Detectability of Heavy Rainfall and Drought in East Asia and Western Pacific Region using GSMaP

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To demonstrate a usefulness for precipitation extremes monitoring in East Asia and Western Pacific region using satellite-based precipitation products, case analysis and statistical analysis for both heavy rainfall and drought are investigated. As one of satellite-based precipitation products, the focus here is on the Global Satellite Mapping of Precipitation (GSMaP) provided by the Japan Aerospace Exploration Agency (JAXA). GSMaP is a product of the Global Precipitation Measurement (GPM) mission, which provides a global hourly rain rate with a 0.1 x 0.1 degree resolution. Though there are various products in GSMaP, we use Near-real-time Gauge-adjusted Rainfall Product (GSMaP GNRT) that is the most suitable for monitoring.

Heavy rainfall for daily and weekly precipitation is defined by threshold of 90th percentile or more over periods from April 2000 to March 2019. From comparison between GSMaP GNRT and CPC GAG, it is indicated that a threat score increases as total precipitation increases. In results by three thresholds (90th, 95th and 99th percentile), the higher the percentiles, the lower the detectability. If the forecast is wrong, the number of “false alarm” tends to be higher than “Misses”. Furthermore, it is suggested that a threat score varies greatly from region to region. In Australia where is dry area, the detection rate for a threshold of 90th or 95th percentiles is relatively high. On the other hand, in Indonesia where is a rainy island country, the detection rate for even a threshold of 90th percentile is low. Such low detectability in snowfall areas, mountains and rainy island nations may be caused by characteristics of GSMaP products of algorithm version 6 used in this study such as are the non-implementation of the snowfall estimation method, the limitation of Orographic/non-orographic rainfall classification scheme and difficulty of coastal estimation.

Short-term drought from one-month to three-month are defined by Standardized Precipitation Index (SPI) calculated by GSMaP GNRT since April 2000. From comparison of SPIs between GSMaP GNRT and CPC GAG, correlation coefficients in East Asia and Western Pacific region are 0.712 in 1-month SPI, 0.728 in 2-month SPI, and 0.735 in 3-month SPI, that is, the longer the accumulation period of precipitation, the higher the detection rate. Especially, correlation coefficients in Australia, which has experienced numerous droughts in recent years, are higher; 0.763, 0.786, and 0.794. Moreover, it seems that GSMaP GNRT tends to detect drought intensity somewhat weakly.

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