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Weather Divide in Winter Season in Japan Analyzed by AMeDAS Data

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Abstract

The distribution of weather divides in Japanese winters was identified using 30-year data of the Automated Meteorological Data Acquisition System (AMeDAS) operated by the Japan Meteorological Agency. Two kinds of weather divide were defined, one is a cloudy weather divide (CWD) determined by the high-frequency grids of large gradients in the sunshine duration distribution, and the other is a precipitation area border (PAB) where the edge of daily precipitation areas frequently appeared. The CWD appeared continuously in eastern Japan along the Pacific backbone ranges, but it was discontinuous in the central mountain ranges and western Japan. The CWD also appeared in Pacific coastal areas, such as east of Kamikouchi, south of the Kii Peninsula, and southeast of Shikoku Sanchi. The PAB overlapped with the CWD distribution in eastern Japan, and it was enhanced throughout the Sekigahara-Tamba Kochi and Chugoku Sanchi areas, but the CWD in pacific coastal areas was not associated with the PAB. Most of the weather divides were caused by the winter monsoon pressure pattern, and some PABs in northwestern Tohoku and Hokkaido areas occurred with passing pacific coastal extratropical cyclones. The distribution of the weather divides in cold-winter years was dependent on the dominance of Satoyuki/Yamayuki weather patterns, and weather divides became unclear in warm winters.

Key words : weather divide, AMeDAS, sunshine duration, precipitation, winter monsoon

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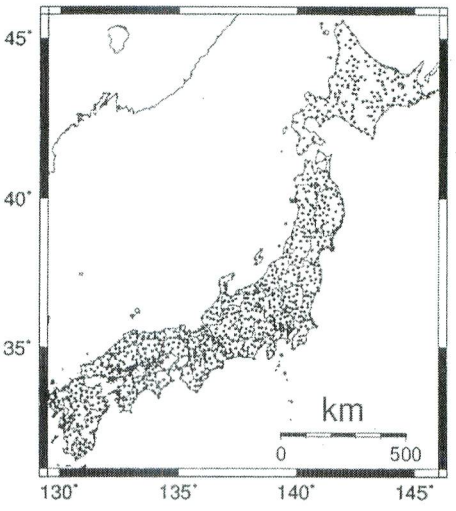

Fig. 1 Distribution of 1231 AMeDAS observation points (785 points for sunshine duration observation).

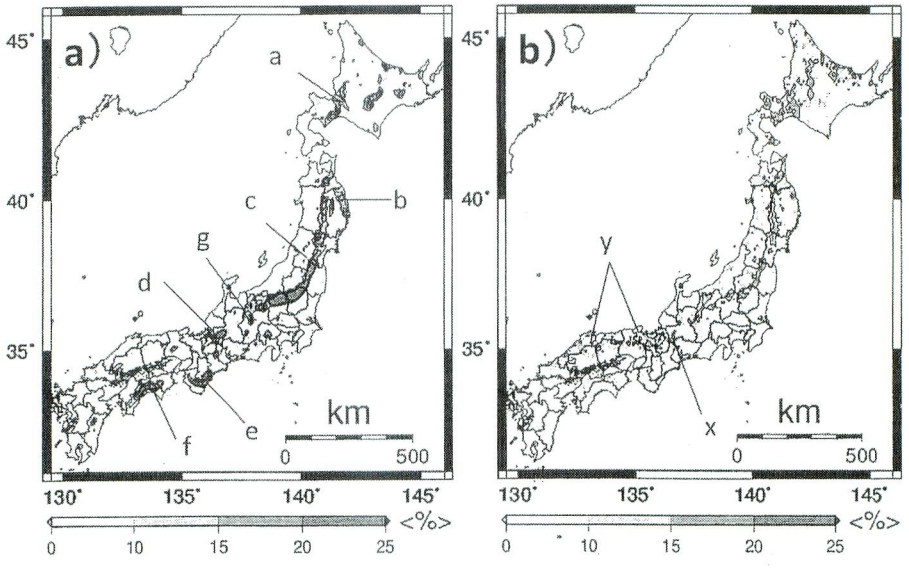

Fig. 2 30-years average of relative frequency (%) for weather divide determined by a) sunshine duration and b) precipitation amount.

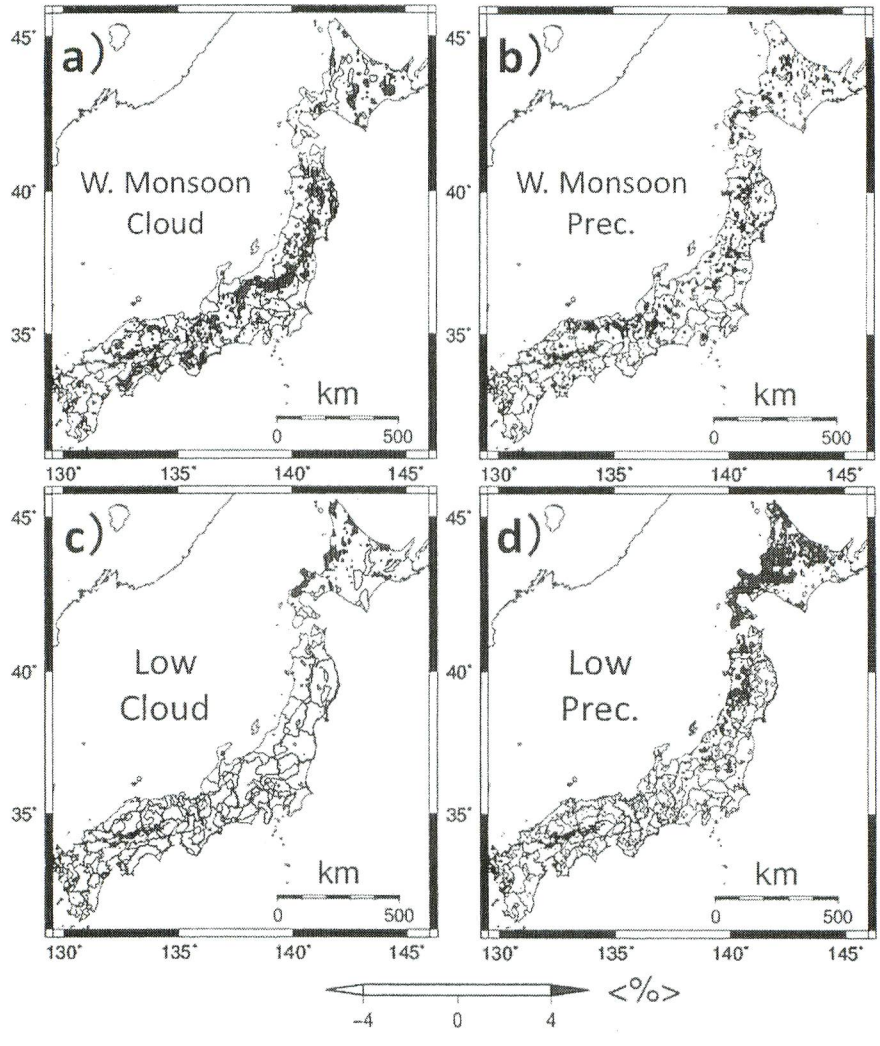

Fig. 3 Percentage anomaly of weather divides in cases of winter monsoon (upper) and passing of extratropical cyclones (lower). Figures (a and c) to the left are determined by sunshine duration and figures (b and d) to the right are determined by precipitation amount. Dark (washed) colored areas correspond to 4% increase (decrease) from the 30-years average frequency distribution (Fig. 2).

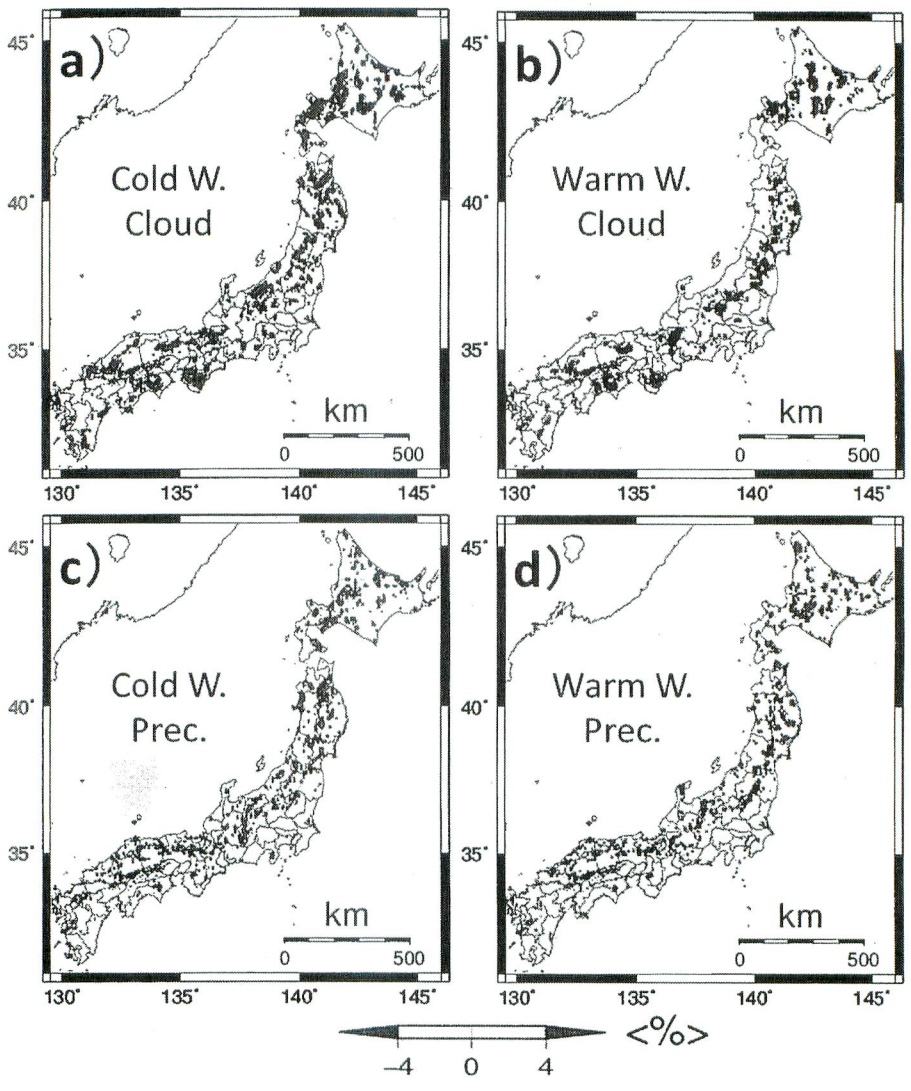

Fig. 5 Percentage of anomalies of weather divide in 1983/1984 winter as a being representative of cold winters (left) and 2006/2007 winter as being representative of warm winter (right). Upper figures (a and b) are determined by sunshine duration and lower figures (c and d) are determined by precipitation amount. Red (blue) areas correspond to 4% increase (decrease) from the 30-year average frequency distribution (Fig. 2).

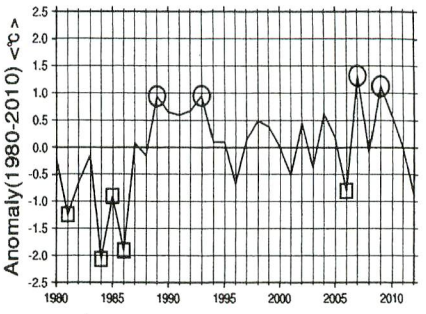

Fig. 4 Cold (square mark) and warm (round mark) winters determined from winter anomaly temperatures during the period 1980–2010.

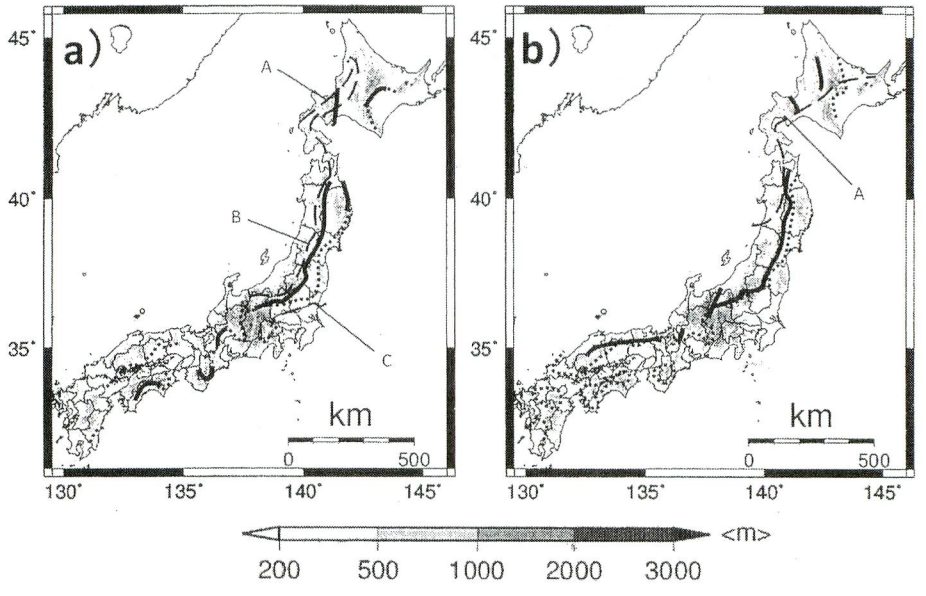

Fig. 6 Schematic diagrams of the distribution of weather divides in Japan determined by data on: a) sunshine duration and b) precipitation amount. Solid lines indicate a division with more than a 15% probability, and dotted lines indicate additional divisions especially for winter monsoon days. Long-dotted lines indicate divisions due to other reasons.

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