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Sea Ice Motion and Deformation in the Marginal Ice Zone Through SAR

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The objective of this study is to explore motion and deformation of sea ice in the marginal ice zone (MIZ). Sea ice properties in MIZ are highly variable and complex due to the complexity of the ocean dynamic and thermodynamic processes, as well as atmosphere-sea, ice-ocean interactions. These processes (and interactions) play important roles in the distribution of heat, mass, and momentum fluxes in polar region and in the control of the ice edge and its location. In earlier studies, sea ice features include thinckness, type and motion were analyzed using the high resolution synthetic aperture radar (SAR) imagery. A segmentation technique with dynamic local thresholding was used to analyze and segment unstructured sea ice data. The initial classification was supplemented using statistical attributes and heuristic geophysical knowledge organized in expert systems. Then, statistical methods were used to derive ice motion map from the classified images and to perform ice floe tracking. Using SAR images and an ocean-ice interaction model, Liu et al. [1994] studied ocean-ice interactions in MIZ associated with wind, wave, eddies and upwelling/downwelling. In this paper, we extend the earlier studies to include motion and deformation analysis of the sea ice floes, as well as the possible effects of ocean-ice interactions associated with wind and waves. We focus our study in the Bering Sea region. With the sea ice images well classified, it is efficient to track ice floes of different sizes and to study ice motion and deformation such as translation, rotation, convergence and divergence. We also perform mathematical analysis on the two-layer ocean and ice interaction model studied by Liu et al. [1994]. Finally, inter-comparisons between remotely sensed products and model simulations will be discussed.