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Vertical wind observations in clouds using the Equatorial Atmosphere Radar and Mie lidar

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Variations of vertical air velocity (W) in the midlevel shallow-layer clouds are described by a case study observed at West Sumatra, Indonesia (0.2S, 100.32E) in the nighttime between 8 and 9 May 2004. W and spectral width (used as a proxy of W turbulence) were computed using frequency power spectrum observed by vertical beam of a 47-MHz wind profiler. W and spectral width were obtained with 150-m vertical and 166-s time intervals. Using altitude profiles of received signal intensity observed by a 532-nm Mie lidar, altitude where received signal intensity was significantly larger than below (above) was considered as lower (upper) cloud boundary.
Most of the shallow-layer clouds were observed at 6.0-8.5 km. In the top part of clouds (about 0-5 00 m below the estimated cloud tops), downward W up to about 0.2-0.3 m/s and spectral width up to about 0.5-0.6 m/s were observed. In the middle part of clouds (about 500-1000 m below the estimated cloud tops), W showed large variations even every observation intervals (166 s). Both the standard deviation of W during the observation period and spectral width were large (about 0. 5-0.7 m/s). These results demonstrate that a combination of VHF wind profiler and lidar is useful to observe wind variations in and around midlevel shallow-layer clouds with high time and vertical resolutions.
Altitude profiles of temperature observed by radiosondes showed that the air was absolutely stable near the top part of clouds and conditionally stable below. Possible relationship between W and temperature is discussed.

Keywords: Equatorial Atmosphere Radar, lidar, cloud, turbulence, troposphere, turbulence