Assessing ice-induced attenuation of water waves in a directional wave basin

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Wave-ice interaction is a critical factor in the dynamics of the marginal ice zone (MIZ), the region between open ocean and an expanse of ice floes of varying size and shape. This interaction works both ways: while waves cause the fractures of ice floes, the presence of ice floes affects waves through scattering and various dissipative processes. In order to assess the latter, a laboratory experiment has been carried out in the coastal directional basin at Plymouth University. Sea ice has been simulated with a plastic sheet of 1mX1mX0.005m of polypropylene, which holds the same density (~0.9 g/cm^3) of ice. Experiments have been conducted using monochromatic as well as random wave fields with different steepness and wavelengths (both shorter and larger than the floe). The wave field has been monitored before and after the simulated ice floe with a number of wave probes deployed along the basin, including a 6-probe array to track directional properties. On the whole, results show a substantial scattering and dissipation of the wave field. This seems to depend on the amount of wave overtopping on the ice floe.