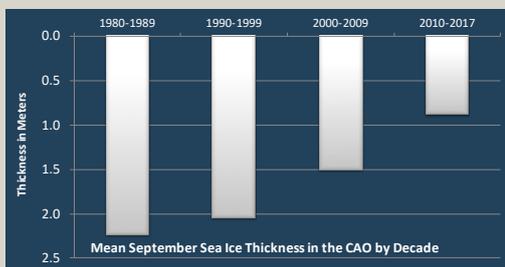
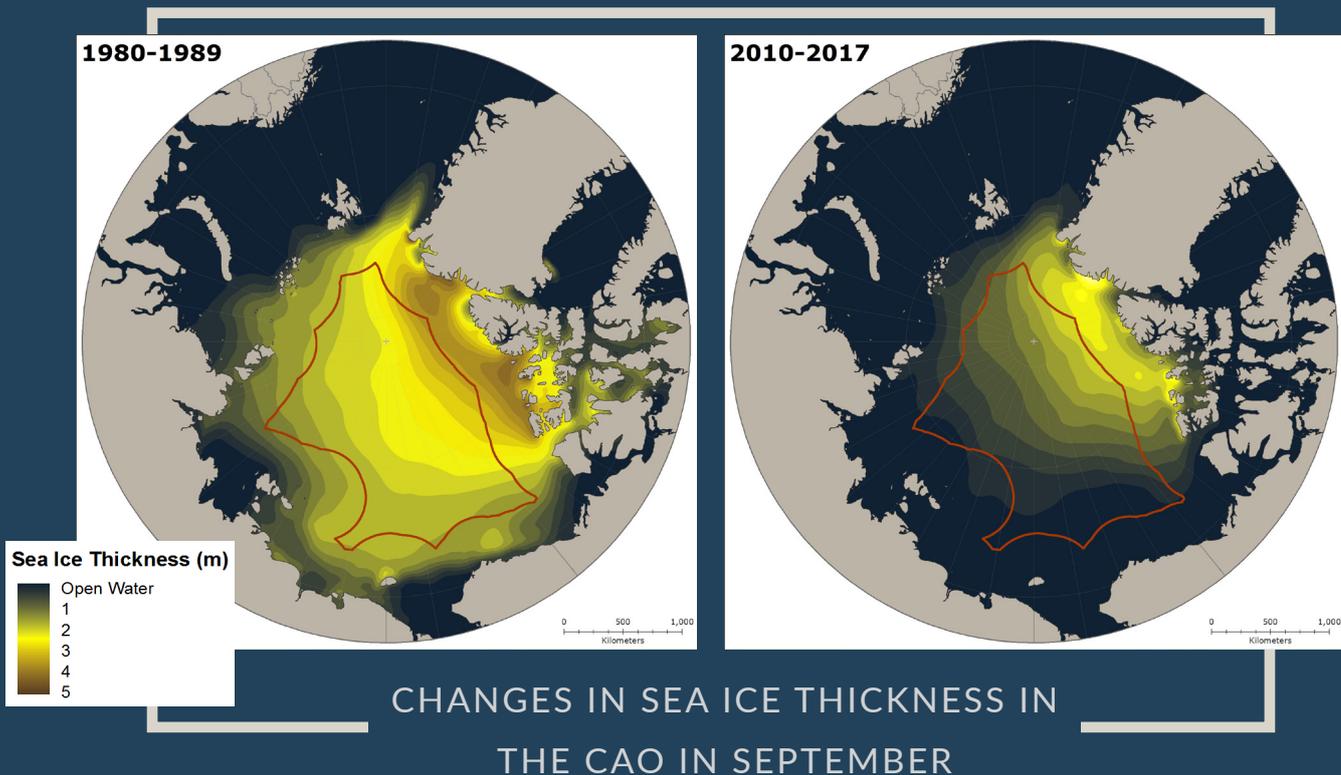


# ARCTIC SCIENCE BRIEF:

## Sea Ice in the Central Arctic Ocean

Dramatic changes to the Arctic Ocean in recent decades, first observed along coastlines, have reached even the Central Arctic Ocean (CAO) surrounding the North Pole, where satellites first began measurements of ice extent and thickness in the 1980s.

The CAO encompasses 2.8 million square kilometers of high seas, defined by international law as waters at least 200 nautical miles from the nearest coast. To protect this region as melting ice allows increasing access, 10 countries recently concluded a binding international agreement to prevent the start of commercial fishing for at least 16 years. During that period, a joint program of scientific research will study the extent of biological changes to Arctic life occurring along with decreasing sea ice.



### Sea Ice Thickness

Before the last two decades, the Central Arctic Ocean was largely covered by ice throughout the year. Because the ice persisted through the summer, it grew thicker the following winter, creating a large area of multi-year ice. This old ice was strong and resilient, making it very difficult for ships to reach the waters around the North Pole. Only the strongest icebreakers were up to the task.

In the first decade of satellite measurement in the 1980s, ice thickness in the CAO at the time of minimum ice extent measured an average of 2.2 meters. From 2010 to 2017, this same average has decreased by 60 percent to less than a meter of thickness. The thinner ice cap includes far less multi-year ice, and is more susceptible to wind and higher temperatures. Strong winds can open vast areas of open water, and warmer weather and seawater can melt far more of today's fragile ice than would have been possible only a couple decades ago. As a result, Arctic sea ice is no longer resilient, making the region more accessible to human activities, human influences and damage inflicted by humans.

For further information:

[www.climate.gov/news-features/featured-images/old-sea-ice-continues-disappearing-arctic-ocean-0](http://www.climate.gov/news-features/featured-images/old-sea-ice-continues-disappearing-arctic-ocean-0)  
[www.climate.gov/news-features/videos/old-ice-arctic-vanishingly-rare](http://www.climate.gov/news-features/videos/old-ice-arctic-vanishingly-rare)

Data source:

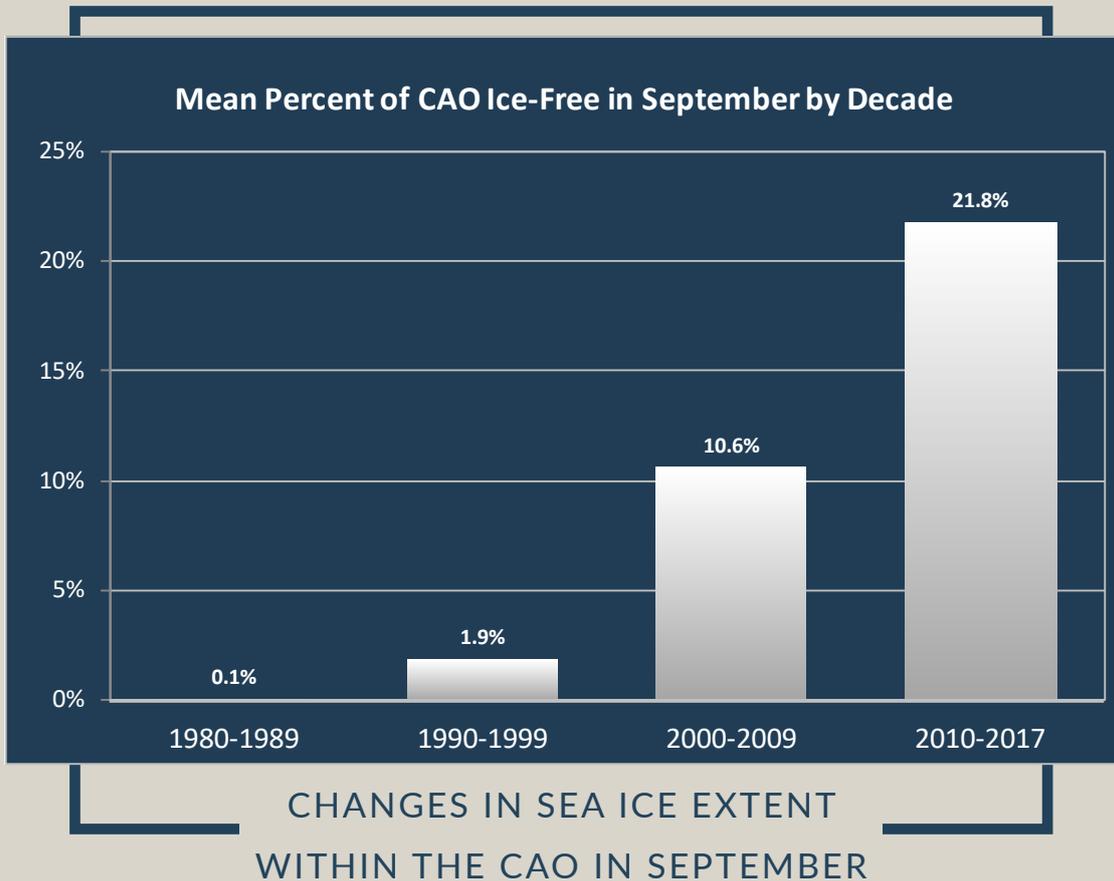
[http://psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/data/model\\_grid](http://psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/data/model_grid)

For information about the data, see:

Zhang, Jinlun and D.A. Rothrock: Modeling global sea ice with a thickness and enthalpy distribution model in generalized curvilinear coordinates, *Mon. Wea. Rev.* 131(5), 681-697, 2003

## Sea Ice Extent

Persistent sea ice over the Central Arctic Ocean made the region inaccessible to humans until the strongest icebreakers were built in the 20<sup>th</sup> century. But since 2000, more and more open water is appearing in summer months.



In the 1980s, an average of only 1 percent of this high seas region was open water (defined as having less than 15 percent ice cover) in September, when sea ice reaches its annual minimum. For the period from 2010 to 2017, this figure soared to an average of 22 percent. The single-year high so far is 42 percent, in 2012. Most of the open water is on the Pacific side of the Arctic Ocean, over the fishable waters of the Chukchi Cap that are less than 2000 meters deep. Without sea ice in this region, fishing vessels can access this area. And all Arctic sea ice models predict further declines in summer extent, so the percentage of open water is expected to increase.