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The impact of large-scale atmospheric patterns on Heatwaves in summer Northern China based on Self-Organizing Map

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Heatwave is affected by large-scale atmospheric circulation on temperature-related climates in the context of global warming. Recently Northern China have experienced an increase in heatwaves which is partly due to the atmospheric circulation. This study aims to address the influence clearly. Northern China heatwaves are computed on excess hot factor (EHF) and the five EHF indexes are studied afterwards to get a picture of heatwaves in summer Northern China. China circulation patterns are classified into nine typical circulation patterns on self-organizing map (SOM) which then can be described quantitatively by pattern factors: frequency, persistence and maximum persistence. Pearson correlation analysis and stepwise regression analysis are applied for exploring the impact. Results show the spatial pattern of the times of individual heatwave event (HWN) and the days of the longest heatwave duration (HWD) are high value everywhere in Northern China. The overall EHF indexes all rising in time series ($P<0.05$) and the regional heatwave occurrence have trends of 0.79 day per year ($P<0.05$). However, the factors of the patterns show inconspicuous tendency. Two patterns with significant correlations ($P<0.05$) are proved to be suggestive of Okhotsk Sea high and West Pacific Subtropical High. It declares that the Okhotsk Sea high favors Northern China heatwave occurrence rather than subtropical high: the warm center over Okhotsk Sea transfer heat upper and west, generating the high temperature and persist high pressure system, causing heatwave happening in summer Northern China. The two related atmospheric circulation patterns explain 38% of the heatwave occurrence based on stepwise regression model, the Okhotsk Sea high gets the coefficient of 0.443 and the subtropical high is -0.347.