Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AAS22-17 Room:301A Time:May 26 09:45-10:00

The analysis of the relation between non-precipitation echoes and wind structure of sea breeze

NAGUMO, Nobuhiro[1*] ; KATO, Teruyuki[1]

[1]Meteorological Research Institute

Local severe weathers by isolated cumulonimbus cloud occasionally occurs in summer of Kanto Plain. One of the trigger is known to be a local circulation as a sea breeze front. The local circulation structure under no precipitation condition cannot be detected by operational radar and ground observation network as AMeDAS, however, non-precipitation echoes are occasionally observed in fine day or around area of heavy rain in rainy day. The case on July 23, 2013 was representative of non-precipitation echoes prior to the local heavy rain. The Doppler Radar for Airport Weather (DRAW: 60 km in observation radius) set at Haneda detected the behavior of non-precipitation echoes which showed convergence near coast line and moved toward inland several hours before cumulonimbus generations. Finally heavy rain occurred near the non-precipitation echoes convergence line. This fact suggested that the non-precipitation echoes have a relation with sea breeze structure. To clarify the detail relations between non-precipitation echoes and sea breeze as generation source and distribution of the echoes, we analyzed the dense network observation data consisting of Doppler lidar (6 km in observation radius) and surface observation system with operational observation network of DRAW. The Doppler lidar was installed at Tokyo Institute of Technology in Ookayama, which is 10 km northwest of DRAW at Haneda. This lidar succeeded in observing air structure around sea breeze front and made possible the complex observation with DRAW. Furthermore, we performed the high-resolution simulation (250 m) of JMA-NHM (Non-Hydrostatic Model of Japan Meteorological Agency) to discuss the generation and distribution of non-precipitation echoes.

Dopper lidar image (SN ratio/Doppler Velocity) depicted the sea breeze structure with landward lower flow and counter current above. The sea breeze thickness was about 1500 m at maximum and had Lobes and Cleft structures. In the lidar detectable range, two Lobe-like shapes and one gap (Cleft) between two Lobes were observed. Next, non-precipitation echoes observed by DRAW were shown rather several kilometers seaward (leeward) from the sea breeze front observed by the lidar. The distribution of non-precipitation echoes also showed vertical direction of perturbations with its flow and the echo convergence line showed gradual approach toward sea breeze front. Additionally, The non-precipitation echoes exhibited interesting relations with the sea breeze structure. In the rear of Lobes and thin Cleft structures, non-precipitation echoes distributed at lower altitudes near surface (~200 m) and in front of the Lobe structures was higher altitudes (~800 m) and convergence were detected around Cleft structures (front of Lobe - Cleft).

JMA-NHM simulation of 250 m resolution represented the above-mentioned wind structure well. The front of Lobe showed upward flow and the rear showed down flow. Surface convergence was simulated around Cleft structures. The up- and downward wind exhibited the horizontal circulation in Lobe structures.

In this presentation, we will show the results of observation (e.g., Lobes and Cleft structure, convergence of echoes, and vertical perturbations of echoes) and the discussion results about the relation between non-precipitation echoes distribution and wind structures focusing on pressure perturbation and thermal/mechanical structures.

Keywords: Local circulation, Dense observation (Radar/Lidar), Numerical Simulation