precipitation well and provide more realistic spatial distribution pattern (Bador et al. 2020; Fu et al. 2022). Shared Socioeconomic Pathways (SSPs) are an integrated scenarios to support different research groups and assess the uncertainty in efforts to mitigate climate change and prepare for its impacts (O'neill et al. 2014). Using this framework helps in predicting the climate in future according to greenhouse gas emissions release.

Due to ambiguity in future climate, study on climate extremes using climate models is critical for early planning and mitigation. Few researches have been conducted in this country on climate uncertainties and their impact, but there are still significant gaps and unknown territory that require further investigation and attention. Thus, this study aimed to assess the accuracy of HighResMIP CMIP6 models in replicating historical extreme precipitation indices (1982-2014) in Malaysia. Additionally, this research also focuses to analyse anticipated changes in extreme precipitation over Malaysia under the high emission scenario SSP5-8.5 for future projections (2015-2050).

Materials and Methods

Data used for this study is derived from the literature review of published works including academic articles, journals, conference papers textbooks and internet materials. The researchers gathered much materials for the research but summarized the characteristics that centered more on "The Impact of Plastic Pollution on Climate Change Globally". This enabled the researchers to generate the synthesis of various researchers' views on the subject matter.

Results and Discussion

Conclusion

The impact of plastic pollution on climate change is a complex issue. Plastic pollution doesn't directly cause climate change but does contribute indirectly through its lifecycle. Reducing plastic use, promoting recycling, and transitioning to more sustainable materials are essential steps to mitigate these impacts and address both plastic pollution and climate change. By recognizing the link between plastic pollution and climate change, policymakers, industries, and individuals can work together to develop effective strategies and take concrete steps towards a more sustainable future. It is essential to address the problem of plastic pollution holistically, considering its environmental, social, and economic impacts, while striving to mitigate its contribution to climate change.

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Declaration of Interest Statement

We declare that we have no conflict of interests.

References

Anabaraonye B., Anukwonke C.C., Samuel I.C, Dibia, Onwuzuruike U., Olisah N.C., Ezeukwu J.C., Leveraging multi-stakeholder partnership to combat climate change in Africa. International Journal of Research in Civil Engineering and Technology vol. 3 no 2 pp. 21-27, June 2022.

Carson, H.S., Colbert, S.L., Kaylor, M.J., and McDermid, K.J. Small plastic debris changes water movement and heat transfer through beach sediments. Mar Pollut Bull vol. 62 pp. 1708–1713, Feb. 2011.

Free C.M., Jensen O.P., Mason S.A., Eriksen M., Williamson N.J., Boldgiv B. High-levels of microplastic pollution in a large, remote, mountain lake Mar. Pollut. Bull., vol. 85 pp. 156-163, May 2014 10.1016/j.marpolbul.2014.06.001

Geyer R., Jambeck J.R., Law K.L. Production, use, and fate of all plastics ever made Sci. Adv., vol. 3 May 2017, Article e1700782, 10.1126/sciadv.1700782

IPCC, 2019 Pörtner H. O., Roberts D. C., Masson-Delmotte V., Zhai P., Tignor M., Poloczanska E., Mintenbeck K., Alegria A., Nicolai M., Okem A., Petzold J., Rama B., Weyer N.M.(Eds), IPCC Special Report on the Ocean and Cryosphere in a Changing Climate Aug. 2019

IPCC, 2021 Summary for policymakers Pörtner H. O, Roberts D.C., Masson-Delmotte V., Zhai P., Tignor M., Poloczanska E., Mintenbeck K., Alegria A., Nicolai M., Okem A., Petzold J., Rama B., Weyer N.M. (Eds.), Climate Change 2021: The Physical Science Basis. Contribution of Working Group 1 to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change July 2021.

Jambeck,J.R., R. Geyer, C. Wilcox, T.R. Siegler, M. Perryman, A. Andrady, R. Narayan, K.L. Law Plastic waste inputs from land into the ocean Science, vol. 347 pp. 768-771 March 2015 10.1126/science.1260352

Napper,I.E., B.F.R. Davies, H.Clifford, S. Elvin, H.J. Koldewey, P.A. Mayewski, K.R. Miner, M. Potocki, A.C. Elmore, A.P. Gajurel, R.C. Thompson Reaching new heights in plastic pollution—preliminary findings of microplastics on Mount Everest One Earth, vol. 3 pp. 621-630, Feb. 2020 10.1016/j.oneear.2020.10.020

Narayan R., Law K.L. Reducing environmental plastic pollution by designing polymer materials for managed end – of – life. Nature Reviews Materials vol. 7 pp. 104 – 116, June 2021

Obbard, R.W., S. Sadri, Y.Q. Wong, A.A. Khitun, I. Baker, R.C. Thompson Global warming releases microplastic legacy frozen in Arctic Sea ice Earth's Future, vol. 2 pp. 315-320, May 2014, 10.1002/2014ef000240

Stafford R., Jones P.J.S., Viewpoint – ocean plastic pollution: a convenient but distracting truth? Mar. Policy, vol. 103 pp. 187-191, March 2019 10.1016/j.marpol.2019.02.003

Ummenhofer C.C., G.A.Meehl Extreme weather and climate events with ecological relevance: a review Philos. Trans. R. Soc. B Biol. Sci. Sept. 2017, 10.1098/rstb.2016.0135

Vicedo – Cabrera A.M., Scovronick N., Sera F., Royé D., Schneider R., Tobias A., Astrom C., Guo Y., Honda Y., Hondula D.M., Abrutzky R., Tong S., de S.Z.S.Coelho M., Saldiva P.H.N., Lavigne E., Correa P.M., Ortega N.V., Kan H., Osorio S., Kyselý J., Urban A., Orru H., Indermitte E., Jaakkola J.J.K., Ryti N., Pascal M., Schneider A., Katsouyanni K., Samoli E., Mayvaneh F., Entezari A., Goodman P., Zeka A., Michelozzi P., de'Donato F., Hashizume M., Alahmad B., Diaz M.H., Valencia C.D.L.C., Overcenco A., Houthuijs D., Ameling C., Rao S., Di Ruscio F., Carrasco-Escobar G., Seposo X., Silva S., Madureira J., Holobaca I.H., Fratianni S., Acquaotta F., Kim H., Lee W., Iniguez C., Forsberg B., Ragettli M.S., Guo Y.L.L., Chen B.Y., Li S., Armstrong B., Aleman A., Zanobetti A., Schwartz J., Dang T.N., Dung D.V., Gillett N., Haines A., Mengel M., Huber V., Gasparrini A. The burden of heat-related mortality attributable to recent human-induced climate change Nat. Clim. Chang., vol. 19 pp. 59, April 2021 10.1038/s41558-021-01058-x

Vitousek S., Barnard P.L., Fletcher C.N., Frazer N., Erikson L., Storlazzi C.D. Doubling of coastal flooding frequency within decades due to sea-level rise Sci. Rep., vol. 7 pp. 1-9, July 2017 10.1038/s41598-017-01362-7

Woodall L.C., Sanchez-Vidal A., Canals M., Paterson G.L.J., Coppock R., Sleight V., Calafat A., Rogers A.D., Narayanaswamy B.E., Thompson R.C., The deep sea is a major sink for microplastic debris R. Soc. Open Sci., vol. 1, June 2014, Article 140317, 10.1098/rsos.140317