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CROSS-SPECTRUM ANALYSIS APPLIED TO AIR POLLUTION TIME SERIES FROM SEVERAL URBAN AREAS OF ROMANIA

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Abstract

The paper presents the application of cross-spectrum analysis (CSA) to air pollution and meteorological time series collected from seven air quality monitoring stations located in three urban agglomerations of Romania, affected by industrial and traffic pollution: Braşov, Ploieşti and Târgovişte. Data have been collected from November 2011 till March 2012, at one hour sampling rate. The purpose of the analysis was to reveal the correlations between two series at different frequencies. The *in-sync* interaction assessments started from the cross-periodogram, which was realized by smoothing using Parzen window. All computed cross-amplitude values were interpreted as a measure of covariance between the respective frequency components in the two series, selecting five highest peaks with the associated corresponding periods, which were filtered out and decreasingly ranked. The results show an important contribution of short-term fluctuations (12 hours and 24 hours periods) to the total variance for the analyzed pollutants (nitrogen dioxide, sulfur dioxide and suspended particles), with significant dependence on the meteorological factor (incident radiation, air temperature or relative humidity) and less on the site conditions. Many significant bivariate correlations were also observed in the total of 48 possible pollutant – meteorological factor pairs: 33 ($p < 0.01$) and 3 ($p < 0.05$). This type of data analysis might help the identification of constants or patterns characterizing the interactions between variables, which is a useful tool for the parameterization and calibration of air pollution models.

Key words: air pollution, cross-spectrum analysis, meteorological data, time series

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