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The Indian-Atlantic Ocean exchange as a key player of deglacial climate change

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Modelling results show that gradual global warming during deglaciation leads to an abrupt resumption of the thermohaline circulation after being stalled, while Northern Hemisphere warming is not sufficient to trigger an augmentation in presence of reasonable meltwater fluxes to the North Atlantic. The modelled deglaciation scenarios include a sequence of meltwater pulses at 19,000 years before present and the Heinrich-I events in the North Atlantic. The abrupt transition to an interglacial thermohaline circulation is related to large-scale salinity advection of near surface waters from the South Atlantic/Indian Ocean and the tropics to the formation areas of North Atlantic deep water, as well as heat release from the sub-surface North Atlantic. The transition can be related to the onset of the Bølling/Allerød warm interval 14,700 years ago. The interglacial circulation mode is characterized by a strong insensitivity to deglacial meltwater pulses, but possesses a distinct bistability in the Hysteresis curve for cumulative positive freshwater fluxes to the North Atlantic. Therefore, the restarted ocean circulation bears the potential for a delayed long term weakening of the thermohaline circulation in response to the large meltwater pulse 1A, which occurred about 1,000 year before climate conditions in the Northern Hemisphere dropped back to glacial conditions during Younger Dryas that ended rapidly 11,700 years ago. Comprising, we find that warming induced Southern Ocean changes are an integral part of deglacial changes in the thermohaline circulation, since Southern Hemisphere warming also evolves as a “seesaw” response to a meltwater reduced Atlantic overturning circulation in a deglacial global warming scenario.