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AGRICULTURAL FORECASTING AT TALLAHASSEE, FLORIDA

J. S. Smith
WBAS, Tallahassee, Florida

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TAILORING FOR AGRICULTURE

The general agricultural forecasts specify the elements common to state and zone forecasts along with parameters especially related to crop culture - relative humidity, dew, frost, drying conditions, rainfall amounts, and percentage of sunshine. Special seasonal forecasts consist of: winds for plant growers, minimum temperatures for sugar cane interests, vegetation wetting, evapotranspiration, and special dust and spray parameters.

One problem in forecasting special parameters for Gulf Coastal agriculture is applicable to all weather forecasting for the entire eastern half of the country - lack of sufficient basic information to specify initial conditions, especially over the Gulf. However, the purpose of this paper is not to belabor this formidable point, but to discuss some of the special forecasts associated with the agricultural program and the problems surrounding them. As with all forecasts, it is advisable to understand the user's basic needs.

VEGETATION WETTING

Fungus growth needs two factors - heat and humidity. In the Tri-State area near Tallahassee there are at least two very large crops that have severe fungus infection if left unattended. They are pecans and tobacco. Let us delve into the weather effects on the first of these.

Pecan scab is a fungus infection which causes extensive loss to the pecan industry. It attacks only new and growing tissue. Mature tissue apparently is immune to scab damage. During the early spring, the continuous production of new leaves and other tissue provides susceptible surfaces. By early summer most leaf growth has ceased, setting up general immunity to pecan scab. Mid-summer increases in rainfall coupled with high temperatures can produce a secondary flush of growth which is extremely susceptible to the scab. From early summer budding to maturity in late summer, pecan nuts are continuously a prospective host to the fungus. Under critical conditions, pecan scab will thrive and spread rapidly. Since germination of spores is dependent on favorable weather, an accurate determination of temperatures and wetness - both past and future - is extremely important to good cultural practice.

While wet vegetation produces an environment favorable for germination of spores, temperature controls the rate of fungus growth, and the rate of infection. With temperatures below 55 degrees Fahrenheit, infection is very slow requiring leaf wet periods of 48 hours or more. Since leaf wet periods are cumulative, it is absolutely essential to know the time distribution of wetting periods. With optimum temperatures for infection, scab infestation occurs in as short a period as six hours of wet vegetation.

Widespread fog coupled with showers may cause a vegetation wetting period of ten to sixteen hours or more. If this occurs with temperatures above 55 degrees, precautionary sprays are recommended immediately.

Rain and fog cause wetting occasionally - dew - nearly every day. Showers are characteristically spotty, but dew formation is generally applicable to the entire area. After several years experience with dew gage readings of intensity, a dew forecast rule, applicable with clear skies and light winds, based on expected minimum spread between temperature and dew point is as follows:

Spread, ^{o}F	Dew Intensity
4	very light
3	light
2	moderate
1 or 0	heavy to very heavy

Forecasts are made using dew data for the previous day and anticipated changes in the controlling factors. It is necessary to summarize and integrate station reports to give hours of wetting and mean temperatures during the wet period. The forecast advisory specifies the number of hours of wet vegetation and corresponding mean temperature for the past 24 hours and the same type information expected during the next 24 hours. Using this information, appropriate tables may be used to determine if protective measures are necessary and when to apply them.

MINIMUM TEMPERATURES

Special temperature forecasts for sugar cane interests are applicable primarily to seed cane culture. It is highly advantageous for this cane to remain uncut as long as possible without damage from cold. Hence a forecast as far in advance as possible of freezing temperatures is extremely helpful. Forecasts tailored for cane growers are not specialized, but are an extension of routine minimum temperature forecasts.

D. R. Davis and the writer studied minimum temperatures at Tallahassee (1), and the results were beneficial in preparing sugar cane forecasts as well as other temperature forecasts. The purpose of the research was to determine just how much temperatures vary from one inch above the ground to shelter level under different weather conditions. Data for October to December for one year were used. Temperature variations from the one inch to shelter level ranged from zero to five degrees with the average being less than two degrees.

Raw data are shown in Table 1. In addition to temperature, there is shown opaque sky cover between 1 a.m. and 7 a.m. and total wind movement computed by adding the seven hourly wind speed observations at Tallahassee. More wind movement increased the difference in temperature at the two levels while greater cloud cover had an opposite effect.

From Table 1 it is noted that the greatest temperature difference - five degrees - occurred on October 26. Wind speed for this case averaged 10 mph - normally considered sufficient to eliminate any significant inversion near the ground. Frequently, when there was total opaque sky cover, heavy fog was prevalent. Consequently, little temperature difference was noted between levels on these occasions because of the common dew point limit for radiative effects.

In Table 2 observations are summarized by sky conditions and winds. With very light winds (under three knots) and clear to partly cloudy sky (less than .7 opaque cover) the average difference was 1.5 degrees, and the temperature range between levels was only one to two degrees. Under similar sky cover, but with stronger winds, the temperature differential increased. This would lead one to believe that the lower level temperatures were not representative of ambient air temperature but measured radiative effects on the unsheltered thermometer at the one inch level.

WIND FORECASTS

Spring is the season when wind becomes critical for plant growers in the Tri-state area. Whenever the wind reaches sustained speed of 20 mph with gusts to about 30 mph, considerable blowing or drifting sand results. This sand literally sandblasts the plants at or near the ground with disastrous losses to plant stands. The severity of the damage is a function of several factors - soil moisture and type, field orientation, condition of the soil, and, of course, wind speed. Several practices can be utilized to minimize damage, but to do so effectively, timely and accurate wind forecasts are needed. Wind forecasts are also used very effectively in fighting forest fires.

Early in the Tallahassee Agricultural Program, winds were forecast using surface and 2000 foot wind maps from the National Facsimile Circuit. This procedure was inadequate as well as untimely, and plotting and analyzing the wind field at 2000 feet eventually became routine practice. The following series of charts at 24 hour intervals were used before 6-hourly analysis became standard. They will be used here to illustrate how a wind speed maximum can be tracked and converted into surface forecasts.

At 0600Z on March 4, 1962 (Fig. 1), there was a 40 knot isotach near Oklahoma City at 2000 feet. Considering the wind flow, this situation posed no threat to the Tri-state area and during the afternoon of the 4th the highest wind speed at Tallahassee was only 10 knots.

Figure 2 shows the wind analysis 24 hours later, 0600Z March 5. Strong winds were threatening the Tri-state area as the flow was northwesterly and a speed maximum of 48 knots was noted at Jackson, Mississippi, only 300 miles away. At Tallahassee during the afternoon the surface wind was unusually strong with the maximum one minute speed being 27 knots and gusts as great as 41 knots.

On March 6 (Figure 3), another maximum of 30 knots was shown at Jackson. This too was advected downstream bringing afternoon gusts to 38 knots at Tallahassee.

The final chart of the series (Fig. 4) shows the isotach maximum moving rapidly southward from the area of interest and indicating rapidly diminishing winds for the forecast. At Tallahassee, the highest wind during the afternoon of March 7 was only 8 knots.

Shortly after the usefulness of these analyzed charts was recognized, a program of 6-hourly wind analyses at 2000 feet was started. A corresponding accuracy in maximum surface wind forecasting followed in both agricultural and fire-weather service programs.

EVAPOTRANSPIRATION

Forecasts of this type are based primarily on two factors - percent of sunshine and mean daylight temperatures. Sufficient wind to transport evaporated moisture is always assumed. Forecasts are seasonal for irrigation operations and are applied by using tables which relate mean daylight temperature and percent of sunshine to evapotranspiration over freshly irrigated soil for bi-monthly periods.

TABLE 1

OCTOBER 1962

DATE	SHELTER	GROUND	DIFFERENCE	CLOUD	WIND
1					
2					
3					
4					
5					
6					
7	59	57	-2	.1	18
8	66	65	-1	.1	18
9	71	69	-2	.3	57
10	61	58	-3	.1	55
11	57	54	-3	.1	28
12	60	60	0	.7	46
13	63	61	-2	0	24
14	64	63	-1	0	38
15	63	61	-2	0	40
16	63	61	-2	0	40
17	62	60	-2	0	35
18	65	63	-2	.2	59
19	54	52	-2	0	37
20	50	47	-3	0	26
21	55	53	-2	.1	23
22	67	65	-2	.8	48
23	50	48	-2	0	36
24	48	46	-2	0	90
25	37	34	-3	0	42
26	39	34	-5	0	62
27	35	32	-3	0	42
28	37	34	-3	0	40
29	46	44	-2	0	36
30	57	57	0	.9	0
31	55	53	-2	.4	51

NOVEMBER 1962

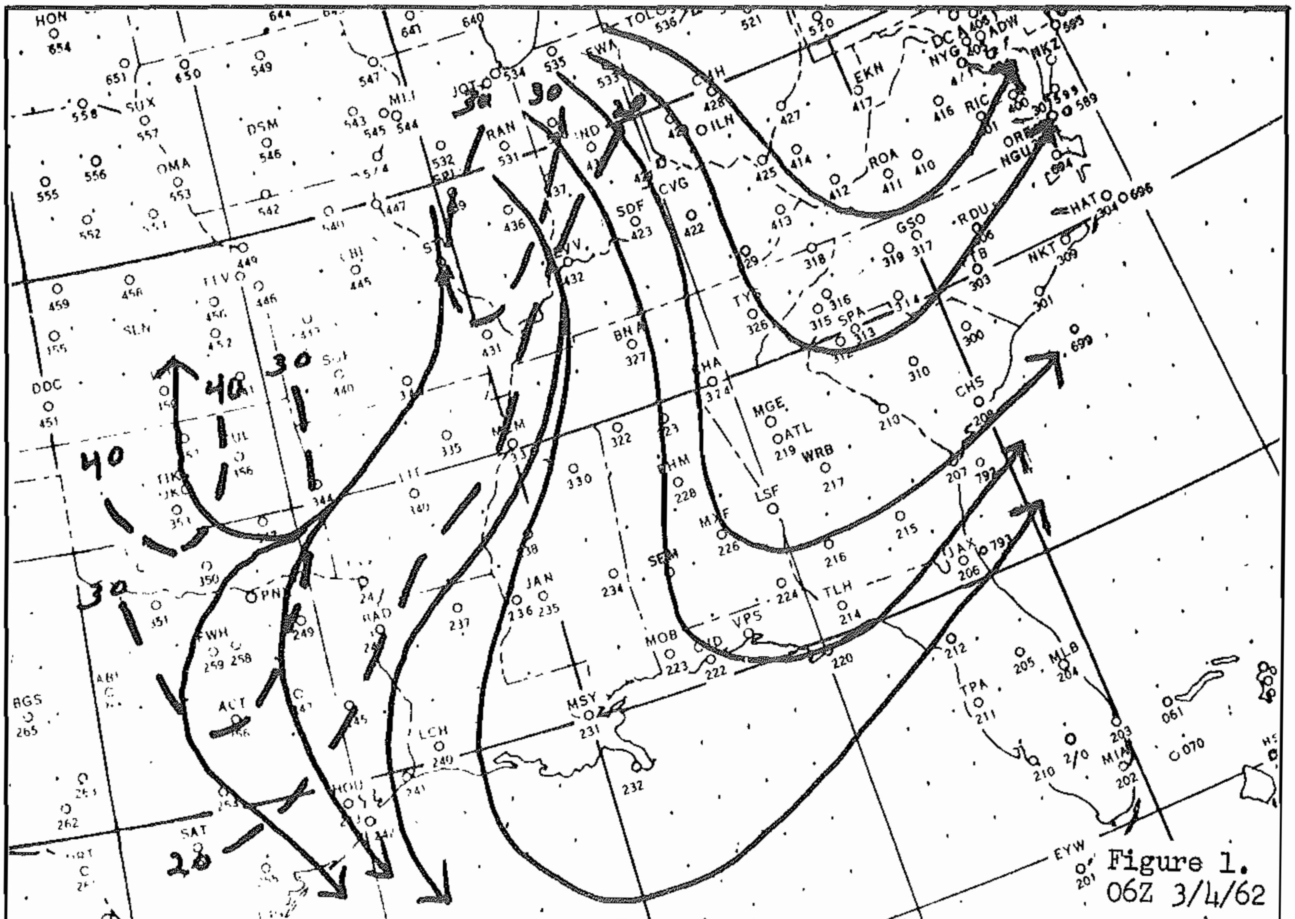
DATE	SHELTER	GROUND	DIFFERENCE	CLOUD	WIND
1	40	38	-2	.0	66
2	37	35	-2	.1	33
3	43	--	--	.9	29
4	42	--	--	.4	30
5	41	39	-2	0	49
6	35	31	-4	0	50
7	50	--	--	.7	63
8	59	59	0	1.0	57
9	54	53	-1	1.0	58
10	36	34	-2	0	64
11	33	32	-1	0	3
12	45	42	-3	.5	26
13	55	53	-2	1.0	92
14	43	41	-2	0	56
15	31	29	-2	0	4
16	39	38	-1	.9	3
17	53	52	-1	.9	8
18	60	--	--	.8	71
19	52	50	-2	.7	44
20	54	52	-2	.8	30
21	60	--	--	1.0	63
22	49	48	-1	0	79
23	36	34	-2	0	48
24	39	37	-2	0	27
25	45	43	-2	.5	30
26	45	43	-2	0	67
27	33	32	-1	0	56
28	52	51	-1	1.0	59
29	52	52	0	1.0	48
30	53	53	-1	1.0	59

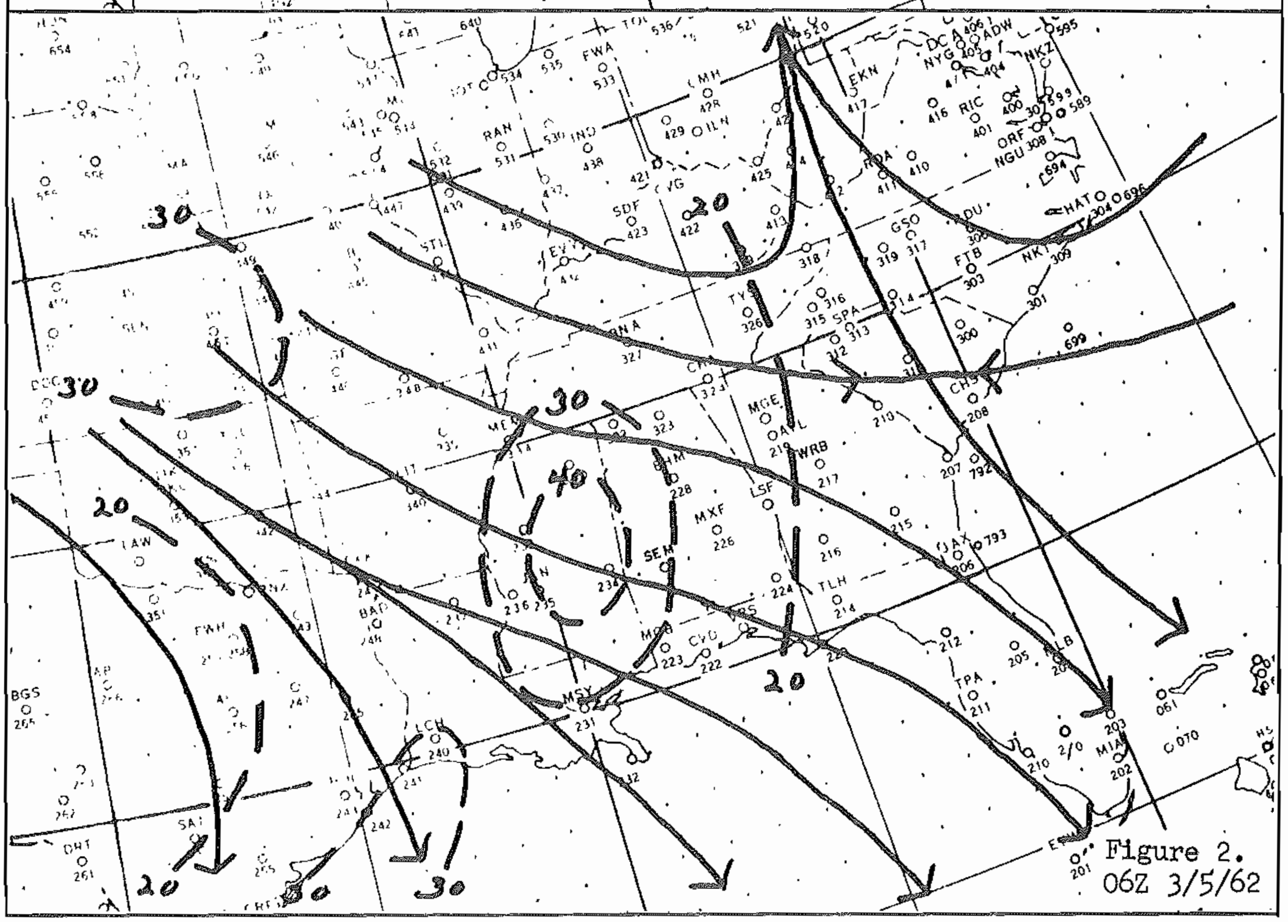
DECEMBER 1962

DATE	SHELTER	GROUND	DIFFERENCE	CLOUD	WIND
1	55	49	-2	.6	59
2	46	44	-2	0	50
3	38	36	-2	0	36
4	39	38	-2	0	4
5	41	--	--	.4	0
6	33	32	-1	0	64
7	21	20	-1	0	9
8	41	--	--	.8	23
9	31	29	-2	0	45
10	30	30	0	0	71
11	25	24	-1	0	7
12	26	24	-2	.7	119
13	10	8	-2	0	77
14	19	17	-2	0	23
15	22	20	-2	0	4
16	38	37	-1	.8	0
17	44	43	-1	.8	16
18	40	39	-1	.9	0
19	40	39	-1	.3	0
20	49	47-	-2	.7	6

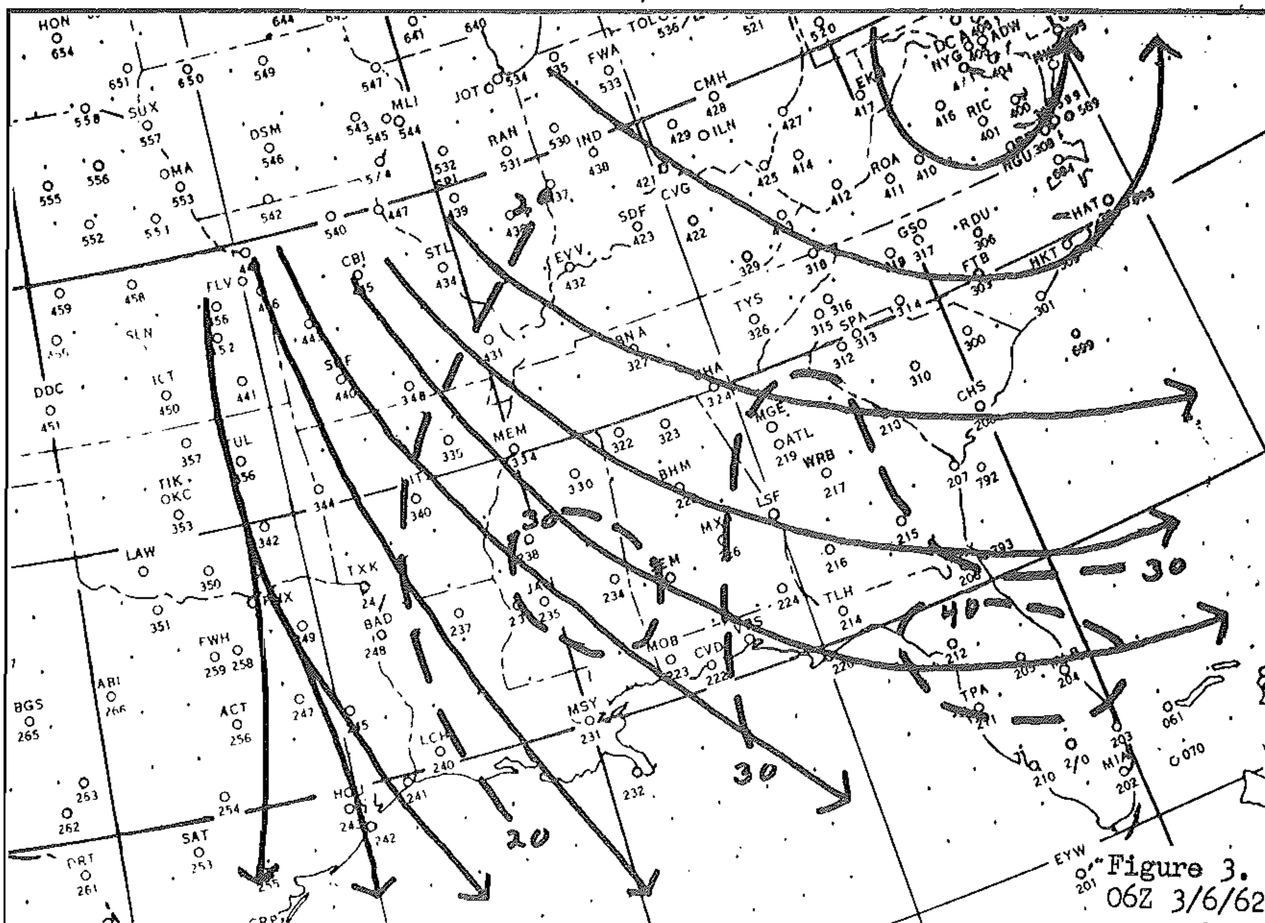
TABLE 2

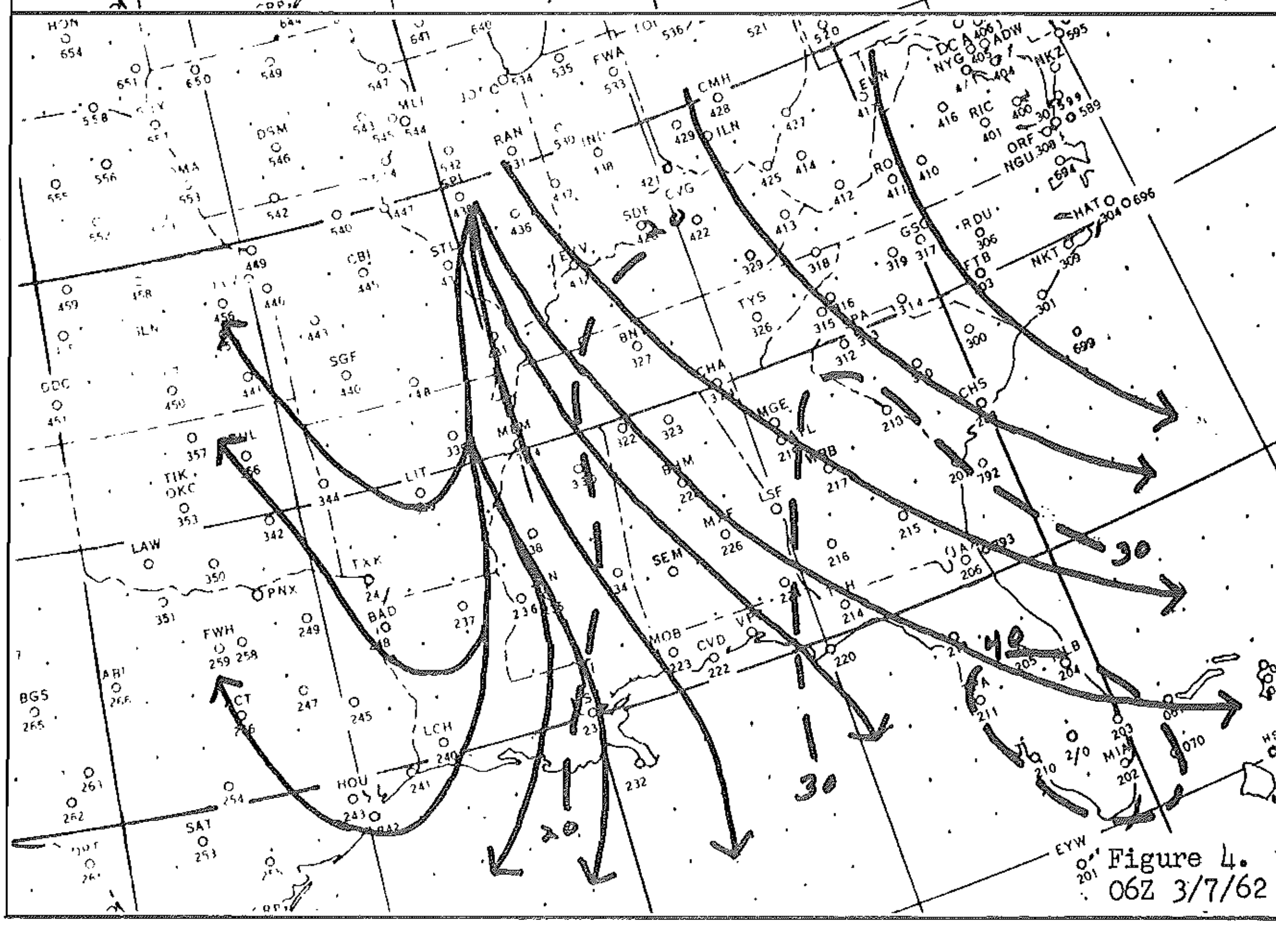
SKY / WINDS	CLEAR UNDER .3			PARTLY CLOUDY .3 - .7			CLOUDY ABOVE .7		
	AVERAGE	NO. CASES	RANGE	AVERAGE	NO. CASES	RANGE	AVERAGE	NO. CASES	RANGE
UNDER 20	1.5	12	1-2	1.5	3	1-2	.8	5	0-1
21 to 48	2.2	44	1-3	1.8	7	0-3	1.3	4	0-2
ABOVE 48	2.1	33	0-5	2.0	8	2	1.0	5	0-2





Figures 1 and 2. Streamline and isotach analyses for dates and times shown.





Figures 3 and 4. Streamline and isotach analyses for dates and times shown.