The impact of extreme weather events on air quality in Budapest, Hungary

V. Gácser[1], A. Molnár[2]

[1]Department of Earth and Environmental Sciences, University of Pannonia, Veszprém, P.O. Box 158, H-8201, Hungary
[2]MTA-PE Air Chemistry Research Group, University of Pannonia, Veszprém, P.O. Box 158, H-8201, Hungary
Keywords: heat-wave, air pollutants, visibility
Presenting author email: gacserv@mk.uni-pannon.hu

Weather and climate extreme events frequently lead to negative effect on air quality, mainly in urban areas. It is well known, that atmospheric stability highly influences the concentrations of different air pollutants due to hindering both the vertical and the horizontal movements in the air. High pressure weather systems which bring typical stable situations occur frequently in the Carpathian Basin both in summer and wintertime.

In winter, when a high pressure builds over Hungary, it usually develops low-level inversion and fog that can become persistent. Consequently this results in extremely low visibility as well as elevated concentrations of the air pollutants, like PM10, SO_2, soot, etc., which frequently exceeds the health limit. High pressure system can also cause stable air stratification in summertime. Due to high irradiation and temperature intensive photochemical reactions take place in the lower troposphere. Among others the higher concentration of tropospheric O_3, NO_X, and decreasing visibility allude to development of photochemical smog. These air pollution episodes take place usually in dry, hot periods which frequently related to heat-waves. Climate simulations indicate a drying climate in Hungary with more extreme temperature events (IPCC 2012; HREX 2012). On the basis of long term data analysis more hot days, longer heat-waves and longer dry periods can already be registered in Hungary (Bartholy *et al*, 2007, 2010)

The aim of this work is to study how weather situations leading to extreme air pollution episodes. Two special years, 2010 and 2011 were chosen for this analysis. In 2010 excessively high amount of precipitation (170% of the yearly average amount) has occurred, while 2011 was extreme dry (yearly precipitation 70% of average amount) and warm with a few heat-waves. In this work the air quality (SO_2, NO_2, NO_x, O_3, PM10) (www.kvvm.hu/olm), as well as meteorological data (temperature, precipitation, air pressure, visibility) are evaluated (Integrated Surface Hourly Observations, NOAA National Data Center) at Marczell György Main Observatory, Budapest. In addition, the analyzed synoptic weather maps from these periods (www.met.hu) are also studied.

Our preliminary result show, that especially the concentration of the PM10 and tropospheric ozone follows the changing of the weather situation. PM10 episodes were monitored in both years that were connected to high pressure systems in fall and wintertime. During these events PM10 concentration frequently exceeded the heath limit (24-hours, 50 μgm^{-3}). On the other hand in summer the severe air pollution episodes can be characterized by ozone concentration. In 2010 – the whole summer was rather changeable and wet – the daily ozone concentration ranged between 40 and 70 $\mu g/m^3$; and during only two shorter stable periods the ozone concentration exceeded 70 $\mu g/m^3$. The summer in 2011 was much dryer with much more sunshine, and even the means daily ozone concentration was higher than in 2010; it ranged between 55 and 85 $\mu g/m^3$.

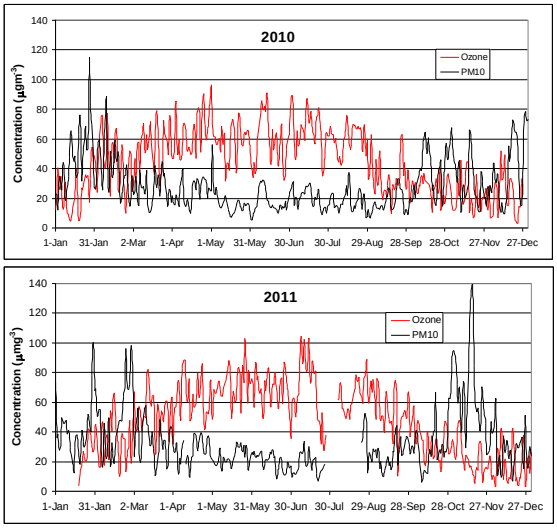

Figure 1: Daily PM10 and ozone concentration in Budapest, Hungary.

This work was supported by TÁMOP-4.2.2.A-11/1/KONV-2012-0064 Project.

IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, et al (eds.)]. Cambridge University Press.

HREX: Hungarian Report on Extreme Events; 2012

Bartholy, J, Pongrácz, R. (2010) *Physics and Chemistry of the Earth* **35**, 43-51

Bartholy, J, Pongrácz, R. (2007) *Global Planetary Change* **57**, pp. 83-95