

Tatarskii's Extraordinary Work, and Some Current Problems in the Field

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Many people in this special session were deeply influenced by the work of scientist Valerian I. Tatarskii. Some of us are also fortunate to have known and worked with him. I was one of the lucky people who worked directly with Dr. Tatarskii and was profoundly inspired by his extraordinary power and his warmest friendship. I had previously read his 1961 book "Wave Propagation in a Turbulent Medium" and his famous 1971 monograph, "The effects of the turbulent atmosphere on wave propagation". In 1985 I served as Feature Editor of JOSA on the topic "Wave Propagation and Scattering in Random Media", and requested that Tatarskii be the lead author on a paper "Wave Propagation and Scattering in Random Media with Fluctuating Turbulent Parameters" (Tatarskii and Zavorotny). In 1989, Tatarskii and I served as co-chairs of the Tallin workshop on "Wave Propagation and Scattering in Random Media" with top American scientists and Russian scientists from the Academy of Science Institute of Atmospheric Physics, USSR. In 1989 and 1990, Tatarskii was invited to the University of Washington to present two lectures on the topic "New Theoretical Developments in Wave Propagation". In 1992, Tatarskii, Zavorotny, and I organized a conference at the University of Washington on "Wave Propagation and Scattering in Random Media". In this talk, I discuss my experiences working with Dr. Tatarskii, and present some applications related to his work along with current and outstanding problems in this field.

One of the important problems is the effect of random media on communication through a mixture of random media and deterministic media. This requires the study of the Mutual Coherence Function, which includes the effects of diffraction in deterministic and random media and the eigenvalues of this complex environment. Next, it is important to consider the Sommerfeld problem with rough surfaces and a random medium. Related to this problem are the random media effects on the acoustic Rayleigh surface wave, such as the seismic coda wave. A study of seismic coda waves requires the study of the space-time Fourier transform of acoustic waves in the heterogeneous earth. This is an important topic, since coda waves show the characteristics of the source and the medium and whether an earthquake is man-made or natural. Many years ago, Sommerfeld noted "Poisson diffraction" similar to "antipodal imaging". This imaging problem is more recently described as "hard-wall imaging", or "seeing around corners", and requires signal processing techniques for waves in random media. Another topic of interest is the relationship among the "shower curtain effect", "reciprocity", and the modulation transfer function (MTF). These and other outstanding problems of waves in random media that are related to Tatarskii's work will be discussed.