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Subseasonal Predictability of East Asian Summer Circulation Patterns in GloSea6

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The East Asian summer is characterized by frequent extreme weather events, such as high-temperature events and heavy rainfall, which have significant socioeconomic impacts. These events are strongly influenced by the modulation of large-scale atmospheric circulation patterns, defined as quasi-stationary spatial arrangements of high and low-pressure systems that govern the weather of a region for several days to weeks. Consequently, identifying and predicting these key patterns is of significant importance. In this study, we objectively classify the major atmospheric circulation patterns over East Asia into 12 modes by applying a K-means clustering algorithm to the daily 500hPa geopotential height field from the ERA5 reanalysis dataset (1979-2020) for the boreal summer (JJA).

The reanalysis data revealed a recent decreasing trend in the frequency of modes associated with Korean Peninsula high-temperature events, alongside an increasing trend in modes associated with summer precipitation events. An analysis of the performance of GloSea6 showed that while the 1-2week predictability for summer precipitation-related modes remained stable or slightly increased compared to the past, the predictability for high-temperature-related modes has significantly decreased in recent years. This finding suggests a considerable degradation in the forecasting capability of the model for a specific type of extreme weather (high-temperature events) within a changing climate. This research provides a framework for objectively diagnosing the performance of a model for specific circulation regimes, contributing to a better understanding of the potential and limitations of subseasonal predictability for extreme weather in East Asia.

Keywords: East Asia, K-means clustering, GloSea6, predictability

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