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# The risk of a major weakening of the Thermohaline Circulation – an economic view

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A major weakening of the Thermohaline Circulation (THC) is the classical example for rapid climate change. While such an event is considered very unlikely by the IPCC, and does not appear in the IPCC's global warming scenarios of the $21^{st}$ century, it seems that it cannot be excluded. The uncertainties in models and observations are still large, and the time horizon of scenarios has rarely been extended beyond 2100AD. Therefore it is essential to understand the risks of a THC breakdown. There are numerous studies on the oceanographic and climatological aspects of such an event, yet there has hardly been any work on its impacts on ecosystems, economy, and society. To close this gap, this talk outlines results from a recently completed project that has carried out an Integrated Assessment of a THC weakening, focusing on Europe. This Integrated Assessment consists of a comprehensive impact analysis, an elicitation of experts' judgments, and an Integrated Assessment model. The impact analysis starts with long-term model scenarios of global warming that display a THC weakening. We compare scenarios with the same $CO_2$ concentrations, but with differing freshwater fluxes, to account for the large uncertainty about how strong the latter will be in the future. For the purpose of this talk, we compare one scenario of strong THC weakening, leading to a breakdown by 2150AD, with another scenario of minor THC weakening until 2100AD and a recovery thereafter. Using these scenarios, impacts on climate, marine ecosystems, and vegetation are studied, using several models on different spatial scales. This extends to economic impacts in fishery and agriculture,

and the damages and costs arising from an additional sea level rise of up to 80 cm that could be triggered by a strong THC weakening. Concerning fisheries we focus on cod and capelin fishery in the Barents Sea region. In the THC breakdown scenario its profits go down to zero in the 2060's, meaning a loss of about 170 million Euros. While this sum is large on a regional and sectoral scale, it is small in relation to the respective gross national product. For cereal production, the impact of a THC breakdown might be positive. For instance, the cereal production for Europe as a whole increases by 5% in the 2150's in this scenario. However, in some regions losses could occur as well. The damages and costs of additional sea level rise, in Europe, are again large regionally, but minor in comparison to the gross national products. Estimates from two different sources are in the order of several hundred million Euros to a few billion Euros per year, in the end of the $21^{st}$ century and for Europe as a whole. We stress that our study is based on scenarios from one single climate model and therefore should be considered as exemplary. The impacts of a THC breakdown are probably more severe elsewhere than in Europe if a shift of the tropical rainfall belt is triggered.