Change in Arctic Sea Ice over the past 50 years

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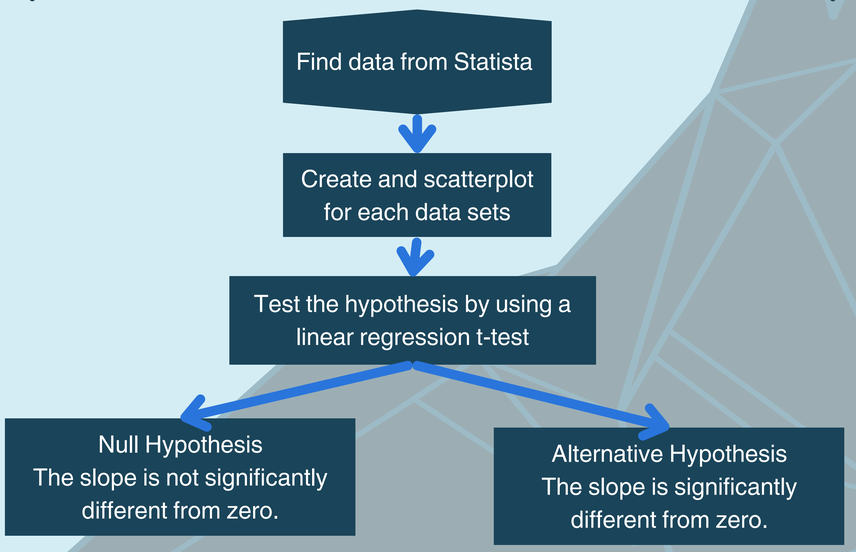
Introduction

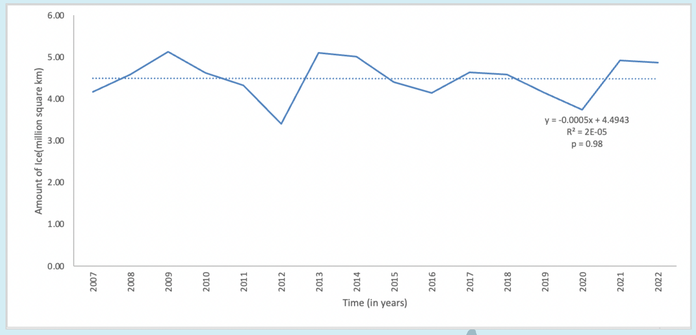
- Arctic sea ice is a vital component of our global climate system. It helps regulate the planet's temperature, provides a habitat for many species of wildlife, and plays a crucial role in the Earth's water cycle. However, in recent years, this important resource has been decreasing at an alarming rate, due to climate change and other human activities.
- Sea ice is made up of ice that is formed during the winter months and survives the summer months. During the winter, the Arctic Ocean is covered with a layer of ice that can vary in thickness from a few centimeters to several meters. This ice serves as an important habitat for many species of wildlife, including polar bears, seals, and walruses.
- It also helps regulate the planet's temperature by reflecting sunlight back into the atmosphere, keeping the Arctic region cooler than it would be without the ice. Arctic sea ice cover was considered to have a near-steady seasonal pattern, reaching an area of approximately 15 million km2 in March and withdrawing to approximately 7 million km2 in September (Kwok & Untersteiner, 2011). Unfortunately, Arctic sea ice is decreasing at an alarming rate.
- This decrease is largely due to climate change, as rising temperatures cause the ice to melt. In addition, human activities such as fishing, shipping, and drilling can have a negative impact on Arctic sea ice. These activities can cause stress and disruption to the fragile Arctic ecosystem, resulting in further decreases in the continue amount of ice.
- Research on geographical statistics indicate that the legacy of Arctic Sea ice is closely intertwined with climate change caused mainly by greenhouse and orbital forcing, sea ice level and quantity are rapidly decreasing (Polyak, Alley, Andrews, Brigham-Grette, Cronin, Darby, & Wolff, 2010).
- Therefore I hypothesized that the Arctic sea ice has declined significantly with time.

Methods



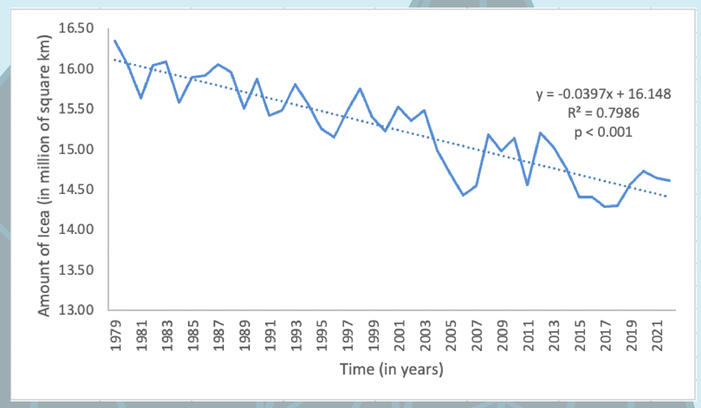
Results

Figure 1



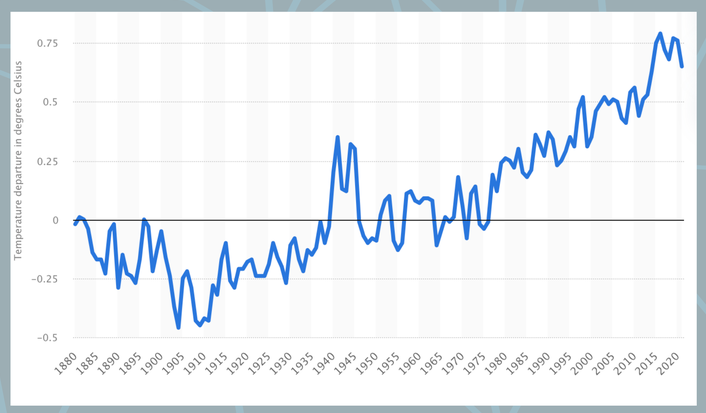
Note. Represents the minimum amount of ice extent through 2007 - 2022; there is not a significant difference with time (p=0.98) in the data set with time (Statista, 2023).

Figure 2



Note. Represents the maximum amount of ice extent through 1979 - 2022; there is a significant decrease in temperature with time ($p < 0.001$, Statista, 2023).

Figure 3. *Global Ocean Temperature Anomalies 1881 - 2021*



Note. From "Global ocean temperature anomalies 1880-2021 " by National Oceanic and Atmospheric Administration, 2022, *Climate at a Glance* (https://www.statista.com/statistics/736147/ocean-temperature-anomalies-based-on-temperature-departure/?locale=en)

Conclusion

- The minimum extent of Arctic sea ice data results showed no significant change in the amount of ice present in 2007 - 2022. However in the maximum extent data does show a significant decrease. Generally, I believe this supports my hypothesis.
- One reason the minimum sea ice extent may not have shown a significant decrease is that it may not have been a large enough data set (too short a period of time).
- A major climatic event was recorded in the summer of 2007, were it indicates a reaching record of th eminimum decline of the Arctic sea ice cover. Perovich, Richter-Menge, Jones, and Light collaborated in the reaserch study *"Sunlight, water, and ice: Extreme Arctic sea ice melt during the summer of 2007"* in 2018 were they stated "ice mass balance observations demonstrate that there was an extraordinary large amount of melting ice on the bottom of the ice in the Beaufort Sea in the summer of 2007 (Perovich, Richter-Menge, Jones, and Light, 2018)."
- They also proposed that solar paneling of the outer ocean was a significant warming factor for the observed increased Beaufort Sea bottom melting.
- Sea ice with thinner ice layers may be more particularly prone to atmospheric forcing. During the Arctic winter and spring of 2015, a group of scientists went on a six-month expedition to study the atmosphere, snow, sea ice, ocean, and marine ecosystem. The researchers discovered that younger, thinner ice is displacing older, thicker sea ice (Granskog, Gerland, Spreen, Steen, & Smedsrud, 2016).
- It revealed evidence that sea-ice dynamics are changing as it thins. The thinner the ice, the more likely to be exposed it is to breaking and becoming vulnerable to Arctic storms and waves (Granskog, Gerland, Spreen, Steen, & Smedsrud, 2016).

References

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