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In situ and lidar derived boundary layer profiles of winds and turbulence

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Recent developments in Doppler lidar technology have produced operational systems for real-time measurements of boundary layer profiles of horizontal winds and turbulence. New lidar scanning patterns and signal processing algorithms have demonstrated reliable high resolution capabilities that are ideally suited for the most challenging conditions such as stable night time boundary layers. The most interesting new information is contained in the profiles of small scale turbulence which are essential for defining the total observation error statistics for optimal data assimilation algorithms. In addition, these profiles can be used to define the boundary layer height and therefore constrain the model parameterization and provide critical information for transport and diffusion models. Recent results are presented for typical and more challenging conditions in a suburban environment. High vertical resolution in situ profiles of velocity, temperature, and small scale turbulence are compared with lidar derived profiles. The roughness sublayer and mixing height are clearly resolved for these various atmospheric conditions. The fundamental issues for providing the most useful information to a given numerical weather prediction model are addressed such as the optimal spatial average. Some of the challenges for stable boundary layer studies are also highlighted.