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Nutrients and Acid in the Rain and Dry Fallout at Fayetteville, Arkansas (1980-1982)

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NUTRIENTS AND ACID IN THE RAIN AND DRY FALLOUT AT FAYETTEVILLE, ARKANSAS (1980-1982)

Wet and dry fallout at Fayetteville, Arkansas have been collected separately and analyzed since April, 1980. The precipitation-weighted-average pH for two yearly periods of rainfall were 4.72 (6/80-5/81) and 4.75 (6/81-5/82). This corresponds to a concentration of the acid ion, H^+, of about 18 parts per billion (ppb). Pure water in equilibrium with the CO_2 of the air would have a pH of 5.65 (2.2 ppb of H^+). The range of pH during this two year period was 3.86-7.74(140-0 ppb H^+) for the rainfall. Aqueous extracts of the dry fallout were always in the 6.75-7.87 pH range, i.e., neutral to slightly alkaline. The slight amount of acidity in the Fayetteville rainfall should be easily neutralized by dry fallout and soil.

Ammonium bisulfate, NH_4HSO_4, is the major acidic chemical in the rains. Sulfur tends to increase in winter months presumably due to the greater use of fossil fuels. Northern rains have the most acidity. Wet and dry fallout add significant amounts of nutrients to the local soils with 25-87% of the total flux being dry fallout. A major contributor are dust storms which bring in soil from adjacent states.

Iron and zinc were the most prevalent heavy metals in the wet fallout. Their concentrations were very low averaging less than 10 ppb for Fe and 15 ppb for Zn. Northernly and southernly rains had the most Fe and Zn and correspond to directions in which there are smelters.

George H. Wagner and Kenneth F. Steele

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KEYWORDS --*acid rain/Arkansas/chemistry and wind direction/ion flux/ *metals/*nutrients/*rain.

I. INTRODUCTION

Acid rain has been in the headlines for several years. The name itself stirs the emotions and conjures up visions of dead fish and dying vegetation. In this era of self-flaggelation, man gets the blame for the atmosphere's acid constituents (NO_3^- from autos, $SO_4^=$ from combustion of fossil fuel). Actually, nature is not blameless and the causes and processes involved in acid rain need to be firmly established. That is the spirit behind the work reported here - to get the facts. As pointed out in an editorial from The Wall Street Journal of 9/7/82, even Hiawatha may have encountered a low pH in Gitche Gumee.

The local effort began in mid-1980 with two sets of collectors located at the NOAA weather station at the University Farm, 2 miles north of the university campus. One set of collectors was for research directed toward locally oriented goals, while the second set was devoted to the aims of The National Atmospheric Deposition Program (NADP) as carried out by Project NC-141 of the Association of Experiment Stations. The present report summarizes the results of two years work - June 1980 to June 1982. Dry Fallout data from NC-141 are incomplete at this writing and do not extend beyond 3/11/1981. Locally determined compositions are reported in some cases up to 9/1/82.

In previous publications (Wagner and Holloway, 1974; Wagner and Holloway, 1975; Wagner, 1975) the compositions of rains collected in open containers on top of the Chemistry Building at the U. of Ark.

were reported on. Data in present report are considered more reliable due to improvements in collection, storage and analysis techniques.

Rain during its formation and during its falling to the earth removes aerosols and gases from the atmosphere. Aerosols are the microscopic solid particles such as ammonium sulfate or sodium chloride which have formed in or been added to the atmosphere. Examples of gases are ammonia from earth nitrogen processes, and sulfur dioxide from combustion of coal, or from oxidation of hydrogen sulfide which came from the earth via sulfate reducing bacteria. In the absence of rain, the earth and vegetation are peppered with falling aerosols. Thus, it is important to measure the dry fallout as well as the wet fallout (rain) when the total flux of exogenous material is desired.

The following ionic materials in order of decreasing amount (chemical equivalents) have been found in the local rains and dry fallout

Ca^{2+}, H^+, SO_4^{2-}, NH_4^+, NO_3^-, K^+, Mg^{2+}, Na^+, and Cl^-.

All of these, except H^+ and Cl^-, could be classed as important soil nutrients. Lesser amounts of several other inorganic materials, HCO_3^-, H_2O_2, O_3, SO_3^-H, NO_2^-, and some organic materials, such as formaldehyde, organic acids and alcohols are undoubtedly present but were not analyzed for.

The NADP has an interest in isopleth maps for these various ions, particularly H^+($pH = -\log H^+$), for the USA. To this end a common analytical laboratory of high precision, The Central Analytical Laboratory of The Illinois State Water Survey Urbana, is used by all participants, which includes the Fayetteville site, for rains collected on a weekly basis and dry fallout collected bimonthly. The latest such map for pH is shown in Figure 1.

Local research interests have been in eposodic events, i.e., the concentration of the various ions in each rain. Dry fallout has been measured as well and, fortunately so, because NADP has placed a low priority on their dry fallout analyses and only a few were available at the time for this report. In the local research marked "U. of Ark. Research", in the various tables there is interest in correlating the ionic content of the rains with their source direction. In this way pollution sources could be monitored. Heavy metals such as Pb, Fe, Mn, Zn, Cu and Ni were of interest in the local research and were measured during the first year of rain collection. Sr has been measured because it occurs in the local limestones and its weathering from the limestones might be related to the amount in the local rain water. Li and Ba were also measured for a large number of rains but were both essentially nil, i.e., less than detection limits of 0.0003 ppm Li and 0.01 ppm Ba.

A smooth operating system has been set up for collecting and measuring of various parameters of local rains. It is hoped that the measurements, at least of pH, will be continued for years to come to provide a historical record of this vital parameter. At the present the yearly weighted average pH for Fayetteville rains of 4.75 indicated no acidity problem, particularly in view of the widespread limestone in the area. However, trends and changes should be monitored lest there be an alarming change.

Filters from all rains containing the weighed particulate matter have been preserved and are available for research purposes. A petrographic study of the particulates should be of interest and useful in identifying their sources. The morphology of particulates has been shown (p. 106 of Stern, 1976; Knip and Lippmann, 1979) to indicate their source. For example, particulates from a coal burning power plant have a unique roundness, indicative of their high temperature source.

II. METHODS

Two Aerochem Metrics Model 301 Collectors were installed side by side, as shown in Figure 2, at the weather station at the University Farm, Fayetteville in May, 1980. A collector consists of two plastic buckets, one of which is covered when no rain is falling, and one is open. A sensor moves the cover to the open container at the beginning of a rain, and returns it to the rain collector when the rain stops. In this way the wet fallout (rain) and dry fallout are collected separately and can be analyzed - the rain samples as such, and the dry fallout by extracting with 250 ml of deionized-distilled water overnight to obtain the water soluble constituents. The collector buckets are polyethylene and all storage of samples - in polyethylene or polypropylene bottles which had been rinsed with concentrated HNO_3 - stood for 3-13 hours, and finally rinsed repeatedly with distilled water and stored full of deionized-distilled water until just before use.

The operation of the collector units, the handling of the samples, and the techniques of pH and conductivity measurement are given in detail in the Site Operator's Manual (Bigelow, 1982). We have added the following:

(1) pH and conductivity measurements were made in 2 ounce polyethylene bottles in duplicate, using two Markson Model 88 pH meters and a Markson Model 10 conductivity meter.

(2) All rains analyzed locally were filtered through a preweighed 0.45 μm Millipore filter, after pH and conductivity

measurement and before chemical analyses, and the weight of the particulates determined. The filters were first washed with 150 ml of deionized-distilled water to remove a small titer of Na^+ and NH_4^+. The particulate weight is listed in Table 1A as insolubles.

The pH and conductivity measurements on the CAL samples were made, of course, before shipment to CAL via UPS and were the only measurements, other than rain amount made locally on these samples. These measurements were repeated at CAL and are the values reported in the appropriate tables. A comparison of the two measurements is given under Results.

The various analytical techniques used locally are summarized in the following Table. These are all approved by either, or both, EPA (1974) and APHA (1971). The one exception is the sulfate analytical scheme which was developed here (Wagner and Steele, 1982).

Heavy metals were by three methods as noted in Table 3. The extraction method, denoted by the heading EX, used the chelation and MIBK extraction technique of Nix and Goodwin (1970). Rains were also concentrated by evaporation from a Teflon beaker (denoted by AC in Table 3) in order to increase the detection limits. Raw rain water (denoted by AR) was also run directly when reasonably concentrated, i.e., usually small rains, or on dry fallout aqueous extractions.

Determining the source direction for a rain cell was done directly by observing the movement of the rain clouds when the rain occurred during daylight hours. Many times the direction changes during the course of the rain. When this happens the rain is apportioned on a percentage basis to the number of other directions - 50% when two directions are involved or 33% when three directions are observed. At night the determination of source direction can be difficult and many means have been used - TV and newspaper weather maps, wind direction, and data from the Federal Weather Groups at the local airport.

Summary of Analytical Methods

(A) Using Atomic Spectroscopy

Element	Apparatus*	Mode	Wave Length (nm)	Flame	Additions**
Na^+	JA	emission	589.6	H_2-Air	K^+ or Cs^+
K^+	JA	emission	766.5	H_2-Air	Na^+ or Cs^+
Ca^{2+}	JA	concentration	422.7	C_2H_2-N_2O	Na^+,K^+ or Cs^+
Mg^{2+}	JA	concentration	285.2	C_2H_2-N_2O	Na^+,K^+ or Cs^+
Sr^{2+}	JA	emission	460.7	C_2H_2-N_2O	Na^+,K^+ or Cs^+
Li^+	JA	emission	670.7	H_2-Air	---

(B) Using Chemical Methods

Element	Method
Cl^-	Titrate with Hg^{++} reagent (Hach, p.2-27)*** using diphenyl-carbazone indicator and microburette (0.01 ml markings).
NO_3^-	Low range Nitrate method of Hach, p.2-78, based on Cadmium reduction.
NH_4^+	Phenate methods, see p.232 of APHA (1971) **** .
SO_4^{2-}	Hach (p.2-114) turbidometric for dry fallout samples, i.e., high sulfate. For rains used method of Wagner and Steele (1982).

* Jerrell-Ash modernized solid-state model 82-500 spectrometer.

** Alkali metals added to give 1000 ppm in test solution of all knowns, unknowns and blanks.

*** Hach (1975).

**** For rains through 5-31-81 and dry fallouts through 5-19-81 direct nesslerization (Hach 2-75) was used but gave high results due to positive interferences by organics.

III. RESULTS

1. Precision

The results have been condensed into a series of Tables for individual rains (Tables 1A, 1B and 3), for weekly accumulations (Tables 2A and 2B), for monthly flux of ions (Tables 4, 5, 8A and 8C), for yearly flux of ions (Tables 6A, 6B, 6C and 6D) and for rains from a given direction (Figures 4-22).

The first three rains in Table 1A and 1B were each caught in collectors 1W and 2W and provide a measure of the duplication of the two collectors. The agreement is generally quite good and indicates duplication in both collection and analyses. Because the collectors are only a few yards from the U. S. Weather Station gauge, collection efficiency was measured for 1W and 2W collectors by comparing inches of rainfall collected against that of the weather station. The efficiencies for June, 1980 through May, 1981 were 94% for 1W and 92% for 2W. Measurements of pH and conductivities over this same time period were compared for measurements made locally before shipment to CAL and the measurement of CAL. Of 36 pH measurements during this time period, 1 was the same, 6 averaged 0.2 pH units greater and 29 averaged 0.28 pH units lower when measured locally. As will be seen when comparing the yearly fluxes measured at Fayetteville and CAL, there is evidence that unfiltered samples shipped to CAL undergo some ion exchange of H^+ for other metal cations, i.e., neutralization and dissolution with the particulate matter in these unfiltered samples during the shipment and storage before analysis. For the first 36 samples on which specific conductivity was measured by both laboratories, the values measured at Fayetteville averaged 3.3 μmhos greater for 12 of the samples and an average of 3.6 μmhos less for 24 of the samples.

The same explanation of reaction with particulate matter during shipment should hold here also.

We have done much better on blind analytical samples submitted to the two laboratories as shown below:

	Values obtained at:					
	Fayetteville		CAL		median of 57 other sites	
Date	pH	μmhos	pH	μmhos	pH	μmhos
June, 1980	4.32	22.4	4.25	24.5	4.30	22.5
July, 1982	4.62	12.0	4.54	12.2	4.60	13.0

2. The Variables

Many variables are believed to be involved in determining the ionic composition of rain water. These variables are: (a) source direction (SD) of the rain cell, (b) size of the rain, i.e., cm of rainfall, (c) amount of particulate matter in the rain, in mg per cm of rain, (d) time interval since the last rain, and (e) the season of the year. Each of these needs some elaboration.

Rain cells originating in the S and SW should contain more Na and Cl because of the Gulf of Mexico in this direction and its probable addition of NaCl aerosols. We are, however, at about the distance indicated by Junge (300-500 kilometers) where the sea influence on rain composition fades out. For factor (b) imagine a rain drop formed in a cold, upper atmospheric cloud, losing water by evaporation as it falls through a warmer, lower atmosphere. The ionic content should increase. Particulate matter, item (c), added to the rain by turbulance, i.e., high winds, could partially dissolve or ion exchange with other ions in the rain water and may neutralize the acid ions, H^+. Item (d) may be very important when a very heavy rain preceeds by only a few hours, or a day, another rain. Rain drops pick up ionic matter during their formation (this is called rainout) and during their descent (called washout). A previous heavy rain could clean the atmosphere and limit the washout of a succeeding rain. This occurs within each rain, and the latter part of a rain should be more dilute ionicly. The seasons, due to temperature changes, changes in growth of vegetation, changes in amount of automotive travel, and changes in combustion of fossil fuel, should be a factor in rain composition.

In the many studies on rain composition done previously and in present times, there is a great obsession with the concentration of each ionic species, usually in ppm or in the case of H^+, as pH. This is true both nationally and internationally. While concentration may be important physiologically to a plant, i.e., the rain which falls on it directly, the important variable to the soil should be the flux, the amount of material deposited per unit area per unit of time. For this reason, importance is placed on flux in this report.

3. Individual Rains

A rain of 10 cm fell on 6-30-81. Fortunately, this large rain was selected for fractionation. Eight fractions were collected and analyzed. The results are plotted as cumulative flux in Figure 3. Each point represents the cumulated flux to that point in the rain. The slope of the curve at any point is the concentration of the particular ion in ppm if all rain were collected up to that point and analyzed. Note that for the most part, the slope of curves, i.e., the concentration, decreases in the latter parts of the rain. This is interpreted as a decrease in the rainout and washout efficiencies for removal of ions. The same decrease is noted in fractionated rain 7-30-81. Thus, we have here in its most simple form, the effect of rain size (cm) on ionic concentration. When investigating the effects of other variables it will be important to keep rain size constant.

Occasionally, two rains occur so clos ether as to appear as a cont tion of the same rain. The dis ion of a separate rain can us ly be made by a change in source direction of the rain and the ionic concentrations may increase instead of decrease. An example is rain 5-28-82A and 5-28-82B. Another type is exhibited by rain 6-15-82 where there was a great increase in wind velocity during the collection of the second fraction. In this case the con- ntration of some ions and very noticeably, the amount of particulates increased.

(a) Nutrients and Acid by Source Direction of Rain

Figures 4 - 22 contain ionic data on pure SW, W, NW and N rains. These are rains which from beginning to end were from the same direction. As pointed out earlier, the size of a rain is an important variable. In order to keep this variable constant, the flux of the various ions, all at 1 cm of rain was interpolated from best curves for Figures 4-21, and are summarized in the following Table. For all source directions, 1 cm is about the average rain.

Flux for a 1 cm Rain
(average for all seasons)
(units are μeq./m^2/rain)

Ion	SW	W	NW	N
Ca^{2+}	150	120	100*	50*
Mg^{2+}	30	25	15*	12*
K^+	15	15	10	7
Na^+	35	70	40	50
NH_4^+(as N)	250	230	350	150
H^+	250	250	250	400
NO_3^-(as N)	250	220	250	100
Cl^-	70	100	60	80
$SO_4^=$	450	500	400	400

* for rains with <1 mg of particulates

For the most part there is little effect of source direction on ionic flux. NH_4^+ shows a maximum from the northwest and H^+ a maximum from the north. Sulfate has the highest flux of all ions and ammonium bisulfate is the indicated composition of the most prevalent aerosol. Ca^{2+} and Mg^{2+} in NW and N rains were less for those rains with low amounts of particulates and are the fluxes shown in the Table. This may reflect contamination from (1) the limestone quarry slightly NW of and 1 mile from the collectors or, (2) the tilled crops just N of the collectors.

(b) Heavy Metals (Fe and Zn) by Source Direction of Rain

Figure 22 is a plot of Fe and Zn average concentration of rains for various source directions plotted versus the average particulate content. The most concentrated Zn rains were from the N and SW and the most concentrated Fe rains were from the SE and NW. No large effect due to particulates is indicated.

Figures 23A and B plot the average Fe and Zn concentration of various SD rains versus the average rain size in cm for that SD. There is a large effect of rain size on Fe concentration with the latter diminishing rapidly as average rain size increases from 1 to 5 cm. The high Fe content of the NW rains appears to be a consequence of the small rains from this direction. N and SW rains have the highest average Zn concentration with rain size not a factor.

Pure SW rains in Figure 24 show no seasonal effects on the flux per rain of FE or Zn.

(c) Seasonal Effects of Individual Rains

Data for Fe and Zn on pure SW rains are plotted in Figure 24. Rains occurring during fall and winter months are denoted by horizontal bars on the plotted points to distinguish them from rains occurring during the spring and summer months. No seasonal trends were detectable.

All pure rain data of other ions were also given a bar for rains during the fall and winter (Sept. through Feb.) months in Figures 4-22. The Mg^{2+} flux suggests low trend for these months as does the flux of Na^{+} for pure SW rains. Compared to the spring and summer months there are few rains in the fall and winter and data points are scarce, especially so in rains from non-SW directions, which also are scarce.

(d) Unusual Rains

1. May 20, 1980 - Mt. St. Helens Ash Arrives

Ash from Mt. St. Helens was predicted to arrive in Arkansas on May 20, 1980. Almost exactly at noon on this date a light rain (0.57 cm) fell in Fayetteville, apparently triggered by the ash. The pH of the rain was 4.57, slightly more acid than the average for the year (4.72), but not highly unusual. The particulate content of this rain was quite high (14.2 mg). Other parameters were: μmho (27), NO_3^- (1.2 ppmN) $SO_4^=$(3.6 ppm), Cl^-(0.76 ppm), Na^+(.128 ppm), K^+(.105 ppm), Ca^{2+}(.64 ppm) and Mg^{2+}(.1 ppm). All of these concentrations are slightly elevated above that expected for a "normal" rain, but less that expected based on the very high particulates content which might have been expected to have dissolved more material in the rain. Appendix I and II note much higher concentrations of contaminants at other sites from Mt. St. Helens.

The most important item is the particulates which from the wet fallout of this one rain on May 20, 1980 are equivalent to 0.74 lb., of solids per acre in the Fayetteville area. This is more than the yearly wet fallout flux of K^+ or Mg^{2+} (see Table 6F). Still the amount is less than that from a dust storm type of rain from West Texas described in the next section.

2. March 17, 1981 - West Texas Red Clay Arrives

On the above date a reddish rain fell generally over Arkansas. This was caused by a low-pressure cell over southern Kansas which caused 60 mph winds to suck up dust in arid West Texas.

The particulates from this 0.518 cm rain weight 43 mg, the pH was alkaline (7.12) which is very unusual, and the conductivity 22 µmhos, a normal value. Other parameters for the rain were (in ppm): NO_3^-(.45), $SO_4^=$(3.0), Cl^-(.07), Na^+(.12), K^+(.3), Ca^{2+} (3.4), Mg^{2+}(.145), and Sr^{2+}(.012). The last four measurements are considered very high. Not only were the particulates high in this rain, but also in those rains immediately following: 3-21-81 rain (9.6 mg) and 3-28/29-81 rain (3.5 mg).

The Fayetteville area received from this one rain, 2.24 lb., of solids per acre, apparently transported from West Texas. This is more than the yearly wet fallout flux of all ions except Ca^{2+} and $SO_4^=$.

4. Monthly Flux - Seasonal Effects

Table 4 summarizes the monthly flux from rains of several ions over the two-year period June, 1980 through May, 1982. Because the ions are washed out of the atmosphere by rain, it is natural to expect, to a first approximation, that the more the rain, the more is washed out. For this reason, the monthly flux and the monthly rainfall are shown in Table 4 as a percent of the yearly total. In general, the flux of the various ions rises and falls with the amount of precipitation. There are some notable exceptions. The low pH of 4.25 for July, 1980 is associated with H^+ and NO_3^- fluxes of 11% and 8% respectively, which are considerably greater than the 4% of yearly rainfall in July. A similar situation holds for August, 1980. Auto exhausts and biological soil activity are two major sources of nitrogen oxides and acids. Increased auto driving and ground temperatures probably account for these July and August, 1980 anomalies. They were repeated, but not as strongly, in July and August, 1981, and strongly in September, 1981.

From November, 1980 through March, 1981 the $SO_4^=$ percent exceeded rain percent in agreement with an increase in a major source of atmospheric sulfur during this period - the burning of coal, oil and natural gas. This same effect has been noted in Wisconsin and Iowa (p. 114 of Tabatabai, 1981). Only slightly excessive $SO_4^=$ was observed from December, 1981 through February, 1982. The greatest $SO_4^=$ excess was in July, August and September, 1981, contrary to expectations. This difference is not due to a change in the prevailing

SD (source direction). Then rains that might produce excess $SO_4^=$, i.e., NW, N, NE and E, accounted for 40% of the rainfall in the 7/80 throught 9/80 interval and 38% in the 7/81 through 9/81 interval.

5. Yearly Flux

This is considered the most important data set in the report. Individual rains and even monthly data can vary considerably and contain many irregularities. Yearly data though should average out to a more consistent pattern. This is borne out in the data presented below. To the soil the yearly flux seems most important.

a. Nutrients and Acid

The yearly flux for the various ions are summarized in Tables 6E, 6F and 6G for the two years: 6/80 to 5/81 and 6/81 to 5/82. In Table 6E the units are milliequivalents per square meter per year and in Table 6F the units are pounds per acre per year. Analyses of wet fallout by both CAL and the University of Arkansas are shown. The agreement is considered good but does indicate some slight ion exchange of H^+ for other ions of the particulates in the CAL samples during the collection, shipment and storage period before the analyses at CAL. At this writing (10-25-82) only a few dry fallout analyses have been received from CAL. The summary Tables of yearly flux are thus based on University of Arkansas analyses.

The precipitation-weighted-average pH for the two periods is 4.72 (6/80 - 5/81) and 4.75 (6/81 - 5/82). The wet and dry fallout flu[illegible] of other ions are compared for these two years in the last tw[illegible]s of Table 6E. The wet fallout fluxes of Ca^{2+}, K^+, Na^+ and

NO_3^- are about the same for the two periods, whereas the wet fallout fluxes of Mg^{2+}, NH_4^+, H^+, Cl^- and $SO_4^=$ are greater for the second year in proportion to the greater rainfall. The 1941-70 normal rainfall for Fayetteville is 113 cm. Thus, the second year of these measurements (6/81 - 5/82) was quite normal in total rainfall (114 cm), whereas the first year was dry (76 cm). Dry fallout fluxes for the two years are quite comparable except for K^+ and Na^+, which are lower for the second year, perhaps reflecting less dust or less contamination (bird feces in the warmer months). Dry fallout is a very significant (25-87%) part of the total flux of all the ions. About 60% of the wet fallout ionic material appears to be NH_4HSO_4, amonium bisulfate.

Iowa is the nearest state to Arkansas for which yearly nutrient fluxes in fallout have been reported. Using open collectors, which collect wet and dry fallout together, average yearly fluxes for 1971-73 for 6 stations in Iowa were 5.6 lb/A/yr for NH_4-N, 5.5 lb/A/yr for NO_3-N, and 42.8 lb/A/yr for $SO_4^=$ (Tabatabai and Laflen, 1976). Comparable values for Arkansas from Table 6F are respectively, 2.86, 2.23 and 14.5 for 6/80 - 5/81 and 2.41, 1.87 and 18.3 for 6/81 - 5/82.

b. Nutrients and Acid by Source Direction of Rain

Tables 6A, 6B and 6C summarize the data on this topic, all analyses of which were done at the University of Arkansas. Tables 6B and 6C summarize the data respectively for wet fallout for the periods 6/1/80 - 5/31/81 and 6/1/81 - 5/31/82. During the first period NH_4^+ analyses were done by direct nesslerization which gives high results due to positive interference from organics. This accounts for the higher cations/anion ratio for the first period (av. = 1.53), compared to the second period (av. = .97). The phenate method of analysis for NH_4^+ was used in the second period.

In comparing the two yearly periods the following should be noted:

(1) The first yearly period was dry (78 cm of rain) compared to the second yearly period (111 cm of rain), and the 30 year norm for Fayetteville (113 cm).

(2) About one-third of all ionic material from rain comes from the SW, the prevailing wind direction. This was true for both years but was more consistently so for the second yearly period.

(3) The % of the total wet deposition of an ion from a given direction generally follows the % of the total rain from that direction. Some exceptions, either much greater or much less than the rain %, have been underlined. The N and NW directions were consistent over the two years in providing exceptional amounts of NH_4^+, NO_3^- and H^+. This may partially be due to the smaller average rain size from these directions and/or to regional or point source of pollutants. This same effect was detected in individual rains (see 3a) and persisted even when comparisons were made at the same rain size (1 cm).

c. Heavy Metals (Fe and Zn) by Source Direction of Rain

In Table 6D the yearly flux and average concentration of Fe and Zn in rains is tabulated by source direction for the period 4/17/80 to 3/13/81. The average rain and particulates per cm of rain for the period are also listed by source direction. These data are plotted in Figures 22, 23A and 23B. The N and SW have higher concentrations of Zn than other source directions. Smelters are located in both directions: N (Missouri), SW (El Paso and Corpus Christi). Highest Fe concentrations were from the NW but this may be due to the small rain sizes (see Figure 23A).

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Table 1A
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	µmhos/cm/25°C.	Insolubles* mg.	Insolubles* mg/cm of rain
4-17-80	1W	.861	N	--	---	16.5	2.0	2.3
4-17-80	2W	.851	N	--	---	15.8	1.6	1.9
4-24-80	1W	.704	SW	5.59	2.5	15.7	6.7	9.5
4-24-80	2W	.704	SW	4.83	15	17.9	3.6	5.1
4-26-80	1W	1.344	NW- N	4.37	40	17.0	.7	.52
4-26-80	2W	1.334	NW- N	4.40	40	17.0	.8	.60
5-1-5-80	1W+2W	.188	SW	5.81	1.5	58.0	6.8	36.2
5-12-80	1W	1.445	SW	5.28	5	6.5	7.0	4.8
5-12-80	2W	1.372	SW	5.32	5	6.3	6.9	5.0
5-15-80	1W	3.300	NE- E	4.59	25	14.0	1.1	.33
5-18-80	1W	2.614	SE	4.65	23	18.0	0	0
5-20-80	1W	.569	SW- W	4.57	25	27.0	14.2	25.0
5-22-23-80	1W	.185	N	3.86	120	68.0	0	0
5-30-31-80	1W	1.039	W	4.42	35	33.0	0	0
6-16-80	2W	3.503	SW- W	5.44	3.2	5.2	1.1	.31
6-17-80	2W	1.085	W	4.52	30	23.0	.9	.83
6-19-80	2W	.955	S	5.13	8	6.8	.4	.42
6-20-80	2W	1.750	SW- W	4.97	10	9.6	.5	.29
6-22-80	2W	5.479	SW- W	4.63	22	12.5	1.1	.20
6-30-80	2W	.549	W-NW	4.56	28	38.0	4.7	8.6
7-17-80	1W	.208	SW	5.66	2	25.7	.2	.96
7-21-80	1W	1.709	N	4.27	50	31.0	2.4	1.4
7-26-80	1W	.772	NW- N	4.10	80	48.0	0	0
8-14-80	1W	.366	SW	4.14	70	49.0	1.8	4.9
8-18-80	1W	.838	SW- W	4.81	15	20.0	0	0
9-2-80	1W	.968	SW	4.99	10	11.0	.4	.41
9-3-80	1W	.264	S-SW	4.75	17	12.7	0	0
9-9-80	1W	4.054	W-NW	4.75	17	11.1	.3	.07
9-14-80	1W	.145	SW- W	4.74	17	59.4	0	0

Table 1A (Continued)
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	µmhos/cm/25°C.	mg.	Insolubles* mg/cm of rain
9-16-17-80	1W	.653	W-NW	4.51	30	33.6	2.8	4.3
9-23-80	1W	1.166	SW- W	5.73	1.7	11.5	1.7	1.46
9-25-80	1W	1.925	W	4.84	13	10.0	1.2	.62
9-27-28-80	1W	.665	E-SE	5.49	3	2.4	10.7	16.0
10-16-17-80	1W	3.607	S-SW	5.40	4	6.8	3.7	1.04
10-23-24-80	1W	.681	NW	4.47	32	16.1	9.4	13.8
10-26-27-80	1W	1.950	SE- S	4.75	17	8.3	1.0	.52
11-14-15-80	1W	1.387	N	4.50	30	17.0	.9	.65
11-16-17-80	1W	2.210	N	4.56	28	13.5	.7	.32
11-22-23-80	1W	.295	SW- W	4.51	30	14.0	.6	2.04
11-26-27-80	1W	.442	NW	4.98	10	7.1	.6	1.38
12-8-80	1W	4.511	S-SW	5.04	9	3.6	.7	.14
12-26-80	1W	.290	NW	5.00	10	12.0	.6	2.04
12-26-80	2W	.270	NW	5.22	6	8.1	---	----
1-19-21-81	1W	1.305	S-SW	5.61	2.3	4.1	1.3	1.07
1-29-81	1W	.348	SW	4.38	40	29.0	1.1	3.15
1-31-81	1W	.660	SE- S	4.71	18	9.0	1.1	1.67
2-9-10-81	1W	2.055	S	4.65	22	11.5	.1	.30
2-21-81	1W	.732	SW	4.97	10	14.3	2.7	3.68
2-22-81	1W	.321	W-NW	6.76	<1	23.0	4.8	15.0
2-27-28-81	1W	3.023	SW	5.05	9	6.7	.6	.18
3-3-81	1W	1.326	W	4.59	26	11.8	.7	.53
3-7-8-81	1W	.711	NE- E	4.65	22	9.7	1.1	1.54
3-13-15-81	1W	.254	SW- W	4.17	66	42.0	2.0	7.87
3-17-81	1W	.518	S	7.12	0	22.0	43.5	84.0
3-21-81	1W	.678	SE	5.25	6	18.2	10.1	14.94
3-28-29-81	1W	2.367	SW- W	4.77	17	9.8	4.0	1.71
4-3-81	1W	.185	SW- W	4.91	12	21.7	4.3	23.2
4-14-81	1W	.737	NW- N	4.85	14	21.3	1.5	2.1
4-18-19-81	1W	2.860	S-SW	5.04	9	7.5	1.4	.52

Table 1A (Continued)
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	µmhos/cm/25°C.	mg.	Insolubles* mg/cm of rain
4-19-81	1W	.749	NW- N	4.70	20	11.8	.8	1.07
4-22-81	1W	2.865	SW	5.02	9.5	6.7	.6	.18
4-28-81	1W	.813	W	4.70	20	16.2	1.1	1.54
4-30-81	1W	.221	SW	4.60	24	28.1	1.6	2.7
5-4-81	1W	.566	S	4.56	27	19.0	.9	1.6
5-5-81A	1W	.368	S	4.59	23	16.8	.6	1.62
5-5-81B	1W	.208	S	4.48	32	28.6	.6	2.88
5-9-10-81	1W	2.774	SW	4.77	17	8.9	1.5	.58
5-13-81A	1W	2.614	N	4.67	21	17.8	13.9	5.29
5-13-81B	1W	.351	N	4.54	28	21.4	2.0	5.73
5-16-81	1W	.152	S	4.45	33	20.0	0	0
5-18-81	1W	1.447	SE- S	4.60	23	19.9	2.0	1.40
5-23-81	1W	.244	SW	4.93	11	16.5	0	0
5-24-81	1W	.439	SW	4.74	17	9.8	0	0
5-25-81	1W	.559	S	4.76	17	9.8	.6	1.08
5-28-29-81	1W	.526	NW- N	4.64	22	11.8	.8	.91
5-29-30-81	1W	1.514	S-SW	5.00	9.7	9.3	8.9	5.83
5-31-81	1W	1.105	NE	4.98	9.8	5.3	.5	.45
6-2-81	1W	.180	S-SW	4.21	60	35.1	.8	4.53
6-4-6-81	1W	5.436	E-SE	5.73	1.7	2.2	1.0	.18
6-13-81	1W	.234	S	5.68	2	5.7	.6	2.58
6-15-16-81	1W	4.148	SW	4.95	11	5.6	.8	.19
6-19-81	1W	1.636	SW- W	4.96	11	8.1	5.0	3.06
6-20-81	1W	.386	NW	4.87	13	16.0	1.4	3.62
6-30-81	Fract. 1 1W	2.095	NW-SW	4.56	27	13.5	-	-
6-30-81	" 2 1W	.648	NW-SW	4.49	30	15.5	-	-
6-30-81	" 3 1W	.489	NW-SW	4.40	37	18.0	-	-
6-30-81	" 4 1W	1.044	NW-SW	4.58	25	9.5	-	-
6-30-81	" 5 1W	.737	NW-SW	4.64	22	9.5	-	-

Table 1A (Continued)
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	µmhos/cm/25°C.	mg.	Insolubles* mg/cm of rain
6-30-81	Fract.6 1W	1.939	NW-SW	4.88	10	4.3	-	-
6-30-81	" 7 1W	2.100	NW-SW	5.02	9	3.5	-	-
6-30-81	" 8 1W	.964	NW-SW	4.91	12	5.0	-	-
6-30-81	Composite 1W	10.02	NW-SW	4.70	19	8.4	-	-
7-6-81	1W	1.199	NE	5.31	4.7	5.4	.6	.48
7-7-81	1W	.366	S	5.27	5	3.4	0	0
7-16-81	1W	.259	SW- W	5.38	4	25.0	-	-
7-17-81	1W	.084	SW- W	5.44	3.5	15.6	-	-
7-19-81	1W	.399	SW	4.72	18	17.9	1.5	3.75
7-21-81	1W	.302	NE-NW	4.70	19	21.3	.8	2.64
7-21-81B	1W	.414	SW- W	5.32	4.7	16.8	1.7	4.11
7-27-28-81	1W	4.694	SW- W	4.57	27	13.9	.6	.12
7-30-81	Fract.1 1W	.781	E- S	4.83	14	8.3	-	-
7-30-81	" 2 1W	.357	S-SE	5.26	5.4	2.5	-	-
7-30-81	" 3 1W	.249	S-SE	5.17	6	4.2	-	-
7-30-81	Composite 1W	1.387	S-SE	4.96	10.4	6.1	1.8	1.30
8-1-81	1W	.460	SE	4.22	56	31.8	1.4	3.11
8-2-4-81	1W	4.587	---	4.79	16	9.2	1.4	.31
8-6-81	1W	1.692	NW	4.79	16	14.0	-	-
8-11-81	1W	.456	NW	4.19	62	29.6	.7	1.40
8-16-81	1W	.312	NE	4.91	12	9.8	0	0
8-17-81	1W	1.466	NE	4.85	14	8.0	.5	.34
8-26-81	1W	1.603	NW-SW	4.35	43	26.6	.8	.53
8-27-81	1W	.991	NW	4.75	18	16.2	.7	.70
9-7-81	1W	2.172	SW- W	4.43	37	13.7	.5	.23
9-12-81	1W	.533	SW	4.13	72	42.4	.6	1.20
9-13-14-81	1W	2.466	S	4.38	40	21.7	1.3	.53
9-27-81	1W	.320	N	4.57	27	30.0	.6	1.88
10-5-6-81	1W	.465	N-NW	4.92	12	15.4	.6	1.29

Table 1A (Continued)
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	μmhos/cm/25°C.	mg.	Insolubles* mg/cm of rain
10-10-81	1W	.465	N-NW	4.92	12	15.4	.6	1.29
10-10-81	1W	.094	N	5.82	1.5	12.3	0	0
10-11-13-81	1W	3.901	SE	4.68	20	11.6	.8	.21
10-13-14-81	1W	2.347	SE-S-SW	5.24	5.5	8.1	.5	.21
10-16-81	1W	.191	SE	5.47	3.2	6.0	0	0
10-17-81	1W	.305	S-SW	5.22	6.0	5.7	0	0
10-21-22-81	1W	4.740	NE-N-NW	4.60	24	14.3	1.9	.40
10-25-26-81	1W	.744	N	4.58	25	12.3	.7	.94
10-31-11-1-81	1W	4.169	S-SW	4.82	15	5.5	.6	.14
11-3-81	1W	1.290	NW	4.50	31	14.1	-	-
11-4-81	1W	.248	W	4.46	35	14.7	0	0
11-26-81	1W	.102	S-SW	6.74	.2	28.6	2.2	21.6
11-29-30-81	1W	1.755	NE-E-SE	4.73	19	9.8	.8	.46
12-13-81	1W	.188	N-NW	4.31	49	27.4	0	0
12-22B-81	1W	1.285	W	5.25	5.6	12.5	.7	.54
1-2-3-82	1W	.767	---	5.20	6.3	13.0	.6	.78
1-12-82	1W	.274	SW-W-NW	4.52	30	15.8	.7	2.55
1-21-22-82	1W	1.730	NE-E-SE	5.71	1.9	4.3	2.3	1.33
1-22-82	1W	.051	SW	5.99	1.0	12.8	0	0
1-29-31-82	1W	8.486	SW-NW-N	5.10	7.9	5.2	.8	.09
2-3-82	1W	.053	N	4.77	17	33.1	0	0
2-8-9-82	1W	.229	NW	4.32	48	30.8	0	0
2-11-12-82	1W	.038	SW- W	4.56	27	23.6	-	-
2-16-82	1W	1.798	SW- S	4.43	36	19.0	.7	.39
3-2-82	1W	.168	SW- S	4.52	30	5.1	.8	4.76
3-3-82	1W	1.039	S	4.54	29	21.6	1.0	.96
3-12-82	1W	.050	NW	7.25	0	77.1	2.6	52.0
3-14-82	1W	2.283	S-SW	4.98	10	14.1	1.4	.61
3-15-82	1W	1.311	S-SW	5.06	8.6	10.9	11.0	8.39

Table 1A (Continued)
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	µmhos/cm/25°C.	mg.	Insolubles* mg/cm of rain
3-29-82	1W	.036	W	7.74	0	113	7.9	219.0
4-2-82	1W	(1.91)	SW	( )	( )	( )	-	-
4-7-8-82	1W	1.200	NW	4.65	22	12.3	15.2	12.7
4-19-82A	1W	.107	SW	4.47	33	27.3	1.2	11.2
4-19-82B	1W	.132	W	4.86	14	23.8	.8	6.1
4-25-26-82	1W	1.765	S-SE	4.43	38	20.5	4.0	2.27
4-28-29-82	1W	1.173	SW	4.26	54	28.0	.9	.77
5-5-6-82	1W	.318	S-SW	4.55	28	17.8	1.4	4.40
5-12-13-82	1W	3.912	S-SW	4.60	24	6.8	1.7	.43
5-13-82	1W	5.385	S	5.04	9	4.0	18.6	3.45
5-14-82	1W	.310	SW	4.61	24	18.5	1.7	5.48
5-18-82	1W	1.499	S-SW	5.17	6.4	34.1	7.6	5.07
5-24-82	1W	.584	W	4.57	25	12.0	1.5	2.6
5-26-82	1W	.732	W-SW	4.88	13	10.0	.9	1.2
5-28-82A	1W	.693	SW	4.81	15	11.5	.5	.7
5-28-82B	1W	.404	S-SW	4.71	19	18.0	.5	1.2
5-31-82	1W	1.989	SW	4.55	27	14.0	.8	.4
6-2-82	1W	3.200	SW	4.40	28	21.0	2.2	.7
6-3-4-82	1W	3.175	W	4.33	46	26.0	.7	.2
6-9-82	1W	.635	W-NW	4.93	12	12.0	.7	1.1
6-11-82	1W	2.179	W	4.51	30	16.0	2.8	1.3
6-15-82Fract.1	1W	18.15	W	5.03	9.4	5.2	4.9	.3
6-15-82 " 2	1W	.668	W	5.11	7.3	9.6	.8	1.2
6-15-82Composite	1W	18.820	W	5.03	9.3	5.4	5.7	.3
6-25-82	1W	1.757	W-SW	5.41	3.8	3.7	.7	.4
6-27-82	1W	3.010	S-SW	4.56	28	14.2	1.6	.5
7-7-82	1W	.386	SW	4.92	12	12.7	.2	.5
7-27-28-82	1W	.269	S-SW	4.65	23	27.3	.6	2.2

Table 1A (Continued)
Individual Rains (U. of Ark. Research)
Amount (cm), Source Direction (SD), pH, Conductivity, Insolubles

Rain	Collector	cm	SD	pH	ppb H+	µmhos/cm/25°C.	mg.	Insolubles* mg/cm of rain
7-29-30-82	1W	7.976	S-SW	4.63	23	14.6	1.3	.2
8-7-8-82	1W	3.480	SW	4.37	43	20.8	1.0	.3
8-11-82	1W	.315	SW	3.92	120	56.2	.2	.6
8-27-82	1W	2.273	W	5.35	4.3	9.0	4.2	1.8
8-30-82	1W	1.092	N	4.48	32	18.2	1.2	1.1

*Weight of material is mg retained on 0.45 µm Millipore filter.

Table 2A
Weekly Rain Accumulations, Ion Concentrations
(Analyzed by Ill, State Water Survey)

Week Ending	cm of rain	pH	umhos	ppm CA^{2+}	ppm Mg^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+	H^+	ppm 3	ppm Cl^-	ppm $SO_4^=$	ppm PO_4^{3-}	cations/anions
5-27-80	.768	4.36	33.3	.55	.047	.058	.395	.98	44	.66	.25	4.93	<.003	1.04
6-3-80	1.127	4.28	34.5	.46	.078	.071	.429	.72	50	.62	.55	4.48	<.003	1.00
6-10-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
6-17-80	4.015	4.95	7.9	.28	.032	.040	.165	.17	11	.19	.29	1.16	<.003	1.06
6-24-80	8.973	4.80	9.8	.11	.017	.020	.510	.13	16	.19	.65	1.37	<.003	.91
7-1-80	.584	5.40	28.7	1.87	.187	.138	.665	.93	3.7	.98	.58	4.62	<.003	1.15
7-8-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
7-15-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
7-22-80	1.785	4.76	18.1	.49	.032	.035	.084	.70	17	.47	.24	2.48	<.003	1.07
7-29-80	.809	4.40	33.9	1.07	.060	.183	.115	.68	39	1.00	.39	3.59	<.003	1.06
8-5-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
8-12-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
8-19-80	1.162	4.80	19.5	.51	.080	.223	.474	.34	16	.57	.71	2.04	<.003	.95
8-26-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
9-2-80	.220	4.66	33.9	.87	.081	.129	.297	1.18	22	.96	.52	4.75	<.003	.95
9-9-80	.986	5.25	6.8	.15	.017	.028	.059	.17	5.4	.15	.20	1.02	<.003	.79
9-16-80	4.237	5.10	8.4	.16	.023	.019	.029	.34	7.5	.20	.12	1.34	<.003	.96
9-23-80	1.857	5.56	15.2	1.12	.065	.064	.164	.33	2.6	.35	.43	2.44	<.003	.94
9-30-80	2.595	5.22	5.3	.09	.011	.009	.060	.13	5.8	.12	.22	.61	<.003	.84
10-7-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
10-21-80	3.437	5.07	8.5	.17	.022	.026	.116	.18	8	.14	.23	1.05	<.003	.97
10-28-80	2.618	4.80	9.9	.07	.011	.015	.034	.16	16	.16	.12	.96	<.003	.95
11-4-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
11-11-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
11-18-80	4.043	4.59	15.2	.14	.013	.004	.015	.16	24	.19	.16	1.75	<.003	.84

Table 2A (Continued)
Weekly Rain Accumulations, Ion Concentrations
(Analyzed by Ill, State Water Survey)

Week Ending	cm of rain	pH	umhos	ppm 2+ CA	ppm 2+ Mg	ppm K+	ppm Na+	ppm (as N) NH+ 4	H+	ppm (as N) NO- 3	ppm Cl-	ppm SO= 4	ppm 3- PO 4	cations / anions
11-25-80	.310	4.65	12.8	.21	.022	.010	.029	.14	22	.23	.16	1.60	<.003	.85
12-2-80	.557	5.27	7.0	.16	.016	.012	.020	.19	5	.23	.12	.79	<.003	.81
12-9-80	4.794	5.28	4.7	.03	.009	.009	.072	.09	5	.08	.18	.49	<.003	.84
12-16-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
12-23-80	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
12-30-80	.107	5.94	13.2	.51	.043	.405	.483	.35	1.1	.31	.71	1.50	<.003	1.18
1-6-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
1-13-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
1-21-81	1.163	5.88	6.7	.07	.003	.005	.004	.33	1.3	.16	.13	.57	<.003	1.07
1-27-81	.088	4.96	15.0	.36	.038	.035	.073	.59	11	.27	.19	1.25	<.003	1.53
2-3-81	1.000	4.78	17.6	.27	.029	.024	.051	.39	16	.25	.16	2.28	<.003	.90
2-10-81	2.043	4.63	14.6	.09	.008	<.002	.018	.12	23	.20	.16	1.24	<.003	.86
2-17-81	.099	5.47	19.1	.39	.062	.007	.048	.97	3.3	.47	.26	3.14	<.003	.99
2-24-81	1.042	6.48	19.3	.72	.062	.045	.054	1.17	.34	.38	.14	3.09	<.003	1.34
3-3-81	1.889	5.05	11.3	.06	.007	.011	.048	.28	8.5	.15	.13	.92	<.003	1.04
3-10-81	2.052	4.57	15.0	.14	.014	.012	.020	.19	26	.23	.11	1.40	<.003	1.03
3-17-81*	.518	7.12	22.0	3.40	.145	.300	.120	.60	.09	.45	.07	3.90	--	2.06
3-24-81	1.336	6.89	23.4	1.97	.140	.121	.203	.34	.12	.47	.24	2.61	<.003	1.54
3-31-81	2.199	5.00	12.5	.17	.025	.025	.116	.23	10	.14	.20	1.70	<.003	.85
4-7-81	.177	6.78	28.1	1.90	.395	.023	.025	.46	.16	.63	1.02	4.15	<.003	1.01
4-14-81	.699	5.24	23.4	.70	.149	.111	.648	.77	5.6	.63	.86	3.42	<.003	.99
4-21-81	3.418	5.02	11.6	.08	.029	.036	.161	.19	9.4	.18	.22	.87	<.003	1.00
4-28-81	2.835	5.18	8.1	.10	.017	.025	.065	.17	6.2	.13	.06	.75	<.003	1.09
5-5-81	1.962	5.41	16.4	.22	.035	.072	.127	.35	3.8	.39	.23	1.70	<.003	.71
5-12-81	3.106	4.98	12.4	.20	.023	.010	.038	.45	10	.20	.05	1.35	<.003	1.12
5-19-81	4.632	5.02	16.1	.50	.052	.051	.177	.37	9.4	.28	.27	2.39	<.003	.95
5-26-81	1.276	5.06	11.1	.23	.020	.026	.039	.22	8.8	.27	.19	1.03	<.003	.86

Table 2A (Continued)
Weekly Rain Accumulations, Ion Concentrations
(Analyzed by Ill, State Water Survey)

Week Ending	cm of rain	pH	umhos	ppm Ca^{2+}	ppm Mg^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+	H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$	ppm PO_4^{3-}	cations/anions
6-2-81	3.248	6.86	23.0	.40	.040	.402	.062	1.90	.12	.23	.22	1.82	.383	2.36
6-9-81	5.331	6.12	4.5	.06	.003	.006	.020	.16	.72	.05	.03	.22	<.003	1.76
6-16-81	4.339	5.36	7.1	.08	.018	.014	.104	.15	4.3	.14	.11	.64	<.003	.97
6-23-81	1.977	5.79	11.4	.50	.049	.040	.327	.14	1.5	.23	.24	1.47	<.003	1.03
6-30-81	10.136	4.91	9.0	.08	.008	.005	.087	<.02	12	.13	.06	.56	<.003	.95
7-7-81	1.210	5.56	10.8	.16	.078	.028	.062	.38	2.7	.16	.11	1.69	.008	.95
7-14-81	.352	5.19	8.3	.16	.040	.029	.094	<.02	6.4	.07	.13	.59	<.003	1.08
7-21-81	1.044	5.83	22.1	1.53	.191	.066	.291	.36	1.4	.70	.43	2.12	<.003	1.23
7-28-81	5.023	4.82	17.2	.21	.033	.018	.112	.16	15	.27	.15	1.26	<.003	.90
8-4-81	6.399	4.77	15.2	.14	.031	.018	.072	.12	17	.15	.10	1.06	<.003	1.10
8-11-81	2.230	5.41	8.9	.41	.064	.031	.132	.33	3.7	.33	.15	1.29	<.003	1.09
8-18-81	1.793	4.98	15.5	.13	.029	.011	.051	.19	10	.17	.10	1.46	<.003	.79
8-25-81	.593	3.75	107.8	3.29	.757	.353	1.610	<.02	180	.03	1.52	4.02	.067	3.69
9-1-81	2.576	4.75	29.4	.39	.051	.033	.054	.59	18	.38	.12	2.94	<.003	.95
9-8-81	2.156	4.80	13.9	.24	.073	.035	.100	.30	16	.21	.13	1.92	<.003	1.02
9-15-81	2.922	4.61	22.7	.43	.044	.031	.043	.51	23	.49	.07	1.99	<.003	1.13
9-22-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
9-29-81	.290	5.31	29.9	1.71	.352	.091	.653	.75	4.8	.92	.82	5.32	<.003	1.02
10-6-81	.491	5.76	13.0	.58	.061	.045	.267	.60	1.7	.48	.38	2.06	.012	1.03
10-14-81	3.986	4.79	10.9	.14	.025	.041	.083	.10	10.6	.19	.14	1.07	<.003	.93
10-20-81	3.022	5.61	4.3	.07	.022	.026	.057	.17	2.4	.11	.05	.67	<.003	.98
10-27-81	5.827	4.68	13.6	.17	.027	.028	.088	.20	20	.22	.11	1.80	<.003	.90
11-3-81	4.205	6.53	13.1	.15	.044	.354	.043	.48	.28	.11	.05	.62	.275	1.86
11-10-81	1.526	4.76	15.7	.26	.036	.030	.057	.38	18	.31	.04	1.92	<.003	1.01
11-17-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
11-24-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
12-1-81	1.884	5.46	7.8	.41	.046	.035	.155	.22	3.4	.15	.22	1.37	<.003	1.11

Table 2A (Continued)
Weekly Rain Accumulations, Ion Concentrations
(Analyzed by Ill, State Water Survey)

Week Ending	cm of rain	pH	umhos	ppm CA^{2+}	ppm Mg^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+	H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$	ppm PO_4^{3-}	cations / anions
12-8-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
12-15-81	.203	5.00	23.1	.87	.397	.069	.494	.35	9.7	.61	.55	3.68	<.003	.99
12-22-81	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
12-29-81	1.335	5.27	13.3	.38	.078	.053	.370	.43	5	.25	.63	2.57	<.003	.88
1-6-82	.767	5.44	16.4	.70	.068	.075	.175	.61	3.5	.39	.18	3.69	<.003	.88
1-12-82	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
1-19-82	.318	4.70	13.5	.29	.052	.014	.045	.12	19	.31	.08	1.35	<.003	.93
1-26-82	1.850	4.16	6.6	.08	.040	.012	.077	.16	6.6	.14	.06	.98	<.003	.91
2-2-82	9.010	5.11	5.0	.07	.012	.011	.072	.08	7.2	.05	.15	.68	<.003	.95
2-9-82	.279	5.59	19.7	1.04	.276	.058	.394	.44	2.5	.58	.46	3.32	.024	1.02
2-16-82	2.415	4.46	20.1	.15	.012	.031	.034	.23	34	.26	.06	2.26	<.003	.91
2-23-82	.060	5.34	22.5	.60	.093	.042	.106	1.29	4.3	.51	.23	4.85	<.003	.97
3-2-82	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
3-9-82	1.249	4.45	24.2	.31	.035	.040	.085	.63	34	.39	.11	3.69	<.003	.96
3-16-82	3.630	5.46	3.4	.35	.054	.043	.187	.17	3.4	.15	.23	1.43	<.003	.99
3-23-83	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
3-31-82	.033	7.58	106.6	16.4	.807	.778	1.496	.06	--	.93	1.39	11.33	<.003	2.85
4-6-82	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
4-13-82	1.256	5.45	10.4	.67	.073	.073	.103	.19	3.4	.22	.21	1.82	<.003	1.06
4-20-82	.250	5.66	238	1.02	.110	.127	.222	.75	2.1	.43	.65	4.19	<.003	.94
4-27-82	1.848	4.73	16.5	.39	.042	.021	.045	.30	18.5	.24	.06	2.54	<.003	.90
5-4-82	1.193	4.44	25.9	.45	.070	.034	.049	.38	35	.38	.16	4.18	<.003	.80
5-11-82	.349	5.56	13.3	.47	.122	.186	.324	.33	2.7	.44	.63	2.04	<.003	.86

* U. of Ark. Analyses.

Table 1B
Individual Rains (U. of Ark. Research)[a]
Concentration of Various Ions

Rain	ppm Ca^{2+}	ppm Mg^{2+}	ppb Sr^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+ (b)	ppb H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$
4-17-80	.59	.085	<1	.115	.081	.70	-	.55	.56	(2.23)
4-17-80	.57	.050	-	.074	.080	.70	-	.58	-	-
4-24-80	.72	.055	3	.125	.164	1.10	2.5	.24	.12	3.15
4-24-80	.33	.045	-	.115	.128	1.14	15.0	.27	-	-
4-26-80	.26	.020	1	.031	.062	.42	40	.18	.20	.97
4-26-80	.22	.020	-	.021	.025	.41	40	.22	-	-
5/1-5/80	4.03	.026	11	.320	.128	3.55	1.5	1.84	-	(1.91)
5-12-80	.31	.035	1	.052	.050	.76	5	.11	.44	1.33
5-12-80	.35	.050	-	.054	.045	.76	5	.12	-	-
5-15-80	.055	.010	0.5	.012	.023	.07	25	.05	.36	.51
5-18-80	.10	.015	0.9	.023	.029	.49	23	.17	.48	1.23
5-20-80	.64	.095	1	.105	.128	1.90	25	1.20	.76	3.60
5/22-23-80	.32	.065	<1	.066	.084	1.59	120	.31	-	(2.59)
5/30-31-80	.37	.070	<1	.080	.410	.83	35	.16	.64	4.05
6-16-80	.18	.030	<1	.030	.064	.24	3.2	.14	.37	.77
6-17-80	.27	.040	2	.043	.180	.46	30	.60	.32	1.33
6-19-80	.21	.030	1	.035	.069	.25	8	.28	.36	.72
6-20-80	.30	.020	<1	.052	.043	.54	10	.16	.28	.67
6-22-80	.04	.010	<1	.027	.044	.67	22	.28	.20	.97
6-30-80	1.55	.130	7	.180	.510	2.35	28	1.07	.56	2.85
7-17-80	1.66	.110	161	.115	.530	4.40	2	.70	(.60)	1.80
7-21-80	.20	.020	6	.038	.092	2.70	50	.39	.38	1.90
7-26-80	.68	.030	6	.068	.053	2.04	80	.96	.24	2.90
8-14-80	.88	.100	5	2.31	.550	3.30	70	1.40	.52	5.20
8-18-80	.22	.060	1	.062	.345	.46	15	.35	.48	1.80

Table 1B (Continued)
Individual Rains (U. of Ark. Research)[a]
Concentration of Various Ions

Rain	ppm Ca^{2+}	ppm Mg^{2+}	ppb Sr^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+(b)	ppb H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$
9-2-80	.22	.020	<1	.031	.052	.63	10	.26	.28	2.05
9-3-80	.13	.020	<1	.104	.088	.83	17	.29	.20	(1.82)
9-9-80	.02	.010	<1	.021	.039	1.13	17	.11	.36	1.05
9-14-80	2.63	.170	11	.366	.322	4.70	17	2.09	.48	(1.66)
9-16-19-80	1.80	.100	9	.133	.100	2.68	30	.76	.12	5.33
9-23-80	.84	.050	14	.087	.170	.38	1.7	.16	.40	1.73
9-25-80	.12	.100	<1	.025	.072	.38	13	.14	.24	1.05
9-27-28-80	.06	.005	<1	.020	.027	.19	3	.09	.32	.89
10-16-17-80	.30	.030	3	.108	.105	.37	4	.29	.24	1.63
10-23-24-80	.09	.015	1	.063	.086	.72	32	.29	.12	2.00
10-26-27-80	.06	.012	<1	.045	.069	.24	17	.09	.16	1.31
11-14-15-80	.09	.010	<1	.034	.250	.57	30	.19	.08	3.08
11-16-17-80	.04	.007	<1	.015	.034	.26	28	.13	.36	1.95
11-22-23-80	.11	.005	<1	.048	.098	.49	30	.16	.28	1.59
11-26-27-80	.19	.007	<1	.068	.060	.32	10	.17	<.04	1.38
12-8-80	.05	.007	<1	.021	.068	.14	9	.07	.28	2.20
12-26-80	.26	.027	2	.135	1.05	.37	10	.22	.24	2.46
1-19-21-81	.10	.003	2	.026	.060	.53	2.3	.13	.08	1.64
1-29-81	.43	.030	4	.125	.140	1.47	40	.57	.36	4.20
1-31-81	.11	.010	4	.028	.040	.35	18	.08	.16	1.23
2-9-10-81	<.10	.010	1	.040	.041	.31	22	.16	.12	1.95
2-21-81	.21	.015	1	.050	.125	.97	10	.27	.09	(2.69)
2-22-81	1.60	.055	5	.080	.063	1.85	<1	.79	.46	3.30
2-27-28-81	.09	.010	<1	.012	.027	.47	9	.13	.13	1.04
3-3-81	.11	.010	1	.080	.020	.29	26	.15	.10	3.59

Table 1B (Continued)
Individual Rains (U. of Ark. Research)[a]
Concentration of Various Ions

Rain	ppm Ca^{2+}	ppm Mg^{2+}	ppb Sr^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+(b)	ppb H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$
3-7-8-81	.09	.020	1	.043	.027	.33	22	.20	.20	1.[illegible]
3-13-15-81	.72	.060	8	.490	.240	1.25	66	.92	<.05	(2.83)
3-17-81	3.40	.145	10	.300	.120	.60	0	.45	.07	3.00
3-21-81	1.08	.090	4	.082	.300	1.06	6	.65	.09	3.55
3-28-29-81	.16	.020	<1	.028	.100	.45	17	.11	.17	1.34
4-3-81	.96	.120	78	.108	.070	1.41	12	.80	.68	(1.89)
4-14-81	.60	.080	<1	.038	.540	.95	14	.87	.56	1.87
4-18-19-81	.09	.025	<1	.007	.200	.34	9	.14	.27	1.34
4-19-81	.06	.020	<1	.010	.130	.33	20	.23	<.05	1.51
4-22-81	.08	.020	<1	.005	.076	.33	9.5	.11	<.05	1.51
4-28-81	.20	.020	<1	.020	.190	1.03	20	.27	.46	2.00
4-30-81	.66	.060	<1	.050	.150	1.95	24	1.20	.47	(2.17)
5-4-81	.19	.025	<1	.007	.140	.57	27	.28	.31	1.45
5-5-81A	.03	.010	<1	.010	.100	.76	23	.29	.35	(1.96)
5-5-81B	.10	.010	<1	.010	.080	1.82	32	.78	1.12	(1.62)
5-9-10-81	.06	.010	<1	.002	.040	.31	17	.15	<.05	.80
5-13-81A	.56	.025	2	.007	.140	.88	21	.32	.05	2.00
5-13-81B	.54	.050	4	.025	.225	.97	28	.38	.11	2.10
5-16-81	.15	<.01	<10	.010	.200	.57	33	.18	.32	5.13
5-18-81	.28	.005	1	.025	.295	.96	23	.20	.34	3.45
5-23-81	.90	.008	3	.030	.150	.96	11	.27	<.05	3.90
5-24-81	.22	.010	4	.038	.076	.42	17	.34	<.05	(1.80)
5-25-81	.10	.010	4	.005	.058	.34	17	.19	.25	.29
5-28-29-81	.12	<.005	4	.052	.050	.75	22	.26	<.05	.72
5-29-30-81	.14	.040	4	.210	.047	.68	9.7	.15	.12	1.31
5-31-81	.04	<.005	2	.033	.020	.45	9.8	.08	.21	2.46

Table 1B (Continued)
Individual Rains (U. of Ark. Research)[a]
Concentration of Various Ions

Rain	ppm Ca^{2+}	ppm Mg^{2+}	ppb Sr^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+(b)	ppb H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$
6-2-81	.20	<.025	20	.100	.165	.98*	60	.55	.72	(3.20)
6-4-6-81	.03	<.005	2	.008	.015	.05	1.7	.03	<.05	0.87
6-13-81	.25	.025	20	.230	.235	.45	2.0	.10	.15	1.47
6-15-16-81	.04	.010	2	.020	.080	.08	11	.07	.31	1.20
6-19-81	.23	.025	3	.030	.105	.23	11	.11	.35	1.15
6-20-81	.84	.060	8	.066	.086	.25	13	.38	.54	2.55
6-30-81Fr.1	.14	<.005	2	.041	.050	.25	27	.19	.40	.97
6-30-81Fr.2	.14	<.005	4	.038	.065	.09	30	.24	.37	1.27
6-30-81Fr.3	.11	<.005	2	.026	.070	.20	37	.21	.28	1.53
6-30-81Fr.4	.04	<.005	2	.017	.015	.06	25	.09	.35	.84
6-30-81Fr.5	.04	<.005	2	.017	.025	.13	22	.07	.39	1.26
6-30-81Fr.6	.02	<.005	4	.008	.008	.02	10	.02	.40	.53
6-30-81Fr.7	.02	<.005	2	.008	.008	.06	9	.02	.52	.63
6-30-81Fr.8	.06	<.005	4	.015	.014	.06	12	.06	.30	.65
6-30-81Comp.	.065	<.005	3	.020	.026	.11	19	.09	.40	.84
7-6-81	.05	.010	<1	.013	.025	.13	4.7	.11	.28	1.20
7-7-81	<.02	.007	2	.014	.020	.12	5	.14	.32	<.40
7-16-81	2.08	.120	4	.112	.306	.16	4	.92	<.05	8.84
7-17-81	(1.00)	(.030)	(3)	(.112)	(.150)	(.25)	3.5	.93	(.15)	(2.00)
7-19-81	.48	.014	2	.050	.110	.26	18	.32	.34	.42
7-21-81	.84	.060	3	.066	.065	.51	19	.57	.08	3.48
7-21-81B	.72	.110	2	.060	.094	.24	4.7	.60	.22	3.68
7-27-28-81	.02	.017	1	.013	.085	.16	27	.15	.30	3.05
7-30-81Fr.1	.02	.005	1	.080	.035	.18	14	.18	.27	.53
7-30-81Fr.2	<.02	<.005	1	.018	.001	(.08)	5.4	.04	<.05	<.20
7-30-81Fr.3	.03	<.005	1	(.018)	.001	(.10)	6	.08	.17	(<.20)

Table 1B (Continued)
Individual Rains (U. of Ark. Research)[a]
Concentration of Various Ions

Rain	ppm Ca^{2+}	ppm Mg^{2+}	ppb Sr^{2+}	ppm K^+	ppm Na^+	ppm (as N) NH_4^+(b)	ppb H^+	ppm (as N) NO_3^-	ppm Cl^-	ppm $SO_4^=$
7-30-81Comp.	.019	.004	1	.053	.021	(.14)	10.4	.13	.19	(.34)
8-1-81	.14	.020	<1	.043	.087	.50	56	.40	.35	.79
8-2-4-81	.12	.015	7	.010	.051	.04	16	.27	.32	2.26
8-6-81	.30	.025	1	.013	.100	.58	16	.23	.32	2.78
8-11-81	.24	.010	1	.048	.033	.72	62	.54	.22	3.99
8-16-81	.18	.010	<2	.026	.050	.36	12	46	.62	.84
8-17-81	.03	<.005	2	.007	<.010	.16	14	.11	.18	2.73
8-26-81	.22	.012	2	.016	.025	.15	43	.58	.21	3.73
8-27-81	.13	.010	1	.025	.005	.94	18	.94	.10	3.26
9-7-81	.14	.015	7	.010	.033	.26	37	.18	<.05	1.52
9-12-81	.54	.025	1	.130	.031	.87	72	.99	.21	2.21
9-13-14-81	.14	.010	5	.016	.005	.26	40	.48	.12	2.36
9-27-81	1.71	.352	(5)	.091	.653	.75	26	1.12	.74	5.32
10-5-6-81	.42	.045	<2	.310	.240	.33	12	.63	.48	1.05
10-10-81	.32	.040	<8	2.00	.200	1.16	1.5	.26	(.40)	(2.35)
10-11-13-81	.05	.010	<2	.016	.070	.06	20	.10	.22	.25
10-13-14-81	.12	<.005	<2	.010	.015	.08	5.5	.02	.16	.74
10-16-81	.05	<.025	<10	.080	.175	.20	3.2	.08	.17	2.35
10-17-81	.12	.015	<2	.048	.168	.12	6.0	.05	1.07	2.52
10-21-22-81	.08	.010	<2	.025	.087	.19	24	.16	.37	.40
10-25-26-81	<.05	.005	<2	.020	.023	.13	25	.10	.44	.63
10-31-11-1-81	.02	.005	2	.010	.030	.06	15	.04	<.05	1.73
11-3-81	.19	.015	<2	.023	.020	.32	31	.20	.11	.90
11-4-81	.18	.015	<6	.090	.033	.24	35	.27	<.05	.15
11-26-81	2.00	.175	<5	1.90	.700	.63	.2	.23	.43	.25
11-29-30-81	.16	.018	<1	.110	.08z	.24	19	.07	.32	.75

Table 2B
Weekly Rain Accumulations (Analyzed by Ill. State Water Survey).
Ion Flux Per Week

Week Ending	cm of Rain	Ca^{++}	Mg^{++}	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	(as P) $PO_4^=$
5-27-80	.768	.422	.036	.045	.303	.752	.034	.506	.192	3.78	<.0006
6-3-80	1.127	.518	.088	.080	.483	.815	.060	.702	.620	5.05	<.001
6-10-80	0.0	--	--	--	--	--	--	--	--	--	--
6-17-80	4.015	.112	.128	.161	.662	.687	.045	.743	1.164	4.66	<.004
4 Weeks	5.910	1.052	.252	.286	1.448	2.254	.139	1.951	1.976	13.49	<.006
6-24-80	8.973	.987	.153	.197	4.575	1.186	.143	1.701	5.831	12.29	<.009
7-1-80	.584	1093	.109	.081	.389	.540	.002	.574	.339	2.70	<.0007
7-8-80	0.0	--	--	--	--	--	--	--	--	--	--
7-15-80	0.0	--	--	--	--	--	--	--	--	--	--
4 Weeks	9.557	2.080	.262	.278	4.964	1.726	.145	2.275	6.170	14.99	<.01
7-22-80	1.784	.874	.057	.062	.150	1.249	.031	.842	.428	4.42	<.002
7-29-80	.809	.866	.049	.148	.093	.554	.032	.809	.316	2.91	<.0007
8-5-80	0.0	--	--	--	--	--	--	--	--	--	--
8-12-80	0.0	--	--	--	--	--	--	--	--	--	--
4 Weeks	2.593	1.740	.106	.210	.243	1.803	.063	1.651	.744	7.33	.003
8-19-80	1.162	.591	.093	.259	.551	.397	.019	.661	.825	2.37	<.001
8-26-80	0.0	--	--	--	--	--	--	--	--	--	--
9-2-80	.219	.191	.018	.028	.065	.259	.005	.211	.114	1.04	<.0003
9-9-80	.986	.144	.017	.028	.058	.169	.006	.147	.197	1.01	<.001
4 Weeks	2.367	.926	.128	.315	.674	.825	.030	1.019	1.136	4.42	<.002
9-16-80	4.237	.661	.097	.080	.123	1.450	.034	.842	.508	5.68	<.0042
9-23-80	1.857	2.079	.121	.119	.304	.607	.005	1.027	.798	4.53	<.002
9-30-80	2.595	.221	.029	.023	.156	.343	.016	.322	.571	1.58	<.0026
10-7-80	0.0	--	--	--	--	--	--	--	--	--	--
4 Weeks	8.689	3.961	.247	.222	.583	2.400	.055	2.191	1.877	11.79	<.009
10-14-80	0.0	--	--	--	--	--	--	--	--	--	--

Table 2B (Continued)
Weekly Rain Accumulations (Analyzed by Ill. State Water Survey).
Ion Flux Per Week

Week Ending	cm of Rain	$Ca^{‡}$	$Mg^{‡}$	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	(as P) $PO_4^=$
10-21-80	3.438	.591	.076	.089	.399	.614	.029	.489	.790	3.61	<.0033
10-28-80	2.618	.191	.029	.039	.089	.408	.042	.426	.314	2.51	<.0026
[illegible]	0.0	--	--	--	--	--	--	--	--	--	--
4 weeks	6.056	.782	.105	.128	.488	1.022	.071	.915	1.104	6.12	<.006
11-11-80	0.0	--	--	--	--	--	--	--	--	--	--
11-18-80	4.043	.562	.053	.016	.061	.660	.105	.785	.647	7.08	<.004
11-25-80	.309	.066	.007	.003	.009	.044	.007	.073	.050	.50	<.0003
12-2-80	.555	.091	.009	.007	.011	.104	.003	.128	.067	.44	<.0007
4 Weeks	4.907	.719	.069	.026	.081	.808	.115	.986	.764	8.02	<.005
12-9-80	4.794	.139	.043	.043	.345	.447	.025	.368	.863	2.35	<.005
12-16-80	0.0	--	--	--	--	--	--	--	--	--	--
12-23-80	0.0	--	--	--	--	--	--	--	--	--	--
12-30-80	.274	.141	.012	.111	.132	.096	.001	.085	.194	.411	<.0003
4 Weeks	5.068	.280	.055	.154	.477	.543	.026	.453	1.057	2.76	<.005
1-6-81	0.0	--	--	--	--	--	--	--	--	--	--
1-13-81	0.0	--	--	--	--	--	--	--	--	--	--
1-21-81	1.163	.078	.003	.006	.005	.380	.002	.181	.151	.663	<.001
1-27-81	.088	.031	.003	.003	.006	.050	.001	.024	.017	.110	.000
4 Weeks	1.251	.109	.006	.009	.011	.430	.003	.205	.168	.773	<.001
2-3-81	1.000	.269	.029	.024	.051	.389	.017	.251	.160	2.28	<.001
2-10-81	2.043	.190	.016	<.004	.037	.254	.048	.402	.327	2.53	<.002
2-17-81	.099	.038	.006	.001	.005	.096	.000	.047	.026	.311	<.000
2-24-81	1.042	.746	.065	.047	.056	1.220	.000	.397	.146	3.22	<.001
4 Weeks	4.184	1.243	.116	.074	.149	1.959	.065	1.097	.659	8.34	<.004
3-3-81	2.889	.179	.020	.032	.139	.809	.026	.430	.375	2.66	<.003
3-10-81	2.052	.279	.029	.025	.041	.399	.056	.463	.226	2.87	<.002
3-17-81	0.0	--	--	--	--	--	--	--	--	--	< --

Table 2B (Continued)
Weekly Rain Accumulations (Analyzed by Ill. State Water Survey).
Ion Flux Per Week

Week Ending	cm of Rain	$Ca^{‡}$	$Mg^{‡}$	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	(as P) $PO_4^=$
3-24-81	1.336	.263	.187	.162	.271	.457	.000	.630	.321	3.49	<.0013
4 Weeks	6.277	.721	.136	.219	.451	1.665	.082	1.523	.922	9.02	<.006
3-31-81	2.200	.367	.055	.055	.255	.513	.022	.298	.440	3.74	<.0023
4-7-81	.177	.336	.070	.004	.004	.081	.000	.111	.181	.74	<.0003
4-14-81	.699	.492	.104	.078	.453	.538	.004	.442	.601	2.39	<.001
4-21-81	3.418	.287	.099	.123	.550	.638	.033	.625	.752	2.97	<.003
4 Weeks	6.494	1.482	.328	.260	1.262	1.770	.059	1.476	1.974	9.84	<.006
4-28-81	2.835	.295	.048	.071	.184	.458	.019	.358	.170	2.13	<.003
5-5-81	1.962	.430	.069	.141	.249	.687	.008	.771	.451	3.34	<.006
5-12-81	3.106	.621	.071	.031	.118	1.081	.033	.631	.155	4.19	<.003
5-19-81	4.632	2.297	.241	.236	.820	1.729	.045	1.318	1.250	11.07	<.004
4 Weeks	12.535	3.643	.429	.479	1.371	3.982	.105	3.078	2.026	20.73	<.012
5-26-81	1.276	.290	.026	.033	.050	.278	.011	.340	.242	1.31	<.001
6-2-81	3.248	1.312	.130	1.306	.201	6.163	.00	.748	.714	5.91	.406
6-9-81	5.331	.293	.016	.032	.107	.870	.004	.289	.160	1.17	<.005
6-16-81	4.339	.347	.078	.061	.451	.641	.019	.588	.477	2.78	<.004
4 Weeks	14.194	2.242	.250	1.432	.809	7.952	.034	1.965	1.593	11.17	.406
6-23-81	1.977	.980	.097	.079	.646	.277	.003	.464	.474	2.90	<.002
6-30-81	10.136	.780	.081	.051	.882	.158	.126	.128	.608	5.68	<.01
7-7-81	1.210	.197	.094	.034	.075	.461	.003	.199	.133	2.04	<.003
7-14-8	.352	.056	.014	.010	.033	.005	.002	.026	.046	.21	<.0003
4 Weeks	13.675	2.013	.286	.174	1.636	.881	.134	.817	1.261	10.83	<.014
7-21-81	1.044	1.599	.199	.069	.304	.373	.002	.728	.449	2.21	<.001
7-28-81	5.023	1.045	.166	.090	.563	.821	.077	1.372	.753	6.33	<.005
8-5-81	6.399	.870	.198	.115	.461	.796	.110	.939	.640	6.78	<.006
8-11-81	2.230	.905	.143	.069	.294	.746	.009	.735	.334	2.88	<.023
4 Weeks	14.696	4.419	.706	.364	1.622	2.736	.198	3.774	2.176	18.20	<.015

Table 2B (Continued)
Weekly Rain Accumulations (Analyzed by Ill. State Water Survey).
Ion Flux Per Week

Week Ending	cm of Rain	$Ca^{‡}$	$Mg^{‡}$	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	(as P) $PO_4^=$
8-18-81	1.793	.235	.052	.020	.091	.348	.019	.308	.179	2.62	<.002
8-25-81	.593	1.950	.449	.209	.954	.009	.106	.020	.901	2.38	.013
9-1-81	2.576	1.012	.131	.085	.139	1.522	.046	.983	.309	7.57	<.003
9-1-81	2.156	.513	.157	.075	.216	.637	.034	.453	.280	4.14	<.002
4 Weeks	7.118	3.710	.789	.389	1.400	2.516	.205	1.764	1.659	16.71	.013
9-15-81	2.922	1.242	.129	.091	.126	1.500	.072	1.419	.205	5.82	<.003
9-22-81	0.0	--	--	--	--	--	--	--	--	--	--
9-29-81	.290	.495	.102	.026	.189	.219	.001	.266	.238	1.54	.0003
10-6-81	.491	.285	.030	.022	.131	.294	.001	.237	.187	1.01	.002
4 Weeks	3.703	2.022	.251	.139	.446	2.013	.074	1.922	.630	8.37	.002
10-14-81	3.986	.574	.100	.163	.331	.403	.065	.774	.558	4.27	<.004
10-20-81	3.022	.208	.066	.079	.172	.517	.007	.341	.151	2.02	<.003
10-27-81	5.827	.973	.157	.163	1.513	1.178	.123	1.263	.641	10.49	<.006
11-3-81	4.205	.639	.185	1.483	.181	2.028	.001	.446	.210	2.61	.377
4 Weeks	17.040	2.394	.508	1.893	1.197	4.126	.196	2.824	1.560	19.39	.377
11-10-81	1.526	.401	.055	.046	.087	.582	.027	.469	.061	2.93	.002
11-17-81	0.0	--	--	--	--	--	--	--	--	--	--
11-24-81	0.0	--	--	--	--	--	--	--	--	--	--
12-1-81	1.884	.768	.087	.066	.292	.410	.007	.285	.414	2.58	<.002
4 Weeks	3.410	1.169	.142	.112	.379	.992	.034	.754	.475	5.51	<.004
12-8-81	0.0	--	--	--	--	--	--	--	--	--	--
12-15-81	.203	.177	.081	.014	.100	.071	.002	.124	.112	.748	<.003
12-22-81	0.0	--	--	--	--	--	--	--	--	--	--
12-29-81	1.335	.512	.104	.071	.494	.571	.007	.329	.841	3.43	<.001
4 Weeks	1.538	.689	.185	.085	.594	.642	.009	.453	.953	4.178	<.004
1-6-82	.767	.533	.052	.057	.134	.471	.003	.298	.138	2.83	<.001

Table 2B (Continued)
Weekly Rain Accumulations (Analyzed by Ill. State Water Survey).
Ion Flux Per Week

Week Ending	cm of Rain	Ca^{++}	Mg^{++}	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	(as P) $PO_4^=$
1-12-82	0.0	--	--	--	--	--	--	--	--	--	--
1-19-82	.318	.091	.017	.004	.014	.037	.006	.099	.025	.429	<.001
1-26-82	1.850	.141	.074	.022	.142	.303	.013	.259	.111	.181	<.002
4 Weeks	2.935	.756	.143	.083	.290	.811	.022	.656	.274	3.44	<.002
2-2-82	9.010	.622	.108	.099	.649	.701	.070	.488	1.351	6.126	<.009
2-9-82	.279	.290	.077	.016	.110	.121	.001	.161	.128	.925	.002
2-16-82	2.415	.360	.029	.075	.082	.544	.084	.638	.145	5.458	<.002
2-23-82	.060	.035	.005	.002	.006	.075	.000	.029	.013	.281	<.000
4 Weeks	11.764	1.307	.219	.192	.847	1.441	.155	1.316	1.637	12.790	.007
3-2-82	0.0	--	--	--	--	--	--	--	--	--	--
3-9-82	1.249	.388	.005	.050	.106	.787	.045	.485	.137	4.609	<.001
3-16-82	3.630	1.255	.196	.156	.676	.621	.013	.641	.834	5.188	<.004
3-23-82	0.0	--	--	--	--	--	--	--	--	--	--
4 Weeks	4.879	1.643	.201	.206	.782	1.408	.058	1.026	.971	9.797	.002
3-31-82	.033	.541	.027	.026	.049	<.002	.000	.030	.046	.374	<.000
4-6-82	0.0	--	--	--	--	--	--	--	--	--	--
4-13-82	1.256	.839	.092	.092	.129	.244	.004	.272	.264	2.285	<.001
4-20-82	.250	.255	.027	.032	.055	.188	.001	.108	.162	1.046	<.000
4 Weeks	1.539	1.635	.146	.150	.233	.433	.005	.410	.372	3.705	.000
4-27-82	1.848	.712	.078	.039	.083	.545	.035	.450	.111	4.694	<.002
5-4-82	1.193	.539	.084	.041	.058	.455	.044	.458	.191	4.986	<.001
5-11-82	.349	.963	.041	.065	.113	.117	.001	.154	.220	.712	<.000
5-18-82	9.292	.372	.084	.121	.390	.650	.083	.818	.743	7.900	<.007
4 Weeks	12.682	1.786	.289	.266	.644	1.767	.163	1.880	1.265	11.182	<.010
5-25-82	2.070	.555	.122	.070	.296	.644	.019	.570	.393	2.794	<.002
6-1-82	3.678	.559	.074	.099	.298	.686	.049	.756	.515	4.633	<.003

Table 3
Individual Rains, Heavy Metal Concentrations
(units in ppb)

Method* Rain Date	Fe EX	Fe AC	Fe AR	Mn AC	Zn EX	Zn AC	Zn AR	CU EX	CU AC	CU AR	Ni AC	Pb EX	Pb AC
4-17-80	4	--	--	--	23	22	--	<1	--	<1	--	<6	--
4-24-80	<2	--	--	--	33	--	27	2	--	--	--	<6	--
4-26-80	--	13	--	4	--	6	--	--	2	--	<1	--	<1
5-1-5-80	20	--	--	--	29	--	27	<1	--	--	--	--	<6
5-12-80	--	20	--	5	--	8	--	--	2	--	2	--	<1
5-15-80	--	<1	--	1	--	6	--	--	1	--	<1	--	<1
5-18-80	12	<1	--	1	15	9	--	2	17	--	1	<6	<1
5-20-80	6	--	--	--	5	--	10	<1	--	--	--	<6	--
5-22-23-80	24	--	--	--	<1	--	25	3	--	--	--	<6	--
5-30-31-80	<2	--	--	--	12	--	13	<1	--	--	--	<6	--
6-16-80	<2	<1	--	2	6	9	7	--	1	<1	1	<6	<1
6-17-80	4	--	--	--	7	--	10	<1	--	--	--	<6	--
6-19-80	<2	--	--	--	6	--	10	1	--	--	--	<6	--
6-20-80	30	25	--	1	13	15	--	4	6	--	2	<6	<1
6-22-80	--	<1	--	1	--	6	--	--	1	--	1	--	2
7-17-80	24	--	--	--	<1	--	24	--	--	--	--	--	--
7-21-80	--	4	--	3	--	29	--	--	2	--	1	--	1
7-26-80	6	--	8	--	7	--	14	1	--	--	--	<6	--
8-14-80	20	--	--	--	>200	--	210	2.5	--	--	--	<6	--
8-18-80	22	--	20	--	3	--	7	<1	--	--	--	<6	--
9-2-80	10	--	28	--	35	--	30	4	--	--	--	<6	--
9-3-80	<2	--	--	--	74	--	52	1	--	--	--	<6	--
9-9-80	2	--	<10	--	4	--	5	<2	--	--	--	<6	--
9-14-80	32	--	--	--	32	--	32	2	--	--	--	<6	--
9-16-17-80	26	--	40	--	8	--	15	<1	--	--	--	<6	--
9-23-80	6	--	<10	--	45	--	40	<2	--	--	--	<6	--
9-25-80	6	--	16	--	4	--	5	<2	--	--	--	<6	--

Table 3 (Continued)
Individual Rains, Heavy Metal Concentrations
(units in ppb)

Method* Rain Date	Fe EX	Fe AC	Fe AR	Mn AC	Zn EX	Zn AC	Zn AR	CU EX	CU AC	CU AR	Ni AC	Pb EX	Pb AC
9-27-28-80	2	--	20	--	15	--	15	<2	--	--	--	<6	--
10-16-17-80	<2	--	20	--	4	--	4	<2	--	--	--	<6	--
10-23-24-80	18	--	20	--	5	--	10	<2	--	--	--	<6	--
10-26-27-80	6	--	20	--	3	--	15	<2	--	--	--	<6	--
11-14-15-80	10	--	20	--	16	--	10	<2	--	--	--	<6	--
11-16-17-80	4	--	20	--	6	--	10	<2	--	--	--	<6	--
11-22-23-80	--	--	--	--	--	--	5	--	--	--	--	--	--
11-26-27-80	--	--	--	--	--	--	3	--	--	--	--	--	--
12-8-80	2	--	20	--	1	--	5	<2	--	--	--	<6	--
12-26-80	--	--	28	--	--	--	15	--	--	--	--	--	--
1-19-21-81	8	--	28	--	23	--	17	<2	--	--	--	<6	--
1-29-81	--	--	12	--	--	--	30	--	--	--	--	--	--
1-31-81	4	--	8	--	6	--	8	<2	--	--	--	<6	--
2/9/10/81	--	--	<10	--	--	--	--	--	--	--	--	--	--
2-21-81	--	--	12	--	--	--	--	--	--	--	--	--	--
2-22-81	--	--	12	--	--	--	--	--	--	--	--	--	--
2-27-28-81	2	--	<10	--	6	--	--	<2	--	--	--	<6	--
3-3-81	2	--	<10	--	--	--	--	--	--	--	--	--	--

*EX = extracted with MIBK after Nix and Goodwin (1970) then AAS.
AC = concentrated via evaporation to 10-20x then AAS.
AR = determined on raw water by atomic absorption spectroscopy (AAS).

Table 4
Monthly Flux of Various Ions as A % of Yearly Total, and
Compared to % of Yearly Rainfall

Month	% of Yearly Rain	Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	(as N) NH_4^{+}	H^{+}	$\bar{p}H$	(as N) NO_3^{-}	Cl^{-}	SO_4^{2-}
June 1980	17	15	17	15	13	13	16	4.80	20	22	10
July	4	6	4	3	4	11	11	4.25	8	5	4
August	2	3	4	20	6	2	3	4.45	5	3	3
September	13	17	20	10	9	14	11	4.87	11	17	11
October	8	7	7	11	7	5	6	4.94	8	7	7
November	5	1	2	3	6	3	9	4.56	4	6	8
December	6	2	2	3	8	3	3	5.03	2	8	8
January 1981	3	2	1	2	2	2	2	4.90	2	2	3
February	8	6	4	4	3	9	6	4.88	6	5	8
March	8	17	11	14	7	12	8	4.70	8	4	11
April	11	8	13	3	18	8	7	4.90	11	10	10
May	16	16	15	11	17	18	18	4.73	15	11	17
	78.0 cm							4.72			
June 1981	20	10	5	11	14	11	14	5.13	10	24	14
July	8	8	7	5	10	7	8	5.03	10	9	14
August	11	8	5	4	7	15	13	4.67	22	12	20
September	5	5	2	8	2	9	11	4.55	13	3	7
October	15	7	5	15	16	9	15	4.94	9	15	9
November	3	4	2	11	4	4	4	5.07	3	3	2
December	1	4	3	3	8	3	1	4.96	1	4	3
January 1982	10	15	6	7	11	7	4	5.68	6	9	11
February	2	3	1	2	1	4	4	4.13	3	2	4
March	5	13	10	12	14	9	4	4.91	4	7	1
April	6	11	23	12	11	9	9	5.18	6	3	5
May	14	12	31	10	2	13	13	4.90	13	9	10
	110.5 cm							4.74			

Table 5

Monthly Flux of Various Ions in Wet Fallout
(analyzed by Ill. State Water Survey)

(units are millieq./m^2/mo.)

Month Ending*	Ca^{++}	Mg^{++}	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	Cations / Anions	Cm of Rain
6-24-80	1.32	.304	.107	2.49	1.90	2.44	2.26	2.15	4.58	.95	14.12
7-29-80	1.41	.177	.074	.274	1.67	.64	1.59	.51	2.08	1.01	3.18
8-26-80	.30	.077	.066	.240	.286	.186	.47	.23	.50	.96	1.16
9-30-80	1.66	.231	.071	.307	2.01	.618	1.55	.50	2.87	1.00	9.89
10-28-80	.38	.086	.033	.212	.743	.693	.64	.31	1.27	.97	6.06
11-25-80	.32	.049	.005	.030	.493	1.04	.60	.20	1.58	.82	4.35
12-30-80	.14	.047	.024	.177	.414	.317	.39	.28	.60	.88	5.62
1-27-81	.06	.006	.002	.005	.314	.027	.15	.05	.17	1.11	1.25
2-24-81	.62	.095	.019	.065	1.39	.637	.79	.19	1.73	1.04	4.18
3-31-81	2.61	.301	.110	.334	1.76	1.00	1.48	.39	3.08	1.24	8.48
4-28-81	.69	.264	.070	.517	1.25	.537	1.10	.48	1.71	.98	7.13
5-26-81	1.83	.334	.113	.539	2.69	.933	2.16	.59	4.15	.93	10.98
Σyear, 6/80-5/81	11.34	1.97	.694	5.19	14.9	9.07	13.2	5.88	24.3	.99	76.40
% Σcations	26	5	2	12	34	21					
% Σanions							30	14	56		
6-30-81	1.86	.331	.391	.994	5.79	1.52	1.58	.69	3.84	1.66	25.03
7-28-81	1.45	.389	.052	.424	1.19	.84	1.66	.39	2.25	.99	7.63
8-25-81	1.98	.692	.106	.783	1.36	2.44	1.43	.58	3.05	1.45	11.02
9-29-81	1.63	.427	.071	.291	2.77	1.53	2.23	.29	3.97	1.04	7.94
10-27-81	1.02	.290	.109	.499	1.71	1.96	1.87	.43	3.71	.93	13.33
11-24-81	.52	.197	.392	.117	1.86	.28	.65	.08	1.15	1.67	5.73
12-29-81	.73	.224	.039	.385	.75	.16	.53	.39	1.41	.98	3.42
1-26-82	.38	.117	.021	.126	.58	.22	.47	.08	.72	1.13	2.94
2-23-82	.65	.180	.049	.368	1.03	1.55	.94	.46	2.66	.94	11.76
3-31-82	1.09	.187	.059	.361	1.01	.58	.75	.29	2.12	1.04	4.91
4-27-82	.90	.162	.042	.116	.70	.40	.59	.15	1.67	.96	3.35
6-1-82	1.09	.335	.101	.500	1.82	1.96	1.97	.58	4.38	.84	16.58

Table 5 (Continued)

Month Ending*		Ca^{++}	Mg^{++}	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	Cations / Anions	Cm of Rain
Σyear	5/82	13.30	3.53	1.43	4.96	20.6	13.4	14.7	4.41	30.9	1.14	113.64
% ΣCa		23	6	3	9	36	23					
% Σanions								29	9	62		

*Some cover more than 4 weeks: 7/29/80(5), 9/30/80(5), 12/30/80(5), 1/27/81(4 2/3), 3/31/81(5 weeks + 1 day)
6/30/81(5), 9/29/81(5), 12/29/81(5), 3/31/82(5), 5/1/82(5)

Table 6A
Yearly Flux of Ions in Rains by Source Direction
(U. of Ark. Research for 4-17-80 to 4-14-81)

ELEMENT	S	SW	W	NW	N	NE	E	SE	Σ
Rain, cm	9.42	21.36	16.44	5.34	8.06	2.01	2.34	4.93	69.90
H+, ppb x cm.	115.3	305	311.6	141.7	325.1	47.4	48.4	99.7	1393.7
$\bar{p}$pb	12	12	19	27	40	23.5	20.7	20.2	19.9
pH, units	4.92	4.92	4.72	4.56	4.40	4.63	4.69	4.70	4.68
millieq./m^2	1.15	3.05	3.12	1.42	3.25	0.47	0.48	1.0	13.9
NO_3^-, ppm x cm, as N	2.56	6.17	3.71	2.89	3.82	0.155	0.185	1.22	20.7
$\bar{p}$pm	.27	.29	.23	.54	.47	.08	.08	.25	0.30
millieq./m^2	1.83	4.41	2.65	2.06	2.73	.111	.132	.871	14.8
NH_4^+, ppm x cm, as N*	2.82	14.44	10.97	6.16	9.4	.23	.30	2.4	46.72
$\bar{p}$pm	.23	.68	.67	1.15	1.17	.11	.13	.49	0.67
milieq./m^2(N)	2.01	10.3	7.84	4.4	6.71	.16	.21	1.71	33.3
$SO_4^=$, ppm x cm	16.4	30.0	27.5	9.60	18.6	1.44	1.73	7.92	113
$\bar{p}$pm	1.74	1.40	1.67	1.80	2.31	0.72	0.74	1.61	1.62
millieq./m^2	3.41	6.24	5.73	2.00	3.88	.30	.36	1.65	23.6
Cl^-, ppm x cm	1.98	5.48	5.68	1.62	1.88	.667	.774	1.63	19.7
$\bar{p}$pm	.21	.25	.35	.30	.23	.33	.33	.33	.282
millieq/m^2	.558	1.545	1.600	.457	.530	.188	.218	.459	5.56
Na, ppm x cm	.658	1.96	1.79	.589	1.23	.048	.055	.368	6.72
$\bar{p}$pm	.070	.092	.109	.110	.153	.024	.024	.075	.096
millieq./m^2	.286	.853	.779	.265	.536	.021	.024	.160	2.92
K, ppm x cm	.524	1.986	.958	.340	.418	.035	.043	.172	4.50
$\bar{p}$pm	.056	.093	.058	.064	.052	.017	.018	.035	.064
millieq./m^2	.134	.508	.245	.087	.107	.009	.011	.044	1.15
Ca, ppm x cm	6.00	8.22	8.47	4.76	3.22	.248	.284	2.10	36.9

Table 6A (Continued)
Yearly Flux of Ions in Rains by Source Direction
(U. of Ark. Research for 4-17-80 to 4-14-81)

ELEMENT	S	SW	W	NW	N	NE	E	SE	Σ
$\bar{p}pm$	.637	.385	.515	.891	.400	.123	.121	.426	.528
millieq./m^2	1.[illegible]	2.956	2.117	1.189	.806	.062	.071	.524	9.22
Mg, ppm x cm	.2[illegible]	574	.653	.147	.173	.024	.024	.117	1.92
$\bar{p}pm$	.022	.027	.040	.028	.021	.012	.010	.024	.027
millieq./m^2	.167	.472	.537	.121	.142	.020	.020	.096	1.57
Fe^{++}, ppb x cm**	32.4	132.5	80.4	52.3	48.3	1.4	2.0	39.2	388.5
$\bar{p}pb$	3.54	6.79	5.34	9.94	6.53	0.85	1.0	9.25	6.04
millieq./m^2	.0115	.0475	.0288	.0187	.0173	.0005	.0007	.0140	.139
Zn^{++}, ppb x cm**	79.1	309.1	93.0	30.6	111.7	9.9	14.9	49.2	697.5
$\bar{p}pb$	8.6	[illegible].8	6.2	5.8	15.1	6.0	7.5	11.6	10.9
millieq./m^2	.0242	.0946	.0284	.0094	.0342	.0030	.0046	.0150	.213
Σ cations(meq./m^2	5.25	118.1	14.6	7.48	11.5	0.74	0.81	3.53	62.0
Σ anions (meq./m^2	5.80	12.2	10.0	4.52	7.14	.60	0.71	2.98	44.0
cations/anions	0.91	1.48	1.46	1.65	1.61	1.23	1.14	1.18	1.41

*By direct Nesselerization

**For 4-17-80 to 3-3-81

Table 6B
Yearly Flux of Ions in Rains by Source Direction
(U. of Ark. Research for 6-1-80 to 5-31-81)

Ion	S	SW	W	NW	N	NE	E	SE	Σ
				millieq./m^2/year					
Ca^{2+}	1.83	2.55	1.91	1.18	.82	.038	.026	.50	8.85
Mg^{2+}	.22	.48	.47	.12	.14	.008	.033	.13	1.60
K^+	.18	.55	.22	.08	.06	.013	.006	.034	1.14
Na^+	.60	1.07	.65	.40	.57	.014	.008	.27	3.58
NH_4^+(as N)*	4.24	11.5	7.44	4.52	7.98	.21	.13	1.33	37.35
H^+	1.97	3.92	2.81	1.29	3.45	.18	.08	.57	14.27
Σ cations	9.04	20.07	13.5	7.59	13.02	.46	.28	2.83	66.79
NO_3^-(as N)	2.56	4.76	2.45	2.14	3.02	.12	.07	.66	15.74
Cl^-	.97	1.50	1.27	.42	.67	.15	.05	.25	5.28
$SO_4^=$	4.50	7.50	5.00	1.97	3.66	.69	.19	1.50	25.01
Σ anions	5.47	13.8	8.72	4.53	7.4	.96	.31	2.41	43.55
cat./anions	1.29	1.45	1.55	1.67	1.76	.48	.90	1.17	1.53
				units, % of total ion from a given direction					
Ca^{2+}	21	29	22	13	9	.3	.2	5.5	
Mg^{2+}	14	30	29	7.5	9	.5	2	8	
K^+	16	48	19	7	5	1	1	3	
Na^+	17	30	18	11	16	.4	.2	7.4	

Table 6B (Continued)
Yearly Flux of Ions in Rains by Source Direction
(U. of Ark. Research for 6-1-80 to 5-31-81)

Ion	S	SW	W	NW	N	NE	E	SE	Σ
				millieq./m^2/year					
NH_4^+(as N)*	11	31	20	12	21	.5	.2	3.3	
H^+	14	27	20	9	24	1.3	.7	4	
NO_3^-(as N)	16	30	16	14	19	.7	.3	4	
Cl^-	18	28	24	8	13	3	1	5	
$SO_4^=$	18	30	20	8	15	3	1	5	
				Amount of Rain from Various Directions					
cm of rain	14.4	27.1	16.0	5.5	9.66	1.46	.68	3.02	77.8
% of total	18	35	21	7	12	2	1	4	
Av. rain(cm)	1.38	1.56	1.50	0.89	1.23	0.91	0.70	1.08	
				Average Concentrations					
Ca^{2+}(ppm)	.254	.188	.239	.429	.170	.104	.076	.331	.228
Mg^{2+}(ppm)	.019	.022	.036	.027	.018	.007	.059	.052	.025
K^+(ppm)	.049	.079	.054	.057	.024	.035	.035	.044	.057
Na^+(ppm)	.096	.901	.093	.167	.136	.022	.027	.206	.106
NH_4^+(as N,ppm)*	1.35	.594	.651	1.13	1.17	.201	.268	.617	.672
H^+ (ppb)	13.7	14.5	17.6	22.9	36.0	12.3	11.8	19.0	18.3
pH	4.86	4.84	4.76	4.64	4.43	4.90	4.92	4.71	4.74

Table 6B (Continued)
Yearly Flux of Ions in Rains by Source Direction
(U. of Ark. Research for 6-1-80 to 5-31-81)

millieq./m^2/year

Ion	S	SW	W	NW	N	NE	E	SE	Σ
NO_3^- (as N,ppm)	.249	.246	.214	.544	.438	.115	.144	.306	.283
Cl^- (ppm)	.24	.20	.28	.27	.25	.36	.26	.29	.24
$SO_4^=$ (ppm)	1.50	1.32	1.50	1.72	1.82	2.27	1.34	2.38	1.54

* By direct Nesselerization

Table 6C
Yearly Flux of Ions in Rains by Source Direction
(U. of Ark. Research for 6-1-81 to 5-31-82)

Ion	Millieq./m^2/year								
	S	SW	W	NW	N	NE	E	SE	Σ
Ca^{2+}	1.50	3.07	1.28	1.78	.563	.396	.243	.504	9.43
Mg^{2+}	.824	.901	.248	.319	.084	.050	.022	.144	2.59
K^+	.191	.352	.123	.170	.108	.043	.029	.071	1.09
Na^+	.596	1.195	.483	.452	.205	.120	.057	.239	3.35
NH_4^+(as N)*	3.41	5.24	1.63	3.25	.885	.777	.301	.773	16.27
H^+	4.09	6.73	2.18	3.12	1.01	.799	.264	1.482	19.68
Σcations	10.61	17.49	5.94	9.09	2.86	2.19	.916	3.21	52.31
NO_3^-(as N)	2.42	4.78	1.26	2.60	.961	.619	.787	.656	14.08
Cl^-	.932	2.56	1.09	1.16	.566	.483	.126	.463	7.38
$SO_4^=$	6.08	11.37	5.58	4.12	1.43	1.68	.754	1.632	32.65
Σanions	9.43	18.71	7.93	7.88	2.957	2.782	1.667	2.751	54.11
cations/anions	1.13	.93	.75	1.15	.97	.79	.55	1.17	.97

Units, % of Ion from a Given Direction

Ion	S	SW	W	NW	N	NE	E	SE
Ca^{2+}	16	33	14	19	6	4	3	5
Mg^{2+}	32	35	10	12	3	2	1	5
K^+	18	32	11	16	10	4	3	6
Na^+	18	36	14	13	6	4	2	7
NH_4^+(as N)	21	32	10	20	5	5	2	5
H^+	21	34	11	16	5	4	1	8
NO_3^-(as N)	17	34	9	18	7	4	6	5
Cl^-	13	34	15	16	8	6	2	6
$SO_4^=$	19	35	17	13	4	5	2	5

Table 6C (Continued)

	S	SW	W	NW	N	NE	E	SE	Σ
	Amount of Rain from Various Source Directions								
Cm of rain	20.92	34.49	17.91	11.65	5.95	5.72	4.03	9.79	110.5
% of total	19	31	16	11	5	5	4	9	100
av. rain (cm)	.910	.958	1.194	.832	.661	.636	1.01	1.09	-
Ion	Average Concentration for Various Source Directions								
Ca^{2+}(ppm)	.287	.356	.286	.611	.378	.277	.241	.206	.338
Mg^{2+}(ppm)	.048	.032	.017	.033	.016	.011	.007	.018	.028
K^{+}(ppm)	.036	.040	.029	.057	.071	.029	.028	.028	.039
Na^{+}(ppm)	.066	.080	.062	.089	.079	.048	.033	.056	.070
NH_4^{+}(as N, ppm)*	.228	.213	.127	.391	.208	.190	.105	.111	.206
H^{+}(ppb)	19.6	19.5	12.2	26.8	17.0	14.0	6.6	15.1	17.8
pH	4.70	4.70	4.90	4.57	4.76	4.85	5.16	4.82	4.75
NO_3^{-}(as N, ppm)	.162	.194	.098	.312	.226	.152	.273	.094	.178
Cl^{-}(ppm)	.158	.263	.216	.353	.338	.300	.111	.168	.237
$SO_4^{=}$(ppm)	1.40	1.58	1.50	1.70	1.15	1.41	.898	.800	1.42
Na/Cl (atom ratio)	.64	.47	.44	.39	.36	.25	.46	.51	.46

* by phenate method

Table 6D
Yearly Flux of Fe and Zn in Rains by Source Direction
(U. of Ark. Research for Period 4-17-80 to 3-3-81)

	S	SW	W	NW	N	NE	E	SE
Fe, ppb x cm	32.4	132.5	80.4	52.3	48.3	1.4	2.0	39.2
ppb, millieq./m^2	3.54	6.79	5.34	9.94	6.53	.85	1.0	9.25
Zn, ppb x cm	79.1	309.1	93	30.6	111.7	9.9	14.9	49.2
ppb, millieq./m^2	8.6	15.8	6.2	5.8	15.1	6.0	7.5	11.6
Particulates for the period								
mg./cm	0.02	1.54	1.36	2.40	.67	.33	2.85	1.92
Average Rain (for this period)								
cm.	1.91	1.49	1.46	1.01	1.41	3.3	1.98	1.18

Table 6E
Yearly Flux of Nutrient and Acid Ions
(units are millieq./m^2/yr)

Fallout	Ca^{2+}	Mg^{2+}	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^{=}$	$\frac{\text{cations}}{\text{anions}}$	cm of rain
June 1980 through May 1981											
Wet (CAL) (1)	11.3	1.97	.69	5.19	14.9	9.07	13.2	5.88	24.3	.99	76.4
Wet (U of A) (2)	9.4	1.65	1.13	3.35	(36.3)	13.5	13.5	5.02	27.6	1.42	78.0
Dry (U of A) (3)	23.7	2.52	4.65	1.83	(8.0)	-	4.65	1.60	9.5	-	-
(1) + (3)	35.0	4.49	5.34	7.02	(22.9)	9.07	17.9	7.48	33.8	-	-
% Dry = $\frac{100\ (3)}{(1) + (3)}$	68	56	87	26	35	-	26	22	28	-	-
June 1981 through May 1982											
Wet (CAL) (4)	13.3	3.53	1.43	4.96	20.6	13.4	14.7	4.41	30.9	1.14	113.6
Wet (U of A) (5)	9.34	2.56	1.06	2.88	16.0	20.0	13.5	7.38	32.6	.97	110.5
Dry (U of A) (6)	21.4	1.85	1.45	1.17	5.9	-	4.6	1.49	11.9	-	-
(4) + (6)	34.7	5.38	2.88	6.13	26.5	13.4	19.3	5.90	42.8	-	-
% Σ cations (wet)	18	5	2	5	31	39	-	-	-	-	-
% Σ anions (wet)	-	-	-	-	-	-	25	14	61	-	-
% Dry = $\frac{100\ (6)}{(4) + (6)}$	62	34	50	19	22	-	24	25	28	-	-
Ratio of (6-80 to 5-81) to (6-81 to 5-82)											
U of A (wet)	.99	1.55	.94	.82	1.38	1.48	1.00	1.47	1.18	-	1.42
U of A (dry)	.90	1.12	.31	.64	-	-	.99	.93	1.25	-	-

Table 6F
Yearly Flux of Nutrient and Acid Ions in
Wet and Dry Fallouts (Units are lb per acre per year)

Fallout	Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	(as N) NH_4^+	(as N) NH_3^+	Cl^-	$SO_4^=$
				6-80 to 5-81				
wet (CAL)	2.01	0.22	0.24	1.06	1.86	1.65	1.86	10.4
dry (U of A)	4.23	0.28	1.62	0.38	1.00	0.58	0.51	4.1
wet + dry	6.24	0.50	1.86	1.44	2.86	2.23	2.37	14.5
				6-81 to 5-82				
wet (CAL)	2.37	0.40	0.50	1.02	2.57	1.84	1.40	13.2
dry (U of A)	3.82	0.29	0.37	.59	0.74	0.57	.47	5.1
wet + dry	6.19	0.69	0.87	1.61	3.31	2.41	1.87	18.3

Table 6G
Yearly Flux of Miscellaneous Ions for
Wet and Dry Fallout for the Period 4-80 to 3-81

Fallout	(as P) PO_4^{3-}	(as Si) SiO_2	Sr^{2+}	Li^{+}	Fe^{2+}	Mn^{2+}	Zn^{2+}	Ca^{2+}	Ni^{2+}	Pb^{2+}
Wet-conc. (ppb)	<1	<20	2	<1	6.4	1-5	10.4	<2-4	1-2	<6
-millieq./m^2/yr	<0.08	<0.56	0.04	-	0.16	0.06	0.22	-	-	-
Dry-millieq./m^2/yr	2.83	0.28	0.015	-	0.07	0.11	0.03	-	-	-
Dry-as % of total	100	-	27	-	30	65	12	-	-	-

Table 7
Summary, Weekly Flux, Dry Fallout (Analyzed by Ill. State Water Survey)

(units are $\mu g/(cm)^2/week$)

Two Months Ending	Ca^{2+}	Mg^{2+}	K^+	Na^+	(as N) NH_4^+	H^+	(as N) NO_3^-	Cl^-	$SO_4^=$	(as P) PO_4^{3-}
6-3-80	1.393	.108	.765	.286	2.015	0	.103	.354	2.086	[illegible]
8-5-80	.847	.237	2.150	.165	2.248	0	<.000	.389	.954	.459
[illegible]7-80	.433	.221	1.291	.059	.419	0	.022	.168	.765	.294
[illegible]-2-80	1.171	.113	.435	.100	.733	0	.206	.213	1.207	.073
2-3-81	1.117	.027	.034	.053	.026	0	.454	.081	1.554	<.001
3-24-81	1.221	.049	.107	.124	.059	0	.207	.152	1.795	.012

Table 8A

Summary, Monthly Flux, Wet and Dry Fallout
for Ca^{2+}, Mg^{2+}, Sr^{2+}, and K^{+} (U. of A. Research)
(units are $\mu g/cm^2/mo.$)

Month	cm of rain	Ca^{2+} wet	Ca^{2+} dry	Ca^{2+} total	Mg^{2+} wet	Mg^{2+} dry	Mg^{2+} total	Sr^{2+} wet	Sr^{2+} dry	Sr^{2+} total	K^{+} wet	K^{+} dry	K^{+} total
April 1980	2.91	1.43	11.0	12.40	.189	.33	.519	.0039	.048	.052	.229	.412	.641
May	9.34	2.44	6.2	8.64	.321	.34	.661	.0087	.012	.021	.390	1.000	1.39
June	13.32	2.72	4.7	7.42	.337	.28	.617	.0124	.005	.017	.672	4.04	4.71
July	2.69	1.21	4.7	5.91	.080	.28	.360	.0486	.005	.053	.142	4.04	4.18
August	1.20	.50	1.5	2.00	.087	.50	.587	.0027	.005	.007	.891	3.00	3.89
September	9.84	3.23	1.5	4.73	.410	.50	.910	.0287	.004	.033	.426	3.00	3.43
October	6.24	1.26	4.1	5.36	.142	.38	.522	.0179	.006	.024	.500	1.73	2.23
November	4.33	.24	4.1	4.34	.033	.38	.413	.0022	.006	.008	.132	1.73	1.86
December	4.80	.30	4.9	5.20	.039	.11	.149	.0029	.009	.012	.143	.133	.276
January 1981	2.31	.35	4.9	5.25	.021	.11	.131	.0066	.009	.016	.096	.133	.229
February	6.13	1.14	4.3	5.40	.069	.11	.179	.0059	.005	.011	.181	.077	.258
March	5.85	3.27	4.2	7.52	.228	.11	.338	.0131	.005	.018	.624	.077	.701
April	8.43	1.46	4.3	5.71	.255	.14	.395	.0185	.005	.024	.117	.122	.239
May	12.87	3.08	4.2	7.33	.307	.14	.447	.0068	.005	.012	.489	.122	.611
Σ6-80 to 5-81	78.02	18.8	47.3	66.1	2.01	3.04	5.05	.166	.070	.236	4.41	18.2	22.6
June 1981	22.3	1.78	2.15	3.93	.151	.202	.353	.0555	.016	.0715	.473	.186	.659
July	9.10	1.55	2.14	3.69	.203	.202	.405	.0107	.0101	.0208	.210	.186	.396
August	11.57	1.49	2.19	3.68	.161	.162	.323	.0419	.0101	.0520	.178	1.82	1.998
September	5.49	1.00	3.66	4.66	.074	.106	.180	.0307	.0061	.0368	.334	1.03	1.364
October	16.96	1.25	3.66	4.91	.147	.106	.253	.0181	.0060	.0241	.623	2.43	.866
November	3.40	.78	3.65	4.43	.073	.072	.145	.0032	.0060	.0090	.439	.117	.556

Table 8A (Continued)

Summary, Monthly Flux, Wet and Dry Fallout

for Ca^{2+}, Mg^{2+}, Sr^{2+}, and K^{+} (U. of A. Research)

(units are $\mu g/cm^2/mo.$)

Month	cm of rain	Ca^{2+} wet	Ca^{2+} dry	Ca^{2+} total	Mg^{2+} wet	Mg^{2+} dry	Mg^{2+} total	Sr^{2+} wet	Sr^{2+} dry	Sr^{2+} total	K^{+} wet	K^{+} dry	K^{+} total
December	1.47	.74	3.65	4.39	.085	.072	.157	.0044	.0060	.0104	.110	.117	.227
January 1982	11.31	2.82	4.45	7.27	.178	.222	.400	.0224	.0060	.0284	.301	.105	.406
February	2.12	.64	4.45	5.09	.025	.222	.247	.0299	.0060	.0359	.087	.105	.192
March	4.89	2.37	4.78	7.15	.329	.350	.679	.0227	.0130	.0357	.483	.432	.915
April	6.29	2.10	4.78	6.88	.714	.350	1.06	.0078	.0130	.0208	.496	.432	.928
May	15.83	2.18	3.30	5.48	.971	.182	1.15	.0111	.0060	.0171	.401	.910	1.311
Σ6-81 to 5-82	110.46	18.70	42.86	61.56	3.111	2.248	5.352	.3584	.1043	.3625	4.135	5.683	9.818

Table 8B

Summary, Monthly Flux, Wet and Dry Fallout for Na^+, NH_4^+, H^+, NO_3^- and Cl^- (U. of Ark. Research)
(units are $\mu g/cm^2/mo.$)

Month	Na^+ wet	Na^+ dry	Na^+ total	NH_4^+ (as N) wet	NH_4^+ (as N) dry	NH_4^+ (as N) total	H^+ wet	H^+ dry	pH	NO_3^- (as N) wet	NO_3^- (as N) dry	NO_3^- (as N) total	Cl^- wet	Cl^- dry	Cl^- total
April 1980	.270	.495	.765	1.95	1.74	3.68	(.001)	0	4.62	.885	.330	1.215	.67	3.67	4.34
May	.763	.433	1.200	5.33	1.32	6.65	.235	0	4.60	2.02	2.05	4.07	4.33	2.57	6.90
June	1.082	.312	1,394	7.48	1.15	8.63	.215	0	4.80	3.75	.383	4.13	3.88	.77	4.65
July	.308	.312	.620	7.11	1.15	8.26	.148	0	4.25	1.56	.383	1.94	.96	.77	1.73
August	.490	.441	.931	1.59	1.05	2.64	.040	0	4.45	.933	.212	1.14	.59	.27	.86
September	.698	.441	1.139	9.07	1.05	10.12	.141	0	4.87	2.09	.212	2.30	3.07	.27	3.34
October	.573	.211	.784	2.30	1.91	4.21	.073	0	4.94	1.42	.880	2.30	1.26	.28	1.54
November	.477	.211	.688	1.65	1.91	3.56	.121	0	4.56	.673	.880	1.55	1.00	.28	1.28
December	.610	.478	1.088	.74	.84	1.58	.046	0	5.03	.380	.422	.80	1.33	.28	1.62
January 1981	.153	.478	.631	1.43	.84	2.27	.030	0	4.90	.421	.422	.84	.34	.28	.62
February	.278	.280	.558	3.36	.37	3.73	.080	0	4.88	1.172	.590	1.76	.85	.50	1.35
March	.589	.280	.869	3.11	.37	3.48	.111	0	4.70	1.509	.590	2.10	.78	.50	1.28
April	1.485	.390	1.875	4.39	.27	4.66	.098	0	4.90	2.161	.770	2.93	1.88	.73	2.61
May	1.368	.390	1.758	8.59	.27	8.86	.237	0	4.73	2.828	.770	3.60	1.89	.73	2.62
Σ6-80-5-81	8.11	4.36	12.48	50.8	11.2	62.0	1.340	0	4.75	18.9	6.51	25.3	17.8	5.47	23.5
June 1981	.963	.145	1.108	2.46*	2.13*	4.59	.280	0	4.87	1.803	.276	2.079	6.37	.36	6.73
July	.636	.145	.781	1.564	2.13	3.69	.165	0	4.74	1.932	.276	2.208	2.39	.36	2.75
August	.486	.123	.609	3.241	2.60	5.84	.266	0	4.63	4.223	.311	4.534	3.16	.42	3.58
September	.117	.143	.260	1.878	.31	2.19	.226	0	4.37	2.518	.525	3.043	.68	.29	.98
October	1.078	.143	1.221	2.006	.31	2.32	.294	0	4.75	1.784	.525	2.309	4.04	.29	4.33
November	.253	.109	.362	.958	.12	1.08	.082	0	4.60	.471	.305	.776	.75	.18	93
December	.550	.109	.659	.669	.13	.80	.016	0	4.95	.210	.305	.515	1.01	.18	1.18

Table 8B (Continued)

Summary, Monthly Flux, Wet and Dry Fallout for
Na^+, NH_4^+, H^+, NO_3^- and Cl^- (U. of Ark. Research)
(units are $\mu g/cm^2/mo.$)

Month	Na^+ wet	Na^+ dry	Na^+ total	NH_4^+ (as N) wet	NH_4^+ (as N) dry	NH_4^+ (as N) total	H^+ wet	H^+ dry	H^+ pH	NO_3^- (as N) wet	NO_3^- (as N) dry	NO_3^- (as N) total	Cl^- wet	Cl^- dry	Cl^- total
January 1982	.762	.303	1.605	1.605	.11	1.71	.083	0	5.12	1.035	.765	1.800	2.40	.53	2.92
February	.083	.303	.386	.896	.11	1.00	.078	0	4.43	.557	.765	1.322	.51	.53	1.04
March	.901	.465	1.366	2.105	.10	2.21	.070	0	4.84	.708	.800	1.508	1.75	.73	2.48
April	.708	.465	1.173	2.080	.10	2.18	.173	0	4.55	1.180	.800	1.980	.87	.73	1.60
[illegible]y	1.205	.222	1.427	2.890	.10	2.99	.262	0	4.75	2.433	.765	3.198	2.30	.61	2.91
to 5-82	7.74	2.68	10.42	22.35	8.25	30.60	1.995	0	4.75	18.85	6.42	25.27	26.2	5.21	31.43

*Phenate method began, previous analyses by direct nessleration (gives high values).

Table 8C

Summary, Monthly Flux, Wet and Dry Fallout for

$SO_4^{=}$, PO_4^{3-}, Fe, Zn and Mn (U. of Ark. Research)

(units are $\mu g/cm^2/mo$)*

Month	$SO_4^{=}$			PO_4^{3-} (as P)			Fe			Zn			Mn		
	wet	dry	total	wet	dry	total	wet	dry	total	wet	dry	total	wet	dry	total
April 1980	5.4	2.3	7.7	.0582	.11		.0216	.0608	.0824	.0481	.0207	.0688		.0885	
May	13.9	5.8	19.7	.5430	.10		.0746	.0256	.1002	.0885	.0106	.0991		.0630	
June	12.9	4.4	17.3	<.1332	.74		.0722	.0175	.0897	.0986	.0124	.1110		.0820	
July	5.9	4.4	10.3	<.0269	.61		.0165	.0175	.0340	.0600	.0124	.0724		.0820	
August	3.4	4.8	8.2		.34		.0258	.0162	.0420	.0794	.0068	.0862		.0330	
September	15.1	4.8	19.9		.34		.0596	.0162	.0758	.1497	.0068	.1565	spot checked only	.0330	
October	9.8	.9	10.7	usually below detection limit	.12		.0600	.0058	.0658	.0237	.0052	.0289		<.0086	
November	10.8	.9	11.7		.12		.0289	.0059	.0348	.0419	.0051	.0470		<.0080	
December	10.6	6.3	16.9		.05		.0171	.0095	.0266	.0089	.0022	.0111		.0443	
January 1981	4.4	6.3	10.7		.04		.0173	.0096	.0269	.0444	.0022	.0466		.0443	
February	10.2	4.3	14.5		.02		.0259	.0073	.0332	.0368	.0055	.0423		<.0074	
March	13.8	4.3	18.1		.03		(.0233)	.0073	.0306	(.0360)	.0055	.0415		<.0074	
April	12.8	2.0	14.8		.06		(.0233)	.0147	.0380	(.0360	.0055	.0415		<.0074	
May	22.8	2.0	24.8		.45		(.0233)	.0147	.0380	(.0360)	.0055	.0415		<.0074	
Σ6-80 to 5-81	132.2	45.4	177.6	(<1.6)	2.91		.3932	.1422	.5354	.6514	.0751	.7265	(.156)	.3642	.5202
June 1981	21.9	3.3	25.2					.0073			.0032			<.0074	
July	21.5	3.3	24.8					.0074			.0032			<.0074	
August	30.7	3.7	34.4					<.0074			.0074				
September	10.9	4.1	15.0					<.0074			.0074				
October	14.2	4.1	18.4												
November	2.5	4.6	7.1												
December	5.1	4.6	9.7												

Table 8C (Continued)

Summary, Monthly Flux, Wet and Dry Fallout for

$SO_4^{=}$, PO_4^{3-}, Fe, Zn and Mn (U. of Ark. Research)

(units are $\mu g/cm^2/mo$)*

Month	$SO_4^{=}$ wet	$SO_4^{=}$ dry	$SO_4^{=}$ total	PO_4^{3-} (as P) wet	PO_4^{3-} (as P) dry	PO_4^{3-} (as P) total	Fe wet	Fe dry	Fe total	Zn wet	Zn dry	Zn total	Mn wet	Mn dry	Mn total
January 1982	16.8	6.3	23.1												
February	6.1	6.3	12.4												
March	2.4	6.1	8.5												
April	8.5	6.1	15.6												
May	15.9	4.8	20.7												
	156.5	57.3	214.9												

*Values in parentheses are estimatew.

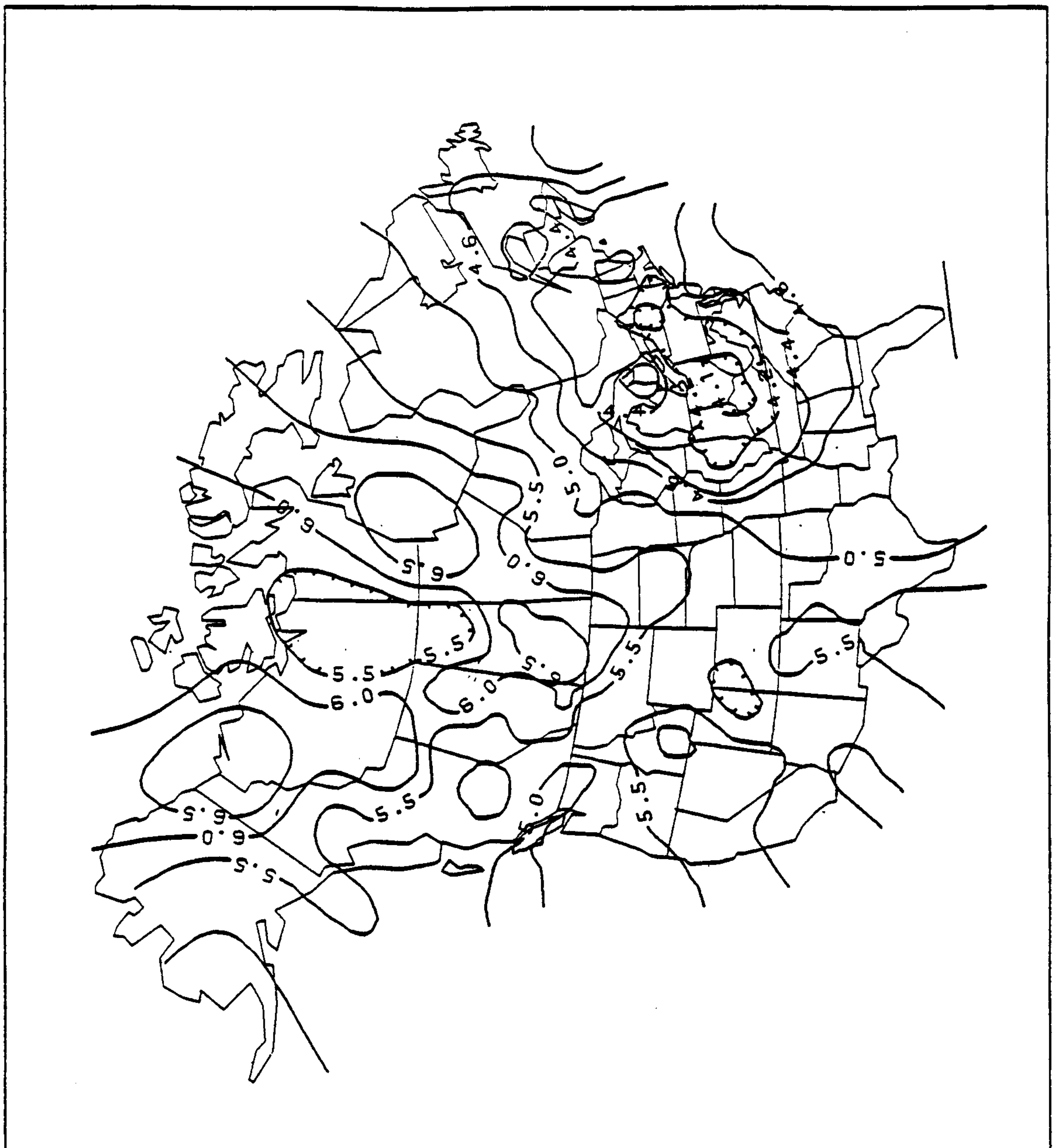
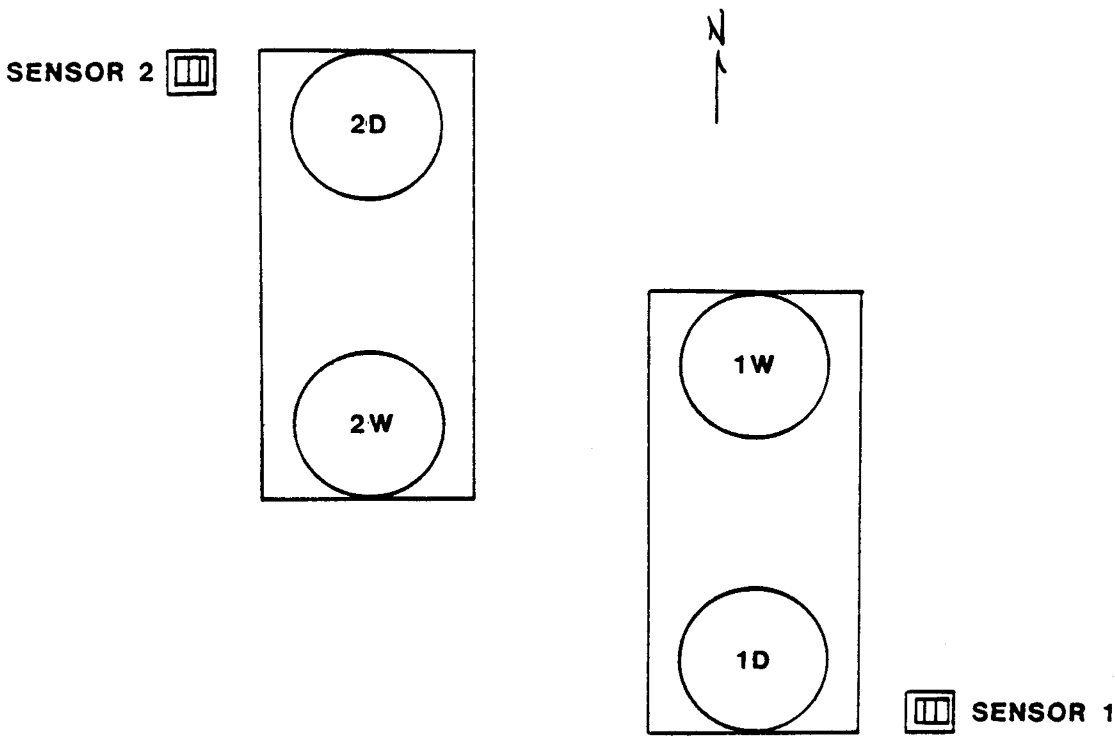


Figure 1. Contour map of pH for NADP stations as of 3-4-82.



DRY COLLECTORS = 1D and 2D

WET COLLECTORS = 1W and 2W(DIAMETERS, MID-RIM TO MID-RIM = 11.6 in.)

MASS OF RAIN(GRAMS) ÷ 1724 = INCHES OF RAIN

HEIGHT OF COLLECTORS (TO TOP) = 54"

COVER NOT SHOWN

SCALE
1 in. 1 ft.

Figure 2. Plan view of two Aerochem Metrics Model 301 collectors installed at the Weather Station, University of Arkansas Farm.

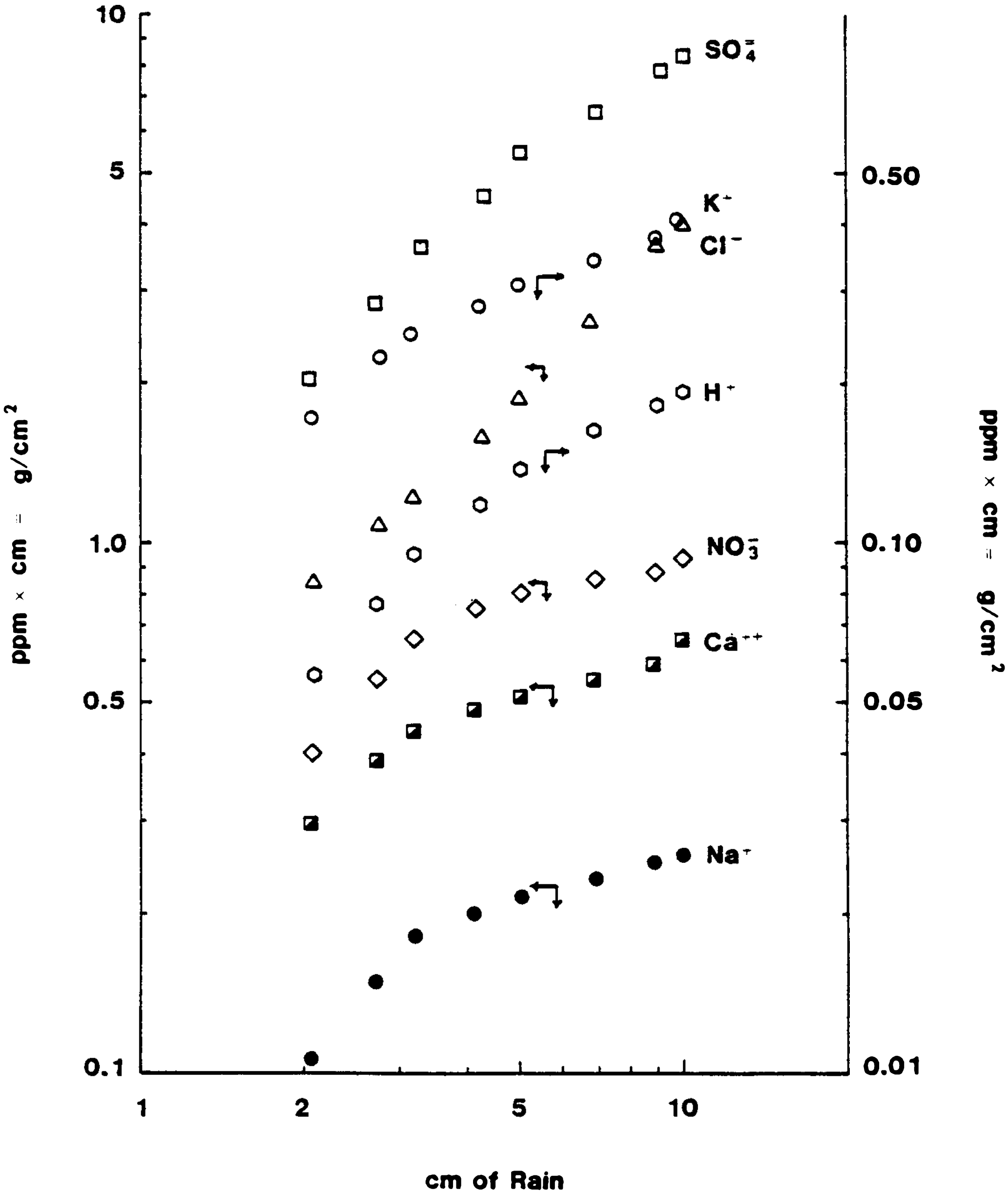


Figure 3. Cumulative flux of Rain of 6-30-81.

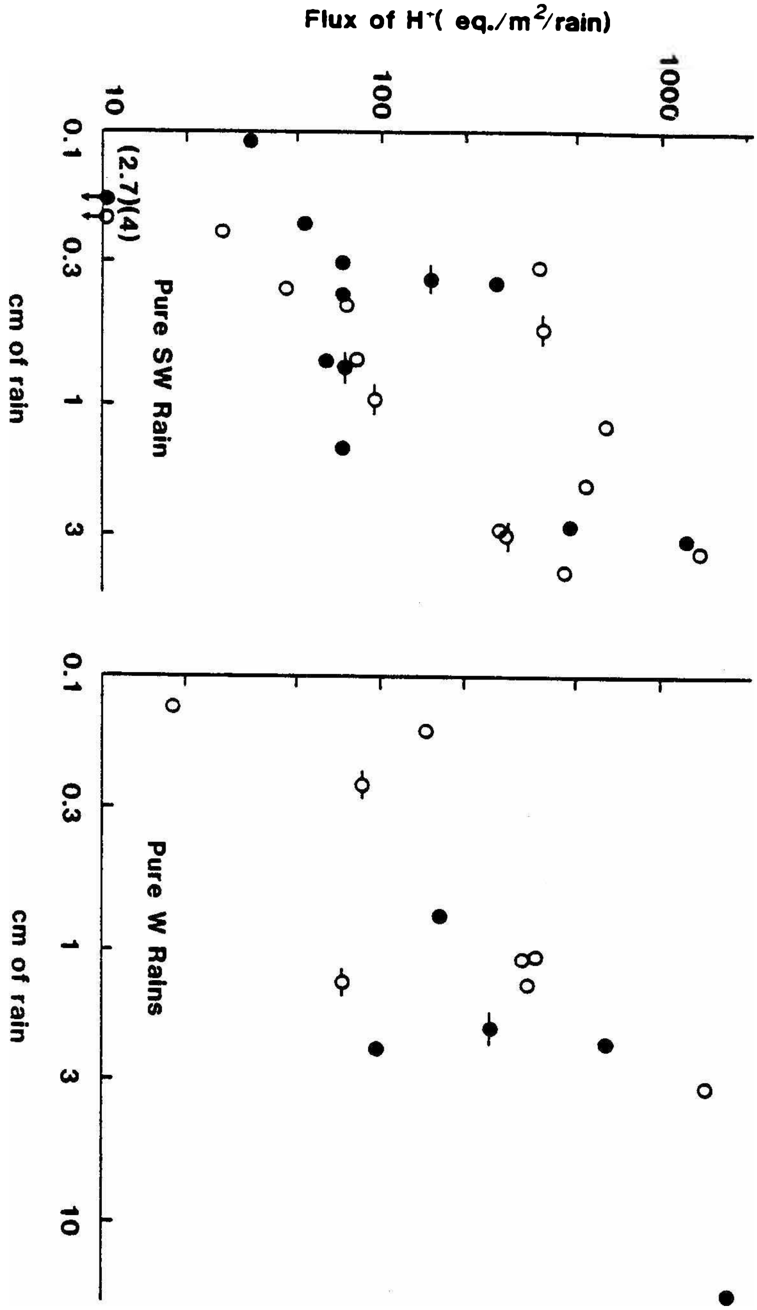


Figure 4. Flux per rain of H^+ for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

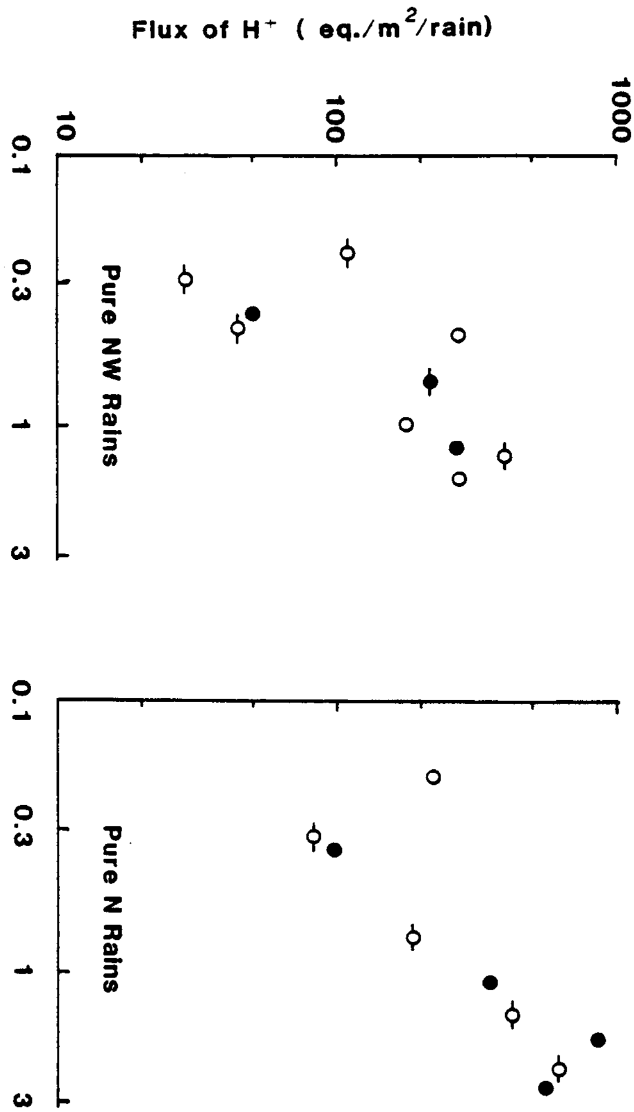


Figure 5. Flux per rain of H^+ for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

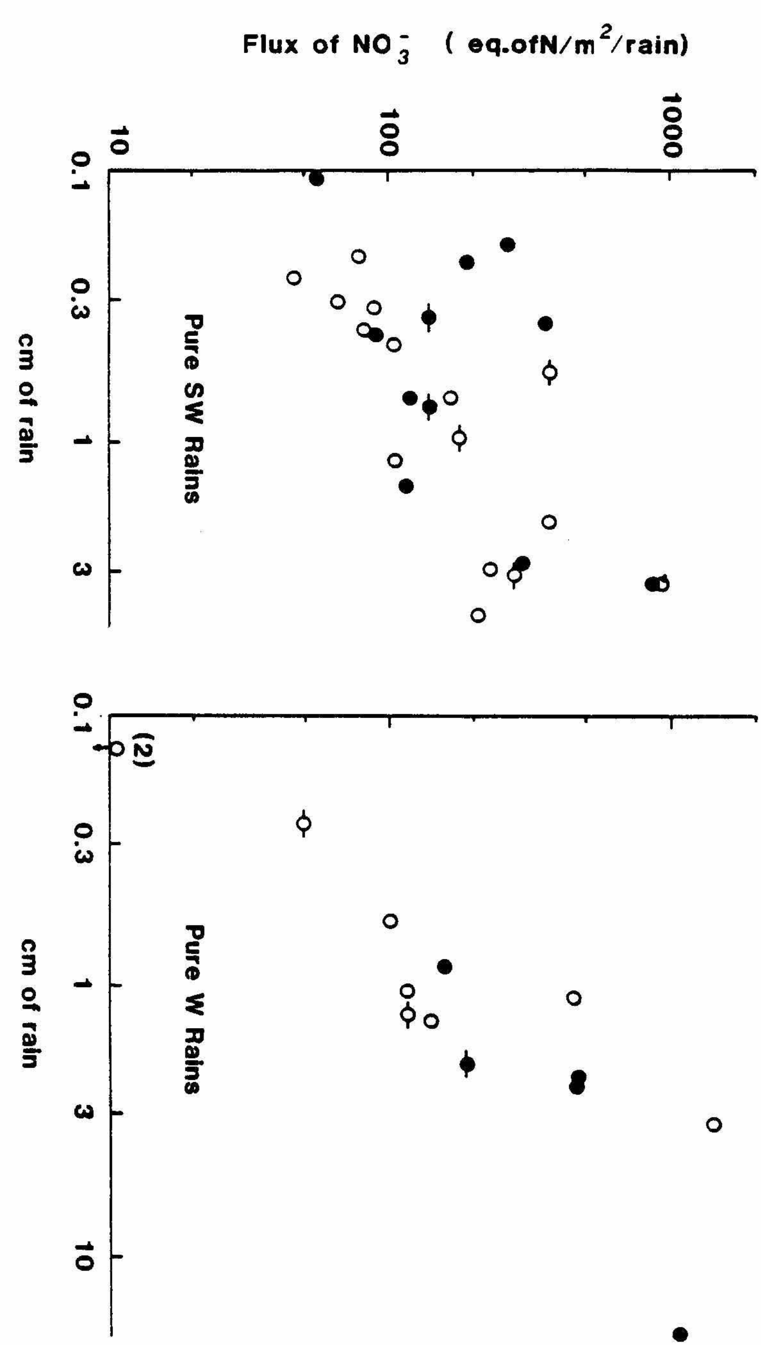


Figure 6. Flux per rain of NO_3^- for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

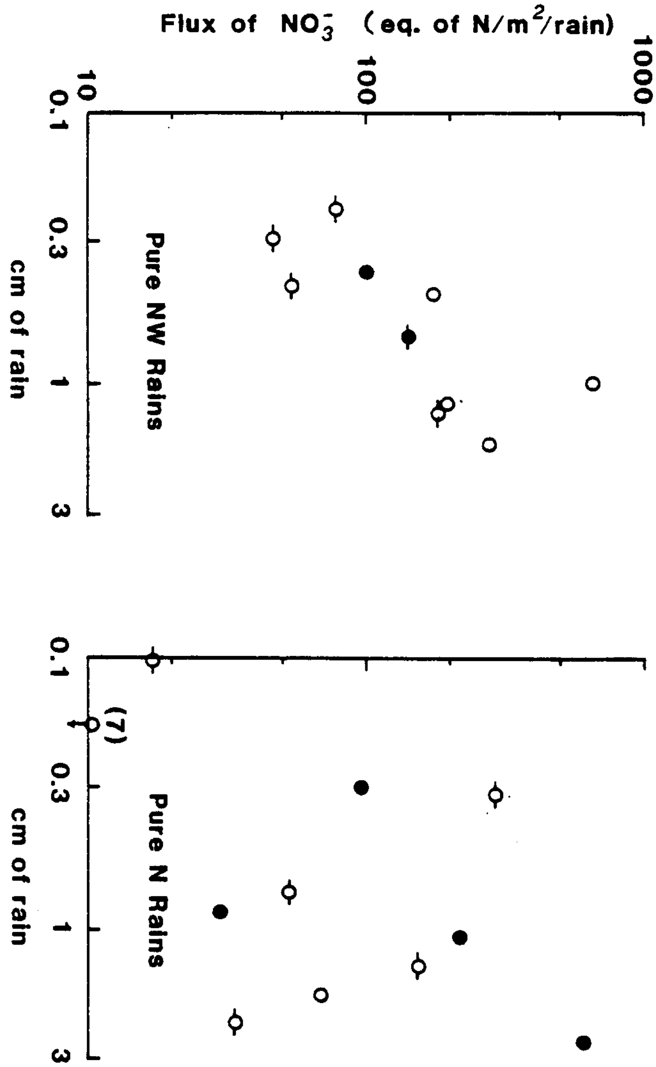


Figure 7. Flux per rain of NO_3^- for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

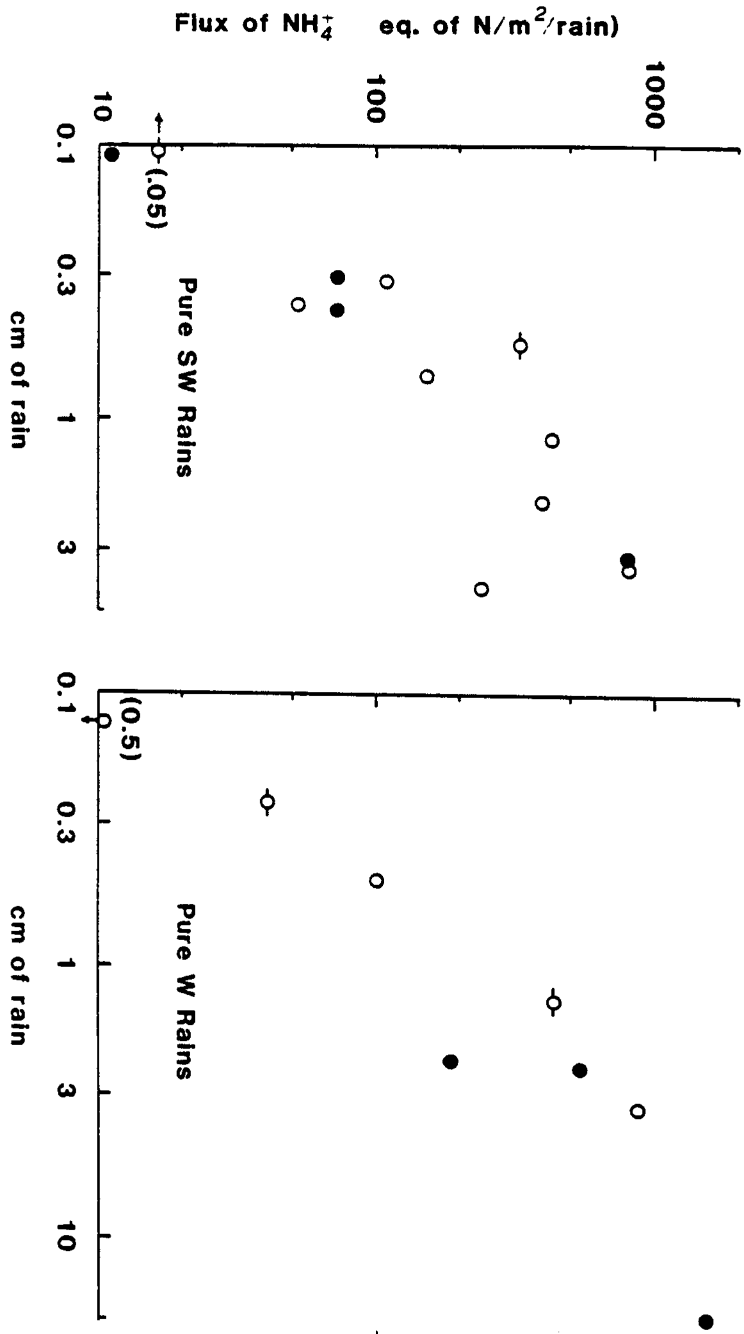


Figure 8. Flux per rain of NH_4^+ for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

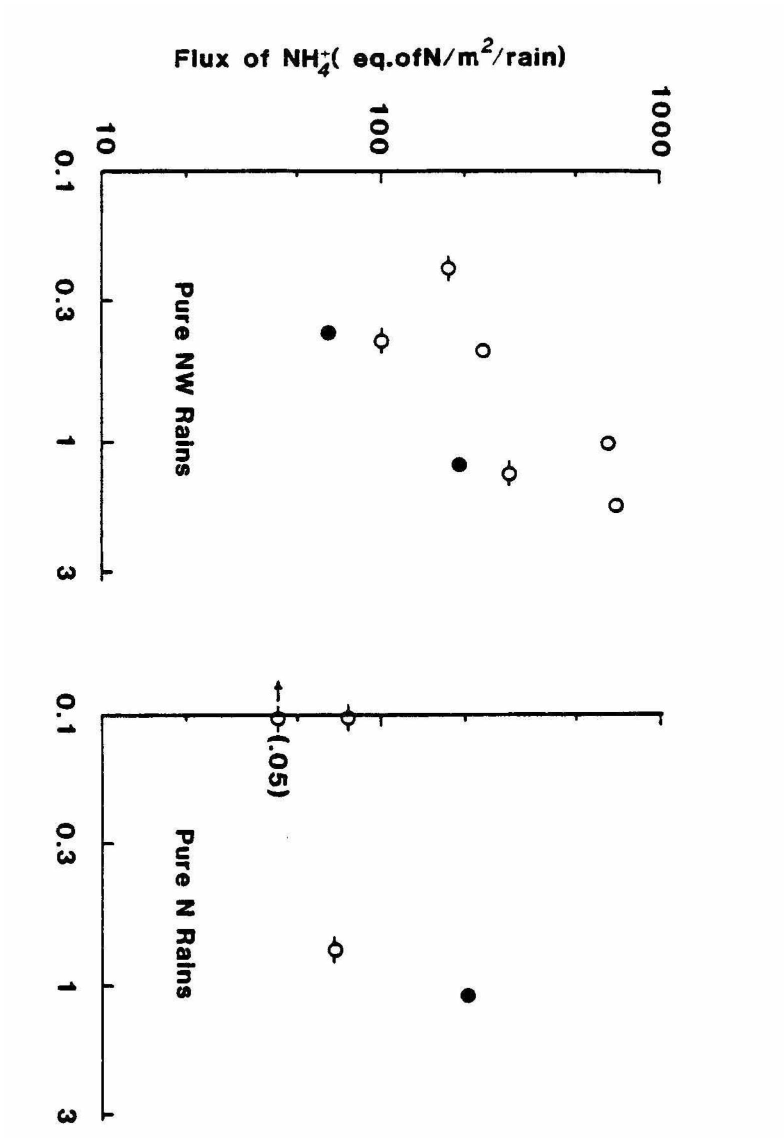


Figure 9. Flux per rain of NH_4^+ for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

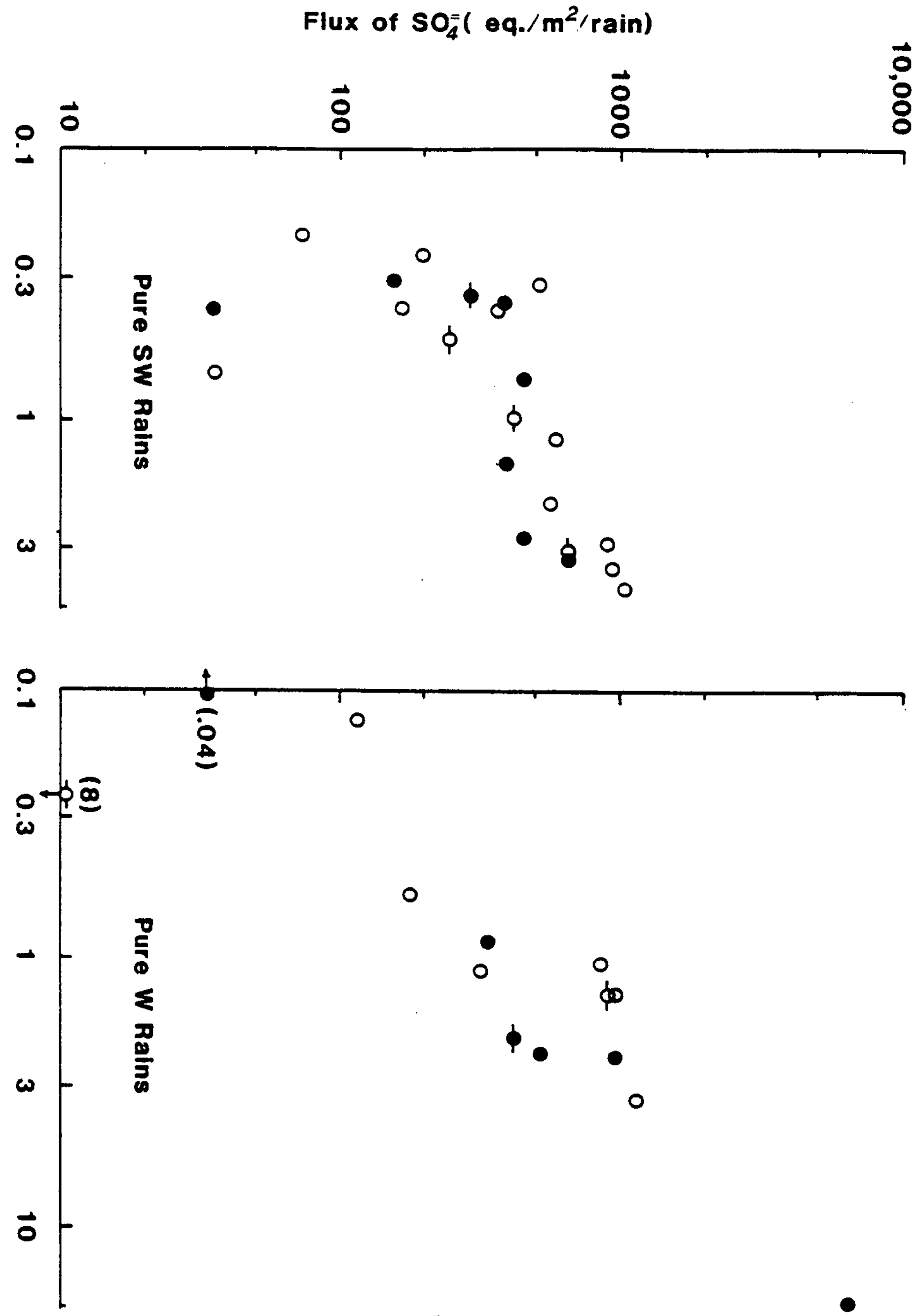


Figure 10. Flux per rain of $SO_4^=$ for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) dennote rains in the fall and winter months (Sept. through Feb.).

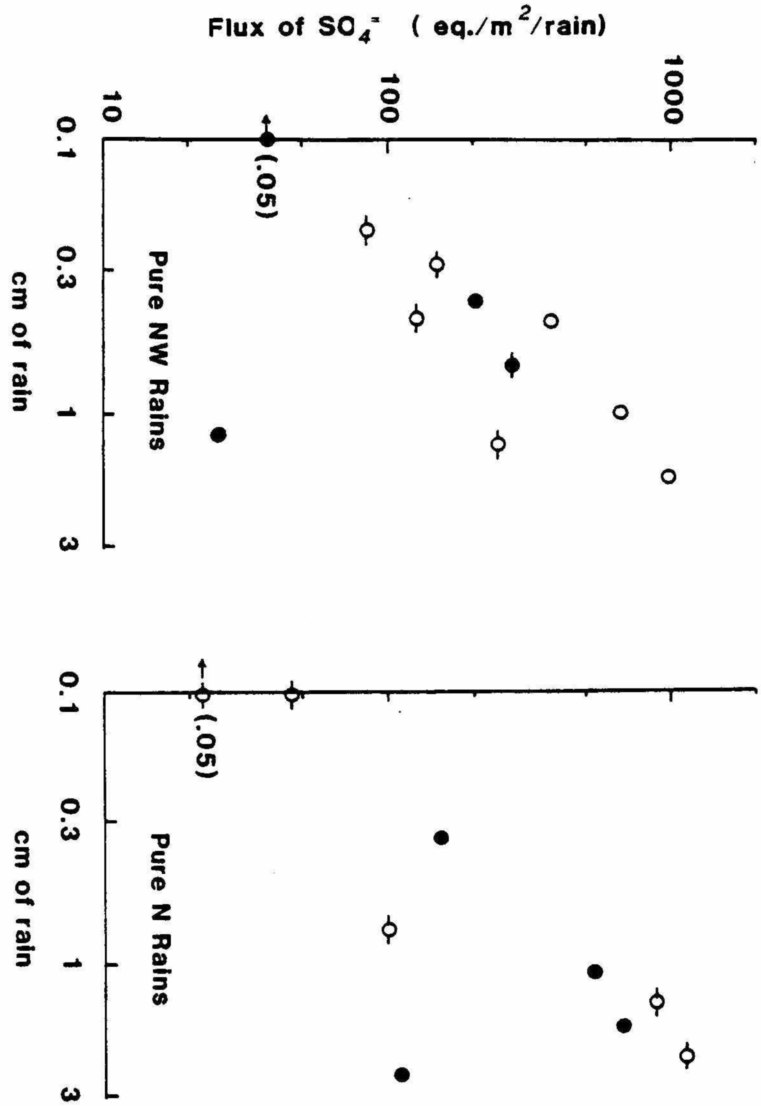


Figure 11. Flux per rain of $SO_4^=$ for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

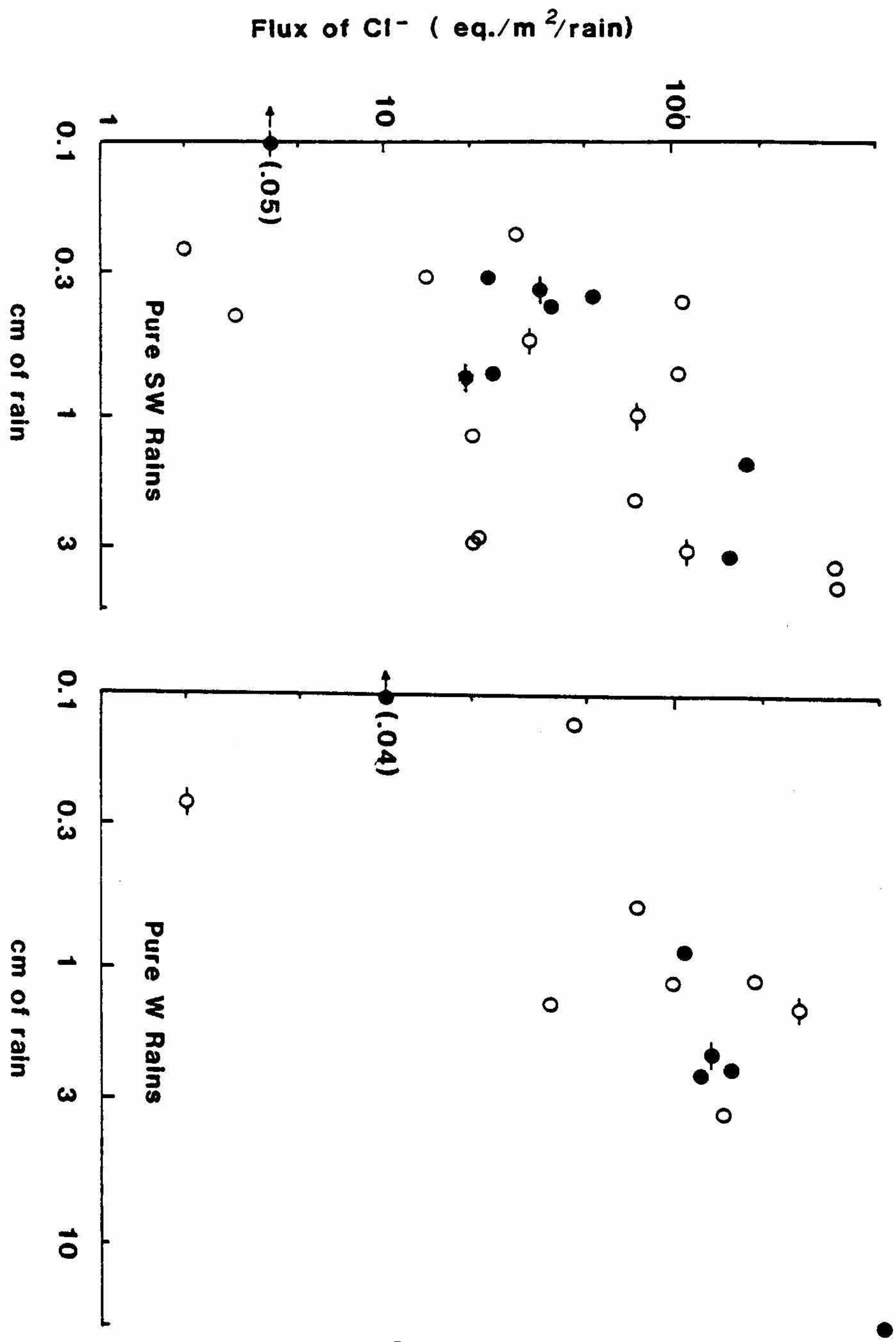


Figure 12. Flux per rain of Cl^- for pure SW and W rains. o denotes < 1 mg particulates per rain, • denotes > 1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

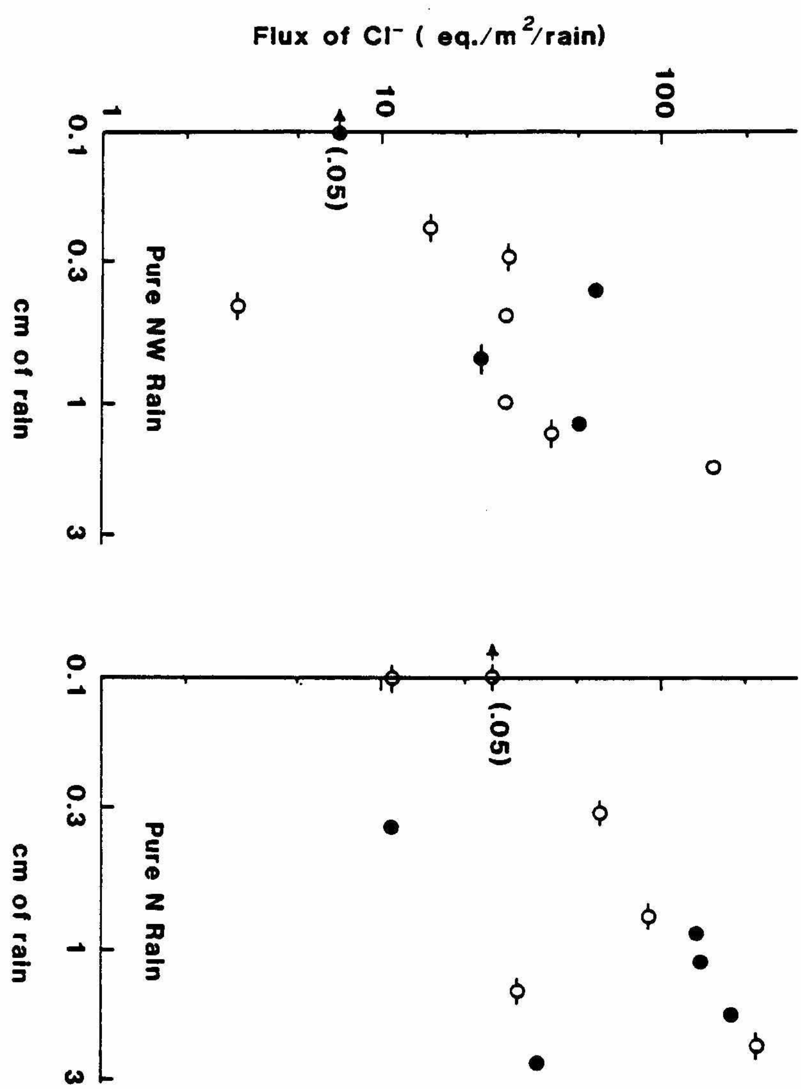


Figure 13. Flux per rain of Cl^- for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

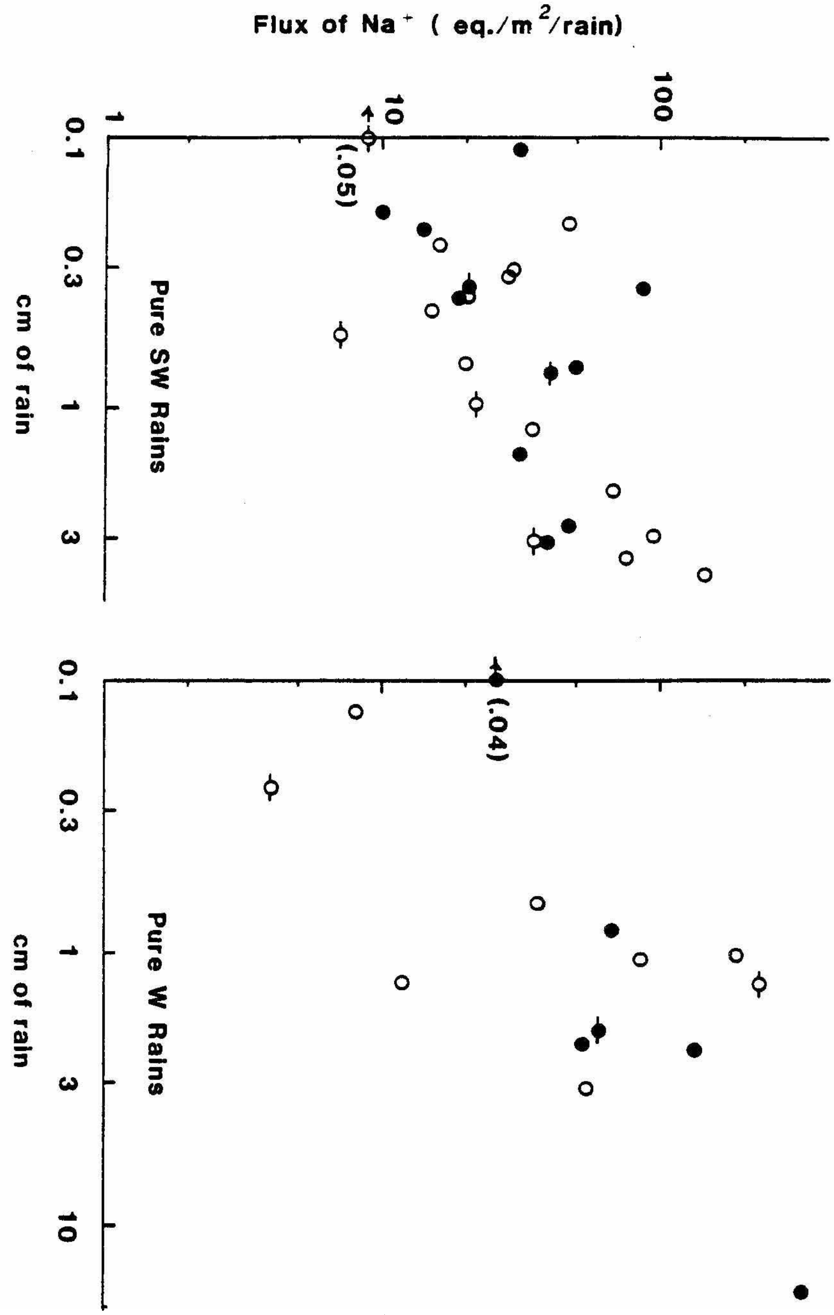


Figure 14. Flux per rain of Na^+ for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- ar -•-) denote rains in the fall and winter months (Sept. through Feb.).

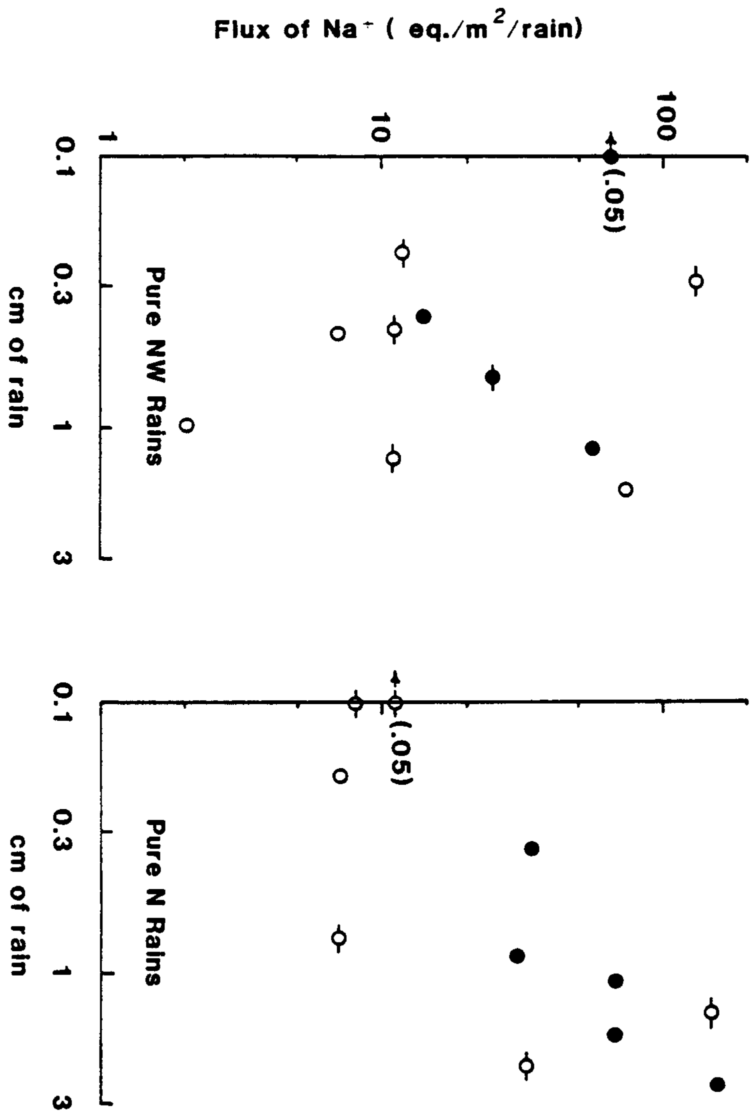


Figure 15. Flux per rain of Na^+ for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

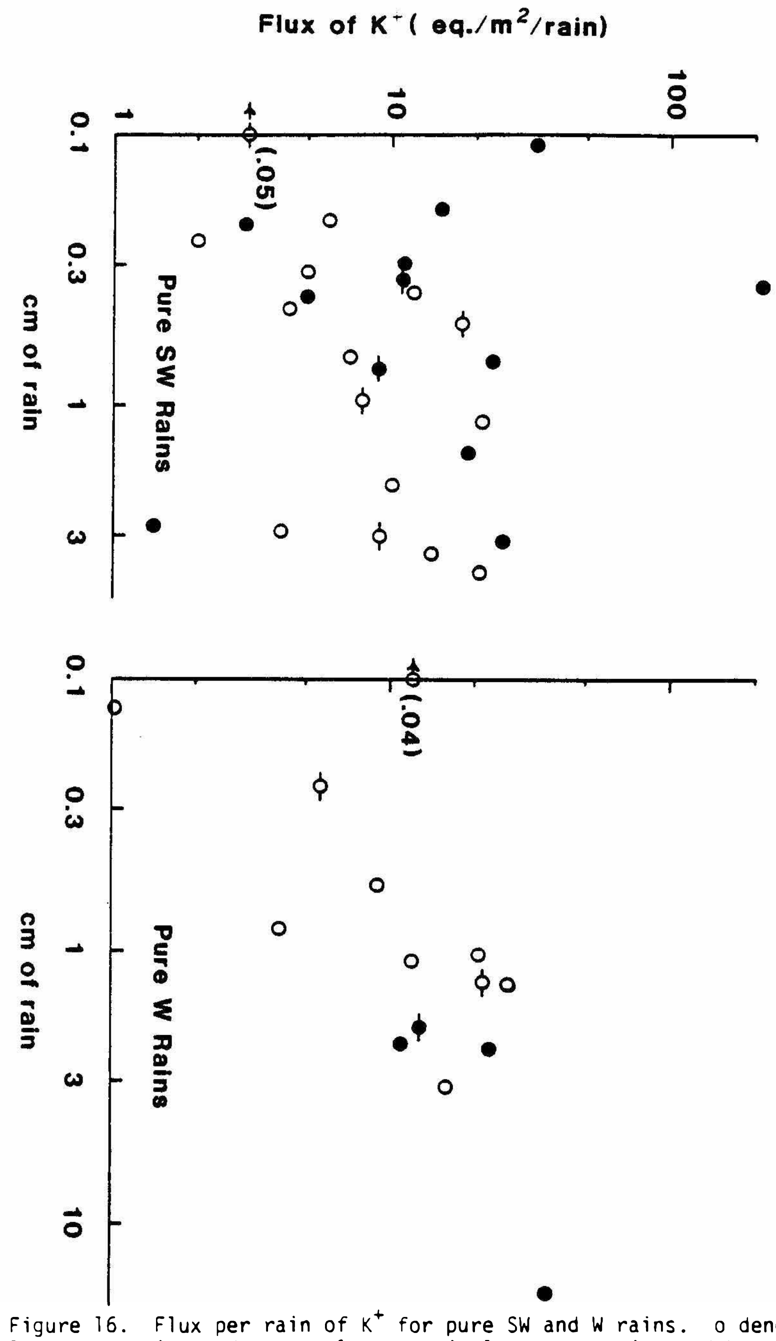


Figure 16. Flux per rain of K^+ for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

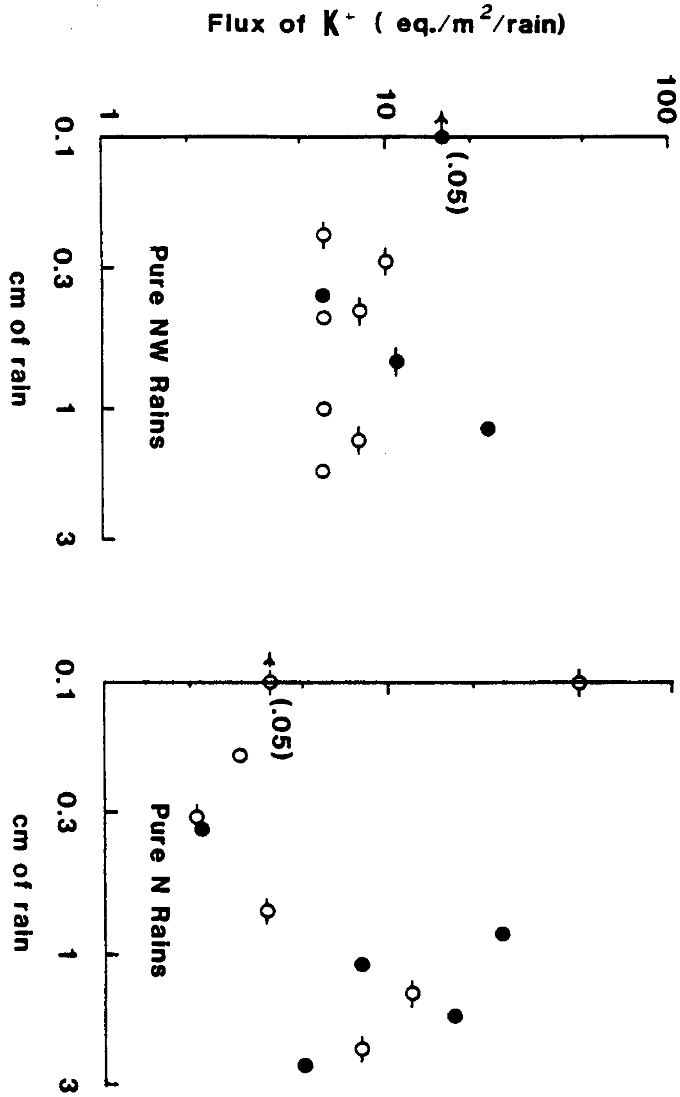


Figure 17. Flux per rain of K^+ for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

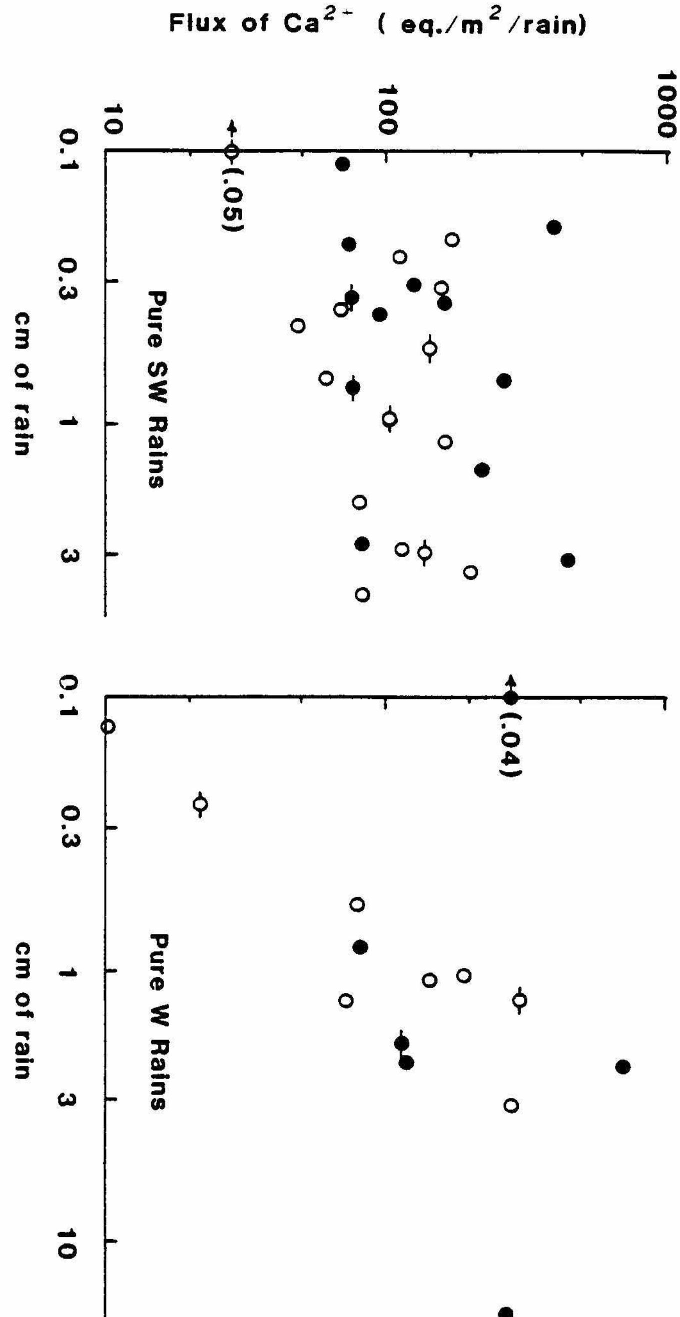


Figure 18. Flux per rain of Ca^{2+} for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

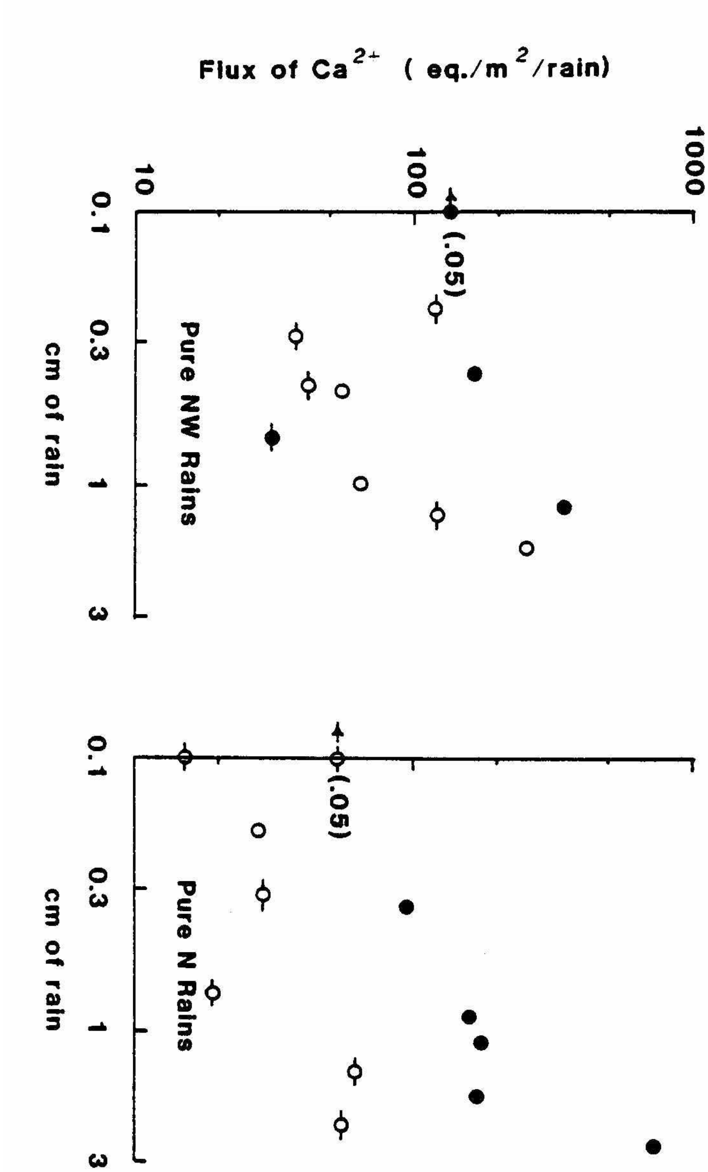


Figure 19. Flux per rain of Ca^{2+} for pure NW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

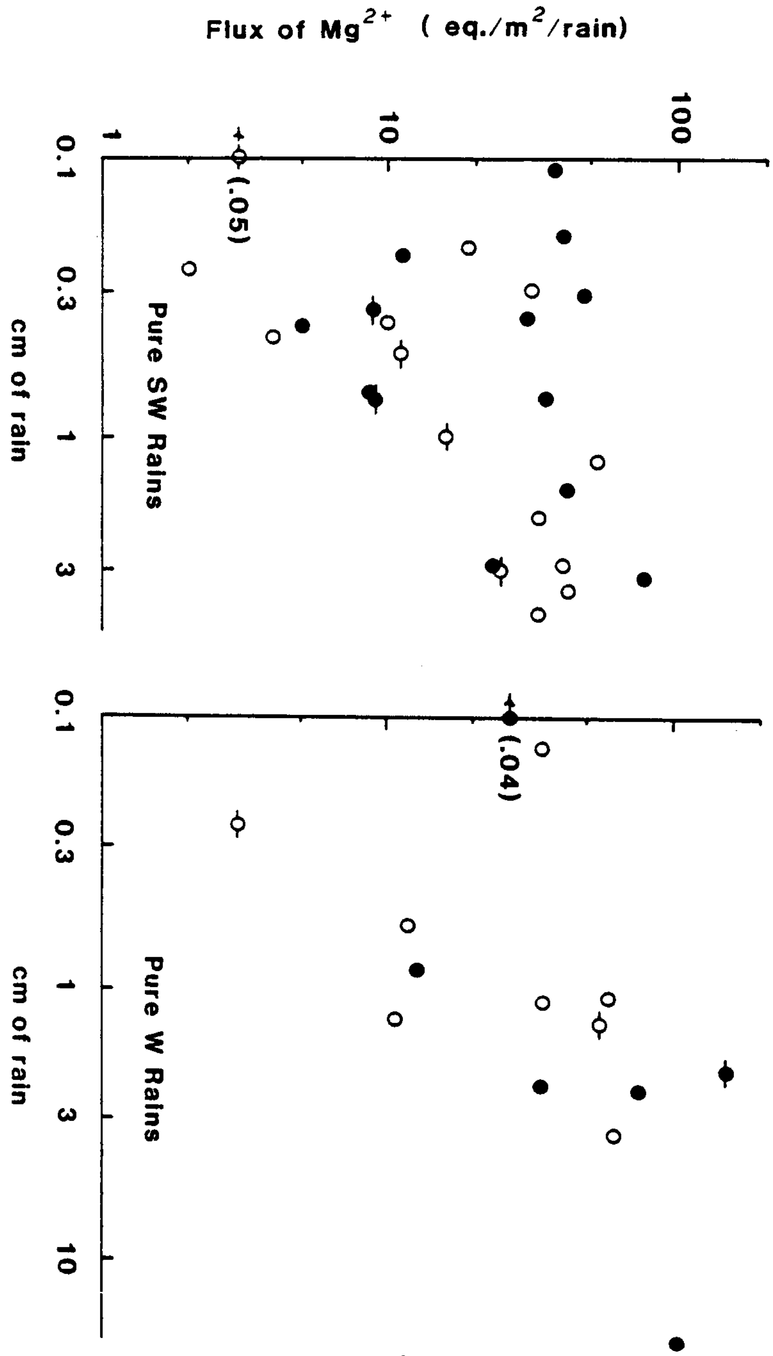


Figure 20. Flux per rain of Mg^{2+} for pure SW and W rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

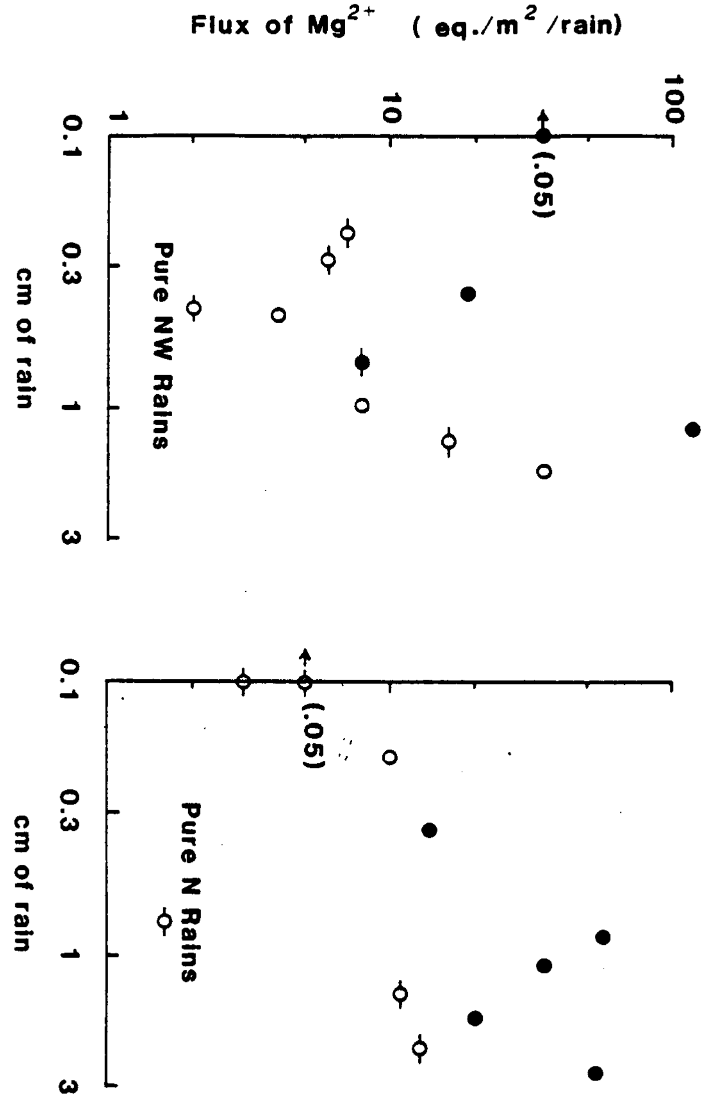


Figure 21. Flux per rain of Mg^{2+} for pure SW and N rains. o denotes <1 mg particulates per rain, • denotes >1 mg particulates per rain, and bars (-o- and -•-) denote rains in the fall and winter months (Sept. through Feb.).

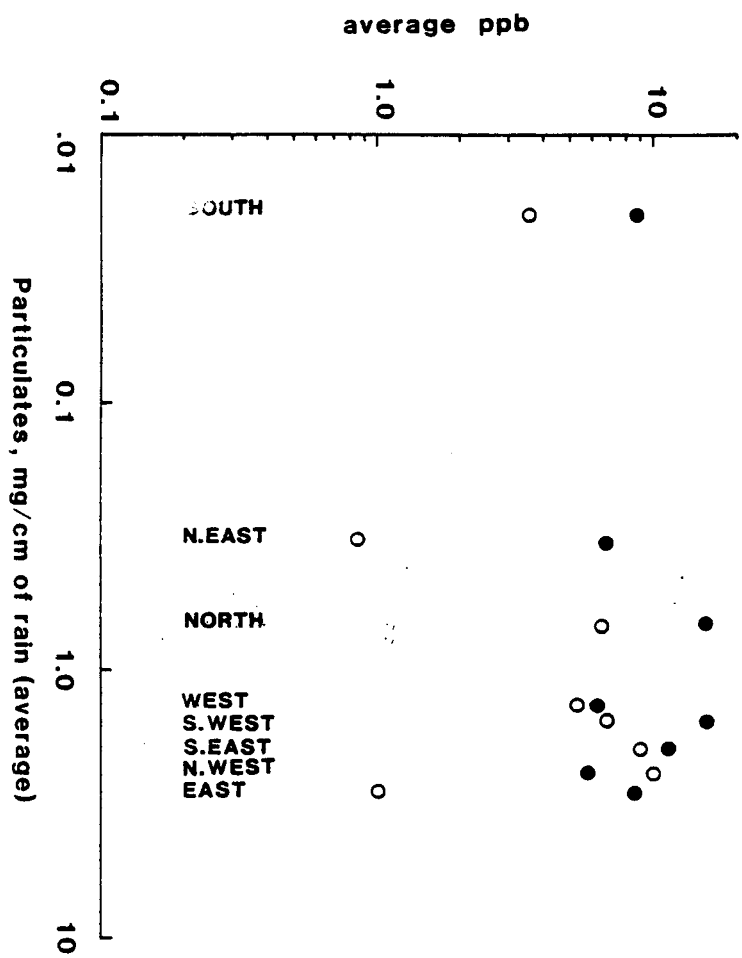


Figure 22. Average concentration by source direction of Fe(-o-) and Zn(-•-) for period 4/17/80 to 3/3/81 as a function of particulates.

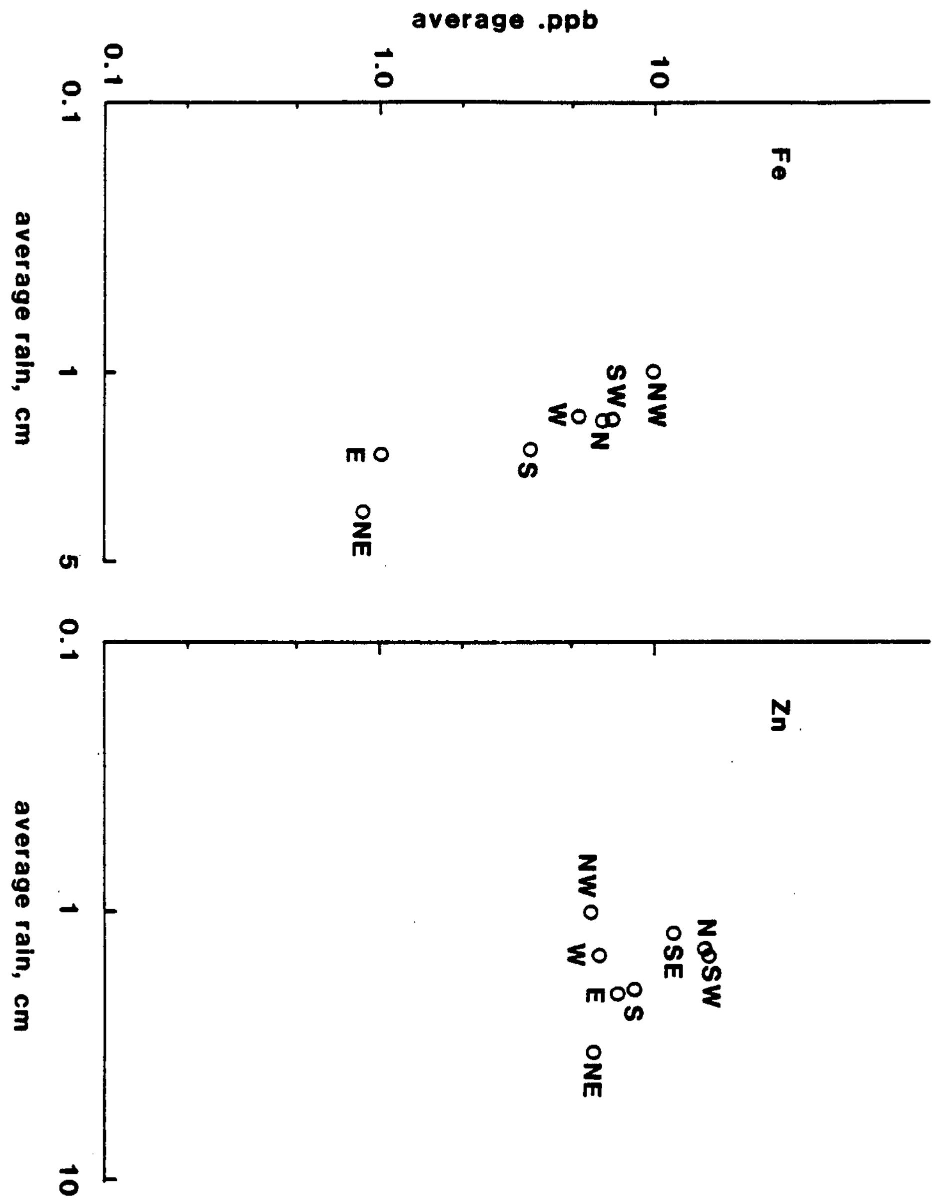


Figure 23A and 23B. Average concentration by source direction of Fe(Fig. 23A) and Zn(Fig. 23B) for the period 4/17/80 to 3/3/81 as a function of average rain size of the source direction.

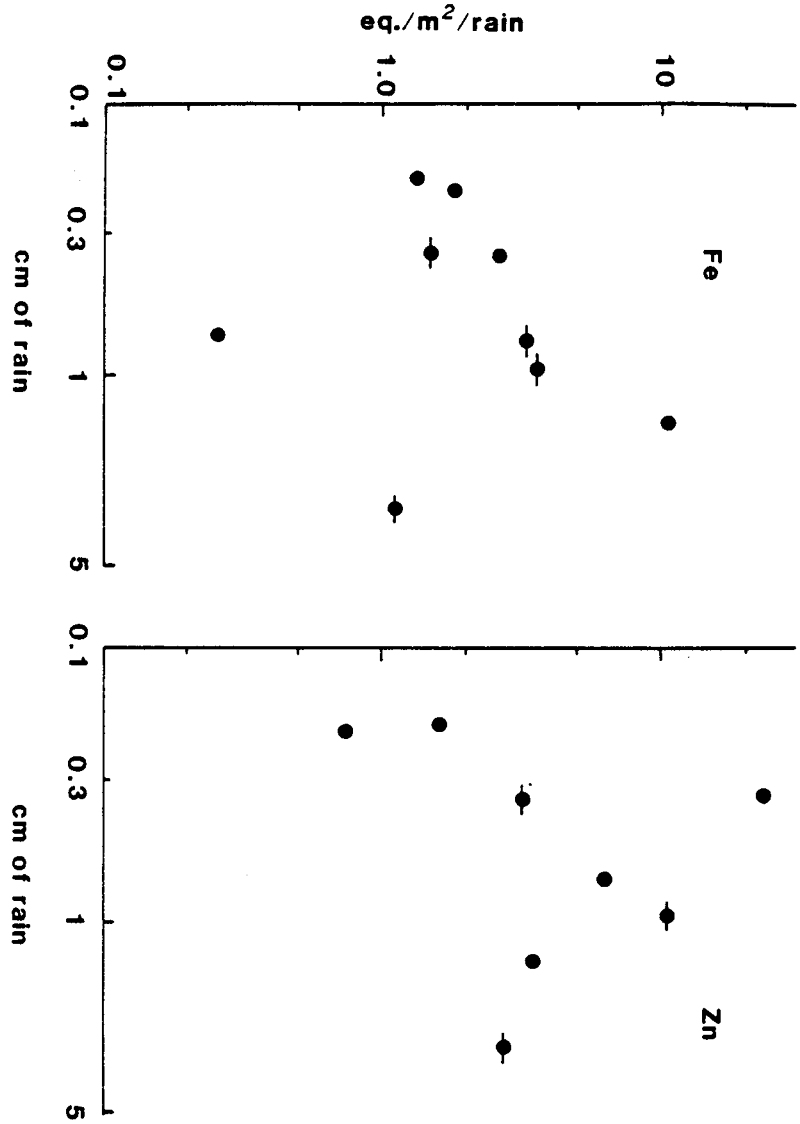


Figure 24. Fe and Zn flux per rain for pure SW rains. Rains during months of March through August, 1980 denoted by •. Rains during months of September, 1980 through February, 1981 denoted by -•-.