



## Weekly Distribution of Duration of Fogs and Haze in Dusheti (Georgia)

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### Abstract

In this work results of an analysis of the weekly distribution of duration of fogs (T, hour) and haze (Q, hour) in Dusheti (42.08 degrees latitude, 44.7 degrees longitude, 900 m a.s.l.) are presented. Dusheti is located in 45 km to the north of Tbilisi in the terrain with the relatively clean atmosphere. Simultaneous observations of the meteorological and atmospheric electricity parameters here are conducted during many decades. As the parameter of aerosol pollution of the atmosphere air electrical conductivity (Y,  $10^{-15}$  ohm-m) is used. The observation period was 20 years, from 1969 to 1988. The comparison of the mean values of the indicated parameters was conducted with the aid of Student's criterion with the level of significance not worse than 0.2.

For example the following results are obtained.

In the indicated period an increase in the aerosol pollution of the atmosphere was observed. In this case, during the weekends the level of the pollution of the atmosphere was less than during the week-days ( $Y_{\text{mean}} = 37.5$  and  $33.9$  for the week-days, and  $38.2$  and  $34.5$  for the weekends in 1969-1978 and 1979-1988 accordingly).

In 1969-1978 during the week-days  $T_{\text{mean}} = 4.08$ ,  $Q_{\text{mean}} = 4.05$  and during the weekends  $T_{\text{mean}} = 2.61$ ,  $Q_{\text{mean}} = 3.68$ .

In 1979-1988 during the week-days  $T_{\text{mean}} = 3.74$ ,  $Q_{\text{mean}} = 2.83$  and during the weekends  $T_{\text{mean}} = 3.76$ ,  $Q_{\text{mean}} = 3.58$ .

Thus, with an increase in the pollution of atmosphere the duration of fogs during the week-days and weekends becomes identical, whereas the duration of haze during the week-days becomes less than into the weekends.

### 1. Introduction

Fogs and haze represented an important climate forming factors. A detailed analysis of the variability of the number of fog and haze days per year, fog and haze duration and some reasons of these variability in Georgia are given in Amiranashvili et al. [1-5]. This work is a continuation of the mentioned investigations.

Several studies have reported that atmospheric pollution is associated to an changeability of the some atmospheric parameters (solar radiation, precipitation, storm activity etc.). For this purpose often carried out the analysis of the data about atmospheric parameters during the week-days and weekends [6-10].

In this work results of an analysis of the weekly distribution of duration of fogs and haze in Dusheti (Georgia) are presented.

### 2. Data Description

Dusheti (42.08 degrees latitude, 44.7 degrees longitude, 900 m a.s.l.) is located in 45 km to the north of Tbilisi in the terrain with the relatively clean atmosphere. Variations in following characteristics of full fog (horizontal visibility less than 1000 m, the sky is invisible to the observer) and haze are examined. Simultaneous observations of the meteorological and atmospheric electricity parameters here are conducted during many decades. As the parameter of aerosol pollution of the atmosphere summary air electrical conductivity is used.

The following designations will be used below: T - duration of fogs, hour; Q - duration of haze, hour; Y - summary air electrical conductivity,  $10^{-15}$  ohm-m;  $\sigma$  - standard deviation,  $\alpha$  - the level of significance. The estimation of difference between the investigated parameters was evaluated according to Student's criterion t with the level of significance not worse

than 0.2. The observation period was 20 years, from 1969 to 1988.

### 3. Results

Results of analysis in tables 1-3 are presented.

Table 1: Difference of mean values of T, Q and Y in the week-days and weekends in different years

Year	Days of week	Parameter	T	Q	Y
1969-1988	Week-days	Mean	3.84	3.68	35.7
		Count	205	590	5218
	Weekends	Mean	3.56	3.64	36.4
		Count	86	254	2087
	Week-days - weekends	$\sigma$	3.47	3.29	9.2
		t	0.61	0.14	-2.8
		$\alpha$	-	-	0.005
1969-1978	Week-days	Mean	4.08	4.05	37.5
		Count	55	411	2608
	Weekends	Mean	2.61	3.68	38.2
		Count	15	165	1044
	Week-days - weekends	$\sigma$	4.42	3.73	9.9
		t	1.88	2.96	9.7
		$\alpha$	0.05	0.2	0.05
1979-1988	Week-days	Mean	3.74	2.83	33.9
		Count	150	179	2610
	Weekends	Mean	3.76	3.58	34.5
		Count	71	89	1043
	Week-days - weekends	$\sigma$	3.37	2.39	8.3
		t	-0.03	-1.7	-2.2
		$\alpha$	-	0.1	0.02
1979-88	Week-days	Mean	3.74	2.83	33.9
1969-78		Mean	4.08	4.05	37.5
1979-88		Count	150	179	2610
1969-78		Count	55	411	2608
1979-88		$\sigma$	3.37	2.39	8.3
1969-78		$\sigma$	4.42	3.73	9.9
Week-days (1979-88) - week-days (1969-78) -		t	-0.52	-4.7	-14.5
		$\alpha$	-	0.001	0.001
1979-88	Weekends	Mean	3.76	3.58	34.5
1969-78		Mean	2.61	3.68	38.2
1979-88		Count	71	89	1043
1969-78		Count	15	165	1044
1979-88		$\sigma$	3.70	3.85	8.2
1969-78		$\sigma$	1.88	2.96	9.7
Weekends (1979-88) - weekends (1969-78)		t	1.75	-0.2	-9.3
		$\alpha$	0.1	-	0.001

Table 2: Ratios between mean values of T, Q and Y in the week-days and weekends in different years

Year	Week-days/weekends %		
	T	Q	Y
1969-1988	107.7	101.0	98.1
1979-1988	99.6	79.1	98.1
1969-1978	156.3	110.1	98.2

Table 3: Ratios between T, Q and Y in the week-days and weekends in two periods of time

	(1979-1988)/(1969-1978) %		
	T	Q	Y
Week-days	91.7	69.9	90.2
Weekends	143.9	97.3	90.3

At first examine the dynamics of the aerosol pollution of atmosphere during the investigated period of time indicator of which is the air electrical conductivity.

In table 1 the mean values of Y during the week-days and weekends for three periods of time (1969-1988, 1969-1978, and 1979-1988) are presented.  $Y_{mean} = 35.7, 37.5$  and  $33.9$  for the week-days, and  $36.4, 38.2$  and  $34.5$  for the weekends in 1969-1988, 1969-1978 and 1979-1988 accordingly. In the correspondence with Student's criterion the level of aerosol pollution of air during the week-days was higher than into the weekends for all three indicated periods of time (decrease of the air electrical conductivity with an increase of the aerosol pollution of atmosphere). It is interesting to note that the ratio between  $Y_{mean}$  during the week-days and weekends is practically constant for all three indicated periods of time (98.1-98.2 %, table 2).

It is also interesting to note that an increase in the aerosol pollution of atmosphere (decrease of air electrical conductivity) in 1979-1988 to comparison with 1969-1978 both for the week-days and weekends occurred practically equally. Ration between mean values of Y in two indicated periods of time is 90.2 % during the week-days and 90.3 % for the weekends (tables 1 and 3).

Let us examine changeability of mean values of fogs and haze duration during the investigated period of time.

The mean values of T and Q during the week-days and weekends for three periods of time (1969-1988, 1969-1978, and 1979-1988) in table 1 are presented.  $T_{\text{mean}} = 3.84, 4.08$  and  $3.74$  for the week-days, and  $3.56, 2.61$  and  $3.76$  for the weekends;  $Q_{\text{mean}} = 3.68, 4.05$  and  $2.83$  for the week-days, and  $3.64, 3.68$  and  $3.58$  for the weekends in 1969-1988, 1969-1978 and 1979-1988 accordingly.

As showed the analysis the difference between  $T_{\text{mean}}$  just as  $Q_{\text{mean}}$  during the week-days and weekends in 1969-1988 is insignificant. In 1969-1978 values of  $T_{\text{mean}}$  and  $Q_{\text{mean}}$  for the week-days accordingly are higher by 56 % and 10 %, than during weekends. In 1979-1988 the difference between  $T_{\text{mean}}$  during the week-days and weekends is insignificant, but value of  $Q_{\text{mean}}$  for the week-days is lower by 21 %, than during weekends (tables 1 and 2).

Ration between values of  $T_{\text{mean}}$  in 1979-1988 and 1969-1978 for the week-days is close to 100 %, and for weekends equally 144 %. Ration between values of  $Q_{\text{mean}}$  in 1979-1988 and 1969-1978 for the week-days equally 70 %, and for weekends is close to 100 % (tables 1 and 3).

#### 4. Summary and Conclusions

The aerosol pollution of atmosphere has a definite effect on fogs and haze duration. With an increase in the pollution of atmosphere the duration of fogs during the week-days and weekends becomes identical, whereas the duration of haze during the week-days becomes less than into the weekends. With an increase in the air pollution for the week-days the duration of fogs does not change, but during week-days it is increases. For the haze duration another picture is observed. During the week-days the duration of haze is decreases, but during week-days it is does not change.

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