METEOROLOGICAL FIELD PATTERNS CLASSIFIED USING SELF-ORGANIZING MAP (SOM)

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In this study, in order to systematically and visually investigate and understand well-known but qualitative and relatively complicated relationships between meteorological fields in the BAIU season and heavy rainfall events in Japan, these meteorological fields were classified using the Self-Organizing Map (SOM) algorithm (Kohonen, 1995). This algorithm can convert complex nonlinear features into simple two-dimensional relationships, and followed by the application of the clustering techniques of the U-matrix and the K-means. It was assumed that the meteorological field patterns be simply expressed by the spatial distribution of wind components at the 850 hPa level and Precipitable Water (PW) in the southwestern area including Kyushu in Japan. Consequently, as shown in Fig. 1, the synoptic fields could be divided into eight kinds of patterns (clusters), which basically revealed five representative meteorological situations characterized by (1) dry air masses, (2) anti-cyclonic flows due to the Pacific high pressure system, (3) the existence of the BAIU front, (4) the intrusion of a large amount of water vapor with LLJ, and (5) the effect of low pressure system.

One of the clusters (Cluster 8) has the notable spatial feature represented by high PW accompanied by strong wind components (LLJ). The pattern indicated a typical meteorological field pattern that frequently causes heavy rainfall in Kyushu in the rainy season as shown by Table. 1. From these results, it can be expected that the SOM technique is available as an effective tool for the classification of complicated non-linear synoptic fields and for the identification of the occurrence of heavy rainfall events.

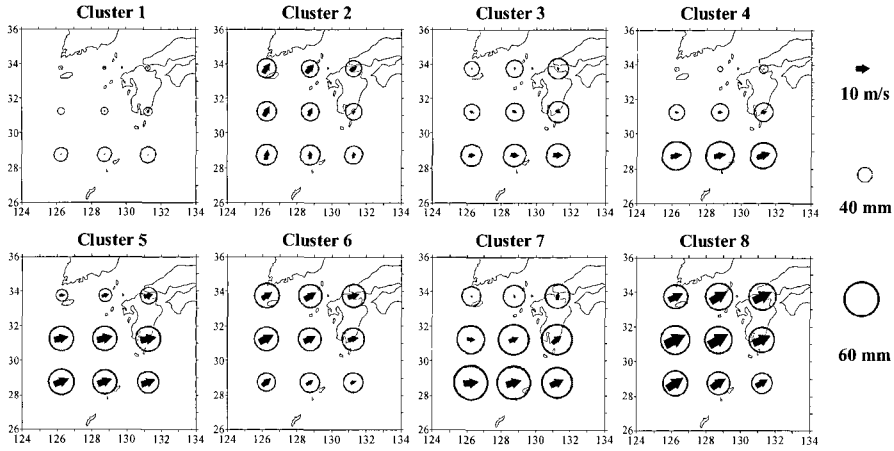

Fig. 1 The average feature of each meteorological field calculated as the average of the weight vectors in each cluster's units. The size of a circle in the figures represents PW values

Table 1. Frequency of rainfall events included in each cluster in the trained SOM

	C1	C2	C3	C4	C5	C6	C7	**C8**	TOTAL
R=0	52	51	11	30	21	13	8	**1**	187
0<R=<10	5	5	18	4	19	14	13	**13**	91
10<R=<20	1	4	6	1	2	3	9	**10**	36
20<R=<30	0	0	5	1	1	5	2	**14**	28
30<R=<40	0	0	1	0	1	3	4	**9**	18
40<R=<50	0	1	1	0	0	0	0	**2**	4
R>50	0	0	0	0	0	0	0	**2**	2
TOTAL	58	61	42	36	44	38	36	**51**	366

REFERENCE

Kohonen T., 1995. Self-Organizing Maps. Springer Series in Information Sciences. 30, 362pp.