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Determination of mixing-layer, stable-layer, and residual-layer heights with the use of radiosonde observations

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The planetary boundary layer (PBL) is repeatedly grown and developed at regular intervals, and classified into various types depending on atmospheric stability and the mechanism of occurrence of turbulence in the boundary layer. The PBL is classified into the convective boundary layer composed of the surface layer, the mixed layer, and the capping inversion at daytime, and the stable boundary layer and the residual layer at nighttime. The PBL height is a key parameter in air pollution models determining the volume available for pollutants to dispersion and the structure of turbulence in the boundary layer. The most common methods for determining PBL height are parameterization methods, remote sounding systems, and utilisation of radiosoundings such as potential temperature, mixing ratios, and wind speed. Since among these methods, methods using radiosonde have advantages and disadvantages depending on the state of atmosphere, we compared each method to find the optimal method according to each atmospheric condition. Radiosonde observations were observed 184 times from November 14, 2014 to November 3, 2015 at three stations including Jungnang, Bucheon and Seolleung which are located in the Seoul metropolitan area. In this study, the cases were classified into daytime and nighttime, thermal stability and instability in the PBL, and strong and weak average wind speed in the PBL. And using the parcel method and the Richardson number R_i method, which are the most traditional methods, the PBL height was determined and compared, and the profiles of temperature, humidity and wind speed were compared and analyzed in consideration of the characteristics of the atmospheric boundary layer.