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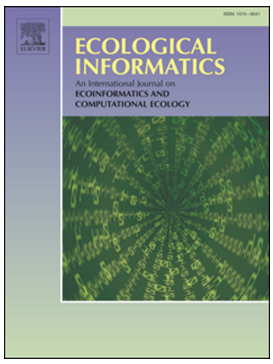

A new fuzzy time series model based on robust clustering for forecasting of air pollution

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ACCEPTED MANUSCRIPT

A NEW FUZZY TIME SERIES MODEL BASED ON ROBUST CLUSTERING FOR FORECASTING OF AIR POLLUTION

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Abstract

In this study, a new Fuzzy Time Series (FTS) model based on the Fuzzy K-Medoid (FKM) clustering algorithm is proposed in order to forecast air pollution. FTS models generally have some advantages when compared with other techniques used in forecasting of air pollution as they do not require any statistical assumptions on time series data; and they provide succesful forecasting results even in situations where the number of observations is small and where data sets include uncertainity, still allowing for generalization. But existing FTS models based on fuzzy clustering fail in modeling of data sets that include outliers such as air pollution data. The potential superiority of the proposed model is to be a robust technique for outliers and abnormal observations. In order to show the performance of the proposed method in forecasting of air pollution, a time series consisting of SO_2 concentrations measured in 65 monitoring stations in Turkey are used. According to the results of analyses, it is observed that the proposed method provides successful forecasting results especially in time series which include numerous outliers.

Keywords: Fuzzy time series, Time Series Analysis, Clustering Analysis, Fuzzy K-Medoid clustering, Forecasting, Air pollution

1. Introduction

Air pollution can be defined as the presence of harmful substances such as carbon monoxide (CO), ozone (O_3), particulate matter (PM), nitric oxide (NO), and nitrogen dioxide (NO_2) in the atmosphere at higher concentrations than their normal ambient rates in such that they cause damage to human health, other living creatures, ecosystems and the environment. Developing early warning systems and providing information on air pollution with forecasting is one of the most effective ways of preventing negative effects on human health and improving life quality. So far, several techniques, fundamentally creating two main categories, have been used in order to forecast air pollution: statistical and soft computing. The main objective of all these methods is analyzing past

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