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Moisture Source-to-Receptor Network for East Asian Summer Monsoon and the Associated Atmospheric Bridges

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There has been growing interest in studying precipitation recycling and identifying relationships between moisture sources and receptors. The network built upon the relationships is crucial for the knowledge of the atmospheric water cycle, weather prediction, and adaptation to hydroclimatic disasters. This study aims to provide an interesting perspective of a Source-to-Receptor (SR) network to study the dynamics of the East Asian Summer Monsoon (EASM). By prescribing 24 sources and 6 EASM subregions, the SR network during the wet season is quantified using the two-dimensional physically-based Dynamical Recycling Model (DRM). Results reveal that in addition to oceanic sources, land sources including the often-overlooked plateau regions play an important role in supplying moisture to most EASM subregions. A seesaw relationship of the Indian Ocean/South Asia sector from April to June and the Pacific Ocean/East Asia sector from July to September is evidenced in the intraseasonal variation of the SR network for EASM subregions including South China coast and Taiwan, Yangtze River basin, South Japan and Korean Peninsula. Conversely, weaker intraseasonal variation is seen in the SR network for the Yellow River basin and North China. During heavy rainfall days, the zonal oscillation of western North Pacific Subtropical High (WNPSH) is deemed crucial to modulate the SR network through enhanced contributions from Bay of Bengal, Indochina, Indian subcontinent and Southwest China (the Philippine Sea and western North Pacific) during the positive (negative) phase. Coupled circulations such as two distinct pressure dipoles and coherent upper-level wave trains from mid-latitudes are responsible for bridging the moisture routes. Lastly, preceding winter/springtime El Niño is likely associated with the enhanced (weakened) moisture supply from the southwesterly (Pacific Ocean) sources. Longer-term variabilities such as the Pacific Decadal Oscillation is also considered influential to the SR network. We believe that the attributable atmospheric bridges and the SR network itself can offer insights to the current understanding of EASM and model simulations of the monsoon systems and the water cycles.