コヒーレントドップラーライダーで観測された境界層内の風速擾乱について

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Wind field disturbances in the boundary layer over Tokyo suburban area observed with coherent Doppoler lidar

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Precise time-spatial structure of wind velocity in the atmospheric boundary layer can be observed with Coherent Doppler lidar. Doppler lidar observed wind velocity under the clear-air condition like wind profiler/MST-type radars, and also it is often free from ground clutter, unlike radars. NICT has been developing a 2-micron band infrared high-power laser; the Doppler observation with the new laser module is eye-safe, so practically we can monitor the wind fields at altitudes as low as buildings avoiding any hazards to human beings.

Conventional techniques of wind profiler-type radars employ radial or line-of-sight wind velocity measurements in often only 3-5 directions of radar beam to retrieve horizontal or 3-dimensional vector winds of as a function of z and t. The lidar wind results of, for example, vertical scan observations present wind fields as a function of x, z, and t, which enables more detailed information in horizontal homogeneity of wind velocity and velocity fluctuations at upper levels. Targets of this work will include to study wind field and horizontal and temporal inhomogeneity of wind velocity fluctuation, which is expected to contribute to validating assumptions made for horizontal wind estimation u, v, and coplanar technique to estimate momentum flux <u’w’>, <v’w’>.

Taking advantage of the eye-safe Doppler lidar, we have observed radial wind velocity at the 0-2 km heights on 2 February 2009. RHI (range height indicator) scan or lidar beam scan observation was conducted in a x-z plane in the northeast to southwest direction. Time series of the height-range cross-section of radial wind speed show that a structure with the 800-m depth standing up from the ground moved toward the lidar with the speed similar to the background wind of 2-3 m/s. The structure may be a thermal or plume flown by the back ground wind field. Associated wind velocity fluctuations are larger around the height of 0.8-1.2 km,