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# Flux-profile relationships in the stable atmospheric surface layer over sea ice: the SHEBA results

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Measurements of atmospheric turbulence made during the Surface Heat Budget of the Arctic Ocean Experiment (SHEBA) are used to examine the profile stability functions of momentum (nondimensional gradient of wind-sped) and sensible heat (nondimensional gradient of temperature), and derivative quantities such as the turbulent Prandtl number and the gradient Richardson number in the stably stratified boundary layer over the Arctic pack ice. Turbulent fluxes and mean meteorological data were continuously measured and reported hourly at five levels on a 20-m main tower for 11 months. The comprehensive data set collected during SHEBA allows studying the profile stability functions in detail, including the very stable case. New parameterizations for the profile stability functions in stable conditions are proposed to describe the SHEBA data; these cover the entire range of the stability parameter z/L from neutral to very stable conditions, where L is the Obukhov length and z is the measurement height. In the limit of very strong stability, stability functions of momentum follows to '1/3' dependence in the very stable regime (in log-log coordinates), whereas stability functions of sensible heat flux initially increases with increasing z/L, reaches a maximum at about z/L = 10, and then tends to level off with increasing z/L. The study also focuses on the self-correlation problem that occurs in plots of the profile stability functions versus z/L because the same variables (primarily the friction velocity) appear in both profile stability functions and z/L.