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RESULTS OF THE EXPERIMENTAL RESEARCHES CARRIED OUT IN A SHELF ZONE OF THE SEA JAPAN IN 2006

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The basic purpose of the experiments carried out in 2006 at the marine hydrophysical research test site of the POI FEBRAS "Cape of Shults" in the area of the Posiet Bay was try – out of tomographic methods of acoustic monitoring of inhomogeneities of various scale. Physical properties of research test site were investigated with horizontal sounding of medium by complex and tone low-frequency acoustic signals at lines with constant and varied depth along a line

Integrated researches of the channel of sound distribution were carried out at the marine hydrophysical research test site of the POI FEBRAS «Cape of Shults» in the area of the Posiet Bay in 2005-2006. Conducting of regular measurements demands the try – out of tomographic methods of acoustic monitoring of inhomogeneities of various scale and development of the block diagram of a hardware complex.

For increase of reliability of the received results, comparison of the characteristics received both in identical, and in different hydrophysical conditions, it is needed elaboration careful of schemes of the experiment, and also ordering and accumulation of experimental data.

The expedition of 2006 continued researches of the influence of hydrophysical and geomorphological characteristics of the area on mutually correlative and spectral properties of acoustic signals in the shelf zone of the Sea of Japan. It was continued studying physical properties of the research test site with horizontal sounding of medium by complex and tone acoustic signals at *quasi-stationary* lines and simultaneous vertical sounding of medium by 2 frequency independent towed echosounder.

One of the important problems was try - out of a mode of remote sounding of ocean with reception of signals by a field of radio hydroacoustical buoys (RHB) and laser deformometer. It was solved the problem of a signal transfer from laser deformometer to a coastal post where reception of signals from RHB was carried out.

With the purpose of exception of the influence of instability of frequency digitization it was carried out relative joint calibration of reception systems "hydrophone-radio channel-computer", it is advanced the system of signals registration. Realization of tests of low-frequency broadband radiator allowed to make simultaneous sounding of medium by signals of different frequency.

The work was aimed at solving the problems of technical character for the perfection of a stationary system of multichannel reception of signals on the radio channel for the reliable reception from maximal distances of 20-30 kms from an open part of the Sea of Japan.

For the exception of the influence of moving of all established hydrophones RHB and radiators on characteristics of the received acoustic signals it was carried out positioning with additional use of active - passive buoys.

In expedition researches saved up allowed us to choose the parameters for the scheme of a standard *quasi-stationary* line with well investigated characteristics of the bottom and constant depth, measurements on which allow us to compare easily the received data to theoretical calculations.

Modernization and perfection of a hardware and software complexes allowed us to increase the range of the radiochannel, a frequency range of the researched signals, a number of simultaneously accepted radiochannels.

It simplifies the solution of a problem of mutual calibration in connection with that signals from deformometer are transferred in the same way as signals from acoustic receivers, over the radiochannel.

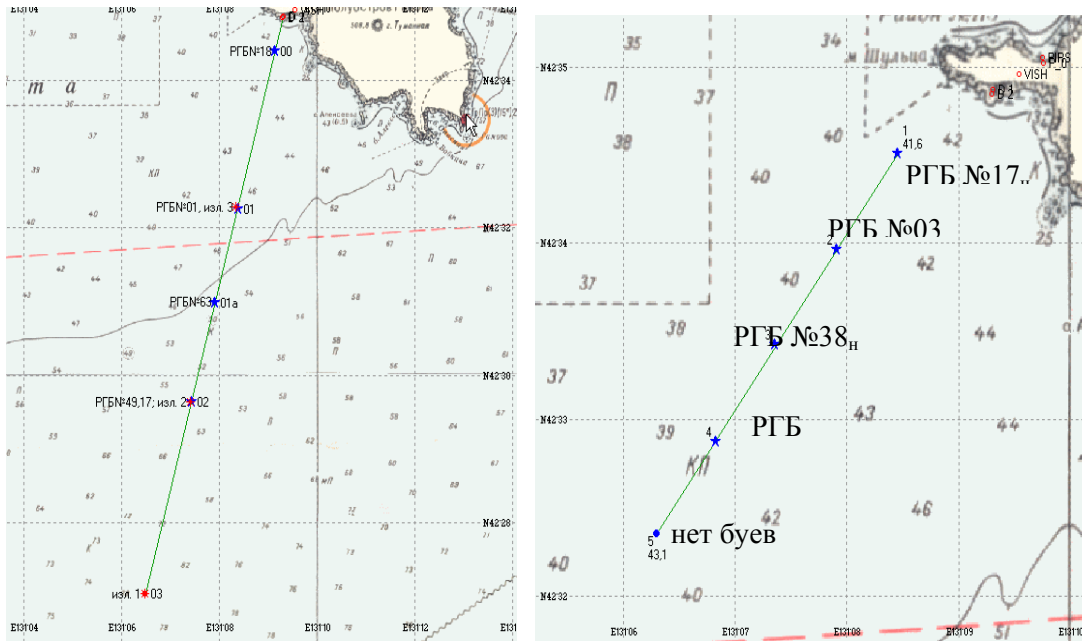
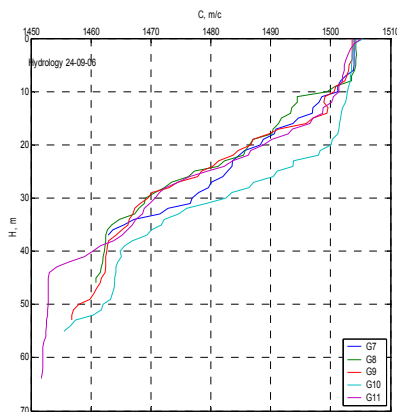


Fig. 1. The scheme of experiments of 24.09.06. (distance from a coast up to point 03 - 15 kms) And of 30.10.06. (distance between point 1 and 5 - 5 kms, 1,25 kms between the next points)

The basic experimental researches were carried out on two lines (fig. 1). The first, 15 kms long, along an axis of the diagram of an orientation of deformometer. As a radiator it was used a low-frequency broadband radiator with a band from 20 up to 1000 Hz which was merged to the depth of 15 m. As the specifying generator it was used the portable computer on which in one file all modes of radiation for one immersing of radiator were presented.



Reception hydrophones were placed at a depth of 20 m at a distance of 2,5-5 kms from each other. The example of calculation of a profile of sound velocity by depth is given in figure 2. Such measurements were carried out 20 in number at different time in points of calibration, radiation and reception of signals on lines.

Fig. 2. A profile of sound velocity in one of the reception points on October, 24, 2006.

Sounding of the sea medium was carried out by tone and complex phase manipulated M - sequences signals received by hydrophones of radio hydroacoustical buoys and a laser deformometer. The structure of radiating signals is given in fig. 3.

Deepening of hydrophones made 20 m, buoys were placed on a line at a constant depth of ~42 m and well investigated structure of the bottom. Radiation of acoustic signals was carried out by broadband radiators and resonant low-frequency radiators according to the scheme specially developed for each stage of work from board of the PVV "Malakhit". As the specifying generator it was used, as well as in the previous expeditions, the portable computer on which in one file all modes of radiation for one immersing of a radiator were presented. As against experiments of the previous years, signals from deformometer were transferred to a coastal post over on the radiochannel. On a coastal post it was conducted the reception of signals over radiochannels and their registration with multichannel analog-to-digital coder L-780 on a hard disk of computer "Pentium 4".

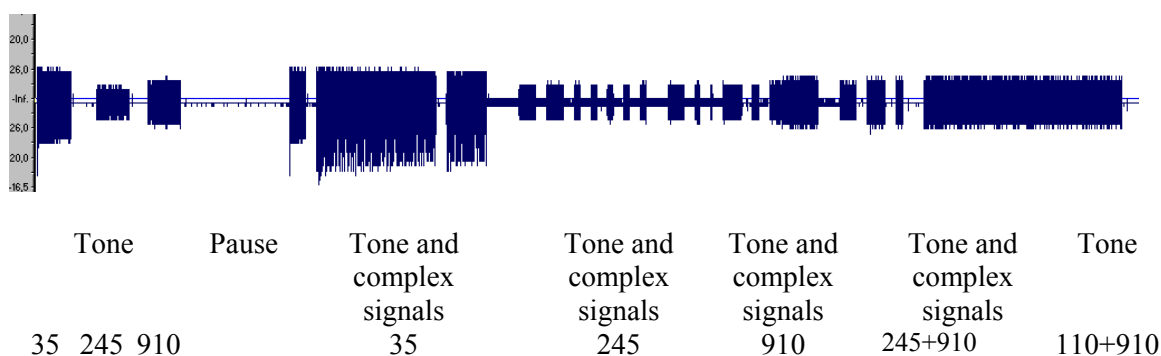


Fig. 3. Structure of the signal radiated in the experiment of September, 24-25 2006. Figures show the frequency in Hz for each fragment of radiation

For the data processing, alongside with earlier developed software for realization of the spectral and correlation analysis, the new programs were used allowing in a mode of real time simultaneously with registration received over the channel of information to visualize, to receive statistical and spectral characteristics. As a result of the spectral processing carried out on all channels with the resolution of 1 Hz, levels of the signals received by hydrophones of buoys, installed in different points of a line and by a deformometer were estimated. Correlation processing allowed us to estimate times of the radiated signals arrival at hydrophones RHB and deformometer. The fragment of calculation of correlation characteristics is given in Fig. 4.

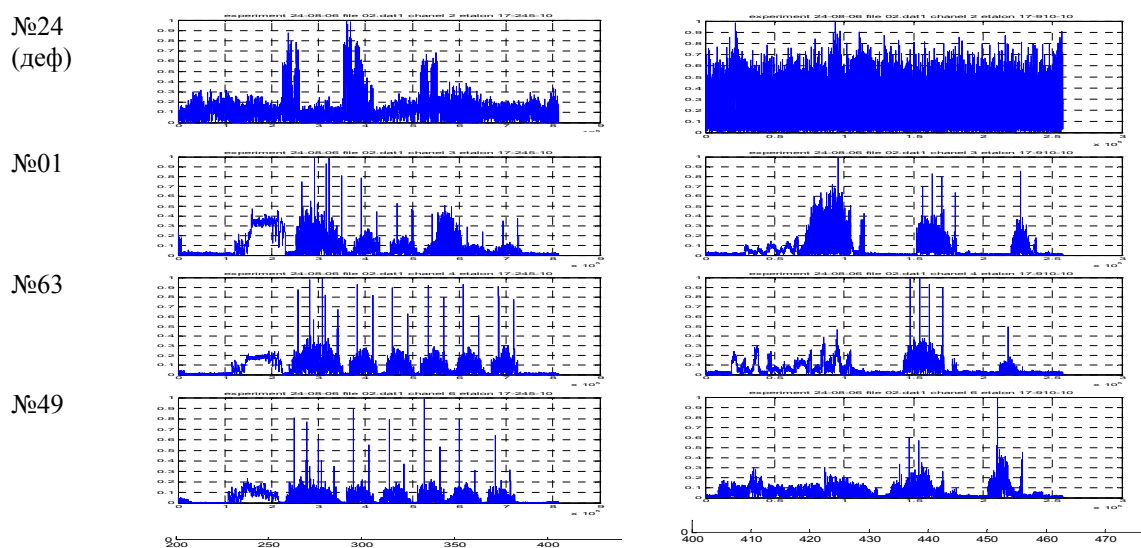


Fig. 4. An example of correlation processing of the received signals for the radiation of 245 Hz and 910 Hz.

Fig. 5 presents an example of spectral processing of the tone signals received at realization of mutual calibration of the through characteristic of RHB reception paths. Figure 5 shows the diagram of relative coefficients of transfer of the end-to-end channels "hydrophone-computer" on the frequencies of 245 Hz and 910 Hz for some of the buoys involved in the experiment.

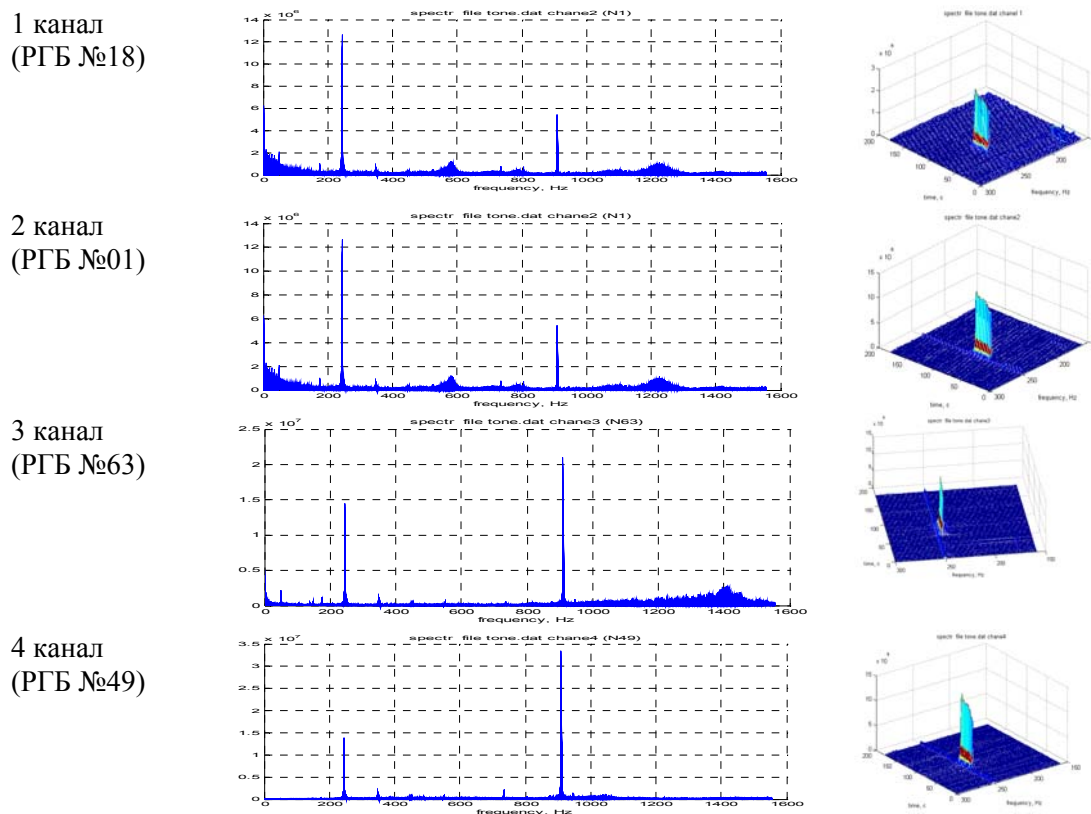


Fig. 5. An example of spectral processing of tone signals at mutual calibration of reception channels of RHB

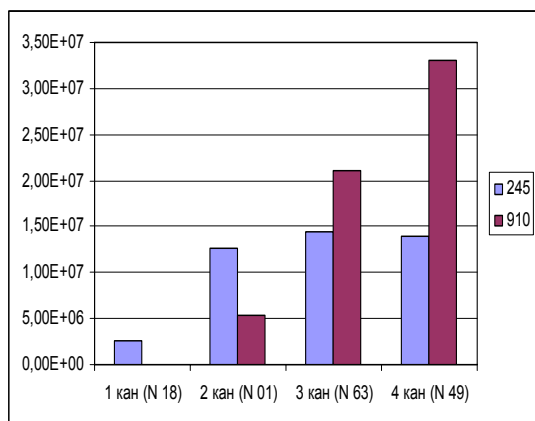


Fig. 6. The diagram of relative coefficients of the transfer averaged on time, on frequencies 245 Hz and 910 Hz

On the reference line of constant depth with well investigated bottom parameters the measurements of the transfer characteristic of hydroacoustic signals were carried out, hydrophysical characteristics of the area were simultaneously registered. Comparison of the results of these data processing with theoretically designed models allow us to determine efficiency of a technique of measurement and to give out recommendations for realization of the further researches. The data received experimentally, and also the information on the equipment and software which were used at measurements for reception of data sets (experimental and modelling), and also processing of the accepted signals, are transferred for arrangement on the Internet - portal of the department of Ocean Acoustics.

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