Researchers project ice-free Arctic by 2058

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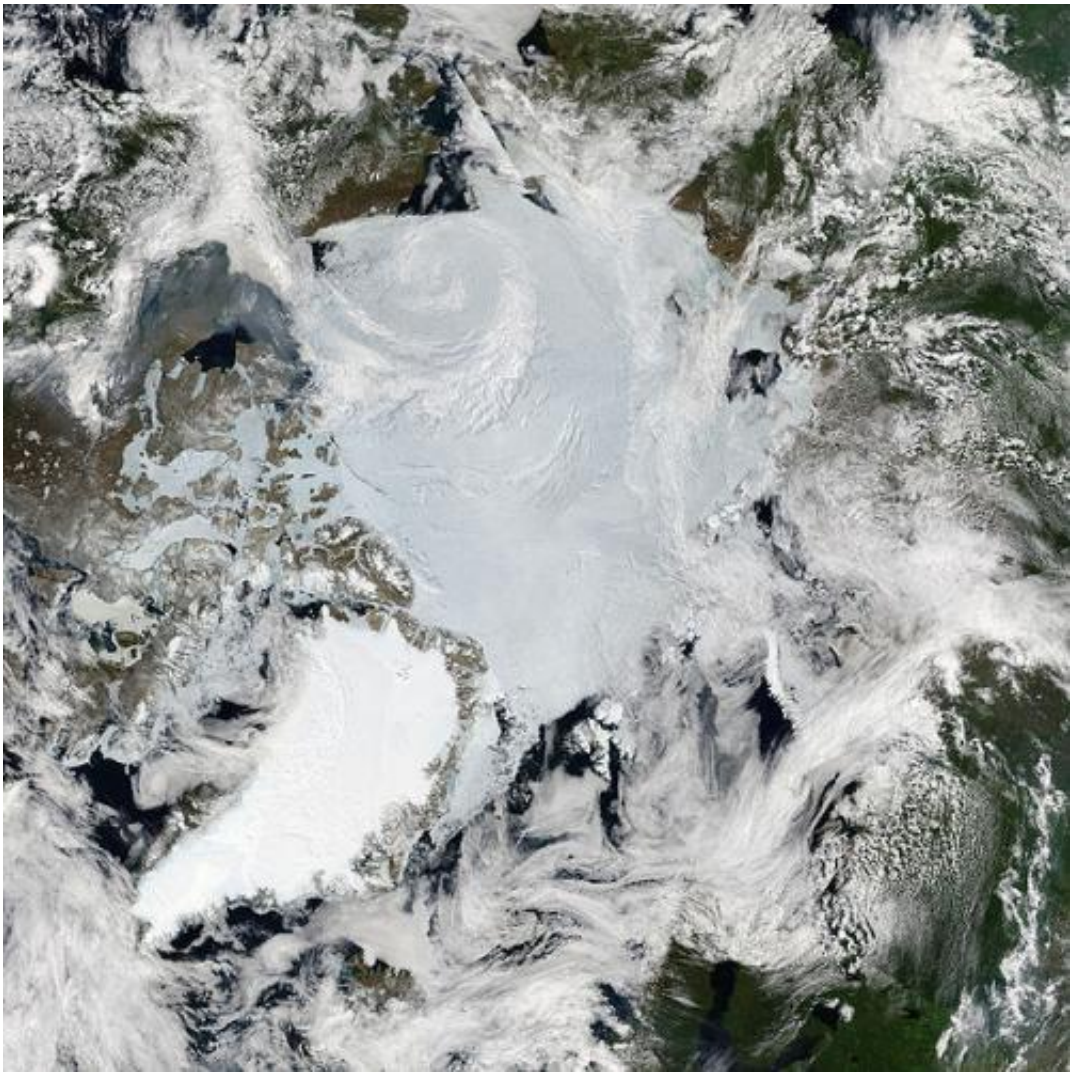

Mosaic of images of the Arctic by MODIS. Credit: NASA

(Phys.org) —A combined team of researchers from the U.S. and China

has projected, using a climate simulation tool, that the Arctic will become September ice-free sometime during the years 2054 to 2058. The group has published a paper describing their methods and findings in *Proceedings of the National Academy of Sciences*.

Ice-free in this context refers to a time period during any given year—generally arriving in September after withstanding the heat of summer. Not long after scientists began to recognize that the planet has been heating up, many began to realize that a warmer planet would mean warmer temperatures in the Arctic—enough warming and the Arctic would eventually become ice-free during part of the year. Many researchers using many models and simulations have sought to project when that might happen, as global warming projections have now made it a near certainty. In this new effort, the research team used a climate modal called Coupled Model Intercomparison Project Phase 5 (CMIP5). Phase 5 is the latest version of the model, which is why the team chose to use it.

One of the factors that the newest version of CMIP5 takes into consideration is ice thickness—the thinner the ice the faster it will melt—recent research suggests ice in the Arctic is growing thinner. It also uses various factors in attempting to simulate ice extent— ice covering less area to start with means less will be left at the end of summer. CIMP5 also allowed the researchers to make comparisons between historical projections and what actually transpired in the real world. As one example, the team gave the simulation data for the time period 1979 through 2011. By running simulations from various models and comparing them, the team was able to come up with a scenario that best represented what actually occurred. Once that was accomplished, they were able to use the same constraints to project most accurately what might occur in the future.

To help improve accuracy, the team also input data into the model that

took into account the fact that more sea ice tends to mean ice will be around longer and vice-versa and applied it using data from the years 2007 to 2012.

The overall result of their simulations gave rise to the same general prediction—that the Arctic will be ice-free for several months of every year, starting sometime during the years 2054 to 2058.

More information: Reducing spread in climate model projections of a September ice-free Arctic, *PNAS*, Published online before print July 15, 2013, doi: 10.1073/pnas.1219716110

Abstract
This paper addresses the specter of a September ice-free Arctic in the 21st century using newly available simulations from the Coupled Model Intercomparison Project Phase 5 (CMIP5). We find that large spread in the projected timing of the September ice-free Arctic in 30 CMIP5 models is associated at least as much with different atmospheric model components as with initial conditions. Here we reduce the spread in the timing of an ice-free state using two different approaches for the 30 CMIP5 models: (i) model selection based on the ability to reproduce the observed sea ice climatology and variability since 1979 and (ii) constrained estimation based on the strong and persistent relationship between present and future sea ice conditions. Results from the two approaches show good agreement. Under a high-emission scenario both approaches project that September ice extent will drop to ?1.7 million km2 in the mid 2040s and reach the ice-free state (defined as 1 million km2) in 2054–2058. Under a medium-mitigation scenario, both approaches project a decrease to ?1.7 million km2 in the early 2060s, followed by a leveling off in the ice extent.