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Comparison of stable boundary layer depth estimation from sodar and profile mast.

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The depth of the atmospheric turbulent mixing layer next to the earths surface, hz, is a key parameter in analysis and modeling of the interaction of the atmosphere with the surface. The transfer of momentum, heat, moisture and trace gases are to a large extent governed by this depth, which to a first approximation acts as a finite reservoir to these quantities. Correct estimates of the evolution of hz assists the would allow accurate prognosis of the near-surface accumulation of these variables, that is, wind speed, temperature, humidity and tracer concentration. Measuring hz however is not simple, especially where stable stratification acts to reduce internal mixing, and indeed, it is not clear whether hz is similar for momentum, heat and tracer. Two methods are compared here, to assess their similarity: firstly using acoustic back-scatter is used as an indicator of turbulent strength, the upper limit implying a change to laminar flow and the top of the boundary layer. Secondly, turbulence kinetic energy profiles, TKE(z), are extrapolated to estimate z for TKE(z) = 0, again implying laminar flow. Both techniques have the implied benefit of being able to run continually (via sodar and turbulence mast respectively) with the prospect of continual, autonomous data analysis generating time series of hz. This report examines monostatic sodar echo and sonic anemometer-derived turbulence profile data from Halley Station on the Brunt Ice Shelf Antarctica, during the austral winter of 2003. We report that the two techniques frequently show significant disagreement in estimated depth, and still require manual intervention, but further progress is possible.