Review of Research for Disaster Prevention NO.42 June 1979

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Data Report of Crustal Tilt Observation (1)

[Okabe, Chikamata and Nodazawa : May-December, 1978]

By

Haruo Sato* and Mariko Tatsukawa**

National Research Center for Disaster Prevention, Japan

地 殻 傾 斜 観 測 資 料 集 （ 1 ）

【岡部・近又・野田沢地殻活動観測施設：1978年5月～12月】

佐藤春夫・立川真理子

国立防災科学技術センター

国立防災科学技術センターは，１９７８年２月から静岡県志太郡岡部町において，ボアホール型傾斜計（力平衡型振子式）による地殻傾斜の群列観則（３ヵ所）を開始した．３観測井は，駿河湾から北西約１２ km の内陸に位置し，一辺約2.5 km の正三角形に配置されている．３観測井の地質は古第三紀の瀬戸川層群に属する．この地殻傾斜観測と併行して，微小地震観測・地中温度観測・雨量及び気圧観測を行なっている．本資料集では，１９７８年５月から１２月までの間の地殻傾斜・地中温度・気圧・雨量の観測データを示す．

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1. Introduction

A crustal tilt observation with an array of borehole-type tiltmeters was started at Okabe-machi, Shida-gun, Shizuoka-ken in February, 1978. Observations of tilt, underground temperature, barometric pressure and precipitation during the interval between May and December, 1978 are reported. The geology around the observation site, the structure of the observation wells, the installation of the instruments and the initial data of tilt were reported in detail in "An array system for observation of the crustal tilt(I)"[H. Sato and H. Takahashi: The Report of National Research Center for Disaster Prevention(1978), 20, 39-62].

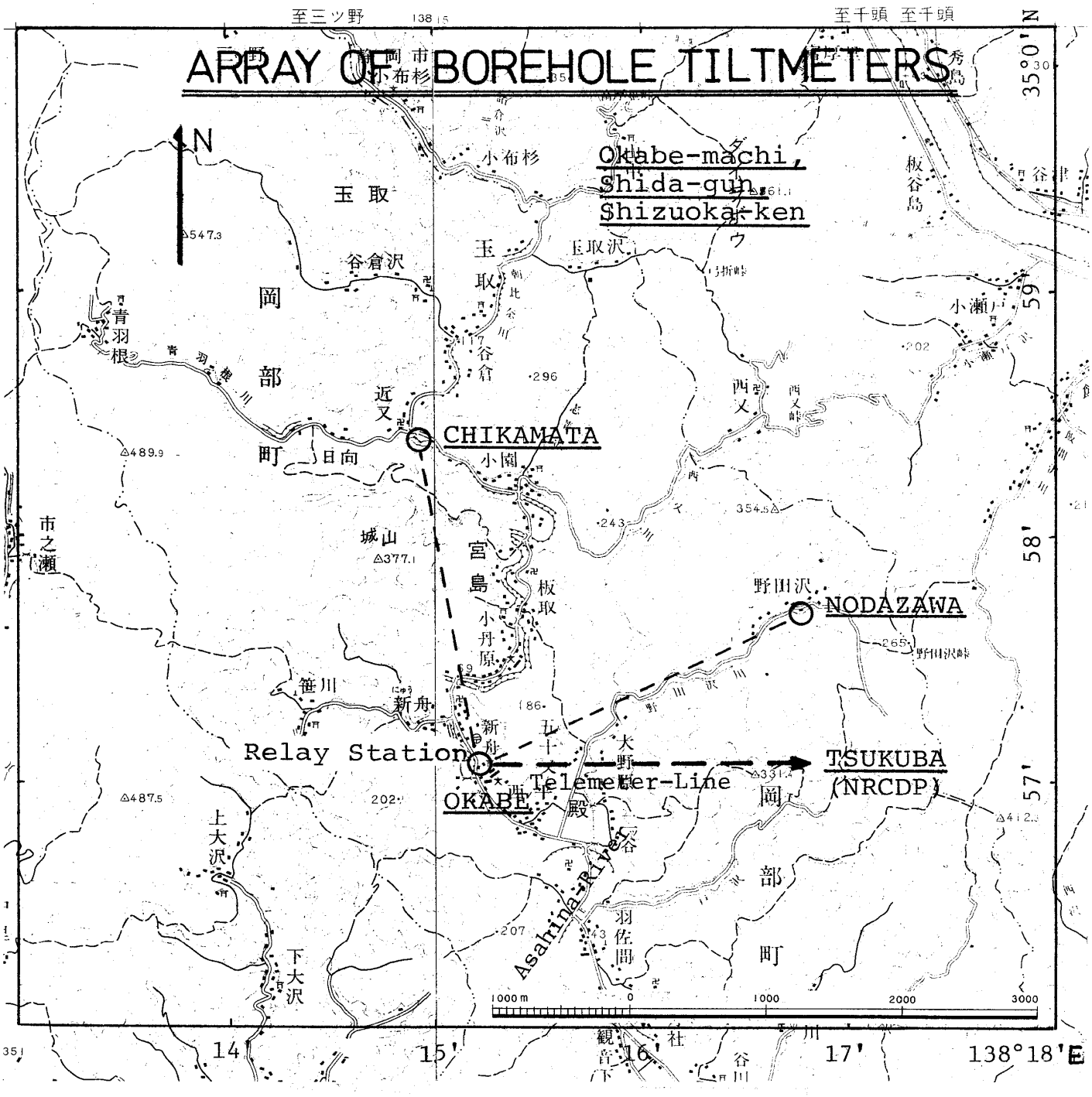
2. List of stations

Station	Long. (E)	Lat. (N)	Altitude ground	Altitude surface sensor	Well depth
Okabe	138°15'13.8"	34°57'00.0"	72m	-30m	101.8m
Chikamata	138°14'55.5"	34°58'19.9"	105m	51m	54.2m
Nodazawa	138°16'47.0"	34°57'37.7"	135m	82m	53.2m

3. List of instruments

Station	At the bottom of the well	On the ground
Okabe	Tiltmeter, Seismometer, Thermometer	
Chikamata	Tiltmeter, Thermometer	Rain gauge
Nodazawa	Tiltmeter, Thermometer	Barometer

Sensor	Type	Sensitivity	Resolution
Tiltmeter	Force balanced pendulum type	100mV/sec.	10^{-3}sec.
Seismometer	Moving coil type(T_0 = 1 sec)	2V/kine(h=0.65)	
Thermometer	Quartz oscillator type	Digital output	0.1°C
Rain gauge	Tipping bucket type	Digital output	1mm
Barometer	Quartz oscillator type	Digital output	0.5mb



Plotted on the topographical map by the Geographical Survey Institute.

4. Telemetering and recording system

-Telemetering system-

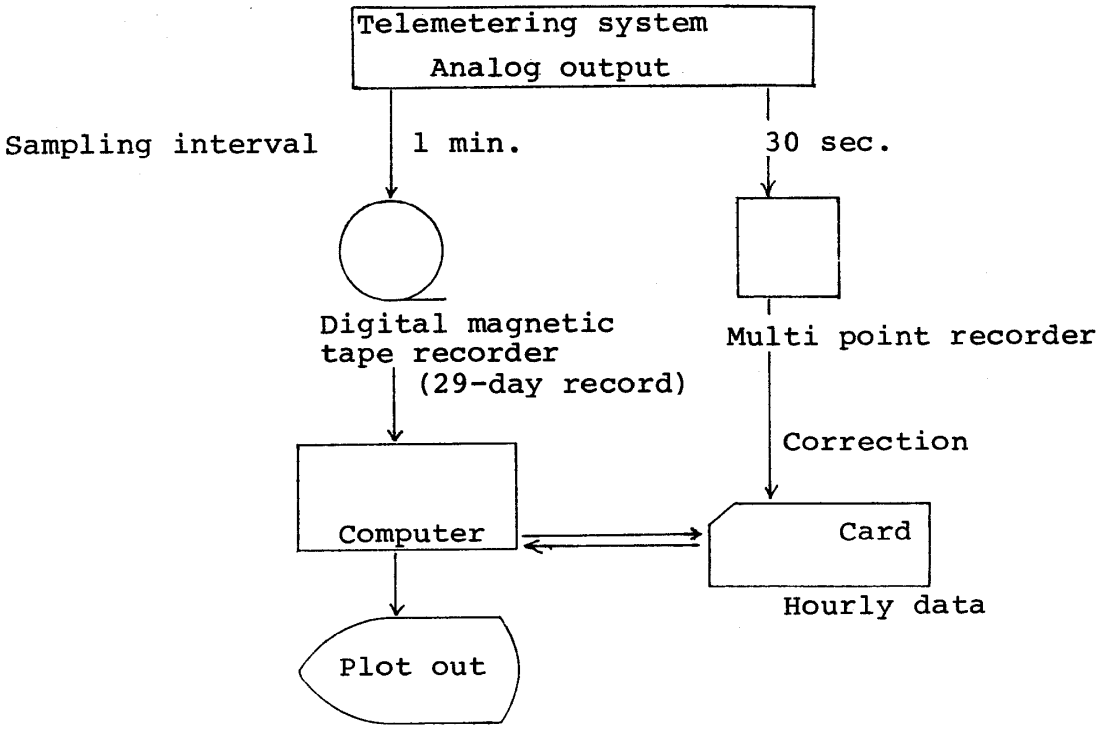
Transmission method	Pulse code modulation
Transmission speed	2400bps and 300bps
Sampling interval	6 sec.

Comp.		Digital data	Analog output(10V f.s.)
Tilt	16bit	1.22×10^{-3} sec/digit	80 secf.s.(Low gain)
			1.25 secf.s.(High gain)
Temp.	10bit	4.88×10^{-3} °C/digit	5.00 °C f.s.
Precip.	10bit	0.195 mm/digit	200 mm f.s.
Baro.	10bit	9.77×10^{-2} mb/digit	100 mb f.s.

-Recording system(10V f.s.)-

Recorder	Samping interval	Remarks
Multi point recorder	30 sec.	164mm (Chart width) 12.5mm/h (Chart speed)
Digital magnetic tape recorder	1 min.	12bit(A/D)

5. Data gathering



6. Tilt steps

Earthquakes occasionally cause tilt steps probably because of the instability of the instruments at the bottom of the boreholes. Remarkable tilt steps which are listed in the following table are eliminated from the yearly and monthly plot of the tilt data except for the step on October 7.

Table of tilt steps

N,E ground down +, Unit(sec)

Date			Okabe		Chikamata		Nodazawa		Earthquake and Remarks
d	h	m	NS	EW	NS	EW	NS	EW	
JUN 12	17	14	0.09	0.13	-0.07	0.05	0.12	-0.11	Off Miyagi Pref.(M=7.4)
OCT 07	05	45	0.	0.	0.	0.	-1.04	1.25	SW Nagano Pref.(M=5.3)
NOV 18	10	30	0.	0.	0.	0.	0.31	0.41	Instrumental ?
DEC 03	22	15	0.	0.	0.	0.	0.03	-0.03	Near Oshima(M=5.4)

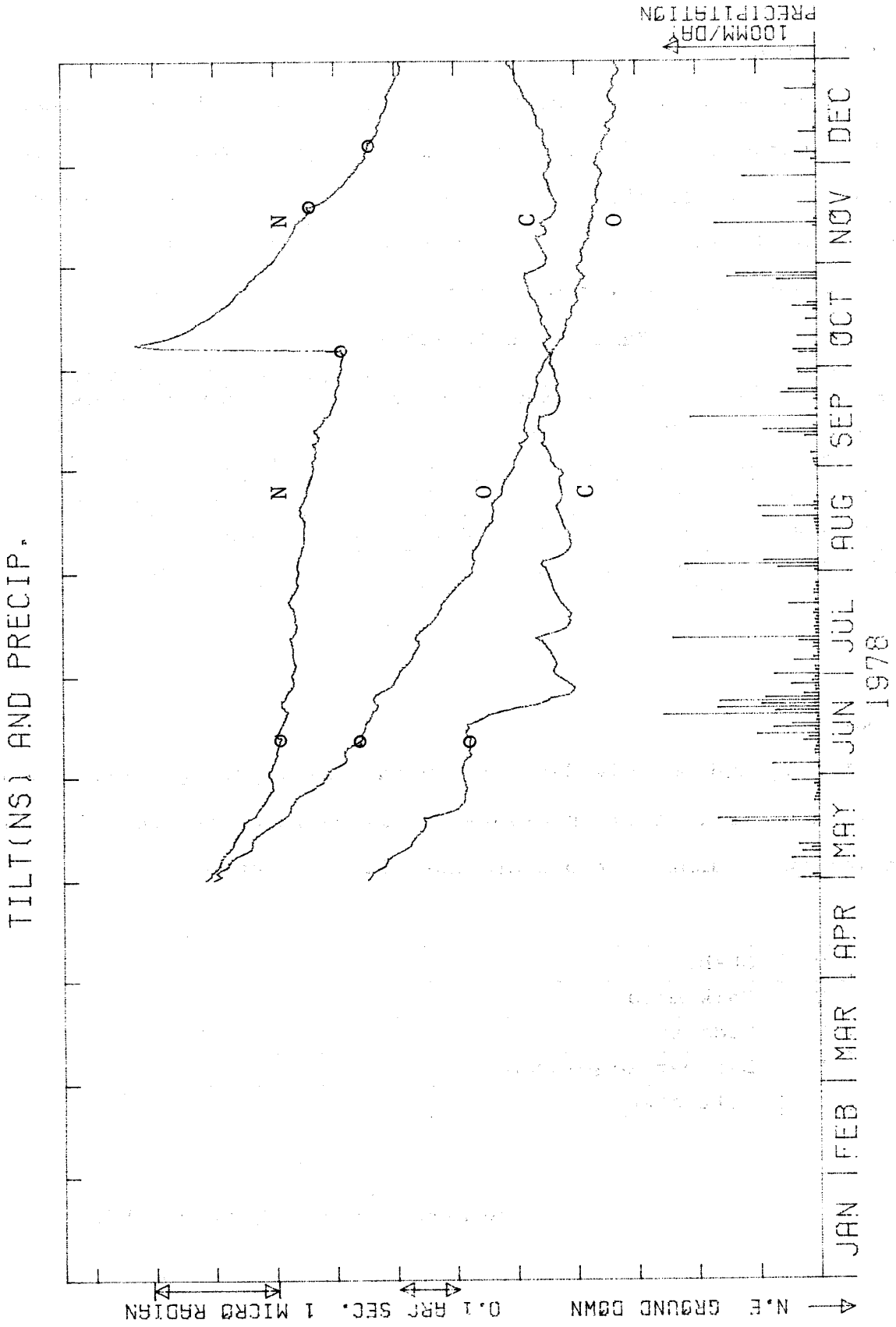
7. Data

Yearly and monthly data of crustal tilt, precipitation, temperature and barometric pressure are illustrated in the following. The following abbreviations are used in the figures.

O	Okabe
C	Chikamata
N	Nodazawa
B	Barometric pressure
o	Tilt step

(Manuscript received April 16, 1979)

[YEARLY DATA]


PRECIPITATION
100MM/DAY
TILT(NS) AND PRECIP.
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JAN
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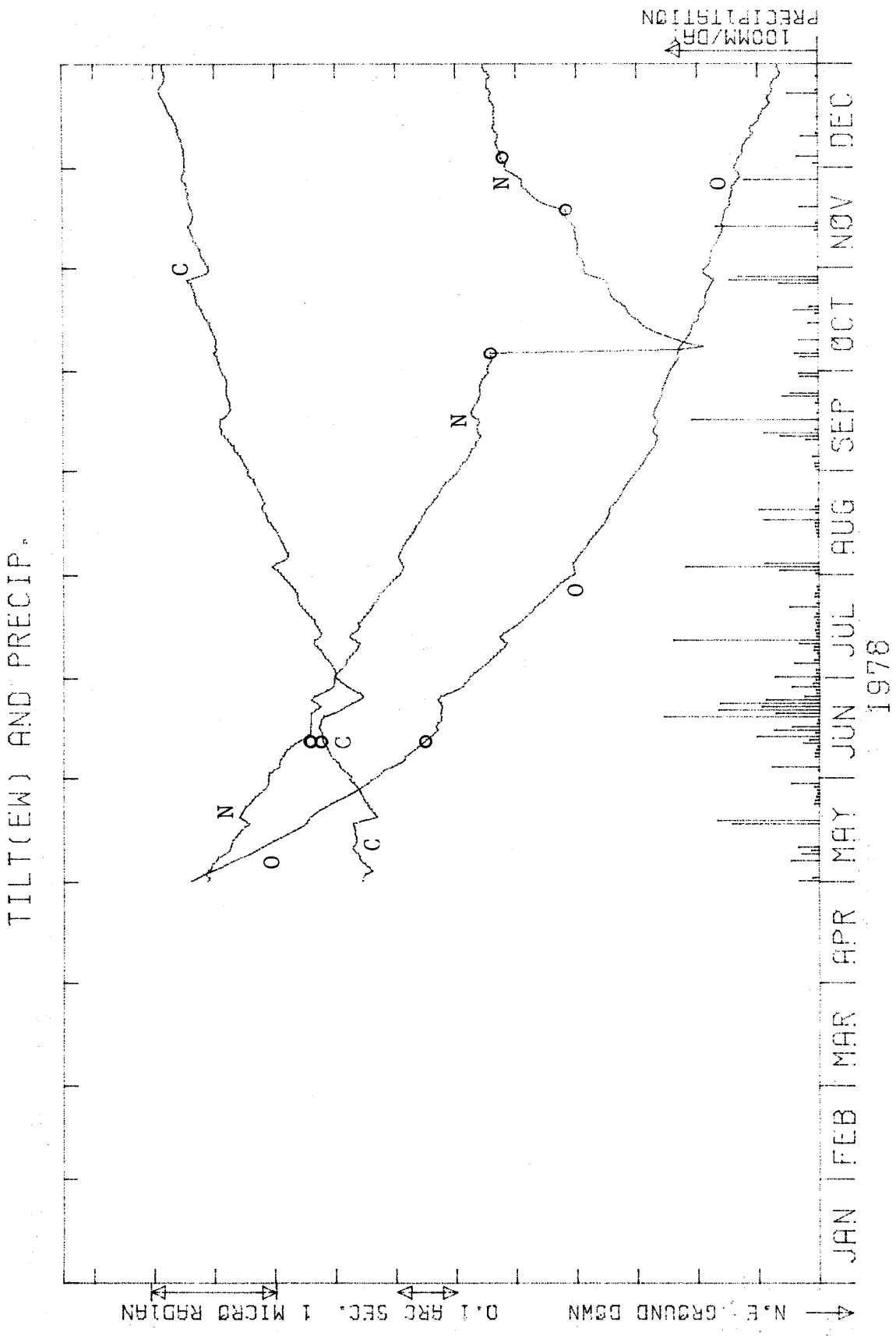
N.E GROUND DOWN
0.1 ARC SEC. 1 MICRO RADIAN


TILT(EW) AND PRECIP.
1978
JAN
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PRECIPITATION
100MM/DAY
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0.1 ARC SEC.
1 MICRO RADIAN
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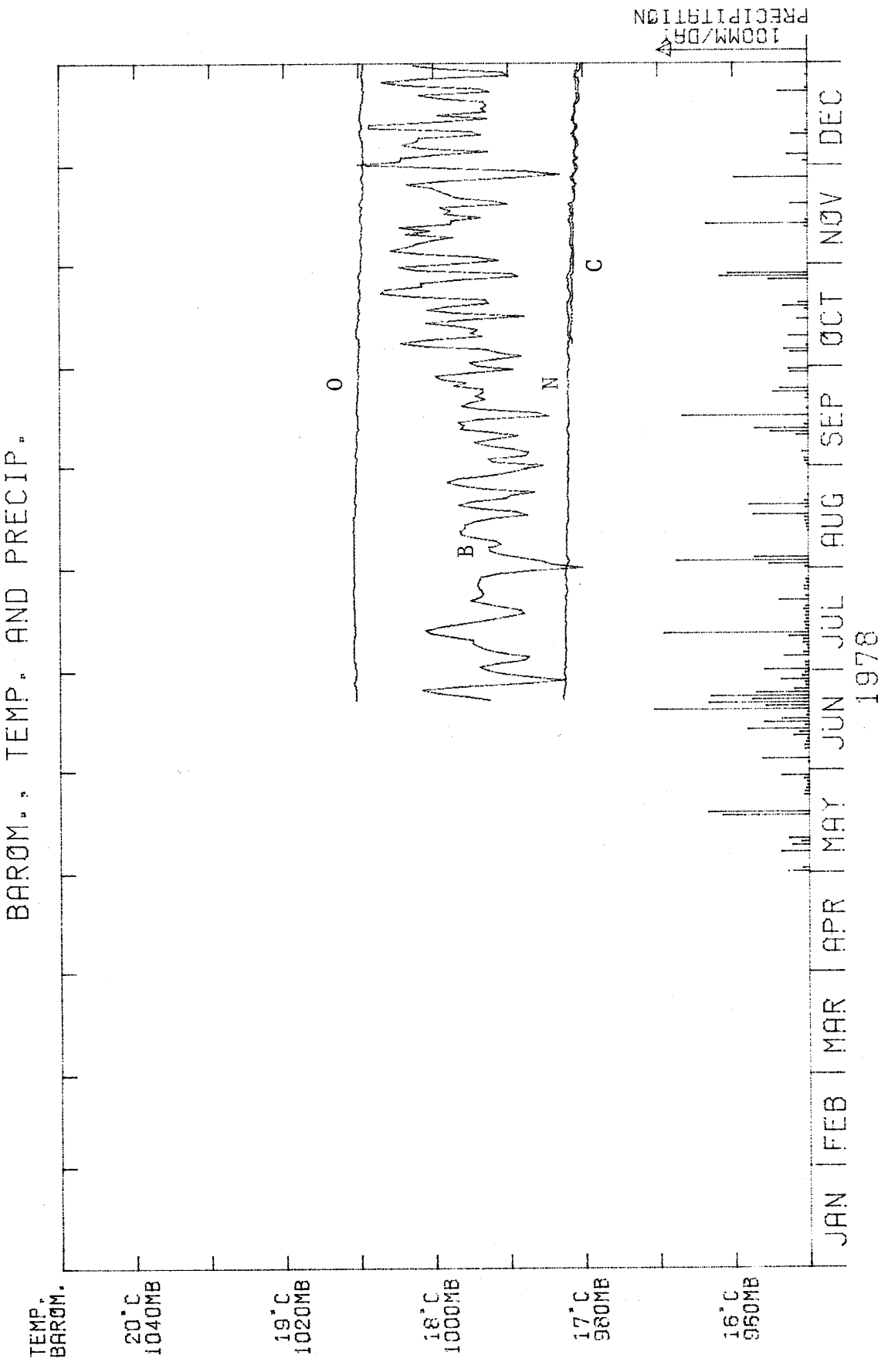
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TEMP.
BARØM.
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19°C
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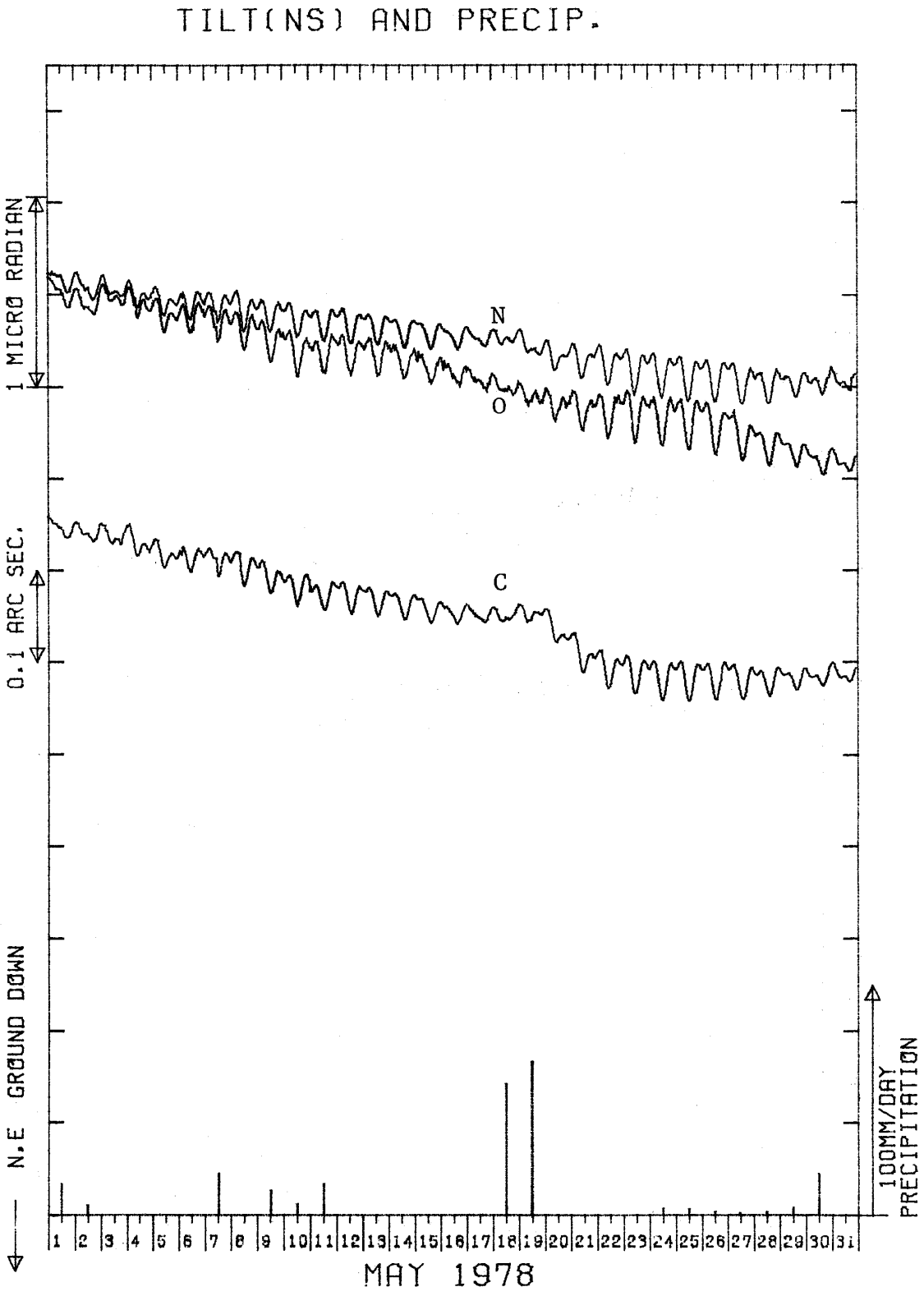
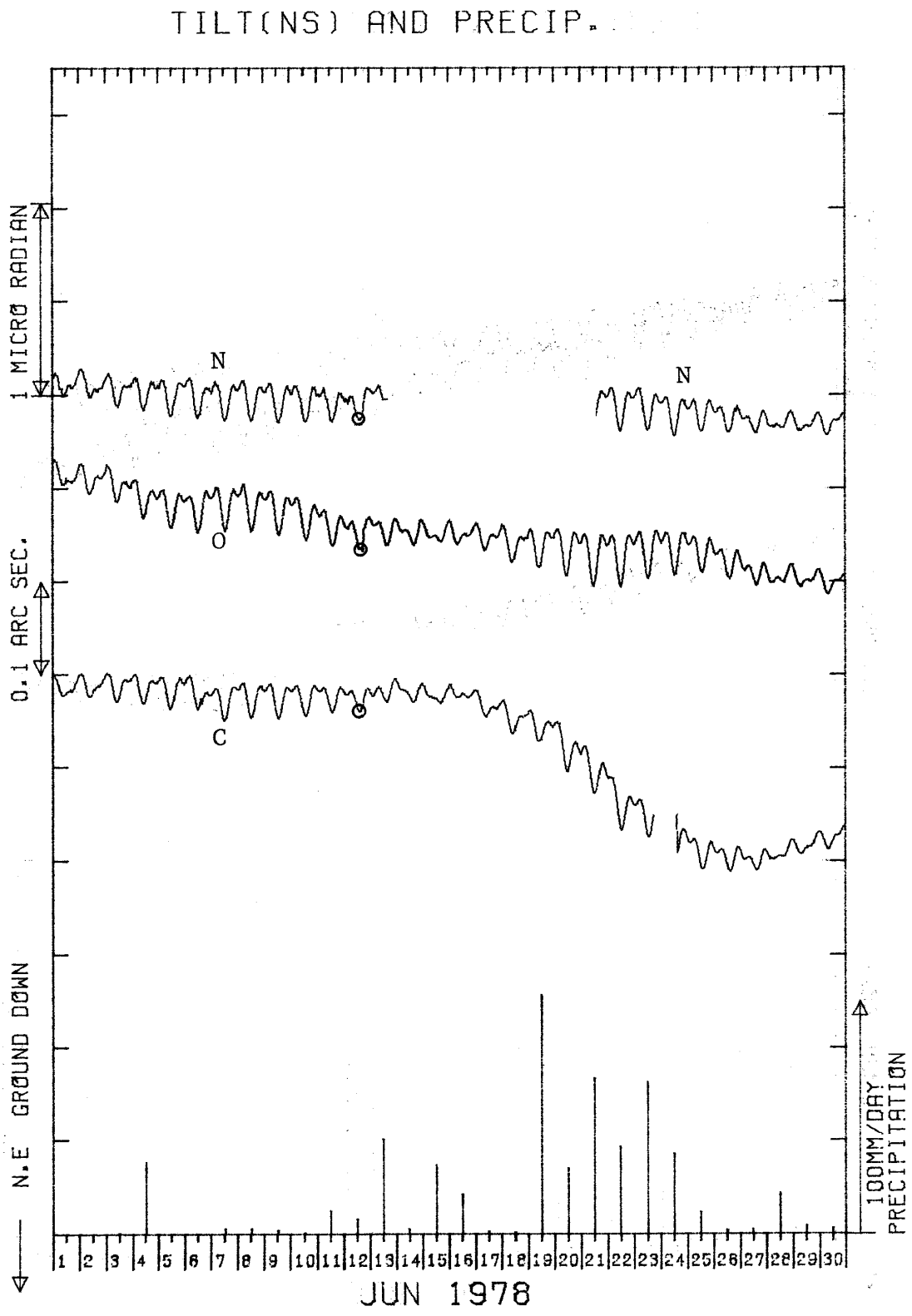
[MONTHLY DATA]

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1 MICRØ RADIAN
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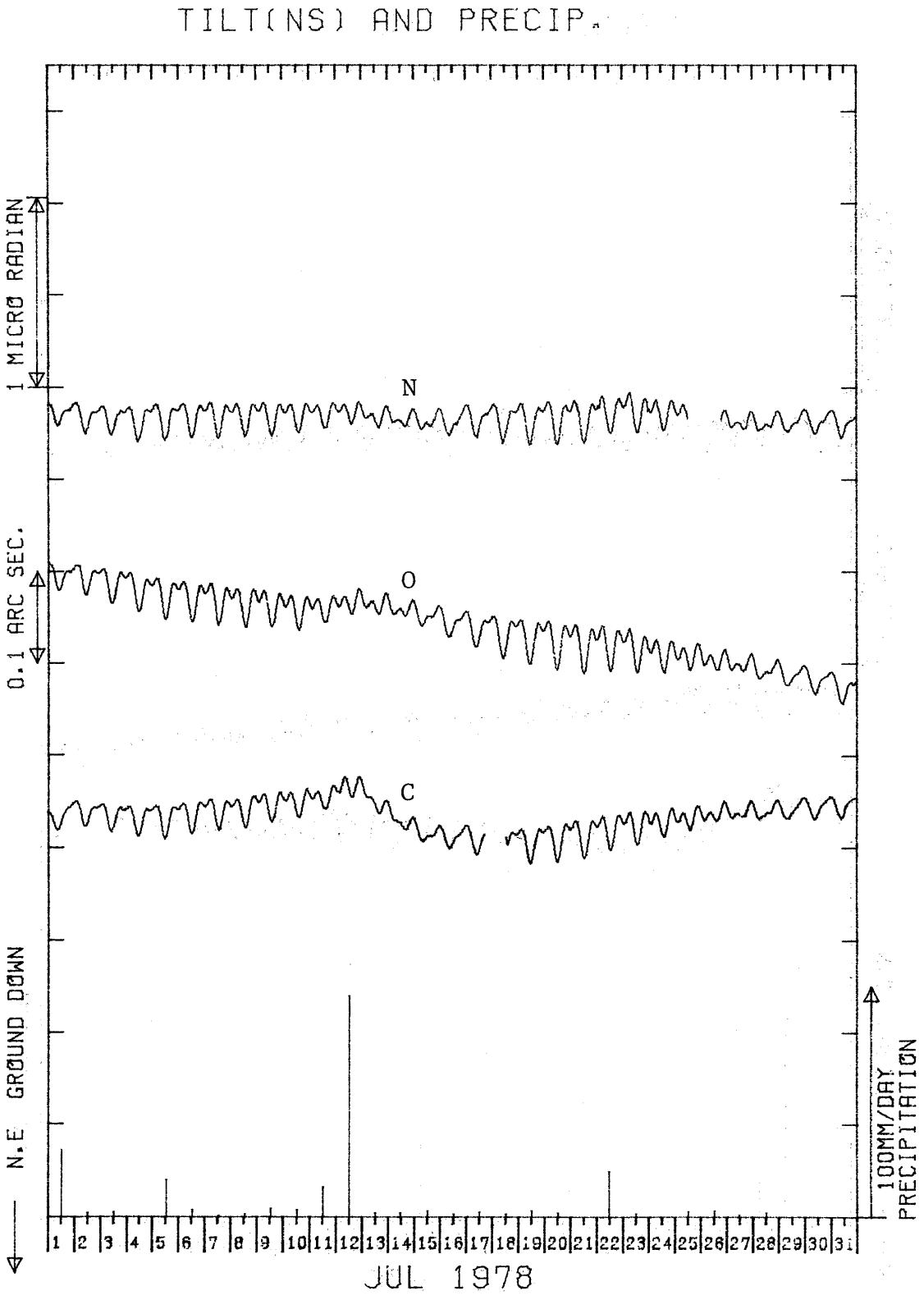
JUN 1978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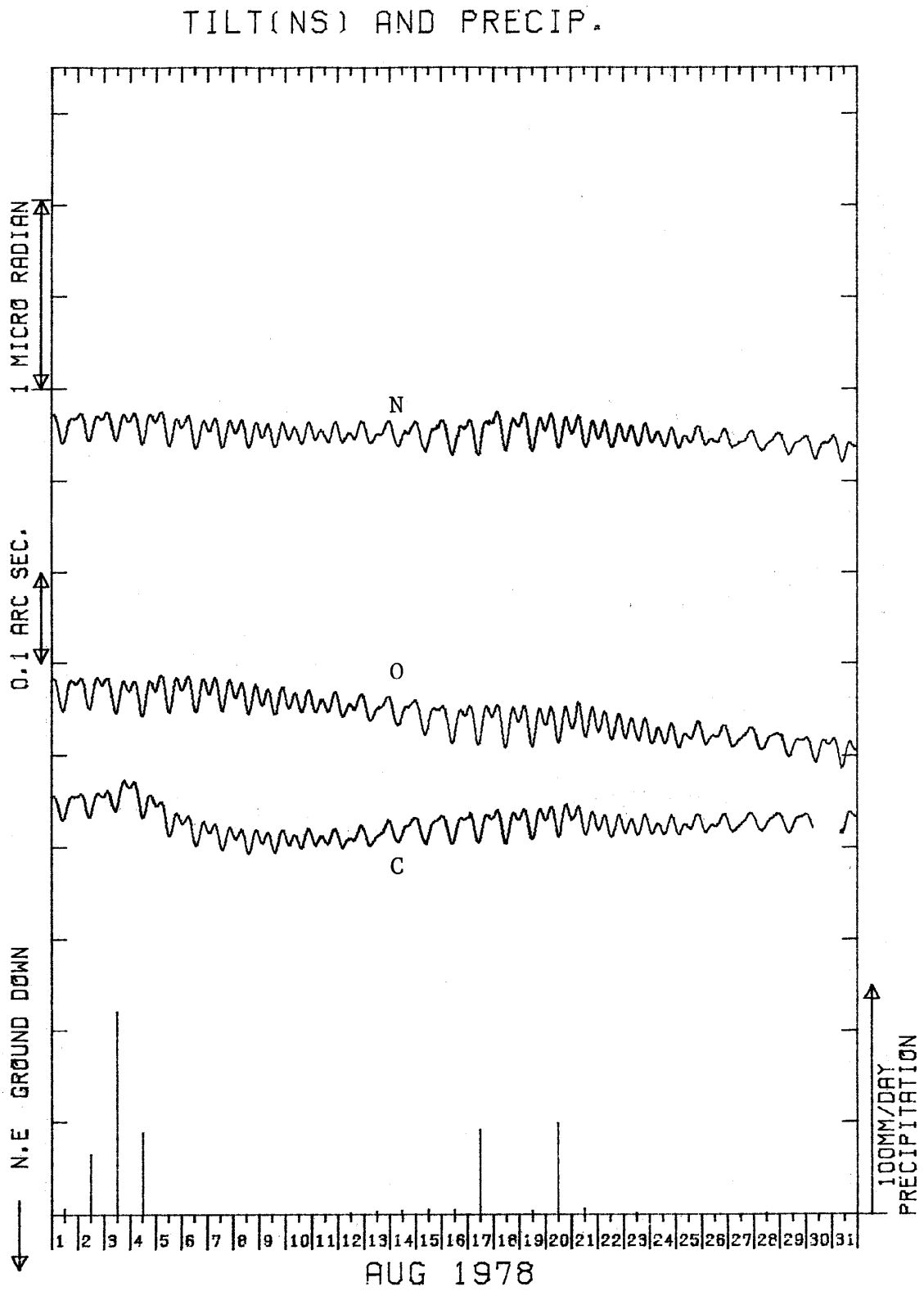
JUL 1978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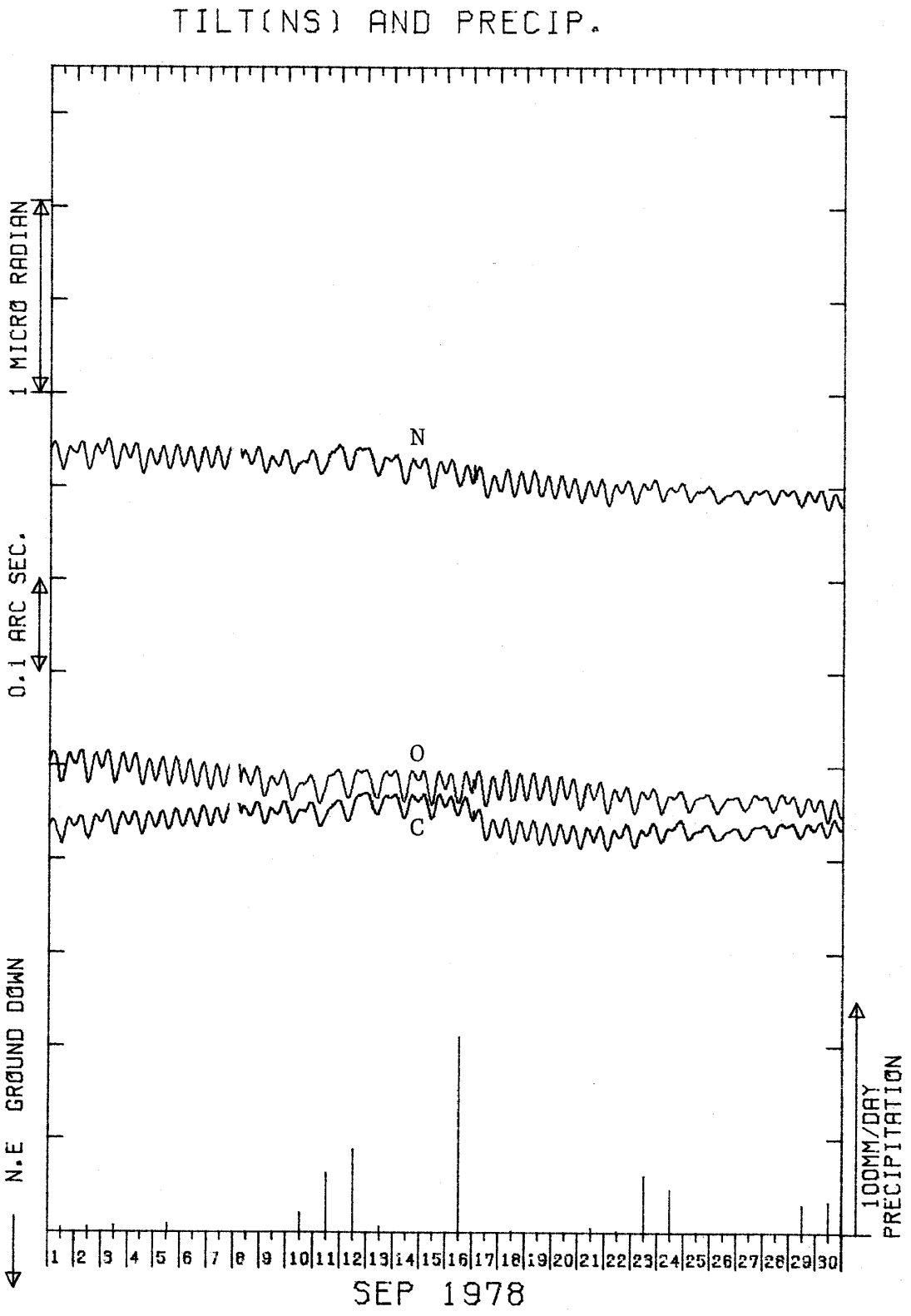
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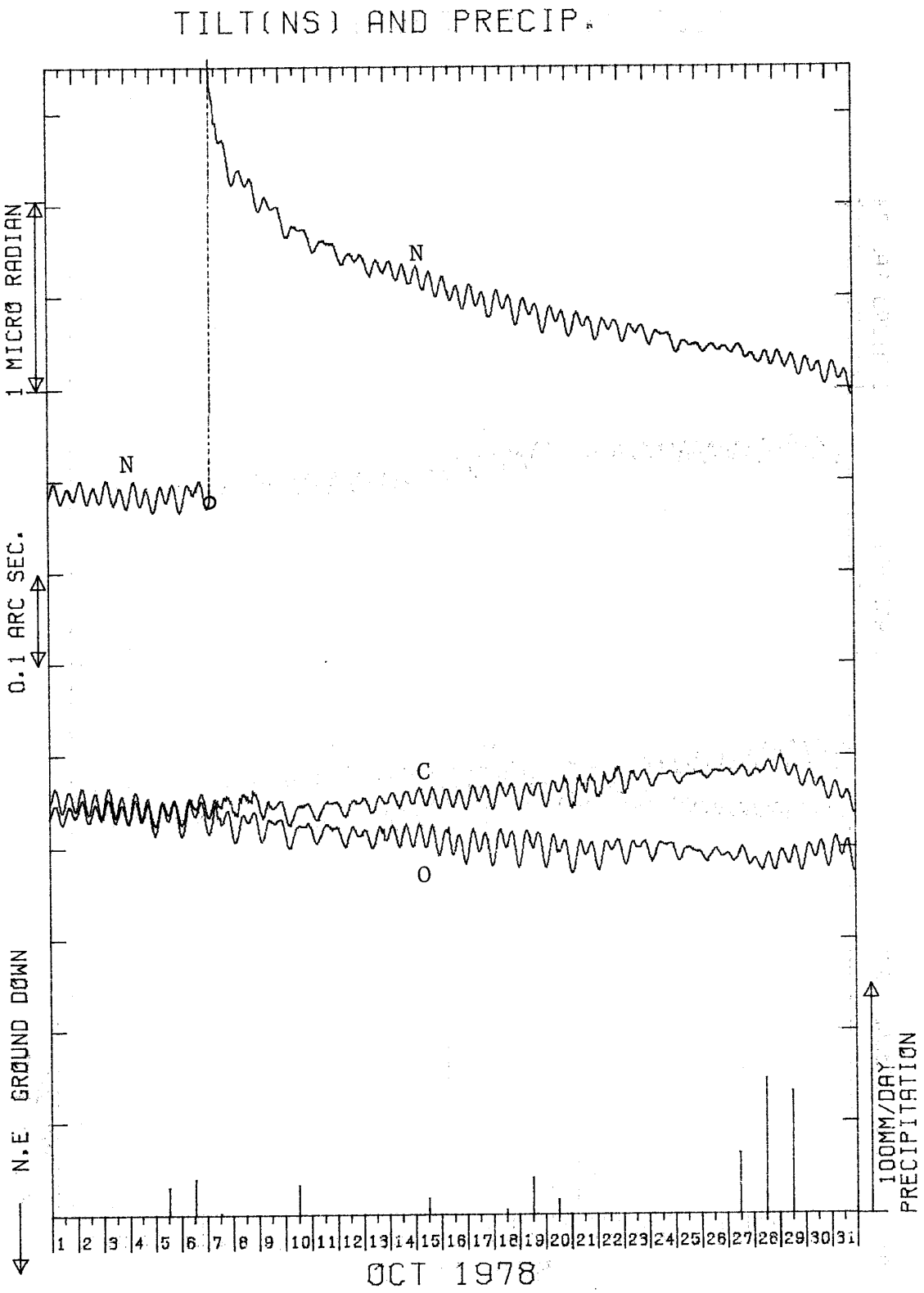
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PRECIPITATION
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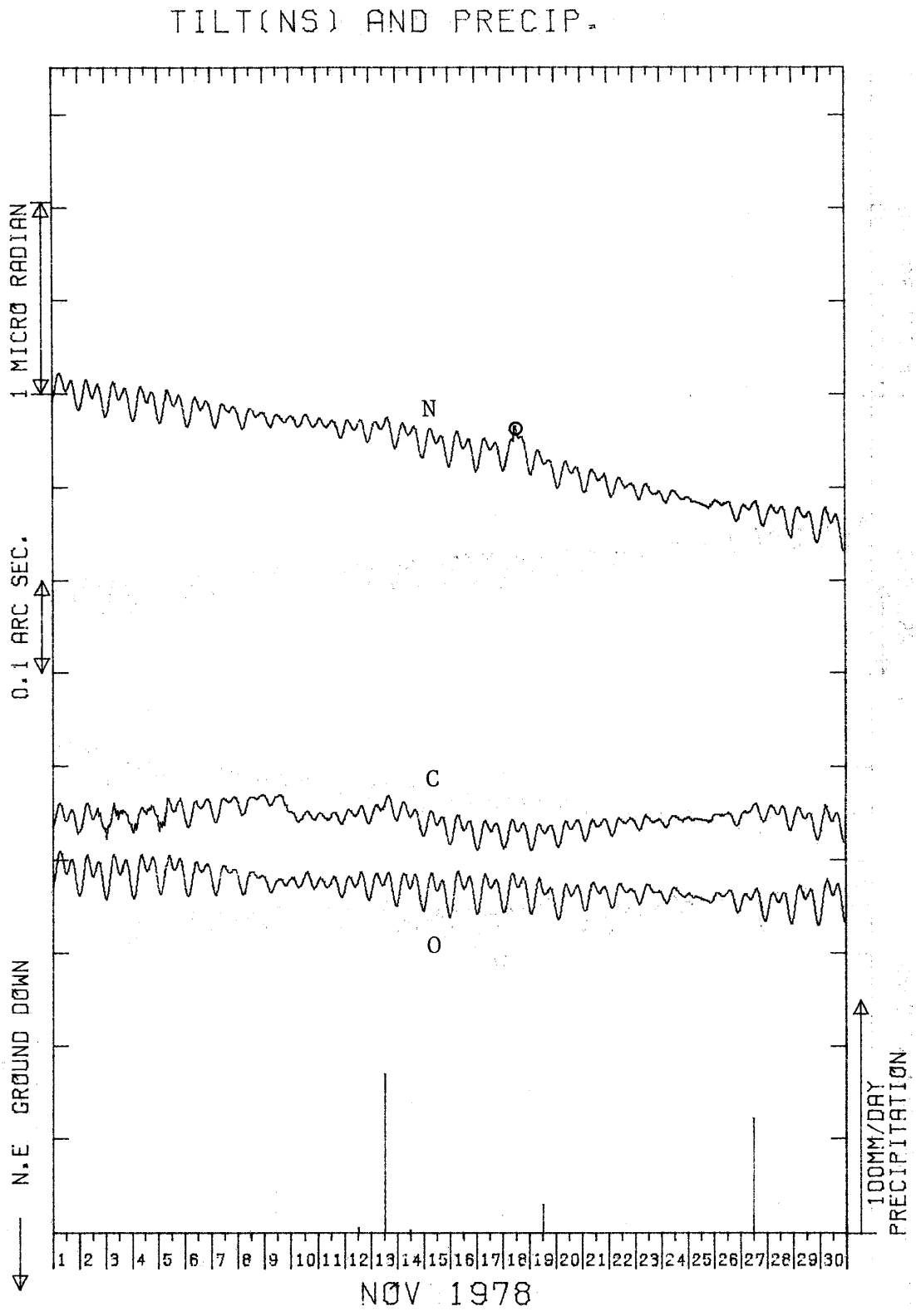
OCT 1978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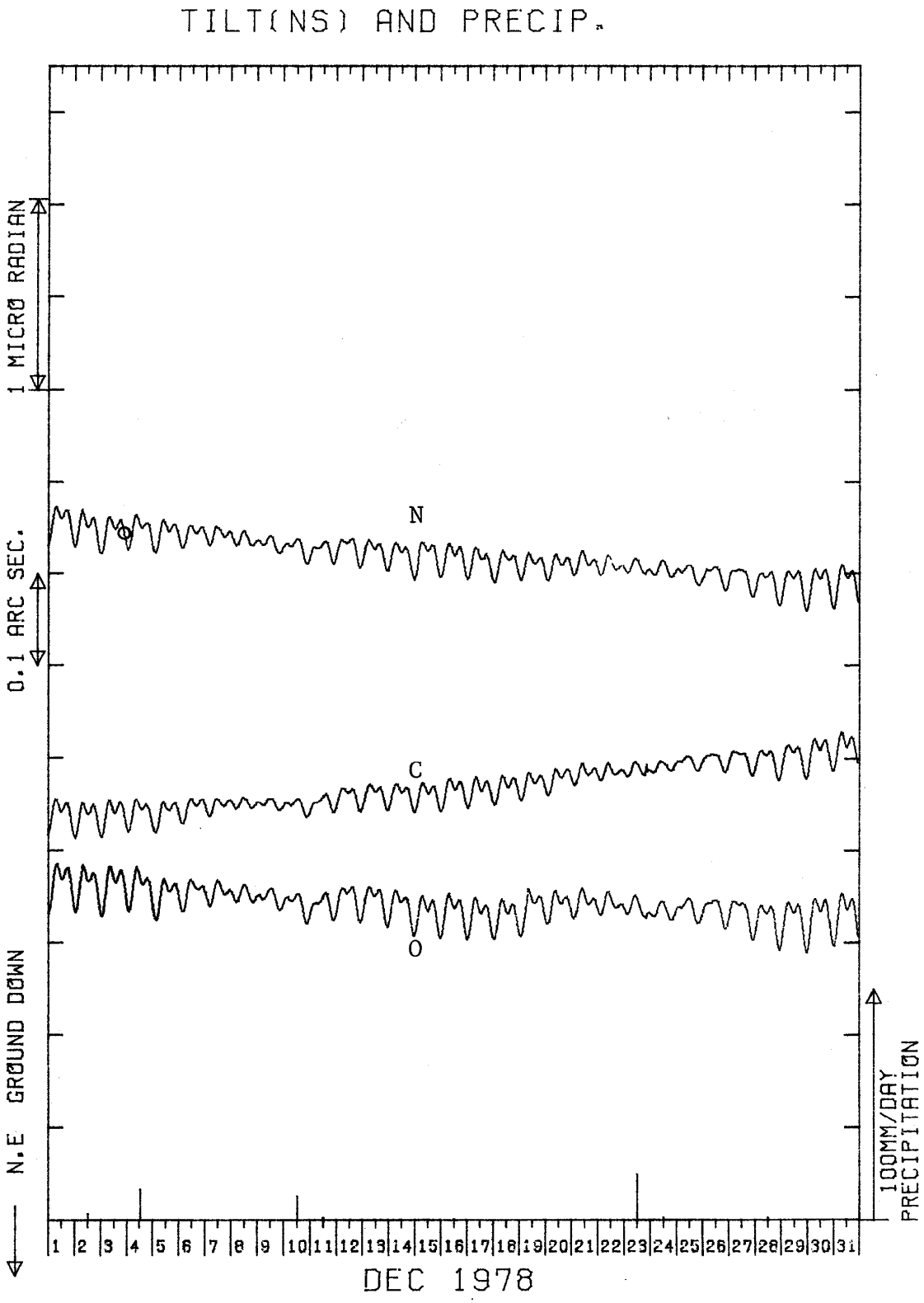
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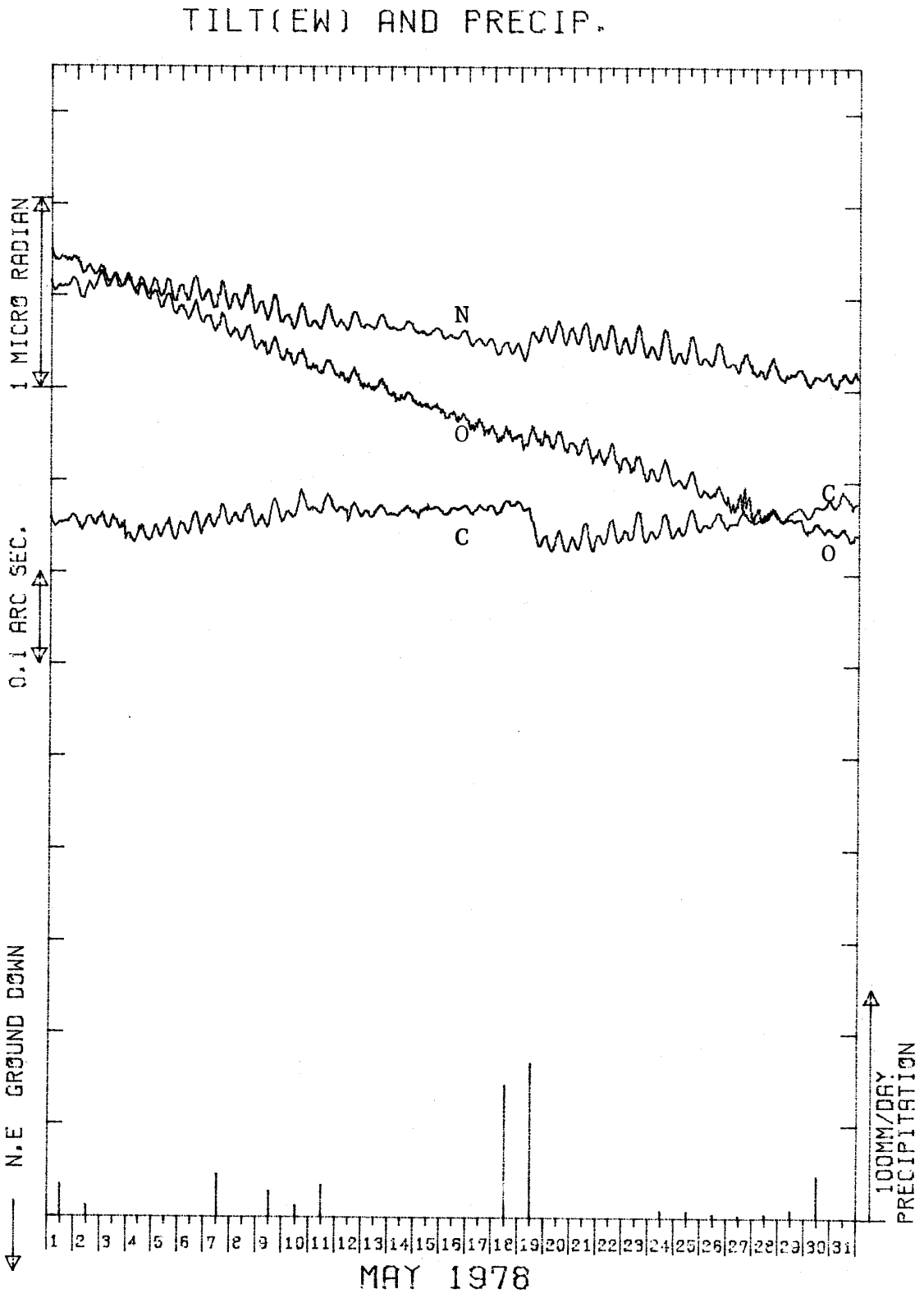
DEC 1978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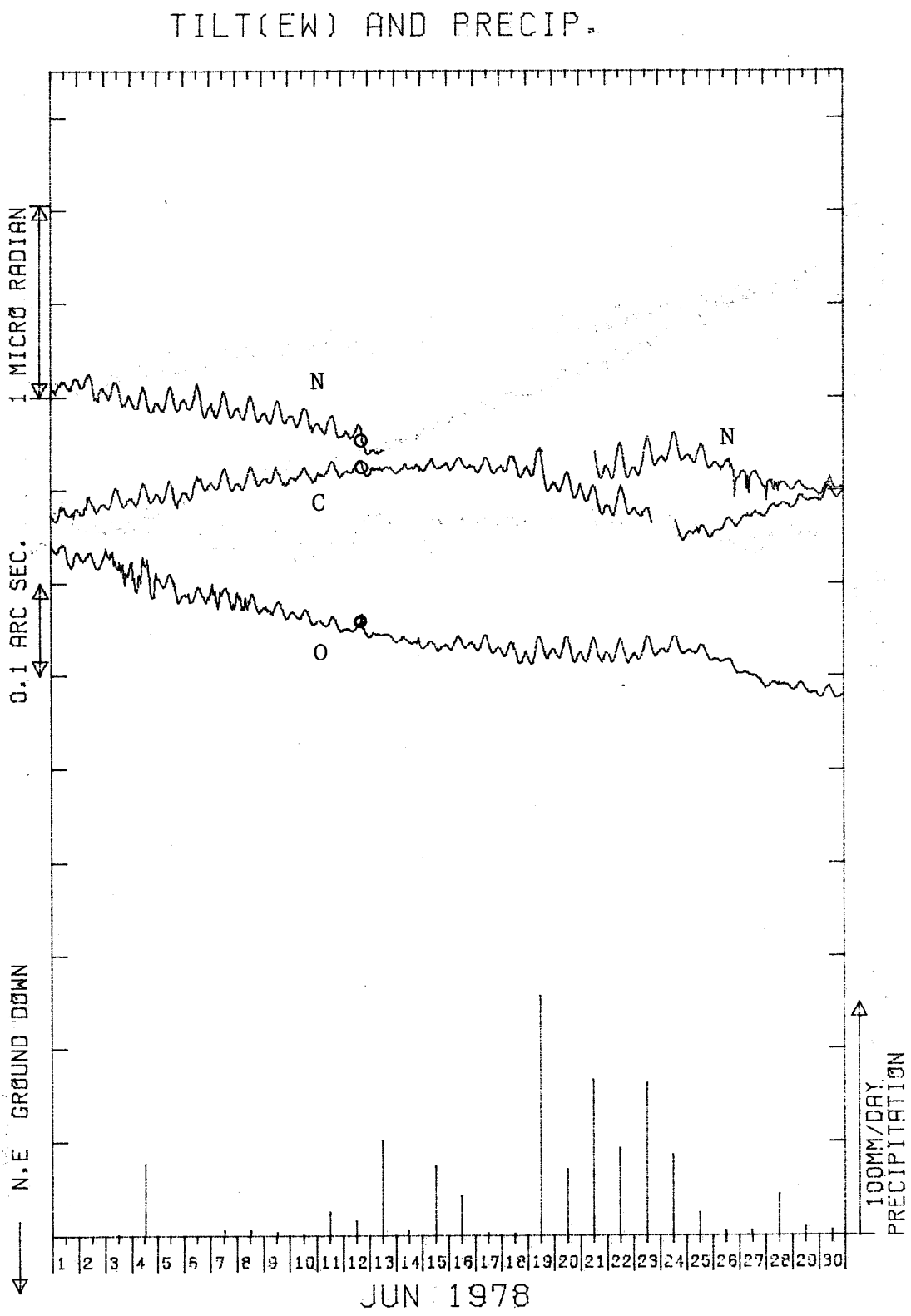
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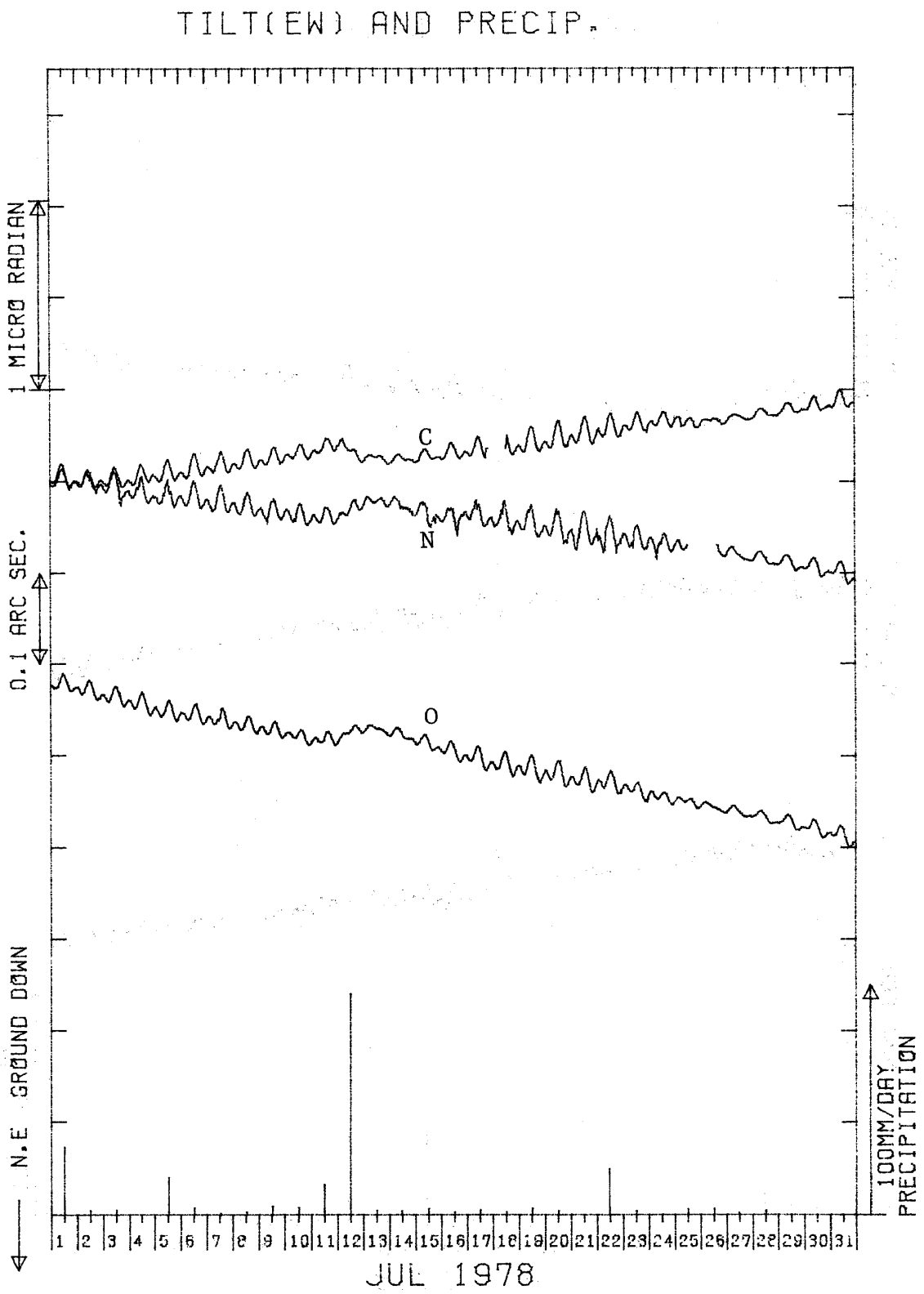
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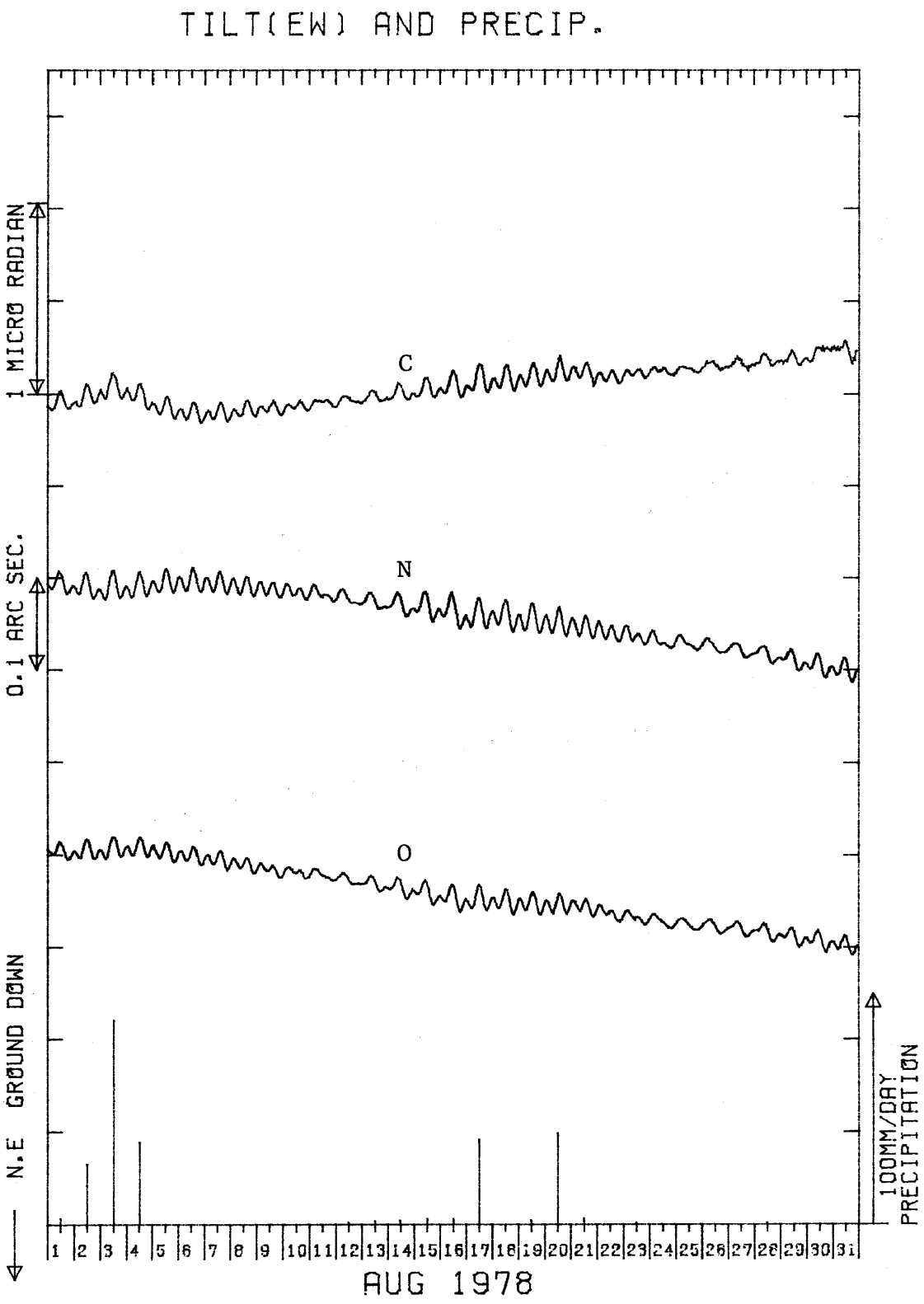
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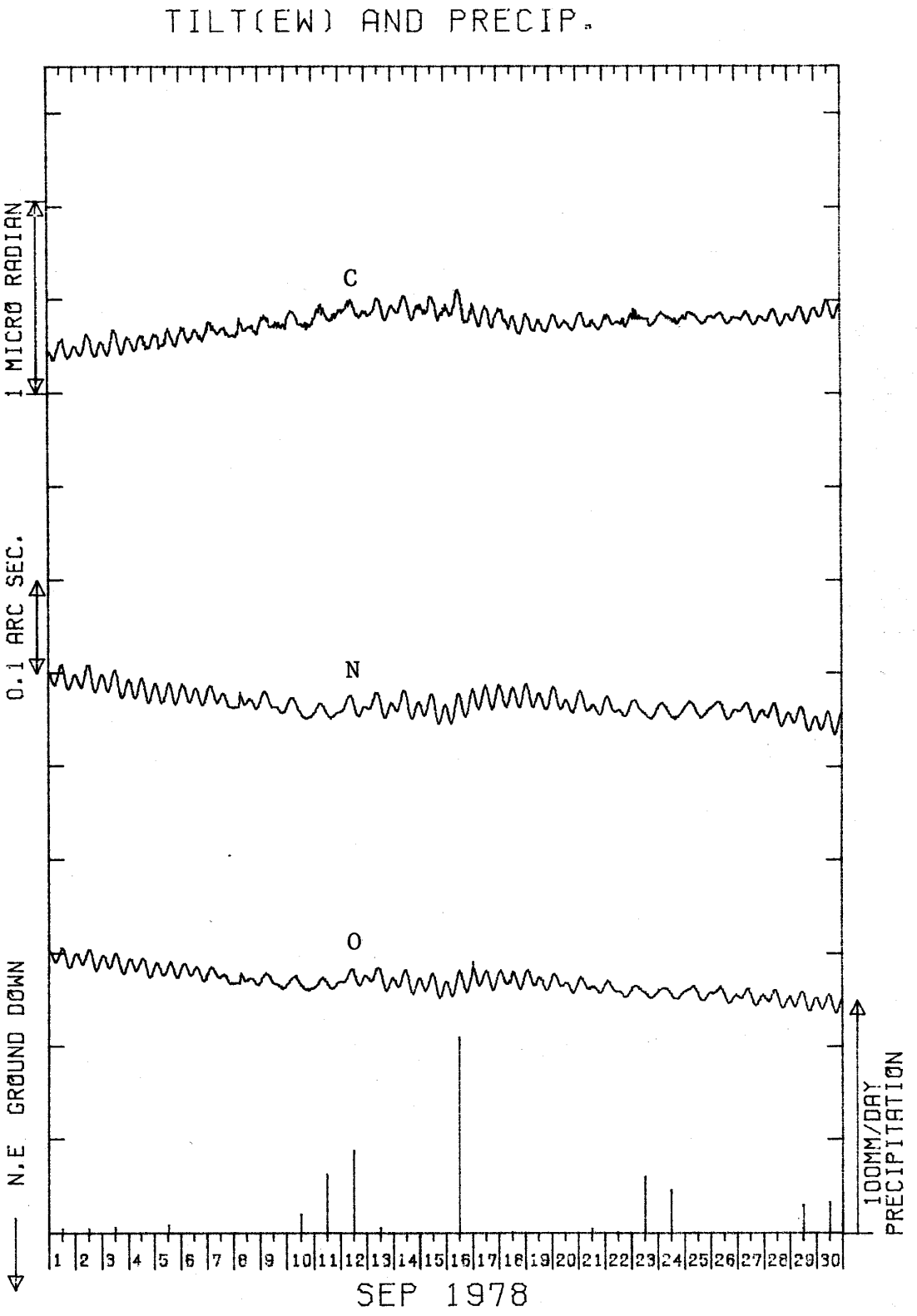
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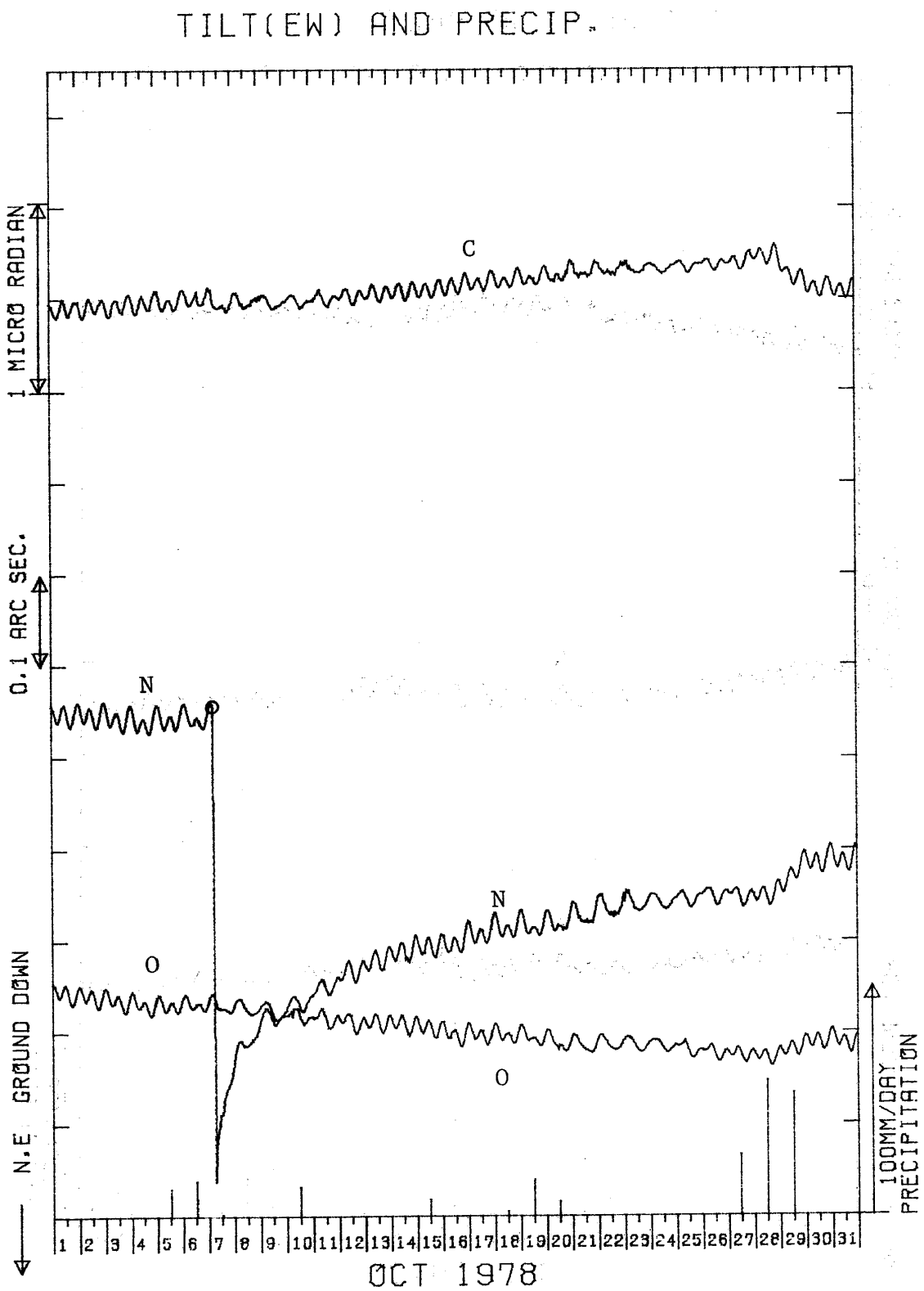
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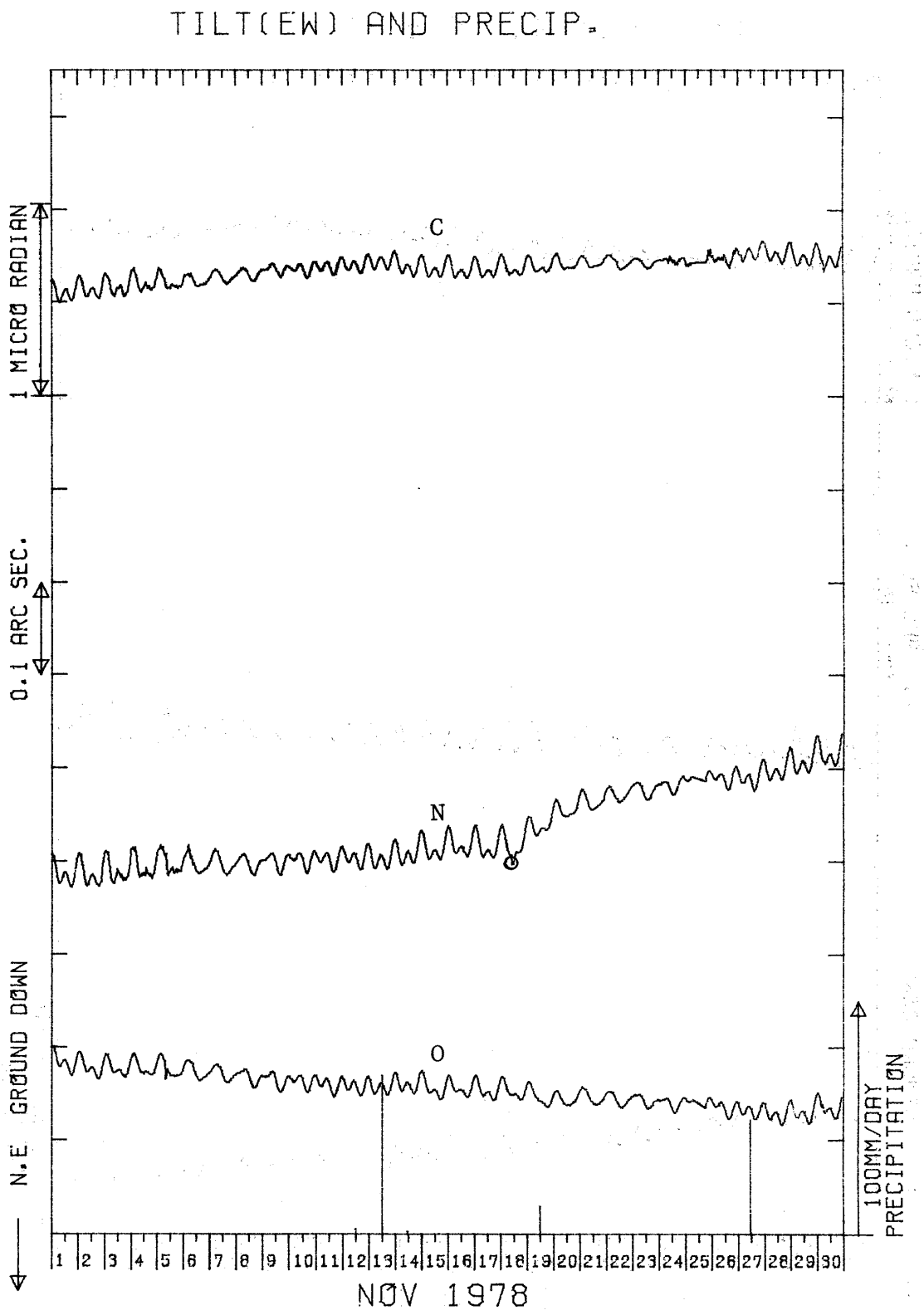
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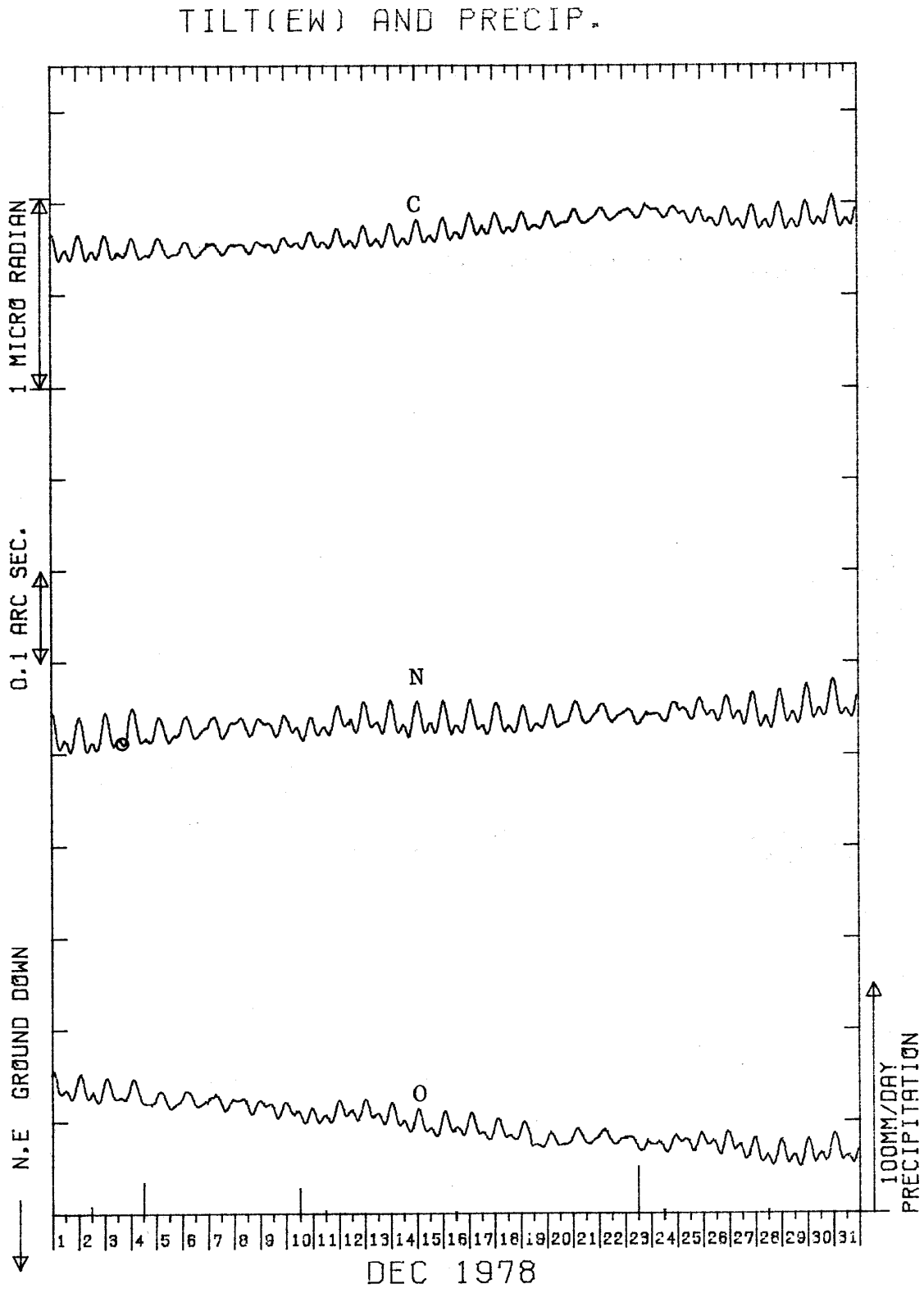
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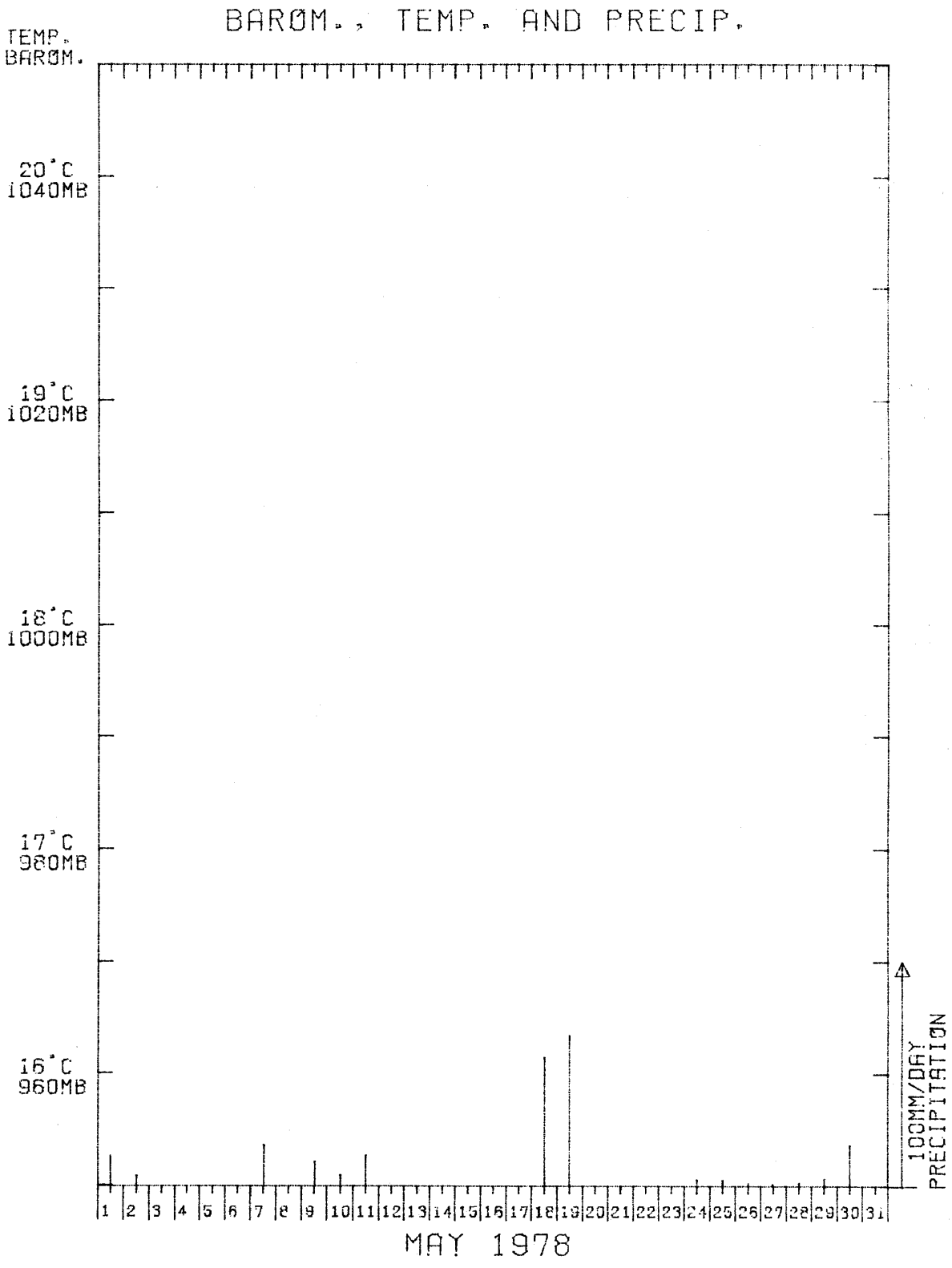
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TEMP.
BARØM.
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1040MB
19°C
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17°C
980MB
16°C
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PRECIPITATION
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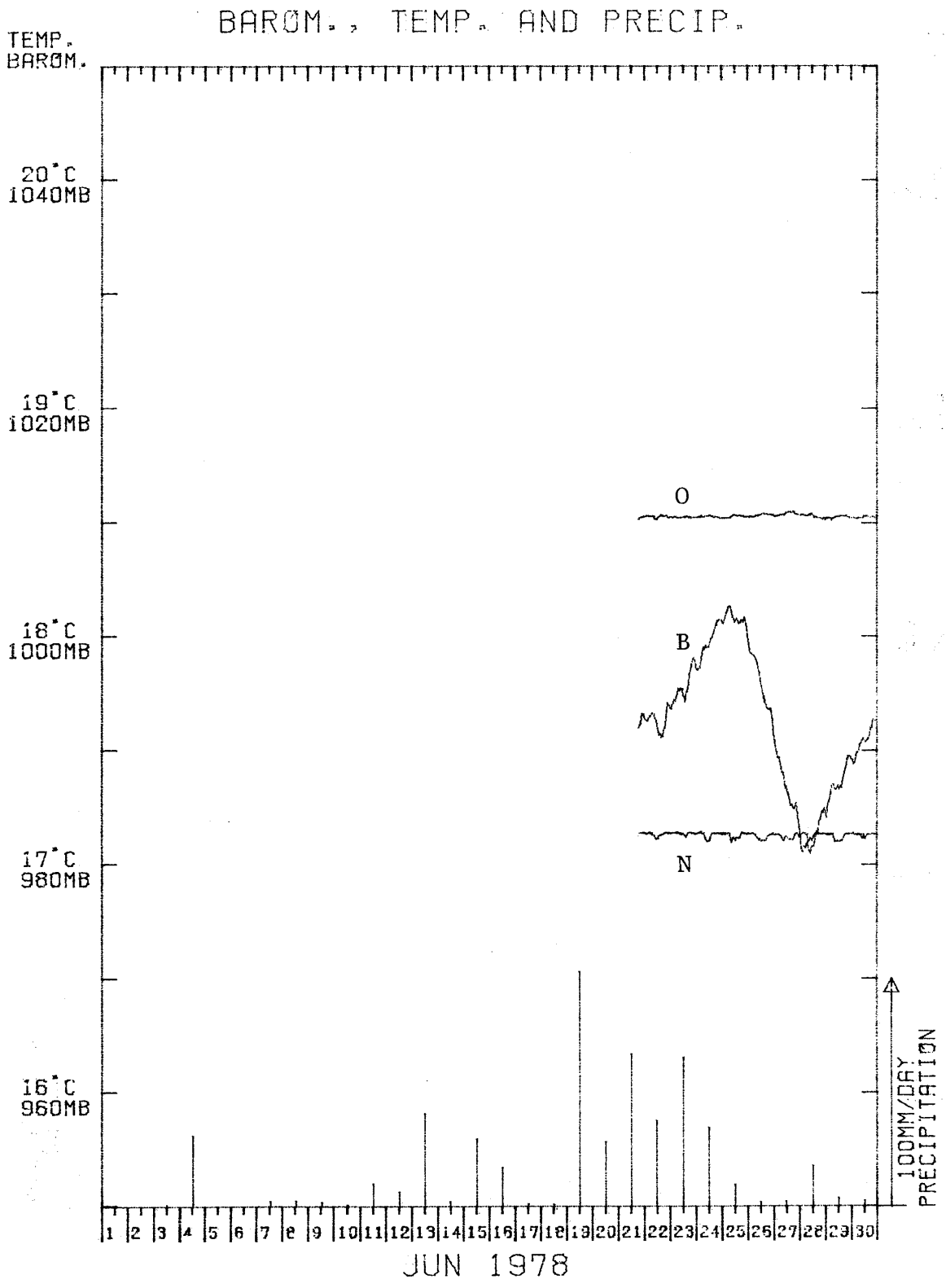
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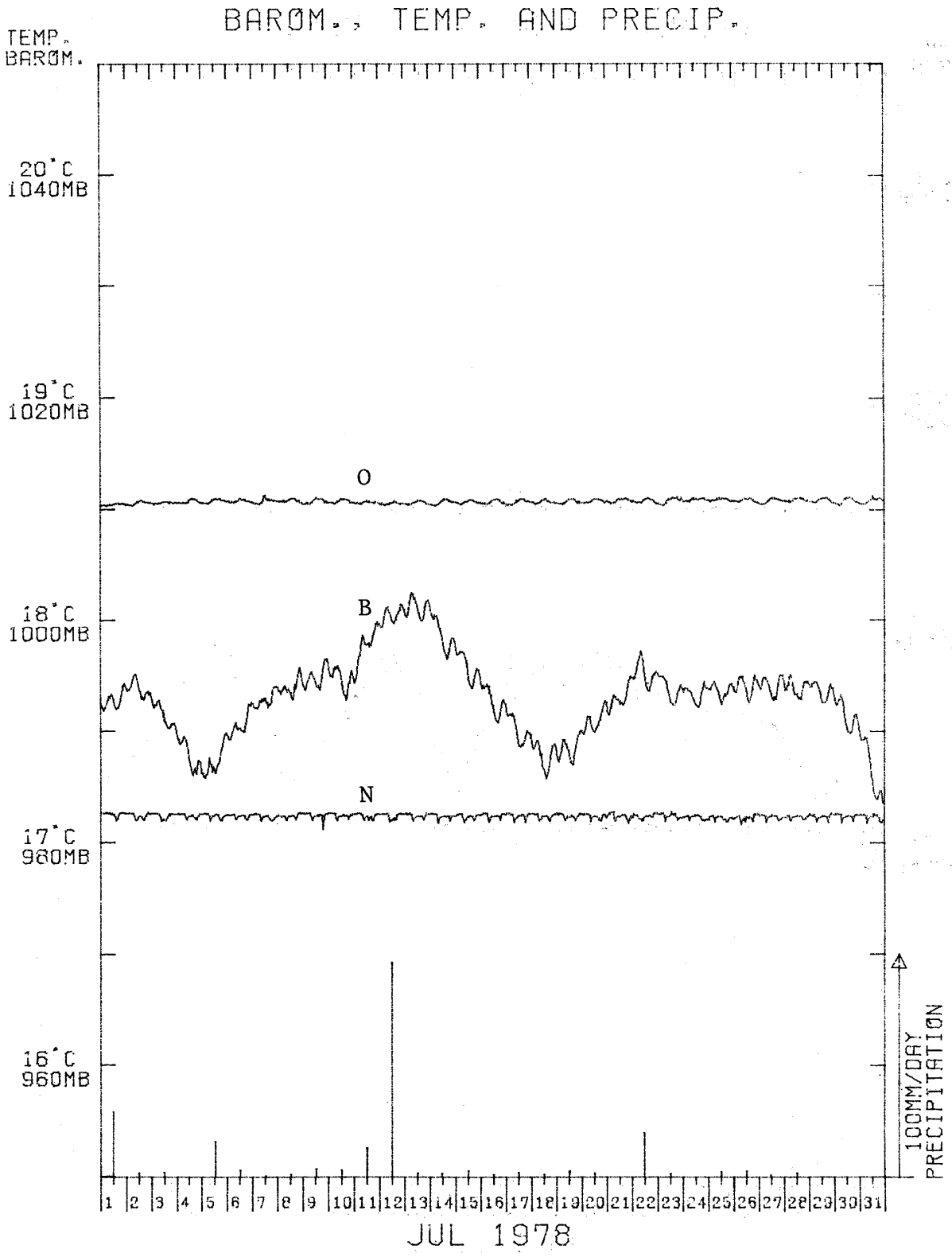
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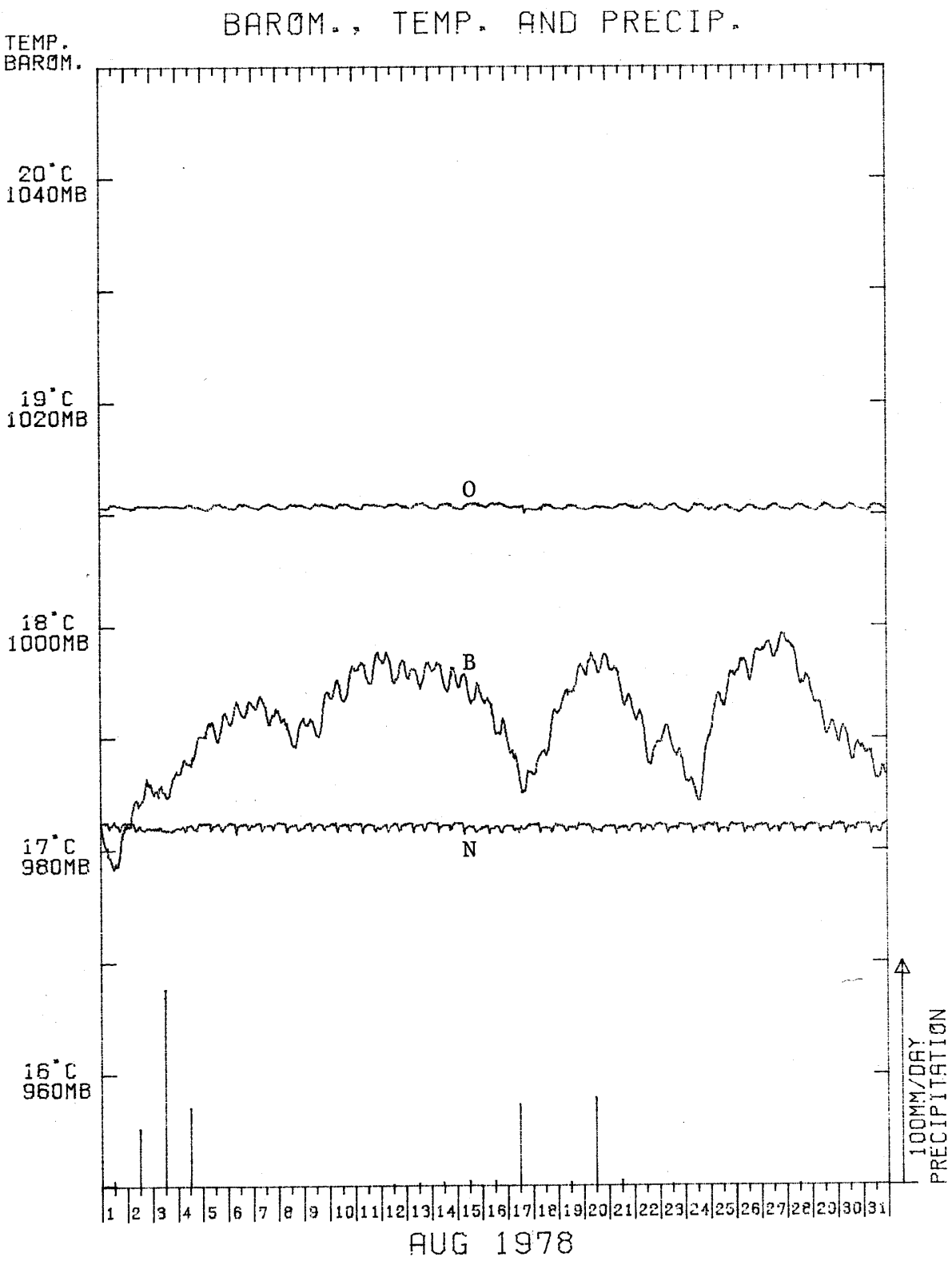
BARØM., TEMP. AND PRECIP.
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PRECIPITATIØN
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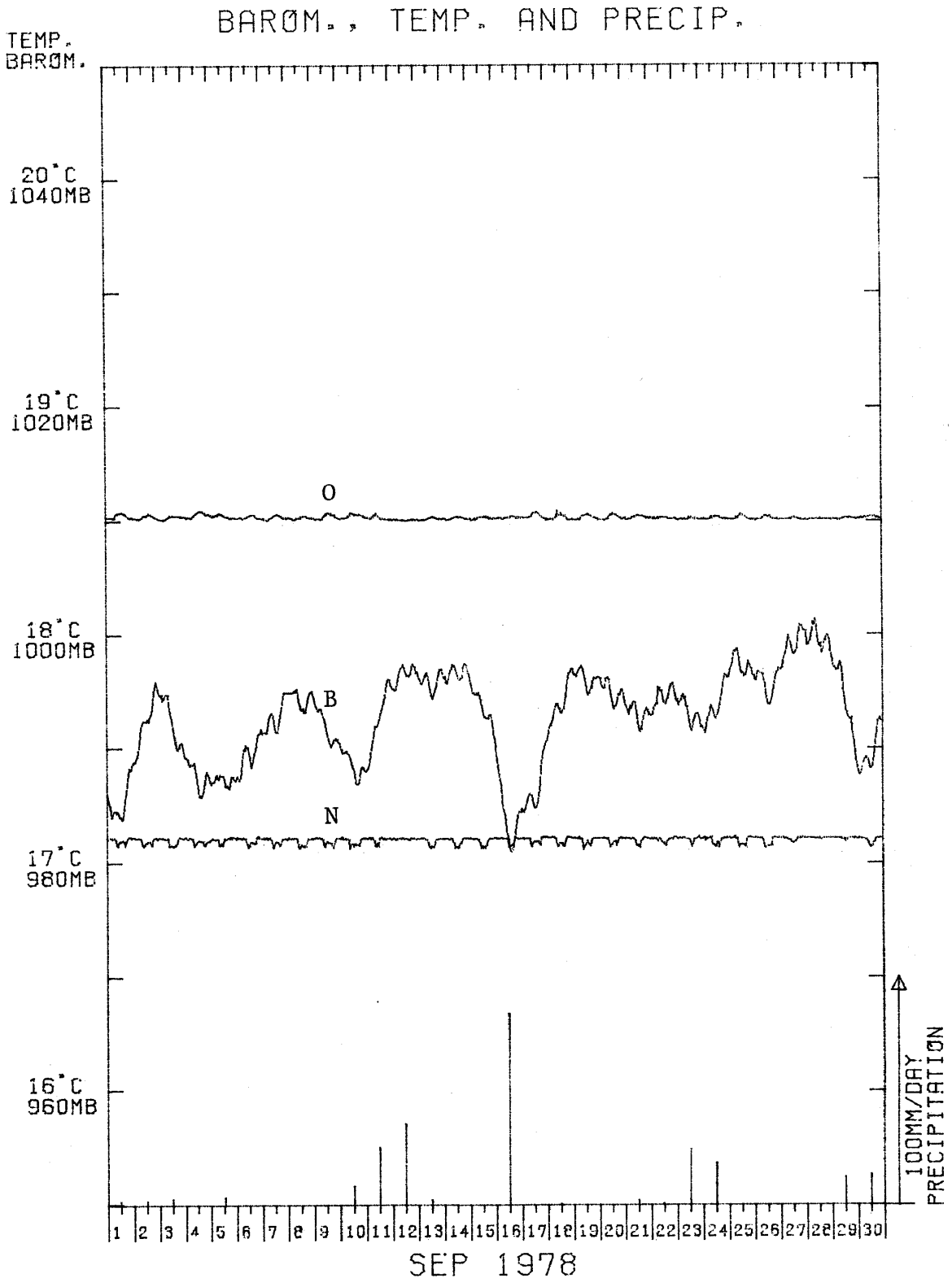
AUG 1978


BARØM., TEMP. AND PRECIP.
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PRECIPITATION
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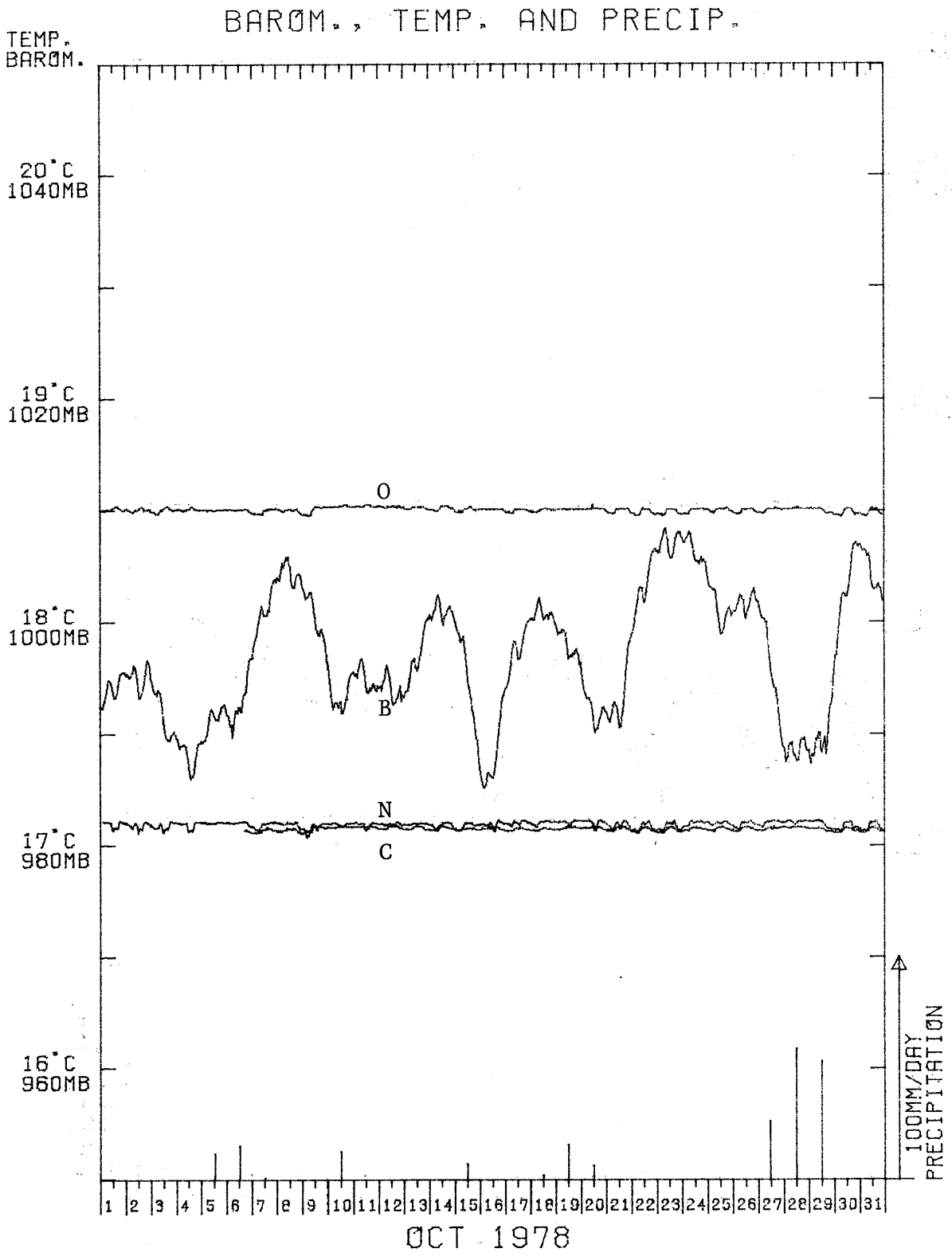
BARØM., TEMP. AND PRECIP.
TEMP.
BARØM.
20°C
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100MM/DAY
PRECIPITATION
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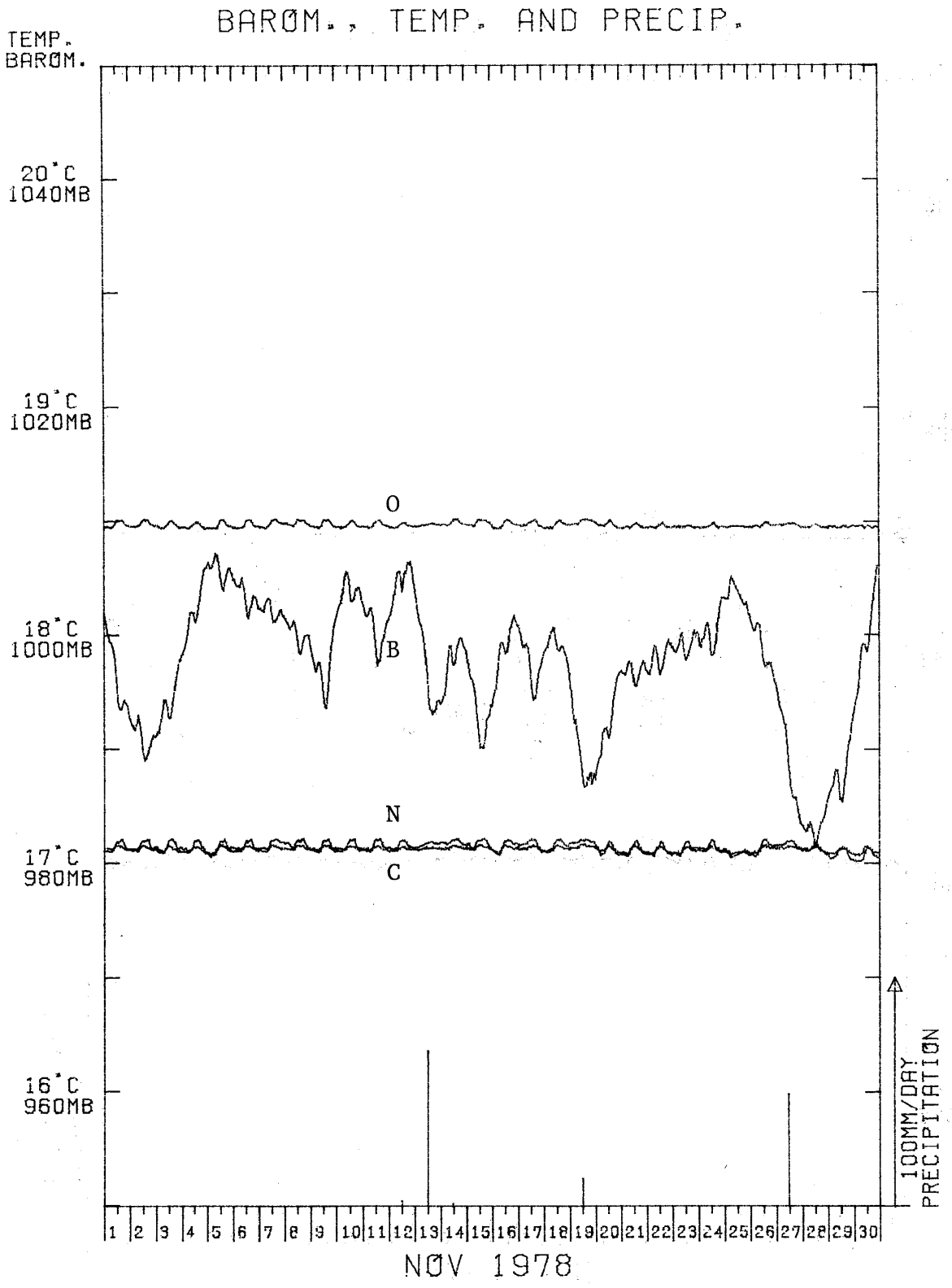
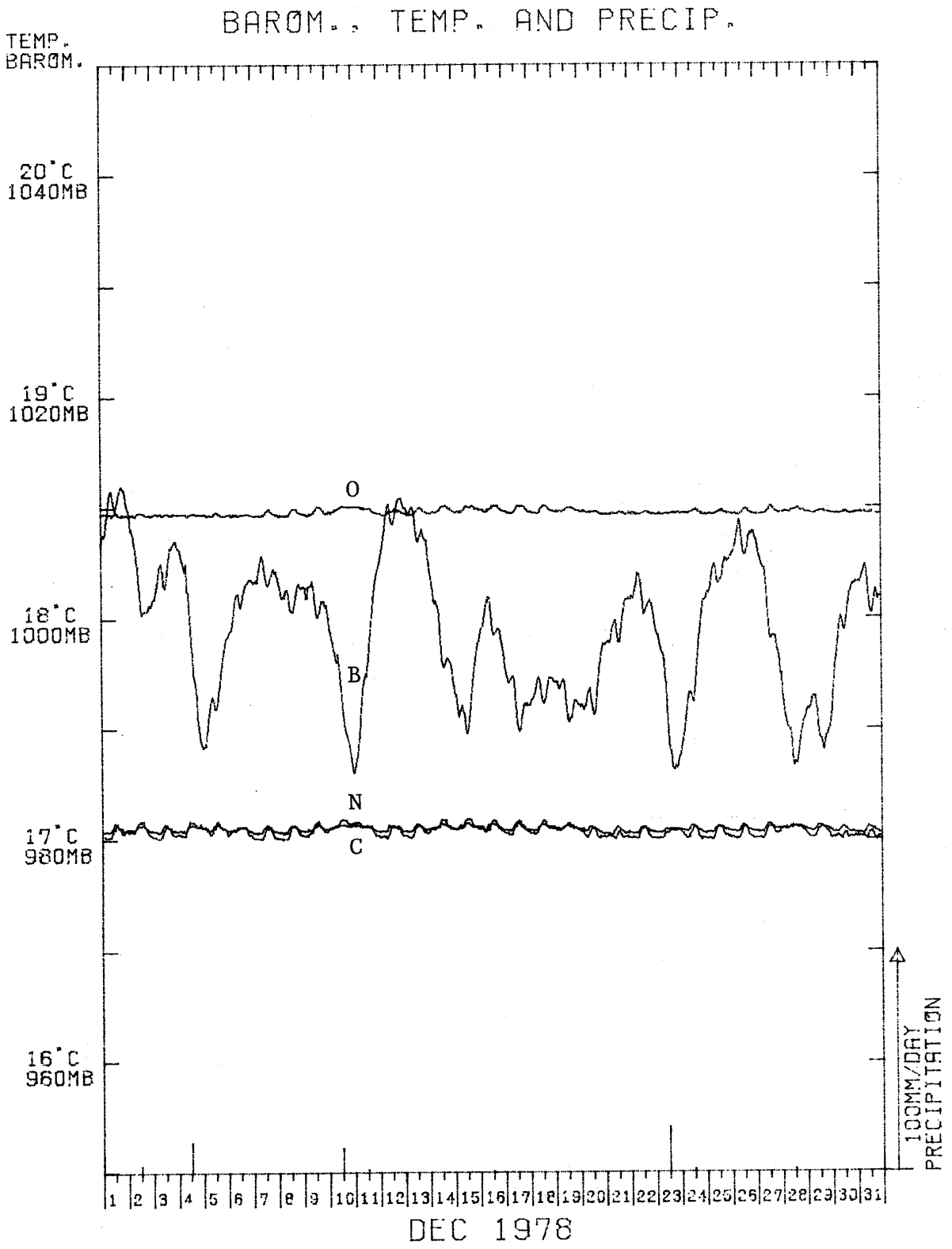
ØCT 1978


BARØM., TEMP. AND PRECIP.
TEMP.
BARØM.
20°C
1040MB
19°C
1020MB
18°C
1000MB
17°C
980MB
16°C
960MB
O
B
N
C
100MM/DAY
PRECIPITATION
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
NØV 1978


BARØM., TEMP. AND PRECIP.
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PRECIPITATIØN
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
DEC 1978