

The Arctic Sea Ice Cover: A New Normal, for Now

Don Perovich

Thayer School of Engineering, Dartmouth College, Hanover, USA

In recent years, the Arctic sea ice cover has undergone significant changes, with a reduction in summer ice extent, a thinning of the ice, longer melt seasons, and a shift from multiyear to first year ice. These observed changes in the Arctic sea ice cover are due to many factors, including warming, atmospheric circulation, ice motion, shifts in cloud cover, advected ocean heat, and the ice albedo feedback. All of these changes enhance the amount of solar energy deposited in the ice-ocean system, thereby increasing ice melt. In particular, there has been a large increase in bottom melting in the periphery of the sea ice cover due in part to solar heating of the upper ocean. The shift from multiyear ice to first year ice contributes to an ice albedo feedback that further enhances solar heat input and melting. Compared to multiyear ice, first year ice tends to have a smaller albedo and a larger transmittance. The enhanced transmitted sunlight contributes to warming of the upper ocean, melting on the bottom of the ice, and is available for primary productivity in the ice and water column. To predict the future state of Arctic sea ice, it is critical to observe and understand the behavior of the atmosphere-ice-ocean system in a predominantly seasonal ice cover. There are key questions regarding snow, ice albedo feedback, ice dynamics, and the transfer of heat and momentum between the atmosphere and ocean that need to be addressed.