

READING TEST

Scientific Motivation

The Earth's climate system is changing as a result of increased greenhouse gas concentrations and their associated net warming effects. Warming is particularly pronounced in the Arctic, where regional temperatures are rising at more than twice the rate as the rest of the globe. This so-called Arctic Amplification effect has been largely attributed to significant regional feedback processes associated with a changing cryosphere and makes the Arctic an ideal laboratory for studying the manifestation of global change.

One of the first and most visible signs of global and Arctic regional change is the dramatic decline in sea ice observed over the past few decades. September annual minimum sea ice extent reached record minima in 2005, 2007, and 2012, with 2012 showing a 49% decrease relative to the 1979-2000 median. In addition to being less spatially extensive, the ice pack is also becoming younger and thinner, moving from an ice pack dominated by multi-year ice to one consisting primarily of first-year ice (Figure 1.2). These changes invoke many important marine-based feedback processes related to the reflectivity of the surface, the productivity of ocean waters, and others. Additionally, associated changes and feedbacks on the terrestrial side related to processes such as methane release from permafrost melt and changing ice sheet mass balances promise to further enhance and amplify Arctic changes.

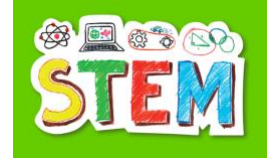
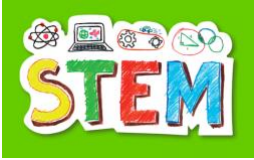
Clearly a “new” Arctic is emerging, with observed changes that are significant relative to the observational record.

Implications of the Arctic in transition, and particularly the changing state of Arctic sea ice and ocean conditions, are becoming increasingly apparent and important. Expanding seasonally ice-free oceans offer new opportunities for resource development, shipping, and other commercial interests.

The summer of 2013 saw the first container-transporting cargo ship transect the Arctic, trimming two weeks off the typical transit time from China to Europe. Additionally, major movements towards seasonally, operational off-shore oil drilling have occurred in Russian and U.S. waters in 2012 and 2013. As these lucrative activities draw more commercial development to the Arctic, it becomes increasingly important to understand and forecast sea ice in the region.

Arctic ecosystems and communities that are uniquely adapted to extreme conditions are also affected by change. While the shrinking habitat for polar bears is one of the most widely panned changes, there are numerous implications further down the food chain that impact ecosystem stability, biodiversity, nutrient cycles, fisheries, and more. Diminished sea ice contributes to a warmer, fresher, and more acidic upper Arctic Ocean, which has implications on the biological pump. Sea ice declines have also been linked to increases in Arctic Ocean primary production. These changes and others have profound sociocultural impacts on northern communities via subsistence practices, regional transportation, and community identity.

Repercussions of Arctic change may extend beyond the Arctic itself, potentially impacting northern hemisphere synoptic circulation patterns, global teleconnections, and lower-latitude weather. Studies suggest that more spatially-extensive open ocean modifies the ocean heat storage and release, impacting atmospheric thickness and large-scale circulation patterns. Associated weakened zonal flow and increased large-scale wave amplitudes are hypothesized to generate slower propagating Rossby waves increasing the likelihood of extreme weather events at mid-latitudes. Some have suggested that these links may not be statistically or physically robust, and may be driven by lower latitude variability.

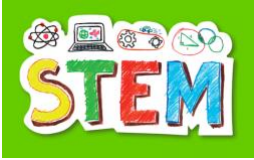


Notwithstanding this important debate about large-scale linkages, changes in sea ice and ocean heat fluxes have been implicated in amplifying the Siberian high leading to cold conditions in far East Asia, cold winters in Europe, spatial redistribution of rainfall in China, and increased early winter snowfall in North America and Europe, among others. Large-scale consequences of Arctic sea ice decline have been linked to circulation and precipitation changes as far south as the tropics.

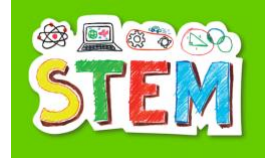
From https://mosaic-expedition.org/wp-content/uploads/2020/12/mosaic_scienceplan.pdf

MCQ_Q

1. Why has the Arctic been chosen to study global warming?
 - a. Because life is more meaningful there than elsewhere
 - b. Because its data are more worrying than in other regions
 - c. Because all the Arctic ice-covered parts are disappearing
 - d. Because it is the only place where global warming is felt
2. When was the highest percentage of ice melting reached?
 - a. In September 2005
 - b. From 1979 to 2000
 - c. In 2012
 - d. In 2007
3. What are the most immediate consequences of these changes?
 - a. Serious problems for the sea ecosystem
 - b. The surrounding environment could be compromised
 - c. They could get precious ice-free lands
 - d. They could handle larger quantities of natural gases
4. Which positive effects could the Arctic obtain from these modifications?
 - a. New ways of travelling and staying
 - b. Greater richness from the subsoil
 - c. Enlargement of livable boundaries
 - d. An increase in economic changes
5. Which governments does the oil extracted belong to?
 - a. To the Arctic region
 - b. To different countries
 - c. To China
 - d. To Europe
6. Why are Arctic animals threatened by climate mutations?
 - a. Because no one will bring food there anymore
 - b. Because they would be acquired by the American countries
 - c. Because they are used to live in the original Arctic settings
 - d. Because the Ocean will dry up more and more



Liceo Classico "Gioacchino da Fiore" – Rende (CS)
Prof.ssa Fabiola Salerno – a.s. 20/21



7. Could Arctic mutations influence weather conditions?
 - a. No. The warming of the seas isn't strongly conditioning
 - b. No, the most recent statistics go towards other directions
 - c. Yes. The exceptional weather occurrences are an evidence
 - d. Yes, even if new studies raise important and new questions

8. What's happening in some Oriental countries?
 - a. Higher temperatures and more abundant rains
 - b. Higher temperatures and more abundant snows
 - c. Their coasts are receding
 - d. Their seas are receding