STATISTICAL ANALYSIS ON THE RELATIONSHIP BETWEEN GLOBAL CLIMATE INDICATORS AND SPATIAL DISTRIBUTION PATTERNS OF MONTHLY PRECIPITATION IN JAPAN

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ABSTRACT

Recently, occurrence of floods and droughts has been reported in many places in the world. For instance, in Japan, it has been pointed out that recent years experienced large fluctuation of annual precipitation and available amount of water in drought years have been decreasing (Water Resource in Japan, 2008). Because the precipitation is principal source of water supply, large fluctuation of precipitation makes stable supply of water difficult. Thereby, the analysis and understanding of variability characteristics of precipitation is very important in order to assure the reliable supply of water in the future. In particular, analysis for long term record of precipitation data is necessary to adequately understand the recent tendencies of precipitation through the comparison with the precipitation behaviors in the past.

As a first step, we compiled monthly precipitation data at 51 of meteorological stations in Japan, using the daily precipitation data provided by JMSBC (Japan Meteorological Business Support Center). The precipitation data covers 104 years from January 1901 to December 2004 and thus total 1248 months of precipitation data were available for each of 51 stations. For each of 51 stations, precipitation data in each month was transformed into non-exceedance probabilities, and the Self-Organizing Map (SOM), which is a nonlinear pattern extraction method, was applied to the transformed monthly precipitation distributions. The precipitation distribution patterns identified by the SOM were used to investigate possible relations between the phase of Pacific Decadal Oscillation (PDO) and long term variability of monthly precipitation distributions in Japan. Then, we also examined the relations between the seasonal state of large scale climate phenomena and variations of monthly precipitation distributions in Japan.

The result indicated negative phase of PDO is likely to be associated with the higher occurrence of high precipitation in eastern Japan (in particular, the Pacific side of Japan) while positive phase of PDO seems to be associated with higher occurrence of countrywide low precipitation. It was also implied large value of winter SOI is associated with higher occurrence of country wide low precipitation in Japan while the large value of winter NPI is associated with the higher occurrence of countrywide high precipitation.