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Wave damping and floe breakup in the marginal ice zone.

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We present a model for wave damping and floe breaking in the Marginal Ice Zone. The most common and accurate wave damping models at present are derived from a scattering model. When compared to experimental data, these models show accurate attenuation rates for short periods, indicating that attenuation due to wave scattering is dominant for short periods. For long periods however, the scattering models do not attenuate as fast as the experimental data. This indicates there is another factor which dominates wave attenuation at long periods. An alternative model is the viscous model which includes an unknown viscosity parameter. This viscosity parameter can be adjusted so that the model fits experimental data. We combine these models and develop an attenuation model which fits the experimental data for both short and long periods.

Using the attenuation model, a model is proposed which can estimate how far waves will propagate into the MIZ and how many floe will be broken. Field measurements have shown that a floe will no longer break if its strain is below $3\text{x}10^{-5}$. Based on a two-dimensional model for the displacement of a set of elastic floes, we can calculate the strain for a given period and floe thickness. In practice, however, ocean waves consist of a power spectrum of waves. We represent this spectrum by the well known and often used Pierson-Moskowitz spectrum. We simulate the total strain by integrating the strain over the whole spectrum. We define the strain envelope by calculating the root mean square of the total strain. Using the model for the attenuation of wave energy, we can estimate the alteration of the wave spectrum for a given floe thickness and floe number. We then predict how many floes will be broken by a given input wave spectrum.