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PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS

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16. Abstract

While awaiting availability of suitable HCMM data, we have analyzed air thermograph records from a weather station representative of the agricultural portion of the test site and from a station representative of the rangeland. Assuming that HCMM overpasses were possible on every day, frequency distributions were prepared from the data of 365 consecutive days showing the differences between air temperatures at HCMM overpass times and maximums and minimums. Air temperatures at nominal day overpass times were within 1°C of maximum temperature during more than half of the days of the year, and within 3°C during more than 90% of the time at both locations. The air temperature differences tended to be greater at night, however during 85% of time the observations were within 3°C at both locations. Using NOAA satellite data, we have represented surface temperatures as isothermal maps using a computer contouring program. The thermal data have also been represented in the form of colored maps prepared by overprinting with a printer/plotter. By selecting temperature ranges using cold winter night data we were able, in general, to separate water (Gulf of Mexico one color, inland bodies another color), cities, irrigated area, and rangeland.

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TYPE II QUARTERLY PROGRESS REPORT

March 1, 1979 to June 1, 1979

A. Problems:

We are still awaiting delivery of suitable data products. Table 1 lists the scenes (paper prints) that we have received so far and the reasons that they have not been used. None of the dates so far received are included in a list of suitable dates that we predicted on the basis of weather records.

B. Accomplishments:

1. Relation of air temperatures to HCMM overpass times.

A portion of the planned HCMM synoptic studies will relate indicated surface temperatures to observed maximum and minimum air temperatures at 24 weather station locations. As a background to these analyses, air thermograph charts have been examined from a weather station representative of the irrigated portion of the test site (SEA Environmental Station, Weslaco), and a station representative of the rangeland (Los Escobas Ranch, Starr County). Assuming that every day was a possible HCMM overpass date, 365 days of record (May 10, 1978 through May 9, 1979) were examined for each of the two sites.

Figure 1 shows the frequency distribution of observed air temperature differences between daily maximum and that at nominal HCMM day overpass time ($T_{max} - T_{HCMMd}$). Nominal overpass time was based on a Reference Day 3 track; our latitude; and equatorial crossing at 1400 hr. The positions of the plotted points in the figure are explained by the fact that the original data were in degrees fahrenheit. The figure shows that air temperatures corresponding to HCMM day overpass times were within 1°C of maximum temperatures on well over half of the days of the year. The air temperatures at overpass time were within 3°C of maximum more than 90% of the time at both locations.

Figure 2 shows the frequency distribution of observed air temperature differences between nominal HCMM night overpass times and daily minimums ($T_{HCMMn} - T_{min}$). Nominal overpass time was based on Reference Day 6 track and equatorial crossing at 0200 hr. The figure shows that the nighttime differences at both locations tended to be greater than daytime, however 85% of the observations were within 3°C. The tendency for greater air temperature differences at night is due to the several hours that intervene between satellite overpass and air temperature inflection, whereas in the daytime a considerably shorter interval was typical. An explanation of the rarely occurring large temperature differences ($T_{HCMMn} - T_{min}$) is the passage of weather fronts and/or rain storms in the intervening period.

2. Surface isothermal maps prepared.

One of our goals in this project is to determine if there are areas in the southern Texas vegetable, citrus, and sugarcane producing region that are more susceptible to freeze damage on the occasional cold nights experienced in the region than other adjacent areas; and, if there are areas susceptible to frost and freeze damage, where the susceptible areas are located. NOAA data tapes have been obtained for two of the coldest nights within the period satellite data are available, 12/21/73 and 12/10/78. The data in these tapes have been reformatted to coincide with linear coordinates of latitude and longitude to match known landmarks within the Lower Rio Grande Valley. Calibration techniques applied separately to each set of data show that a change of 1 in digital count in the original data represents about 3/4 degree C (0.73099 for 1972 and 0.72162 for 1978).

A contouring program has been modified to fit our limited computer and plotter facilities and to produce contour maps of the temperature patterns sensed by the satellite data gathering system. CPU memory capacity of our computer forced us to reduce any area of interest into contiguous blocks of 2048 points in a two dimensional array. The relative dimensions of the array can be adjusted to fit the area of interest. A 32 by 64 arrangement has been satisfactory for the test site area. With this limitation plots have been made of the temperature distribution over the Lower Rio Grande Valley of the two nights for which we have data. Square blocks of pixels have been averaged for each point in the array to plot various sized areas. These temperature contour maps show the moderating influence of water bodies in the Valley such as Falcon Reservoir, Delta Lake, La Sal Vieja, Vaso Marte R. Gomez, and the city of Brownsville. No consistent relation between soil pattern nor geographic location is apparent in the temperature contouring done so far.

3. Color surface temperatue maps prepared.

Color surface maps have been prepared from NOAA thermal satellite data by computer using an overprinting technique with a printer/plotter. By selecting the temperature ranges it was possible, in general, to delineate the following features of a nighttime scene representing the Lower Rio Grande Valley of Texas: Gulf of Mexico, inland bodies of water (different color), cities, irrigated area, and rangeland.

A scene representing the freeze of 12/21/73 showed a slight decrease of surface temperatures inland from the Gulf of Mexico, except for the combined effects of thermal islands associated with large inland bodies of water (Falcon Reservoir and Vaso Marte R. Gomez) and warmer temperatures resulting from better air drainage across the Rio Grande River in Mexico due to more pronounced surface relief.

Numerous small areas >16 km^2 of above average and below average surface temperatures were apparent in the irrigated portion of the test site. Similarly, some areas of warmer temperature (some rather extensive) were present at certain locations in the generally cold rangeland. Some of these temperature irregularities are presently unexplained, and hopefully will be clarified with the analysis of HCMM data.

The minute detail of the printer/plotter map was largely lost in the thermal contouring method described in item (2) when the whole test area was represented.

C. Significant Results:

None.

D. Publications:

None.

E. Recommendations:

None.

F. None

G. Data Utility:

No useful HCMM data or photography imagery were received.

Table 1. HCMM imagery received at Weslaco, Texas as of May 31, 1979 (paper prints).

Date	Type of Data: Day VIS	Day IR	Night IR	Ident. No.	Reference Day and/or Remarks
09 Jun 78			X	028	11? Mostly clouds
12 Jun 78	X	X		043/44	North of test site
18 Jun 78	X	X		016/017	Unknown area
18 Jun 78	X	X		018/019	Unknown area
18 Jun 78	X	X		035/36	p.c., unknown area
06 Jul 78			X	005	Test site cloudy
13 Jul 78	X	X		063/64	13 p.c.-all site not inc.
13 Jul 78	X	X		061/62	North of test site
22 Jul 78			X	82	Baja peninsula
22 Jul 78			X	83	Cloudy, unknown area
31 Aug 78	X	X		028/029	Cloudy
05 Sep 78	X	X		202/203	p.c., appears n. of test site
10 Sep 78	X	X		049/050	Cloudy
26 Sep 78	X	X		045/046	Cloudy, appears n. of test site
27 Sep 78	X	X		024/025	Cloudy
29 Sep 78			X	104	North of test site
29 Set 78			X	105	Test site 30% cloud covered
23 Oct 78	X	X		062/063	p.c., n. of test site
23 Oct 78	X	X		064/065	Test site 35% cloud covered
24 Oct 78	X	X		027/029	Cloudy, unknown area
16 Nov 78			X	220	p.c., unknown area
16 Nov 78			X	221	p.c., unknown area
16 Nov 78			X	016	Cloudy
07 Dec 78			X	017	Cloudy

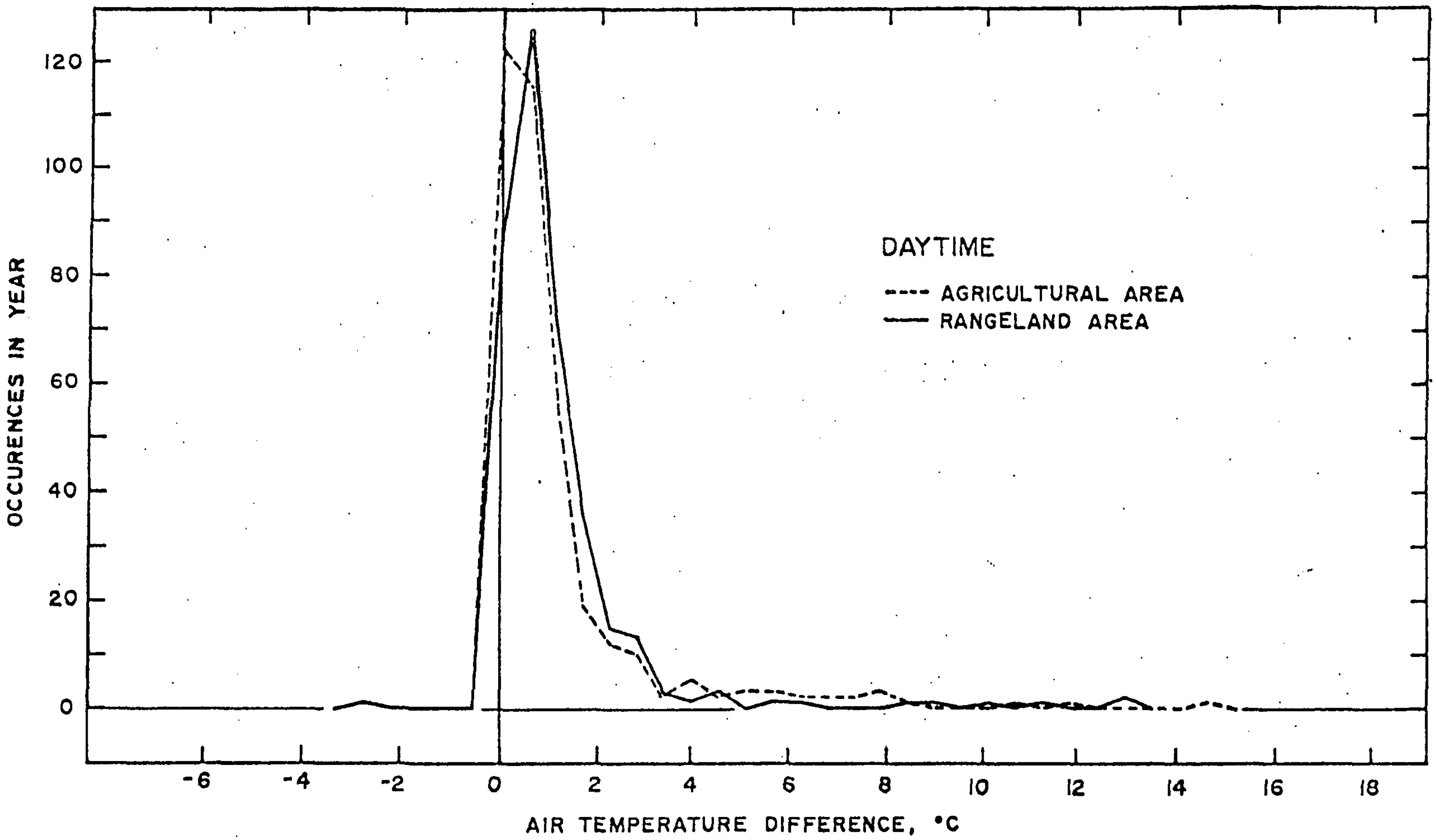

FIG. 1 FREQUENCY DISTRIBUTIONS OF DIFFERENCES BETWEEN MAXIMUM AIR TEMPERATURE AND AIR TEMPERATURE AT NOMINAL HCMM DAYTIME OVERPASS ($T_{MAX} - T_{HCMMd}$). FOR THIS ANALYSIS IT WAS ASSUMED THAT HCMM OVERPASSES WERE POSSIBLE ON EVERY DAY OF 365 CONSECUTIVE DAYS (MAY 10, 1978 THROUGH MAY 9, 1979).

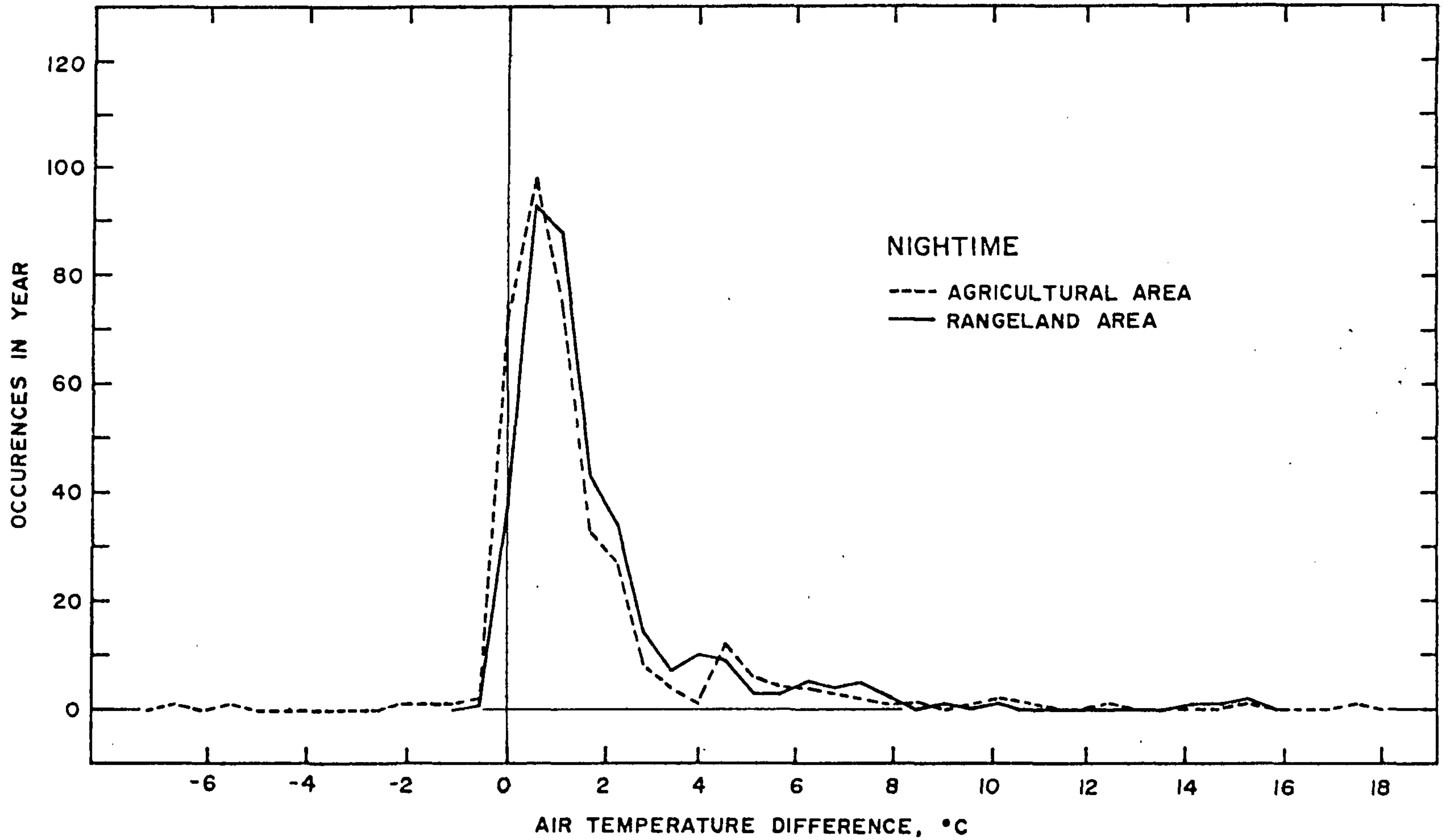

FIG. 2 FREQUENCY DISTRIBUTIONS OF DIFFERENCES BETWEEN AIR TEMPERATURE AT NOMINAL HCMM NIGHTTIME OVERPASS AND MINIMUM AIR TEMPERATURE ($T_{HCMMn} - T_{MIN}$). FOR THIS ANALYSIS IT WAS ASSUMED THAT HCMM OVERPASSES WERE POSSIBLE ON EVERY DAY OF 365 CONSECUTIVE DAYS (MAY 10, 1978 THROUGH MAY 9, 1979).