Investigating Recent Changes in Arctic Sea Ice

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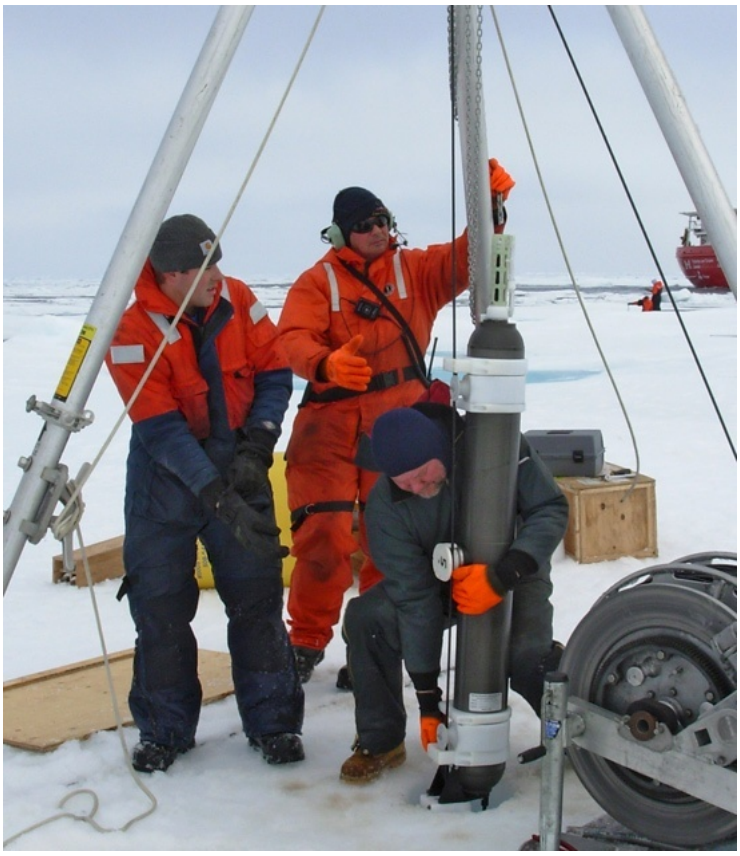
The Arctic is undergoing significant climate changes that include warming atmospheric and ocean temperatures, freshening of sea water, rising sea levels, melting permafrost and the decline of sea ice. The rapid loss of permanent sea ice underscores the need for sustained, uninterrupted Arctic observations and analyses to understand and predict future Arctic changes. Some research suggests that atmospheric circulation, rising global temperatures and complex feedbacks between the sea ice and the ocean will lead to ice-free summers in the Arctic Ocean in as few as 10 years from now, while other studies indicate that the strong natural variability of the Arctic system will inhibit further loss of summer sea ice, at least in the near term. The coming years will be of great significance in Arctic research.

Arctic Ocean circulation and heat transport from the ocean to the overlying sea-ice cover are critical components in the delicate balance of sea ice and climate. One of the most significant recent changes to occur in the Arctic Ocean has been a warming of the Atlantic-derived water that lies beneath the surface waters. This warming affects ice cover where it is possible for the heat to be transported to the surface. With support from the Clark Arctic Research Initiative, we investigated the temperature and salinity of the Atlantic-derived water, based on measurements taken by an observing array of Ice-Tethered Profilers, or ITPs. The ITP system consists of a small surface capsule that sits atop an ice flow and supports a wire rope tether that extends through the ice and down into the ocean, plus an underwater cylinder which is mounted on the tether and cycles vertically along it, carrying oceanographic sensors through the water column. The data is collected and sent to shore in nearly real time.



Lowering an Ice-Tethered Profiler (ITP) through a hole in the ice.

Our observations of vertical heat transport in the central Canada Basin show that it provides only a small fraction of the total heat input to overlying waters, and that most of the ocean heat is derived from incoming solar radiation. Our ongoing analyses are aimed at understanding the fate of the warm waters entering the Arctic from the Pacific and Atlantic Oceans, and the complex relationships between Arctic Ocean heat and fresh water dynamics and atmospheric circulation patterns and thermodynamics.

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