

Ice and Sea State in Arctic Regions

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Radar satellites can provide survey and observation of meteo-marine parameters and sea ice conditions with high resolution. As active sensors the radar satellites are the most prominent equipment for research and surveillance in high latitude regions due to their independence of cloud coverage and sunlight illumination. The latter is especially important for monitoring in Polar Regions, where optical remote sensing observations are not possible during polar night.

TerraSAR-X is an X-band polarimetric SAR (Synthetic Aperture Radar) designed to operate in different modes with the highest resolution up to 1m resolution. TerraSAR-X images provide information on surface wind and integrated sea state parameters (individual ocean waves with wavelengths down to 30m are detectable). Further, sea ice motion, ice type classification, iceberg detection and interaction of ocean waves with sea ice are observable. The TerraSAR-X data allow covering large areas and estimating the spatial distribution of investigated characteristics and thus have been used for validation of ice drift models, which are designed to optimize shipping routes. Simultaneous wave observations at a spatial coverage sufficiently larger than typical ice floes are required to address the wave evolution in the marginal ice zone. TerraSAR-X images span a range of up to 50 km from which a spatial series of wave spectra can be extracted. Cases for the Bering Street and the Greenland Sea are shown where the waves are interacting with newly generated ice.