SESSION 3

The eddy-permitting regime (e.g. ORCA025)

23. Jens Terhaar (LSCE-IPSL – Orsay): Simulated anthropogenic carbon in the Arctic Ocean in three DRAKKAR model configurations.

Abstract: The Arctic Ocean is projected to experience amplified ocean acidification, more than any other region in the world ocean. To simulate its future changes with ocean models, we must first be able to simulate baseline conditions and Arctic acidification over the industrial era, i.e., at least for the main driver, increasing CO2. Here we compare anthropogenic CO2 uptake in DFS-forced simulations of three global configurations of the NEMO-PISCES model (ORCA2, ORCA05, and ORCA025) and we evaluate results with available observations. The comparison revealed a notable dependence of the simulated anthropogenic carbon inventory (total mass stored in Arctic basin) on resolution. While the 2° configuration stored 1.6 Pg C between 1860 and 2005, the ½° and ¼° versions took up 1.9 and 2.2 Pg C, respectively. Those simulated results are lower than data-based estimates (3.0 Pg C), but the latter may over-predict anthropogenic carbon in the Arctic, as already shown in the Mediterranean Sea. Indeed, evaluation of the models with CFC-12 (another transient tracer) suggests that simulated ventilation of subsurface waters are roughly on target in the ORCA025 configuration, while data-based estimates overestimate deep-water concentrations. These simulations further indicate that about ¾ of the anthropogenic carbon in the Arctic Ocean enters that basin through lateral transport rather than by a flux across the air-sea interface (via gas exchange). In other ocean areas, transfer by gas exchange generally dominates. The simulated inventory increases with resolution as net lateral transport of anthropogenic carbon into the basin increases. Wider comparison to results from CMIP5 (typically coarse-resolution models) reveals larger diversity. Lateral transport is generally the dominant means by which anthropogenic carbon enters the Arctic, and that transport appears particularly sensitive to model resolution and bathymetry as well as an ocean model's forcing or coupling to an atmospheric model. *(terhaar.jc@gmail.com). Co-Authors: James Orr, Laurent Bopp*