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The Effect of the Marginal Ice Zone on the Directional Wave Spectrum of the Ocean

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ABSTRACT

During the MIZEX-84 experiment in the Greenland Sea in June–July 1984, a cooperative program was carried out between the Scott Polar Research Institute (SPRI) and the Institute of Oceanographic Sciences (IOS) to measure the change in the directional character of the ocean wave spectrum in the immediate vicinity of the ice edge. The aim was to extend one-dimensional spectral measurements made hitherto so as to study in full the processes of reflection and refraction. Directional spectrum analysis of these records shows that (i) significant reflection of wave energy occurs at the ice edge (detected using Long-Hasselmann analysis); (ii) within the ice the directional spectrum at high frequencies, where attenuation is rapid, broadens to become almost isotropic; whereas (iii) the directional spectrum at swell frequencies, where the attenuation is slower, becomes initially narrower before broadening more slowly than the high frequency energy. An explanation of these effects is offered in terms of scattering theory, which also gives a good fit to the observed rates of attenuation within the ice.

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