

## Preface

Enlargement of recent human activities gives a crisis to the living earth through modification of the earth climate system due to a large amount of combustion of fossil fuels (e.g., COP3 Kyoto Conference, December 1997), extending industrialization, rapid green losses of tropical rain forest and so forth. In these points of view, the environmental sciences, especially geo-sciences are being advanced year by year, but our knowledge is still not enough to understand our living planet. The climate of the earth is a very complex system consisting of atmosphere, ocean, land surface and these interactions. As pointed out in the IPCC(1995), clouds and aerosols are one of the most unknown factors in the earth-atmosphere climate system.

The Atmos-B1 team, established under the Committee for Earth Observation Systems of ESTO/Forum at FY 1995, is the community to make clear the unknown behavior of clouds and aerosols, using a satellite on board both active and passive sensors. The objective of the team is common in the climate research communities of the world. Therefore, the team intended to have an international workshop focused on the latest scientific issues of cloud and aerosol including the feasibility of space observation. The "Workshop on Cloud, Aerosol, and Radiation Budget Measurements from Space and their Sciences" was held on 12-13 March 1998 at Kagetsuen Hotel, Hakone, Japan. This workshop was organized by the Atmos-B1 team, the Cloud-aerosol radiation budget science team, CPR team and MDS/LIDAR team, and supported by NASDA, under the Committee for Earth Observation Systems of ESTO/Forum.

The two-day workshop consists of two parts; firstly we discussed the scientific issues of cloud and aerosol, and then had presentations of each active sensor, integrated mission plan and related topics. The technical program grouped according to the following session topics:

- Cloud and its characteristics,
- Remote sensing of cloud,
- Aerosol observations,
- MDS/CPR plan,
- CPR and cloud,
- Space lidar plan, and
- Future mission plan.

The proceedings contain the extended abstracts presented at this Workshop. These are basically included in the order of presentation. The participant list and agenda of the workshop are attached to this proceedings as a reference. If you have any questions in each abstract, please contact individual authors, shown in the list.

The First MDS-Lidar Workshop was also held at the same place before this workshop and had active and fruitful discussions. Both workshops are linked with common interest in technique and science on cloud and aerosol issues. Therefore almost all participants joined both workshops. The success of these workshops is the result of the participation and support of speakers, sponsors and the organizing committee members. We express sincere thanks to all these participants and members.

Tamio TAKAMURA,  
Chair of Atmos-B1 team

## Statement by the Joint Program Committee

The representation of clouds and aerosols is one of the major sources of uncertainty in numerical models used for weather forecasting and for climate studies which aim to predict the response of the atmosphere to increased concentrations of greenhouse gases. There is an urgent need for a global data set of the vertical structure of clouds and aerosols to improve our understanding of the earth radiation budget and validate the representation of radiation in such models. Recent technological advances mean that it is now feasible, for the first time, to place active instruments such as lidar and radar in space which can provide global data on these vertical profiles. This contrasts with previous instruments which can provide only the properties of cloud top or a single path integrated parameter to represent the vertical structure. This workshop reviews the present status of such instruments, the synergy between them and the requirements and specifications for such instruments in future space missions.

Results of the first lidar to be flown in space during the LITE experiment aboard the NASA space shuttle in September 1994 are presented showing, for example, the vertical structure of the aerosol from biomass burning. The detailed specification of the NASDA future mission demonstration satellite(MDS) lidar due for launch in 2001 and the accompanying planned validation experiments are also described. Plans for an MDS cloud profiling radar to be flown by NASDA are also outlined together with plans for space-borne cloud radars and lidars by NASA and ESA together with the various ground-based radar studies of clouds presently being carried out in different parts of the world.

It became evident during the workshop that there would be enormous benefit in a future space mission which contained both a nadir pointing lidar and radar; the simultaneous data from both instruments leading to a more detailed retrieval of the vertical profile of cloud particle characteristics such as size and concentration and aerosol properties than can be achieved by each instrument separately. These observations using active sensors in addition to the previous ones involving visible, infrared and microwave sensors give many kinds of aspect of characteristics of aerosols and clouds. Measurements of these parameters on a global scale would transform our understanding of the earth radiation budget and provide data for model validation.

As for the past activities to accomplish the attractive satellite plans, there has been several meetings/workshops;

- (1) ISY(International Space Year) Workshop for TRMM follow-on mission on Nov. 1992 in Tokyo, Japan. Recommendation for space-borne CPR has been issued from GEWEX community in this Workshop.
- (2) GEWEX Workshop on the utility and feasibility of a cloud profiling radar on June, 1993 in Pasadena, USA.
- (3) GEWEX CPRT ad hoc science panel meeting on June, 1994 in Luneburg, Germany.
- (4) International Workshop on Space-borne Lidar 1995, on Oct. 1995 in Nara, Japan.
- (5) International Workshop on Space-borne Lidar 1996, Dec. 1996 in Hakone, Japan.

At those meetings, innovative and wider views of future space-borne lidars/CPRs were discussed including the MDS-lidar plan. The Hakone workshop in February this year was more focused on the MDS lidar project, which a lot of efforts had been made to realize based on the discussion in the previous workshops.

It became clear that the accomplishment of the satellite observations with combined sensors would be a key to understand the global climate change and global warming. This task of deploying a radar and lidar together in space will not be easy and it is important that the independent efforts by each space agency are undertaken with a framework of international cooperation.

Joint Program Committee for  
The First Workshop on Mission Demonstration Satellite Lidar  
and  
Workshop on Cloud, Aerosol, and Radiation Budget Measurements  
from Space and Their Sciences

## Joint Program Committee

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# Workshop on Cloud, Aerosol, and Radiation Budget Measurements from Space and Their Sciences

## Agenda

12 March (Thu.) ,1998

- 9:00 - 9:05      Welcome [Y. Haruyama]
- 9:05 - 9:10      Introductory remarks [T. Takamura]
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- 9:10 - 10:30    Session 1 : Cloud and its characteristics [Chair: T. Takamura]
- "Cloud Climatology Using GMS Data" [I. Okada, T. Takamura, K. Ogino and  
                  H. Tamaru]
- "Recent Results from LITE on aerosols and thin clouds in the upper  
                  troposphere" [D. M. Winker]
- "Preliminary results from IMG" [H. Shimoda and R. Imasu]
- "The Estimation of Aerosol Optical Parameters from ADEOS/POLDER Data"  
                  [Y. Kawata and A. Yamazaki]
- 
- 10:30 - 10:40    Coffee Break
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- 10:40 - 12:00    Session 2a : Remote sensing of cloud [Chair: T. Hayasaka]
- "Cloud top height, optical thickness, and effective particle radius of cirrus  
                  retrieved from NOAA AVHRR data." [T. Hayasaka, K. Yamamoto,  
                  N. Sugimoto and I. Matsui]
- "Investigations of Convective Clouds with Ice-phase Process"  
                  [M. Katsumata, H. Uyeda and T. Shinoda]
- "Prospective Methods for Retrieving Cloud Parameters Using Radar  
                  Measurements" [S. Y. Matrosov, A. S. Frisch, R. A. Kropfli and B. E. Martner]
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- 12:00 - 13:00    Lunch
- 13:00 - 15:30    Excursion        e.g., Hakone Museum

- 15:40 - 17:20      Session 2b (Continued): Remote sensing of cloud [Chair: Y. Fujiyoshi]  
 "Role of Spaceborne Cloud Radar in Precipitation Physics" [Y. Fujiyoshi]  
 "Cirrus and mid level clouds remote sensing programme" [P. H. Flamant,  
 H. Chepfer, L. Sauvage and J. Pelon]  
 "Specifications for a Spaceborne Cloud Radar: Algorithms and Synergy for  
 Retrieving Cloud Properties." [A. J. Illingworth, C-L. Liu and R. J. Hogan]  
 "Remote Sensing of Cloud Properties with Lidar and Radiometry"  
 [C. M. R. Platt, S. A. Young and R. T. Austin]  
 "The CARL project : a further step towards the determination of microphysical  
 cloud characteristics from active remote sensing" [J. Pelon, P. Flamant,  
 J. Testud, M. Quante, O. Danne and E. R. Raschke]
- 18:00 - 20:00      Welcome Party

**13 March (Fri.), 1998**

- 9:00 - 10:40      Session 3 : Aerosol observations [Chair: E. V. Browell]  
 "Estimate of the cloud and aerosol effects on the surface radiative flux based on  
 the measurements and the transfer model calculations. Part I: Shortwave  
 forcing in Tateno, Japan" [Y. Takayabu]  
 "LITE and Airborne Lidar Observations of Biomass Burning Plumes"  
 [E. V. Browell, W. B. Grant and S. Ismail]  
 "Optical thickness and transport of the aerosols associated with Asian  
 duststorm over the deserts in northwestern China" [K. Kai]  
 "Combined Passive and Active Laser Sensing of Clouds and Aerosol"  
 [J. Spinhirne]
- 10:40 - 11:00      Coffee Break
- 11:00 - 12:00      Session 4a : MDS/CPR Plan [Chair: A. J. Illingworth]  
 "Plan for a MDS-CPR Mission Project" [T. Nakajima]  
 "Status of Cloud Profiling Radar for MDS" [H. Kumagai]  
 "CLOUDSAT : Status and Prospects" [S. J. Walter]
- 12:00 - 13:30      Lunch

- 13:30 - 14:30    Session 4b (Continued) : CPR and cloud [Chair: H. Kumagai]  
                   "Preliminary Results of the First Observation with an Airborne Cloud Radar  
                   (SPIDER)" [H. Horie, H. Hanado, T. Iguchi, Y. Ohsaki and H. Kumagai]  
                   "The GKSS 95-GHz cloud radar: experimental and theoretical studies in  
                   support of a spaceborne cloud radar mission." [J. Mueller, M. Quante,  
                   E. Raschke, O. Danne, H. Lemke and H. Flint]  
                   "Development of Ka-band Doppler Radar for Cloud and Fog Observation"  
                   [T. Wakayama, S. Watanabe, K. Hamazu, H. Hashiguchi and S. Fukao]
- 14:30 - 14:40    Coffee Break
- 14:40 - 15:40    Session 5 : Space Lidar Plan [Chair: K. Asai]  
                   "Status of MDS-lidar (ELISE) project" [Y. Sasano]  
                   "Status of the ATLID Backscatter Lidar: System and Technology aspects  
                   [A. Culoma]  
                   "Performance of the GLAS, ALR and ISIR Space Flight Experiments"  
                   [J. Spinhirne]
- 15:40 - 16:00    Coffee Break
- 16:00 - 16:40    Session 6 : Future Mission Plan [Chair: T. Nakajima]  
                   "The Earth Radiation Mission" [P. Ingmann]  
                   "Present status of Atmos-B1 program" [T. Takamura]
- 16:40 -            General Discussion and Closing Remarks [N. Motomura, T. Nakajima]

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