Journal of the Serbian Chemical Society
JSCS@tmf.bg.ac.rs • www.shd.org.rs/JSCS
J. Serb. Chem. Soc. 79 (10) S150–S153 (2014)

SUPPLEMENTARY MATERIAL TO

Adaptive-network-based fuzzy inference system (ANFIS) model-based prediction of the surface ozone concentration

MARIJA SAVIĆ, IVAN MIHAJLOVIĆ*, MILICA ARSIĆ and ŽIVAN ŽIVKOVIĆ

University of Belgrade, Technical Faculty in Bor, Management Department, Vojske Jugoslavije 12, 19210 Bor, Serbia

J. Serb. Chem. Soc. 79 (10) (2014) 1323–1334

EXPERIMENTAL DETAILS

Geography

Banat is the part of the Pannonia Plain bordered by the Danube to the south, the Theiss to the west, the Mures to the north and the southern Carpathians to the east (Fig. S-1). The Serbian part of Banat is an area of 8.997 square kilometers located at the northeast of Serbian. The city of Zrenjanin is the center of this region, occupying 1326 km^2, with a population of about 80.000. From the whole territory that belongs to this municipality, 82.5 % is covered by large-scale farmlands. This area is part of a region with a humid continental climate; the average annual temperature is 11.2 °C and rainfall per year is 622 mm. The wind direction is mostly east, southeast or northwest. The average number of sunny hours in the area is 2,000 to 2,200 per year.[1] The Banat is one of the most fertile regions in Europe. All types of wheat and corn are the main agricultural crops of this region. This region is also convenient for the growth of sugar beet and tobacco. Large-scale industrial facilities include agro industry, milling, brewing industry, sugar production, textile industry, and brick production. Furthermore, oil and natural gas are exploited in the region. Most of the agricultural sorts that are grown in Banat are vulnerable to the ozone air pollution.[2]

Air quality monitoring and meteorological data and data collection

The coordinates of the measurement station are 45° 23′ 0.80″ and 20° 23′ 24.53″ at the altitude of 75 m above sea level. The measurements are repeated at 2 min intervals, with calculation of the hourly average value for each hour in the 0–24 interval. The results of the measurements are publicly available at http://www.eko.vojvodina.gov.rs/?q=node/272. The measurements, calibration of the equipment, quality control and standardization are organized by the Regional Committee for Environmental Protection and Sustainable Development, located in Novi Sad, the administrative capital of the Vojvodina Province. The meteorological parameters: wind speed and wind direction, air temperature and humidity, rainfall per year and solar radiation intensity are measured at the same measuring station as the air pollutants. The limiting value of O_3 in the air prescribed by EU is 80 μg m^{-3} using the 1-h values measured between 08.00 and 20.00 hours Central European Time (CET) each day.[3]

* Corresponding author. E-mail: imihajlovic@tf.bor.ac.rs

Fig. S-1. The investigated Serbian Banat region and its position in Europe.

The main motive of the investigations presented in this article was to draw conclusions about the possibilities of predicting the O_3 concentration in the ambient air under different environmental conditions and based on the influence of different input parameters. These input parameters were divided in three groups: the first group consisted of only inorganic compounds (SO_2, NO, NO_2, NO_x, CO, H_2S and PM_{10}); the second group contained the volatile organic compounds (benzene, toluene, *m*- and *p*-xylene, *o*-xylene and ethylbenzene) and the third group consisted only of the meteorological parameters (wind direction, wind speed, air temperature, solar radiation and relative humidity). Constituents of the first group (NOx) were labeled as $X_{1.1}$ to $X_{1.7}$, respectively. In same manner, constituents of the second group (VOCs) were labeled as $X_{2.1}$ to $X_{2.5}$, respectively. Constituents of the third group (meteorological parameters) were labeled as $X_{3.1}$ to $X_{3.5}$, respectively. The output parameter (labeled Y), the predictability of which was analyzed, is the ozone concentration in the ambient air surrounding the rural area near the city of Zrenjanin (Banat, Serbia).

TABLE S-I. Correlation matrix for the input ($X_{1.1}$–$X_{3.6}$) and the output (Y) variables of the investigated occurrence (the number of data points for each variable was 1477) ; correlations in bold are significa nt at the 0.01 level (2 -tailed); correlations in italic are significant at the 0.05 level (2-tailed)

	Y Ozone	$X_{1.1}$ SO_2	$X_{1.2}$ NO	$X_{1.3}$ NO_2	$X_{1.4}$ NOx	$X_{1.5}$ CO	$X_{1.6}$ H_2S	$X_{1.7}$ PM_{10}	$X_{2.1}$ Benzene	$X_{2.2}$ Toluene	$X_{2.3}$ *m,p*-Xylene	$X_{2.4}$ *o*-Xyelene	$X_{2.5}$ Ethylbenzene	$X_{3.1}$ Wind direction	$X_{3.2}$ Wind speed	$X_{3.3}$ Temp.	$X_{3.4}$ Rad.	$X_{3.5}$ Hum.
Y	1																	
$X_{1.1}$	-0.042	1																
$X_{1.2}$	**-0.159**	**0.109**	1															
$X_{1.3}$	-0.006	**0.635**	-0.045	1														
$X_{1.4}$	**-0.197**	**0.264**	**0.764**	**0.173**	1													
$X_{1.5}$	*-0.066*	**0.231**	**0.746**	0.041	**0.655**	1												
$X_{1.6}$	**-0.166**	**0.276**	**0.823**	**0.140**	**0.963**	**0.835**	1											
$X_{1.7}$	*0.059*	**0.120**	**0.273**	-0.035	**0.266**	**0.410**	**0.341**	1										
$X_{2.1}$	**-0.362**	0.006	0.018	**-0.112**	-0.010	**0.225**	**0.072**	**0.299**	1									
$X_{2.2}$	**-0.211**	-0.014	**0.082**	**-0.109**	0.026	**0.303**	**0.126**	**0.258**	**0.884**	1								
$X_{2.3}$	**-0.227**	0.009	**0.133**	*-0.074*	**0.080**	**0.333**	**0.176**	**0.244**	**0.824**	**0.977**	1							
$X_{2.4}$	**-0.355**	0.033	**0.144**	-0.029	**0.097**	**0.307**	**0.178**	**0.224**	**0.829**	**0.927**	**0.956**	1						
$X_{2.5}$	-0.339	0.044	**0.160**	-0.026	**0.111**	**0.328**	**0.197**	**0.231**	**0.821**	**0.929**	**0.966**	**0.968**	1					
$X_{3.1}$	-0.033	**-0.150**	*-0.052*	-0.018	**-0.093**	**-0.088**	**-0.100**	-0.050	-0.038	-0.050	-0.040	-0.001	-0.014	1				
$X_{3.2}$	-0.124	**0.257**	**-0.237**	0.012	**-0.137**	**-0.293**	**-0.205**	**-0.172**	**0.073**	0.030	0.017	0.027	0.011	**-0.07**	1			
$X_{3.3}$	**0.647**	0.030	0.073	**0.221**	0.016	**0.181**	**0.075**	**0.076**	**-0.302**	*-0.057*	-0.024	**-0.108**	**-0.101**	-0.023	**-0.227**	1		
$X_{3.4}$	**0.359**	**0.128**	0.006	**0.154**	-0.009	0.004	-0.007	-0.041	-0.042	0.031	*0.052*	0.040	0.041	-0.001	**0.183**	**0.512**	1	
$X_{3.5}$	**-0.496**	**-0.209**	-0.070	**-0.180**	-0.005	**-0.287**	**-0.105**	-0.034	0.023	**-0.143**	**-0.165**	**-0.111**	**-0.114**	**0.142**	-0.042	**-0.692**	**-0.613**	1

REFERENCES

1. Republic Hydrometeorological Service of Serbia, http://www.hidmet.gov.rs/eng/osmotreni/index.php (accessed in January 2014)
2. I. Fumagalli, B. S. Gimeno, D. Velissariou, L. de Temmerman, G. Mills, *Atmos. Environ.* **35** (2001) 2583
3. Directive EU 2002/3/EC, *Relating to ozone in ambient air*, *Official Journal of the European Union*, 2002.