U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
SYSTEMS DEVELOPMENT OFFICE
TECHNIQUES DEVELOPMENT LABORATORY

TDL Office Note 76-1

SEVERE LOCAL STORM RELATIVE FREQUENCY DISTRIBUTIONS FOR USE IN DERIVING SEVERE THUNDERSTORM FORECAST EQUATIONS

Donald S. Foster

January 1976

SEVERE LOCAL STORM RELATIVE FREQUENCY DISTRIBUTIONS FOR USE IN DERIVING SEVERE THUNDERSTORM FORECAST EQUATIONS

Donald S. Foster

1. Introduction

We have compiled relative frequency distributions of severe local storms for the manually-digitized radar (MDR) grid area shown in figure 1. Monthly 5-year average values for each MDR block were obtained for the period January 1970 to December 1974. When we derive the 1976 screening regression equations for severe local storms, we shall offer daily relative frequencies interpolated from these monthly averages as predictors along with large-scale predictors from operational numerical models.

2. Method of Compiling Frequencies

The monthly frequencies were based on reports of tornadoes, wind gusts $\geq$ 50 knots and/or wind damage, or surface hail $\geq$ 3/4 inches in diameter, taken from the NSSFC severe storm log and archived by TDL in the MOS predictand tape format (Foster and Reap, 1973). Relative frequencies were obtained by counting the number of days during a month when a severe local storm occurred in an MDR block during the six-hour period centered on 0000 GMT and dividing by the number of days in the month. The resulting relative frequency values were averaged for five years then rounded to the nearest tenth of one percent since they are quite low for an individual MDR block. Monthly values were smoothed by a nine-block smoother to avoid irregularities resulting from variations in population density.

3. Variation in the Frequency Patterns

The smoothing of the 5-year averages along with the interpolation of daily values results in a fairly smooth seasonal transition of the frequencies. For example, values reach a mininum in January, increase in the lower Mississippi River valley in February and March, spread northward over the southern plains, central Mississippi River valley and the Ohio River valley in April, and reach their highest values from the Texas panhandle through Oklahoma and Kansas to eastern Nebraska, Iowa, Illinois, Indiana, Ohio, and Pennsylvania in June. Frequency values decrease rapidly in July with the highest values being confined to the northern states. The decreasing trend continues until minimum values are reached again in the fall. This simulation of the seasonal trends in severe local storms should make this predictor a strong contender in the screening regression analysis for the 1976 equations.

Contoured maps of the monthly frequency values are shown in the Appendix for each of the 5 years from 1970 through 1974 along with the 5-year monthly averages

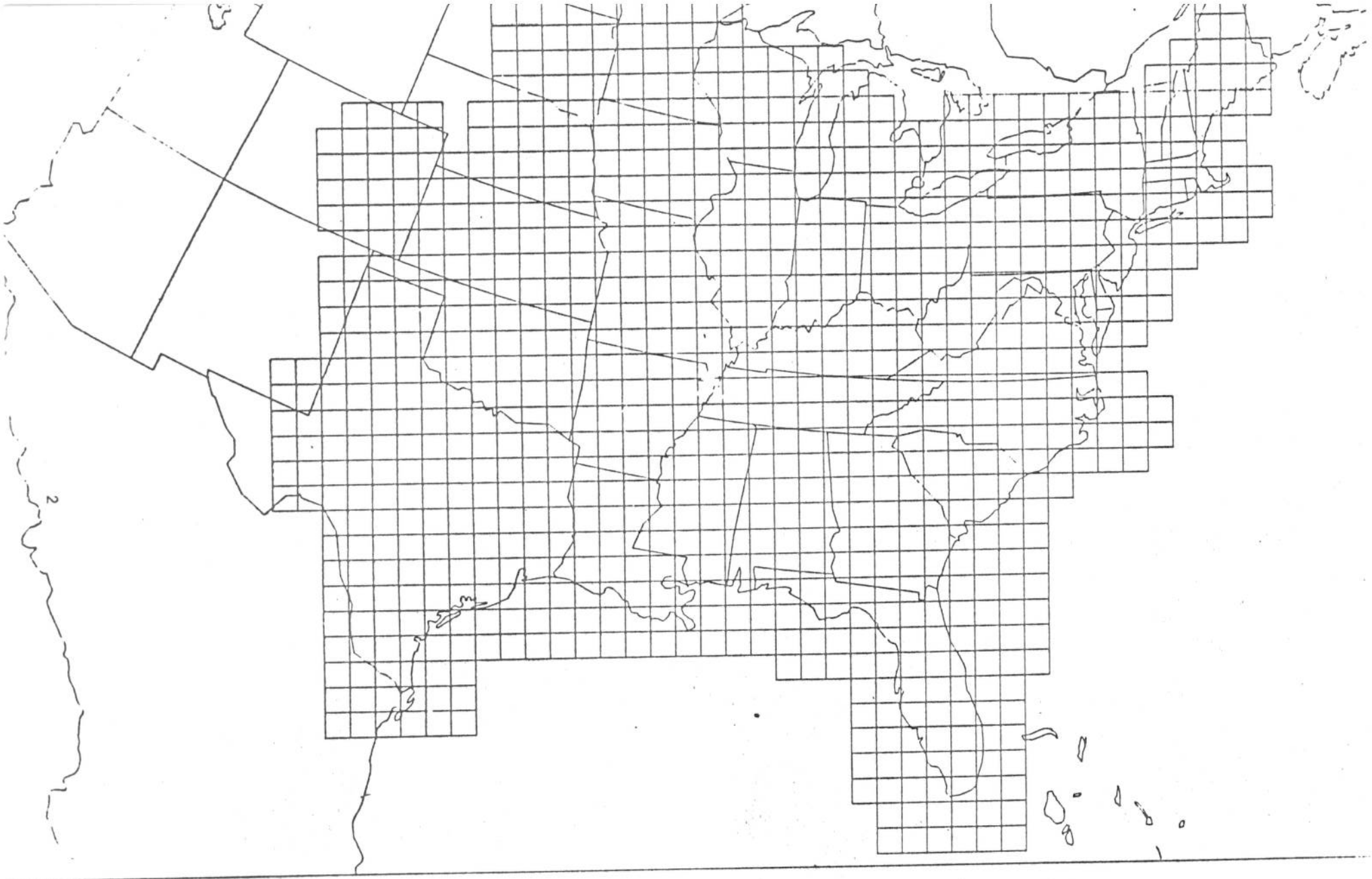


Figure 1. Manually-digitized radar grid area for which relative frequencies of severe local storms were compiled.

4. References

Foster, D. S., and R. M. Reap, 1973: Archiving of manually-digitized radar data, TDL Office Note 73-6, 5 pp.

APPENDIX

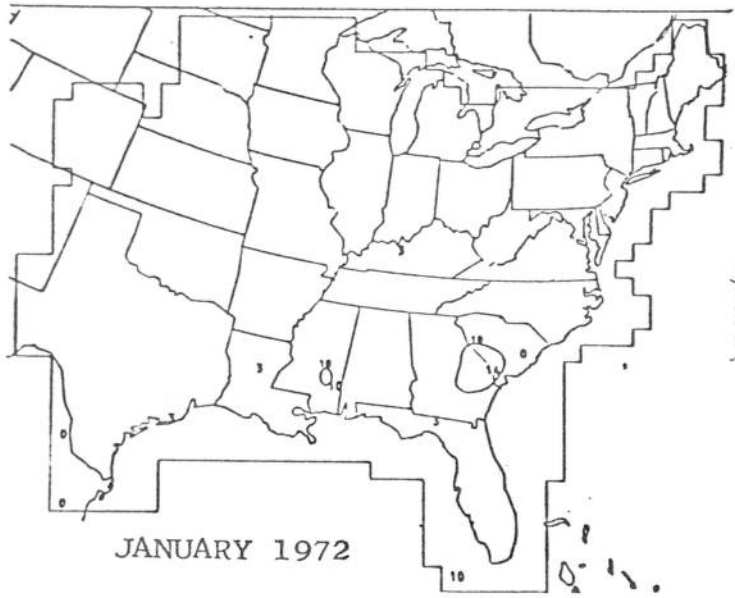
Page

Severe local storm relative frequencies computed from 1970 - 1974 data for:

SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00Z

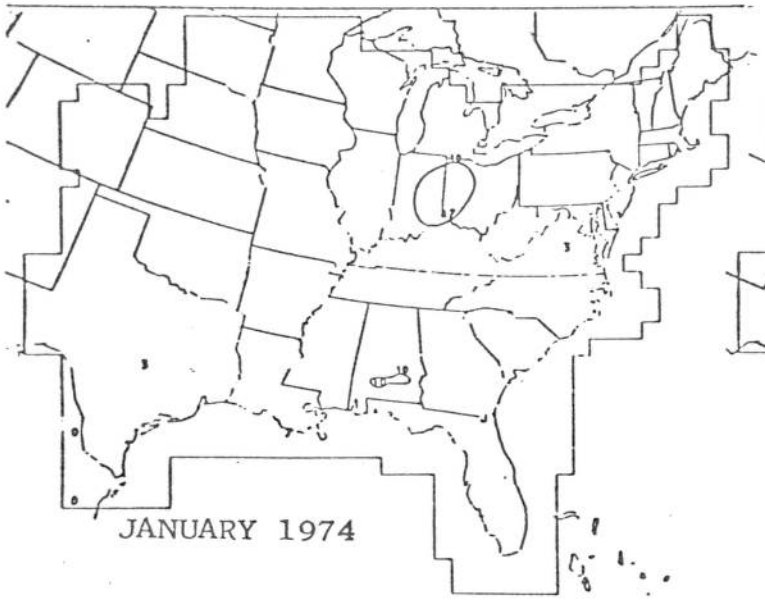
JANUARY 1970

JANUARY 1971

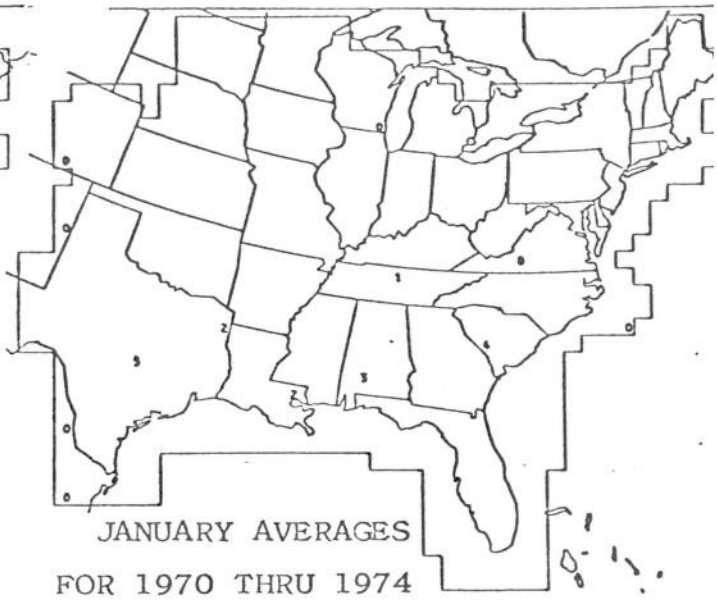


JANUARY 1972

JANUARY 1973

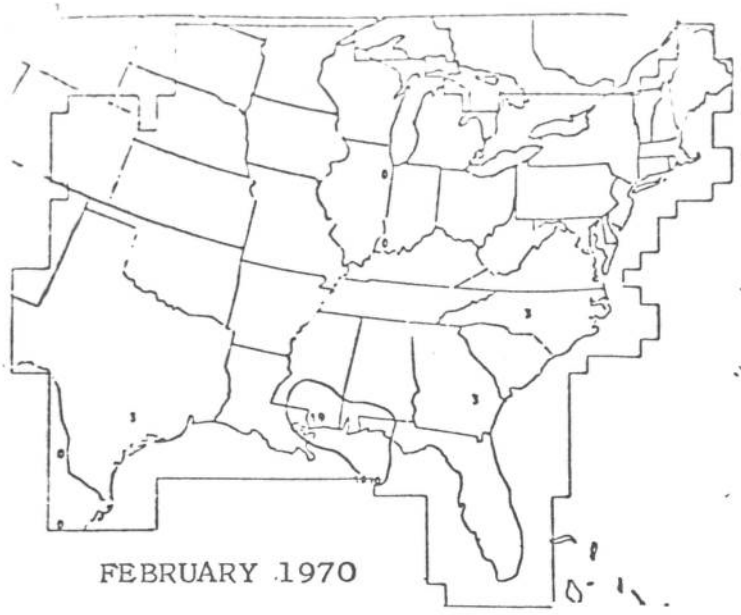


JANUARY 1974

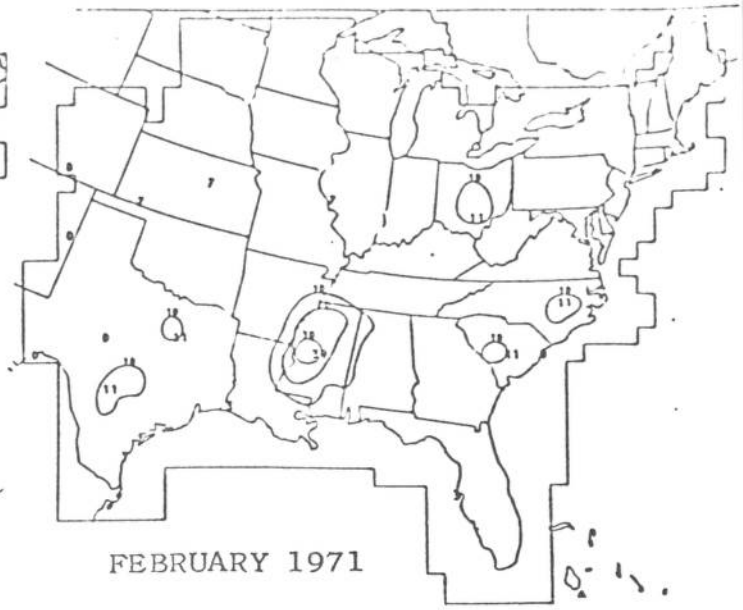


JANUARY AVERAGES
FOR 1970 THRU 1974

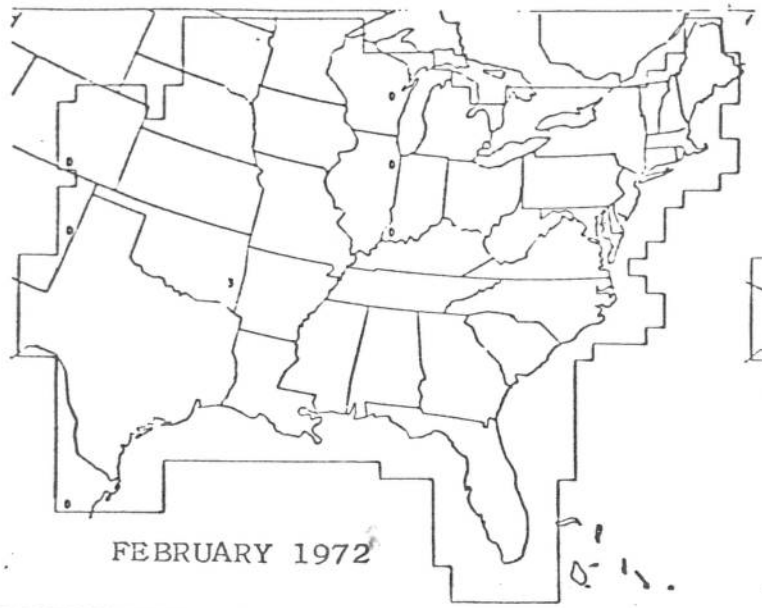
SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD + 3 HRS FM 00Z



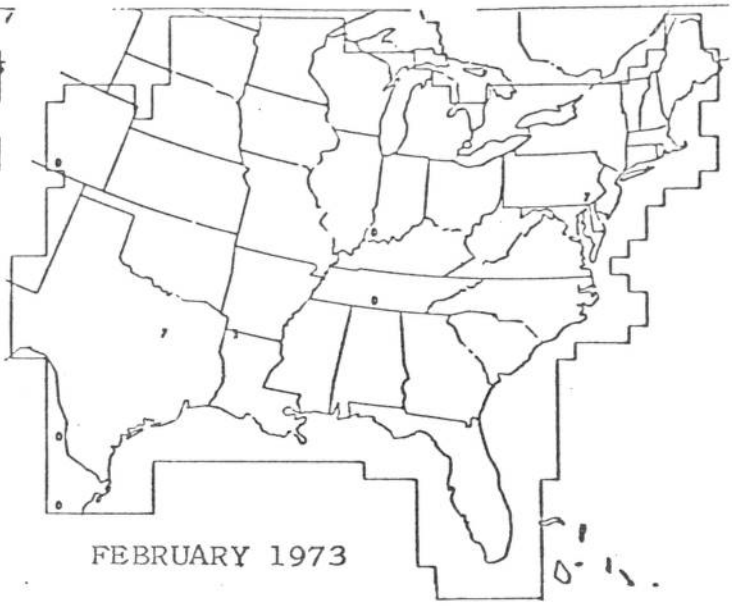
FEBRUARY 1970



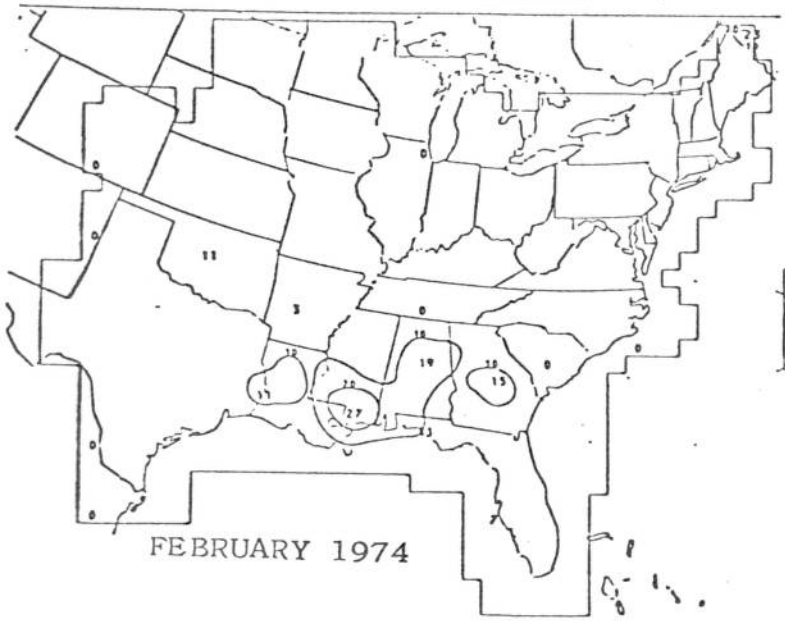
FEBRUARY 1971



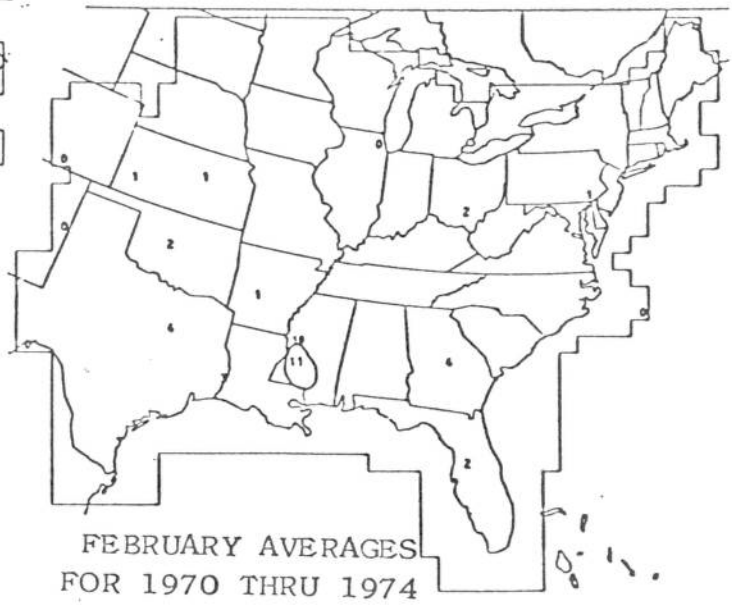
FEBRUARY 1972



FEBRUARY 1973

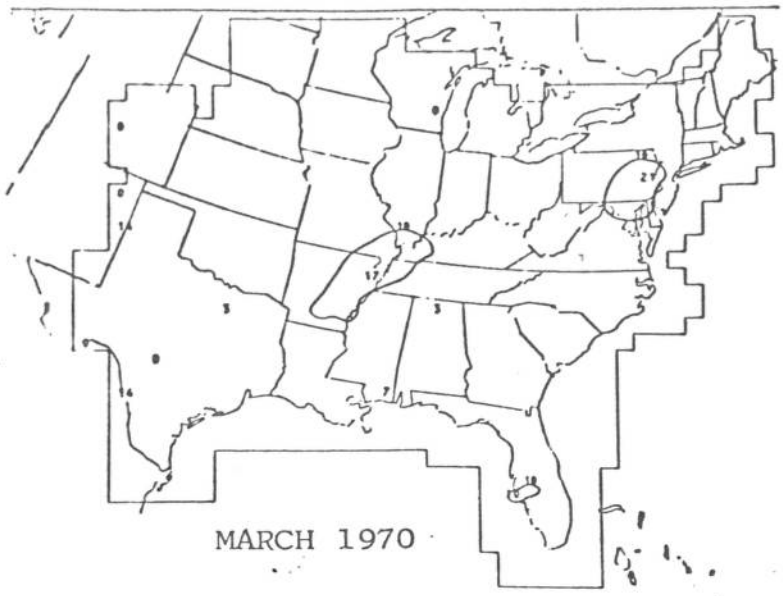


FEBRUARY 1974

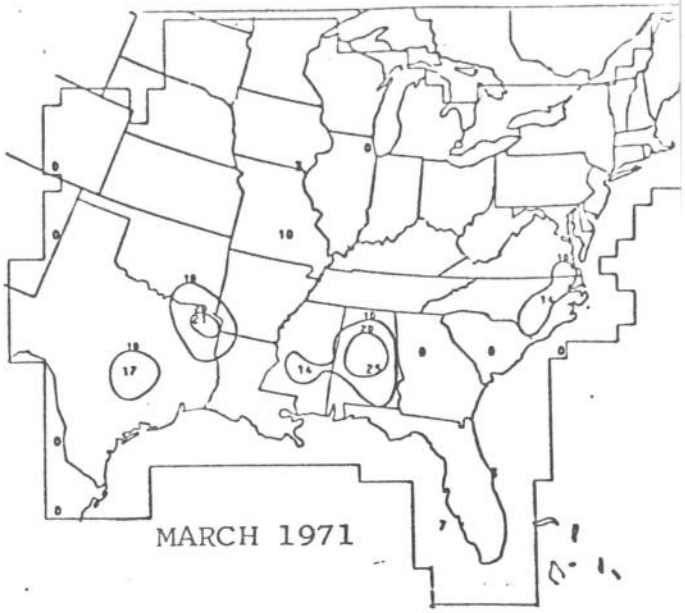


FEBRUARY AVERAGES
FOR 1970 THRU 1974

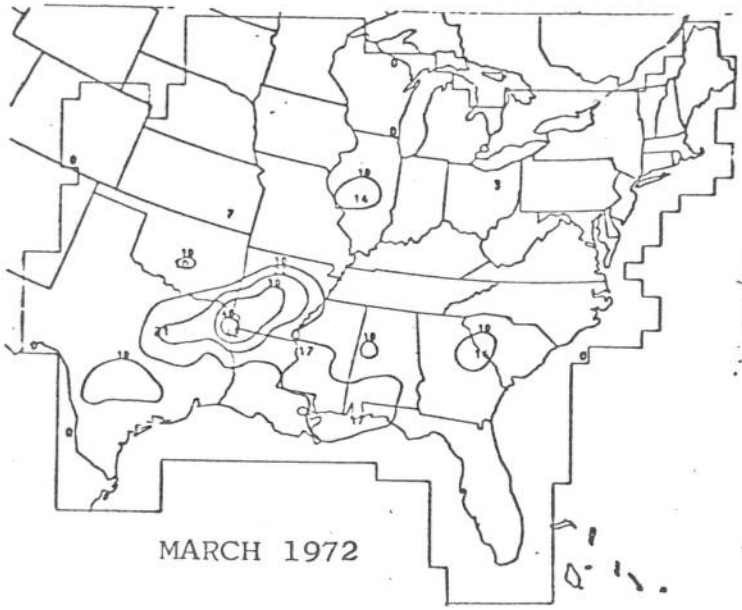
SVR TSTM RELATIVE FREQUENCY(TENTHS OF PERCENT)FOR PRD ± 3 HRS FM 00Z



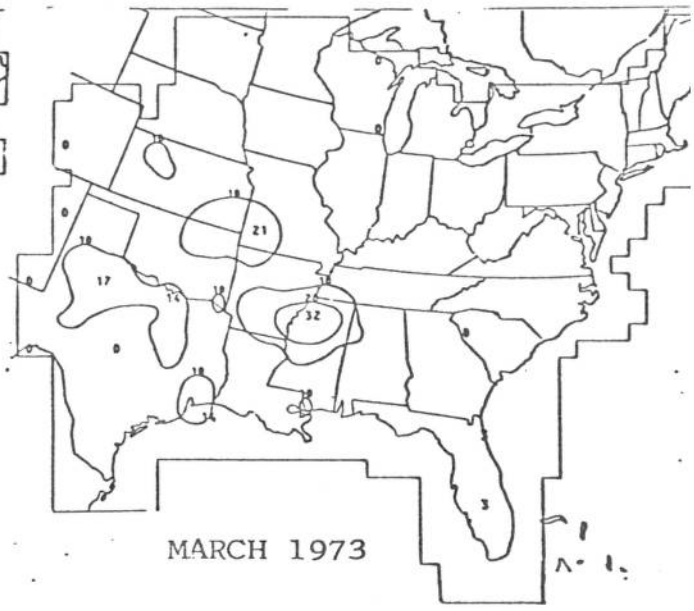
MARCH 1970



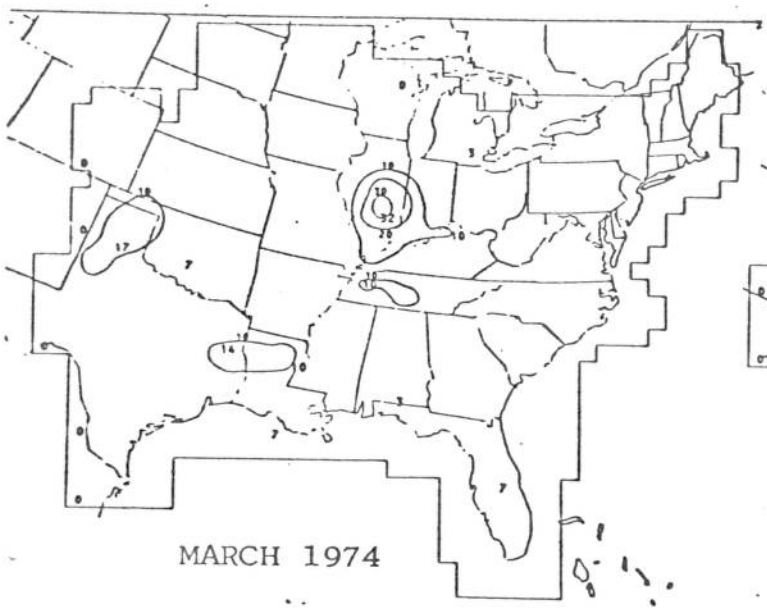
MARCH 1971



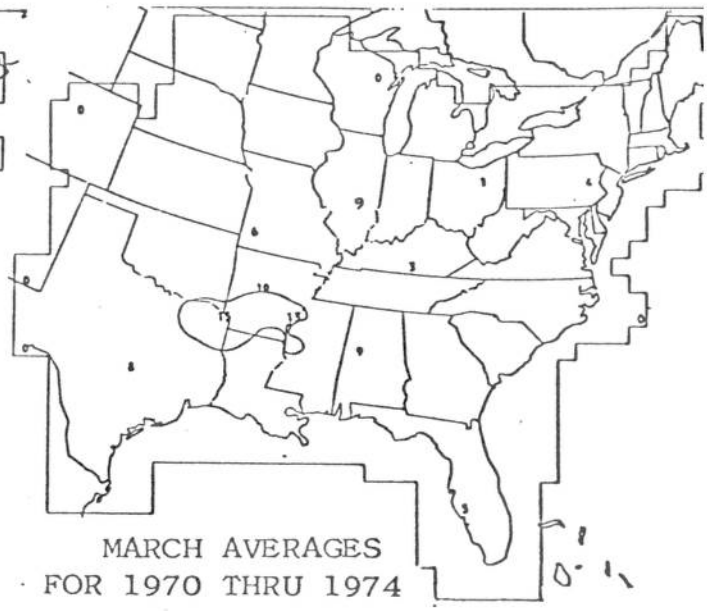
MARCH 1972



MARCH 1973

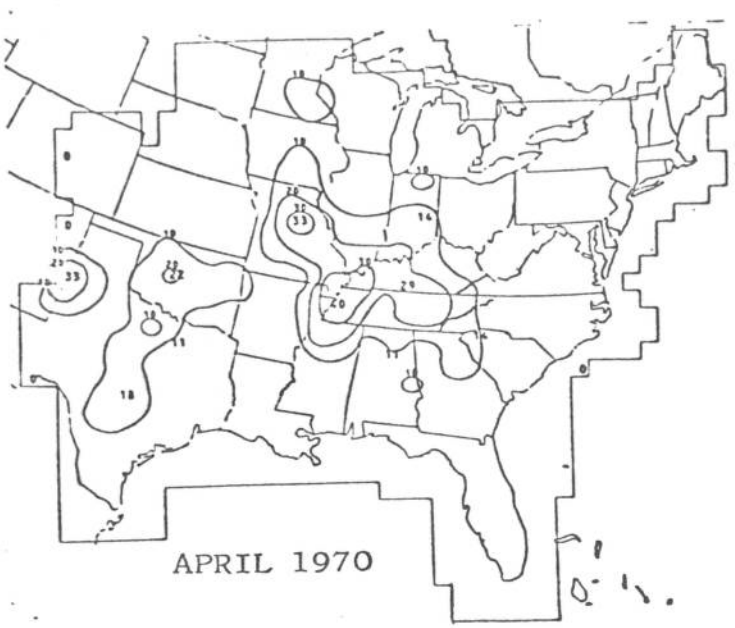


MARCH 1974

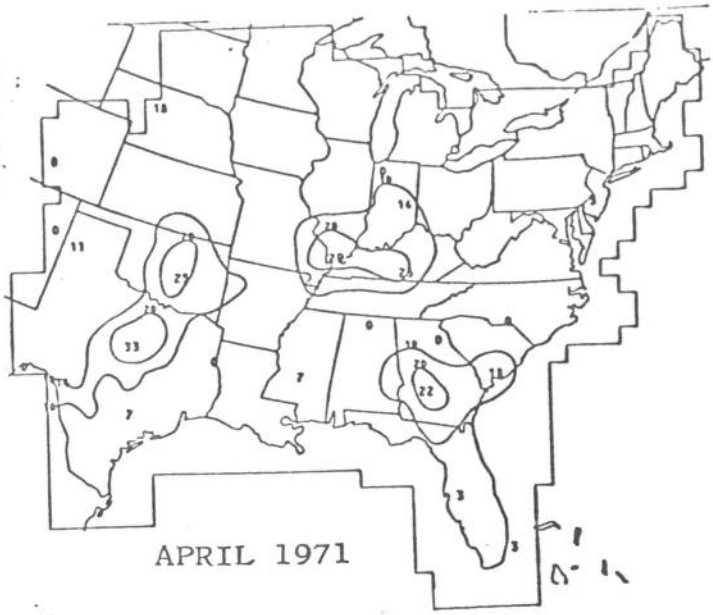


MARCH AVERAGES
FOR 1970 THRU 1974

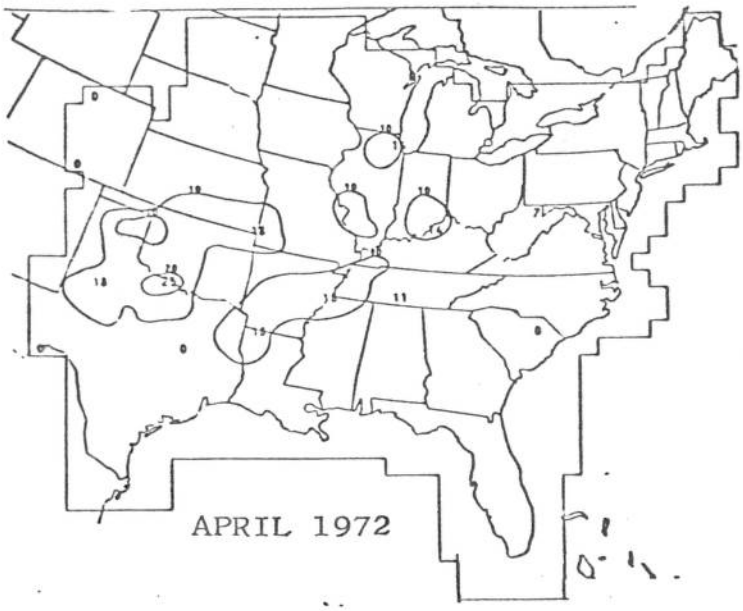
SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00Z



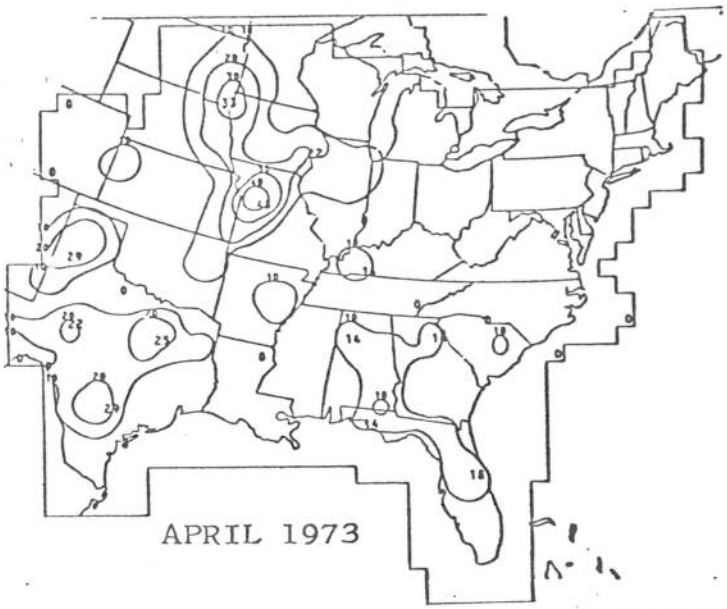
APRIL 1970



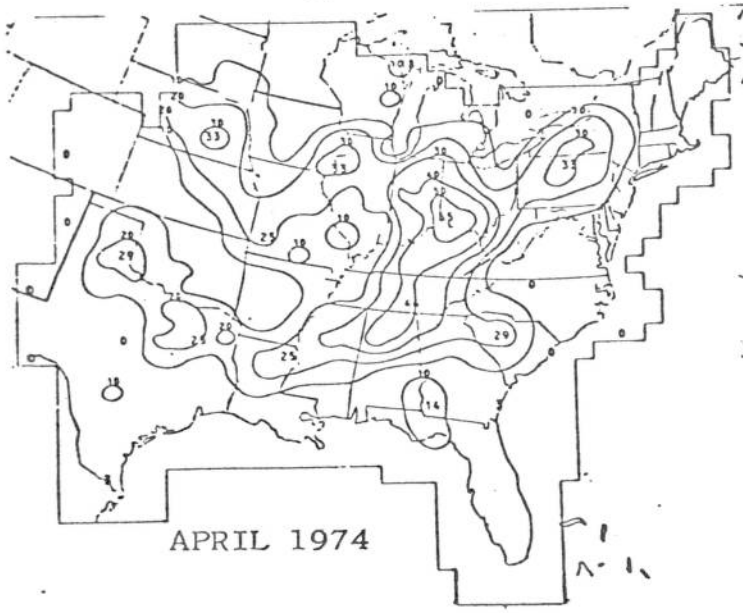
APRIL 1971



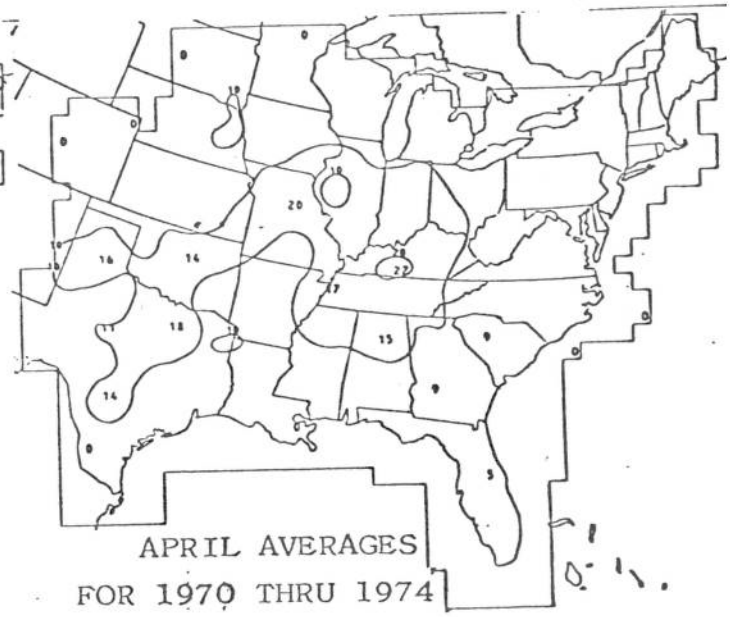
APRIL 1972



APRIL 1973

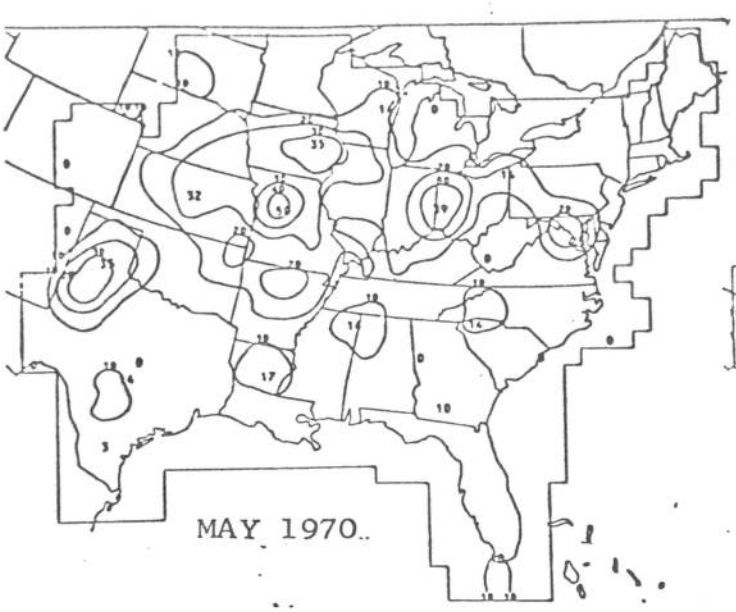


APRIL 1974

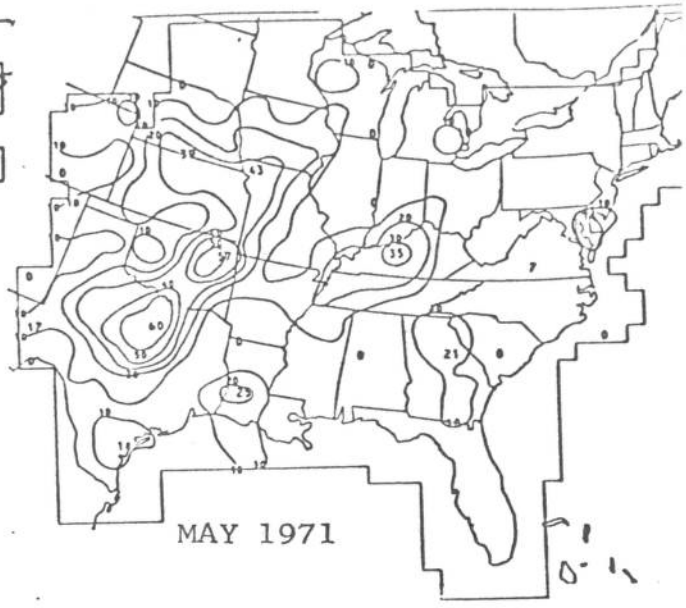


APRIL AVERAGES
FOR 1970 THRU 1974

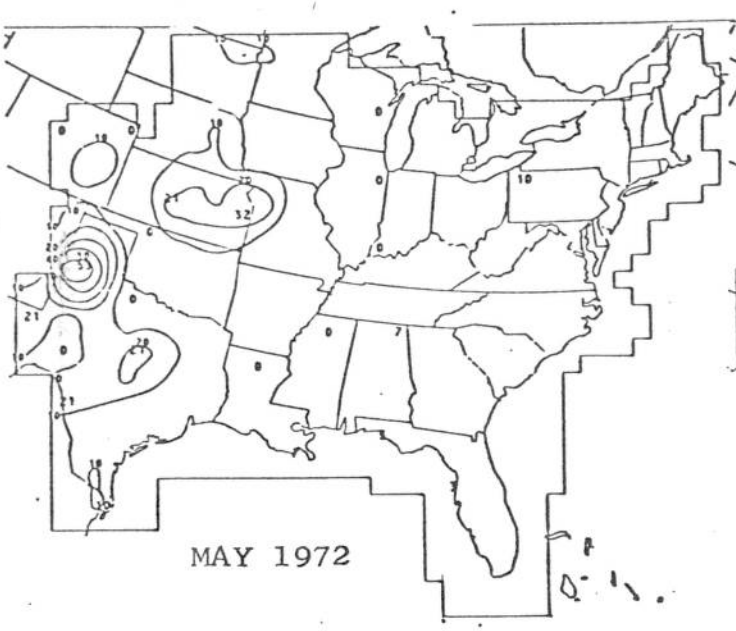
SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00Z



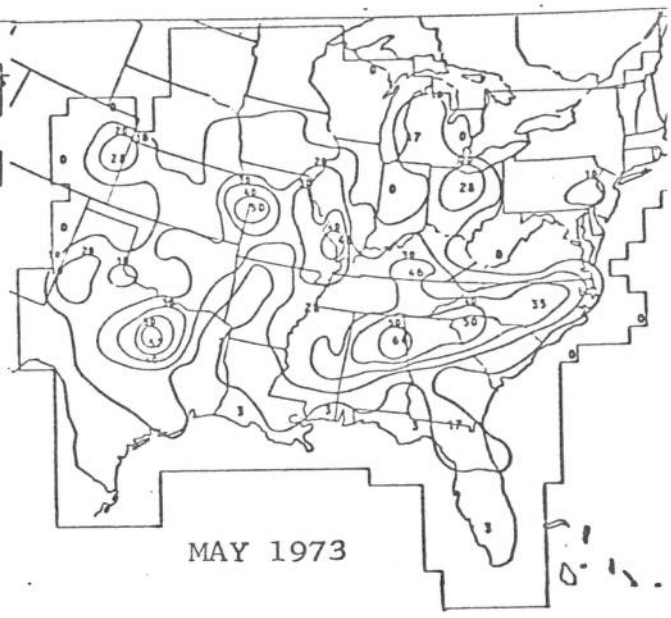
MAY 1970



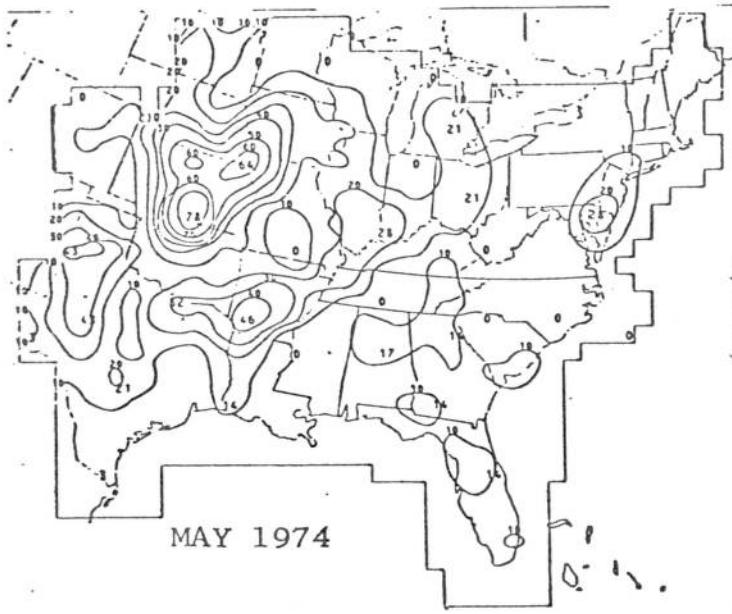
MAY 1971



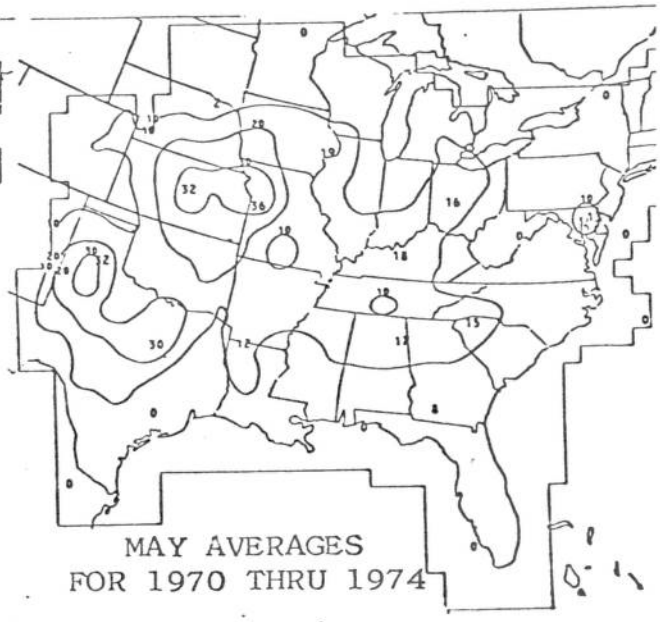
MAY 1972



MAY 1973

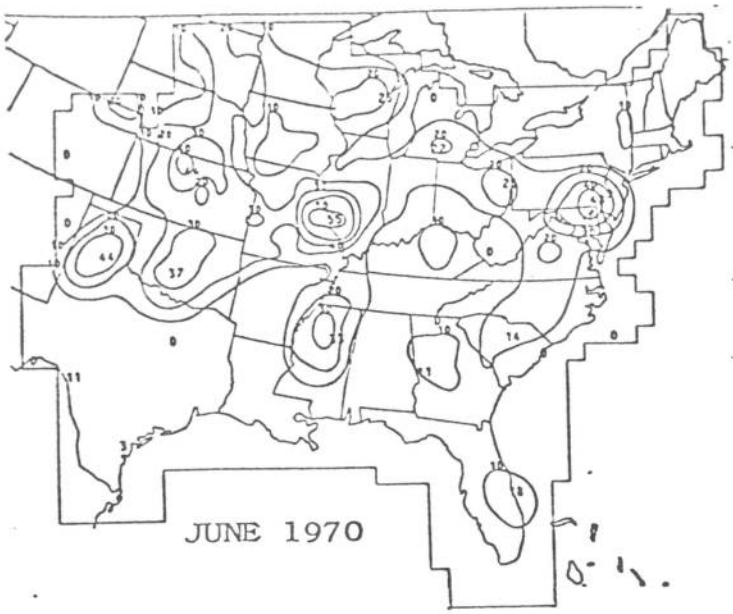


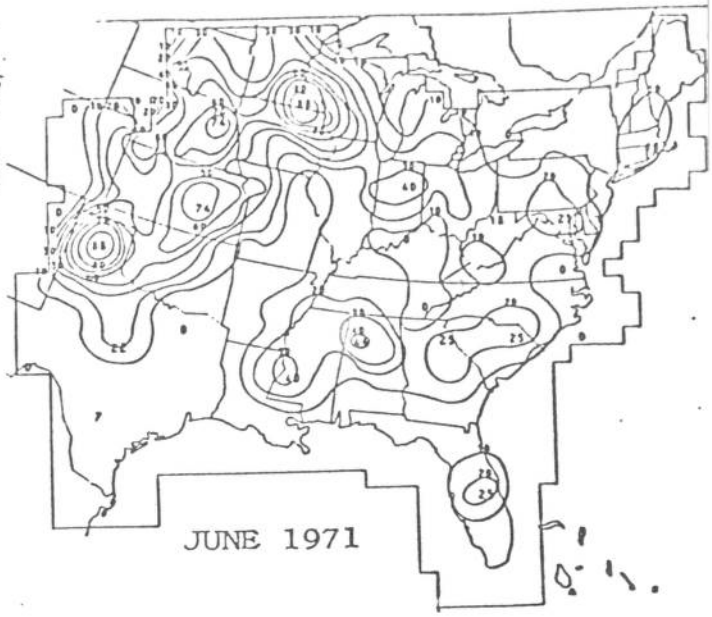
MAY 1974

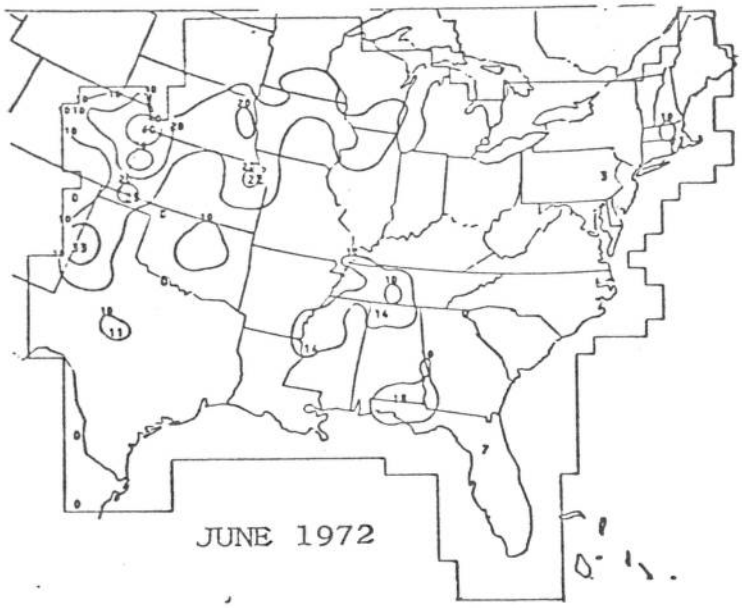


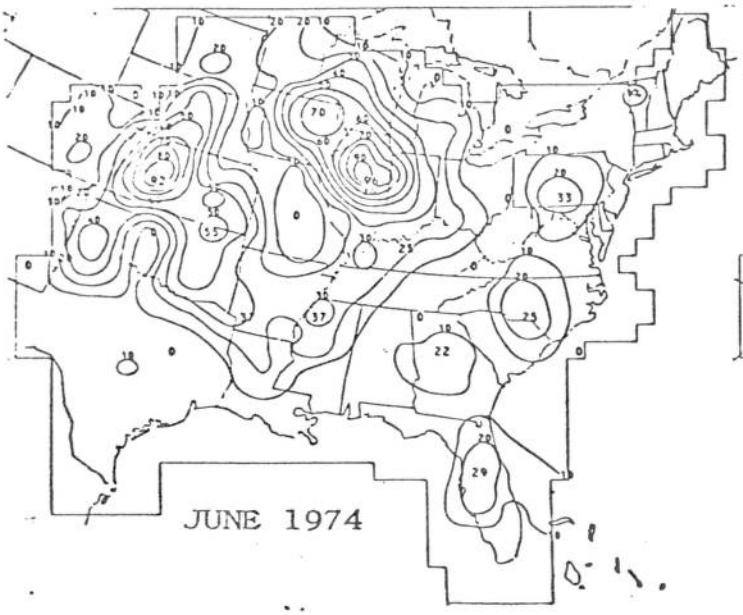
MAY AVERAGES
FOR 1970 THRU 1974

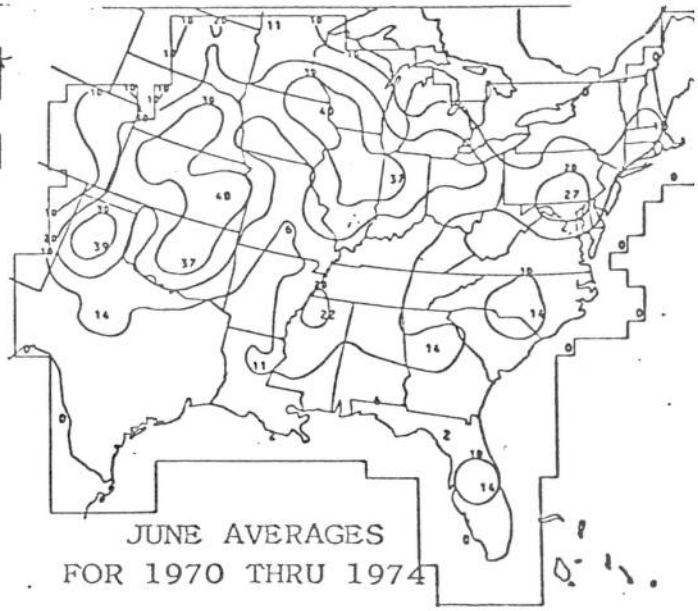
SVR TSTM RELATIVE FREQUENCY(TENTHS OF PERCENT) FOR PRD $\pm$ 3 HRS FM 00Z



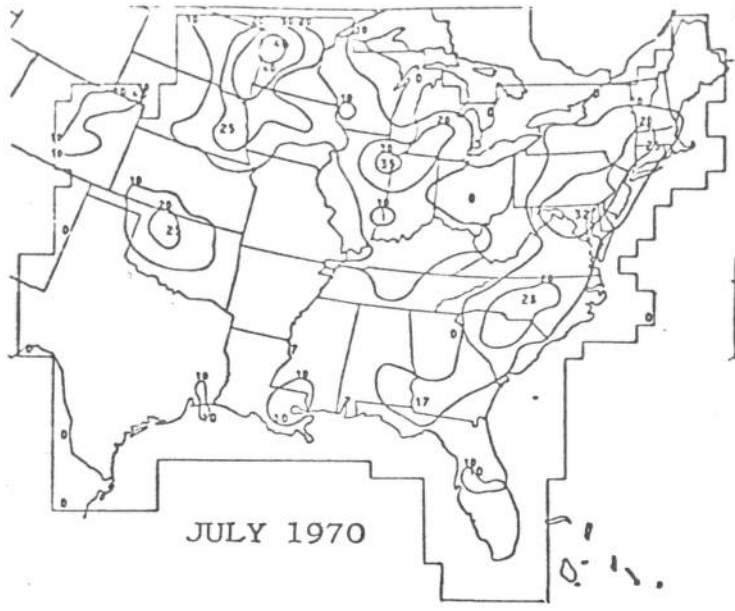


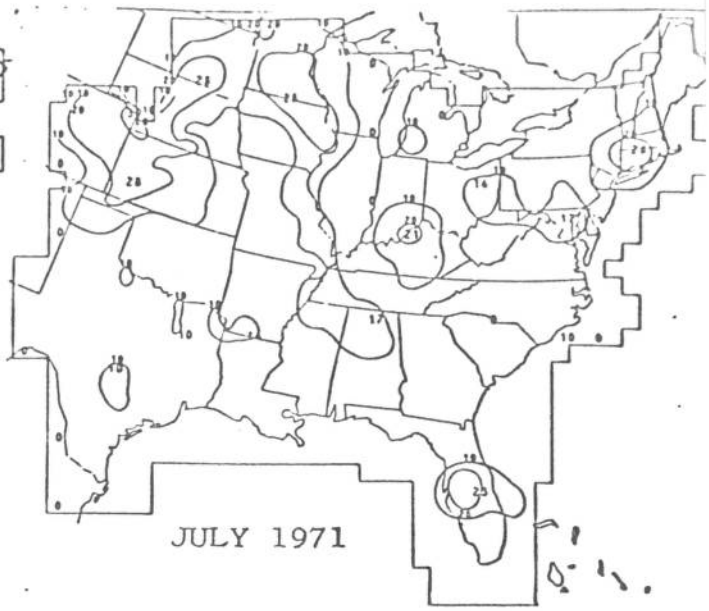


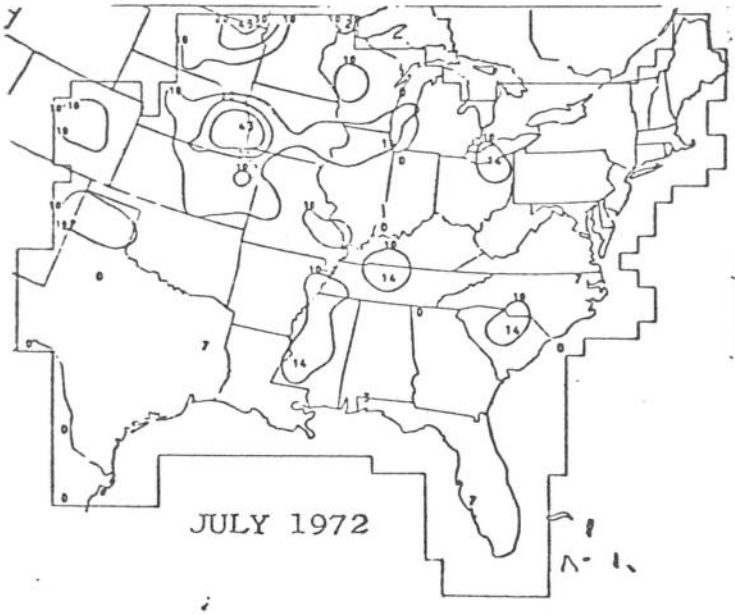


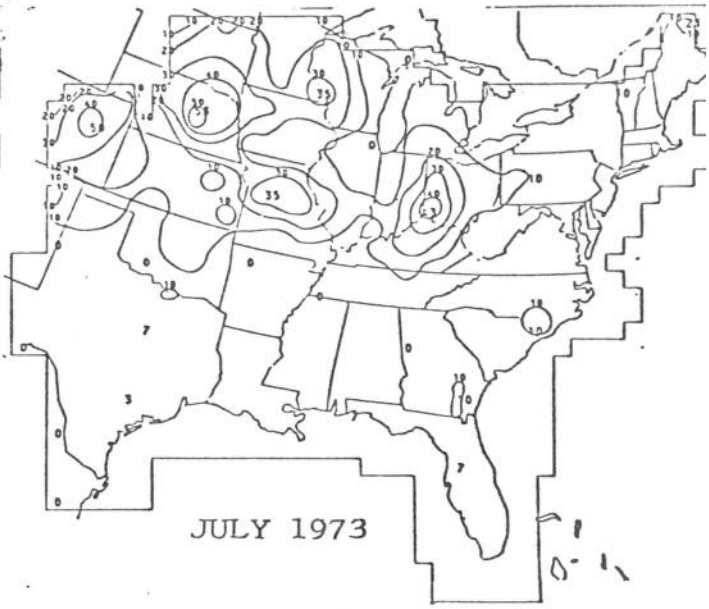


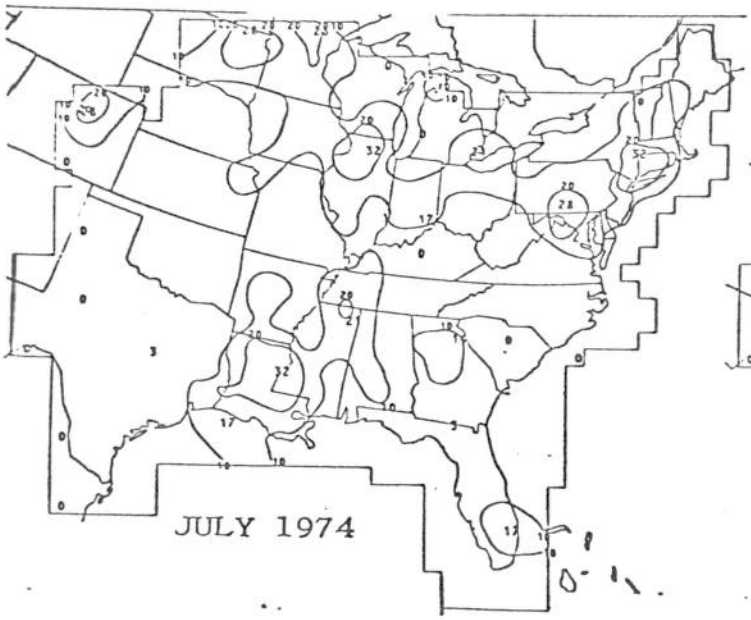
SVR TSTM RELATIVE FREQUENCY(TENTHS OF PERCENT) FOR PRD ±3 HRS FM OOZ

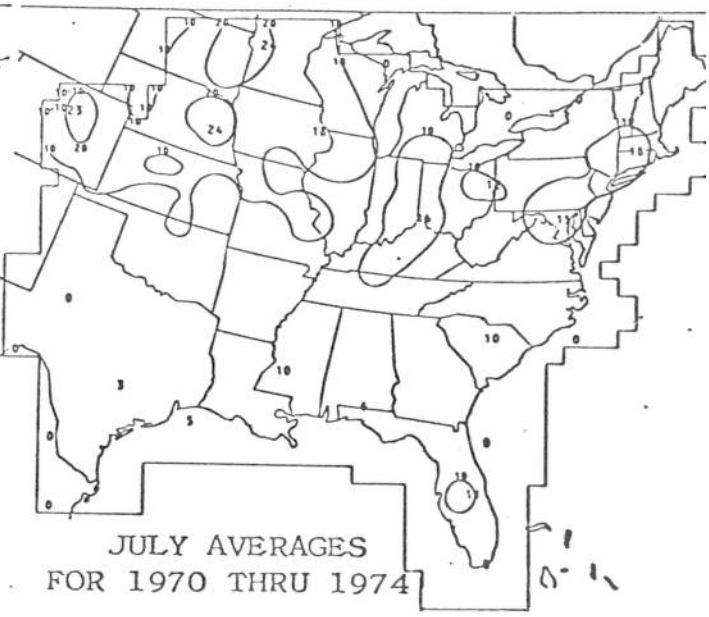




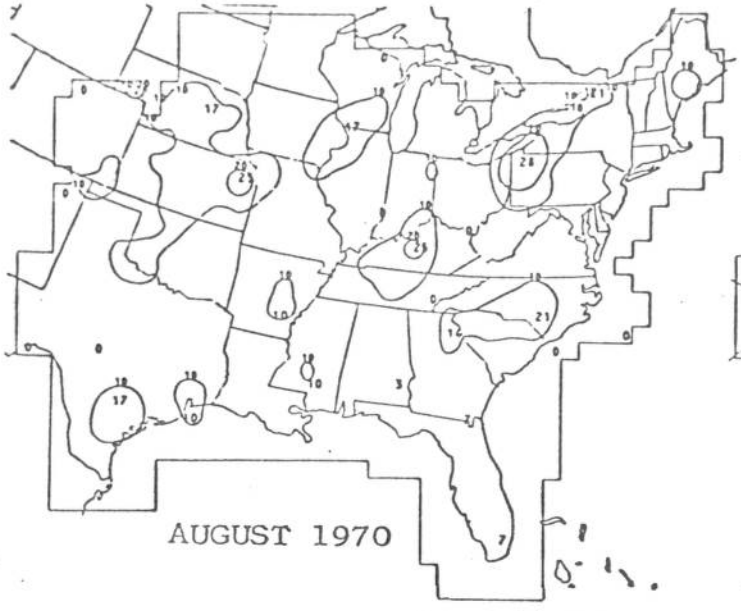




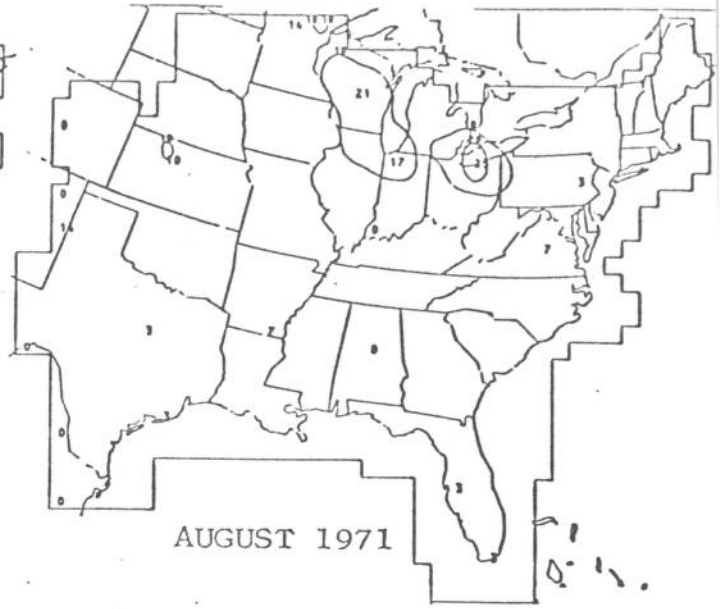




SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD ±3 HRS FM 00Z

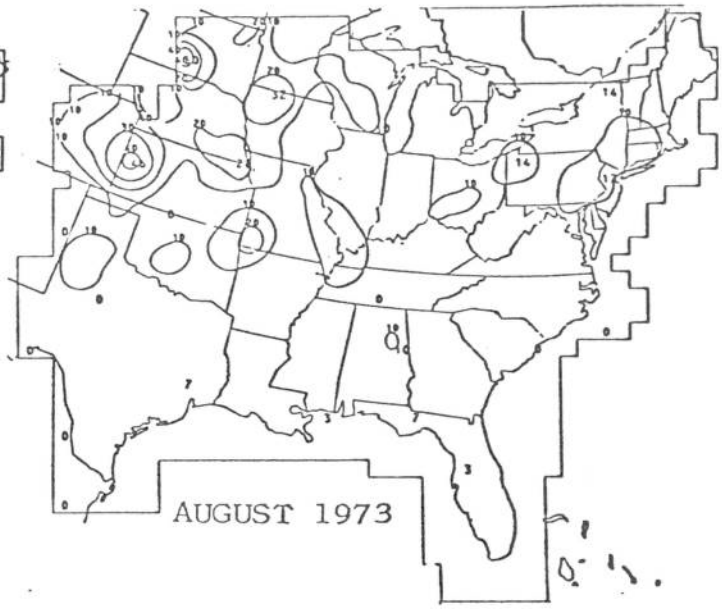


AUGUST 1970

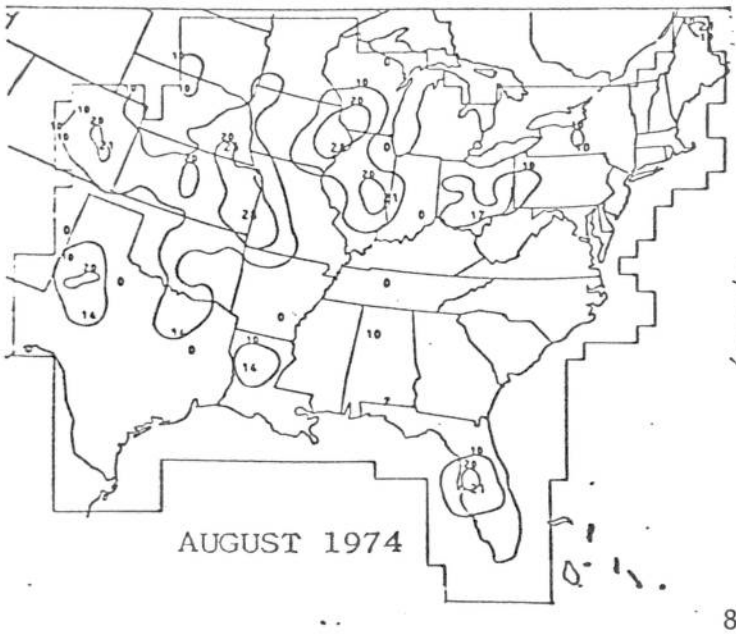


AUGUST 1971

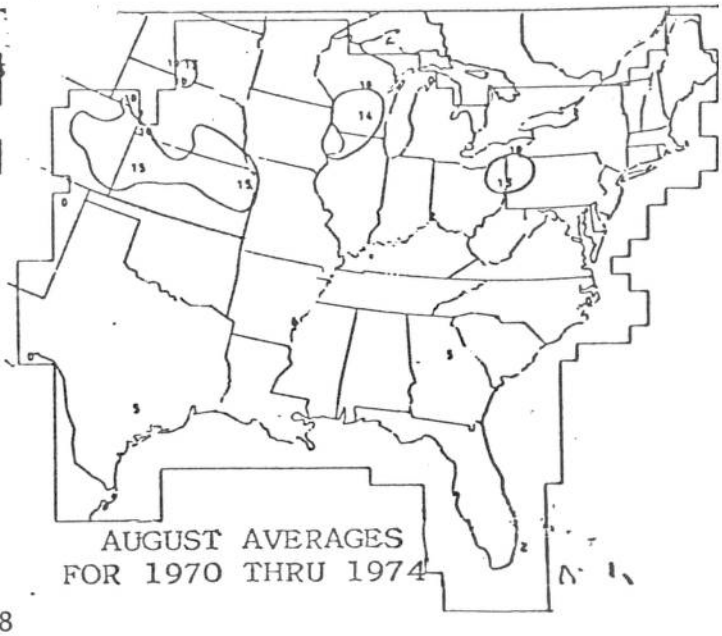
AUGUST 1972



AUGUST 1973

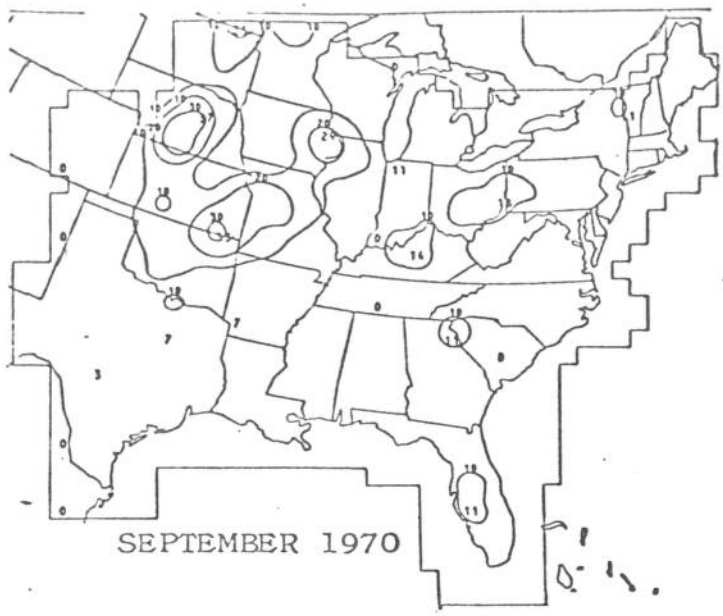


AUGUST 1974

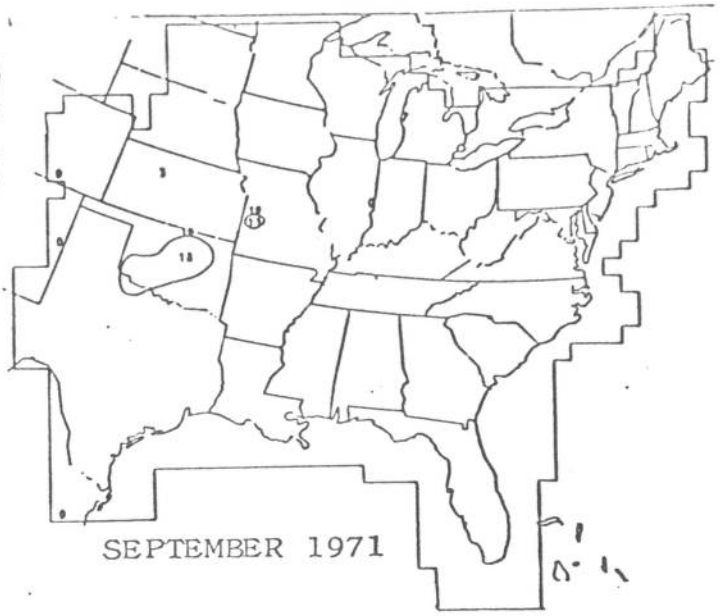


AUGUST AVERAGES
FOR 1970 THRU 1974

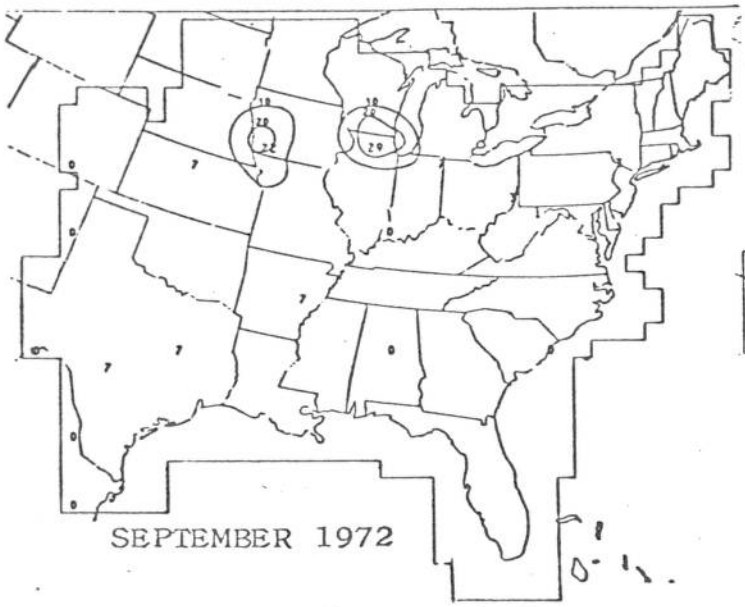
SVR TSTM RELATIVE FREQUENCY(TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00Z



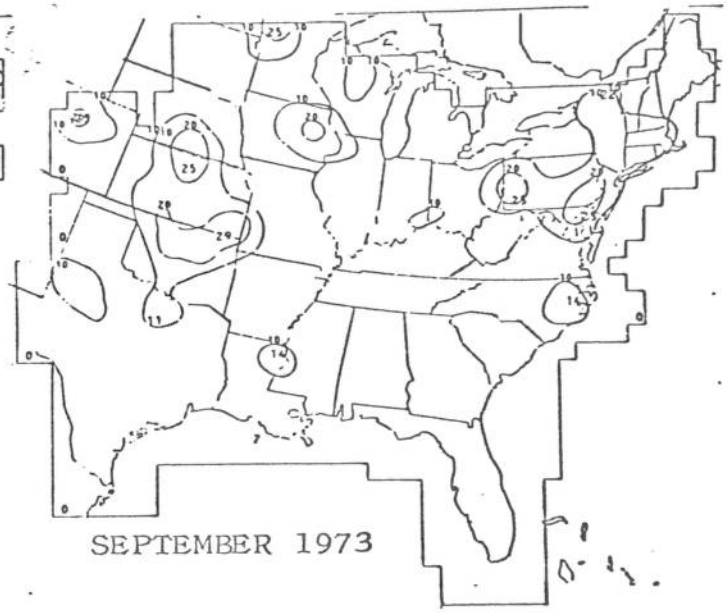
SEPTEMBER 1970



SEPTEMBER 1971

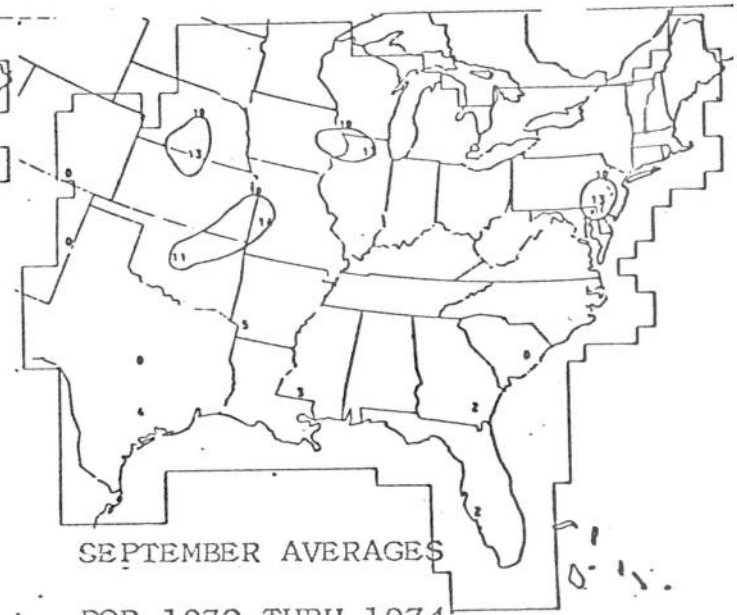


SEPTEMBER 1972



SEPTEMBER 1973

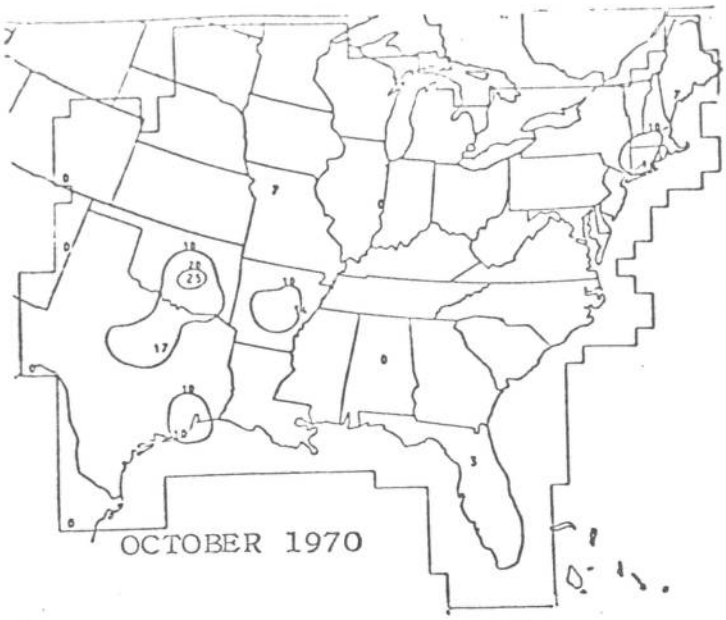
SEPTEMBER 1974



SEPTEMBER AVERAGES

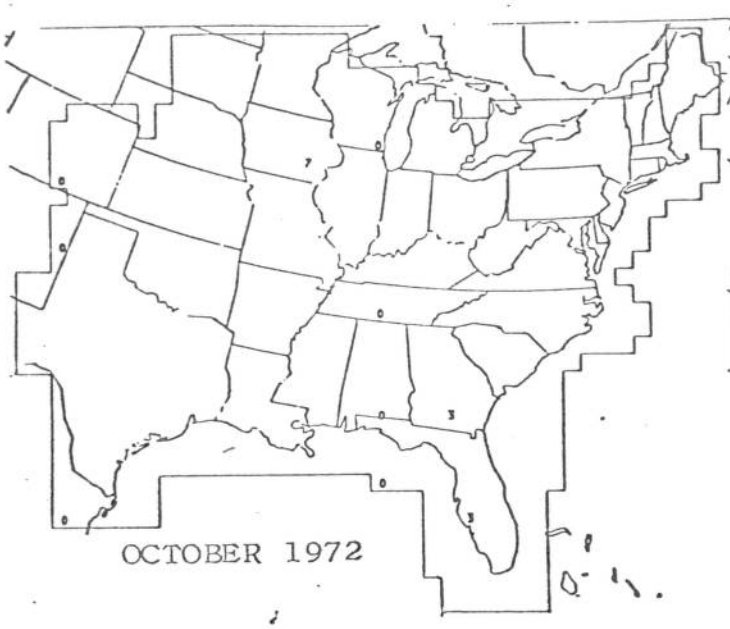
FOR 1970 THRU 1974

SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00Z

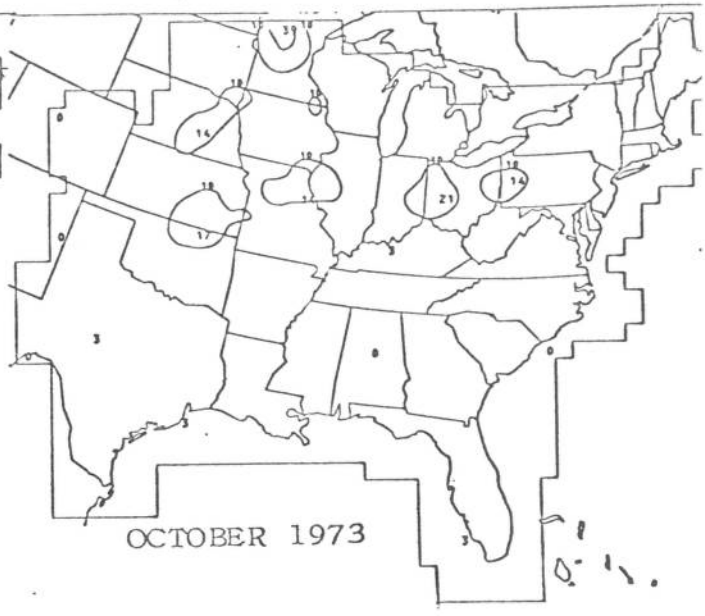


OCTOBER 1970

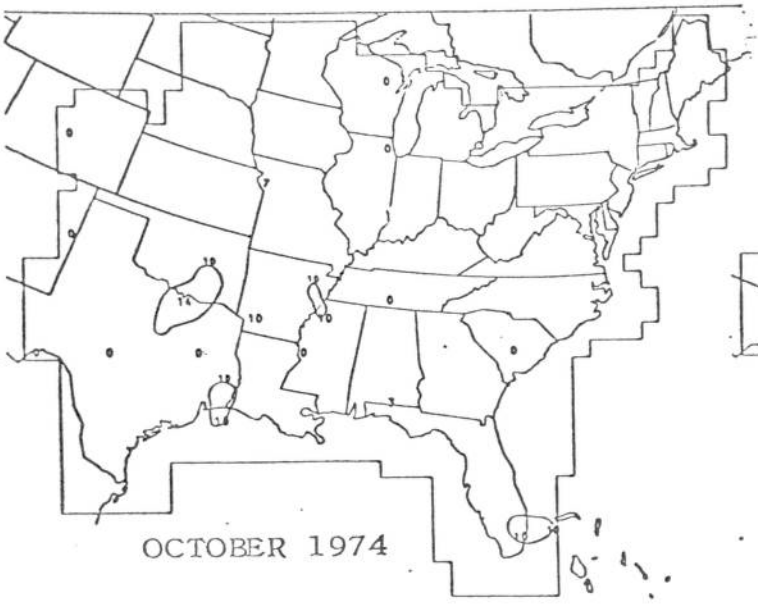
OCTOBER 1971



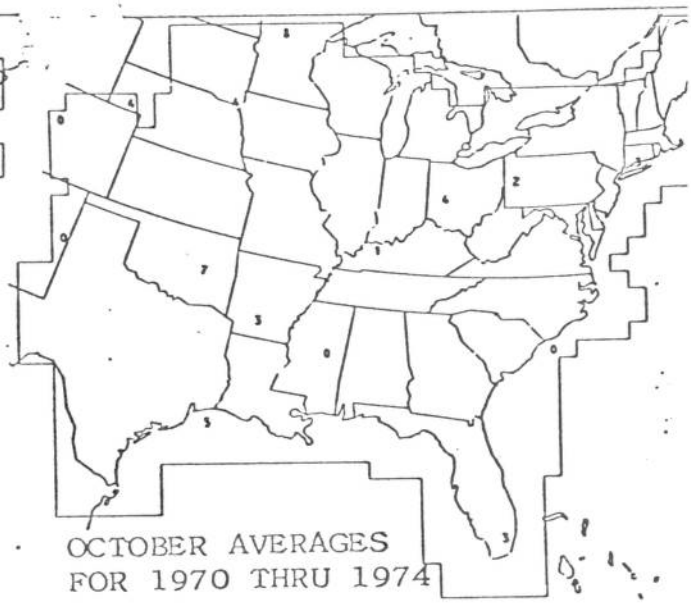
OCTOBER 1972



OCTOBER 1973

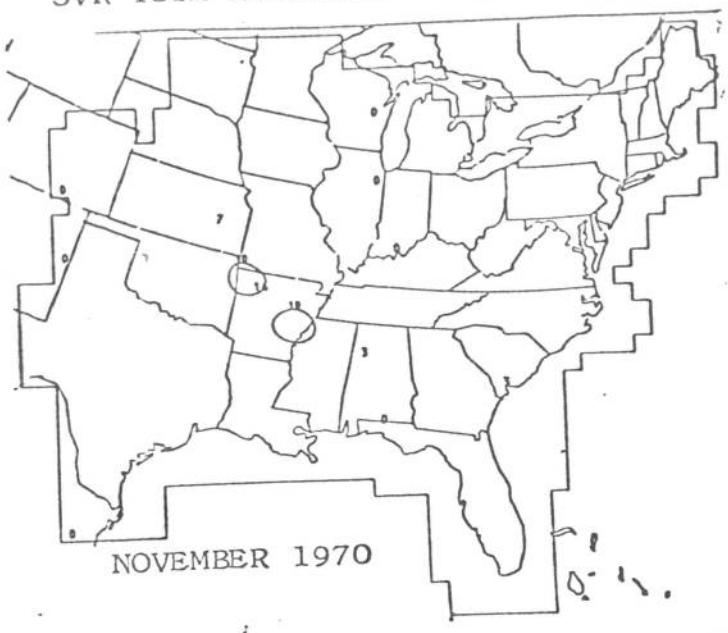


OCTOBER 1974



OCTOBER AVERAGES
FOR 1970 THRU 1974

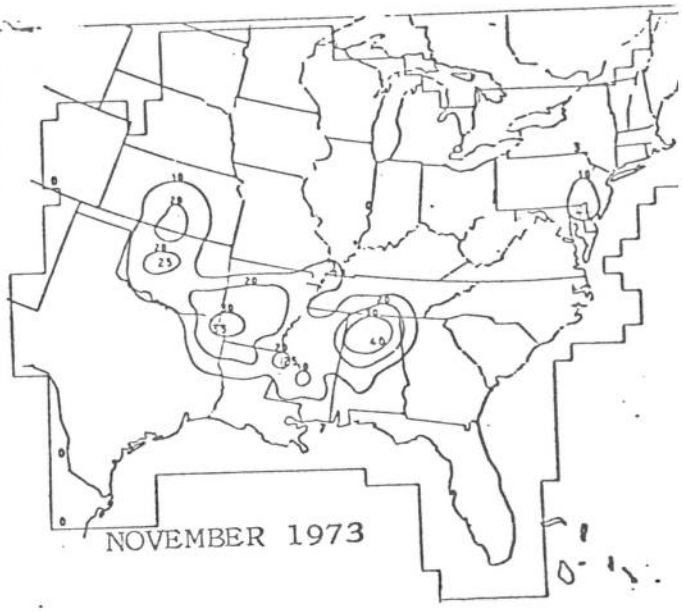
SVR TSTM RELATIVE FREQUENCY(TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00



NOVEMBER 1970

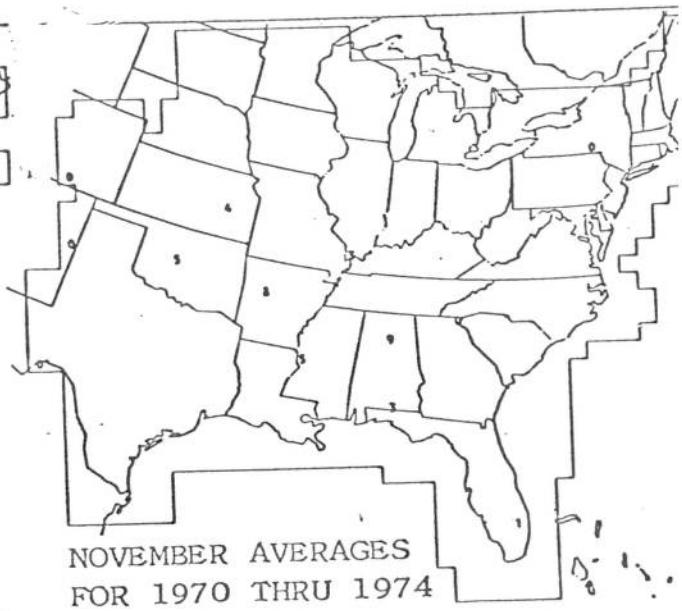
NOVEMBER 1971

NOVEMBER 1972



NOVEMBER 1973

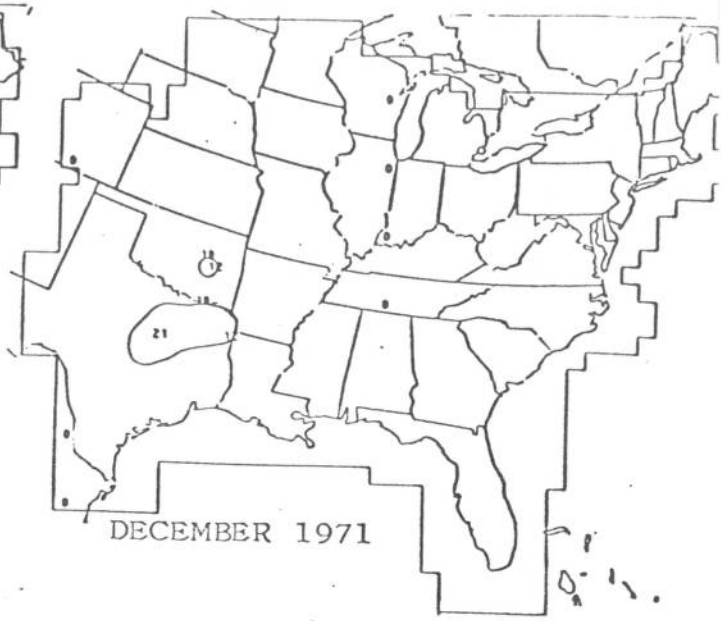
NOVEMBER 1974



NOVEMBER AVERAGES
FOR 1970 THRU 1974

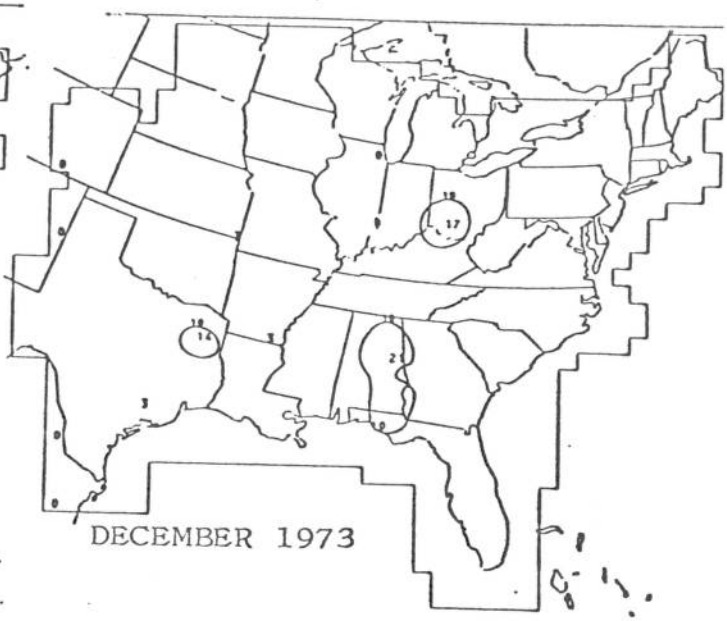
SVR TSTM RELATIVE FREQUENCY (TENTHS OF PERCENT) FOR PRD ± 3 HRS FM 00Z

DECEMBER 1970

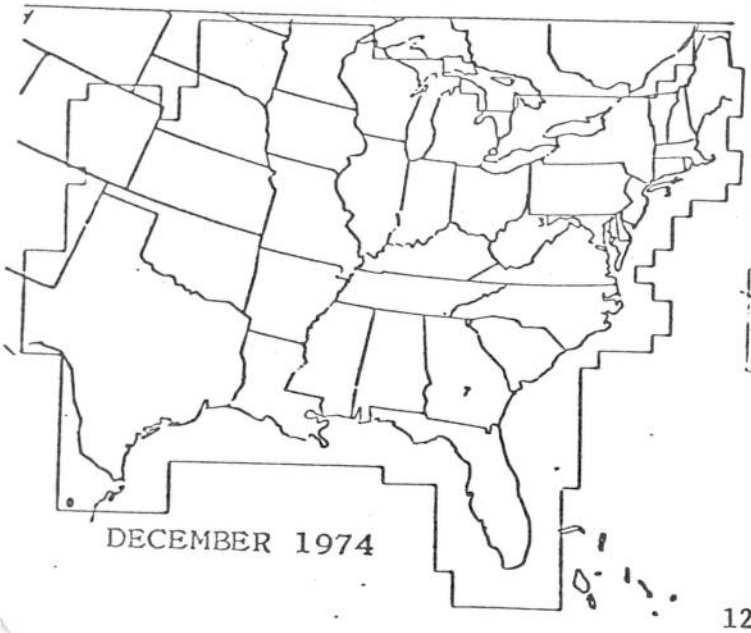


DECEMBER 1971

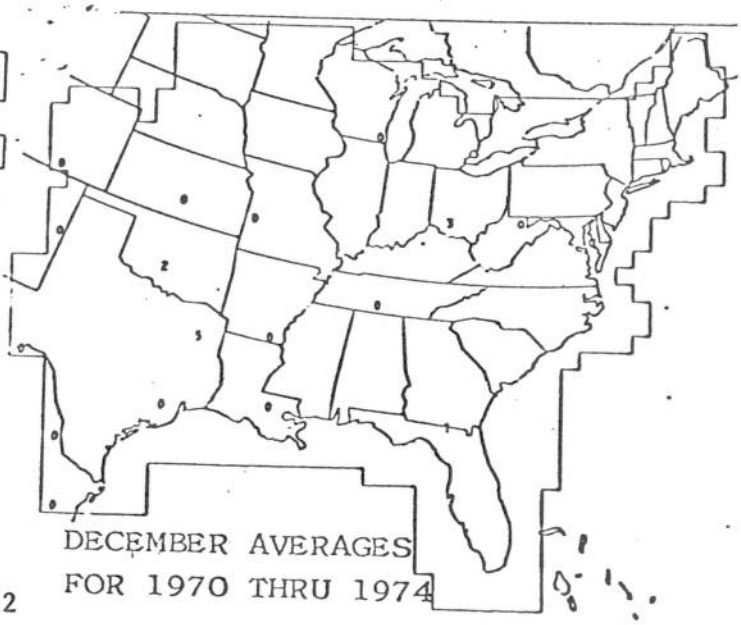
DECEMBER 1972



DECEMBER 1973



DECEMBER 1974



DECEMBER AVERAGES
FOR 1970 THRU 1974