Atmospheric rivers in East Asian summer monsoon: Subseasonal variability and their hydrological impacts

Chanil Park, Seok-Woo Son

School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea

Atmospheric river (AR), which is a narrow corridor along which a large amount of water vapor is transported, is known to play a crucial role in extreme rainfall events in midlatitudes. In this study, by using the newly-released ERA5 reanalysis, subseasonal variation of ARs and their impacts on moisture transport and monsoon rainfall within East Asian summer monsoon (EASM) are explored. In May-July, East Asian ARs are concentrated along the northern boundary of the North Pacific high where southwesterly monsoon flow is prevalent. As the North Pacific high expands, they gradually shift northeastward and decrease in August when the North Pacific high becomes dominant over Korea and Japan. In September-October, when EASM is disorganized, ARs are confined to the Pacific storm track in the open ocean. This distinct sub-seasonal variation of ARs determines 50-90% of anomalous moisture transport within EASM. More importantly, ARs contribute to 40-70% of monsoon rainfalls, especially those associated with heavy rainfall events. This result indicates that the anomalous water vapor transport and the associated rainfall in EASM are largely controlled by ARs rather than a quasi-stationary monsoon flow.

Key words: atmospheric river, East Asian summer monsoon, subseasonal variability, moisture transport, monsoon rainfall