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Transient versus quasi-stationary flavors of atmospheric rivers during East Asian summer monsoon

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Atmospheric rivers (ARs) are generally considered to be transient and concurrent with an extratropical cyclone (Ralph et al. 2018). However, this is not necessarily the case for the ARs in the East Asian summer monsoon (EASM). Despite several climatological surveys on the EASM ARs in recent years (e.g., Park et al. 2021a), through what processes they develop is still unclear because of the complex interplay between monsoonal and extratropical circulations in the region (Horinouchi 2014; Park et al. 2021b).

In this talk, we demonstrate that the EASM ARs have different “flavors” in terms of moisture transport characteristics. By quantifying the relative contribution of high- and low-frequency components of the integrated water vapor transport anomaly (IVTA) for each AR, it is found that both components are important in East Asia summer, in contrast to the ARs in the U.S. west coast where the high-frequency component is predominant.

To investigate the synoptic condition governing the high- and low-frequency IVTA, the EASM ARs are classified into the three categories—1) transient, 2) quasi-stationary and 3) intermediate ARs—depending on the fractional contribution of high-frequency IVTA to total IVTA. While the transient ARs are driven by an extratropical cyclone in an analogy of classical ARs, the quasi-stationary ARs are associated with an anomalously enhanced monsoon flow. The intermediate ARs, which are a majority of summertime ARs in East Asia, show the confounding features of the two types. We suggest that the concept of “transient” and “quasi-stationary” AR flavors offer an important foundation in understanding the EASM ARs with a variety of underlying dynamics. Further implications and possible future works will be also discussed.

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