Investigating the Impact of Cyclones on Short-Term Sea Ice Loss using a Fully-Coupled Atmosphere-Ocean-Ice Model

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Arctic cyclones may be associated with periods of locally enhanced sea ice loss in mid to late summer (July-August), and some recent studies have found that the Great Arctic Cyclone of 2012 (GAC) resulted in a very rapid sea ice retreat in the Beaufort and Chukchi Seas. Here, we use a fully coupled atmosphere-ocean-ice model – the Navy ESPC Model – to explore the relationship between intense synoptic-scale atmospheric cyclones and short-term sea ice melting. We examine the 2012 GAC as well as other recent cyclones with high surface wind speeds over the Beaufort Sea during July-August, and assess the magnitude of the melting and its spatial relationship with the regions of high wind speed. By taking Navy ESPC forecasts at different lead times prior to the cyclones, we can estimate the coupled impact of the cyclone on the sea ice, as forecasts at early enough lead times do not simulate the cyclone (and so its absence may be reflected in different forecasted melting rates). We will also examine the sensitivity of the ice extent at the end of the melt season to the forecast lead time, to determine whether the cyclone-induced melting had a longer-term effect. Finally, we will investigate the hypothesis that the enhanced melting is a consequence of storm-induced upward mixing of warmer water from beneath the oceanic mixed layer.