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KUSAKA, Hiroyuki / HIRATA, Wataru

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Climatology of Precipitation during the Passage of the Double Cyclone

HIRATA Wataru* and KUSAKA Hiroyuki**

(*Graduate Student, University of Tsukuba, **Graduate School of Life and Environmental Science/ Center for Computational Sciences, University of Tsukuba)

The double-cyclone type is considered to be one of the most important pressure patterns around Japan as it is known to cause severe weather such as heavy rain and strong winds in various parts of the country. In this study, double cyclones are classified into the following three types: Heishin type; Nihonkai-L main type; and Nangan-L main type. They are examined in a climatologic context to assess the regional characteristics of precipitation amount and intensity, and snowfall after the passage of double cyclone. Furthermore, precipitation characteristics of each type of double cyclone, the Nihonkai and Nangan lows are examined. Precipitation from the Nihonkai-low main type tends to be weak, although the precipitation caused by the double cyclone is strong along the southern coast and the Hokuriku region of Japan. For the Heishin type, precipitation is observed at nearly 90% of observation points in the whole country. The ratio of observation points with precipitation is greater in eastern Japan for the Nihonkai-low main type. Compared to the Nihonkai low and the Nangan low, the double cyclone tends to cause snowfall more frequently in the whole country. The mean total snowfall amount is the greatest for the Nihonkai-low main type among the three types of double cyclone. The Heishin type and the Nihonkai-low main type have a tendency to cause snowstorms in the Tohoku region and in Hokkaido. The Nangan-low main type may cause relatively calm snowfall nationwide and even bring snowfall to the southern part of Kanto. Heavy precipitation events tend to occur when the southern low moves nearer to the Japanese islands for all of the three types of double cyclone. Moreover, the southern cyclone tends to be stronger than the northern cyclone.

Key words: double cyclone, precipitation, precipitation frequency, snowfall, snowfall frequency

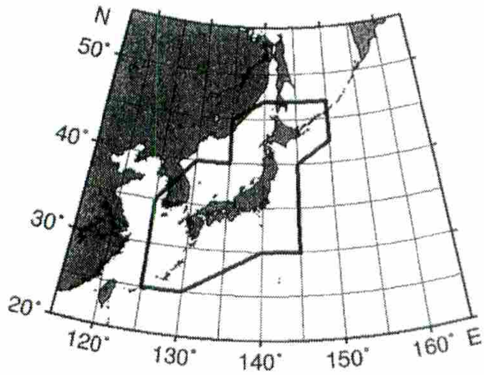

Fig. 1　Analysis area

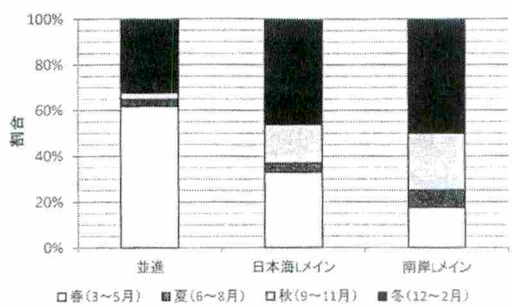

Fig. 2　Seasonal frequency for each type of storm
From left: Heishin, Nihonkai-L main, Nangan-L main.

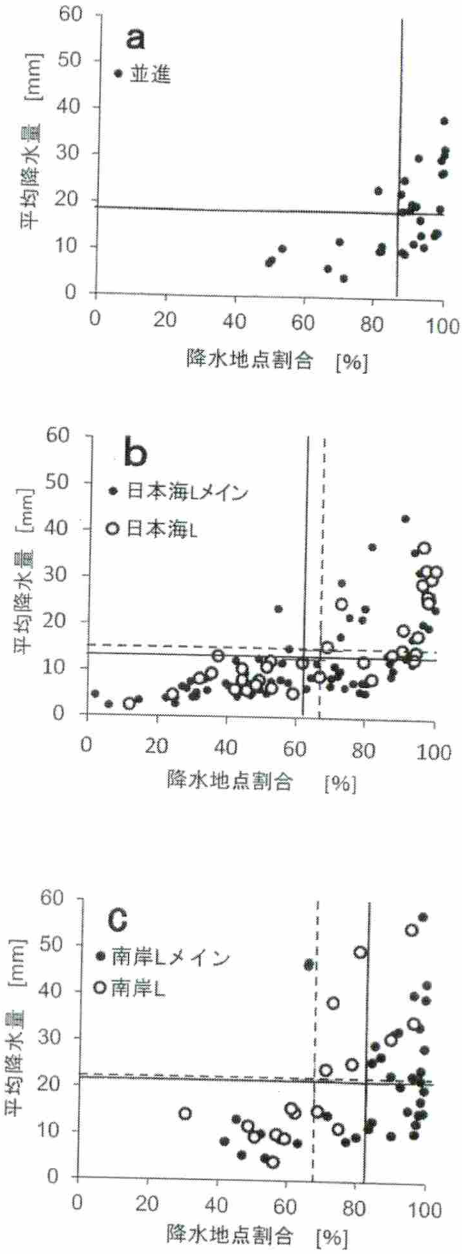

Fig. 4　Relationship between the ratio of observation points with precipitation and the mean precipitation amount
(a) Heishin, (b) Nihonkai-L main and Nihonkai-L, (c) Nangan-L main and Nangan-L.

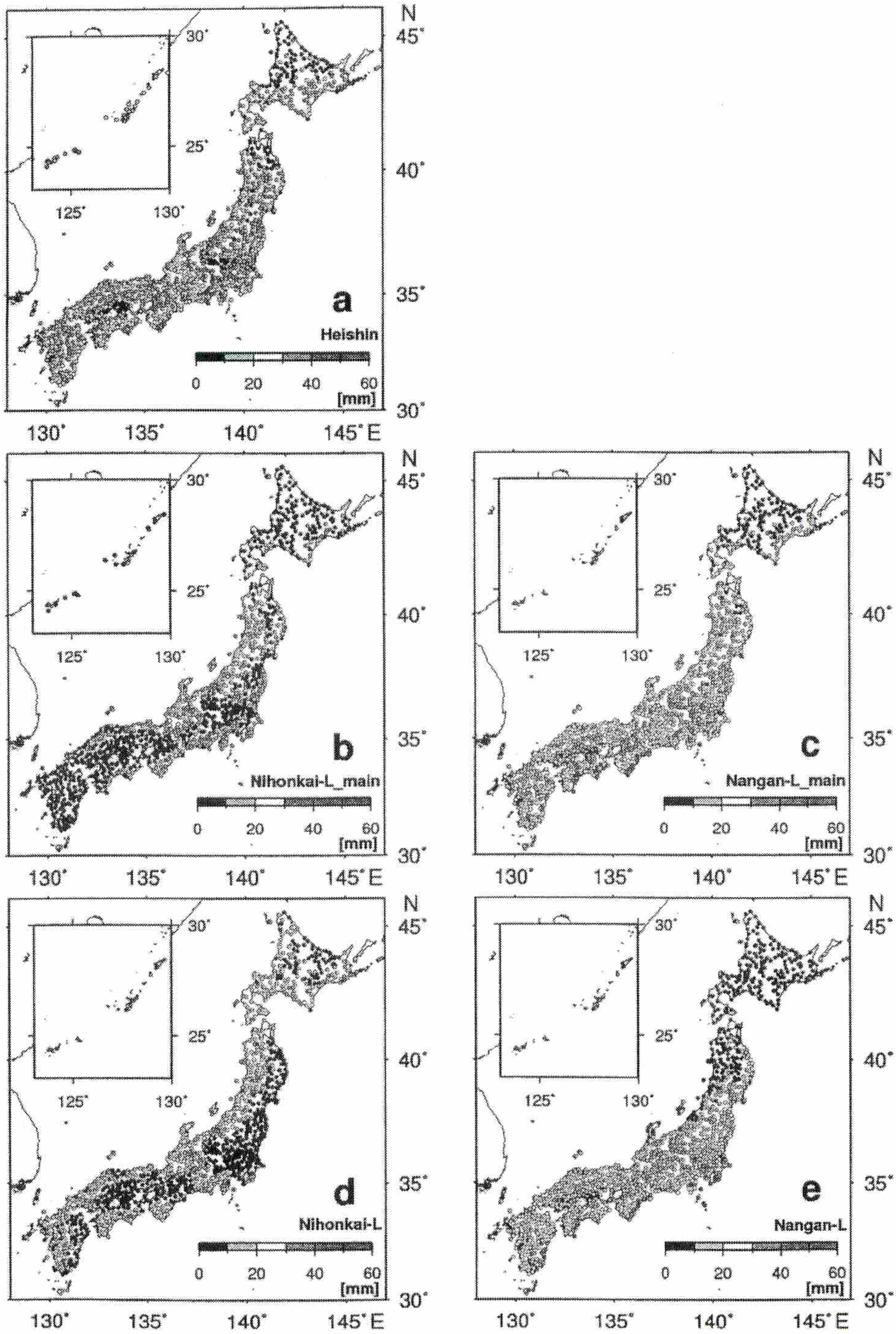

Fig. 3 Distribution of mean precipitation
(a) Heishin, (b) Nihonkai-L main, (c) Nangan-L main, (d) Nihonkai-L, (e) Nangan-L.

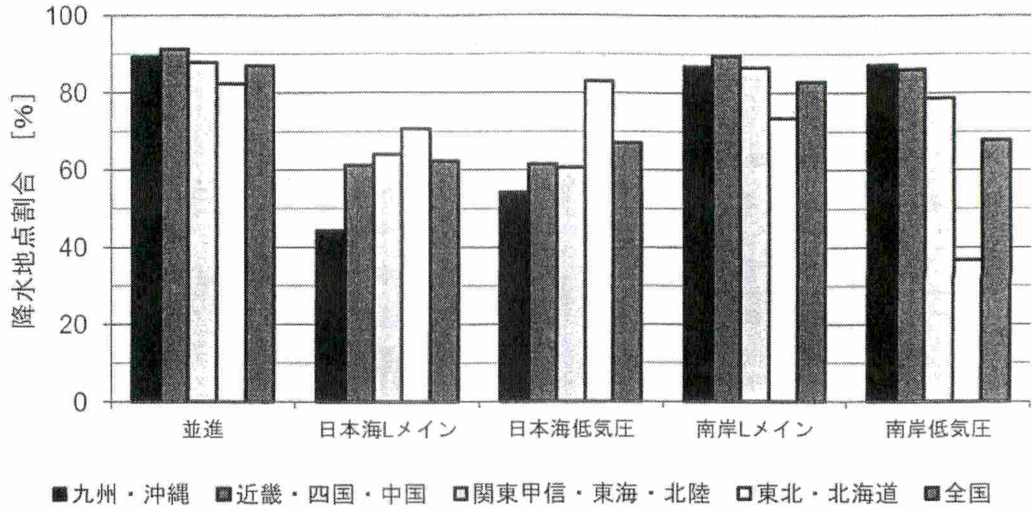

Fig. 5　Ratio of observation points with precipitation by analysis area

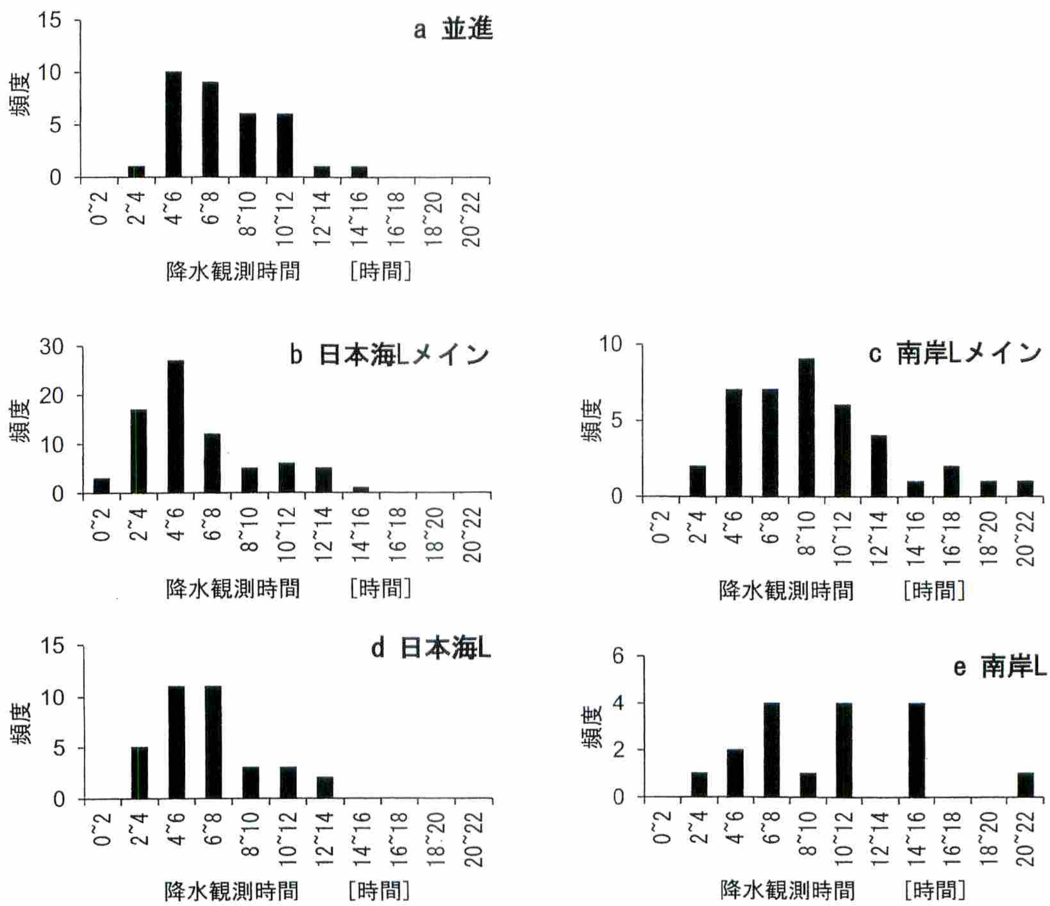

Fig. 6　Histogram of precipitation duration
(a) Heishin, (b) Nihonkai-L main, (c) Nangan-L main, (d) Nihonkai-L, (e) Nangan-L.

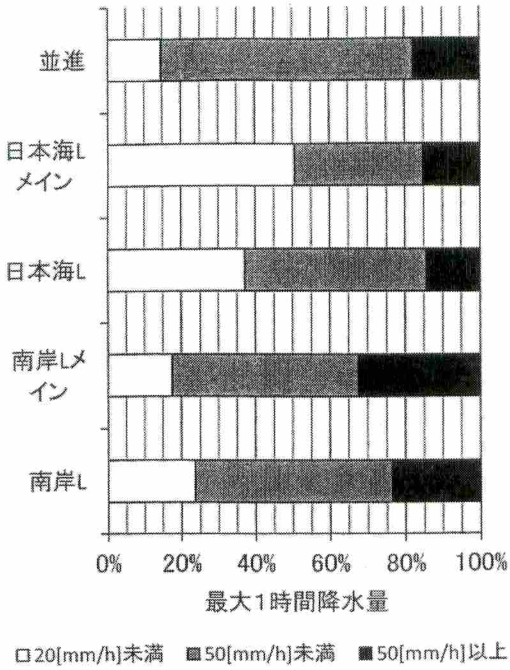

Fig. 7　Tendency of nationwide maximum hourly precipitation for each cyclone type

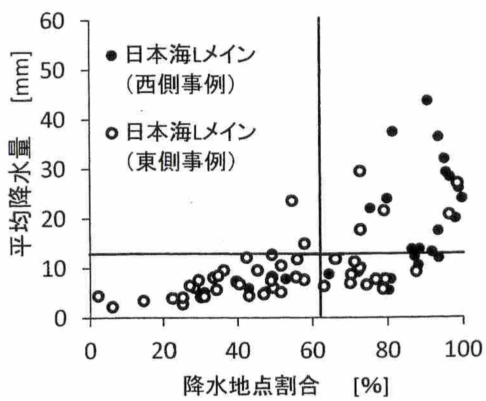

Fig. 8　Relationship between the ratio of observation points with precipitation and mean precipitation amount (western and eastern Nihonkai-L main type)

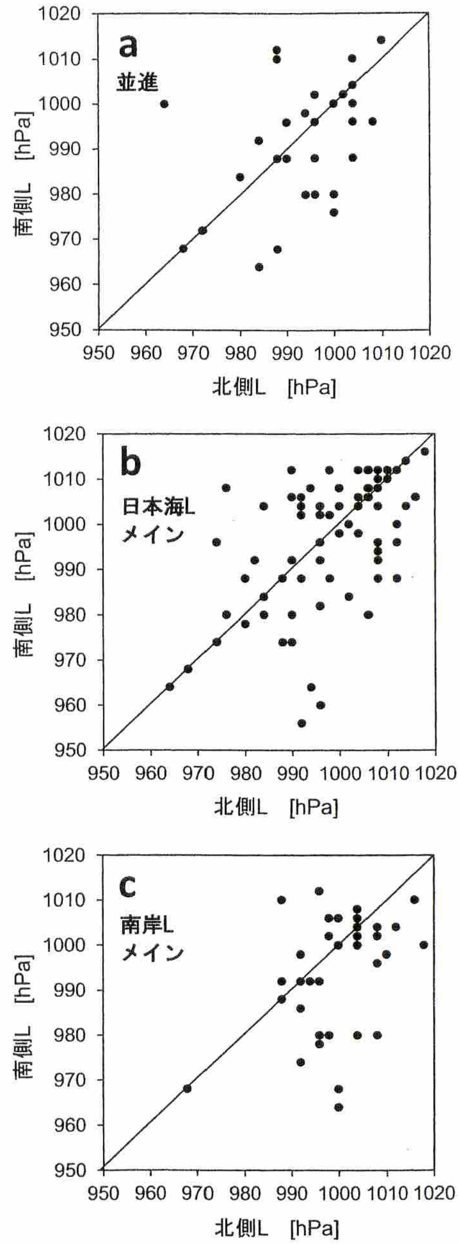

Fig. 10　Scatter plots of minimum pressure of northern and southern lows
(a) Heishin, (b) Nihonkai-L main, (c) Nangan-L main.

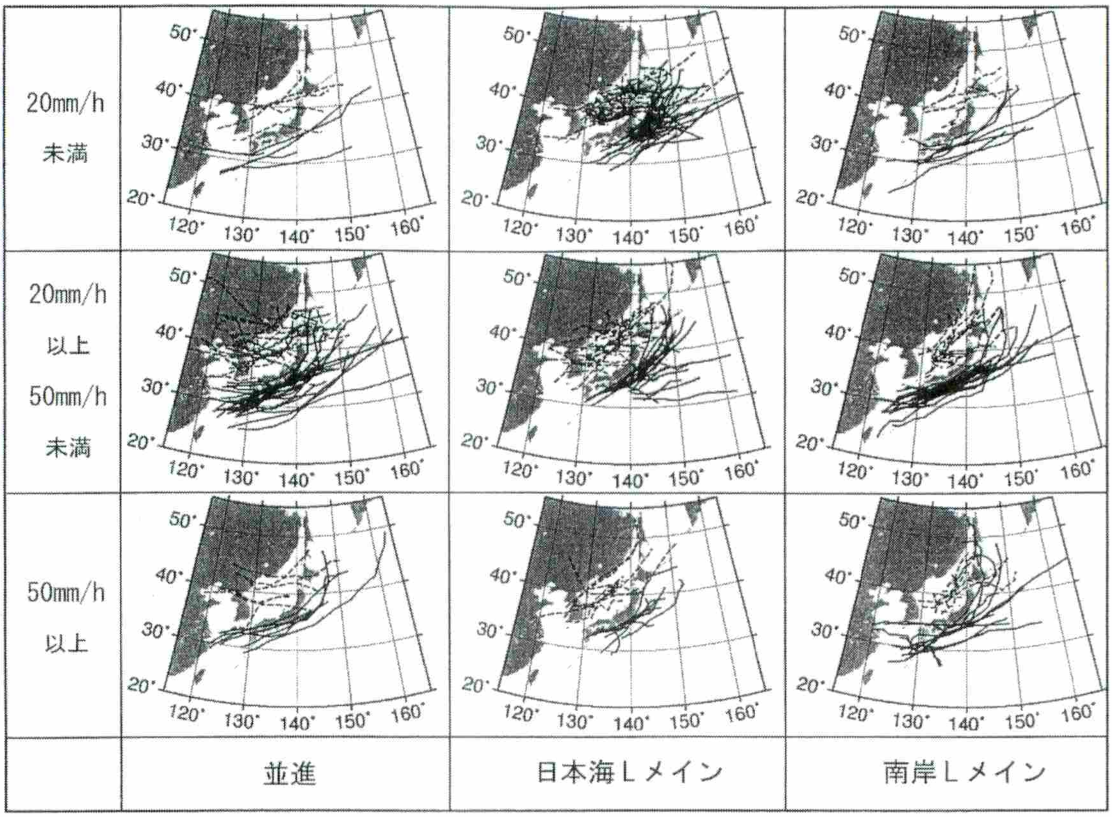

Fig. 9　Cyclone trajectories categorized by precipitation pattern

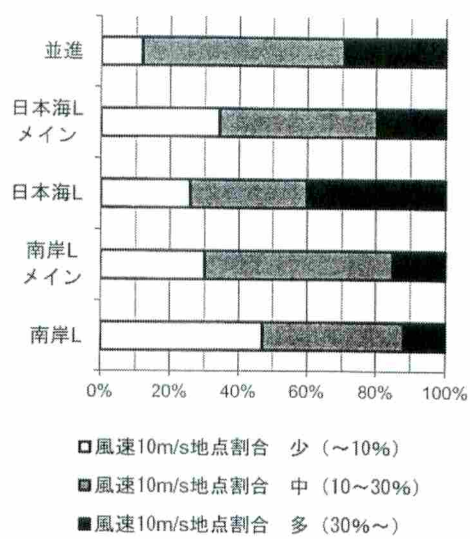

Fig. 13　Trends in the ratio of observation points with strong wind

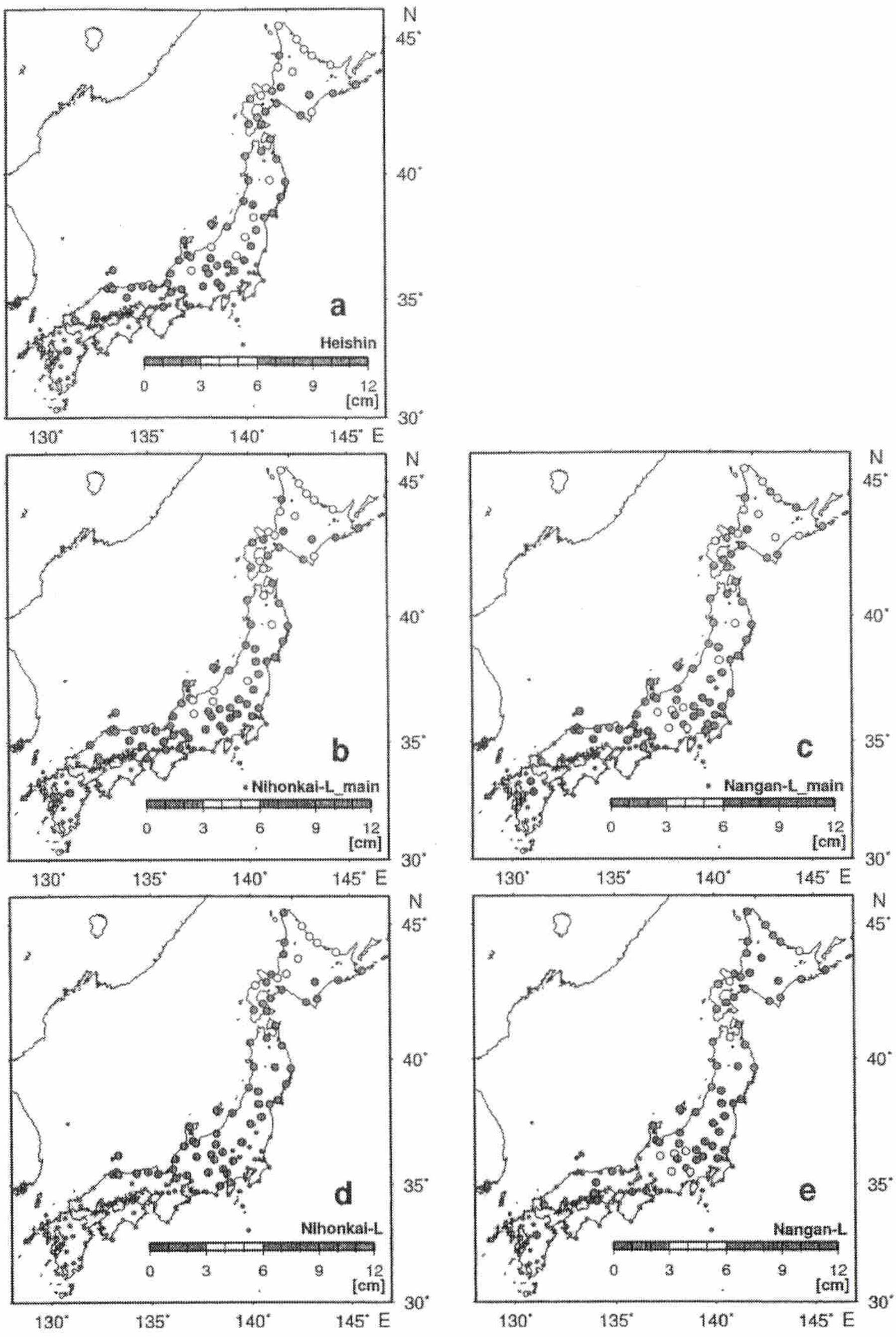

Fig. 11 Distribution of mean snowfall
(a) Heishin, (b) Nihonkai-L main, (c) Nangan-L main, (d) Nihonkai-L, (e) Nangan-L.

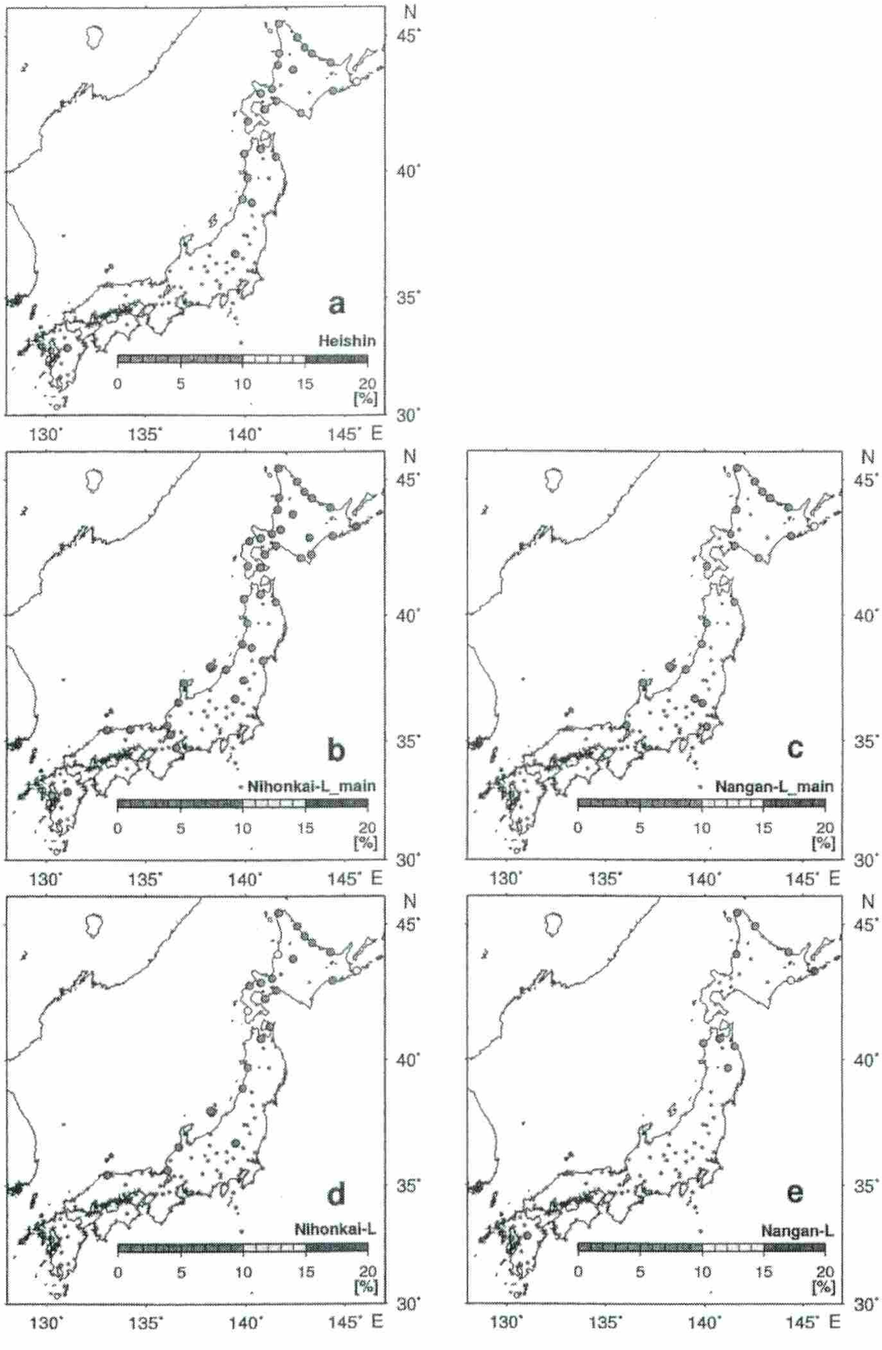

Fig. 12 Distribution of mean Hubuki potential
(a) Heishin, (b) Nihonkai-L main, (c) Nangan-L main, (d) Nihonkai-L, (e) Nangan-L.

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