

## **Synoptic climatological analysis on precipitation characteristics and atmospheric water cycle process around the Japan Islands in the midsummer**

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In East Asia, the remarkable rainy season called the Baiu appears greatly influenced by the Asian monsoon. In the midsummer, the Baiu front moves northward and the Japan Islands area is covered with subtropical high climatologically. However, strong precipitation is sometimes brought in association with the southward shift of the Baiu front or other atmospheric situation. The total precipitation itself around Japan is not as small as in summer around Europe. Furthermore, not only rainfall amount but also rainfall characteristics seem to be neither different from the rainy seasons before and after the midsummer. As such, the present study will examine the rainfall in the midsummer.

In this study, daily precipitation data together with the daily records of the hourly maximum and 10-minute maximum values at the 87 surface meteorological stations of the JMA from the Kanto to the Kyushu District, and the NCEP / NCAR re-analysis data at the grid points with every 2.5 ° latitude / longitude interval grid were used for analyses.

Generally, the large areal averaged precipitation would occur in association with the high occurrence frequency of daily heavy rain or the intense rainfall in a short time such as the large maximum hourly or 10-minute precipitation. However, during the midsummer appearance frequency of the case when the daily areal mean precipitation exceeded the averaged value in August, without the stations with the precipitation equal to or more than 50mm/day, was not so low (here after, referred to as Type A). There appeared another case when the areal averaged precipitation was small, but the number of stations with the maximum 10-minute precipitation equal to or more than 2mm (Type B), together with the case when both the area average precipitation and the number of stations with such intense maximum 10-minute precipitation were considerable (Type C). Referring to the time series of 1 hourly and 10-minute maximum rainfall for each day, each type showed characteristics of convective precipitation rather than stratiform precipitation.

Next, composite atmospheric fields including the large-scale moisture balance for the domain were analyzed, 30.0 N - 37.5 N 127.5 E - 142.5 E. In Type A, water vapor is transported mainly eastward around the Japan Islands. In Type B, the huge water vapor flux passed over the Japan Islands area northward with not so large convergence. It is also noted that the ratio of the moisture flux convergence to the influx even in many Type C when the total precipitation was rather large was not as great as in the western Japan in the mature Baiu stage.

In summary, it is interesting that there are many midsummer rainfall events around the Japan Islands which are characterized by the consumption efficiency of moisture is not so good, such as the ratio of the moisture convergence to the moisture influx was below 20 %. In addition, even without accompanying typhoons and fronts, the cases with high rainfall intensity in a wide area can sometimes appear, although the intense rainfall shows the significant time-spatial localities.