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Hydraulic parameterization of Nordic overflows in a coupled climate model with explicit free surface: Freshwater hosing and global warming

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Most of the dense water that sinks in the Nordic Seas overflows the ridges in the Denmark Strait and the Faroe Bank Channel to form the densest part of North Atlantic Deep Water. The physics of this overflow is poorly represented in coarse resolution models, but might have implication for the dynamic behaviour of the Atlantic meridional overturning circulation (AMOC). Here, we present simulations with the coupled climate model CLIMBER-3α in which we apply a hydraulic parameterization of the overflow introduced by Kösters et al. (GRL, **32**, L04602, 2005). The parameterization is used for the first time in a coupled model with an explicit nonlinear free surface of the ocean.

First results show a better representation of deep water formation in the Greenland Sea as well as a more realistic circulation pattern in the Atlantic. We further present the effects of this parameterization on the stability of the AMOC and in particular its response to global warming scenarios as well as to anomalous freshwater flux to the North Atlantic. We discuss the dynamical behaviour of the model with special emphasis on changes due to the parameterization.