CLIMATE COUNCIL

FACTSHEET: CLIMATE CHANGE & SOARING ARCTIC WINTER TEMPERATURES

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Key Facts:

- Climate change is driving extreme heat in the Arctic, resulting in soaring winter temperatures for the fourth year in a row.
- The Arctic is warming much faster than the global average temperature.
- Nine days in February 2018 reached temperatures above 0°C, which is about 30°C warmer than average for the region.
- Extreme heat has caused shrinkage of sea ice when it should be growing over the winter.
- Temperatures at the northern tip of Greenland have been above freezing for 61 hours in February 2018 – more than three times the number of above-zero hours in any previous year.
- Sea ice has reached record new lows for this time of year (9.4% below the 1981-2010 average).
- The burning of fossil fuels (coal, oil and gas) is rapidly increasing the global average temperature, with even higher temperatures in the Arctic region. Extreme weather events and other climate impacts, including Arctic warming, will only intensify further unless there is a rapid and deep reduction in rising greenhouse gas pollution levels.

BOX 1: SCIENTIFIC COMMUNITY RESPONSE TO RECORD-BREAKING ARCTIC WEATHER

"It's just crazy, crazy stuff...These heat waves – I've never seen anything like this"

Professor Mark Serreze, director of the National Snow and Ice Data Center (USA) (The Independent 2018a).

"The extended warmth really has kind of staggered all of us."

Dr Ruth Mottram, climate scientist, Danish Meteorological Institute (CBC news 2018).

What is happening in the Arctic?

Whilst the Arctic is in perpetual darkness in the depths of winter, temperatures have soared during January and February 2018.

An astounding nine days in February reached temperatures above zero at the Cape Morris Jesup weather station in northern Greenland, with a maximum of 6.2°C on the 24th February, approximately 39°C above the average February temperature (Raspisaniye Pogodi Ltd. 2018).

Temperatures in northern Greenland have been above freezing for 61 hours during February – more than three times the number of hours in any previous year (The Guardian 2018; Raspisaniye Pogodi Ltd. 2018). Although temporary temperature spikes in the Arctic can occur and have been recorded as early as 1896, this event is so unusual because of its intensity and duration (Graham et al. 2017).

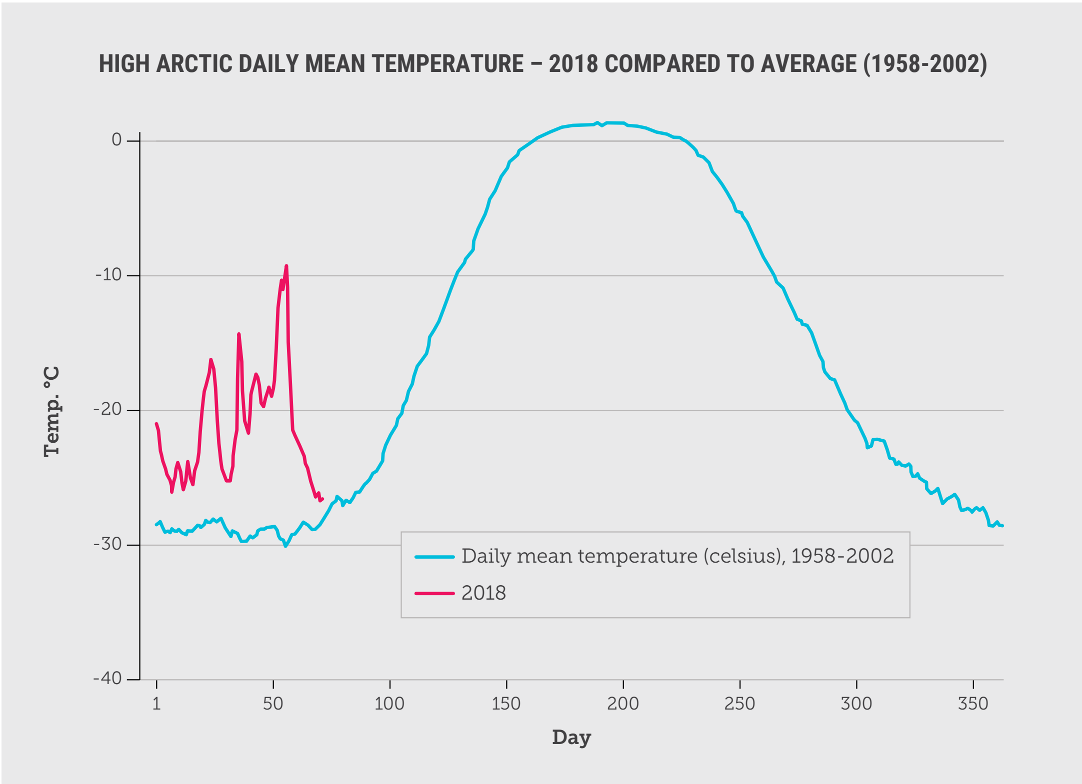

Figure 1: High Arctic Daily Mean Temperature – 2018 compared to average (1958-2002) (north of the 80th parallel) (adapted from DMI 2018).

The extreme heat has caused shrinkage of sea ice when it should be growing over the winter. For example, sea ice set a new record low for January at 13.06 million square kilometres, which is 9.4% below the 1981-2010 average (equivalent to the area of the Northern Territory in Australia) (NOAA 2018a; Figure 2). This broke the previous record set in 2017, with a low of 13.17 million square kilometres of sea ice, which broke the previous record set in 2016, equal to 2006 (NOAA 2018a). Sea ice extent was also the smallest on record for February, 8.8% below the 1981-2010 average (NOAA, 2018b).

High winter temperatures resulted in record low sea ice in January and February 2018.

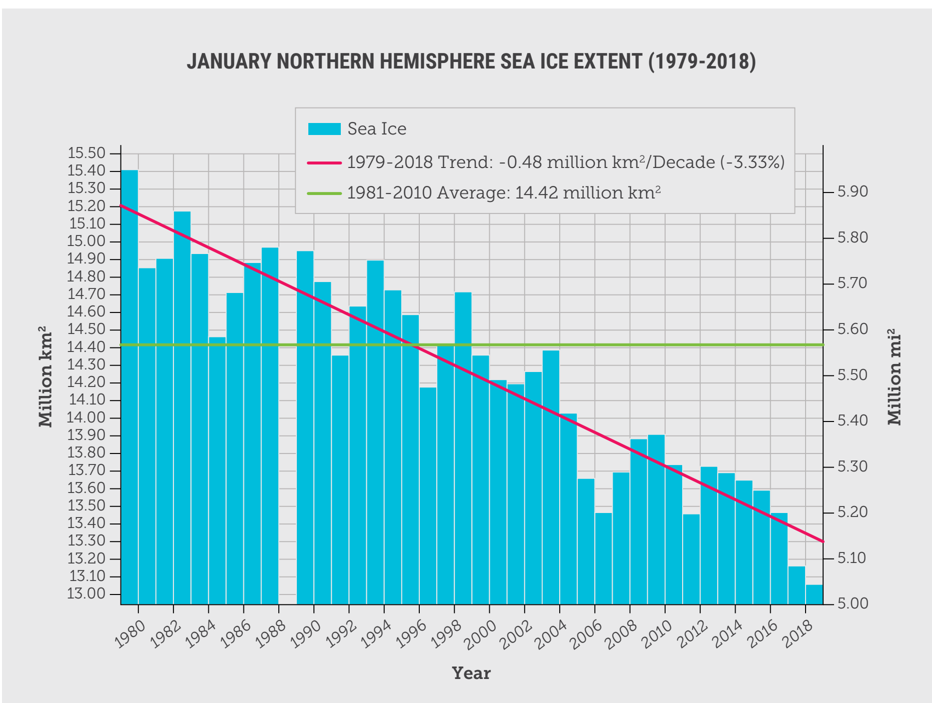

Figure 2: January sea ice extent in the northern hemisphere by year (blue bars), trend (pink line) and average between 1981-2010 (green line) (adapted from NSIDC 2018a).

Meanwhile, temperatures further south in the northern hemisphere winter plummeted, bringing blizzards and freezing conditions across the European continent. Snow even made a brief appearance in Rome.

At least 50 deaths have been linked to the cold conditions in Europe, with as many as 21 deaths occurring in Poland alone (The Independent 2018b). In the UK, the freezing weather cost its economy £1bn a day, which is expected to halve GDP growth for the first three months of the year (The Guardian 2018).

Freezing weather in the UK cost the economy £1 billion a day.

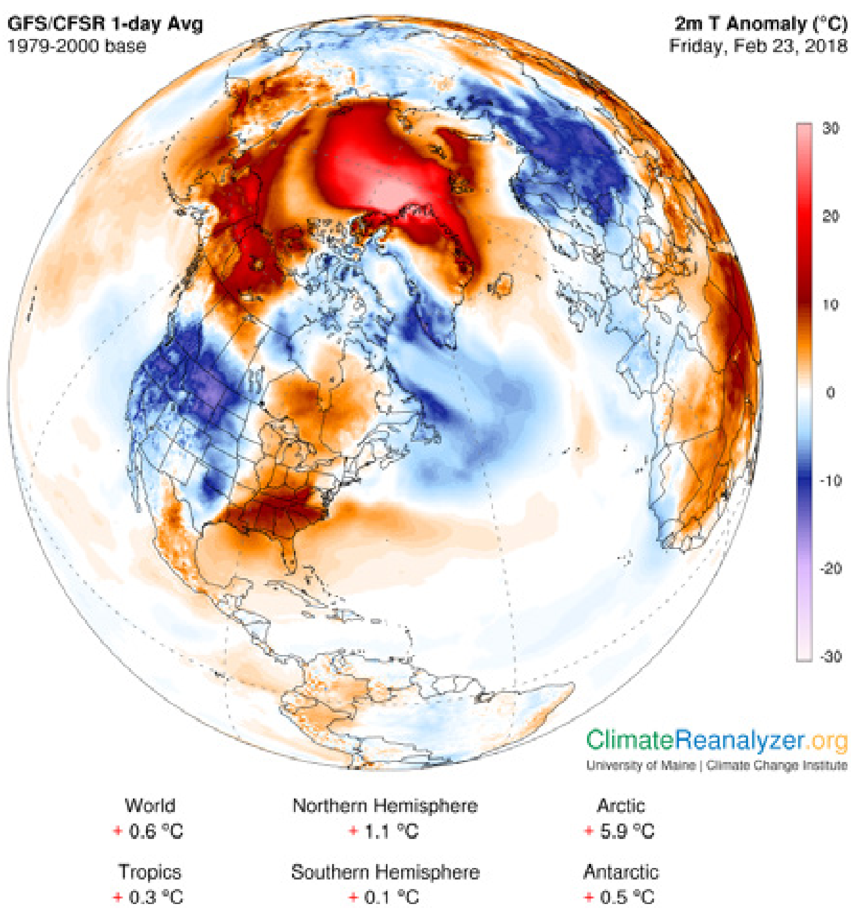

Figure 3: Recent inversion of the Polar Vortex showing extreme temperatures in the Arctic and freezing temperatures in the mid-latitudes (CCI 2018).

Why is this happening?

The extreme warming in the Arctic and the freezing conditions across Europe (Figure 3) are due to the same phenomenon - a temporary weakening and splitting of the polar vortex. This is a circle of winds around the Arctic (roughly 8 km above the Earth's surface) that help to deflect warm air masses away from the Arctic and cold air masses away from Europe and North America.

If the polar vortex weakens, 'kinks' can develop, resulting in weather disruptions across the northern hemisphere, when masses of cold Arctic air are pushed south, while masses of warm air are pushed north (Figure 4). Scientists suspect that climate change may have an influence on this phenomenon through declining sea ice extent linked to warmer Arctic temperatures (Kim et al. 2014).

Winter warming in the Arctic can occur without climate change and there are recorded events stretching back as early as 1896, but now warming events are increasing in frequency and duration. During the past four winters (2015, 2016, 2017 and 2018) extreme warming events were observed with temperatures approaching or exceeding 0°C (Graham et al. 2017; DMI 2018; Raspisaniye Pogodi Ltd. 2018.). This is a remarkable departure from normal conditions when winter temperatures in the Arctic are typically below -30°C (Graham et al. 2017).

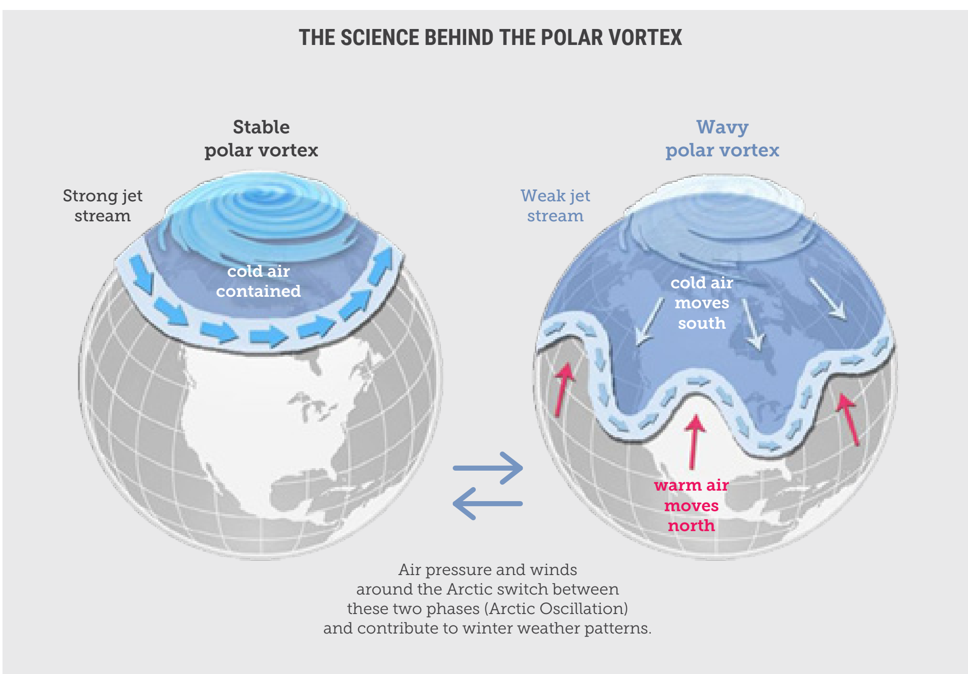

Figure 4: The Science Behind the Polar Vortex (adapted from NOAA 2016).

How is climate change influencing the polar vortex and Arctic warming?

The strength of the polar vortex depends on the temperature differential between the Arctic and the northern mid-latitudes (the temperate region between the Arctic and the Tropics). One recent study (Kim et al. 2014) found that declining sea ice extent in the Arctic from November-December over the Barents-Kara seas weakens the polar vortex during mid-winter, allowing warm air to penetrate into the Arctic from the mid latitudes.

As a consequence of climate change, the Arctic is warming much faster than the global average temperature, so the temperature differential between the Arctic and the mid-latitudes is shrinking. This phenomenon is known as 'Arctic amplification', i.e. global average temperatures have increased by about 1°C above pre-industrial levels, while the Arctic is almost 3°C above average.

One of the main reasons for 'Arctic amplification' is the loss of sea ice. A consequence of declining sea ice is that radiative energy from the sun that would have once been reflected by sea ice is now being absorbed by the ocean, causing it to warm further (a process known as the 'albedo effect').

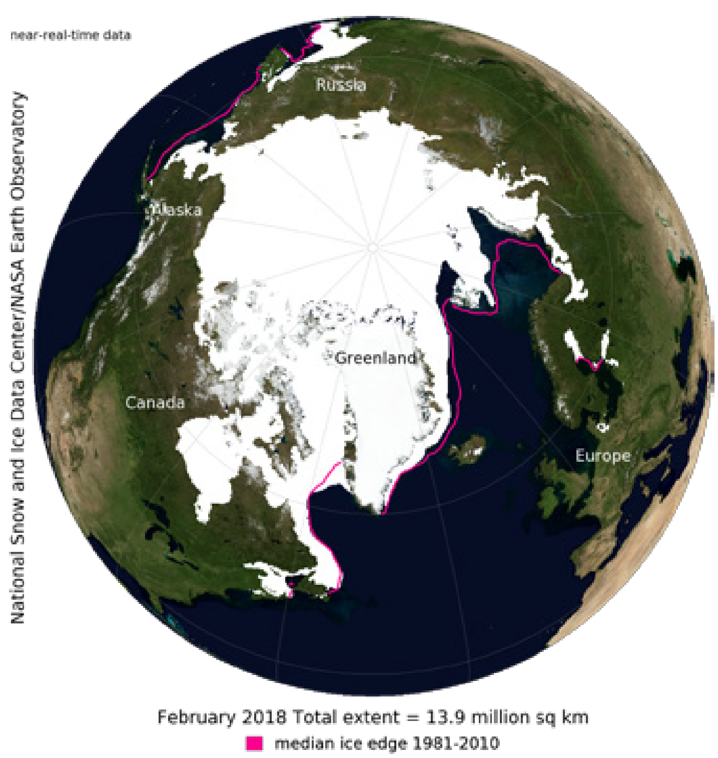

Figure 5: Total sea ice extent in February compared to average ice edge (1981-2010) (NSIDC 2018).

Minimum sea ice extent (occurring in summer) is now declining at a rate of 13.2% per decade relative to the average between 1981-2010 (NASA 2018). The reduction in minimum sea ice extent between 1979 and 2017 is equivalent in size to one third of Australia.

This is leading to more open water, which absorbs solar radiation rather than reflecting it as ice does. This is a vicious circle (called a 'feedback loop' by scientists); as temperatures warm and more sea ice melts, it causes temperatures to warm even more and the cycle continues.

Warming in the Arctic is often called 'the canary in the coal mine'. The burning of fossil fuels (coal, oil and gas) is increasing temperatures and intensifying climate change. Extreme weather events and other climate impacts (e.g. Arctic warming) will only get worse unless we rapidly and deeply reduce our greenhouse gas emissions. The next few years – the last quarter of the Critical Decade – will be decisive to get emissions tracking strongly downwards.

Climate change is influencing extreme weather events, even in the coldest parts of the planet.

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