

METEOROLOGICAL SOUNDING ROCKET PROGRAM AT NATAL

Brazilian participation on EXAMETNET.
Status Report to the Executive Committee
Meeting at Ascochinga-September 1966

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Conselho Nacional de Pesquisas

Comissão Nacional de Atividades Espaciais - G.O.

Laboratório de Física Espacial

São José dos Campos

São Paulo - Brasil

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1 - I N T R O D U C T I O N

In a meeting in August 1965 in Wallops Station in Wallops Island, Virginia U.S.A. Brazil accepted the responsibility of making a series of meteorological rockets launchings fulfilling the proposed EXAMETNET program (Experimental Inter-American Meteorological Rocket Network). This program would consist primarily of 15 firings during 1966 of MASP (Instrumented or Chaff) and ARCAS (instrumented) rockets which selection would depend on the present availability.

The launching dates were chosen in accordance with the International Geophysical Calendar and following a plan suggested during the meeting.

Since a meteorological sounding rocket was being developed in Brazil it was also mentioned the possibility of increasing the frequency to a 30 rockets per year schedule during 1966.

The final decision in Brazil was to try to keep this 30 firings plan as far as possible during 1966. We have however encountered some difficulties with rocket procurement. The operational phase for the Brazilian meteorological rocket has not been reached yet as of the date of this report.

2 - PROGRAM SCHEDULE

Table (2.1) shows the complete 1966 schedule. Up to the date of preparation of this report 5 HASP (Chaff), 3 HASP (instrumented) and 8 ARCAS (instrumented) were launched from Barra da Lagoa Launching Camp, Natal, Brazil.

From these firings we obtained 10 successes, 3 partial successes and 2 failures.

Partial success should be understood as non-acquisition of one type of the experimental data or acquisition of all kind of data during only a small part of the total trajectory.

The schedule modifications are listed and briefly explained in table (2.2).

Due to difficulties with procurement as mentioned before we have been forced to change the program back into the initial 15 firings plan. This modification will begin on September 14th and must be followed until we import the 20 rockets on order (7 with chaff and 13 with instrumented payload).

Possibly by early November we will be following again the 30 rockets per year schedule.

Table (2.3) shows the Brazilian proposed schedule for 1967. It is intended to start the 1967 schedule on 18 January.

TABLE 2.1

MONTH	JAN	FEB	MAR	APR	MAY	JUN
WEEK	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					
Proposed date Firing date Rocket type Result	12 12 HD S	16 16 HD S	16	13	18	15
Proposed date Firing date Rocket type Result	12 12 HD S	16 16 HD S	16 16 HD S	13 13 HI P	18 18 HI S	15 15 A S
MONTH	JUL	AUG	SEPT	OCT	NOV	DEC
WEEK	28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52					
Proposed date Firing date Rocket type Result	13	17	14	12	16	14
Proposed date Firing date Rocket type Result	13 15 A S	27 03 07 A S	31 17 A P	14 28 12 26 02	16 30 14	

LEGEND :

A - ARCAS
 HI - HASP-INSTRUMENTED
 ND - HASP-CHAFF
 S - SUCCESS
 P - PARTIAL SUCCESS

COMMENT:

- JANUARY 12th and JULY 15 th firings have been done in replacement to 2 failures .
 - An Arcas launching at 14 September has not been included on this report.

TABLE 2.2
SCHEDULE MODIFICATIONS

proposed date	firing date	REMARKS
MAR 30 th	No firing	Omission caused by non-correspondence between calibration charts and payloads. This fact was communicated by telegram to Wallops Station that overcame the irregularity.
APR 27 th	MAY 2 nd	Transferred to support the April series of the Grenade Experiment.
JUL 27 th	JUL 13 th and JUL 15 th	Parachute failure in the first shot payload caused it to be unsuccessful. Second shot was delayed to 15 th due to technical problems in the ground instrumentation.
JUL 27 th	AUG 7	Transferred to support the July series of the Grenade Experiment. Due to successive delays of this experiment only one EXAMETNET firing was done.
AUG 3 rd		

1967 SCHEDULE

TABLE 2.3

MONTH	JAN	FEB	MAR	APR	MAY	JUN
WEEK	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					
Proposed date	18 25 01 08 15 22 01 08 15 22 29 05 12 19 26 03 10 17 24 31 07 14 21 28					
50 Hr Ings plan						

MONTH	JUL	AUG	SEPT	OCT	NOV	DEC
WEEK	27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52					
Proposed date	05 12 19 26 02 09 16 23 30 06 13 20 27 04 11 18 25 01 08 15 22 29 06 13					
50 Hr Ings plan						

COMMENT : 1967 firings will be done on Wednesdays.

3 - PERSONNEL

In accordance with the Memorandum of Understanding a small group of Brazilian engineers and technicians were sent to Wallops Station for a three months trainings course in radar operation and maintenance, vehicle preparation and launchings, test director, safety, ground instrumentation, payload and meteorological support.

After this training period the Brazilian group returned and started to train new personnel in order to increase the original group.

At present the following personnel is able to support the EXAMETNET program :

Moacyr Del Tedesco.....	Test Director - safety
Ivan Janvrot Miranda.....	Test Director - safety -Radar
Heitor Borges Jr.	Test Director - safety -V.P. & L.
Ulysses Belcufiné.....	Meteorology - safety
Carlos Girardi.....	Meteorology - safety
Júlio Cesar Nogueira.....	V.P. & L. -payload
Satoshi Yokota.....	Radar - ground instrumentation
Alfredo Stahlberg.....	Radar
Basílio Baranoff.....	Radar

Tutomu Kasse.....	V.P. & L. - Payload - ground instrumentation
Yoshihiro Tomita.....	Payload - ground instrument <u>a</u> tion
Eustásio de A. Ribeiro.....	V.P. & L.
José F. Lopes.....	V.P. & L.
José B. Leite.....	Meteorology
Walkir B. Souza.....	Meteorology
Virgílio V.F. Alves.....	Meteorology
Benedito R. dos Santos.....	Meteorology
Francisco F. Lima.....	Meteorology
João Kreissmann.....	Meteorology
José W. Gonçalves.....	Meteorology
Dilson H.C. Diniz.....	Meteorology
Antônio R.P. Monteiro.....	Meteorology

4 - GROUND INSTRUMENTATION

The ground instrumentation for meteorological rockets consists of :

- a - MPS - 19 Radar System
S-Band
- b - Ground Meteorological Detector (GMD-1 A)
Operation frequency - 1680 MHz
- c - Meteorological Data Receiving and Record
ing System
Operation frequency - 403 MHz
- d - Double Theodolite Warren- Knight model
WK-84

5 - DATA PACKAGE EXCHANGE

DATE	ADDRESSEE	ROCKET NUMBER
JAN 16	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6602/HASP 02 05 CNAE 6602
FEB 20	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6603/HASP 03 06 CNAE 6603
MAR 04	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6604/HASP 04 10 CNAE 6607
MAR 21	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6608/HASP 05 11 CNAE 6608
APR 19	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6609/HASP 06 12 CNAE 6609
MAY 25	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6610/HASP 07 13 CNAE 6610
MAY 29	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6611/HASP 08 14 CNAE 6611
JUN 06 JUN 08	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6612/AR - 01 15 CNAE 6612

5 - DATA PACKAGE EXCHANGE

DATE	ADDRESSEE	ROCKET NUMBER
JUN 21 JUN 27	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6613/AR - 02 16 CNAE 6613
JUL 03	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6614/AR - 03 17 CNAE 6614
JUL 18 JUL 20	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6615/AR - 04 18 CNAE 6615
AUG 12 AUG 26	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6618/AR - 06 21 CNAE 6618
AUG 23 AUG 29	Wallops Station (U.S.A.) C.N.I.E. (Argentina)	BI 6619/AR -07 22 CNAE 6619

6 - METEOROLOGICAL DATA

The following data were obtained at Barreira do Inferno, Natal, Brazil.

Latitude $05^{\circ} 55' S$

Longitude $35^{\circ} 10' W$

JAN 12	12
FEB 16	15
MAR 02	18
MAR 16	21
APR 13	24
MAY 02	27
MAY 18	31
JUN 01	35
JUN 15	38
JUN 29	41
JUL 15	44
AUG 07	47
AUG 17	50

ROCKET DATA

TABLE 6.1a

Date : JAN, 12, 1966

Time : 1500Z

Rocket Type : HASP

Payload : S Band Chaff

A l t . (M S L)	Component Winds (ms ⁻¹)			
km	N	S	E	W
58	18			40
56	20			29
54	13		02	
52	11		20	
50		04	30	
48		01	40	
46		02	35	
44	02		47	
42		12	41	
40		00	30	
M I S D A B E T W E E N 32 TO 40 KM D I S P E R S I O N				
32		06	15	
30		02	12	
28	02		13	
26	07		21	
24		08	27	

R A W I N D A T A

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TABLE 6.1b

Date : JAN, 12, 1966

Time : 1130Z

A l t . (M S L)	Components Winds (m s ⁻¹)			
km	N	S	E	W
26.9	03		20	
26	00		21	
24		06	32	
22		03	28	
20		00	22	
18		03	10	
16		02		13
14		11		17
12		09		25
10		05		25
08	02			14
06	07			01
04	03			00
02		05	10	
SFC		00	05	

METEOROLOGICAL ROCKET SOUNDING DATA

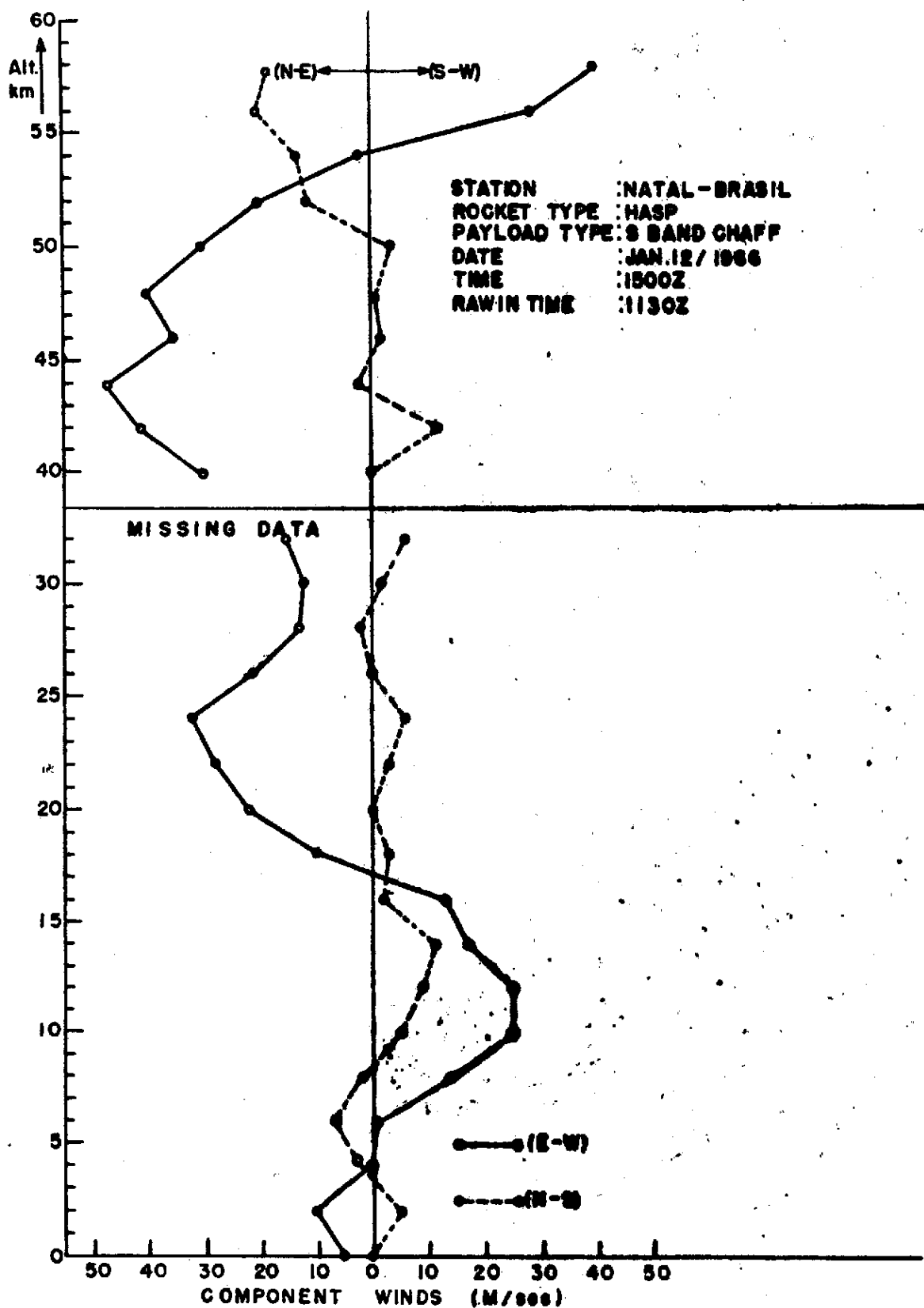


Figure 6.1

ROCKET DATA

TABLE 6.2a

Date : FEB, 16, 1966

Time : 1405Z

Rocket type : HASP

Payload : S Band Chaff

A l t . (M S L)	Component Winds (ms ⁻¹)			
km	N	S	E	W
58	18			13
56	06			00
54	05		05	
52	22		13	
50	20		08	
48	18		12	
46	00		07	
44	07		25	
M I S D A B E T W E E N 38 TO 44 KM D I S P E R S I O N				
38		07	38	
36		07	28	
34		13	14	
32	04		06	
30	04		09	
28	04		12	
26	03		06	
24		04	11	
22	04		28	
20	00		25	
18		01	05	

R A W I N D A T A

TABLE 6.2b

Date : FEB, 10, 1966

Time : 1230Z

A l t . (M S L)	Components Winds ms^{-1}			
km	N	S	E	W
25		08	10	
24		08	05	
22	03		31	
20		03	06	
18		07	03	
16	01			02
14	10			11
12	03			09
10	11			04
08	02			05
06		03		01
04		04	05	
02	01		03	
SFC	00		03	

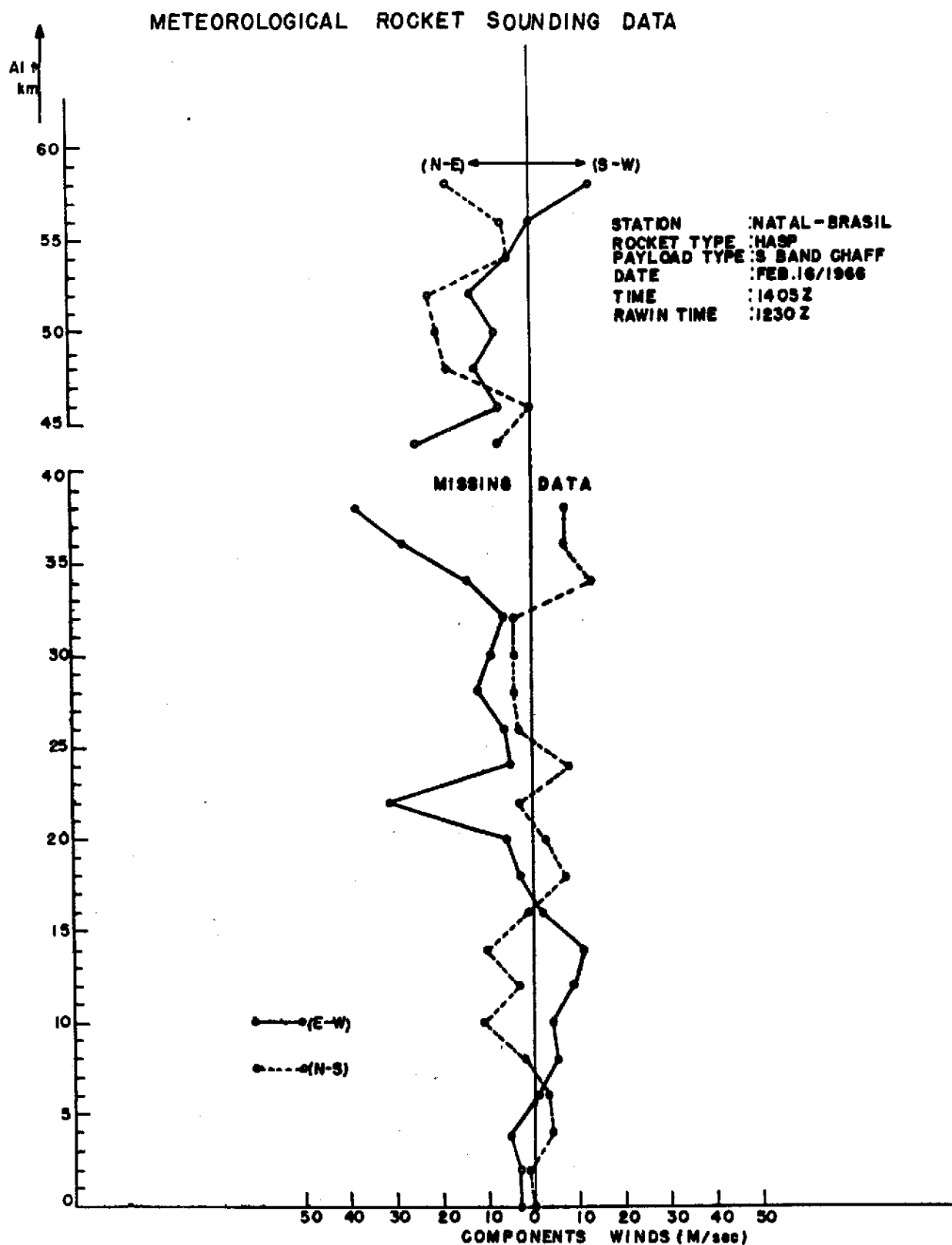


Figure 6.2

ROCKET DATA
TABLE 6.3a

Date : MAR, 02, 1966

Time : 1548Z

Rocket type : HASP

Payload : S Band Chaff

A l t . (M S L)	Component Winds (ms ⁻¹)			
km	N	S	E	W
60		23		32
58		02		27
56	02			38
54	01			40
52	03			20
50	03			12
48	07			11
46	20			02
44	09		12	
42	01		48	
40		01	46	
39		02	55	
M I S D A B E T W E E N 20 TO 39 KM D I S P E R S I O N				
20		04	20	
18	03			02

R A W I N D A T A

TABLE 6.3b

Date : MAR, 02, 1966

Time : 1351Z

A l t . (M S L)	Component Winds (ms ⁻¹)			
	N	S	E	W
km				
20		10	20	
18	03		01	
16		03		08
14		13		22
12		15		21
10		05		12
08		03		02
06	03		03	
04	02		04	
02	01		05	
SFC		01	04	

METEOROLOGICAL ROCKET SOUNDING DATA

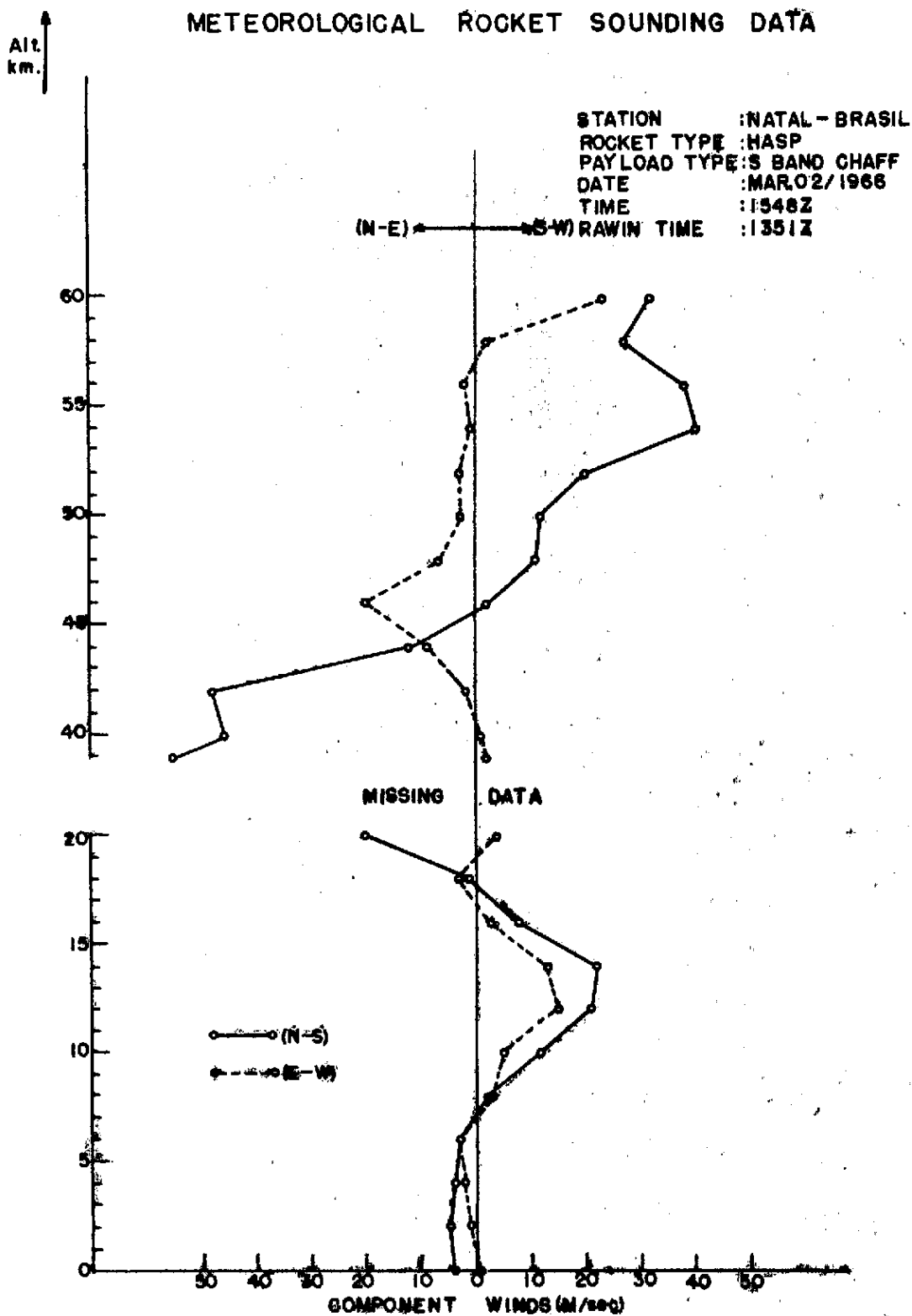


Figure 6.3

R O C K E T D A T A

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TABLE 6.4a

Date : MAR, 16, 1966

Time : 1500Z

Rocket type : HASP

Payload : S Band Chaff

A l t. (M S L)	Component Winds (ms ⁻¹)			
km	N	S	E	W
62		05		62
60	12			41
58	04			20
56	08			28
54	07			24
52		08		31
50		04		33
48	05			25
46	10			26
44	05			03
42		07	12	
40	01		15	
38		03	27	
36		05	16	
34		03	08	
32	01		09	
30	08		08	
28	09		01	
26	03		05	
24		02	13	
22		03	12	
20	02		16	
18		03	06	

R A W I N D A T A

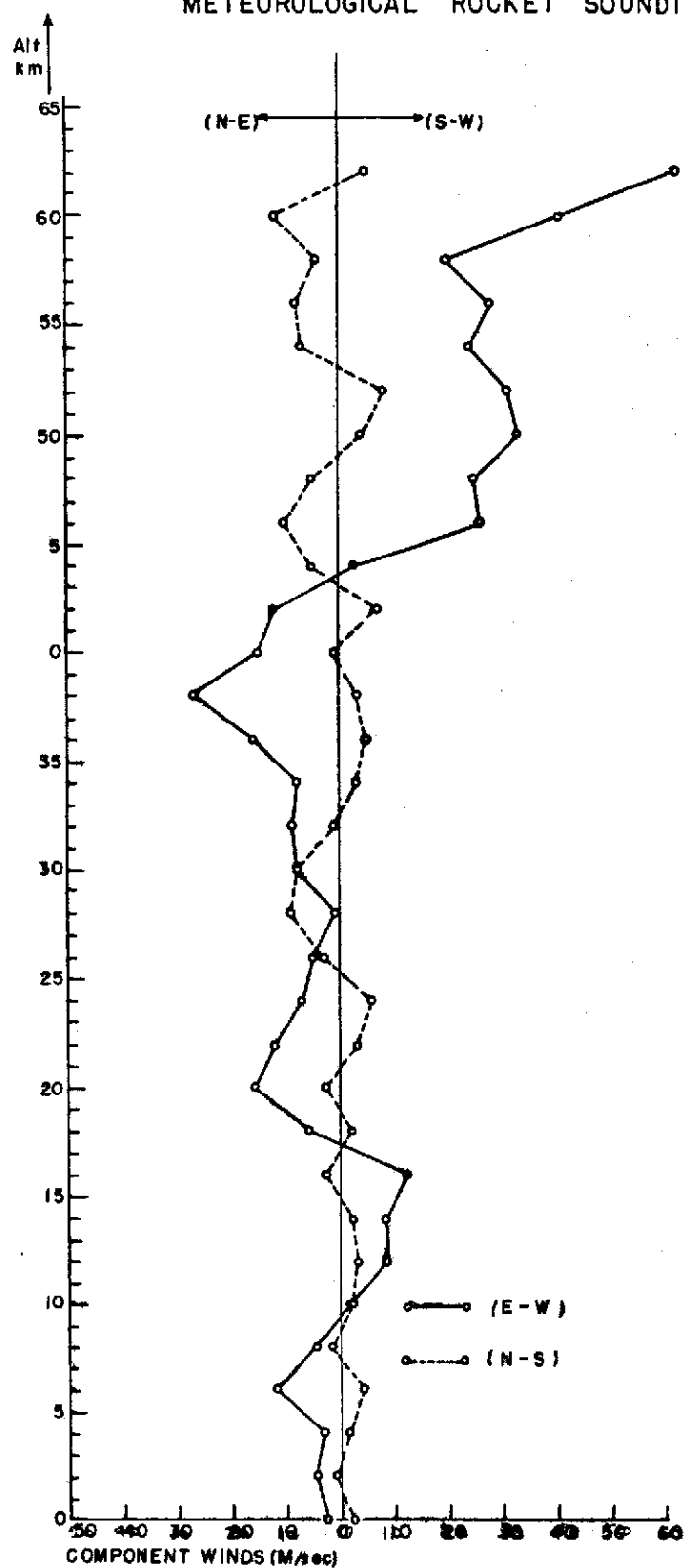
TABLE 6.4b

Date : MAR, 16, 1966

Time : 1233Z

A L T . (M S L)	Component Winds (ms ⁻¹)			
	N	S	E	W
km				
25.9	02		06	
24		06	07	
22		03	12	
20	03		16	
18		02	06	
16	03			12
14		02		08
12		03		08
10		02		01
08	02		05	
06		04	12	
04		01	03	
02	01		05	
SFC		02	03	

METEOROLOGICAL ROCKET SOUNDING DATA



STATION : NATAL - BRASIL
ROCKET TYPE : HASP
PAYLOAD TYPE : S BAND CHAFF
DATE : MAR 16/1966
TIME : 1500Z
RAWIN TIME : 1233Z

Figure 6.4

R A W I N D A T A

TABLE 6.5b

Date : APR, 13, 1966

Time : 1240Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
27.2				00			15
26				12			16
24				03			11
22				02		22	
20				03		16	
18					05	04	
16				02		08	
14					01		05
12					00	02	
10					03	04	
08					03		03
06				01			05
04				03		02	
02				01		01	
SFC				00		00	

METEOROLOGICAL ROCKET SOUNDING DATA

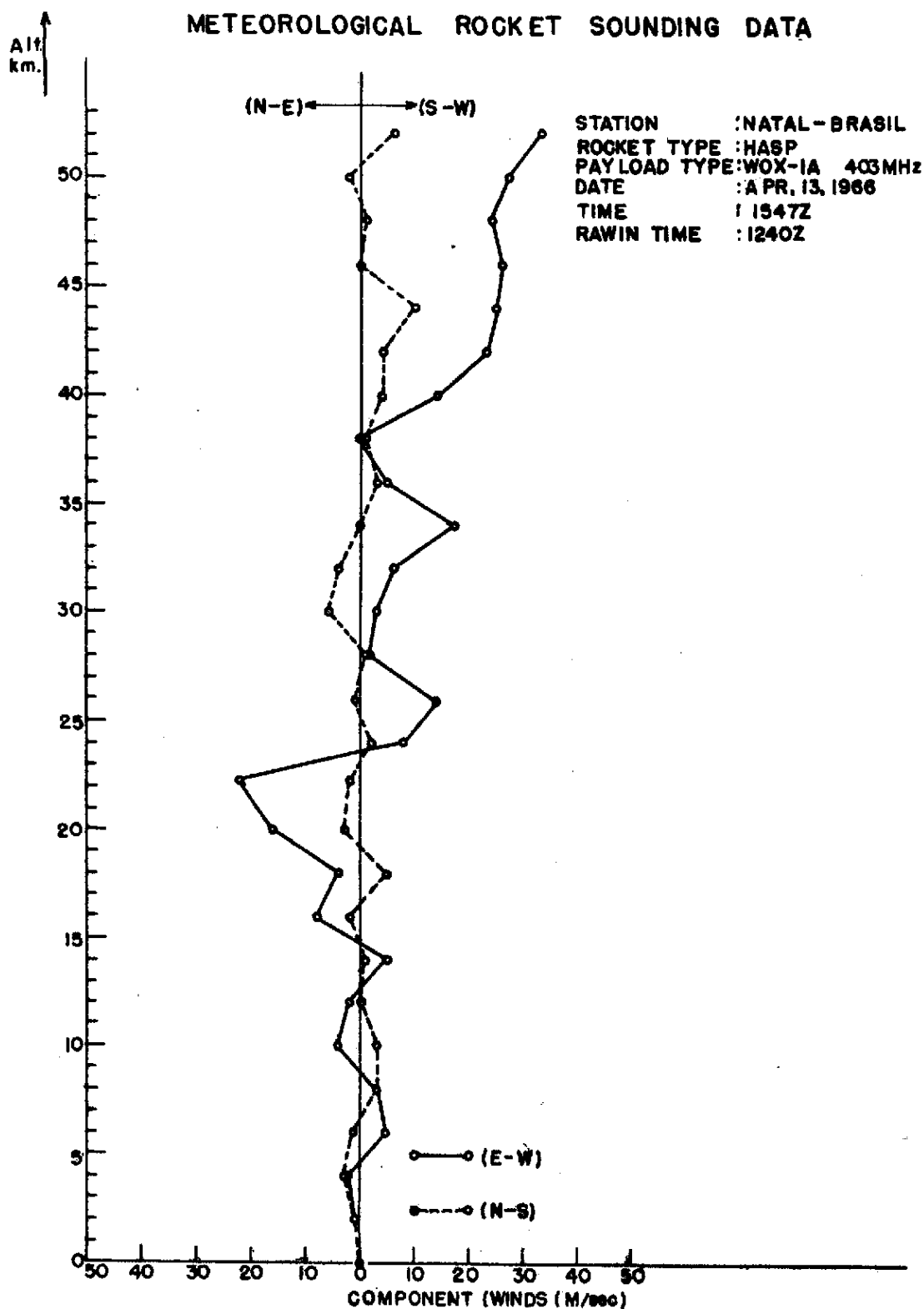


Figure 6.3

ROCKET DATA

TABLE 6.6a

Date : MAY, 02, 1966

Time : 0155Z

Rocket type : HASP

Payload : 403 MHz

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
52.00				02			56
50.00				09			29
48.00				03			32
46.00				01			33
44.00					04		29
43.74	-15.2	1.82	2.466		04		29
42.92	-16.5	2.03	2.759		03		29
41.91	-16.5	2.32	3.150		01		29
41.33	-16.0	2.50	3.392		01		27
40.78	-19.2	2.69	3.693		01		26
39.81	-18.1	3.06	4.180		01		23
39.29	-16.8	3.27	4.453		01		19
38.56	-18.3	3.61	4.932		00		14
38.10	-19.2	3.83	5.260		00		11
37.61	-20.1	4.09	5.634		01		06
37.25	-26.4	4.29	6.065		02		03
37.00	-25.9	4.44	6.263		03		01
35.72	-33.4	5.30	7.711		05	08	
35.48	-33.5	5.48	7.979		04	07	
35.20	-36.2	5.71	8.396		03	06	
33.80	-37.8	6.97	10.324		01	03	
32.98	-36.7	7.84	11.555	01		01	
32.61	-35.5	8.26	12.118	02		00	
31.06	-37.8	10.30	15.266	01			06
30.02	-42.0	11.98	18.069	00			10
29.35	-40.8	13.21	19.819	01			09
28.99	-41.1	13.92	20.912	02			09
28.74	-42.5	14.44	21.821	02			09
27.68	-43.1	16.86	25.559	03			09
27.01	-44.9	18.62	28.437	02			10
26.37	-44.8	20.47	31.250	01			11
25.82	-48.3	22.22	34.452	01			11
24.54	-47.8	26.93	41.665	02			09
24.32	-50.0	27.84	43.496	02			09
23.99	-50.8	29.27	45.897	02			08
23.84	-53.1	29.95	47.454	02			08

R O C K E T D A T A

Cont.

TABLE 6.6a

Date : MAY, 02, 1966

Time : 0155Z

Rocket type : HASP

Payload : 403 MHz

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
23.53	-54.6	31.42	50.121	02			06
23.20	-57.8	33.08	53.554	02			05
22.40	-57.2	37.50	60.551	01			03
21.98	-56.3	40.05	64.396	01			01
21.95	-58.1	40.24	65.241	01			00
21.46	-57.4	43.46	70.237	00		05	
21.28	-58.3	44.71	72.557	00		06	
21.09	-63.3	46.09	76.573		01	08	
20.67	-66.8	49.35	83.384		02	13	
20.48	-64.5	50.90	85.062		02	15	
20.18	-67.3	53.46	90.554		03	19	
19.66	-68.9	58.26	99.454		02	20	
19.60	-72.2	58.84	102.108		02	19	

R A O B D A T A

TABLE 6.6b

Date : MAY, 02, 1966

Time : 0332Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
17	092	-80.4	-	04		01	
16	110	-74.6	-	11			15
14	154	-65.9	-	06			18
12	211	-50.7	-	05			08
10	284	-35.4	40	02		03	
08	375	-18.0	27	04		06	
06	489	- 5.5	29		01	10	
04	626	7.2	30		01	07	
02	798	11.8	87		02	07	
SFC	1006	24.2	77		04	00	

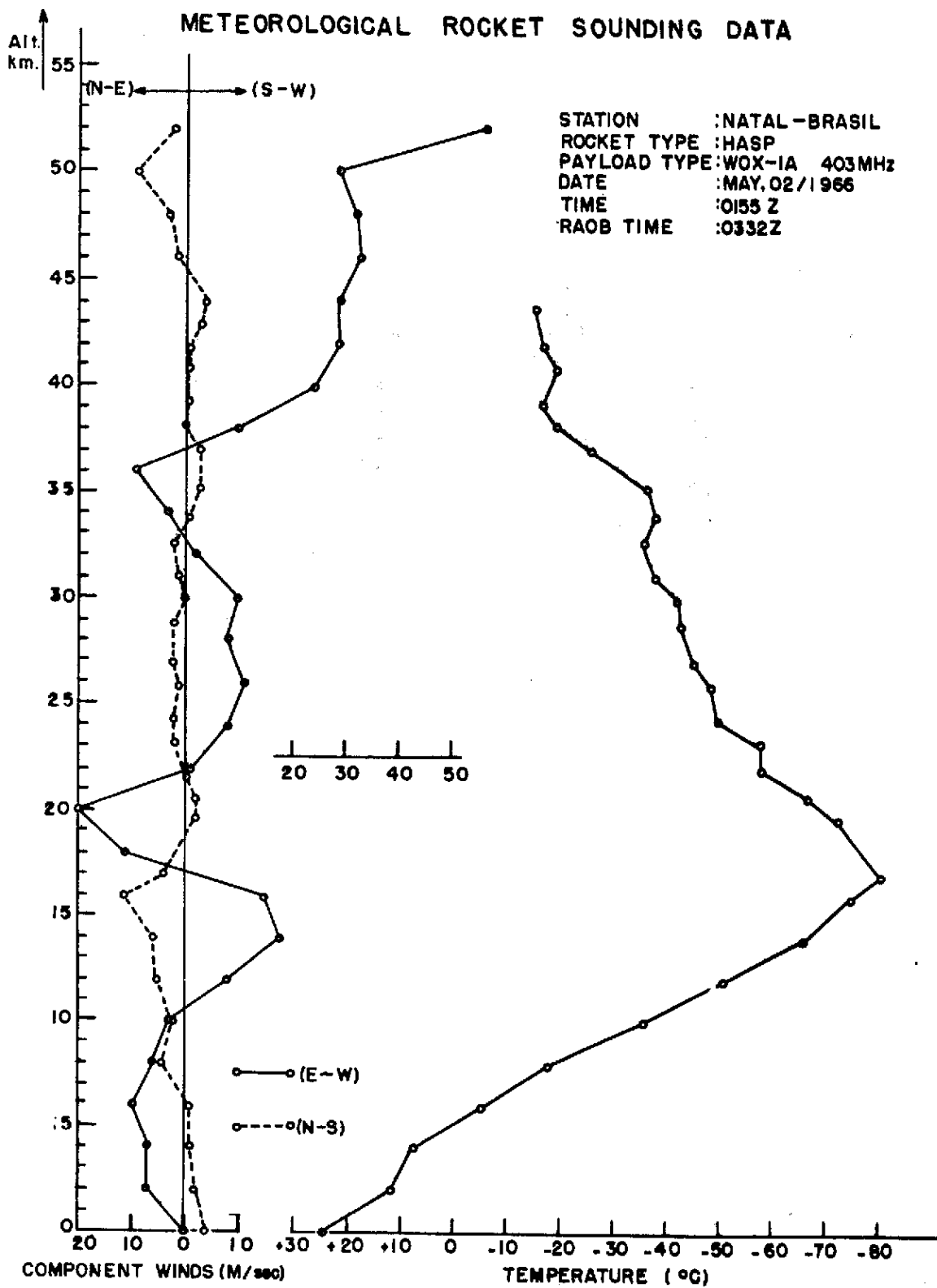


Figure 6.6

ROCKET DATA

TABLE 6.7a

Date : MAY, 18, 1966

Time : 1550Z

Rocket type : HASP

Payload : 403 MHz

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
52.38	11.2	0.68	0.909				
50.91	6.7	0.82	1.077	06			15
50.51	6.9	0.87	1.133	05			13
47.66	3.7	1.24	1.600	13			19
45.66	3.7	1.59	2.053	01			33
44.99	5.1	1.73	2.244		02		36
43.14	- 3.5	2.17	2.811	01			43
42.22	- 3.3	2.44	3.151	08			47
40.98	- 5.0	2.85	3.703	09			49
39.72	- 9.8	3.34	4.423	06			49
38.96	- 10.9	3.68	4.895	02			44
38.39	- 18.0	3.97	5.419		02		40
37.80	- 17.6	4.29	5.849		05		36
37.39	- 19.9	4.53	6.231		07		32
37.19	- 19.0	4.65	6.376		08		30
36.85	- 20.4	4.86	6.708		09		27
36.49	- 21.0	5.10	7.055		11		23
35.86	- 23.2	5.55	7.745		12		18
35.19	- 24.8	6.08	8.535		07		20
34.68	- 26.8	6.52	9.224		03		22
34.13	- 26.2	7.03	9.920	02			24
33.67	- 28.9	7.48	10.684	04			24
33.36	- 27.2	7.81	11.072	05			23
32.62	- 27.5	8.65	12.271	09			23
32.08	- 31.6	9.32	13.449	11			22
31.00	- 35.4	10.85	15.909	08			26
29.99	- 36.4	12.53	18.446	06			30
29.35	- 34.6	13.72	20.050	04			30
28.43	- 37.3	15.64	23.119	01			30
27.13	- 36.1	18.83	27.699	01			30
26.65	- 35.6	20.17	29.597	02			30
25.72	- 43.9	23.07	35.092	03			30
25.50	- 43.9	23.84	36.250	03			31
25.14	- 47.8	25.15	38.907	03			31
24.70	- 48.6	26.87	41.717	03			31
24.05	- 47.2	29.62	45.711	03			32
23.66	- 50.5	31.42	49.200	03			27

R O C K E T D A T A

TABLE 6.7 a

Date . MAY, 18, 1966

Time : 1550Z

Rocket type : HASP

Payload : 403 MHz

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
22.90	- 47.2	35.24	54.372	06			13
22.13	- 52.6	39.60	62.604	07			01
21.91	- 52.4	40.96	64.695	08		03	
21.65	- 55.2	42.64	68.210	07		05	
21.32	- 53.8	44.87	71.329	07		09	
21.21	- 58.2	45.65	74.050	06		09	
20.68	- 62.7	49.67	82.296	06		15	
20.60	- 66.3	50.32	84.824	05		16	
19.07	- 64.1	64.57	107.691	04		21	
17.83	- 73.2	79.30	138.291				

R A O B D A T A

TABLE 6.7b

Date : MAY, 18, 1966

Time : 1300Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
32.8	008	- 33.2	-		02		13
32	009	- 36.8	-	01			11
30	012	- 41.0	-	06			18
28	016	- 42.5	-		01		15
26	022	- 45.0	-	02			17
24	029	- 49.4	-		02		14
22	040	- 54.5	-	05		07	
20	055	- 66.8	-		02	07	
18	077	- 72.7	-		00	08	
16	110	- 78.9	-	01			02
14	154	- 66.8	-		00		12
12	211	- 51.9	-		05		05
10	284	- 34.1	-	03			02
08	375	- 19.0	-		03	03	
06	487	- 9.0	-	02		01	
04	593	0.0	-	01		01	
02	798	11.6	41		03		01
SFC	1006	29.3	68		06	02	

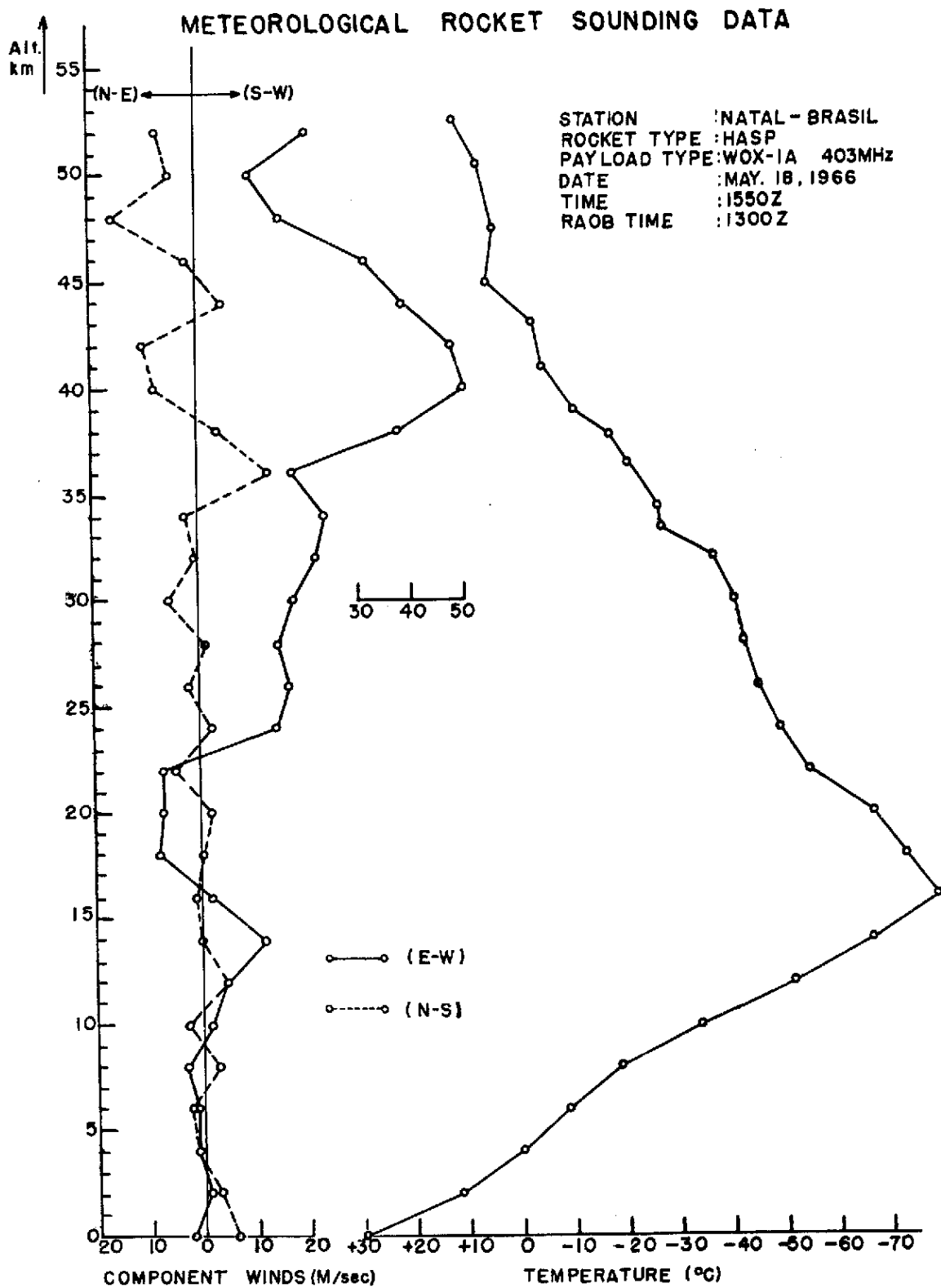


Figure 6.7

ROCKET DATA

TABLE 6.8a

Date : JUN, 01, 1966

Time : 1631Z

Rocket type : ARCAS

Payload : ARCASONDE

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
52.85	+ 4.6	0.66	0.823				
50.60	- 1.9	0.86	1.109	21		04	
46.85	- 0.2	1.37	1.751	02			14
45.26	+ 3.8	1.66	2.095	08			11
42.89	- 8.5	2.23	2.943	03			11
41.24	-11.6	2.76	3.677		02		10
39.87	-11.2	3.29	4.379		06		11
38.50	-18.4	3.93	5.383		04		07
37.06	-18.4	4.76	6.514		04		04
36.64	-19.5	5.03	6.914		04		04
36.18	-26.2	5.35	7.556		04		03
35.51	-27.6	5.87	8.329		01		04
35.27	-30.7	6.06	8.720	01			04
34.14	-31.7	7.10	10.250	09			06
33.83	-30.0	7.41	10.627	09			07
32.46	-29.5	8.96	12.823		01		14
31.85	-32.9	9.76	14.159		04		16
31.55	-29.9	10.17	14.583		04		16
31.09	-29.8	10.84	15.537		03		17
30.94	-27.7	11.07	15.727		02		17
30.48	-31.2	11.80	17.005		02		17
MISDA							
25.97	-43.2	22.50	34.121	00			19
24.63	-47.1	27.45	42.342	00			20
23.77	-47.4	31.23	48.228	00			19
22.86	-51.4	35.83	56.344	00			13
22.46	-56.9	38.12	61.463	00			10
22.04	-55.6	40.70	65.236	00			07
21.34	-63.4	45.48	75.603	01			03
21.03	-60.9	47.80	78.524	01			01

R A O B D A T A

TABLE 6.8b

Date : JUN, 01, 1966

Time : 1310Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
25.7	019	- 53.3	-		04		31
24	025	- 59.0	-		01		20
22	034	- 66.8	-		02		00
20	048	- 75.0	-		01	11	
18	069	- 89.8	-		00	08	
16	099	- 93.0	-	09			01
14	144	- 81.5	-	10			09
12	202	- 63.0	-	10			01
10	276	- 43.0	-	07		01	
08	367	- 28.4	-	03		04	
06	482	- 14.2	78	06		03	
04	622	- 0.3	88	01		04	
02	797	-	-		04	08	
SFC	1007	26.0	67		04	02	

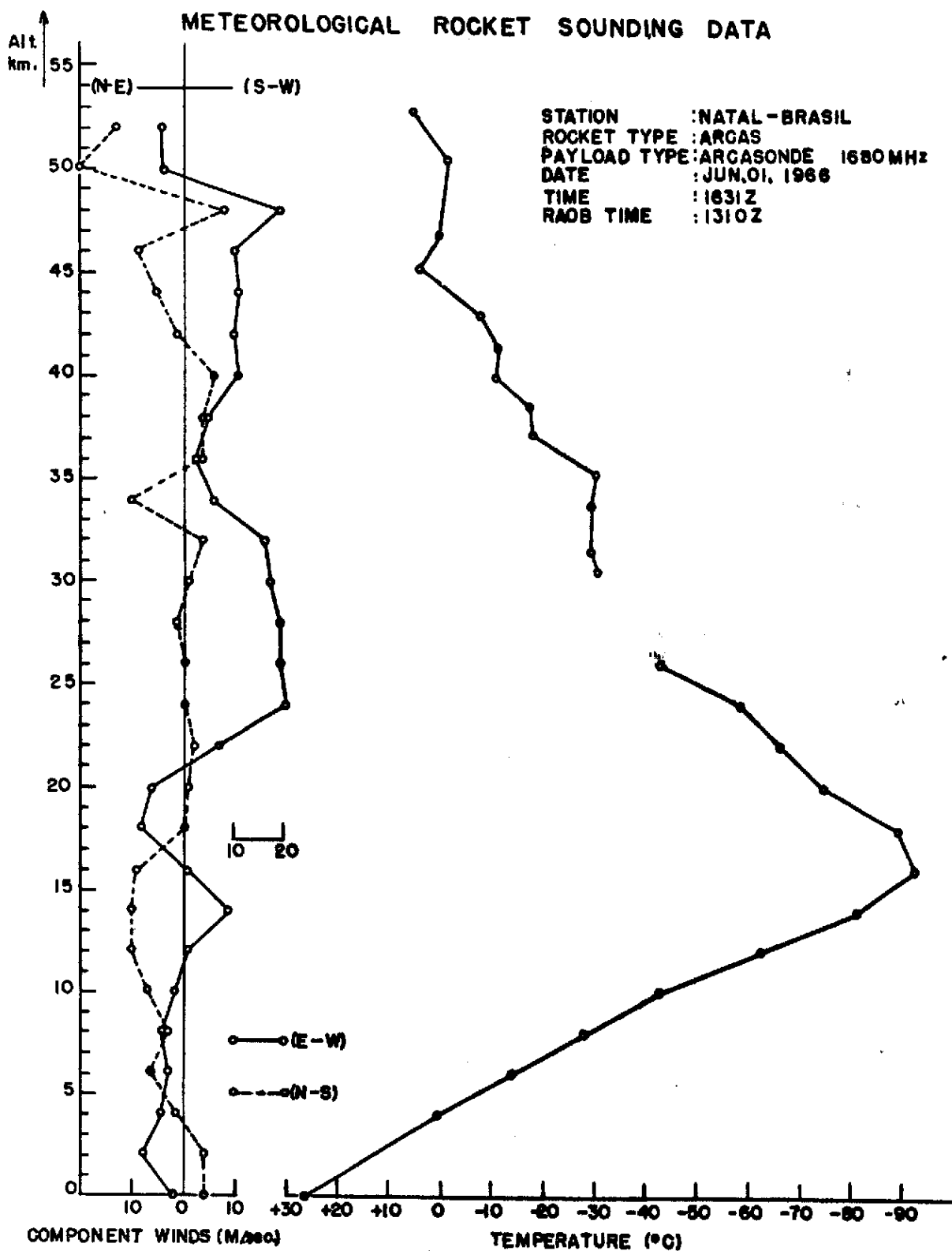


Figure 6.8

ROCKET DATA

TABLE 6.9a

Date : JUN, 15, 1966

Time : 1532Z

Rocket type : ARCAS

Payload : ARCASONDE

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
54.00				02			24
52.00				21			04
50.00				13			18
48.00				15			05
46.00				05		04	
44.00					04	00	
42.00				08			06
41.39	- 9.7	2.66	3.519	05			05
39.84	-15.8	3.25	4.402		03		01
39.47	-17.4	3.41	4.650		02		00
38.71	-21.8	3.77	5.233		01	03	
38.10	-19.7	4.09	5.630	01		06	
37.64	-20.0	4.35	5.993	01		06	
36.88	-25.0	4.82	6.771	01		07	
35.20	-22.2	6.05	8.401	03		02	
34.50	-29.4	6.70	9.580	06			01
32.95	-28.2	8.24	11.726	05			02
32.77	-30.7	8.45	12.146	05			02
32.37	-31.7	8.93	12.896	03			02
31.70	-31.7	9.81	14.162	02			02
30.94	-39.4	10.93	16.297	01			01
30.33	-34.9	11.92	17.447	01			01
29.57	-34.2	13.28	19.372	00			02
28.25	-40.7	16.04	24.061	00			02
24.60	-48.8	27.53	42.785	01			12
22.71	-50.2	36.64	57.805	01		01	
22.37	-53.0	38.60	61.130	01		05	
21.73	-51.2	42.57	66.879	00		10	
20.94	-53.2	48.05	76.175	00		10	
20.63	-6.06	50.44	82.593	00		10	
20.27	-62.2	53.43	88.315		01	10	
19.20	-64.1	63.50	106.392		01	11	

R A O B D A T A

TABLE 6.9b

Date : JUN, 15, 1966

Time : 1241Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
27.5	-	-	-		04		06
26	-	-	-	04			10
24	-	-	-	00			12
22	-	-	-	04			06
20	056	-63.3	-	00		08	
18	078	-77.0	-	04		11	
16	111	-75.0	-		01		08
14	155	-63.8	-		02		12
12	213	-50.8	-		05	03	
10	286	-34.5	-		03	08	
08	353	-23.3	-		06	13	
06	491	-	-	02		09	
04	630	4.2	-	02		04	
02	802	12.9	82		10	07	
SFC	1006	27.0	83		03	04	

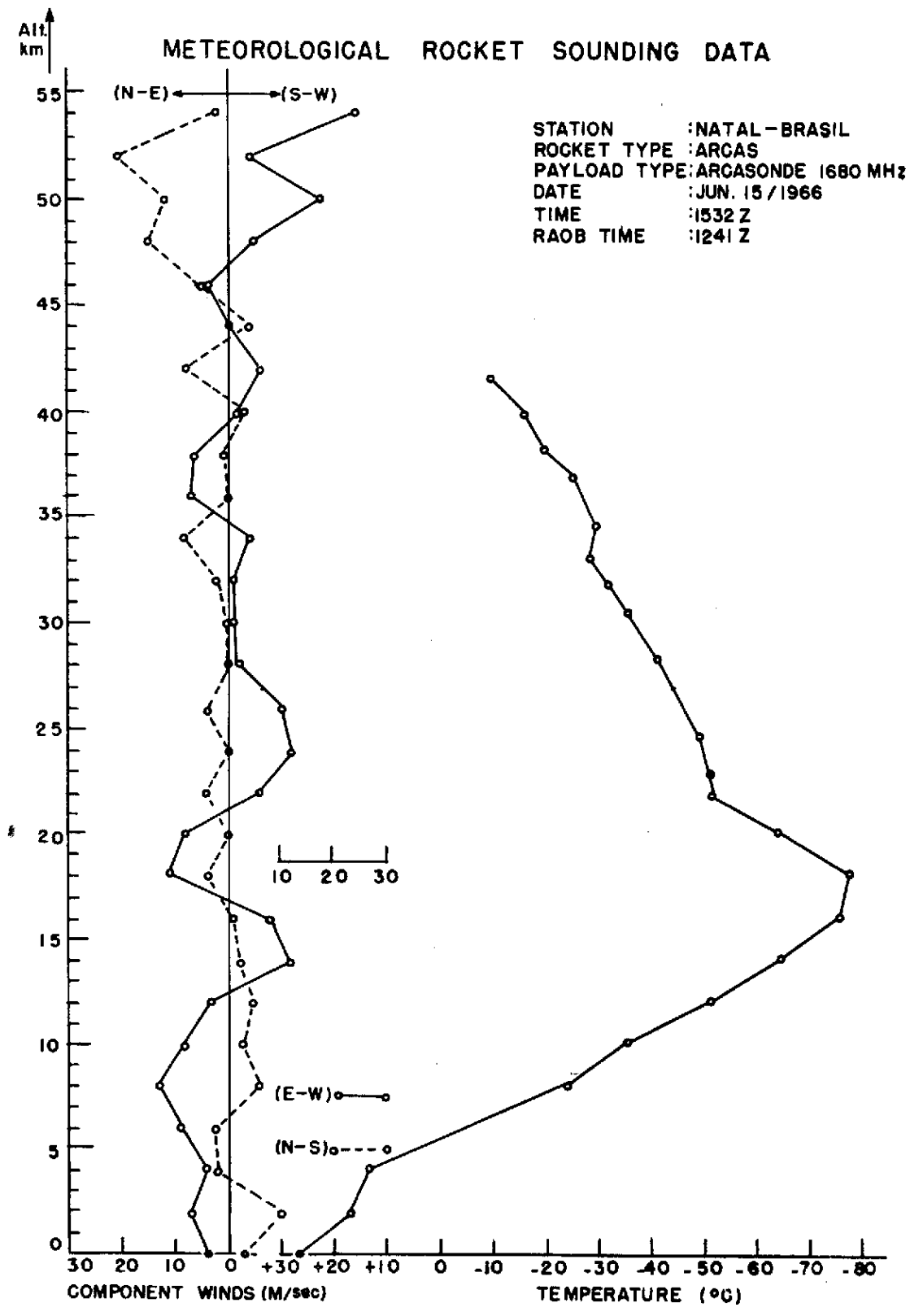


Figure 6.9

ROCKET DATA

- 41 -

TABLE 6.10a

Date : JUN, 29, 1966

Time : 1619Z

Rocket type : ARCA3

Payload : ARCASONDE

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
43.68	-4.3	2.06	2.670				
41.30	-4.1	2.77	3.593				
40.69	-8.7	2.99	3.948				
40.08	-13.0	3.24	4.340	04			04
39.01	-15.9	3.72	5.045	02			06
37.31	-17.4	4.65	6.344	02			07
35.72	-14.9	5.73	7.739	04			01
34.44	-19.0	6.78	9.306		01	02	
33.47	-26.7	7.73	10.937		03	01	
32.49	-29.9	8.85	12.683		04		02
31.70	-27.8	9.87	14.024		05		04
31.46	-31.2	10.20	14.702		05		05
30.57	-34.8	11.56	16.914		04		05
29.26	-37.0	13.93	20.571		03		07
28.83	-36.0	14.82	21.781		02		08
28.50	-41.3	15.54	23.364		02		08
27.52	-42.2	17.93	27.064		00		10
26.97	-45.8	19.44	29.817	01			11
25.51	-45.1	24.15	36.921	01			15
24.26	-51.6	29.15	45.848		01		18
23.32	-50.3	33.63	52.617		01		15
22.68	-55.9	37.11	59.559		00		12
21.61	-55.8	43.84	70.332		01		07
20.42	-55.8	52.77	84.661		02		02
19.81	-58.2	58.07	94.197		02		00
19.02	-63.5	65.88	109.560		02	01	

R A O B D A T A

TABLE 6.10b

Date : JUN, 29, 1966

Time : 1818Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
33	008	-26.3	-		02	01	
32	009	-32.2	-		09		01
30	012	-44.8	-		04		08
28	016	-43.1	-	03			06
26	022	-46.3	-	03			12
24	030	-50.4	-	02			19
22	041	-57.4	-		04		14
20	056	-59.6	-	03			06
18	078	-70.9	-	01			02
16	111	-74.9	-	01			12
14	154	-65.6	-	06			08
12	213	-50.8	-	12			07
10	286	-34.3	-		03		03
08	377	-18.1	-		10	02	
06	490	- 6.5	-		04	02	
04	630	5.7	-		00	05	
02	801	14.5	78		04	07	
SFC	1005	27.8	75		05	04	

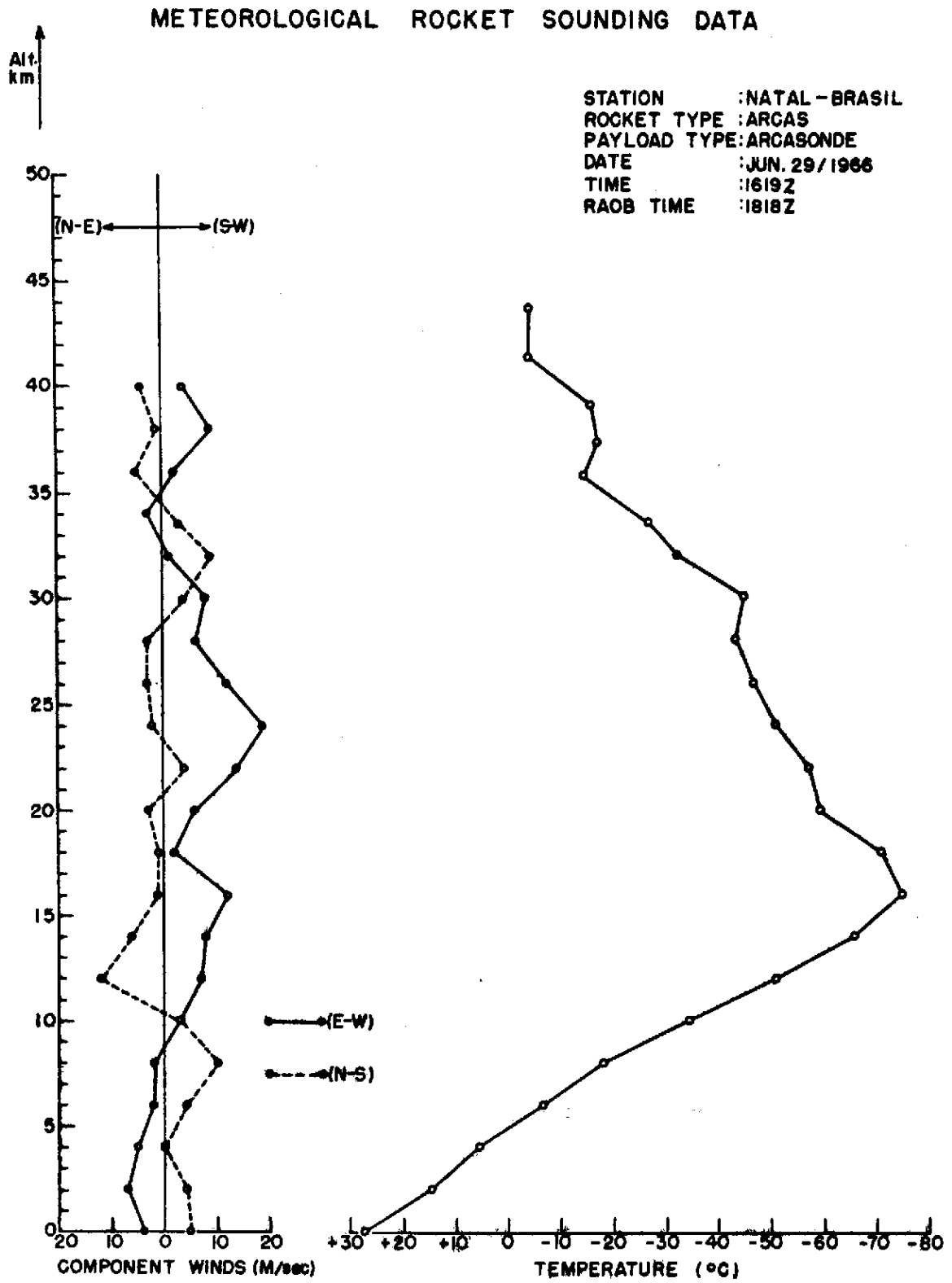


Figure 6.10

ROCKET DATA

TABLE 6.11a

Date : JUL, 15, 1966

Time : 1605Z

Rocket type : ARCAS

Payload : ARCASONDE

Alt. (MSL)	Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W
60.96	-26.1	0.21	0.294				
59.13	-18.1	0.27	0.364				
53.89	- 5.5	0.52	0.678				
49.99	+ 0.1	0.84	1.073	05		49	
48.68	- 5.5	0.99	1.293		09	35	
45.14	- 4.4	1.55	2.005	02		19	
42.49	- 8.6	2.16	2.845	00		19	
41.42	-21.9	2.48	3.445	01		18	
39.41	-18.4	3.24	4.439	02		17	
38.16	-18.4	3.83	5.236	01		24	
37.40	-23.0	4.23	5.902	06		25	
35.42	-29.6	5.55	7.943	15		29	
34.81	-30.1	6.04	8.662	12		32	
33.89	-36.2	6.87	10.111	06		36	
32.67	-38.4	8.18	12.151	02		26	
32.15	-42.0	8.82	13.306	00		22	
31.64	-40.9	9.50	14.265		02	20	
30.97	-44.3	10.48	15.969		03	17	
30.48	-42.3	11.26	17.012		04	15	
29.81	-44.3	12.43	18.936		05	12	
29.53	-41.6	12.95	19.500		05	11	
28.95	-45.6	14.10	21.612		05	08	
28.53	-43.8	15.01	22.816		05	05	
27.52	-48.6	17.44	27.086		03	01	
26.64	-47.7	19.91	30.791	01			01
24.53	-52.6	27.42	43.344	01			09
23.62	-53.1	31.53	49.959	00			10
23.16	-55.6	33.86	54.261	01			10
21.82	-54.6	41.69	66.503	02			08
20.73	-59.6	49.45	80.743	01			05
19.84	-58.1	56.92	92.293	00			02
18.90	-65.6	66.19	111.192	01		03	

R A O B D A T A

TABLE 6.11b

Date : JUL, 15, 1966

Time: 1309Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms^{-1}			
km	Mb	deg. C	%	N	S	E	W
30	012	-44.5	-		06	07	
28	016	-46.8	-		02	01	
26	022	-45.0	-	02			03
24	029	-53.2	-	00			12
22	040	-52.8	-	00			07
20	055	-59.9	-	04		02	
18	077	-77.5	-	00		10	
16	109	-79.4	-		01		13
14	153	-66.1	-	04			09
12	212	-54.6	-	11			10
10	286	-36.0	-	10			03
08	377	-19.2	-	06			00
06	491	- 6.4	-	00		09	
04	631	3.8	29	03			01
02	803	13.9	63		05	08	
SFC	1008	27.7	75		03	03	

METEOROLOGICAL ROCKET SOUNDING DATA

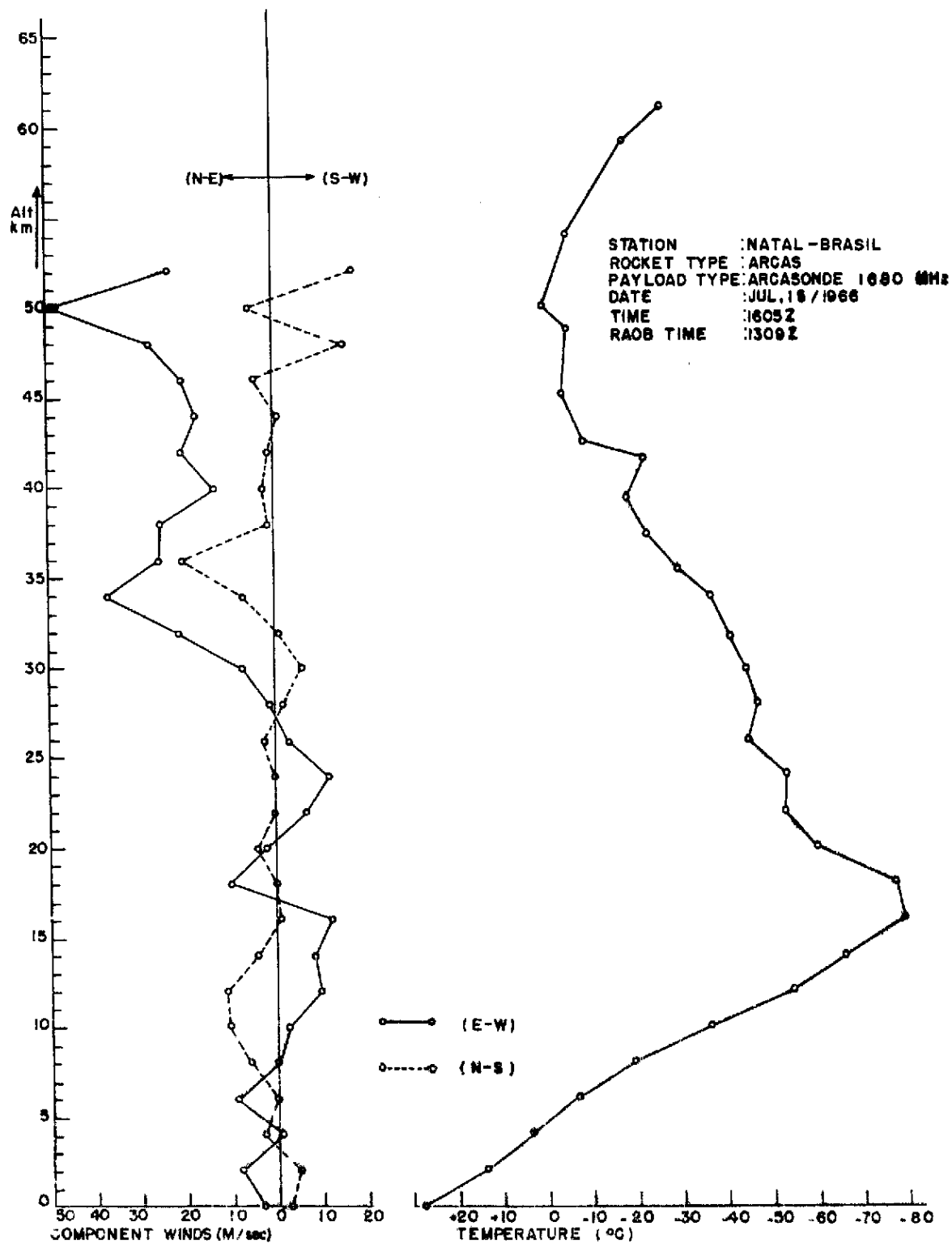


Figure 6.11

R O C K E T D A T A

TABLE 6.12a

Date : AUG, 07, 1966

Time : 0758Z

Rocket type : ARCAS

Payload : ARCASONDE

Alt. (MSL)		Temp.	Pressure	Density	Component Winds ms ⁻¹			
km	deg. C	Mb	gm ⁻³	N	S	E	W	
62.18	- 14.6	0.18	0.239					
60.44	- 14.3	0.22	0.299					
57.82	- 5.6	0.31	0.404					
54.19	- 11.3	0.49	0.653	17			10	
52.06	- 8.6	0.64	0.847		00		06	
50.23	- 7.5	0.81	1.064		10	01		
46.79	- 8.2	1.25	1.648		08		04	
45.35	- 5.7	1.50	1.958		01		06	
43.83	- 5.3	1.82	2.366	12			02	
42.18	- 13.6	2.24	3.014	14			03	
41.15	- 16.1	2.57	3.480	08			05	
40.45	- 16.1	2.81	3.814	02			06	
39.50	- 23.4	3.19	4.454	00			08	
38.86	- 23.4	3.48	4.855	01			09	
38.16	- 21.9	3.82	5.302	03			11	
37.28	- 27.2	4.31	6.103	01			08	
35.94	- 32.3	5.18	7.502		03		02	
35.30	- 31.8	5.67	8.187		02		00	
M I S D A								
31.18	- 39.9	10.18	15.214		00	06		
30.51	- 44.7	11.23	17.133		01	04		
29.69	- 44.8	12.67	19.350		03	01		
29.02	- 47.0	14.00	21.584		03		03	
27.74	- 49.2	16.97	26.415		04		10	
27.10	- 47.3	18.68	28.837		01		14	
25.57	- 51.7	23.54	37.064	02			19	
25.24	- 49.9	24.75	38.658	02			18	
24.48	- 50.7	27.78	43.542	01			18	
24.05	- 50.3	29.66	46.398		00		17	
23.62	- 52.7	31.67	50.087		01		17	
22.86	- 51.7	35.58	56.317		03		18	
22.25	- 57.0	39.10	63.072		04		18	
20.88	- 57.1	48.46	78.212	00			14	
20.09	- 59.6	54.89	89.627	03			11	
19.63	- 59.5	59.05	96.367	04			09	
18.76	- 64.2	67.89	113.292	04			05	

R A O B D A T A

TABLE 6.12b

Date : AUG, 07, 1966

Time : 0250Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	Z	N	S	E	W
23.6	032	-51.8	-	00			17
22	040	-56.8	-	02			15
20	055	-61.3	-	03			03
18	077	-72.8	-		03	01	
16	109	-78.8	-	07			13
14	153	-66.8	-	07			03
12	211	-53.2	-		04	01	
10	285	-36.3	-	04		03	
08	377	-18.5	-	00			03
06	489	-09.5	-	06			00
04	630	03.7	49	00			03
02	802	13.3	72		04		04
SFC	1007	21.7	83		02		01

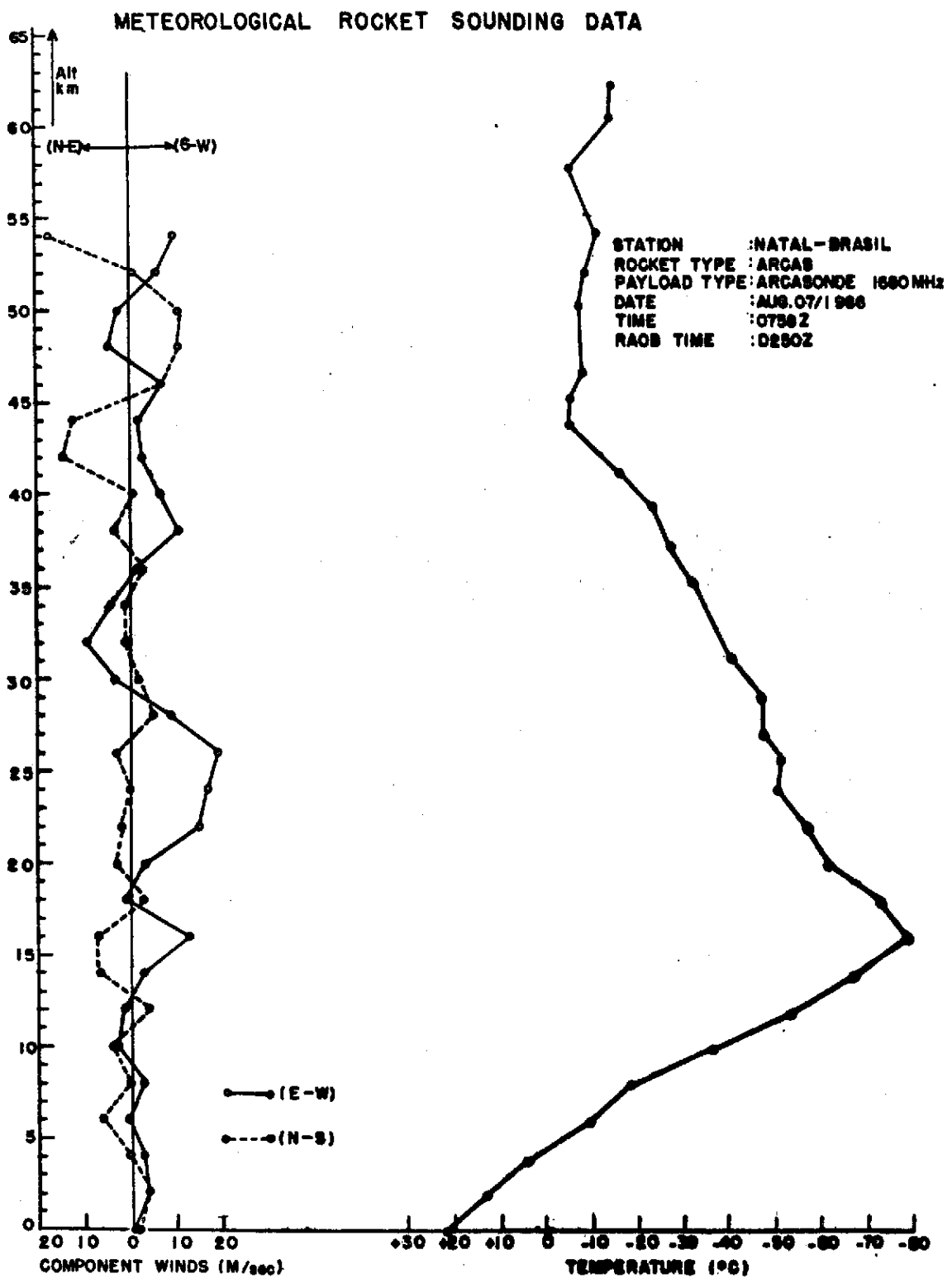


Figure 6.12

R A O B D A T A

TABLE 6.13b

Date : AUG, 17, 1966

Time : 1240Z

Alt. (MSL)	Pressure	Temp.	RH	Component Winds ms ⁻¹			
km	Mb	deg. C	%	N	S	E	W
32.6	008	-39.3	-	11		13	
32	009	-40.8	-	08		13	
30	012	-47.4	-	05		06	
28	016	-50.1	-		03	01	
26	022	-49.3	-	03			01
24	029	-52.7	-		03		09
22	040	-57.4	-		06		05
20	056	-62.7	-	07			01
18	078	-66.4	-		07	01	
16	109	-76.8	-		03	00	
14	153	-66.8	-	02			04
12	211	-53.4	-		04		03
10	285	-36.5	-		05	09	
08	377	-20.1	-		05	18	
06	490	-7.2	-		02	07	
04	630	0.0	39		02		02
02	803	10.6	77		09	03	
SFC	1009	27.2	66		04	05	

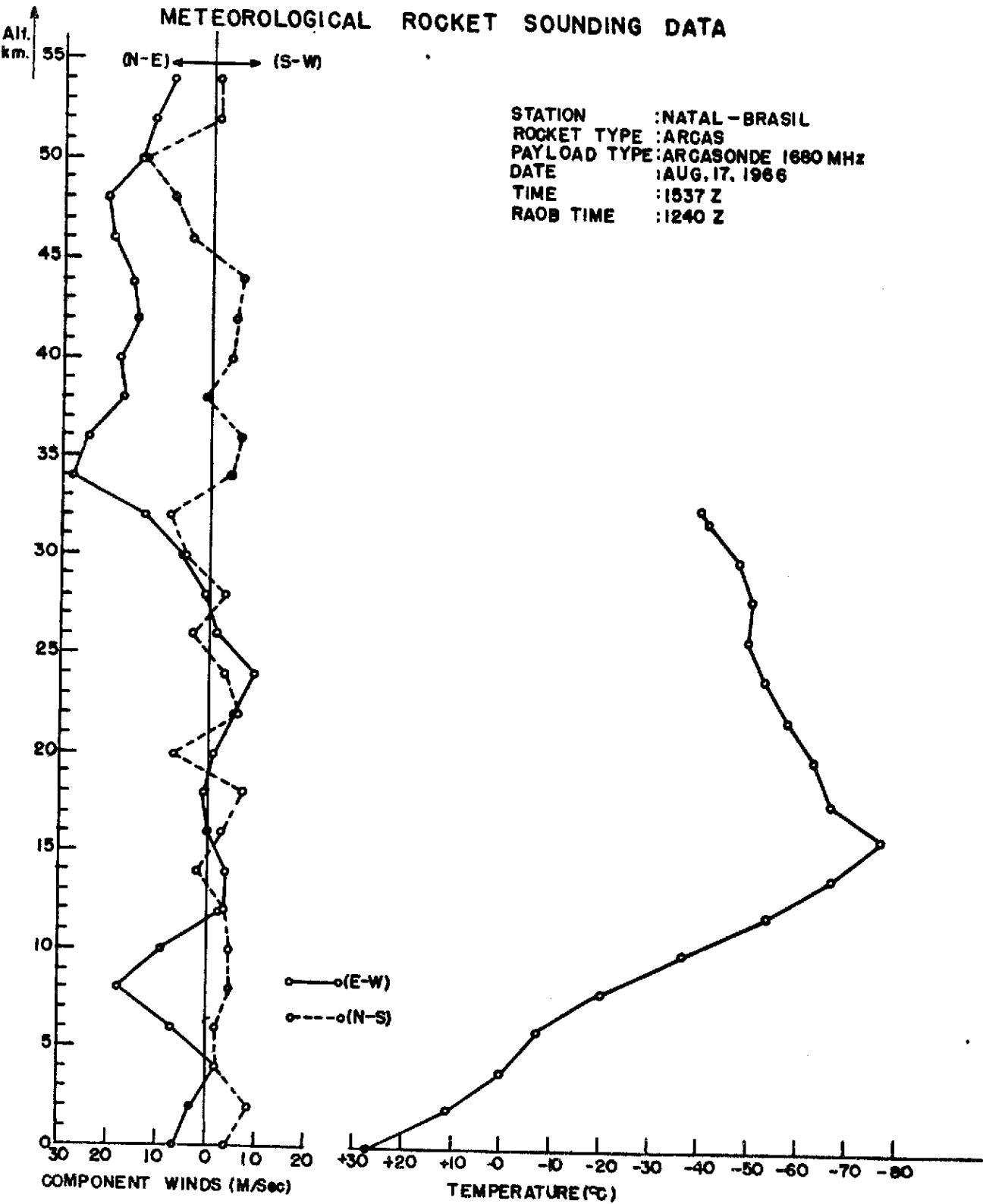


Figure 6.13

7 - TEMPERATURE AND WINDS PRELIMINARY ANALYSIS

It is the intention of this report to present only a brief analysis of the data obtained by the EXAMETNET firings in Natal, Brazil. Later a study will be done by another group assigned to this purpose.

7.1 - TEMPERATURE

Figure (7.1) shows a height-time cross-section of temperature between 2 May and 17 August. The filled circles on the time scale represent approximately the firings dates.

As a first comment, one can note the great stability of the troposphere with a slight cooling during the south - hemisphere winter. The tropopause oscillates between 16 km and 17 km with a temperature of about -80°C . In the stratosphere one can see some conspicuous variations as for instance a cooling region between May and June that goes from 25 km to 58 km.

There is also a cell of $+10^{\circ}\text{C}$ in May which shows a great warming extending up to July through the 0°C isotherm. Another cooling appears in August due to the south-hemisphere winter.

As firings will extend up to the end of 1966 this is expected to give a wider view of the stratosphere temperature distribution.

7.2 - WINDS

Figure (7.2) shows the height-time cross-section between 12 January and 17 August 1966 for winds. This time interval

covers a great portion of Summer, the whole Autumn and almost all the Winter in the south-hemisphere. The filled circles on the time scale represent approximately the firings dates. From this figure one can see an Easterlies predominance between 17 km and 21 km with values up to 30m/sec. Between January and late March Easterlies appear between 17 km and 54 km, lowering the height top by the end of the Winter.

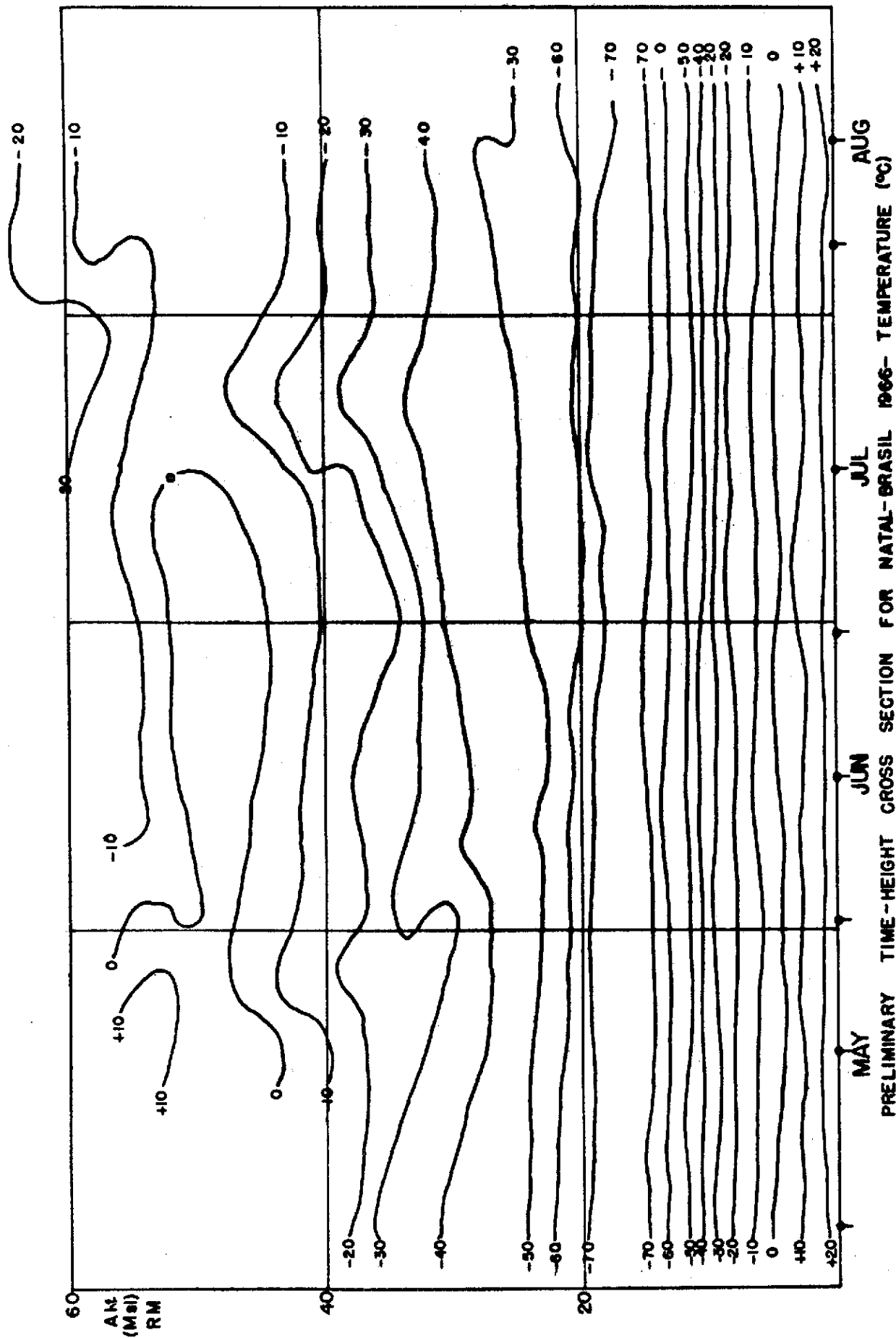
Wind speed intensity attains 55 m/sec. In the lower levels, as expected, there is a complete predominance of Easterlies caused by the trade Winds. However the wind speed is low, attaining the values of 10 m/sec very seldom.

During the Autumn, Easterlies are replaced by the Westerlies between 22 km and 60 km. The Westerlies speed increases with height attaining values up to 50 m/sec.

During all the seasons there is also a layer of West components between 10 km and 17 km which is lower during the Winter. This layer is caused by the antitrade winds that blow all the year in the region of Natal.

A well defined Easterlies cell appears in July probably due to the Winter arrival. Its speed intensity attains up to 50 m/sec.

One interesting remark that may be done deals with the Easterlies prevalence during the south-hemisphere Winter in that equatorial region, what goes frontally against what happens in medium and high latitudes.



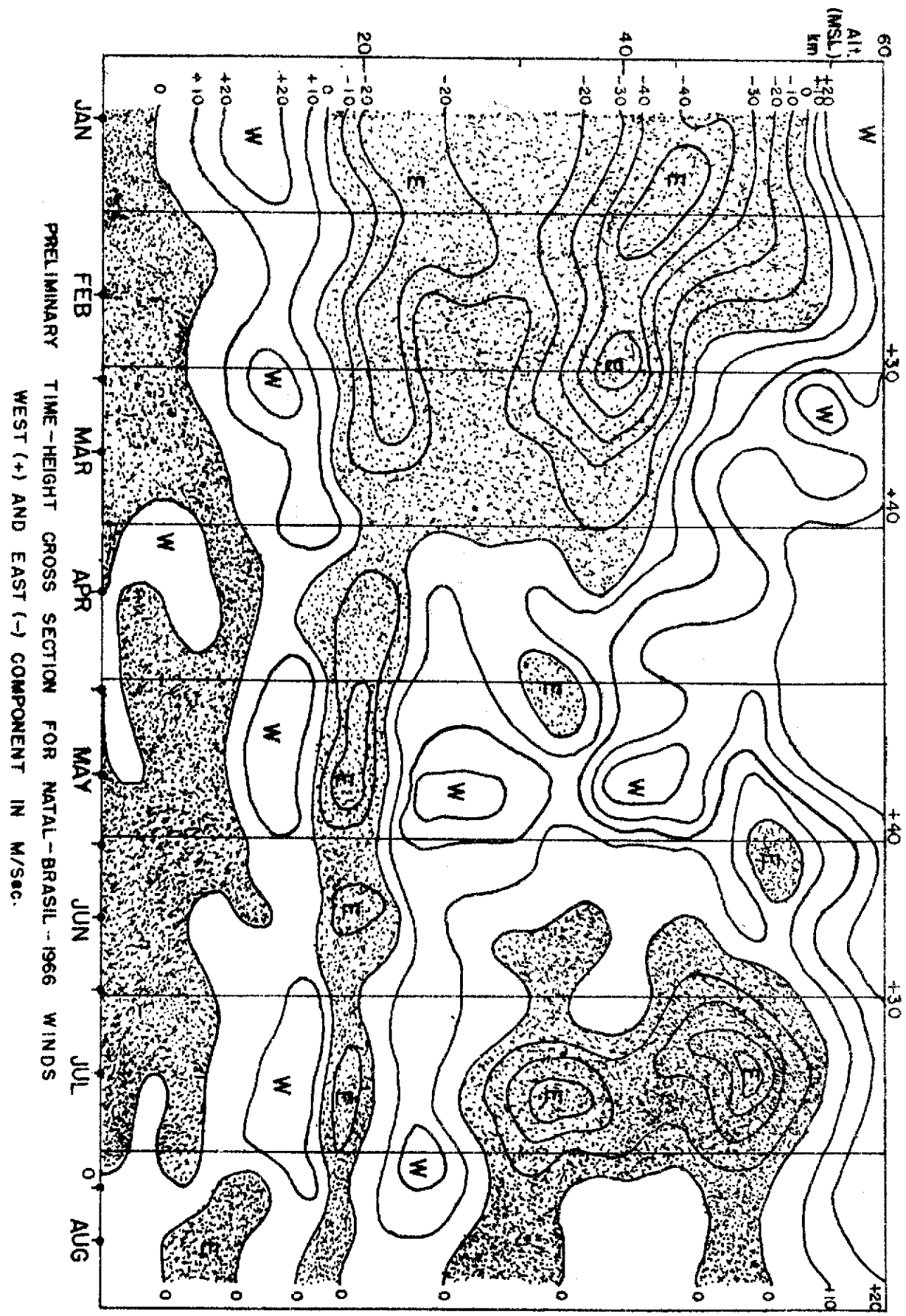


Figure 7.2