

## TipESM: Exploring Tipping Points and their Impacts Using Earth System Models

Anthropogenic emissions of greenhouse gases and land-use changes are warming the planet, reaching around 1.1°C above pre-industrial values. Despite efforts to reduce emissions, global warming relentlessly continues, with the increasing likelihood – exceeding the warming targets of the Paris Agreement, temporarily or permanently. The most recent IPCC 2023 report highlighted that limiting global warming to well below 2°C is becoming extremely challenging.

Several Earth system phenomena are increasingly at risk of rapid and potentially irreversible change.

Tipping Points of significant phenomena such as the West Antarctic and Greenland Ice Sheets, low-altitude coral reefs and permafrost thaw are at risk, even at modest levels of warming. Tipping of Earth system elements runs a high risk that may result in severe – even catastrophic – consequences for ecosystems, biodiversity and society. Coupled with recent research suggesting that tipping points in the Earth system may be reached earlier than previously thought, more robust knowledge of these tipping points and their potential impacts is necessary for societies and policymakers.

### Impact

TipESM delivers a unique contribution to the climate research landscape through advancing our knowledge on the risk of climate Tipping Points and their potential impact on ecological systems and society.

- Advancing knowledge and solution in Earth system science, pathways to climate neutrality, climate change adaptation, climate services, social science for climate action and understanding of climate-ecosystem interactions
- Contribute substantially to key international assessments (Intergovernmental Panel on Climate Change, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, European Environment Agency)
- Increasing the transparency, robustness, trustworthiness and practical usability of the knowledge base on climate and Earth system change for use by policymakers, practitioners, other stakeholders and citizens
- Strengthening the European Research Area with increased knowledge on the risks of crossing climate Tipping Points



### Project Snapshot

**Funded by:** European Union, Horizon Europe Funding Programme

**Start date:** 1 January 2024

**End date:** 31 December 2027

**Project Coordinator:** Danish Meteorological Institute

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### Action

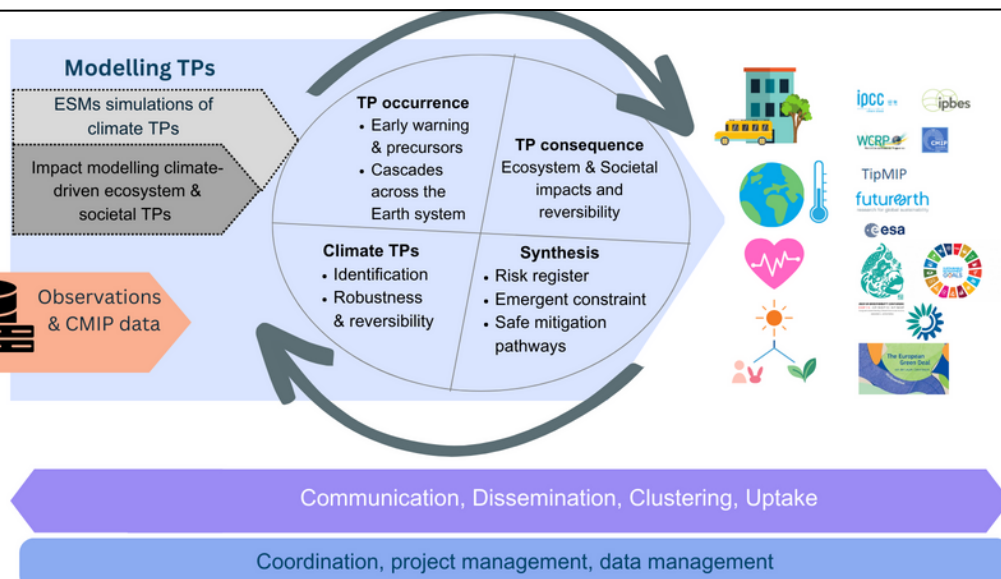
TipESM will deliver a step change in our understanding of climate Tipping Points in the Earth system, including their impact on ecosystems and society, combined with a set of early warning indicators and safe emission pathways that minimize the risk of exceeding such Tipping Points.

TipESM brings together scientists from a range of disciplines to deliver new insights into six key Tipping Point challenges.

- Simulating Tipping Points in the Earth system with the latest generation of Earth System Models
- New knowledge of climate Tipping Points and their driving processes
- Early warning indicators and the risk for cascades of Tipping Points in the climate and ecosystems
- Identifying climate change-driven Tipping Points in ecosystem and society
- New knowledge on the impacts of climate-tipping events on ecosystems and society
- Delivering a set of safe emissions pathways to minimize the risk of crossing Tipping Points



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The conceptual diagram of TipESM shows:

- the planned science work (blocks with light blue in the center, and gray background on the left)
- the dissemination and exploitation activities which will run in parallel with the project and data management (bars at the bottom of the chart).

TipESM will also use observations and the existing WCRP Coupled Model Intercomparison Project (CMIP) archives (in orange) to benchmark the TipESM simulations and develop methods for identifying Tipping Points and early warning indicators. The symbols on the right illustrate the lasting impacts the project will have.

## Project Partners and Associated Partners

### Partners:

- 1- Coordinator: Danmarks Meteorologiske Institut (DMI), Denmark
- 2- Sveriges meteorologiska och hydrologiska institut (SMHI), Sweden
- 3- Centre national de la recherche scientifique (CNRS-IPSL, CNRS-EPOC and their Affiliated Entities: CEA, IRD), France
- 4- Koninklijk Nederlands Meteorologisch Instituut (KNMI), The Netherlands
- 5- Universitetet i Bergen (UiB), Norway
- 6- Potsdam-Institut für Klimafolgenforschung e.V. (PIK), Germany
- 7- Fundación privada Instituto de Salud Global de Barcelona (ISGlobal), Spain

### Associated partners

- 8- University of Leeds (UNIVLEEDS), United Kingdom
- 9- Met Office (METO), United Kingdom
- 10- The University of Reading (UREAD), United Kingdom
- 11- University of Liverpool (ULIVERPOOL), United Kingdom
- 12- Universität Bern (UBERN), Switzerland
- 13- Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft (WSL), Switzerland

## Collaborations

TipESM collaborates closely with the following initiatives and EU-funded projects:

