Summary

Doppler radar dbservation was made in Naha, Okinawa (27°N latitude and 128°E longitude) during the Baiu period, *i.e.* 20 May to 15 June 1987. The objectives of the observation were

1) to describe the morphology of convective systems developed over the maritime subtropics during the Baiu period;
2) to understand the structure of these systems; and
3) to compare the structure with that of convective systems occurring in other regions of the world.

The Baiu period of Okinawa is the formative stage of the Baiu (or Mei-Yu in Chinese) front over eastern Asia. Okinawa in the Baiu period is located in a large-scale confluent zone between the south-southwesterly wind at the western edge of the subtropical Pacific high and the southwesterly wind originating in the Indian Monsoon region. The modified tropical airmass was rerlaced by the Monsoon airmass over Okinawa in the 1987 Baiu period (from 13 May to 26 June 1987). The lower layer of the troposphere was conditionally unstable and the unstable condition was stronger than that of Kyushu and Honshu, Japan, which are located at higher latitudes.

70% of the total rainfall amount during the Okinawa Baiu period was from frontal systems and 30% was not associated with the Baiu front. The frontal convective systems were accompanied by the alternation of the middle-latitude airmass and the subtropical airmass. The nonfrontal mesoscale convective systems occurred within the Pacific high triggered by of cold air advection from the mid-latitudes in the middle troposphere.

Two cases of convective systems associated with the Baiu cold fronts are analyzed. The characteristics of these cold frontal systems are 1) the existence of a deep latent unstable layer in the lower troposphere and free convection triggered by cold air, and 2) a leading edge of free convection, an anvil-like precipitation area aloft ahead of the leading edge and a rear stratiform cloud area. The structure of the convective systems around a kink of a cold front is also examined. A cyclonic shear zone was found to exist at the kink. In the southern part of the kink area updrafts originated from low levels. In the northern Part, updrafts started from southwestern middle levels.

Nonfrontal mesoscale convective systems were one of the typical convective systems

characterizing the Okinawa Baiu period. These systems were categorized into three groups based on the structure and the manner of motion: nonsquall cluster, line-type cluster and squall cluster. Non-squall and line-type clusters did not have a distinctively organized convective region and moved in a direction similar to the lower level wind of the troposphere. Squall systems had unique band-shaped convective regions and traveled against the lower level wind. The horizontal dimension of these systems was less than that of the mesoscale convective systems (MCC) of North America and almost the same as that of GATE mesoscale convective systems.

A well-organized squall cluster was observed in the observation period. It had a length of 460 km and a lifetime of 21 hours. The cluster was divided into four parts: forward stratiform region, convective region, transition zone and rear stratiform region. In the convective region, outflow from convective cells converged with the environmental airflow in the lowest level and new cells were successively formed ahead of the old cells. The system traveled against the lower level winds or perpendicular to the shear vector between the middle and lower level winds. The transition zone consisted of relatively intense downdraft and low radar reflectivity. The rear stratiform region made very weak vertical motion and was formed by precipitation particles which originated in the top of the convective region. The forward stratiform region was one of the unique features of this squall cluster. The descending precipitation particles from anvil clouds aloft and weak updrafts in the lower layer produced this region.

The circulation and structure of a nonfrontal squall cluster were examined. The evolution of this system was divided into two stages: Stage I and Stage II. Convective-scale updrafts and downdrafts prevailed and the system was stationary during Stage I. In Stage II, a mesoscale circulation was formed in the system and began to travel. Strong gusts greater than 25 m/s were observed.

The relatively small squall cluster consisted of long-lived cloud with weak precipitation, with convective echo cells embedded in it. Water vapor was supplied to this cluster by the westerly wind below the 3-4 km levels. This potentially warm layer was overlaid by the dry air coming from higher latitudes with low equivalent potential temperature, and a convectively unstable condition was produced. This differential advection of two airmasses played a main role in maintaining the convective system.