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Similarity scaling systems for stably stratified turbulent flows

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The newest developments of the gradient-based similarity theory in stably-stratified turbulent flows are summarized. Gradient-based similarity scales are classified into two categories, referred to as explicit and implicit. The explicit scaling employs the length scale as a specified function of height above the underlying surface. Within the implicit type, the length scale is locally related to various moments of turbulence. The form of the gradient-based similarity functions, for the considered three implicit scaling systems, is obtained by the renormalization of explicit-type expressions. Similarity functions for the dissipation-type scaling are compared with data obtained during the SHEBA experiment in the Arctic surface layer. Since the implicit approach is not directly dependent on height, it can be applied not only in the stable boundary layer, but also in other stably-stratified turbulent flows in the upper atmosphere, in lakes, and in oceans.