

# THE ECONOMICS OF CLIMATE TIPPING POINTS



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## WHICH TIPPING POINTS HAVE THE LARGEST ECONOMIC IMPACT?

- A tipping point is the point where small changes in a system become significant and, when exceeded or in critical condition, lead to large and often irreversible changes in the state of the system.
- The "social cost of carbon" is a measure of the quantifiable costs and benefits of emitting one additional ton of CO<sub>2</sub> in monetary terms.
- The impact of the climate tipping point will increase social costs and every country inevitably has to allocate costs for dealing with disasters.
- So the concept of tipping points has become an essential concern to minimise the economic risk and impact of interacting tipping points.

## WHAT CAN WE DO?

- Analyse the economic impact of tipping points by building a meta-analytic model capable of incorporating all the tipping points and estimating the overall contribution to the social cost of carbon based on geophysically realistic estimates

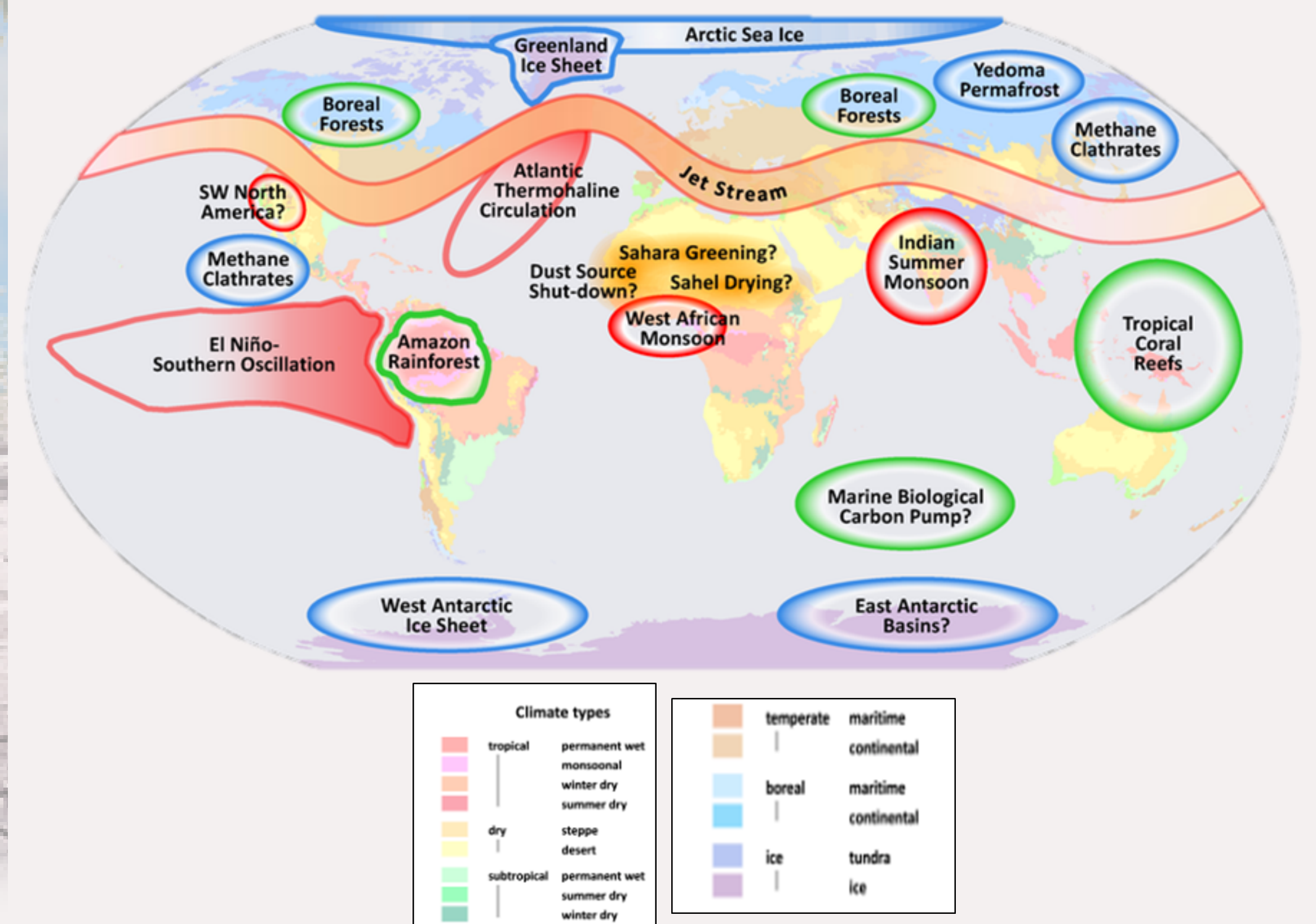


Figure 1. Map of the three groups important tipping elements in the Earth System : ice bodies (cryosphere entities), circulations of the ocean and atmosphere (circulation patterns), and large-scale ecosystems (biosphere components). Source: PIK, 2017.

## Meta-Analytic integrated assessment model (IAM)

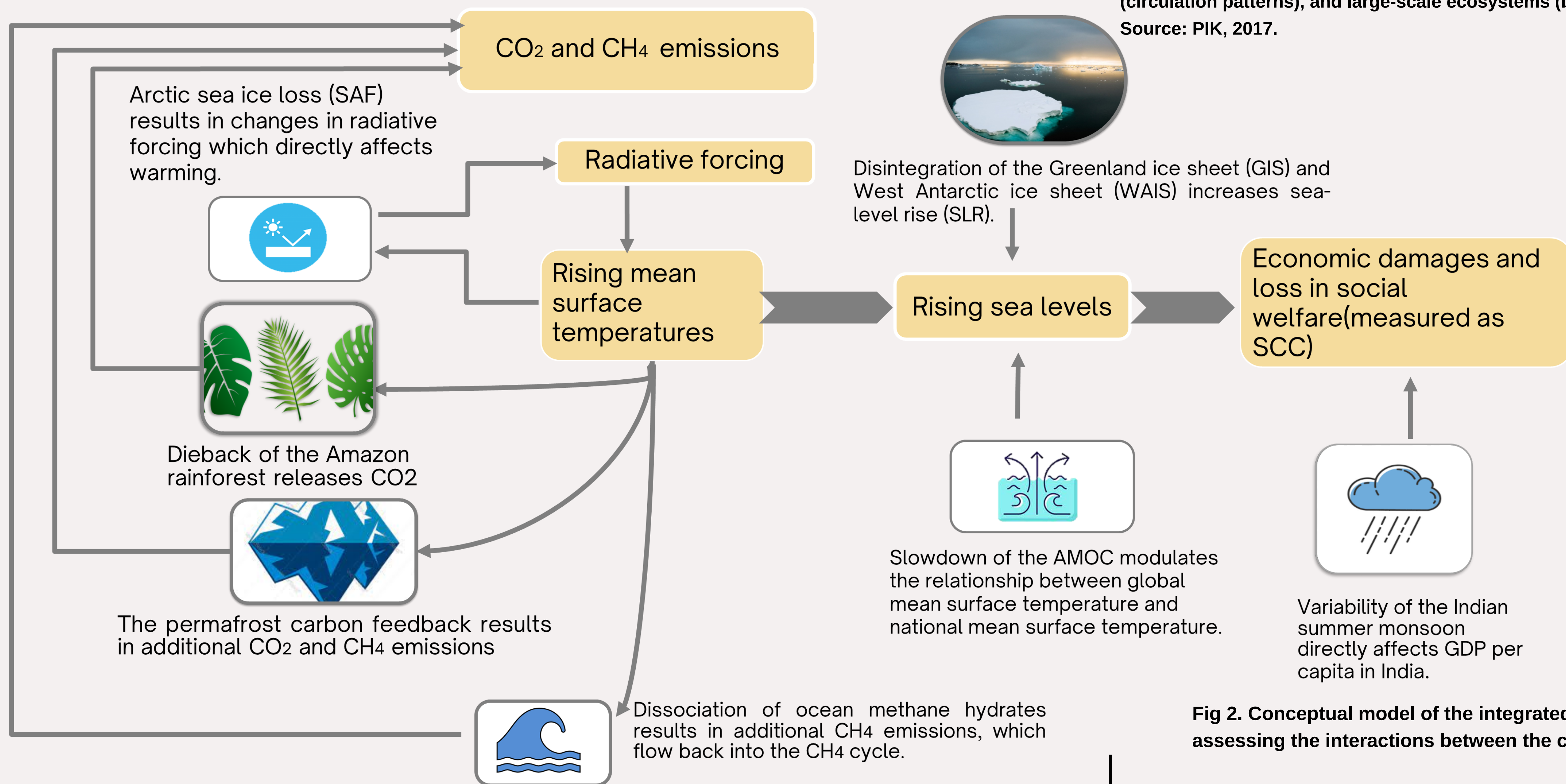


Fig 2. Conceptual model of the integrated assessment model (IAM) assessing the interactions between the climate tipping points.

## CLIMATE TIPPING POINTS ARE EXPECTED TO RAISE THE SOCIAL COST OF CARBON (BUT ONLY IN SOME CASES)

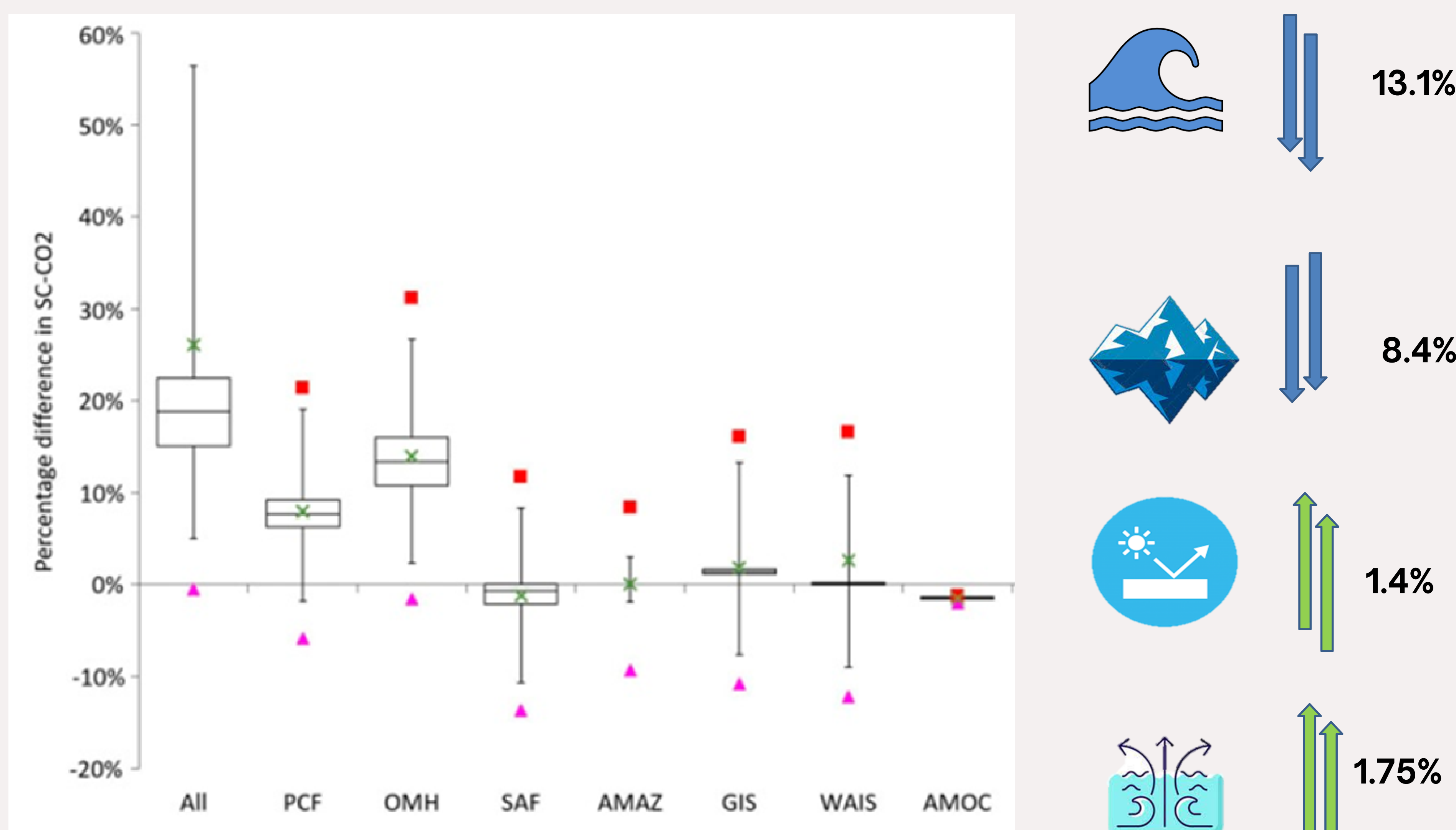


Fig 3: Based on RCP4.5-SSP2 emissions, interaction between all climate tipping points will cause an increase in the social cost of carbon (mean=25%) 1,2.

## CONCLUSION

- Modeling the economic impact parameters of climate tipping points that generate the social costs of carbon or the scaled difference in welfare between the two runs per ton of CO<sub>2</sub> emissions is important
- Meta-Analytic IAM can be used to combine estimates of the economic impacts of all the tipping points in the climate crisis based on geophysical realistic estimates.
- Based on the calculations, climate crisis will increase social costs carbon by 25% of global gross domestic product.
- The tipping points with the highest economic impacts are dissociation of ocean methane hydrates and thawing permafrost (13.1% and 8.4% respectively).

## FUTURE CHALLENGES

- Current climate economics literature misses out on some tipping points, for instance, the boreal forest dieback
- Some modelled processes do not account for some key variables such as the valuation of lost biodiversity with the Amazon dieback tipping point
- Interactions between different climate tipping points also need to be studied and valued with more detail

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