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Variations of the Rainwater pH and EC in northwest Turkey

H. TOROS^a, L. ŞAYLAN^a, B. ÇALDAĞ^a, F. BAKANOĞULLARI^b, O. ŞEN^a and M. A. GÜRBÜZ^b

^a*Istanbul Technical University, Faculty of Aeronautics and Astronautics, Department of Meteorology, 34469, Maslak, Istanbul, Turkey*

^b*Rural Services Kırklareli Atatürk Research Institute, Kırklareli/Turkey*

Corresponding Author: H. TOROS, Istanbul Technical University, Faculty of Aeronautics and Astronautics, Department of Meteorology, 34469 Maslak/Istanbul/Turkey, Tel.: +90 212 285 31 07; Fax: +90 212 285 29 26; E-mail: toros@itu.edu.tr

ABSTRACT

Variations of the Rainwater pH and EC in northwest Turkey

Water is the main driving factor for the agricultural production in the arid and semi arid regions of the world. Not only the amount of water is necessary for the crop growth, its quality must be also adequate. For this reason, analysis of chemical composition in rainwater is very important in the arid and semi arid areas. In this study, the pH and Electrical Conductivity (EC) variations have been measured in the semi arid Thrace region, which is located in northwest Turkey and takes an essential part of the agricultural production in Turkey. To analyze the rainwater chemistry, rainwater samples have been collected using specially designed collectors in four different areas in the region between November 2000 and December 2002. The average pH values four all sites were almost 6.

Key-words: precipitation chemistry, pH, Thrace Region, Turkey.

INTRODUCTION

As a component of the hydrological cycle; the types, amount, quality, intensity and distribution of the precipitation are the focus points for scientific areas such as agriculture, meteorology, hydrology, environment, forestry etc. In recent years, many researchers have been concentrated on the precipitation chemistry to put forth the possible effects of the increment in air pollutants on our ecosystem. In arid and semi arid regions, the precipitation chemistry is very important due to the limited precipitation amount. In this connection, some studies have been carried out on the precipitation chemistry in Turkey (Kaya and Tuncel, 1997; Şaylan et al., 2002; Toros et al., 2000; Toros, 2000; Tuncer et al., 2001).

In this study, the precipitation chemistry has been investigated firstly for four sites in northwestern part of Turkey between November 2000 and December 2002. Here, only the pH and EC variations are presented.

STUDY AREA

This study was carried out in the northwestern part of Turkey (Thrace), which represents an area of 2.5 millions ha (3.1 % of Turkey). 60 % of this area is used for agricultural purposes. In urban and rural areas, the population intensity is high. Approximately 15 % of Turkey's total wheat production, 50 % of the total rice production and 75 % of the sunflower production are obtained from this region (Süzer, 2004).

Climatologically, Thrace region is under the influence of northern and northwestern air currents with rather cold and wet winter and hot summer conditions. It is surrounded by the Black sea, Marmara Sea, Aegean Sea and the Bosphorus channel; Aegean, Black and Marmara Sea influence its climate. This area has intensive industrial activities.

Coal burning in Thrace (Kırklareli, Tekirdağ, Edirne) is main energy source for heating in buildings. The second energy source for heating is natural gas especially in Istanbul. On the other hand, the traffic is very intensive in this region.

MEASUREMENTS

The rainwater samples were collected sequentially from four sites between November 2000 and December 2002. Four precipitation collectors were installed to examine the variability of precipitation composition with time. A precipitation collector was sited to collect the sample sequentially in every 10-min. interval for analysis chemical composition of rainwater. After the initiation of precipitation, the samples were collected during the monitoring period using a specially designed system. The detailed information on the measuring system can be found in Şaylan et al. (2003). Figure 1 represents the locations of the measuring sites. The collected samples of rainwater for major ions (SO_4^{2-} , NO_3^- , Cl^- , Ca^{2+} , Na^+ , Mg^{2+} , K^+ and NH_4^+) concentrations, pH and EC were analyzed.

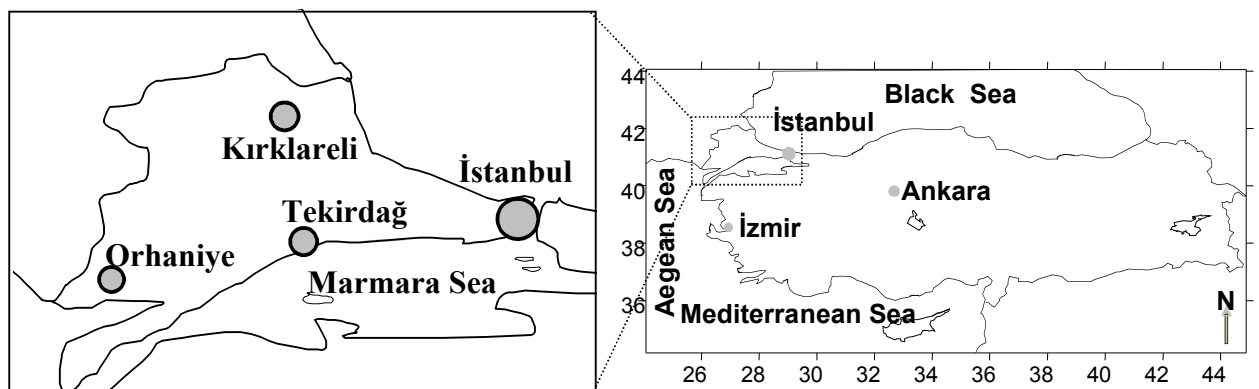


Figure 1. Measurement locations in northwest Turkey.

After collections of the rainwater samples, the pH and conductivity (EC) were measured immediately. After that, the filtered samples were kept in a refrigerator at +4 °C until the analyses at the Laboratory of Rural Services Kırklareli Atatürk Reserch Institute, at the Environmental Engineering laboratory of Istanbul Technical University, and Middle East Technical University. SO_4^{2-} , NO_3^- and Cl^- were analyzed by a Varian Model 2010 ion chromatography, Ca^{2+} , Na^+ , Mg^{2+} and K^+ and by flame atomic absorption spectrometry and NH_4^+ by spectrophotometry (Şaylan et al., 2003).

RESULTS

The sequential samples of rainwater were analyzed for the first time through so long time period in Thrace region. All collected rainwater samples in Thrace region were analyzed. Here, the pH and EC results of the cumulative collected rainwater samples have been presented. Table 1 shows the statistical information of the pH and EC of these collected rainwater samples. As seen in Table 1, the average pH values for all study sites are app. 6. Figure 2 and 3 give the histograms of the frequency of the pH and EC values at these sites.

Table 1. Statistical information of pH and EC for Kırklareli, İstanbul, Edirne and Tekirdağ station.

	Kırklareli		İstanbul		Edirne		Tekirdağ	
	pH	EC*	pH	EC	pH	EC	pH	EC
Number of Sample	69	69	45	46	33	31	51	51
Average	6,0	56	6,0	80	6,2	53	6,0	84
Maximum	7,3	465	7,5	410	7,7	174	7,9	360
Minumum	4,4	6	4,7	0	4,6	8	4,4	13
Standart Deviation	0,7	48	0,7	30	0,6	22	0,7	35

* $\mu\text{S}/\text{cm}$

In Kırklareli, total 69 samples were analyzed. The lowest pH value was estimated as 4.44 on 12 September 2002. 26 % of the all collected rainwater samples were acidic (<5.5 pH) in Kırklareli, which was obtained as 31 % in Istanbul.

The average pH of the total 45 rainwater samples in Istanbul is 6.0. The maximum and minimum pH values are 7.5 and 4.7, respectively. 62 % of the pH values varied between 5.5 and 7. The rain water was acidic in the 31 % of the all samples in Istanbul. On the other hand, the average EC varied between 80 and 84 $\mu\text{S}/\text{cm}$ at the sites near see, whereas between 53 and 56 $\mu\text{S}/\text{cm}$ at the sites in the continental areas. App. 68 % of the EC samples are less than 50 $\mu\text{S}/\text{cm}$ in Kırklareli. 83 % of the EC samples in Istanbul are less than 100 $\mu\text{S}/\text{cm}$.

In Edirne, total 33 rainwater samples were analyzed and the average pH in 15 % of the total samples was less than 5.5. However, the pH values in the 45 % of the total samples were between 6 and 6.5.

In the last site, namely Tekirdağ, 51 samples were analyzed and the pH value was less than 5.5 in the 27.5 % of the total samples.

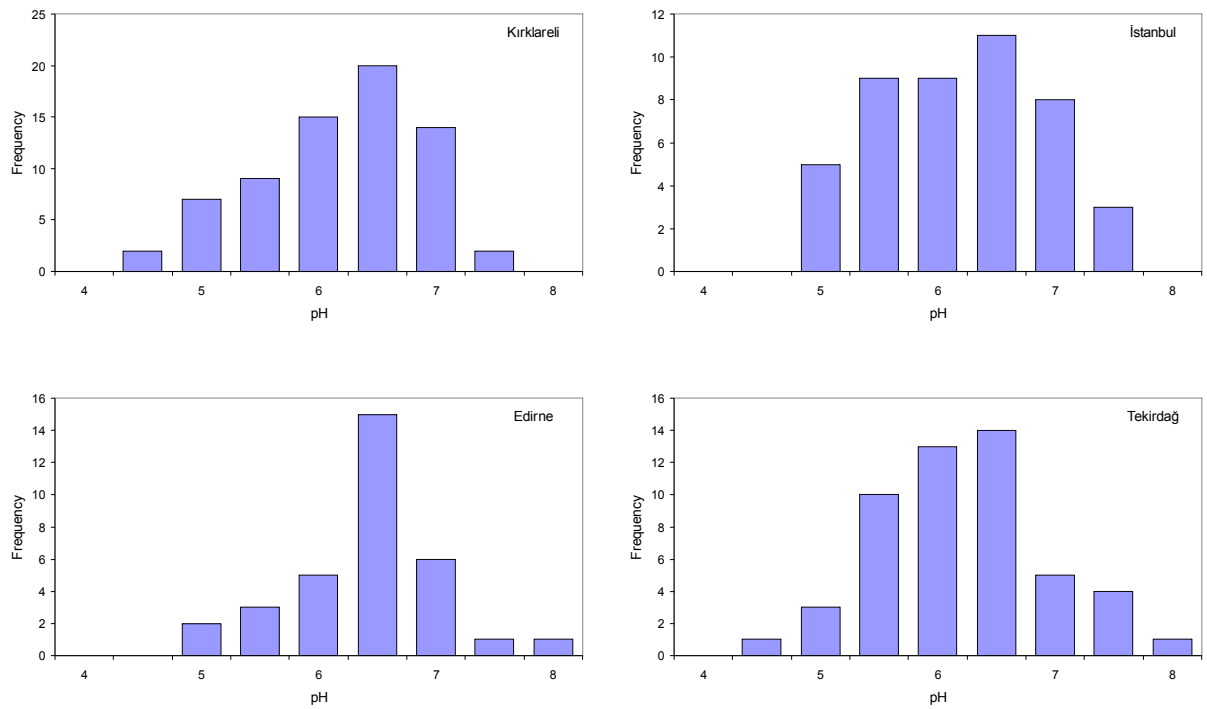


Figure 2. Frequency histograms of pH for Kırklareli, İstanbul, Edirne and Tekirdağ stations.

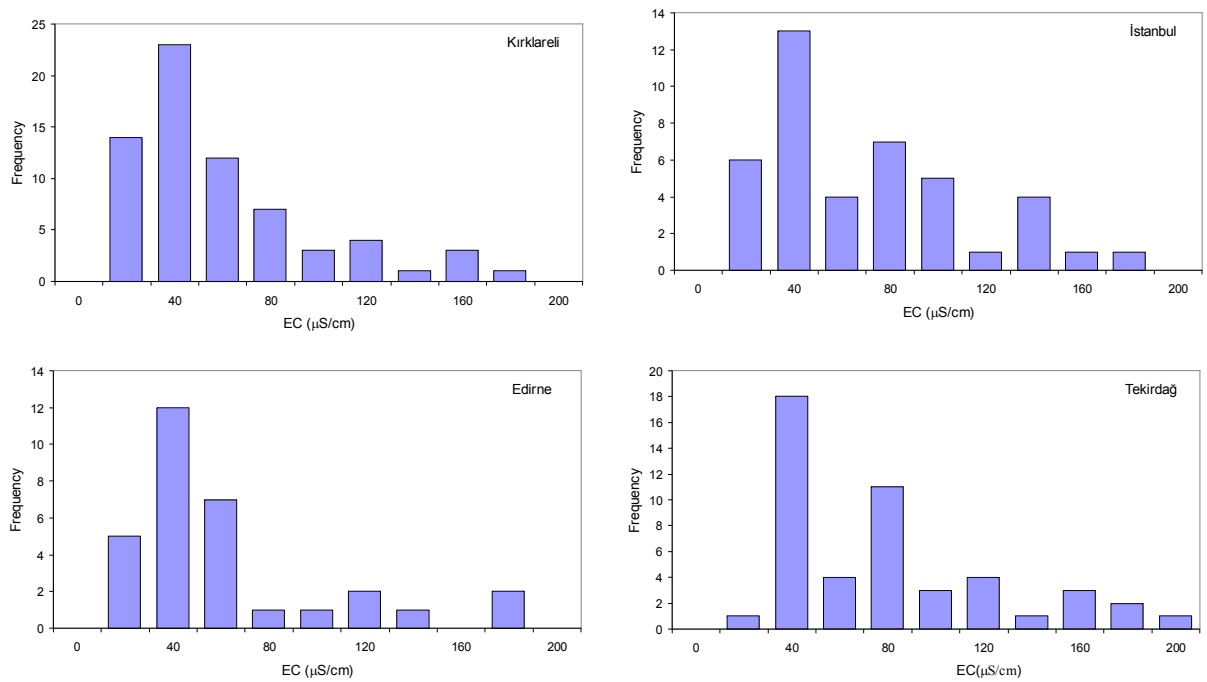


Figure 3. Frequency histograms of EC (µS/cm) for Kırklareli, İstanbul, Edirne and Tekirdağ stations.

In general, it is obvious from the results that the acidic precipitations have been measured in winter season. The comparison of pH values among all cities shows that the minimum pH appears at Tekirdağ with 4.4 on 1 February 2001 (Figure 2). Most of pH values change between the 6 and 6.5 values in all of the sites.

As a result of the analyses, the high ions concentrations in rainwater samples were decreased after the washout of the atmosphere (Şaylan et al., 2003). The pH values are about 6 while the concentrations of major ion are also very high. It may cause the neutralization due to the soil type, which is enriched by CaCO₃. One possible explanation of the high concentration levels for some ions may be to the local, natural and the long-range pollutants transports.

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