Air Pollution in Tbilisi in the Winter Fogs

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Introduction

Several studies have reported that atmospheric pollution is associated to a changeability of the some atmospheric parameters, including fogs (Amirnashvili et al, 2010). From other side the fogs also influence on air pollution – London type of smog, etc. (Amirnashvili et al, 2012). In this work results of an analysis of the influence of fogs on air pollutions in Tbilisi (the capital of Georgia) in December – February 2009-2011 at the windless weather are presented.

Experimental

The measured parameters: radon content (Rn, Bq/m^3) - catalyst of the secondary aerosols formation; sub-micron aerosols by diameter ≥ 0.1 mcm (N, cm^{-3}) and ozone (O_3, mcg/m^3) content - air pollution components; summary small ions concentration (n, cm^{-3}) - air purity indicator, (Amirnashvili et al, 2011, 2012). Measurements into 9, 12, 15 and 17-18 hours were conducted. The presence of fogs was determined visually.

The comparison of the values of the indicated parameters in the cases with the fogs and during the cloudless atmosphere is carried out lower. The estimation of difference between the investigated parameters was evaluated according to Student's criterions with the level of significance $\alpha \leq 0.15$. Linear correlation between the indicated parameters is studied. Minimum value of coefficient of correlation R for cases with the fogs is equal 0.25 and during the cloudless atmosphere – 0.20 (α = 0.15). The dimensionality of the investigated parameters are omitted further to be more convenient.

Results and discussion

As it follows from table 1 in cases with fog in comparison with cloudless atmosphere the mean values of Rn and N increase by 14 and 116 %, bat values of n and O_3 - decrease by 17 and 69 % respectively (air in the fogs is dirtier than in the cloudless weather).

Between all indicated parameters the significant correlation is observed ($\alpha \leq 0.15$). It is remarkable, that in the cases with the fog the processes of the catalyzation of formation of aerosols under the effect of radon occur more intensive than during the cloudless cases (R = 0.79 and 0.43 respectively).

Table 1: Statistical characteristics of Rn, N, n and O_3

Parameters	Fog (44 cases)			
	Rn	N	n	O_3
Max	17.8	23180	1548	30
Min	3.3	205	215	0
Mean	9.3	5554	534	5.3
St Dev	3.8	5619	255	6.5
	Cloudless atmosphere (67 cases)			
Max	19.6	7418	1591	83
Min	2.0	138	172	0
Mean	8.2	2566	639	17.1
St Dev	3.9	1869	309	16.6
	Correlation matrix			
	Fog (Upper part of the matrix)			
Rn	1	0.79	-0.44	-0.37
N	0.43	1	-0.28	-0.27
n	-0.45	-0.47	1	0.30
O_3	-0.37	-0.26	0.34	1
	Cloudless atmosphere (Lower part of the matrix)			

It is important to note that in the cases with the fog, as in the cases with the cloudless weather, impossible in the little contaminated and clean atmosphere inverse correlation between the content of radon and small ions is observed - Tbilisi type of smog (Amirnashvili et al, 2011, 2012).

References

Amiranashvili, A. (2011) Tbilisi Type of Smog as Attribute of Feedback Effect Between the Air Ionization Intensity and Small Ions Concentration. *Proc. of 7th Asia-Pacific Int. Conf. on Lightning, Chengdu, China, November 1-4, 2011, IEEE Xplore Digital Library, ISBN: 978-1-4577-1467-2*, 496 – 499 pp.

Amiranashvili, A., Amiranashvili, V., Khurodze, T. and Nodia, A. (2010) Weekly Distribution of Duration of Fogs and Haze in Dusheti (Georgia), *Proc. 5th Int. Conf. on Fog, Fog Collection and Dew, Munster, Germany, 25-30 July 2010*, 112-114 pp.

Amiranashvili, A., Bliadze, T. and Chikhladze, V. (2012) Photochemical smog in Tbilisi, *Trans.of M. Nodia Institute of Geophysics of Iv. Javakhishvili Tbilisi State University, ISSN: 1512 -1135, vol. LXIII,* 160 pp., (in Georgian)