



## **Sources for the Inter-annual and Decadal Variability of the East Asian Summer Monsoon and Western North Pacific Summer Monsoon**

Seogyeong Kim (1,2) and Kyung-Ja Ha (1,2)

(1) Department of Atmospheric Sciences, Pusan National University, Busan, South Korea (seokyoung56@pusan.ac.kr, kjha@pusan.ac.kr), (2) Center for Climate Physics, Institute of Basic Science, Pusan National University, Busan, South Korea (seokyoung56@pusan.ac.kr, kjha@pusan.ac.kr)

Determining source for the variability of the Asian monsoon is important to prevent a large of losses in various fields. The precipitation pattern associated with the East Asian summer monsoon dynamical index, which includes the region in East Asia and the western North Pacific, appears a dipole pattern. In this study, the East Asian summer rainfall index (EASRI) and western North Pacific summer rainfall index (WNPSRI) are re-defined with the area averaging of precipitation in each region. In addition, these indices have a decadal variability as well as a large inter-annual variability for 1979-2016. In this study, their inter-annual and decadal variability are examined by applying the wavelet and pass filter analysis. We identify the distinct atmospheric and oceanic patterns and investigate the possible sources to cause the variabilities. While major sources of inter-annual variability for EASRI and WNPSRI are common, those of decadal variability are discerned. In the inter-annual variability aspects, the possible sources of EASRI (WNPSRI) are the warming (cooling) pattern in the northern Indian Ocean and western North Pacific region in low latitudes by the Pacific-Japan (PJ) pattern, and wave train and jet stream in mid-latitudes. However, the circum-global teleconnection (CGT) like pattern and mid-latitude jet stream have relatively high impact on the inter-annual variability of EASRI, compared to that of WNPSRI. In the decadal variability aspects, the negative IPO pattern plays a role as a source of only EASRI and the easterly wind and strengthened north Pacific subtropical high induce the southeasterly flow over East Asia. We examine the inter-hemispheric thermal contrast as a source of decadal variability of WNPSRI. As the pattern of Eurasian continental cooling and southern Indian Ocean warming occurs, anomalous large cyclonic circulation covers the Eurasian continent and North Pacific region.