ABSORPTION MEASUREMENTS WITH RIOMETER

C.N.Pq.

Data Summary for the period September through December 1963

by
M. A. SETTE
and
F. DE MENDONÇA

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REPORT Nº LAFE-12
May 1964

The measurements reported herein were performed in cooperation with Stanford Research Institute and A.F. Cambridge Research Laboratories.

Comissão Nacional de Atividades Espaciais
São José dos Campos
São Paulo — Brasil

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ERRATA FOR REPORT LAFE-9, DEC. 1963

The values of absorption on Tables II to XIII (pages 6 to 17) and on the median monthly absorption curves, page 19, should be divided by the factor 2.

RIOMETER MEASUREMENTS

DATA SUMMARY Nº 2

I - INTRODUCTION

This summary is a catalogue of reduced riometer data for the period of observations from September 1963 through December 1963 at São José dos Campos.

This summary will also show (Fig. 1) a "quiet-day" curve for São José dos Campos station which was obtained from the available data of the period of April 1963 to December 1963 - nine months of regular operation.

The dotted part of the "quiet-day" curve indicates that section of the curve which will need future corrections for errors that became apparent while reduction of the riometer data was performed in terms of daily absorption.

For each month, the value of absorption is tabulated for the first minute of each hour to the nearest 0.1 db, and the total number of readings for the month as well as the median value are indicate in the same table. See for instance Tables II through IX. Note that Fig. 2 also shows the monthly medians mentioned above.

A listing of the registered solar flares and related absorption effects during the period under consideration is shown in the Table I.

II - DESCRIPTION OF THE EQUIPMENT

RIOMETER: The riometer (Relative Ionospheric Opacity Meter) is a device for measuring ionospheric absorption using the cosmic noise method.

A high gain receiver is switched automatically between one antenna and noise diode at a given switching frequency (340 cps).

The antenna which in our station is an east-west four elements Yagi, points vertically and receives the cosmic noise. If there is a difference between the antenna power and the noise diode power, a square wave at the switching frequency appears at the detector of the receiver. The detector output is a DC voltage which has an amplitude that is proportional to the difference between the antenna and the diode signal. The voltage is used to adjust the current of a servo diode in order to reduce the above mentioned difference to zero. The diode noise power is proportional to the current which in turn is directly proportional to the antenna noise power. The diode current is recorded in a common pen recorder.

The riometer is calibrated daily by connecting a test noise diode in place of the antenna and passing different value of current readings of the riometer.

The frequency used of 30 Mc/s is low enough to be sensitive to the non-deviative absorption effects of the lower ionosphere and yet it is sufficiently high so that a signal is detectable even under heavy ionospheric disturbances.

III - MEASUREMENTS TECHNIQUE

In the cosmic noise method already mentioned, the absorption is measured by comparing the signal actually received with the signal that would be received in the same system at the same sidereal time under conditions of zero absorption.

In order to measure the absorption it is necessary to establish the local "quiet-day" curve. This curve is obtained from the riometer recording in the hours before the sunrise, when absorption is low. The value of current observed are transferred to the corresponding sidereal time. The highest realiable readings are considered points of the "quiet-day" curve, which is assumed as pointed before to represent values of zero absorption condition.

From the "quiet-day" curve the absorption in db at any time is given by the relation:

$$A\ (db) = 10 \log_{10} Ir/Iq$$

where:

Ir = power noise actually received at a given time.

Iq = power noise from the "quiet-day" curve for the corresponding sidereal time.

IV - TYPE OF SCALING AND DATA REDUCTION

In reducing the riometer data, scaling TYPE I (URSI-AGI Committee 1958) has been used.

The absorption during the first minute of each hour every day throughout a given period of observation is recorded and then averaged. The results give a picture of the daily and seasonal variation of the absorption.

The data reduction was performed in the following manner:

The "quiet-day" curve, assumed to represent ZERO absorption, was plotted as well as curves of constant ratio (I_o/I), in order to obtain a set of parametric curves for given values of absorption in (db).

The actual values of current for each hour are translated to the correct sidereal time and the value of absorption in db is obtained from the parametric curves mentioned above.

The following qualifying symbols have been used for values obtained indirectly from the record:

C failure of equipment
S interference
U value uncertain
I value interpolated

V - ABSORPTION EFFECTS ASSOCIATED WITH SOLAR FLARES

The Sun's ionizing radiation during solar flares is normally enhanced and reaches the lower level of the ionosphere increasing the absorption through the D-region producing the attenuation of the cosmic noise reaching the antenna. Sometimes prior to the observation of attenuation, and depending on the relative position of the Sun and antenna beam, one observes an increase in the flux of energy reaching the antenna as a result of the Sun's HF radio emissions, during solar bursts of intensity over 1.

Some flares occuring during the local sunlight could be clearly related to absorption effect showed in the riometer records.

The information on solar flares, published on the Solar Geophysical Data - Part B - of the Central Radio Propagation Laboratory, was used to analyse the absorption effects on the riometer records. There is a good correlation between the increase in absorption and solar flares accompained by ionospheric effects S-SWF (sudden drop-out and slow recovery).

Table I lists sudden increase in absorption and related solar flares. Also listed together are the bursts events on the range 7 - 41 Mc/s that occurred at about the same time as the flares and that showed some disturbance on the records.

VI - MAGNETIC BREMSSTRAHLUNG FROM RELATIVISTIC ELECTRONS

We expected to make measurements on the excess signal component from the synchrotron radiation of high energy particles trapped in the earth's magnetic field after the July 9, 62 detonation over Johnston Island. This was not possible however, and one reason for that could be that this riometer was set in operation on March 16, 1963, that is, eight months after the detonation. Since the decay of the bremsstrahlung radiation has a time constant of about sixty days, the excess radiation component was already reduced by that time to about 20% of its original value.

The possibility of extracting the excess signal component from the riometer records was upset by the fact that at the time that this riometer was put into operation, the portion of the sky of very high temperature, namely the galactic center, was on the antenna beam in the early hours of the morning when the absorption is normally low.

The excess signal, already reduced in its strenght, was not noticeable over this high level background signal. However there is still hope that using next years zero absorption levels, one might be able to go back in time and establish the above mentioned contribution.

VII - "QUIET-DAY" CURVE ERRORS AND CORRECTIONS

The "quiet-day" curve for this station has been obtained from data of nine months of operation during a period of relatively low absorption. However in this procedure it seems that some errors have been included in the "quiet-day" curve.

A portion of the curve which shows low values of current is the result of including values obtained from hours when the absorption was low but could not be disregarded or considered equal to ZERO. A first trial to correct this error has been made using recent data corresponding to local time between 3AM, and 6AM, and during the local winter. This correction was done in order to get a first approximation of the "quiet-day" curve. It was a correction which consisted of modified values of current that were to correspond to zero absorption in the new curve.

This riometer has been in operation regularly since March 16, '63. Some equipment failure occurred for a week during the month of July and the receiver was off. After that the riometer has been recalibrated and reset and the adjustments of the receiver were not exactly as before.

The available data used in deducing the "quiet-day" curve came from the receiver operating with two different set of parameters. The increase in the absorption level in the early morning after July can be related to the change in the receiver gain. Corrections on the level of the "quiet-day" curve has been introduced in order to make the measurements obtained after the reset of the equipment comparable with those made in the former period.

VIII - CONCLUSION

Except for very strong interference produced by thunder storms, typical of the summer period in this latitude, this station is placed in a very quiet location.

The riometer records are quite free from man made interferences.

Since for reasons mentioned above, there were some errors in the "quiet-day" curve, this report presents the data as a provisional average of monthly absorption.

A few more results of consistent operation of the riometer will provide data for a detailed study of the seasonal variation of non-deviate absorption.

This station will continue its operation and will provide data on ionospheric absorption in a cooperative program for the International Quiet Sun Year (1964 - 1965).

Data will be sent to the World Data Center, as established in the Guide to International Data Exchange, CIG - IQSY Committee.

Acknowledgement:

The riometer in operation at this site was provide to us by the Air Force Cambridge Research Laboratories (Mr. S. Horowitz) through the Stan-

ford Research Institute, Menlo Park, California (Dr. Rolf B. Dyce). Copies of our recordings are sent regularly to SRI. We do appreciate this opportunity for participating in their program of Global Riometer Measurements.

References:

1) Little, C. G., and Leimbach, H. - "The Riometer - A Device for the Continuous Measurements of Ionospheric Absorption"- Proceeding of IRE, Feb. 1959, Vol. 47, pp 315-320.

2) Little, C. G., and Leimbach, H. - "Some Measurements of High--latitude Ionospheric Absorption Using Extra-terrestrial Radio Waves" - Proceeding of IRE, Jan. 1958, Vol. 46, pp 334-348.

3) Mitra, A. P., and Shain, C. A. - "The Measurements of the Ionospheric Absorption Using Observations of 18.3 Mc/s Cosmic Radio Noise" - J. Almosph & Terrestrial Physics, Vol. IV, 1953, pp 203-218.

4) URSI - AGI Committee - Letter in "Questionnaire on Ionospheric Absorption Measurements" - A2, Apendix A, Sept. 15, 1958.

5) Lusignan, B. B. - "Cosmic Noise Absorption Measurements at Stanford, California and Pullman (Washington)" - J. G. R., Vol. 65, nb 12, Dec. 1960, pp 3896-3902.

6) "Riometer Measurements, Data Summary nº 1, January to December 1958" - Radioscience Laboratory, Stanford Electronics Laboratories, Stanford University, Nov. 1959.

7) Goldman, S. C., and Horowitz, S - "Global Riometer Measurements".

Date	Time interval (UT)			Excess absorption in db	Flare			Prov. ion. effects		Bursts				
1963	Start	Max.	End		Type	Start (UT)	End (UT)	Time (UT)	Type	Type	In-tensity	Time interval		Freq. range Mc/s
Sept. 15	13:06	13:10	13:17	0.40	1	13:05	13:35	13:11	Slow S-SWF	-	-	-	-	-
15	20:17	20:28	20:47	0.30	2+	20:08	21:08	20:30	S-SWF	III	1-	20:17:15	20:17:30	30/41Mc
16	10:25	10:28	10:36	0.40	1+	10:18E	10:55D	10:32	S-SWF	-	-	-	-	-
21	18:45	≈19:00	19:30	0.30	-	-	-	-	-	Cont.	2	b13:18	a24:37	18/41Mc
Oct. 18	b16:12	16:12	17:00	0.20	-	-	-	-	-	IV	1	16:13:15	17:33	15/41Mc
18	20:43	20:47	21:00	0.30	-	-	-	-	-	Cont.	3	20:43:30	21:05	7/41Mc
19	16:50	16:57	17:30	1.80	2	16:50	17:25D	16:57	S-SWF	III	2	16:52:15	16:53:15	15/41Mc
21	13:25	13:40	14:20	0.70	1+	13:23	14:20D	13:44	G-SWF	Cont.	1	b13:50	a23:50	20/41Mc
22	13:35	13:50	≈14:30	1.80	2+	13:29	13:54D	13:50	S1-S-SWF	III	1-	13:12:15	13:13	28/41Mc
23	16:43	16:53	17:15	0.50	1	16:17	17:21D	-	S-SWF	Cont.	1	b13:20	a23:38	20/41Mc
29	16:17	16:25	16:40	0.10	-	-	-	-	-	-		-	-	-

TABLE I

PR - CNPq
Comissão Nacional de Atividades Espaciais
São José dos Campos - SP - Brasil

MEAN VALUE OF ABSORPTION DURING THE FIRST MINUTE OF EACH HOUR

Station.....	- SJ	Lat.....	- 23°12'43''S	Freq.....	- 30 Mc/s
Month	- September	Long	- 45°51'35''W	Bandwidth.....	- 30 Kc/s
Year	- 1963	DIP	- 22.5°S	Diode Load Resist....	- 750 ohm
Riometer	- Mark II	Mag. Lat.	- 11.7°S	Audio Threshold	- By pass
		Alt.	- 623 m	Time Int.	- 3 sec
				ACG Time.....	- 4 sec

TABLE II

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	010	010	010	020	040	040	040	050	060	050	040	040	050	060	060	040	100	080	060	010	0	-020	-030	-010
2	-020	-030	-040	-030	-010	-010	0	0	0	010	-010	-010	010	030	030	040	080	040	0	-010	-020	030	040	040
3	-060	-030	-040	-040	-020	-010	010	-010	0	-010	-010	-10	0	010	030	050	080	070	020	0	0	020	-040	-050
4	-040	-030	0	0	-020	-010	-010	-010	0	-010	-010	?	020	030	050	070	100	040	030	040	S	C	C	C
5	C	C	C	C	030	030	040	040	010	0	0	020	030	050	070	060	080	060	070	060	070	040	-010	-010
6	-010	-020	-030	-020	-010	-020	-020	-020	-030	020	0	080	020	040	060	080	100	100	090	070	040	020	0	0
7	0	0	0	0	020	020	020	020	010	010	0	0	0	0	010	030	060	070	080	080	050	0	-010	010
8	0	-020	-030	-030	-020	-020	-020	-010	0	-020	020	-020	0	010	030	060	080	090	110	130	120	0	010	020
9	020	-020	-030	-020	010	010	-020	-010	0	-010	-010	0	0	010	020	0	010	040	020	030	0	-010	-030	010
10	0	-010	-020	010	020	010	0	0	0	-010	-010	0	020	050	030	050	060	070	060	090	100	080	070	060
11	020	020	0	-010	0	-010	-010	-010	-010	-010	-010	0	010	010	020	040	060	070	080	110	140	020	070	060
12	020	0	010	0	020	020	010	0	-010	-010	-010	010	030	010	070	100	120	100	120	100	100	100	070	100
13	050	0	-010	-010	-010	0	0	0	0	0	0	0	020	030	060	090	110	160	130	150	130	140	160	050
14	030	-010	-020	-010	020	010	0	0	0	-010	0	010	020	040	080	120	140	120	130	100	060	070	060	060
15	040	010	020	020	050	030	020	010	0	010	0	010	020	020	050	090	120	080	S	S	170	200	180	140

TIME - UT

Month: September
Year: 1963

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
16	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
17	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
18	040	050	050	030	040	050	050	060	040	060	070	070	C	C	C	C	C	C	C	C	C	C	C	C
19	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
20	C	C	C	040	030	030	040	030	030	050	050	040	020	020	020	030	060	070	100	060	050	070	080	110
21	010	0	0	-010	-010	-010	-010	0	-020	010	0	0	-010	-020	-040	-020	020	070	090	030	040	030	010	010
22	C	C	C	C	C	C	C	C	C	C	C	C	020	030	070	120	140	130	110	050	110	120	150	190
23	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
24	C	0	0	-010	-010	0	0	0	0	0	010	0	0	010	040	070	080	110	060	030	C	C	C	020
25	040	020	0	0	0	010	0	0	0	0	020	010	020	020	050	060	070	060	060	080	070	020	020	030
26	040	020	020	0	0	010	0	0	0	0	010	0	020	040	090	100	110	140	110	080	050	040	020	030
27	020	010	010	0	0	010	0	0	0	010	0	-010	0	020	030	040	050	050	060	070	030	0	0	010
28	020	040	030	0	0	010	0	0	0	010	020	010	030	060	090	120	140	150	130	090	060	040	030	020
29	020	020	-0	0	0	0	0	-010	-010	-010	0	0	C	C	050	060	080	110	110	140	090	050	030	040
30	030	020	0	020	020	0	0	-010	-010	-010	0	0	010	010	0	010	010	010	0	0	5	5	5	050
31																								
Count	20	21	23	24	24	24	24	24	24	24	24	24	23	23	24	24	23	23	23	23	21	21	21	23
Median	020	030	030	020	020	020	020	030	030	030	040	050	050	060	060	070	060	060	070	060	040	040	030	030

TABLE III

TIME-UT

PR - CNPq
Comissão Nacional de Atividades Espaciais
São José dos Campos - SP - Brasil

MEAN VALUE OF ABSORPTION DURING THE FIRST MINUTE OF EACH HOUR

Station.....	- SJ	Lat.....	- 23º12'43''S	Freq.....	- 30 Mc/s
Month	- October	Long	- 45º51'35''W	Bandwidth.....	- 30 Kc/s
Year	- 1963	DIP	- 22.5ºS	Diode Load Resist....	- 750 ohm
Riometer	- Mark II	Mag. Lat.	- 11.7ºS	Audio Threshold	- By pass
		Alt.	- 623 m	Time Int.	- 3 sec
				ACG Time.....	- 4 sec

TABLE IV

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	C	C	030	030	020	020	020	030	020	020	040	050	050	050	050	060	050	070	060	070	030	030	030	040
2	040	010	040	030	020	030	020	030	020	020	040	050	050	050	040	040	030	040	030	020	010	010	030	020
3	020	020	040	020	020	020	020	020	030	020	040	050	050	060	070	060	060	040	040	020	010	020	030	020
4	020	040	030	030	020	020	030	030	030	040	040	050	050	060	080	090	070	050	060	060	020	040	050	040
5	020	020	030	020	010	020	030	030	030	040	050	050	050	050	020	080	060	050	050	040	010	020	020	020
6	020	030	030	020	020	030	030	030	030	050	050	050	050	050	060	070	070	050	060	020	020	020	020	030
7	020	040	030	020	020	020	020	020	040	050	050	050	050	060	050	050	040	040	040	040	030	040	040	030
8	020	040	050	040	020	020	040	040	040	050	050	050	060	060	050	060	070	060	070	080	070	050	040	040
9	030	060	050	040	050	030	040	040	040	050	050	050	060	070	080	080	060	050	070	050	050	050	040	030
10	030	040	020	020	030	040	050	060	040	050	060	060	060	060	060	070	060	060	080	080	080	040	030	030
11	020	030	040	030	020	040	050	060	060	050	060	060	070	070	070	080	060	060	070	060	050	040	040	030
12	030	040	040	040	030	040	050	060	070	050	060	060	070	070	070	070	060	060	080	010	010	040	020	020
13	020	050	030	020	020	030	020	020	030	050	050	050	050	060	050	050	C	C	C	C	C	C	C	C
14	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
15	C	C	050	030	020	020	020	0	0	030	050	050	060	060	090	090	090	100	080	040	040	050	060	070

TIME - UT

Month: October
Year: 1963

TABLE V

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
16	060	010	020	010	010	010	0	010	010	-020	-010	-010	020	030	040	070	080	120	160	210	160	S	S	S
17	020	-030	-020	0	030	020	010	010	010	0	0	010	030	040	080	110	150	170	150	S	C	C	C	C
18	C	-010	010	050	060	020	0	0	010	-010	-010	0	010	040	030	140	130	130	120	090	030	0	020	020
19	010	-010	-010	-010	-010	-010	-010	0	-010	-010	-020	-010	010	020	060	110	120	080	080	070	040	020	070	080
20	020	010	010	010	010	010	0	0	-040	020	-020	-010	0	030	070	100	120	080	080	050	S	S	060	030
21	010	-020	0	0	030	020	0	0	010	0	020	010	010	010	070	100	140	140	150	S	S	S	S	S
22	S	S	S	S	050	070	070	050	030	080	050	060	0	070	090	090	130	160	190	190	160	120	110	060
23	030	050	020	020	050	040	060	040	020	010	040	C	C	C	C	C	110	110	110	110	100	100	100	080
24	030	030	020	020	020	0	020	020	010	0	0	010	0	0	010	020	010	020	050	050	060	010	040	050
25	020	020	020	020	010	030	020	020	010	0	0	010	0	0	040	060	100	120	160	160	140	140	170	100
26	050	040	020	020	020	030	030	020	010	0	010	030	030	050	050	S	S	130	160	160	150	150	180	120
27	010	020	010	020	030	030	020	010	010	0	010	020	040	050	060	080	080	060	080	S	100	120	S	090
28	090	040	030	0	0	060	050	060	050	060	050	060	060	080	140	130	110	120	120	110	120	120	110	060
29	020	020	020	020	030	020	030	020	010	0	010	020	020	050	070	080	090	100	140	150	140	130	100	070
30	050	010	010	010	010	010	010	010	010	-010	010	020	010	020	030	020	030	040	040	030	-010	0	020	040
31	-040	-020	0	0	010	020	010	020	010	0	010	020	030	060	070	080	070	080	070	050	020	060	070	060
Count	28	29	29	29	31	31	31	31	31	31	30	30	30	30	30	29	30	31	30	27	27	26	26	27
Median	020	0	0	0	010	010	010	0	010	0	0	010	020	030	060	080	100	080	090	090	100	060	060	060

TIME-UT

PR - CNPq
Comissão Nacional de Atividades Espaciais
São José dos Campos - SP - Brasil

MEAN VALUE OF ABSORPTION DURING THE FIRST MINUTE OF EACH HOUR

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		Alt.	- 623 m	Time Int.	- 3 sec
				ACG Time	- 4 sec

TABLE VI

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	-010	0	020	020	030	020	020	020	0	0	010	010	030	050	060	090	100	120	120	080	S	S	S	080
2	020	020	020	020	020	030	030	0	010	0	010	020	030	040	070	090	110	120	120	120	130	S	080	070
3	040	-010	010	020	050	040	010	0	0	0	-010	020	020	020	050	070	070	110	100	060	0	030	040	030
4	0	-010	0	010	020	020	010	0	0	0	020	010	0	020	050	070	090	100	090	070	030	020	030	020
5	0	010	0	0	010	020	010	010	0	0	020	020	030	040	070	070	090	110	120	130	110	S	100	030
6	0	-010	050	040	040	030	020	0	0	0	020	020	020	050	060	050	070	070	090	070	030	020	030	020
7	0	010	020	020	030	030	020	020	0	0	0	010	020	040	070	070	080	120	S	S	S	140	110	080
8	100	080	070	050	090	100	060	040	030	020	030	030	040	050	060	030	040	040	070	070	040	040	040	040
9	-010	010	020	020	050	040	040	030	0	0	020	040	040	040	060	060	070	080	090	080	040	050	060	070
10	060	060	050	040	060	030	020	020	0	010	020	020	040	040	050	050	060	070	S	100	130	170	150	080
11	040	070	070	080	070	080	070	060	050	050	050	050	070	070	060	040	060	070	060	050	050	070	060	040
12	040	010	020	020	020	030	020	080	0	0	010	010	020	030	050	040	050	070	080	080	060	070	070	010
13	-020	-020	0	030	020	030	020	010	0	0	0	010	030	050	070	070	080	100	100	090	090	090	070	020
14	-020	-020	-010	0	0	030	010	C	C	C	C	C	C	C	C	C	C	070	060	060	050	020	040	020
15	-010	020	010	020	050	040	030	020	010	010	010	0	020	040	030	040	050	070	050	060	C	C	C	C

TIME - UT

Month: November
Year: 1963

TABLE VII

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
16	C	C	060	100	100	080	080	080	040	040	050	070	050	070	060	040	050	050	060	040	040	030	040	-020
17	-020	0	0	020	040	040	020	0	0	0	010	0	020	040	080	040	060	070	070	060	020	020	030	020
18	010	010	010	020	040	020	040	030	040	050	040	060	070	090	070	090	120	130	130	080	100	080	070	060
19	020	020	020	020	020	040	020	0	0	020	010	020	030	040	040	050	080	100	120	100	070	090	070	040
20	020	020	030	040	050	040	030	010	0	010	010	020	020	040	020	020	060	C	C	C	090	070	050	050
21	050	060	050	040	070	090	060	040	030	040	040	050	050	050	040	050	080	110	110	030	080	040	040	020
22	010	020	020	020	030	020	020	0	0	0	0	0	010	040	030	050	070	C	C	C	060	100	080	040
23	S	040	050	040	070	050	020	010	0	010	0	010	030	050	050	060	080	110	110	070	060	050	060	050
24	050	040	020	030	030	030	020	010	010	010	010	010	030	050	040	060	090	110	110	100	060	070	060	070
25	050	060	030	050	070	050	010	0	0	0	010	020	020	040	060	070	080	090	090	100	070	060	060	040
26	040	050	060	040	040	040	010	0	0	0	0	030	020	050	040	040	050	S	S	S	060	040	020	030
27	010	010	010	030	030	020	010	0	0	0	020	040	040	060	060	100	110	100	040	C	090	100	070	070
28	050	040	050	060	050	040	020	0	0	010	010	020	040	040	050	070	100	100	070	070	100	080	020	0
29	020	020	030	040	050	040	020	0	010	010	030	030	030	060	060	060	080	S	S	S	C	C	C	C
30	010	020	020	030	040	020	0	0	0	-010	0	020	040	050	060	050	060	060	030	0	0	020	040	010
31																								
Count	28	29	30	30	30	30	30	29	29	29	29	29	29	29	29	29	29	26	24	24	26	25	27	28
Median	020	020	020	030	040	040	020	010	0	0	010	020	030	040	060	060	080	100	090	070	060	060	060	040

TIME-UT

PR - CNPq
Comissão Nacional de Atividades Espaciais
São José dos Campos - SP - Brasil

MEAN VALUE OF ABSORPTION DURING THE FIRST MINUTE OF EACH HOUR

Station.....	- SJ	Lat.....	- 23º12'43''S	Freq.....	- 30 Mc/s
Month	- December	Long	- 45º51'35''W	Bandwidth.	- 30 Kc/s
Year	- 1963	DIP	- 22.5ºS	Diode Load Resist....	- 750 ohm
Riometer	- Mark II	Mag. Lat.	- 11.7ºS	Audio Threshold	- By pass
		Alt.	- 623 m	Time Int.	- 3 sec
				ACG Time.....	- 4 sec

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	030	030	030	030	040	040	030	0	0	0	0	010	030	040	050	070	080	080	050	040	010	040	040	030
2	020	020	030	040	030	030	020	0	010	010	010	010	030	030	020	050	050	050	070	050	010	010	010	010
3	010	020	030	040	030	020	0	0	0	0	0	010	030	020	020	050	070	080	060	090	100	050	010	020
4	020	010	030	030	030	010	0	0	0	0	0	c	040	020	040	070	090	090	080	070	080	040	040	030
5	030	020	040	050	030	030	020	020	010	010	030	040	040	040	040	070	070	060	060	070	050	040	010	0
6	010	0	010	010	0	0	010	010	010	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
7	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
8	020	030	050	030	020	030	0	0	0	0	010	020	040	040	060	080	100	090	080	080	050	070	060	050
9	010	010	040	030	040	030	010	0	0	0	0	030	020	040	040	050	040	110	050	0	c	c	c	c
10	010	010	030	030	020	020	020	020	010	020	020	010	030	040	050	070	040	050	020	c	c	c	c	c
11	010	030	040	040	030	020	020	0	010	0	020	030	040	040	050	070	040	050	050	040	060	040	040	0
12	010	040	050	050	030	040	020	010	010	0	020	020	040	040	070	090	090	080	070	100	080	070	060	040
13	030	040	040	040	050	030	020	0	030	010	010	030	040	050	060	070	070	080	070	090	100	070	030	020
14	040	040	050	040	040	030	020	010	030	0	020	020	030	040	040	080	080	070	060	080	050	020	020	030
15	020	030	040	030	040	030	010	010	020	0	020	020	010	030	040	060	050	060	060	080	100	050	010	190

TABLE VIII

TIME - UT

Month: December
Year: 1963

Hour / Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
16	020	030	030	040	010	0	0	0	0	060	0	020	020	020	040	060	070	060	060	070	070	060	010	020
17	030	030	040	040	020	020	020	020	0	010	010	020	020	030	070	060	060	080	080	020	030	020	020	010
18	020	020	040	040	020	020	020	010	010	0	010	030	020	020	040	060	070	070	080	080	050	010	020	030
19	020	030	040	040	010	020	010	020	010	020	0	030	010	020	030	040	030	050	050	060	040	0	0	0
20	010	030	020	030	010	020	0	0	010	010	020	040	030	020	040	050	050	040	060	060	040	010	0	C
21	0	C	C	C	C	C	C	C	C	C	C	C	C	C	050	060	050	030	050	070	030	010	0	0
22	020	030	030	020	010	010	0	020	020	030	020	050	020	020	040	040	040	020	040	050	050	010	0	0
23	010	020	020	020	010	0	0	0	030	020	010	40	020	030	040	040	030	020	050	C	C	C	C	C
24	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	060	050	030	030	030	030	0	020	040
25	050	0	050	040	030	030	010	020	010	010	020	020	020	030	050	050	050	040	050	070	100	040	020	020
26	050	070	050	060	020	020	0	020	0	0	020	030	010	020	040	040	C	C	C	C	C	C	C	C
27	C	C	C	C	C	C	C	C	C	C	C	C	C	C	030	040	030	020	030	060	070	020	0	020
28	0	040	040	020	010	0	0	C	C	C	010	020	0	030	050	050	060	040	040	030	020	020	020	030
29	050	040	040	030	020	0	0	C	C	C	0	010	010	030	040	050	050	020	020	030	020	010	010	030
30	030	030	040	020	020	0	0	C	C	0	0	020	010	040	050	050	060	S	S	0	020	010	0	020
31	020	030	040	030	020	0	0	010	010	0	0	010	010	040	050	060	060	040	050	070	060	010	0	010
Count	28	27	27	27	27	27	27	24	24	23	26	26	26	26	28	29	28	27	27	26	25	25	25	25
Median	020	030	040	030	020	020	010	010	010	010	010	020	020	030	040	060	060	060	060	060	050	020	010	020

TABLE IX

TIME-UT

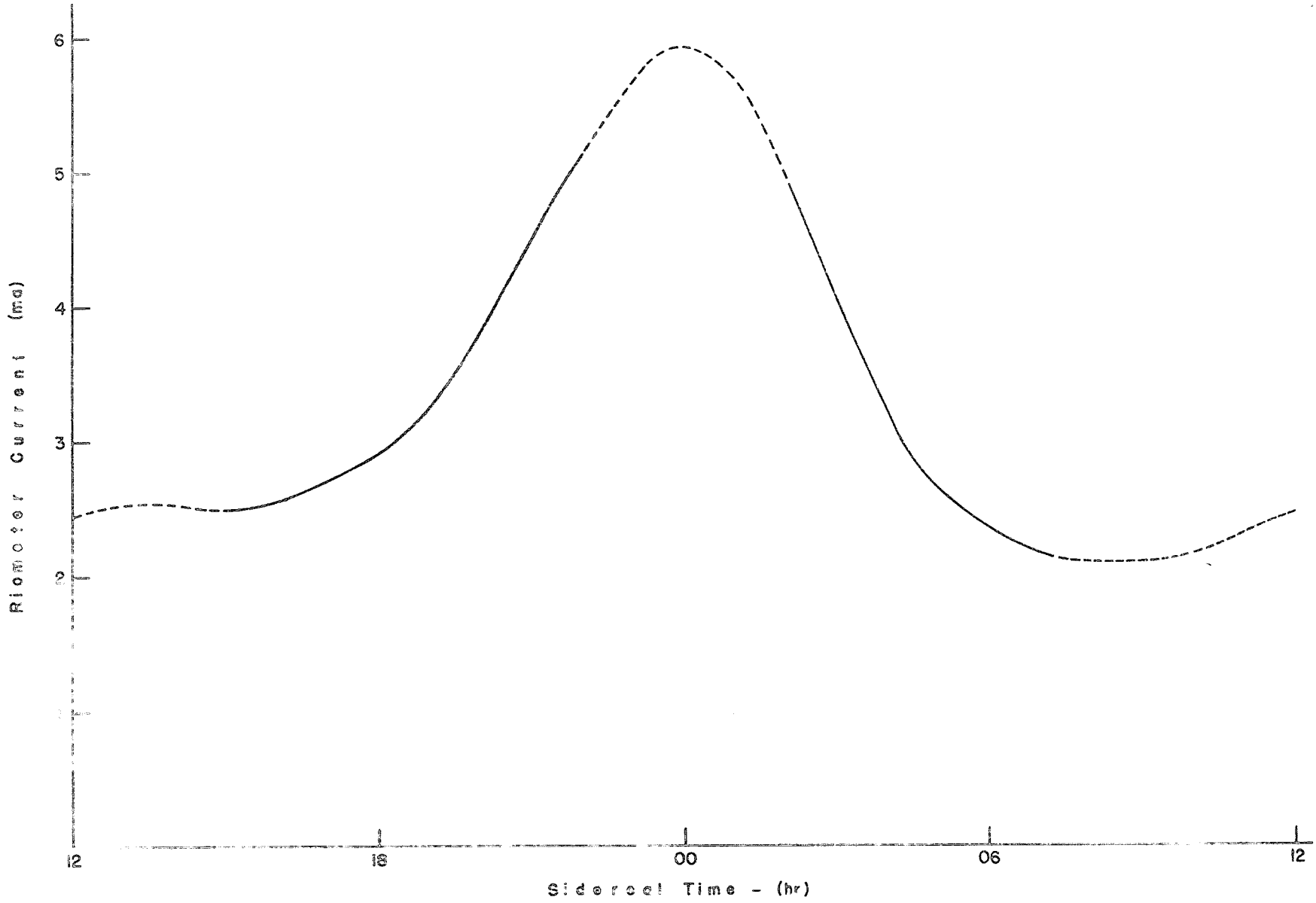

FIG: I - QUIET-DAY CURVE

SÃO JOSÉ DOS CAMPOS - SP (BRASIL)

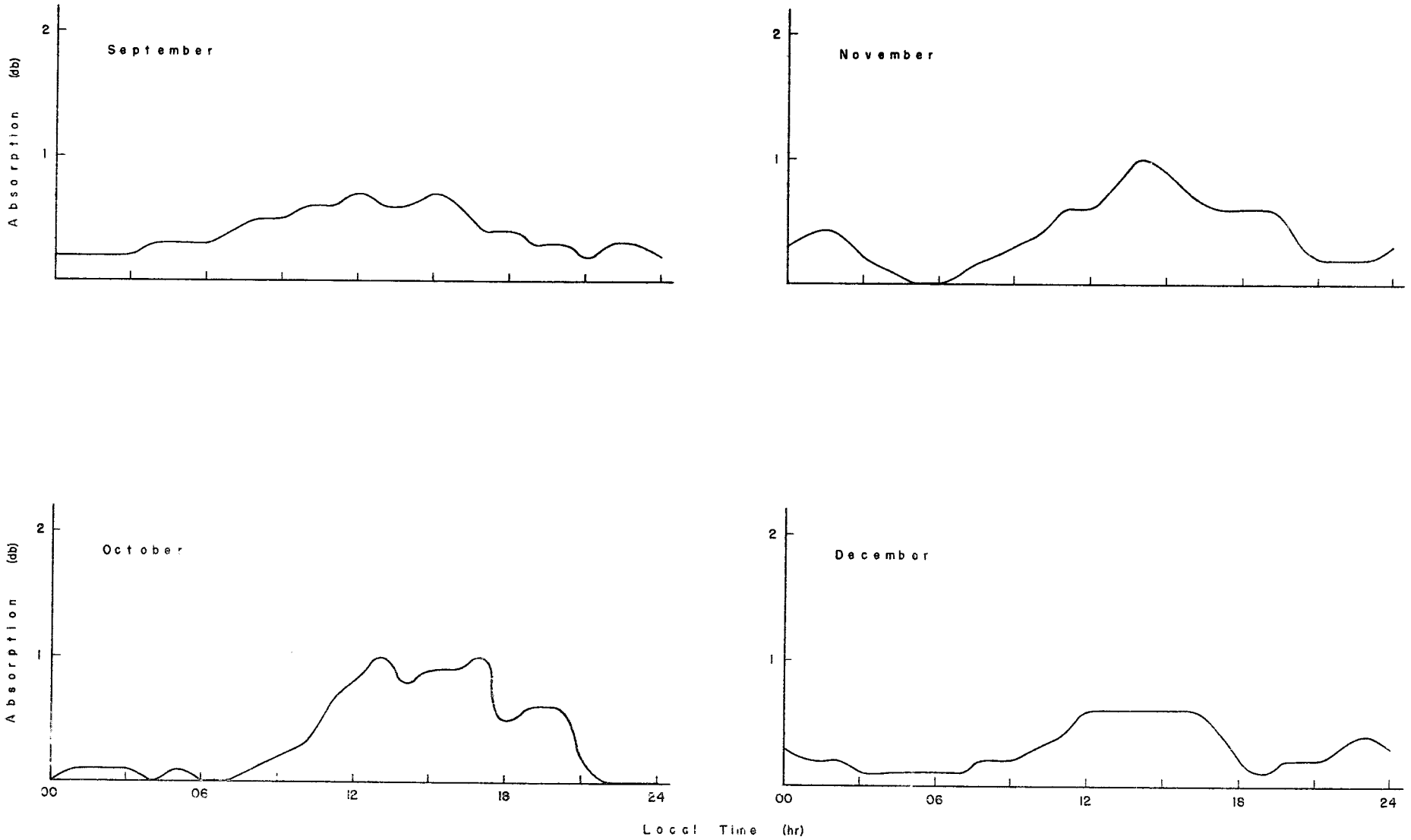

FIG: II MEDIAN MONTHLY ABSORPTION CURVES (September - December — 1963)