Global risk of plastic mobilisation during flood events

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Goals of this study

- Model the risk of plastic mobilisation during flood events
- Understand and visualise this risk globally
- Compare the results with data on flood protections to assess effectiveness

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Introduction

- Riverine plastic pollution negatively impacts human livelihood and ecosystem health

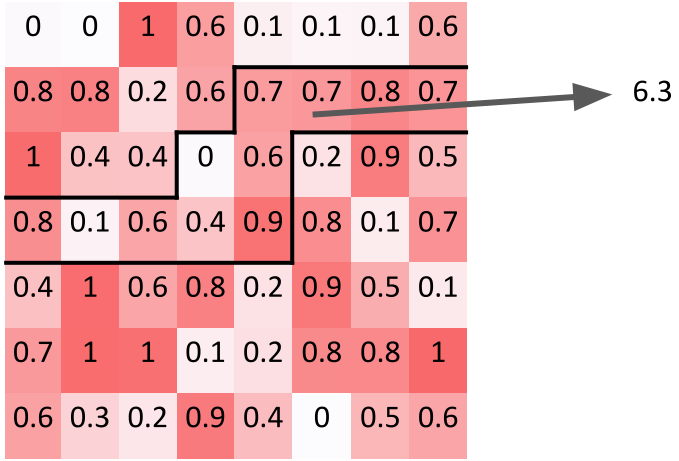
- Floods are hypothesized to be major drivers of plastic mobilization

- A global assessment of plastic mobilization through floods is lacking

Methodology

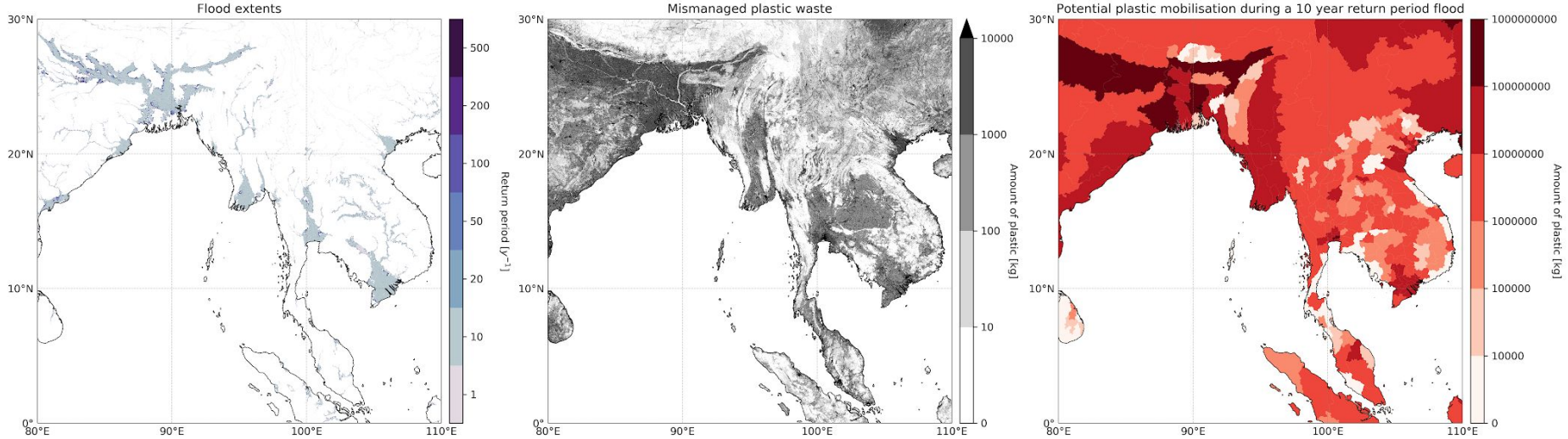
To model the global additional plastic mobilisation in flood conditions we overlaid different global datasets:

- Mismanaged plastic waste (Lebreton, 2019)
- Flood extent maps for different return periods (Dottori et al., 2016)
- FLOPROS flood defence data (Scussolini et al., 2016).



The mismanaged plastic within the river (or flood extent) is summed and presented at sub-country scale.

Methodology

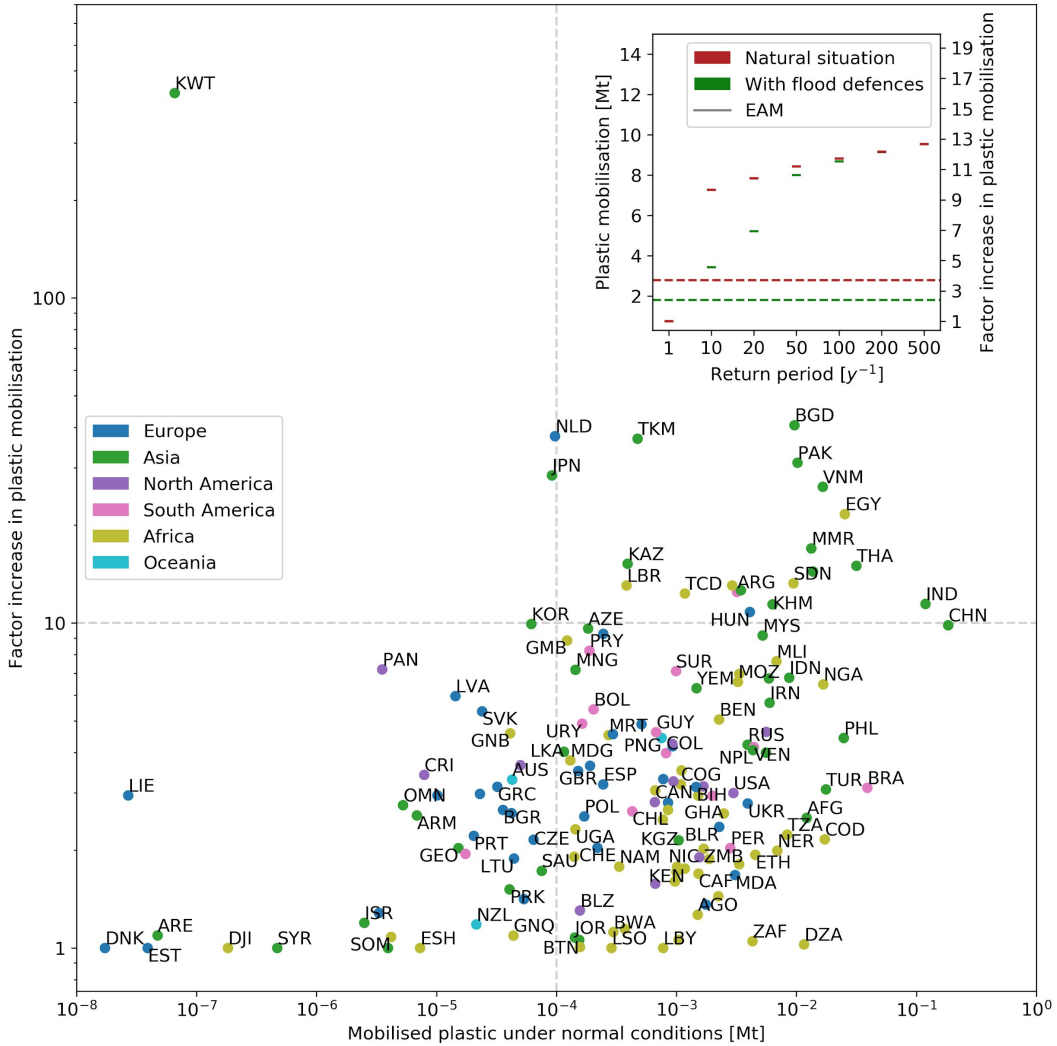


(A) represents the flood extents at different return periods and the river network
(B) Distribution of the mismanaged plastic waste and
(C) Aggregating the mismanaged plastic waste in the 10-year return-period flood extent

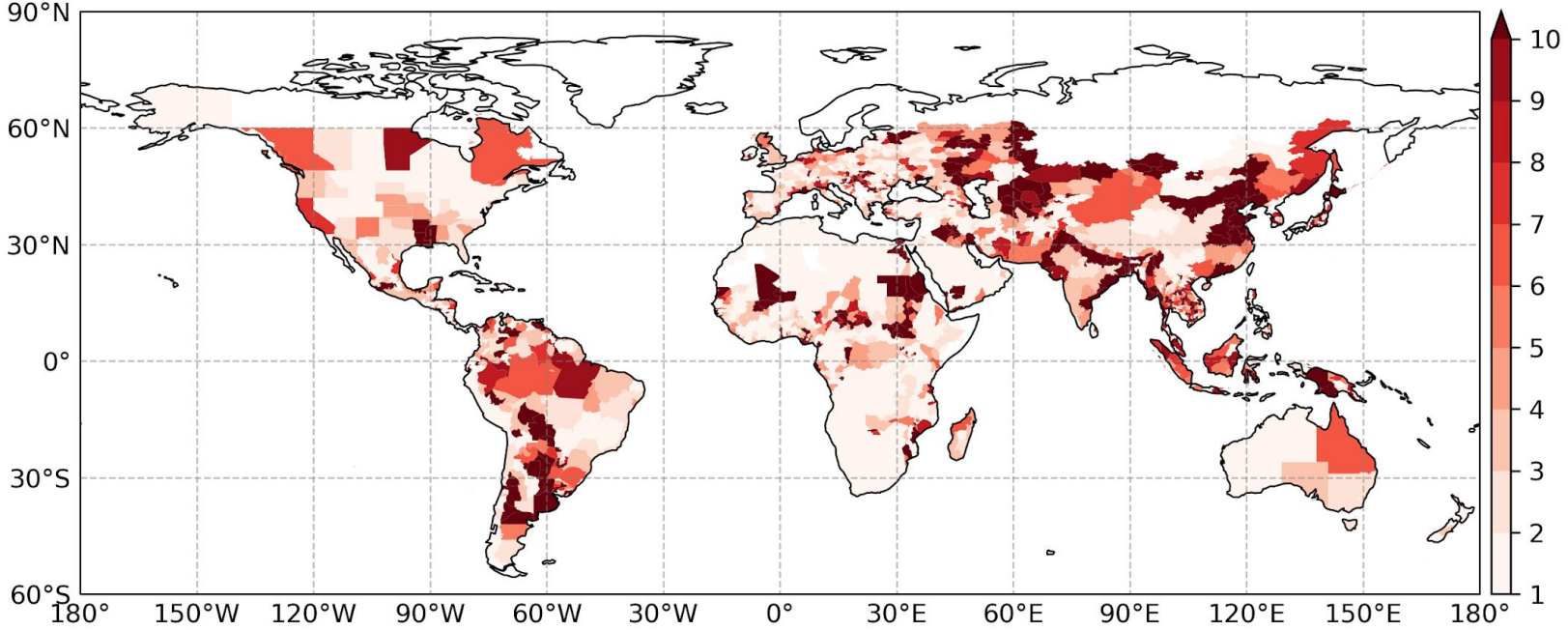
Results

(Main) Country level representation of potential plastic mobilisation during non-flood conditions and the factor of increase of the emissions during a 10-year return-period flood.

(Sub) Global representation of potential mobilisation during floods of different return periods. The red bars show the natural situation while the green bars represent the situation with flood defences in place. The horizontal lines show the expected annual mobilisation when taking floods into account (compounding the different return periods).



Results

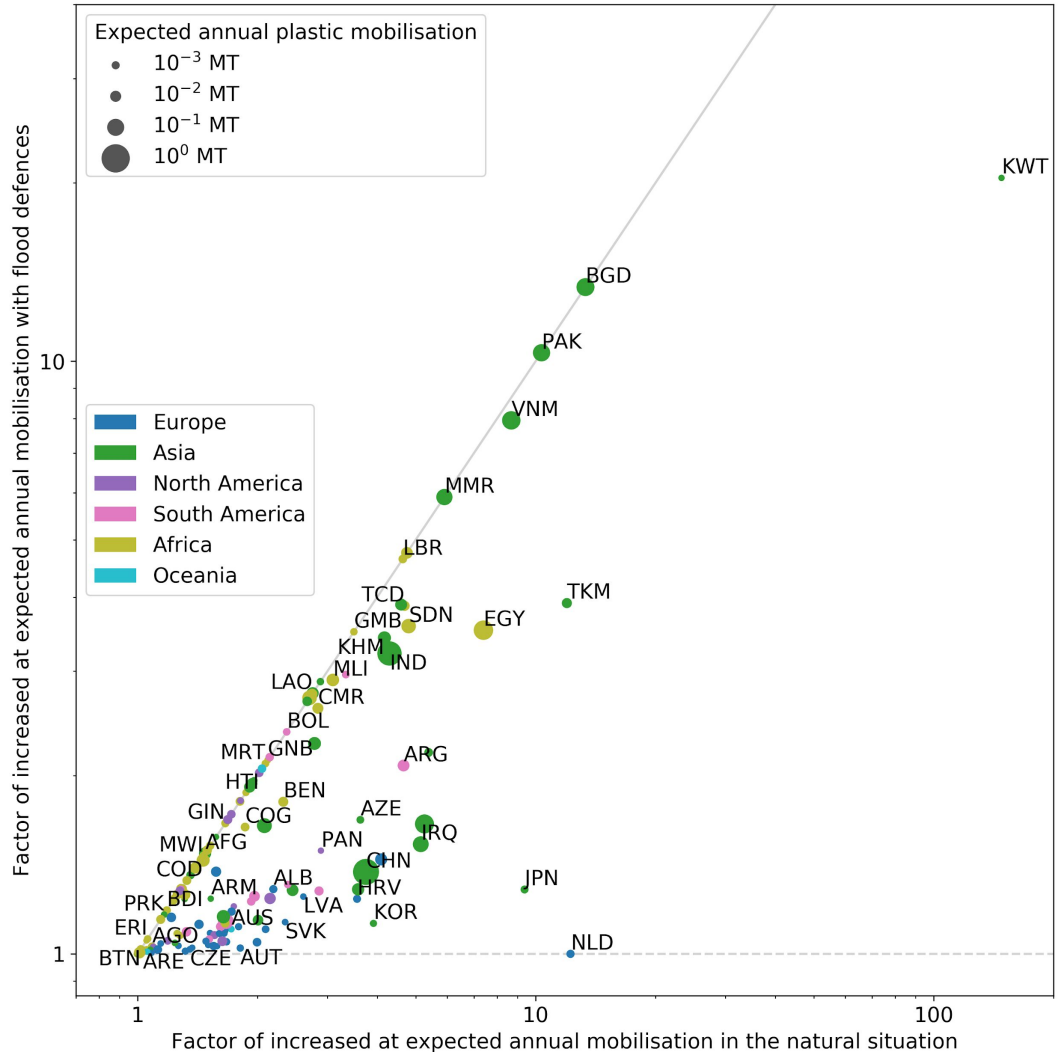


Global representation of plastic mobilisation during a 10-year return-period flood, normalised with the non-flood mobilisation. Interesting to note are the delta regions - especially in densely populated areas - that are heavily affected by mobilisation due to flooding. Even regions that are less often linked to riverine plastic such as the Mississippi, Rhine and Danube delta show up in this representation.

Results

- Country level representation of the normalised (against the non-flood situation) expected annual plastic mobilisation in the natural (x-axis) and protected (y-axis) situation.

- Many of the countries with the highest levels of plastic mobilisation lie close to the 1:1 line.



Take home messages

- Riverine flooding is globally an important driver of plastic mobilisation
- This effect varies substantially between and within countries. The most heavily affected areas can be linked to densely populated delta regions.
- Compounding the effect of the different return periods can give us insight in the effectiveness of flood defences on this phenomenon.

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