

Weak-Turbulent Theory of Wind-Driven Sea

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A bulk of experimental data on the wind-driven sea collected in physical oceanography for several decades can be explained in a framework of a simple analytical theory based on the Hasselmann kinetic equation for squared amplitudes of the wave with stochastic phases. The theory is based on the assumption that the main physical process in the wind-driven sea is four-wave nonlinear resonant interaction. As a result, in the leading order, the surface wave turbulence is described by conservative kinetic equation that does not include forcing and dissipation terms. This equation has a rich family of self-similar solutions, which can be found from the next approximation; this approximation is the balance equation for wave action. The theory, supported by massive numerical experiments makes possible to explain a lot of experimental data in the major fetch-limited and duration-limited experiments; these data include fetch and duration dependence of integral characteristics of the sea, such as energy and mean frequency, as well as shapes of spectra both in the equilibrium range and in the energy-containing spectral area.

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