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Universality of Wind-Wave Spectra and Exponents of Wind-Wave Growth

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Self-similarity is implied in various experimental parameterizations of wind-wave spectra. Moreover, the forms of wave spectra are assumed to be very close to a universal one (e.g. JONSWAP spectra). The *self-similarity and universality* features have been detailed in the series of numerical experiments for solutions of the Hasselmann equation for deep water waves with different functions of wave input and dissipation.

First, in the 'academic' series with artificial functions of wave input and dissipation the features of self-similarity have been demonstrated in 'the pure state'. The scaling of these solutions is shown to be in perfect agreement with one of the family of the asymptotic self-similar solutions of the Hasselmann equation. Additionally, the forms of these solutions in self-similar coordinates are found to depend very slightly on the family parameter. Thus, *quasi-universality of the wind-wave spectra* has been demonstrated in this series of numerical experiments.

In the second series the different 'realistic' parameterizations of wind-wave input have been used (Snyder *et al.* 1981, Hsiao & Shemdin 1983, Plant 1982, Donelan & Pierson 1987 *etc.*) in a wide range of wind speeds ($U_{wind} = 5 - 30$ m/sec). It is shown that wind-wave spectra (solutions of the Hasselmann equation) can be described effectively as a *self-similar 'core'* superimposed on a *non-self-similar background*. The 'core' evolution does not depend essentially on details of wave input and, thus, such parameters of wave growth as the magnitude and the position of the spectral peak can be predicted quite well within the self-similar dependencies. On the contrary, the mean wave frequency and the total wave energy (or mean wave height) can be affected significantly by the non-self-similar background that depends dramatically on details

of wave generation.

The numerical results are shown to be consistent with conventional parameters of wind-wave growth.

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