

## Effects of the Pacific high and the Tibetan high on occurrence of drought and cool summer in northern Japan

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Meteorological disasters, including drought, cool summer, and heavy rain, have a serious effect on the crop yields in Japan. In this study, the connections between occurrence of agro-meteorological disasters in northern Japan and pressure and temperature fields in the tropospheric and lower stratospheric circulation over East Asia are examined. Based on the monthly air temperature for northern Japan, hot summer years and cool summer years in northern Japan are extracted from the 35-year (1980-2014) sample. To investigate the connection between the hot/cool summer in northern Japan and atmospheric circulation over East Asia in summer, composite differences (hot summer years minus cool summer years) of several variables such as geopotential height, temperature, and vertical p-velocity are calculated. In addition, the statistical significance of these composite differences is evaluated using Welch's t test. The analysis showed high pressure anomalies over northern Japan in the troposphere and lower stratosphere. This indicates that both the North Pacific high and the Tibetan high tend to extend to northern Japan during the hot summer years. On the other hand, cool summer in northern Japan seems to be associated with the weakening of these highs. Additionally, we show the meridional circulation and rainfall distribution in hot/cool summer years.

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