Oceanological Monitoring of Fishing Areas using Lidars

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Abstract — Some advantages of lidar remote sensing methods are described along with the tasks for solving which these methods are used. Examples of modern lidar systems designed for the oceanological monitoring are also given.

Keywords — oceanological monitoring, polarization lidars, spectral lidars, fishery.

The lidars are successfully used to solve a wide range of fishery problems: measuring the hydrooptycal characteristics of the sea surface layer, locating fish schools and estimating the corresponding biomass [1,2], finding the phytoplankton concentration [3], registering the water pollution [4], etc.

The remote character of the lidar measurements allows carrying them out from aboard a moving carrier (plane, ship). No restrictions are imposed on the speed and course of the carrier. Lidar sounding allows measurements in the water without submerging any devices and therefore without affecting the processes and objects studied.

Ship lidar "Gidrobiont" (SLG) was designed by JSC "Giprorybflot" in cooperation with the Institute of Oceanology RAS for installation on research and fishing ships. The main feature of the SLG is the combination of polarization and spectral channels in its design.

Two methods are used for processing the echo signal formed during sounding of sea water with short unidirectional laser pulse. The first one analyses the time dependency of degree of polarization of the echo signal and therefore provides the possibility of getting vertical profiles of hydrooptical characteristics and locating and depth measurements for different inhomogeneities in sea water. The second one uses spectral analysis of the echo signal allowing locating phytoplankton clusters in the surface water layer and determining their characteristics.

In 2013 the lidar was subjected to marine tests, during which:

- the influence of height of the lidar over water surface, angle of sounding and initial divergence of laser beam on the sounding results was studied;

- sounding of water and different objects was carried out at different water transparency values;

- a possibility to register artificial targets simulating fish depending on their sinking velocity and also fast-moving targets was studied;

- echo signals from real fish schools, medusa aggregations and solitary fish were registered;

- bathymetric measurements (sea bottom sounding) were carried out at different water transparency values and sounding angles.

The marine tests were accompanied by measurements of sea water characteristics using transparency meter, STD probe, photo and video registration of sounding objects (fish and medusas) with surface and submerged cameras.

Lidars of this kind installed on research and fishery ships will allow solving the tasks of rapid detection, identifying and monitoring sea hydrobionts, obtaining main oceanological parameters of their habitat in the fishing grounds of the World Ocean and also remote sensing data calibration.

References

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