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Impact of ocean stratification on the Arctic Ocean ice cover - investigated by using a coupled 1-D numerical model

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To investigate the impact of ocean stratifications on the ice cover, a one-dimensional numerical model (Björk, 1989) is used to compute oceanic heat flux and ice thickness development, during the ice growth season. The Arctic Ocean is divided into six regions according to their stratification of the upper layer. Observed salinity and temperature profiles, from several stations within each region, are used as initial conditions in the model. Observed data come from the NODC data base. Resent observations, from ice tethered profilers (ITP´s) deployed during the IPY period, is also used to increase the spatial coverage. The computations show that the central regions have a largest ice growth, more than 0.7 m, over one growth season, using an initial ice thickness of 2 m. The large ice growth is due to the present cold halocline layer preventing upward mixing of heat from below. The weak stratification in the Nansen Basin enables deeper mixing into the warm Atlantic layer, which reduces the ice growth to a minimum of 0.25 m at some locations. In the Canada Basin the inflow of warm Pacific summer water generates a temperature maximum at 50 m. This heat reservoir is large enough to reduce the ice growth to about 0.55 m, in spite of the strong salinity stratification in the region. The regions with the largest ice growth have correspondingly the lowest annual mean oceanic heat fluxes, around 0.5 W m^{-2}. However some locations in the Nansen and Canada Basins have heat fluxes larger than 1 W m^{-2}. In our investigation we found a net melting over a full year only for one station, located close to the Bering Strait.