CLIMATE ANALYTICS

1.5°C A tipping point for the Arctic

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Summary

The Arctic is warming at more than double the pace of the global average. The surface air temperature between January and March 2016 and 2018 was recorded at 6°C above the 1981-2010 average. Between 2014 and 2018 the annual surface air temperature exceeded that of any year since 1900.

Sea ice is continuously melting over all months of the year. The average minimum sea ice extent per decade has decreased by 31% from 1979-1988 to 2009-2018. The Greenland Ice Sheet is continuously losing mass and contributing to global sea level rise. June snow cover extent has declined by around 13% per decade from 1967 to 2018. Permafrost temperature has increased between 2007 and 2016 leading to increased thawing of the permafrost layer during summer.

The range of polar species is contracted while temperate species are expanding into the Arctic, leading to increased competition. The introduction of invasive species is threatening local flora and fauna. Important species such as reindeer and salmon are showing shifts in abundance and distribution.

At global warming levels of 1.5°C, the **Arctic annual mean surface temperature increase will be twice the global average**. There is high confidence that the magnitude and frequency of heat and cold extremes will increase and decrease respectively.

The first summer season with a practically sea-ice free Arctic Ocean will likely occur before 2050. At 1.5°C global warming, the likelihood of a sea ice-free September in 2100 is substantially lower than at 2°C global warming. The risk of crossing the tipping point of the Greenland Ice Sheet increases rapidly above 1.5°C. At 2°C of warming, there is a higher than 50% chance that the tipping point will be crossed. Seasonal snow cover is projected to decrease by 8% with every additional degree of warming. Near-surface permafrost will essentially disappear within this century.

Arctic communities are reaching socio-ecological tipping points. Changes such as sea ice loss, glacial melt and ecosystem shifts, which are exacerbated above 1.5°C, are threatening cultural identities, mental health, food sovereignty and water security. Communities are facing sea level rise and infrastructure collapse due to permafrost thaw further diminishing livelihoods.

The Arctic Council fails to adequately address fossil fuel emissions. The declarations resulting from the biennial ministerial meetings have recognised the threat posed by climate change, as well as the value of climate science, indigenous knowledge and the need for both mitigation and adaptation efforts. However, member countries are reluctant to adequately address the main driver of observed Arctic climate change.

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Introduction

The Arctic is home to approximately four million people from over 40 different ethnic groups, living across three continents and eight countries. It provides habitat to an abundance of endemic species including iconic species like the Polar Bear and the Walrus.

The physical processes within the Arctic region are key components of the global climate system. However, the entire region is subject to the most rapid and extreme climate change worldwide.

This briefing will summarise some of the observed and projected impacts on the physical, biological, and human dimensions as outlined by the most recent IPCC reports. It will also take a look at different possible responses and link to the latest research beyond the IPCC assessment.

The Arctic – a hotspot for unprecedented climate change impacts

Changes in atmosphere and ocean

The Arctic has experienced accelerated warming, a phenomenon called 'Arctic amplification'. Increases in mean air temperature and extreme heat have emerged in all Arctic regions (Figure 1).

Over the past two decades, Arctic mean surface air temperature has increased by more than double the global average. The surface air temperature from January to March 2016 and 2018 was registered at 6°C above the 1981-2010 average. The annual surface air temperature from 2014 to 2018 was higher than any year since 1900.

The additional warming in the Arctic is driven by feedbacks from sea ice and snow cover loss. The coupled atmosphere-cryosphere system is increasingly diverging from its 20th-century state, with published scientific literature showing medium evidence and high agreement (Meredith et al., 2019).

Climatic impact-drivers in the Arctic

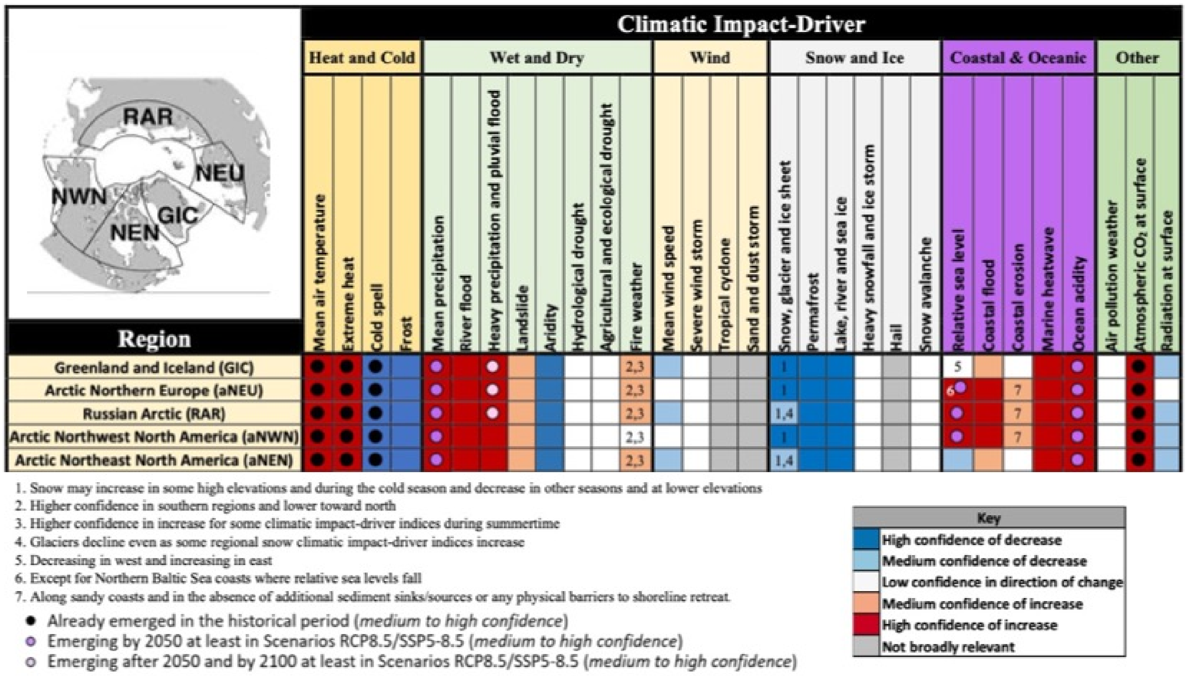

Figure 1: *Summary of the direction of change for projected climatic impact-drivers (CID) in the Arctic, representing their aggregate characteristic changes for mid-century under scenarios RCP4.5, SSP3-4.5, SRES A1B, or above within each AR6 region, approximately corresponding to global warming levels between 2°C and 2.4°C (for CIDs independent of sea-level rise).The table also includes the assessment of observed or projected time-of-emergence of the CID change signal from the natural inter-annual variability if found with at least medium confidence.* (Ranasinghe et al., 2021)

Climate change is affecting oceans. The summer upper mixed layer in the Arctic Ocean has heated by 0.5°C per decade from 1982 to 2017. This is predominantly due to an increase in absorbed solar radiation linked to sea ice loss, as well as ocean heat transferred from lower latitudes throughout the 21st century.

The Arctic Ocean has been 'freshening' which refers to a decrease in salinity caused by increased freshwater inputs. Between 1976 and 2017, freshwater runoff from the continents increased by 3.3 ± 1.6% and 2.0 ± 1.8% from Eurasia and North America respectively (Meredith et al., 2019). The increased surface warming paired with decreased upper layer salinity in high latitudes has led to more stable stratification of the upper ocean since at least 1970 (Fox-Kemper et al., 2021).

The Arctic Ocean has experienced continuous acidification as a result of CO_2 uptake. Acidification leads to the dissolution of carbonate minerals, such as aragonite, which is essential to several marine organisms such as molluscs and cold-water corals. An expansion of the area which is corrosive to mineral aragonite has been observed from 1990 to 2010, even resulting in cases of extreme aragonite undersaturation (Meredith et al., 2019).

Extreme events including heat waves and wildfires

Climate change has led to an increase in the occurrence of extreme events. In the first six months of 2020, Siberia experienced exceptionally high surface air temperatures with records reaching 36-38°C in June. Compared to the 1952-1980 average, the 2020 mean temperature from January to May was 5.3°C warmer. This once-in-130-years event is 600 times more likely to occur than it would have been at the beginning of the 20th century (Ciavarella et al., 2020).

Along with extreme temperatures, the Arctic has seen an increase in the extent and frequency of wildfires. There is high confidence that both spatial extent and frequency of wildfires have been without precedent over the last 10,000 years. Satellite-based estimates of boreal area burned per year reached 80,000 km^2 between 1997 and 2011 (Meredith et al., 2019).

The Arctic is closely linked to global weather patterns. Changes in Arctic sea ice extent and snow cover are likely to contribute to cold extremes in North America and can be linked to the Texas cold wave in February 2021 (Cohen et al., 2021).

Cryosphere changes including sea ice, glaciers, permafrost

There is very high confidence that sea ice is continuously declining over all months of the year. The most substantial reductions are observed in September with a very likely range of 12.8 ± 2.3% sea ice loss per decade between 1979 and 2018. This loss is unprecedented over the last 1000 years (Meredith et al., 2019).

Overall observation has shown a decrease of the sea ice extent minimum of 31% averaged by decade from 1979-1988 to 2009-2018 (Landrum & Holland, 2020). The decline in sea ice measured from satellite observations between 1971 and 2019 has followed a linear progression in relation to the global mean surface temperature (Fox-Kemper et al., 2021).

Apart from a decline in spatial extent, sea ice has been shifting to thinner and younger ice. There is very high confidence that the proportion of the area covered by at least five years old, thick ice has declined by roughly 90% (Meredith et al., 2019).

The Greenland ice sheet has declined rapidly during the early 2000s and is continuing on a steep decline. There is very high confidence that the summer ice loss has been increasing since the 1990s. Current ice loss is unprecedented for at least 350 years at a rate 2.5 times higher than preindustrial levels (Meredith et al., 2019).

The Greenland ice sheet has seen a mass reduction of 4140-5640 Gt from 1992 to 2020, with an average rate of 39 (very likely range: -3 to 80) Gt yr^{-1} between 1992 and 1999, 175 (131 to 220) Gt yr^{-1} between 2000 and 2009, and 243 (197 to 290) Gt yr^{-1} between 2010 and 2019. This has contributed 13.5 (11.4 to 15.6) mm to global sea level rise.

The decline has been driven by both discharge and surface melt, with the latter emerging as the dominant driver over the past decade. The biggest reductions have been observed in the Northwest and Southeast of Greenland as can be seen in Figure 2 (Fox-Kemper et al., 2021).

Greenland mass change relative to 2015

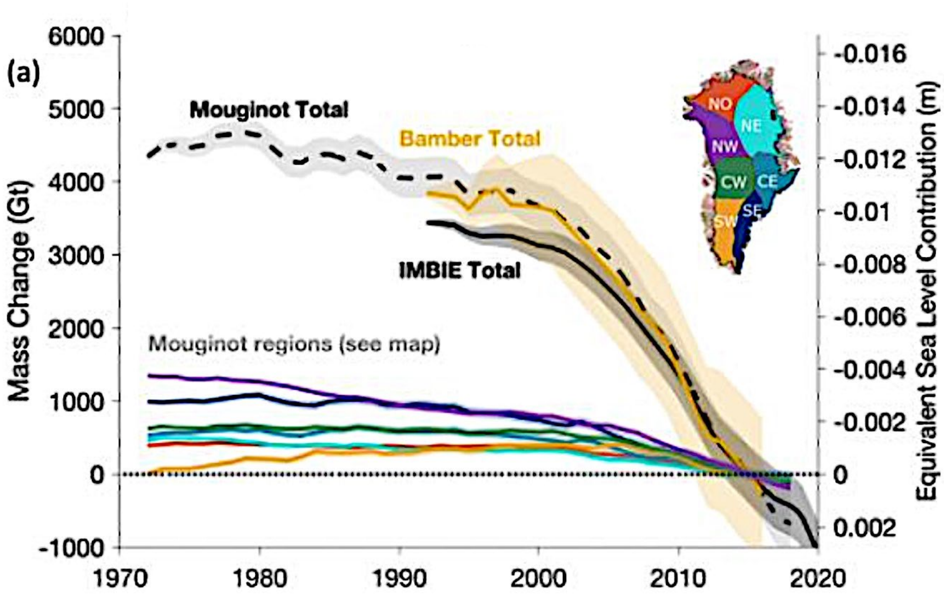

Figure 2: *Total observed mass change in Greenland and for each of the major Greenland ice sheet drainage basins shown in the inset figure for the periods 1972 – 2016, 1992-2018, and 1992–2020.* (Fox-Kemper et al., 2021)

Other Arctic glaciers are showing similar declining trends, with a mass loss of 212 ± 29 Gt yr^{-1} between 2006-2015, equivalent to sea level rise at a rate of 0.6 ± 0.1 mm yr^{-1} (Meredith et al., 2019).

Snow cover has been decreasing at 1.9 (1.0 to 2.8) million km^2 per 1°C of warming between 1981 and 2010. There is very high confidence that spring snow cover in the Northern Hemisphere has declined since 1978 with high confidence of this trend going back to the 1950s (Fox-Kemper et al., 2021). The extent of snow cover in June has declined by 13.4 ± 5.4% per decade between 1967 and 2018 (Meredith et al., 2019).

Global warming has led to an increase in permafrost temperature resulting in permafrost thaw. Permafrost temperature has increased over the past three to four decades with high confidence. In the ten years from 2007 to 2016, permafrost has warmed by 0.29 (0.17 to 0.41) °C globally. Simultaneously, the active layer - the layer of permafrost thawing in summer and refreezing in winter - has been increasing throughout the Arctic.

This phenomenon is highly dependent on the surface conditions. Discontinuous and sporadic permafrost regions have seen complete permafrost thaw in recent decades (Fox-Kemper et al., 2021). Thawing permafrost has the potential of releasing additional methane and CO_2 into the atmosphere. The soil within the Arctic and boreal permafrost regions contains 1460-1600 Gt of organic carbon (Meredith et al., 2019).

Biosphere changes (terrestrial and marine)

The regional species composition is changing throughout the Arctic. There is high confidence that the timing, duration, and intensity of primary production is changing. Overall gross primary productivity is increasing with rising temperatures (Figure 3).

Marine primary production specifically is altered by seasonal sea ice extension and thickness, ocean temperature and stratification (Meredith et al., 2019). Changes in these parameters have led to the expansion of suitable areas for Arctic microalgae by 6.6% for intertidal and 30.8% for subtidal algae over the past six to seven decades. Warming has further led to faster growth as well as larger biomass and cover (Krause-Jensen et al., 2020).

Gross primary productivity change with temperature

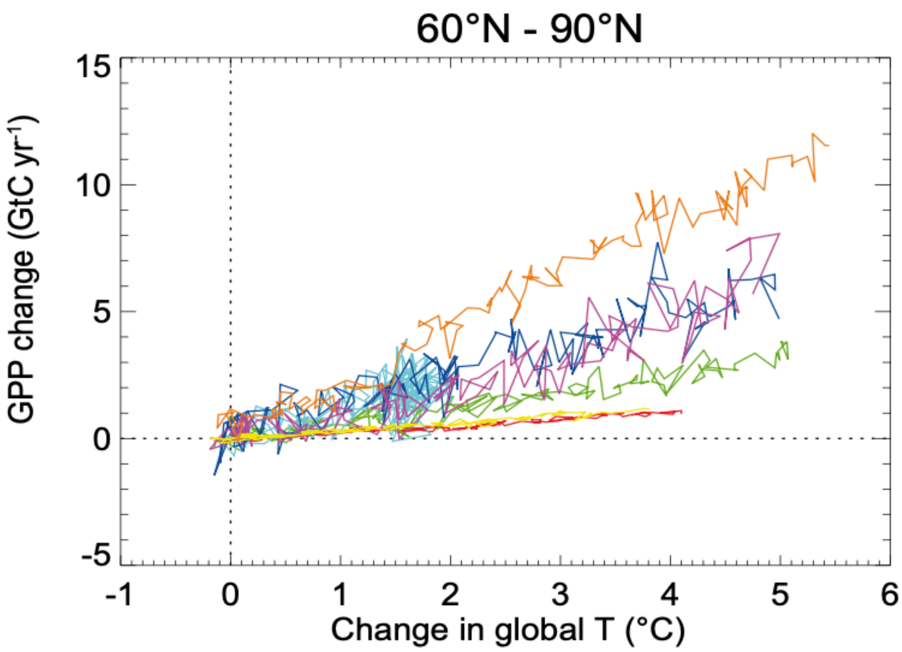

Figure 3: *The response of terrestrial productivity (gross primary production, GPP) to climate change for 60-90°N. Data come from the Coupled Model Intercomparison Project Phase 5 (CMIP5) archive (http://cmip-pcmdi.llnl.gov/cmip5/). Seven Earth System Models were used: Nor-ESM-ME, yellow; CESM, red; (IPLS)-CM5-LR, dark blue; GFDL, pale blue; MPI-ESM, pink; HadGEM2-ES, orange; CanESM2, green. Data plotted against the global mean temperature increase above pre-industrial levels from simulations with a 1% per year increase in CO_2 ('1pctCO₂').* (Ove Hoegh-Guldberg et al., 2018)

Polar fish and ice-associated species are seeing their range contract as temperate species start to expand into the Arctic. In some areas, this leads to higher competition and predation on smaller fish species affecting the whole fish community (Meredith et al., 2019).

A genomic study has revealed the direct and indirect loss of migrating Arctic charr populations. Two types of Arctic charr populations are distinguished. Resident populations spend their entire life cycle in one freshwater system. Anadromous populations, hereafter referred to as migrating populations, spend most of their life cycle in seawater and return to freshwater only to spawn.

According to the study, migrating populations at the southern range limit may be unable to adapt to continuous temperature increases. This can be linked to a North-South gradient in genomic vulnerability, a measure of the genomic ability to adapt to future climate change, with the highest vulnerability observed towards the South.

A further change in migrating Arctic Charr populations is driven by an increase in precipitation and terrestrial primary production. The increasing influx of nutrients to freshwater systems is reducing the need to migrate and causing a shift from migratory behavior to residency (Layton et al., 2021).

There is high confidence that terrestrial ecosystems are a net carbon sink during the summer growing season. The carbon uptake is increasing with growing vegetation density and biomass. Throughout the terrestrial ecosystems, an overall greening of the tundra biome is observed, although some areas experience browning.

The Arctic plant species composition is changing with an increase in woody shrub biomass. While warming favours increased primary production, it may also lead to decreasing biodiversity. The range expansion of subarctic species and the synchronous range contraction for Arctic species leads to increased competition. This poses a major threat to unique Arctic species. Alien species, such as the American mink, are threatening local fauna and flora in subarctic regions and may expand northwards with changing climate.

There is high confidence that the abundance and distribution of reindeer and salmon are changing. Reindeer and Caribou are key drivers of Arctic ecology and important food sources for local communities. Reindeer population changes have been observed with occurrences of mass starvation and widespread mortality due to diseases. Migratory tundra caribou numbers have declined by about 3 million individuals from 1990 to 2017 (Meredith et al., 2019).

Impacts on livelihoods and indigenous peoples

Indigenous communities live in close relationship with their surroundings, making changes in environmental conditions highly impactful on people's livelihood, cultural practices, economies, and autonomy. There is high confidence that the daily life of the Arctic population is influenced by the effects of climate change. These include changes in ice and snow cover, vegetation and wildlife behaviour.

Traditional knowledge of values and skills connected to these environmental factors is affected. Younger generations no longer gain the same experience and confidence with traditional indicators. Simultaneously, confidence in traditional indicators is being lost when it comes to safe travel and navigation.

Consequences of climate change, such as reduced ice cover and permafrost thaw, are posing an increasing risk of injury and death during travel. In some families, the traditional ways of travelling on ice are no longer taught (Huntington et al., 2021).

Sea ice has been associated with the freedom to travel, hunt, and fish. Observed changes lead to impacts on the individual and collective mental health. Concern for family members is rising due to climate change-induced environmental change is showing as an emotional impact on communities. This has been observed to be significantly higher for women compared to men.

Climate change is also threatening indigenous food security. Changes in quality and availability of traditional resources have been observed. Access to herding, hunting, fishing, foraging and gathering areas is also impacted.

There has been a shift in hunting seasonality for animals such as the bearded seal (Ugruk). The Ugruk hunting season has shortened between 2003 and 2019 with the end of the season being registered approximately 26 days earlier than a decade ago (Hauser et al., 2021).

Traditional marine resources have further been impacted by the increase in shipping activity. The distance travelled by ships in the Canadian Arctic has nearly tripled from 1990 to 2015. Ship-source underwater noise, as well as ship strikes, pose a threat to marine mammal species such as beluga, narwhal and bowhead whales (Huntington et al., 2021).

Projected risks and tipping points for the Arctic

Climate impacts at 1.5°C and beyond

It is virtually certain that the high latitudes of the Northern Hemisphere are warming faster than the global average.

At global warming levels of 1.5°C, the Arctic annual mean surface temperature will be twice the global average. This amplification increases with temperature. At 4°C of global warming, the Arctic is projected to be 2.4-times hotter. There is high confidence that the magnitude and frequency of heat extremes will increase, and cold extremes will decrease (Ranasinghe et al., 2021).

The entire regional water cycle is projected to intensify. This means increased precipitation, evapotranspiration and river discharge. For 1.5°C to 2°C of global warming, regions set to experience the highest increase in heavy precipitation events include several Arctic regions, namely Alaska and western Canada, eastern Canada, Greenland and Iceland, northern Europe and northern Asia.

There is high confidence that snow cover will continue to decrease under all emissions scenarios. Under a low emissions scenario (RCP2.6), autumn and spring snow cover will potentially stabilise after a 5-10% reduction. Under a very high emissions scenario (RCP8.5), however, snow cover will continuously decline by another 15-25% at the end of the 21st century (Meredith et al., 2019). Current observations point to a reduction in seasonal snow cover by 8% with every 1°C of global warming (Fox-Kemper et al., 2021).

There is high confidence that near-surface permafrost will essentially disappear within this century. The upper 3m permafrost volume is projected to decline by 25% with every additional degree of warming. Under a low emissions scenario (RCP2.6) permafrost will decrease by 2-66%. Under a very high emissions scenario (RCP8.5), this increases to 30-99%. Limiting warming to 1.5°C is vital to avoid abrupt thaw and ground subsistence induced by permafrost loss (Meredith et al., 2019).

Increases in wildfires are projected for the remainder of the century throughout most tundra and boreal regions. The intensity and frequency will be influenced by the interactions of changing climatic conditions and vegetation shifts (Meredith et al., 2019).

Earth system tipping points in the Arctic

Sea ice

Under all illustrative socioeconomic pathway scenarios assessed by the IPCC Working Group I, a sea ice-free Arctic Ocean during the seasonal minimum will likely be observed for the first time before mid-century. There is robust evidence that the practically sea ice-free state would become the new normal by the end of the century under high emissions scenarios (Figure 4).

Changes in Arctic sea ice area for September

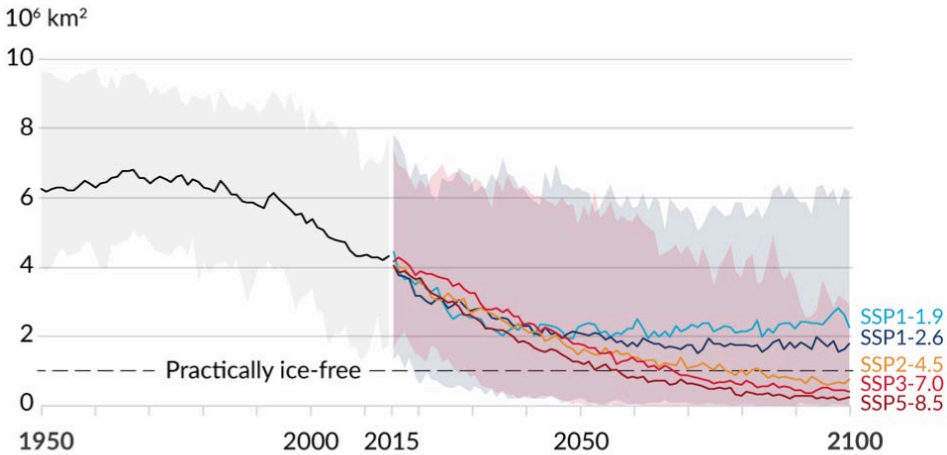

Figure 4: *September Arctic sea ice area in 10^6 km^2 based on CMIP6 model simulations. Very likely ranges are shown for SSP1-2.6 and SSP3-7.0. The Arctic is projected to be practically ice-free near mid-century under intermediate and high GHG emissions scenarios.* (Fox-Kemper et al., 2021)

For a given year, the probability of the seasonal minimum being sea ice-free increases with greenhouse gas concentrations and is substantially higher at 2°C compared to 1.5°C of global warming. A temporary temperature overshoot is not expected to show long-term consequences for sea ice coverage. (Fox-Kemper et al., 2021; Meredith et al., 2019; Ove Hoegh-Guldberg et al., 2018).

Marine systems

The Atlantic Meridional Overturning Circulation (AMOC) will very likely decline over the 21st century accompanied by a decrease in North Atlantic Deep Water (NADW) formation. This is associated with lower density in the northern North Atlantic and Arctic basins because of increased freshwater input and sea surface temperature.

The weakening of the AMOC could be further amplified by increased freshwater input from the melting Greenland ice sheet. Limiting global warming to 1.5°C will considerably lower the decline, and a stabilisation of the AMOC is projected past 2060. There is medium confidence that no abrupt collapse will happen before the end of the 21st century (Fox-Kemper et al., 2021).

The Arctic Ocean will be increasingly affected by acidification due to continuous CO_2 uptake. The extent of acidification will be less pronounced at 1.5°C global warming compared to 2°C.

Under a very high emissions scenario (RCP8.5), Calcium Carbonate ($CaCO_3$) undersaturation is very likely to be a year-round phenomenon by 2100. Under a low emissions scenario (RCP2.6), $CaCO_3$ undersaturation will be noticeably reduced (Meredith et al., 2019).

Greenland ice sheet

There is high confidence that the extent of mass reduction of polar glaciers is dependent on the mitigation measures taken. The reductions from 2015 to 2100 are projected to be 16 ± 7% under a low emissions scenario (RCP2.6) and 33 ± 11% under a very high emissions scenario (RCP8.5) respectively. The Greenland ice sheet will more likely than not reach a tipping point at 2°C of global warming.

Limiting global warming to 1.5°C is crucial to avoid a continuous decline due to increased surface melt and albedo-melt feedback. The ice sheet will potentially be lost over thousands of years (Meredith et al., 2019). The Greenland ice sheet alone would contribute 0.01-0.10m (SSP1-2.6), 0.04-0.13m (SSP2-4.5) and 0.09-0.18m (SSP5-8.5) to global sea level rise by 2100 (Fox-Kemper et al., 2021).

Tipping points for socio-ecological systems in the Arctic

There is high confidence of rising food insecurity for Arctic indigenous peoples. Repercussions will be felt throughout Arctic communities considering the strong link between food, culture, identity, values, and way of life. These effects will be substantially reduced if global warming is limited to 1.5°C compared to a 2°C scenario.

For reindeer herders, climate change means an increased risk of herd mortality due to extreme events, lower foraging quality as a result of the ecological shift towards shrubs on tundra pasture, and impacts on herd mobility. Commercial and subsistence fisheries are subjected to increased risks from ecosystem stressors, leading to implications for regional economies as well as global fish and shellfish supplies. The threat to marine mammals is further intensified by a projected increase in cargo ship traffic and an increased demand for Arctic cruise tourism.

The Arctic population is facing an increased risk of pathogen and contaminant exposure. Contaminant pathways are changing because of warmer waters and the loss of sea ice. This can lead to bioaccumulation and biomagnification of contaminants in important food species. Shellfish harvested from warmer waters leads to an increase in the chance of obtaining foodborne gastroenteritis. Thawing permafrost can lead to the release of stored mercury and subsequent accumulation in marine ecosystems.

There is high confidence that the water supply will be impacted by changes in hydrology. Communities are reliant on ponds, streams, icebergs, and multi-year ice as a drinking source and often consume untreated water. Small remote communities will especially become vulnerable to water security due to their limited capacity to respond to water supply threats. Warming trends may increase the duration and frequency of exposure to contaminant and waterborne diseases when consuming untreated drinking water. After periods of rapid snowmelt, for example, bacteria can increase in the water supply and result in acute gastrointestinal illness.

Arctic communities are faced with increasing infrastructure failure resulting from sea level rise and permafrost thaw. By 2050 up to 70% of Arctic infrastructure is projected to be in areas threatened by permafrost thaw and concurrent subsidence. Communities are facing relocation caused by increasing coastal flooding (Meredith et al., 2019).

Climate change in Arctic Council declarations

The Arctic Council was established in 1996 to strengthen cooperation between the Arctic States, namely Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States of America. A specific focus was put on sustainable development and protecting the Arctic environment.

Climate change was mentioned in the first ministerial meeting in 1998 and the assessment of climate change effects was welcomed. In 2000 the Arctic Council adopted the Arctic Climate Impact Assessment. The assessment was requested to provide information on climate vulnerability and change in the region. It was also asked to include policy recommendations and be able to inform policy-making processes and the IPCC.

The Inari Declaration of 2002 reiterated this commitment to sustainable development and environmental protection and added the aim for an "increased focus on climate change" within the first statement. The 2002 Inari Declaration also added an entire section on climate change, mainly talking about the negative impacts of climate change and the need to address vulnerabilities.

Mitigation was first mentioned in the 2004 Reykjavik Declaration. Policy recommendations elaborated in the Arctic Climate Impact Assessment were endorsed, and the Arctic State's commitment to the UNFCCC through the "adoption of climate change mitigation strategies across relevant sectors" was included.

In the following years, the sections on climate change were expanded and more emphasis was put on the overarching impacts of climate change on all aspects of development and the environment.

In 2013, climate change was recognised as "the most serious threat" to Arctic biodiversity, and the climate change section was renamed "Acting on Climate Change". While mitigation and emissions reductions had been mentioned previously, the Kiruna Declaration (2013) strengthened its language by recognising the need for "substantial cuts in emissions" and committing to strengthened efforts in finding solutions.

However, while the contribution of CO_2 and non-CO_2 greenhouse gases to global warming was recognised, the Arctic Council declarations have shown a clear reluctance to cover CO_2 mitigation. Instead of pushing for fossil fuel phase out, the Arctic Council declarations repeatedly emphasised "environmentally sound oil and gas activities" (The Tromsø Declaration, 2009), pushing the focus from CO_2 mitigation to black carbon, methane, and hydrofluorocarbon emissions reduction.

Throughout the Arctic Council Declarations, climate science has been acknowledged as an important aspect in understanding and acting on climate change. The wealth of indigenous knowledge and benefits of including indigenous voices in decision-making processes were also recognised (Arctic Council, 1996).

The importance of climate change to the work of the Arctic Council was especially evident in 2019. Under the Trump administration, the USA blocked all recognition of climate change, leading to the first ministerial meeting without an agreed-upon declaration (Arctic Council Member States, 2019).

In 2021, however, the talks were taken up again. The 2021 Reykjavik Declaration stressed "the importance of achieving the Paris agreement goals" and, for the first time, added specific targets for the reduction of black carbon emissions at 25-33% below 2013 levels by 2025, but again omitting any language on stringent measures to phase out fossil fuels (Arctic Council, 2021).

Conclusion

Due to the drastic amplification of changes in the polar north compared to the rest of the world, the Arctic provides a preview of what the rest of the world will experience in the future in terms of temperature change and climate impact risks for particularly vulnerable natural and human systems.

Observed melting land and sea ice, extreme heat events, wildfires, and a shift in species composition ring the alarm bells loudly.

Changes in the Arctic affect the entire planet: from a slow-down of the Atlantic Meridional Overturning Circulation and accelerated global sea level rise to changing northern Hemispheric seasonal weather patterns.

Every fraction of a degree matters for avoiding the worst Arctic climate impacts for ecosystems, people, and the entire planet.

Ongoing climate change pushes the Arctic towards several tipping points such as the loss of sea ice and the collapse of the Greenland Ice Sheet. Adhering to the long-term temperature goal of 1.5°C is essential to limit the chances of reaching these tipping points.

Indigenous communities live in close relationship with their environment and are directly affected by climate change. To improve resilience to climate change in Arctic communities, innovative tools and practices need to be implemented. These must include and build on local and indigenous participation.

The Arctic Council has recognised climate change as a serious threat. While the importance of climate change mitigation and adaptation are being acknowledged, the perceived importance of the oil and gas industry for the region’s development has hindered any serious mitigation efforts so far.

To avert the worst impacts of climate change, immediate regional and global action is needed.

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