Can we use ice sheet reconstructions to constrain meltwater for deglacial simulations?

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Abstract

Freshwater pulses from melting ice sheets are thought to be important for driving climate variability. This study investigates challenges in simulating and understanding deglacial climate evolution within this framework, with emphasis on uncertainties in the ocean overturning sensitivity to meltwater inputs. The response of the model used in this study to a single Northern Hemisphere (NH) meltwater pulse is familiar: a weakening of the overturning circulation, an expansion of NH sea ice cover and a meridional temperature seesaw. Nonlinear processes are vital in shaping this response, and are found to have a decisive influence when more complex scenarios with a history of pulses are involved. For this study, a meltwater history for the last deglaciation (21-9 ka) was computed from the ICE-5G ice sheet reconstruction, and the meltwater was routed into the ocean through idealized ice sheet drainages. Forced with this meltwater history, model configurations with different freshwater sensitivities produce a range of outcomes for the deglaciation. Theses outcomes are determined by the thresholds for collapse and resumption of the overturning circulation, as well as the dependence of the sensitivity on the changing background climate. For all sensitivity configurations, there is a mismatch between the simulated deglaciation and proxy records, indicating that uncertainties in the meltwater scenario play an important role as well. This study illustrates that current uncertainties in model sensitivity to freshwater and meltwater reconstructions are limiting in efforts to forward-model deglacial climate variability using data-constrained meltwater forcing scenarios.

Strata-specific bacterial diversity in aquifers of the Thuringian Basin/Germany

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The INFLUINS (Integrated fluid dynamics in sedimentary basins) project investigates coupled dynamics of near surface and deep flow patterns of fluids, transported materials and component substances in the Thuringian Basin. The extensive basin landscape is located in eastern Germany and belongs to the Triassic period of Bunter sandstone (Buntsandstein), shell limestone (Muschelkalk) and Keuper, which crop out at the surface. Older sediments and Permian (Zechstein) can be found at the edges of the basin. With microbial investigations, we are analyzing the bacterial diversity of ground- and mineral water at different locations to see whether there are special patterns in bacterial distributions originating from the different rock strata. This will facilitate understanding fluid movement in the Thuringian Basin. We determined bacterial diversity from water samples out of two natural springs and ten groundwater wells by cultivation and subsequent morphological, physiological and molecular identification. To elucidate differences to other rock strata, we compared these samples to two brine springs (4.62 M and 1.03 M salt content), located in Permian aquifers. First results show that the largest proportions were found to be members of Bacilli and γ- proteobacteria, including the genera *Pseudomonas* and *Bacillus*. Next steps will be a comparison of cultivation-dependent and cultivation-independent methods to gain further information on bacterial strains which where uncultivable or suppressed by other bacteria strains.