A.V.Kulakov

SPATIAL TEMPORAL VARABILITY OF SOUND FIELDS IN THE COASTAL WEDGE OF KAMCHATKA WEST SHORE

N. N. Andreev Acoustics Institute
Russia, 117036 Moscow, Shvernik st., h.4
Tel.: (095) 4399487; Fax: (095) 126-8411;
E-mail: bvp@àkin.ru

Changes of spatial (transversal) correlation radius with increase of distance to sound source — underwater explosions were analysed. Signal correlation radius for frequencies 600-800 Hz by permission of arrivals upon the narrow beam groups surpasses 6 km if distance to the source doesn't surpass 60 km. The radius decreases with growth of distance and composes 3.5-4 km in the most distant points of track.

Investigation of sound fields spatial temporal variability characteristics in an ocean lets to reveal role and relative part in the variability of different processes going in an ocean environment. Besides knowledge of variability parameters does possible choice of quasi-optimal information processing algorithms and founded prognosis of work efficiency of underwater sound complexes.

In particular it is important to take into consideration spatial variability parameters by choice of configuration and receiver antennas fix with large apertures. Such positional systems are frequently used for monitoring any ocean region and as rule are mounted in the coastal regions. Lower measurements results of the horizontal radius of the spatial sound fields correlation in coastal wedge of Kamchatka Pacific ocean shore with use of the sound explosion sources are described. Significances of radiuses are measure of spatial temporal variability of sound fields. Application of underwater explosions in quality signal source was due to their power, broadband. Besides impulse character of radiation carries to the permission on the time many signals going upon the individual rays or narrow ray groups it is decreased in its turn influence of tossing and drift of the ship which charges were thrown down of on the results. Temporal permission of separate arrivals lets to analyse their part in the degradation of the spatial coherence of additional field. With this aim short temporal correlation function determined expression of $R_{st}(t,t) = \frac{1}{T}\int_{t-T}^{t} s_1(t)s_2(t-t)dt$

is measured and what's more averaging interval T must gratify condition of $T_1 > T > 1/\Delta f$. Here $s_1(t)$ è $s_2(t)$ — signals arriving on the hydrophones, T_1 — lag time of multipath signals, Δf — analysis frequencies band.

Lower resuls of experiment carried vicinity Kamchatka shore (to south from Avachinscy bay) in summer time are represented

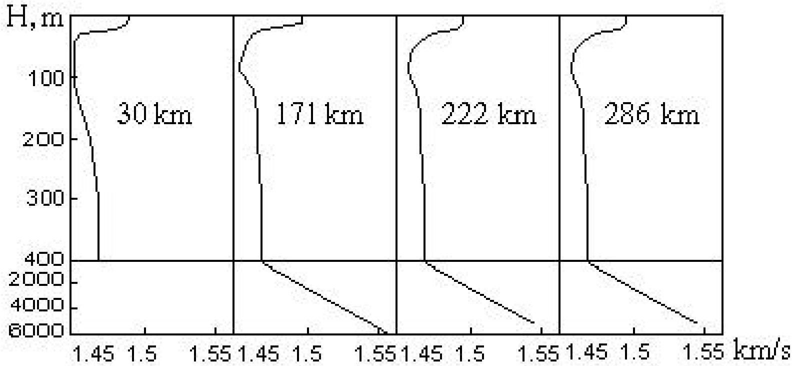

Fig. 1. Dependences of sound speed versus bound in the four dots of track (digits by curves — distance from hydrophones)

by the distances face to face 1, 4 and 6 km. Their reciver signals was transmitted upon radio channels (via radio buoys) on board of the ship drifted vicinity hydrophones where they were entered in electronic computer for analysis and likewise recoded on tape-recorder.

The other ship which charges with weight of 270 g supplied hydrostatic detonators were thrown down in motion of started in point nearly hydrophones and moved on the track by which derection composed 8° to perpendicular of line connecting reciver dots. Charges underminning was done by the horizons 150 m $\pm$ 3 m and 300 ì $\pm$3 m per intervals 14 km (on the each horizon).

Fig. 2 plots illustrate dependences of correlation function significances among signals arriving on the hydrophones with change of distance among reciver dots by diffrent distances to the source. Analysis was carried on the frequences ~ 600-800 Hz. On the figures peak significances of short temporal correlation function $R_{st}(t,t)$ (marks $\times$ correspond to explotions by the bound 150 m, $\circ$ — explosions by the bound 300 m) are represented. Besides on the figures correlation significances by averaging time T coincided with lag time T_l, t. i. when signals arriving upon the all rays are accounted, are shown too (mark $*$, underminnings on bound 150 m). In last event low significance of correlation

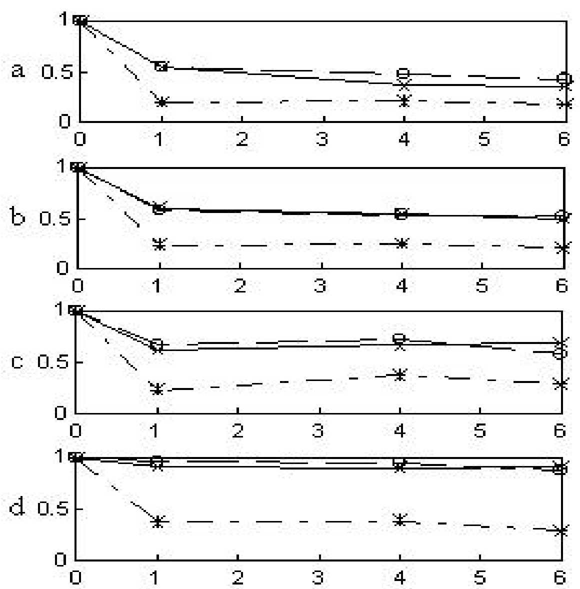

Fig. 2. Dependence of peak significances of the short temporal correlation function versus distance among hydrophones by different distances to source a — 304 km; b — 154 km; c — 56 km; d — 14 km. Dots correspond to $\times$ — underminning bound of 150 m, $\circ$ — 300 m, $*$ — 150 m ïðè $T = T_l$.

First of all it will be noted high significance of $R_{st}(t)$: it composes 0.90-0.95 by explosions vicinity hydrophones and 0.55-0.60 by explotions in the distant dots of track. It is easily noted that for underminnings by any from two bounds spatial correlation radius of signals arriving on the hydrophones upon the narrow ray groups exceeds 6 km by any distance of underminning point up to ~ 60 km. Further growth of distance to sound source carries to decrease of radius (decrease of radius occurs slightly faster by underminnings by bound of 150 m). It composes 3.5-4.0 km by maximum distance of ship which explosions are carried out of (~ 300 km).

This way it may certify that spatial signals correlation radius has considerable growth by permission (temporal or spatial) of signals arriving upon the separate rays or narrow ray groups and consequently work efficiency of reciver antenna by which such permission of signals was realized increases.

REFERENCES

1. Galkin O. P., Popov R. U., Simakina E. V. Measuremants ways of spatial temporal sound fields structure in a deam ocean // in coll. “Acoustic measurements. Methods and means.” IV session of Russian acoustic comunity, M. 1995.
2. Galkin O. P., Kommissarova N. N., Popov R. U., Semenov U. V., Simakina E. V. Peculiarities of characteristics of the sound fields in coastal wedge // Acoust. J. 2000. (submitted).