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Continuing Development of a Multi-sensor Analysis of Arctic Polynyas

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In this study we seek to examine the variability of Northern Hemisphere polynyas and their response to recent large-scale atmospheric patterns. Recent climate changes, starting with the large 1989 shift in the Arctic Oscillation (AO), have strongly affected the ice circulation and export in the Arctic Ocean. It appears likely that polynya activity, and thus their possible role in the variability in the Arctic halocline, may be directly related to these significant shifts in atmospheric circulation. However, no recent large-scale remote sensing assessment of Arctic polynya activity has been performed during this dynamic period. Our first task is to make use of a unique combination of both current and soon-to-be-launched satellite sensors to determine an optimum approach to detect polynyas. The second task is to develop a time series of polynya activity particularly since 1989 to determine the response of the polynya ice production to large-scale changes in the atmosphere.

This paper describes our efforts to develop a multi-sensor approach to the detection of Arctic polynyas. We combine passive microwave data from SSM/I, AVHRR imagery, SAR imagery from RADARSAT, and scatterometer data from QuikScat. This initial suite of instruments captures the polynya opening and closing and permits tracking of the areas of thin ice formation over time. We estimate thin ice thickness and heat flux from AVHRR and then compare these estimates with different SSM/I algorithms and procedures. The most successful comparison is with 37 GHz V/H ratio, which has proven to be sensitive up to 20 cm thickness. We will present results from a major polynya events in the western Arctic for the winters of 1999/2000 and 2000/20001.