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The Impacts of Dynamic and Thermodynamic Components on Late Summer Rainfall Anomalies over the Regional Asian Monsoons

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The present talk is to demonstrate the relative contributions of dynamic and thermodynamic components to the different regional Asian Monsoons such as Southwest, Western North Pacific Monsoon, and East Asian summer monsoon (EASM). Decomposing of moisture budget into the dynamic and thermodynamic components make to disentangle the sources of interannual variability of the summer monsoons. From analysis by the moisture budget, it is noted that the Asian monsoon is mostly caused by changes in winds (dynamic component); interestingly, changes in moisture (thermodynamic component) play an important role in monsoon rainfall anomalies only for East Asia (27.09%). In terms of the dynamic component over East Asia, strong continental heating, resulting in enhanced land-sea contrast, is identified as crucial to a local development of winds toward East Asia, and it ultimately strengthens a meridional wind, which is accompanied by the western North Pacific subtropical high. In addition, the negative winter North Atlantic Oscillation could induce the enhanced moisture advection term of the dynamic component over East Asia through barotropic Rossby wave propagation. The thermodynamic component has a localized effect on net precipitation at midlatitudes, with an enhanced wave train pattern with a zonal wavenumber-5, which reinforces the Okhotsk high. These distinct large-scale circulation patterns together create favorable conditions for heavy rainfall over East Asia when the two components are positively in-phase. Here I want to emphasize that the extreme heavy rainfall is noticeable when the Eurasian blocking occurs. This study is hopefully expected to improve the predictability of extreme rainfall in the regional monsoon regions.