Nakanishi, M., H. Niino, and T. Anzai, 2022: Stability functions in the stable surface layer derived from the Mellor–Yamada–Nakanishi–Niino (MYNN) scheme. *J. Meteor. Soc. Japan*, **100**, 245-256. http://doi.org/10.2151/jmsj.2022-013

Plain Language Summary: Stability functions based on Monin–Obukhov similarity theory for momentum and heat in the stable surface layer are derived from the Mellor–Yamada–Nakanishi–Niino (MYNN) scheme. The resulting "MYNN" stability functions can be approximated by linear functional forms. Momentum and heat fluxes obtained from the MYNN stability functions are compared with those from previously proposed stability functions and observational data of the Surface Heat Budget of the Arctic Ocean experiment (SHEBA).

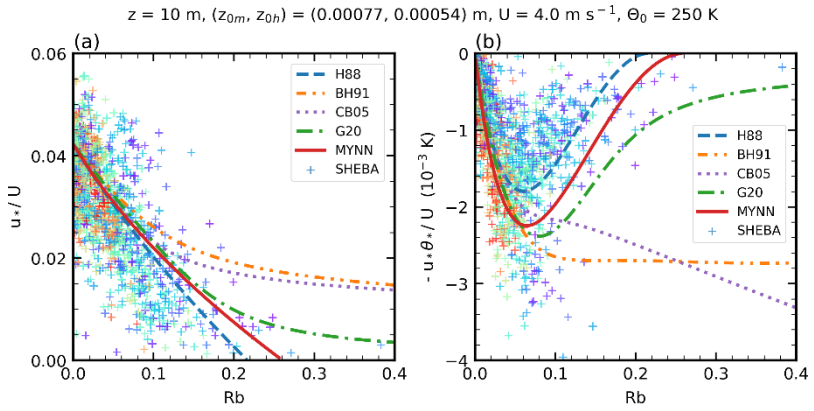

Figure 1. (a) Friction velocity u_*/U and (b) upward heat flux $-u_*\theta_*/U$ as a function of the bulk Richardson number Rb. Red lines show results from the MYNN stability functions, and crosses show hourly averaged SHEBA data at 10 m height for the wind speed between 3 and 5 m s^{-1}.

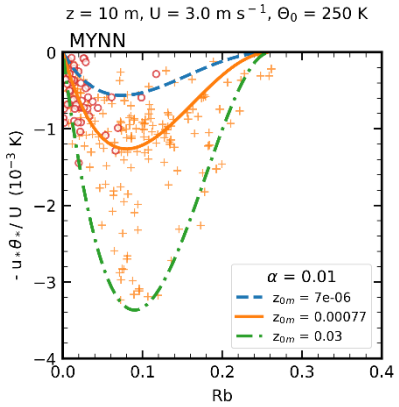

Figure 2. Dependence of upward heat flux $-u_*\theta_*/U$ obtained from the MYNN stability functions on Rb. Lines show dependence of the heat fluxes on the roughness length for momentum, z_{0m}, for fixed $\alpha = 0.01$, where α is the ratio of the roughness length for heat, z_{0h}, to z_{0m}. Orange crosses and red circles show hourly averaged SHEBA data at 10 m height for the wind speed between 2.8 and 3.2 m s^{-1}, where the red circles indicate the data during summer of the SHEBA.

- Momentum and heat fluxes obtained from the MYNN stability functions show good agreement with hourly averaged SHEBA data at 10 m height.
- The MYNN stability functions suggest that significant variations of the fluxes observed for a period of winter when the ice was covered with dry snow may have been caused by those of the surface roughness around the observational site.
- The MYNN stability functions predict that the bulk and flux Richardson numbers approach critical values of 0.26 and 0.21, respectively, in the limit of $z/L \to \infty$, where L is the Obukhov length.
- These critical values result from Kolmogorov hypothesis applied to the turbulent dissipation in the MYNN scheme and are considered to correspond to a transition from Kolmogorov to non-Kolmogorov turbulence.