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NATIONAL WEATHER SERVICE
NATIONAL METEOROLOGICAL CENTER

OFFICE NOTE 353

HEMISPHERIC AND GLOBAL MODEL 12-72 HOUR S1 SCORES 1978 - 1988

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INTRODUCTION

Hemispheric and global model 12-72 hour S1 score (see APPENDIX) verification records, January 1978 thru December 1988, are summarized in tables. The trend in 60 and 72 hour forecast scores is the primary concern of this paper; twelve thru 48 hour scores, presented previously in Office Note 343, are also included for completeness and as an aid in the evaluation of the longer range forecast tendencies.

NMC's operational model from January 1978 thru July 1980 was the Six-Layer Primitive Equation (6LPE) hemispheric model; the Spectral global model became operational in August 1980.

S1 SCORE RECORD

Verification scores are presented for 49 point and 33 point grid networks; they are subareas of NMC's 63 point lat-lon grid; gridpoint spacing is five degrees latitude by ten degrees longitude for the area bounded by 25 to 55 degrees north latitude and 65 to 145 degrees west longitude. In Figure I, the 49 point grid (49PT) is shown on the top and the 33 point grids, west (WEST33) and east (EAST33), on the bottom.

S1 score tables for 12-72 hour 6LPE and Spectral model forecasts, 1978-1988, are tabulated as follows:

TABLE	LEVEL	PERIOD	AREA
I	MSL	Month	49PT
II	500MB	Month	49PT
IIIA	500MB	Month	WEST33
IIIB	500MB	Month	EAST33
IV	MSL,500MB	Year	49PT
V	500MB	Year	WEST33,EAST33

Note that the verification record for 60 and 72 hour forecasts is not comprised of a complete set of monthly forecasts; only forecasts from 00Z initial times were used in 60 hour evaluation from January 1978 thru October 1980 and in 72 hour verification from January 1978 thru July 1988.

DISCUSSION

A sharp drop (improvement) in yearly S1 scores was observed between 1977 and 1978 (Hirano, 1988); this is a consequence of the reduction in 6LPE forecast mesh length in January 1978 to the original LFM grid mesh length. Specifying 1978 S1 scores as a standard ("base"), differences in both yearly and monthly scores with "base" year scores are analyzed.

A. Annual Differences

Figure II is a graph of average yearly 49PT S1 differences with 1978 scores; MSL is on the left, 500MB on the right, and 24, 48, and 72 hours are plotted on the bottom, center, and top respectively; LFM score differences with the "base" year 6LPE are given as Xs for 24 and 48 hours. A heavy vertical line is used to highlight 1981 values; this is the first complete year of Spectral model forecasts. Negative differences, lower S1 scores than "base" year scores, imply that forecasts are better.

LFM 24 hour scores at MSL and 500MB are steady. At 48 hours, there is a gradual lowering of scores thru 1986, which suggests a continued decline in the difficulty in weather predictability. There is no immediate impact on forecast quality with the implementation of the Spectral model; thru 1986, the steady decrease in S1 scores is due to "ease" in predictability, however, the larger differences observed at 24 hours is probably the result of refinements made in the analysis and forecast system.

In 1987 and 1988, a significant drop in Spectral model scores is found at all forecast hours; this is a consequence of the modification in November 1986 of the Spectral model from 12 to 18 layers and the inclusion of better physics (GFDL). Improvement is observed at all forecast hours; it is greatest at 72 hours and much larger at MSL than at 500MB.

Figure III is a graph of average yearly 500MB S1 score differences with 1978 scores for WEST33 (leftside) and EAST33 (right side); the format is the same as Figure II. The "ease" of predictability is unchanging over the east and improving over the west; it is clear that there is a greater difference between Spectral model and LFM forecast quality in 1987 and 1988 than is accounted for strictly by predictability.

B. Monthly Differences

Monthly S1 score differences with "base" year values at 72 hours are plotted on figures IV and V for MSL and 500MB 49PT and 500MB 33PT grids respectively. In both figures, monthly data is clustered by seasons: winter (WIN), autumn (AUT), summer (SUM),

and spring (SPR); December differences are displaced one year in order to maintain the seasonal trend with January and February data. Circles, dots, and xs are used for the first, second, and third months respectively of each season.

In Figure IV, improvement in MSL 1987 and 1988 forecasts is observed during all seasons; summertime forecasting is significantly altered, changing from poorer to much better than "base" year prediction. At 500MB the trend is similar; the most consistent seasonal patterns are found during SUM and AUT.

Monthly trends within seasons for 72 hour 500MB forecasts on the 33PT grid, Figure V, are quite variable over EAST33; over WEST33, rather consistent trends are found for SPR, SUM, and AUT.

CONCLUDING REMARKS

The most important change in the quality of longer range model forecasts occurred when the Spectral model vertical configuration was modified and improved physics was incorporated in November 1986. Summertime MSL forecasts were most profoundly affected.

Yearly MSL S1 scores given in Table IV indicate that 60 and 72 hour 1987 and 1988 values are comparable with 1978 scores at 36 and 48 hours respectively; this implies that there is a net gain of about 24 hours in forecast quality. At 500MB, improvement is slightly smaller, approximately 18 hours or so.

APPENDIX: S1 SCORE

Teweles-Wobus S1 Score (1954)

$$\text{S1 SCORE} = 100 \frac{\sum |e_G|}{\sum |G_L|}$$

where, e_G = the error in the forecast gradient
G_L = observed or forecast gradient, whichever is larger

REFERENCES

Hirano, R., 1988: S1 Score Verification, October 1975-December 1987. NMC Office Note 343.

Teweles, S. and H. Wobus, 1954: Verification of Prognostic Charts. Bull. Amer. Meteor. Soc., 35, pp. 455-463.

van Haaren, R. J., 1978: Comparative Verification of the National Meteorological Center's (NMC) Operational Forecast Models. Preprints, Conference on Weather Forecasting and Analysis and Aviation Meteorology, October 16-19, 1978, Silver Spring, MD. (AMS).

TABLE I: MEAN SEA LEVEL MONTHLY S1 SCORE
12 THRU 72 HOURS

OPERATIONAL MODELS: 6-Layer Primitive Equation model thru JUL80, Spectral model AUG80 -

VERIFYING ANALYSES: Hough analysis thru 25JUL84, Optimum Interpolation method 25JUL84 -

VERIFICATION GRID: 49 point lat-lon grid. This is a subset of a 63 point grid which covers the area between 65 and 145 west longitude and between 25 and 55 north latitude. Gridpoint spacing is 5 degrees latitude by 10 degrees longitude.

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YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1978	JAN	32.9	39.7	47.9	55.0	63.0	68.2
	FEB	35.0	41.8	51.7	55.5	61.7	67.8
	MAR	36.5	42.4	52.7	59.2	65.9	72.7
	APR	33.9	38.9	47.4	51.2	58.0	66.4
	MAY	35.9	42.5	52.3	58.7	63.3	71.1
	JUN	38.4	43.7	51.3	57.4	62.8	69.1
	JUL	39.7	43.6	51.1	56.5	61.0	64.9
	AUG	38.9	43.8	50.1	54.7	60.0	64.4
	SEP	38.5	44.8	55.6	62.0	70.4	74.7
	OCT	32.6	37.1	45.4	52.2	58.6	64.7
	NOV	34.7	41.9	49.7	54.1	61.3	69.4
	DEC	35.4	42.7	51.1	58.3	64.4	69.8
1979	JAN	33.5	40.9	49.5	59.3	60.5	66.9
	FEB	34.6	40.9	48.8	52.9	58.2	61.6
	MAR	35.6	41.0	49.3	54.5	58.6	68.2
	APR	39.6	45.0	54.4	60.5	64.8	72.6
	MAY	38.4	43.5	52.6	58.5	64.7	72.7
	JUN	38.7	42.0	51.1	57.1	62.8	71.4
	JUL	41.1	44.3	53.3	58.9	63.3	67.7
	AUG	42.1	45.7	54.6	61.2	65.5	70.4
	SEP	37.0	40.6	48.9	55.6	63.3	67.9
	OCT	36.2	41.7	49.6	56.2	61.3	68.6
	NOV	35.2	41.2	49.0	55.0	62.1	68.1
	DEC	33.1	39.0	47.3	52.6	56.8	61.6
1980	JAN	34.1	41.6	49.9	55.8	62.2	68.1
	FEB	35.2	41.6	50.8	56.5	62.9	66.7
	MAR	34.8	39.5	47.3	52.3	57.3	64.4
	APR	35.7	41.3	49.8	54.7	58.3	65.2
	MAY	38.0	42.5	51.0	56.6	63.4	68.3
	JUN	37.1	42.2	50.9	58.9	63.5	68.8
	JUL	38.4	44.7	54.8	62.0	69.1	73.7
	AUG	36.1	42.2	50.9	58.0	62.2	67.5

TABLE I(CONTD): MEAN SEA LEVEL MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1980	SEP	35.4	43.0	51.4	57.8	64.1	70.8
	OCT	30.2	37.5	45.4	51.9	57.4	65.4
	NOV	28.1	36.1	43.4	51.2	58.1	63.3
	DEC	32.4	40.7	46.2	51.8	56.3	62.6
1981	JAN	31.5	39.9	47.1	53.1	59.4	65.4
	FEB	31.2	39.1	46.3	54.3	62.1	66.7
	MAR	32.6	39.9	47.9	54.9	59.8	65.2
	APR	33.1	39.6	47.2	54.9	62.9	70.3
	MAY	35.2	42.5	51.4	58.3	65.5	73.4
	JUN	37.9	46.6	55.9	63.5	69.8	76.4
	JUL	38.9	45.8	54.3	61.4	68.7	74.6
	AUG	40.4	46.6	55.0	61.6	68.5	75.3
	SEP	35.0	41.6	50.3	57.6	63.9	71.0
	OCT	29.5	37.1	45.5	53.1	60.7	68.1
	NOV	29.7	38.9	46.5	53.5	59.3	66.8
	DEC	30.0	39.2	47.6	56.2	62.9	70.8
1982	JAN	31.1	40.4	47.1	54.6	60.2	65.2
	FEB	31.4	40.3	48.0	56.6	61.1	68.4
	MAR	30.1	37.9	45.4	53.3	60.8	66.9
	APR	30.4	38.9	46.5	52.5	57.2	62.1
	MAY	36.0	44.8	54.4	61.5	67.4	73.5
	JUN	40.5	48.6	58.6	65.4	70.1	75.8
	JUL	41.6	48.6	57.3	63.1	69.2	73.9
	AUG	41.1	48.2	56.5	62.8	69.7	74.3
	SEP	35.4	42.5	50.7	57.5	64.4	70.8
	OCT	28.8	37.2	45.6	52.8	59.7	67.6
	NOV	28.5	37.7	45.9	51.2	57.1	61.9
	DEC	27.8	36.7	44.7	52.8	58.5	61.7
1983	JAN	28.2	36.4	43.9	51.1	56.4	60.9
	FEB	28.3	37.1	46.0	53.4	60.3	67.9
	MAR	27.0	36.0	42.8	49.1	55.6	59.6
	APR	31.7	42.8	50.9	57.9	65.0	71.1
	MAY	32.8	42.4	50.3	56.2	60.6	68.2
	JUN	33.7	42.3	51.9	57.8	63.3	68.5
	JUL	33.8	42.0	52.8	60.2	68.0	72.6
	AUG	36.4	44.6	54.3	61.5	68.1	72.7
	SEP	29.6	37.9	46.6	53.1	59.1	65.0
	OCT	30.8	37.6	46.0	52.2	58.4	64.4
	NOV	31.7	39.0	46.8	53.6	59.5	63.6
	DEC	34.9	42.6	49.6	55.6	60.9	64.5
1984	JAN	34.6	40.0	46.6	52.7	58.5	64.1
	FEB	30.6	38.8	47.1	55.1	63.0	69.0
	MAR	30.3	39.6	46.9	53.1	59.6	64.1
	APR	30.7	37.2	45.4	52.5	59.0	65.1
	MAY	33.6	40.4	48.8	55.0	61.5	67.6
	JUN	36.3	40.6	50.7	57.7	64.9	71.0

TABLE I(CONTD): MEAN SEA LEVEL MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1984	JUL	38.5	40.5	49.0	55.3	62.7	68.2
	AUG	36.1	39.0	46.9	53.6	61.3	67.6
	SEP	29.3	39.9	44.9	55.2	58.5	63.0
	OCT	27.7	37.9	46.4	53.3	60.1	65.4
	NOV	26.7	37.4	44.9	51.7	57.4	63.7
	DEC	27.8	38.3	46.2	53.6	62.5	68.1
1985	JAN	26.7	36.1	43.1	50.2	57.8	64.2
	FEB	26.2	36.5	45.4	53.2	61.4	66.3
	MAR	27.0	37.2	45.8	53.4	61.1	66.8
	APR	30.1	38.6	48.6	55.8	61.5	66.4
	MAY	32.2	40.2	50.6	59.0	66.9	71.7
	JUN	32.8	39.8	50.9	58.7	65.9	71.7
	JUL	37.6	40.6	51.2	58.5	64.9	68.3
	AUG	34.8	37.7	47.6	55.7	62.7	67.4
	SEP	28.3	35.8	44.9	52.6	59.4	64.8
	OCT	25.9	34.6	43.2	49.8	55.9	63.8
	NOV	28.3	40.4	49.5	58.0	64.7	71.2
	DEC	26.8	34.8	42.9	49.7	55.7	61.6
1986	JAN	25.3	35.1	43.4	50.8	57.7	63.4
	FEB	28.0	38.6	47.3	55.3	62.4	68.8
	MAR	26.8	35.4	42.7	49.9	56.4	60.7
	APR	28.7	38.5	47.6	55.3	61.8	68.8
	MAY	30.1	37.4	46.7	53.3	59.4	64.9
	JUN	35.2	39.1	47.7	54.9	61.6	67.7
	JUL	37.1	39.3	49.2	56.6	62.8	67.3
	AUG	35.9	38.1	46.9	53.2	58.6	63.8
	SEP	30.3	35.4	43.8	51.0	58.8	64.6
	OCT	27.8	36.8	45.8	52.4	58.0	65.6
	NOV	24.4	34.4	42.6	50.2	58.4	66.2
	DEC	21.1	29.3	36.5	43.4	50.2	57.0
1987	JAN	21.3	30.4	38.2	45.4	51.9	57.2
	FEB	20.9	30.6	40.0	47.1	53.3	58.7
	MAR	20.9	29.3	36.1	43.2	48.6	54.4
	APR	25.3	34.4	42.2	49.1	55.0	59.7
	MAY	29.1	33.5	40.0	45.5	51.7	56.4
	JUN	28.3	35.5	41.5	46.2	50.7	55.5
	JUL	31.0	36.8	42.2	47.1	52.7	57.8
	AUG	30.0	36.3	41.4	46.1	49.7	52.2
	SEP	28.6	36.2	42.5	48.6	54.0	57.4
	OCT	22.0	30.4	37.0	44.5	51.5	56.7
	NOV	19.5	27.4	34.0	40.2	45.8	52.1
	DEC	20.3	28.2	35.6	42.2	48.4	54.0
1988	JAN	19.9	28.1	35.6	42.3	49.0	53.9
	FEB	21.7	28.9	35.7	42.7	49.3	56.5
	MAR	21.3	28.9	36.3	43.0	49.2	54.9
	APR	23.3	32.3	40.1	46.6	52.4	57.6

TABLE I(CONTD): MEAN SEA LEVEL MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1988	MAY	25.3	32.2	39.2	44.6	49.1	51.4
	JUN	26.9	33.7	38.9	44.0	48.3	52.0
	JUL	31.3	35.9	40.9	45.9	50.6	53.0
	AUG	27.1	32.5	38.2	44.2	49.3	52.2
	SEP	23.7	31.2	38.7	45.8	51.6	56.3
	OCT	21.0	27.8	35.0	41.8	48.9	54.4
	NOV	18.9	27.2	34.3	40.6	45.8	51.4
	DEC	19.4	27.4	35.6	42.6	47.3	52.9

TABLE II: 500MB MONTHLY S1 SCORE
12 THRU 72 HOURS

OPERATIONAL MODELS: 6-Layer Primitive Equation model thru JUL80, Spectral model AUG80 -

VERIFYING ANALYSES: Hough analysis thru 25JUL84, Optimum Interpolation method 25JUL84 -

VERIFICATION GRID: 49 point lat-lon grid. This is a subset of a 63 point grid which covers the area between 65 and 145 west longitude and between 25 and 55 north latitude. Gridpoint spacing is 5 degrees latitude by 10 degrees longitude.

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YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1978	JAN	20.5	26.4	32.5	38.3	43.7	49.4
	FEB	20.8	25.6	31.3	36.4	41.3	45.9
	MAR	18.1	23.3	29.8	35.7	40.4	45.8
	APR	22.0	27.8	34.9	41.3	47.7	54.1
	MAY	22.2	28.8	35.5	41.0	47.4	51.4
	JUN	22.7	27.2	33.7	38.9	42.8	48.7
	JUL	24.5	28.6	34.2	38.0	39.9	44.4
	AUG	22.9	27.6	32.8	37.5	41.7	46.0
	SEP	23.4	28.4	34.8	39.5	45.1	49.1
	OCT	19.8	25.0	31.4	36.3	40.4	44.8
	NOV	18.8	24.0	29.2	33.7	39.5	44.7
	DEC	18.0	23.7	29.8	34.9	39.3	42.9
1979	JAN	18.9	25.3	32.3	38.6	44.0	48.5
	FEB	18.2	22.9	27.8	31.5	36.0	38.0
	MAR	20.0	25.4	32.1	37.7	42.0	47.7
	APR	19.5	25.3	31.5	38.2	43.3	48.9
	MAY	21.3	27.6	32.8	38.8	44.6	51.3
	JUN	22.2	27.3	32.4	37.7	42.4	48.2
	JUL	24.9	29.2	34.9	39.6	43.6	48.4
	AUG	23.4	27.8	33.2	37.9	43.4	47.6
	SEP	21.2	26.0	31.7	37.2	41.7	46.6
	OCT	19.4	25.2	30.2	34.9	38.7	43.1
	NOV	18.4	24.5	29.0	35.2	39.9	44.2
	DEC	18.3	23.4	28.8	33.6	37.9	41.1
1980	JAN	18.2	23.6	28.3	34.1	39.4	45.3
	FEB	19.2	24.9	29.8	35.7	40.7	44.9
	MAR	18.9	23.9	28.7	34.4	40.3	44.9
	APR	20.4	26.5	32.3	38.0	42.7	47.4
	MAY	21.8	27.4	34.0	39.9	46.3	51.2
	JUN	21.4	25.8	31.4	36.5	40.2	45.9
	JUL	21.8	26.4	31.7	36.4	42.4	47.4
	AUG	20.5	25.6	30.8	35.4	40.7	46.0

TABLE II(CONTD): 500MB MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1980	SEP	16.7	22.3	27.6	32.4	38.2	42.6
	OCT	15.1	21.1	27.0	32.8	38.6	43.1
	NOV	15.5	21.8	28.3	34.7	39.4	43.7
	DEC	13.7	18.9	24.1	29.2	33.2	38.8
1981	JAN	15.6	21.2	27.0	32.3	38.1	43.5
	FEB	15.6	22.0	28.4	34.4	39.9	46.1
	MAR	18.2	25.3	32.4	38.3	43.8	49.3
	APR	16.0	22.1	27.8	33.2	38.3	43.4
	MAY	19.6	26.4	32.6	38.5	43.7	49.0
	JUN	19.6	26.5	32.2	37.8	42.2	46.2
	JUL	21.3	27.5	32.8	38.2	43.7	50.9
	AUG	22.3	28.2	33.6	38.2	42.9	49.0
	SEP	18.9	26.0	32.2	37.8	43.1	49.0
	OCT	15.0	20.7	26.8	33.0	38.9	45.7
	NOV	17.6	23.6	29.8	35.3	39.9	43.8
	DEC	15.4	21.7	27.8	33.9	39.1	45.1
1982	JAN	13.8	19.0	24.0	28.7	32.8	38.2
	FEB	13.9	19.1	23.5	27.6	31.5	38.6
	MAR	15.7	21.8	27.0	32.3	37.7	44.9
	APR	16.4	21.8	27.2	33.0	36.7	42.3
	MAY	19.8	27.4	34.5	40.8	46.9	51.6
	JUN	19.3	25.5	31.3	36.2	41.8	46.9
	JUL	20.6	26.2	32.0	37.0	42.2	47.1
	AUG	18.2	22.8	27.5	32.0	38.0	45.3
	SEP	17.6	23.4	29.1	35.1	40.7	46.1
	OCT	17.1	22.9	28.9	35.1	41.2	48.2
	NOV	15.0	20.5	25.5	30.0	34.5	40.2
	DEC	15.2	21.4	27.1	32.6	38.0	44.1
1983	JAN	16.1	22.2	28.2	34.1	39.0	43.8
	FEB	17.8	24.0	29.6	35.7	41.1	46.9
	MAR	18.7	25.3	30.7	36.2	42.9	50.8
	APR	17.6	24.6	30.8	37.4	42.4	48.9
	MAY	17.7	24.1	29.5	34.7	39.4	44.3
	JUN	19.7	26.4	32.1	38.4	44.2	48.1
	JUL	19.1	25.4	31.1	36.5	42.1	47.7
	AUG	17.9	23.4	28.3	33.0	37.9	42.2
	SEP	16.7	22.2	27.1	32.2	35.9	40.6
	OCT	16.8	23.5	29.1	35.0	39.4	46.5
	NOV	18.0	25.4	31.0	37.1	42.1	48.5
	DEC	15.9	20.5	25.6	30.6	35.4	41.8
1984	JAN	15.6	19.7	24.5	29.7	34.2	40.0
	FEB	17.0	23.0	29.5	36.2	41.5	46.9
	MAR	16.6	22.3	27.9	33.4	38.4	43.4
	APR	18.0	24.4	30.6	36.1	41.6	47.0
	MAY	17.2	23.2	28.8	34.4	39.2	43.2
	JUN	18.9	25.2	31.4	37.0	41.6	44.5

TABLE II(CONTD): 500MB MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1984	JUL	18.6	24.1	29.2	34.6	40.3	46.3
	AUG	16.7	23.2	29.4	35.3	41.4	46.8
	SEP	14.4	21.1	27.3	32.7	37.6	41.4
	OCT	13.6	20.6	26.6	32.1	36.6	41.0
	NOV	16.1	23.3	29.6	35.3	40.3	45.1
	DEC	11.8	18.3	24.7	31.0	36.8	39.8
1985	JAN	12.5	18.7	25.4	32.5	40.3	47.5
	FEB	12.1	18.9	25.1	31.0	36.8	40.1
	MAR	14.3	21.3	27.7	32.8	38.0	42.6
	APR	13.3	19.9	25.7	31.6	37.0	41.4
	MAY	15.3	23.2	30.7	37.6	43.6	48.5
	JUN	15.9	24.2	31.8	39.1	44.4	49.4
	JUL	16.5	22.9	28.1	32.8	37.0	41.3
	AUG	16.5	23.6	29.4	34.7	40.3	45.7
	SEP	13.8	21.8	28.5	34.5	39.3	43.3
	OCT	12.8	19.4	25.3	30.9	35.4	40.5
	NOV	11.8	18.8	24.9	30.4	35.7	41.4
	DEC	11.0	16.8	22.7	28.6	33.4	38.2
1986	JAN	12.0	18.6	25.0	31.3	36.2	40.3
	FEB	12.7	19.1	25.3	31.8	37.4	41.0
	MAR	12.7	18.5	24.0	28.9	34.0	37.8
	APR	14.0	21.4	27.9	34.2	40.1	46.1
	MAY	15.2	22.5	28.8	33.8	38.8	43.1
	JUN	14.6	20.6	26.1	31.6	37.4	42.4
	JUL	17.3	23.6	29.1	34.0	38.7	43.7
	AUG	15.9	22.0	28.0	33.4	38.8	45.0
	SEP	13.9	19.6	25.0	30.6	36.1	41.7
	OCT	13.0	19.7	26.6	32.5	37.3	42.0
	NOV	11.0	16.7	22.4	28.7	33.9	38.6
	DEC	12.0	18.5	24.4	29.9	35.8	41.6
1987	JAN	11.3	18.1	24.9	30.9	36.2	39.6
	FEB	12.6	19.8	26.1	32.1	36.9	40.7
	MAR	12.5	19.4	25.6	31.5	37.3	42.4
	APR	13.0	20.7	27.7	33.6	38.4	42.9
	MAY	13.4	20.0	25.9	30.9	35.3	39.8
	JUN	13.1	18.9	24.3	28.7	33.1	38.4
	JUL	14.7	20.2	25.7	30.6	35.2	39.6
	AUG	13.6	19.8	25.0	29.6	33.2	37.4
	SEP	12.2	18.0	23.4	29.0	34.4	39.9
	OCT	10.6	16.3	21.6	26.9	32.1	37.8
	NOV	11.4	17.7	23.6	29.2	34.3	37.5
	DEC	11.0	16.9	22.7	28.2	33.1	37.8
1988	JAN	9.7	15.2	20.8	26.0	30.9	34.2
	FEB	9.3	14.2	19.4	24.8	30.0	34.7
	MAR	10.8	17.2	22.8	28.4	33.4	37.9
	APR	12.4	19.9	26.6	32.9	38.9	43.4

TABLE II(CONTD): 500MB MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1988	MAY	13.0	19.8	25.7	31.3	36.4	41.0
	JUN	13.4	19.1	24.6	28.9	33.5	37.6
	JUL	15.1	21.4	26.7	31.8	36.8	41.2
	AUG	15.2	22.2	28.9	34.6	39.9	43.2
	SEP	13.0	19.6	26.2	32.2	37.6	42.9
	OCT	11.1	17.0	22.4	27.8	33.0	38.4
	NOV	11.1	17.1	22.4	27.2	31.6	36.0
	DEC	9.0	14.2	19.5	24.4	28.4	32.3

TABLE IIIA: 500MB WEST33 MONTHLY S1 SCORE
12 THRU 72 HOURS

OPERATIONAL MODELS: 6-Layer Primitive Equation model thru JUL80, Spectral model AUG80 -

VERIFYING ANALYSES: Hough analysis thru 25JUL84, Optimum Interpolation method 25JUL84 -

VERIFICATION GRID: 33 point lat-lon grids for western and eastern United States. Between 25N and 55N, WEST33 is the area from 105W to 145W and EAST33 is the area from 105W to 145W; gridpoint spacing is 5 degrees latitude by 10 degrees longitude.

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YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1978	JAN	26.9	32.4	37.9	44.1	50.2	55.4
	FEB	25.8	31.6	36.6	41.0	45.4	45.9
	MAR	24.5	31.5	38.0	44.0	47.2	53.2
	APR	24.9	29.8	36.6	42.2	49.6	53.2
	MAY	24.1	32.4	39.3	42.8	50.1	52.6
	JUN	25.8	33.8	39.2	44.8	46.8	50.7
	JUL	29.4	34.0	39.1	45.5	45.5	50.3
	AUG	25.1	31.2	36.1	40.7	44.4	47.9
	SEP	26.5	31.8	37.1	42.8	47.4	52.0
	OCT	23.6	30.4	34.6	40.0	43.4	48.4
	NOV	23.0	31.1	33.9	39.6	43.2	48.7
	DEC	21.0	27.7	32.5	37.6	43.6	47.2
1979	JAN	23.8	31.3	37.1	44.5	49.8	52.9
	FEB	21.4	25.6	29.5	32.9	38.7	40.9
	MAR	23.6	29.4	36.6	40.8	43.3	47.9
	APR	23.0	29.7	34.2	39.7	45.4	49.8
	MAY	23.9	31.1	36.3	41.5	46.3	51.3
	JUN	25.1	30.8	35.6	40.3	44.9	48.1
	JUL	28.0	32.8	38.2	43.0	46.6	52.7
	AUG	28.8	33.6	39.7	43.8	48.2	53.4
	SEP	27.3	31.6	38.5	42.8	46.3	50.6
	OCT	23.0	29.0	33.0	37.6	40.9	45.1
	NOV	22.8	29.4	33.0	37.4	40.4	44.9
	DEC	21.4	25.7	30.8	35.1	37.3	39.4
1980	JAN	21.9	27.5	31.4	37.6	43.4	47.9
	FEB	24.4	30.9	35.7	40.0	43.8	47.8
	MAR	23.6	29.0	33.8	37.9	44.1	47.4
	APR	22.7	28.8	34.2	39.0	42.9	46.0
	MAY	24.2	30.4	36.4	41.7	46.6	50.8
	JUN	24.9	29.7	34.4	39.6	43.3	50.0
	JUL	24.1	28.6	33.4	38.5	43.0	48.6
	AUG	24.7	30.7	35.2	39.2	44.0	49.4

TABLE IIIA(CONTD): 500MB WEST33 MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1980	SEP	20.7	26.4	31.8	36.6	41.7	46.6
	OCT	19.0	26.0	31.9	37.4	40.7	43.3
	NOV	19.5	26.4	32.5	40.2	39.2	43.4
	DEC	18.5	24.3	29.8	33.5	36.2	41.8
1981	JAN	22.8	29.8	36.4	40.4	44.6	49.3
	FEB	20.2	26.7	33.6	39.9	44.7	51.7
	MAR	22.0	30.2	36.7	41.9	45.8	49.4
	APR	19.5	26.1	31.6	36.8	41.1	45.1
	MAY	22.1	28.8	34.1	39.2	43.6	50.1
	JUN	22.0	28.7	34.1	38.7	42.1	46.9
	JUL	27.2	33.6	38.3	43.6	49.2	58.2
	AUG	25.3	31.2	35.9	39.9	44.0	52.1
	SEP	22.0	29.6	35.5	40.5	44.3	49.0
	OCT	18.2	24.0	29.5	35.9	41.7	48.1
	NOV	21.2	26.7	31.9	35.5	38.5	41.9
	DEC	18.8	25.4	31.5	36.2	39.0	43.9
1982	JAN	17.6	22.5	27.0	31.5	34.7	38.6
	FEB	18.5	23.7	27.3	30.9	34.8	42.6
	MAR	19.2	25.7	31.1	35.9	40.5	47.3
	APR	18.4	23.2	27.6	31.8	35.8	39.9
	MAY	21.3	29.0	35.8	42.5	47.6	51.7
	JUN	23.5	28.8	34.2	38.6	44.3	49.9
	JUL	24.7	30.3	36.4	40.4	45.8	52.2
	AUG	23.3	28.0	32.8	36.8	43.0	52.6
	SEP	21.1	26.8	33.0	39.2	45.0	51.6
	OCT	19.8	25.5	31.3	36.5	42.0	49.6
	NOV	18.5	24.6	30.1	34.5	37.9	42.7
	DEC	19.0	26.5	31.8	36.9	41.3	45.9
1983	JAN	20.7	26.5	31.6	36.3	39.8	44.5
	FEB	20.4	26.6	31.7	35.2	38.5	44.5
	MAR	20.1	26.3	30.6	35.2	40.1	45.7
	APR	20.1	26.4	31.8	38.2	42.3	47.4
	MAY	21.2	27.2	32.9	38.2	42.3	47.4
	JUN	22.5	28.8	34.8	40.4	44.9	48.4
	JUL	21.5	27.9	33.1	37.1	42.0	47.8
	AUG	21.5	27.2	31.5	36.2	41.9	48.2
	SEP	21.3	27.0	31.8	36.0	39.3	45.3
	OCT	20.1	27.5	32.4	37.0	39.3	45.4
	NOV	19.7	27.0	31.5	34.8	39.3	43.7
	DEC	20.2	26.1	29.9	34.6	39.5	48.1
1984	JAN	20.8	26.5	31.4	37.7	42.0	47.4
	FEB	21.7	28.0	33.5	37.9	40.9	45.4
	MAR	19.9	26.0	31.1	35.7	40.3	45.4
	APR	19.9	26.4	32.2	37.1	40.7	45.3
	MAY	20.8	27.0	32.4	36.7	39.7	43.3
	JUN	22.7	28.9	34.2	38.1	41.9	43.7

TABLE IIIA(CONTD): 500MB WEST33 MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1984	JUL	23.2	28.8	33.8	39.1	43.8	50.4
	AUG	20.2	27.1	33.3	38.7	44.0	48.6
	SEP	18.4	25.3	30.7	35.6	40.6	45.8
	OCT	15.3	22.5	28.1	32.9	36.4	40.6
	NOV	19.8	26.6	32.6	37.4	40.9	43.4
	DEC	15.1	22.6	29.7	37.0	43.0	47.1
1985	JAN	18.3	25.9	33.2	39.9	46.1	52.8
	FEB	15.7	22.7	28.1	33.8	39.4	42.5
	MAR	17.7	25.2	30.4	33.6	37.6	41.7
	APR	16.7	24.0	29.8	34.2	39.1	42.8
	MAY	19.2	27.3	34.1	40.3	44.9	46.4
	JUN	18.8	26.6	33.9	39.6	43.8	47.4
	JUL	20.5	28.1	33.4	37.6	42.2	45.8
	AUG	19.1	26.5	31.9	35.8	40.1	45.1
	SEP	16.7	25.1	31.9	37.9	43.4	48.0
	OCT	15.3	22.2	27.3	31.8	36.0	39.4
	NOV	14.3	21.1	27.0	33.4	38.6	43.4
	DEC	15.5	23.2	29.6	35.4	38.7	42.3
1986	JAN	17.3	25.6	31.0	35.1	38.0	40.1
	FEB	16.3	22.8	28.5	34.1	38.0	40.4
	MAR	15.8	22.9	28.9	33.2	36.8	38.7
	APR	16.2	24.6	30.5	35.8	39.4	44.8
	MAY	16.2	23.4	29.3	33.1	37.4	41.1
	JUN	17.9	24.2	29.9	34.9	40.8	45.0
	JUL	20.0	26.5	31.9	36.3	41.6	47.5
	AUG	20.6	27.5	32.6	36.7	41.4	46.7
	SEP	16.0	21.9	27.8	34.1	40.5	45.9
	OCT	16.5	23.3	29.9	35.3	39.8	43.1
	NOV	14.4	20.4	26.2	31.8	36.4	41.1
	DEC	15.7	23.2	29.4	34.8	38.9	44.4
1987	JAN	14.0	21.3	27.1	31.2	34.5	37.4
	FEB	15.1	23.4	30.0	35.0	39.6	44.4
	MAR	15.2	23.0	28.0	31.9	36.0	39.6
	APR	14.9	22.6	28.8	32.3	35.9	40.2
	MAY	15.8	23.3	29.7	34.4	38.7	42.6
	JUN	15.7	21.8	27.5	31.2	36.2	41.7
	JUL	15.8	21.8	27.3	31.5	35.8	39.4
	AUG	16.8	23.2	28.8	33.1	36.5	40.8
	SEP	14.8	21.2	26.3	31.6	36.6	41.6
	OCT	14.1	20.9	26.6	31.2	36.6	43.0
	NOV	13.8	20.6	26.4	30.8	35.2	37.4
	DEC	13.2	19.7	24.6	29.1	33.1	35.9
1988	JAN	13.1	19.9	25.6	30.0	34.1	37.9
	FEB	13.4	20.1	26.9	33.1	37.4	40.4
	MAR	13.4	20.7	27.0	32.4	37.4	43.1
	APR	14.4	22.0	29.2	35.3	41.4	45.8

TABLE IIIA(CONTD): 500MB WEST33 MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1988	MAY	14.6	20.9	25.6	30.4	34.7	38.4
	JUN	15.3	21.3	26.6	30.6	34.9	38.3
	JUL	17.5	23.7	29.0	33.5	38.4	42.0
	AUG	18.1	25.8	32.6	38.4	43.8	48.4
	SEP	15.6	22.9	29.6	35.3	40.7	46.1
	OCT	14.6	21.4	27.1	32.0	37.0	41.8
	NOV	12.8	18.7	23.2	27.3	30.6	34.2
	DEC	12.1	18.8	24.6	29.1	32.3	35.7

TABLE IIIB: 500MB EAST33 MONTHLY S1 SCORE
12 THRU 72 HOURS

OPERATIONAL MODELS: 6-Layer Primitive Equation model thru JUL80, Spectral model AUG80 -

VERIFYING ANALYSES: Hough analysis thru 25JUL84, Optimum Interpolation method 25JUL84 -

VERIFICATION GRID: 33 point lat-lon grids for western and eastern United States. Between 25N and 55N, WEST33 is the area from 105W to 145W and EAST33 is the area from 105W to 145W; gridpoint spacing is 5 degrees latitude by 10 degrees longitude.

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YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1978	JAN	17.8	23.4	29.3	34.8	39.4	44.3
	FEB	19.0	22.8	28.6	33.6	38.2	43.9
	MAR	15.5	19.4	25.5	31.1	36.4	41.1
	APR	19.7	23.9	29.4	36.3	42.8	51.0
	MAY	23.0	27.4	35.4	39.6	45.0	49.2
	JUN	22.4	24.6	30.6	34.4	40.1	46.3
	JUL	24.6	26.2	31.5	33.6	36.1	41.3
	AUG	24.6	28.7	33.8	38.6	40.7	45.0
	SEP	22.2	25.8	32.8	36.1	42.7	46.1
	OCT	18.7	23.1	30.8	34.7	39.3	43.1
	NOV	17.4	22.0	27.0	32.9	36.4	40.6
	DEC	17.0	21.7	27.9	31.5	37.3	41.1
1979	JAN	17.3	22.0	29.0	33.5	39.4	45.2
	FEB	17.0	20.8	27.1	29.3	33.5	35.8
	MAR	18.0	22.5	28.6	34.9	39.9	45.4
	APR	18.5	23.1	29.5	36.1	41.6	47.6
	MAY	20.4	25.4	30.3	36.5	42.1	49.2
	JUN	21.9	26.3	31.3	36.3	40.6	47.4
	JUL	24.8	28.0	33.1	37.0	41.4	45.1
	AUG	22.2	25.6	30.3	34.6	41.1	44.0
	SEP	19.6	24.2	29.0	34.5	39.2	44.4
	OCT	17.8	22.7	28.0	32.5	36.9	41.4
	NOV	16.3	22.0	26.4	32.8	38.4	42.7
	DEC	17.3	22.9	28.3	32.8	37.8	41.9
1980	JAN	17.2	22.3	27.0	32.2	37.3	43.3
	FEB	16.8	21.5	26.3	32.2	37.6	41.4
	MAR	16.7	20.8	25.2	31.3	35.9	41.2
	APR	19.5	24.8	30.5	36.5	41.0	46.8
	MAY	20.6	24.9	30.7	36.1	43.2	48.4
	JUN	20.3	24.0	29.3	33.8	37.6	42.4
	JUL	21.4	25.3	30.6	34.8	41.2	44.9
	AUG	19.7	23.9	29.5	34.6	40.7	45.4

TABLE IIIB(CONTD): 500MB EAST33 MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1980	SEP	15.2	20.3	25.4	30.6	35.8	39.8
	OCT	13.7	19.0	24.3	30.1	36.4	42.2
	NOV	13.1	18.8	25.5	32.4	39.1	43.2
	DEC	11.6	16.3	21.3	27.0	31.6	36.9
1981	JAN	12.7	17.2	28.6	28.0	34.1	39.4
	FEB	13.4	19.6	26.0	31.6	37.0	42.5
	MAR	15.7	21.4	28.2	33.8	38.9	45.1
	APR	14.0	19.4	25.0	30.6	35.3	41.0
	MAY	18.0	24.1	30.7	36.7	42.3	46.3
	JUN	18.4	24.8	30.9	36.8	41.6	45.1
	JUL	19.3	25.0	31.2	36.6	41.7	46.8
	AUG	21.6	27.0	33.4	38.3	43.3	48.1
	SEP	17.5	24.1	29.8	35.7	41.6	48.2
	OCT	13.6	19.5	26.2	32.1	38.0	44.1
	NOV	14.8	20.7	27.4	34.2	39.4	43.6
	DEC	13.3	19.0	24.9	31.4	37.8	44.3
1982	JAN	12.0	17.2	22.4	26.9	31.2	37.6
	FEB	11.7	17.0	22.2	26.5	30.2	36.4
	MAR	12.9	17.1	23.2	28.4	34.0	41.0
	APR	15.1	20.8	26.4	30.9	35.6	41.7
	MAY	19.7	26.6	33.2	38.9	45.2	50.6
	JUN	17.2	22.7	28.5	33.2	38.6	42.6
	JUL	18.6	23.5	29.3	34.5	39.4	42.6
	AUG	16.1	20.4	24.9	29.2	34.6	40.3
	SEP	17.0	22.4	27.8	33.2	38.3	42.3
	OCT	16.1	21.7	27.7	34.6	41.2	47.4
	NOV	12.8	17.5	22.0	26.2	31.4	37.6
	DEC	13.0	18.6	24.0	29.2	34.9	41.9
1983	JAN	13.5	19.1	25.7	31.8	37.0	41.8
	FEB	15.5	21.2	27.6	34.4	40.7	46.1
	MAR	16.6	22.4	28.3	34.3	41.3	49.2
	APR	15.9	22.2	28.6	34.4	39.4	46.3
	MAY	16.3	21.9	26.8	31.1	35.6	40.4
	JUN	18.2	24.0	29.2	35.8	41.9	46.4
	JUL	18.3	23.5	29.8	36.0	41.7	47.0
	AUG	16.9	22.0	27.6	32.0	36.2	39.2
	SEP	15.0	20.1	25.3	30.7	34.7	38.6
	OCT	15.5	20.8	26.7	33.4	39.3	46.1
	NOV	16.5	22.7	29.0	36.7	42.2	49.1
	DEC	13.8	17.7	23.3	27.8	32.0	36.8
1984	JAN	13.6	17.2	21.5	26.1	30.4	35.7
	FEB	14.6	20.2	27.1	34.8	41.7	47.0
	MAR	15.2	20.5	26.0	31.9	37.0	41.8
	APR	16.7	22.5	28.4	34.0	40.4	46.0
	MAY	15.6	21.0	26.3	32.3	38.3	42.5
	JUN	17.4	22.6	28.8	34.7	39.7	44.1

TABLE IIIB(CONTD): 500MB EAST33 MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1984	JUL	17.9	22.6	27.6	32.9	38.8	43.3
	AUG	16.6	22.4	28.7	35.0	41.3	47.3
	SEP	12.9	19.2	26.3	31.9	36.6	39.4
	OCT	12.6	19.5	25.9	31.6	37.2	42.3
	NOV	13.3	19.7	26.4	32.3	38.1	44.3
	DEC	10.0	15.5	21.3	26.8	32.2	35.4
1985	JAN	10.6	16.0	22.0	28.6	36.4	43.4
	FEB	10.9	17.2	23.6	29.1	34.8	38.8
	MAR	12.0	18.3	24.9	30.9	36.2	40.6
	APR	12.1	18.4	24.4	30.7	36.3	41.3
	MAY	13.3	20.1	27.3	38.9	40.0	47.1
	JUN	15.3	22.9	30.8	38.9	44.7	50.4
	JUL	15.2	20.5	26.3	31.2	34.5	37.5
	AUG	16.6	23.1	29.8	35.9	41.8	46.7
	SEP	13.2	20.6	27.4	33.3	37.8	41.9
	OCT	11.4	17.6	24.0	30.3	35.3	41.4
	NOV	11.2	18.1	24.2	29.0	34.3	40.1
	DEC	9.3	14.4	19.8	25.3	30.9	36.1
1986	JAN	9.8	15.1	21.6	29.0	35.2	39.8
	FEB	10.8	16.7	23.0	29.2	35.2	38.8
	MAR	10.8	15.4	20.2	25.0	30.4	35.3
	APR	13.0	19.7	26.3	32.7	39.9	46.2
	MAY	15.4	22.4	29.3	35.0	40.4	44.5
	JUN	13.7	19.1	24.5	30.3	36.0	41.3
	JUL	15.9	21.5	27.3	32.5	37.1	41.4
	AUG	14.7	20.3	26.8	32.9	38.4	44.8
	SEP	13.3	18.8	23.9	28.8	33.4	39.2
	OCT	11.5	18.1	31.6	31.0	35.8	40.8
	NOV	9.7	15.2	21.1	27.2	32.4	36.6
	DEC	10.1	15.5	21.1	26.4	32.9	38.9
1987	JAN	10.0	16.3	23.1	29.6	35.9	39.8
	FEB	11.0	17.5	22.9	29.0	33.9	37.2
	MAR	11.1	17.2	23.7	30.4	37.1	43.0
	APR	12.1	19.8	27.4	34.4	40.3	45.1
	MAY	12.4	18.2	23.4	28.1	32.2	36.4
	JUN	12.3	17.6	22.9	27.2	31.4	36.6
	JUL	14.8	19.2	24.5	29.7	34.4	38.9
	AUG	13.1	18.5	23.3	27.7	31.2	35.1
	SEP	12.0	17.3	22.5	27.9	33.4	39.1
	OCT	9.7	14.8	19.9	24.9	29.7	34.6
	NOV	10.2	16.0	21.7	27.8	33.3	37.2
	DEC	9.7	15.2	21.3	27.0	32.1	38.1
1988	JAN	8.2	12.9	18.2	23.5	28.5	31.8
	FEB	8.1	12.1	16.7	21.6	26.9	32.3
	MAR	9.7	15.2	20.6	25.6	30.1	33.4
	APR	11.4	18.3	24.5	30.6	36.2	41.0

TABLE IIIB(CONTD): 500MB EAST33 MONTHLY S1 SCORE

YEAR	MONTH	12HR	24HR	36HR	48HR	60HR	72HR
1988	MAY	12.5	19.1	25.8	32.2	37.4	41.8
	JUN	13.0	18.2	23.7	28.2	33.0	37.3
	JUL	15.1	20.8	26.3	31.2	36.3	40.7
	AUG	14.8	21.1	27.4	32.8	37.6	39.7
	SEP	13.0	19.2	25.4	31.2	36.4	41.4
	OCT	10.1	15.2	20.4	26.0	31.0	36.7
	NOV	10.1	15.4	21.0	26.2	31.4	36.4
	DEC	7.6	11.8	16.4	21.2	25.3	29.2

TABLE IV: AVERAGE YEARLY S1 SCORES
MEAN SEA LEVEL AND 500MB, 12-72 HOURS

OPERATIONAL MODELS: 6-Layer Primitive Equation model thru JUL80, Spectral model AUG80 -

VERIFYING ANALYSES: Hough analysis thru 25JUL84, Optimum Interpolation method 25JUL84 -

VERIFICATION GRID: 49 point lat-lon grid. This is a subset of a 63 point grid which covers the area between 65 and 145 west longitude and between 25 and 55 north latitude. Gridpoint spacing is 5 degrees latitude by 10 degrees longitude.

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		12HR	24HR	36HR	48HR	60HR	72HR
MSL.....							
YEAR	1978	36.0	41.9	50.5	56.2	62.5	68.6
	1979	37.1	42.2	50.7	56.9	61.8	68.2
	1980	34.6	41.1	49.3	55.6	61.2	67.1
	1981	33.8	41.4	49.6	56.9	63.6	70.4
	1982	33.6	41.8	50.1	57.0	63.0	68.5
	1983	31.6	40.1	48.5	55.2	61.3	66.6
	1984	31.9	39.1	47.0	54.1	60.7	66.4
	1985	29.8	37.7	47.0	54.5	61.5	67.0
	1986	29.2	36.4	45.0	52.2	58.8	64.8
	1987	24.8	32.4	39.2	45.4	51.1	56.0
	1988	23.3	30.5	37.4	43.7	49.2	53.9
500MB.....							
YEAR	1978	21.1	26.4	32.5	37.6	42.4	47.3
	1979	20.5	25.8	31.4	36.8	41.5	46.2
	1980	18.6	24.0	29.5	34.9	40.2	45.1
	1981	17.9	24.3	30.3	35.9	41.1	46.8
	1982	16.9	22.7	28.2	33.4	38.6	44.5
	1983	17.7	23.9	29.4	35.1	40.1	45.8
	1984	16.2	22.4	28.3	34.0	39.1	43.8
	1985	13.8	20.8	27.1	33.0	38.4	43.3
	1986	13.7	20.1	26.1	31.7	37.0	41.9
	1987	12.4	18.8	24.7	30.1	34.9	39.5
	1988	11.9	18.1	23.8	29.2	34.2	38.6

TABLE V: AVERAGE YEARLY 500MB S1 SCORES
WEST33 AND EAST33, 12-72 HOURS

OPERATIONAL MODELS: 6-Layer Primitive Equation model thru JUL80, Spectral model AUG80 -

VERIFYING ANALYSES: Hough analysis thru 25JUL84, Optimum Interpolation method 25JUL84 -

VERIFICATION GRID: 33 point lat-lon grids for western and eastern United States. Between 25N and 55N, WEST33 is the area from 105W to 145W and EAST33 is the area from 105W to 145W; gridpoint spacing is 5 degrees latitude by 10 degrees longitude.

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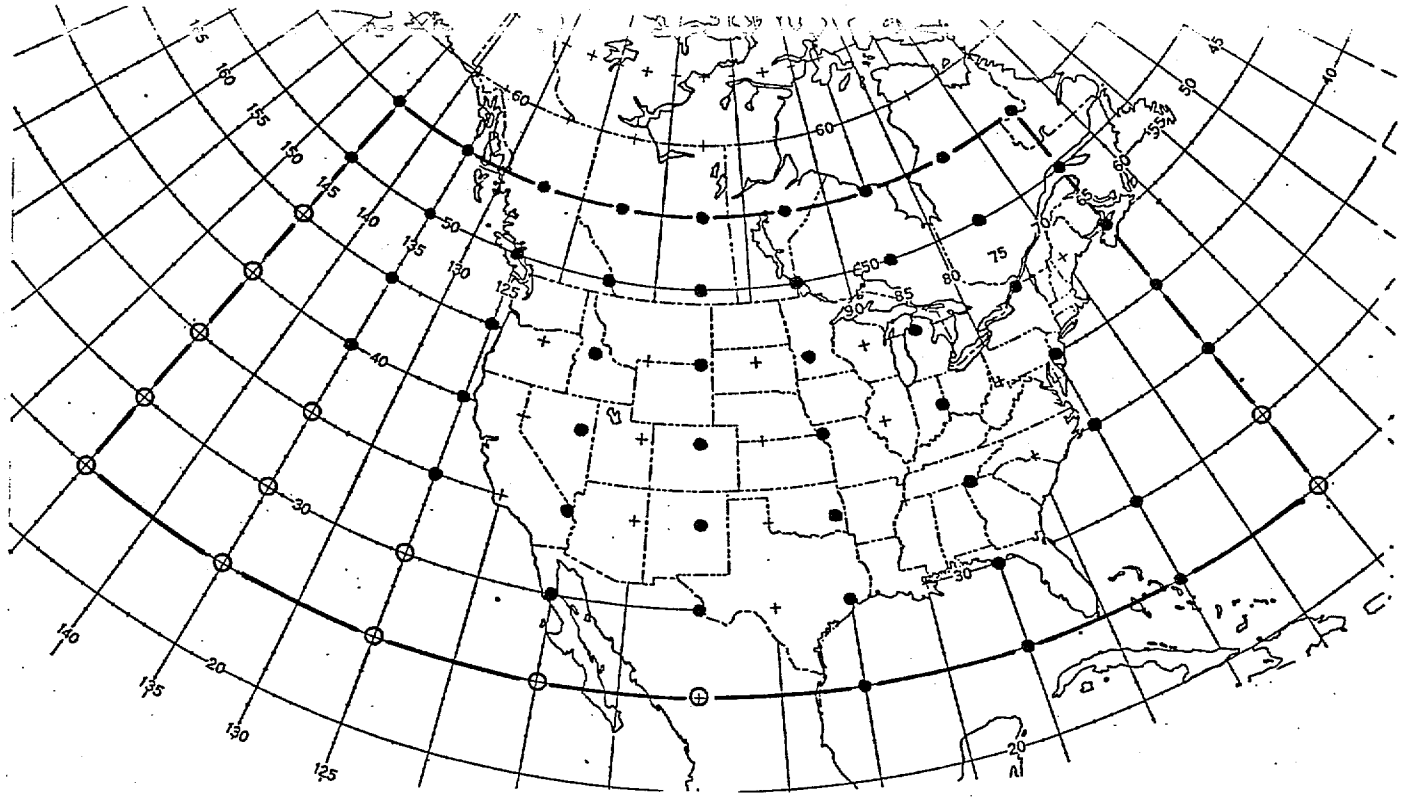
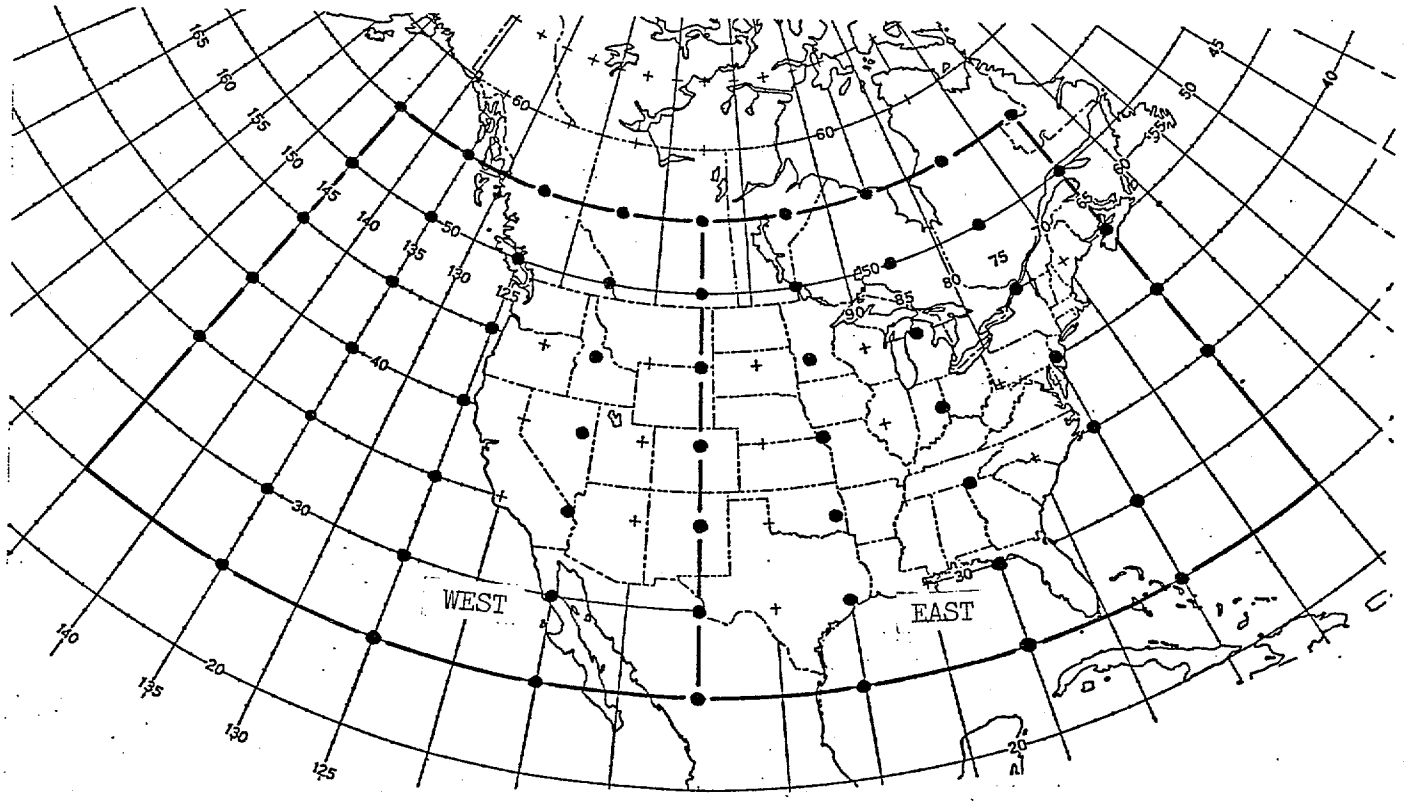
		12HR	24HR	36HR	48HR	60HR	72HR
WEST33.....							
YEAR	1978	25.0	31.5	36.7	42.1	46.4	50.5
	1979	24.4	30.0	35.3	40.0	44.0	48.1
	1980	22.3	28.2	33.4	38.4	42.4	46.9
	1981	21.8	28.4	34.1	39.0	43.2	48.8
	1982	20.4	26.2	31.6	36.3	41.1	47.1
	1983	20.8	27.0	32.0	36.6	40.8	46.4
	1984	19.8	26.3	31.9	37.0	41.2	45.5
	1985	17.3	24.8	30.9	36.1	40.8	44.8
	1986	16.9	23.9	29.7	34.6	39.1	43.2
	1987	14.9	21.9	27.6	31.9	36.2	40.3
	1988	14.6	21.4	27.3	32.3	36.9	41.0
EAST33.....							
YEAR	1978	20.2	24.1	30.2	34.8	39.5	44.4
	1979	19.3	23.8	29.3	34.3	39.4	44.2
	1980	17.2	21.8	27.1	32.6	38.1	43.0
	1981	16.0	21.8	28.5	33.8	39.3	44.6
	1982	15.2	20.5	26.0	31.0	36.3	41.9
	1983	16.0	21.5	27.3	33.2	38.5	43.9
	1984	14.7	20.2	26.2	32.0	37.6	42.4
	1985	12.6	18.9	25.4	31.9	36.9	42.1
	1986	12.4	18.2	24.7	30.0	35.6	40.6
	1987	11.5	17.3	23.0	28.6	33.7	38.4
	1988	11.1	16.6	22.2	27.5	32.5	36.8

I

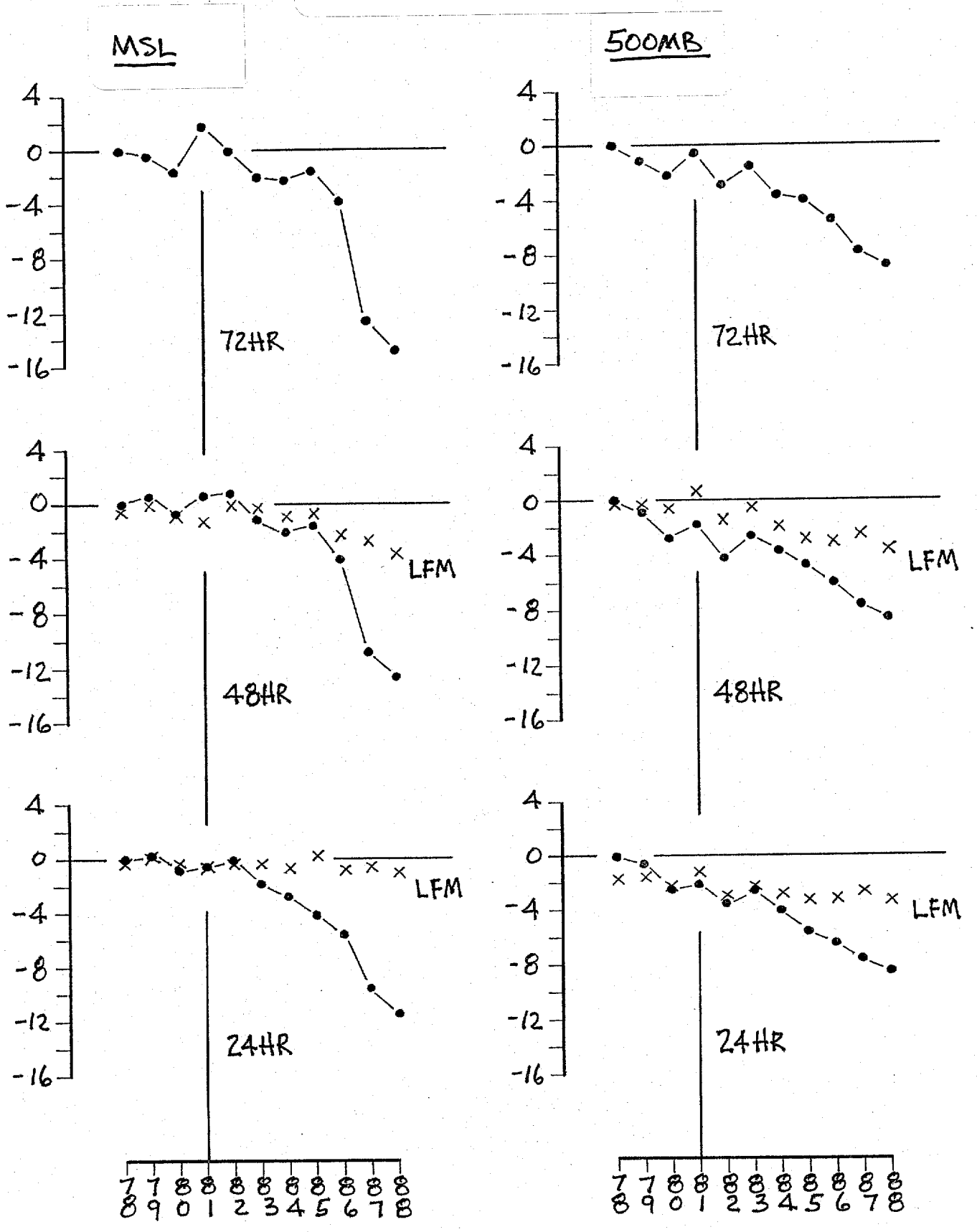


49 POINT (●) AND 63 POINT (O,●) GRIDS



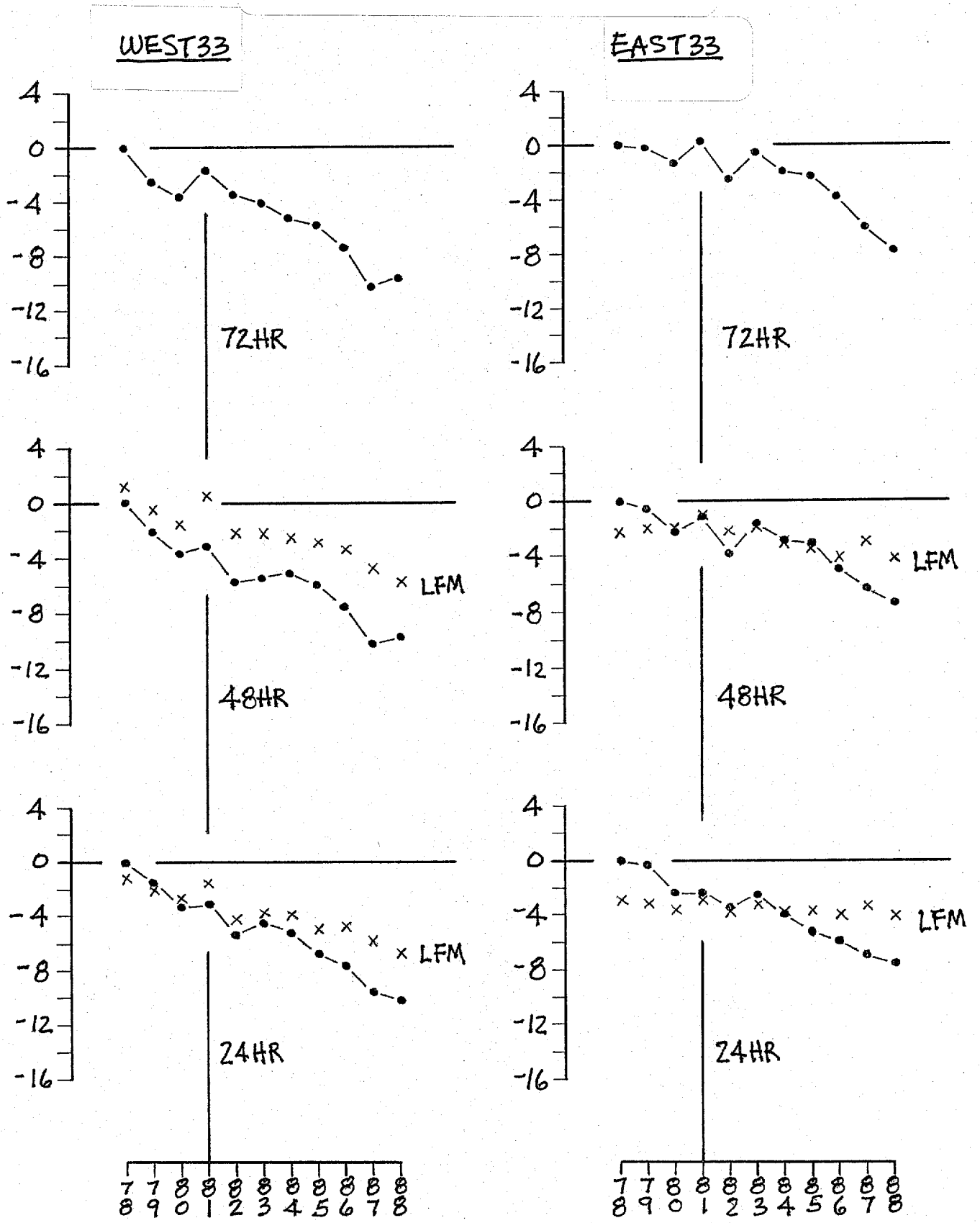
33 POINT WEST AND EAST GRIDS

AVERAGE S1 SCORE DIFFERENCE ($S1_{yr} - S1_{1978}$)
49PT GRID



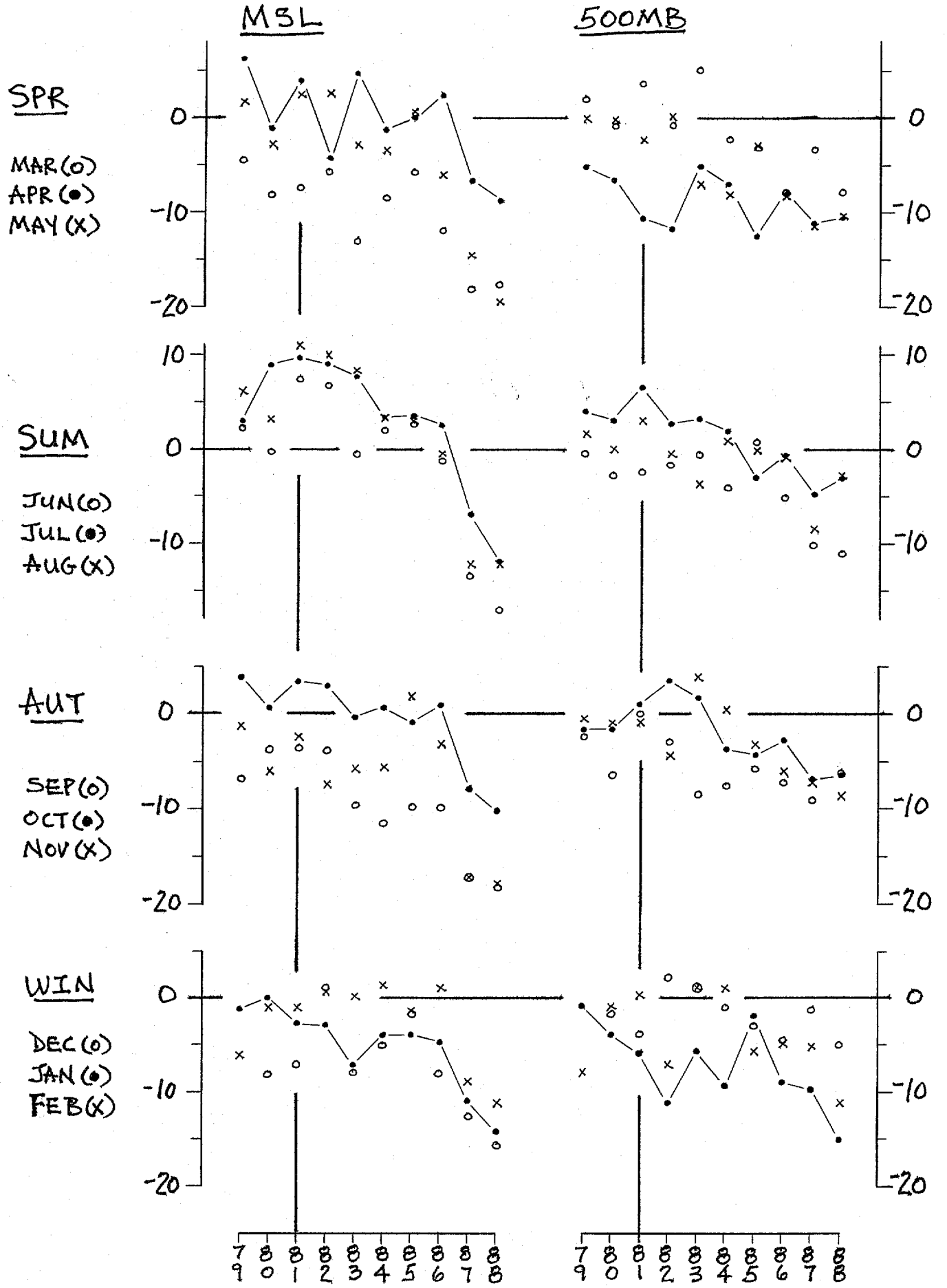
AVERAGE S1 SCORE DIFFERENCE ($S1_{yr} - S1_{1978}$)

500MB, 33PT GRID



IV

72HR S1 SCORE DIFFERENCE ($S1_{yr} - S1_{1978}$) : 49PT GRID



V

72HR S1 SCORE DIFFERENCE ($S1_{yr} - S1_{1978}$) : 33PT GRID

500MB