A LASER RADAR SYSTEM FOR SIMULTANEOUS DETECTION AND PROCESSING OF MULTIPLE ATMOSPHERIC PARAMETERS

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ABSTRACT

The laser radar technique has been developed for remotely measuring various atmospheric parameters, such as humidity, temperature, visibility, turbidity and aerosol features. Until now, only one of these parameters has been customarily observed with a single laser radar system. However, simultaneous measurements of these multiple atmospheric parameters will lead to accurate and new information of the atmosphere and increase actually the potentiality of the laser radar technique in various fields of application.

This paper is concerned with a multi-purpose laser radar system developed for the use in the simultaneous measurement of several atmospheric parameters and meteorological conditions.

The schematic of our laser radar system is shown in Fig. 1. The laser transmitter is the second harmonic of the Q-switched Nd-YAG laser with 50 pps, 1 W average power at the wavelength of 532 nm. The receiving telescope is consisted of a 50-cm diam. Fresnel lens and the backscattered lights are detected simultaneously with one or two photomultipliers after passing through interference filters. The signals from the two photomultipliers, for instance, are gain-switched and the output is once recorded in a 10-MHz transient recorder (Data Lab. Model DL 905) and then fed into a medium-scale computer (NEAC Model 3200) placed about 150 m distant from the location of the laser radar system. The data are processed in real time and displayed in PPI and/or RHI formats.

The filters are changed automatically by the computer control for the sequential measurements of spatial distributions of the following atmospheric parameters: 1) humidity or water vapor mixing ratio derived from the measurement of the ratio of vibrational Raman scattering intensities of H_2O and N_2 molecules, 2) absolute temperature measured from the rotational Raman profile of air molecules[1)], 3) visibility

or extinction coefficient obtained by the measurement of the N_2 vibrational Raman scattering or the rotational Raman scattering of the air molecules, 4) various aerosol parameters resulted from the Mie / Raman scattering intensity ratio, and 5) ice-water content of clouds measured from the depolarization of the Mie scattering. This system will also be applicable to the measurements of wind velocity[2] and spatial distribution of various molecular density using the method of differential absorption via scattered energy[3].

We are now investigating the performance of this system and some experimental results will be reported at the conference.

References

1) T. Kobayasi, H. Shimizu and H. Inaba, The paper reported in this conference, III-8.
2) V. E. Derr and C. G. Little, Applied Optics 9, p.1976 (1970).
3) H. Inaba and T. Kobayasi, The paper reported in this conference, VI-13.

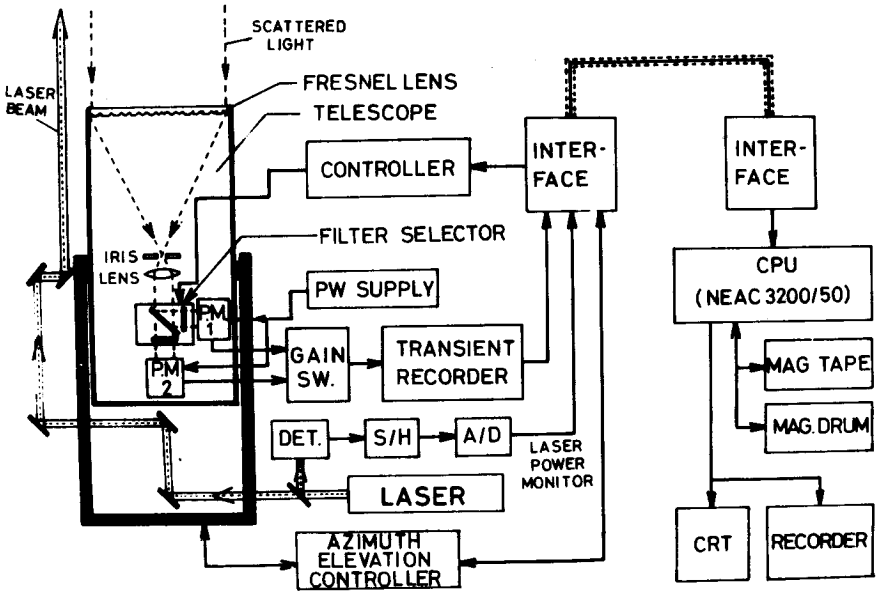

Fig. 1 A schema of the laser radar system for simultaneous detection and processing of multiple atmospheric parameters.