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Sensitivity of the simulated arctic sea ice cover to the representation of the diurnal cycle

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The sea ice cover permanently interacts with the ocean and atmosphere, exchanging fluxes of heat, water and momentum. However, in the current generation of global coupled GCMs, the coupling between sea ice and atmosphere is done on a daily basis. This does not allow to correctly represent the diurnal cycle of the surface temperature of sea ice, affecting heat exchanges with the atmosphere. The global coupled climate model CNRM-CM3.3 (includes OPA8 ocean model and Gelato3 sea ice model coupled with ARPEGE-Climate v4) is used to assess to what extent it is possible to better represent this diurnal cycle. One of the means to achieve that is to increase the vertical resolution of the temperature profile within the ice slab near the ice-atmosphere interface. Three experiments were run and analysed in the Arctic in preindustrial mode (greenhouse gases and aerosol concentrations are held constant to their 1860 values). In the first experiment, the vertical resolution of all the ice levels is constant, and the coupling frequency with the ocean and atmosphere components is 24h. The second experiment differs from the first one by the introduction of the variable vertical levels. A third experiment was conducted with the same enhanced vertical discretisation, but with a coupling frequency of 3h. These simulations were run for 50 years and are compared to each other. In particular, the simulated sea ice volume differs significantly from one experiment to another (up to 25% over the whole Arctic).