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### **IN SITU MEASUREMENTS OF AN ENERGETIC WAVE EVENT IN THE ARCTIC MARGINAL ICE ZONE**

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We will describe a wave event which occurred approximately 77 degrees north (latitude), in the vicinity of Hopen Island off of Svalbard, Norway on May 2-3, 2010, and we will discuss the role played by this wave event in breaking up the ice cover. To our knowledge, these are the largest waves recorded in the Arctic with substantial ice cover present. The wave conditions were inferred by analyzing the GPS records of the R/V Lance as it inadvertently encountered the energetic wave event. The results indicate three distinct periods of ice-wave interaction: 1) wave blocking by ice, 2) fracturing of ice by wave forcing which allowed uninhibited propagation of the peak waves, and 3) an extension of allowed waves to higher frequencies due to interaction with ice floes which were reducing in diameter. A 3rd generation, spectral wind-wave model, with no representation of ice, was applied following the path of R/V Lance. During phase 1, when the waves were blocked, the model severely over-predicts this energy, as one would expect. During phase 2, when the waves are not impeded by the ice, the model agrees with measurement of the low frequency energy. This indicates a kind of binary behavior where pre-fractured ice allowed no transmission of wave energy and post-fractured ice allowed total transmission of energy of low frequency wave energy. The propagation speed of the fractured-ice front is estimated to be of the same order of magnitude as the peak wave group velocity. The results--where the wave energy impacts the ice in a way that in turn affects the waves energy--imply that two-way, wave-ice coupling is necessary and the predictive skill of a wave model in an icy environment will depend critically upon the resolution and accuracy of the ice model.