Higher-than-normal Temperatures and Record-low Snowfall in Japan from December 2019 onward

27 January 2020
Tokyo Climate Center, Japan Meteorological Agency
https://ds.data.jma.go.jp/tcc/tcc/

Summary

- Since December 2019, eastern and western Japan have seen significantly above normal temperatures, and the Sea of Japan side of the country has experienced record-low snowfall.
- These climate extremes are attributed to weaker-than-normal southward cold air-flow to Japan's main islands and synoptic climate conditions characterized by non-persistence of typical winter pressure patterns around Japan. These phenomena may be attributable to a northward meandering of the subtropical jet stream over and around Japan and a persistent positive phase of the Arctic Oscillation.

1. Climate conditions

Since December 2019, area-averaged temperatures for eastern and western Japan have been significantly above normal (Figures 1 and 2), and the Sea of Japan side of the country has experienced record-low snowfall. At many observation stations on the Sea of Japan side of eastern and western Japan, cumulative snowfall ratios from 1 November 2019 to 23 January 2020 were less than 20% of the normal (Figures 3 and 4).

2. Characteristics of atmospheric circulation causing Japan's climate conditions

These climate extremes are attributed to weaker-than-normal southward cold air-flow to the main archipelago, in addition to synoptic climate conditions with non-persistence of typical winter pressure patterns around Japan. Such climatic events may be attributable to the following (Figure 5):

- The subtropical jet stream meandered northward over and around Japan, possibly due to enhanced convective activity in the western part of the Indian Ocean and suppressed convection over and around the Maritime continent. These contrasting convective patterns were likely affected by higher-than-normal Sea Surface Temperatures (SSTs) in the western part of the Indian Ocean.
- Since January 2020, a positive phase of the Arctic Oscillation pattern (Thompson and Wallace, 1998) has been clearly seen in the Northern Hemisphere, so that the cold air mass over the Arctic area has been unlikely to move southward to the mid-latitudes. The polar front jet stream were also clearly observed from the north of Lake Baikal to the southeastern coast of Russia, resulting in a weakening of a cold air mass over the eastern part of Siberia.

3. Outlook

The Japan Meteorological Agency's one-month forecast issued on 23 January predicted ongoing weaker-than-normal southward cold air-flow to the main Japanese archipelago. Thus, a tendency for warmer-than-normal conditions throughout Japan and lower snowfall on the Sea of Japan side of the country is expected to prevail until the end of February (Figure 6). Be sure to check the latest weather forecasts and information for updates.

Reference

Thompson, D. W. J, and J. M. Wallace, 1998: The Arctic Oscillation signature in the wintertime geopotential height and temperature fields. *Geophys. Res. Lett.*, **25**, 1297-1300.

JMA website:

Seasonal forecasts (including Monthly outlook) for Japan:
https://www.jma.go.jp/en/longfcst/

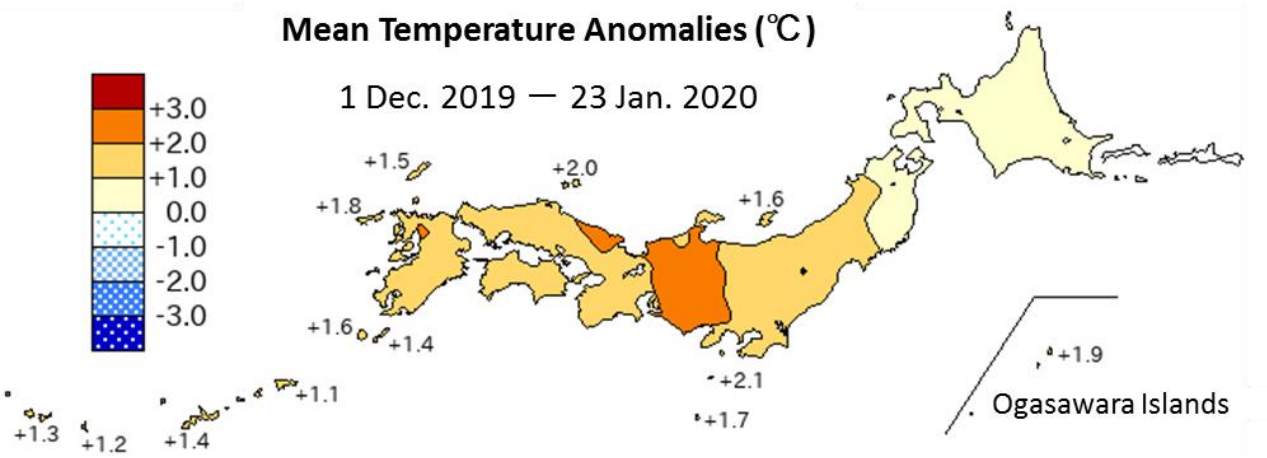


Figure 1. Mean temperature anomalies from 1 December 2019 to 23 January 2020

The base period for the normal is 1981 – 2010.

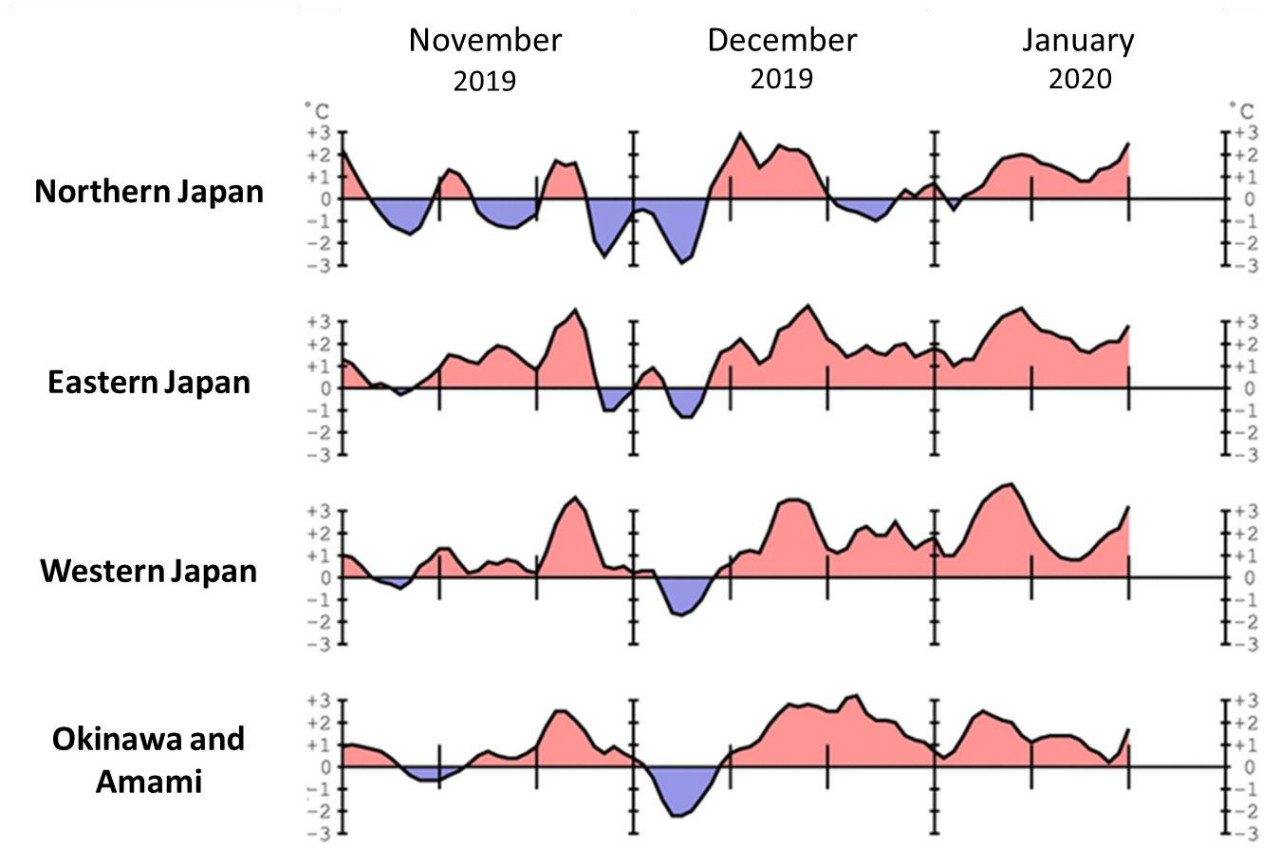


Figure 2. Time-series representations of 5-day running mean temperature anomalies after 1 November 2019 (as of 23 January 2020)

The base period for the normal is 1981 – 2010.

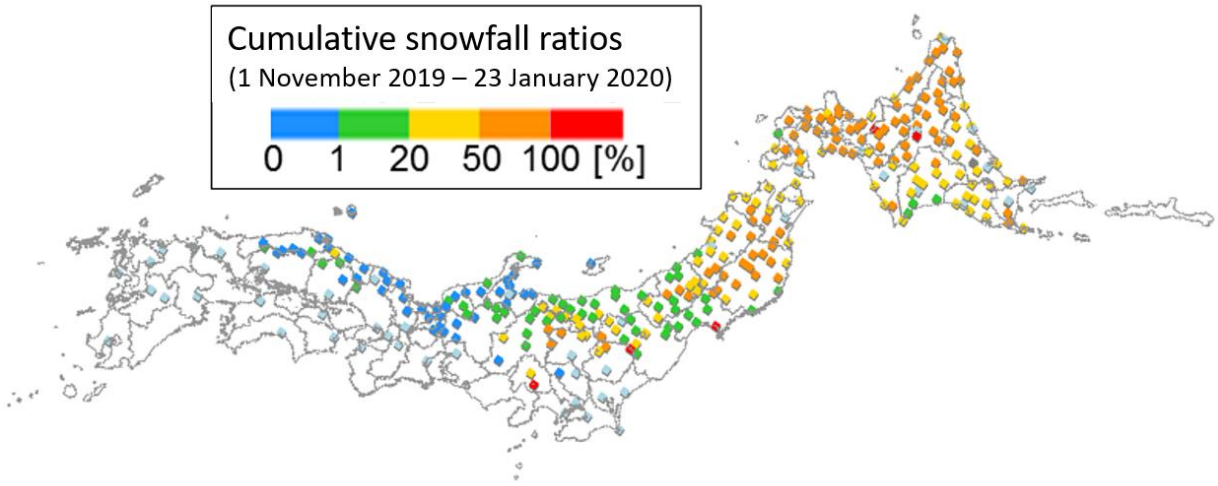


Figure 3. Cumulative snowfall ratios (1 November 2019 to 23 January 2020)

The base period for the normal is 1981 – 2010. Here, cumulative snowfall is the sum of daily snowfall for the targeted periods. Station colors are as per the legend, with light-blue stations representing points where observation is conducted but normal values are not computed.

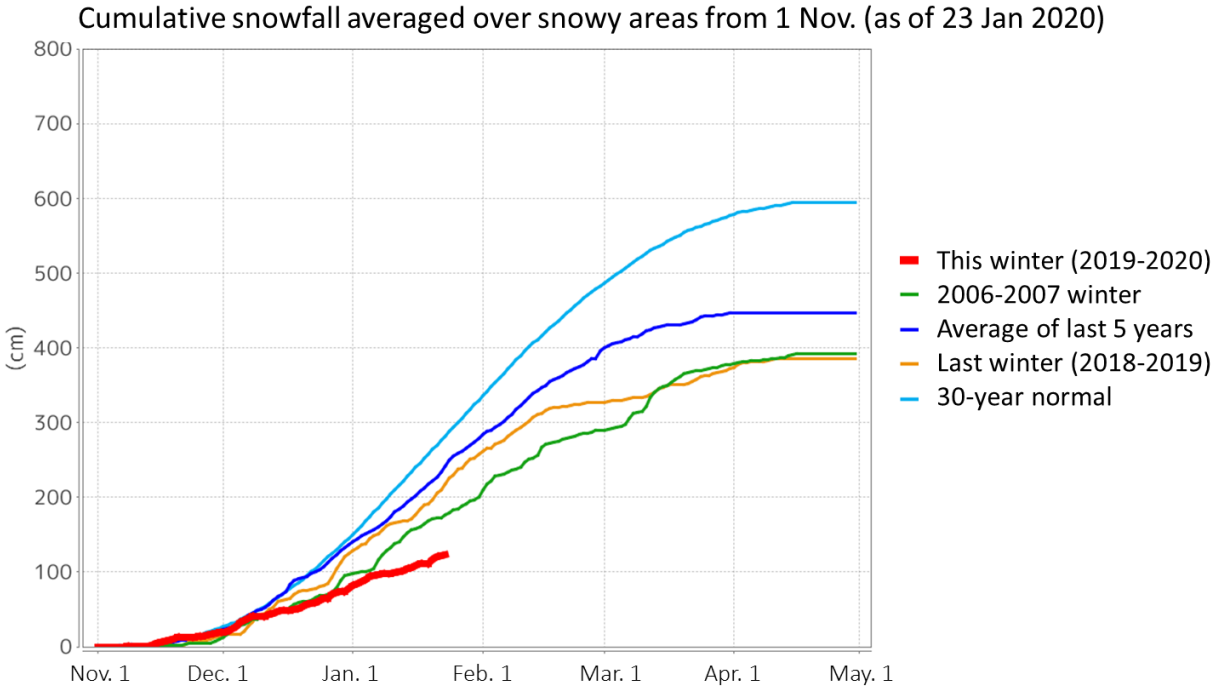


Figure 4. Cumulative snowfall averaged over snowy areas from 1 November (as of 23 January 2020)

The red line shows a cumulative time-series representation of snowfall for winter 2019 – 2020, while the green and orange lines show the same for the winters of 2006 – 2007 and 2018 – 2019, which had little snow. The light- and dark-blue lines represent the 30-year normal (1981 – 2010) and the average for 2015 – 2019, respectively. Figures are based on Automated Meteorological Data Acquisition System (AMeDAS) observations in snowy areas as designated under the Act on Special Measures for Heavy Snowfall Areas. The number of observatories varies from year to year, with 261 stations for the normal and 277 for winter 2019 – 2020 as examples.

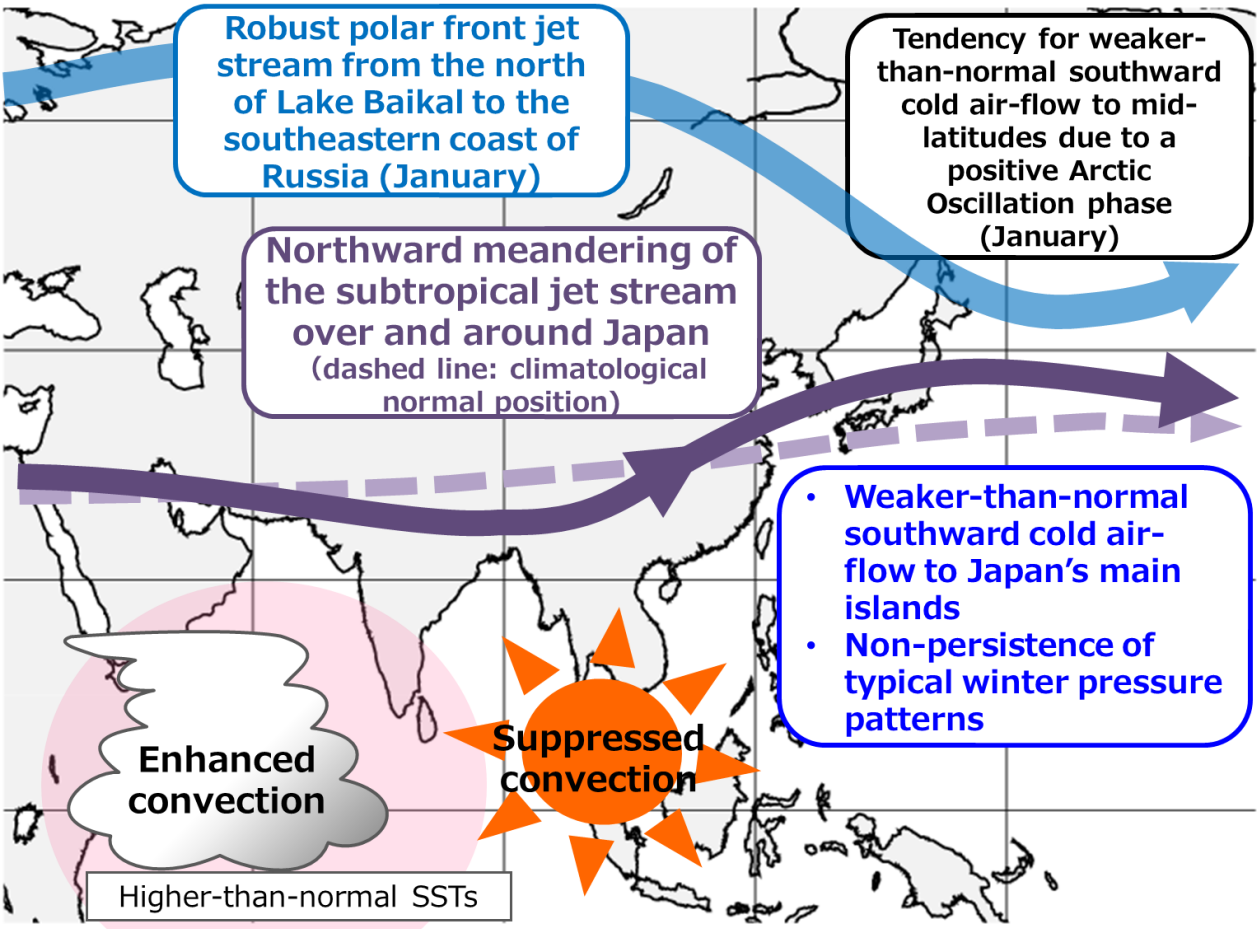
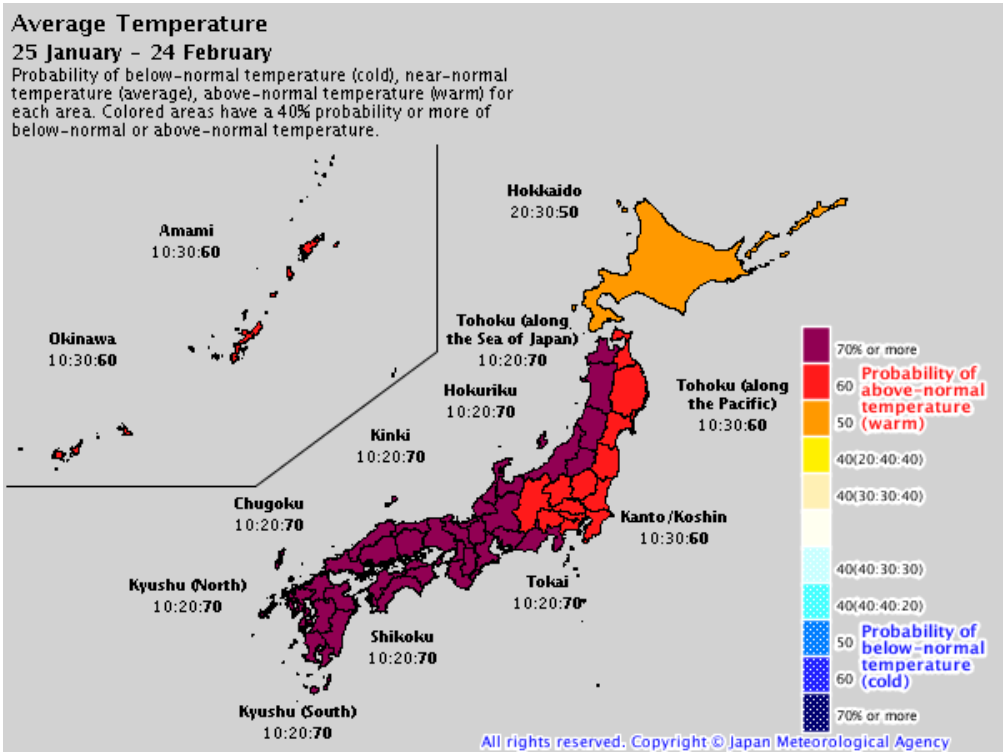


Figure 5. Primary factors behind higher-than-normal temperatures and record-low snowfall in Japan from December 2019 onward



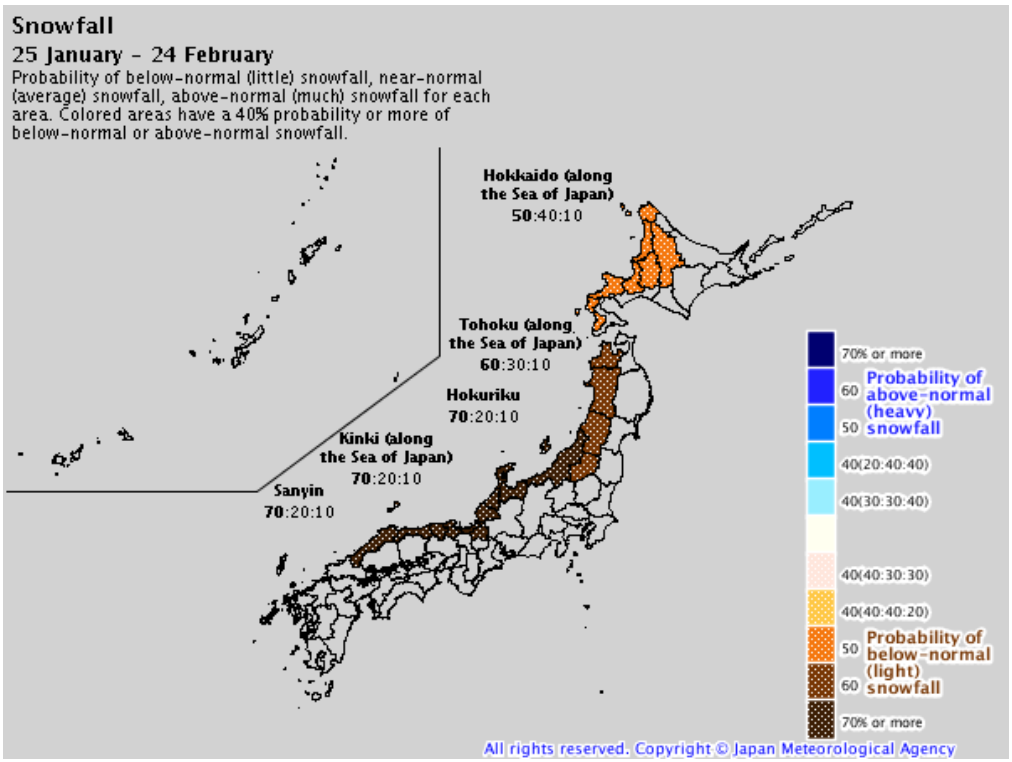
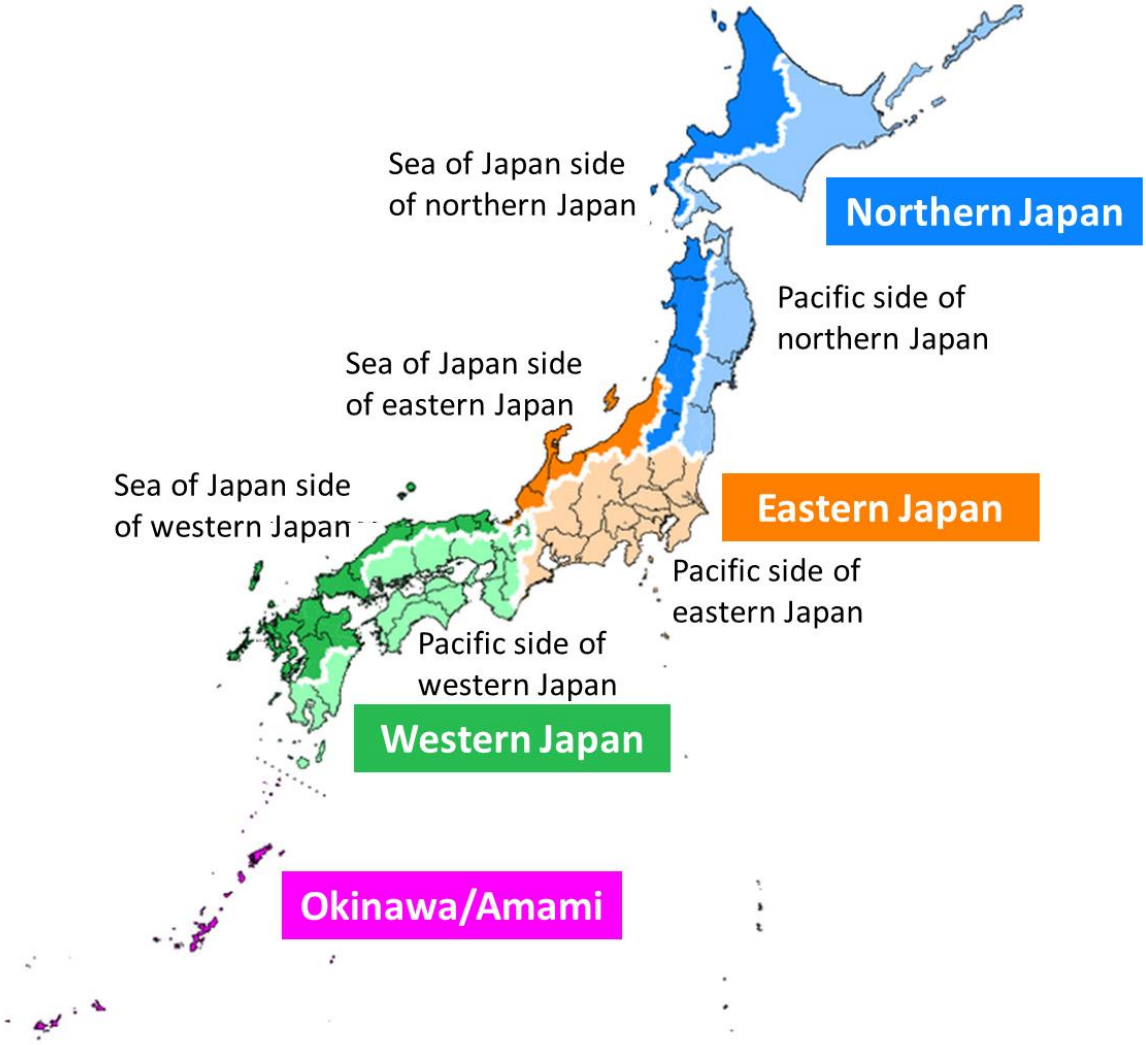


Figure 6. JMA's one-month forecast issued on 23 January (Forecast period: 25 January to 24 February 2020)

Top: average temperature; bottom: snowfall



Climatological regions of Japan

The country has four divisions (northern, eastern, western Japan and Okinawa/Amami).