Radio science observatory on board the Ukrainian research vessel *Noosphere*

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In 2021, the former flagship of Britain's Royal Scientific Navy RRS *James Clark Ross* was bought by Ukraine and renamed to *Noosphere* (http://uac.gov.ua/en/icebreaker-noosphere-en/). At the end of January 2022, *Noosphere* should depart to its first voyage from Ukraine to Antarctica under the Ukrainian flag. Currently work is underway to install a radio observatory for diagnostics of the ionosphere and ocean surface on board the ship. The equipment to be installed includes high frequency (HF) and very low frequency (VLF) receivers and corresponding antenna systems.

HF instrument is identical to devices used in the network of Doppler HF receivers that was deployed in the Antarctic at the Ukrainian Antarctic station *Akademik Vernadsky* (UAS), on the Svalbard archipelago, in Ukraine and Africa. Doppler measurements of long-distance HF propagation signals have been continuously carried out at the UAS since 2000. During the voyage, on-board bistatic sounding of the ionosphere synchronously with the measurements performed by ground-based stations will be carried out using signals of time service stations, such as RWM and CHU, and special transmitters. The range of tasks to be addressed includes studies of the features of long-distance propagation of HF radio waves, in particular, by scattering on plasma irregularities in auroral ovals, as well as ionospheric inhomogeneities of various natures. The HF instrument will also be used to study scattering of HF signals by the sea surface waves and to solve the radio-oceanographic problems of restoring the characteristics of sea waves based on the results of spectral processing of ionospheric signals received on-board.

The second line of measurements will be the monitoring of global lightning activity and the conditions of the lower ionosphere in VLF band. VLF receiving facility was installed at the UAS in 2019, which makes it possible to detect and locate the sources of super-powerful lightning discharges at a distance up to ten thousand kilometers, as well as to measure the variations in the height of the lower ionospheric layers. Installation of a similar synchronous VLF ship-borne instrument will allow conducting a two-position location finding of powerful lightnings and diagnostics of the lower ionosphere in different regions of the globe. It should be noted that, together with the already operating three-position (Ukraine-Antarctic-Arctic) ELF system, the land-ship VLF system will essentially complement a synchronous network for monitoring the global thunderstorm activity.

We are also investigating the possibility to receive the signals of Doppler ionosondes, which are currently operating in Ukraine and UAS [1], on board the ship. If implemented, simultaneous sounding of the ionosphere in vertical and oblique modes with varying distance between the ionospheric reflection points while the ship is moving would be possible.

1. Zalizovski, A., Koloskov, O., Kashcheyev, A., Kashcheyev, S.,Yampolski, Y., Charkina, O.: Doppler vertical sounding of the ionosphere at the Akademik Vernadsky station. *Ukrainian Antarctic Journal*, 1, 2020, p. 56-68. DOI: https://doi.org/10.33275/1727-7485.1.2020.379