

4.102 Vertical profiles of particle light extinction coefficient in the low troposphere in Shanghai in winter based on Tethered balloon measurements.

Early Career Scientist

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Abstract:

A state-of-the-art cavity attenuated phase shift single scattering albedo monitor (CAPS PM_{ssa}) was set up in a tethered balloon to study the vertical profiles of particle light extinction coefficient (b_{ext}) in the low troposphere (<1000 m) in Shanghai during 12-29 December 2015. In total, 90 vertical profiles of b_{ext} were obtained, 67 of which were measured continuously from ground surface to approximately 1000 m. 50 groups of b_{ext} at several fixed heights (e.g., 400 m, 500 m, 700 m, and 950 m) were also measured for about 70 h. A clear transition height (TH) was generally observed for vertical profiles of b_{ext} below 1000 m all day long. TH could be observed mostly at about 400-500 m, 100 m, 400-700 m during early night (18:00-20:00), late night, morning, respectively. During periods with PM_{2.5} at ground surface higher than 75 $\mu\text{g}/\text{m}^3$, stable TH were always formed below about 700 m and the average difference below and above the TH can be as high as 605 Mm^{-1} , about 9-fold higher. Detailed analysis of vertical profiles also revealed several higher b_{ext} at higher altitudes, which is mainly caused by regional transport at around 350 m and 500 m in winter in Shanghai. Comparatively, b_{ext} was relatively well vertically mixed below 1000 m during clean periods when PM_{2.5} < 75 $\mu\text{g}/\text{m}^3$ at ground surface. The transport of air masses could affect the general pollution level of PM concentrations and vertical profiles of b_{ext} . The study elucidates the vertical evolution characteristics of b_{ext} below 1000 m in winter in Shanghai, which will provide hints to aerosol optical model in the vertical direction. The study is also of importance to validate the retrieval algorithm of lidar measurements at the height range of 300-1000 m, and makes a good complement of the blind zone below 300 m.