

Observations of Air Plankton in Land with the High-Sensitivity and High-Resolution Millimeter Wave Radar

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1. Development of the Millimeter Wave Radar FALCON-I

In order to investigate thin, high altitude clouds, which influence global energy balance, we developed a low-power and high-sensitivity cloud profiling radar named FALCON-I transmitting frequency

modulated continuous wave (FM-CW) at 95 GHz for ground-based observations. Millimeter wave at 95 GHz is used to realize much higher sensitivity than lower frequencies to small cloud particles. FALCON-I, which is an FM-CW type radar, realizes similar sensitivity with much smaller instantaneous output power to a pulse type radar. Two 1m-diameter parabolic antennas separated by 1.4m each other are used for transmitting and receiving the wave. The direction of the antennas is fixed at the zenith. FALCON-I is designed to observe clouds between 0.3 and 20 km in height with a high spatial resolution of 15 m. The sensitivity of FALCON-I is about -45 dBZ at the range (height) of 1 km, where Z is the radar reflectivity factor in mm^6/m^3 .

2. Observations of Air Plankton with FALCON-I

Using the developed millimeter-wave FM-CW radar FALCON-I, we have observed clouds and air in various areas in the land and the ocean. With observations in the land, many point objects in clear sky have been detected. Diffuse echo even in clear sky has already been recognized with many meteorological radars and are thought to be floating insects, so called, air plankton. The high sensitivity and high spatial resolution of FALCON-I can recognize such echo as point objects, each of which probably corresponds to individual insect.

3. Distribution and Characteristics of Air Plankton

We detected many air planktons with observations in NICT Koganei, Tokyo, for few weeks' observations in May 2006.

They were not detected with observations above oceans on board on the research vessel MIRAI of JAMSTEC. Air planktons distribute up to about

2 km above the ground level. The horizontal velocities of air planktons derived from the data of

FALCON-I were almost same as those of wind speed obtained with the wind profiler at radio

frequency. These results show that FALCON-I is one of useful instruments to investigate air planktons in land.