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Which type of WNPSH indices can be better applied, defined by the geopotential height, the eddy geopotential height, or the stream function?

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The western North Pacific subtropical high (WNPSH) is a crucial circulation system affecting weather and climate over China. To quantitatively measure its strength and spatial pattern, the geopotential height was firstly used to define WNPSH indices (H indices). However, due to global warming, the H indices have shown significant increasing trends in recent decades, causing some disturbance to reveal the interdecadal variation of WNPSH. Then, the eddy geopotential height (He indices) and stream function (R indices) have been successively used to redefine WNPSH indices to reflect the WNPSH's actual interdecadal variation. Here, for further understanding the performances of these three types of WNPSH indices in the interannual variability, some comparisons have been made by using various statistical methods and machine learning models. The results show that, in the statistical characteristics, the He and R indices have normal distributions and are stationary time series with no systematic changes over time, while the H indices do not. Regarding the indication for summer precipitation in eastern China, the R indices perform well generally, but the other two types of indices are better in indicating regional precipitation. Also for predictability, the temporal correlation coefficients between the prediction results and the R indices are above 0.80, the same as the H indices which are used in operational applications until now. Overall, the R indices have obvious advantages whatever statistical characteristics or indication for precipitation. Using R indices as a benchmark to further improve indication of regional precipitation can provide more references for future operational applications.