Tracing Water and Sediment Transport in Simulations of Present–day, Glacial, and Interglacial Ocean Circulation Regimes

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Modeling the global ocean thermohaline conveyor at present, at the Last Glacial Maximum, and at a subsequent meltwater event is revisited using a combination of MOM–2 ocean global circulation model, a sediment transport model, and a water transport visualization techniques employing particles and additional tracers. The modeled changes of sediment deposition rates, linked to the changes of the global deep–ocean thermohaline circulation, provide a better understanding of the glacial–to–interglacial variability of the conveyor dynamics, and help to identify the regions of the world ocean that are most sensitive to the glacial and meltwater impacts. In addition to the well–known local changes of the conveyor in the Atlantic Ocean during the last glaciation and subsequent meltwater events, the simulations show the global character of these impacts, detected as far from the North Atlantic as the Indian and the southwestern Pacific Oceans. As deep convection plays crucial role in the global thermohaline conveyor and regulates the changes of the conveyor on time scale of years to millennia, different tracer mixing schemes were tested to address the sensitivity of the conveyor dynamics on the millennial time scale. Based on these simulations, we challenge the idea of a global conveyor–like deep flow strongly connecting the surface waters of northern parts of the North Atlantic and North Pacific Oceans at Holocene/modern, or glacial, or meltwater intervals.

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