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Spatial and temporal variability of oceanic heat flux to the Arctic ice pack

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In order to simulate the large-scale structure and temporal variability of oceanic heat flux (F_w) to the Arctic ice pack, observations of heat in the mixed layer and ice dynamics are compared with parameterizations and climatologies. Long term drifting platform observations of seawater temperature and salinity (primarily from automated buoys) are used to describe the annual cycle of temperature above freezing (ΔT_f) in the mixed layer beneath the ice pack, which are modulated by ice-ocean friction velocities ($u*$) determined from the platform drifts to produce estimates of F_w between 1975 and 1998. In the Transpolar Drift, ΔT_f is not negligible in winter, which implies a positive F_w to the ice pack by means other than solar heating. A parameterization based solely on the solar zenith angle (with a 1 month lag) is found to largely describe the observed ΔT_f (with root-mean-square error of 0.03 $^{\circ}$C), despite the lack of an albedo or open water term. A reconstruction of F_w from 1979 to 2002 is produced by modulating parameterized ΔT_f with $u*$ based on daily ice drift estimates from a composite satellite and *in situ* dataset. The reconstructed estimates are corrected for regional variations, and compared to independent estimates of F_w from ice mass balance measurements, indicating annual F_w averages between 3 to 4 W m^{-2} depending on the selection of underice roughness length in the ice-ocean stress calculations. Although the interannual variations in ΔT_f are fixed by the parameterization in the derived reconstruction, the dynamics indicate an overall positive trend (0.2 W m^{-2} per decade) in Arctic F_w, with the largest variations found in the southern Beaufort Gyre.