Modeling and Forecasting Particulate Matter (PM10) Concentrations in the Caribbean Area

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The aim of this study is to model and predict the concentrations of particulate matter whose aerodynamic diameter is less than or equal to 10 μm (PM10). In this work, we focused on the forecasting of PM10 data and the heteroskedasticity behavior of their residual variance using the **S**easonal **A**uto**R**egressive **I**ntegrated **M**oving **A**verage (*SARIMA*) and the **G**eneralized **A**uto**R**egressive **C**onditional **H**eteroskedastic (*GARCH*) processes. They model PM10 data in Guadeloupe (GPE) and Puerto Rico (PR) based on seasonality of African dust and extreme events. First, the issue of missing data is addressed using algorithms that we have proposed. Then, the coupled *SARIMA-GARCH* model was developed and compared with empirical PM10 data [1]. The *SARIMA* process is representative of the main PM10 sources, while the heteroskedasticity of its residual errors is also taken into account by the *GARCH* process. In this framework, the PM10 data from GPE and PR are decomposed into the sum of the background atmosphere (B_t = anthropogenic activities + marine aerosol), African dust seasonality (S_t = mineral dust) [2], and the extreme events processes (C_t) [3]. Akaike's information criterion (*AIC*) helped us to choose the best model. Forecast evaluation indexes such as the Mean Absolute Percentage Error (*MAPE*), the Mean Absolute Scale Error (*MASE*), and Theil's U statistic provided significant results. Specifically, the *MASE* and U values were found to be almost zero [4]. Thus, these indexes validated the forecasts of the coupled *SARIMA-GARCH* model. To sum up, this coupled model is an effective tool for predicting the behavior of PM10 in the Caribbean area.

Keywords : PM10 ; Coupled SARIMA-GARCH model ; heteroskedasticity ; forecast ; Caribbean area.

References

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