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On " Voice of Sea" Generation Mechanism

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ABSTRACT
Physical model of self-sustained infrasonic air oscillations related to interaction of fresh gale with choppy sea surface is proposed. It is shown that air infrasonic oscillations are expected inside moving 3D cavities in sea surface generated by gale and detected far from its region. Interaction of wind with moving sea wave crests is shown to be of weaker impact on oscillations in far field. For wind velocity in the range from 10 to 40 m/s deepest cavities acquire resonance frequencies in the range of 3.0 - 0.7 Hz, *i.e.* frequencies much lower than their quarter wavelength resonance frequencies. In the course of oscillations effective wind velocity applied to cavities can achieve value from 0.4 to 0.6 of wind velocity, while air self-sustained oscillations velocity amplitude can run up in the range from 0.2 to 0.3 of wind velocity. Wind intensification leads to oscillations frequency decrease and oscillation energy losses increase with wind velocity cubed. Cavities natural frequencies are transformed due to air attached mass and volume elasticity additional transformation under wind influence in the range from 1.05 to 1.9 with respect to resonance frequencies at rest. Amplitude of self-sustained oscillation in atmosphere is expected to increase with wind velocity cubed, while cavity air oscillation velocity-linear with wind velocity. Wind velocity threshold of an order of 25 - 30 m/s overcome is necessary to observe effect. Spectral peaks on resonance frequencies in the range 0.7 - 2.5 Hz are expected in effect observation. Infrasonic signals observable far from whole gale in atmosphere, sea water thickness and earth crust on self-sustained oscillation frequency and its harmonics frequencies beginning from third harmonic 2.1 - 7.5 Hz are regarded as phenomenon signs.

KEYWORDS
Infrasound; Sea Surface-Atmosphere Interaction; Whole Gale; Wind Velocity; Oscillation Frequency; Sea Noise; Self-Sustained Oscillations

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References
[1]   V. V. Shuleikin, " On Sea Voice," Comptes Rendus Aca- demie des Sciences USSR, Vol. 3, No. 8, 1935, p. 259.

[2]   N. N. Andreev, " On Sea Voice," Comptes Rendus Aca demie des Sciences USSR, Vol. 23, No. 7, 1939, p. 625.

[3]   V. V. Shuleikin, " Physics of the Sea," Nauka, Moscow, 1968.

[4]   B. P. Konstantinov, " Hydrodynamic Sound Generation and Sound Propagation in Bounded Media," Nauka, Len ingrad.

[5]   L. M. Milne-Thomson, " Theoretical Hydrodynamics," McMillan, London, 1960.

[6]   H. Lamb, " Hydrodynamics," Gostechizdat, Moscow, 1947.

[7]   L. Prandtl and O. G. Tietjens, " Fundamentals of Hydro and Aeromechanics," McGraw-Hill, New York, 1934.

[8]   L. D. Landau and E. M. Lifshitz, " Course of Theoretical Physics," Hydrodynamics Pergamon, Oxford,

1975.

[9]   L. G. Loitsiansky, " Mechanics of Fluid and Gas," Science, Moscow, 1987.

[10]   D. I. Blokhintsev, " Acoustics in Moving Inhomogeneous Media," Taylor Francis, London, 1998.

[11]   M. A. Isakovich, " General Acoustics," Nauka, Moscow, 1973.

[12]   O. M. Phillips, " Upper Ocean Dynamics," Gidrometeoiz dat, Leningrad, 1980.

[13]   P. M. Morse and K. U. Ingard, " Theoretical Acoustics," Mac-Grow Hill, New York, 1968.

[14]   M. A. Isakovich and B. F. Kuryanov, " To the Theory of Low Frequency Ocean Noises," Soviet Physics
        Acoustics, Vol. 16, No. 1, 1970, p. 62.

[15]   J. P. Lysanov, " To Space and Time Sea Roughness Corre lation Evaluation," Oceanology, Vol. 15,
        No. 3, 1975, p. 405.

[16]   J. W. Miles, " On the generation of surface waves by the shear flow," Journal of Fluid Mechanics,
        Vol. 6, No. 4, 1959, pp. 568-582. doi:10.1017/S0022112059000830

[17]   N. Curle, " The Influence of Solid Boundaries upon Aero dynamic Sound," Proceedings of the Royal
        Society A, Vol. 231, 1955, p. 505.

[18]   H. S. Ribner, " Reflection, Transmission and Amplification of Sound by Moving Medium," Journal of
        the Acoustical Society of America, Vol. 29, 1957, p. 435.

[19]   J. I. Gromov, A. V. Rimsky-Korsakov and A. G. Semenov, " Resonator in Finite Amplitude Sound Wave
        Field," Soviet Physics Acoustics, Vol. 23, No. 1, 1977, p. 160.

[20]   A. D. Lapin and M. A. Mironov, " Rigid Plane Cut Conductance Streamlined by Flow," Acoustical
        Physics, Vol. 49, No. 1, 2003, p. 98.

[21]   D. Ronnenberger, " The Acoustical Impedance of Holes in the Wall of Flow Ducts," Journal of Sound
        and Vibration, Vol. 24, No. 1, 1972, p. 133.

[22]   M. S. Howe, " Acoustics of Fluid-Structure Interactions," Cambridge Monographs on Mechanics,
        Cambridge, 2008.

[23]   M. A. Mironov, " Hole Impedance in Screen between Moving Medium and Medium at Rest," Acoustical
        Physics, Vol. 28, No. 4, 1982, p. 528.

[24]   V. F. Kopyev, M. A. Mironov and V. S. Solntseva, " Possible Generation Mechanism of ' Sea Voice' ,"
        Proceed ings of the 12 Brekhovskih' s Conference on Ocean Acous tics, Moscow, 2009, p. 272.

[25]   A. V. Rimsky-Korsakov and A. G, Semenov, " Self-Sus tained Oscillations of Gaseous Ring Jet,"
        Acoustical Physics, Vol. 42, No. 1, 1996, p. 116.

[26]   A. Michalke, " The Instability of Free Shear Layers. A Survey on the State of Art," Deutsche Luft und
        Raumfahrt, FB 70-51, 1970.

[27]   T. Kh. Sedelnikov, " Self-sustained Noise Generation in Gaseous Jet Outflow," Nauka, Moscow,
        1971.

[28]   T. Kh. Sedelnikov and A. G. Semenov, " Wiener-Hopf Technique Application to Problem of Semi-
        Infinite Su personic Jet Noise Generation," Proceedings of Acoustics Institute, No. 4, 1968, p. 76.