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Detection of urban effects on precipitation in the Seoul metropolitan area, South Korea

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With growing urban population and expanding urban areas, the importance of understanding urban effects on precipitation keeps increasing. This study attempts to detect urban effects on precipitation in the Seoul Metropolitan Area (SMA), South Korea by analyzing hourly rain gauge data during 2005–2020. Precipitation events are categorized according to 850-hPa wind directions, and the precipitation increases from the upwind to downwind regions are examined for different duration and intensity classes of precipitation events. The downwind precipitation increase is largest in summer (39%), especially in August (64%). The August precipitation is analyzed in detail. Precipitation statistically significantly increases in Seoul for weak winds and 25–50 km downwind of the center of Seoul for westerly winds, and the precipitation increases are largest in the afternoon. For the precipitation increases, the increases in frequency and intensity of precipitation events are responsible. Short-duration and heavy precipitation events associated with small-sized precipitation systems initiated within the SMA are mainly responsible for the precipitation increases. The downwind precipitation increase also occurs for southwesterly, southerly, and southeasterly winds, but the increases are associated with large-sized precipitation systems.