ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

JULY 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

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TABLE OF CONTENTS

	Page
Introduction	1
Sites	1
Instrumentation	1
Data Reduction and Storage	2
Figures	
1. Location Map, Isthmus of Panama.	3
2. Frequency of Observations.	4
3. Albrook Forest Site, Generalized Plot.	5
4. Chiva Chiva Open Site, Generalized Plot.	6
5. Instrument Location on Towers.	7
Data Summary Sheets	
Monthly Means of Air Temperature by Hour	8
Monthly Ranges of Air Temperature by Hour.	9
Monthly Means of Relative Humidity by Hour	10
Monthly Ranges of Relative Humidity by Hour.	11
Monthly Means of Other Elements by Hour.	12
Monthly Means of Wet Bulb Temperature by Hour	
Monthly Means of Barometric Pressure by Hour	
Monthly Means of Precipitation by Hour	
Monthly Totals of Precipitation by Hour	
Monthly Ranges of Other Elements by Hour	13
Monthly Ranges of Wet Bulb Temperature by Hour	
Monthly Ranges of Barometric Pressure by Hour	
Monthly Ranges of Precipitation by Hour	
Monthly Means of Wind Speed by Hour.	14
Monthly Ranges of Wind Speed by Hour	15
Relative Frequencies of Wind Directions (46 meters, Albrook)	16
Relative Frequencies of Wind Directions (26.5 meters, Albrook)	17
Relative Frequencies of Wind Directions (4 meters, Albrook)	18
Relative Frequencies of Wind Directions (46 meters, Chiva Chiva)	19
Relative Frequencies of Wind Directions (26.5 meters, Chiva Chiva)	20
Relative Frequencies of Wind Directions (4 meters, Chiva Chiva).	21
Summary of Elements with Non-Hourly Frequencies of Observation.	22
WBGT (Albrook)	
Evaporation (Albrook)	
Precipitation (Manual gauge network, Albrook)	
Precipitation (Stem Flow, Albrook)	
WBGT (Chiva Chiva)	
Evaporation (Chiva Chiva)	
Minimum Grass Temperature (Chiva Chiva)	

MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

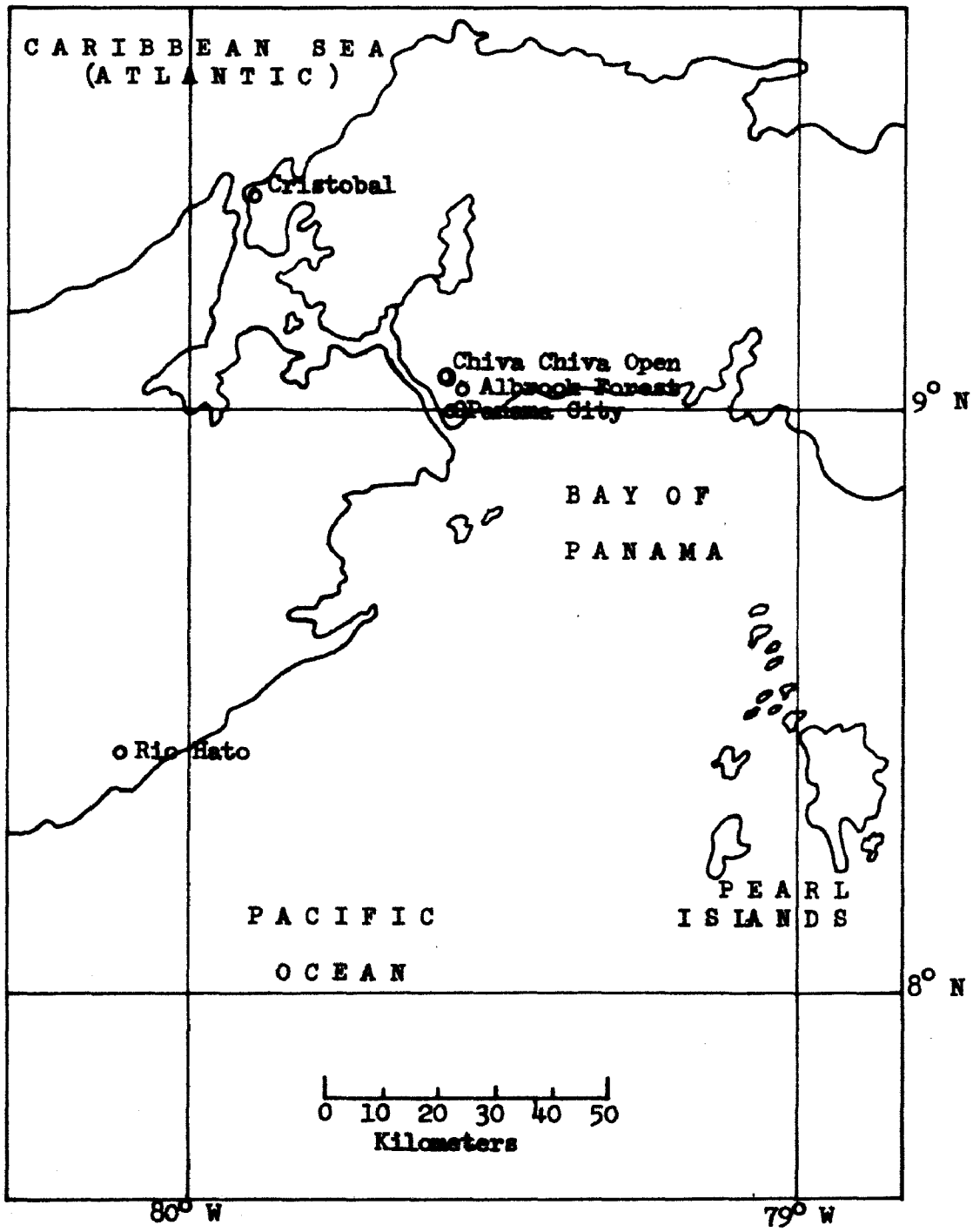

FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters) Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0	Frequency
Temperature:											
Dry Bulb	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	1	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
Relative Humidity	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	2	-	2	Once Daily
Precipitation:											
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Wind:											
Direction	-	-	-	-	1	-	-	1	-	1	Continuously
Speed	-	-	-	3**	1	-	3**	1	-	1	Hourly**/Continuously

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly

\# Instrument descriptions are contained in the Environmental Data Base semiannual reports.

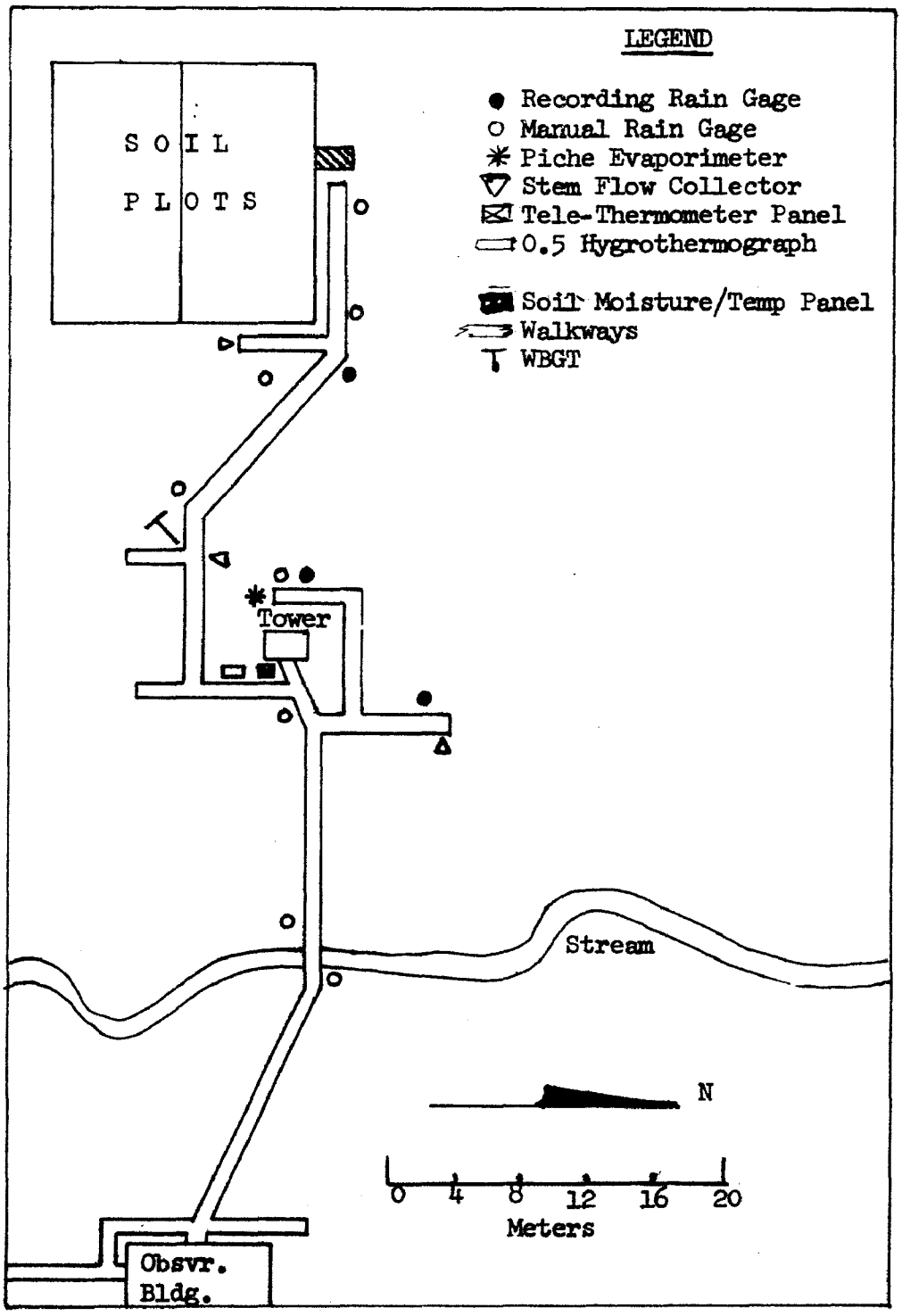

FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

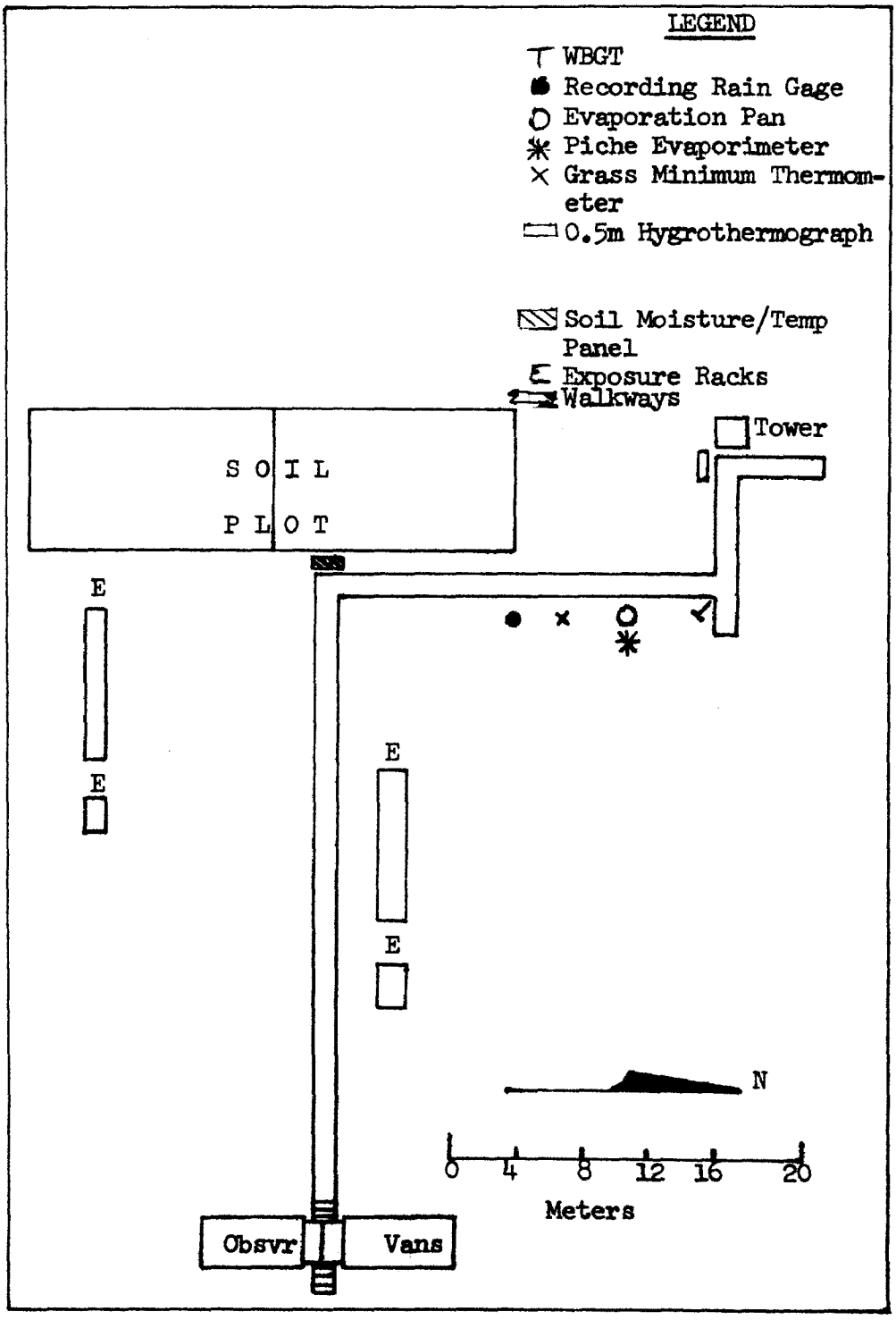

FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

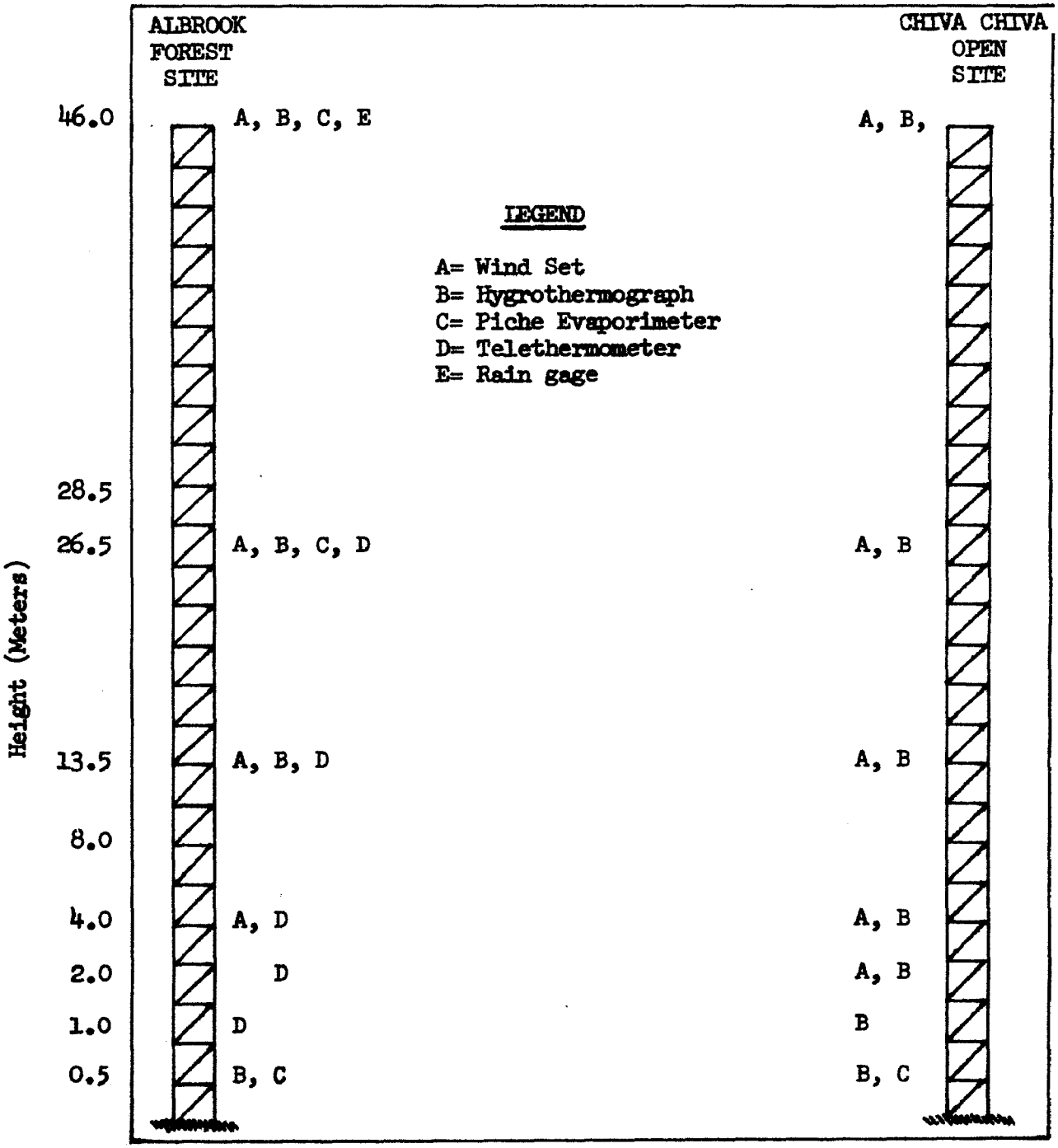

FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	3.2	3.5	4.1	4.1	3.4	4.6	5.5	7.4	11.2	12.6	10.5	11.5	12.2	14.3	14.7	12.3	10.9	10.1	6.4	5.5	5.3	4.4	4.1	4.5				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	3.9	3.8	3.7	3.5	3.7	3.5	5.7	8.1	11.8	11.6	9.5	12.0	10.7	13.5	15.1	14.2	14.4	12.5	8.4	5.9	4.5	4.6	4.0	4.5				
	13.5 m	4.4	4.2	4.5	4.5	4.6	5.0	5.7	6.7	10.5	9.2	11.5	11.5	10.8	13.3	13.6	13.1	11.0	9.6	9.1	6.4	5.3	5.0	4.2	4.5				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	4.9	5.2	3.9	3.5	4.1	5.2	5.8	7.6	9.6	8.9	11.1	11.1	11.4	13.1	13.1	11.4	8.7	7.8	6.7	6.1	5.3	5.5	5.3	5.5				
	2.0 m	4.9	5.2	3.9	3.5	4.1	5.2	5.0	6.5	9.0	8.2	11.0	11.0	11.0	12.1	13.1	10.6	7.9	7.7	6.5	6.2	5.2	5.3	4.8	4.8				
	1.0 m	5.2	5.0	3.5	3.7	4.0	4.8	5.2	6.5	8.8	7.7	9.5	10.2	9.7	12.0	12.0	10.3	8.2	7.7	6.6	6.4	5.6	5.5	4.5	4.7				
	0.5 m	4.3	3.8	3.7	3.8	3.9	4.2	4.4	5.9	7.8	7.6	8.7	9.2	8.0	12.3	10.5	9.9	8.5	7.2	6.6	5.1	5.3	4.6	5.0	4.1				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	4.8	3.6	4.7	3.7	4.3	5.6	7.7	12.3	16.6	13.3	11.9	11.4	14.0	14.1	13.6	11.1	10.3	8.9	7.5	6.5	5.1	4.9	4.9	4.7				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	4.0	3.7	4.4	4.5	4.6	6.0	9.3	12.7	17.6	11.9	11.4	11.0	13.3	14.4	13.6	11.7	10.7	8.8	7.0	6.7	5.6	5.1	4.9	4.8				
	13.5 m	3.8	4.2	4.2	4.2	4.4	5.8	9.4	13.4	17.3	12.0	11.3	11.0	13.7	15.0	14.1	12.3	10.6	8.6	6.9	6.5	5.3	5.4	4.8	4.1				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	5.0	5.8	6.3	6.8	6.6	6.4	7.1	10.9	15.3	13.0	13.1	13.5	12.2	12.1	15.0	15.6	11.3	8.5	6.4	5.7	5.6	5.7	5.6	6.7				
	2.0 m	6.2	5.5	5.5	5.5	5.5	5.5	6.8	10.5	16.1	13.5	13.5	14.2	13.0	13.6	16.4	14.1	12.9	8.9	5.7	6.4	5.3	5.3	5.2	6.3				
	1.0 m	5.8	5.0	5.9	6.0	6.1	6.1	7.1	12.1	15.6	18.1	15.8	17.4	14.5	18.9	16.3	15.0	13.9	9.8	5.9	6.3	5.5	6.5	6.0	6.1				
	0.5 m	5.5	5.0	5.5	5.3	5.8	5.8	7.2	11.8	15.7	14.8	15.6	17.1	15.0	18.2	16.0	15.0	14.0	9.6	6.0	6.4	5.5	6.2	5.5	6.2				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	75.3	75.2	75.1	75.0	74.8	74.5	74.8	76.0	78.1	80.3	81.9	83.1	83.3	82.5	81.4	79.1	78.3	77.5	76.5	76.1	75.9	75.8	75.7	75.6	740	71.2	77.6	88.5
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	75.0	74.8	74.6	74.5	74.3	74.2	74.6	76.0	78.1	80.4	82.1	83.4	83.4	82.7	81.7	79.6	78.7	77.6	76.4	75.8	75.6	75.4	75.3	75.0	744	71.0	77.5	88.8
	13.5 m	75.0	74.9	74.7	74.4	74.2	74.0	74.2	75.5	77.2	78.9	80.3	81.3	81.6	81.4	80.8	79.2	78.3	77.4	76.5	76.0	75.7	75.5	75.4	75.2	734	70.9	77.0	86.8
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	74.6	74.4	74.3	74.1	73.9	73.7	74.3	76.1	77.6	79.0	80.1	81.1	81.1	81.0	80.2	78.6	77.7	76.9	75.9	75.6	75.3	75.2	75.1	74.9	744	70.5	76.7	86.8
	2.0 m	74.6	74.4	74.2	74.1	73.9	73.7	74.2	75.9	77.3	78.7	79.9	80.9	80.8	80.8	80.3	78.4	77.6	76.8	75.9	75.7	75.4	75.2	75.0	74.8	744	71.0	76.6	86.3
	1.0 m	74.7	74.5	74.3	74.2	73.9	73.7	74.3	75.8	77.2	78.5	79.6	80.6	80.8	80.7	80.1	78.4	77.6	76.8	76.0	75.7	75.4	75.3	75.2	75.0	744	70.8	76.6	85.8
	0.5 m	75.1	74.9	74.8	74.7	74.5	74.3	74.5	75.7	77.0	78.3	79.5	80.4	80.6	80.7	80.2	78.9	78.2	77.5	76.6	76.1	76.0	75.7	75.6	75.4	743	72.0	76.9	86.5

Chiva Chiva (Open site)	46.0 m	75.3	75.1	75.0	74.9	74.7	74.6	75.7	78.1	80.3	81.8	82.7	83.7	83.4	82.0	80.7	79.2	78.1	77.3	76.5	76.3	76.1	75.9	75.8	75.5	739	71.6	77.9	88.8
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	75.2	75.0	74.9	74.8	74.6	74.4	75.6	78.2	80.1	81.6	82.3	83.5	83.3	82.3	81.0	79.5	78.3	77.6	76.7	76.5	76.2	76.0	75.8	75.6	744	71.0	77.9	89.6
	13.5 m	75.1	74.9	74.8	74.6	74.5	74.3	75.6	78.5	80.6	81.9	82.8	83.8	83.7	82.6	81.3	79.7	78.5	77.8	76.7	76.4	76.1	75.9	75.6	75.3	744	71.2	78.0	89.6
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	74.7	74.3	74.2	74.0	73.9	73.8	75.0	77.7	79.7	81.7	83.0	84.5	84.7	83.8	82.1	80.4	79.2	78.2	77.0	76.7	76.4	76.0	75.4	75.1	738	70.2	78.0	89.8
	2.0 m	74.6	74.2	74.2	74.0	73.8	73.6	74.9	77.6	79.9	82.1	83.5	85.0	85.2	84.3	82.6	80.6	79.3	78.2	76.9	76.5	76.3	75.8	75.2	74.9	738	70.9	78.0	91.1
	1.0 m	74.5	74.2	74.1	73.7	73.6	73.3	75.1	78.0	80.5	82.8	84.1	85.7	85.0	83.9	82.5	80.4	79.1	77.9	76.4	76.0	75.8	75.3	75.1	74.9	741	70.2	78.0	93.2
	0.5 m	74.4	74.0	74.0	73.6	73.6	73.3	75.0	78.1	80.7	83.2	84.7	86.4	85.6	84.2	82.6	80.5	79.2	77.9	76.5	76.1	75.8	75.2	75.1	74.7	741	70.3	78.1	92.9

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	95	95	95	95	95	95	95	93	87	82	78	76	76	77	81	85	87	89	91	93	94	94	95	95	740	64	89	97
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	95	95	95	95	95	96	96	92	87	82	78	76	75	77	80	84	86	88	90	94	94	95	95	95	734	63	89	98
	13.5 m	96	96	96	96	96	97	97	96	92	87	85	81	81	81	83	87	88	89	91	93	94	95	95	95	733	61	91	99
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	97	97	97	98	98	98	98	95	92	90	88	85	87	86	87	90	92	93	94	95	96	97	97	97	744	67	93	100
	2.0 m	97	97	98	98	98	98	98	96	93	91	89	87	89	87	88	91	93	93	95	96	96	97	97	97	744	70	94	100
	1.0 m	97	97	98	98	98	98	98	97	94	92	91	89	89	89	90	92	94	94	95	96	96	97	97	97	744	67	95	100
	0.5 m	97	97	97	97	97	98	97	96	95	93	91	90	91	90	91	93	93	94	95	96	96	96	96	97	742	77	95	100
Chiva Chiva (open site)	46.0 m	94	95	95	95	95	95	93	88	83	79	77	74	75	77	82	85	87	88	91	91	91	92	92	93	737	63	88	98
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	94	95	95	95	96	95	93	87	83	79	77	74	74	76	81	85	86	88	91	92	92	93	93	94	737	58	88	98
	13.5 m	95	96	95	96	96	96	93	86	81	78	77	75	75	76	81	85	86	88	91	92	92	93	93	94	738	64	88	99
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	96	96	96	97	97	97	95	89	84	79	76	73	72	75	79	83	86	87	90	92	92	93	94	95	738	57	88	100
	2.0 m	96	96	96	97	97	97	96	90	85	80	77	73	73	75	79	83	86	88	91	92	93	94	95	95	738	55	89	100
	1.0 m	96	97	97	97	97	97	96	89	83	80	77	74	75	77	81	85	88	89	92	93	94	95	95	96	729	63	89	100
	0.5 m	96	97	96	97	97	98	97	91	85	81	78	74	76	79	80	84	87	89	92	93	94	96	94	95	741	60	89	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	4	6	5	4	4	4	3	12	20	25	28	29	30	31	30	29	26	25	19	11	10	10	9	4				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	12	10	12	11	11	10	10	15	16	25	21	22	21	32	33	32	28	22	16	12	12	11	10	11				
	13.5 m	9	9	10	8	6	6	6	10	12	20	25	30	33	35	37	34	31	31	28	22	16	13	12	11				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	10	11	9	5	6	4	6	11	18	21	25	28	31	32	28	30	27	24	20	12	12	10	10	8				
	2.0 m	10	12	6	5	6	6	6	10	15	14	25	26	27	24	25	24	27	22	16	12	10	9	11	7				
	1.0 m	8	8	6	6	5	4	4	7	11	13	20	25	31	24	20	21	25	20	14	12	10	10	11	9				
	0.5 m	6	8	8	7	6	6	7	4	10	12	19	21	19	23	20	15	19	16	13	9	7	8	8	7				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	9	9	9	8	8	8	9	22	28	23	27	25	27	28	33	29	23	22	16	12	7	10	10	9				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	8	9	8	7	8	7	10	22	32	24	26	29	30	32	37	32	27	23	15	10	8	9	8	8				
	13.5 m	9	10	9	10	9	8	13	23	28	21	23	23	24	24	33	29	24	23	17	11	8	10	10	10				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	11	12	10	10	10	8	11	19	28	24	31	30	33	34	40	36	28	23	20	13	8	11	14	14				
	2.0 m	10	10	10	8	8	7	10	17	30	25	31	29	35	34	38	35	29	23	18	12	11	9	11	9				
	1.0 m	9	8	10	10	11	11	11	23	32	25	28	28	26	28	37	32	26	24	16	8	11	9	8	8				
	0.5 m	10	9	8	12	13	13	10	19	27	30	35	38	34	38	38	36	29	27	14	10	11	12	20	20				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means[2] of other Elements by Hour																							Monthly Summary			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	73.9	73.8	73.7	73.7	73.5	73.3	73.9	75.0	75.7	76.6	77.2	77.5	77.8	77.5	77.2	76.2	75.8	75.2	74.7	74.7	74.5	74.5	74.4	74.2	744	70.4	75.2	81.2
	WB (2.0 m)	74.0	73.8	73.8	73.7	73.5	73.3	73.8	75.1	75.7	76.7	77.3	77.8	78.0	77.7	77.4	76.4	76.0	75.3	74.8	74.7	74.6	74.5	74.4	74.2	744	70.9	75.3	81.0
	WB (0.5 m)	74.5	74.3	74.2	74.1	73.9	73.8	73.9	75.0	75.9	76.7	77.5	78.0	78.5	78.3	78.0	77.1	76.6	76.1	75.5	75.2	75.1	74.9	74.8	74.7	742	70.8	75.7	81.4
	BP	.753	.738	.727	.722	.724	.729	.746	.758	.766	.773	.772	.762	.742	.724	.706	.698	.696	.702	.717	.736	.756	.766	.775	.767	744	.640	.740	.875
	P1	0.00	0.04	0.01	0.01	0.05	0.20	0.15	0.12	0.10	0.01	0.06	0.02	0.02	0.23	0.11	0.35	0.11	0.08	0.05	0.03	0.01	0.01	0.00	0.39	69	0.01	7.91	0.90
	P2	0.00	0.01	0.02	0.00	0.03	0.32	0.26	0.07	0.06	0.04	0.05	0.01	0.04	0.38	0.06	0.40	0.08	0.02	0.00	0.01	0.00	0.00	0.00	0.22	37	0.01	4.76	0.69
	P3	0.00	0.05	0.00	0.00	0.03	0.20	0.25	0.06	0.11	0.03	0.00	0.00	0.00	0.77	0.05	0.48	0.34	0.06	0.00	0.00	0.00	0.00	0.00	0.50	25	0.01	4.99	0.77
	P4	0.00	0.02	0.00	0.00	0.03	0.21	0.27	0.22	0.07	0.04	0.02	0.00	0.00	1.20	0.14	0.47	0.21	0.03	0.01	0.00	0.00	0.00	0.01	0.25	41	0.01	7.97	1.20
Chiva Chiva (Open site)	WB (4.0 m)	73.8	73.6	73.4	73.4	73.4	73.1	73.9	75.2	75.8	76.5	77.0	77.3	77.4	77.2	76.8	76.3	75.8	75.4	74.9	74.9	74.8	74.5	74.2	74.1	738	70.2	75.1	80.3
	WB (2.0 m)	73.7	73.5	73.4	73.3	73.2	73.1	74.0	75.4	76.2	77.0	77.6	78.0	78.1	77.8	77.2	76.5	75.9	75.4	74.9	74.8	74.7	74.5	74.1	74.0	738	70.3	75.2	81.5
	WB (0.5 m)	73.6	73.3	73.2	73.1	73.1	73.0	74.3	76.1	77.2	78.2	79.0	79.4	79.2	78.7	77.4	76.5	75.9	75.3	74.7	74.6	74.4	74.2	73.8	73.7	741	68.3	75.5	83.1
	BP	.849	.834	.823	.818	.818	.824	.838	.851	.864	.870	.870	.861	.840	.824	.807	.797	.795	.800	.814	.834	.852	.862	.870	.865	744	.740	.837	.950
	PS	0.09	0.00	0.00	0.03	0.09	0.44	0.23	0.25	0.07	0.02	0.07	0.05	0.26	0.79	0.06	0.35	0.06	0.02	0.02	0.00	0.00	0.00	0.05	0.11	57	0.01	10.55	1.66

[1] WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2] Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges[2] of other Elements by Hour																							Monthly Summary*			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	WB (4.0 m)	4.3	4.2	3.3	3.5	3.9	4.9	5.6	6.2	7.0	6.5	6.3	6.0	7.2	7.7	6.5	5.8	4.5	4.9	4.8	4.3	4.2	4.5	4.6	4.7				
	WB (2.0 m)	4.2	4.1	3.7	3.4	3.8	5.0	5.1	6.0	7.3	6.3	6.2	6.0	6.6	7.7	7.7	5.7	5.1	5.5	4.4	4.1	4.1	4.4	4.1	4.5				
	WB (0.5 m)	3.7	3.6	3.4	3.7	3.8	4.1	4.8	6.0	7.2	6.4	5.8	5.8	4.9	7.2	6.9	6.7	5.6	5.8	4.4	4.4	4.1	4.0	4.1	3.6				
	BP	.120	.125	.135	.140	.120	.145	.160	.170	.140	.130	.135	.135	.140	.140	.140	.135	.120	.125	.110	.115	.120	.125	.115	.130				
	P1	0.00	0.05	0.00	0.00	0.05	0.51	0.35	0.12	0.22	0.01	0.02	0.00	0.02	0.06	0.19	0.86	0.26	0.19	0.13	0.03	0.00	0.00	0.00	0.00				
	P2	0.00	0.00	0.00	0.00	0.02	0.54	0.19	0.13	0.09	0.00	0.00	0.00	0.00	0.33	0.01	0.68	0.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00				
	P3	0.00	0.01	0.00	0.00	0.00	0.45	0.39	0.08	0.15	0.01	0.00	0.00	0.00	0.00	0.00	0.55	0.47	0.10	0.00	0.00	0.00	0.00	0.00	0.00				
	P4	0.00	0.01	0.00	0.00	0.00	0.67	0.63	0.24	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.50	0.09	0.00	0.00	0.00	0.00	0.00	0.48				
Chiva Chiva (Open site)	WB (4.0 m)	5.3	5.1	4.6	5.1	4.9	5.2	5.8	7.5	8.7	7.3	6.1	5.8	6.1	5.2	6.4	7.1	6.2	5.3	4.6	4.4	4.2	3.6	4.3	4.9				
	WB (2.0 m)	5.0	4.8	4.4	4.6	4.6	5.2	5.7	7.7	9.1	7.8	6.6	6.0	7.3	5.4	6.9	7.1	6.6	5.1	4.6	3.9	3.9	3.8	4.1	4.8				
	WB (0.5 m)	5.2	4.7	4.7	5.6	6.0	9.5	7.5	8.4	9.0	8.9	8.2	7.7	7.5	9.6	7.5	7.2	7.8	4.7	4.5	4.9	3.7	5.0	7.5	8.5				
	BP	.125	.120	.125	.135	.130	.125	.155	.155	.130	.125	.130	.135	.135	.135	.135	.130	.130	.130	.120	.125	.120	.120	.115	.115				
	PS	0.00	0.00	0.00	0.04	0.20	0.23	0.46	0.45	0.11	0.01	0.11	0.07	0.74	1.65	0.12	1.42	0.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00				

* No monthly summary was computed for the ranges.

[1] WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2] Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	5	6	6	6	6	6	6	6	6	5	6	7	7	9	8	8	8	7	7	7	6	6	6	5	631	0	6	17
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	3	2	2	2	2	2	1	2	3	3	4	4	4	4	4	3	4	3	3	2	2	3	3	2	449	0	3	12
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	669	0	0	6
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											
Chiva Chiva (Open site)	46.0 m	5	4	5	4	4	5	4	5	6	6	7	7	8	8	9	7	8	8	8	7	6	5	6	5	371	0	6	18
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	4	3	3	3	3	4	3	4	5	5	7	6	8	8	8	8	7	7	5	5	4	4	5	4	575	0	5	21
	13.5 m	2	1	2	1	1	1	1	1	3	3	4	4	5	5	7	6	6	6	5	4	4	3	2	2	733	0	3	18
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	3	2	2	2	2	3	2	3	5	5	6	5	6	7	7	6	6	5	4	3	3	2	3	3	673	0	4	14
	2.0 m	1	0	1	0	0	0	0	1	1	1	2	2	3	3	4	4	3	3	2	2	1	1	1	1	734	0	2	12
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

Note: Data at 46.0 meters represent the first 21 days of the month only.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	9	12	11	6	10	11	11	10	11	13	16	11	11	12	10	16	10	13	12	13	10	11	10	11				
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	6	4	6	4	5	5	5	6	7	9	12	9	7	9	7	8	8	7	7	5	5	8	7	5				
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	1	3	2	1	6	1	1	2	2	1	2	2	2	2	2	1	1	1	1	1	1	1	0				
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	12	8	8	7	12	11	10	8	10	11	14	14	14	11	13	9	10	11	8	11	7	8	12	10				
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	13	14	13	6	8	16	6	6	7	7	11	13	19	10	14	11	9	12	9	9	7	8	9	7				
	13.5 m	10	10	10	5	5	6	4	5	8	7	12	13	18	11	12	10	10	10	8	9	8	7	9	8				
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	7	7	7	5	5	14	6	5	7	8	11	11	11	9	10	9	11	9	6	7	6	6	7	6				
	2.0 m	5	5	4	3	3	4	1	3	5	5	7	8	10	7	12	8	8	7	5	5	4	4	5	3				
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

Note; Data at 46.0 meters represent the first 21 days of the month only.

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.

(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.4	3.4	3.4	3.4	3.4			3.3	3.3	3.3	3.3	10.0			6.4	10.0	13.7	13.7	10.3	3.4	10.7	6.8	10.3	3.5
NNE						3.4					3.3		3.3	3.3	3.2	10.0	6.8				3.5	3.4		3.5
NE					3.4		3.4					3.3		3.3	3.2	3.3	10.3	3.4			3.5	3.4		3.5
ENE		3.4						3.3						3.3		3.3	6.8						3.4	
E	3.4						3.4		3.3			3.3			9.7			3.4						
ESE						3.4		3.3																3.5
SE					3.4								3.3	3.3			6.8							
SSE						3.4		3.3	3.3				3.3	6.6		6.6								
S								3.3			6.6	10.0	10.0	10.0	9.7									
SSW							3.4			6.6	6.6	3.3												
SW	3.4	3.4	3.4			3.4		3.3	3.3	3.3	3.3	3.3	3.3	6.6										
WSW	3.4			10.3	3.4		17.1		10.0		6.6	20.0	13.3	10.0			3.4		10.3		3.5			3.5
W	17.1	3.4	6.8	10.3	10.3	17.1	3.4	20.0	20.0	13.3	6.6	20.0	26.6	6.6	12.9	26.6	20.6	13.7	13.7	6.8	17.7	13.7	6.8	14.2
WNW	27.3	41.0	20.6	20.6	20.6	24.0	24.0	20.0	13.3	29.9	20.0	10.0	6.6	10.0	22.6	13.3	10.3	3.4	17.1	30.7	21.3	17.1	30.7	31.9
NW	13.7	27.3	34.1	41.0	34.1	34.1	27.3	23.3	13.3	23.3	23.3	6.6	20.0	20.0	29.0	20.0	20.6	41.0	34.1	34.1	17.7	37.6	34.1	21.3
NNW	20.6	10.3	27.3	13.7	10.3	6.8	6.8		20.0	10.0	16.6	10.0	10.0	16.6	3.2	6.6		17.1	10.3	17.1	10.3	14.2	6.8	7.0
CALM	6.8	6.8	3.4		10.3	3.4	10.3	16.6	10.0	10.0	3.3							3.4	3.4	6.8	7.0	6.8	6.8	7.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45005

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	15.4	11.5	7.6	7.6	7.6	3.8	7.3	7.0	14.2	6.8	3.5	10.7	7.0	3.5	6.0	10.3	7.0	7.0	14.2	10.7	11.0		3.8	16.0
NNE		3.8				3.8			3.5	3.4	7.0		3.5		3.3	10.3	7.0	3.5	3.5	14.2	3.6			
NE	3.8									3.4	3.5	3.5	3.5		6.6	3.4	10.7	3.5			3.6			4.0
ENE																6.8	3.5							
E						3.8	3.6	3.5			3.5													
ESE													3.5		3.3		3.5	3.5			3.6			4.0
SE						3.8					3.5		3.5	10.7	3.3		3.5							
SSE								3.5					3.5	10.7	6.6	3.4								
S				3.8			3.6			3.4	3.5	3.5	10.7		6.6					3.5	3.6			
SSW											3.5	3.5							3.5					
SW	3.8				3.8			3.5	3.5		7.0	14.2	14.2	3.5					3.5				3.8	
WSW				3.8	3.8				7.0	3.4	3.5	7.0	3.5	10.7		3.4								4.0
W	3.8	3.8		3.8		3.8	3.6			10.3	3.5	10.7	7.0	7.0			10.7			3.5	7.3	10.7		
WNW	7.6	15.4	7.6	7.6	11.5	7.6	7.3	21.3	10.7	13.7	10.7	10.7	7.0	14.2	16.6	17.1	7.0	3.5	7.0	3.5	11.0	7.0	11.5	
NW	30.7	26.9	38.3	7.6	30.7	26.9	18.4	24.9	28.4	24.0	10.7	14.2	7.0	14.2	26.6	30.7	24.9	39.0	31.9	24.9	11.0	31.9	26.9	32.0
NNW	23.1	30.7	30.7	46.0	19.1	26.9	22.1	14.2	17.7	10.3	24.9	10.7	17.0	14.2	10.0		7.0	21.3	17.7	17.7	29.4	24.9	34.5	28.0
CALM	11.5	7.6	15.4	19.1	23.1	19.1	33.1	21.3	14.2	20.6	10.7	10.7	7.0	10.7	10.0	13.7	14.2	17.7	17.7	21.3	14.7	24.9	19.1	12.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N					3.8	3.8			3.8	3.8		3.8		3.8	7.3		4.0	7.9	4.0				4.0	
NNE			3.6													7.6	7.9							
NE								3.8				7.6	3.8		3.6						4.0			
ENE																						4.0		
E									3.8				3.8	3.8										
ESE	3.6																							
SE																								
SSE																								
S		3.6				3.8					3.8					3.8		4.0	4.0				4.0	
SSW										3.8										4.0				
SW								3.8		3.8	3.8		7.6	3.8	3.6	3.8	4.0	4.0	4.0					
WSW			3.8						3.8	7.6		3.8					4.0							
W									7.6		11.5		7.6	3.8	3.6	7.6	4.0	4.0						
WNW			3.8						3.8	3.8					7.3			4.0		4.0				4.1
NW			3.8	3.8	3.8	3.8	4.0	7.6	7.6		3.8	3.8		11.5		3.8		4.0	4.0	7.9	4.0			
NNW			3.8	3.8			4.0		3.8	3.8	3.8	3.8	3.8		11.0	3.8	7.9		7.9			4.0		
CALM	95.6	91.9	84.5	92.1	92.1	88.3	92.0	84.5	65.2	72.9	72.9	76.8	72.9	72.9	62.5	69.1	68.0	72.0	76.0	84.0	92.0	92.0	92.0	95.7

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45893

CHIVA CHIVA (Open site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	11.7	5.9							4.8					5.0	5.0	5.0	5.0		5.0			15.0	16.7	16.7
NNE														5.0		10.0								
NE										4.8														
ENE					6.3				4.8							5.0	5.0							
E						5.9				4.8	9.5							5.0						
ESE																5.0								
SE													5.0		10.0				5.0					
SSE									4.8		4.8		5.0	5.0										
S										4.8		5.0												
SSW																								
SW								4.8				5.0	5.0	5.0				5.0						
WSW					6.3				4.8	4.8	9.5	10.0		5.0								5.0		5.6
W	17.6			5.9	6.3	5.9	23.8	4.8	23.8		9.5	10.0	20.0	5.0	10.0		5.0			5.0		5.0	5.6	5.6
WNW	29.3	29.3	11.7	41.0	18.7	29.3	23.8	47.6	33.3	23.8	19.0	15.0	25.0	35.0	30.0	20.0	20.0	20.0	15.0	30.0	25.0	15.0		11.1
NW	23.4	52.8	58.5	35.2	43.6	46.9	23.8	28.6	19.0	52.4	38.1	40.5	20.0	25.0	35.0	55.0	40.0	45.0	65.0	60.0	55.0	50.0	50.8	38.9
NNW	5.9		17.6	11.7	6.3	11.7	19.0	9.5	4.8	4.8	9.5	15.0	20.0	10.0	10.0		25.0	25.0	10.0	5.0	20.0	10.0	22.2	11.1
CALM	11.7	11.7	11.7	5.9	12.4		9.5	4.8															5.6	11.1

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45889

CHIVA CHIVA (Open site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	12.9	12.9	16.1	6.6	16.6	3.3	6.4	9.7	3.2	6.4	9.7	6.4	22.6	3.2	6.4	3.2	16.1	16.1	12.9	9.7	16.1	9.7	3.3	10.3
NNE	3.2	3.2	6.4	3.3	3.3	3.3		3.2		3.2		3.2		3.2	6.4	3.2				3.2	3.2	3.2	6.6	6.8
NE	3.2	3.2		3.3					6.4	3.2				6.4		6.4		3.2	3.2		3.2	3.2	3.3	
ENE						3.3	3.2	3.2	3.2		3.2											6.4		
E					6.6	6.6	6.4	3.2	3.2	3.2	6.4			3.2		3.2	3.2	3.2			3.2			3.4
ESE					3.3						3.2	3.2			3.2	3.2		3.2						
SE		3.2									3.2		6.4		9.7	9.7	3.2		3.2			3.2		
SSE								3.2			3.2		3.2	3.2										
S				3.3								3.2		3.2				3.2	3.2					3.4
SSW							3.2	3.2																
SW	3.2	3.2	6.4			3.3	6.4	3.2	3.2		3.2	6.4		9.7							3.2	3.2		3.4
WSW	3.2	3.2		3.3		3.3	6.4		6.4	6.4	6.4		6.4	6.4		3.2	3.2	3.2				3.2	6.6	
W	12.9	3.2	3.2	3.3	6.6	13.3	9.7	16.1	6.4	3.2	9.7	12.9	12.9	9.7	9.7	3.2	3.2	6.4		3.2	3.2	6.4	13.7	
WNW	9.7	12.9		20.0		16.6	12.9	22.6	25.8	12.9	9.7	9.7	12.9	12.9	19.4	6.4	9.7	6.4	6.4	9.7	12.9		3.3	13.7
NW	16.1	22.6	25.8	23.3	39.9	20.6	12.9	19.4	29.0	38.7	22.6	19.4	22.6	25.8	32.2	38.7	32.2	22.6	41.9	41.9	32.2	35.5	20.0	24.0
NNW	19.4	16.1	22.6	23.3	13.3	20.0	19.4	12.9	12.9	22.6	16.1	29.0	12.9	12.9	12.9	19.4	29.0	32.2	29.0	29.0	22.6	22.6	53.1	20.6
CALM	16.1	16.1	19.4	10.0	10.0	6.6	12.9				3.2	6.4								3.2		3.2		

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A.

CHIVA CHIVA (Open site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	24.0	10.3	17.1	6.8	14.2	13.7	6.4	6.4		16.1	16.1		19.4	6.4	9.7	6.4	16.1	16.1	16.1	6.4	29.0	12.9	13.3	16.6
NNE		6.8	3.4	3.4	7.0	3.4			3.2		3.2	3.2		6.4	3.2	3.2	6.4				3.2	6.4		
NE	10.3	13.7	6.8	10.3		3.4	6.4	3.2	6.4					3.2		3.2		3.2		3.2		6.4	3.3	6.6
ENE	3.4					6.8	3.2	3.2		3.2	3.2							3.2				3.2	6.6	
E	3.4		6.8	3.4	3.5	6.8	3.2	3.2	3.2							6.4					3.2	3.2		3.3
ESE						3.4	6.4			3.2	3.2		6.4		3.2	3.2		3.2				6.4	3.3	
SE												3.2		3.2	3.2	6.4	6.4	3.2		3.2				
SSE					3.5									3.2	3.2	3.2				3.2	3.2			
S					3.5	6.8					3.2	3.2	3.2	6.4	3.2				3.2				3.3	3.3
SSW							3.2	3.2				3.2	3.2							3.2				
SW		3.4		6.8	3.5			3.2	9.7		9.7	9.7	6.4	9.7		3.2		6.4				3.2		
WSW	3.4			6.8		3.4	3.2	9.7	3.2	3.2	3.2	6.4	6.4	6.4	3.2		3.2			3.2				3.3
W	3.4	6.8	6.8	6.8	7.0	6.8	12.9	12.9	12.9	9.7	9.7	9.7	9.7	9.7	19.4	9.7	16.1	9.7	19.4	6.4	3.2	16.1	10.0	16.6
WNW	13.7	3.4	10.3	10.3	3.5	10.3	19.4	16.1	16.1	29.0	6.4	9.7	9.7	16.1	19.4	19.4	9.7	12.9	12.9	16.1	6.4	9.7	3.3	3.3
NW	20.6	13.7	27.3	17.1	21.3	13.7	16.1	22.6	25.8	22.6	29.0	32.2	29.0	22.6	22.6	19.4	25.8	25.8	29.0	29.0	35.5	12.9	20.0	20.0
NNW	10.3	17.1	10.3	10.3	21.3	13.7	6.4	16.1	16.1	12.9	12.9	19.4	6.4	6.4	9.7	16.1	16.1	16.1	19.4	25.8	16.1	16.1	26.6	20.0
CALM	6.8	24.0	10.3	17.1	10.7	6.8	12.9		3.2													3.2	10.0	6.6

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

SUMMARY OF NON HOURLY DATA

JULY 1967

Summary of Elements with Non-hourly Frequencies of Observations						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index[1] (at 1.0 meters)	Index value	434	70.5	77.0	82.8
		Dry bulb temp.	434	70.5	77.9	86.0
		Wet bulb temp.	434	70.3	76.5	82.0
		Black bulb temp.	434	71.0	78.5	88.0
	Evaporation[3] (in. at 4 levels)	Piche (46.0 m)	29	0.043	5.921*	0.470
		Piche (26.5 m)	28	0.043	5.392*	0.518
		Piche (13.5 m)	27	0.006	1.641*	0.140
		Piche (0.5 m)	26	0.006	0.814*	0.085
	Precipitation from Raingauge Network[2] (in. at 1.0 meters)	Gauge # 1	27	0.01	5.18*	1.04
		Gauge # 2	28	0.01	8.44*	1.10
		Gauge # 3	28	0.01	8.41*	1.23
		Gauge # 4	27	0.01	8.29*	1.26
		Gauge # 5	28	0.01	7.24*	1.20
		Gauge # 6	28	0.01	7.34*	1.05
		Gauge # 7	28	0.01	8.01*	1.25
		Gauge # 8	28	0.01	7.17*	1.15
	Stem Flow[2] (in. at 2.0 meters)	Small tree	26	0.01	8.81*	2.00
		Medium tree	23	0.01	9.32*	2.00
		Large tree	20	0.01	39.75*	11.49
Chiva Chiva (Open site)	WBGT Index[1] (at 1.0 meters)	Index value	432	69.8	79.7	89.6
		Dry bulb temp.	432	70.0	80.5	94.8
		Wet bulb temp.	432	69.8	77.0	83.3
		Black bulb temp.	432	70.0	88.6	118.1
	Evaporation[3] (in. at 0.5 meters)	Piche	31	0.006	4.025*	0.482
		Pan	27	0.021	3.653*	0.287
	Minimum Grass temp[3] (°F at grass tips)	None	29	67.5	70.7	74.0

* Total Values

1 - Hourly observations between 0600 and 1900 hours inclusive
2 - Six hourly observations
3 - Daily observations

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13. ABSTRACT

This report contains detailed microclimatic data for July 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.

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Data Base						

AD

MONTHLY MICROCLIMATIC SUMMARY

AUGUST 1967

ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

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Fort Clayton, Canal Zone

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ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

AUGUST 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

USATECOM Project No. 9-4-0013-01

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TABLE OF CONTENTS

Page

Introduction 1
Sites. 1
Instrumentation. 1
Data Reduction and Storage 2

Figures
1. Location Map, Isthmus of Panama. 3
2. Frequency of Observations. 4
3. Albrook Forest Site, Generalized Plot 5
4. Chiva Chiva Open Site, Generalized Plot. 6
5. Instrument Location on Towers. 7

Data Summary Sheets
Monthly Means of Air Temperature by Hour 8
Monthly Ranges of Air Temperature by Hour. 9
Monthly Means of Relative Humidity by Hour 10
Monthly Ranges of Relative Humidity by Hour. 11
Monthly Means of Other Elements by Hour. 12
Monthly Means of Wet Bulb Temperature by Hour
Monthly Means of Barometric Pressure by Hour
Monthly Means of Precipitation by Hour
Monthly Totals of Precipitation by Hour
Monthly Ranges of Other Elements by Hour. 13
Monthly Ranges of Wet Bulb Temperature by Hour
Monthly Ranges of Barometric Pressure by Hour
Monthly Ranges of Precipitation by Hour
Monthly Means of Wind Speed by Hour. 14
Monthly Ranges of Wind Speed by Hour 15
Relative Frequencies of Wind Directions (46 meters, Albrook) . . 16
Relative Frequencies of Wind Directions (26.5 meters, Albrook). 17
Relative Frequencies of Wind Directions (4 meters, Albrook). . . 18

Relative Frequencies of Wind Directions (26.5 meters, Chiva Chiva). 19
Relative Frequencies of Wind Directions (4 meters,Chiva Chiva). 20
Summary of Elements with Non-Hourly Frequencies of Observation. 21
WBGT (Albrook)
Evaporation (Albrook)
Precipitation (Manual gauge network, Albrook)
Precipitation (Stem Flow, Albrook)
WBGT (Chiva Chiva)
Evaporation (Chiva Chiva)
Minimum Grass Temperature (Chiva Chiva)

MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N,	79° 33'W
Chiva Chiva	09° 01'N,	79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

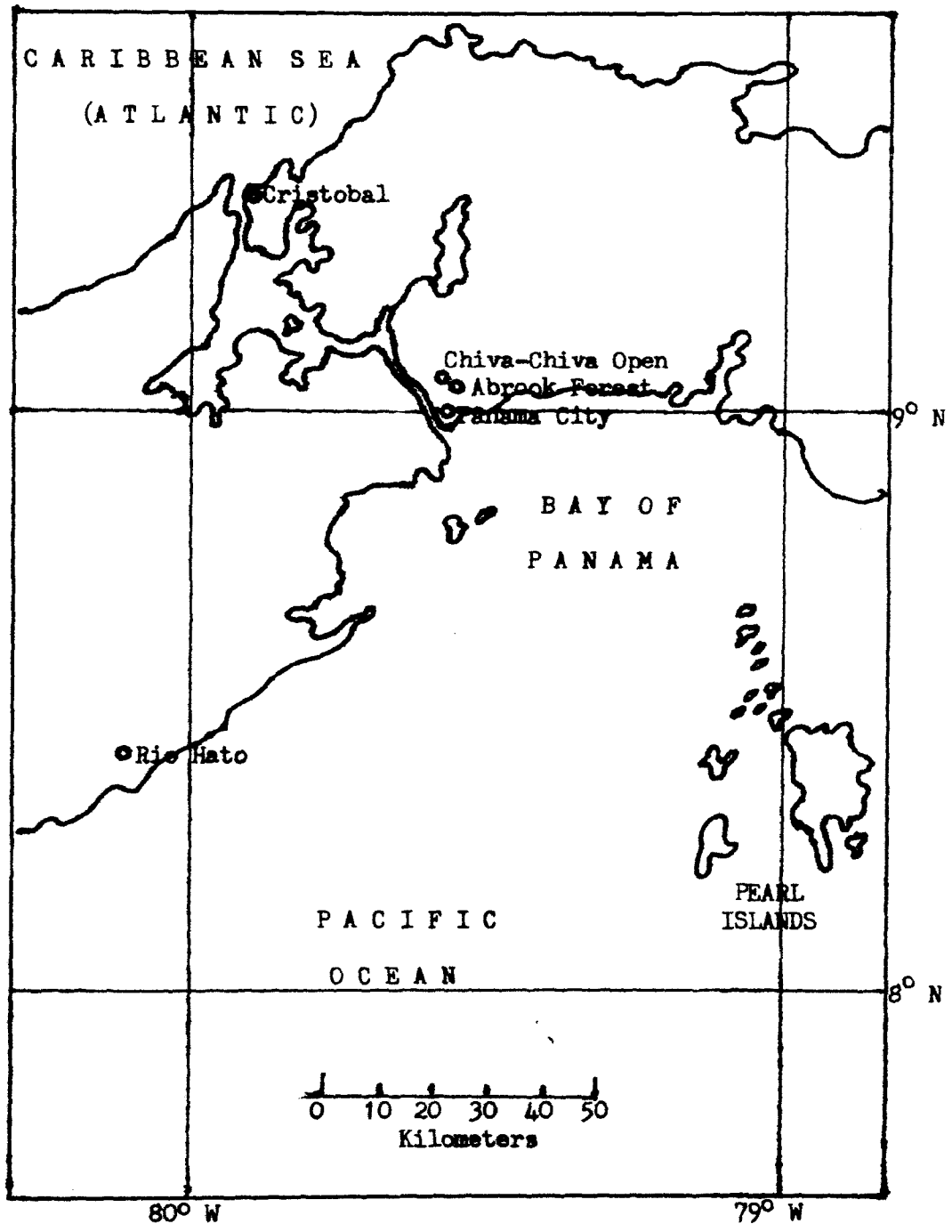

FIGURE 1.

LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters) Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0	Frequency
Temperature:											
Dry Bulb	-	1	1	1	1	2	1	1	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	1	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
Relative Humidity	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	2	-	2	Once Daily
Precipitation:											
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	-	2	-	-	-	-	-	-	4 Times Daily
Wind:											
Direction	-	-	-	-	1	-	-	1	-	2	Continuously
Speed	-	-	-	3**	1	-	3**	1**	-	2	Hourly**/Continuously

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly

Instrument descriptions are contained in the Environmental Data Base semiannual reports.

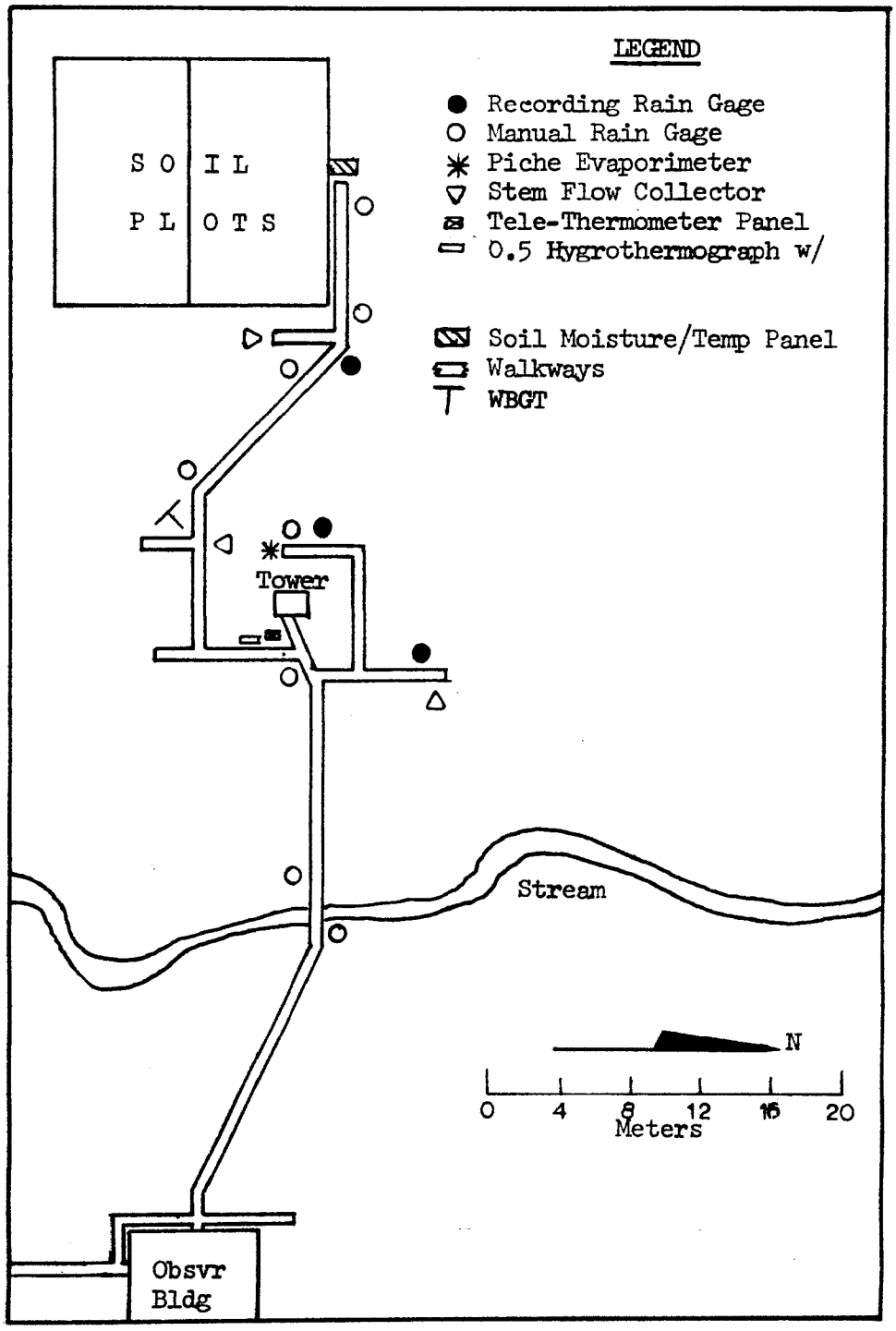

FIGURE 3.

ALBROOK FOREST SITE, GENERALIZED PLOT

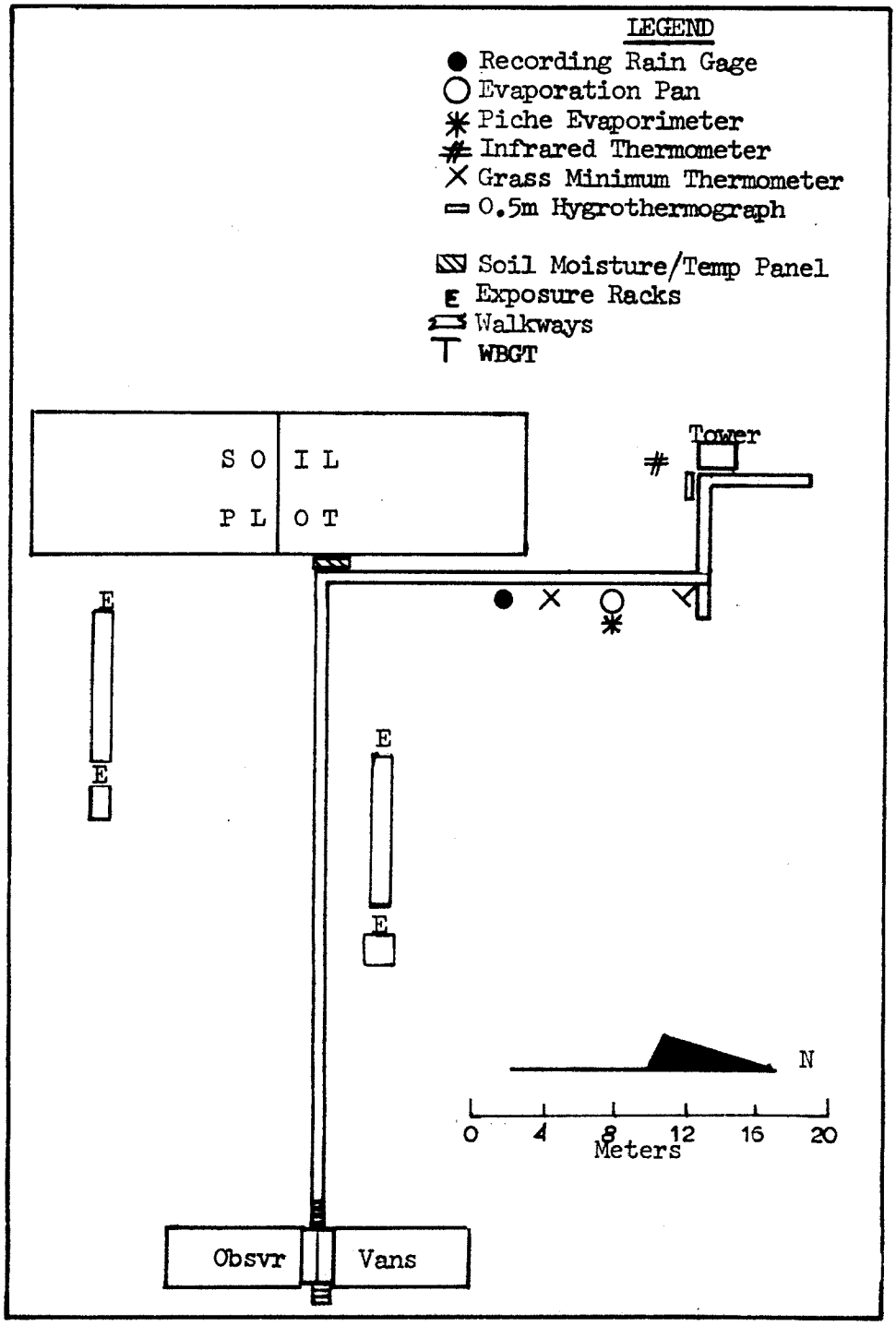

FIGURE 4.

CHIVA CHIVA OPEN, GENERALIZED PLOT

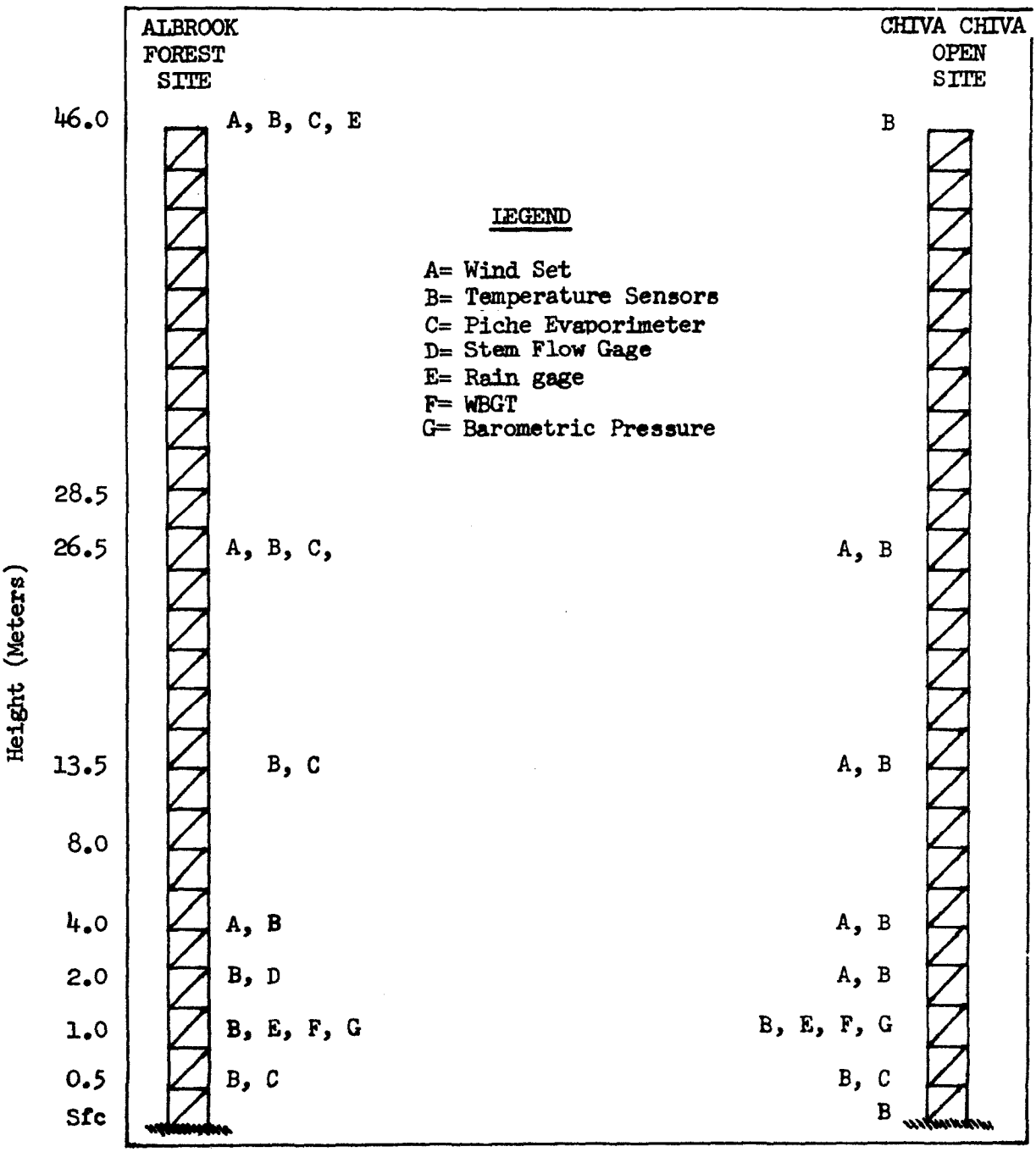

FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	75.5	75.4	75.2	75.0	74.9	74.8	75.4	77.1	79.5	81.4	82.8	82.7	82.5	81.4	81.2	80.3	79.1	77.9	76.7	76.4	76.2	76.1	75.8	75.7	740	71.2	77.9	88.2
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	75.4	75.2	75.1	74.9	74.8	74.7	75.3	77.2	79.7	81.7	83.4	83.4	83.3	82.5	82.0	80.8	79.8	78.5	76.8	76.3	76.0	75.9	75.7	75.5	744	71.4	78.1	89.0
	13.5 m	75.2	74.9	74.8	74.6	74.5	74.4	74.7	76.3	78.3	80.1	81.7	82.2	82.1	81.4	81.0	80.3	79.3	78.1	77.0	76.4	76.0	75.7	75.3	75.2	666	71.0	77.5	87.5
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	74.7	74.6	74.5	74.3	74.2	74.2	75.0	76.9	78.7	80.1	81.6	81.3	81.4	80.5	79.9	79.3	78.7	77.4	76.4	76.0	75.7	75.5	74.9	74.9	735	70.0	77.1	87.2
	2.0 m	74.7	74.6	74.5	74.2	74.2	74.2	75.0	76.7	78.4	79.7	81.1	81.1	81.3	80.3	79.8	79.1	78.7	77.4	76.4	76.1	75.7	75.5	74.9	74.8	736	70.0	77.0	86.5
	1.0 m	74.8	74.7	74.5	74.3	74.2	74.2	75.0	76.6	78.3	79.6	80.9	80.8	81.1	80.3	79.6	79.0	78.7	77.5	76.6	76.2	75.8	75.6	74.9	74.9	736	70.0	77.0	86.7
	0.5 m	75.1	75.0	74.9	74.7	74.5	74.4	74.9	76.4	78.0	79.3	80.7	80.9	81.0	80.4	79.9	79.2	78.8	77.6	76.7	76.3	76.1	75.8	75.2	75.1	722	71.3	77.1	86.1
Chiva Chiva (Open site)	46.0 m	76.0	75.8	75.7	75.5	75.4	75.5	75.5	76.5	78.5	80.4	81.8	82.2	81.9	81.0	80.4	79.8	78.8	78.2	77.5	77.0	76.6	76.6	76.4	76.1	744	70.6	77.9	88.8
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	75.7	75.6	75.3	75.2	75.1	75.1	75.3	76.7	78.7	80.4	81.9	82.4	82.2	81.1	80.6	79.9	78.9	78.2	77.3	76.8	76.5	76.3	76.2	75.7	744	70.5	77.8	87.7
	13.5 m	75.5	75.5	75.2	75.0	74.9	74.9	75.4	77.0	79.0	80.9	82.2	82.6	82.5	81.5	80.8	80.2	79.2	78.4	77.4	76.8	76.5	76.3	75.9	75.5	744	70.5	77.9	88.8
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	74.8	74.5	74.3	74.0	74.0	74.1	75.7	78.6	80.7	82.7	84.0	84.1	84.2	82.7	81.8	80.9	79.5	78.5	77.1	76.5	76.1	75.8	75.1	74.7	743	69.5	78.1	89.7
	2.0 m	74.7	74.5	74.2	74.0	73.9	73.9	75.7	78.8	81.2	83.4	84.8	84.8	84.8	83.2	82.3	81.5	80.0	78.6	77.2	76.5	75.9	75.7	75.0	74.6	742	69.0	78.3	91.4
	1.0 m	74.5	74.3	74.0	73.7	73.7	73.7	75.8	79.0	81.6	84.1	85.3	85.3	84.8	83.3	82.2	81.2	79.6	78.1	76.7	76.0	75.4	75.2	74.8	74.5	741	68.3	78.2	93.7
	0.5 m	74.4	74.2	74.0	73.7	73.6	73.5	75.7	79.2	82.0	84.2	85.9	85.5	84.9	83.6	82.2	81.4	79.7	78.2	76.7	76.0	75.4	75.2	74.8	74.4	734	68.5	78.2	93.3

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	6.1	6.1	5.6	5.7	6.1	5.7	5.6	8.0	10.2	11.4	10.9	13.0	13.9	14.5	15.7	14.8	13.9	12.1	8.0	6.9	6.7	6.3	6.1	6.0				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	5.1	5.0	4.8	5.0	5.6	5.9	5.5	7.5	10.4	11.9	11.5	15.0	15.2	15.5	15.7	15.1	14.9	12.6	8.9	7.1	5.8	5.5	5.3	5.2				
	13.5 m	8.0	8.3	7.2	7.2	8.0	8.0	8.1	11.1	11.0	10.8	12.1	14.0	14.3	16.0	14.2	14.0	14.0	12.9	10.0	7.1	6.7	6.3	5.8	5.3				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	4.3	6.0	5.6	6.5	6.6	6.8	7.3	8.8	9.8	9.9	11.3	14.2	14.4	12.3	12.0	11.5	11.0	11.8	9.5	9.0	6.9	5.3	5.2	5.0				
	2.0 m	4.4	6.2	5.5	6.5	6.6	7.0	7.2	8.6	9.5	9.5	11.0	13.5	13.2	12.5	12.0	10.5	10.3	11.4	9.5	8.8	6.3	5.5	5.2	4.9				
	1.0 m	4.2	6.4	5.4	6.2	6.2	7.0	7.2	8.3	9.8	9.3	11.0	13.7	12.8	12.3	12.1	10.5	9.4	11.0	10.0	8.3	6.7	6.4	5.1	5.1				
	0.5 m	4.0	6.2	5.1	6.1	5.8	5.9	6.8	7.8	9.5	8.2	10.2	12.5	11.3	12.7	11.9	10.8	10.5	9.9	8.4	8.1	6.4	6.3	4.9	5.1				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	6.3	5.5	4.3	5.1	5.0	5.5	6.0	7.6	9.6	12.7	10.1	15.9	15.0	16.6	14.8	13.7	16.9	13.0	10.5	8.9	5.5	6.0	6.3	6.7				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	6.5	5.5	4.6	5.3	5.1	5.5	5.9	7.8	9.2	11.8	10.2	15.3	14.5	15.4	14.0	12.2	17.0	12.9	11.1	8.5	6.0	6.0	6.6	7.2				
	13.5 m	6.7	5.3	4.4	5.4	5.3	5.9	5.6	8.4	9.9	12.3	10.8	17.0	14.5	16.5	14.1	13.5	17.5	13.4	10.6	9.2	7.5	5.9	6.7	7.3				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	6.9	5.2	4.9	5.3	5.9	6.1	5.4	10.8	12.8	12.9	12.0	17.9	15.2	16.0	14.6	16.0	17.7	14.5	10.5	9.2	8.4	7.8	6.7	6.8				
	2.0 m	6.3	5.8	5.3	5.8	5.8	5.8	5.9	10.9	12.9	14.0	12.5	19.2	17.0	18.8	15.9	16.5	19.1	15.9	11.0	9.6	8.7	7.2	7.3	6.8				
	1.0 m	6.5	5.5	5.8	6.3	6.4	6.1	4.9	11.2	13.5	12.1	14.2	21.7	19.9	19.6	16.0	17.5	18.9	15.3	9.3	8.9	7.8	7.0	6.8	6.7				
	0.5 m	6.3	5.6	5.3	6.2	5.5	5.9	5.0	11.9	13.8	12.9	15.6	21.3	19.5	20.2	15.5	17.6	18.7	14.7	9.3	8.9	7.8	6.8	6.8	6.8				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	94	94	94	94	94	94	93	90	84	77	75	75	77	79	80	82	84	87	90	91	92	92	93	94	734	63	87	97
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	95	95	95	95	95	95	95	91	85	80	76	76	78	79	80	83	85	89	93	94	94	94	95	95	738	64	89	98
	13.5 m	96	96	96	96	96	97	96	95	90	86	82	80	81	83	84	87	88	90	92	93	95	95	96	96	665	63	91	98
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	97	97	96	97	97	97	96	95	91	89	84	85	85	86	88	90	90	92	93	94	95	95	97	96	734	66	93	100
	2.0 m	97	97	97	97	97	97	97	96	93	90	87	86	86	88	89	92	91	93	94	94	95	96	97	97	735	69	93	100
	1.0 m	97	97	97	97	97	97	97	96	94	92	88	89	87	89	92	93	92	93	94	94	95	95	97	97	711	68	94	100
	0.5 m	97	96	97	96	97	97	96	96	94	93	90	90	90	90	92	93	93	94	95	95	95	95	97	97	721	75	94	100
Chiva Chiva (Open site)	46.0 m	93	94	94	94	94	94	94	91	87	82	78	77	78	80	82	83	86	87	89	90	92	92	92	93	743	60	88	99
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	94	94	94	95	95	95	94	92	86	82	78	77	77	80	82	84	85	87	89	91	92	93	92	94	744	60	88	99
	13.5 m	94	94	95	95	95	95	94	91	86	82	78	76	77	80	81	83	85	87	90	91	92	93	93	94	744	60	88	100
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	96	96	96	97	97	96	94	88	84	79	76	75	75	78	81	83	86	88	92	93	94	94	95	95	743	60	89	100
	2.0 m	96	96	96	96	96	96	94	88	83	78	75	75	74	78	80	82	85	88	92	93	94	94	95	96	742	60	88	100
	1.0 m	96	96	97	97	97	97	95	88	82	77	74	75	76	79	81	83	85	89	93	94	95	95	96	96	734	63	89	100
	0.5 m	97	97	97	97	98	97	95	89	84	79	76	76	77	81	82	82	86	89	92	94	95	95	96	96	732	60	90	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	9	9	7	7	7	7	9	14	26	31	30	32	33	31	30	28	29	23	18	15	13	12	8	9				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	5	6	5	7	6	6	6	15	25	30	29	31	26	29	31	28	29	26	16	13	9	6	6	6				
	13.5 m	5	5	6	5	4	4	4	5	19	23	30	33	32	32	31	28	26	25	18	15	10	9	8	7				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	7	14	14	13	14	10	15	15	19	22	29	30	30	32	33	21	19	20	18	17	17	16	10	9				
	2.0 m	8	14	14	13	14	11	15	15	17	20	28	29	25	26	26	18	18	18	16	16	16	16	10	8				
	1.0 m	8	14	14	13	13	10	15	14	16	18	30	24	25	32	20	16	17	17	15	16	15	17	8	8				
	0.5 m	6	15	14	13	13	10	12	14	15	15	23	22	18	19	21	16	18	18	15	16	16	14	6	8				
Chiva Chiva (Open site)	46.0 m	13	13	15	15	11	13	16	21	23	27	30	34	29	30	35	33	35	29	24	20	13	14	13	14				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	13	13	13	15	10	12	11	13	17	27	28	35	31	34	31	29	31	26	21	17	15	15	14	15				
	13.5 m	12	12	14	15	11	15	14	14	22	27	30	36	28	32	36	30	32	24	18	16	15	14	14	14				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	17	11	12	12	12	12	11	20	25	24	31	38	28	37	37	36	34	26	18	16	14	14	11	10				
	2.0 m	11	10	15	13	10	9	11	21	25	28	31	38	33	38	37	33	34	25	16	13	10	10	8	7				
	1.0 m	9	9	11	12	7	10	11	24	28	29	32	34	29	31	32	31	29	23	13	10	9	8	8	6				
	0.5 m	11	11	13	13	7	10	12	20	24	29	35	39	34	34	36	37	34	26	14	14	13	11	10	8				

* No monthly summary was computed for the ranges.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Means[2] of other Elements by Hour																							Monthly Summary			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	74.0	73.9	73.8	73.6	73.5	73.6	74.3	75.7	76.6	77.3	77.7	77.5	77.6	77.2	77.1	76.8	76.5	75.5	75.0	74.7	74.6	74.5	74.2	74.1	734	69.9	75.4	81.0
	WB (2.0 m)	74.0	73.9	73.8	73.6	73.6	73.6	74.3	75.7	76.8	77.5	77.9	77.7	77.8	77.5	77.3	77.1	76.7	75.6	75.1	74.8	74.6	74.6	74.3	74.1	735	69.8	75.5	81.0
	WB (0.5 m)	74.4	74.2	74.2	74.0	73.9	73.8	74.2	75.6	76.8	77.7	78.4	78.5	78.5	78.0	78.0	77.5	77.2	76.1	75.6	75.2	75.0	74.9	74.5	74.4	721	70.4	75.8	81.5
	BP	.757	.741	.727	.720	.721	.729	.746	.764	.779	.782	.776	.760	.739	.719	.703	.689	.690	.703	.718	.735	.751	.767	.775	.769	744	.595	.740	.845
	P1	0.00	0.01	0.00	0.00	0.00	0.02	0.05	0.10	0.04	0.00	0.03	0.12	0.02	0.30	0.20	0.35	0.11	0.07	0.04	0.02	0.03	0.00	0.00	0.00	50	0.01	6.16	1.24
	P2	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.09	0.01	0.00	0.01	0.11	0.01	0.33	0.13	0.37	0.12	0.06	0.09	0.05	0.00	0.00	0.04	0.00	36	0.01	4.87	1.25
	P3	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.06	0.02	0.00	0.02	0.14	0.02	0.29	0.25	0.29	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	35	0.01	4.60	1.05
	P4	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.19	0.01	0.06	0.00	0.10	0.01	0.40	0.29	0.25	0.06	0.06	0.06	0.01	0.00	0.00	0.03	0.00	36	0.01	4.77	1.10
Chiva Chiva (Open site)	WB (4.0 m)	73.9	73.8	73.5	73.5	73.4	73.3	74.4	75.8	76.8	77.3	77.6	77.5	77.5	77.1	76.9	76.6	76.0	75.7	75.3	74.9	74.7	74.6	74.1	73.8	743	68.6	75.3	80.8
	WB (2.0 m)	73.8	73.6	73.4	73.2	73.1	73.0	74.5	76.1	77.1	77.7	78.2	78.1	78.0	77.5	77.2	76.9	76.2	75.8	75.2	74.9	74.6	74.5	73.9	73.7	743	68.2	75.4	81.7
	WB (0.5 m)	73.7	73.6	73.4	73.1	73.1	73.0	74.7	76.7	78.0	78.9	79.5	79.1	78.9	78.6	77.5	76.9	76.2	75.6	75.0	74.7	74.3	74.1	73.9	73.7	737	68.2	75.7	82.8
	BP	.853	.836	.822	.816	.819	.825	.839	.857	.874	.877	.875	.864	.838	.821	.801	.787	.787	.797	.813	.830	.847	.862	.871	.865	743	.690	.861	.945
	PS	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.46	0.11	0.05	0.00	0.16	0.10	0.34	0.26	0.13	0.21	0.09	0.06	0.02	0.00	0.00	0.01	0.00	54	0.01	8.61	1.60

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2] Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges[2] of other Elements by Hour																							Monthly Summary*			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	WB (4.0 m)	3.4	3.5	3.2	3.5	3.8	5.0	4.0	5.2	6.0	5.5	5.2	7.7	8.4	8.5	7.9	8.2	9.3	9.0	7.6	6.9	4.8	3.5	4.0	4.3				
	WB (2.0 m)	3.5	3.5	3.2	3.5	3.8	4.9	4.1	5.2	6.0	5.7	5.6	8.3	9.0	8.8	8.2	8.1	9.2	9.0	7.9	7.0	4.8	3.5	4.1	4.0				
	WB (0.5 m)	3.4	3.8	3.4	3.5	3.7	4.5	4.6	4.7	6.2	5.6	6.6	8.5	8.6	9.2	9.2	8.5	8.9	9.3	8.0	7.5	6.1	4.7	4.5	4.1				
	BP	.165	.175	.175	.175	.195	.195	.195	.175	.195	.160	.165	.170	.160	.160	.155	.150	.150	.145	.135	.130	.135	.135	.145	.145				
	P1	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.23	0.06	0.00	0.03	0.37	0.02	1.23	0.42	0.86	0.25	0.15	0.08	0.04	0.03	0.00	0.00	0.00				
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.21	0.00	1.24	0.24	0.94	0.18	0.17	0.15	0.00	0.00	0.00	0.00	0.00				
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.00	0.00	0.29	0.01	1.04	0.38	1.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00				
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.01	1.05	0.56	0.60	0.13	0.12	0.07	0.00	0.00	0.00	0.00	0.00				
Chiva Chiva (Open site)	WB (4.0 m)	4.0	4.2	4.2	4.7	4.2	4.5	4.2	6.2	6.5	5.9	5.8	9.1	8.4	8.8	7.4	7.8	11.3	10.8	8.8	6.7	5.8	4.7	5.1	5.3				
	WB (2.0 m)	4.5	5.5	4.0	5.0	4.8	5.1	4.1	6.5	7.1	7.0	6.2	9.7	9.0	9.6	7.5	8.5	12.0	11.3	9.5	7.5	6.5	5.0	5.5	5.8				
	WB (0.5 m)	4.7	5.0	4.5	5.0	4.8	4.8	3.9	7.5	8.1	6.4	7.5	11.0	10.4	10.7	8.2	9.0	12.8	10.7	8.2	7.3	5.5	4.7	5.0	5.6				
	BP	.155	.175	.180	.175	.190	.190	.170	.180	.175	.170	.165	.160	.160	.175	.145	.160	.160	.135	.150	.125	.135	.135	.155	.140				
	PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.24	0.00	0.00	0.44	0.27	0.53	1.59	0.51	0.71	0.24	0.08	0.02	0.00	0.00	0.00	0.00				

* No monthly summary was computed for the ranges.

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)

PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2]Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	5	6	5	5	6	5	6	5	5	5	7	8	8	8	8	7	8	7	7	6	6	6	5	6	672	0	6	21
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	2	2	2	2	2	2	2	2	2	2	3	4	4	4	4	4	3	3	3	2	3	2	2	2	464	0	3	14
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	699	0	0	4
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

Chiva Chiva (Open site)	46.0 m	This level was not instrumented for wind speed at this time																											
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	4	3	4	3	3	3	3	4	5	5	6	7	7	7	6	7	7	5	5	4	4	4	3	3	743	0	5	27
	13.5 m	2	1	1	1	1	1	1	2	2	3	3	4	4	4	5	6	5	4	3	3	2	2	1	1	744	0	3	25
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	2	2	2	1	2	1	2	3	4	4	5	6	6	7	5	6	5	4	3	3	2	2	2	2	743	0	3	25
	2.0 m	1	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	3	2	1	1	1	1	0	0	744	0	1	19
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

AUGUST 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	9	10	12	8	15	10	10	11	11	8	12	15	15	17	15	17	21	11	15	13	16	14	9	13				
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	5	4	4	4	5	5	5	7	7	4	14	8	10	8	10	11	10	7	8	8	14	8	5	5				
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	0	0	3	2	3	2	4	4	2	3	0	1	1	0	0	0	1	1				
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	This level was not instrumented for wind speed at this time																											
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	10	12	13	13	7	9	9	10	9	13	13	16	14	13	9	12	26	12	11	12	8	6	10	11				
	13.5 m	9	6	7	8	5	4	7	7	7	12	10	12	12	14	8	12	24	12	9	10	6	5	4	6				
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	7	12	12	9	4	6	5	9	9	12	12	13	14	12	7	11	24	10	7	8	6	5	8	8				
	2.0 m	3	2	2	1	2	2	3	4	3	7	8	7	7	9	6	8	19	7	5	5	3	3	2	3				
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

ALBROOK (Forest site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.2		6.4	3.2	3.2	3.2	9.7		6.4	6.4	3.2	12.9	6.6	9.7	9.7	3.2				3.2	9.7	6.4		3.2
NNE				6.4	3.2	3.2	6.4	3.2	6.4	3.2		3.2	3.3				3.2			6.4		3.2		
NE	3.2	3.2		3.2	3.2	6.4	3.2	3.2	3.2	6.4				3.2			3.2	9.7	3.2					
ENE			3.2					3.2		3.2			3.3			3.2	3.2							3.2
E							3.2		3.2	3.2	3.2	3.2	6.6			3.2	3.2							
ESE								3.2		3.2		3.2	3.3				3.2	3.2						
SE					3.2			3.2	9.7	3.2	3.2					3.2		6.4	3.2					
SSE									3.2	3.2	6.4	9.7	3.3	3.2	6.4									
S										6.4	9.7	16.1	13.3	12.9	9.7	3.2				3.2				
SSW				3.2						3.2	9.7	3.2	6.6	3.2	6.4		3.2				3.2		3.2	
SW	3.2		9.7			3.2		9.7	3.2	16.1	9.7	12.9	13.3	12.9	6.4	19.4	3.2	9.7	6.4	9.7	3.2	3.2		3.2
WSW	9.7	3.2	3.2	3.2	9.7	3.2	3.2	12.9	12.9		16.1	9.7	10.0	16.1	9.7	9.7	6.4	19.4	9.7	3.2	3.2	9.7	9.7	22.6
W	22.6	25.8	22.6	38.7	22.6	29.0	9.7	22.6	22.6	22.6	19.4	6.4	10.0	12.9	25.8	29.0	22.6	29.0	25.8	25.8	22.6	22.6	22.6	25.8
WNW	32.2	41.9	32.2	19.4	22.6	16.1	25.8	9.7	9.7	6.4	3.2	6.4	16.6	6.4	9.7	12.9	16.1	6.4	25.8	22.6	25.8	12.9	29.0	12.9
NW	19.4	22.6	16.1	19.4	19.4	19.4	22.6	22.6	16.1	12.9	6.4	9.7		3.2	12.9	3.2	12.9	6.4	16.1	16.1	22.6	19.4	9.7	16.1
NNW		3.2	3.2	3.2	6.4	9.7	9.7	6.4	3.2		6.4			9.7		6.4	12.9	6.4	3.2			9.7	16.1	3.2
CALM	6.4		3.2		6.4	6.4	6.4				3.2	3.2	3.3	6.4	3.2	3.2	6.4	3.2	6.4	9.7	9.7	12.9	9.7	9.7

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45835

ALBROOK (Forest site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	6.4	3.2	9.7	9.7	3.2	9.7	6.4	12.9	3.2	9.7	9.7	9.7		6.4	6.4	9.7	12.9	9.7	19.4	3.2	6.4	6.4	9.7	3.2
NNE	3.2	3.2				3.2		3.2		3.2		3.2	3.3	12.9	3.2			3.2	3.2	6.4	3.2	9.7	3.2	
NE	3.2	6.4		6.4	3.2	6.4	3.2		6.4							3.2	3.2	3.2		6.4	3.2	3.2		3.2
ENE					3.2		3.2			3.2		3.2										3.2		
E								3.2	6.4	9.7	3.2	3.2	3.3	3.2					3.2				3.2	
ESE				3.2			3.2		3.2	3.2					3.2	6.4	3.2							
SE			6.4		3.2					6.4	3.2	3.2	6.6	3.2		3.2		3.2						
SSE											3.2	3.2	3.3	6.4	9.7		3.2	3.2						
S						3.2		3.2	3.2	6.4	16.1	25.8	23.3	9.7	3.2		6.4			3.2		3.2		
SSW					3.2	3.2		3.2		6.4			3.3	6.4										
SW					3.2	3.2	3.2	6.4	6.4		6.4	6.4	6.6	3.2	3.2		3.2	3.2					3.2	
WSW							3.2	3.2			6.4		3.3				3.2							3.2
W	12.9	6.4	6.4		9.7	3.2	6.4	9.7	9.7	3.2	6.4	3.2	3.3	9.7	22.6	12.9	12.9	12.9	3.2	6.4	6.4	9.7		6.4
WNW	3.2	19.4	6.4	16.1	9.7	6.4	9.7	3.2	6.4	6.4	9.7	9.7		3.2	9.7	19.4	6.4	16.1	9.7	12.9	6.4		3.2	19.4
NW	25.8	32.2	29.0	25.8	12.9	19.4	19.4	25.8	25.8	19.4	22.6	16.1	23.3	12.9	19.4	25.8	19.4	12.9	35.5	25.8	35.5	16.1	29.0	22.6
NNW	25.8	12.9	19.4	19.4	32.2	19.4	25.8	9.7	9.7	12.9	6.4	6.4	10.0	16.1	16.1	12.9	16.1	19.4	16.1	22.6	25.8	32.2	35.5	22.6
CALM	19.4	16.1	22.6	19.4	16.1	22.6	16.1	16.1	19.4	9.7	6.4	6.4	10.0	6.4	3.2	6.4	9.7	12.9	9.7	12.9	12.9	16.1	12.9	19.4

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

ALBROOK (Forest site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N											3.7	6.6	3.3		3.3	3.3								
NNE																								
NE															3.3	6.6								
ENE																3.3						3.3		
E															3.3									
ESE													3.3											
SE														3.3										
SSE																								
S													3.3											
SSW																								
SW																								
WSW											3.7			3.3				3.3						
W										7.3			3.3		3.3				3.3		3.3			
WNW														3.3				3.3						
NW									3.8		3.7			6.6	3.3		3.3			3.3				3.3
NNW													6.6					3.3	3.3				3.3	
CALM	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	95.8	92.3	88.9	93.0	79.7	83.0	83.0	86.4	96.3	89.7	93.0	96.3	96.3	96.3	96.3	96.3

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

CHIVA CHIVA (Open site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	16.1	9.7	6.4	25.8	12.9	16.1	12.9	9.7	25.8	6.4	6.4	12.9	12.9	6.4	12.9	16.1	19.4	25.8	16.1	6.4	29.0	22.6	19.4	22.6
NNE	9.7	9.7	12.9	16.1	6.4	12.9	12.9	3.2	9.7	9.7	3.2	3.2	9.7	6.4	6.4	3.2	3.2	3.2	12.9	12.9	3.2	6.4		
NE	3.2	6.4		3.2	3.2	3.2		6.4		3.2		3.2	6.4	3.2	6.4		6.4	3.2	6.4	3.2	12.9	9.7	9.7	3.2
ENE	3.2		3.2	3.2	3.2	3.2		3.2		6.4							3.2	3.2		6.4		3.2		
E			3.2								3.2				3.2	6.4			3.2					3.2
ESE					3.2		3.2		3.2		3.2	3.2				6.4	9.7	3.2		3.2	3.2	3.2		
SE						3.2					9.7	3.2	6.4	3.2				9.7		3.2				3.2
SSE										6.4		6.4	9.7	3.2										
S			3.2	6.4	6.4	6.4			9.7	9.7	9.7	6.4	6.4	6.4	16.1	9.7	3.2			3.2			3.2	
SSW							3.2	3.2			3.2	9.7	3.2	3.2	3.2									3.2
SW	3.2		6.4					3.2	3.2	3.2	3.2	3.2		6.4	3.2								6.4	3.2
WSW	3.2	6.4						6.4	3.2	3.2		3.2		9.7	3.2	9.7		3.2		9.7	6.4			
W	9.7	3.2	6.4	9.7	6.4	6.4	3.2	3.2	9.7	9.7	6.4	6.4	9.7		12.9	6.4	9.7	9.7	3.2	3.2	9.7	3.2	3.2	3.2
WNW	6.4	22.6	12.9	6.4	3.2	6.4	9.7	3.2	9.7	3.2	6.4	6.4	6.4	16.1		3.2	6.4	9.7	3.2	3.2	6.4	6.4	6.4	3.2
NW	16.1	9.7	12.9	19.4	22.6	25.8	22.6	38.7	12.9	12.0	22.6	19.4	16.1	19.4	12.9	25.8	12.9	19.4	25.8	19.4	6.4	22.6	9.7	35.5
NNW	25.8	19.4	29.0	6.4	19.4	9.7	22.6	16.1	12.9	25.8	19.4	12.9	12.9	16.1	19.4	12.9	25.8	9.7	29.0	25.8	22.6	22.6	32.2	9.7
CALM	3.2	12.9	3.2	3.2	12.9	6.4	9.7	3.2			3.2												9.7	9.7

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45555

CHIVA CHIVA (Open site) AUGUST 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.
(%)

Dir \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	12.9	10.0	6.4	19.4	6.4	6.4	6.4	9.7	6.4	12.9		12.9	6.4	3.2	9.7	6.4	19.4	9.7	22.6	12.9	16.1	29.0	6.4	6.4
NNE	3.2	3.3	6.4	6.4	3.2	6.4	3.2			3.2			3.2	3.2	3.2	3.2	6.4	3.2	3.2		3.2		9.7	3.2
NE	9.7	6.6		6.4	9.7	12.9	3.2			3.2			3.2					3.2	3.2	9.7	6.4	6.4		3.2
ENE			3.2		3.2		3.2	3.2		3.2	3.2		3.2	3.2	3.2	3.2	3.2			3.2		6.4	3.2	3.2
E		3.3	6.4	3.2							3.2		3.2			6.4		3.2		3.2		3.2		
ESE	3.2				3.2				3.2		3.2						6.4							
SE									3.2	3.2	6.4	3.2	6.4					3.2						
SSE			3.2						3.2	3.2	3.2	3.2		6.4	3.2						3.2			
S		3.2			3.2					6.4	3.2	12.9	12.9	6.4	16.1	9.7	3.2			6.4	3.2			6.4
SSW			9.7		3.2	6.4			3.2		3.2	6.4								3.2	3.2			
SW		3.3				3.2		9.7	12.9	3.2	6.4	12.9	12.9	22.6	9.7	3.2	3.2				6.4	6.4	6.4	
WSW		3.2	3.2		3.2			3.2	9.7	3.2	6.4	3.2		9.7	9.7	16.1	3.2	6.4	3.2	6.4	3.2		3.2	3.2
W	9.7	3.3	6.4	3.2			3.2	9.7	16.1	9.7	6.4	16.1	9.7	3.2	6.4	6.4	9.7	12.9	6.4	12.9	3.2	6.4	12.9	6.4
WNW	9.7	13.3		6.4	12.9		12.9	29.0	9.7	12.9	16.1	9.7	6.4	9.7	6.4	16.1	6.4	22.6	16.1	6.4	3.2	12.9	9.7	3.2
NW	16.1	6.6	19.4	9.7	9.7	9.7	22.6	12.9	3.2	12.9	19.4	9.7	12.9	19.4	19.4	16.1	35.5	16.1	35.5	22.6	35.5	16.1	12.9	19.4
NNW	22.6	10.0	12.9	6.4	19.4	16.1	12.9	16.1	25.8	22.6	19.4	9.7	19.4	12.9	12.9	12.9	3.2	19.4	9.7	12.9	12.9	12.9	12.9	16.1
CALM	12.9	33.2	22.6	38.7	22.6	38.7	32.2	6.4	3.2														22.6	29.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45885

SUMMARY OF NON HOURLY DATA

AUGUST 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index[1] (at 1.0 meters)	Index value	434	70.2	77.4	82.6
		Dry bulb temp.	434	69.5	78.3	87.1
		Wet bulb temp.	434	69.5	76.8	82.0
		Black bulb temp.	434	72.0	78.8	87.5
	Evaporation[3] (in. at 4 levels)	Piche (46.0 m)	31	0.079	7.353*	0.451
		Piche (26.5 m)	31	0.055	5.201*	0.317
		Piche (13.5 m)	29	0.012	2.156*	0.179
		Piche (0.5 m)	25	0.006	0.889*	0.073
	Precipitation from Raingauge Network[2] (in. at 1.0 meters)	Gauge # 1	20	0.01	6.31*	2.30
		Gauge # 2	20	0.02	6.58*	2.75
		Gauge # 3	20	0.02	7.13*	2.36
		Gauge # 4	20	0.01	6.88*	2.33
		Gauge # 5	20	0.01	5.02*	1.61
		Gauge # 6	20	0.02	5.64*	1.45
		Gauge # 7	21	0.02	5.43*	1.93
		Gauge # 8	20	0.01	5.48*	1.81
	Stem Flow[2] (in. at 2.0 meters)	Small tree	20	0.01	5.61*	1.13
		Medium tree	18	0.01	6.24*	3.04
		Large tree	9	0.01	40.57*	34.84
Chiva Chiva (Open site)	WBGT Index[1] (at 1.0 meters)	Index value	434	69.1	80.1	90.7
		Dry bulb temp.	434	69.2	81.0	94.1
		Wet bulb temp.	434	69.2	77.2	83.0
		Black bulb temp.	434	68.5	89.5	120.2
	Evaporation[3] (in. at 0.5 meters)	Piche	31	0.012	4.372*	0.305
		Pan	28	0.003	4.803*	0.939
	Minimum Grass temp[3] (^{o}F at grass tips)	None	28	68.2	70.9	74.0

1 - Hourly observations between 0600 and 1900 hours inclusive

2 - Six hourly observations

3 - Daily observations

*Total Values

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13. ABSTRACT

This report contains detailed microclimatic data for August 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.

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Microclimatology						
Tropic Environment						
Humid Tropics						
Panama Canal Zone Microclimatology						
Data Base						

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MONTHLY MICROCLIMATIC SUMMARY

SEPTEMBER 1967

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ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY
TROPIC TEST CENTER
Fort Clayton, Canal Zone

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ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

SEPTEMBER 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

USATECOM Project No. 9-4-0013-01

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TABLE OF CONTENTS

	Page
Introduction	1
Sites	1
Instrumentation	1
Data Reduction and Storage	2
Figures	
1. Location Map, Isthmus of Panama	3
2. Frequency of Observations	4
3. Albrook Forest Site, Generalized Plot	5
4. Chiva Chiva Open Site, Generalized Plot	6
5. Instrument Location on Towers	7
Data Summary Sheets	
Monthly Means of Air Temperature by Hour	8
Monthly Ranges of Air Temperature by Hour	9
Monthly Means of Relative Humidity by Hour	10
Monthly Ranges of Relative Humidity by Hour	11
Monthly Means of Other Elements by Hour	12
Monthly Means of Wet Bulb Temperature by Hour	
Monthly Means of Barometric Pressure by Hour	
Monthly Means of Precipitation by Hour	
Monthly Totals of Precipitation by Hour	
Monthly Ranges of Other Elements by Hour	13
Monthly Ranges of Wet Bulb Temperature by Hour	
Monthly Ranges of Barometric Pressure by Hour	
Monthly Ranges of Precipitation by Hour	
Monthly Means of Wind Speed by Hour	14
Monthly Ranges of Wind Speed by Hour	15
Relative Frequencies of Wind Directions (46 meters, Albrook)	16
Relative Frequencies of Wind Directions (26.5 meters, Albrook)	17
Relative Frequencies of Wind Directions (4 meters, Albrook)	18
Relative Frequencies of Wind Directions (26.5 meters, Chiva Chiva)	19
Relative Frequencies of Wind Directions (4 meters, Chiva Chiva)	20
Summary of Elements with Non-Hourly Frequencies of Observation	21
WBGT (Albrook)	
Evaporation (Albrook)	
Precipitation (Manual gauge network, Albrook)	
Precipitation (Stem Flow, Albrook)	
WBGT (Chiva Chiva)	
Evaporation (Chiva Chiva)	
Minimum Grass Temperature (Chiva Chiva)	

MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

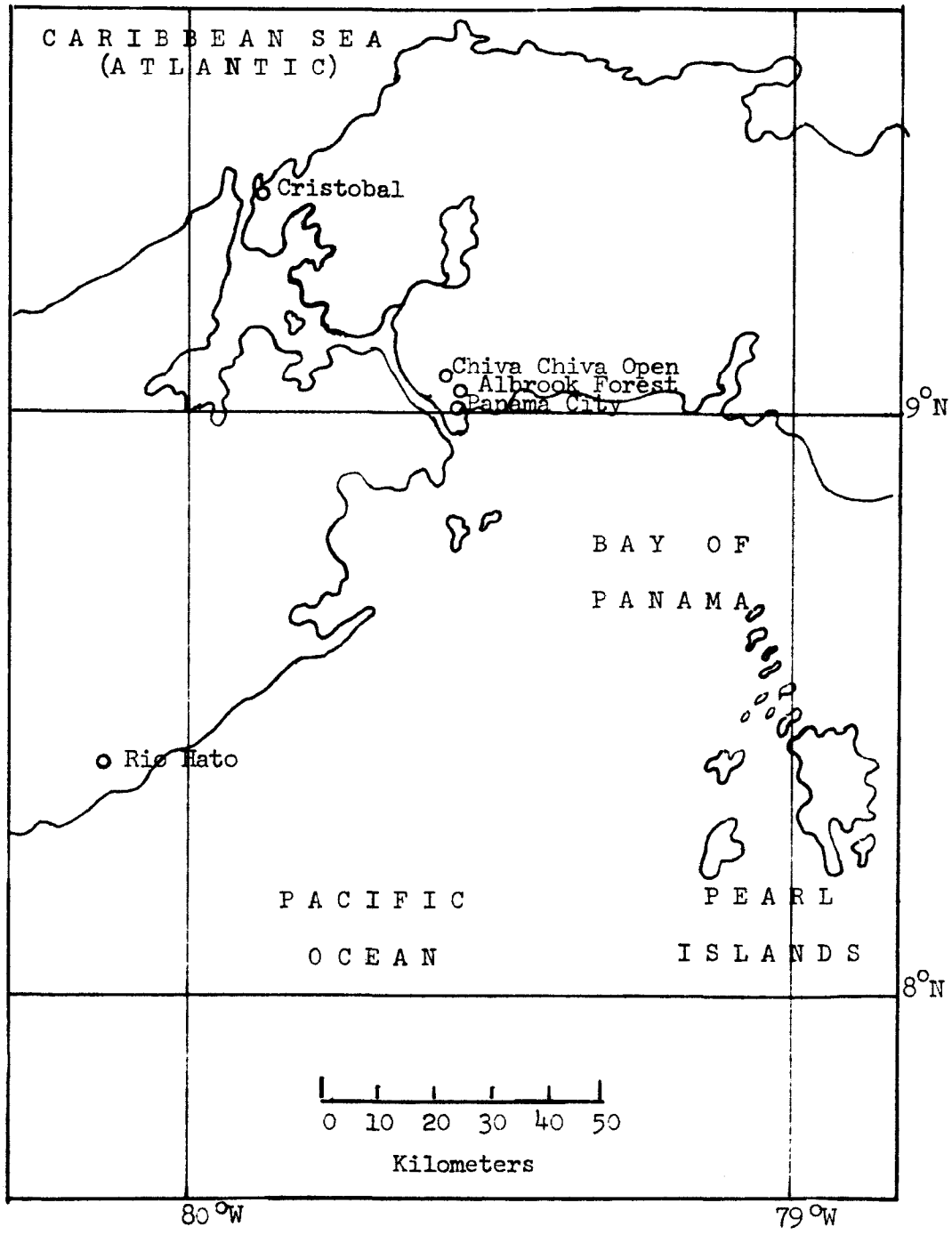

FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element:	Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0	Frequency
Temperature:											
Dry Bulb	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	1	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
Relative Humidity	-	1	3	1	1	-	1	1	-	1	Hourly*/Continuously
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	2	-	2	Once Daily
Precipitation:											
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	-	2	-	-	-	-	-	-	4 Times Daily
Wind:											
Direction	-	-	-	-	1	-	-	1	-	2	Continuously
Speed	-	-	-	3**	1	-	3**	1**	-	2	Hourly**/Continuously

1. Albrook and Chiva Chiva.
2. Albrook only.
3. Chiva Chiva only.

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly.

Instrument descriptions are contained in the Environmental Data Base semiannual reports.

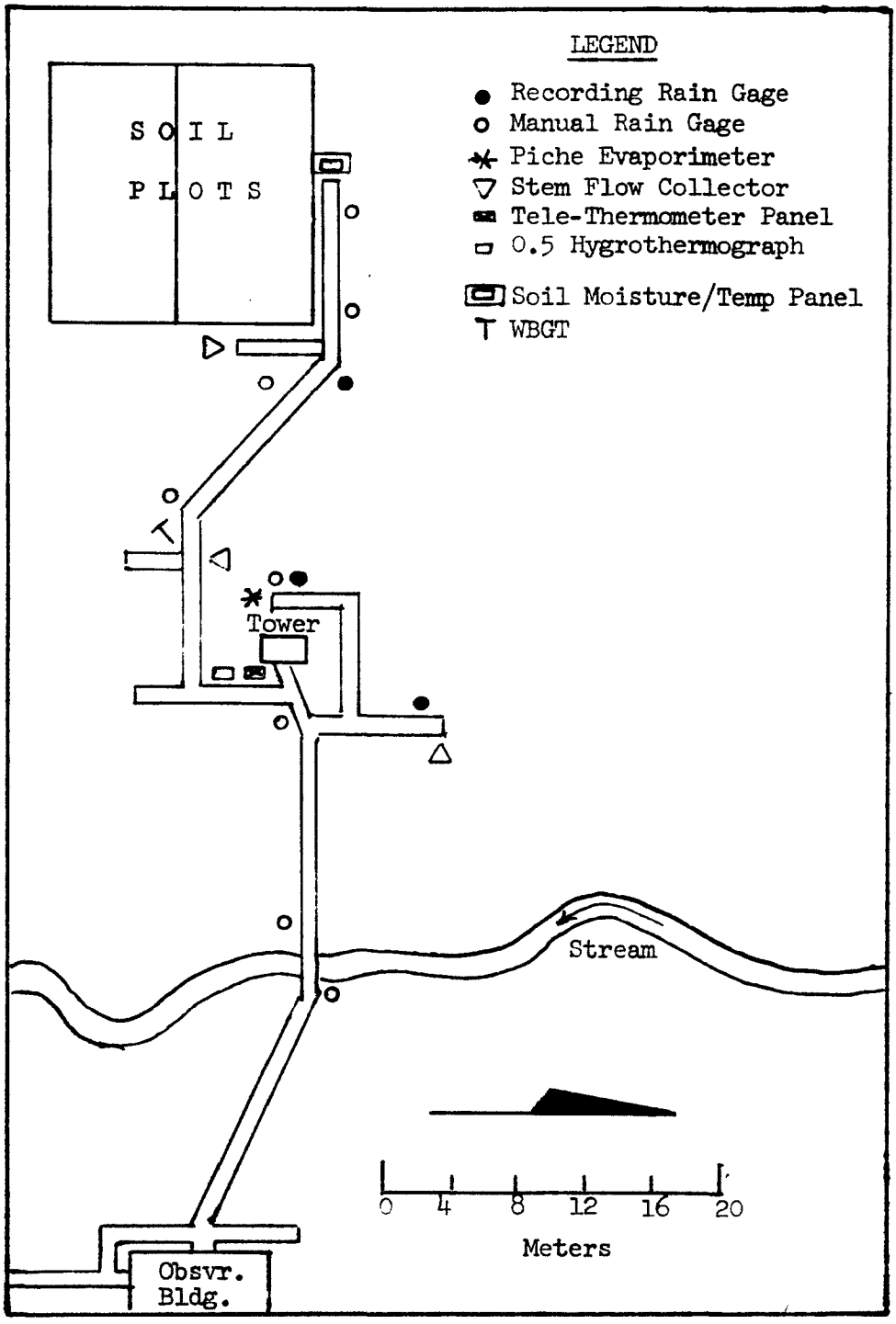

FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

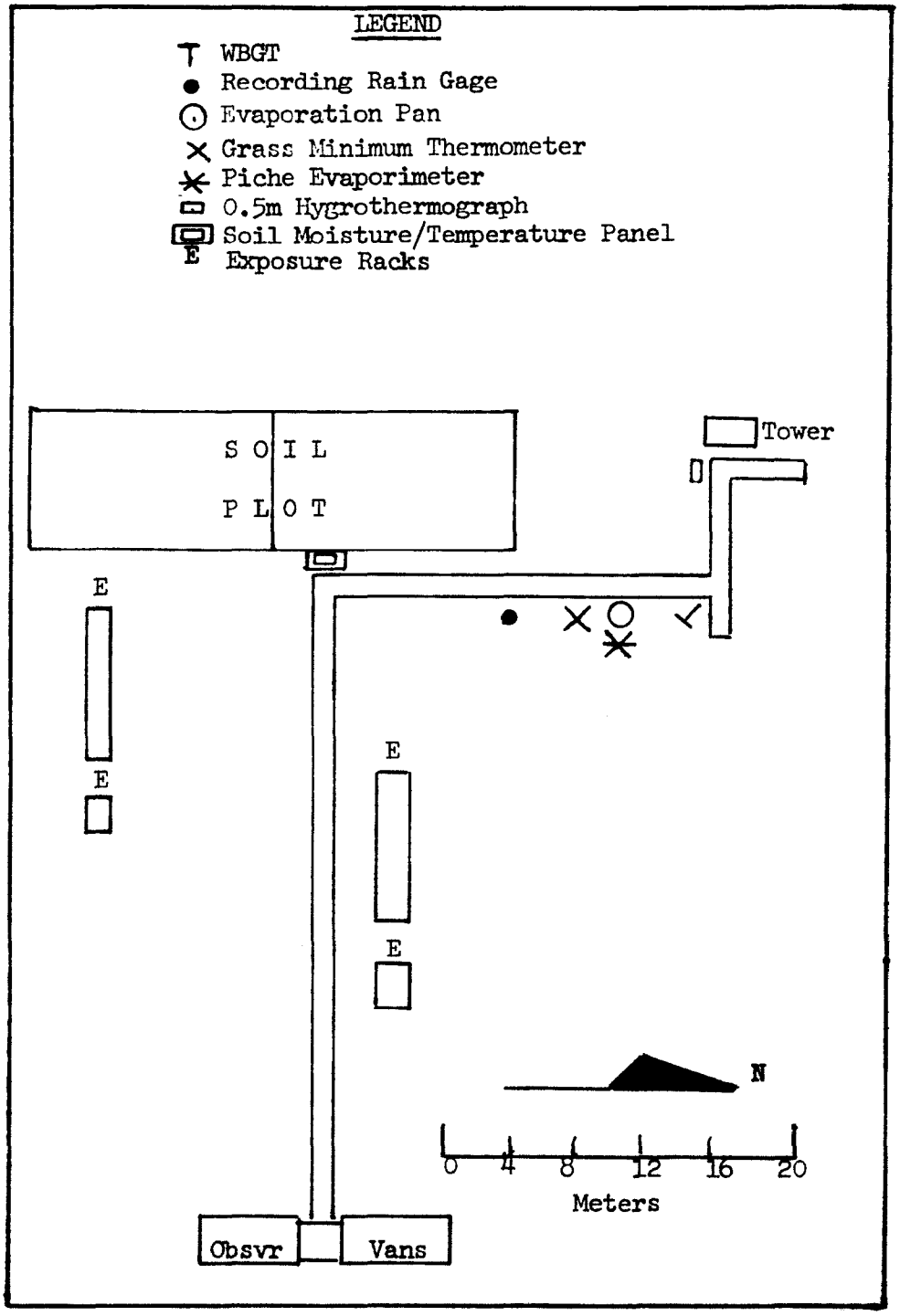

FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

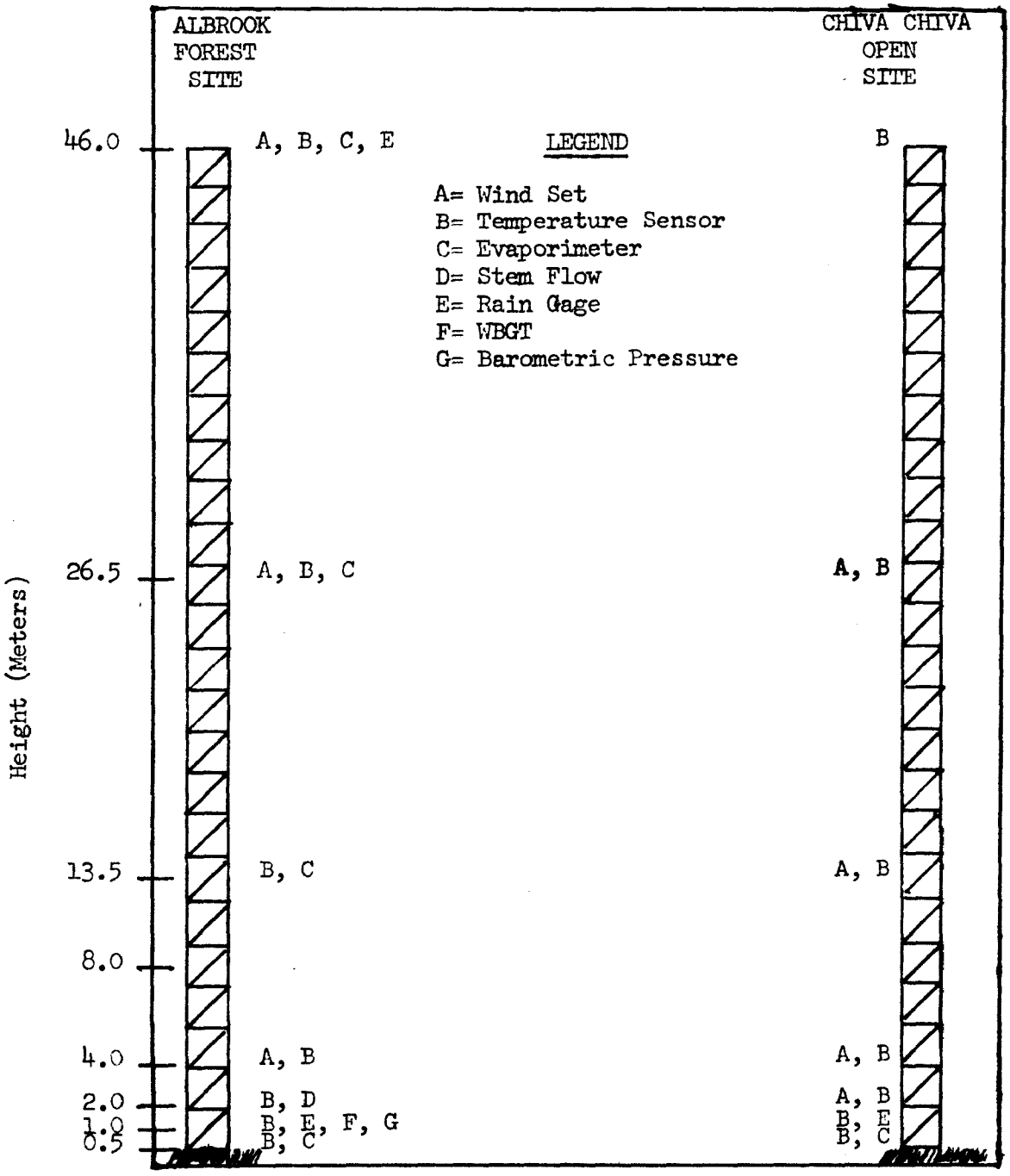

FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Means of Air Temperature by Hour (^{O}F)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	74.2	74.0	73.6	73.5	73.4	73.4	73.9	75.9	78.7	80.3	81.8	82.3	82.4	80.6	79.6	78.6	77.6	76.6	75.5	75.2	74.9	74.7	74.5	74.3	720	70.0	76.6	87.0
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	73.4	73.3	73.0	72.9	72.8	72.8	73.7	76.4	79.3	81.2	83.1	83.8	83.7	82.1	80.7	79.5	78.2	76.7	75.0	74.5	74.2	74.1	73.8	73.6	720	69.1	76.7	88.6
	13.5 m	73.7	73.5	73.4	73.2	73.0	73.1	73.5	75.3	77.5	79.2	81.0	82.1	82.4	81.4	79.9	78.8	78.1	77.1	75.9	75.3	75.0	74.6	74.3	74.0	713	70.0	76.5	88.0
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	73.6	73.4	73.3	73.0	72.7	72.9	73.6	75.6	77.6	78.9	80.1	81.0	80.9	79.3	78.7	78.0	77.1	76.1	75.3	75.0	74.8	74.5	74.2	73.8	594	69.5	76.1	84.9
	2.0 m	73.6	73.5	73.3	73.0	72.8	72.9	73.5	75.5	77.3	78.7	79.8	80.6	80.7	79.2	78.6	77.9	77.1	76.1	75.4	75.0	74.8	74.5	74.2	73.8	594	69.3	76.0	84.7
	1.0 m	73.7	73.5	73.4	73.0	72.9	72.9	73.5	75.3	77.0	78.3	79.5	80.3	80.4	79.1	78.4	78.0	77.1	76.2	75.6	75.1	74.9	74.7	74.3	74.0	594	69.0	76.0	84.8
	0.5 m	74.3	74.1	73.9	73.7	73.6	73.4	73.6	75.2	76.8	78.2	79.3	80.2	80.4	79.4	78.7	77.9	77.4	76.7	75.9	75.5	75.3	75.0	74.8	74.5	657	69.4	76.1	83.7

Chiva Chiva (Open site)	46.0 m	74.0	73.9	73.7	73.7	73.5	73.3	73.8	75.4	77.8	79.4	80.9	81.8	81.8	80.1	79.5	78.1	77.5	76.7	76.0	75.4	75.1	74.9	74.5	74.3	714	68.7	76.4	86.9
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	73.6	73.4	73.2	73.2	73.1	72.8	73.5	75.5	77.9	79.6	80.8	81.8	82.0	80.3	79.7	78.2	77.5	76.8	75.7	75.2	74.8	74.6	74.1	73.8	711	68.2	76.3	87.2
	13.5 m	73.3	73.0	72.8	72.9	72.8	72.4	73.5	75.6	78.0	79.8	81.2	82.0	81.9	80.2	79.7	78.4	77.4	76.6	75.5	75.0	74.7	74.2	73.8	73.5	712	67.5	76.2	87.7
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	73.5	73.3	73.0	72.9	73.0	72.8	75.0	78.5	80.3	82.4	83.8	84.1	84.1	82.1	81.3	79.7	78.6	77.3	75.7	75.2	74.9	74.5	74.2	73.8	681	68.1	77.0	90.1
	2.0 m	73.4	73.2	72.9	72.7	72.8	72.6	75.3	78.9	80.8	82.9	84.4	84.7	84.7	82.6	81.7	79.9	78.8	77.3	75.8	75.2	74.8	74.3	74.1	73.7	681	67.8	77.1	90.6
	1.0 m	73.3	73.0	72.7	72.5	72.4	72.3	75.0	78.7	81.5	83.8	85.1	85.4	85.5	83.2	81.5	79.8	78.8	77.2	75.6	75.2	74.8	74.3	73.9	73.5	714	67.0	77.4	91.2
	0.5 m	73.2	73.0	72.6	72.4	72.3	72.2	75.2	79.5	82.1	84.6	86.4	86.0	86.0	83.9	81.9	80.0	78.8	77.2	75.7	75.1	74.7	74.2	73.8	73.5	720	67.0	77.7	93.2

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																						Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	6.3	6.1	5.6	5.4	5.5	6.0	6.1	7.3	10.5	12.0	11.7	11.6	11.1	13.6	13.3	11.3	10.5	8.1	6.1	5.3	5.7	5.2	6.1	6.6				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	5.8	5.9	6.2	6.1	6.0	6.0	5.8	7.6	10.7	12.5	12.7	13.8	12.8	15.0	13.5	12.3	12.4	9.3	5.7	4.7	5.1	5.2	6.5	5.7				
	13.5 m	5.6	6.0	5.5	5.8	4.8	5.2	6.0	6.1	7.9	9.0	10.8	11.7	13.1	13.3	12.8	10.9	9.5	7.4	5.3	4.9	5.1	5.5	5.8	5.9				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	5.3	6.0	5.9	5.1	5.1	4.9	6.2	5.4	8.0	8.4	9.2	10.9	9.8	11.9	9.0	9.2	8.0	5.0	3.9	4.5	5.2	5.8	6.0	5.7				
	2.0 m	5.3	5.9	5.7	5.2	5.2	5.0	6.5	5.2	7.9	8.3	8.3	10.2	10.0	11.5	8.7	8.1	7.7	4.8	3.8	4.5	5.2	5.5	6.0	5.7				
	1.0 m	5.5	5.9	5.5	5.1	4.9	5.0	6.8	4.7	6.8	7.4	8.6	8.8	9.8	11.3	8.2	7.0	7.0	4.8	3.1	4.0	5.0	4.9	6.5	5.7				
	0.5 m	5.8	6.1	6.0	6.1	6.4	6.9	6.3	5.3	4.9	7.4	8.0	9.2	8.6	9.1	10.0	7.7	7.7	6.6	5.5	5.1	5.7	5.9	6.2	5.8				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	6.7	7.5	7.8	7.9	7.3	5.3	6.6	6.2	7.1	9.9	11.9	13.0	12.3	15.7	13.2	10.3	9.8	7.8	6.1	6.4	6.2	6.0	6.2	5.8				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	6.2	7.6	7.5	7.0	6.6	6.0	6.7	6.4	8.1	9.8	10.9	12.9	11.9	15.7	13.1	10.9	10.0	8.0	6.0	6.3	5.8	5.2	5.9	6.3				
	13.5 m	5.9	7.8	7.5	7.1	6.9	7.5	6.8	7.0	7.6	10.0	10.3	12.2	11.4	16.5	13.9	10.6	10.1	7.9	5.3	5.5	5.9	5.7	5.7	6.5				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	5.7	7.1	6.7	7.2	7.8	7.5	9.4	9.1	10.3	11.6	13.3	14.4	13.2	19.5	12.3	13.8	11.4	8.4	5.9	5.8	6.3	6.6	5.8	5.9				
	2.0 m	6.3	7.6	7.3	7.7	7.8	7.5	9.3	9.2	10.9	12.4	14.8	14.7	13.5	19.9	12.4	14.0	12.1	8.5	5.9	6.1	6.6	7.3	6.1	5.8				
	1.0 m	6.8	7.3	7.3	7.7	8.3	8.1	9.2	10.8	13.8	16.2	15.7	15.2	13.9	20.0	15.3	12.2	11.6	7.0	5.4	6.0	6.7	7.0	6.1	6.1				
	0.5 m	6.5	7.2	7.1	8.2	7.9	8.1	8.2	12.0	15.2	18.6	16.8	15.0	16.5	21.5	16.0	12.8	11.5	7.2	5.7	5.9	6.9	7.0	6.0	6.2				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	94	94	94	94	95	95	94	91	86	81	76	76	76	79	81	83	85	88	92	93	93	94	94	94	649	62	88	98
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	96	96	96	96	97	96	96	92	86	81	75	74	74	77	81	84	87	90	94	95	95	95	96	96	646	54	89	100
	13.5 m	97	97	97	97	98	97	97	96	91	87	81	79	77	80	84	86	89	91	94	95	95	96	97	97	642	56	91	100
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	98	98	98	98	99	98	98	97	93	89	87	84	84	88	90	92	93	96	97	97	97	98	98	98	594	68	94	100
	2.0 m	98	98	98	98	98	98	98	97	94	91	89	86	86	89	91	93	95	96	97	97	97	98	98	98	594	68	95	100
	1.0 m	98	98	98	98	98	98	98	98	96	94	91	89	88	91	93	94	95	97	97	97	98	98	98	98	594	68	96	100
	0.5 m	96	97	96	97	96	97	97	96	96	94	92	91	90	90	91	94	94	95	95	96	96	96	96	96	680	75	95	100
Chiva Chiva (Open site)	46.0 m	95	95	95	95	96	96	95	92	86	81	77	75	75	80	82	84	86	87	89	91	91	92	94	94	693	55	89	100
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	96	95	96	96	96	97	96	93	86	81	78	74	74	79	81	84	85	88	91	92	93	93	95	95	710	56	89	100
	13.5 m	97	97	97	97	97	97	96	92	86	81	76	74	74	78	81	83	86	89	92	93	94	94	96	96	712	56	89	100
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	97	97	97	97	97	97	94	87	83	78	75	72	74	79	80	83	86	90	94	94	95	96	97	97	682	57	90	100
	2.0 m	97	97	97	97	97	97	92	87	83	77	73	72	74	78	79	82	86	90	94	95	95	96	97	97	681	56	89	100
	1.0 m	This level was not instrumented for relative humidity at this time																											
	0.5 m	97	98	98	98	98	98	94	87	82	78	75	74	74	79	81	85	88	92	95	96	97	98	98	97	719	57	90	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	10	10	10	9	7	6	6	15	25	31	33	34	27	32	29	24	22	23	17	16	12	12	11	10				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	11	12	12	5	5	5	8	16	27	35	39	41	39	43	33	29	29	29	13	13	12	12	7	8				
	13.5 m	4	6	5	4	4	4	4	12	19	29	36	36	39	42	30	27	21	15	14	13	11	9	8	5				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	5	7	4	4	4	4	7	10	18	22	27	29	32	26	24	21	16	10	8	9	7	6	14	14				
	2.0 m	5	5	4	4	4	4	7	8	18	19	25	24	32	24	23	11	14	10	8	8	5	6	14	14				
	1.0 m	4	4	5	4	4	4	6	5	12	14	23	19	32	22	17	11	8	9	8	8	4	6	15	14				
	0.5 m	14	15	16	17	17	16	6	6	8	12	20	19	19	23	22	20	18	14	18	17	17	17	16	16				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	15	9	12	8	12	9	7	14	22	27	37	44	38	37	36	30	26	19	22	16	16	13	12	16				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	14	15	14	13	12	10	10	20	22	22	32	40	31	33	34	27	24	17	16	17	15	14	11	14				
	13.5 m	13	14	12	13	9	9	12	22	21	27	34	40	32	34	37	28	26	20	20	17	18	14	9	15				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	12	12	11	8	8	8	27	26	26	30	34	37	33	37	36	31	25	19	17	15	13	10	8	8				
	2.0 m	8	12	10	8	5	4	31	23	27	35	37	36	30	35	35	29	25	19	16	14	12	6	6	7				
	1.0 m	This level was not instrumented for relative humidity at this time																											
	0.5 m	8	10	10	14	8	11	15	35	42	32	36	32	37	39	36	28	25	19	16	12	12	7	8	8				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Means[2] of other Elements by Hour																							Monthly Summary			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	73.1	72.9	72.7	72.5	72.3	72.4	73.2	75.0	75.9	76.5	77.0	77.0	77.0	76.5	76.3	76.0	75.6	75.1	74.6	74.2	74.2	73.9	73.6	73.3	717	68.0	74.6	80.0
	WB (2.0 m)	73.1	73.0	72.7	72.5	72.3	72.5	73.1	74.9	76.1	76.8	77.1	77.3	77.3	76.7	76.5	76.2	75.8	75.2	74.7	74.3	74.2	74.0	73.7	73.4	717	68.0	74.7	80.0
	WB (0.5 m)	73.6	73.4	73.2	73.0	72.9	72.8	72.9	74.4	76.0	76.8	77.5	78.2	78.3	77.3	76.8	76.5	76.2	75.7	75.0	74.7	74.5	74.3	74.1	73.9	711	68.7	75.1	80.9
	BP	.766	.752	.741	.735	.738	.746	.766	.787	.801	.806	.801	.782	.754	.729	.715	.708	.705	.717	.732	.747	.767	.780	.784	.778	720	.620	.756	.875
	P1	0.20	0.13	0.18	0.10	0.01	0.01	0.39	0.15	0.02	0.06	0.12	0.08	0.03	0.57	0.33	0.23	0.15	0.07	0.18	0.37	0.51	0.20	0.11	0.05	70	0.01	15.23	2.55
	P2	0.14	0.04	0.08	0.14	0.01	0.00	0.23	0.07	0.01	0.05	0.07	0.03	0.05	0.52	0.15	0.11	0.04	0.13	0.20	0.31	0.47	0.20	0.04	0.04	57	0.01	9.29	2.20
	P3	0.07	0.11	0.05	0.02	0.01	0.00	0.36	0.12	0.02	0.06	0.10	0.07	0.09	0.75	0.36	0.16	0.02	0.10	0.04	0.26	1.26	0.21	0.06	0.04	63	0.01	12.62	2.50
	P4	0.27	0.12	0.13	0.01	0.00	0.01	0.24	0.10	0.02	0.02	0.07	0.07	0.01	0.79	0.42	0.17	0.07	0.19	0.03	0.43	1.13	0.70	0.13	0.07	57	0.01	12.83	2.80
Chiva Chiva (Open site)	WB (4.0 m)	73.0	72.8	72.6	72.4	72.5	72.3	73.7	75.8	76.5	77.0	77.4	77.3	77 6	76.9	76.5	75.6	75.4	75.1	74.5	74.1	73.9	73.6	73.6	73.2	705	67.8	74.7	80.5
	WB (2.0 m)	72.8	72.6	72.3	72.1	72.2	72.0	73.6	76.0	76.8	77.3	77.6	77.7	78.0	77.0	76.8	75.7	75.5	75.1	74.5	74.1	73.9	73.5	73.4	73.0	704	67.2	74.7	81.2
	WB (0.5 m)	72.7	72.6	72.3	72.1	72.0	71.9	74.0	76.4	77.4	78.7	79.5	78.9	79.0	78.2	77.2	76.3	75.9	75.5	74.7	74.2	74.0	73.7	73.4	72.9	719	67.0	75.1	85.0
	BP	.855	.840	.831	.829	.836	.845	.863	.882	.898	.903	.899	.878	.845	.827	.813	.804	.800	.811	.827	.841	.860	.875	.878	.871	720	.720	.850	.980
	PS	0.01	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.09	0.09	0.18	0.06	0.08	0.36	0.03	0.07	0.07	0.13	0.26	0.03	0.02	0.00	0.00	0.01	47	0.01	4.72	0.90

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)

PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2] Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Ranges[2] of other Elements by Hour																							Monthly Summary*			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	WB (4.0 m)	5.6	6.2	6.7	6.3	6.7	7.0	6.1	4.3	5.1	4.9	5.4	5.1	4.6	7.0	7.0	7.0	6.2	5.2	4.2	3.9	6.0	5.4	5.1	5.4				
	WB (2.0 m)	5.7	6.2	6.4	6.0	6.5	7.0	6.0	4.4	4.7	5.2	5.4	5.8	4.7	7.0	6.9	6.8	6.0	5.3	4.1	4.0	5.6	5.2	5.0	5.4				
	WB (0.5 m)	5.2	5.4	6.2	6.5	6.5	6.8	6.6	5.1	4.6	5.5	6.3	6.6	6.8	6.5	7.0	6.8	5.9	5.6	4.6	4.4	5.2	5.2	5.9	5.2				
	BP	.110	.115	.115	.120	.125	.120	.120	.105	.120	.115	.130	.120	.130	.115	.130	.140	.150	.145	.145	.130	.120	.115	.115	.120				
	P1	0.00	0.00	0.26	0.18	0.00	0.00	0.17	0.14	0.02	0.09	0.19	0.06	0.03	2.54	0.84	0.46	0.26	0.26	0.97	1.74	1.97	0.56	0.00	0.07				
	P2	0.00	0.05	0.21	0.00	0.00	0.00	0.05	0.02	0.00	0.08	0.12	0.03	0.03	2.19	0.52	0.37	0.02	0.29	0.36	1.19	1.39	0.00	0.00	0.00				
	P3	0.00	0.18	0.13	0.00	0.00	0.00	0.32	0.20	0.01	0.00	0.24	0.00	0.15	2.49	0.82	0.39	0.04	0.41	0.11	0.99	2.49	0.59	0.00	0.00				
	P4	0.00	0.03	0.15	0.00	0.00	0.00	0.37	0.02	0.03	0.00	0.24	0.06	0.00	2.79	1.04	0.54	0.20	0.43	0.03	1.24	2.24	0.00	0.00	0.00				
Chiva Chiva (Open site)	WB (4.0 m)	5.3	5.8	5.9	5.6	6.8	7.0	6.6	4.5	6.2	4.7	5.5	7.9	7.1	9.3	7.0	7.2	6.8	4.8	4.4	4.4	4.7	5.6	5.5	5.0				
	WB (2.0 m)	6.0	7.0	6.6	6.5	7.5	7.5	6.7	5.0	6.7	5.2	5.6	8.5	7.0	10.0	7.0	7.5	6.5	5.0	4.5	5.0	5.0	6.0	5.8	5.4				
	WB (0.5 m)	5.9	6.6	6.2	6.8	7.5	7.7	6.5	6.4	7.2	8.4	8.7	10.8	7.3	11.0	9.9	7.7	7.0	4.7	5.4	5.2	5.1	5.5	5.7	5.3				
	BP	.135	.105	.125	.120	.120	.115	.110	.125	.125	.110	.140	.130	.115	.135	.125	.135	.135	.140	.120	.120	.125	.120	.115	.125				
	PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.08	0.13	0.84	0.05	0.14	0.15	0.49	0.74	0.01	0.00	0.00	0.00	0.00				

* No monthly summary was computed for the ranges.

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2] Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	2	3	4	3	3	3	2	4	4	4	5	6	6	6	6	5	5	4	4	4	4	4	3	3	485	0	4	15
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	1	1	1	1	1	1	1	2	2	2	3	4	4	4	4	3	3	2	1	2	2	1	1	1	700	0	2	8
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	712	0	0	1
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											
Chiva Chiva (Open site)	46.0 m	This level was not instrumented for wind speed at this time																											
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	2	2	3	3	3	3	2	4	5	5	5	6	8	7	6	6	5	4	3	3	3	3	3	2	551	0	4	18
	13.5 m	0	0	1	0	0	0	1	1	2	2	3	3	4	3	4	4	2	2	1	1	1	1	1	0	719	0	2	10
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	1	1	1	1	2	1	0	2	3	3	4	4	4	3	4	4	2	1	1	1	2	1	1	1	190	0	2	10
	2.0 m	0	0	0	0	0	0	0	0	0	1	1	1	2	2	2	2	1	1	1	1	1	1	0	0	584	0	1	8
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	5	9	8	7	8	6	5	9	10	9	9	13	13	10	11	11	10	9	10	14	9	9	8	10				
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	5	5	3	3	3	3	4	5	6	6	4	5	7	7	6	6	5	6	4	8	7	5	3	5				
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0				
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											
Chiva Chiva (Open site)	46.0 m	This level was not instrumented for wind speed at this time																											
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	4	7	8	8	7	6	6	9	12	8	10	10	18	13	9	12	7	7	6	7	8	7	7	5				
	13.5 m	2	6	7	5	3	2	4	6	10	6	7	10	9	10	10	10	7	6	4	5	6	6	6	4				
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	2	3	3	3	4	3	1	5	8	6	7	8	6	7	7	8	5	4	5	4	4	2	3	3				
	2.0 m	0	3	4	3	1	1	2	2	2	3	2	3	7	8	5	6	4	3	3	3	4	3	4	1				
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

* No monthly summary was computed for the ranges.

ALBROOK (Forest site) SEPTEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N				3.3	3.3		3.3		3.3	6.7				3.3		10.0	3.3		3.3	3.3	6.7	3.3	3.3	
NNE	3.3	6.7	3.3			10.0	3.3						3.4	3.3	3.3			3.3	3.3	3.3				
NE	3.3		3.3	3.3	13.3						6.7	3.3				3.3		3.3	6.7		3.3	3.3	10.0	6.7
ENE			6.7	6.7	3.3		10.0	3.3	3.3		3.3			3.3	3.3					3.3				
E		3.3	3.3	6.7		13.3	3.3	3.3							3.3								3.3	3.3
ESE	3.3								3.3		3.3	6.7		3.3										
SE	10.0		6.7	6.7	3.3			13.3	6.7	6.7	10.0	10.0		3.3		3.3		3.3		3.3		3.3		
SSE		3.3					3.3		6.7	6.7		6.7	13.7	3.3	13.3		3.3	6.7						
S	6.7	13.3	10.0	3.3	10.0	6.7	6.7	6.7	23.3	30.0	30.0	56.7	51.5	43.3	36.7	33.3	26.7	13.3	10.0	10.0	13.3	10.0	6.7	6.7
SSW		3.3	3.3		3.3		6.7	6.7	6.7	6.7	10.0		6.9	6.7		3.3	6.7	10.0				3.3	6.7	
SW	3.3	3.3		6.7		10.0		6.7	6.7	10.0		3.3	6.9		3.3	13.3	3.3	10.0	10.0	10.0	20.0	10.0		6.7
WSW	10.0	6.7	3.3		6.7	10.0	3.3	16.7	3.3	10.0	10.0	3.3	6.9	3.3		10.0	10.0	13.3	3.3	3.3	6.7		10.0	10.0
W	10.0	20.0	23.3	13.3	3.3		10.0	6.7	6.7	10.0	16.7		3.4	13.3	6.7	10.0	10.0	10.0	26.7	10.0	13.3	16.7	20.0	13.3
WNW	13.3	10.0	10.0	16.7	16.7	16.7	13.3	16.7	10.0	6.7	3.3		3.4	3.3	16.7		20.0	6.7	3.3	20.0	10.0	10.0	10.0	13.3
NW	10.0	13.3	6.7	3.3	20.0	10.0	6.7	6.7	13.3	3.3		10.0		6.7	6.7	3.3	6.7		6.7	6.7	6.7	13.3	6.7	10.0
NNW	3.3	3.3	6.7	3.3			3.3		3.3		3.3					3.3		3.3		6.7	3.3	10.0		
CALM	23.3	13.3	13.3	26.7	16.7	23.3	26.7	13.3	3.3	3.3	3.3		3.4	3.3	6.7	6.7	10.0	16.7	26.7	20.0	16.7	16.7	23.3	30.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

ALBROOK (Forest site) SEPTEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.

(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		10.3	6.9		6.9	3.4	10.3			10.0	6.7			10.0	10.0	6.9				6.7	6.7	6.9	3.4	
NNE	3.4	6.9	3.4	3.4															3.3	3.3	3.3	6.9		
NE							3.4		6.9	3.3	6.7	3.3			6.7								3.4	
ENE									3.4		3.3													3.4
E			3.4	6.9				3.4			3.3			3.3	3.3		3.3							
ESE										10.0		3.3			3.3	3.4								
SE	3.4		3.4		3.4		3.4	3.4	6.9		6.7	3.3	6.9	10.0	3.3	6.9		3.3	3.3			3.4		
SSE				3.4					3.4	3.3	10.0	10.0	24.0	3.3	3.3	3.4	10.0							
S	3.4	3.4	6.9		3.4	3.4	10.3	10.3	20.6	26.7	23.3	50.0	44.6	40.0	26.7	24.0	16.7	20.0	3.3	6.7		3.4	3.4	
SSW					3.4					3.3	6.7	3.3		3.3	6.7	6.9	3.3	3.3				3.4		
SW								24.0		3.3	6.7	6.7			6.7	3.4	6.7			3.3	3.3		3.4	
WSW					3.4				6.9	3.3		3.3			3.3	3.4		6.7			3.3	3.4		
W			3.4		3.4	3.4		3.4	6.9	6.7	3.3			6.7	3.3	3.4	3.3	10.0	6.7	6.7	3.3		6.9	3.4
WNW	10.3	3.4		10.3		10.3	10.3	13.7	3.4	3.3	6.7	6.7	13.7	6.7		3.4	3.3	6.7	10.0	6.7	6.7	10.3		6.9
NW	3.4	17.2	10.3	10.3	20.6	13.7	10.3	3.4	6.9	13.3	16.7			10.0	16.7	13.7	26.7	20.0	30.0	16.7	20.0	17.2	13.7	10.3
NNW	10.3	3.4	13.7	13.7	6.9	17.2	6.9	17.2	17.2	3.3		10.0	6.9	3.3	3.3	13.7	20.0	10.0	3.3	10.0	10.0	10.3	13.7	13.7
CALM	65.2	54.9	48.1	51.5	48.1	48.1	44.6	20.6	17.2	10.0			3.4	3.3	3.3	6.9	6.7	20.0	40.0	40.0	43.3	34.3	51.5	61.9

IMPRESORA, S. A. 48835

* Note: Due to rounding, percentage totals do not equal 100%.

ALBROOK (Forest site) SEPTEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

(%)

Dir \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N														3.3										
NNE																								
NE																								
ENE													6.7											
E																								
ESE								3.3																
SE																								
SSE																								
S																								
SSW									3.3			3.3												
SW							3.3																	
WSW																								
W										3.3														
WNW												3.3	3.3											
NW																								
NNW										3.3	3.3													
CALM	100.0	100.0	100.0	100.0	100.0	100.0	96.7	96.7	96.7	93.3	96.7	96.3	90.0	96.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA. S. A. 45895

CHIVA CHIVA (Open site) SEPTEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Dir \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	14.8	3.7	14.8	7.4	25.9	7.4	14.8	14.8	22.2	22.2	11.1	7.4	3.7	14.8	7.2	14.2	7.2	7.2	7.4	18.5	18.5	14.8	25.9	3.7
NNE		14.8	11.1	3.7	7.4	7.4	3.7	7.4	11.1			3.7	3.7		10.7	3.5	14.2	3.5	11.1	11.1		14.8	7.4	
NE	3.7	3.7	3.7	7.4		7.4	7.4			7.4	7.4	3.7		3.7		7.2	7.2	3.5	3.7		3.7	3.7	3.7	3.7
ENE		3.7		3.7		7.4			3.7						3.5				3.7	7.4		3.7	7.4	
E		3.7	7.4		3.7		3.7		3.7		3.7		3.7	3.7				3.5		3.7	11.1	3.7		
ESE	3.7		7.4	11.1	7.4		3.7	3.7					3.7		7.2		3.5			3.7	3.7	3.7		11.1
SE			3.7		3.7			11.1	7.4	11.1	3.7	7.4		7.4	7.2	3.5	7.2	3.5		3.7	7.4			
SSE		7.4		3.7		3.7			3.7	3.7	11.1	3.7		7.4	7.2	7.2	3.5	7.2	7.4	3.7		3.7	3.7	3.7
S	7.4	7.4	7.4			7.4	11.1	14.8	33.3	37.0	37.0	44.4	59.2	48.1	24.9	24.9	17.9	17.9	22.2	7.4				
SSW								3.7				3.7	3.7			7.2	7.2			3.7	3.7			
SW					3.7	3.7										7.2		7.2	3.7			3.7	3.7	3.7
WSW		7.4		18.5	3.7	7.4		3.7						3.7					3.7	3.7	3.7	3.7	3.7	3.7
W	7.4	3.7			7.4	7.4	3.7	11.1			7.4	3.7			3.5			10.7			7.4	3.7	7.4	7.4
WNW	25.9	7.4	14.8	14.8	14.8	11.1			3.7		3.7	11.1	7.4		14.2	7.2	17.9		7.4	7.4			7.4	11.1
NW	18.5	11.1	18.5	11.1	11.1	18.5	11.1	14.8	3.7	7.4	7.4		7.4	3.7	14.2	7.2	10.7	28.6	18.5	11.1	29.6	29.6	14.8	25.9
NNW	7.4	11.1	3.7	7.4		7.4		3.7		7.4		7.4	3.7	7.4		10.7	3.5	7.2	11.1	14.8	7.4	3.7	7.4	18.5
CALM	11.1	14.8	7.4	11.1	11.1	3.7	40.7	11.1	7.4	3.7	7.4	3.7	3.7								3.7	7.4	7.4	7.4

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45888

CHIVA CHIVA (Open site) SEPTEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		13.3	3.3	10.0	6.7	10.0	10.0	3.3	10.3	6.9	3.4	10.3	10.3	3.4	13.3	13.3	3.3	3.3	13.3	10.0		10.0	6.7	10.0
NNE	3.3		10.0	13.3	6.7	6.7							3.4	3.4	3.3	6.7	10.0			10.0	6.7	3.3	3.3	6.7
NE	20.0	6.7	13.3	13.3	6.7	6.7	3.3	3.3	3.4				3.4	3.4				3.3	6.7	16.7	10.0	13.3	3.3	13.3
ENE	6.7	10.0	10.0	3.3		6.7		6.7					3.4		3.3	3.3	3.3	3.3	3.3	6.7	3.3		10.0	6.7
E	6.7	6.7		3.3	3.3			3.3	10.3	10.3	13.7			6.9	3.3			3.3			3.3	3.3	6.7	3.3
ESE				3.3	6.7			3.3	3.4	6.9		6.9			3.3		6.7		6.7	6.7	6.7	3.3		3.3
SE	3.3	3.3	6.7			6.7			6.9		13.7	10.3	3.4	13.7	10.0	6.7	13.3	6.7				3.3	3.3	
SSE	3.3	3.3	3.3		3.3	3.3			3.4	6.9	3.4			3.4	13.3	16.7	3.3	10.0	10.0		3.3			
S		6.7		6.7	3.3	3.3	13.3	16.7	24.0	41.2	27.5	41.2	54.9	44.6	16.7	20.0	13.3	6.7	10.0	6.7	3.3		10.0	
SSW								3.3				3.4				3.3		6.7						3.3
SW	3.3	6.7			6.7	3.3					3.4				3.3		3.3				6.7	6.7	10.0	10.0
WSW			3.3	3.3		10.0	3.3	6.7	3.4			3.4	3.4		6.7	6.7	6.7	6.7	6.7	3.3	3.3		3.3	6.7
W	10.0	6.7	3.3		6.7	6.7	13.3			3.4		3.4	10.3	6.9	13.3	3.3	3.3	10.0	6.7	6.7	10.0	13.3		10.0
WNW	13.3	6.7		6.7	6.7	10.0		6.7	3.4	3.4	6.9	10.3		3.4	3.3	16.7	13.3	16.7	10.0	6.7	10.0	13.3	13.3	3.3
NW	16.7	6.7	26.7	13.3	10.0	10.0	6.7	20.0	13.7	10.3	10.3	6.9	3.4	10.3	6.7		6.7	16.7	13.3	10.0	23.3	16.7	16.7	16.7
NNW	6.7	16.7	10.0	13.3	10.0	10.0	3.3	10.0	6.9		10.3					3.3	6.7		6.7	10.0		3.3	6.7	3.3
CALM	6.7	6.7	10.0	10.0	13.3	6.7	46.7	16.7	10.3	10.3	6.9	3.4	3.4				6.7	6.7	6.7	6.7	10.0	10.0	6.7	3.3

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45893

SUMMARY OF NON HOURLY DATA

SEPTEMBER 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index[1] (at 1.0 meters)	Index value	419	68.2	76.7	81.5
		Dry bulb temp.	419	68.0	77.5	86.2
		Wet bulb temp.	419	68.0	76.2	80.8
		Black bulb temp.	419	68.8	78.0	88.2
	Evaporation[3] (in. at 4 levels)	Piche (46.0)	30	0.024	5.573*	0.360
		Piche (26.5)	29	0.024	3.879*	0.244
		Piche (13.5)	28	0.006	1.177*	0.104
		Piche (0.5)	23	0.006	0.611*	0.104
	Precipitation from Raingauge Network[2] (in. at 1.0 meters)	Gauge # 1	31	0.01	12.62*	3.15
		Gauge # 2	31	0.01	17.98*	4.72
		Gauge # 3	31	0.01	16.88*	3.95
		Gauge # 4	31	0.01	14.49*	3.87
		Gauge # 5	30	0.01	13.79*	3.25
		Gauge # 6	33	0.01	14.00*	3.48
		Gauge # 7	33	0.01	12.75*	3.15
		Gauge # 8	29	0.01	14.14*	3.51
	Stem Flow[2] (in. at 2.0 meters)	Small tree	24	0.01	5.07*	0.99
		Medium tree	25	0.01	4.75*	0.93
		Large tree	21	0.01	33.54*	11.00
Chiva Chiva (Open site)	WBGT Index[1] (at 1.0 meters)	Index value	420	66.9	79.8	90.9
		Dry bulb temp.	420	67.0	80.3	99.0
		Wet bulb temp.	420	67.0	76.9	86.5
		Black bulb temp.	420	66.5	90.0	120.6
	Evaporation[3] (in. at 0.5 meters)	Piche	26	0.012	3.525*	0.281
		Pan	20	0.046	4.471*	1.893
	Minimum Grass temp[3] (°F at grass tips)	None	28	62.5	69.8	78.0

1 - Hourly observations between 0600 and 1900 hours inclusive

2 - Six hourly observations

3 - Daily observations

*Total Values

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13. ABSTRACT

This report contains detailed microclimatic data for September 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.

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MONTHLY MICROCLIMATIC SUMMARY

OCTOBER 1967

ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY
TROPIC TEST CENTER
Fort Clayton, Canal Zone

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ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

OCTOBER 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

USATECOM Project No. 9-4-0013-01

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TABLE OF CONTENTS

PAGE

Introduction 1
Sites 1
Instrumentation 1
Data Reduction and Storage 2

Figures
1. Location Map, Isthmus of Panama 3
2. Frequency of Observations 4
3. Albrook Forest Site, Generalized Plot 5
4. Chiva Chiva Open Site, Generalized Plot 6
5. Instrumen Location on Towers 7

Data Summary Sheets
Monthly Means of Air Temperature by Hour 8
Monthly Ranges of Air Temperature by Hour 9
Monthly Means of Relative Humidity by Hour 10
Monthly Ranges of Relative Humidity by Hour 11
Monthly Means of Other Elements by Hour 12
Monthly Means of Wet Bulb Temperature by Hour
Monthly Means of Barometric Pressure by Hour
Monthly Means of Precipitation by Hour
Monthly Totals of Precipitation by Hour
Monthly Ranges of Other Elements by Hour 13
Monthly Ranges of Wet Bulb Temperature by Hour
Monthly Ranges of Barometric Pressure by Hour
Monthly Ranges of Precipitation by Hour
Monthly Means of Wind Speed by Hour. 14
Monthly Ranges of Wind Speed by Hour 15
Relative Frequencies of Wind Directions (46 meters, Albrook) 16
Relative Frequencies of Wind Directions (39 meters, Albrook) 17
Relative Frequencies of Wind Directions (26.5 meters, Albrook) . . . 18
Relative Frequencies of Wind Directions (4 meters, Albrook) 19
Relative Frequencies of Wind Directions (26.5 meters, Chiva Chiva) 20
Relative Frequencies of Wind Directions (4 meters, Chiva Chiva). . . 21
Summary of Elements with Non-Hourly Frequencies of Observation . . . 22
Evaporation (Albrook)
Precipitation (Manual gauge network, Albrook)
Evaporation (Chiva Chiva)
Minimum Grass Temperature (Chiva Chiva)

MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

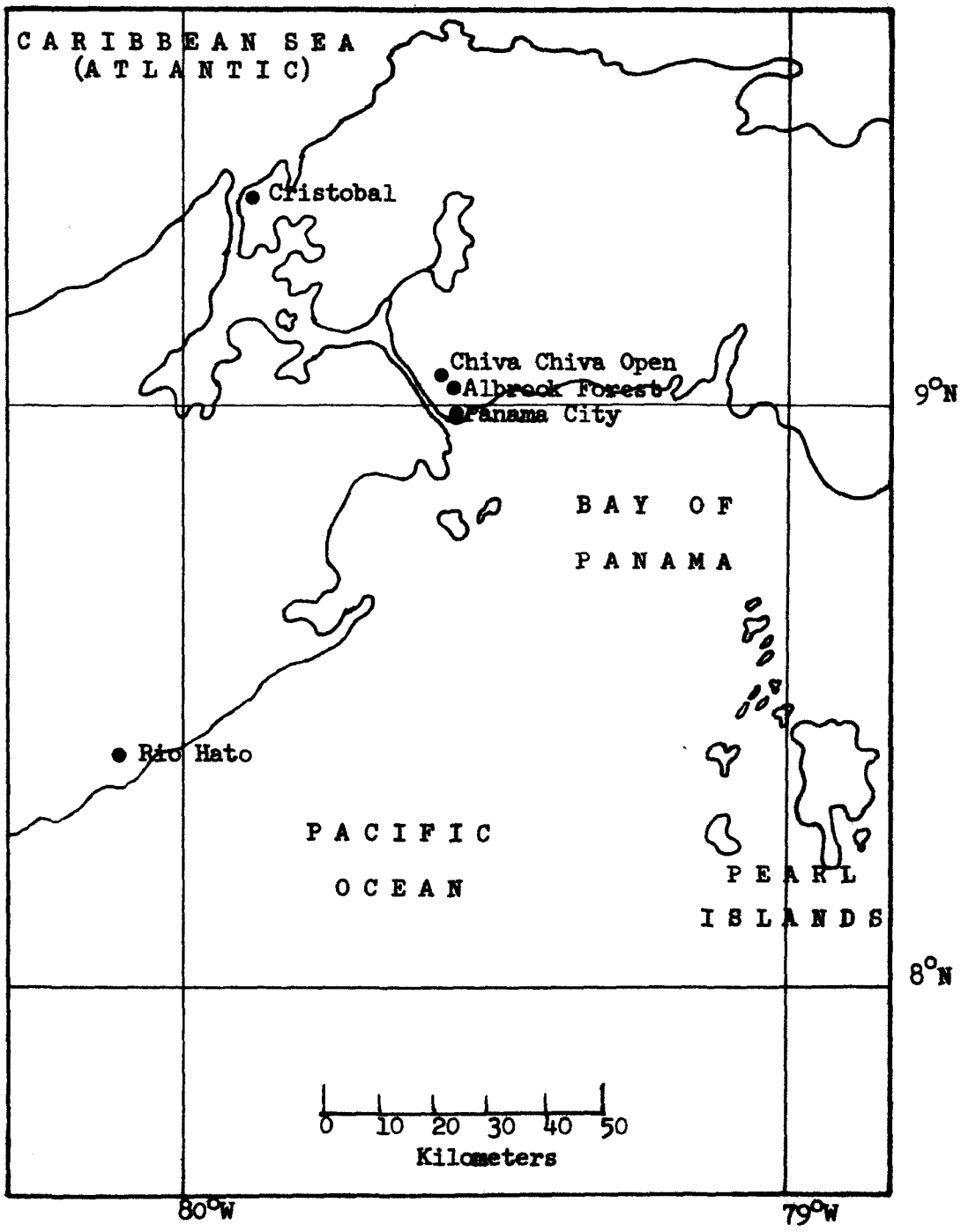

FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS,

# Element	Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	39.0	46.0	Frequency
Temperature:											
Dry Bulb	-	1	1	2	2	-	1	1	-	1	Hourly*
Wet Bulb	-	1	-	2	2	-	-	-	-	-	Hourly*
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily
Relative Humidity	-	1	2	2	2	-	1	1	-	1	Hourly*
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	2	-	2	Once Daily
Precipitation:											
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Wind:											
Direction	-	-	-	-	1	-	-	1	2	2	Continuously
Speed	-	-	-	3	1	-	3	1	-	2	Hourly

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

* Observations made with sling psychrometer when recorders are inoperative.

\# Instrument descriptions are contained in the Environmental Data Base Semiannual reports.

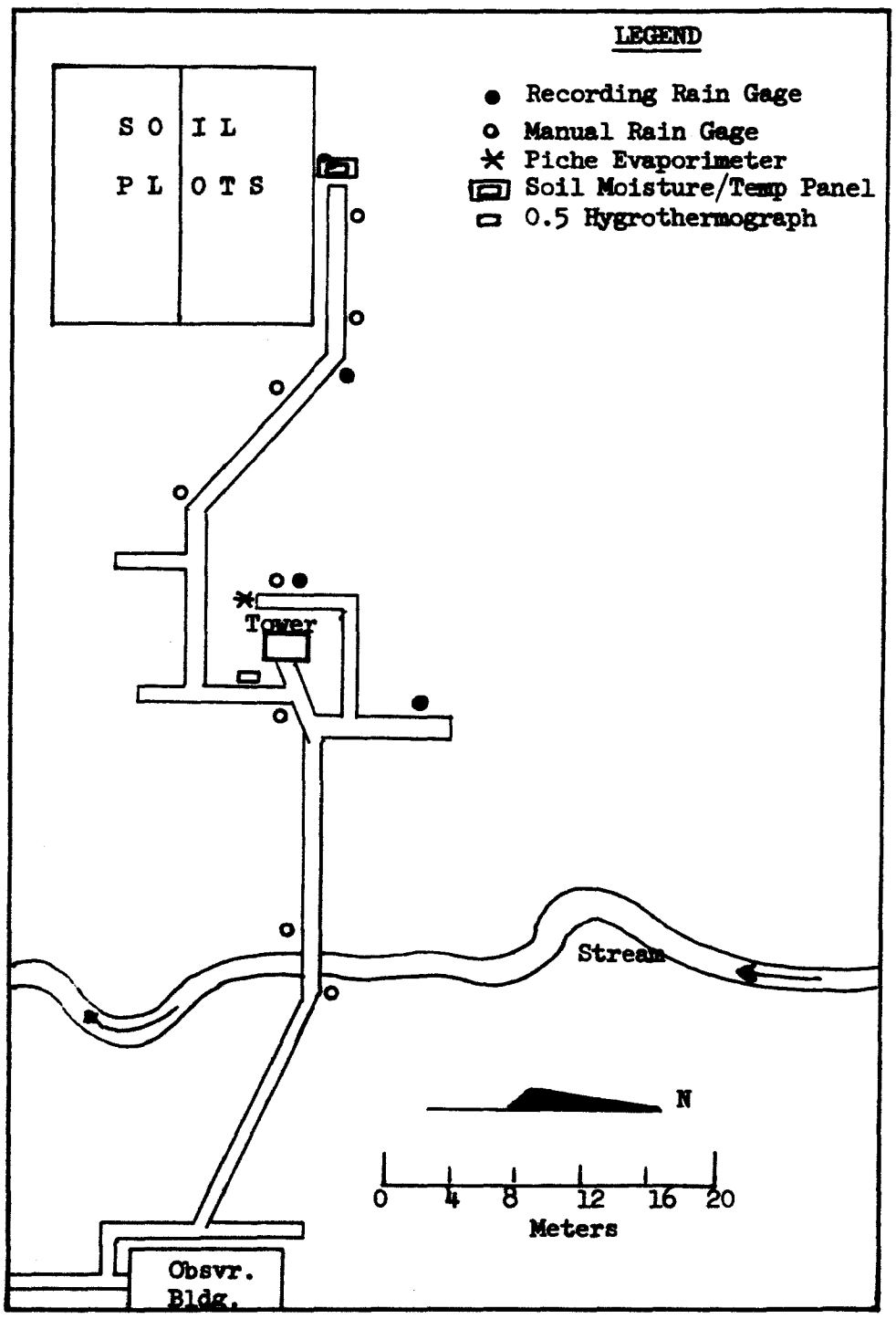

FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

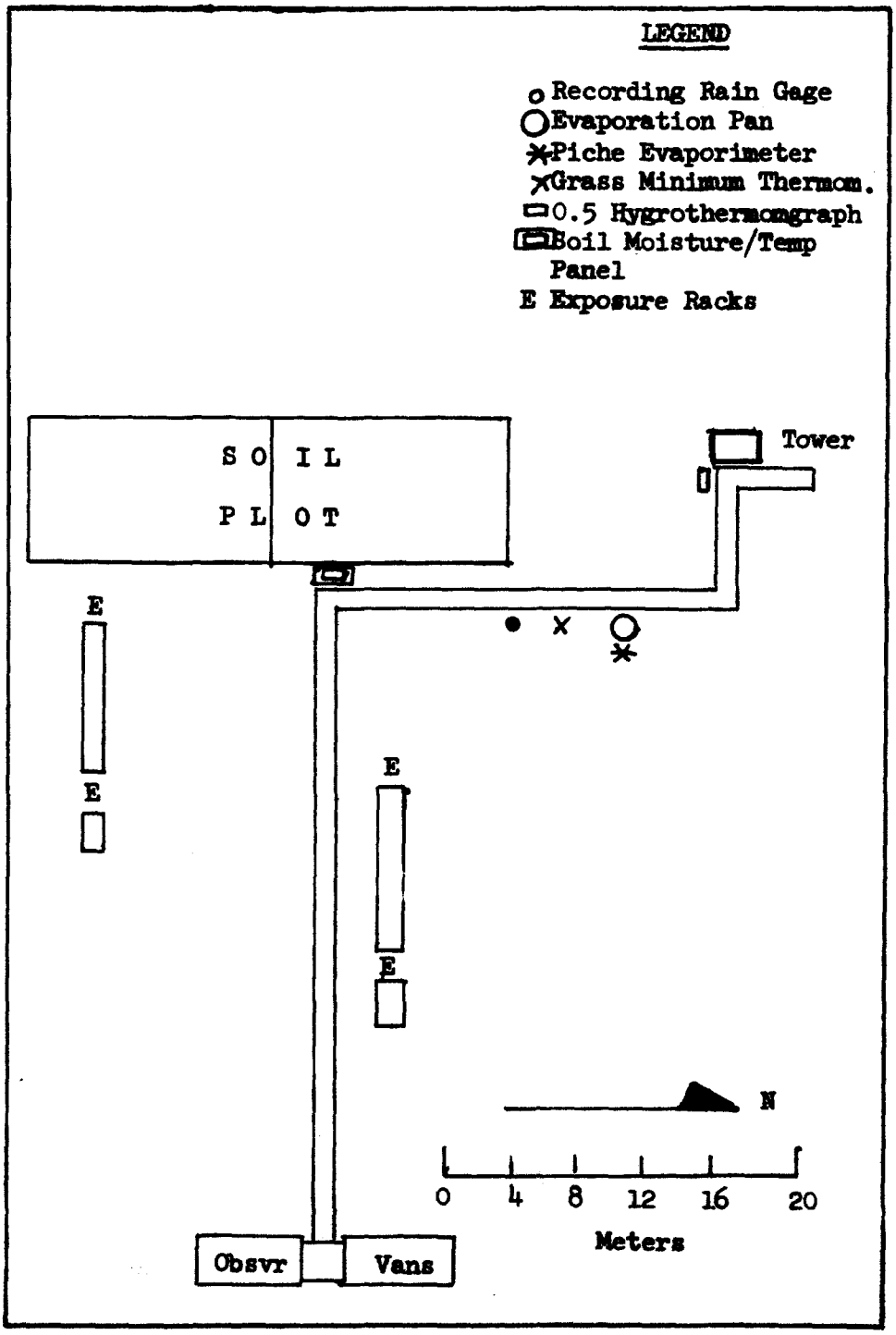

FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

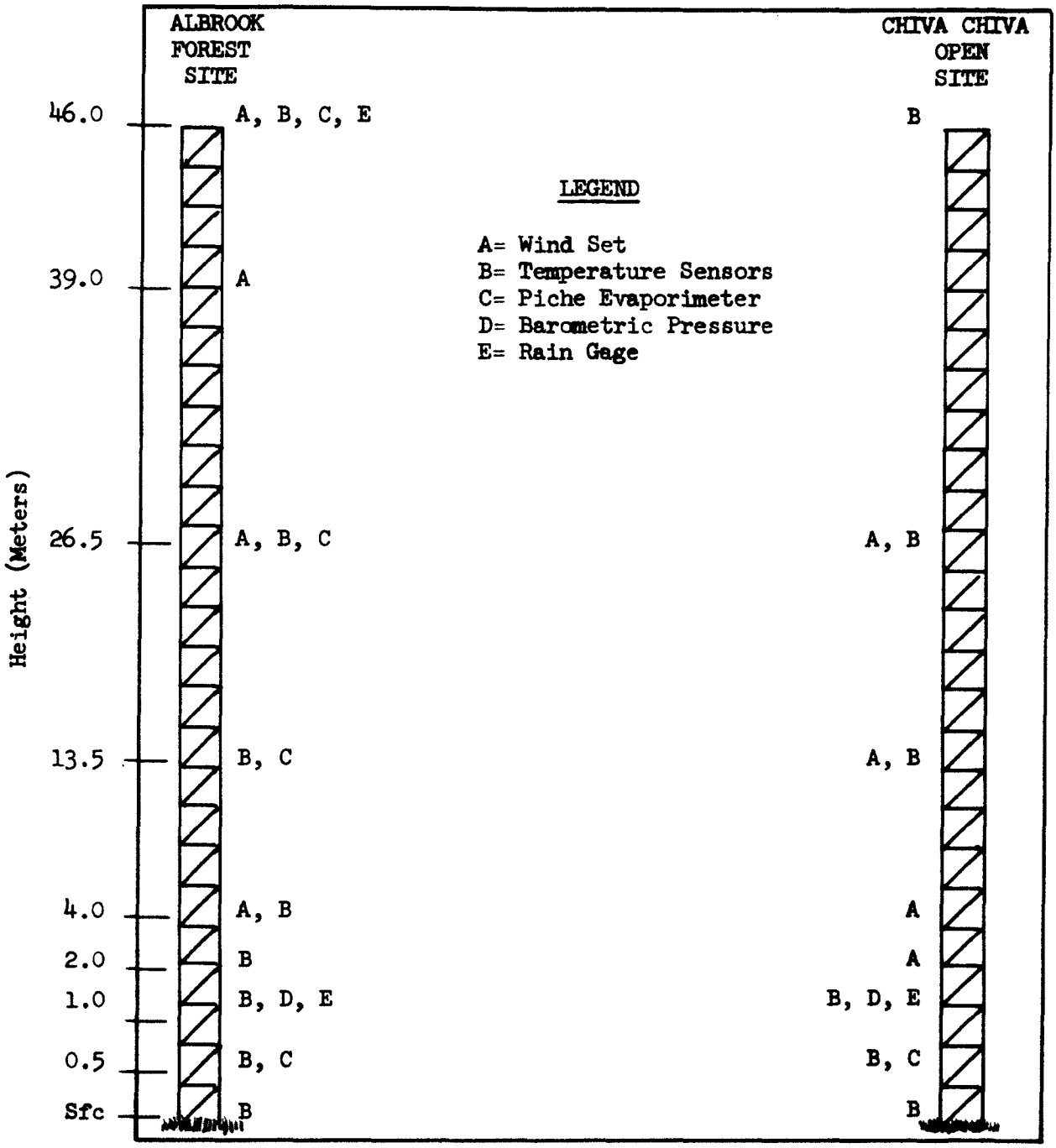

FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	74.4	74.2	74.0	73.9	73.7	73.7	74.5	76.4	78.9	80.9	82.4	82.2	81.1	79.7	79.0	78.7	77.8	76.8	75.8	75.4	75.1	75.0	74.9	74.7	722	71.3	76.7	86.7
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	74.0	73.9	73.7	73.7	73.5	73.6	74.6	76.9	79.5	81.5	82.8	83.0	82.0	80.6	79.8	79.3	78.1	76.5	75.4	75.0	74.7	74.5	74.3	74.1	744	71.0	76.9	87.3
	13.5 m	73.8	73.6	73.5	73.4	73.2	73.2	73.9	75.8	78.3	80.1	81.4	82.3	81.3	80.2	79.6	79.0	78.1	76.7	75.8	75.2	74.9	74.5	74.4	74.0	742	69.5	76.5	86.3
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	73.9	73.8	73.6	73.4	73.3	73.3	74.1	76.1	78.1	79.5	80.4	80.7	79.5	79.1	78.8	78.3	77.4	76.3	75.7	75.2	74.9	74.7	74.5	74.3	720	69.7	76.3	84.3
	2.0 m	73.9	73.8	73.6	73.4	73.3	73.3	74.0	76.0	77.8	79.2	79.9	80.4	79.3	79.0	78.7	78.3	77.5	76.4	75.8	75.3	75.0	74.8	74.5	74.4	720	69.7	76.2	84.0
	1.0 m	74.0	73.7	73.6	73.4	73.3	73.3	74.1	75.7	77.5	78.8	79.6	80.0	79.1	78.6	78.6	78.0	77.4	76.4	75.7	75.2	75.0	74.8	74.5	74.4	721	69.7	76.1	83.3
	0.5 m	74.1	74.1	73.9	73.8	73.6	73.6	74.0	75.3	77.0	78.4	79.2	79.8	79.5	78.7	78.6	78.2	77.5	76.6	75.8	75.4	75.1	74.7	74.6	74.3	740	70.2	76.1	82.4
Chiva Chiva (Open site)	46.0 m	73.5	73.3	73.2	73.0	72.9	73.1	73.6	74.8	77.1	79.3	80.5	80.4	79.9	78.8	78.5	77.8	77.0	76.0	75.2	74.7	74.6	74.3	74.0	73.8	743	69.8	75.8	85.2
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	73.3	73.1	72.9	72.8	72.6	72.6	73.6	75.0	77.0	79.1	80.6	80.4	80.1	79.0	78.7	77.9	77.1	76.0	75.0	74.5	74.2	74.0	73.6	73.4	744	68.3	75.7	85.2
	13.5 m	73.0	72.7	72.6	72.4	72.3	72.3	73.4	74.9	77.3	79.1	80.4	80.4	80.0	79.0	78.6	77.9	77.1	75.9	74.9	74.3	73.9	73.6	73.3	73.0	741	67.8	75.7	86.0
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	This level was not instrumented for air temperature at this time																											
	2.0 m	This level was not instrumented for air temperature at this time																											
	1.0 m	73.1	73.0	73.0	72.7	72.7	72.5	75.0	78.4	81.8	84.1	85.7	85.1	83.8	81.5	80.6	79.9	78.2	76.2	75.3	74.7	74.2	73.8	73.5	73.3	725	69.0	77.2	93.0
	0.5 m	73.1	73.0	72.9	72.7	72.6	72.5	75.2	78.7	82.3	84.6	86.0	85.5	84.0	81.5	81.2	80.0	78.3	76.2	75.3	74.7	74.2	73.9	73.6	73.4	732	69.0	77.3	96.0

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	3.8	3.7	4.1	4.4	4.7	4.7	3.8	5.8	9.4	11.6	12.7	12.2	11.2	13.3	10.5	10.4	9.0	8.1	6.5	5.4	5.2	5.1	5.1	5.0				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	4.0	4.0	4.2	5.0	5.0	4.5	3.6	5.8	8.7	10.4	10.5	11.4	10.4	12.3	10.6	10.3	8.1	6.7	4.9	4.2	3.4	3.7	4.0	4.1				
	13.5 m	6.1	6.2	6.3	7.1	7.4	7.5	5.5	4.5	6.8	9.9	10.9	11.4	9.9	10.8	11.1	9.9	8.6	6.9	6.0	4.9	4.6	4.7	5.3	6.3				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	4.9	5.7	6.4	5.8	6.0	5.8	5.6	5.3	6.9	9.8	9.3	9.3	10.1	10.3	9.0	8.0	7.9	5.9	5.2	5.3	5.0	4.4	4.5	4.5				
	2.0 m	4.9	5.9	5.9	5.8	6.1	6.1	4.8	5.3	6.5	9.5	8.7	9.3	10.2	9.3	8.9	7.9	7.3	6.1	5.5	5.3	5.2	4.7	4.9	4.9				
	1.0 m	4.6	5.5	6.1	6.3	6.4	6.3	5.0	5.3	6.4	6.7	7.7	8.5	10.0	8.0	7.8	8.0	6.5	6.1	5.1	4.7	5.7	4.0	5.0	5.5				
	0.5 m	6.1	6.6	6.3	6.1	5.9	5.7	4.4	3.6	4.4	5.5	6.7	7.0	8.6	8.2	8.0	7.5	8.1	6.6	5.7	5.5	5.3	5.4	6.2	6.1				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	5.6	6.3	5.6	6.2	6.5	5.9	5.8	7.0	8.4	9.9	10.6	10.7	10.9	11.2	11.9	10.6	9.6	7.8	6.5	6.1	5.3	5.1	4.2	5.0				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	6.0	6.0	5.4	6.2	8.0	6.2	6.8	5.6	7.7	8.8	10.2	11.2	11.6	12.2	12.8	10.2	10.4	7.8	6.9	6.3	5.2	5.4	5.6	5.0				
	13.5 m	5.9	7.4	5.8	6.6	8.0	6.7	6.9	6.8	7.9	9.0	10.8	12.1	12.0	12.2	12.8	10.4	10.8	7.5	7.0	6.7	5.6	5.0	5.2	5.2				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	This level was not instrumented for air temperature at this time																											
	2.0 m	This level was not instrumented for air temperature at this time																											
	1.0 m	5.0	4.7	5.8	5.8	6.8	7.0	8.5	12.0	14.3	18.8	16.7	15.9	14.8	15.7	12.8	13.2	12.9	7.8	6.8	5.1	5.0	5.3	4.8	4.7				
	0.5 m	4.7	4.5	5.5	5.2	7.0	7.0	9.2	15.2	16.4	22.0	17.5	18.5	18.0	15.9	13.9	13.2	12.9	7.9	6.8	4.8	5.0	5.3	4.8	4.1				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	95	95	95	95	95	95	94	92	87	82	78	78	81	84	85	88	88	91	94	94	94	94	94	94	686	63	90	97
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	96	96	95	96	96	96	95	91	85	81	77	77	80	83	85	87	90	94	95	95	95	95	95	95	707	64	90	99
	13.5 m	97	97	97	97	97	97	96	94	92	88	86	85	87	89	90	92	93	95	96	96	96	96	96	96	706	68	93	99
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	97	98	98	98	98	98	97	96	92	90	88	86	89	90	92	94	95	96	97	97	97	97	97	97	698	65	95	100
	2.0 m	97	98	97	98	98	98	97	97	93	91	90	88	90	91	93	95	96	97	96	97	97	97	97	97	698	72	95	100
	1.0 m	97	98	98	98	98	98	97	97	96	94	93	92	92	93	94	96	96	97	97	97	97	97	98	97	699	77	96	100
	0.5 m	97	97	97	97	97	96	96	96	96	94	94	92	92	94	94	95	96	96	97	97	97	97	97	97	741	71	96	100
Chiva Chiva (Open site)	46.0 m	96	96	96	97	96	96	95	93	88	83	79	80	81	84	86	87	88	91	92	94	94	94	95	95	669	60	91	100
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	96	97	97	97	97	97	95	93	87	82	78	78	80	83	84	85	87	90	92	94	94	95	96	96	741	59	90	100
	13.5 m	98	98	98	98	98	98	96	94	88	83	80	79	81	84	85	86	88	91	94	95	96	97	97	97	739	60	92	100
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	This level was not instrumented for relative humidity at this time																											
	2.0 m	This level was not instrumented for relative humidity at this time																											
	1.0 m	This level was not instrumented for relative humidity at this time																											
	0.5 m	98	98	98	98	98	98	94	88	82	79	77	78	80	83	86	88	91	96	97	97	98	98	98	97	732	52	91	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	5	5	5	5	5	4	6	14	27	28	28	34	30	28	23	20	19	12	6	5	9	5	5	5				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	6	6	6	6	6	6	6	17	26	31	31	35	31	34	29	27	18	10	8	7	9	9	6	6				
	13.5 m	6	6	6	5	7	4	6	8	20	21	31	23	25	27	18	16	15	11	8	7	9	10	6	7				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	6	6	6	5	9	4	7	7	23	28	28	28	28	35	16	14	16	11	11	11	9	12	7	8				
	2.0 m	6	6	5	4	8	4	7	8	14	27	25	28	27	27	15	14	12	10	12	11	10	11	8	8				
	1.0 m	6	6	5	4	8	6	6	8	10	15	22	19	23	21	14	13	9	10	9	11	9	11	8	9				
	0.5 m	20	19	21	22	21	21	22	22	21	29	22	26	17	16	11	14	14	15	14	19	7	19	19	18				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	8	8	10	7	10	10	14	18	21	30	32	29	20	37	21	21	23	15	10	12	11	9	9	12				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	8	5	7	8	11	7	13	15	20	27	26	32	32	41	31	25	22	12	12	12	11	9	10	9				
	13.5 m	5	9	5	6	7	8	14	17	21	27	24	30	31	40	31	24	24	14	13	13	11	8	6	9				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	This level was not instrumented for relative humidity at this time																											
	2.0 m	This level was not instrumented for relative humidity at this time																											
	1.0 m	This level was not instrumented for relative humidity at this time																											
	0.5 m	5	4	8	7	20	5	18	34	37	48	36	33	37	36	28	26	22	12	9	8	8	10	10	25				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Means[2] of other Elements by Hour																							Monthly Summary			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	73.3	73.3	73.1	73.0	72.8	72.8	73.7	75.2	76.3	77.0	77.3	77.3	76.8	76.6	77.0	76.9	76.3	75.4	74.9	74.5	74.2	74.0	73.9	73.7	698	68.5	75.0	80.0
	WB (2.0 m)	73.3	73.3	73.1	73.0	72.9	72.9	73.6	75.2	76.4	77.1	77.5	77.5	77.0	76.8	77.2	77.0	76.4	75.6	75.0	74.6	74.3	74.1	73.9	73.7	698	68.7	75.1	80.6
	WB (0.5 m)	73.5	73.4	73.2	73.1	73.0	72.9	73.2	74.6	76.0	77.2	77.7	78.0	77.8	77.3	77.3	77.0	76.8	75.8	75.1	74.6	74.6	74.1	73.9	73.7	741	66.0	75.2	81.0
	BP	.744	.727	.715	.712	.715	.728	.752	.769	.784	.791	.784	.759	.728	.708	.688	.680	.685	.695	.710	.731	.752	.764	.766	.759	741	.620	.735	.850
	P1	0.01	0.01	0.00	0.04	0.02	0.01	0.02	0.04	0.05	0.12	0.09	0.06	0.18	0.18	0.21	0.16	0.40	0.06	0.02	0.08	0.02	0.09	0.06	0.62	78	0.01	9.44	1.18
	P3	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.05	0.03	0.07	0.05	0.03	0.18	0.23	0.16	0.02	0.21	0.03	0.05	0.03	0.02	0.03	0.12	0.32	51	0.01	5.36	0.87
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.06	0.01	0.30	0.25	0.19	0.03	0.88	0.04	0.02	0.02	0.01	0.01	0.26	0.33	32	0.01	5.77	1.28
Chiva Chiva (Open site)	WB (0.5 m)	72.7	72.7	72.4	72.3	72.2	72.1	73.9	75.7	77.8	79.1	79.7	79.6	79.2	77.4	77.8	77.2	76.3	75.3	74.6	74.1	73.7	73.4	73.1	73.0	732	65.0	75.2	85.0
	BP	.845	.827	.819	.816	.822	.837	.856	.873	.890	.896	.886	.860	.833	.811	.793	.787	.792	.804	.818	.838	.859	.871	.870	.862	739	.730	.840	.960
	PS	0.00	0.00	0.00	0.00	0.04	0.00	0.02	0.12	0.17	0.05	0.03	0.38	0.15	0.25	0.14	0.24	0.50	0.09	0.14	0.06	0.02	0.06	0.21	0.96	84	0.01	15.60	1.93

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2]Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Ranges[2] of other Elements by Hour																							Monthly Summary*			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	WB (4.0 m)	4.2	4.8	5.5	6.0	7.3	6.3	4.9	4.0	4.3	5.1	5.3	5.5	6.0	6.7	6.9	7.0	7.2	5.4	4.8	4.0	4.0	3.6	3.6	4.0				
	WB (2.0 m)	4.2	5.0	5.5	6.0	7.1	6.3	4.9	3.8	4.4	4.7	5.3	5.6	7.6	6.0	6.9	7.0	7.1	5.7	4.4	4.1	4.2	3.6	3.9	4.0				
	WB (0.5 m)	8.5	8.4	9.1	9.9	10.0	9.3	9.0	6.8	6.2	6.6	6.2	7.0	6.5	6.8	7.0	7.5	7.7	8.5	8.4	8.5	5.2	8.0	8.2	8.2				
	BP	.120	.120	.125	.120	.125	.120	.120	.135	.120	.115	.115	.125	.115	.110	.115	.110	.100	.090	.090	.115	.115	.105	.100	.100				
	P1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.00	0.09	0.09	0.51	0.87	0.66	0.62	1.17	0.11	0.02	0.16	0.01	0.11	0.00	0.00				
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.02	0.00	0.28	0.86	0.66	0.06	0.81	0.00	0.05	0.05	0.02	0.03	0.00	0.00				
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	1.27	0.89	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Chiva Chiva (Open site)	WB (0.5 m)	4.9	4.7	7.0	6.8	10.2	7.0	8.6	9.4	7.4	10.0	8.0	12.0	11.9	9.0	8.8	9.7	7.9	6.0	5.2	3.9	4.3	4.3	4.7	4.3				
	BP	.110	.120	.135	.115	.110	.110	.110	.135	.115	.125	.130	.125	.115	.110	.130	.110	.100	.110	.100	.115	.105	.090	.095	.105				
	PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.12	0.05	0.00	1.06	0.49	1.31	0.56	1.04	1.92	0.47	0.30	0.07	0.02	0.14	0.39	0.00				

* No monthly summary was computed for the ranges.

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

[2]Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	3	3	3	3	3	3	3	4	4	4	5	5	6	5	5	5	4	4	5	4	4	3	3	3	698	0	4	13
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	1	1	1	1	1	1	1	2	2	3	3	4	4	3	3	3	2	2	2	2	2	2	2	1	659	0	2	10
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	552	0	0	1
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

Chiva Chiva (Open site)	46.0 m	This level was not instrumented for wind speed at this time																											
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	2	2	2	2	2	2	1	3	5	5	5	6	7	6	6	6	6	4	4	3	3	2	3	3	604	0	4	18
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	1	1	1	1	1	1	1	2	3	4	4	5	6	5	4	5	4	2	2	2	2	1	1	1	672	0	3	18
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

OCTOBER 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	7	7	6	7	7	6	6	5	5	8	9	13	10	10	11	9	11	8	9	7	8	9	10	8				
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	5	6	4	5	6	5	5	5	7	7	7	10	9	8	7	7	10	5	7	6	5	8	8	5				
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	0	0	0	0	0	0	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0				
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											
Chiva Chiva (Open site)	46.0 m	This level was not instrumented for wind speed at this time																											
	28.5 m	This level was not instrumented for wind speed at this time																											
	26.5 m	7	6	6	4	6	6	8	6	18	6	7	8	13	11	10	18	16	6	8	7	7	6	5	8				
	13.5 m	This level was not instrumented for wind speed at this time																											
	8.0 m	This level was not instrumented for wind speed at this time																											
	4.0 m	5	5	4	3	3	7	5	6	18	8	9	10	15	11	8	15	15	5	6	6	5	4	4	4				
	2.0 m	This level was not instrumented for wind speed at this time																											
	1.0 m	This level was not instrumented for wind speed at this time																											
	0.5 m	This level was not instrumented for wind speed at this time																											

* No monthly summary was computed for the ranges.

ALBROOK (Forest site) OCTOBER 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.

(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	11.1		11.1						10.0		9.1		9.1						10.0		22.2	14.3		
NNE		11.1				22.2	11.1	30.0					9.1		22.2			10.0		11.1				
NE	11.1				11.1	11.1					9.1	9.1	9.1	9.1							11.1			
ENE							11.1	10.0	10.0							11.1			10.0	11.1		14.3		
E				11.1	11.1	11.1	11.1	10.0	10.0		9.1										11.1		12.5	
ESE								10.0					9.1	9.1	11.1									
SE										10.0	9.1	9.1				11.1								
SSE										10.0	9.1						20.0	10.0					12.5	
S								10.0	20.0	20.0	18.2	36.4	27.3	27.3	22.2	11.1	20.0	10.0	10.0					
SSW			22.2							30.0	9.1			9.1		22.2			10.0		11.1	14.3		12.5
SW	11.1	11.1	11.1	22.2	11.1	11.1			20.0	20.0	18.2	18.2	9.1	9.1	33.3	11.1	40.0	40.0	10.0	11.1	11.1	14.3	37.5	37.5
WSW	11.1	11.1		22.2	33.3	11.1	11.1		10.0	10.0	9.1		18.2	18.2	11.1	11.1	10.0		20.0	11.1	11.1	28.6		25.0
W	11.1	44.4	33.3	11.1	11.1	11.1	11.1		10.0	10.0	9.1		18.2	18.2	11.1	11.1	10.0		20.0	11.1	11.1	14.3		
WNW	11.1			11.1			22.2					9.1				11.1				11.1				
NW		11.1						10.0											10.0	11.1				
NNW							11.1		10.0			9.1		9.1				10.0						
CALM	33.3	11.1	22.2	22.2	22.2	22.2	11.1											20.0		22.2	11.1		37.5	25.0

* Note: Due to rounding, percentage totals do not equal 100%.

This data represents only the first eleven days of the month.

The instrument was removed as of 11 October, 1400 hours.

IMPRESORA, S. A. 45005

ALBROOK (Forest site) OCTOBER 1967

Relative Frequencies* of Wind Directions by Hour at 39.0 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N						10.0	5.0		5.0	10.5				10.0	4.8	9.5		4.8		4.8			4.8	4.8
NNE				10.0				5.0		5.3			5.3	5.0				4.8			9.5		9.5	9.5
NE		5.0	5.0	5.0		10.0								5.0						4.8			4.8	4.8
ENE					5.0	10.0	10.0		5.0						4.8		4.8			4.8				
E					5.0	5.0	5.0	5.0	5.0				5.3	5.0	4.8					4.8		9.5		
ESE								5.0	5.0		5.3		5.3				4.8						4.8	
SE								5.0	5.0	5.3		5.3					4.8					4.8		
SSE											5.3	5.3	5.3											
S	10.0			5.0					5.0	36.8	42.0	52.5	42.0	30.0	38.1	28.6	23.8	9.5	9.5				4.8	9.5
SSW	25.0	5.0	5.0	10.0	15.0		5.0	5.0	10.0	10.5	21.0	10.5	5.3	10.0	4.8	9.5	19.0	33.3	14.3	14.3	19.0	9.5	9.5	
SW	20.0	25.0	40.0	20.0	20.0	10.0	15.0	30.0	15.0	5.3	15.8	10.5	10.5	15.0	14.3	23.8	19.0	19.0	19.0	19.0	14.3	28.6	28.6	19.0
WSW	20.0	10.0	15.0	15.0	30.0	20.0	20.0	20.0	20.0	10.5	10.5	5.3		5.0		4.8	14.3	14.3	14.3	14.3	19.0	9.5	9.5	28.6
W	10.0	15.0	15.0	20.0	10.0	25.0	20.0	20.0	5.0			10.5	10.5	10.0	4.8	9.5		9.5	33.3	19.0	19.0	9.5	19.0	9.5
WNW		10.0	15.0	5.0	5.0	10.0	5.0		10.0	5.3					4.8	4.8	4.8			4.8	4.8	4.8		
NW	5.0	20.0		5.0	10.0		5.0		5.0	5.3			10.5		19.0	4.8	4.8		4.8	9.5	14.3	9.5		
NNW		10.0					10.0	5.0	5.0	5.3				5.0		4.8			4.8			14.3	4.8	14.3
CALM	10.0		5.0	5.0										4.8										

* Note: Due to rounding, percentage totals do not equal 100%.

This data represents only the last 20 days of the month.

The instrument was installed as of 11 October, 1500 hours.

ALBROOK (Forest site) OCTOBER 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	12.0	20.0	16.0	12.0	4.0	12.0	4.0	3.8	3.8	4.1			8.0	7.7	16.0	20.0	3.8	19.2	23.1	4.0	12.0	4.5	4.1	8.3
NNE			4.0				8.0		7.7	4.1		4.0		7.7	4.0	4.0	3.8	3.8		8.0	8.0			4.1
NE					4.0			7.7	3.8				8.0	7.7	4.0	4.0	3.8			4.0		4.5	8.3	
ENE		4.0				4.0												7.7		4.0				
E			8.0	4.0		8.0	4.0						4.0		4.0	4.0	7.7							
ESE								7.7	15.4				8.0					3.8			4.0	4.5		
SE	4.0						7.7	3.8			12.0	4.0	4.0	3.8	8.0		3.8							
SSE									7.7	4.1	4.0	8.0	4.0	3.8		4.0		3.8						
S	4.0	4.0			4.0					12.4	24.0	44.0	32.0	30.8	20.0	24.0	7.7		3.8	4.0			4.1	4.1
SSW				4.0					3.8	4.1		4.0	8.0				11.5		3.8					
SW							8.0	3.8		4.1	12.0		4.0	3.8	4.0	4.0	3.8				4.0			
WSW										8.3	8.0			3.8	8.0	8.0	7.7	7.7		4.0	4.0	4.5		
W	4.0		4.0	4.0				7.7	3.8	16.6		4.0		11.5	4.0	4.0	7.7	7.7		4.0		4.5	4.1	
WNW	8.0		8.0	4.0		4.0	8.0	7.7	15.4	8.3	12.0	8.0						11.5		8.0	4.0		8.3	
NW	8.0	8.0		8.0	12.0		16.0	19.2	15.4	8.3		4.0		7.7	12.0	8.0	23.1		34.6	8.0	24.0	22.7	16.6	12.4
NNW	4.0	16.0	12.0	16.0	24.0	20.0	12.0	11.5	3.8	12.4	12.0	12.0	16.0	7.7	8.0	8.0	7.7	11.5	7.7	20.0	8.0	13.6	4.1	12.4
CALM	56.1	48.0	48.0	48.0	51.9	51.9	40.0	23.1	15.4	12.4	16.0	8.0	4.0	3.8	8.0	8.0	7.7	23.1	26.9	32.0	32.0	40.8	49.9	58.1

IMPRESORA, S. A. 45695

* Note: Due to rounding, percentage totals do not equal 100%.
This data represents only the first 27 days of the month.
The instrument was removed as of 27 October, 1200 hours.

ALBROOK (Forest site) OCTOBER 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N			4.0					7.7						4.0		4.0					4.0	8.3		
NNE					8.0					4.1					4.0	4.0		3.8	7.7		4.0		4.1	4.1
NE	4.0							3.8					4.0			4.0		3.8			4.0			
ENE	4.0	8.0															11.5		7.7					
E				4.0	4.0	4.0			3.8				4.0					3.8						
ESE						4.0	4.0		3.8	4.1		4.0			4.0									
SE	4.0									4.1		8.0			8.0			3.8		4.0	4.0			
SSE													4.0											
S	4.0	4.0	8.0														3.8						8.3	4.1
SSW				4.0																				
SW						4.0				4.1						4.0		3.8			4.0		4.1	
WSW									3.8													4.1		
W					4.0											4.0				4.0				
WNW			4.0	4.0								4.0		4.0		4.0		3.8		8.0		4.1		4.1
NW		4.0				4.0			3.8						4.0		3.8	3.8						
NNW		4.0	4.0				8.0										3.8		3.8	4.0		4.1	8.3	12.4
CALM	84.0	80.0	84.0	84.0	84.0	84.0	88.0	88.6	84.8	83.0	100.0	84.0	88.0	92.0	80.0	76.0	76.9	73.1	80.8	80.0	80.0	78.9	74.7	74.7

* Note: Due to rounding, percentage totals do not equal 100%.

This data represents only the first 27 days of the month.
The instrument was removed as of 27 October, 1200 hours.

IMPRESORA, S. A. 45995

CHIVA CHIVA (Open site) OCTOBER 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	4.0		7.9	4.0	12.0	12.0	7.9	7.9	24.1	4.0	8.6		4.0	4.0	12.0	16.7	12.0	7.9	12.0		4.0	12.0	7.9	7.9
NNE	4.0	7.9			4.0	4.0		4.0	7.9				4.0	4.0	4.0				7.9	4.0		4.0	7.9	
NE			4.0			4.0	4.0	7.9				4.5	4.0	4.0						4.0		7.9		
ENE			4.0								8.6	4.5		4.0	4.0						4.0			
E				4.0		4.0		4.0		4.0		4.5	7.9	4.0						4.0	7.9	4.0	4.0	
ESE										7.9	13.1		4.0	4.0	4.0	4.1				4.0				
SE									4.0	7.9		9.1	4.0		4.0	4.1	7.9							
SSE		4.0	4.0						4.0				4.0		12.0	12.5	4.0	4.0	4.0	4.0		4.0		
S				4.0					16.0	20.0	26.2	27.4	24.1	32.0	12.0	8.3	16.0	4.0					4.0	7.9
SSW	4.0														4.0								4.0	4.0
SW	4.0									4.0				4.0		4.1			4.0			4.0		
WSW	4.0		4.0	4.0	4.0		4.0			4.0	8.6	9.1			4.0	4.1		4.0	4.0					
W		4.0	4.0	16.0	4.0	12.0				7.9	4.3	4.5	4.0				16.0			4.0		7.9	7.9	7.9
WNW	20.0	7.9	4.0	16.0	28.0	7.9		12.0	7.9	4.0		9.1	12.0	24.1	7.9	12.5	7.9	32.0	12.0	28.0	16.0	4.0	28.0	16.0
NW	12.0	16.0	12.0	16.0	24.1	7.9	12.0	32.0	24.1	16.0	13.1	22.7	16.0	12.0	28.0	12.5	28.0	32.0	44.0	16.0	28.0	24.1	24.1	32.0
NNW	16.0	24.1	20.0	12.0		16.0	20.0	7.9	4.0	20.0	17.4	4.5	7.9	4.0	4.0	16.7	7.9	7.9	4.0	12.0	24.1	7.9		7.9
CALM	32.0	36.0	36.0	24.1	24.1	32.0	52.0	24.1	7.9				4.0			4.1		7.9	7.9	20.0	16.0	20.0	12.0	16.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 46666

CHIVA CHIVA (Open site) OCTOBER 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.2	3.2	6.4	3.2	19.4	12.9	3.2	6.4	16.1	9.7	6.4		3.2		3.2	12.9	6.4		3.2	3.2	3.2	16.1		
NNE	6.4	3.2		12.9	6.4	6.4	3.2	3.2	3.2					3.2	3.2		6.4		6.4	3.2	9.7	6.4		6.4
NE	9.7	3.2	6.4	9.7	6.4	6.4	3.2	9.7			3.2	3.2	3.2	6.4					3.2	6.4	6.4	6.4	3.2	6.4
ENE	6.4	9.7	3.2		3.2		3.2					3.2	3.2		3.2			3.2	3.2		6.4			3.2
E		3.2		3.2	3.2	3.2		3.2		3.2	3.2	6.4	3.2	3.2	3.2		3.2			3.2		3.2	3.2	3.2
ESE					3.2				3.2	6.4			3.2		3.2	6.4			9.7	3.2			3.2	
SE		3.2						6.4	3.2	3.2	9.7	9.7	9.7	3.2		9.7	6.4	3.2		3.2	3.2	3.2	3.2	
SSE	3.2		6.4	3.2					3.2				3.2		6.4	3.2	3.2					3.2	3.2	3.2
S	3.2					6.4	9.7	3.2	16.1	22.6	29.0	22.6	22.6	35.5	29.0	9.7	12.9	9.7	3.2		3.2	3.2		3.2
SSW				3.2		3.2					3.2									3.2		6.4		3.2
SW	3.2		3.2	3.2				3.2		6.4	6.4	3.2		3.2		3.2	3.2	3.2	6.4	6.4	3.2	9.7	3.2	3.2
WSW		3.2	3.2	6.4		6.4						3.2			3.2	6.4	6.4	9.7		9.7	3.2	3.2	6.4	
W	3.2		3.2	6.4	6.4		3.2	12.9	12.9		3.2	16.1	6.4	12.9	6.4	3.2	3.2	16.1		12.9	3.2		12.9	6.4
WNW	9.7	3.2	3.2	3.2	6.4	6.4	3.2	12.9	6.4	9.7	9.7	3.2	6.4	6.4	6.4	6.4	16.1	3.2	16.1	6.4	9.7		3.2	6.4
NW	9.7	16.1	12.9	12.9	3.2	3.2	16.1	6.4	9.7	12.9	9.7	9.7	16.1	12.9	16.1	12.9	19.4	25.8	19.4	9.7	12.9	3.2	9.7	12.9
NNW	3.2	9.7	9.7	9.7	6.4	9.7	3.2	3.2	6.4	9.7	3.2	3.2	9.7	3.2	6.4	16.1		12.9	6.4	9.7	12.9		6.4	6.4
CALM	38.7	41.9	41.9	22.6	35.5	35.5	51.6	29.0	19.4	16.1	12.9	16.1	9.7	9.7	9.7	9.7	12.9	12.9	22.6	19.4	22.6	35.5	41.9	35.5

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45888

SUMMARY OF NON HOURLY DATA

OCTOBER 1967

Summary of Elements with Non-hourly Frequencies of Observation

Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	Evaporation[3] (in. at 4 levels)	Piche (46.0 m)	27	0.018	4.044*	0.238
		Piche (26.5 m)	27	0.012	2.823*	0.183
		Piche (13.5 m)	25	0.006	1.024*	0.104
		Piche (0.5 m)	13	0.006	0.335*	0.055
	Precipitation from Raingauge Network[2] (in. at 1.0 meters)	Gauge # 1	35	0.01	6.32*	1.41
		Gauge # 2	40	0.01	10.53*	1.71
		Gauge # 3	40	0.01	9.50*	1.68
		Gauge # 4	39	0.01	10.12*	2.42
		Gauge # 5	34	0.01	7.78*	1.58
		Gauge # 6	40	0.01	8.42*	1.35
		Gauge # 7	38	0.01	10.19*	2.16
		Gauge # 8	35	0.01	8.16*	1.33
Chiva Chiva (Open site)	Evaporation[3] (in. at 0.5 meters)	Piche	28	0.006	2.480*	0.201
		Pan	28	0.015	4.259*	0.448
	Minimum Grass temp[3] (^{o}F at grass tips)	None	21	65.0	70.0	74.0

3 - Daily observations

2 - Six hourly observations

* Total Values

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13. ABSTRACT

This report contains detailed microclimatic data for October 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.

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Data Base						

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MONTHLY MICROCLIMATIC SUMMARY

NOVEMBER 1967

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ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

NOVEMBER 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

USATECOM Project No. 9-4-0013-01

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TABLE OF CONTENTS

	PAGE
Introduction	1
Sites	1
Instrumentation	1
Data Reduction and Storage	2
Figures	
1. Location Map, Isthmus of Panama	3
2. Frequency of Observations	4
3. Albrook Forest Site, Generalized Plot	5
4. Chiva Chiva Open Site, Generalized Plot	6
5. Instrument Location on Tower	7
Data Summary Sheets	
Monthly Means of Air Temperature by Hour	8
Monthly Ranges of Air Temperature by Hour	9
Monthly Means of Relative Humidity by Hour	10
Monthly Ranges of Relative Humidity by Hour	11
Monthly Means of Other Elements by Hour	12
Monthly Means of Wet Bulb Temperature by Hour	
Monthly Means of Barometric Pressure by Hour	
Monthly Means of Precipitation by Hour	
Monthly Totals of Precipitation by Hour	
Monthly Ranges of Other Elements by Hour	13
Monthly Ranges of Wet Bulb Temperature by Hour	
Monthly Ranges of Barometric Pressure by Hour	
Monthly Ranges of Precipitation by Hour	
Monthly Means of Wind Speed by Hour	14
Monthly Ranges of Wind Speed by Hour	15
Relative Frequencies of Wind Directions (39 meters, Albrook)	16
Relative Frequencies of Wind Directions (32 meters, Albrook)	17
Relative Frequencies of Wind Directions (26.5 meters, Chiva Chiva)	18
Relative Frequencies of Wind Directions (4 meters, Chiva Chiva)	19
Summary of Elements with Non-Hourly Frequencies of Observation	20
Evaporation (Albrook)	
Precipitation (Manual gauge network, Albrook)	
Evaporation (Chiva Chiva)	

MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N,	79° 33'W
Chiva Chiva	09° 01'N,	79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

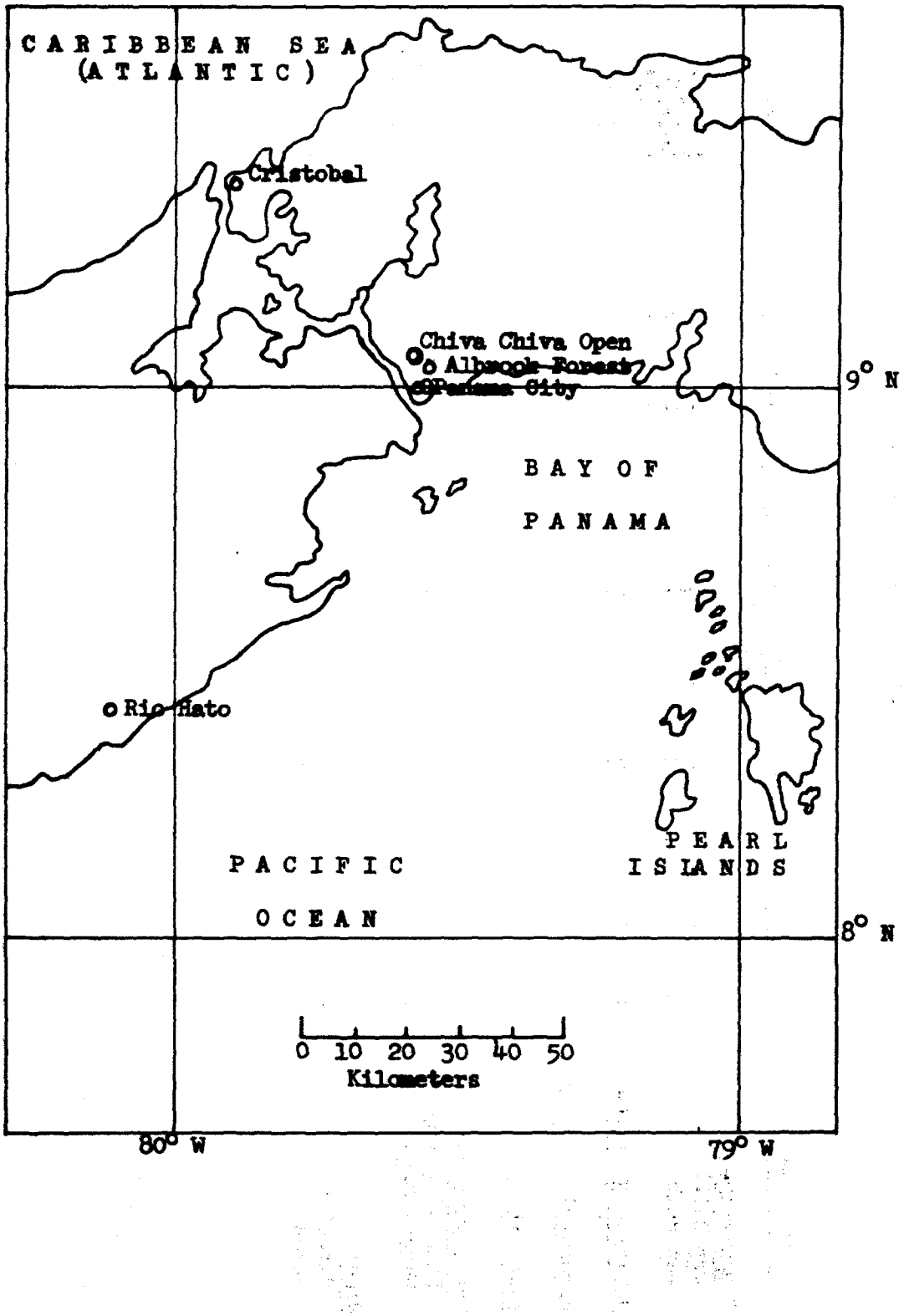

FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	0.5	1.0	2.0	4.0	13.5	26.5	30.0	32.0	39.0	46.0	Frequency
Temperature:											
Dry Bulb	1	2	2	2	1	1	-	-	-	1	Hourly*
Wet Bulb	1	-	2	2	-	-	-	-	-	-	Hourly*
Relative Humidity:	1	2	2	2	1	1	-	-	-	1	Hourly*
Barometric Pressure:	-	1	-	-	-	-	-	-	-	-	Continuously
Evaporation:	1	-	-	-	2	2	-	-	-	-	Once Daily
Precipitation:											
Recording Gage	-	1	-	-	-	-	-	-	-	2	Continuously
# Manual Gage	-	2	-	-	-	-	-	-	-	-	4 Times Daily
Wind:											
Direction	-	-	-	-	-	-	-	2	2	-	Continuously
Speed	-	-	-	3	-	3	2	2	2	-	Hourly

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

* Observation made with sling psychrometer when recorders are inoperative.

\# Instrument descriptions are contained in the Environmental Data Base semiannual reports.

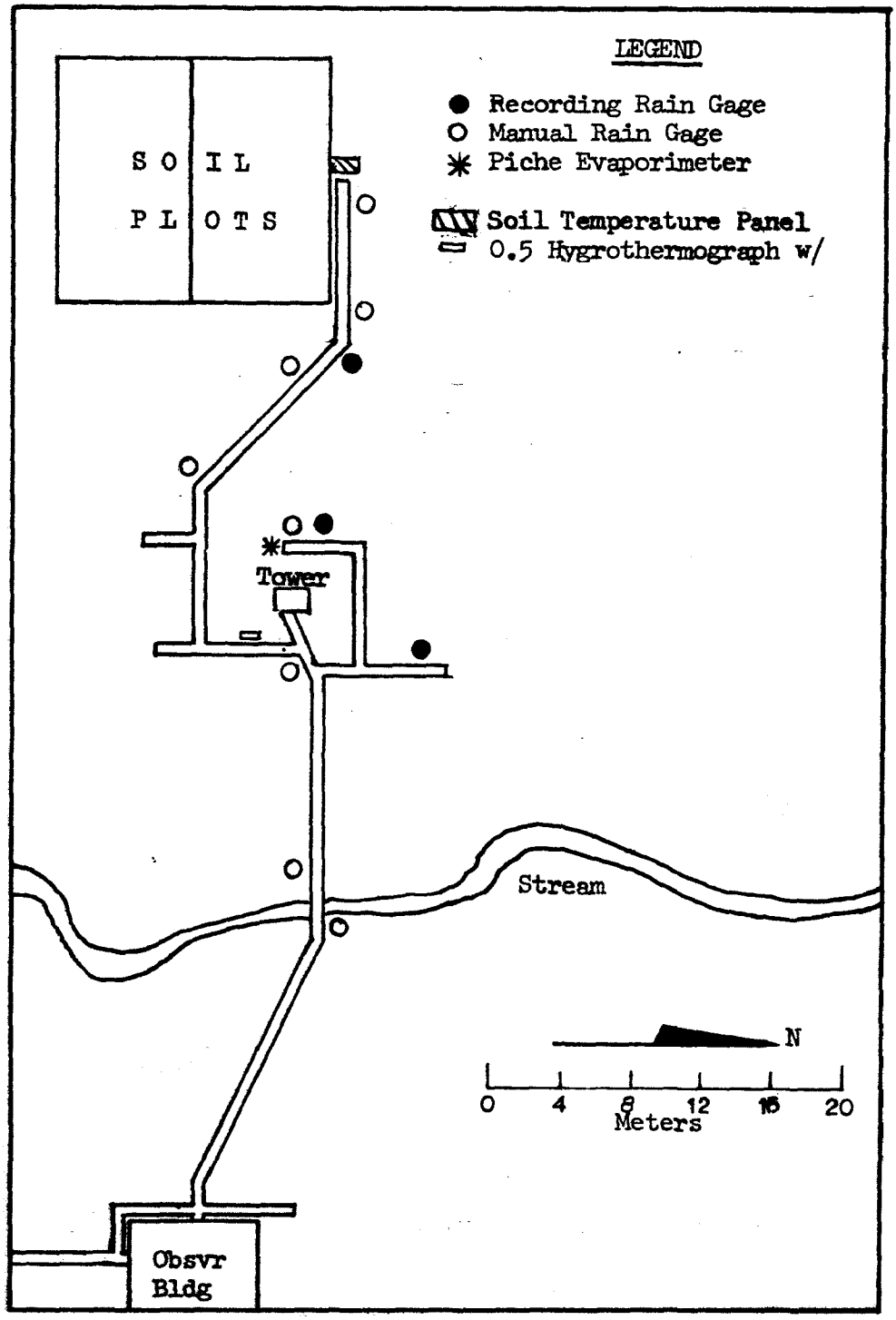

FIGURE 3.

ALBROOK FOREST SITE, GENERALIZED PLOT

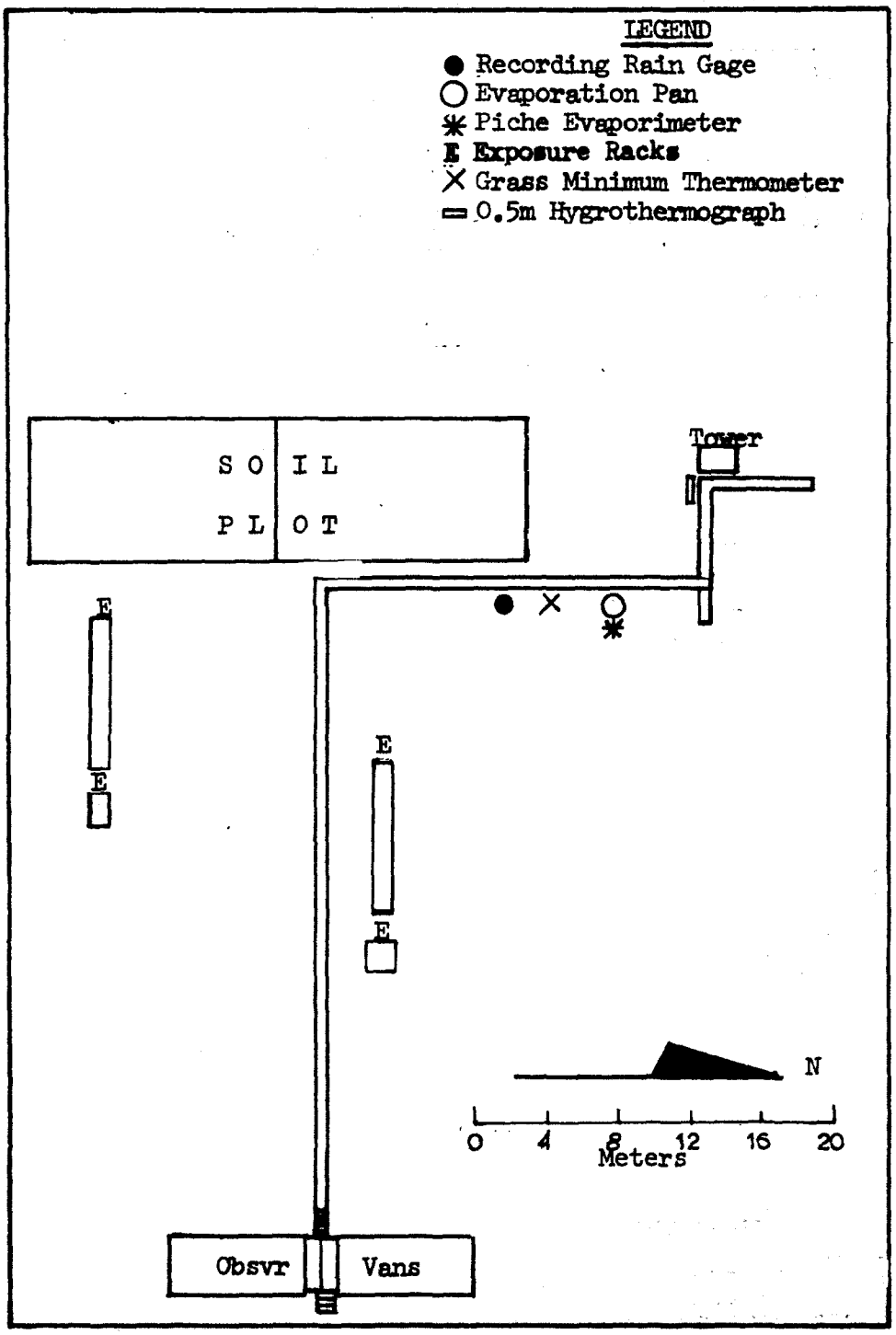

FIGURE 4.

CHIVA CHIVA OPEN, GENERALIZED PLOT

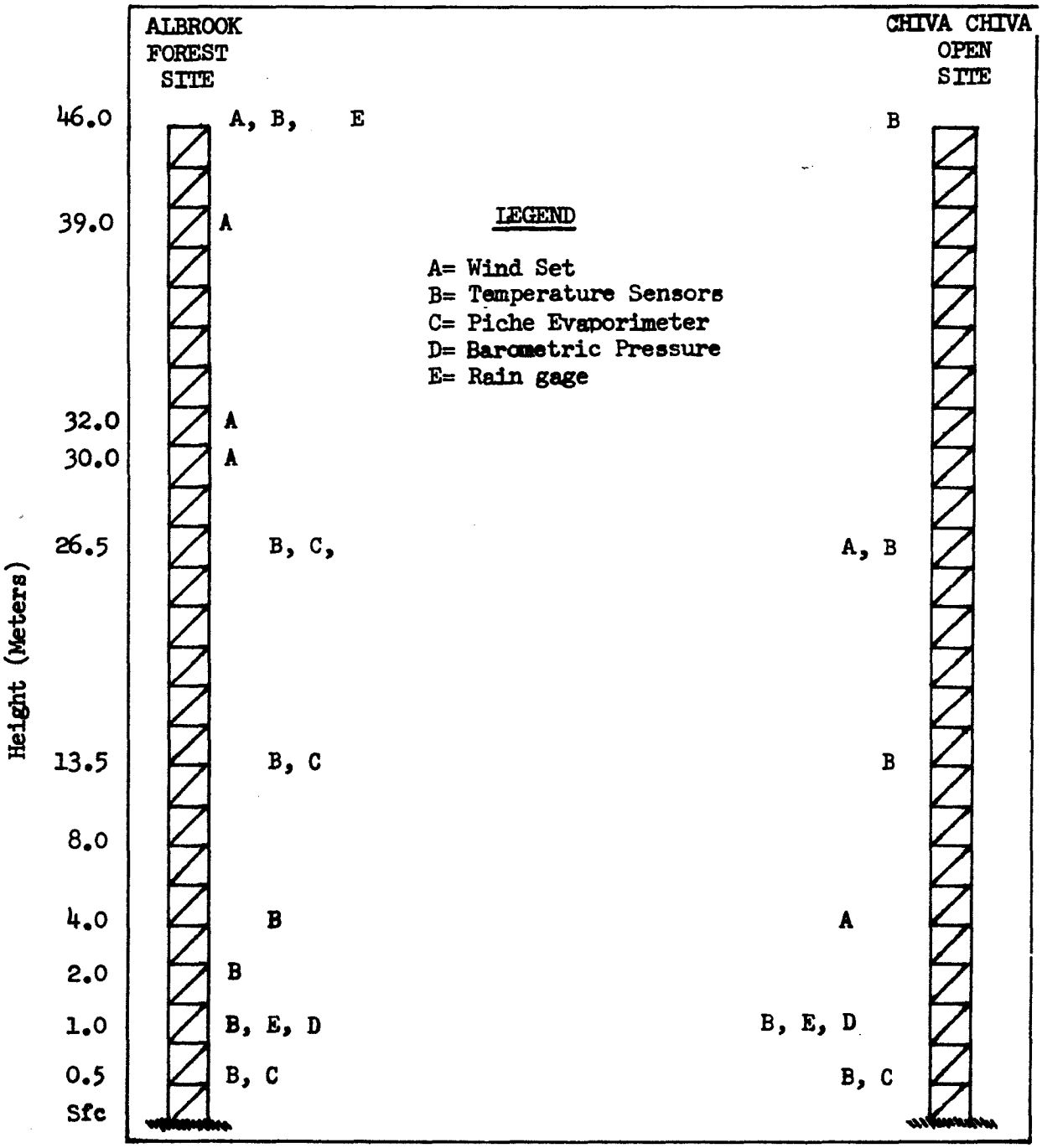

FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	74.5	74.2	73.9	73.8	73.8	73.9	74.6	76.4	78.6	80.5	81.9	81.9	80.7	80.3	80.1	79.3	78.4	77.3	76.5	76.0	75.5	75.2	74.8	74.6	720	70.7	77.0	86.6
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	73.6	73.5	73.3	73.2	73.1	73.2	73.9	76.1	78.5	80.8	82.1	82.2	81.3	80.3	80.0	79.2	78.0	76.2	75.1	74.5	74.2	74.1	73.8	73.6	720	69.3	76.4	85.5
	13.5 m	74.1	74.0	73.8	73.7	73.6	73.6	73.7	75.3	77.1	79.3	80.8	81.5	80.9	80.2	79.9	79.3	78.4	77.4	76.3	75.7	75.3	74.9	74.6	74.4	715	69.5	76.6	85.5
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	73.9	73.8	73.6	73.5	73.4	73.4	73.9	75.9	77.6	79.2	80.0	80.3	79.4	78.8	78.8	78.2	77.3	76.2	75.5	75.1	74.7	74.4	74.0	74.0	705	70.0	76.1	85.1
	2.0 m	73.6	73.6	73.5	73.3	73.3	73.2	73.5	75.0	76.9	78.4	79.7	79.8	79.2	78.9	78.6	77.9	77.2	76.2	75.4	74.9	74.5	74.2	73.9	73.8	716	69.5	75.8	83.5
	1.0 m	73.7	73.7	73.6	73.4	73.3	73.3	73.5	74.9	76.7	78.1	79.3	79.5	78.9	78.6	78.5	77.9	77.2	76.3	75.4	75.0	74.6	74.3	74.1	73.8	718	69.5	75.7	83.5
	0.5 m	73.7	73.7	73.6	73.4	73.3	73.3	73.5	74.9	76.6	78.0	79.2	79.2	78.8	78.4	78.4	77.8	77.2	76.2	75.5	75.0	74.6	74.4	74.1	73.9	718	69.6	75.7	82.5
Chiva Chiva (Open site)	46.0 m	73.6	73.5	73.5	73.3	73.5	73.2	73.5	75.0	77.0	79.1	80.3	81.1	80.2	79.6	79.4	78.6	77.9	76.8	75.9	75.2	75.1	74.8	74.4	73.9	702	68.6	76.2	86.3
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	73.6	73.4	73.4	73.3	73.2	73.2	73.6	75.2	77.3	79.2	80.5	81.4	80.5	79.9	79.8	78.8	78.1	76.8	75.9	75.2	75.0	74.7	74.4	73.9	704	68.6	76.3	86.5
	13.5 m	73.2	73.1	73.2	72.9	72.9	72.8	73.3	75.0	77.1	79.1	80.4	81.1	80.4	79.8	79.7	78.6	77.9	76.5	75.5	74.8	74.6	74.3	74.0	73.6	684	68.5	76.0	86.0
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	This level was not instrumented for air temperature at this time																											
	2.0 m	This level was not instrumented for air temperature at this time																											
	1.0 m	This level was not instrumented for air temperature at this time																											
	0.5 m	73.5	73.4	73.2	72.9	72.9	73.0	74.5	78.4	81.0	83.2	84.5	85.5	82.8	82.1	81.8	81.0	79.2	76.9	76.1	75.2	74.7	74.4	74.0	73.9	697	68.0	77.5	89.8

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	4.0	4.7	4.7	4.0	4.6	4.9	5.2	7.2	9.5	10.7	12.0	12.7	13.1	10.7	11.2	12.0	11.1	5.2	5.9	5.3	3.7	4.9	6.0	4.4				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	3.5	3.6	4.9	5.0	4.6	4.6	3.7	4.6	7.5	8.6	9.9	5.6	11.4	10.7	10.5	10.1	8.9	6.2	3.4	3.4	3.8	3.9	4.2	6.0				
	13.5 m	7.5	5.5	6.2	6.0	5.5	5.3	5.4	4.0	6.2	8.0	8.9	8.3	10.8	10.9	9.6	9.6	7.1	5.7	5.0	4.2	5.5	5.9	6.0	4.7				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	5.3	5.5	5.5	5.2	5.8	5.3	5.2	4.8	5.2	6.7	7.8	8.1	11.0	8.2	7.2	7.7	5.9	4.0	5.0	4.2	4.9	5.0	5.5	6.0				
	2.0 m	6.3	5.3	5.6	5.1	5.1	5.4	5.9	5.0	4.9	6.0	7.5	8.2	9.8	8.8	7.6	6.9	6.1	4.2	4.9	4.9	5.0	5.4	5.9	6.4				
	1.0 m	6.5	5.5	5.9	5.1	5.2	5.8	5.2	4.9	4.9	5.6	6.5	8.1	8.9	8.9	6.7	6.4	6.2	3.8	4.7	5.1	5.0	5.0	4.9	6.5				
	0.5 m	6.6	5.3	5.8	5.0	5.1	5.1	5.2	4.5	4.1	5.9	6.2	7.0	8.2	7.0	7.2	6.1	5.8	4.0	4.1	5.0	5.0	5.0	4.9	6.4				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	4.7	5.2	4.8	5.1	7.0	5.3	5.8	6.5	8.1	10.2	10.2	12.8	11.0	11.0	11.4	9.1	7.0	6.7	7.1	9.6	6.0	6.1	6.0	5.1				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	4.5	5.1	5.2	5.6	5.0	5.5	5.3	7.8	10.2	9.4	11.2	12.8	11.2	10.8	11.4	9.5	7.0	6.2	6.7	9.0	5.3	5.5	5.2	5.6				
	13.5 m	5.1	6.7	5.9	5.5	6.0	5.3	5.1	6.8	6.3	8.0	10.8	11.9	11.7	11.0	12.4	10.0	7.7	6.4	6.7	9.0	5.9	6.5	5.8	6.0				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	This level was not instrumented for air temperature at this time																											
	2.0 m	This level was not instrumented for air temperature at this time																											
	1.0 m	This level was not instrumented for air temperature at this time																											
	0.5 m	7.5	6.8	6.0	6.0	6.9	6.1	7.5	8.8	10.3	10.5	13.5	10.1	14.9	11.8	12.3	9.0	7.5	6.8	5.4	5.7	5.9	6.3	5.2	6.5				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	94	94	95	95	94	94	92	89	85	81	76	76	80	81	81	83	86	87	89	91	91	92	92	93	719	59	88	99
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	97	97	96	97	96	96	96	93	88	82	78	79	81	84	85	87	90	95	95	96	96	96	96	97	710	65	91	99
	13.5 m	97	97	97	97	97	96	96	95	92	87	83	82	84	85	87	89	91	93	94	95	95	96	96	96	716	66	92	100
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	97	97	97	97	97	97	97	95	93	90	89	89	91	92	92	92	95	96	96	97	97	97	97	97	704	75	95	100
	2.0 m	99	98	99	99	99	99	99	98	97	94	92	92	93	93	95	96	96	98	98	98	99	99	99	98	711	73	97	100
	1.0 m	99	98	98	99	99	99	98	98	97	95	93	93	94	94	96	96	97	98	98	98	98	98	98	98	718	75	97	100
	0.5 m	99	99	99	99	99	99	99	99	98	96	95	96	95	96	97	97	98	98	99	99	98	99	99	99	717	81	98	100
Chiva Chiva (Open site)	46.0 m	96	96	96	96	95	96	96	93	90	85	82	79	81	83	86	88	90	91	92	94	94	94	95	96	684	62	91	100
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	95	96	96	95	96	95	95	92	88	82	79	76	80	82	83	84	86	89	91	93	93	94	94	95	656	61	90	100
	13.5 m	97	98	97	97	97	97	96	94	89	84	80	77	81	83	84	86	88	91	93	95	96	96	96	97	646	60	91	100
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	This level was not instrumented for relative humidity at this time																											
	2.0 m	This level was not instrumented for relative humidity at this time																											
	1.0 m	This level was not instrumented for relative humidity at this time																											
	0.5 m	97	97	97	97	97	97	96	89	84	79	76	75	81	81	82	83	87	92	94	95	96	95	97	96	696	60	90	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	13	8	9	10	8	11	12	15	22	28	36	38	36	35	30	36	27	18	20	18	17	16	19	11				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	4	4	4	4	4	4	4	12	19	25	31	31	32	30	27	33	28	18	12	5	5	4	4	3				
	13.5 m	7	6	6	6	6	6	7	11	18	21	29	29	31	32	28	32	30	19	11	12	9	9	8	7				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	10	9	8	8	8	8	8	11	18	19	21	23	24	24	24	24	15	11	11	10	8	9	8	8				
	2.0 m	5	5	5	4	5	5	6	8	10	17	18	27	24	26	16	13	9	9	9	5	7	5	5	5				
	1.0 m	5	5	5	4	5	5	5	6	10	13	17	23	20	25	14	12	9	8	7	5	8	5	6	5				
	0.5 m	4	5	5	4	3	4	5	6	8	14	17	19	18	16	13	9	7	5	5	4	5	4	6	4				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	8	9	10	9	20	9	8	12	22	26	28	38	35	37	31	26	21	29	19	16	17	16	15	10				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	8	7	10	8	8	10	10	15	16	27	27	33	31	32	28	34	21	25	15	12	8	11	9	9				
	13.5 m	7	8	9	6	6	10	8	13	19	24	29	35	33	37	33	30	22	21	13	11	10	10	7	7				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	This level was not instrumented for relative humidity at this time																											
	2.0 m	This level was not instrumented for relative humidity at this time																											
	1.0 m	This level was not instrumented for relative humidity at this time																											
	0.5 m	12	12	11	14	10	12	16	24	24	31	35	30	40	34	35	32	23	17	13	12	14	14	10	10				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Means[2] of other Elements by Hour																							Monthly Summary			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	73.1	73.0	72.9	72.7	72.6	72.5	73.1	74.7	75.7	76.6	77.1	77.5	77.0	76.6	76.7	76.2	75.9	75.1	74.4	74.1	73.8	73.5	73.2	73.1	704	66.8	74.7	80.0
	WB (2.0 m)	73.4	73.3	73.2	73.1	73.1	73.0	73.3	74.6	76.1	76.9	77.7	77.8	77.4	77.1	77.3	77.0	76.4	75.7	75.0	74.5	74.2	74.0	73.7	73.5	715	69.5	75.1	80.5
	WB (0.5 m)	73.6	73.5	73.4	73.3	73.2	73.1	73.3	74.7	76.1	77.1	78.0	78.2	77.8	77.6	77.6	77.3	76.7	75.9	75.2	74.8	74.3	74.2	73.9	73.7	717	69.5	75.3	80.6
	BP	.750	.733	.722	.716	.724	.736	.758	.777	.791	.796	.779	.757	.731	.706	.687	.683	.694	.707	.726	.746	.761	.771	.772	.758	718	.620	.741	.860
	P1	0.01	0.00	0.00	0.01	0.05	0.17	0.01	0.03	0.03	0.04	0.07	0.08	0.45	0.05	0.10	0.13	0.12	0.32	0.08	0.17	0.02	0.01	0.10	0.00	75	0.01	9.83	1.43
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.02	0.02	0.03	0.29	0.02	0.11	0.15	0.04	0.45	0.03	0.01	0.00	0.00	0.09	0.03	43	0.01	4.70	0.82
	P4	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.02	0.00	0.02	0.05	0.25	0.02	0.09	0.13	0.10	0.07	0.03	0.08	0.02	0.00	0.04	0.04	44	0.01	4.40	0.69
Chiva Chiva (Open site)	WB (0.5 m)	72.8	72.8	72.7	72.3	72.3	72.4	73.6	75.8	77.1	77.8	78.2	78.6	77.8	77.5	77.4	76.8	76.1	75.2	74.7	74.1	73.7	73.4	73.3	73.2	697	67.5	75.0	81.0
	BP	.841	.822	.811	.806	.812	.829	.850	.870	.884	.887	.873	.846	.821	.796	.779	.776	.785	.801	.820	.841	.856	.864	.863	.855	720	.685	.833	.950
	PS	0.05	0.02	0.03	0.01	0.06	0.10	0.03	0.00	0.06	0.02	0.28	0.11	0.10	0.14	0.08	0.06	0.01	0.01	0.10	0.15	0.13	0.01	0.02	0.01	48	0.01	4.08	0.75

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P4 - Precipitation under open canopy (in.)

[2]Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Ranges[2] of other Elements by Hour																							Monthly Summary*			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	WB (4.0 m)	6.6	6.7	7.0	7.5	7.9	8.0	8.0	6.0	5.1	5.8	4.1	6.0	5.9	5.9	5.8	6.5	5.5	5.3	5.8	5.5	5.9	5.9	7.0	6.7				
	WB (2.0 m)	6.0	5.0	5.1	5.1	5.2	5.6	5.8	4.1	4.0	4.1	5.3	4.7	6.7	5.1	6.4	6.0	5.5	3.4	3.9	4.6	4.2	4.6	6.0	5.9				
	WB (0.5 m)	6.1	5.1	5.1	5.0	5.2	5.1	5.3	4.0	3.4	4.4	5.4	4.9	6.5	5.0	5.8	5.7	4.7	3.1	3.4	4.7	4.3	4.2	5.3	5.8				
	BP	.130	.135	.145	.135	.135	.140	.135	.135	.135	.140	.150	.135	.140	.130	.135	.125	.130	.130	.125	.130	.130	.140	.145	.220				
	P1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.20	1.42	0.09	0.18	0.50	0.23	0.60	0.11	0.60	0.00	0.00	0.18	0.00				
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.80	0.03	0.14	0.23	0.06	0.00	0.01	0.00	0.00	0.00	0.00	0.02				
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.67	0.03	0.24	0.41	0.12	0.09	0.00	0.12	0.00	0.00	0.03	0.00				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	WB (0.5 m)	7.5	6.0	5.9	6.2	6.0	7.0	6.0	5.2	6.0	5.3	5.2	5.0	7.2	5.2	6.8	4.8	4.8	4.9	4.1	5.3	6.0	6.5	5.0	6.0				
	BP	.145	.140	.145	.125	.130	.135	.130	.130	.165	.175	.180	.160	.145	.150	.155	.160	.160	.135	.135	.140	.140	.135	.125	.140				
	PS	0.10	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.08	0.00	0.72	0.23	0.23	0.49	0.06	0.11	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00				

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P4 - Precipitation under open canopy (in.)

[2]Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	39.0 m	5	5	4	5	5	5	4	4	5	5	6	6	6	6	6	5	5	5	5	5	6	5	4	5	685	0	5	14
	32.0 m	3	3	3	3	3	3	3	3	4	3	4	4	4	4	4	3	3	3	3	3	3	3	2	3	711	0	3	11
	30.0 m	0	0	0	0	0	0	4	2	4	4	4	6	3	4	5	2	6	7	12	10	12	16	10	10	21	0	6	16
Chiva Chiva (Open site)	26.5 m	3	2	3	3	3	3	3	4	5	6	6	7	8	7	7	7	5	5	4	3	4	3	3	3	712	0	4	16
	4.0 m	2	2	3	2	2	2	2	3	4	5	5	5	6	5	5	6	4	4	3	3	3	2	2	2	555	0	3	14

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

NOVEMBER 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	39.0 m	9	8	9	9	9	7	8	9	10	8	7	11	11	13	9	9	8	10	9	9	9	11	9	8				
	32.0 m	6	6	7	6	6	6	6	7	9	8	7	8	7	10	6	8	6	6	6	6	6	8	6	6				
	30.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12	12	0	0	0	0	0	0				
Chiva Chiva (Open site)	26.5 m	7	8	7	8	7	6	6	8	11	10	11	13	9	15	13	15	10	14	10	8	11	7	6	8				
	4.0 m	4	5	5	6	4	5	5	7	9	9	10	12	10	14	10	13	8	7	7	6	8	5	5	6				

* No monthly summary was computed for the ranges.

ALBROOK (Forest site) NOVEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 39.0 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.3	3.3		3.3		10.0					6.7	13.3	6.7			10.3	3.4	3.4	3.4	3.3			3.3	3.3
NNE				3.3	3.3	3.3				6.7	6.7									3.3	3.3			3.3
NE	3.3	3.3	3.3	6.7			3.3		3.3			3.3		3.3	10.0				6.9		3.3	3.3		3.3
ENE	3.3	3.3	3.3				3.3	3.3	3.3				3.3	6.7									3.3	
E	3.3		3.3		3.3	3.3	10.0	10.0	3.3			3.3	10.0		3.3	3.4			3.4	3.3	6.7	3.3		
ESE							6.7		3.3			3.3	3.3	3.3		6.9							3.3	3.3
SE		3.3	3.3	3.3					6.7	6.7	10.0	3.3	6.7		3.3	6.9	6.9	3.4				3.3	3.3	
SSE		3.3									6.7			3.3	3.3	3.4	6.9	3.4						3.3
S			6.7	3.3				3.3		20.0	20.0	26.7	23.3	23.3	20.0	17.2	24.0					3.3		
SSW	16.7	23.3	6.7	13.3	20.0	3.3	6.7	16.7	16.7	20.0	16.7	20.0	16.7	13.3	13.3	10.3	6.9	6.9	10.3	16.7	3.3	20.0	13.3	13.3
SW	13.3	23.3	13.3	13.3	13.3	26.7	13.3	13.3	33.3	16.7	16.7	3.3	10.0	6.7	16.7	6.9	10.3	17.2	13.7	13.3	26.7	10.0	6.7	16.7
WSW	20.0	13.3	16.7	16.7	30.0	20.0	26.7	30.0	10.0	10.0		3.3		16.7	3.3	6.9	10.3	20.6	20.6	26.7	30.0	23.3	20.0	23.3
W	20.0	13.3	23.3	20.0	3.3	16.7	20.0	6.7	10.0	13.3	6.7	6.7	13.3	16.7	3.3	13.7	24.0	20.6	20.6	13.3	13.3	20.0	26.7	16.7
WNW	3.3		3.3	6.7	10.0	3.3	3.3	6.7	10.0	3.3	6.7	6.7	3.3	3.3	10.0		3.4	13.7	10.3	6.7	6.7		3.3	3.3
NW	6.7	6.7	3.3	3.3	6.7	6.7		6.7			3.3			3.3	10.0	10.3		3.4	6.9	3.3		3.3	10.0	6.7
NNW	6.7		6.7	3.3	3.3	3.3	3.3			3.3		6.7	3.3		3.3	3.4	3.4	3.4		6.7	3.3	6.7	3.3	
CALM		3.3	6.7	3.3	6.7	3.3	3.3	3.3										3.4	3.4	3.3	3.3	3.3	3.3	3.3

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA. S. A. 45895

ALBROOK (Forest site) NOVEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 32.0 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	13.3	3.3	3.3	16.7	3.3	3.3	10.0		6.7	3.3	6.7	6.7	13.3	10.0	3.3	6.9	6.9	10.3	10.3	10.0	6.7	16.7	6.7	10.0
NNE	3.3		3.3					3.3		10.0		3.3		3.3	6.7	3.4	3.4				6.7	3.3	6.7	3.3
NE	3.3	3.3	6.7			3.3	3.3				6.7	3.3		3.3	6.7			6.9	6.9	6.7	3.3		3.3	3.3
ENE		3.3		3.3		3.3		6.7	3.3	3.3	6.7		3.3		3.3	3.4			3.4					
E		3.3	3.3	3.3			3.3	3.3	3.3			3.3	3.3		3.3	3.4				3.3		6.7	3.3	3.3
ESE	3.3					3.3	3.3	6.7	3.3			3.3	3.3	6.7				3.4			6.7			
SE			3.3			6.7	3.3		3.3				6.7			10.3	3.4	3.4						
SSE		3.3					3.3		6.7	3.3		10.0	3.3				3.4							
S		3.3		3.3						13.3	26.7	13.3	23.3	23.3	23.3	20.6	17.2			3.3				
SSW		3.3	3.3							3.3	3.3	6.7	3.3			3.4		3.4		3.3		3.3		
SW				3.3	6.7				6.7	13.3	10.0	10.0	6.7	3.3				3.4		6.7				
WSW	3.3	3.3	3.3			3.3	6.7	3.3		3.3	6.7	6.7		6.7	6.7	3.4			3.4			6.7	3.3	3.3
W	13.3	10.0	3.3	3.3	13.3	3.3	6.7	3.3	6.7	3.3	6.7		10.0	6.7	10.0	3.4	13.7		10.3	10.0	6.7	3.3	3.3	13.3
WNW	6.7	10.0	6.7	6.7	6.7	13.3	6.7	6.7	16.7	6.7	6.7	6.7	3.3	10.0	13.3	3.4	6.9	3.4	10.3		3.3	3.3	13.3	6.7
NW	26.7	26.7	36.7	16.7	33.3	23.3	23.3	40.0	16.7	20.0	10.0	10.0	13.3	6.7	10.0	24.0	24.0	30.9	17.2	30.0	33.3	26.7	26.7	20.0
NNW	16.7	16.7	16.7	26.7	23.3	26.7	20.0	20.0	23.3	13.3	10.0	6.7	6.7	13.3	13.3	10.3	10.3	24.0	30.9	20.0	20.0	20.0	23.3	23.3
CALM	10.0	10.0	13.3	13.3	13.3	10.0	10.0	6.7	3.3	3.3		10.0		6.7		3.4	10.3	10.3	6.9	6.7	13.3	10.0	10.0	13.3

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45893

CHIVA CHIVA (Open site) NOVEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	10.0	3.3	10.0			13.7	13.3	6.7	6.7	10.3	6.9	27.5	17.2	16.7	10.0	10.0	10.0		6.9	13.3		3.3	10.0	6.7
NNE	3.3	6.7	3.3	3.3	3.3			3.3	3.3					3.3	3.3		3.3	6.7			3.3	3.3		
NE			3.3	13.3			3.3			3.4			3.4	6.7		3.3		3.3	6.9		6.7	3.3		6.7
ENE							3.3			3.4								3.3	3.4			3.3	6.7	3.3
E					3.3		6.7			3.4	6.9		6.9								3.3	3.3		
ESE			3.3						3.3							3.3			3.4					3.3
SE				3.3					3.3	6.9	3.4	6.9	6.9	6.7	6.7	3.3	6.7	3.3		3.3		3.3	3.3	
SSE	3.3	3.3							3.3		3.4	6.9	3.4	6.7		6.7		3.3		3.3				
S		3.3		3.3					6.7		13.7	13.7	20.6	13.3	16.7	6.7	6.7							
SSW						3.4		3.3								3.3	3.3	3.3						
SW		3.3								6.9						3.3				3.3				
WSW								3.3						3.3	3.3		6.7		3.4					3.3
W	3.3	3.3		6.7	10.0		6.7			3.4	6.9	3.4	3.4			3.3	3.3		6.9	6.7		6.7	3.3	3.3
WNW	3.3	3.3	6.7		6.7		6.7	6.7	6.7		10.3	3.4	6.9			6.7	6.7	6.7		3.3	3.3	16.7	6.7	6.7
NW	53.3	50.0	33.3	46.7	46.7	48.1	40.0	50.0	33.3	34.3	37.8	24.0	17.2	30.0	40.0	33.3	33.3	37.8	34.3	33.3	60.0	33.3	50.0	46.7
NNW	6.7	10.0	16.7	10.0	16.7	17.2	16.7	20.0	26.7	24.0	10.3	13.7	13.7	13.3	20.0	16.7	13.3	23.3	17.2	23.3	16.7	16.7	10.0	10.0
CALM	16.7	13.3	23.3	13.3	13.3	17.2	3.3	6.7	6.7	3.4							6.7	10.0	17.2	10.0	6.7	6.7	10.0	10.0

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

CHIVA CHIVA (Open site) NOVEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	10.0	10.0	13.3		20.0	6.7	6.7	6.7	6.7	20.0	10.0	13.3	3.3	13.3	10.0	13.3	6.7	3.4	6.7	16.7		3.3	6.7	3.3
NNE	3.3		3.3	6.7		13.3	10.0	6.7	3.3	3.3			6.7	10.0		3.3	6.7	3.4		6.7	13.3		10.0	16.7
NE	6.7	16.7	3.3	10.0	6.7	6.7	6.7				3.3	3.3	6.7		3.3			6.9	3.3			10.0	3.3	3.3
ENE		3.3	6.7	3.3	3.3	3.3														3.3	3.3	3.3	3.3	
E	3.3		6.7	3.3	3.3	3.3				3.3		3.3	6.7					3.4				3.3	10.0	3.3
ESE						3.3				6.7					3.3		6.7	6.9				3.3		
SE	3.3	6.7	3.3	10.0					3.3			3.3	6.7			3.3		3.4	6.7				3.3	3.3
SSE		3.3	3.3						6.7		3.3	13.3		3.3	3.3	10.0				3.3	3.3	3.3		
S	3.3			3.3			6.7	3.3		3.3	10.0	3.3	10.0	10.0	6.7		10.0		3.3			3.3	3.3	
SSW		3.3			3.3	3.3		3.3	3.3			3.3			3.3	6.7			6.7			3.3		
SW			3.3	3.3	3.3			6.7	10.0	3.3			3.3		3.3	6.7				13.3	6.7			
WSW	6.7		3.3		3.3			3.3	3.3		10.0	6.7	3.3		3.3		6.7	3.4	3.3		3.3	3.3	6.7	3.3
W	20.0	20.0	6.7	16.7		10.0	20.0	10.0	13.3	13.3	13.3	6.7	16.7	6.7	3.3	13.3	3.3		10.0	13.3	3.3	16.7	6.7	26.7
WNW	20.0	10.0	20.0	10.0	20.0	20.0	10.0	13.3	6.7	6.7	10.0	3.3		6.7	13.3	10.0	10.0	13.7	13.3	6.7	10.0	3.3	10.0	13.3
NW	13.3	13.3	10.0	10.0	16.7	20.0	20.0	23.3	30.0	13.3	26.7	13.3	16.7	33.3	20.0	10.0	23.3	20.6	20.0	20.0	30.0	16.7	26.7	20.0
NNW	10.0	6.7	10.0	10.0	6.7	3.3	6.7	13.3	3.3	16.7		13.3	6.7	3.3	16.7	13.3	13.3	24.0	10.0	3.3	13.3	3.3	6.7	3.3
CALM		6.7	6.7	13.3	13.3	6.7	13.3	10.0	10.0	10.0	13.3	13.3	13.3	13.3	10.0	10.0	13.3	10.3	26.7	13.3	13.3	23.3	3.3	3.3

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45893

SUMMARY OF NON HOURLY DATA

NOVEMBER 1967

Summary of Elements with Non-hourly Frequencies of Observation

Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	Evaporation[3] (in. at 3 levels)	Piche (26.5 m)	21	0.004	2.201*	0.232
		Piche (13.5 m)	17	0.006	0.688*	0.092
		Piche (0.5 m)	7	0.006	0.213*	0.061
	Precipitation from Raingauge Network[2] (in. at 1.0 meters)	Gauge # 1	33	0.01	6.16*	1.05
		Gauge # 2	35	0.01	11.02*	1.32
		Gauge # 3	34	0.01	8.74*	1.20
		Gauge # 4	33	0.01	8.37*	1.14
		Gauge # 5	33	0.01	8.49*	1.19
		Gauge # 6	34	0.01	8.95*	1.08
		Gauge # 7	32	0.01	9.91*	1.33
		Gauge # 8	33	0.01	7.47*	0.91
Chiva Chiva (Open site)	Evaporation[3] (in. at 0.5 meters)	Piche	24	0.006	3.179*	0.299
		Pan	23	0.039	4.187*	0.640

2 - Six hourly observations

3 - Daily observations

* Total Values

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13. ABSTRACT

This report contains detailed microclimatic data for November 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.

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Data Base						

AD

MONTHLY MICROCLIMATIC SUMMARY

DECEMBER 1967

ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY
TROPIC TEST CENTER
Fort Clayton, Canal Zone

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ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY MICROCLIMATIC SUMMARY

DECEMBER 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

USATECOM Project No. 9-4-0013-01

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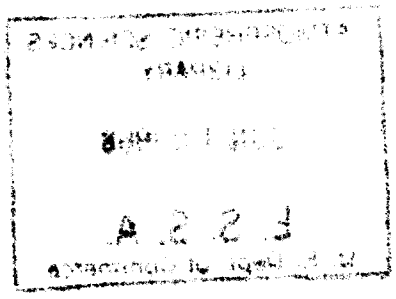

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TABLE OF CONTENTS

PAGE

Introduction 1
Sites 1
Instrumentation. 1
Data Reduction and Storage 2

Figures
1. Location Map, Isthmus of Panama. 3
2. Frequency of Observations. 4
3. Albrook Forest Site Generalized Plot 5
4. Chiva Chiva Open Site, Generalized Plot. 6
5. Instrument Location on Towers. 7

Data Summary Sheets
Monthly Means of Air Temperature by Hour 8
Monthly Ranges of Air Temperature by Hour. 9
Monthly Means of Relative Humidity by Hour 10
Monthly Ranges of Relative Humidity by Hour. 11
Monthly Means of Other Elements by Hour. 12
Monthly Means of Wet Bulb Temperature by Hour
Monthly Means of Barometric Pressure by Hour
Monthly Means of Precipitation by Hour
Monthly Totals of Precipitation
Monthly Ranges of Other Elements by Hour. 13
Monthly Ranges of Wet Bulb Temperature by Hour
Monthly Ranges of Barometric Pressure by Hour
Monthly Ranges of Precipitation by Hour
Monthly Means of Wind Speed by Hour. 14
Monthly Ranges of Wind Speed by Hour 15
Relative Frequencies of Wind Directions (39 meters, Albrook) . . . 16
Relative Frequencies of Wind Directions (32 meters, Albrook) . . . 17
Relative Frequencies of Wind Directions (30 meters, Chiva Chiva). 18
Relative Frequencies of Wind Directions (4 meters, Chiva Chiva) ...19
Summary of Elements with Non-Hourly Frequencies of Observation 20
Evaporation (Albrook)
Precipitation (Manual gauge network, Albrook)
Evaporation (Chiva Chiva)
Minimum Grass Temperature (Chiva Chiva)

MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

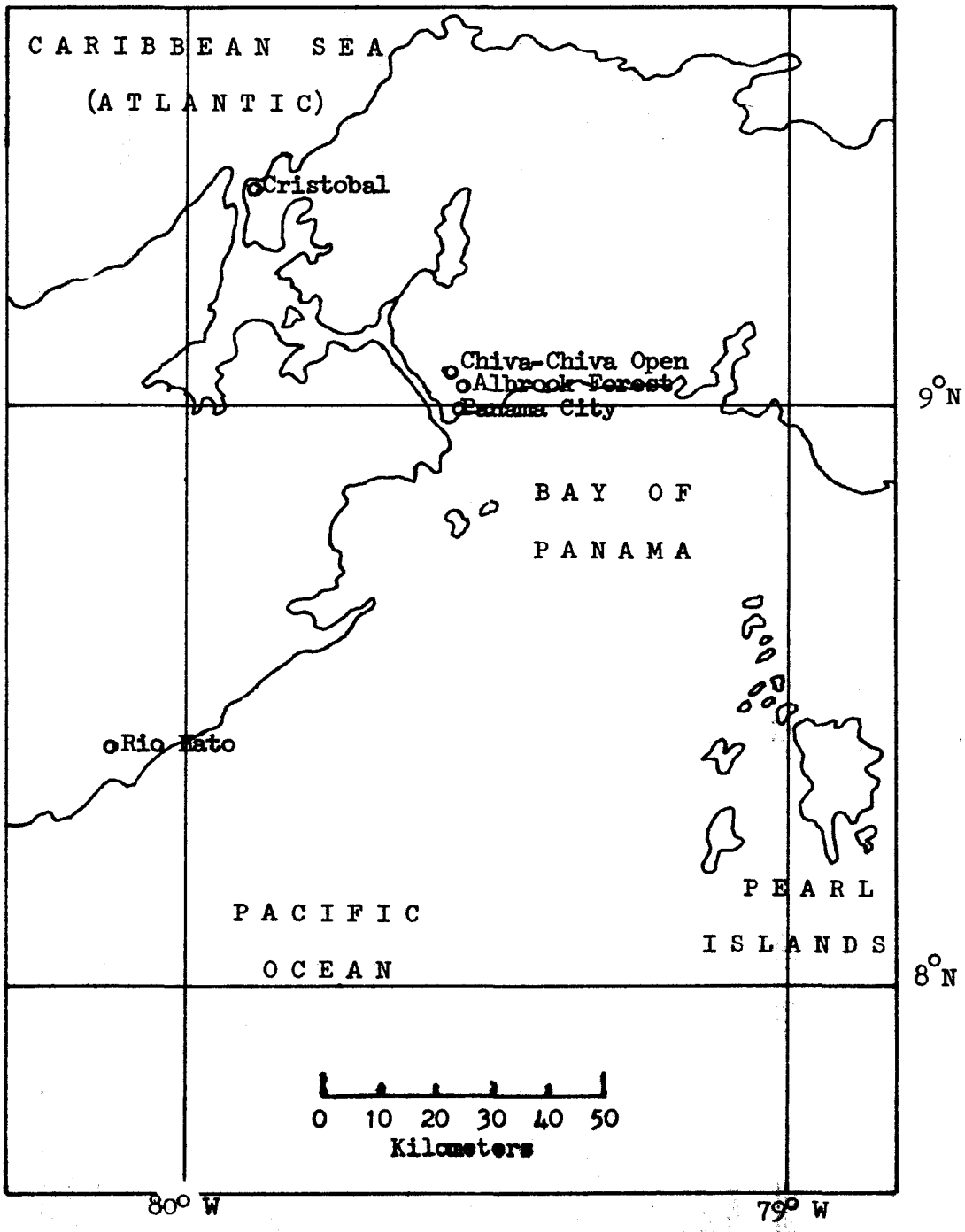

FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters) Sfc	0.5	1.0	2.0	4.0	13.5	26.5	30.0	32.0	39.0	46.0	Frequency
Temperature:												
Dry Bulb	-	1	2	2	2	2	2	-	3	-	1	Hourly*
Wet Bulb	-	1	-	2	2	-	-	-	-	-	-	Hourly*
Grass Minimum	3	-	-	-	-	-	-	-	-	-	-	Once Daily
Relative Humidity	-	1	2	2	2	1	2	-	3	-	1	Hourly*
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	-	2	-	2	Once Daily
Precipitation:												
Recording Gage	-	-	1	-	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	-	4 Times Daily
Wind:												
Direction	-	-	-	-	3	-	-	3	1	-	-	Continuously
Speed	-	-	-	-	3	-	3	-	2	2	-	Hourly

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

* Observations made with sling psychrometer when recorders are inoperative.

\# Instrument descriptions are contained in the Environmental Data Base semiannual reports.

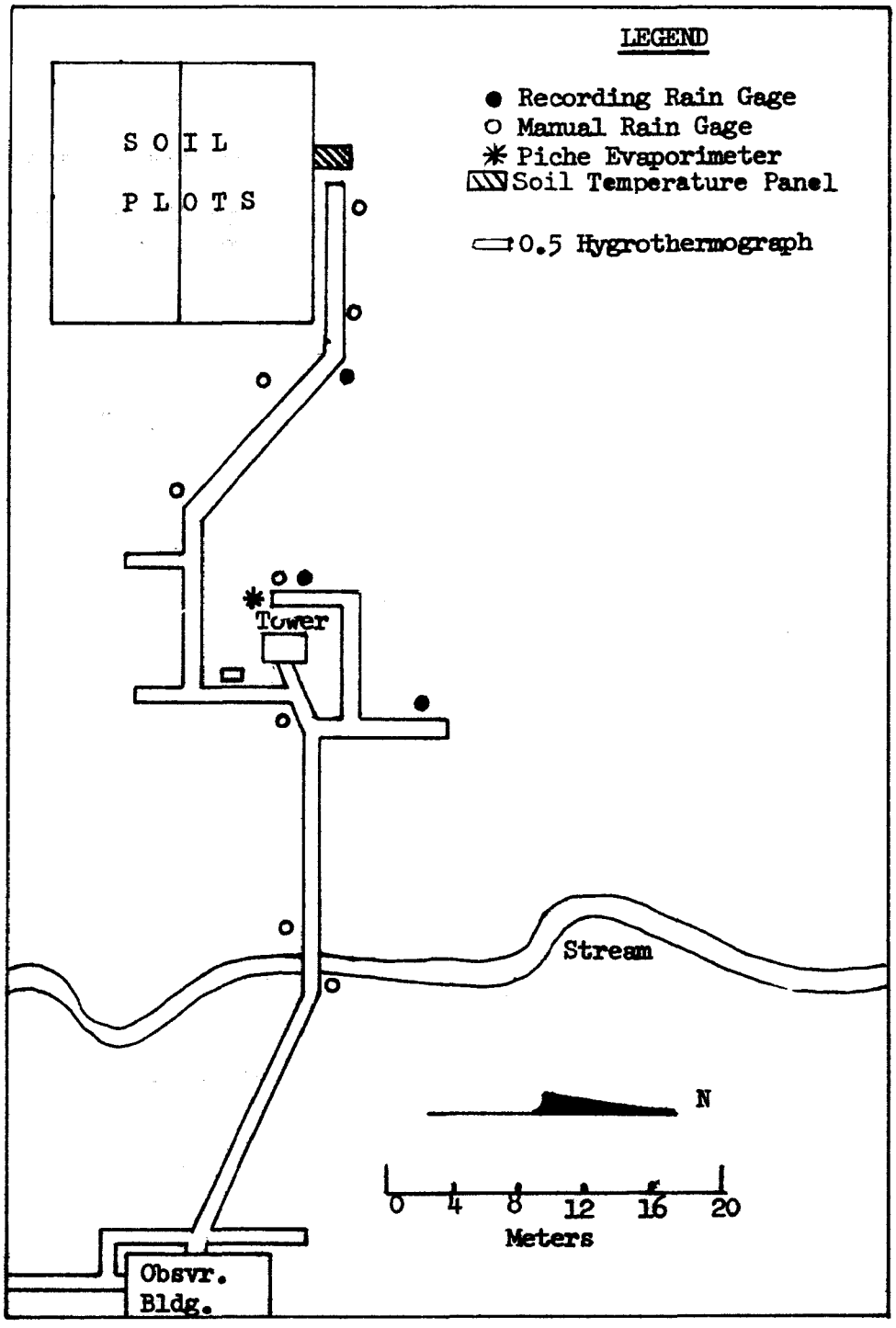

FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

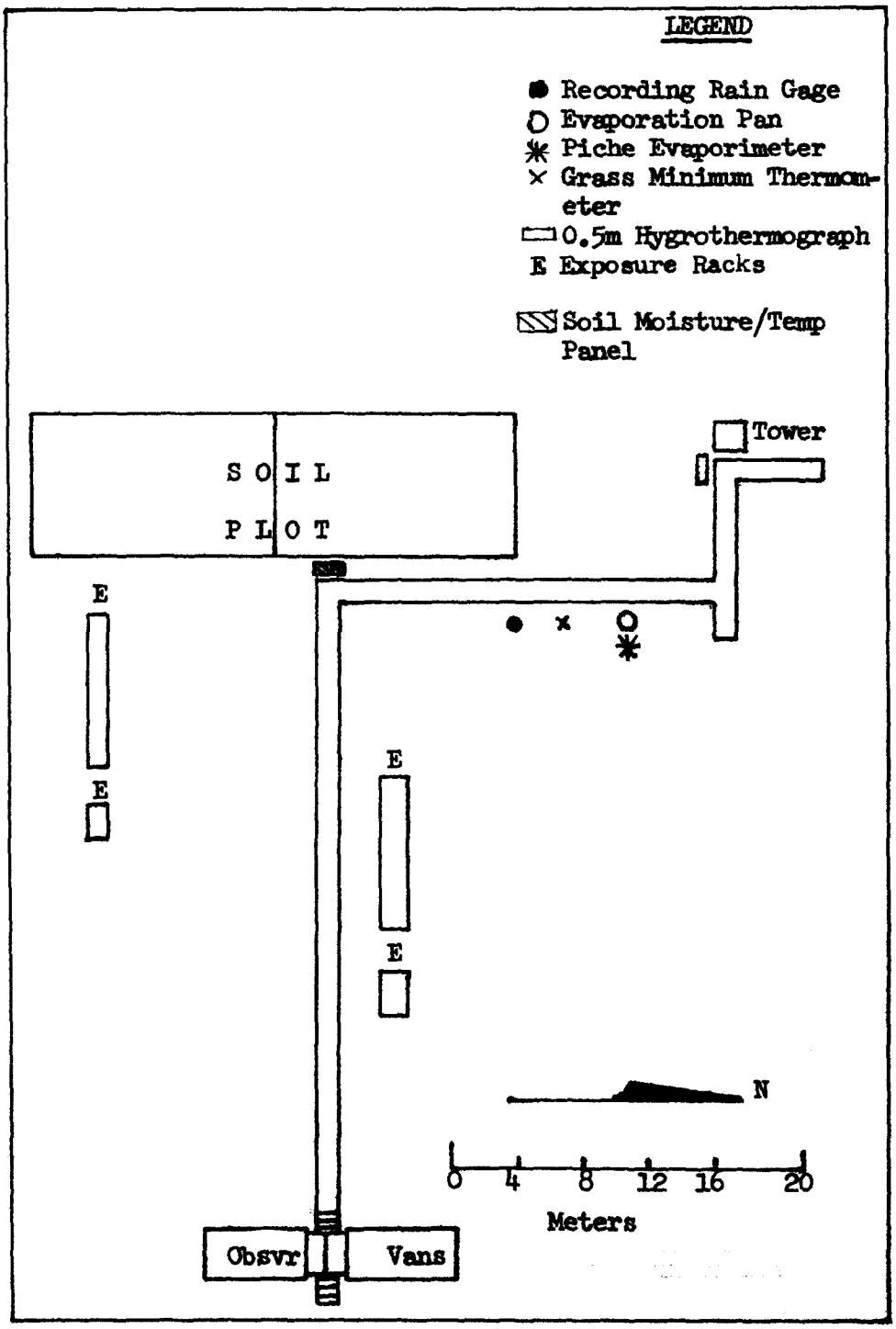

FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

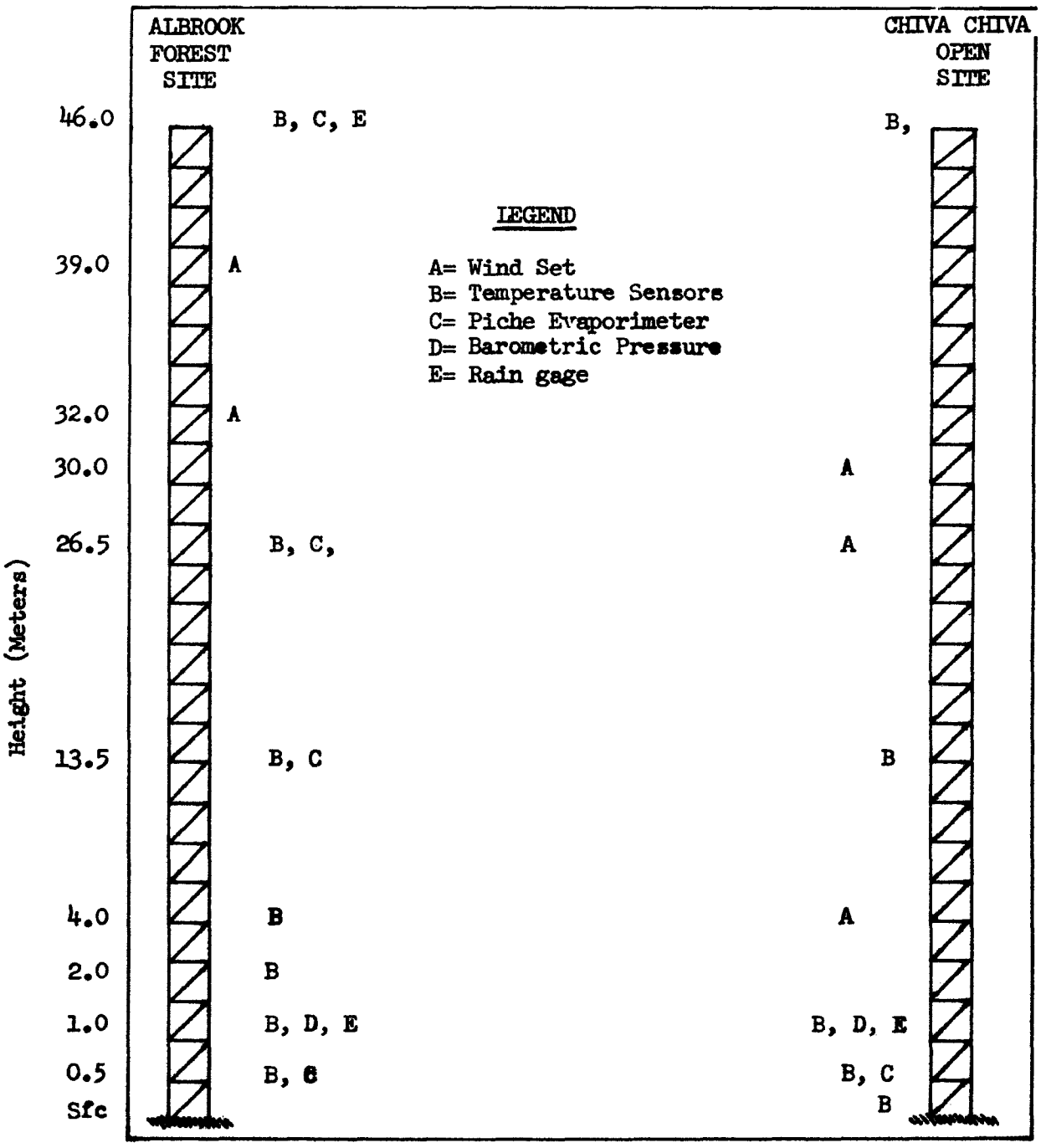

FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	74.7	74.5	74.3	74.2	74.0	74.1	74.6	76.5	79.3	81.2	82.8	83.6	83.1	82.6	81.8	80.9	79.9	78.2	77.0	76.3	75.8	75.3	75.1	74.8	743	70.7	77.7	87.2
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	73.8	73.7	73.5	73.4	73.2	73.2	73.6	75.7	78.8	81.8	83.6	84.4	84.0	83.4	82.5	81.1	79.9	77.6	76.0	75.3	74.7	74.4	74.1	74.0	744	69.9	77.3	87.8
	13.5 m	73.8	73.8	73.4	73.3	73.2	73.0	73.4	75.0	77.3	79.4	81.1	81.8	81.7	81.1	80.7	80.0	79.2	77.4	76.1	75.3	74.9	74.6	74.3	74.0	721	69.3	76.6	85.0
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	73.6	73.4	73.0	72.7	72.5	72.5	73.0	74.9	77.1	78.9	80.3	80.6	80.6	80.1	79.7	78.9	77.9	76.3	75.3	74.8	74.3	74.0	73.8	73.7	743	68.2	75.9	85.6
	2.0 m	73.2	73.0	72.8	72.5	72.5	72.2	72.4	74.1	76.6	78.7	80.1	80.9	80.5	80.0	79.6	78.7	77.8	76.4	75.2	74.5	74.1	73.8	73.6	73.4	743	68.0	75.7	84.9
	1.0 m	73.3	73.1	72.8	72.6	72.6	72.3	72.5	74.0	76.3	78.2	79.7	80.3	80.1	79.7	79.5	78.5	77.7	76.3	75.3	74.5	74.2	73.9	73.6	73.5	743	67.5	75.6	84.7
	0.5 m	73.4	73.3	72.9	72.8	72.6	72.5	72.6	74.1	76.3	78.0	79.6	80.1	79.9	79.6	79.3	78.5	77.7	76.3	75.4	74.7	74.3	74.1	73.7	73.7	742	68.0	75.6	84.3
Chiva Chiva (Open site)	46.0 m	74.5	74.3	74.0	73.9	73.9	73.7	74.0	76.1	78.5	80.4	82.3	83.3	83.5	82.9	82.4	80.9	80.1	78.6	77.0	76.5	75.9	75.4	75.1	74.9	744	69.2	77.6	87.0
	32.0 m	74.3	74.1	73.7	73.6	73.5	73.3	73.7	75.6	78.6	80.6	82.3	83.4	83.8	83.1	82.5	81.0	80.1	78.4	76.9	76.3	75.7	75.2	74.8	74.7	744	68.9	77.5	87.0
	13.5 m	74.1	73.9	73.6	73.5	73.2	72.8	73.3	76.1	79.2	81.3	83.2	84.5	84.4	83.8	82.8	81.4	80.4	78.4	77.0	76.1	75.6	75.1	74.7	74.5	744	67.4	77.6	89.1
	0.5 m	73.5	73.1	72.7	72.4	71.8	71.7	73.2	77.9	81.3	83.7	85.9	86.5	86.6	86.0	84.3	82.8	80.6	78.0	76.4	75.7	75.1	74.5	74.0	73.7	706	65.0	78.0	92.5

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Alpcook (Forest site)	46.0 m	4.7	5.5	6.0	6.1	5.6	6.5	6.7	6.3	7.5	8.9	11.7	10.9	10.2	16.1	16.3	14.0	11.8	8.9	7.8	5.5	5.8	5.2	4.8	7.0				
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	5.9	6.3	6.4	6.5	6.3	6.1	8.6	6.4	8.1	10.4	10.1	9.9	12.2	15.6	15.0	14.0	12.0	7.4	5.9	5.3	5.2	5.7	5.9	6.0				
	13.5 m	7.0	5.6	7.0	7.1	6.6	5.6	5.6	6.4	5.8	7.2	9.2	7.8	7.8	12.8	13.0	12.9	11.5	8.2	6.9	5.4	5.5	4.9	5.4	6.4				
	8.0 m	This level was not instrumented for air temperature at this time																											
	4.0 m	7.6	7.3	7.8	8.5	8.0	8.0	6.9	5.0	3.8	7.4	7.7	9.6	9.2	11.8	13.0	10.3	9.6	7.2	5.9	5.2	5.9	5.8	6.8	7.0				
	2.0 m	7.1	7.0	7.7	8.0	7.1	7.8	7.1	5.5	4.2	5.4	8.9	7.5	8.4	12.1	12.3	10.0	8.1	6.7	6.2	5.2	6.0	6.1	6.3	7.1				
	1.0 m	7.4	7.0	7.8	8.6	7.1	7.1	7.2	5.7	3.8	5.2	8.5	7.8	8.3	11.4	12.1	9.9	8.0	6.5	7.1	5.0	5.7	6.0	6.6	7.5				
	0.5 m	7.3	7.2	7.6	8.1	7.1	7.1	7.1	5.7	3.8	4.2	7.9	7.0	8.0	10.1	11.0	9.2	7.8	5.7	6.1	5.0	5.7	6.1	6.5	6.5				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	6.2	7.2	8.2	8.1	7.2	8.6	6.8	8.7	6.1	9.5	9.5	10.0	9.8	15.4	16.0	13.4	10.9	8.1	6.4	6.2	5.6	6.0	4.7	4.4				
	32.0 m	6.1	7.2	8.0	8.0	7.7	8.3	9.0	9.8	6.9	9.3	10.0	10.7	10.6	15.2	16.0	13.8	10.5	8.2	6.0	6.2	6.1	6.1	5.1	4.9				
	13.5 m	7.2	7.7	8.5	9.3	8.9	9.5	10.8	9.6	7.8	10.3	11.0	11.5	12.9	15.8	15.6	14.5	10.7	7.6	6.6	6.4	6.6	6.0	6.6	5.7				
	0.5 m	7.9	9.3	10.5	11.5	11.0	12.1	10.0	8.9	9.9	12.3	12.9	13.5	14.0	12.4	17.2	16.1	10.7	7.3	8.4	6.7	7.6	8.2	7.3	7.2				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																							Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	46.0 m	16	14	16	19	24	21	16	21	27	34	42	48	45	47	50	42	36	31	25	20	20	17	17	21				
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	7	9	8	9	13	13	10	13	22	25	33	34	33	37	35	34	33	33	25	17	11	16	8	8				
	13.5 m	9	11	9	8	11	12	10	9	13	20	34	35	40	39	40	35	32	27	21	19	11	10	9	9				
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	9	11	11	6	12	9	6	12	15	25	25	37	42	34	37	23	21	20	14	10	10	9	7	10				
	2.0 m	8	6	5	8	5	5	4	5	11	22	30	34	34	28	38	20	18	17	12	10	10	6	9	7				
	1.0 m	5	5	5	9	5	5	4	7	10	19	28	34	35	25	33	23	17	16	10	9	8	6	8	6				
	0.5 m	5	8	5	8	4	4	5	4	11	14	28	31	35	19	22	18	17	14	12	8	7	6	7	5				

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	20	17	16	15	21	17	17	21	20	26	37	37	39	44	44	44	33	30	29	19	18	17	14	18				
	32.0 m	18	18	18	20	20	17	17	23	21	30	37	35	40	44	42	41	35	28	28	19	15	13	16	16				
	13.5 m	20	20	19	17	21	17	15	20	22	30	40	40	44	43	44	42	35	27	24	19	17	15	17	17				
	0.5 m	14	8	11	16	9	13	12	20	28	27	35	39	39	41	44	43	36	24	19	14	12	14	10	10				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	89	89	89	90	90	90	88	85	79	74	70	68	69	70	73	76	77	81	83	85	86	88	88	89	741	46	82	100
	28.5 m	This level was not instrumented for relative humidity at this time																											
	26.5 m	95	95	95	95	95	95	95	93	87	80	74	73	74	76	79	81	83	87	91	93	94	94	95	95	742	60	88	99
	13.5 m	96	96	96	96	96	96	97	95	91	85	80	78	80	80	82	84	85	88	91	93	93	95	95	95	730	58	90	99
	8.0 m	This level was not instrumented for relative humidity at this time																											
	4.0 m	96	96	96	97	97	97	97	96	93	89	87	85	87	89	90	91	92	94	95	96	96	97	97	96	740	58	94	100
	2.0 m	98	98	98	98	98	98	99	98	96	92	89	87	88	90	92	93	94	95	96	97	97	98	97	98	740	62	95	100
	1.0 m	98	98	98	98	98	99	99	98	96	94	91	89	91	93	92	94	94	95	96	97	97	98	98	98	743	64	96	100
	0.5 m	98	98	99	98	99	99	99	99	98	95	92	91	93	94	94	95	95	96	97	98	98	98	98	98	743	65	97	100
Chiva Chiva (Open site)	46.0 m	91	91	93	92	92	93	92	87	83	77	71	68	68	70	72	77	78	81	85	86	88	89	90	91	744	52	84	100
	32.0 m	92	92	93	93	93	94	93	90	83	77	72	69	69	71	73	77	78	82	86	88	89	91	91	91	744	52	84	100
	13.5 m	93	93	93	93	93	94	94	91	82	76	71	67	68	69	72	76	78	82	86	88	90	91	92	91	743	50	84	100
	0.5 m	97	98	98	97	98	97	96	89	81	78	73	70	71	73	76	77	81	87	91	92	93	94	96	95	704	55	87	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Means[2] of other Elements by Hour																								Monthly Summary			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	72.8	72.6	72.3	72.1	72.0	71.9	72.4	74.1	75.6	76.4	76.9	77.0	77.4	77.4	77.1	76.7	76.1	75.0	74.2	73.8	73.5	73.3	73.1	73.0	743	67.7	74.4	80.5
	WB (2.0 m)	72.8	72.7	72.5	72.2	72.1	71.9	72.1	73.7	75.6	76.8	77.4	77.8	77.7	77.7	77.5	77.1	76.3	75.2	74.5	73.8	73.5	73.4	73.0	73.0	743	67.0	74.6	81.0
	WB (0.5 m)	73.1	72.9	72.7	72.5	72.5	72.2	72.5	73.9	75.8	76.9	77.7	78.1	78.1	78.1	78.0	77.3	76.7	75.6	74.8	74.2	74.0	73.7	73.4	73.4	743	67.3	74.9	82.0
	BP	.759	.743	.726	.724	.730	.745	.767	.783	.798	.801	.791	.768	.742	.716	.700	.696	.702	.717	.734	.754	.772	.782	.782	.777	739	.600	.750	.890
	P1	0.01	0.05	0.02	0.49	0.00	0.02	0.16	0.00	0.01	0.33	0.16	0.07	0.10	0.15	0.08	0.21	0.30	0.02	0.01	0.00	0.00	0.00	0.00	0.00	53	0.01	7.04	1.04
	P2	0.00	0.00	0.00	0.47	0.02	0.00	0.00	0.00	0.00	0.00	0.07	0.05	0.26	0.53	0.06	0.14	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23	0.01	4.59	1.25
	P4	0.00	0.00	0.00	0.70	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.16	0.46	0.09	0.13	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13	0.01	3.44	0.82
Chiva Chiva (Open site)	WB (0.5 m)	72.8	72.5	72.2	71.8	71.4	71.1	72.4	75.4	76.7	77.8	78.7	78.4	78.8	78.8	78.0	76.9	76.0	75.0	74.3	74.0	73.7	73.3	73.1	72.8	704	64.8	74.8	83.2
	BP	.859	.842	.827	.823	.827	.841	.859	.880	.897	.902	.892	.867	.838	.812	.798	.796	.802	.819	.835	.854	.872	.882	.881	.874	742	.695	.849	.995
	PS	0.00	0.00	0.06	0.55	0.11	0.00	0.00	0.02	0.00	0.00	0.02	0.02	0.25	0.13	0.13	0.28	0.18	0.04	0.00	0.20	0.00	0.00	0.00	0.00	29	0.01	5.11	1.25

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P4 - Precipitation under open canopy (in.)

[2] Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Ranges[2] of other Elements by Hour																							Monthly Summary*			
Site	Code[1]	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Alsbrook (Forest site)	WB (4.0 m)	7.6	7.2	7.6	8.3	8.0	8.1	6.9	5.5	4.8	5.4	4.5	6.9	6.8	8.0	8.1	7.2	6.5	6.2	4.5	5.2	6.3	5.8	7.1	6.9				
	WB (2.0 m)	7.7	7.2	8.0	9.0	7.9	8.0	7.6	5.7	5.2	5.9	4.1	5.9	6.0	9.2	9.1	8.2	7.0	5.9	5.7	5.9	6.3	6.5	6.3	7.0				
	WB (0.5 m)	7.8	7.0	7.9	8.7	7.1	7.8	7.1	6.2	4.8	5.0	4.9	4.8	6.0	9.9	9.9	8.9	6.9	5.8	6.1	5.9	6.0	6.9	6.6	7.5				
	BP	.190	.185	.175	.170	.160	.160	.170	.195	.190	.190	.190	.185	.180	.175	.165	.160	.165	.160	.185	.180	.185	.180	.175	.175				
	P1	0.00	0.00	0.00	0.95	0.00	0.02	0.45	0.00	0.00	0.00	0.00	0.15	0.36	0.50	0.17	0.74	1.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00				
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.74	1.24	0.14	0.36	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.69	0.00	0.24	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Chiva Chiva (Open site)	WB (0.5 m)	8.0	8.5	10.0	10.0	10.5	11.7	9.3	8.2	9.1	8.2	7.8	7.2	7.8	9.7	10.3	8.4	6.5	6.1	6.3	7.4	7.3	8.0	7.2	7.5				
	BP	.190	.205	.205	.180	.175	.165	.200	.210	.210	.195	.180	.200	.185	.190	.180	.170	.170	.175	.195	.185	.195	.180	.175	.190				
	PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.45	0.19	1.24	0.30	0.06	0.00	0.00	0.00	0.00	0.00	0.00				

* No monthly summary was computed for the ranges.

WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P4 - Precipitation under open canopy (in.)

[2]Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																							Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.
Albrook (Forest site)	39.0 m	5	5	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	5	5	5	5	6	5	5	606	0	5	14
	32.0 m	3	3	3	3	3	3	3	3	3	3	4	4	3	4	4	4	4	3	3	3	3	.4	3	3	742	0	3	11
Chiva Chiva (Open site)	26.5 m	4	4	4	3	3	3	3	4	5	7	7	8	9	8	9	9	8	7	6	5	5	5	4	4	744	0	5	17
	4.0 m	3	3	2	2	2	2	2	3	5	6	6	7	8	7	8		7	5	4	4	4	3	3	3	744	0	4	15

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

DECEMBER 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Albrook (Forest site)	39.0 m	8	9	8	8	12	9	7	10	8	9	11	9	10	14	12	14	11	12	10	11	12	11	10	7				
	32.0 m	6	6	6	7	8	5	6	9	6	7	8	7	7	11	8	10	9	8	8	5	7	7	6	5				
Chiva Chiva (Open site)	26.5 m	10	10	12	8	9	15	9	10	9	11	12	13	15	11	14	15	12	9	14	10	13	10	10	12				
	4.0 m	7	7	7	4	5	9	7	6	9	11	10	13	14	9	12	12	13	10	11	7	10	7	9	8				

* No monthly summary was computed for the ranges.

ALBROOK (Forest site) DECEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 39.0 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N				25.0								25.0			33.3		33.3							
NNE	25.0																	33.3	33.3					33.3
NE											25.0									33.0				
ENE					25.0																			
E																								
ESE									25.0															
SE										50.0	25.0		25.0											
SSE										25.0														
S				50.0						25.0	25.0	50.0	25.0	25.0		33.3	33.3							
SSW	50.0		25.0	25.0	25.0	25.0								25.0		33.3					33.3	33.3	33.3	33.3
SW		25.0	25.0		25.0	25.0	66.6	25.0	25.0		25.0		25.0			33.3		33.3	66.6	66.6	66.6	66.6	33.3	
WSW	25.0	50.0	25.0		25.0			25.0					25.0	25.0	33.3								33.3	33.3
W		25.0										25.0			33.3									
WNW								25.0	25.0															
NW						50.0	33.3	25.0						25.0				33.3						
NNW			25.0																					
CALM									25.0								33.3							

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 48809

ALBROOK (Forest site) DECEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 32.0 m.
(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	19.4	6.4	19.4	6.4	16.1	19.4	16.7	16.1	19.4	20.1	12.9	9.7	9.7	12.9	22.6	16.1	16.1	22.6	29.0	22.6	16.1	19.4	12.9	25.8
NNE				3.2	3.2	6.4	3.3	6.4	6.4	6.6	6.4	6.4		22.6		9.7	9.7	12.9		3.2	3.2			
NE			3.2	6.4	3.2				6.4	3.3	9.7	6.4	16.1	6.4	9.7	9.7	6.4	6.4	3.2					3.2
ENE									3.2		3.2	3.2	6.4	3.2	3.2	3.2								
E	3.2			3.2				6.4	3.2		3.2	3.2	3.2	3.2	6.4	3.2	6.4	3.2						
ESE									3.2		12.9						3.2							
SE					3.2				9.7	6.6		3.2	3.2		9.7	6.4			3.2	3.2				
SSE										6.6		3.2	3.2	3.2										
S			3.2						6.4	10.1	12.9	19.4	12.9	12.9	12.9	6.4	3.2		3.2				3.2	
SSW					3.2							3.2	3.2		3.2	3.2								
SW				3.2			3.3	6.4		10.1			6.4	9.7		6.4	3.2							3.2
WSW		3.2		6.4	3.2				.	3.3		9.7		6.4	3.2	3.2	3.2				3.2		9.7	
W			3.2	6.4	3.2		6.6	9.7	3.2	3.3	6.4	3.2			3.2	6.4	12.9			3.2	3.2	3.2	3.2	6.4
WNW	3.2	9.7	3.2	6.4	6.4	9.7	6.6	12.9	12.9	6.6	12.9	3.2	3.2	3.2	3.2	6.4		6.4	6.4	6.4	9.7	6.4	12.9	9.7
NW	35.5	19.4	25.8	16.1	22.6	19.4	13.4	19.4	9.7	16.7	9.7	6.4	6.4	3.2	9.7	3.2	19.4	16.1	25.8	29.0	29.0	25.8	12.9	19.4
NNW	29.0	48.4	32.2	35.5	35.5	38.7	36.7	16.1	16.1	6.6	3.2	19.4	19.4	9.7	9.7	12.9	12.9	19.4	25.8	22.6	22.6	38.7	38.7	32.2
CALM	9.7	12.9	9.7	6.4	3.2	3.2	13.4	6.4			6.4		6.4	3.2	3.2	3.2	3.2	12.9	3.2	9.7	12.9	6.4	6.4	

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45895

CHIVA CHIVA(Open site) DECEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 30.0 m.
(%)

Dir. \ Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.2	3.2	6.4	6.4	3.2			6.4	3.2	3.2	9.7	9.7	12.9	9.7		3.2	3.2	3.2	6.4	3.2		3.2		
NNE		6.4	6.4	3.2	3.2	3.2												6.4						
NE	3.2							6.4	9.7			3.2	3.2	3.2	3.2			3.2		6.4				
ENE							3.2	3.2			3.2	9.7		6.4		3.2								
E										3.2			3.2											3.2
ESE								3.2									3.2	3.2						
SE	3.2				3.2				3.2				3.2		6.4	9.7		3.2						
SSE					3.2					3.2	3.2				6.4									
S				6.4	3.2		6.4		3.2	9.7	16.1	3.2	16.1	9.7	3.2	6.4	3.2		6.4					3.2
SSW	3.2		3.2		6.4	6.4		3.2				3.2		6.4						3.2	6.4		3.2	6.4
SW	3.2	3.2		3.2		6.4	6.4	3.2	3.2	6.4		3.2				6.4	3.2					3.2	6.4	
WSW	3.2		3.2	3.2	9.7			3.2	3.2			3.2									3.2	6.4	6.4	3.2
W		3.2	3.2	9.7	6.4	9.7	9.7	12.9	6.4	6.4	3.2	3.2	3.2		6.4	3.2	12.9	6.4	9.7	9.7	6.4	9.7	3.2	22.6
WNW	38.7	25.8	16.1	29.0	22.6	25.8	25.8	25.8	25.8	32.2	32.2	12.9	16.1	19.4	29.0	19.4	22.6	29.0	16.1	41.9	41.9	35.5	25.8	22.6
NW	25.8	32.2	35.5	19.4	22.6	22.6	25.8	25.8	35.5	22.6	22.6	41.9	38.7	41.9	25.8	35.5	38.7	41.9	51.6	22.6	25.8	32.2	38.7	25.8
NNW		3.2	6.4	6.4	3.2	6.4	3.2		6.4	12.9	9.7	6.4		3.2	19.4	12.9	12.9	3.2	3.2	3.2	6.4		3.2	6.4
CALM	16.1	22.6	19.4	12.9	12.9	19.4	19.4	6.4					3.2						6.4	9.7	9.7	9.7	12.9	6.4

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 45555

CHIVA CHIVA (Open site) DECEMBER 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.

(%)

Hr. / Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	7.7	7.7	15.4		23.1	7.7		16.7	16.7	8.3	25.0	8.3		8.3	8.3		8.3	8.3	16.7	8.3			8.3	
NNE				23.1		15.4		8.3		8.3			8.3			8.3	8.3	8.3	8.3					8.3
NE	7.7	15.4	7.7	7.7	15.4	15.4		8.3		8.3		16.7		16.7	8.3		8.3	16.7		8.3				
ENE		7.7		7.7	7.7		8.3																	16.7
E		7.7			7.7		8.3				8.3					16.7				8.3		8.3		
ESE	7.7			7.7	7.7									8.3						8.3				
SE							16.7						8.3		8.3	8.3	8.3	16.7	8.3					
SSE											8.3		8.3			8.3					8.3			
S	30.7	7.7	7.7	23.1	7.7	7.7				16.7	25.0	8.3		8.3		8.3	8.3			8.3			8.3	8.3
SSW								8.3		8.3		8.3											8.3	
SW	7.7	7.7					8.3	8.3	8.3		8.3		8.3		8.3	8.3		8.3	8.3			16.7	8.3	8.3
WSW			7.7	7.7		7.7						8.3					8.3			8.3	16.7	8.3		
W	7.7	7.7	15.4	7.7		7.7	8.3	16.7	8.3	8.3	8.3	16.7	16.7	16.7				8.3		16.7	16.7	8.3		16.7
WNW				7.7	7.7	7.7	16.7	8.3	16.7	16.7			25.0	8.3	33.3	8.3	25.0		25.0	8.3	8.3	8.3	16.7	16.7
NW	15.4	23.1	15.4	7.7	15.4	23.1	8.3	25.0	41.7	25.0	8.3	33.3	16.7	25.0	25.0	33.3	16.7	16.7	16.7		25.0	33.3	25.0	16.7
NNW	7.7		15.4						8.3		8.3		8.3	8.3	8.3		8.3	16.7	8.3	25.0	16.7	8.3	8.3	8.3
CALM	7.7	15.4	15.4		7.7	7.7	25.0												8.3		8.3	8.3	16.7	

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA, S. A. 43593

SUMMARY OF NON HOURLY DATA

DECEMBER 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	Evaporation[3] (in. at 4 levels)	Piche (46.0 m)	29	0.073	8.699*	0.549
		Piche (26.5 m)	31	0.024	5.521*	0.348
		Piche (13.5 m)	29	0.006	1.857*	0.171
		Piche (0.5 m)	16	0.012	0.615*	0.067
	Precipitation from Raingauge Network[2] (in. at 1.0 meters)	Gauge # 1	19	0.01	4.60*	1.80
		Gauge # 2	22	0.01	8.55*	2.58
		Gauge # 3	21	0.01	6.46*	1.95
		Gauge # 4	20	0.01	5.75*	2.36
		Gauge # 5	21	0.01	6.85*	2.53
		Gauge # 6	21	0.01	6.48*	2.45
		Gauge # 7	21	0.01	6.94	1.90
		Gauge # 8	19	0.01	5.15*	2.35
Chiva Chiva (Open site)	Evaporation[3] (in. at 0.5 meters)	Piche	28	0.018	5.664*	0.427
		Pan	29	0.043	4.761*	0.385
	Minimum Grass temp[3] (^{o}F at grass tips)	None	26	43.2	63.3	73.8

* Total Values

2 - Six hourly observations

3 - Daily observations

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13. ABSTRACT

This report contains detailed microclimatic data for December 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.

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