CHARACTERIZATION OF COASTAL POLYNYAS IN THE ARCTIC WITH REMOTE SENSING TECHNIQUES AND COMPARISON WITH NUMERICAL MODEL INVESTIGATIONS

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Coastal polynyas in the Arctic basin from the winter period are characterized using ESA European Remote Sensing satellite (ERS)-1/2 Synthetic Aperture Radar (SAR). A SAR polynya algorithm is used to delineate open water, new ice, and young ice, and to define the size and shape of polynyas. In order to extract radiometric and contextual information in the ERS SAR PRI images, three different image classification routines are developed and applied. No in situ data have been available for verification of the polynya shapes and sizes, but one of the ice classification routines has been verified earlier using ground truth data. The SAR polynya algorithm is demonstrated to be able to discriminate between the polynya and the surrounding ice area for 85 analyzed cases. The results from the SAR algorithm are compared to passive microwave data (a recent Polynya Signature Simulation Method (PSSM)) and a numerical polynya model (NPM) forced by National Center for Environmental Predictions (NCEP) wind fields and air temperatures. The PSSM calculates the polynya shape and size, and delineates open water and thin ice. For polynyas of all sizes it has a correlation of 0.69 compared to the SAR images. For polynyas with widths greater than 10 km the correlation increases to 0.83. The NPM computes offshore coastal polynya widths, heat exchange, and ice production. Compared to SAR data, it overestimates the maximum size of the polynya by about 15% and has a correlation of 0.71 compared to the analyzed SAR PRI images. The polynyas in our main investigation area, located at Franz Josef Land, are found to be primarily wind driven. The surrounding large-scale ice drift and tidal currents have little effect on the polynya behavior. The presentation will demonstrate that the SAR polynya algorithm in combination with the NPM is a powerful tool for investigating and characterizing polynyas and other coastal sea ice openings at various scales in the Arctic.