

Response of tropical climate to polar sea ice melt in climate model simulations

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The Arctic sea ice is melting rapidly in response to global warming. The future projections based on high emission scenarios by climate models suggest that we will have ice free summers in the poles by the middle of 21st century. The effect of polar sea ice melt on low latitudes is poorly understood. Recent research suggests that the melting of Arctic and Antarctic sea ice can affect deep tropics through ocean dynamics. The shutdown of oceanic meridional overturning circulation would result in excessive heat accumulation in the tropical oceans. Such a response to the polar sea ice melt can affect tropical weather systems, including the Indian summer monsoon (ISM).

Here, we investigate the effect of polar sea ice melt on mean and synoptic scale features of ISM using a suite of experiments using coupled and uncoupled climate models. A control (CTRL) run using coarse resolution coupled Community Earth System Model (CESM1.2.2) has been performed for 350 years. Another experiment in which the albedo of the sea ice is lowered is performed for 50 years by branching off the CTRL simulation at 300th year. The increased absorption of solar radiation in this experiment would lead to a melting of sea ice. This experiment is designated as sea ice melt experiment (SIME). As the coarse resolution simulations are unable to resolve the synoptic scale weather systems, we have run an ensemble of high-resolution Community Atmospheric Model (CAM5) by using the sea surface temperature and sea ice concentration annual cycles from the coupled model simulations. Our results show that in SIME simulations, the LPS genesis frequency declines by 23%.