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Glacial-interglacial changes of ocean temperatures and their sensitivity to atmospheric temperature and ocean circulation

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We have developed a three-dimensional coupled dynamical ocean energy balance atmosphere model which allows extensive sensitivity studies and ensemble simulations over several glacial-interglacial cycles. With this, the model is considerably more efficient than most three-dimensional Earth System models of intermediate complexity (EMICs). We have performed several coupled 800,000-year simulations including orbital forcing and with prescribed greenhouse gas and ice-sheet forcings. We focus on glacial-interglacial changes of surface and deep-ocean temperatures at various regions, compare the model results to reconstructions from marine sediment cores and analyze the sensitivity of local ocean temperature to changes in atmospheric temperature, Atlantic meridional overturning circulation (AMOC) and Antarctic Bottom Water (AABW). A combination of model results and temperature reconstructions potentially permits a reconstruction of past changes in overturning circulation. With the model we identify locations where a sampling of water masses permits reliable results.