

## [OptimESM: Optimal High Resolution Earth System Models for Exploring Future Climate Changes](#)

### Description

OptimESM will develop a novel generation of Earth system models (ESMs), combining high resolution with an unprecedented representation of key physical and biogeochemical processes. These models will be used to deliver cutting-edge and policy-relevant knowledge around the consequences of reaching or exceeding different levels of global warming, including the risk of rapid change in key Earth system phenomena and the regional impacts arising both from the level of global warming and the occurrence of abrupt changes.

OptimESM will achieve these goals by bringing together four ESM groups with Integrated Assessment Modelling teams, as well as experts in model evaluation, Earth system processes, machine learning, climate impacts and science communication. OptimESM will further develop new policy-relevant emission and land use scenarios, including ones that realise the Paris Agreement, and others that temporarily or permanently overshoot the Paris targets. Using these scenarios, OptimESM will deliver long-term projections that will increase our understanding of the risk for triggering potential tipping points in phenomena such as ice sheets, sea ice, ocean circulation, marine ecosystems, permafrost, and terrestrial ecosystems.

OptimESM will further our understanding of the processes controlling such tipping points, attribute the risk of exceeding various tipping points to the level of global warming, and develop a range of techniques to forewarn the occurrence of tipping points in the real world. AI-methods for statistical downscaling will be developed and applied to improve our understanding of the effect of long-term global change and tipping points on regional climate, particularly extreme events. New knowledge and data from OptimESM will be actively communicated to other disciplines, such as the impacts and policy research communities, as well as the general public. This knowledge will provide a solid foundation for actionable science-based policies.

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