28PD4 SIBERIAN MULTIFREQUENCY LIDAR STATION FOR GROUND - BASED SUPPORT MEASUREMENTS IN LITE EXPERIMENT

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INTRODUCTION

In recent years, much attention has been devoted to the problem of climatic-ecological monitoring of the atmosphere where ozone and aerosol are of considerable importance in investigating the ecology and the climate of the earth. In the vast territory of Siberia the city of Tomsk is a single point where regular lidar monitoring of stratospheric aerosol (since 1986) and ozone (since 1989) have been performing [1,2]. Because of such geographic position, the data of long-term observations of ozone and aerosol obtained in Tomsk, can be of particular interest for the specialists in the field of planetary climatology, ecology and atmospheric physics. In 1994 the NASA/Langley Research Center plans to begin a series of flights on the space shuttle with a spaceborne lidar (The Lidar in Space Technology Experiment -LITE). The spaceborne lidar has been designed to observe clouds, tropospheric and stratospheric aerosols, characteristics of the planetary boundary layer and stratospheric density and temperature perturbations. LITE program propose to perform sounding at three wavelengths of Nd : YAG laser, namely, 1064, 532 and 355 nm.

At the Siberian Lidar Station in Tomsk it is possible to perform sounding of stratospheric aerosol at the wavelengths of 353, 532 and 1064 nm. The 57° satellite orbit inclination makes it possible to encompass the Tomsk territory (56° N). therefore the data on ground-based sensing of the stratosphere, obtained in Tomsk, can be used for referencing and comparing with the results of experimental data of the LITE program.

A MULTIFREQUENCY LIDAR STATION

A simplified block-diagram of the multifrequency multichannel lidar station is presented in Fig. 1, the main parameters are given in Table 1.

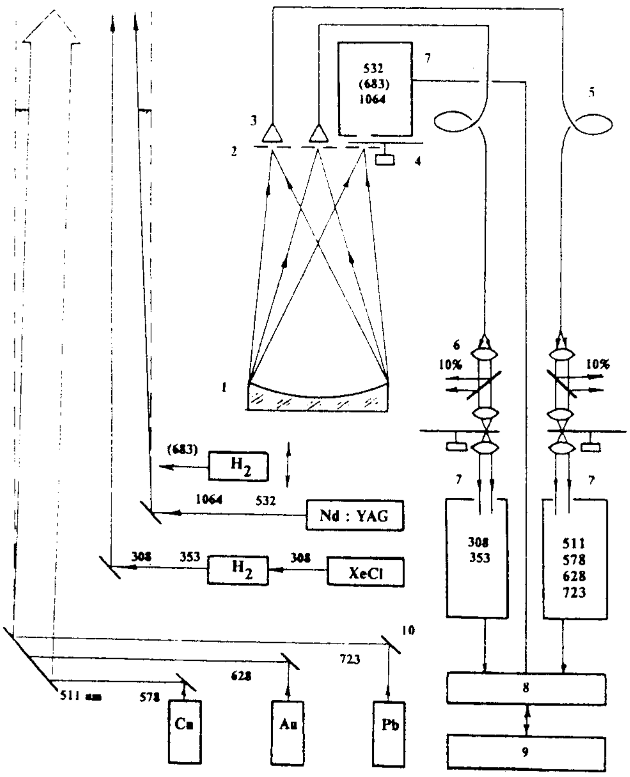

Fig. 1. Block diagram of the multifrequency lidar:
1 - 2,2 m receiver mirror;2 - field diaphragm;3 - phocon;4 - chopper;
5 - fiber; 6-lenses;7 - cell of spectral selection with PMT; 8 - photon counter;9 - computer
10 - beam-deflection mirrors.

Table 1. Parameters of the multifrequency lidar

Parameters of sounding				
aerosol scattering ratio				
microstructure characteristics of aerosol				
ozone concentration				
range of sounding heigts	10 - 35 km			
Trasmitter				
Laser	λ, nm	E, mJ	P_{av}, W	f, Hz
XeCl	308	50		50-100
XeCl+Raman-cell (H_2)	353	30		50-100
Nd:YAG	1064	150		10
Nd:YAG+fre-quency doubled	532	60		10
532+Raman-cell (H_2)	683	30		10
Cu	511		2	$2.5\ 10^3$
	578		1	$2.5\ 10^3$
Au	628		2	$2.5\ 10^3$
Pb	723		1	$2.5\ 10^3$

Receiver	Registration
Telescope diameter, m -2.2	Photon counting regime
Telescope focal length, m -10	Spatial resolution: 50 -500 m
	Strobe number: 512
Field of view, mrad 0.5-1	Temporal resolution: 15 - 30 min

For sounding the stratospheric ozone we use the UV DIAL channel, based on the Raman-shifted excimer XeCl laser. Other kinds of the lasers are used for multifrequence aerosol sounding.

For a sounding channel at the Nd : YAG laser wavelengths the spectral selection cell consisting of spectral dividing mirrors, interference filters, collimating and focusing lenses is located together with a photomultiplier (PMT) immediately in a focal plane of a receiving mirror. At the other sounding lines the optical signal is transmitted from the receiving mirror focus to systems of spectral selection and recording with the use of a phocon optically mounted with a monofilatment fiber or using a cable of optical fibers.

To cut off the signal from the near range the mechanical choppers are utilized operating synchronously with lasers.

Simultaneous sounding of ozone and aerosol makes it possible to reveal correlation couplings in dynamics of stratospheric ozone and aerosol, especially under conditions of strong aerosol turgidity of the atmosphere, which was clearly defined after the Mt. Pinatubo eruption in 1991. The availability of aerosol sounding multifrequency data enables one to reconstruct microstructure characteristics of stratospheric aerosol.

The latest results of the aerosol and ozone lidar observations over the Tomsk are presented in paper.

REFERENCES

1. El'nikov A.V., Marichev V.N., and Zuev V.V. Routine Lidar Observations of Vertical Stratospheric Ozone Distribution over Western Siberia - In: Abstracts of Papers of 15 Int. Laser Radar Conf., Tomsk, USSR, 1990, Part I, p.214-217.
2. El'nikov A.V., Zuev V.V. Marichev V.N. et al. The First Lidar Observations of the Ozone Layer over the West Siberia. Atmospheric Optics, v2, No 9, p.995-996,1989 (in russian).
3. McCormick, D.M. Winker, E.V. Browell et al. "Scientific Investigations Planned for the Lidar In - Space Technology Experiment (LITE)" Bulletin of the American Meteorological Society, Vol. 74, No. 2, February 1993, p.205-214