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Sea surface temperature: High latitude SSTs and their interaction with the Arctic Sea Ice

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With the advent of polar orbiting satellites in the late 1970's we have been able to study remote locations like the Arctic in great detail and are now able to observe trends with the Arctic sea ice. The Arctic has warmed 2 to 3 ∞C since the 1950's and sea surface temperatures (SST) have been increasing since 1995. The melt season length of the ice in the summer has increased by 6.4 days/decade for the entire Arctic, with individual areas seeing a larger increase. Arctic sea ice extent has been decreasing at a rate of -10.2 to -11.4% per decade from 1979 to 2007 and the ice pack has been decreasing in thickness as well, moving from a predominately thick multi-year ice pack to a more vulnerable thin first-year ice pack. This decrease in ice extent and thickness has allowed a larger area of open ocean in the summer months, strengthening the ice-ocean interactions in the Arctic. The timing of melt onset is crucial to the maintenance of the ice pack for the duration of the melt season, especially where the first-year ice pack melts and exposes the Arctic Ocean. This enhances the ice-albedo feedback and causes a large input of heat into the ocean, which then has to be released in order for freezing to occur in the fall. In these areas, early melting allows for the SSTs to increase and for more heat to be absorbed by the system. This large the amount of heat absorbed delays freeze-up because it takes longer for this heat to be lost. In years when the SST is warmer than average we should expect to see the melt season length to be longer than years when the SST is below average. In this study we focus primarily on the first-year ice pack of the Chukchi/Beaufort Seas, the Laptev/East Siberian Seas and the Kara/Barents Seas to determine how SSTs are influenced by melt onset and how they impact freeze-up in the fall. This is accomplished by analysis of the SST dataset produced by the National Climate Data Center's Advanced Very High Resolution Radiometer (AVHRR), and a melt and freeze onset data set produced from SMMR and SSM/I microwave data for the years 1982-2009. AVHRR's SST product has a spatial resolution of 1/4∞ and temporal resolution of 1 day. The goal was to better understand the role of first-year ice-ocean interactions, the role that SSTs play in impacting melt season length and if these trends are influencing the ice-ocean interactions in the Arctic in recent decades.