ABOUT STATE OF ATMOSPHERIC ACOUSTIC CHANNELS

I.Yu Lobycheva [(1)], ***E. A Ponomarev*** [(2)] , ***A.G Sorokin*** [(3)]

[(1)] Institute of Solar-Terrestrial Physics Siberian Branch Russia Academy Science, P.O. Box 291, Irkutsk, 664033, Russia, e-mail: loir@iszf.irk.ru

[(2)]As (1) above but e-mail: pon@iszf.irk.ru

[(3)]As (1) above but e-mail: sor@iszf.irk.ru

Abstract

An important component of control and monitoring systems, in the meantime, is the acoustic channel model, providing for estimating the signal source availability/non-availability based on coordinates and the meteorological situation. Fundamental and applied importance of this task is such that many strong scientific teams around the globe (in the US, France, the Netherlands, Sweden, India, as well as in Mongolia) are engaged in tackling this issue [1,2].

Thus, the major channel for long-distance propagation is an acoustic wave-guide in the temperature minimum region provided the wind direction is favourable.

The analysis of signal propagation conditions along an acoustic wave-guide relies on using a certain integral index - the "wave-guide potential"U. The entire air space is divided into two regions: 1) U>0 - the zone of infrasound propagating via waveguide; 2) U<0 - the zone of freely propagating infrasound. Thereby, analysis of the potential enables ducting regions to be identified in air space for infrasound signals.

The time interval under analysis encompasses the entire 1986 for 17 selected coordinate points. The pathway under investigation is oriented towards the north-eastern Atlantic at an azimuth of approximately 320 degrees, which corresponds to the prevailing arrival of microbaroms as indicated by 1986 data from the ISTP SB RAS infrasonic measurement station "Badary".

At station ‘Badary’’, at a distance of 2100km from the explosion site, the infrasonic signal with the amplitude of 0.18 mbar, a period of 1–5 s, and a duration of 600 s was observed. The arrival azimuth corresponded to the source and was about 2511, and the sliding angle was 271. A modeling of the atmospheric acoustic channel, corresponding to that event, gives a good agreement with experimental data. It is evident that a large number of modes, including the modes corresponding to the observed frequencies, can reach the observation point via the calculated acoustic channel. The height ‘‘z’’ for the medium propagating mode is about 20 km. The sliding angle f in the acoustic channel is about 261 and is close to the observed angle (271). A very useful tool for testing atmospheric acoustic channels is infrasound from nuclear explosions.

According to the results before conspicuous summer/winter asymmetry was discovered and three characteristic zones may be distinguished in the behaviour of the potential U.

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References

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