THE INFLUENCE OF THE METEOROLOGICAL CONDITIONS ON THE EXTREME HIGH PM_{10} CONCENTRATIONS IN HUNGARIAN URBAN AREAS

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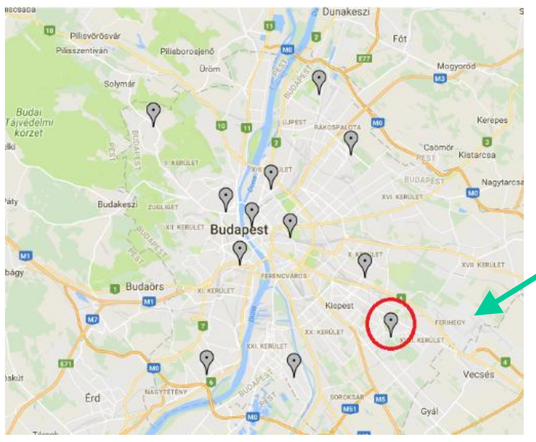
INTRODUCTION

Nowadays particulate matter (PM) is one of the most frequently mentioned pollutants since it has many negative impacts on the ecosystem, built environment and especially on human health.

Local and regional meteorology, including wind speed, wind direction, atmospheric stability, long-range transport and pollution dispersion are all factors that play an important role in PM concentration reduction strategies. Analysis of local and regional meteorology is important to fully understand the processes responsible for the spatial and temporal distribution of PM in all geographic regions.

In this work, the effects of meteorological parameters on mass concentrations of particles with an aerodynamic diameter of 10 µm or less (PM_{10}) and their seasonal behaviour were investigated.

AIR QUALITY MONITORING NETWORK OF BUDAPEST



TEMPORAL VARIATION OF THE CONCENTRATION OF PM_{10}

It was observed that mostly during the heating season concentration values above the threshold value can be detected. Figure below shows the number of times in a year when PM_{10} concentrations exceeded the threshold value between 2006 and 2015.

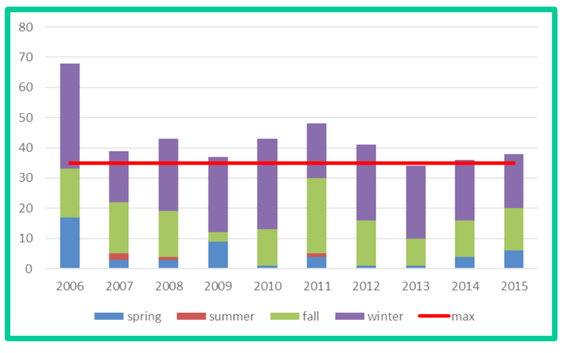
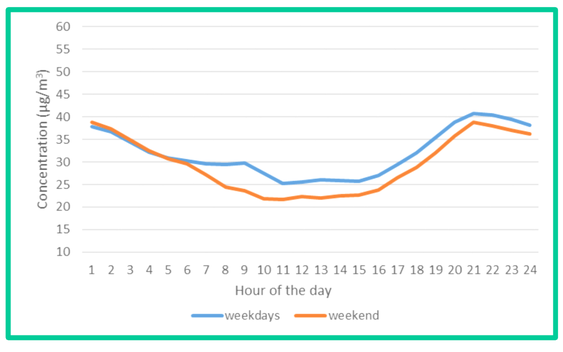
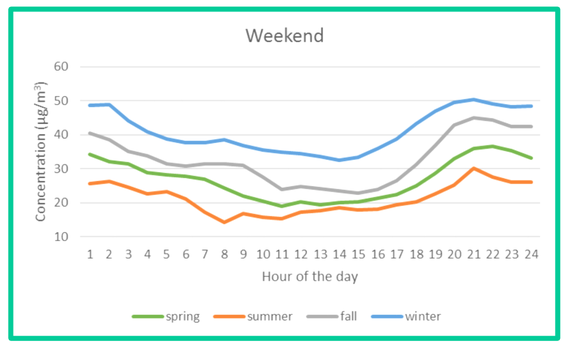
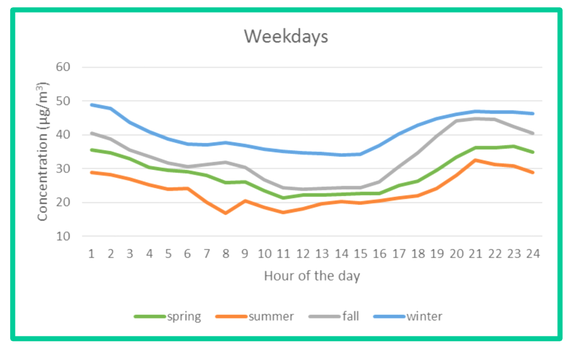


Figure below shows the diurnal variations of PM_{10} concentrations in Budapest Gilice tér station during the weekdays and weekends of the year.

Figures on the right hand side show the average diurnal variations of PM_{10} concentrations seasonally. The four seasons are displayed separately.







REGRESSION ANALYSIS

Correlation coefficients between PM_{10} and several meteorological parameters:

	spring	summer	fall	winter
temperature (°C)	-0,17	0,15	-0,22	-0,42
visibility (m)	-0,40	-0,29	-0,45	-0,46
wind direction	-0,16	-0,21	-0,25	-0,23
wind speed (m/s)	-0,29	-0,21	-0,36	-0,42
relative humidity (%)	0,11	0,06	0,26	0,20
pressure (hPa)	0,13	0	0,24	0,21
global radiation (J/cm²)	-0,25	-0,24	-0,23	-0,12

The aim of our regression analysis was to determine the meteorological situation in which the PM_{10} concentration is expected to exceed the 50 μgm^{-3} concentration limit.

The outcome of our regression analysis makes it possible to predict whether the PM_{10} concentration in an exact situation will exceed the 50 μgm^{-3} value or not.

The equation, which predicts the PM_{10} concentration using the values of temperature (T), visibility (V) and wind speed (WS) is:

$$PM_{10}=59.09 - 1.67*[T] + 0.0006*[V] - 3.91*[WS], \quad R^2=0.32$$

This equation is not able to forecast the exact PM_{10} concentration, it just indicates, whether the concentration will be over 50 μgm^{-3}or not.

ACKNOWLEDGEMENTS

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CONCLUSIONS

As a result of our investigation, it can be stated that the meteorological conditions have significant roles in the development of smog situations in Budapest in winter.

The results of our regression analysis showed that the concentration of PM_{10} is associated with specific meteorological parameters. However, the results in this study show that the relationship between PM_{10} and each meteorological parameter is not too strong.