



Climate change is significantly altering the Arctic Ocean: The need for increased collaboration.

Jeremy Wilkinson
British Antarctic Survey, Cambridge, UK

Abstract

Climate change continues to dramatically and disproportionately impact the Arctic Ocean. No corner of this unique region of our planet has remained unscathed, the changes are occurring across all domains atmosphere, sea ice, and ocean. This in turn has a profound impact on how the Arctic marine ecosystem functions, as well as the of local and indigenous peoples who depend on this ocean for their livelihood.

Sea ice is possibly the most visible parameter of Arctic change, with the satellite records showing that there is less sea ice in every single month when compared to the late 20th century. This loss shows no sign of abating, with the latest output from the majority of high-confidence, climate models suggesting the Arctic Ocean will be essentially sea ice free, in summer, before 2050 (figure 1).

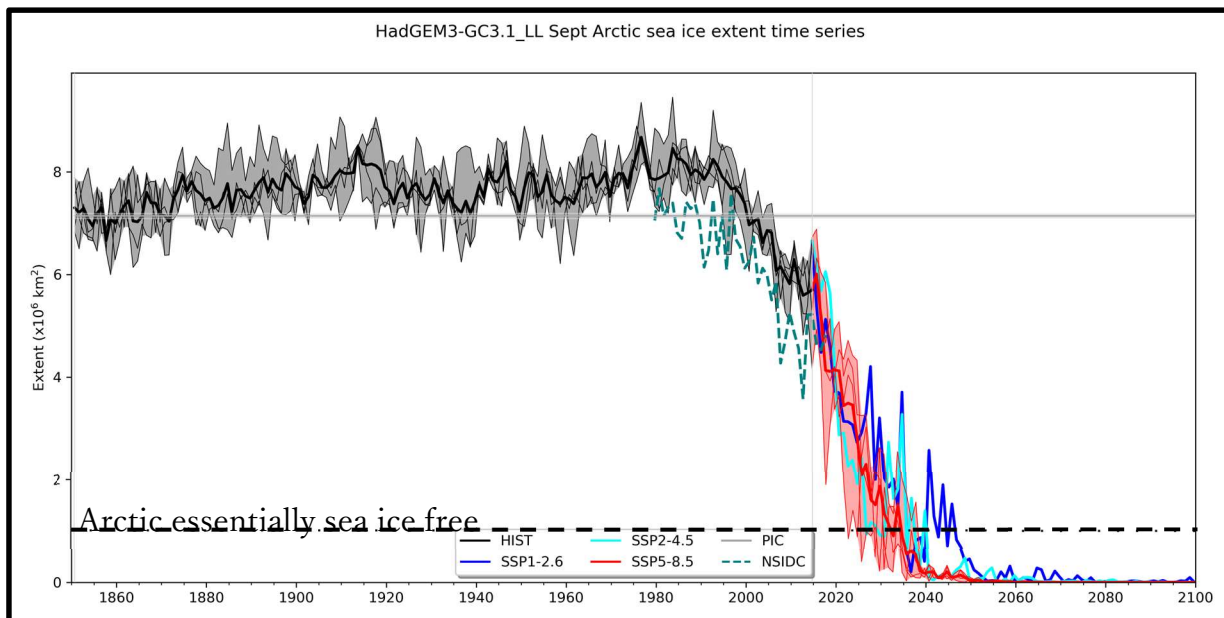


Figure 1. Summer Arctic sea ice extent from the UK's HadGEM3-LL CMIP6 model under different emission scenarios. Note: Black line is historical, green dotted line satellite observations, blue line single projection for the low CO₂ scenario SSP1-2.6, and red line from the high CO₂ scenario SSP5-8.5. Traditionally the 1 million km² mark has been used as a benchmark for an ice free Arctic (black dotted line). Figure courtesy of Ed Blockley, UK Met Office

There is considerable uncertainty in the exact date because of naturally occurring variations in climate and choices made now about ongoing emissions, with some models suggesting it is likely to occur in the 2030s. Whilst the 2030 date for an ice free Arctic is sombre enough, the



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biggest concern is that under all emission scenarios climate models suggest the Arctic will be ice free in summer after 2050. **In other words, climate models suggest that the process of an ice free Arctic in summer has started, and that it cannot be stopped or changed.**

Knowing that an summer ice free Arctic is an inevitability, understanding the Arctic marine system today and the impact of these future changes is a priority. But this cannot be performed by one country alone; the consequence of change in the Arctic marine environment is a global issue, one that requires collaborative, international action to make a significant impact.

Like many nations the UK has a vibrant and dynamic Arctic research community, one that works across all high northern latitudes, seasons, disciplines and peoples. However, lack of inter-country funding makes meaningful collaboration between researchers from different countries exceedingly difficult. Furthermore, research programmes are usually focused on short-term studies of around 3 years, the need for long-term data observational programmes at key locations across the Arctic Ocean is a priority. It is encouraging to hear that Japan's new research icebreaker will be an international research platform, we need other countries to reciprocate this commendable strategy and make it substantially easier for international research community to access infrastructure and to co-develop research programmes together. The Distributed Biological Observatory concept, Synoptic Arctic Survey, MOSAiC and the Arctic research programmes within EU's Polar Cluster show what is possible when scientists from different nations come together. It is unfortunate that loss of Arctic sea ice in summer is likely to be the catalyst that will focus our minds on the Arctic Ocean and allow us to address the numerous knowledge gaps that presently exist.