REMOTE SENSING OF THE WATER OBJECTS WITH THE OPTICAL ADAPTIVE IDENTIFIER

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Abstract. *Microwave radiometry allows effective observations of the environmental parameters for of soil-vegetation system.*
In the paper are developed methods for the microwave monitoring data processing allowing to reconstruct the SVS characteristics with consideration of vegetation types and giving a possibility to synthesize their spatial distribution.
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1. Introduction

A solution of the majority from applied problems within the agrometeorology, forestry, animal husbandry, and other areas of human activity directed on the nature protected is made difficult for the reason that effective methods of *soil-vegetation* system (SVS) control are insufficiently developed.
During last years global carbon cycle problem acquired a specific significance through the greenhouse effect also. Knowledge of the SVS state allows to have the real picture of spatial distribution for the carbon sinks and sources on the land.
As it well known, among the types of remote sensing techniques, microwave radiometry proves effective observations of SVS environmental parameters.
However, a quality of these observations is function of different environmental conditions mainly depending on the SVS type.
That is why it is necessary to develop the methods for the microwave monitoring data processing allowing to reconstruct the SVS characteristics with consideration of vegetation types and giving a possibility to synthesize their spatial distribution.

2. Remote sensing with the optical adaptive identifier

Pollution of water objects by heavy oil spills, industrial wastes, red tides, etc. has led to serious degradation of the environment. There are a number of studies demonstrating the potential of remote sensing techniques for monitoring water pollution. In this study the problems involved in remote sensing of the water objects are identified, and various examples of extraction of pollution patterns are given. At the present time the method of influence on spectral characteristics of water pollution is intensively studied.
The question is how do different kinds of water pollution influence on sun radiation of wavelengh 330 - 680 nm, entered a photoreceiver by a water objects [1]. It is clear that generally speaking spectral portrait of the water object greatly depends on a lighting condition.
The aim of our paper is to discuss possible methods of forming spectral patterns of the natural water objects and the some known water pollutions, which can be identified in any lighting conditions.
The proposed methods are based on a number of assumptions and does not pretend for

universality. As some technical local effects (also of construction of the device) are possible but not connected directly with an essence of the problem we shall not discuss them here. At the investigation of the water objects we use the information from two of the modern science - spectral analysis and theory of pattern recognition. In general the task of recognition consists in identifying with a recognizing system the objects presented with one of the known (given) classes [2,3].

The principle of identification can be both known for the system and unknown.

In the first case, the system for identifying of a concrete objects uses the experience. It is a making decision rule of classification - the rule of conclusion.

In the second case the task consists of search of unknown yet making decision rule of belonging a concrete object to one of the given classes. The solution of the task of recognition in the second case is divided into two stages: teaching on the given material (examples) as a result of which the decision is formed and then - application of this rule of making the decision by the system to diagnose a concrete object. The optical adaptive identifier is one of the such teaching recognition system

The paper describes a structure of the optical adaptive identifier [1]. Adaptive Identifier (AI) is an information system that consists of the eight-channel spectrophotometer, interface, PC IBM, software and extending database. AI has two modifications:

- stationary, in which the measurements are realized in real time regime;
- portable, when the measurements and data processing are spreader by time.

The service software system provides the result visualization of the monitoring date processing in a form of graphics, tables and maps. Spectral structure of radiation leaving from water bears information about a substance absorbed and scattered in a water. It is a physical basis of remote methods for analysis of a structure of natural waters.

The knowledge of spectral distribution of luminance of each water component permits to determine percent amount of the latter of a water object researched. The principle of action of the adaptive identifier is the next. The light flow, on which way the modulator with the eight color filters is installed, enters a photo receiver. The modulator is rotated by the micro engine, and as a result the light flow is consistently cut by the color filters. From the photo receiver the signal enters an amplifier of a constant current and further enters the input of the analog-digital converter. In portable modification data are digitalized in the block of an energy independent memory, and then through an interface are read in a personal computer. As the intensity of a scattered radiation depends upon a light exposure of a water surface, the automatic adjustment of amplification is used in order to take into account it.

For research of the spectral characteristics of water environment four objects were chosen: a coastal zone of the East sea, ponds for cultivation a shrimp, the Saigon river and the Dongnai river. The spectral characteristics of the water objects mentioned above are considered.

As one can see from the consideration, all the curves pass through the point (4.1), which gives the basis to consider the channel 4 (510 nm) invariant for specified objects. The largest differences in curves in points 5, 6, 7, show that channels 5,6,7 are the most informative. It is seen, that investigated waters are rather visibly distinguished under optical characteristics. A maximum concentration of yellow substance and organic material corresponds to the Saigon river, minimum - to the Dongnai river. Sea water in the Vungtau region is characterized by a high degree of concentration of weighed particles. Essential excess of the level, equal 1, by a signal in channels 5,6,7 gives the basis to think about fluorescence of chlorophyll "a" [4] at the wavelength 690 nm and pigments accommodating it in the red range. As it is marked in [5], there is the linear dependence between the amount of a fluorescent material and a yellow substance, which is formed from hydrocarbon with "Mayer reaction ". Reaction is

accelerated with increasing temperature, in an alkaline environment in the presence of amino acids, that is characteristic of the water objects of south region. With the adaptive identifier some experiments for detection of oil and petrol films on a water surface and for estimation of their thickness were spent.
The results are the following: Sensitivity of the device is not worse than 0.1 mm on thickness of a film from above downwards under the conditions 5% of a maximum light exposure. In these experiments the channels of the wavelength 398 nm, 439 nm and 480 nm were the most informative for the mentioned objects.

Conclusions

In the paper the combination of experimental and theoretical studies of attenuation of microwave radiation by the vegetation cover is presented.
Really it is possible to synthesize experimental dependence between the attenuation and restricted set of vegetation parameters.
An estimation of attenuation of microwave radiation by vegetation cover in real time regime is possible only with application of microwave models and interpolation algorithms.

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