Introduction

The Atlantic thermohaline circulation (THC) transports large amounts of heat northwards, acting as a heating system for the northern North Atlantic and north-western Europe. Paleo-reconstructions (1) and model simulations (2,3) have shown the THC to be stable only within certain limits beyond which the circulation shuts down. Because of its possibly severe consequences, a collapse of the THC may be considered as “dangerous anthropogenic interference with the climate system” that Article 2 of the UN Framework Convention on Climate Change (UNFCCC) calls to avoid.

Emission corridors preserving the THC

Emission corridors embrace the range of CO₂ emissions that are allowed under normatively defined policy-goals or ‘guardrails’. They are calculated along the conceptual and methodological lines of the tolerable windows approach (4,5). The aim of this paper is to derive emission corridors compatible with the goal of reducing the risk of a THC collapse while taking into account the socio-economically acceptable pace of emission reductions. The analytical tool employed for the scope of this analysis consists of a reduced-form climate model (6) coupled to a box model of the Atlantic THC (7) and allows for the relevant uncertainties to be taken into account.

Sensitivity of emission corridors

The emission corridors are sensitive to:
- physical parameters, i.e., climate and North Atlantic hydrological sensitivity.
- the guardrails, i.e., the minimum admissible intensity of the THC, the maximum admissible rate of emission reductions and the minimum admissible transition time towards a decarbonizing economy.

Risk emission corridors

If probability distribution functions (PDFs) can be attached to uncertain model parameters, it is possible to calculate emission corridors obeying the guardrails with a given probability.

References: