Relationship between daily atmospheric circulation patterns and daily precipitation over Iran

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Abstract

The present study investigates the relationship between large-scale atmospheric circulation patterns and precipitation over Iran. On the basis of the location of the dominant centres of action, large-scale daily atmospheric circulation maps have been classified into twelve circulation patterns (CPs) by applying PCA to the 500 hPa geopotential height fields coupled with the K-means clustering technique.

To link daily CPs to daily precipitation variability over Iran we used daily gridded precipitation dataset with 0.5 × 0.5 degree spatial resolution, provided by Asian Precipitation-Highly-Resolved Observational Data Integration Towards Evaluation of the Water Resources (APHRODITE's Water Resources). For this purpose we computed the Performance Index (PI) for daily precipitation at 638 regularly spaced grids over the country with 0.5 × 0.5 degree spatial resolution. The PI index provides a measure of the relative contribution of a given CP to the total precipitation amount. Results suggest that statistically significant relationship exist between the identified CPs and precipitation occurrences over Iran. We found that most CPs have minor contribution to precipitation occurrences over Iran. However, two out of the 12 identified CPs are responsible for precipitation occurrences over the majority portion of the target area, while some others may contribute to precipitation occurrences in some parts of the country. On the basis of the obtained results the identified CPs can be categorized into precipitation produce CPs and dry weather CPs. The results also demonstrate the influencing areas corresponding to each precipitation producing CP by which it is possible to characterize the precipitation regime over the target area.

Key words: Weather types, Principal Component Analysis, Cluster Analysis, Atmospheric Circulation Patterns, PI, Precipitation, Iran.