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Simulation And Forecasting of Daily Pm10 Concentrations Using Autoregressive Models In Kagithane Creek Valley, Istanbul

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A time series approach using autoregressive model (AR), moving average model (MA) and seasonal autoregressive integrated moving average model (SARIMA) were used in this study to simulate and forecast daily PM10 concentrations in Kagithane Creek Valley, Istanbul. Hourly PM10 concentrations have been measured in Kagithane Creek Valley between 2010 and 2014 periods. Bosphorus divides the city in two parts as European and Asian parts. The historical part of the city takes place in Golden Horn. Our study area Kagithane Creek Valley is connected with this historical part. The study area is highly polluted because of its topographical structure and industrial activities. Also population density is extremely high in this site. The dispersion conditions are highly poor in this creek valley so it is necessary to calculate PM10 levels for air quality and human health. For given period there were some missing PM10 concentration values so to make an accurate calculations and to obtain exact results gap filling method was applied by Singular Spectrum Analysis (SSA). SSA is a new and efficient method for gap filling and it is an state-of-art modeling. SSA-MTM Toolkit was used for our study. SSA is considered as a noise reduction algorithm because it decomposes an original time series to trend (if exists), oscillatory and noise components by way of a singular value decomposition. The basic SSA algorithm has stages of decomposition and reconstruction. For given period daily and monthly PM10 concentrations were calculated and episodic periods are determined. Long term and short term PM10 concentrations were analyzed according to European Union (EU) standards. For simulation and forecasting of high level PM10 concentrations, meteorological data (wind speed, pressure and temperature) were used to see the relationship between daily PM10 concentrations. Fast Fourier Transformation (FFT) was also applied to the data to see the periodicity and according to these periods models were built in MATLAB an Eviews programmes. Because of the seasonality of PM10 data SARIMA model was also used. The order of autoregression model was determined according to AIC and BIC criteria. The model performances were evaluated from Fractional Bias, Normalized Mean Square Error (NMSE) and Mean Absolute Percentage Error (MAPE). As expected, the results were encouraging.

Keywords: PM10, Autoregression, Forecast

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