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Factors Influencing Markov Chains Predictability Characteristics, Utilizing *SPI*, *RDI*, *EDI* and *SPEI* Drought Indices in Different Climatic Zones

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Abstract Comparability analyses were carried out to investigate behavioural aspects of effective drought index (*EDI*), standardized precipitation index (*SPI*), reconnaissance drought index (*RDI*) and standardized precipitation evapotranspiration index (*SPEI*), considering 3-month, 6-month and annual time periods. Investigations included parametric/non-parametric correlation analysis among indices, climatic zone influence, record length impacts and evapotranspiration role (*RDI* and *SPEI*) on Markov chains predictability characteristics. Except for the *EDI*, all indices/cases (all climatic zones) showed significant correlation. In arid/semi-arid climates, the 3-month and 6-month maximum drought severities were detected by the *RDI* and annual maximum drought severities were detected by the *SPEI*, emphasizing the evapotranspiration influence. In all climatic zones, the *EDI* values for wet (dry) periods were higher (lower), compared to other indices. First order dependency was detected for the *EDI* (all cases) and the *SPI* (most cases), over entire period (1951–2011) and sub-periods [(1951–1981), (1982–2011)]. The largest number of second order dependency was detected by the *SPEI*, followed by a relatively large number of such cases by the *RDI* (3-month time period), for the 61-year data period. This research showed that several factors influence Markov chains predictability characteristics in drought studies, particularly the impact of record length and evapotranspiration (*RDI* and *SPEI*) were confirmed.

Keywords Comparability analyses · Markov chains order dependency · Meteorological drought indices (*SPI*, *RDI*, *EDI*, *SPEI*) · Evapotranspiration role · Record length influence

1 Introduction

Drought indices are continuous functions of rainfall and/or temperature, river discharge or other measurable hydro-meteorological variables, commonly used to quantify the definition

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