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Using natural helium-3 and 14C simulations to study the impact of the geothermal heating and vertical mixing parameterization on ORCA ocean general circulation model's deep circulation.

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We use natural helium-3 and natural 14C simulations to study the effect of the geothermal heating and different vertical mixing parameterization on modeled deep ocean circulation. Helium3 is injected in the deep ocean through hydrothermal activity, is particularly adapted for testing the effect of the geothermal heating on models' deep ocean circulation. Its mode of injection in the ocean is related to the heat released to the ocean along ridges axis, with high isotopic values that provides an oceanic distribution with salient horizontal gradients that are particularly adapted for testing the modeled deep oceanic transport. Natural 14C is injected in the ocean at the air-sea interface. Its source in the ocean is well known and provides a severe constraint on the modeled deep circulation. The simulations are performed with the same version of the ORCA model developed at LODyC (France). For these simulations, natural Helium-3 is injected along axes of mid-ocean ridge, with a flux linearly proportional to the geothermal heating rate. We compare the models results with measurements collected during major global scale ocean observation programs (GEOSECS, WOCE), and show how natural helium-3 and natural 14C simulations provide useful information for testing different version of models' deep ocean circulation. The analysis will particularly focus on the AABW ventilation