IPCC The Ocean and Cryosphere in a Changing Climate
24th September 2019 Summary for Policymakers (agreed to by all world govenments)

The Arctic (excerpts)

The cryosphere refers to frozen components of the Earth system. Around 10% of Earth's land area is covered by glaciers or ice sheets.

Today, around 4 million people live permanently in the Arctic region, of whom 10% are Indigenous.

A1. Over the last decades, global warming has led to widespread shrinking of the cryosphere, with mass loss from ice sheets and glaciers, reductions in snow cover and Arctic sea ice extent and thickness, and increased permafrost temperature .

A1.1 Ice sheets and glaciers worldwide have lost mass. Between 2006 and 2015, the Greenland Ice Sheet lost ice mass at an average rate of 27 Gt /yr (equivalent to 0.77 mm /yr of global sea level rise), mostly due to surface melting. In 2006–2015, the Antarctic Ice Sheet lost mass at an average rate of 15 mm /yr), mostly due to rapid thinning and retreat of major outlet glaciers draining the West Antarctic Ice Sheet. Glaciers worldwide outside Greenland and Antarctica lost mass at an average rate of 220 Gt /yr (equivalent to 0.61/yr sea level rise) in 2006–2015.

A1.2 Arctic June snow cover extent on land declined by 13.4 % per decade from 1967 to 2018, a total loss of approximately 2.5 million km2 , predominantly due to surface air temperature increase.

A1.3 Permafrost temperatures have increased to record high levels (1980s-present)including the recent increase by 0.29°C ± 0.12°C from 2007 to 2016 averaged across polar and high mountain regions globally. Arctic and boreal permafrost contain 1460–1600 Gt organic carbon, almost twice the carbon in the atmosphere. There is medium evidence with low agreement whether northern permafrost regions are currently releasing additional net methane and CO_2 due to thaw.

A1.4 Between 1979 and 2018, Arctic sea ice extent has very likely decreased for all months of the year. September sea ice reductions are very likely 12.8 % per decade. These sea ice changes in September are likely unprecedented for at least 1000 years. Arctic sea ice has thinned, concurrent with a transition to younger ice: between 1979 and 2018, the areal proportion of multi-year ice at least five years old has declined by approximately 90%.

Feedbacks from the loss of summer sea ice and spring snow cover on land have contributed to amplified warming in the Arctic where surface air temperature likely increased by more than double the global average over the last two decades. Changes in Arctic sea ice have the potential to influence mid-latitude weather, but there is low confidence in the detection of this influence for specific weather types. Antarctic sea ice extent overall has had no statistically significant trend (1979–2018) due to contrasting regional signals and large interannual variability

A3.5 Extreme wave heights, which contribute to extreme sea level events, coastal erosion and flooding, have increased in the Southern and North Atlantic Oceans by around 1.0 cm yr^{-1} and 0.8 cm yr^{-1} over the period 1985– 2018 (medium confidence). Sea ice loss in the Arctic has also increased wave heights over the period 1992–2014

A7.1 Food and water security have been negatively impacted by changes in snow cover, lake and river ice, and permafrost in many Arctic regions. These changes have disrupted access to, and food availability within, herding, hunting, fishing, and gathering areas, harming the livelihoods and cultural identity of Arctic residents including Indigenous population

A7.2 In the Arctic, negative impacts of cryosphere change on human health have included increased risk of food- and waterborne diseases, malnutrition, injury, and mental health challenges especially among Indigenous peoples

B1.3 Arctic autumn and spring snow cover are projected to decrease by 5–10%, relative to 1986–2005, in the near-term (2031–2050), followed by no further losses under RCP2.6, but an additional 15–25% loss by the end of century under RCP8.5

B1.4 Widespread permafrost thaw is projected for this century and beyond. By 2100, projected near-surface (within 3–4 m) permafrost area shows a decrease of 24 % (likely range) for RCP2.6 and 69 % for RCP8.5. The RCP8.5 scenario leads to the cumulative release of tens to hundreds of billions of tons (GtC) of permafrost carbon as CO2 and methane to the atmosphere by 2100 with the potential to exacerbate climate change. Lower emissions scenarios dampen the response of carbon emissions from the permafrost region. Methane contributes a small fraction of the total additional carbon release but is significant because of its higher warming potential. Increased plant growth is projected to replenish soil carbon in part, but will not match carbon releases over the long term

B1.7 Arctic sea ice loss is projected to continue through mid-century, with differences thereafter depending on the magnitude of global warming: for stabilised global warming of 1.5°C the annual probability of a sea ice free September by the end of century is approximately 1%, which rises to 10–35% for stabilised global warming of 2°C

B4.2 On Arctic land, a loss of globally unique biodiversity is projected as limited refugia exist for some High-Arctic species and hence they are outcompeted by more temperate species

B4.3 About 20% of Arctic land permafrost is vulnerable to abrupt permafrost thaw and ground subsidence, which is projected to increase small lake area by over 50% by 2100 for RCP8.5.

Wildfire is projected to increase for the rest of this century across most tundra and boreal regions, and also in some mountain regions, while interactions between climate and shifting vegetation will influence future fire intensity and frequency

B5.3 Warming, ocean acidification, reduced seasonal sea ice extent and continued loss of multi-year sea ice are projected to impact polar marine ecosystems through direct and indirect effects on habitats, populations and their viability (medium confidence). The geographical range of Arctic marine species, including marine mammals, birds and fish is projected to contract