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# Predicting rogue waves in random oceanic sea states

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We investigate rogue waves in the framework of the nonlinear Schrödinger (NLS) equation and it's higher order extensions. In numerical simulations of the NLS equation we correlate the development of rogue waves in oceanic sea states characterized by the JONSWAP spectrum with the proximity to homoclinic solutions of the NLS equation. Using the inverse spectral theory of the NLS, we obtain a simple criterium for predicting the occurrence and strength of rogue waves. In simulations of higher order NLS equations, we find that a chaotic regime greatly increases the likelihood of rogue waves. Enhanced focusing is shown to occur due to chaotically generated optimal phase modulations. A Melnikov analysis indicates persistence of homoclinic solutions $O(\epsilon)$–close to the optimally phase modulated solutions of the NLS.