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Madden–Julian Oscillation related to the prolonged heavy rainfall in East Asia in 2020

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In East Asia, unusually long-term and heavy rainfall in 2020 resulted in concentrated socio-economic damage and flooding. In this study, the characteristics of the Madden–Julian Oscillation (MJO) related to the prediction of heavy rainfall in East Asia were analyzed using the sub-seasonal to seasonal (S2S) prediction model. In 2020, unusually high precipitation fell in East Asia, compared to an average year, for an extended time. Precipitation was concentrated from the end of June to the middle of August; therefore, the analysis was carried out with an initial model date of July 2, 2020, while the lead-time was selected 1–31 day (July 3 to August 1). The model underestimated cumulative precipitation compared to observations, with KMA and UKMO having the lowest errors and ECMWF and CMA having the largest errors. The 850-hPa position altitude and wind field anomaly was analyzed and averaged over the prediction period. The results revealed that models with large errors showed different locations for the western and northern boundaries of the high pressure in the western North Pacific region, relative to observations, or else underestimated the size of the high-pressure zone. Based on the MJO prediction phases for July in the S2S models, models with good precipitation prediction performance in East Asia mainly showed phases 1–3 that were similar to observations and their amplitudes were also large. In contrast, models with poor prediction performance exhibited fewer instances of phases 1–3 on strong days or their amplitudes were small. This suggests that if an S2S model predicts the characteristics of the MJO accurately, similar to observations, it could improve predictions of summer precipitation in East Asia.

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