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Statistics of rogue waves in random sea states and their dependence on inverse scattering data.

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Extreme waves are frequently modeled using the nonlinear Schrodinger (NLS) equation and it's higher order extensions (HONLS). In earlier work we introduced δ, the "splitting distance" between two consecutive simple points in the Floquet spectrum of the associated Zakharov-Shabaat problem of the NLS equation, as a measure of proximity to instabilities in the wavefield. As and alternative to the Benjamin-Feir index, the splitting distance can be seen as a measure of the localization of the energy in the wave field. In [1] we correlated the development of localized rogue waves in random sea states characterized by JONSWAP spectra with the splitting distance δ.

In [2] Sura shows that the kurtosis (κ) and skewness (s) of deep ocean field data obey the relationship $\kappa = 3/2s^2 + c$ which is not satisfied by Gaussian or double exponential noise. Here we show that sea states modeled using the HONLS equation and random phase JONSWAP initial data exhibit a significant deviation from Gaussianity and satisfy Sura's relation between the skewness and kurtosis. For the HONLS equation, δ is not invariant in time. We determine both the initial splitting distance δ_0 and the time averaged splitting distance δ_{avg}. We find that the maximum strength, skewness, and kurtosis of the sea state are strongly dependent on δ_{avg}. Using the Mori-Janssen relationship between kurtosis and $\mathcal{P}$, the probability a wave height exceeds a given quantity, we determine $\mathcal{P}(\delta_{avg})$.

References

1 A.L. Islas and C.M. Schober, Predicting rogue waves in random oceanic sea states, Phys. Fluids **17** (2005)

2 P. Sura and S.T. Gille, Stochastic dynamics of sea surface height variability, J. Phys. Oceanogr. **40** (2010).