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Часть 1. Приборы и технологии

Рецензируемый научный журнал, в котором публикуются материалы по различным областям фундаментальной и прикладной науки, анализируется опыт внедрения новых технологий, изобретений и открытий.

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AUTONOMOUS GEOHYDROACOUSTIC ICE BUOY OF NEW GENERATION

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Highlights

- new information-measuring platform and software for seismic equipment have been developed
- the group of autonomous geohydroacoustic buoys have been created for ice-class antenna systems
- carried out long-term comparative measurements under conditions of geophysical observatory
- working capacity confirmed and main parameters of the new device evaluated
- the device corresponds to the world analogues in key characteristics

Abstrcat. Results of development, creation of prototypes and full-scale tests of geohydroacoustic measuring buoys of the new generation are presented. They are designed to be used independently as acoustic, hydroacoustic and seismoacoustic measurements in the sea or on land, as well as in the distributed ice-class antenna systems intended for monitoring of the Arctic waters covered with drifting ice. The geohydroacoustic ice buoy represents a complete information-measuring stand-alone device, which includes the use of removable vector hydroacoustic receiving modules (0.01–2.5 kHz) and broadband molecular-electronic receivers (0.03–50 Hz) of a new generation, as well as original tools for digitizing geohydroacoustic information, recording in internal memory and subsequent operational transmission obtained scientific data. The information-measuring system is based on a 24-bit analog-to-digital converter that provides recording of signals in a large dynamic range, which makes it possible to perform measurements with analog broadband sensors in both passive and active modes. A distinctive feature of the geohydroacoustic buoy is the integration in its composition of power elements, this leads to the possibility

of reliable autonomous operation of the entire measuring system for several weeks. The results of long laboratory bench tests conducted at the geophysical observatory of the GS RAS in Obninsk showed high technical capabilities of the new generation of geohydroacoustic buoys. Comparative analysis in the measurement of signals caused by microseismic noise and teleseismic earthquakes, confirmed that the proposed measuring instrument is not inferior in its key indicators to the world analogues.

Keywords: seismometer, buoy, molecular-electronic sensor, ADC, geohydroacoustic wave field, information-measuring system, ice class antenna.

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References

Agafonov V.M., Avdyukhina S.Yu., Egorov E.V., Sobisevich A.L., Sobisevich L.E. Patent RF no. 2650839, *Byulleten' izobreteniy* (Bulletin of Inventions), 2018, no. 11 [in Russian].

Agafonov V.M., Egorov I.V., Shabalina A.S. Operating principles and technical characteristics of a small-sized molecular-electronic seismic sensor with negative feedback, *Seismic Instruments*, 2014, vol. 50, no. 1, pp. 1–8. DOI: 10.3103/S0747923914010022

Agafonov V.M., Neeshpapa A.V., Shabalina A.S. Electrochemical Seismometers of Linear and Angular Motion. *Encyclopedia of Earthquake Engineering.* Springer-Verlag Berlin Heidelberg, 2015. DOI: 10.1007/978-3-642-36197-5_403-1

Antonov A.N., Avdyukhina S.Yu., Egorov I.V., Zhostkov R.A., Likhodeev D.V., Presnov D.A., Shabalina A.S. Broadband seismic station for seismic prospecting on the seabed and in the transit zone based on molecular-electronic sensors, *Materialy nauchno-prakticheskoy konferentsii "Seismicheskie tekhnologii-2017"* (Proceedings of the scientific and practical conference "Seismic Technologies-2017"), 2017, pp. 64–67 [in Russian].

Asming V.E., Baranov S.V., Vinogradov Yu.A., Voronin A.I. Seismic and infrasonic monitoring on the Spitsbergen archipelago, *Seismic Instruments,* 2013, vol. 49, no. 3, pp. 209–218. DOI: https://doi.org/10.3103/S074792391303002X

Asming V.E., Baranov S.V., Vinogradov A.N., Vinogradov Yu.A., Fedorov A.V. Using an infrasonic method to monitor the destruction of glaciers in arctic conditions, *Acoustical Physics*, 2016, vol. 62, no. 5, pp. 583–592. DOI: https://doi.org/10.1134/S1063771016040035

Fedorov A.V., Asming V.E. Monitoring of Spitsbergen glaciers activity by seismic method, *Nauka i Tekhnologicheskie Razrabotki* (Science and Technological Developments), 2015, vol. 94, no. 4, pp. 44–52. [in Russian].

Gorbenko V.I., Zhostkov R.A., Likhodeev D.V., Presnov D.A., Sobisevich A.L. Feasibility of using molecular-electronic seismometers in passive seismic prospecting: Deep structure of the Kaluga ring structure from microseismic sounding, *Seismic Instruments,* 2017, vol. 53, no. 3, pp. 181–191. DOI: 10.3103/S0747923917030045

Gordienko V.A., Goncharenko B.I., Ilyushin Ya.A. Peculiarities of the formation of vector-phase structure of ocean noise fields, *Akusticheskij zhurnal* (Acoustic Journal), 1993, vol. 39, no. 3, pp. 455–466 [in Russian].

Dmitrichenko V.P., Presnov D.A., Rudenko O.V., Sobisevich A.L., Sobisevich L.E., Sukhoparov P.D., Tikhotsky S.A., Shurup A.S. Patent RF no. 2646528, *Byulleten' izobreteniy* (Bulletin of Inventions), 2018, no. 7 [in Russian].

Presnov D.A., Zhostkov R.A., Sobisevich A.L., Shurup A.S. On-site observations of seismoacoustic waves under the conditions of an ice-covered water medium, *Bulletin of the Russian Academy of Sciences: Physics,* 2017, vol. 81, no. 1, pp. 68–71. DOI: 10.3103/S1062873817010233

Rogozhin E.A., Antonovskaya G.N., Kapustian N.K. Current state and prospects of the development of an Arctic seismic monitoring system, *Seismic Instruments*, 2016, vol. 52, no. 2, pp. 144–153. DOI: https://doi.org/10.3103/S0747923916020079

Sobisevich A.L., Presnov D.A., Zhostkov R.A., Sobisevich L.E., Shurup A.S., Likhodeev D.V., Agafonov V.M. Geohydroacoustic noise monitoring of the under-ice waters of the northern seas, *Nauka i tekhnologicheskie razrabotki* (Science and Technological Developments), 2017, vol. 96, no. 3, pp. 3–18. [Special issue "Applied Geophysics: New Developments and Results. Part. 1. Seismology and Seismic Exploration"]. [in Russian]. DOI: 10.21455/std2017.3-1

Vinogradov Yu.A., Asming V.E., Baranov S.V., Fedorov A.V., Vinogradov A.N. Seismic and infrasonic monitoring of glacier destruction: A pilot experiment on Svalbard, *Seismic Instruments*, 2015, vol. 51, no. 1, pp. 1–7. DOI: https://doi.org/10.3103/S0747923915010119

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