the experiment will be considered successful and the novel method against collision could be recommended to be used in domestic space-based AIS systems.

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POLARIMETRY OF ATMOSPHERE: EVIDENCE FROM CONDENSED MEDIUM

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Abstract: Optoelectronic system for polarization measurements is presented. The system consists of channel of analysis that is based on the method of polarization visualization and of analysis of spatial distributions of polarized light back scattered by the turbid medium. The results which were obtained and developed methods can be used in lidar applications.

Keywords: polarized light, back scattering, air pollution, biotissue.

Introduction

Nowadays one of the most socially important problem is the problem of air pollution. The analysis of nature of the pollution can be carried out rather efficiently by laser optoelectronic methods. There were developed the technologies on the basis of lidar probing that allowed to determine remotely the spatial contamination level.

There such is a wide variety of lidar systems, all of them are differ in the number of used lasers and the methods of detecting aerosol particles. They feature systems, based upon polarized measurements by which it is possible to define the type of aerosol particles and, moreover, assess the spatial orientation of the scattering particles [1].

Theory

The functional principle of such systems is as follows. Partially polarized light can be most fully described within the Stokes-Mueller matrix formalism [1–2]. The condition of polarization of back dispelled signals resulting from scattering of the probing bunch in the atmosphere including on an atmospheric aerosol of various nature, is characterized generally by degree of a depolarization of the accepted radiation. The polarization of light scattered from different atmospheric aerosols can be characterized by the depolarization ratio of the incoming radiation. Backscattering matrix of the studied aerosols is measured by changing the polarization mode of the probe radiation, as well as using the polarimeter at the input of the lidar receiving system. The type of particles (spherical or non-spherical) and degree of spatial orientation (for example, of crystalline microparticles in the clouds of the upper tier) are determined by the structure of the backscattering matrix and ratio of individual elements. Since this matrix carries comprehensive information of the condition of the aerosol ensemble, thus, observing changes in matrix elements in time and space, it is possible to obtain data not only about the aerosol microstructure at a specific altitude, but also to estimate the parameters of external physical fields. Regular aerosol observations in the upper layers of the atmosphere allow promptly to detect the appearance of another type of aerosol above the observation point, that can give information about the atmospheric circulation and the trans-regional weather travel.

The studies in this field are of prime importance due to wide usage of optical models, that are used in calculation programs of the atmospheric radiation balance. Those programs use optical models in which the orientation property of non-spherical cloud particles, for example, ice crystals in cirrus clouds, is not taken into account. That’s the reason why the model is used, at best, assuming a chaotic orientation of particles, which leads to a decrease in the accuracy of the calculations.

The enhancing of the optical model of clouds of the upper tier levels is extremely important for understanding the key issues of global climate change on our planet.

Methods

The expansion and perfection of the polarimetric method of polarized light scattered from the object is connected with the increasing range of the materials of the investigated objects from gaseous to solid. In this paper, a technique for analyzing polarization parameters of light backscattered from a quite turbid media, a biological tissue is developed. In particular, the possibilities of the method of polarization imaging [3–4] of the subtissue were investigated, as well as the effect of absorption of multiply scattering media on the degree of polarization. Biotissues were chosen as the research objects.

These both methods are based on the analysis of spatial distributions backscattered from the media, polarized light. As a result, the image of a subtissue of increased contrast was obtained. The technique of correlation analysis of polarized images was developed, the parameters of residual polarization for the object were determined.

Conclusion

On the basis of the results, the design of the polarimetric sensor is currently being developed and tested. It allows us to register the condition of both the surface tissues of the human body and intracavitary tissues, for example, of the oral cavity.

The results obtained and the methods developed can be used in lidar applications. Thereafter the techniques will be improved and we will be able to receive completely new information.

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