Appropriateness of Clustered Raingauge Stations for Spatio-Temporal Meteorological Drought Applications

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Abstract Appropriateness of optimum clusters of raingauge stations (obtained from validated clustering techniques), is investigated for spatio-temporal meteorological drought applications. The study area is the semi-arid Karkheh watershed (western Iran), representing 16 raingauge stations with 41 years of data. The Kendall-tau and Mann-Kendall tests detected annual rainfall data dependency and significant temporal trend. A boxplot approach identified rainy months for SPI drought analysis (time scales of 3-, 6-, 9- and 12-month). Validity assessment of nine clustering techniques detected five clusters (all time scales) as being optimum. Validity indices detected combination of station geographical location/mean annual precipitation for data clustering as the best solution for 3-month SPI and combination of station geographical location/mean maximum SPI for longer time scales (the 3-month time scale indicating slightly different station combination). Cluster appropriateness for spatio-temporal drought applications was based on achievement of relative coherency, observed among SPI time series graphs of member stations. Coherency achievement required removal of at least one member from every cluster (all time scales). Non-coherent SPI time series behaviour was observed in one cluster with two members (time scales>3-month). Few clusters had one member. According to results, clustered raingauge coherency should be considered prior to spatio-temporal meteorological drought applications.

Keywords Clustering techniques · Cluster validation and selection · SPI time series data · SPI time scale

1 Introduction

Drought as normal recurrent feature of climate is identifed by a deficiency in moisture availability over an extended period. Among the well-known drought categories, meteorological drought deals with deficiency in precipitation. Drought events and characteristics are

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