

Detect anomalies and extreme events in meteorological series data

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Abstract

The objective of this research was to study the rainfall variability in the South of Brazil in terms of homogeneous areas for extreme events. It was applied the K-means algorithm (cluster) and the Regional Frequency Analysis technique to a daily time series of precipitation data from the National Water Agency (ANA) (1981-2010). The results indicated 8 precipitation homogeneous regions and in each of them can occur extreme precipitation events exceeding at least 100mm daily.

Key words: Times series, Rainfall, Regional Frequency Analysis.

Introduction

The meteorological events can be classified into normal or extreme events. According to the Special Report (IPCC, 2012), an extreme event is defined as “the occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends (“tails”) of the range of observed values of the variable”. The objective of this study was to identify homogeneous areas of precipitation and the occurrence of extreme events in the south region of Brazil.

Results and Discussion

Daily precipitation time series from weather stations of the National Water Agency (ANA), from 1981-2010 were evaluated. The K-means algorithm – cluster technique based on Euclidean distance metric was applied to identify the homogeneous precipitation zones. The Regional Frequency Analysis Technique (Hosking and Wallis, 1993) was applied for the extreme precipitation event evaluation. The results indicated 8 precipitation homogeneous regions (Figure 1).

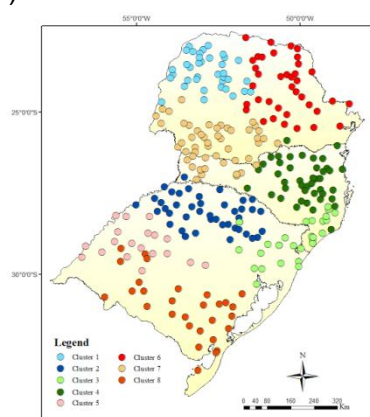


Figure 1. Homogeneous precipitation regions in the South region - Brazil.

Table 1. Return periods

Cluster	Average (daily maximum)	Return 5 years	Return 10 years	Return 50 years
1	93mm	1.20	1.36	1.73
2	100mm	1.21	1.37	1.72
3	86mm	1.21	1.38	1.72
4	85mm	1.21	1.39	1.79
5	107mm	1.21	1.36	1.68
6	85mm	1.20	1.37	1.75
7	102mm	1.21	1.37	1.72
8	100mm	1.27	1.45	1.74

The table 1 shows that the precipitation daily maximum can return 20% higher than the average daily maximum in a five year return period for cluster 1 i.e. 112mm/5years. For cluster 8 the five year return period can be 127mm/5years or 27% higher than 100mm (the average daily maximum for cluster 8).

Conclusions

The K-means clustering technique was efficient to identify homogeneous areas with extreme daily rainfall, considering the main assumption of homogeneity for the Frequency Analysis Regional Analysis.

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