Sea ice-Ocean modeling at CNRM-GAME for global climate studies: recent improvements of the sea-ice component

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GELATO model is the sea-ice component of the CNRM-CM Global Coupled model (GCM). The current version of CNRM-CM (CNRM-CM5) is used at CNRM for Coupled Model Intercomparison Project phase 5 (CMIP5) experiments. It includes the Arpege-Climat atmospheric component and the NEMO-OPA9 ocean dynamic model, including the dynamic-thermodynamic GELATO multicategory sea-ice model. We developed a forced configuration of the coupled ice-ocean model NEMO-GELATO in order to produce an hindcast of the Arctic and Antarctic sea-ice covers. The ice/ocean model is forced by atmospheric fields from the ERAinterim reanalysis during the period 1990-2009. Performance of the model is addressed, including the sensitivity to the forcing data. Additionally, some physical processes, not much represented in current GCM, were implemented in GELATO to improve sea-ice mean state and variability. To better capture the transformation of the ice surface during the melt season, we implemented a semi-empirical parametrization of melt ponds, which are known to play a crucial role in the high-latitude feedbacks. Performance of this parametrization is investigated, in both forced and coupled modes. In the forced configuration, the evolution of the surface albedo during the spring-summer seasons compares well with data sampled during the 1997-1998 SHEBA campaign. We also introduced a simple parametrization of snow densification through wind effect. This process induces a thickening of the ice, mainly in the Antarctic where the snow cover is the thickest. The sea-ice/ocean hindcast is meant to be used for initialization of seasonal forecasts using the fully coupled model CNRM-CM5.