

Takahashi, N., 2023: A trial of climate classification based on dynamic climatology using distribution of frontal zone in mid- and high latitudes. *J. Meteor. Soc. Japan*, **101**, 411-430.

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**Plain Language Summary:** This study classified the climate from temperate to polar regions based on dynamic climatology using objective frontal data at mid- and high latitudes created by a thermal-based method with  $\theta_e$ . The unique features of our method for frontal data creation included adding conditions for the geopotential height at 500-hPa and incorporating latitude-dependent parameters. Moreover, the behavior of the frontal zone was also shown, including interannual variations due to various phenomena affecting global climate and long-term trends for 42 years from 1979 to 2020.

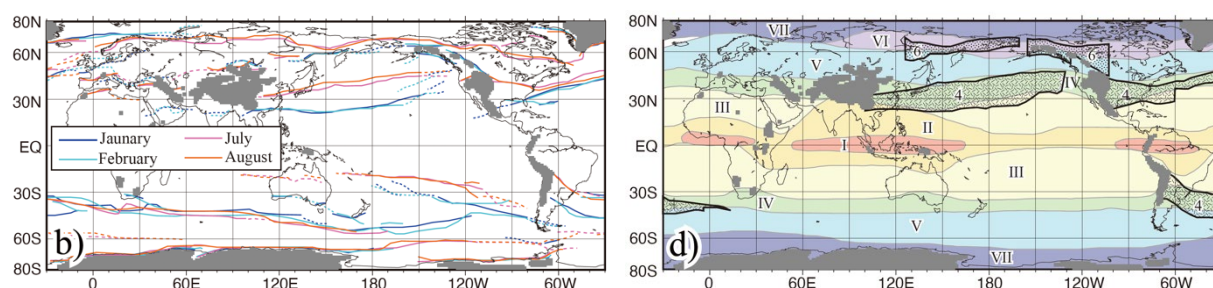


Figure 1. Climatic divisions based on the position of the frontal zone. b) distributions of frontal zones in January, February, July, and August. d) climatic divisions based on (b). In (d), color shadings with Roman numerals indicate Alisov's climatic zones, and the hatched areas with Arabic numerals indicate the climatic zones defined in this study.

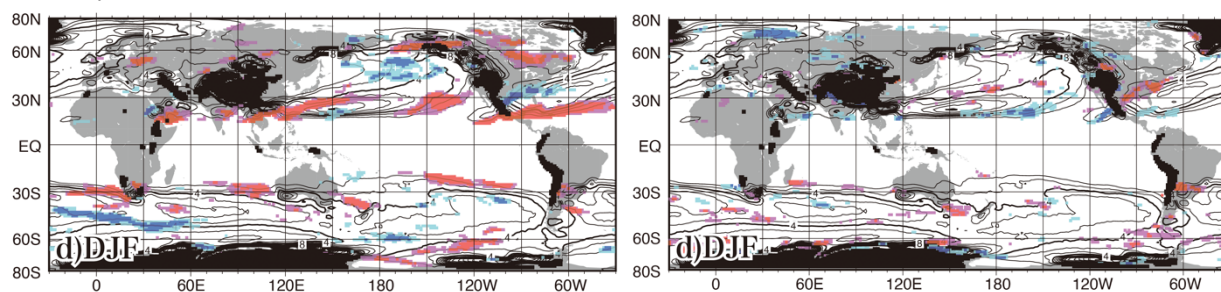


Figure 2. Areas of statistical significance in boreal winter. The left and right panels show the results of correlation analysis between the Niño-3 SST index and frontal frequency and a trend analysis in frontal frequency, respectively. Red and magenta: positive coefficients or trends with  $p < 0.01$  and  $0.01 \leq p < 0.05$ , respectively; blue and cyan: negative coefficients or trends with  $p < 0.01$  and  $0.01 \leq p < 0.05$ , respectively. The contours denote the mean frontal frequency by 1 %.

- Climate classification was possible in areas with distinct north-south migration in a clear frontal zone corresponding to areas east of the great mountains at the mid-latitudes.
- The interannual variations in the frontal zone associated with ENSO, PDO, and AO were consistent with and explainable to the regional climate variability as reported by previous studies.
- Several distinctive trends were revealed, e.g., the partial northward shifts in the polar frontal zones over the North Pacific and the North Atlantic in boreal winter.