



Impacts of thermohaline circulation shutdown in the twenty-first century

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Experiments with idealised models and climate reconstructions based on paleo proxies suggest that the Atlantic thermohaline circulation ('THC') could have stable 'on' and 'off' states. Although the possibility of shutdown of the THC in response to anthropogenic climate change is currently considered to be small, it adds to the range of uncertainty of climate projections.

Here we discuss climate impacts of a hypothetical shutdown of the THC in the 2050s, using the climate model HadCM3. Previous studies have generally focussed on the effects of THC shutdown in pre-industrial climate. Here we take into account increased greenhouse gas concentrations according to an IS92a emissions scenario. THC shutdown causes cooling of the Northern Hemisphere of -1.7 deg C, locally stronger. Over western Europe cooling is strong enough for a return to pre-industrial conditions. Global warming restricts the increase in sea ice cover after THC shutdown, reducing the amount of cooling over NW Europe, but increasing it over North America compared to a pre-industrial shutdown. This is a non-linearity in the local temperature response to THC shutdown. Precipitation change after THC shutdown is generally opposite to that caused by global warming, except in western and southern Europe, where summer drying is enhanced, and in Central America and southeast Asia, where precipitation is also further reduced. Local rise in sea level after THC shutdown can be large along Atlantic coasts (+/- 25 cm), but is difficult to project due to the transient nature of any potential shutdown.