

OCEAN OPTICS – FUNDAMENTAL STUDIES AND APPLIED DESIGNS

This special issue is based on materials of IX All-Russian Conference with international participation "Current Problems in Optics of Natural Waters» (ONW'2017). The journal has always paid much attention to the problems of ocean optics and published more than 30 articles on this topic, starting with a large review by I.M. Levin in the first issue of "Fundamental and Applied Hydrophysics" (No. 1, 2008). The problems of ocean optics undoubtedly correspond to the subject of the journal: they include both the fundamental research, which began yet in the 18th century by the founder of photometry Pierre Bouguer ("Optical treatise on the gradation of light", 1760), and applied developments. The first makes a scientific basis, the second is aimed at obtaining the data needed for the exploitation of ocean resources and the implementation of practical human activity, on the development of optical methods for studying and monitoring.

Ocean Optics as a science, on the one hand, is a section of physics - optics of scattering media, on the other hand, an important section of oceanology, directly connected with other ocean sciences - hydrology and hydrodynamics, marine biology, biogeochemistry. The above aspects were fully considered at the ONW'2017 conference and, as far as it possible, are reflected in this special issue.

The first ONW conference was held in 2001 in St. Petersburg as a continuation at the international level of the plenums of the Working Group on Ocean Optics of the Commission on the Problems of the World Ocean, created in 1973 by Prof. K. S. Shifrin. The plenums were held in different cities and enjoyed great popularity; in total 11 plenums were held. They were discontinued after 1990, in connection with the well-known events of those years.

The optical conferences managed to revive only after 11 years, when the international conferences "Current Problems in Optics of Natural Waters» (ONW) were established by the P. P. Shirshov Institute of Oceanology, its St. Petersburg branch and the Institute of Applied Physics Russian Academy of Sciences, in order to provide scientific communication between Russian and foreign specialists. Above all, it concerned scientific youth - the conferences gave them the opportunity to obtain experience and to make themselves known at international level. The first seven conferences (six in St. Petersburg, one in Nizhny Novgorod) were held with the active participation of Russian and foreign specialists; both from the CIS countries (Azerbaijan, Belarus, Ukraine) and from far abroad (17 countries, including Great Britain, Germany, Italy, Canada, China, Poland, USA, France, Japan, etc.).

Unfortunately, due to the worsening international situation, the participation of foreign specialists in the last two conferences has noticeably decreased. Nevertheless, a high scientific level was managed to maintain at these conferences; in particular, many interesting reports were presented at the IX conference ONW'2017. Due to the limited volume and for other reasons, not all of them were able to be included in this special issue. The extended abstracts of presentations at ONW'2017 are published in Proceedings of the Conference (SPbF IO RAS, 2017. 242 pp.). The twelve articles presented in this special issue are grouped into four sections, according to the topics of the conference.

In Section "Fundamental Problems of the Theory of Radiation Transfer, Propagation of Radiation in Water and Underwater Vision", the article "On the diagnostics of optical inhomogeneities in water by lidar on photon-density waves" is presented by A. G. Luchinin, L. S. Dolin, M. Yu. Kirillin (Institute of Applied Physics RAS, Nizhny Novgorod). Although the article has a pronounced applied orientation, its main content is connected with the solution of the fundamental problem of propagation of the sinusoidally modulated light beams in a scattering inhomogeneous medium. Under conditions of single scattering, a medium with an inhomogeneous scattering coefficient can act on the high-frequency envelope of the light field as a volume diffraction grating,

and this opens up additional possibilities for selective diagnostics of macro-inhomogeneities in the scattering medium. The possibility of such diagnostics under conditions of multiple scattering is considered in the article.

In Section "Inherent Hydrooptical Characteristics; Optics of the Polar Seas; Variability of Hydrooptical Characteristics Depending on Hydrophysical Processes" is presented the article "Reflective properties of Arctic summer ice in the visible and infrared ranges" by E. P. Zege with co-authors (Institute of Physics of the National Academy of Sciences of Belarus, Minsk, Institute of Environmental Physics, University of Bremen, Germany); its content is directly related to the problem of global warming in the Arctic. One of the most important factors of warming is a decrease in the reflectivity of the sea surface as a result of the degradation of the ice cover. For quantitative assessment, when developing methods for remote (in particular, satellite) sensing, knowledge of the optical properties of sea ice is required, especially in summer, when it melts, breaks down, and the melt ponds are formed. The article summarizes the main results of the authors on the study of the reflectivity of melting Arctic ice, which may be of interest to the readers of the journal.

Three other articles in this Section are devoted to various aspects of the variability of the optical characteristics of different water basins: the Gorky Reservoir (A. A. Molkov and co-authors, Nizhny Novgorod), the Kara Sea (D. I. Glukhovets, Yu. A. Gol'din, IO RAS, Moscow), the Black Sea (M. E. Lee, A. A. Latushkin, O. V. Martynov, MHI RAS, Sevastopol).

In Section "Remote Sensing, Including Satellite Color Sensors and Lidars" four articles are presented. The article "Algorithms of determination of the spectral-energy characteristics of a random field of internal waves by the lidar echo signals" by I. S. Dolina, L. S. Dolin describes new algorithms for determining the characteristics of pycnoclinic internal waves, based on use of data on the power fluctuations in the lidar echo signal.

Three other articles deal with various aspects of the use of satellite ocean color data. The possibility of quantitative assessment of the coccolithophore bloom parameters in the Barents Sea is considered in the article by P. G. Karally et al. (IO RAS, Moscow; IO RAS, Gelendzhik). In the article V. V. Suslin, T. Ya. Churilova (MHI RAS, IMBI RAS, Sevastopol) three different algorithms for processing the data of the SeaWiFS and MODIS satellite scanners to estimate the concentration of chlorophyll-*a* mainly in the western half of the Black Sea are compared. In the article T. Ya. Shulga, V. V. Suslin (MHI RAS, Sevastopol) is analyzed the possibility of using the results of the modeling with assimilation to restore the loss of satellite information (primarily due to cloudiness) while monitoring the content of the passive admixture in the surface layer of the Azov Sea.

In Section "Optics of the Sea Surface and the Marine Atmosphere; Instruments for Measuring Optical Characteristics", three articles are presented. The article by R. G. Gardashov (Institute of Geography of the National Academy of Sciences of Azerbaijan, Baku) "About the method of specular points" is devoted to the named method for studying the wavy sea surface from remote sensing data. It is based on an analysis of the statistical characteristics of solar glints, but in principle it allows to estimate the "instantaneous" relief of the sea surface by using the instantaneous image and fixing the number, location and the radiance values of the sun glints on the sea surface. Such a possibility is considered in the article.

In the article by D. G. Turlaev (IAP RAS, Nizhny Novgorod) are presented the results of testing the algorithm for reconstructing the slope vector of the wavy water surface by using its image obtained under natural light conditions with a clear, cloudless sky. In addition to the image of the wavy water surface, the image of the "mirror" part of the sky, reflected from the smooth surface, is used. Under certain assumptions, the algorithm makes it possible to find, with reasonable accuracy, the slopes of waves running in different directions.

The article by I. V. Goncharenko, V. V. Rostovtseva, B. V. Konovalov (IO RAS, Moscow) describes a three-channel optical complex for measuring from board of the moving ship the spectral radiance reflectance, and the algorithm for processing the measured data. The field studies in different regions of the Black Sea have shown the effectiveness of the proposed technical solutions, algorithms and processing programs.

This special issue is dedicated to the 100th anniversary of the outstanding Soviet scientist in the field of atmospheric and ocean optics, Prof. K. S. Shifrin. The content relates only to one of the directions of the many-sided scientific activity of K. S. Shifrin, which covered both the electrical properties of semiconductors, and the scattering of electromagnetic waves by particles, and the inverse problems of scattering theory, and propagation of the radiation in the atmosphere, the kinetics of cloud formation and precipitation, and the development of the method of passive microwave thermal radiolocation.

The presentations on the main achievements of K. S. Shifrin were made at the special session held within the framework of the XIV All-Russian Conference "Applied Hydroacoustic and Hydrophysics Technologies" (GA-2018), St. Petersburg, May 23-25, 2018. The articles based on these presentations are planned to publish in one of the nearest issues of "Fundamental and Applied Hydrophysics".

O. Kopelevich