

## Summary

This report contains the results of researches done in the two WCRP-related research programs on cloud and radiation which were carried out at the MRI (Meteorological Research Institute) of the Japan Meteorological Agency, during the 7 years from FY1984 through FY1990. This report consists of two parts. Part I describes development of four original instruments for cloud and radiation measurements in the research program "Development of Instruments and Methods of Cloud and Radiation Observation" (FY1984-86). Part II contains the results of various research activities in the research program "Field experiments and Theoretical Modeling of Cloud-Radiation Processes" (FY1987-90).

### **Part I Development of Instruments and Methods of Cloud and Radiation Observation (FY1984-86)**

Four unique instruments for cloud and radiation observation have been developed in this research program. A major purpose of our cloud and radiation observations is to make clear the relationship between the radiative properties of clouds and their microphysical and macrophysical structures. In order to start cloud observations at the MRI, especially *in-situ* aircraft observations, for which our experiences and instruments had been very poor, development of new devices was required. These should give more detailed information on cloud microphysical and radiative properties than obtained by the conventional instruments. The newly developed four instruments are a special video sonde for measuring cloud particles, an airborne video-microscope for cloud particle measurement, an airborne measuring system of cloud interstitial aerosols, and an airborne multi-channel cloud pyranometer system. With a combined use of the first three instruments, three dimensional distributions of cloud forming particles can be measured. Further, the development of multi-channel cloud pyranometers may improve our understanding of the relation between solar spectral reflectances and cloud microphysical properties. The characteristics of the instruments developed are described in each separate section in Chapter 1.

#### 1) Cloud Particle Video Sonde (Sec. 1.1)

A special sonde for measuring cloud particles, which is named a Cloud Particle Video Sonde (CPVS), has been developed. When a CPVS quipped with a small TV camera is