

New approaches to studying the sulfate reduction metabolism using sulfur and oxygen isotopes

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Reduced cloudiness and enhanced downwelling radiation are associated with the unprecedented 2007 Arctic sea ice loss. Over the Western Arctic, total summertime cloud cover estimated from spaceborne radar and lidar data decreased by 16% from 2006 to 2007. The clearer skies led to downwelling shortwave (longwave) radiative fluxes increases of +32 Wm⁻² (-4 Wm⁻²) from 2006 to 2007. Over three months, simple calculations show that these radiation differences alone could enhance surface ice melt by 0.3 m, or warm the surface ocean by 2.4 K, which enhances basal ice melt. Increased air temperatures and decreased relative humidity associated with an anti-cyclonic circulation pattern explain the reduced cloudiness. Longer-term observations show that the 2007 cloudiness is anomalous in the recent past, but is not unprecedented. Thus, in a warmer world with thinner ice, our work suggests that natural weather and cloud variability is an increasingly important control on sea ice extent minima.