

ACID RAIN EVENTS AT THE LOŠINJ ISLAND

Kisele kiše na otoku Lošinju

SONJA VIDIČ, VESNA ĐURIČIĆ AND ALICA BAJIĆ

Državni hidrometeorološki zavod
Grič 3, 41000 Zagreb, Hrvatska

Abstract – For the period June 1987 – December 1989, daily precipitation samples were collected at Veli Lošinj, health resort located at the southern part of the Lošinj island. The main purpose of the measurement programme was to determine frequency and conditions of acid rain occurrences. Bulk precipitation samples were collected and analysed with regard to precipitation acidity only, which significantly limited the scope of the research. It was found that for the whole period 32% of samples were acidic, with the average precipitation-weighted pH to be 4.83. It was noted that strong acidity was correlated with larger precipitation amount.

Key word index: precipitation, rain acidity.

Sažetak – U radu su diskutirani rezultati analize kiselosti oborine u Velom Lošinju u razdoblju od lipnja 1987. do prosinca 1989. Osnovni cilj programa mjerenja bio je odrediti učestalost i uvjete u kojima dolazi do povećane kiselosti uzoraka oborine na području Dječje bolnice za alergijske bolesti. Nažalost, na promatranom području sakupljani su balk uzorci oborine a njihova analiza provedena samo s obzirom na jednu komponentu kvalitete oborine – kiselost pH. Tek potpuna analiza uzoraka koja bi obuhvatila i koncentracije glavnih iona u oborini omogućila bi i otkrivanje veze između kiselosti kiša i uzroka njihovoga nastanka. Iz podataka 101 uzorka utvrdili smo da je u promatranom razdoblju čak 32% kiša bilo kiselo, s prosječnom volumno otežanom vrijednošću pH od 4.83. Također se pokazalo da postoji pozitivna korelacija između veće količine oborine i niskih vrijednosti pH.

Ključne riječi: oborina, kisele kiše.

INTRODUCTION

The purpose of this work was to investigate occurrences of acid rain at almost clean and unpolluted area – the Lošinj island, being well known as a health resort area at the Northern Adriatic for more than 100 years. Mild climate during the whole year and the large area of forest induce conditions predisposed for health and recovery. Determination to preserve this natural resource initiated first measurements and study of air and precipitation pollution. (Vidič et al., 1994, UNEP).

Lošinj island lies at the South of the Kvarner Bay, about 90 km away from Rijeka. There are no significant pollution sources at the island itself. The two closest emission source areas are Rijeka and highly industrialised Northern Italy. Rijeka, urban and industrial area extends about twenty kilometres in a Northwest – Southeast direction in the narrow coastal region (see detailed description and Figure 1 in the paper: Bajić et. al., 1994, in this volume).

Plastic bottles with bulk precipitation daily samples were collected at meteorological station Veli Lošinj, located inside the area of the Children's Hospital for Allergic Diseases and delivered to the Public Health

Institute of Rijeka where pH measurements were made. Collection of samples had started in June 1987 and a series of 101 daily pH values has been available for the study. This comprised about 75 vol. % of total precipitation in the period.

RESULTS AND DISCUSSION

Table 1 summarises average pH values for seasons and years. The year 1989 was rather dry, with total annual precipitation amount of 642 mm, while 10 year average annual precipitation amount for Veli Lošinj is 902 mm.

Precipitation-weighted average pH for the whole period is less than 5 (4.83), with the smallest value in winter, though differences are generally not well pronounced. Cumulative and relative frequency distributions of pH show that almost 50 % of data have $\text{pH} < 5.6$ (Figure 1). In winter, 30% of data have $\text{pH} \leq 5.0$, while in autumn it is about 40%. The greater alkalinity (spring and summer) may originate from impurities in the air that are not man-made produced (i.e. needles, organic compounds of trees, insects, birds etc.).

The connection between pH value and the corresponding precipitation amount is given at the Figure 2. Although correlation coefficients are low, an indication appears that higher amounts of precipitation are in relation with lower pH values (stronger acidity), but the correlation is significant on 5% level only for spring.

Furthermore, data show that the rain at the Lošinj island is acidic in average. Still, two important aspects, as possible explanations of that, should be discussed. The first one is that this area is under the strong influence of the sea-spray, which can stipulate higher

concentration of sulphate. This leads to the conclusion that during the long dry periods with weak winds and well pronounced local circulation pattern we can expect sea-salt sulphate deposition. In addition, bulk sampling that has been done here includes both – wet and dry deposition which certainly reflects sample characteristics. Therefore, it should be expected that the acidity of precipitation is a result of several combined effects: sea-salt deposition, dry deposition, long-range transport of pollutants and regional pollution.

Table 1. Average seasonal and annual precipitation-weighted pH values for Veli Lošinj, June 1987–December 1989.

Tablica 1. Srednje sezonske i godišnje volumno otežane vrijednosti pH za Veli Lošinj, lipanj 1987–prosnac 1989.

	Winter	Spring	Summer	Autumn	All Years	Year 1987	Year 1988	Year 1989
pH _{avg}	4.87	4.81	4.90	4.98	4.83	5.02	4.85	4.81
N	18	29	23	31	101	24	39	38
RR	225	313	401	558	14988	377	590	531
% anal.	64	63	87	78	74	38	70	83

N – number of samples
 RR – precipitation amount in mm
 % anal. – percentage of analysed volume of precipitation

N – broj uzoraka
 RR – količina oborine u mm
 % anal. – postotak analizirane količine oborine

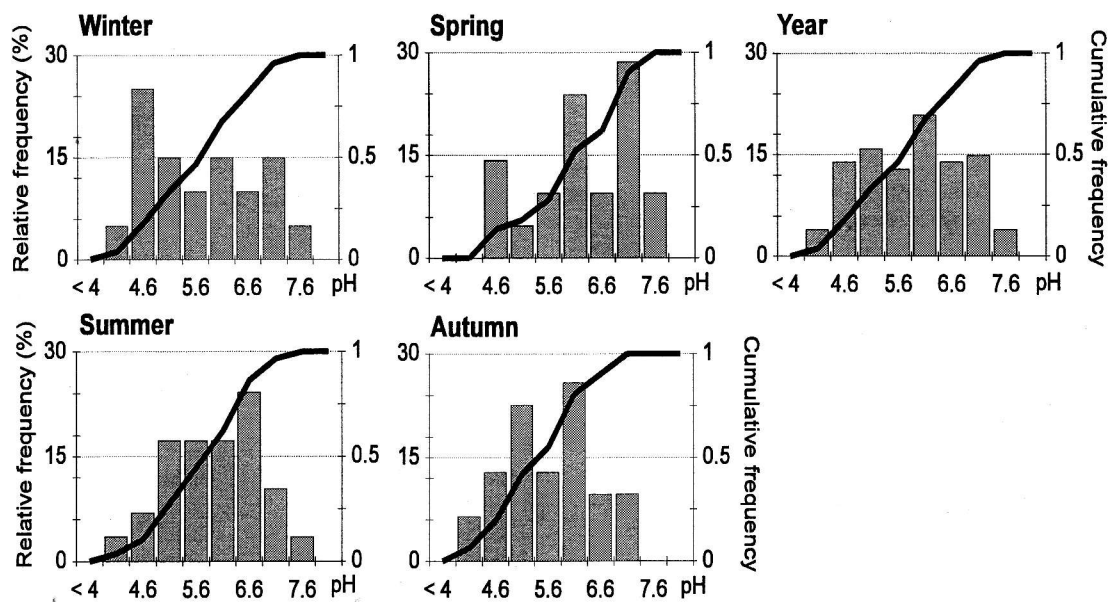


Figure 1. Frequency distribution of pH value at Veli Lošinj, 1987–1989.

Slika 1. Relativna čestina Ph vrijednosti u Velom Lošinj, 1987–1989.

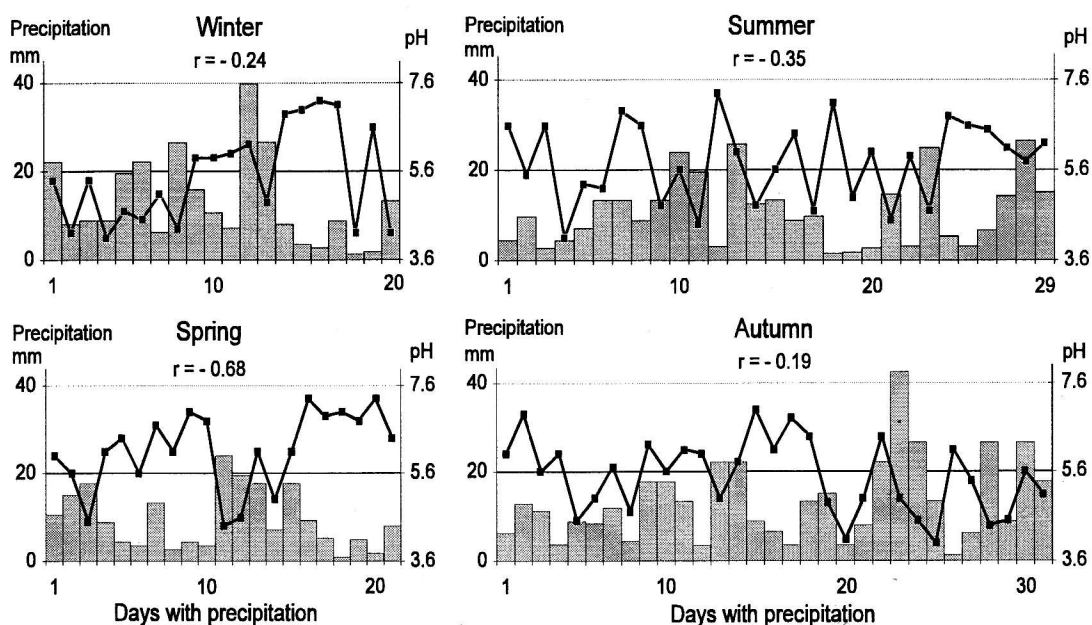


Figure 2. Daily precipitation amount with corresponding pH values, Veli Lošinj, 1987–1989.

Slika 2. Dnevna količina oborine s odgovarajućim vrijednostima pH, Veli Lošinj, 1987–1989.

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