A warming Arctic – Opportunity and Challenge

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The Arctic is the region surrounding the North Pole and traditionally taken to be the region north of the Arctic Circle (of latitude 66.5°N) (Figure 1). It consists of large ocean areas surrounded by three major continents – Asia, Europe and North America. As the ocean areas are ice-covered for long periods around the year, shipping activities over the region are expected to increase in the years to come.

Figure 1 Map of the Arctic. Three definitions of the Arctic are shown: the Arctic Circle at 66.5°N (in dotted line), the tree line (in green); the 10°C isotherm (in red) —*Credit: Map courtesy the Perry-Castañeda Library Map Collection. Tree line is based on information from National Geographic 1983, Armstrong et al. 1978, and Young 1989. (Source: US National Snow and Ice Data Center)*

The climate of the Arctic is unique as compared with other parts of the world. During winter months, the sun remains very low in the sky or does not rise at all and the surface is largely ice-covered. As winter becomes established, the edge of sea ice extends southward along all longitudes, reaching its greatest extent in February or March. Winter temperatures are well below freezing and average January temperatures are lower than -40°C in some parts of Siberia. In summer, the sun is high up in the sky for most of the day and the sea ice within the Arctic region recedes to its least extent in August or September on average. The summer temperatures generally range from about -10°C to 10°C. Figure 2 shows the monthly average

climatic conditions in selected stations around the Arctic Circle.

Precipitation amounts over much of the Artic are low and mainly in the form of snowfall. For example, the mean annual precipitation at Inuvik in northern Canada is less than 250 mm (Figure 2). However, the Atlantic sector of the Arctic between Greenland and Scandinavia is wetter due to the influx of moisture from cyclones forming in the Atlantic Ocean, especially in winter. For example, the mean annual precipitation in Tromsoe in northern Europe is around 1030 mm (Figure 2).

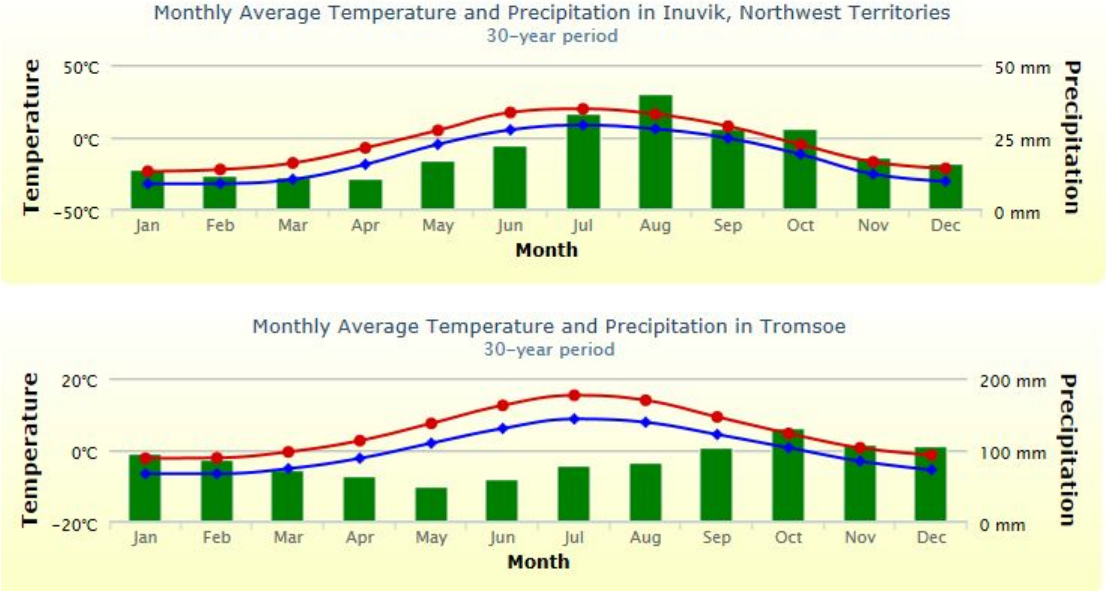

Figure 2 Climatic conditions at Inuvik (68°N 134°W) in northwestern Canada and Tromsoe (70°N 19°E) in northern Europe. (Source: WMO World Weather Information Service, climatological information provided by Meteorological Service of Canada and Norwegian Meteorological Institute respectively)

Day to day weather in the Arctic region is affected by weather systems such as travelling cyclones and anticyclones (Figure 3). Polar lows may also form when cold Arctic air flows south over relatively warm waters. These lows may bring showers and gale to storm force winds over the waters. Areas with semi-permanent lows in the Arctic, such as the Aleutian low in the northern Pacific and the Icelandic low near Iceland, are also regions with rather frequent cyclone passage, particularly in winter.

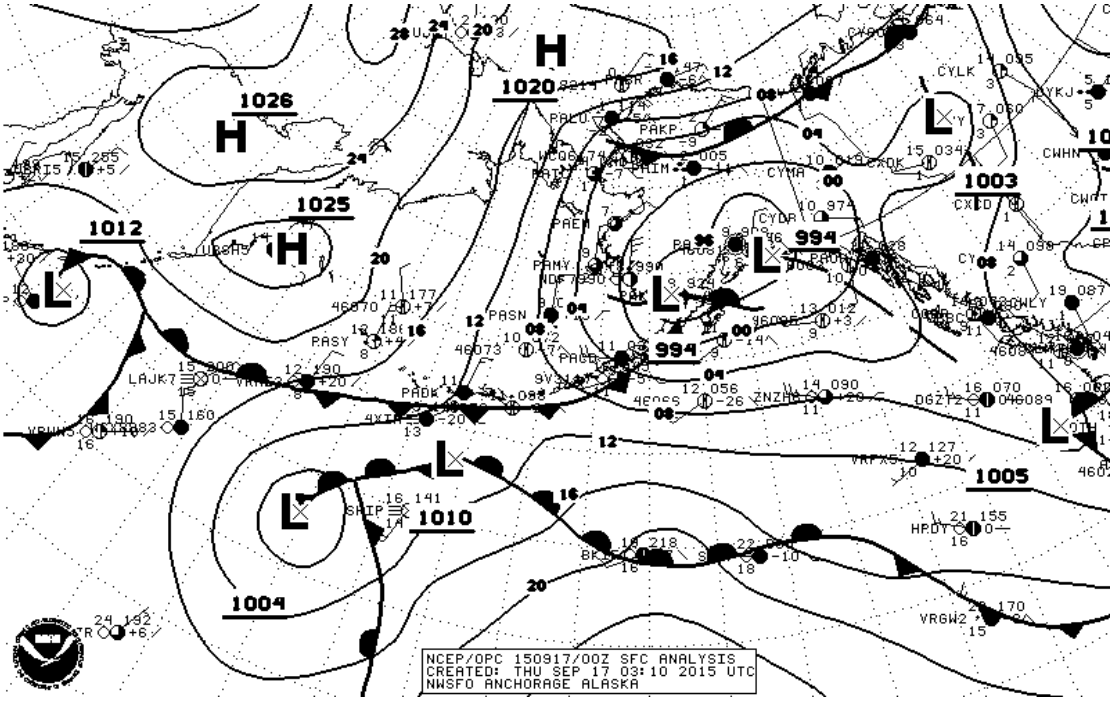

Figure 3 Travelling cyclones and anticyclones around Alaska near the Arctic region. (Source: NOAA's National Weather Service Marine Radiofax Charts)

The Arctic region has become warmer and the Arctic ice extent has been decreasing in recent years under global warming (Figure 4). Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) published in 2013, the Greenland ice sheets have been losing mass and the Arctic sea ice cover has continued to decrease in extent over the last two decades. According to the report, it is very likely that the Arctic sea ice cover will continue to shrink and thin during the 21st century as global mean surface temperature rises.

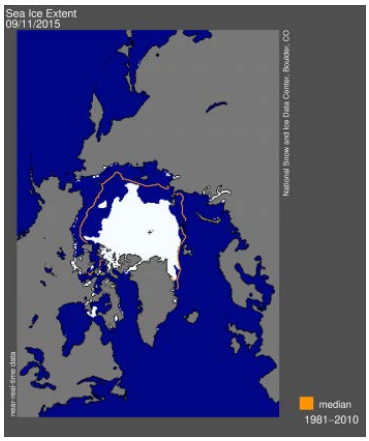

Figure 4 Arctic sea ice extent for 11 September 2015. The orange line shows the 1981 to 2010 average extent for the day. (Source: US National Snow and Ice Data Center)

The loss of sea ice in the Arctic will provide new opportunities for trade and shipping across the Arctic Ocean and easier access for ship-based tourism. This will present new challenges to the shipping community as risks would be involved in travelling over the polar waters. To promote the safety for ships operating in the polar waters, the International Maritime Organization (IMO) has adopted the International Code for Ships Operating in Polar Waters (Polar Code) which is expected to come into force on 1 January 2017. The aim is to provide safe ship operation and protection of the polar environment amidst the natural hazards and navigation risks in the polar waters. Details of the Polar Code can be found at: http://www.imo.org/en/MediaCentre/HotTopics/polar/Pages/default.aspx.

In the Seventeenth Session of the WMO Congress held in Geneva in 2015, one of the priorities for 2016 to 2019 was to improve operational meteorological and hydrological monitoring, prediction and services in the polar region as well as in high mountain region. Actions proposed include: (a) operationalizing the Global Cryosphere Watch (GCW) which would provide authoritative, understandable and usable data, information, and analyses on the past, current and future state of the cryosphere to meet the needs of WMO members and partners in delivering services to users and other concerns; (b) better understanding the implications of changes in these regions on the global weather and climate patterns; and (c) advancing the polar prediction under the Global Integrated Polar Prediction System. The Observatory will keep abreast of the latest developments and evaluate their impacts to the shipping community.