EGU26-2398, updated on 06 Jun 2026
https://doi.org/10.5194/egusphere-egu26-2398
EGU General Assembly 2026

Planetary Boundary Layer Height on the Northern Mount Everest Region Retrieved from Wind Lidar Observations

Xiaowen Zhou, Yaoming Ma, Fanglin Sun, and Binbin Wang
Lanzhou University, College of Atmospheric Science, Lanzhou, China (zhouxw2024@lzu.edu.cn)

A coherent Doppler wind lidar (Wind3D 6000) has been operating in the northern Mount Everest region since 2023. We retrieved the planetary boundary layer height (PBLH) from the Lidar observation spanning October 2023 to September 2025 using a hybrid algorithm that combines SNR-based thresholding and wavelet covariance transform (WCT) techniques, adapted to cloud and humidity regimes. The results were compared with the PBLH from radiosonde observations and reanalysis data. We find that the modified retrieval shows close agreement with radiosonde observations (R^2 = 0.895) and outperforms the manufacturer's own default outputs and two reanalysis products (ERA5 and MERRA-2). Case studies for a clear-sky day, a cloudy day, and a strong-wind episode illustrate the strengths of the lidar-derived PBLH: rapid convective growth under clear skies, abrupt collapse in cloud-limited conditions, and mechanically sustained deep layers during high-wind periods. In contrast, the reanalysis product consistently misrepresents the timing and magnitude of these diurnal transitions. Composite statistics reveal a robust diurnal cycle characterized by a shallow nocturnal layer (≈300 – 400 m), rapid growth after sunrise, and a late-morning maximum of 1.5 – 1.8 km. Seasonally, daytime PBLH peaks in spring and reaches its minimum in winter, except for a distinct June low attributable to enhanced monsoon-related clouds and moisture. Comparisons of monthly daytime biases show that ERA5 consistently underestimates PBLH, whereas MERRA-2 and the operational lidar algorithm overestimate it throughout the year. This two-year PBLH record from a high-altitude site on the north of Mount Everest establishes a valuable benchmark for evaluating and improving boundary-layer parameterizations over extreme mountain terrain, despite limitations in nocturnal validation and occasional data gaps during adverse weather conditions.