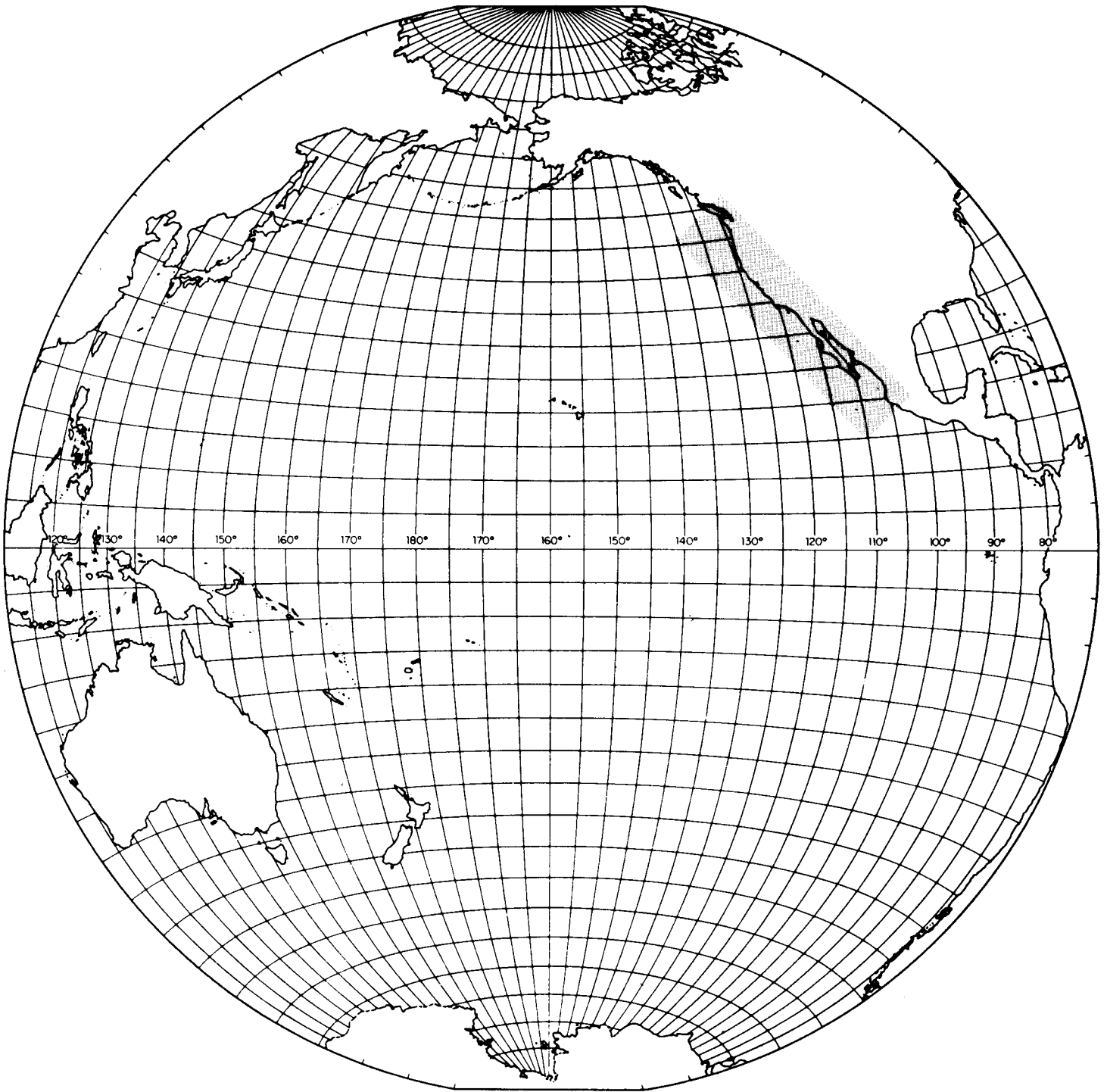


STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE



**CALIFORNIA COOPERATIVE OCEANIC  
FISHERIES INVESTIGATIONS**

ATLAS No.25

CALIFORNIA  
COOPERATIVE  
OCEANIC  
FISHERIES  
INVESTIGATIONS

*Atlas No. 25*

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

*Cooperating Agencies:*

CALIFORNIA ACADEMY OF SCIENCES  
CALIFORNIA DEPARTMENT OF FISH AND GAME  
STANFORD UNIVERSITY, HOPKINS MARINE STATION  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE  
UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

June, 1977

## THE CALCOFI ATLAS SERIES

This is the twenty-fifth in a series of atlases containing data on the hydrography and plankton from the region of the California Current. The field work was carried out by the California Cooperative Oceanic Fisheries Investigations,<sup>1</sup> a program sponsored by the State of California under the direction of the State's Marine Research Committee. The cooperating agencies in the program are:

California Academy of Sciences  
California Department of Fish and Game  
Stanford University, Hopkins Marine Station  
National Oceanic and Atmospheric Administration, National Marine Fisheries Service<sup>2</sup>  
University of California, Scripps Institution of Oceanography

CalCOFI atlases<sup>3</sup> are issued as individual units as they become available. They provide processed physical, chemical and biological measurements of the California Current region. Each number may contain one or more contributions. A general description of the CalCOFI program with its objectives appears in the preface of Atlas No. 2.

This atlas was prepared by the Data Collection and Processing Group of the Marine Life Research Program, Scripps Institution of Oceanography.

CalCOFI Atlas Editorial Staff:

Abraham Fleminger and John G. Wyllie, Editors

CalCOFI atlases in this series, through June 1977, are:

- No. 1. Anonymous, 1963. CalCOFI atlas of 10-meter temperatures and salinities 1949 through 1959.
- No. 2. Fleminger, A., 1964. Distributional atlas of calanoid copepods in the California Current region, Part I.
- No. 3. Alvarino, A., 1965. Distributional atlas of Chaetognatha in the California Current region.
- No. 4. Wyllie, J.G., 1966. Geostrophic flow of the California Current at the surface and at 200 meters.
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- No. 10. Isaacs, J.D., A. Fleminger and J. K. Miller, 1969. Distributional atlas of zooplankton biomass in the California Current region: Spring and Fall 1955-1959.
- No. 11. Ahlstrom, E. H., 1969. Distributional atlas of fish larvae in the California Current region: jack mackerel, *Trachurus symmetricus*, and Pacific hake, *Merluccius productus*, 1951 through 1966.
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- No. 13. Smith, P. E., 1971. Distributional atlas of zooplankton volume in the California Current region, 1951 through 1966.
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- No. 15. Wyllie, J.G., and R.J. Lynn, 1971. Distribution of temperature and salinity at 10 meters, 1960-1969 and mean temperature, salinity and oxygen at 150 meters, 1950-1968 in the California Current.
- No. 16. Crowe, F. J. and R. A. Schwartzlose, 1972. Release and recovery records of drift bottles in the California Current region, 1955 through 1971.
- No. 17. Ahlstrom, E. H., 1972. Distributional atlas of fish larvae in the California Current region: six common mesopelagic fishes—*Vinciguerria lucetia*, *Triphoturus mexicanus*, *Stenobranchius leucopsarus*, *Leuroglossus stilbius*, *Bathylagus wesethi* and *Bathylagus ochotensis*. 1955 through 1960.
- No. 18. Brinton, E., 1973. Distributional atlas of Euphausiacea (Crustacea) in the California Current region. Part II.

- No. 19. Bowman, T. E. and M. W. Johnson, 1973. Distributional atlas of calanoid copepods in the California Current region, 1949 and 1950.
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- No. 22. Namias, J., 1975. Northern hemisphere seasonal sea level pressure and anomaly charts, 1947-1974.
- No. 23. Ahlstrom, E. H. and H. G. Moser, 1975. Distributional atlas of fish larvae in the California Current region: Flatfishes, 1955 through 1960.
- No. 24. Brinton, E., and J. G. Wyllie. Distributional atlas of euphausiid growth stages off southern California, 1953 through 1956.
- No. 25. Eber, L. E. Contoured depth-time charts (0 to 200m, 1950 to 1966) of temperature, salinity, oxygen and sigma-t at 23 CalCOFI stations in the California Current.

<sup>1</sup> Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

<sup>2</sup> Formerly called U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries.

<sup>3</sup> For citation this issue in the series should be referred to as CalCOFI Atlas No. 25.

CONTOURED DEPTH-TIME CHARTS (0 TO 200m, 1950 TO 1966)  
OF TEMPERATURE, SALINITY, OXYGEN AND SIGMA-T AT 23  
CALCOFI STATIONS IN THE CALIFORNIA CURRENT.

L.E. Eber

CALCOFI ATLAS NO. 25

A. Fleminger and J. G. Wyllie, Editors  
Marine Life Research Program  
Scripps Institution of Oceanography  
La Jolla, California

June, 1977

# CONTOURED DEPTH-TIME CHARTS (0 TO 200m, 1950 TO 1966) OF TEMPERATURE, SALINITY, OXYGEN AND SIGMA-T AT 23 CALCOFI STATIONS IN THE CALIFORNIA CURRENT.

L. E. Eber<sup>1</sup>

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### Introduction

Oceanographic data taken on CalCOFI cruises have been presented in three previously published CalCOFI Atlases, Nos. 1, 4 and 15 (Anon. 1963; Wyllie 1966; Wyllie and Lynn 1971). Two of these (Nos. 1 and 15) deal principally with horizontal distributions of temperature and salinity at 10 meters for individual CalCOFI cruises from 1949 through 1969. Atlas No. 15 also contains monthly mean charts of temperature, salinity and oxygen at 150 meters. Atlas No. 4 depicts geostrophic flow at the surface and 200 meters by month and for individual cruises from April 1949 through April 1965.

This atlas depicts the variation with time of temperature, salinity, oxygen and sigma-t in the upper 200 meters, at 23 stations in the CalCOFI area. The stations were selected to provide representative coverage of conditions both along and across the path of the mean current. Their locations are shown on the CalCOFI basic station plan (chart 1). The lines along which stations are occupied run perpendicular to the coast and are spaced 40 n mi (74 km) apart. In the conventional CalCOFI numbering system, a decimal point is used to separate line number, to the left, from station number, to the right. With the exception of chart 1, the decimal point has been omitted from the CalCOFI station number in this atlas and three digits each are used to designate line and station. Thus, station 90.45 (station 45 on line 90), in conventional notation, appears as 090045. The station numbers are given on the charts below each panel on the left hand side, following the parameter designation.

The time series are ordered sequentially by station number along each of five CalCOFI lines, 60, 80, 90, 100 and 120. Stations 60, 70 and 90 were selected for all five lines; other station selections were based on considerations of inshore coverage and frequency of occupancy. Stations 53 and 55 on line 90 were considered to be the same for the purpose of constructing the time series and are identified herein as station 090054. In general, only one of these two stations was occupied by a cruise. The frequency of occupancy by month is given for each station in Table 1. Although the source data extended from 1950 to 1968, the time sections were limited to the period 1950 to 1966, owing to the infrequency of cruises in subsequent years.

<sup>1</sup>Southwest Fisheries Center, National Marine Fisheries Service, La Jolla, California.

Table 1. Frequency of occupancy by month during 1950-1968.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
060060	12	2	2	11	5	9	14	4	4	6	4	1
060070	8	2	2	10	3	6	13	4	4	6	4	1
060090	8	2	2	9	7	7	12	3	4	5	4	1
080055	14	12	9	13	7	10	11	5	6	9	7	5
080060	14	10	10	15	5	14	10	6	5	8	6	5
080070	13	12	7	13	6	10	13	6	6	10	4	6
080090	12	8	7	13	6	12	13	5	5	9	2	5
090028	11	8	5	11	6	11	12	6	7	12	7	7
090037	14	12	8	15	8	14	15	5	9	12	5	8
090045	10	12	7	14	10	12	13	6	7	12	6	7
090054	11	10	8	13	8	11	13	6	9	12	8	7
090060	10	12	6	13	7	12	14	7	7	11	6	7
090070	10	13	7	13	8	11	15	7	7	12	5	6
090090	11	9	7	14	8	9	13	5	3	10	0	3
100030	11	8	4	10	5	7	14	4	3	10	4	4
100050	10	10	5	13	6	5	16	5	5	9	4	6
100060	12	9	7	12	6	7	16	6	3	8	5	5
100070	12	9	5	13	7	6	12	6	4	10	4	5
100090	9	8	6	14	7	6	12	1	3	8	2	1
120050	8	15	9	14	10	11	14	9	2	10	5	6
120060	6	12	5	14	6	6	14	10	2	9	5	6
120070	8	13	5	14	7	6	12	9	3	10	6	5
120090	4	11	5	9	7	4	11	7	3	9	5	2
Monthly totals	238	219	138	290	155	206	302	132	111	217	108	109

The charts are an outgrowth of a computer-based system to facilitate retrieval, analysis and presentation of CalCOFI oceanographic data (Eber and Wiley 1976). This system was developed following a set of guidelines and recommendations set forth principally by P. Smith, R. Owen, R. Lynn and R. Hewitt. The data processing for the present application, involving more than 900 computer runs, was performed by J. Metoyer.

The source data used for this atlas were obtained from magnetic tape files prepared in the format prescribed for the National Oceanographic Data Center (NODC). The interpolated values of parameters at standard depths, contained in these files, differ slightly from those published in Oceanographic Observations of the Pacific (1950-1959) and in the Physical and Chemical Data Report Series (Univ. of Calif., Scripps Institution of Oceanography 1961-1971). This resulted from different interpolation procedures. The observed values are the same in both cases, however, and the published data were used for reference in processing the NODC files.

### Temperature, Salinity, Oxygen and Sigma-t Charts

The distributions of temperature, salinity, oxygen and sigma-t with depth and time are presented by means of contour plots in 4-year segments beginning on Chart 2. Each parameter occupies a separate panel. The corresponding anomalies from the monthly station mean are shown in similar fashion on facing pages.

The dots appearing in the panels indicate the actual observed depths at which temperature, salinity and oxygen were sampled. The contours were computed from standard (interpolated) depths. The dots were plotted at the month and year on the horizontal axis corresponding to the year-month code designating the cruise on which each station was occupied. Consequently, the elapsed time between successive occupancies of a station is not accurately represented by the horizontal displacement of dots on the time section.

The contours were generated and plotted by computer and reproduced unaltered except for

thickening of selected contours, addition of hatching (on the anomaly charts), relocation of labels, etc. as needed for graphic enhancement. The method used for computing contour coordinates requires that the parameter field be defined at each point of a rectangular grid. The resolution of the parameter field afforded by a grid depends on the spacing between grid points, or grid interval. For this atlas, the grid intervals chosen were 10 meters along the depth (vertical) axis and 1 month along the time (horizontal) axis.

The procedure for fitting parameter values at standard depths<sup>1</sup> to grid points has been described in detail by Eber and Wiley (1976). Briefly, it consists of two steps: 1) vertical interpolation of the standard depth values to the 10-meter grid points, followed by 2) horizontal interpolation of 10-meter grid values to fill areas of missing data for cruises in which a station was not occupied. In step 2, a grid value was given weight on a decreasing scale out to  $\pm 2$  grid points at the same depth, subject to an additional constraint whereby the interpolation could not be carried across more than 2 months of missing data. Consequently, gaps appear in the contoured sections where the interval between successive occupancies of a station exceeded 2 months. In the horizontal interpolation, grid values were assigned a weighting factor of 12 for the grid point at which they were designated, and weights of 2 and 1, respectively, for adjacent grid points at  $\pm 1$  and  $\pm 2$  grid intervals on either side. This procedure effected some smoothing, which can result in a diminishing of horizontal gradients.

In cases where an occupied station was isolated in the time series by gaps of more than 2 months from both preceding and subsequent occupancies, the depths of contours for the respective parameters are indicated by short, horizontal line segments.

Instances of missing data within contoured portions of the sections are readily identified by the absence of dots. It should be noted that in such cases both phase and amplitude of seasonal fluctuations cannot be accurately represented by the contours. During the 1960's, when quarterly cruise schedules were adopted, this problem becomes more severe.

### Monthly Means, Standard Deviations and Anomaly Charts

Monthly means of the four parameters were computed for standard depths at each station from all data available in the source file (1950-1968). For this purpose, each observation was classified according to the actual month the station was occupied, rather than the month

designated by the cruise code, which could be different since cruises frequently overlapped adjacent months.

The monthly means for each station were fitted to a depth-time grid, preliminary to contouring, using the same method described for individual parameter values, except that the weight given to a mean for determination of grid point values was amplified in proportion to the number of observations (years) which it represented. This was done to suppress noise which might be introduced by monthly means representing only a few years. Referring to Table 1, it can be seen that the mean seasonal cycles computed in this manner are mainly determined by January or February, April, July and October due to a higher frequency of cruises in these months.

The contoured fields of mean monthly temperature, salinity, oxygen and sigma-t are presented for each station following the 16-year time series plots. As noted above, some of the lesser month-to-month variation depicted by the contours may reflect year-to-year differences rather than mean monthly changes, owing to insufficient data.

Mean seasonal charts of standard deviation with depth are presented for each station on facing pages, opposite the mean parameter charts. The contoured fields of standard deviation were prepared in the same way as described for the monthly mean parameter fields, from values of standard deviation computed at standard depths for each station. The formula used for this purpose was

$$SDEV = \sqrt{(\sum X_i^2 - (\sum X_i)^2/N)/N}$$

where  $X_i$  are the parameter values and  $N$  is the number of observations (years). There were some instances of  $N = 1$ , yielding a zero value for standard deviation. No special provision was made for such cases. Their effect on the contoured fields of standard deviation, however, is small owing to the procedure for fitting values to grid points in which the values are weighted according to the number of years ( $N$ ) they represent.

The monthly mean parameter values at standard depths were used to compute anomalies. For this purpose, each monthly mean value was assigned to a specific day, taken as the average of the observation dates associated with that monthly mean. Then for each observation date, an interpolated mean was found, using the two monthly means which bracketed that date. The anomaly was obtained by subtracting the interpolated mean from the respective parameter value associated with the observation.

When a monthly mean for a station was missing,

<sup>1</sup>Standard depths are 0, 10, 20, 30, 50, 75, 100, 125, 150 and 200 meters.



meaning the station had not been occupied in that month, no anomaly was computed if the date of an observation fell between the assigned dates of the monthly means for the preceding and following months. The only cases of missing monthly means encountered in the preparation of this atlas involved station 090090 at which there were no observations at all for November, and station 120090 at which no oxygen values were obtained in December.

Departures from monthly means for temperature, salinity, oxygen and sigma-t are also presented as contoured fields in depth-time sections and appear on facing pages to those containing the

corresponding parameter values. Areas represented by negative anomalies are distinguished by hatching.

The anomalies were computed at the standard depths for each station and cruise by subtracting monthly means, determined in advance for standard depths at each station, from the respective parameter values. These anomaly values were then fitted to the depth-time grid by vertical and horizontal interpolations as described in the preceding section. Consequently, the anomaly contours also reflect some horizontal smoothing which could diminish gradients and the magnitudes of maxima and minima in some cases.

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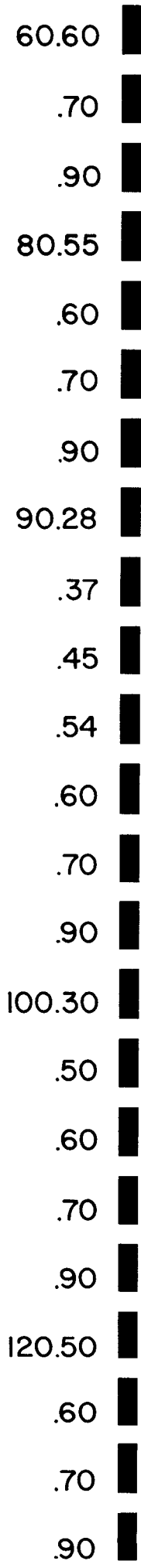
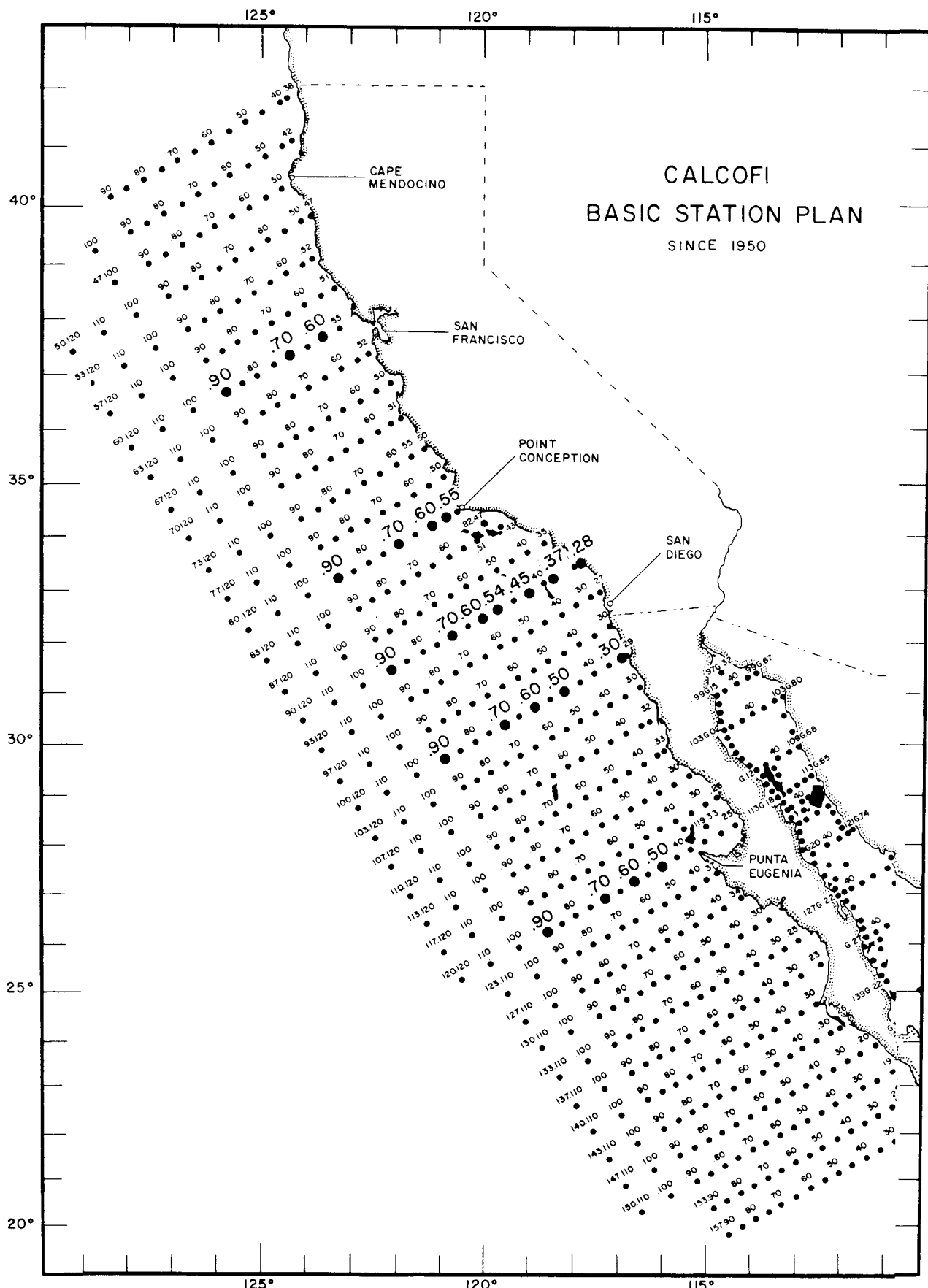
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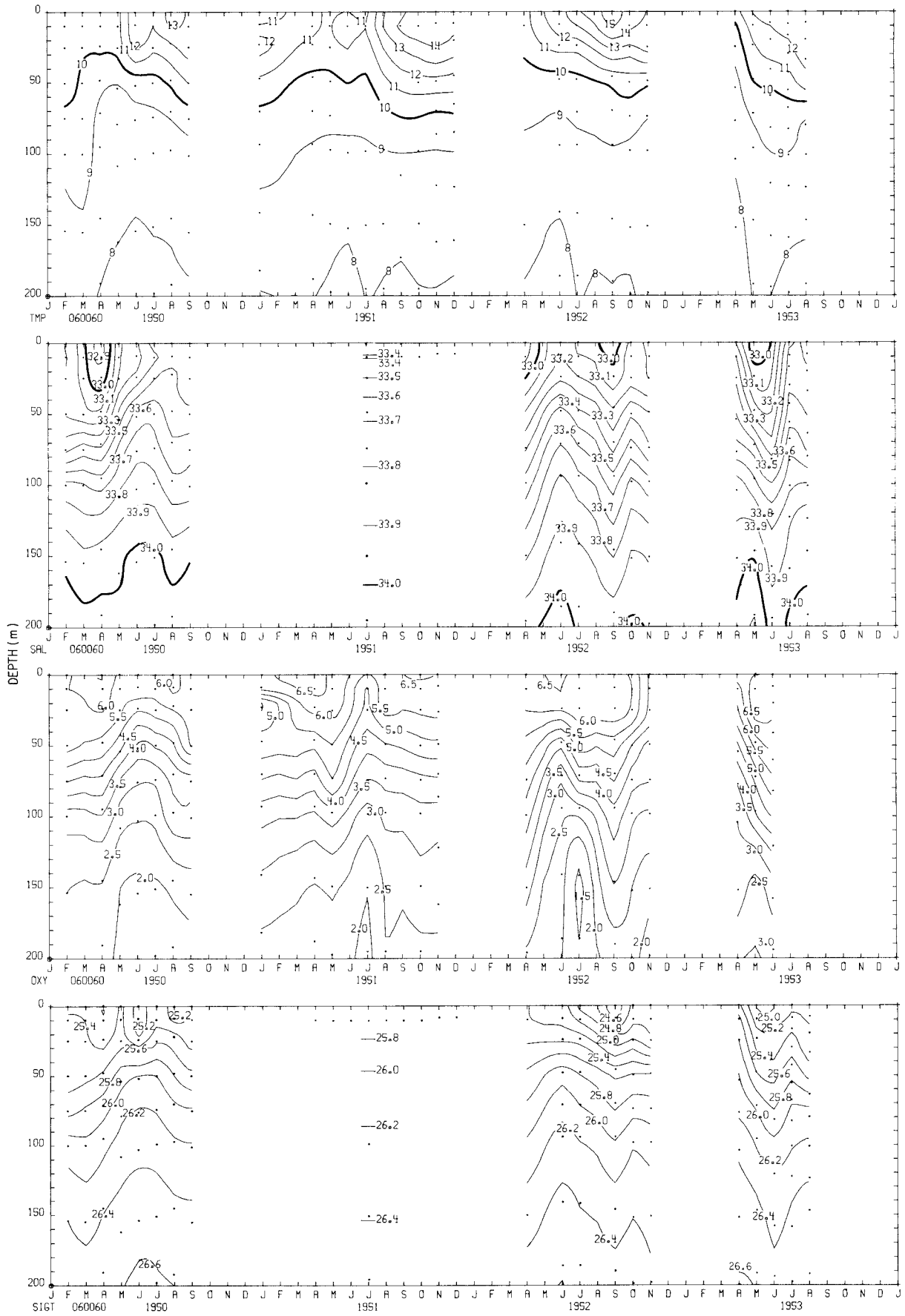
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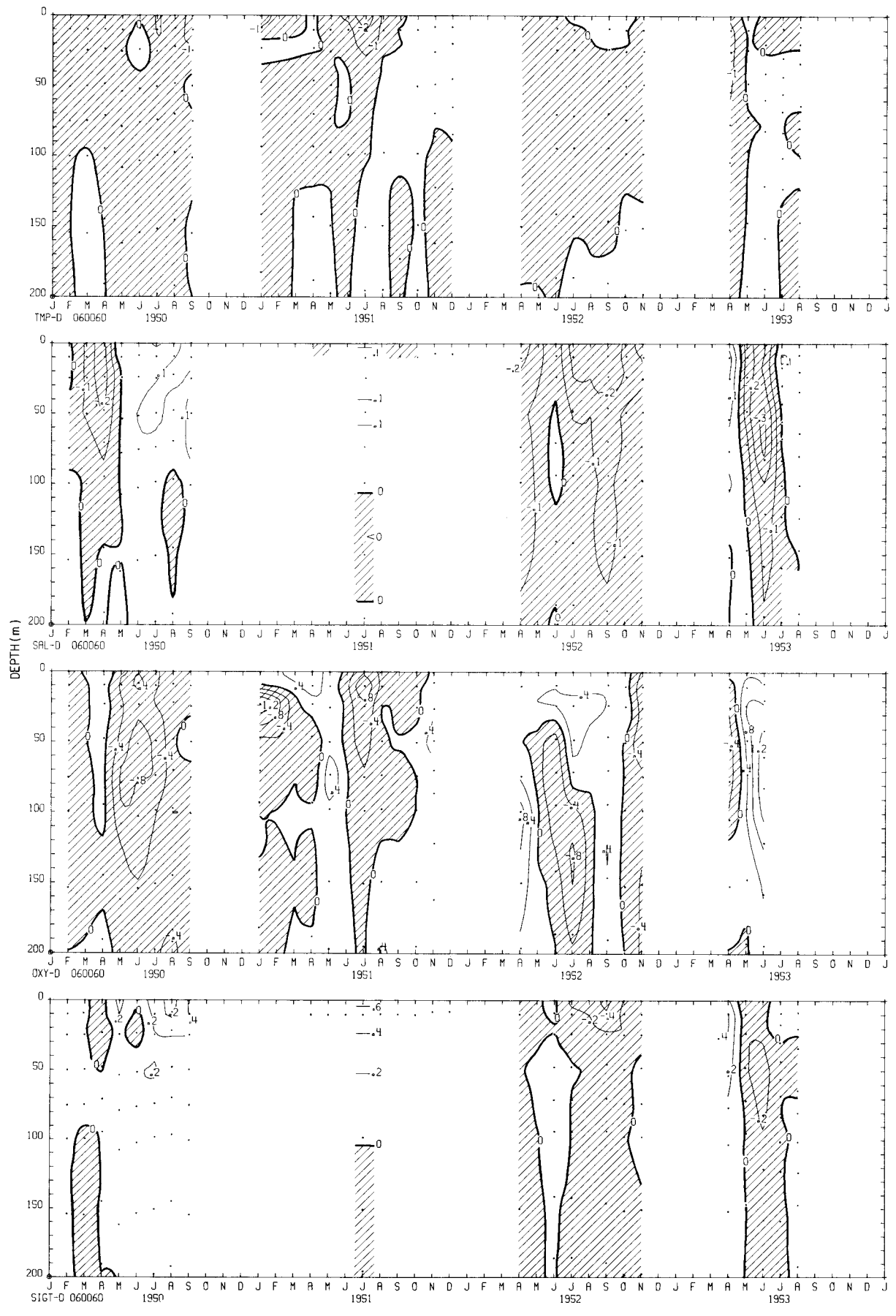
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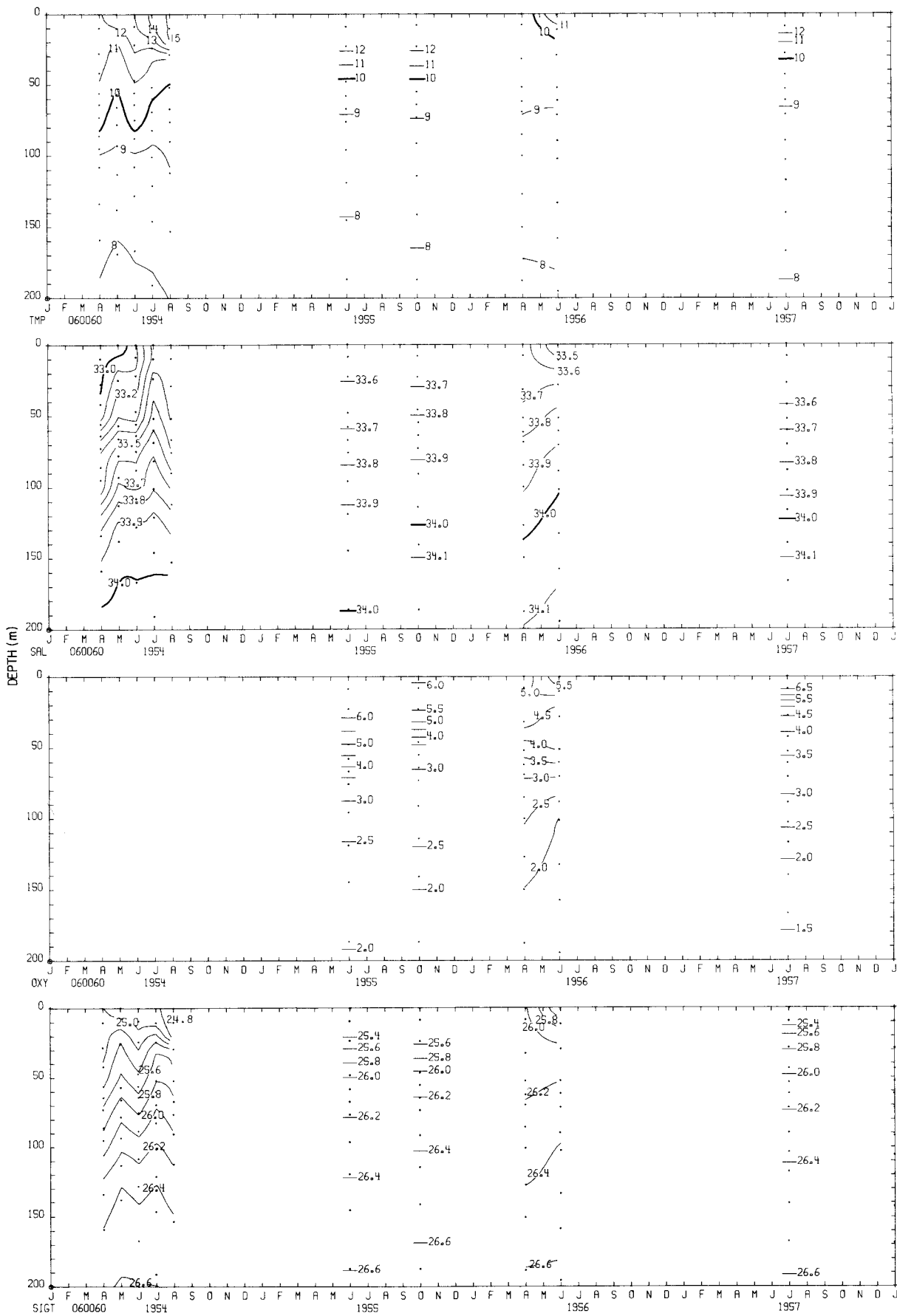


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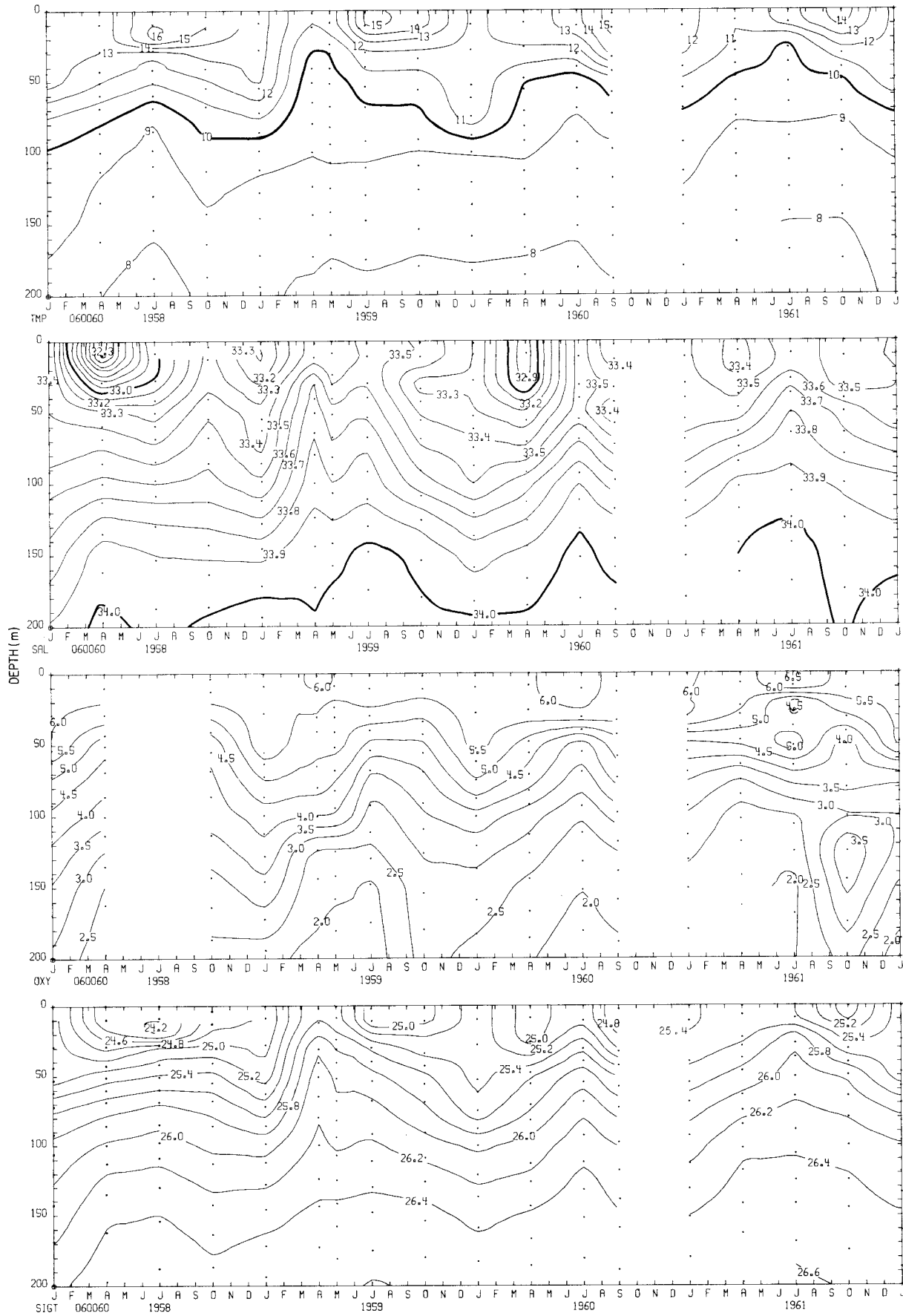
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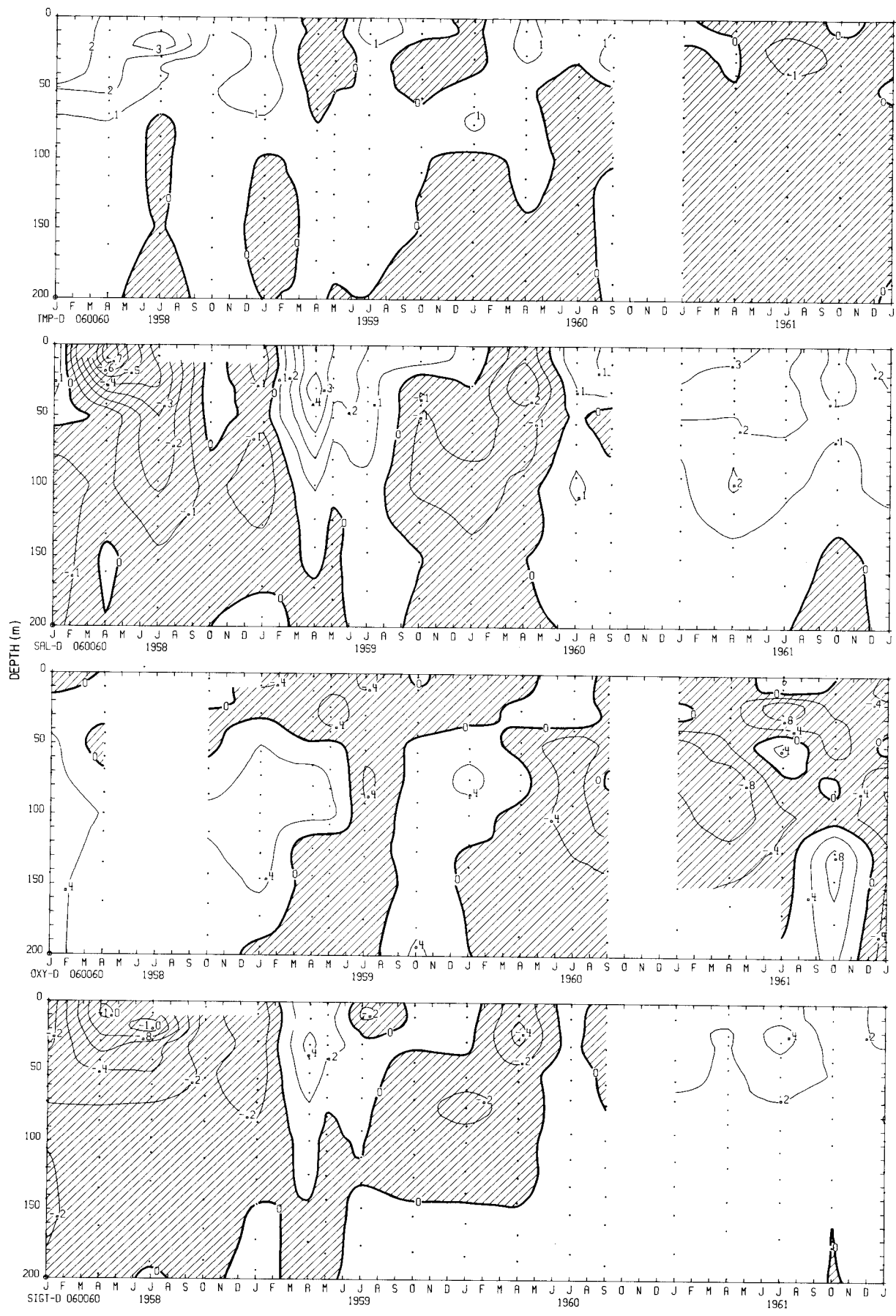




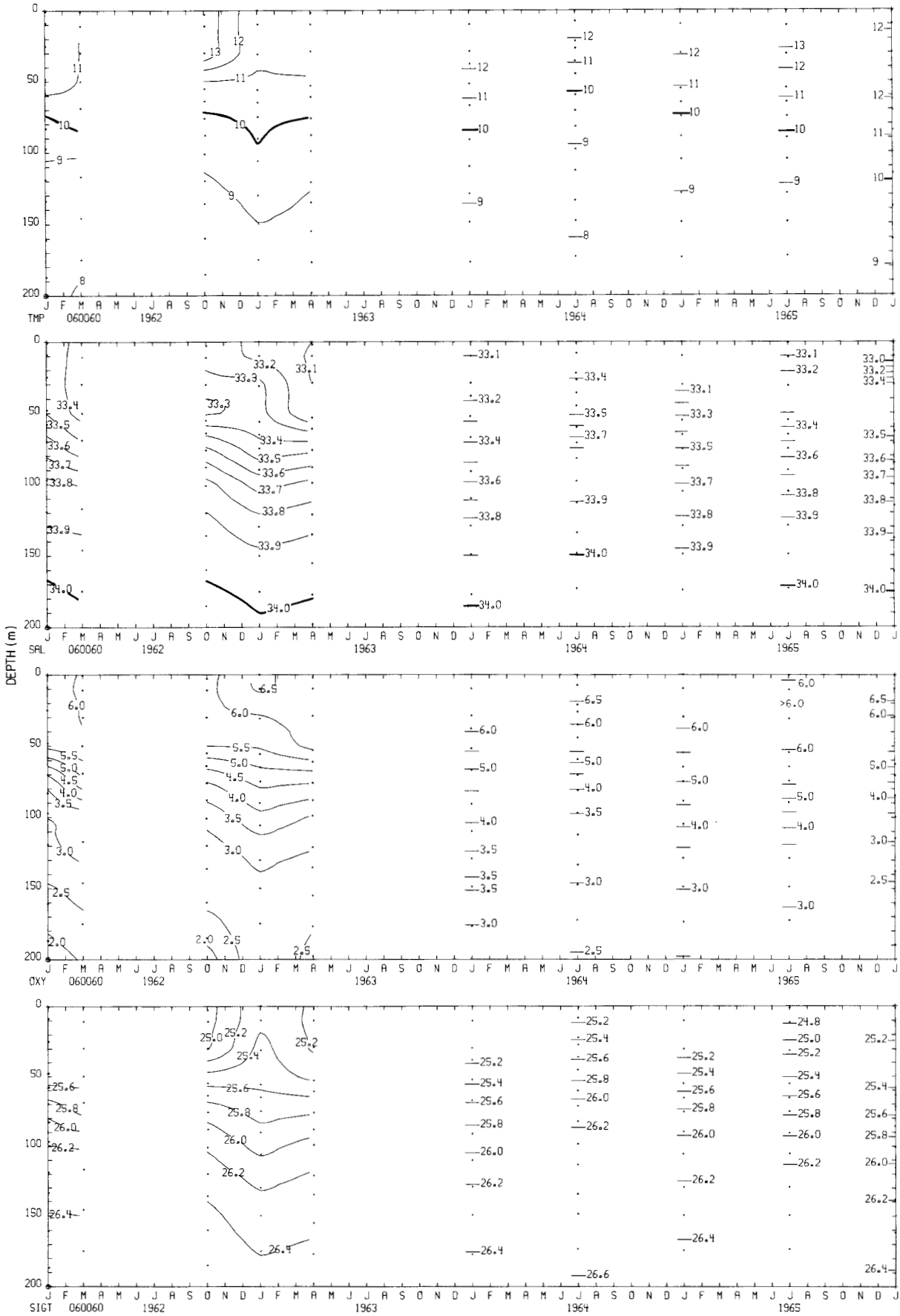


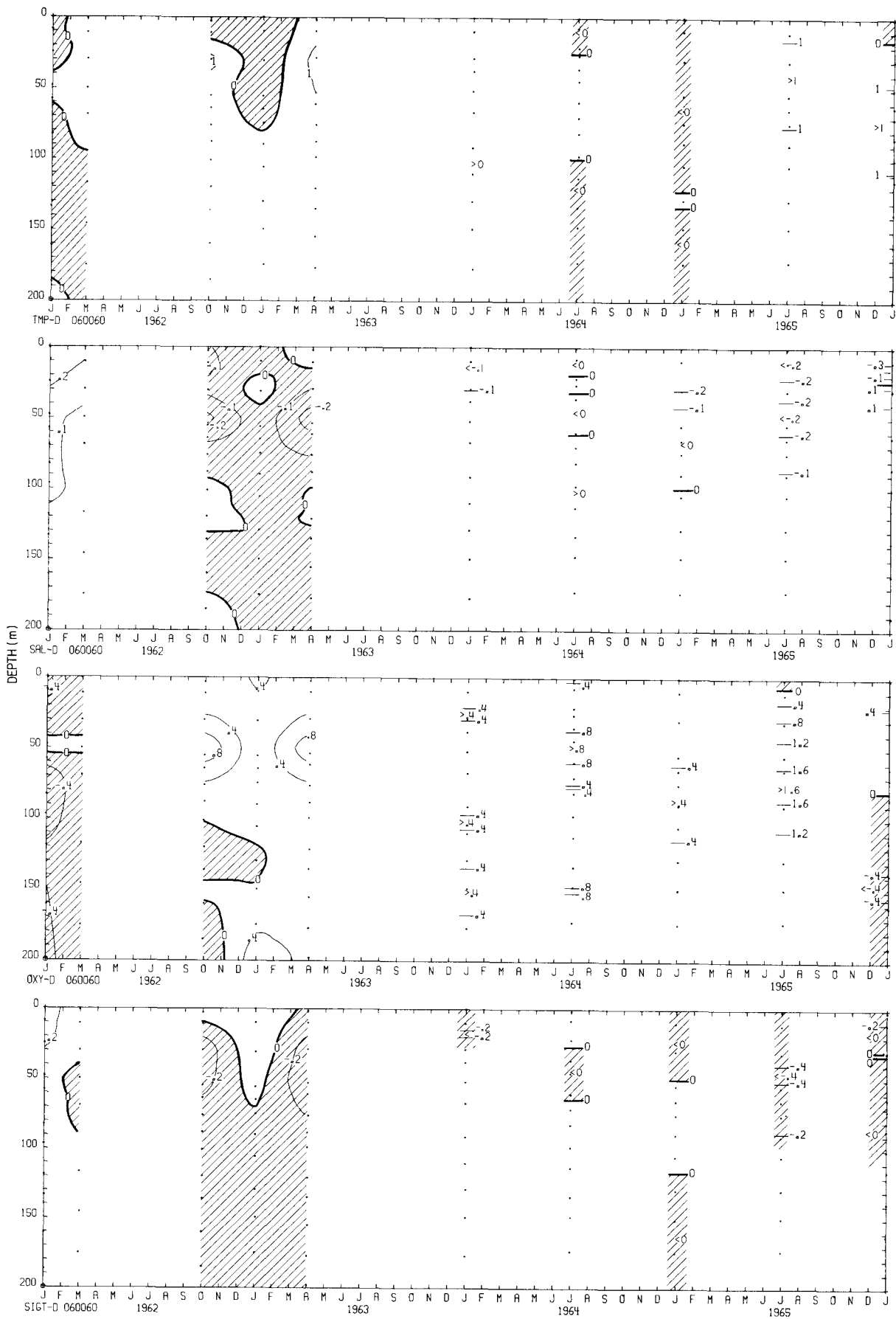


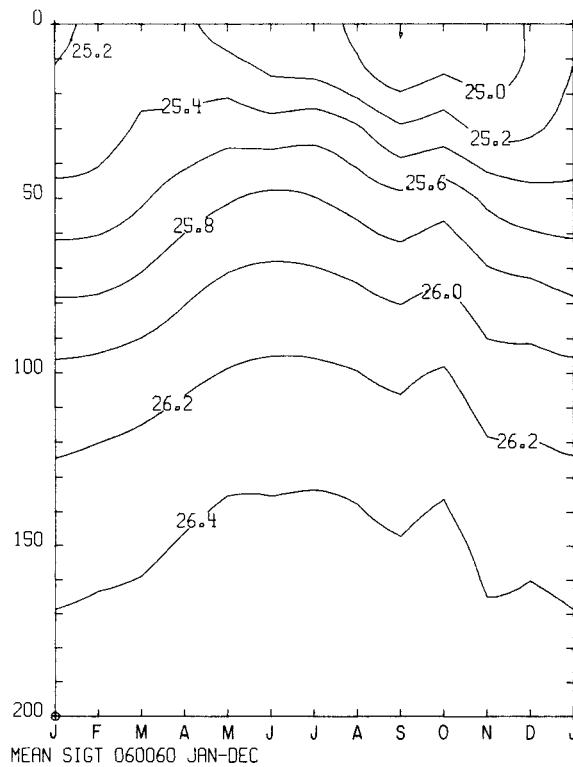
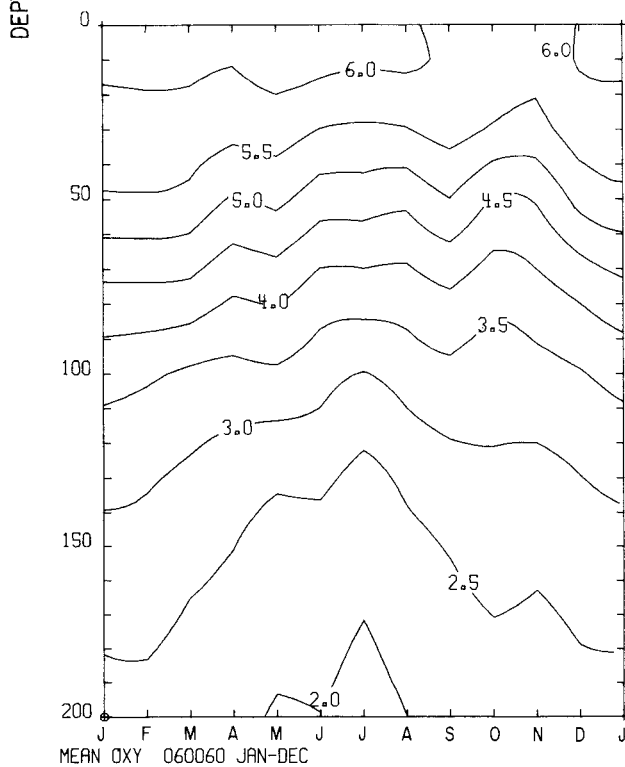
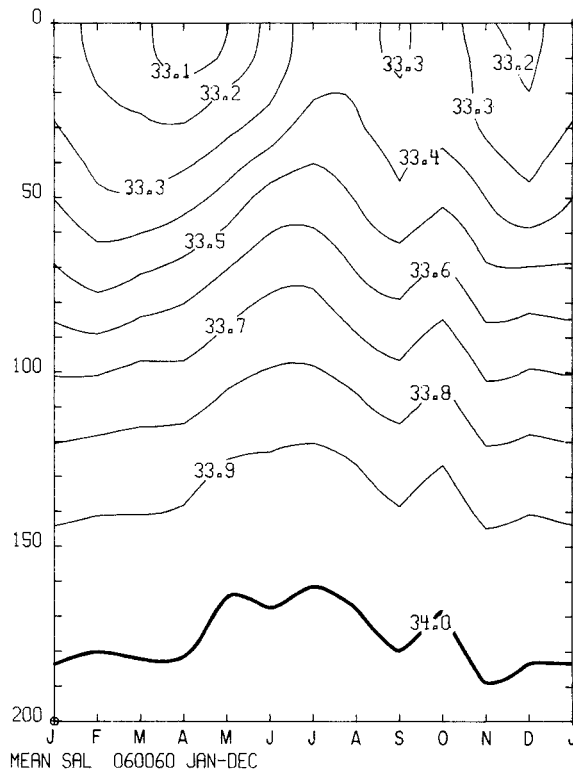
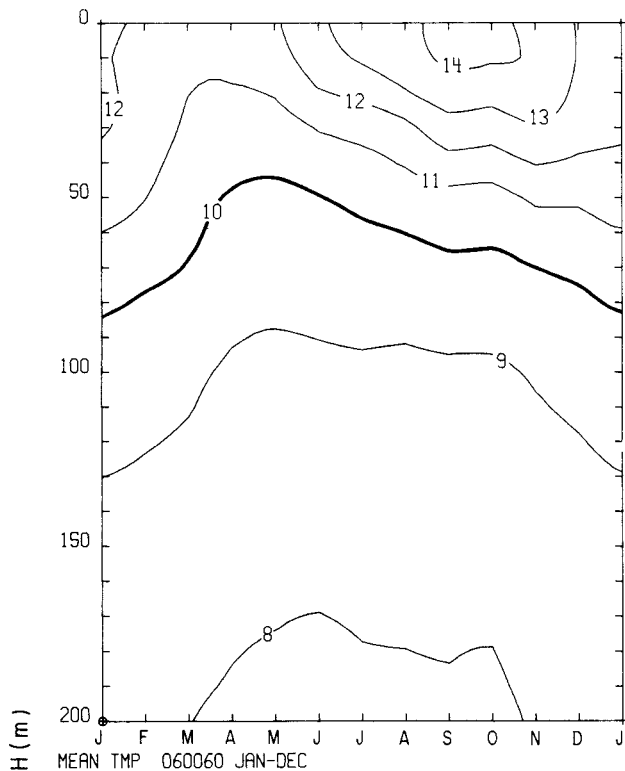


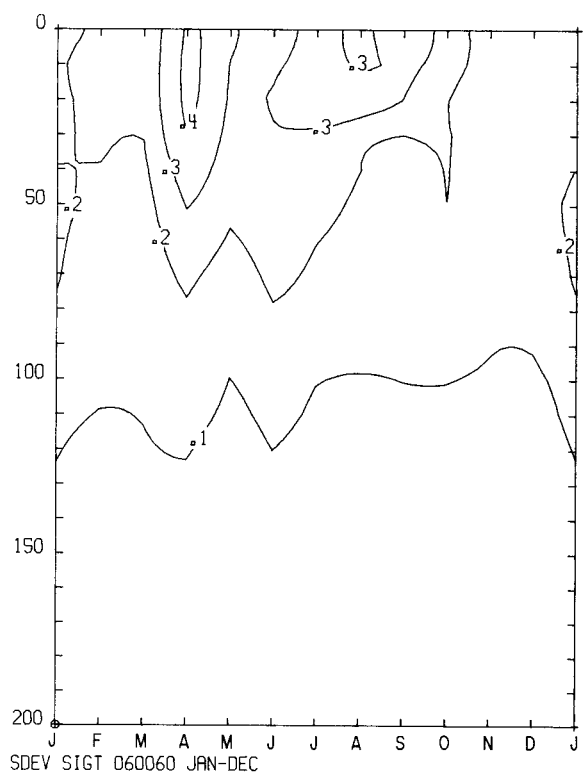
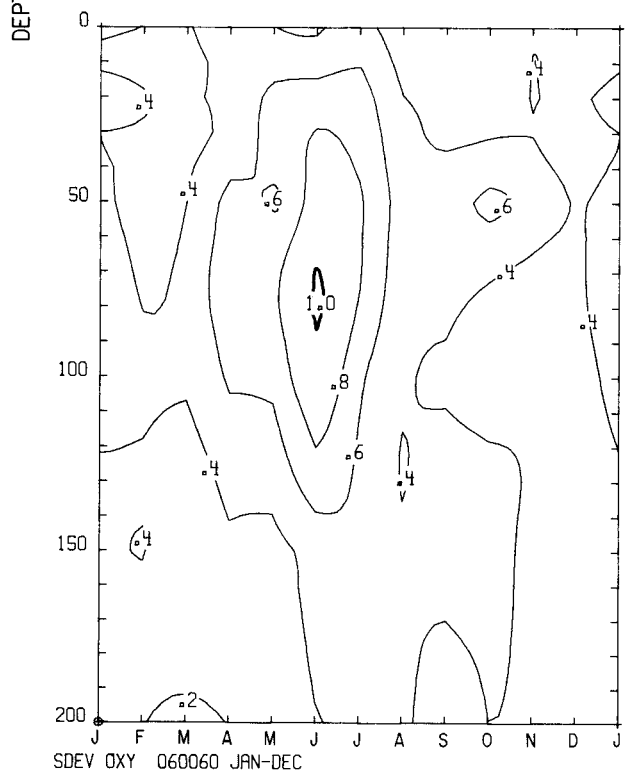
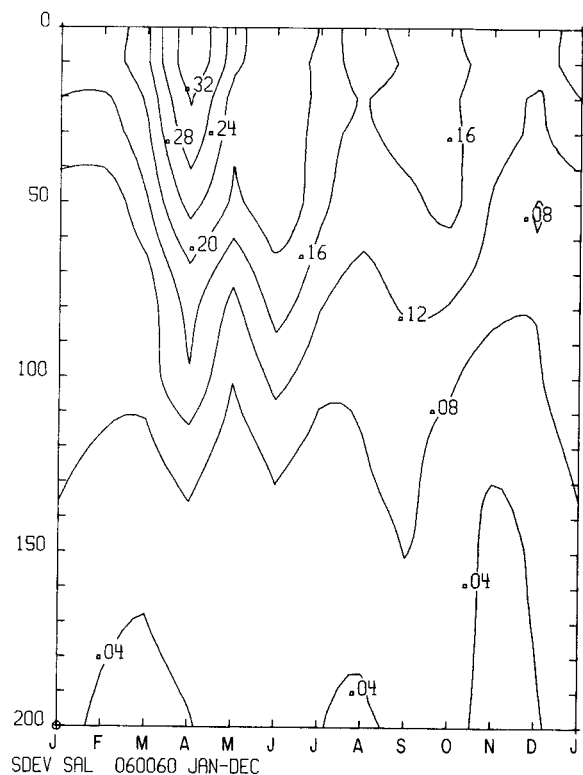
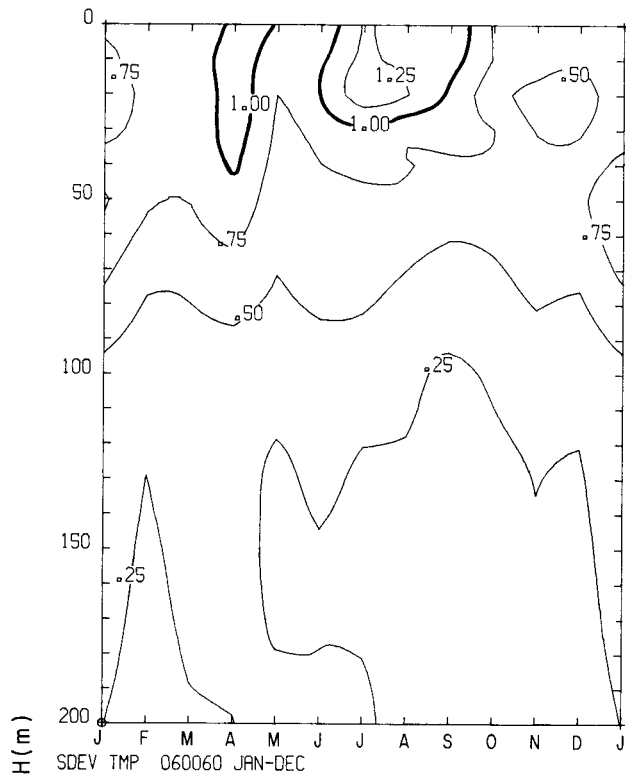


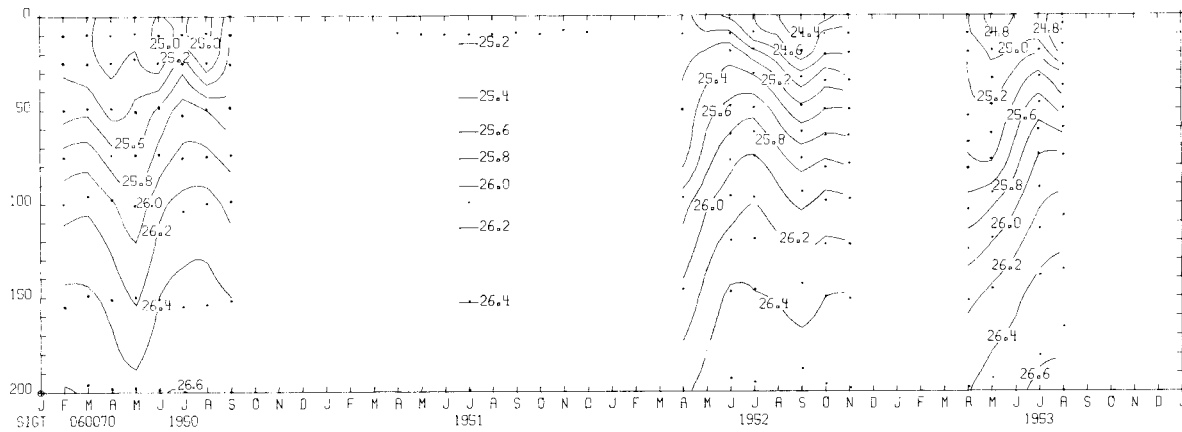
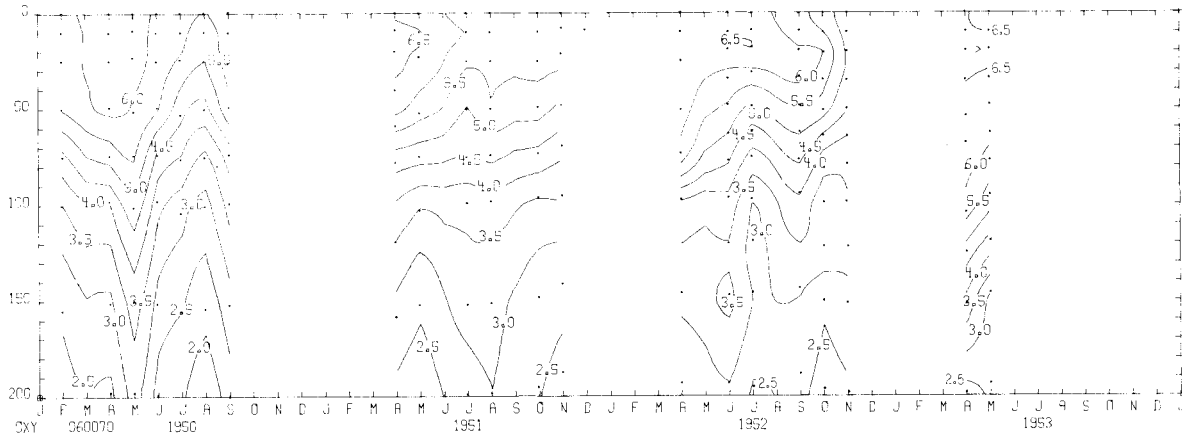
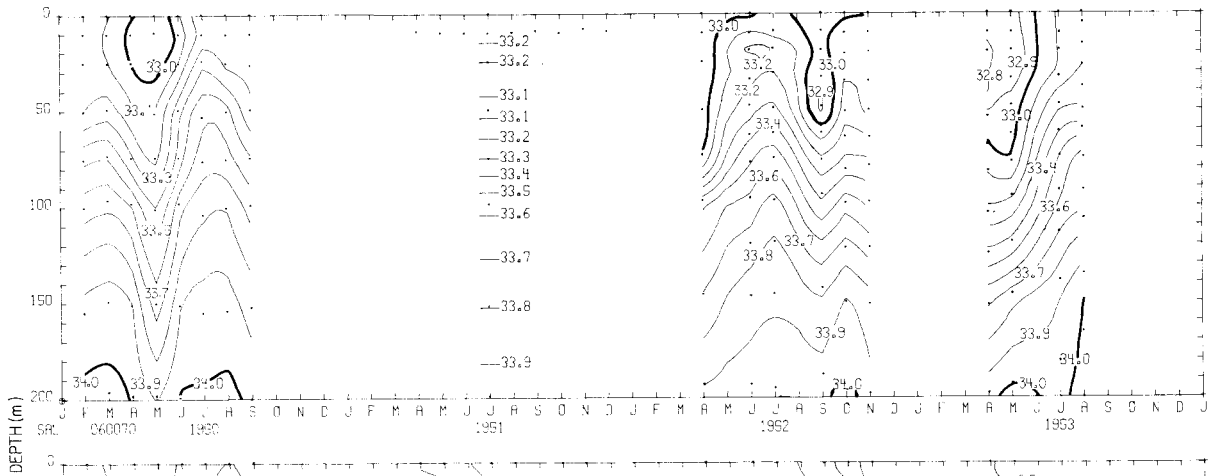
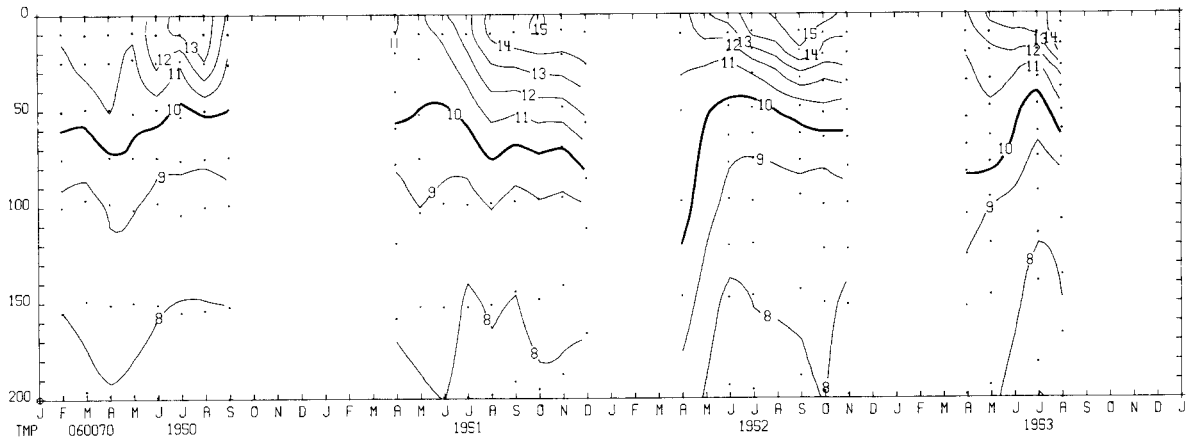


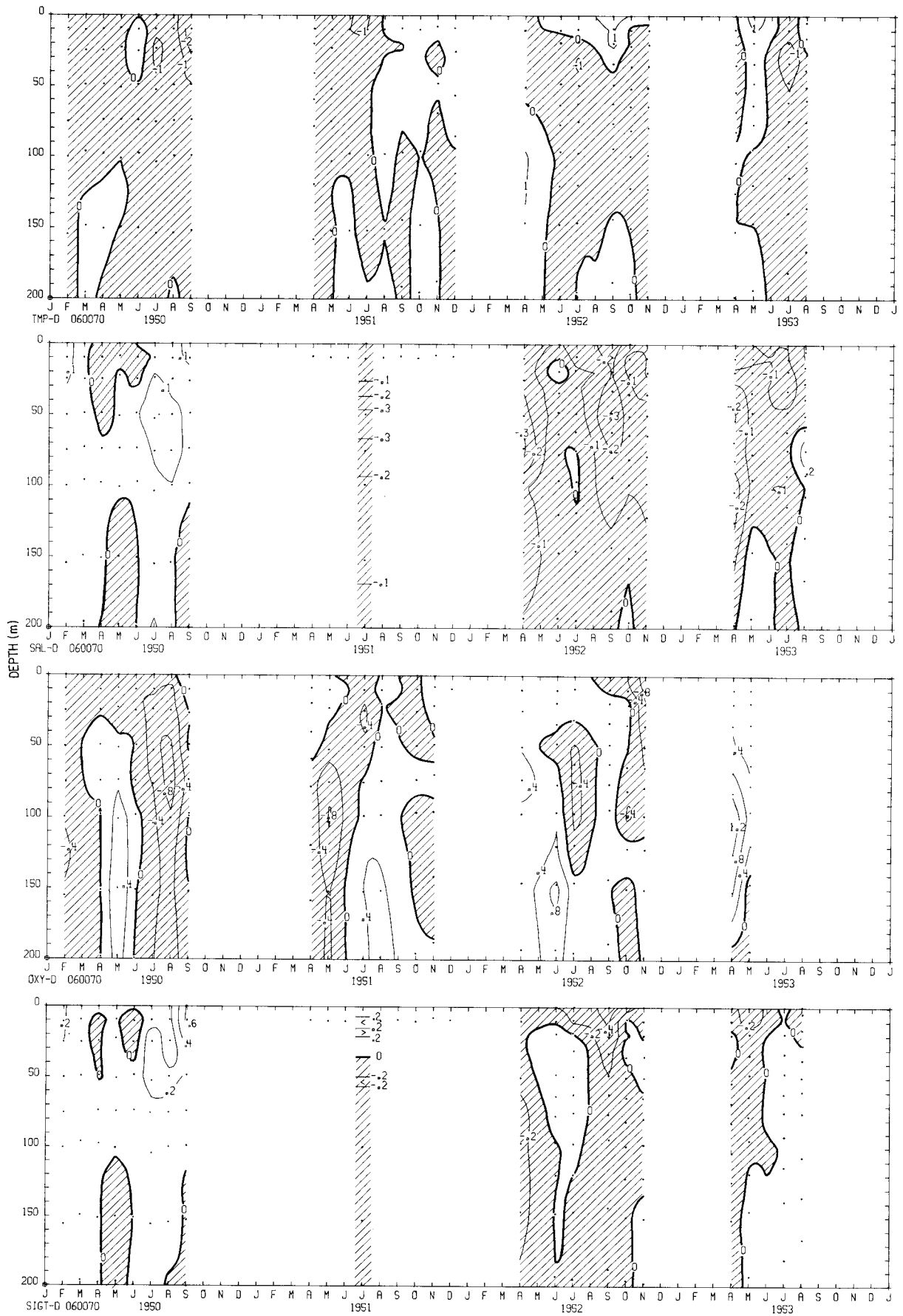


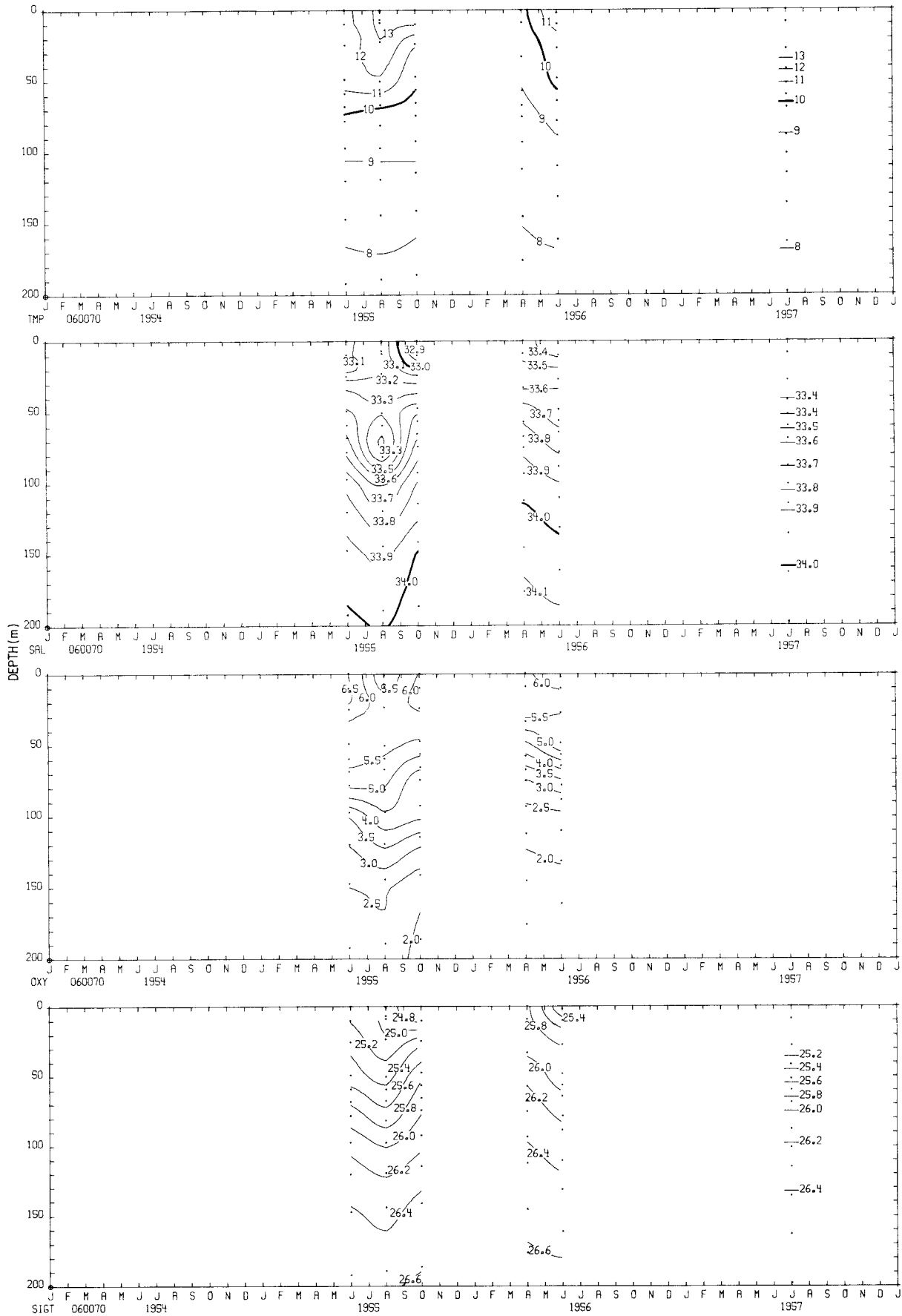


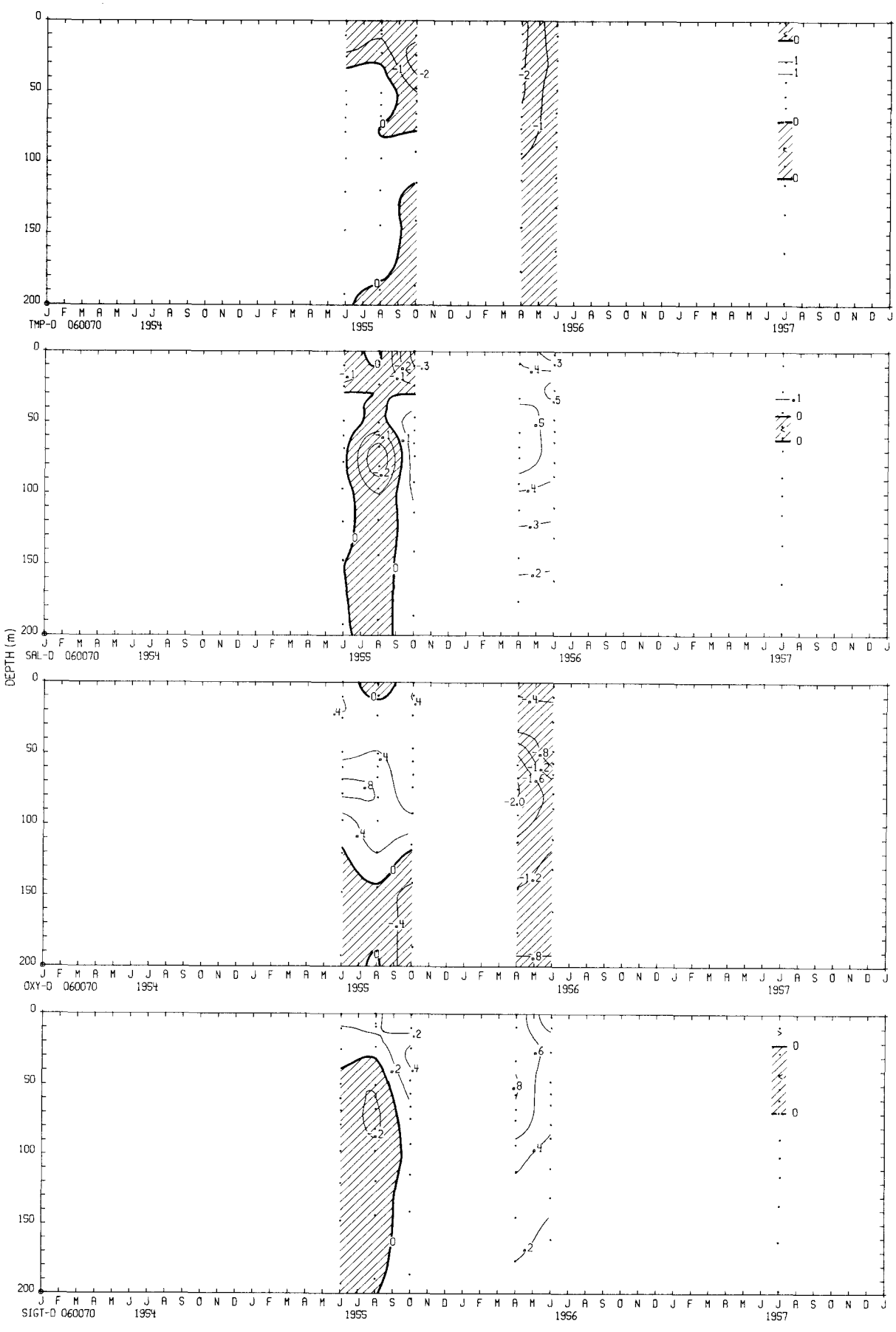




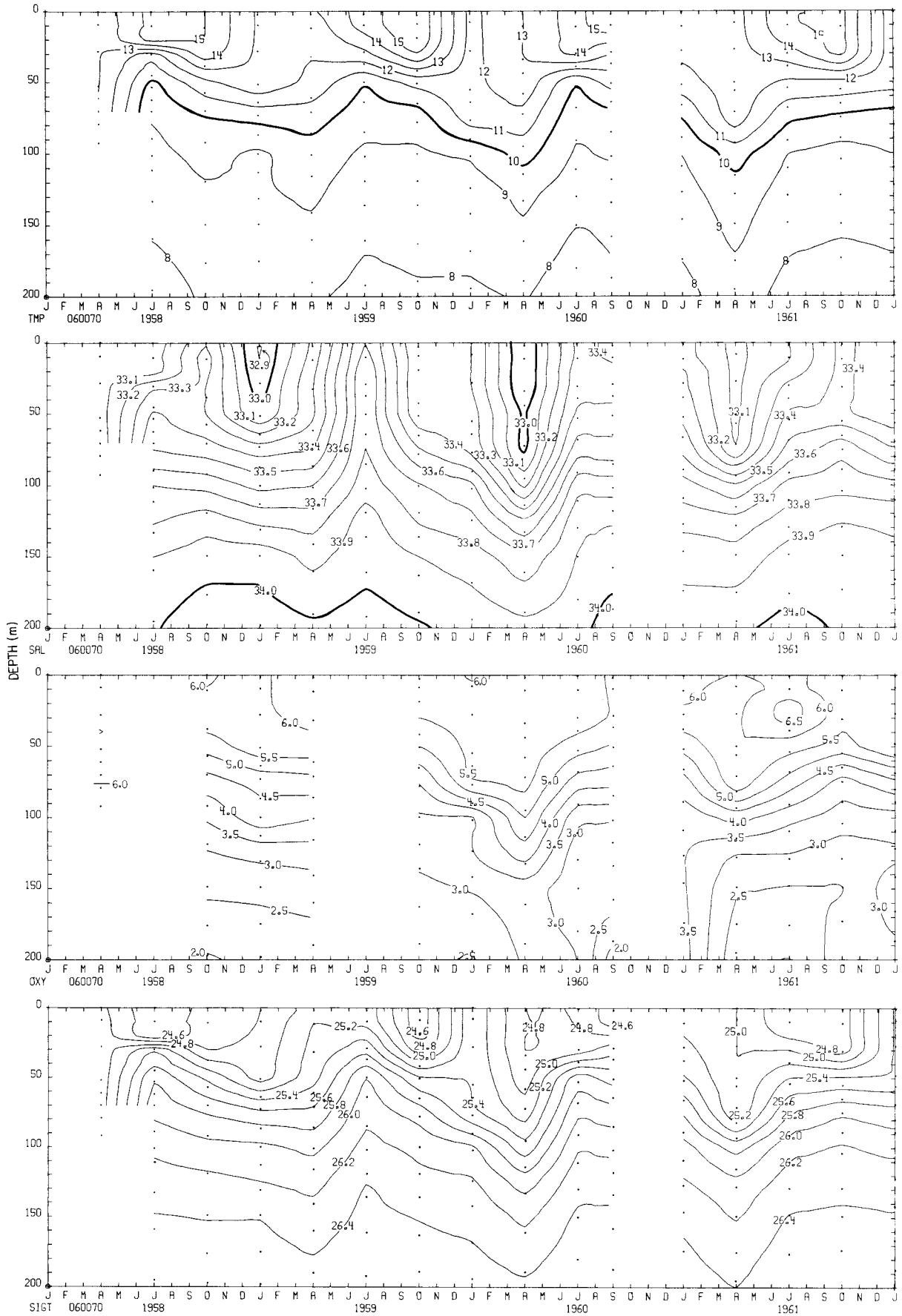


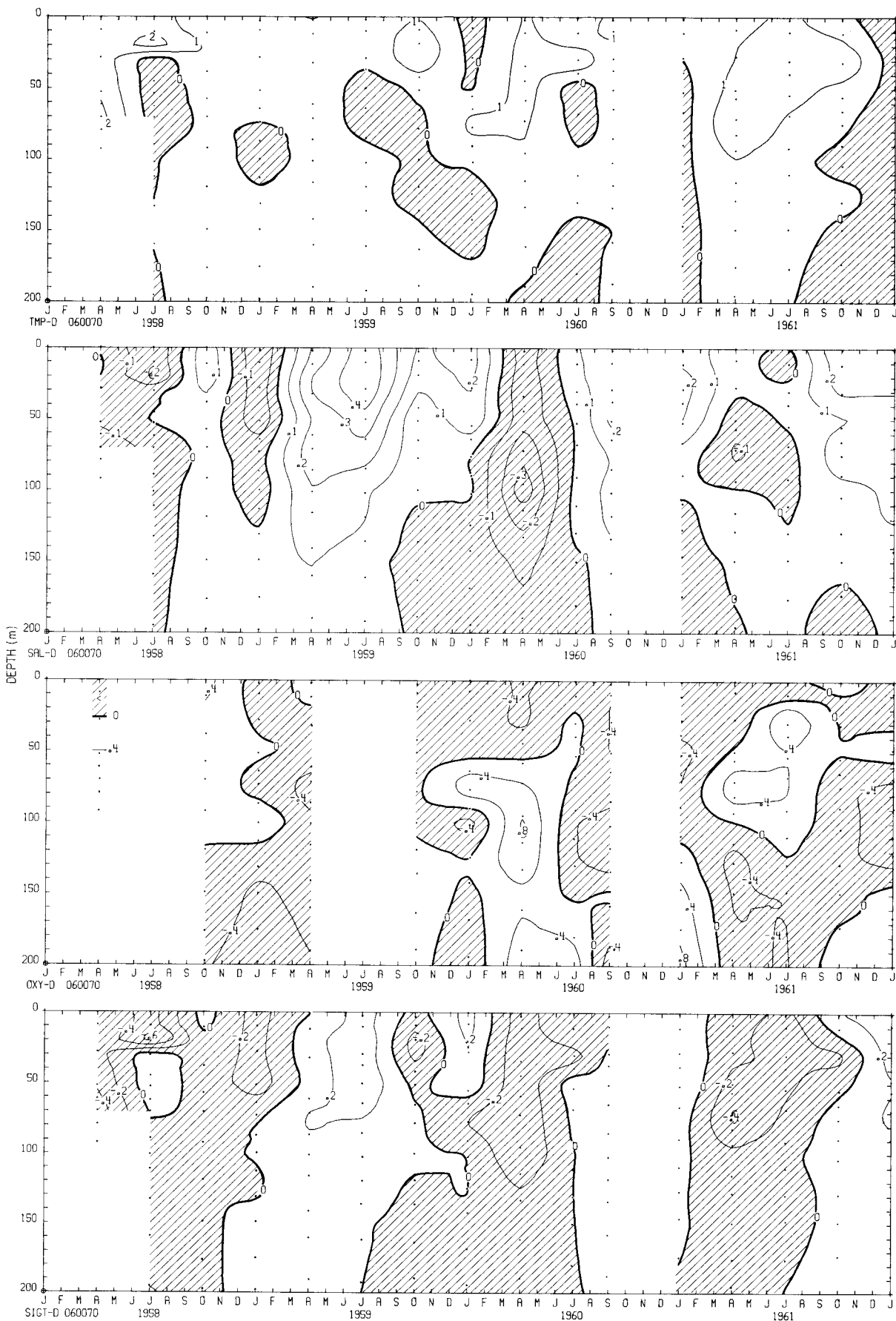


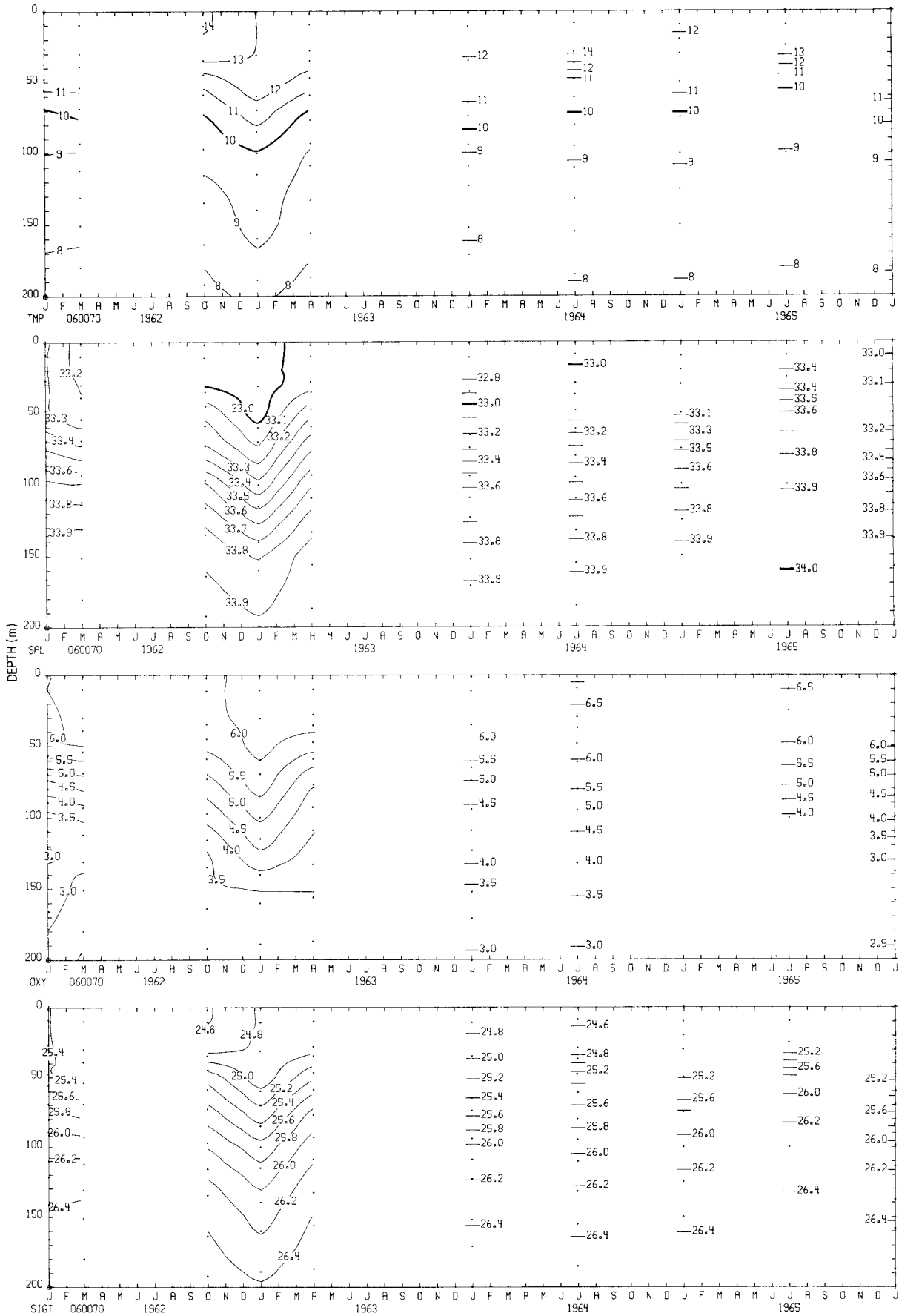


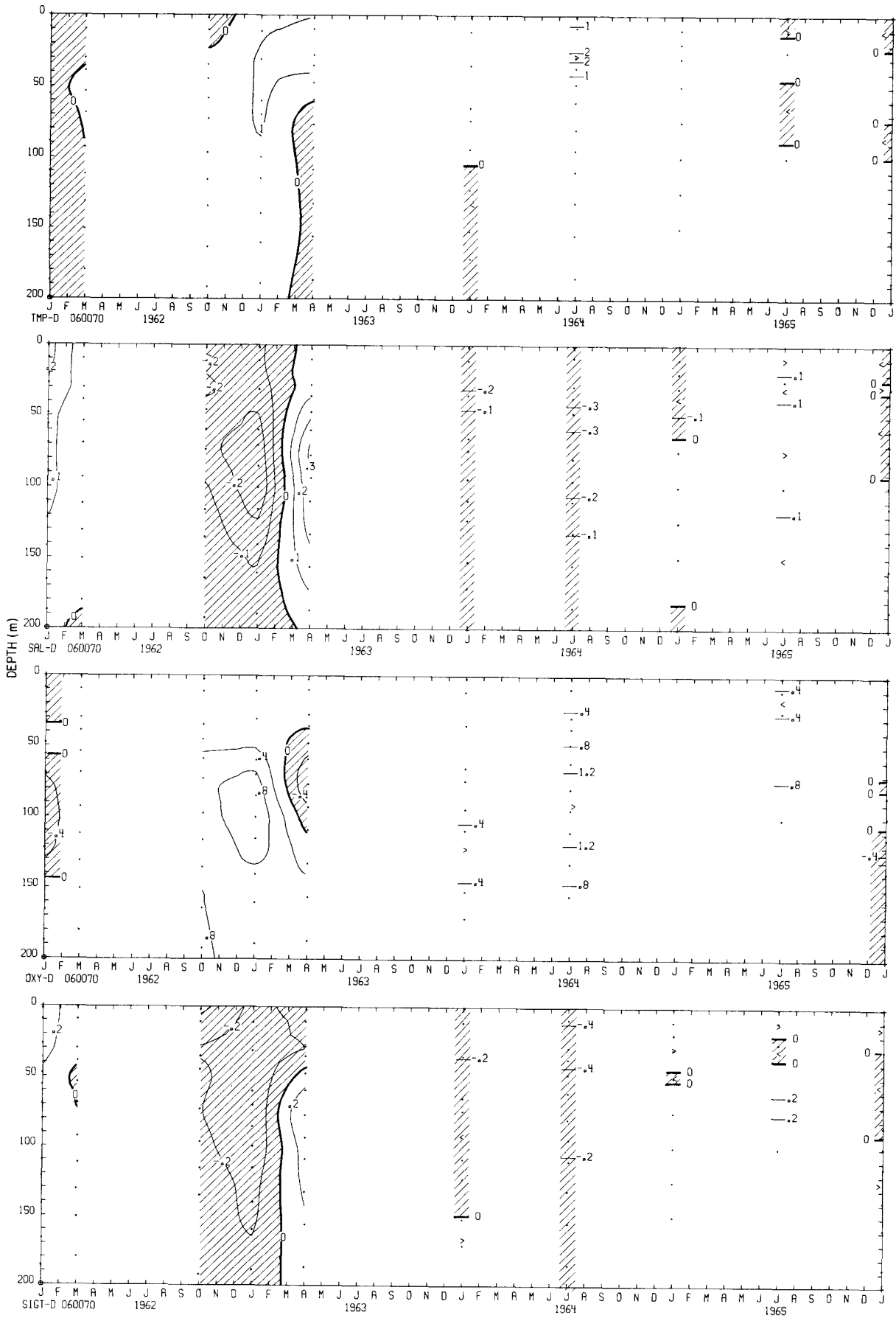


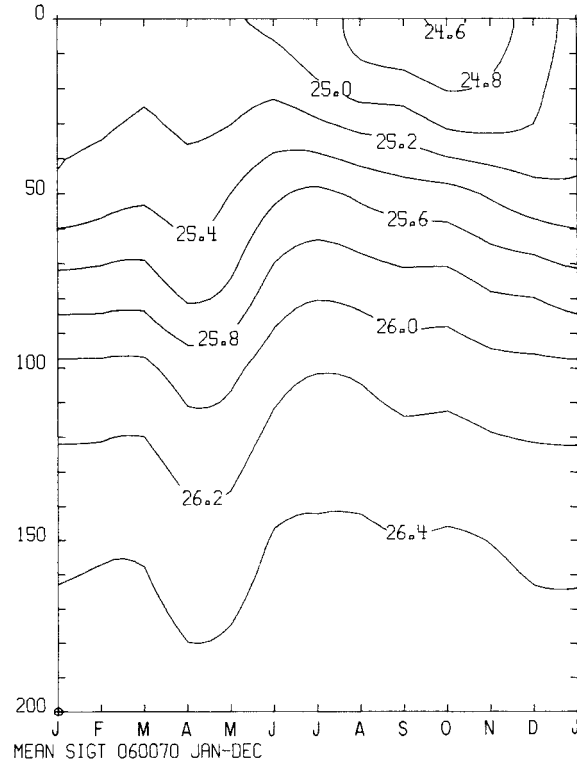
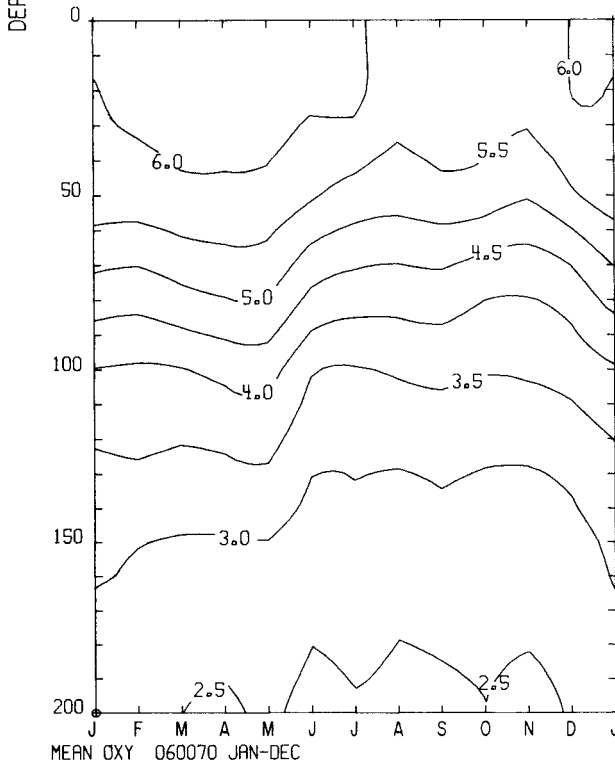
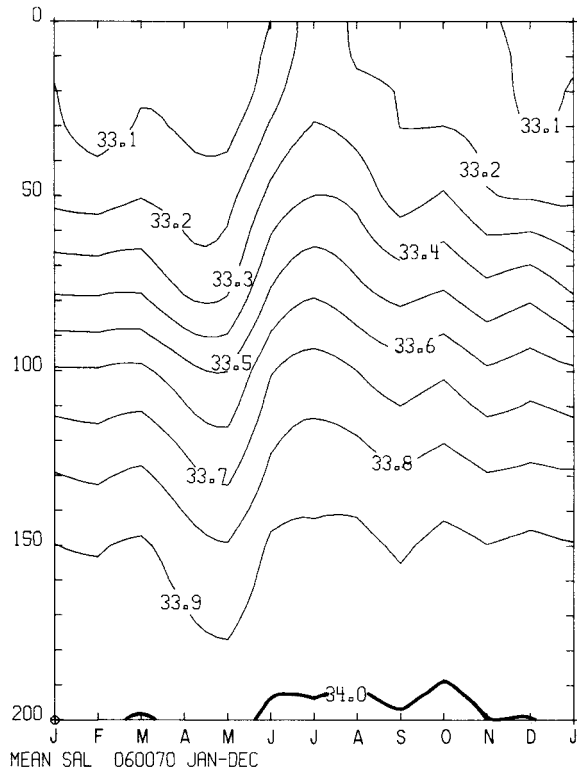
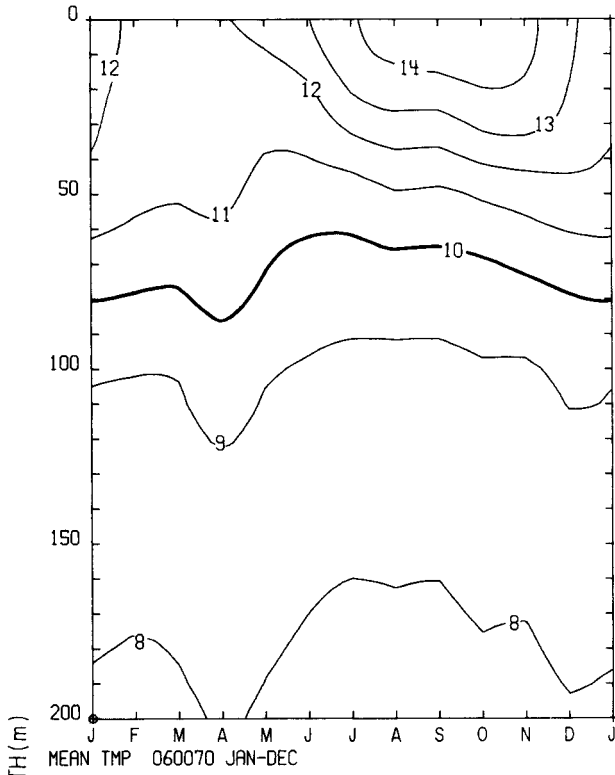


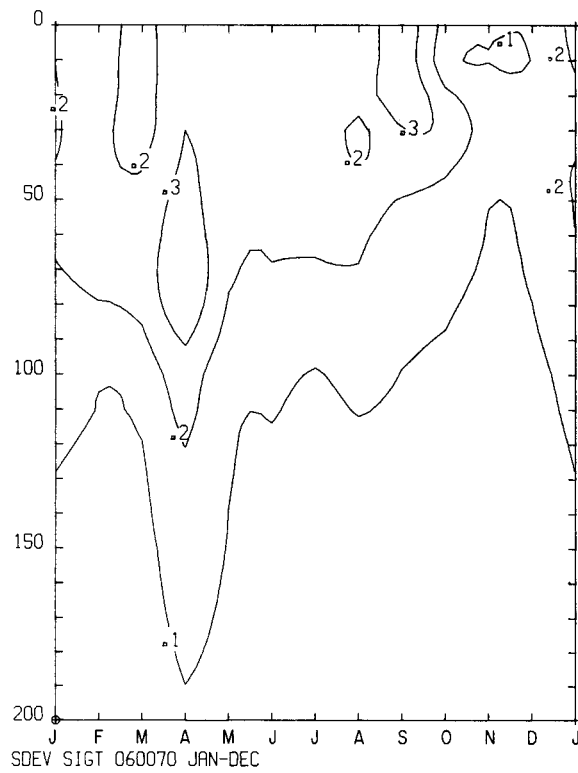
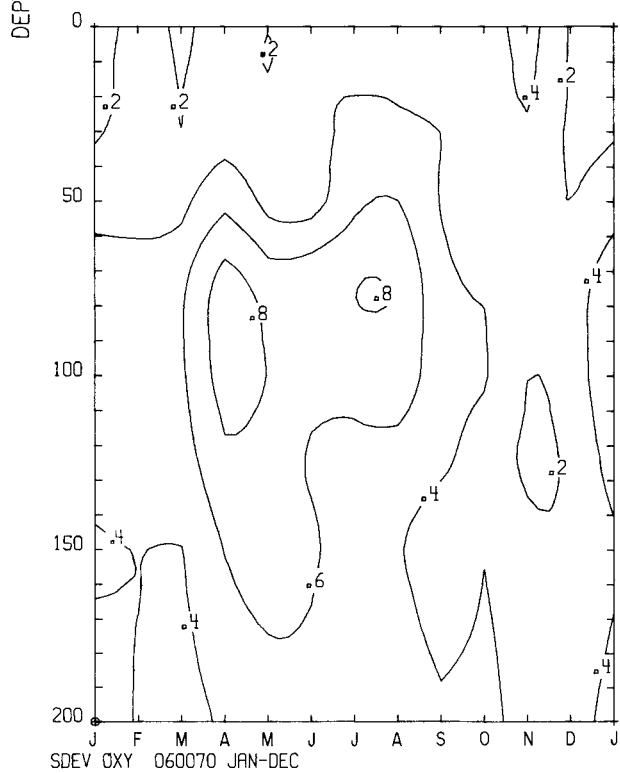
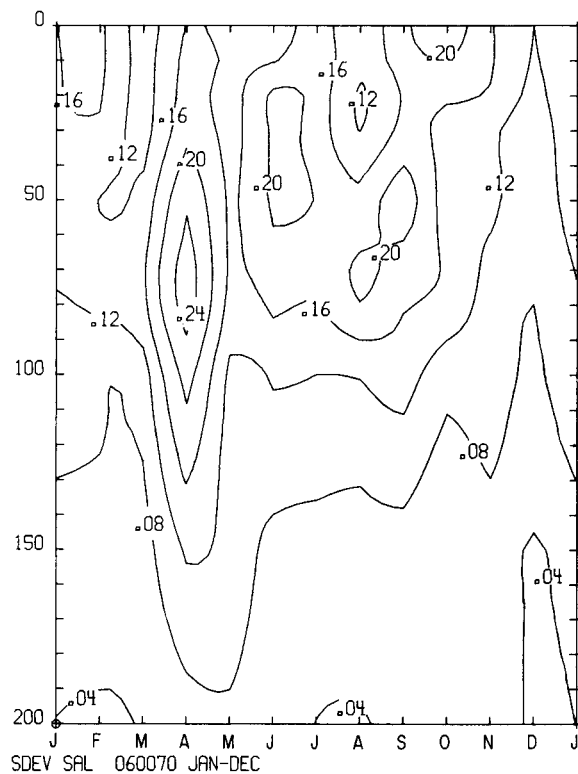
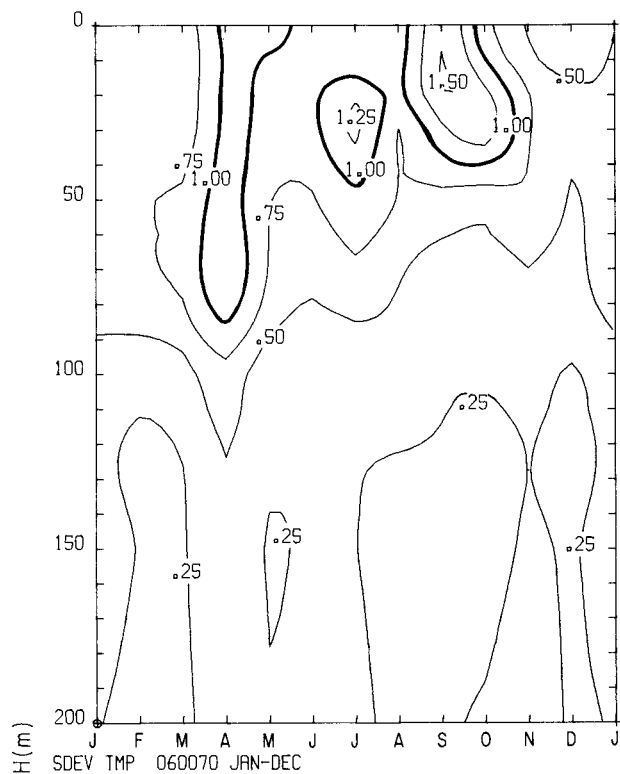


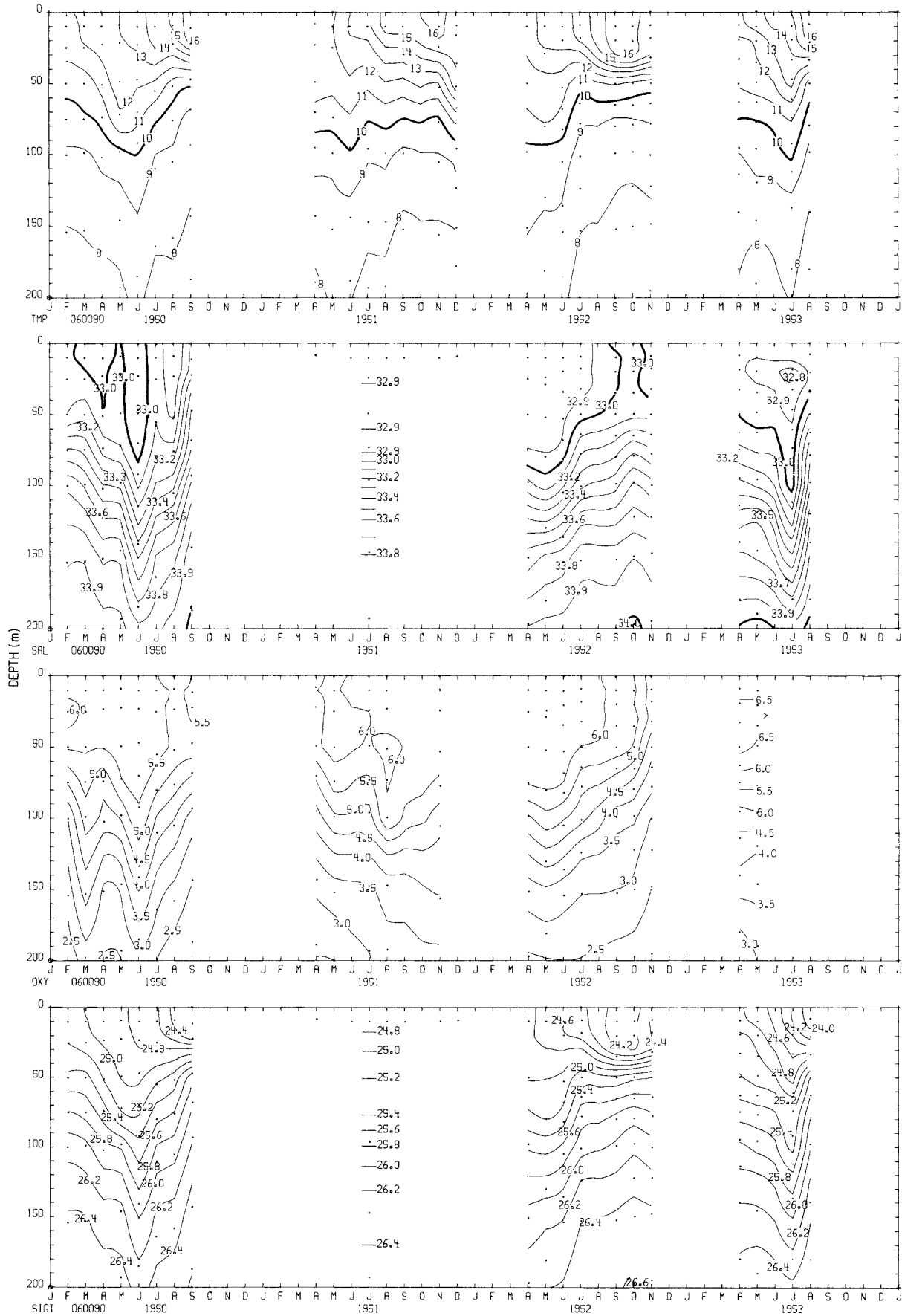


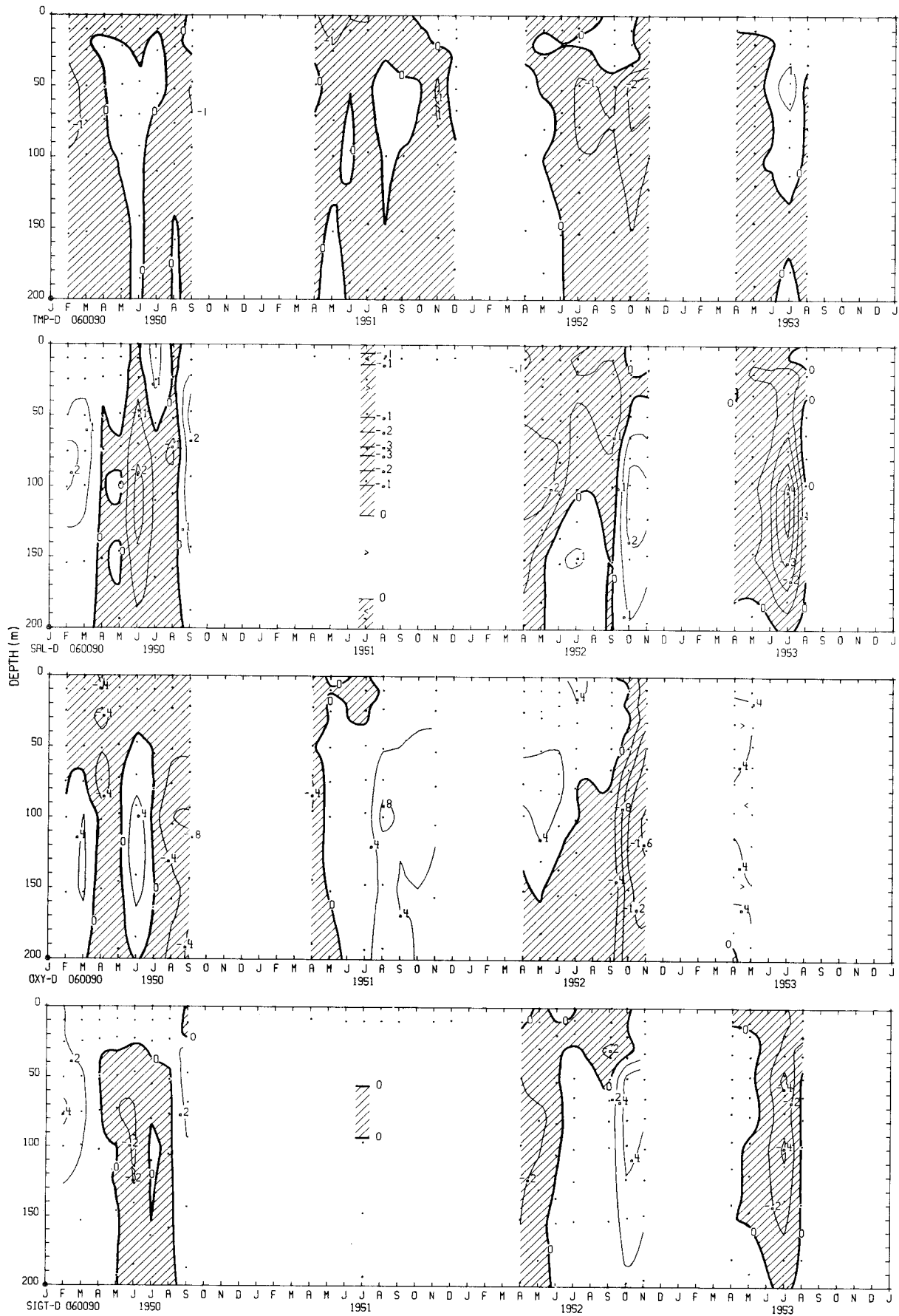




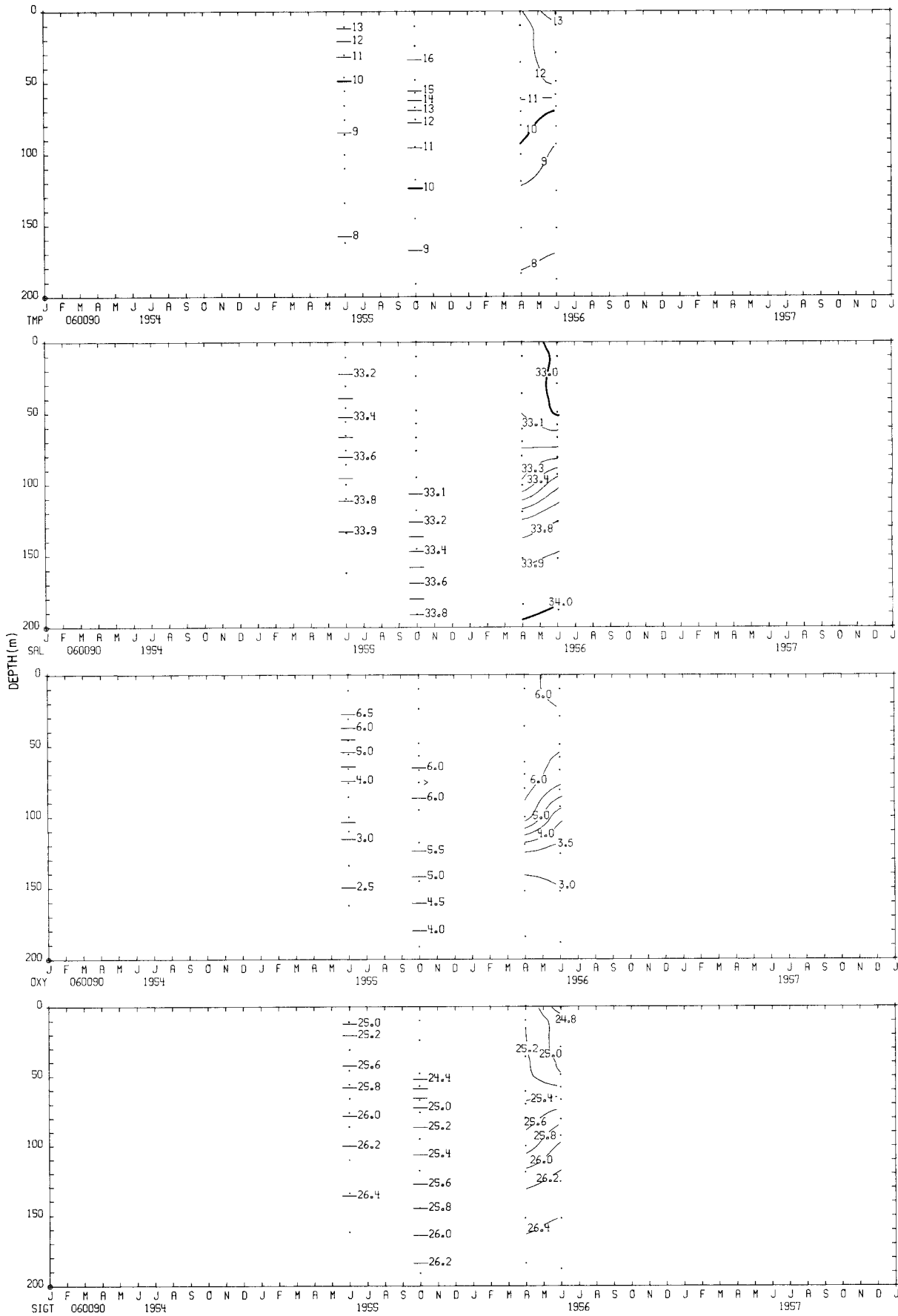


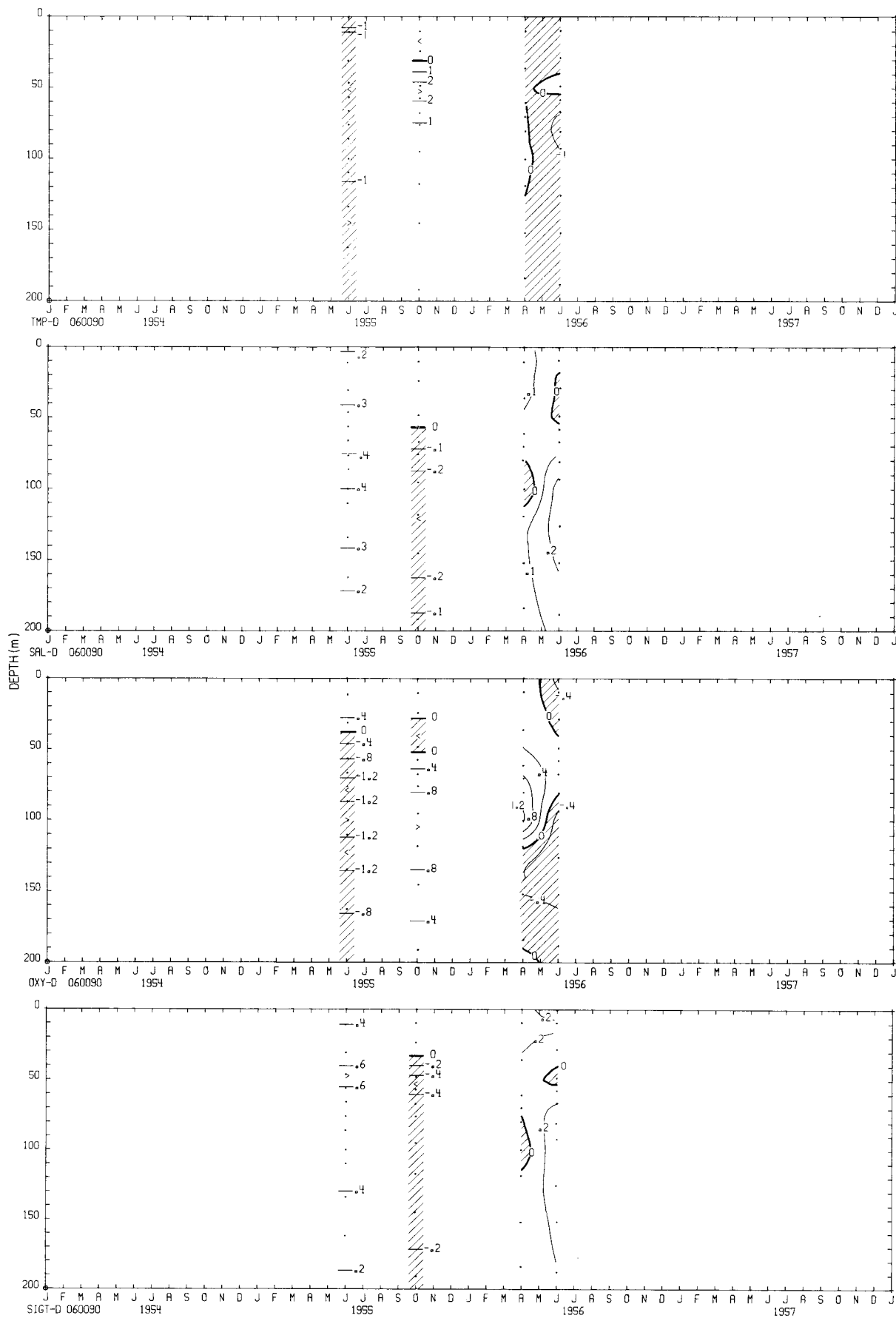


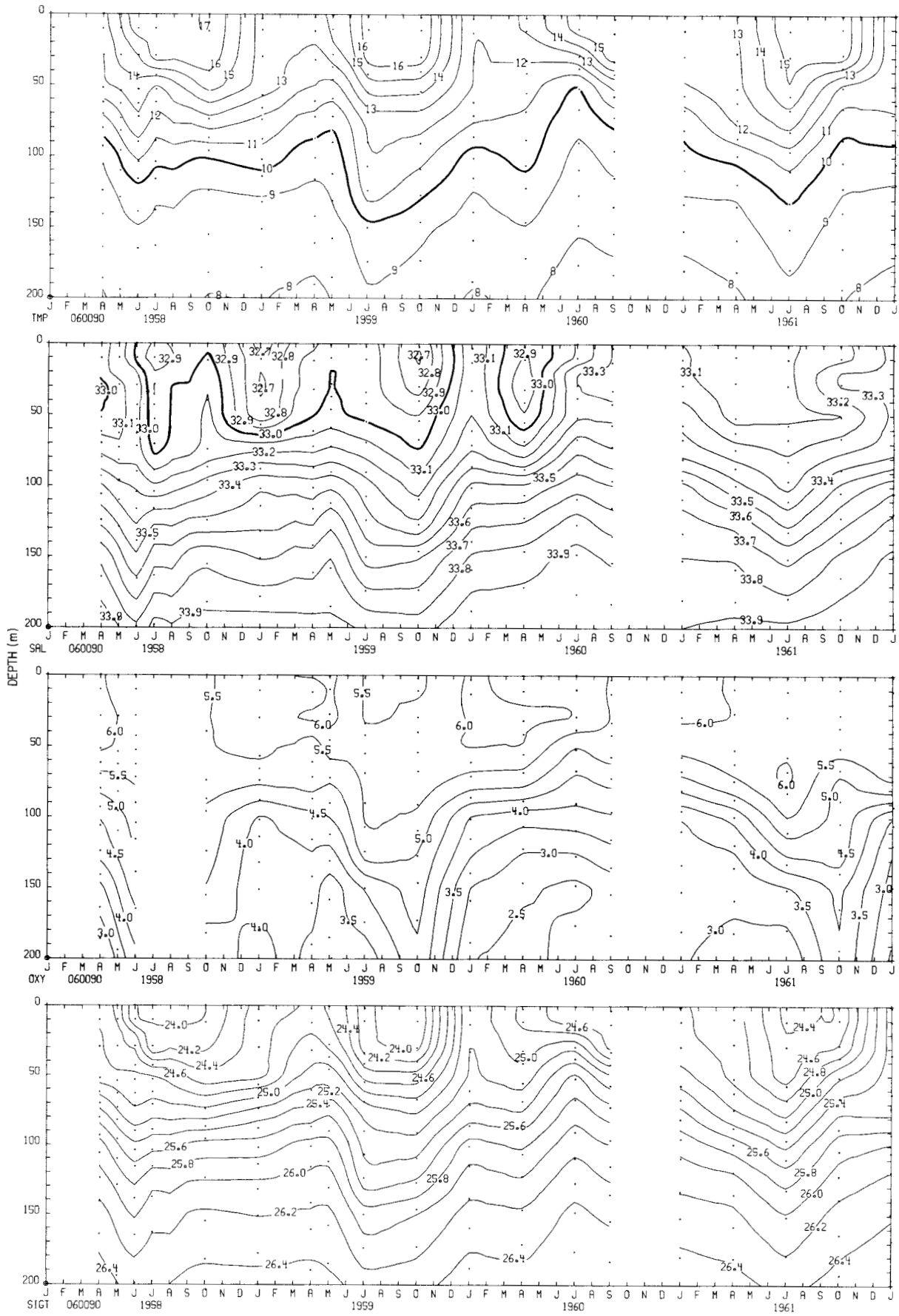


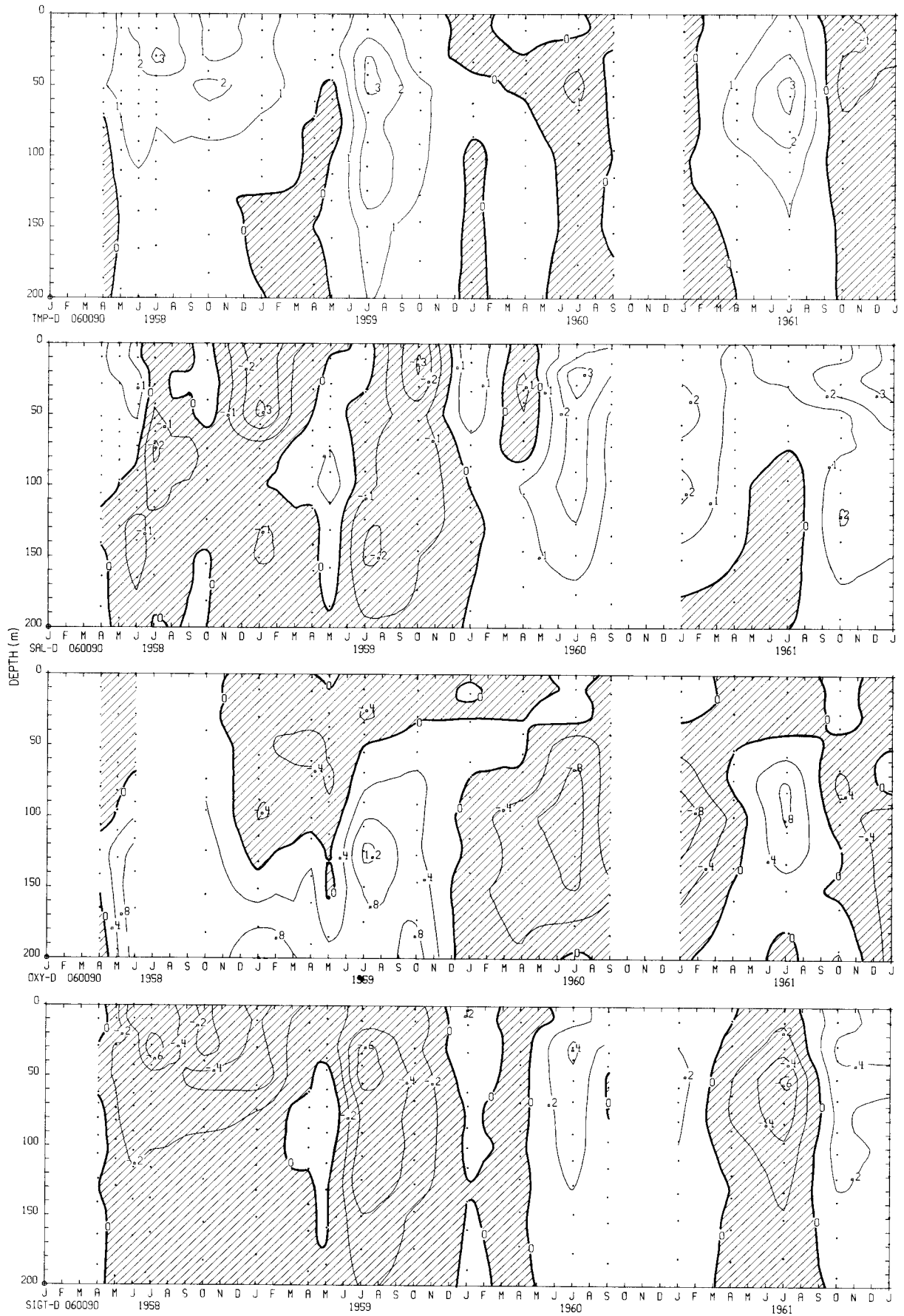


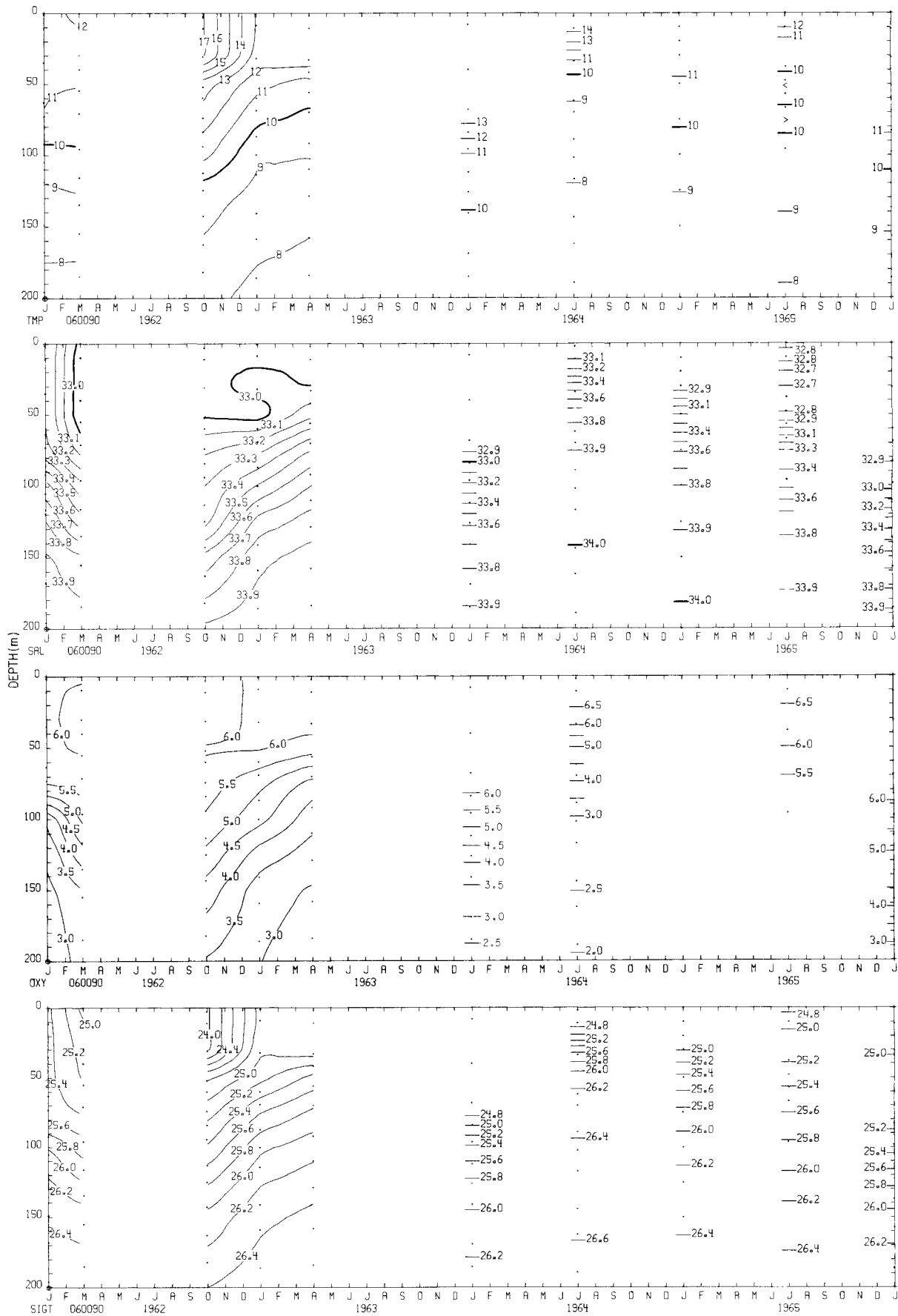


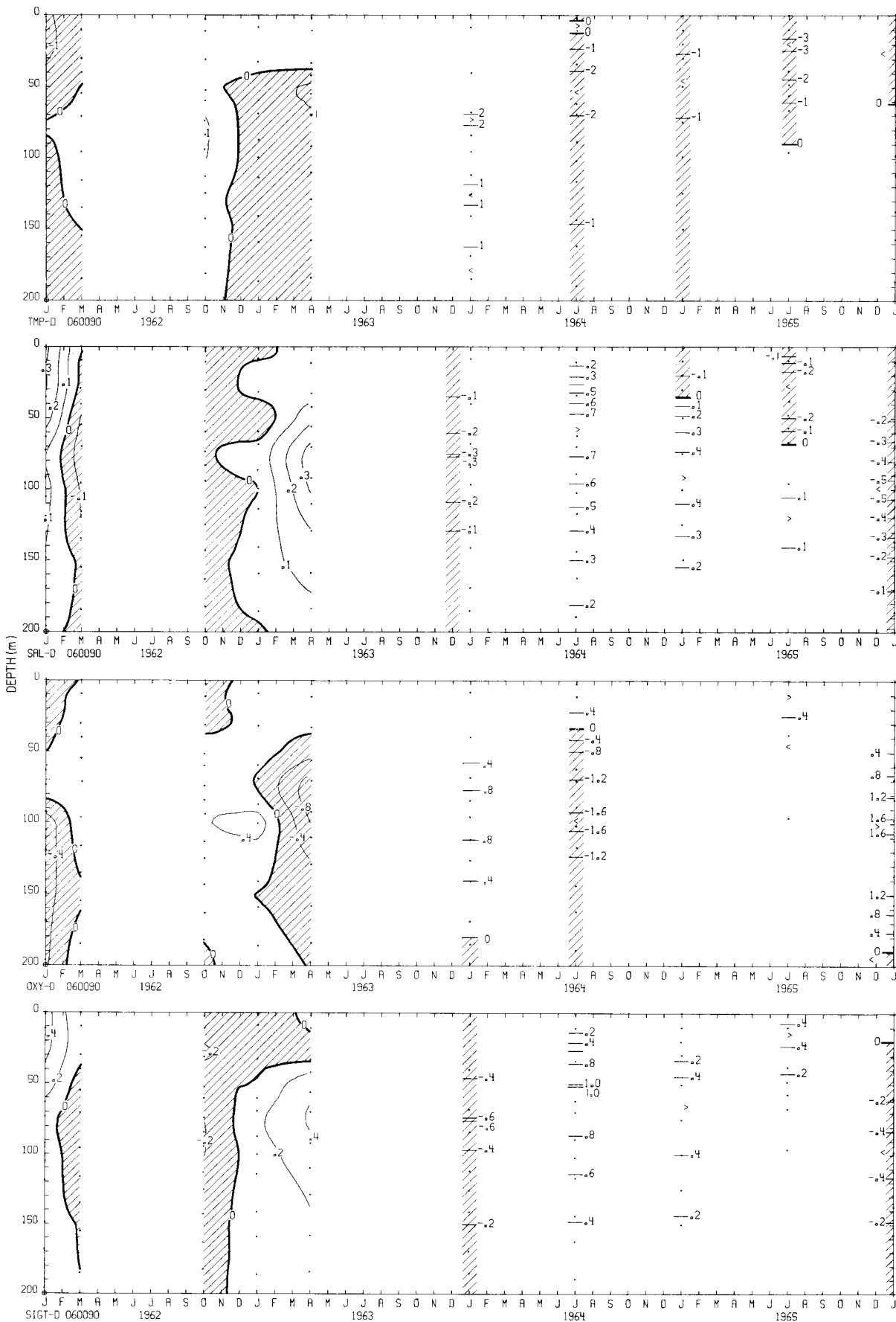


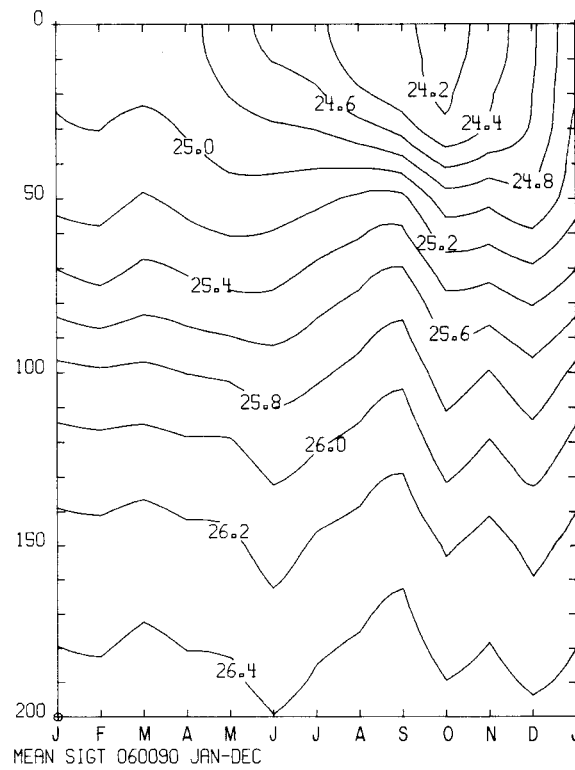
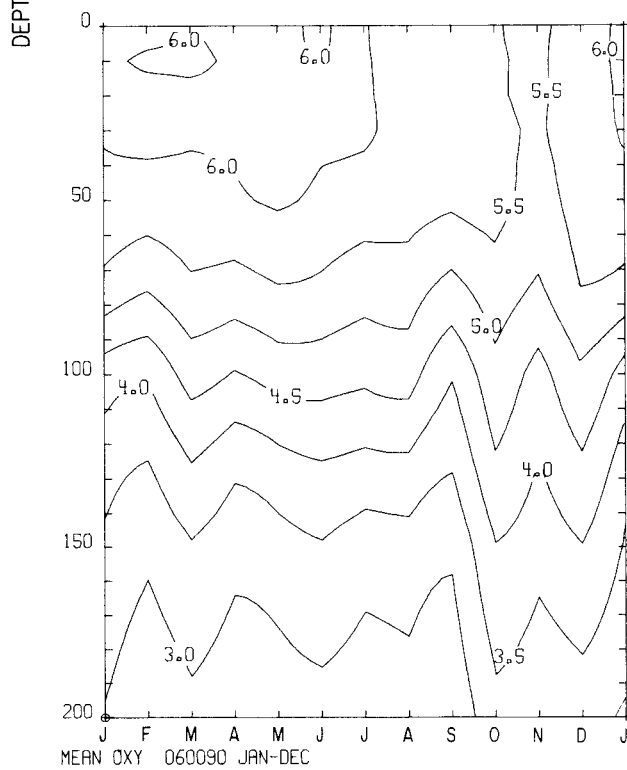
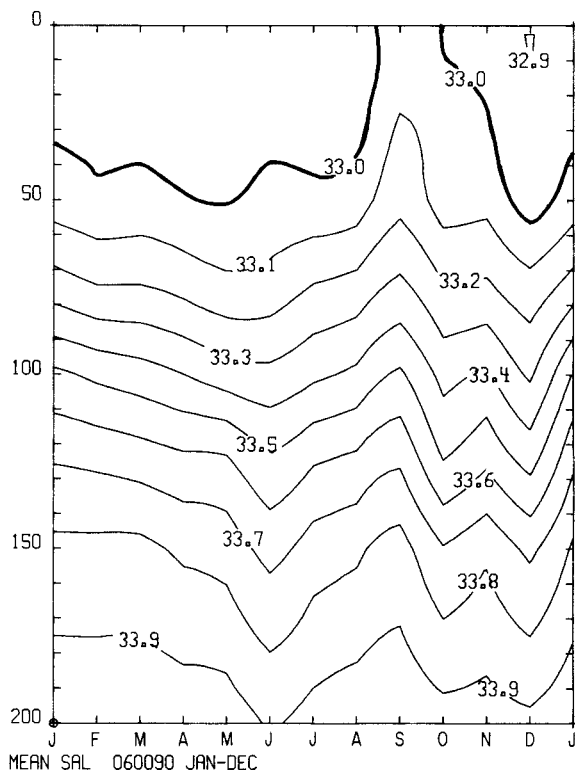
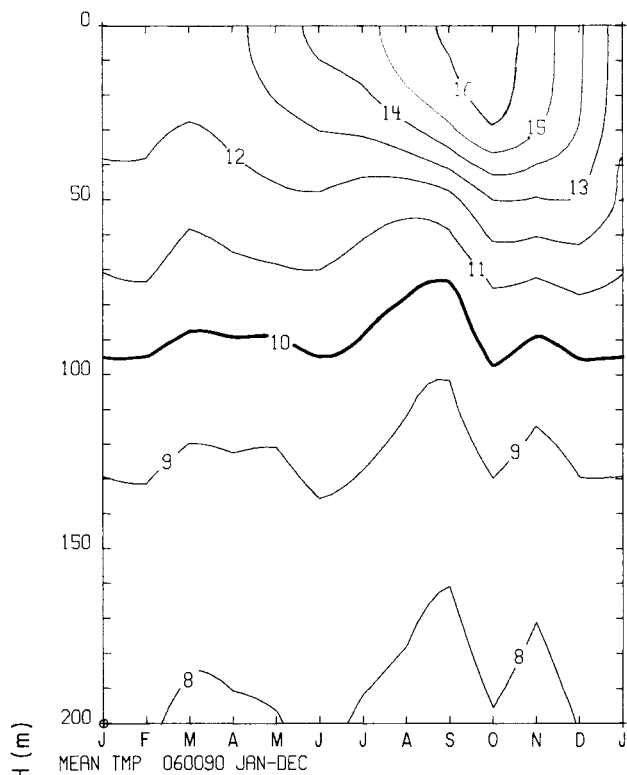


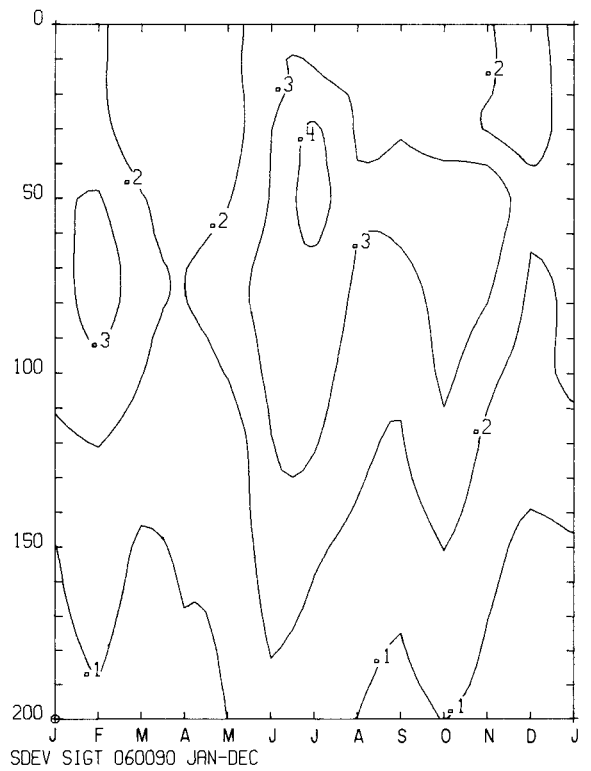
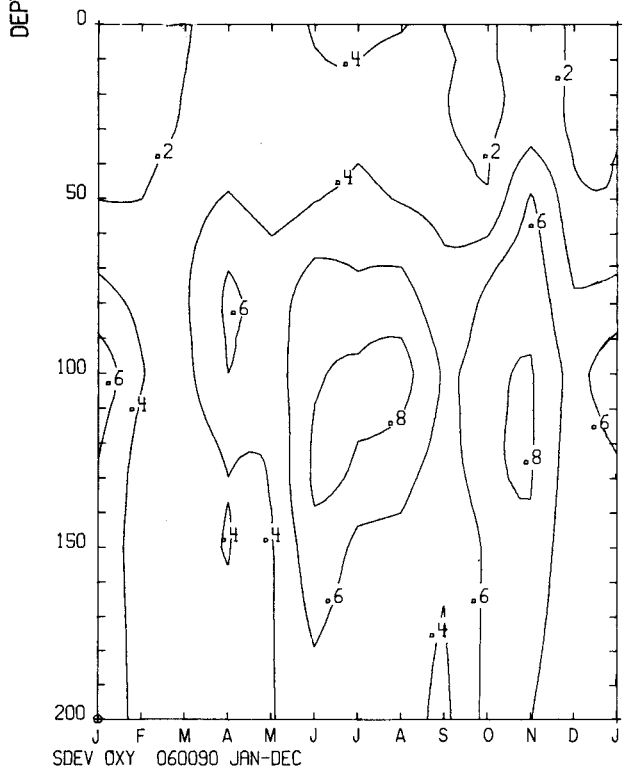
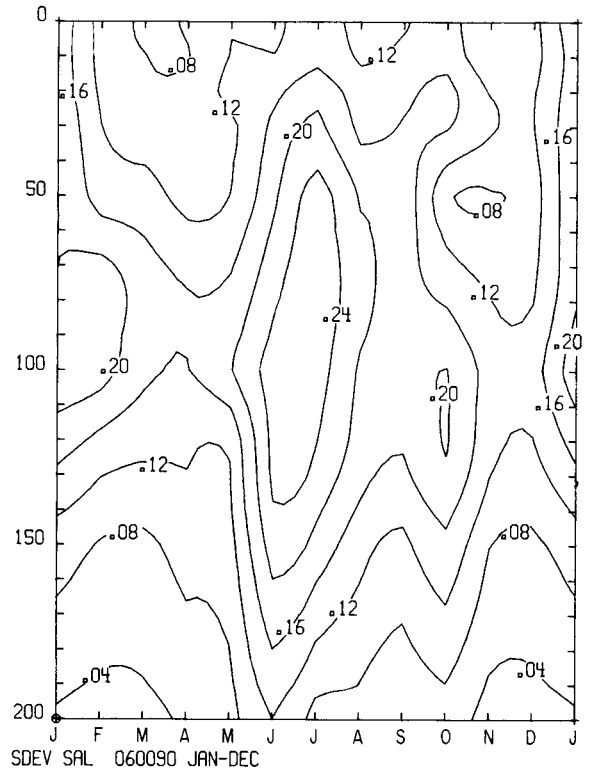
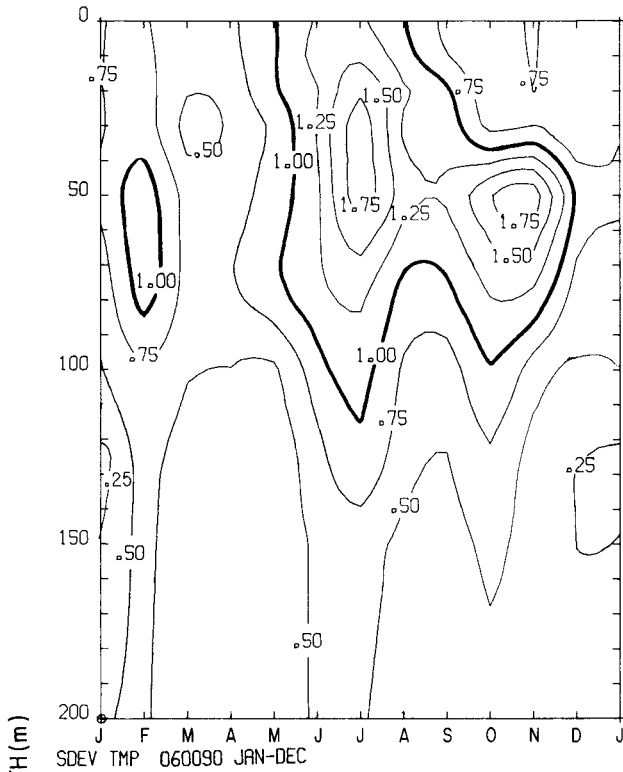




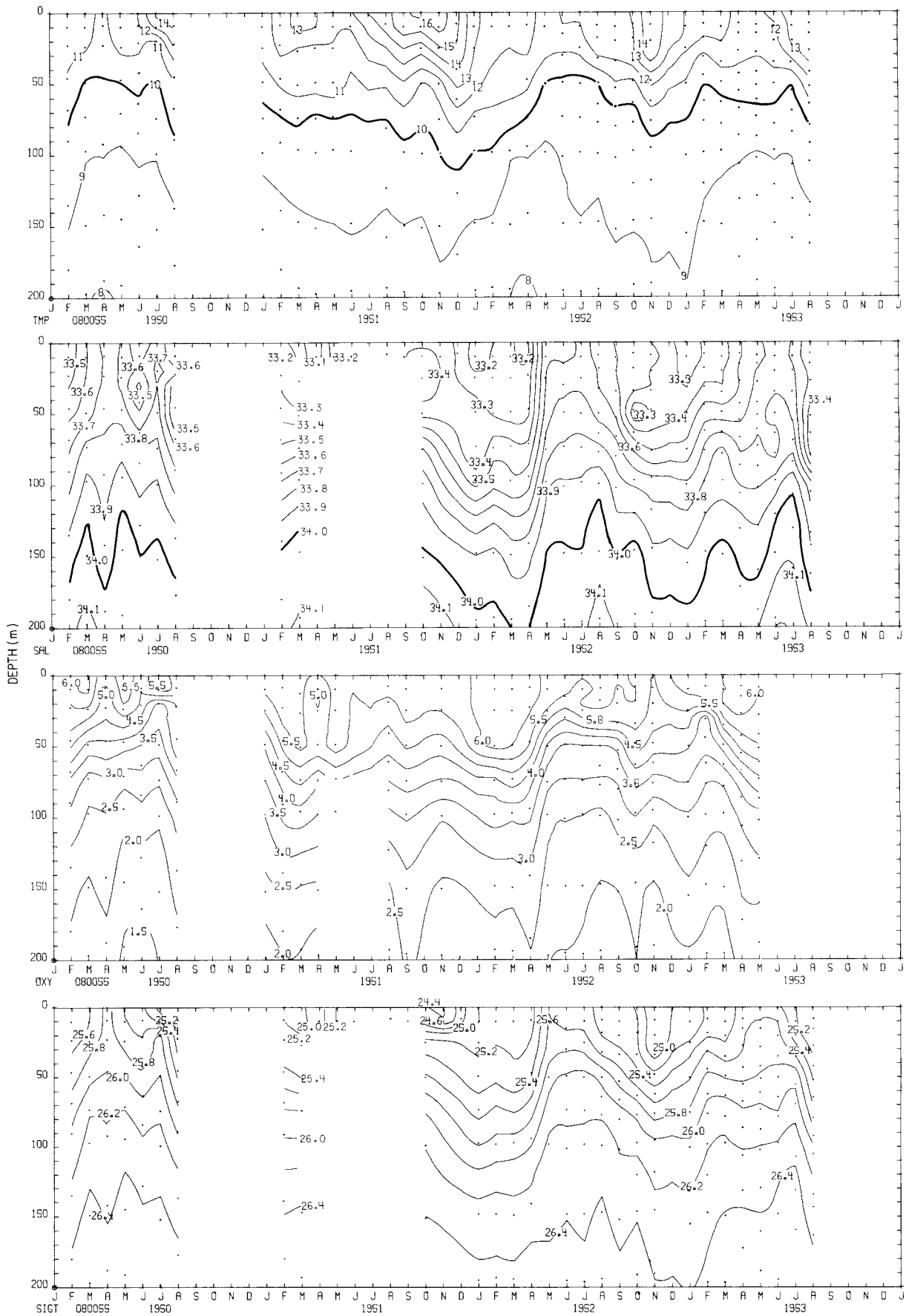


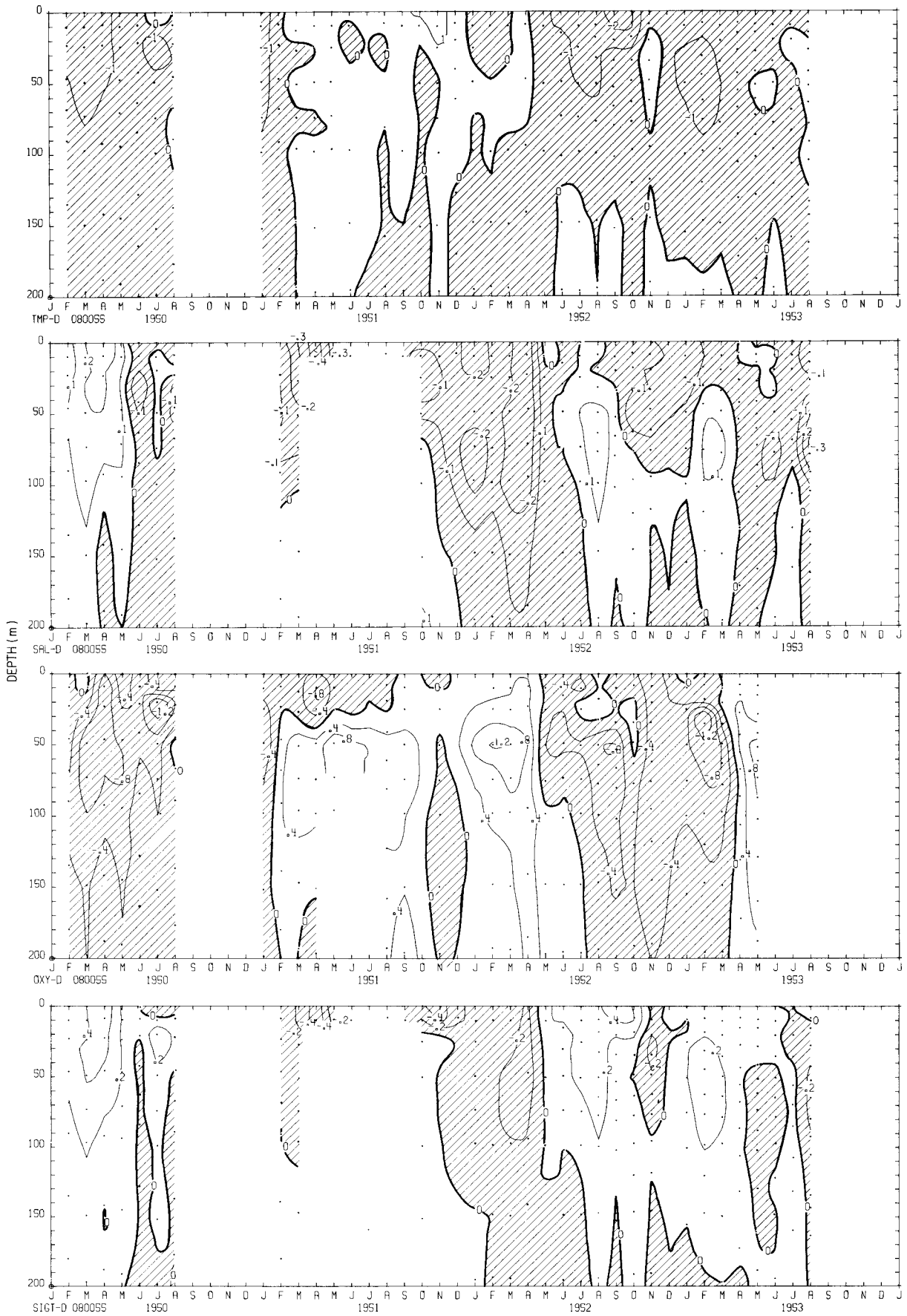


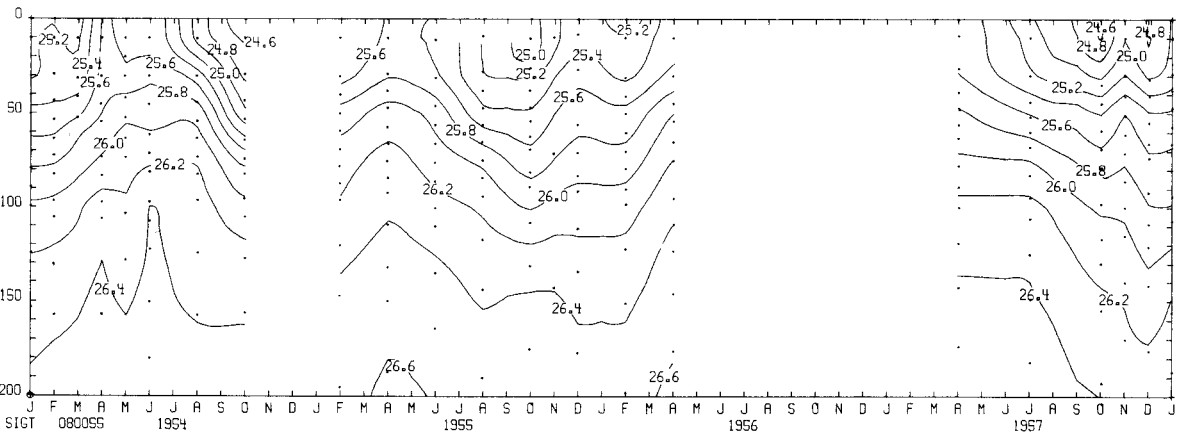
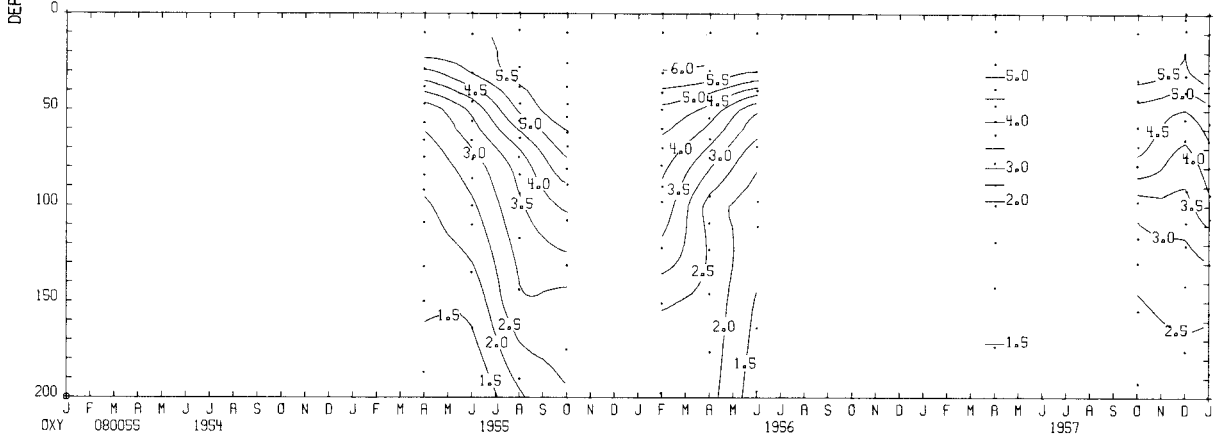
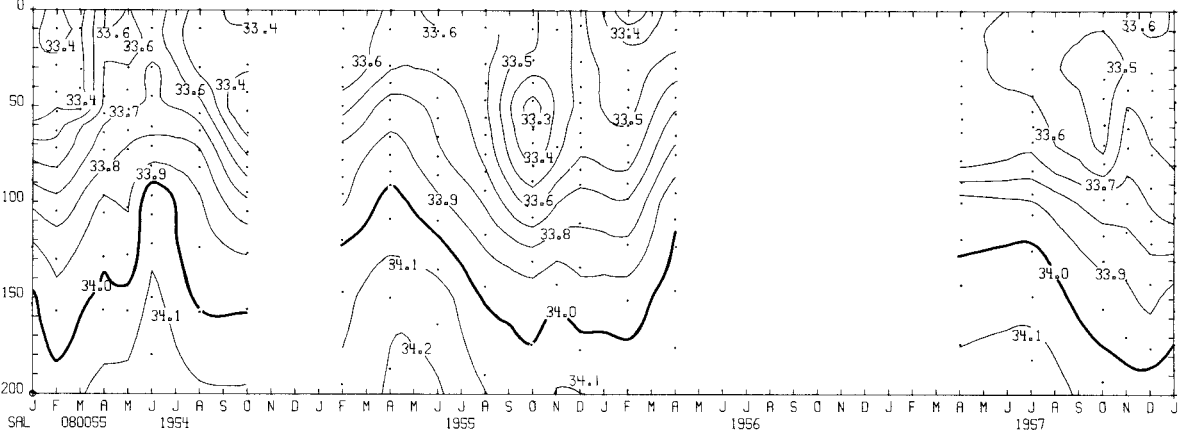
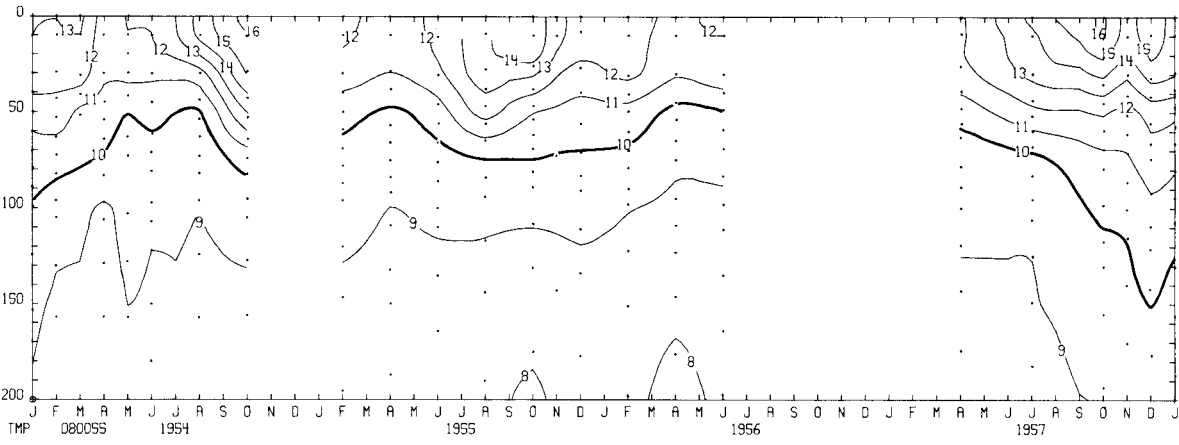


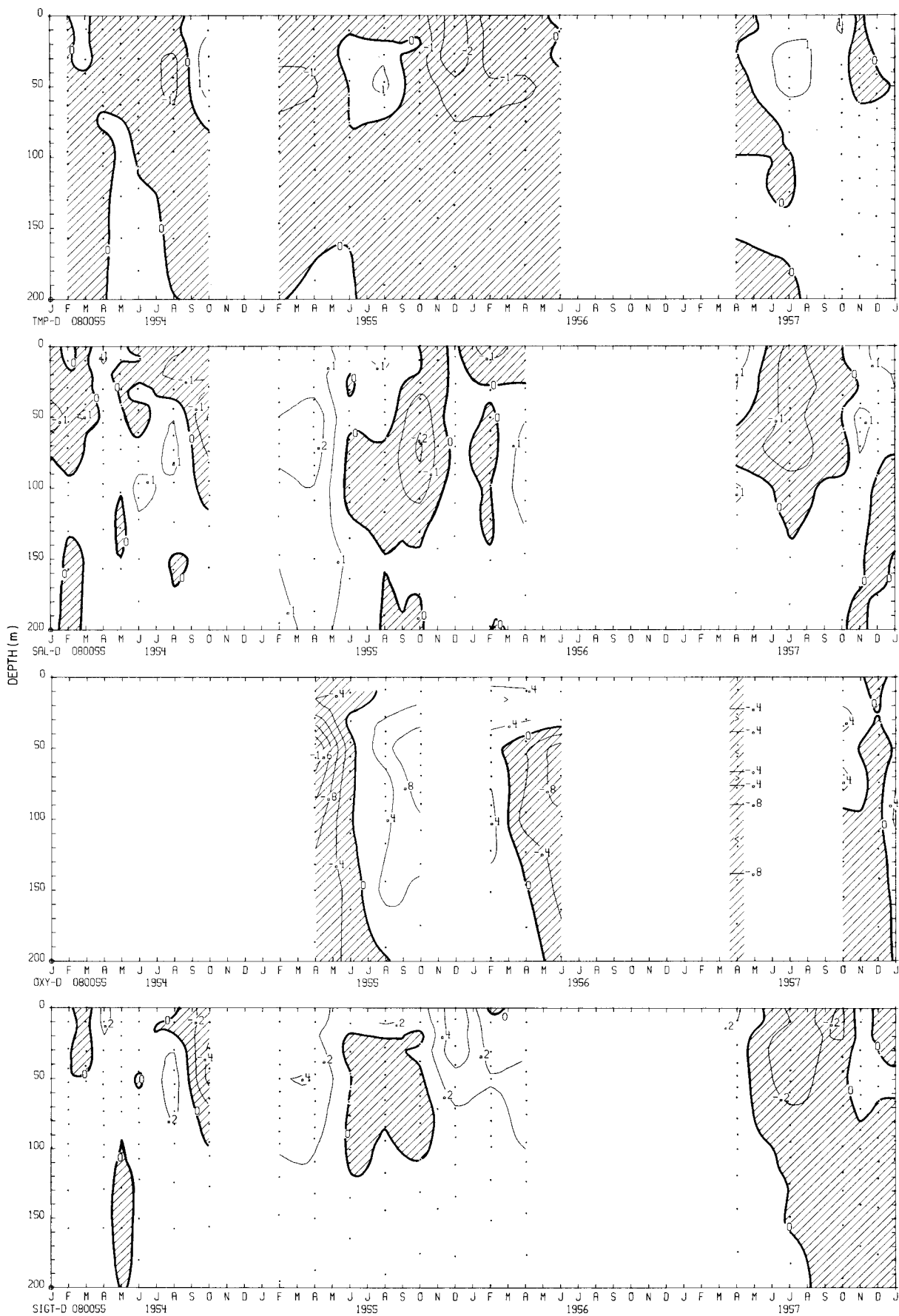


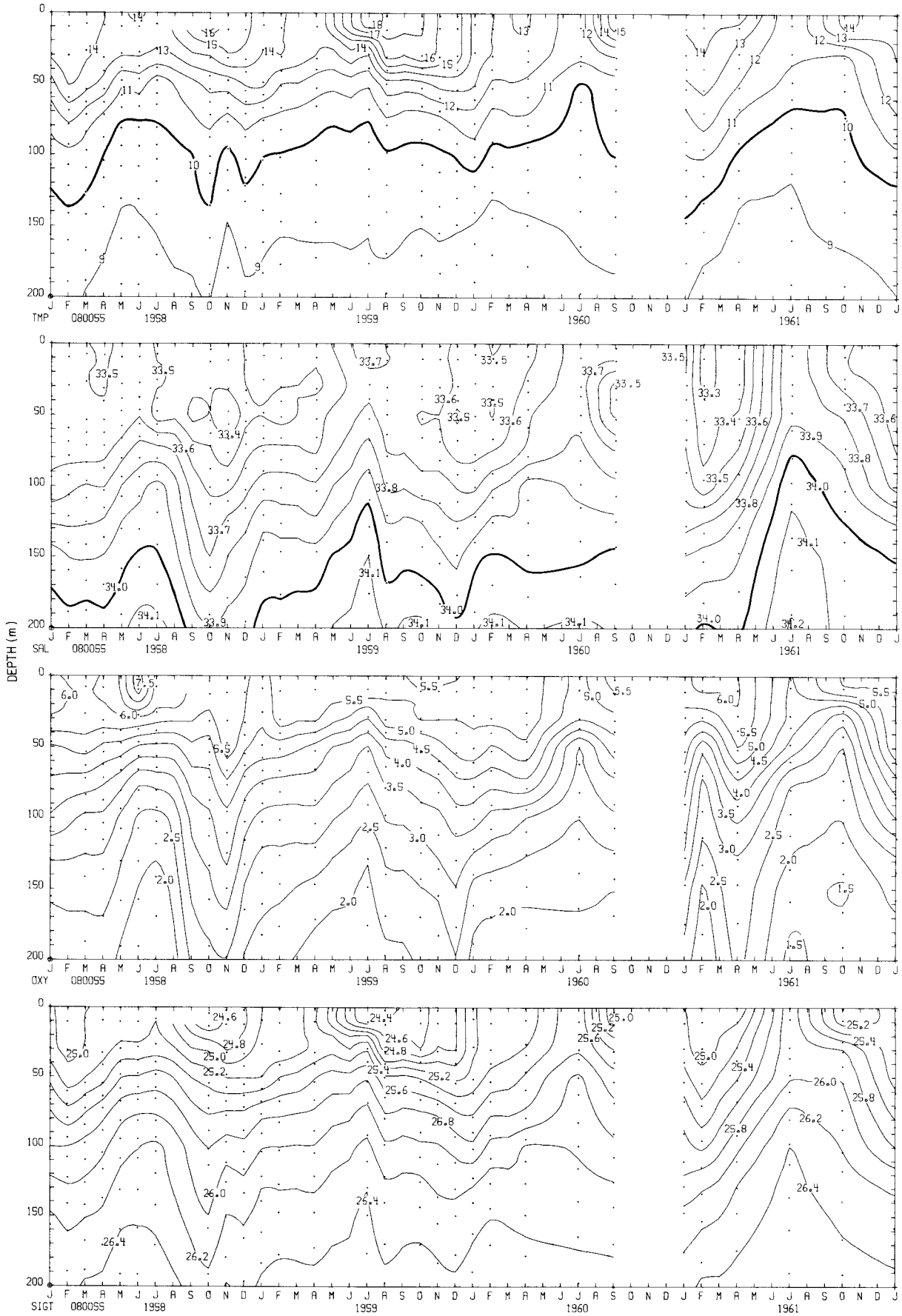


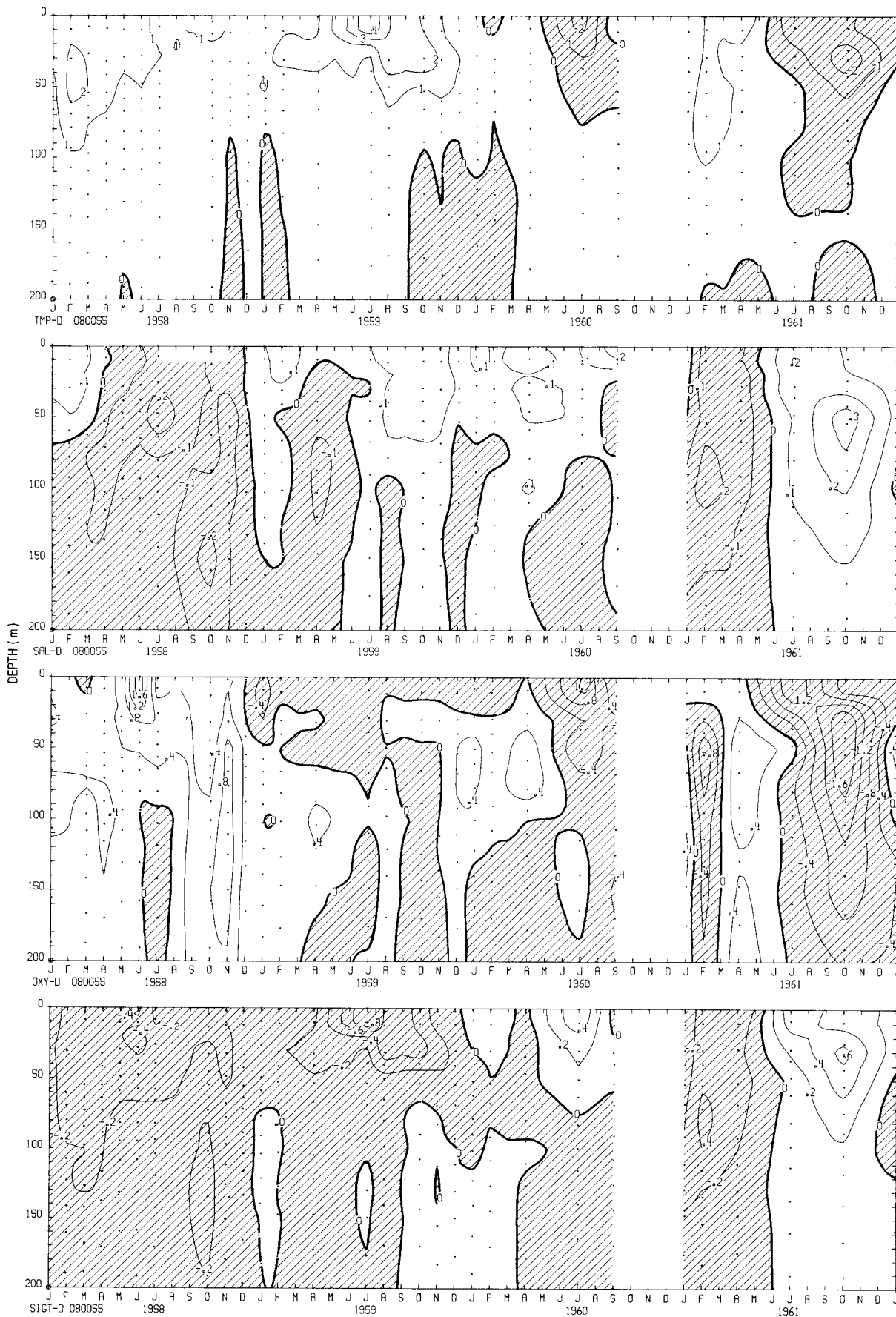


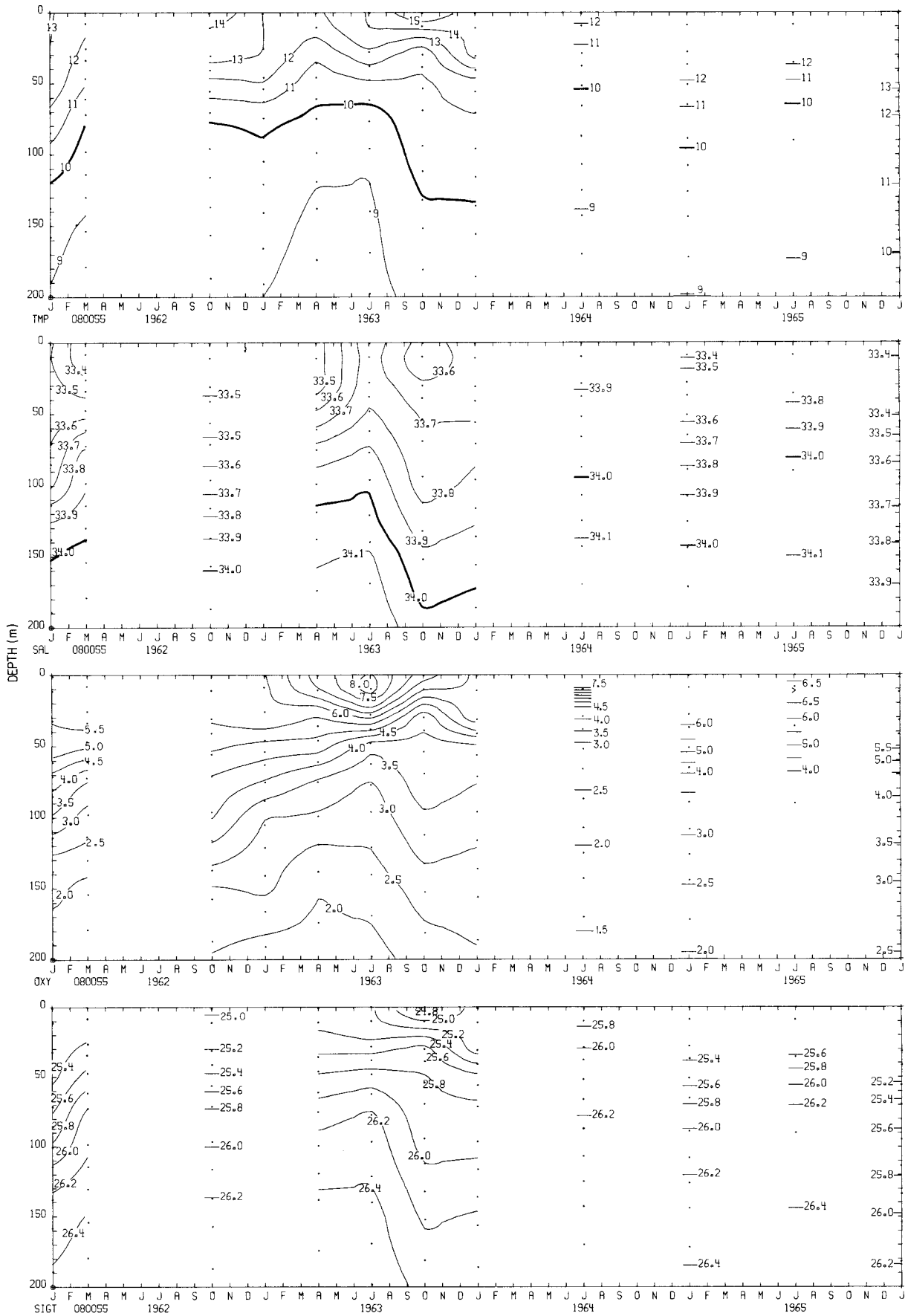






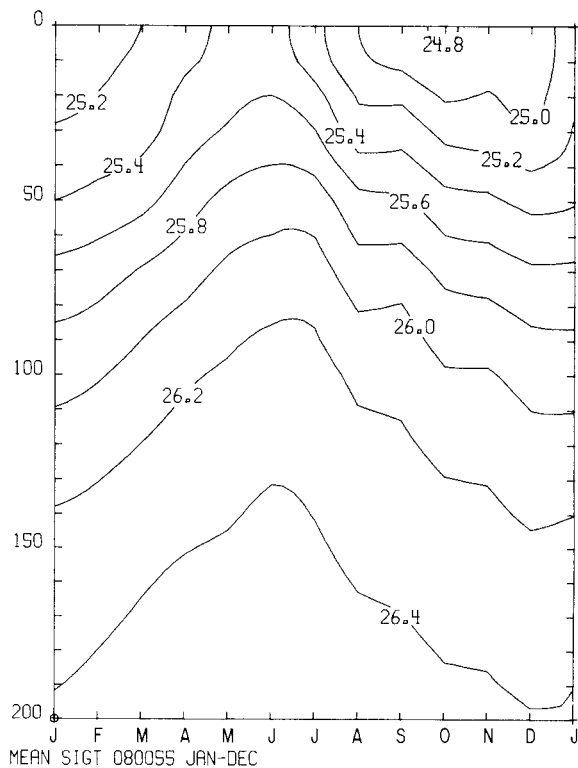
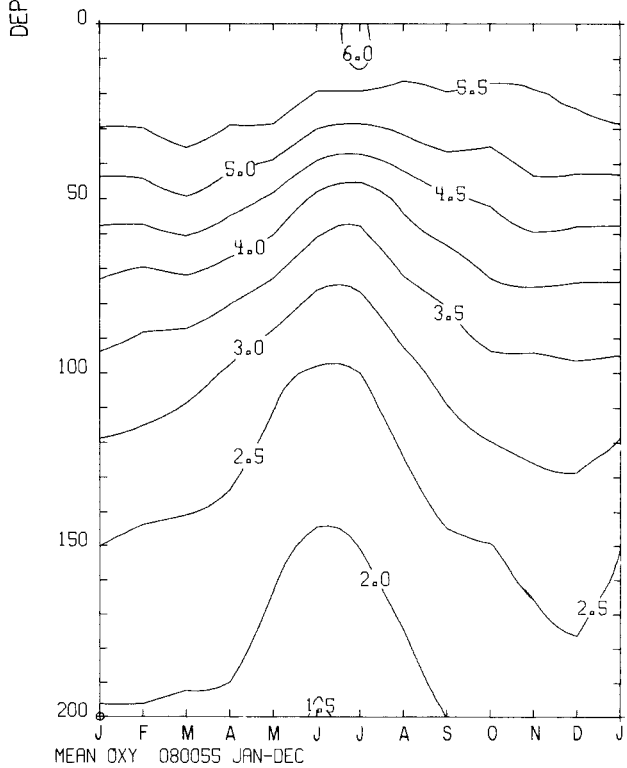
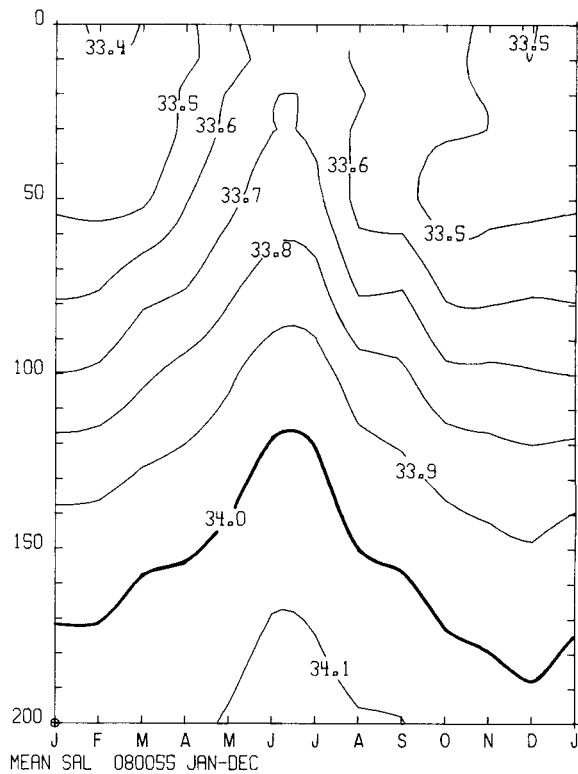
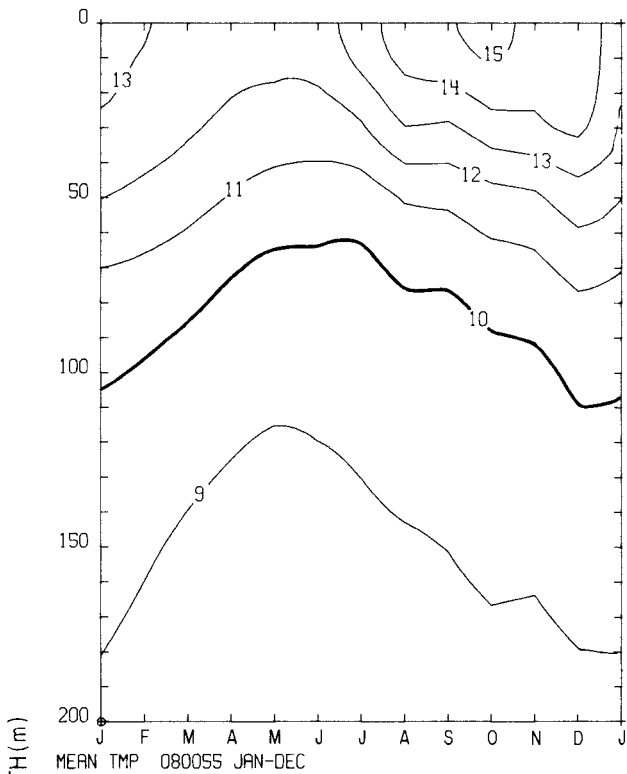


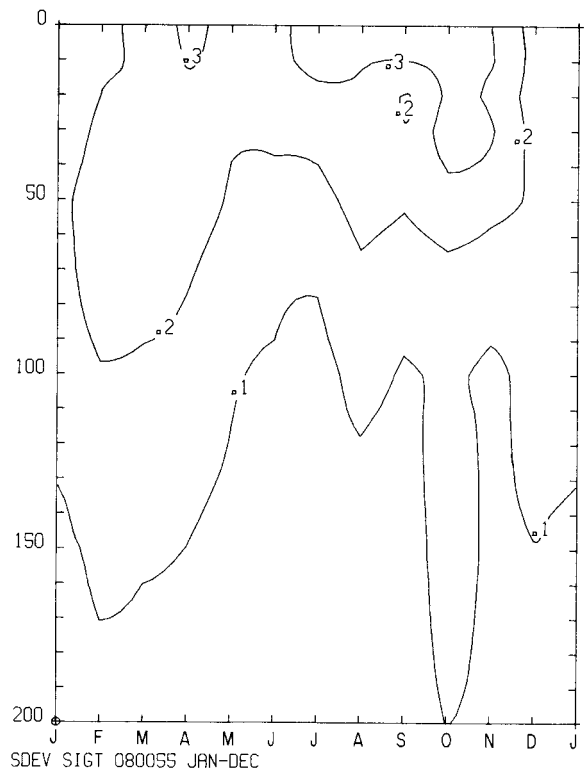
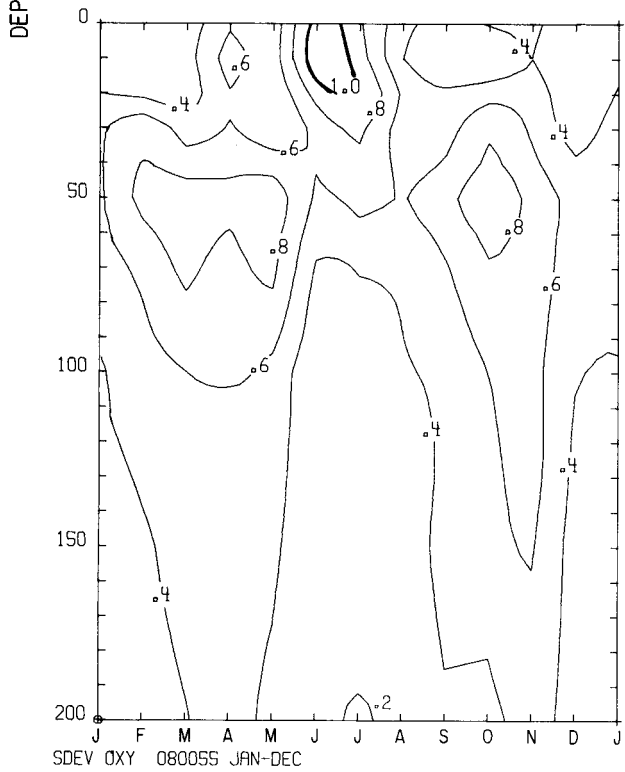
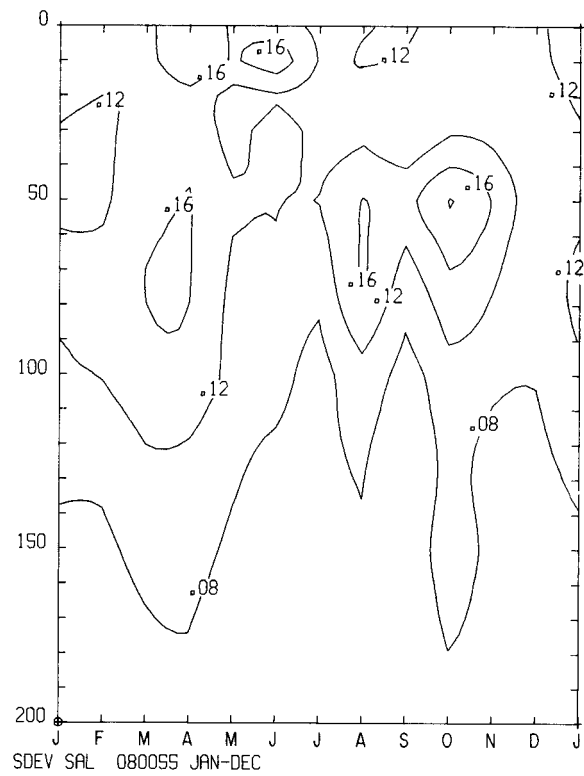
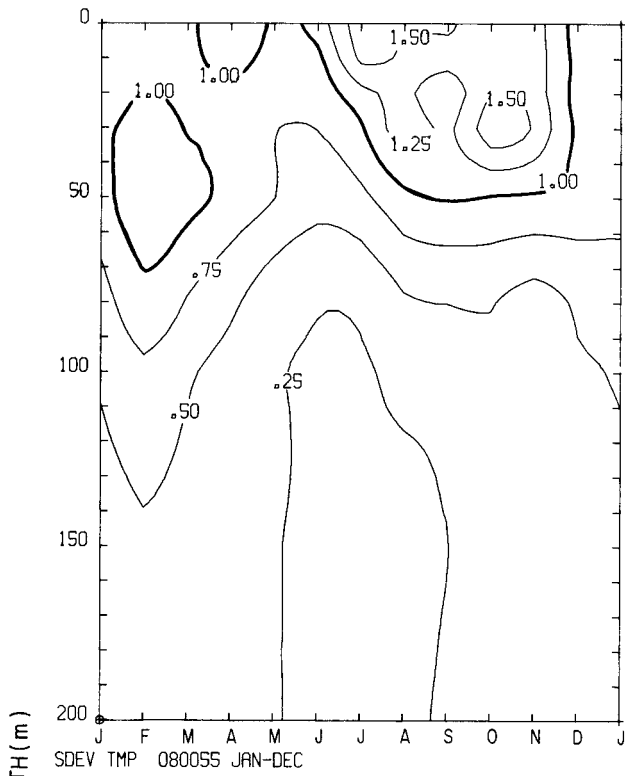


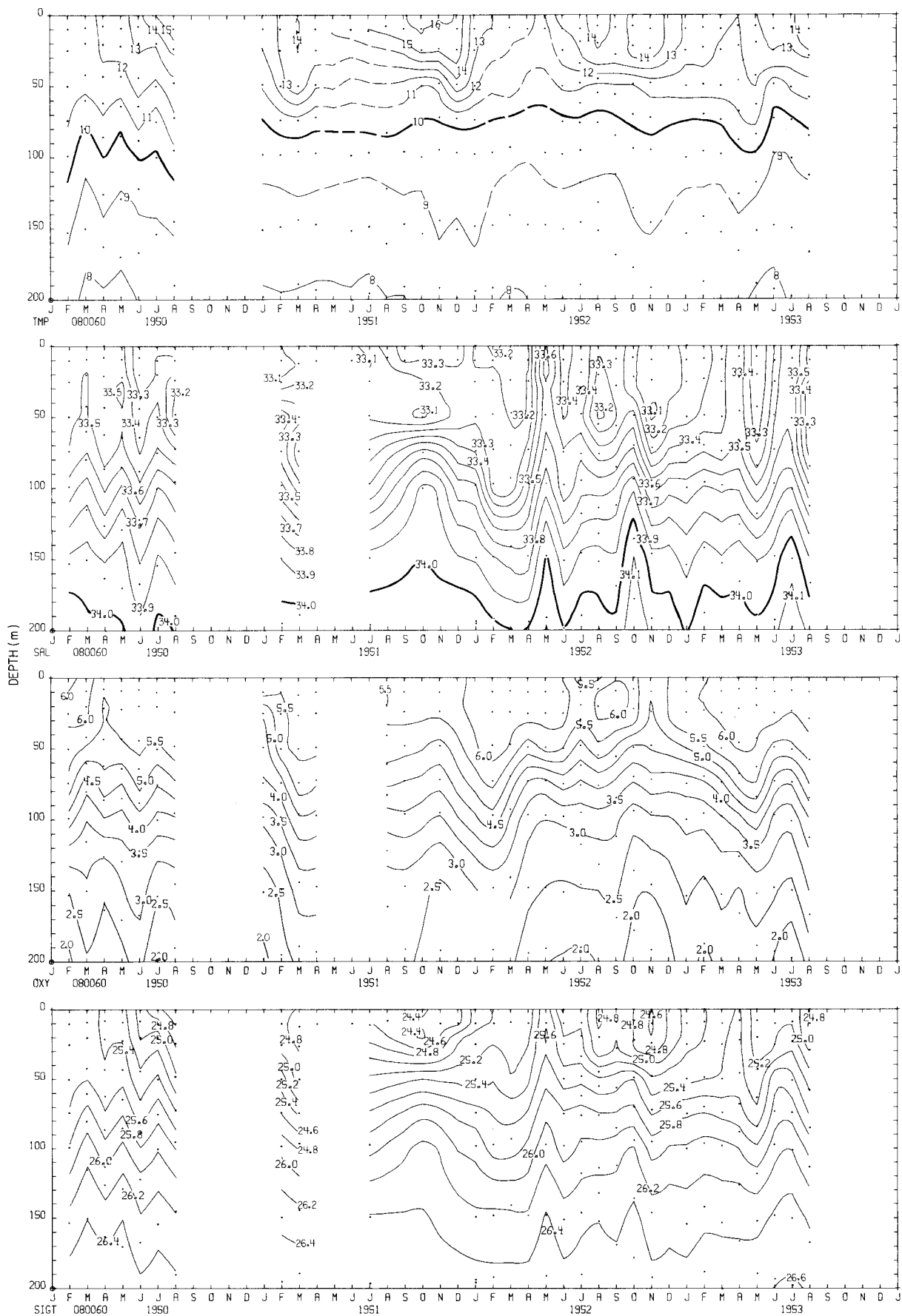


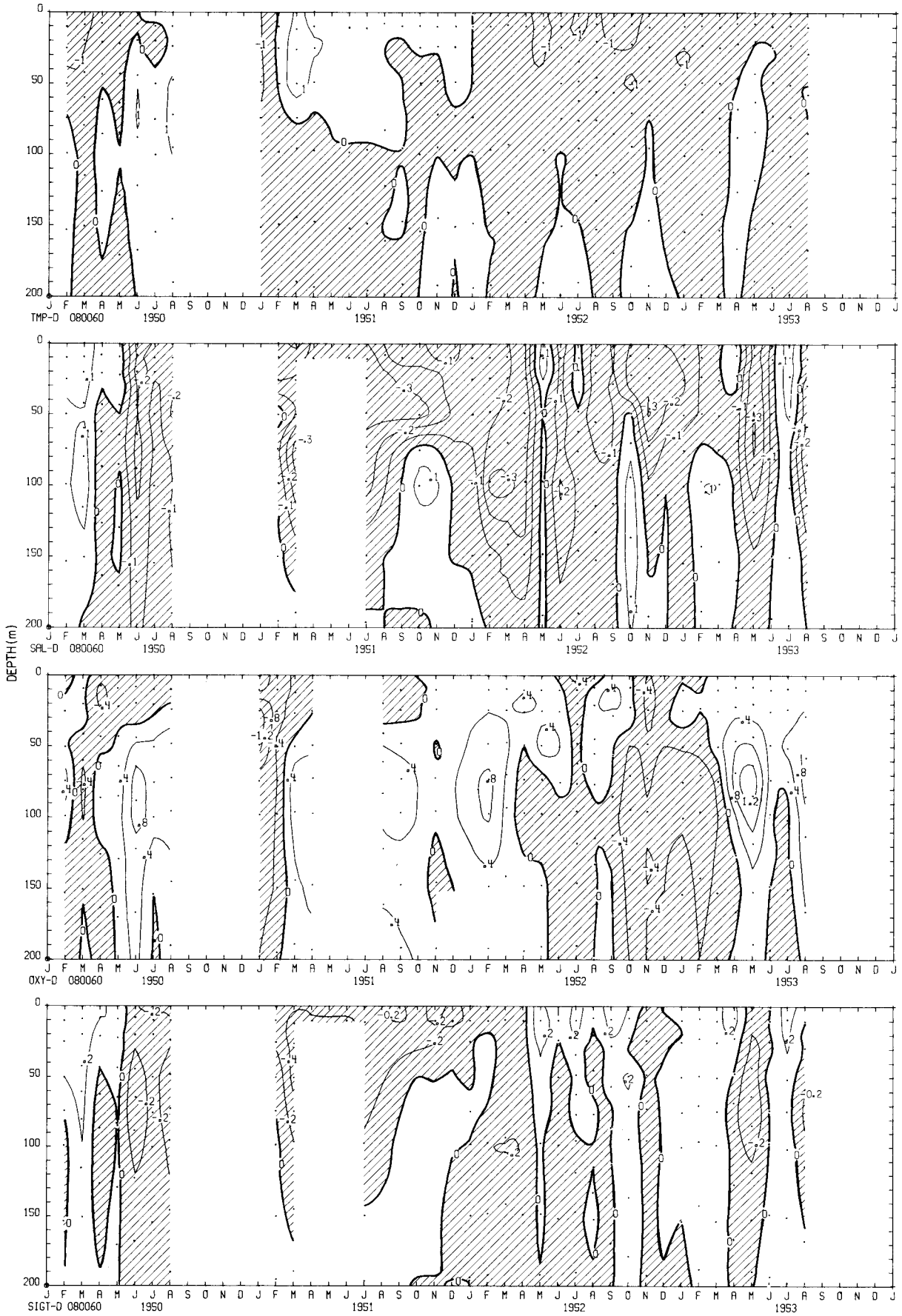


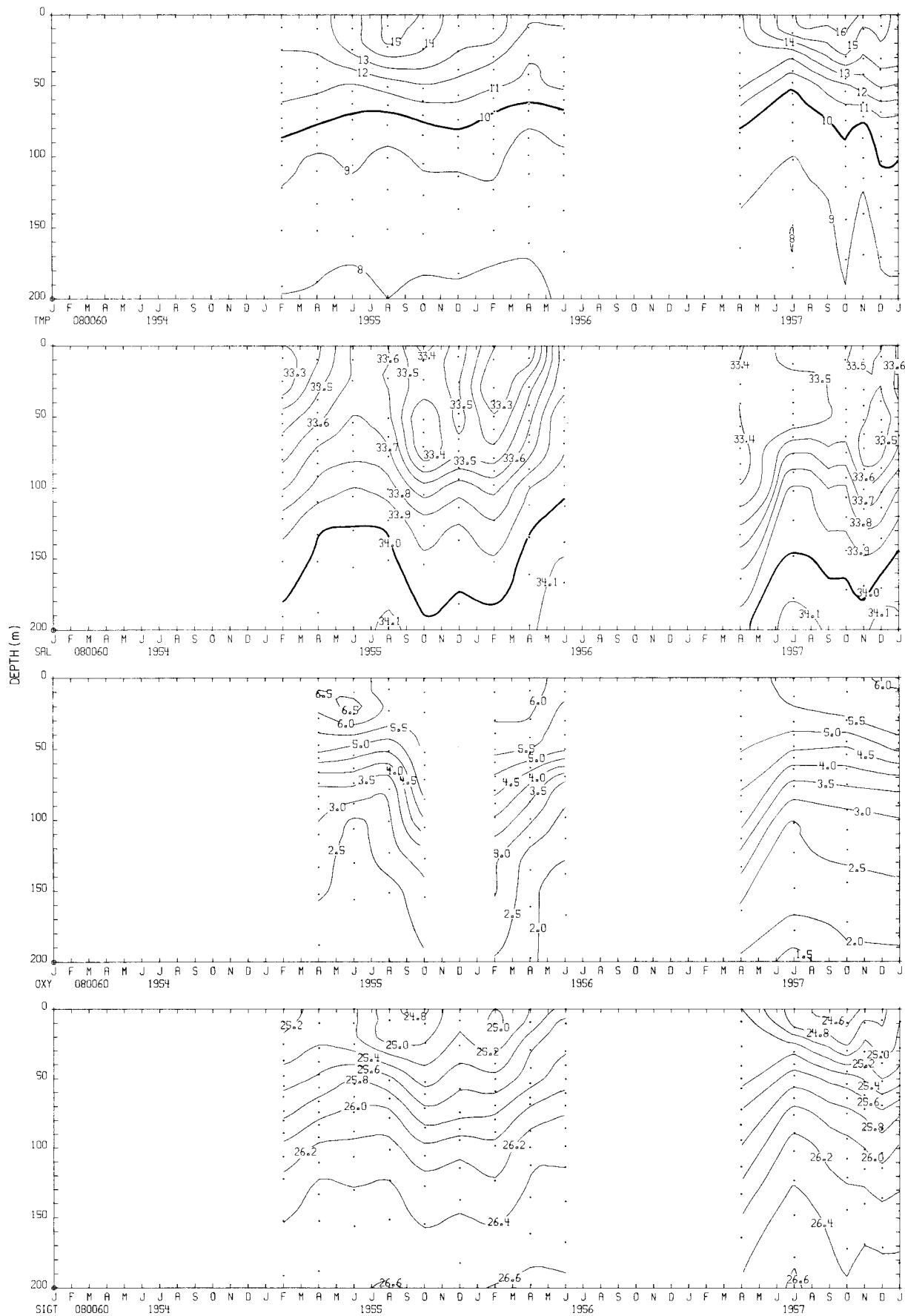


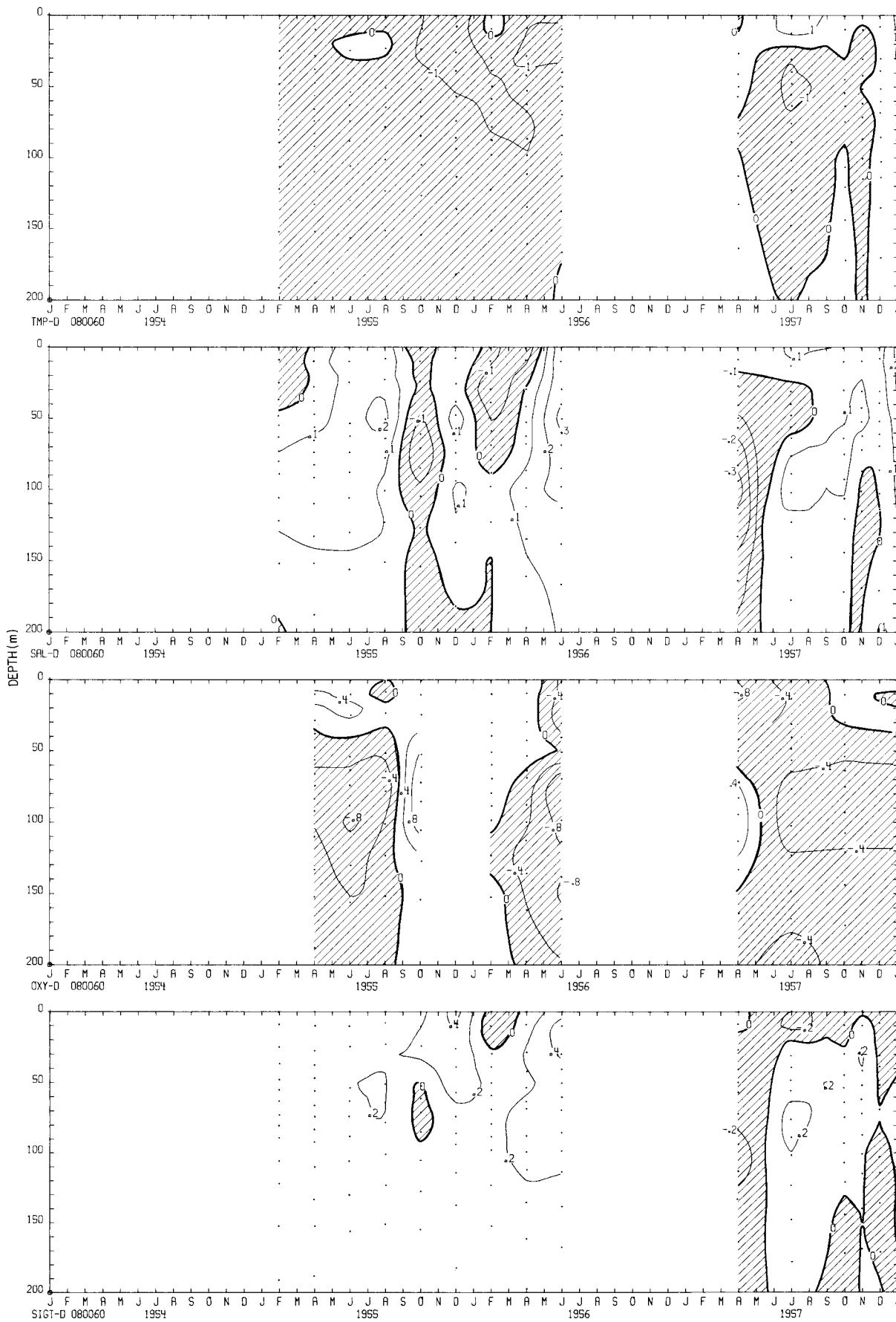


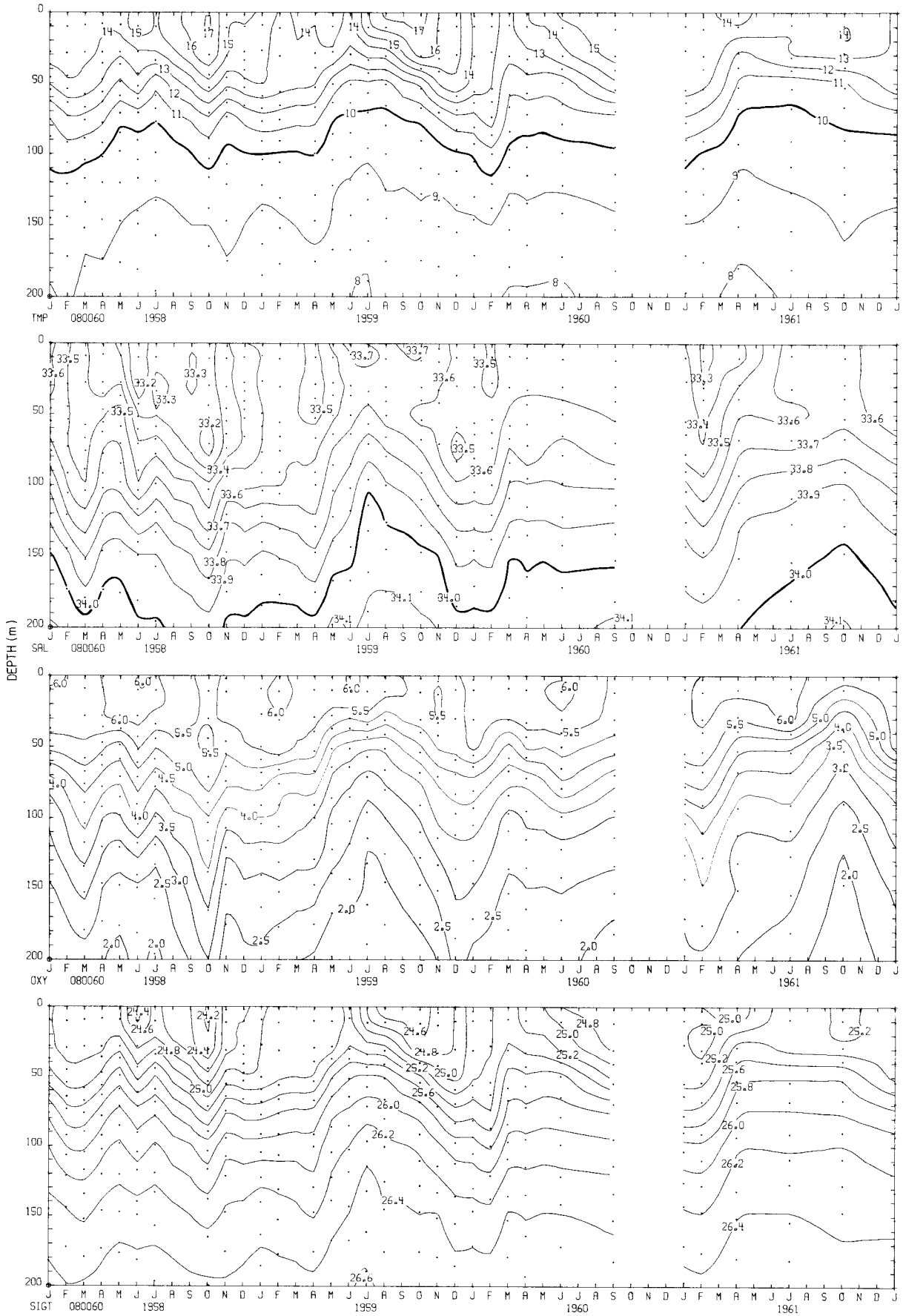






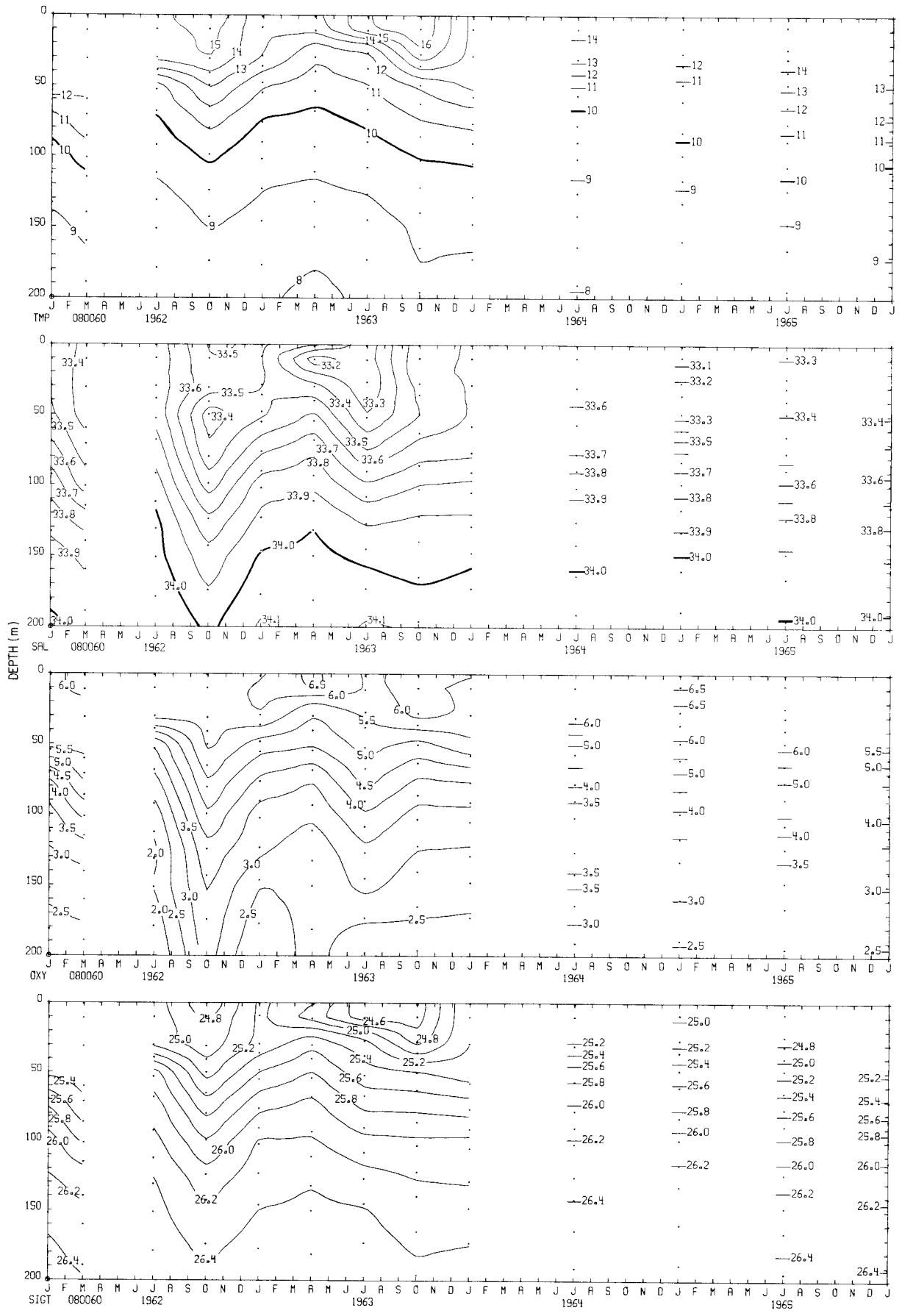


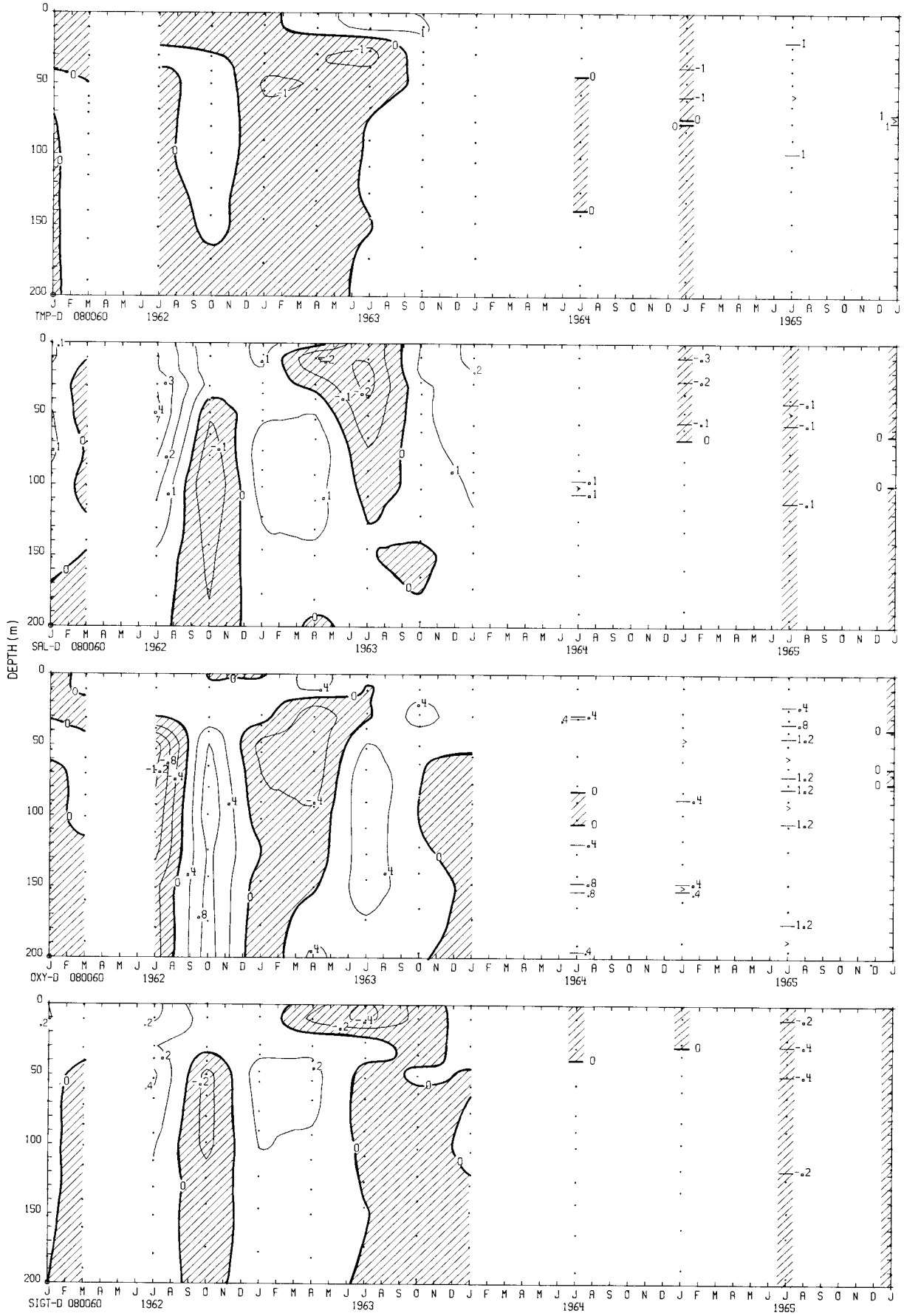


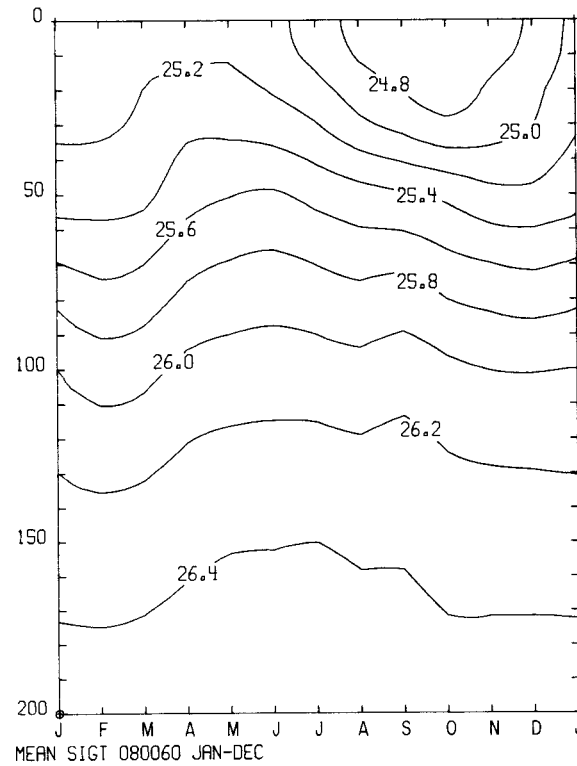
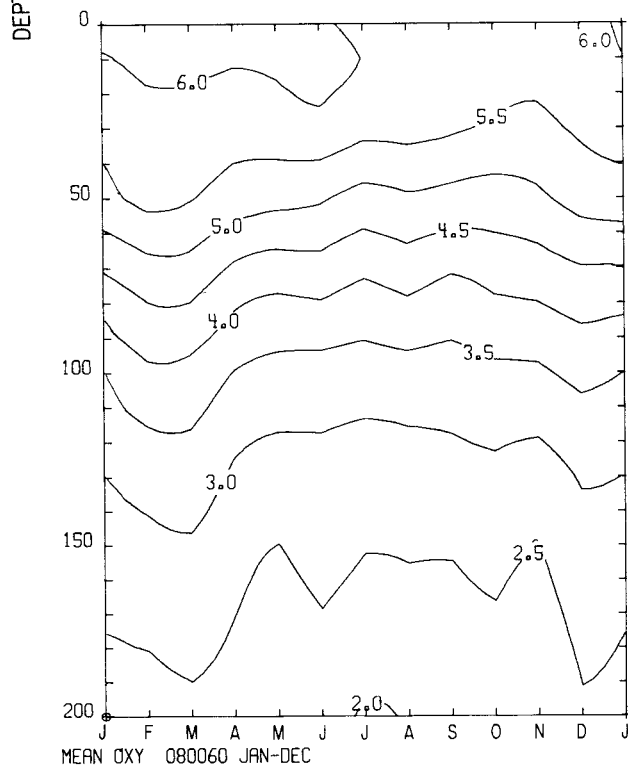
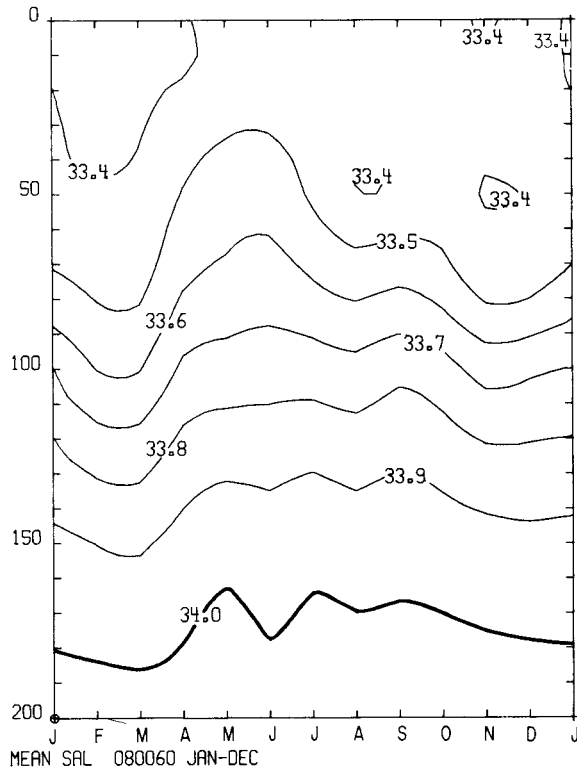
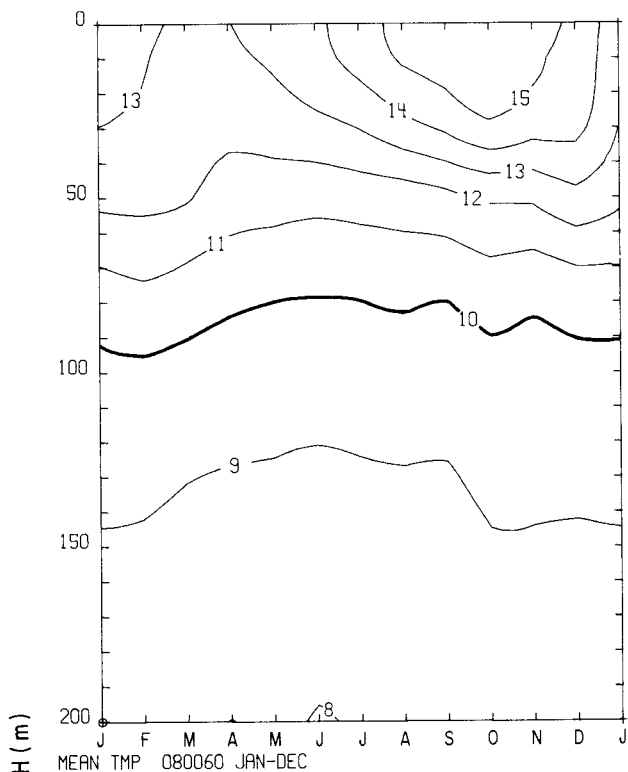


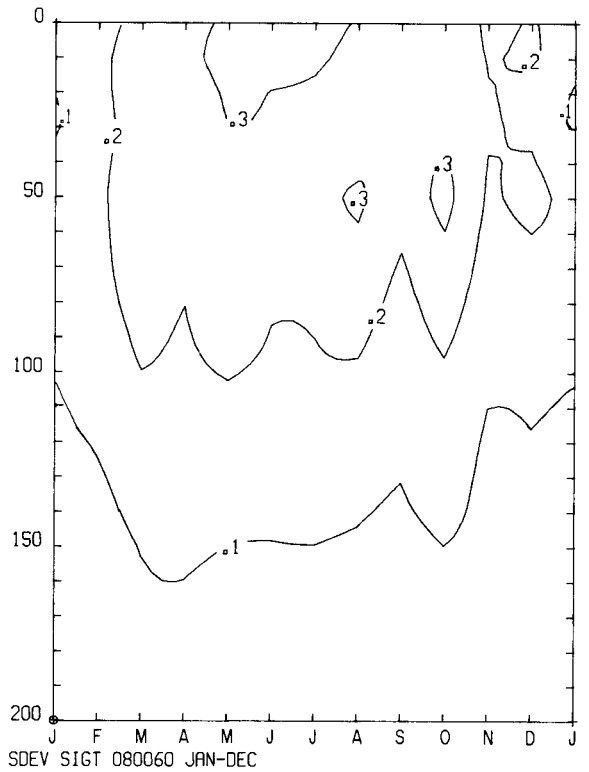
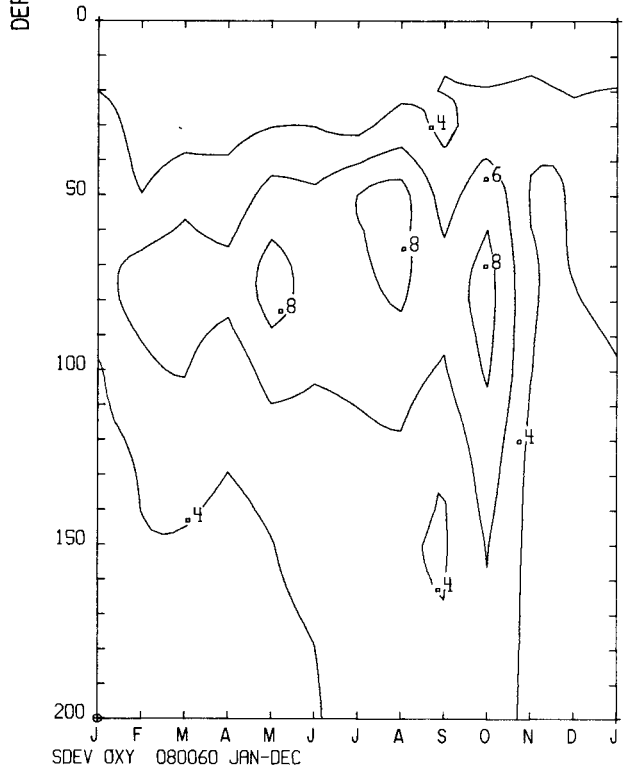
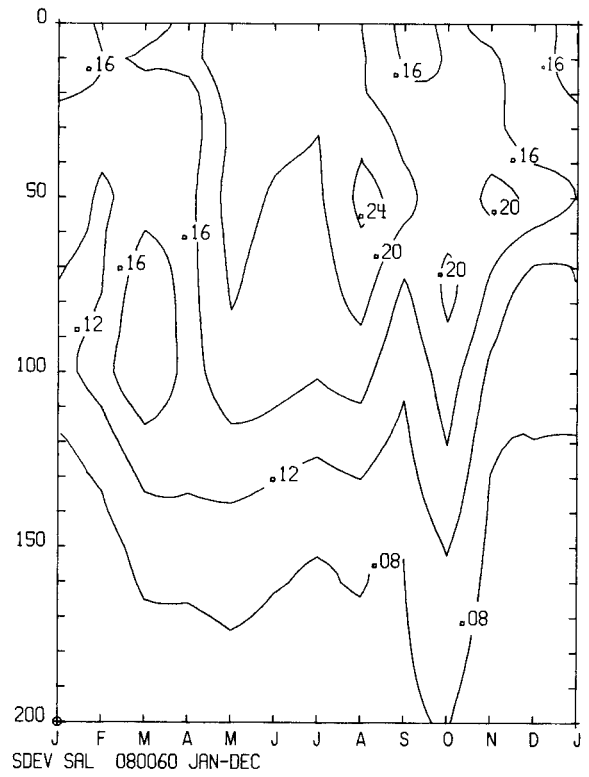
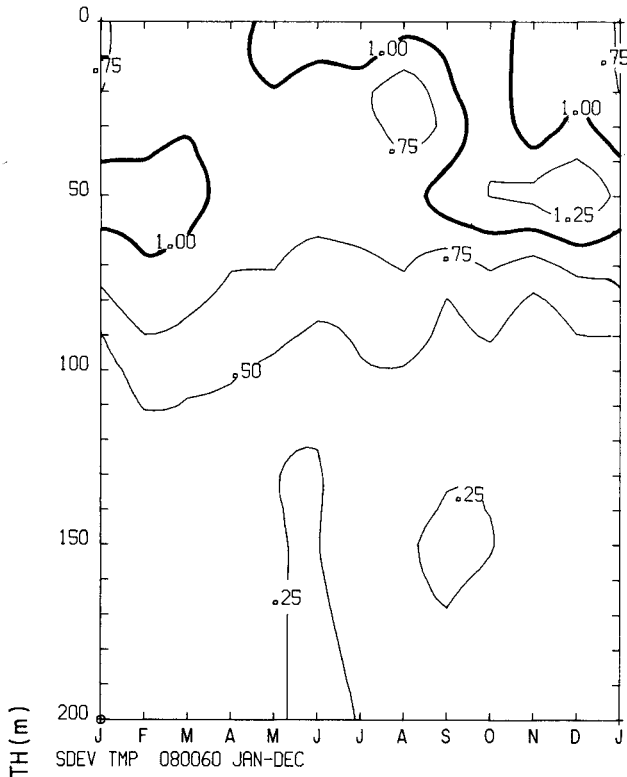


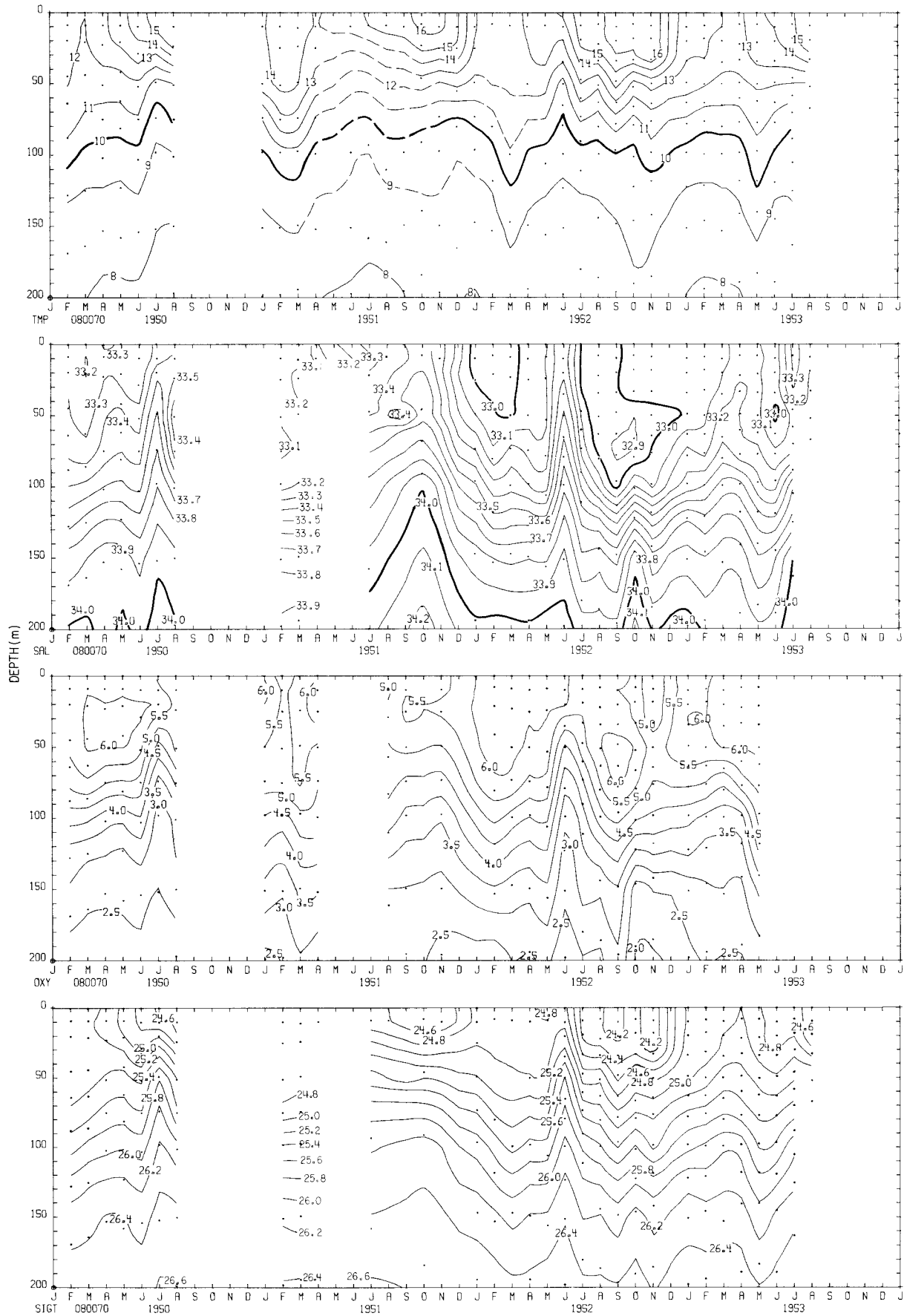


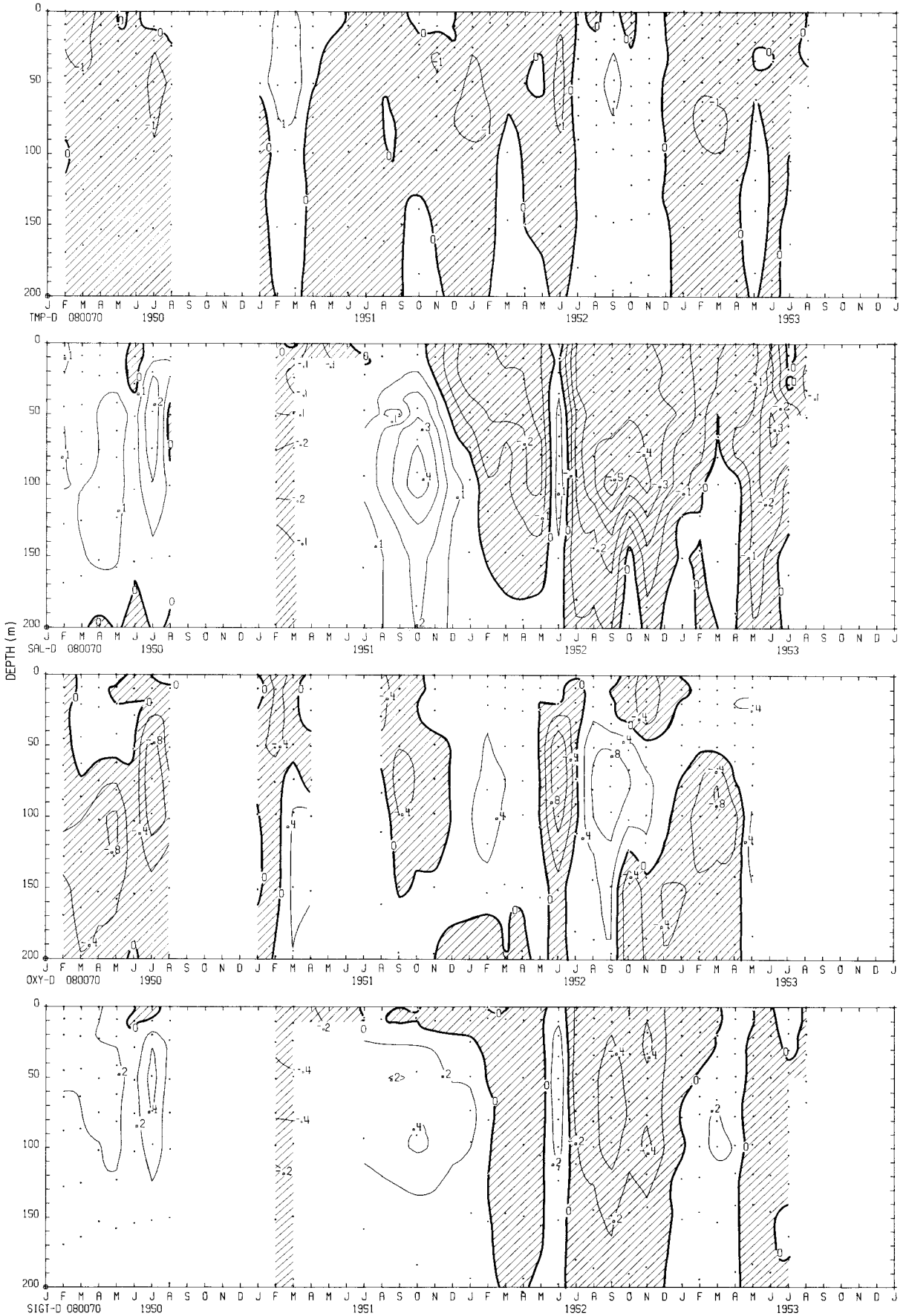


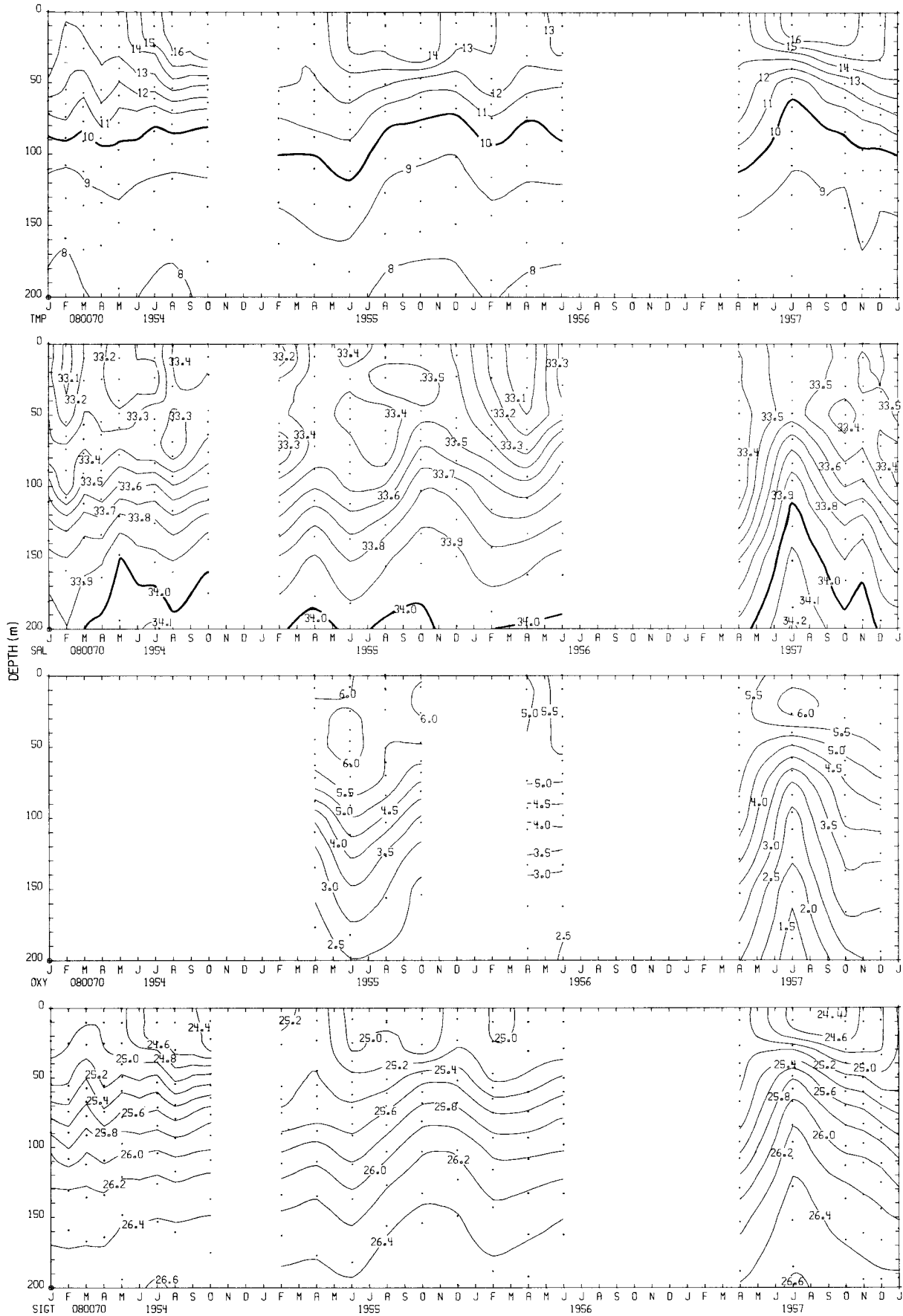


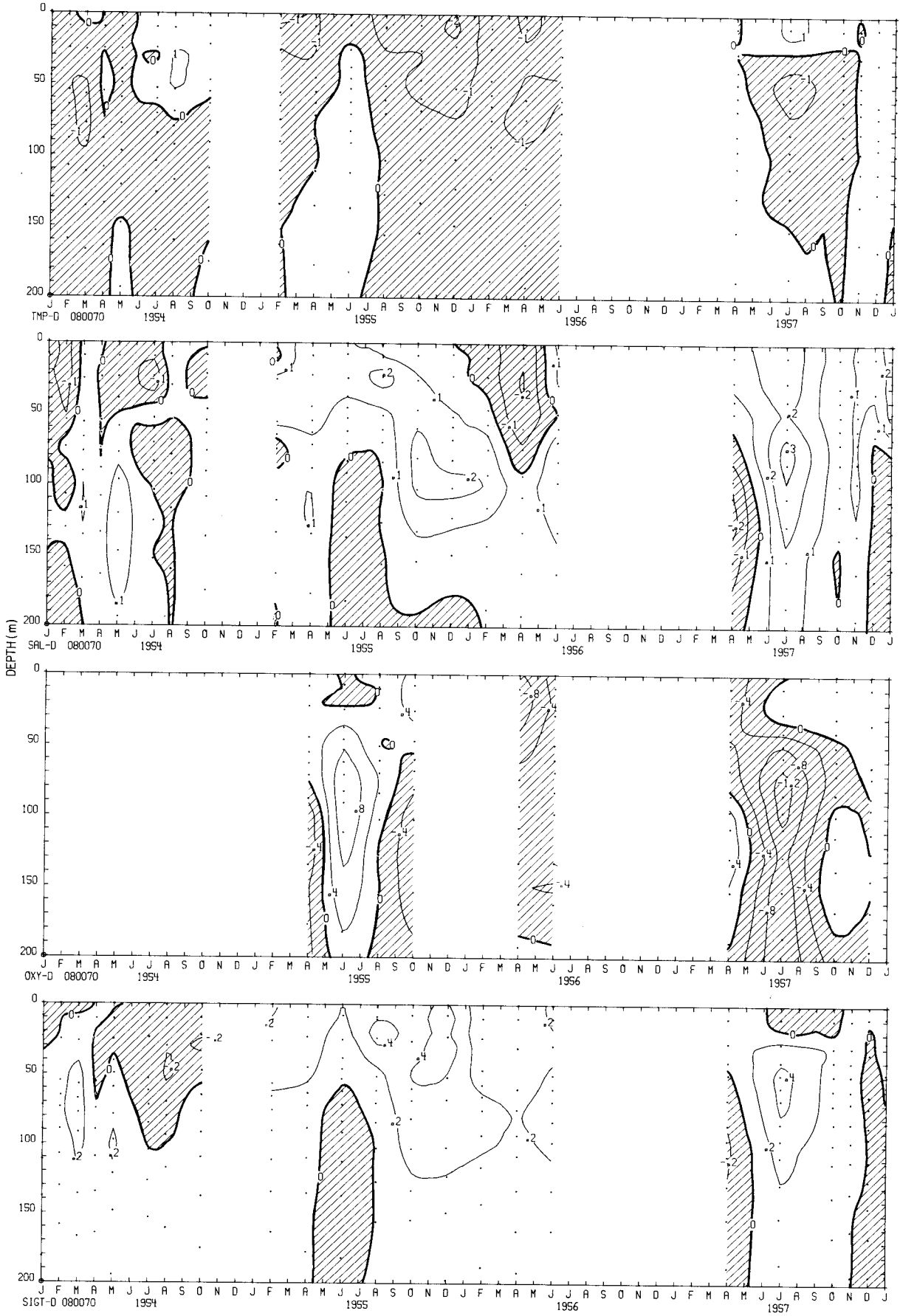




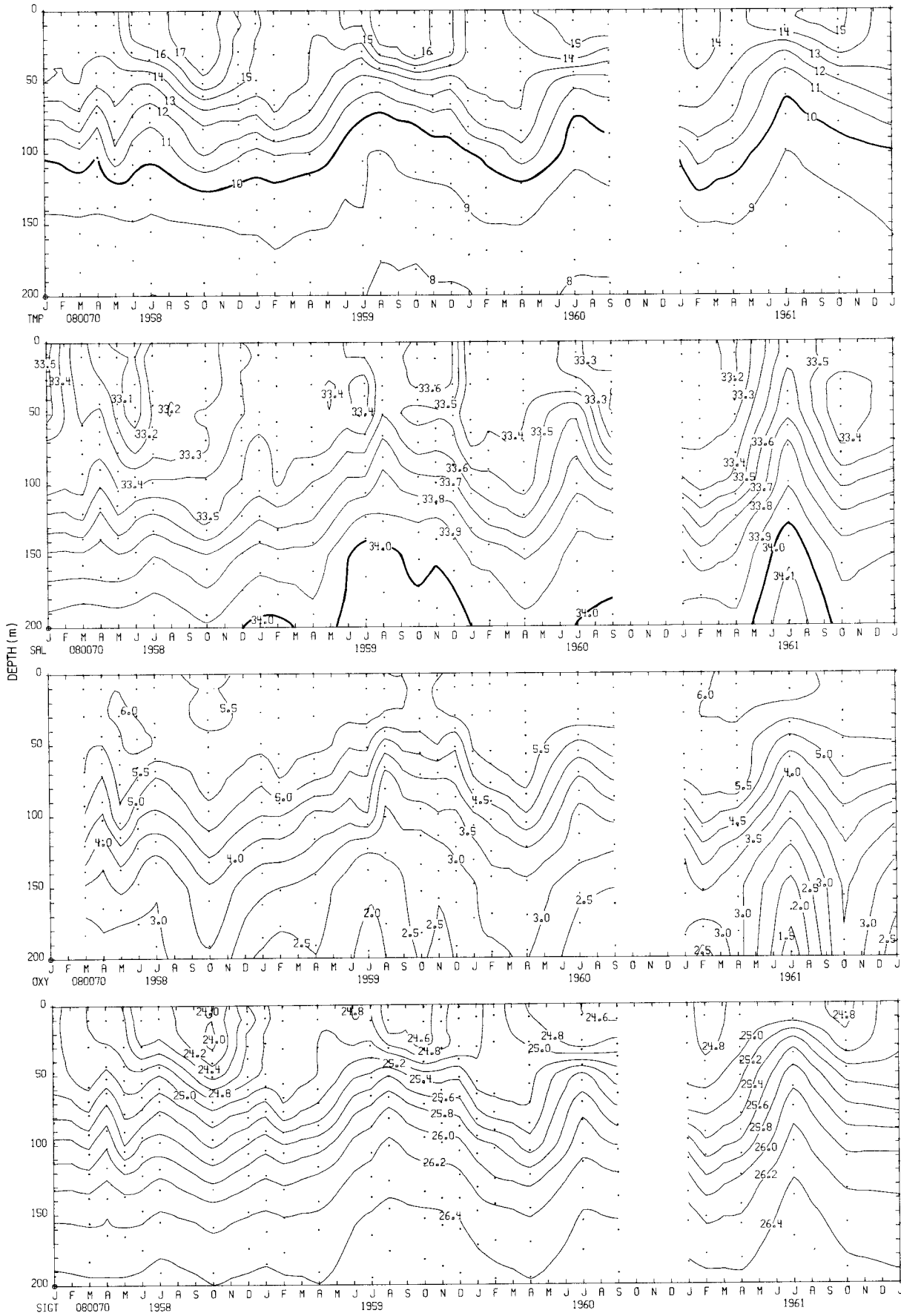


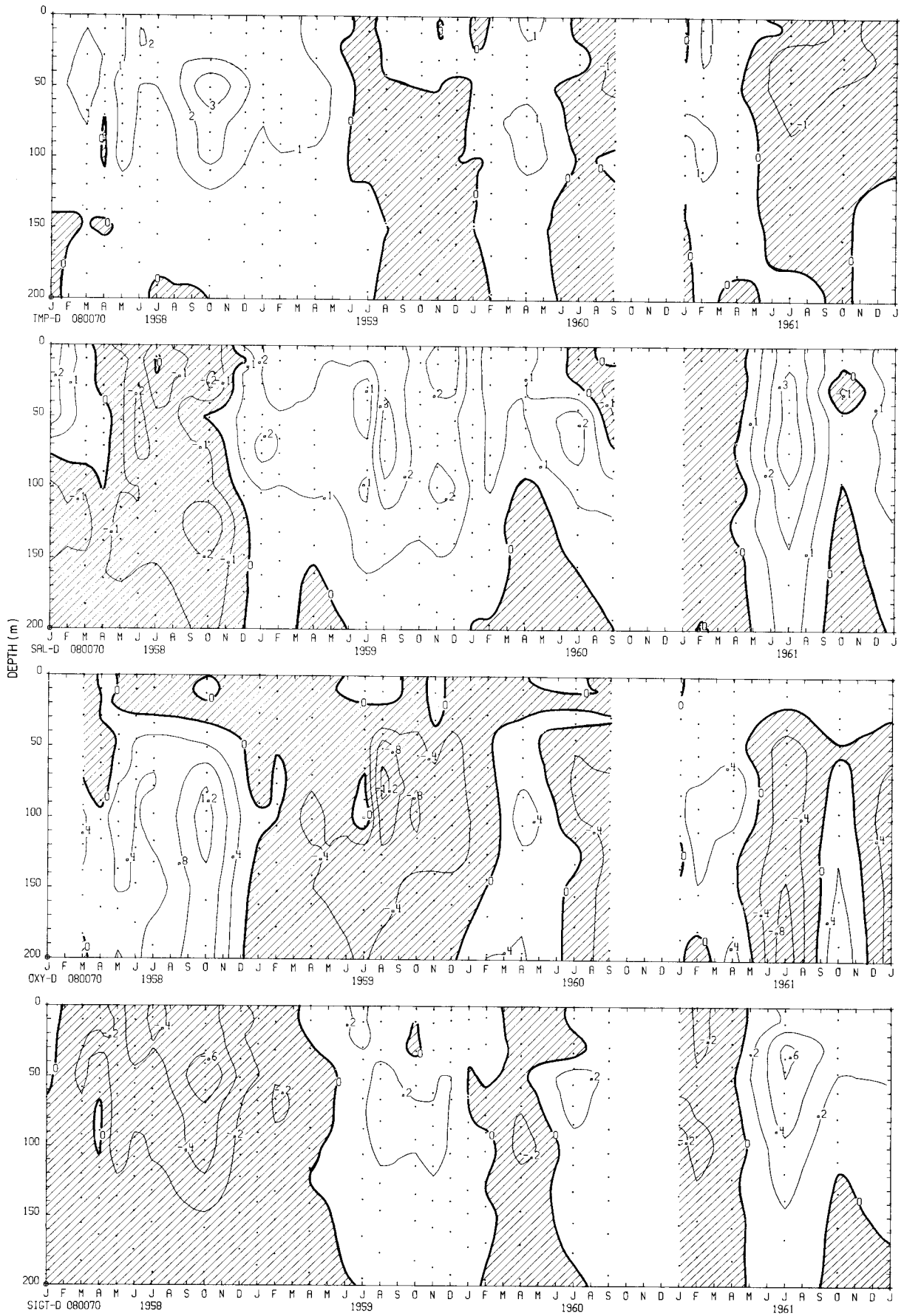


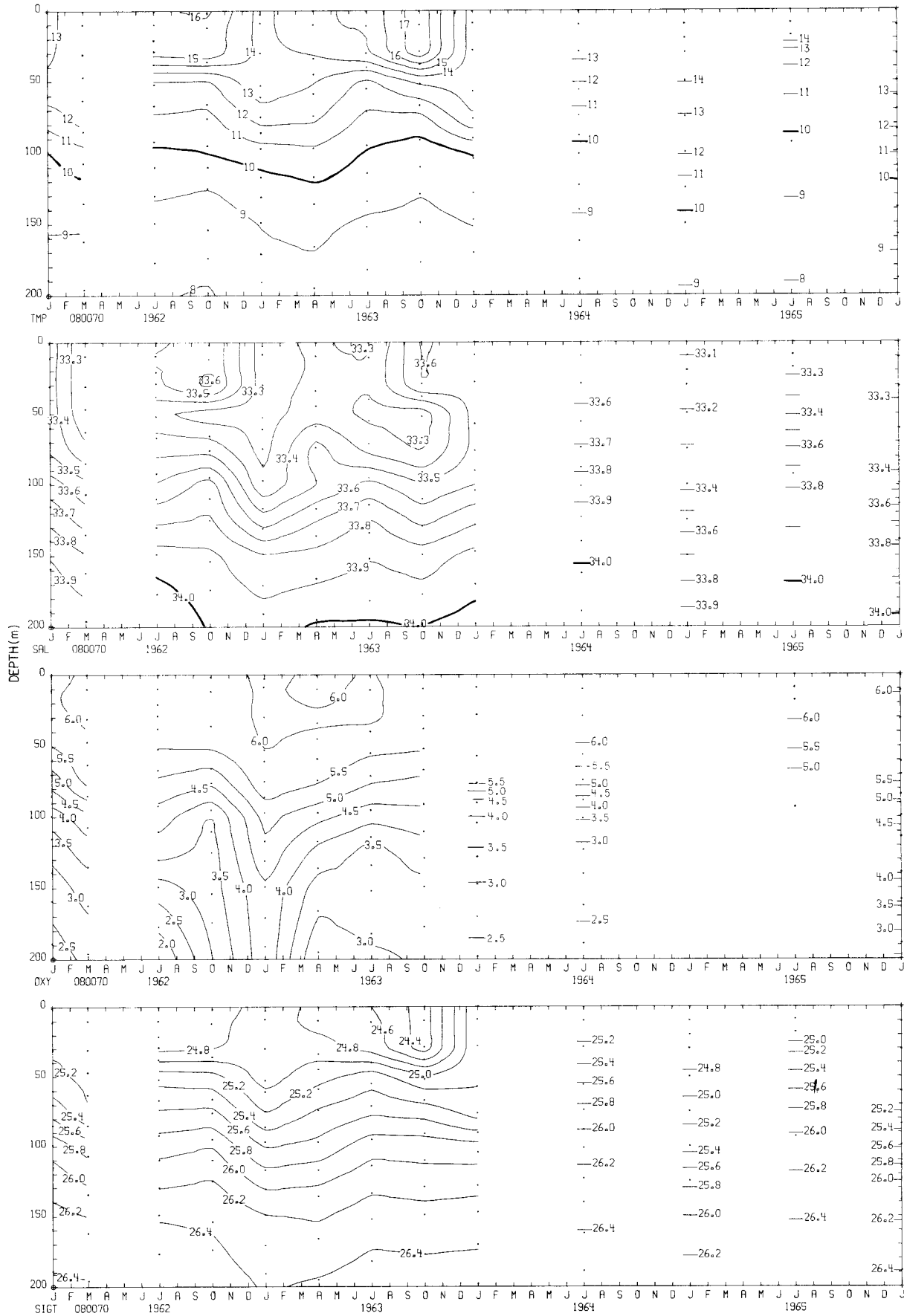


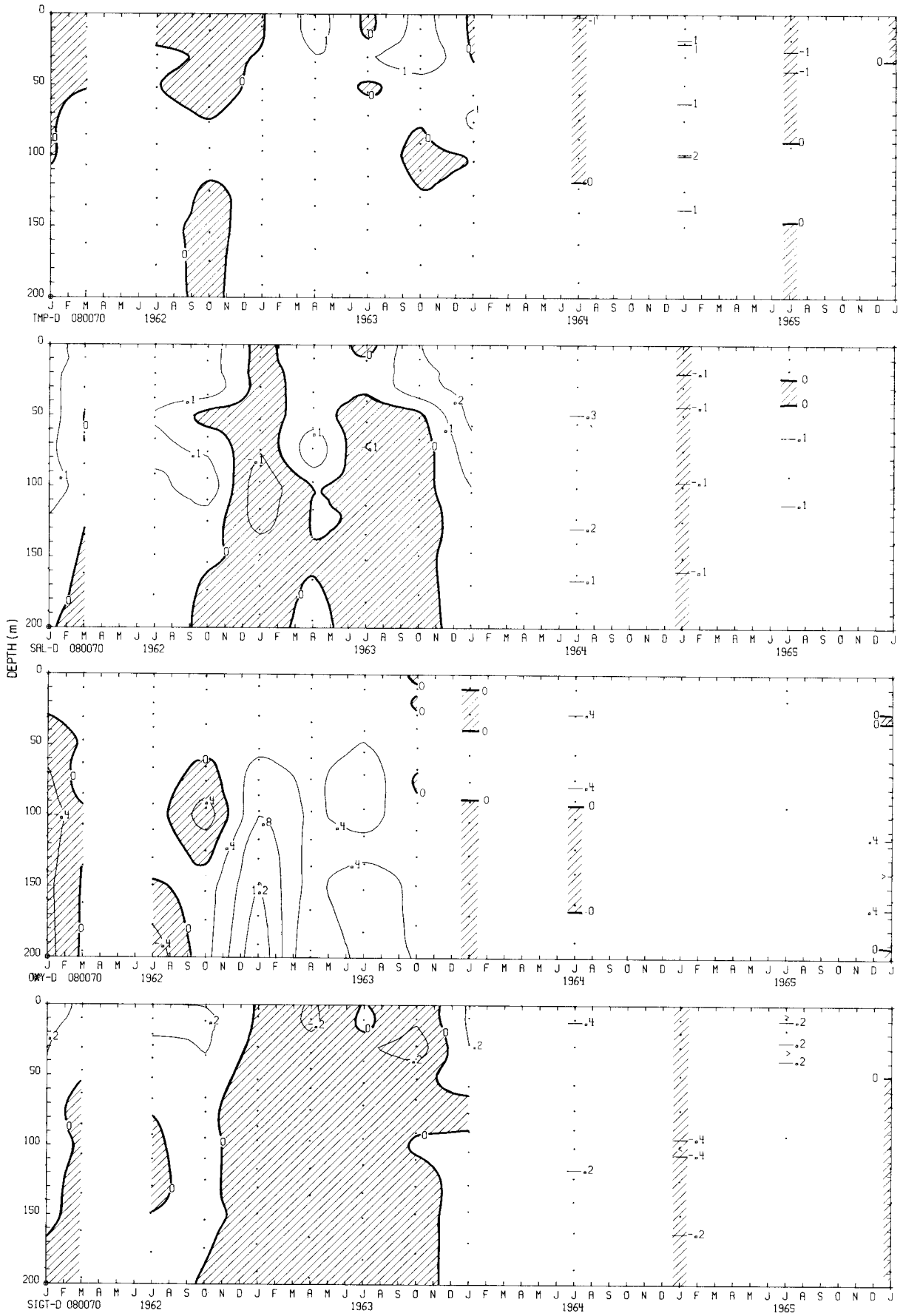


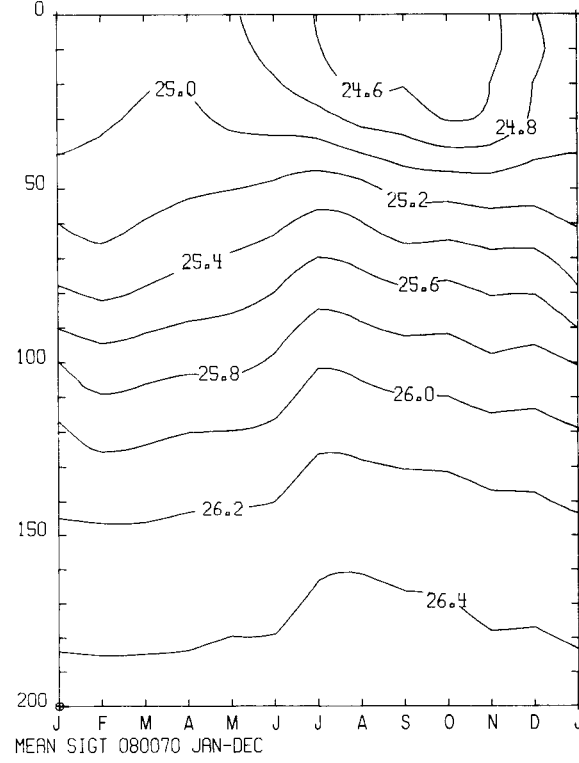
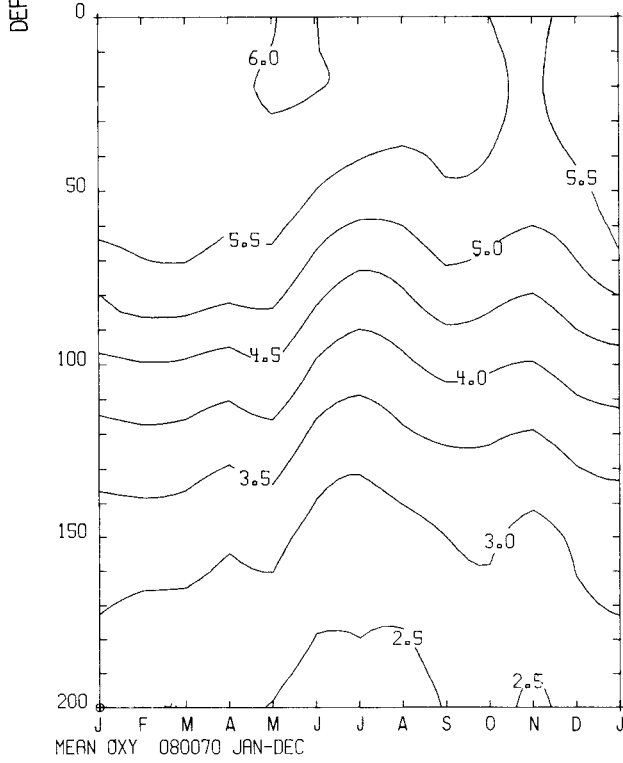
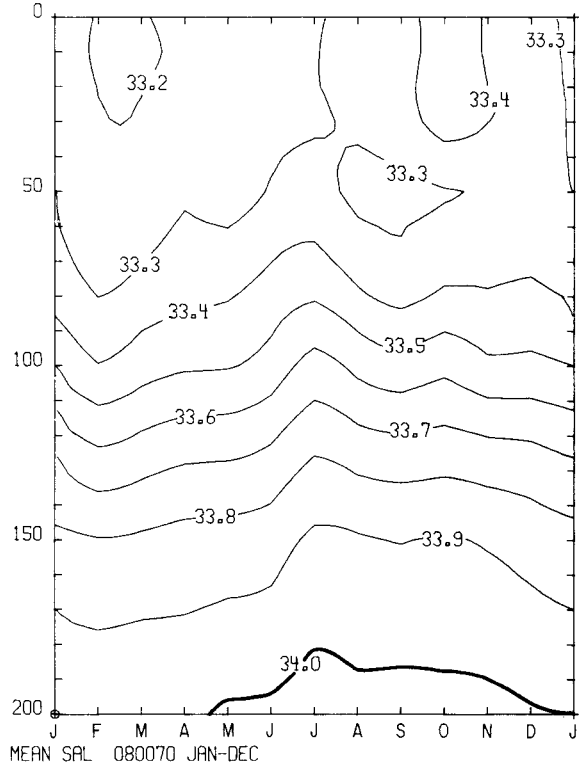
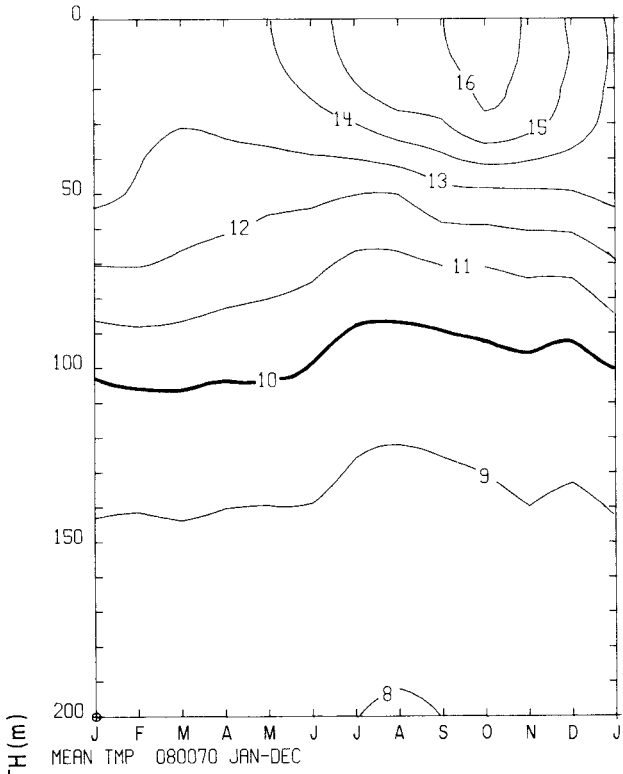


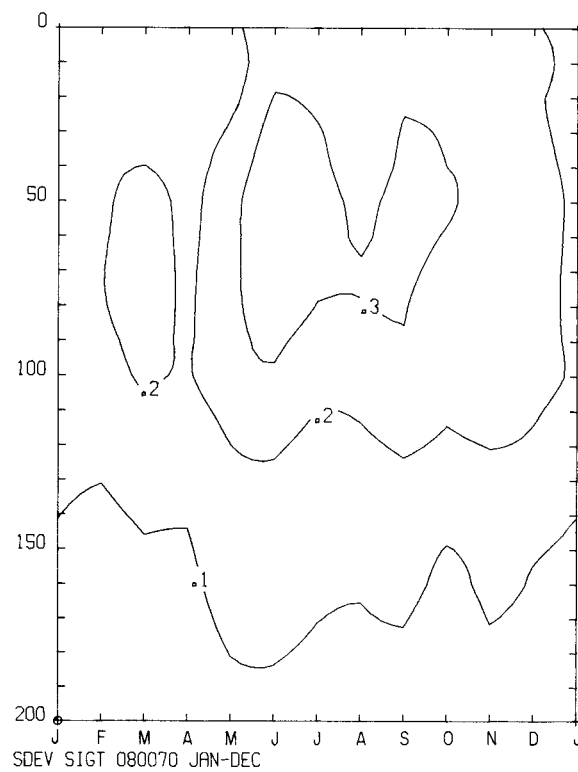
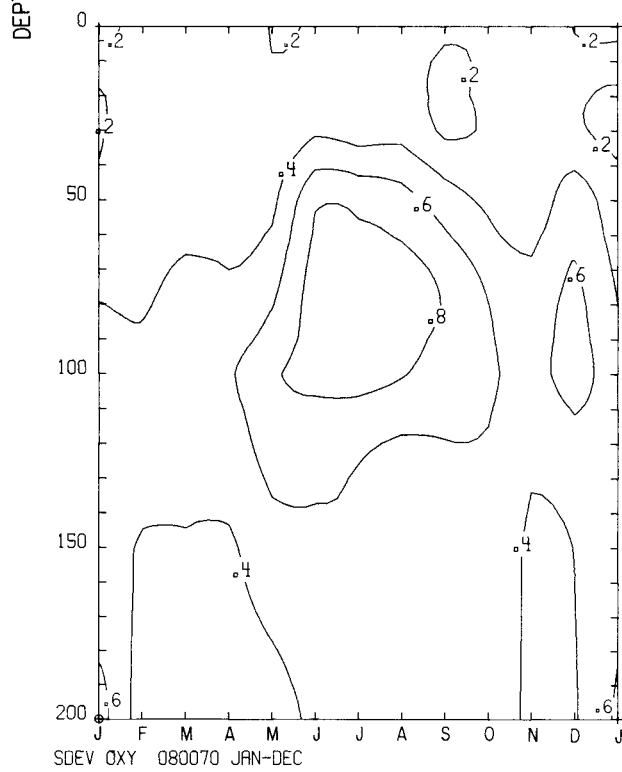
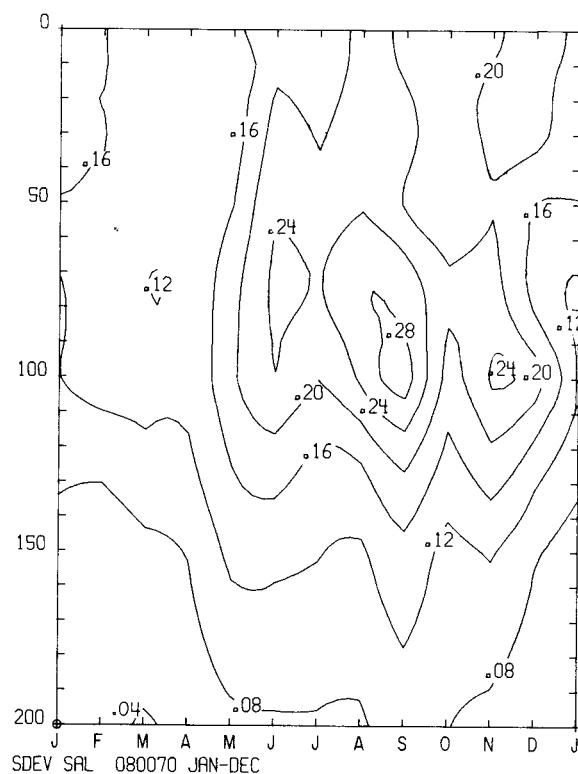
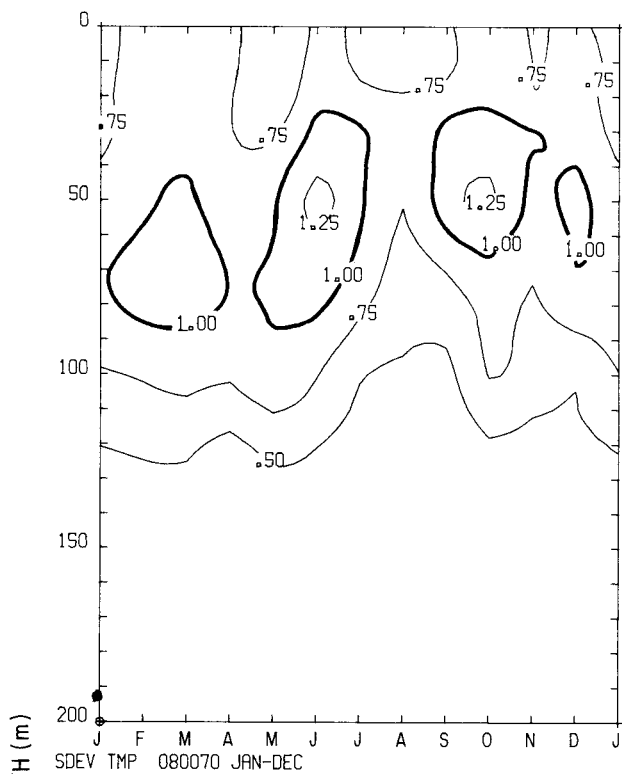


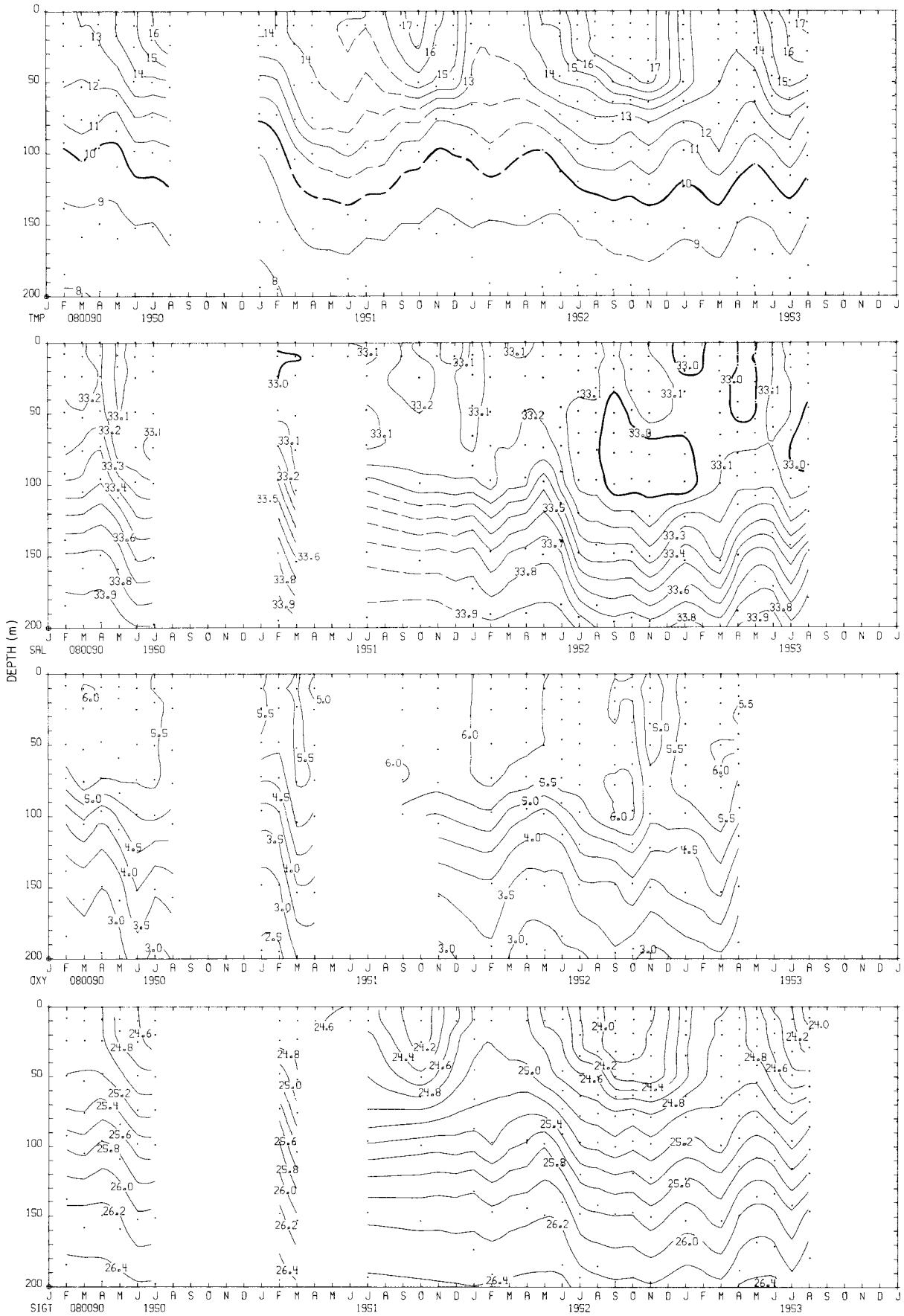


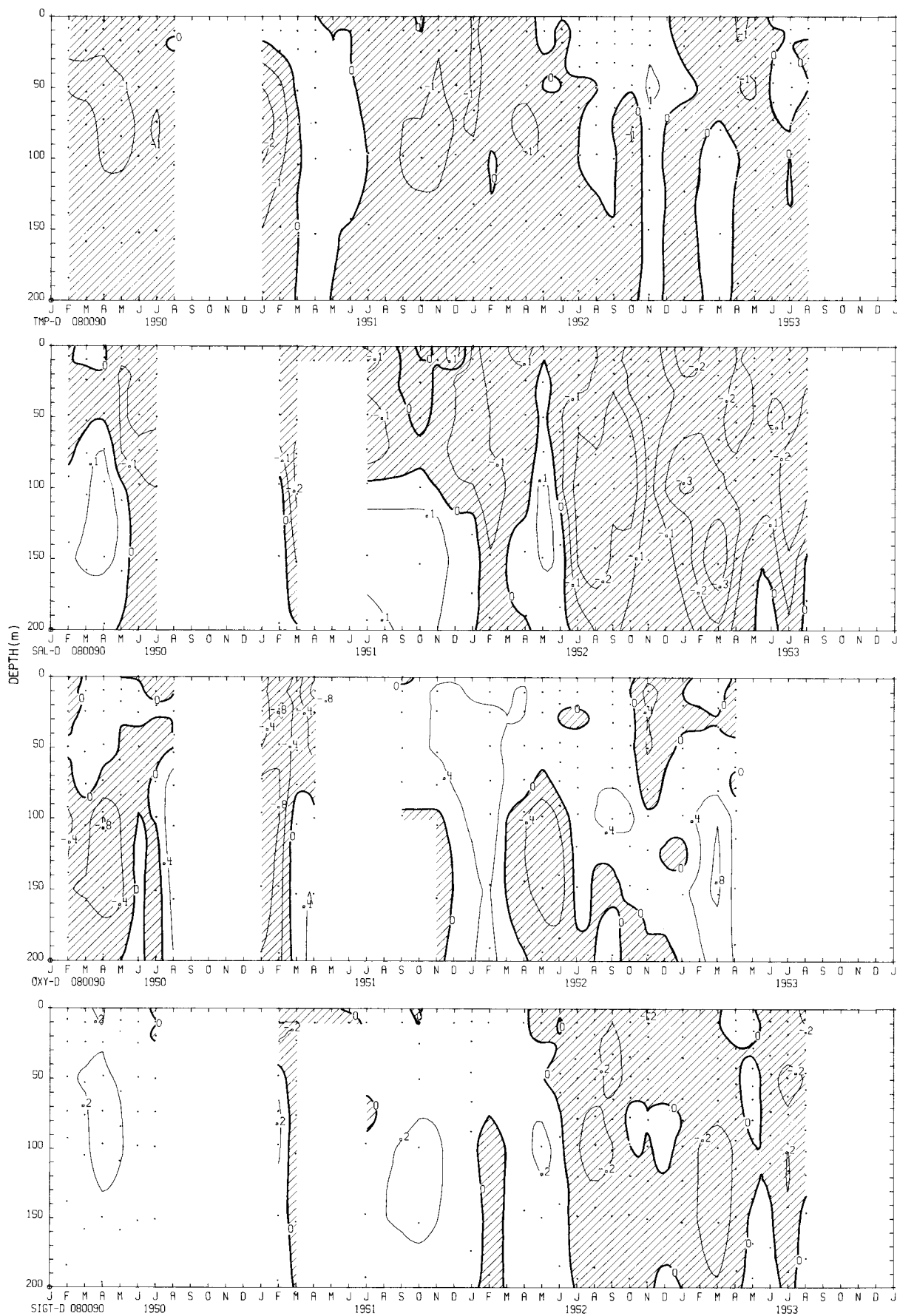




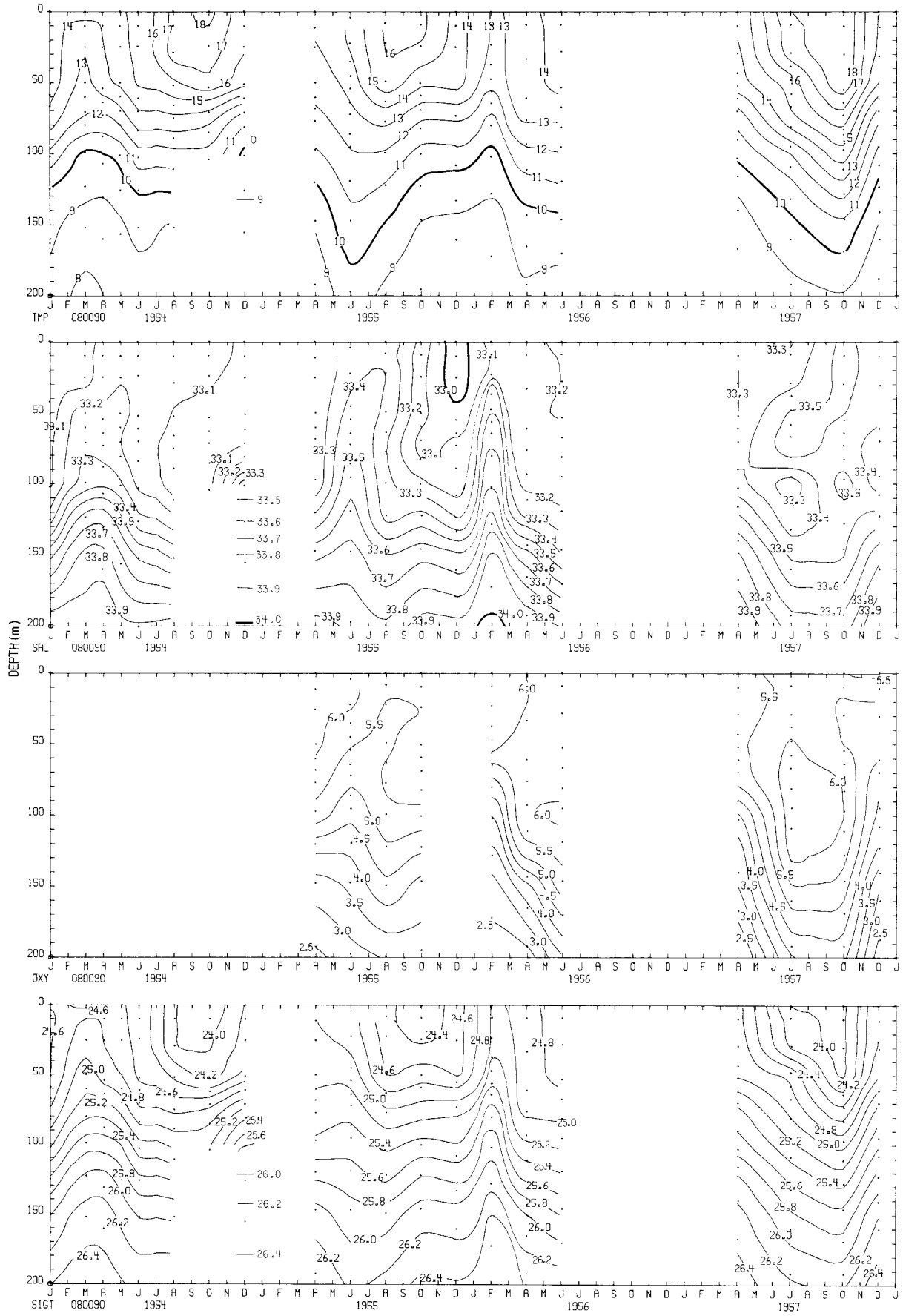


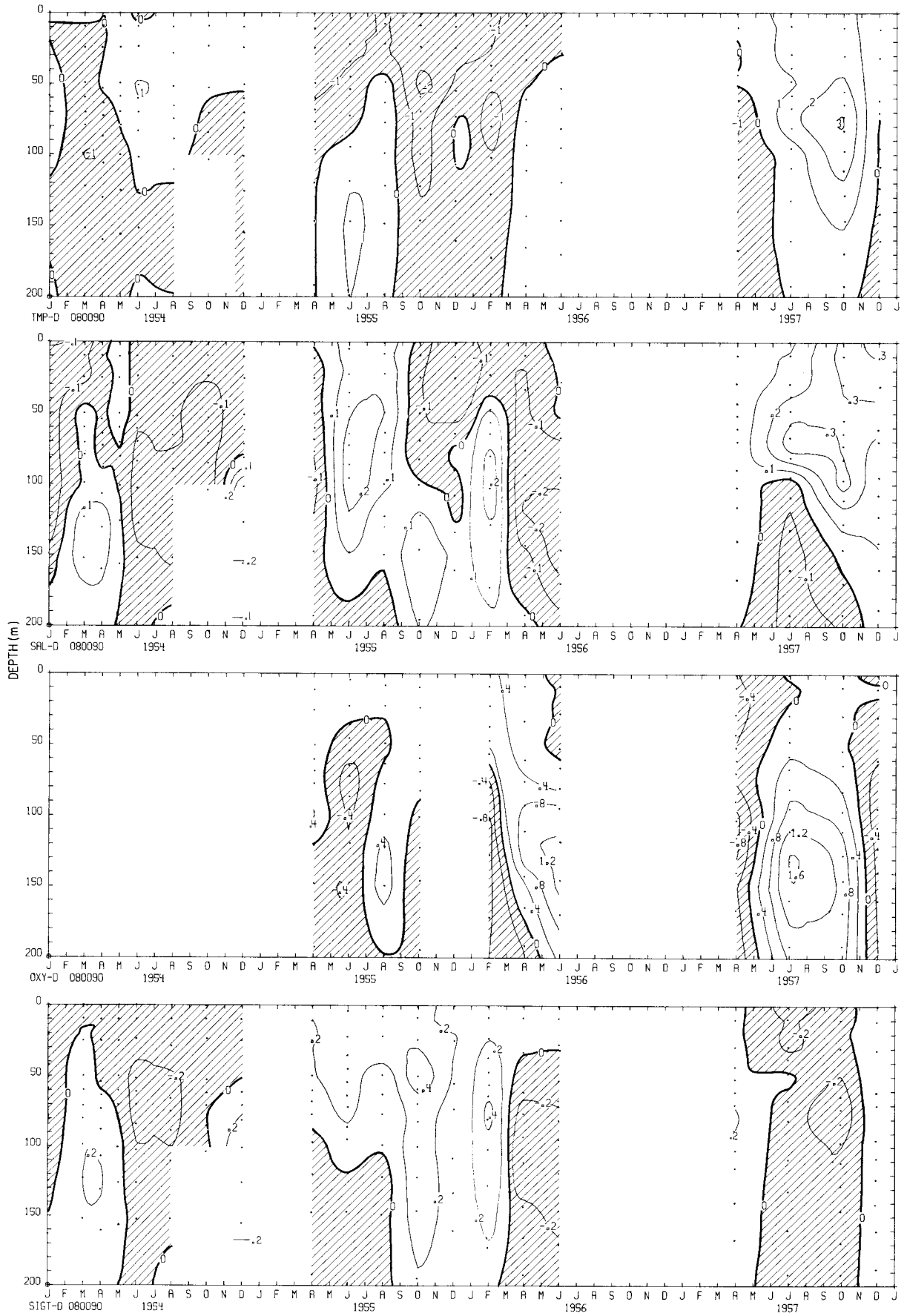


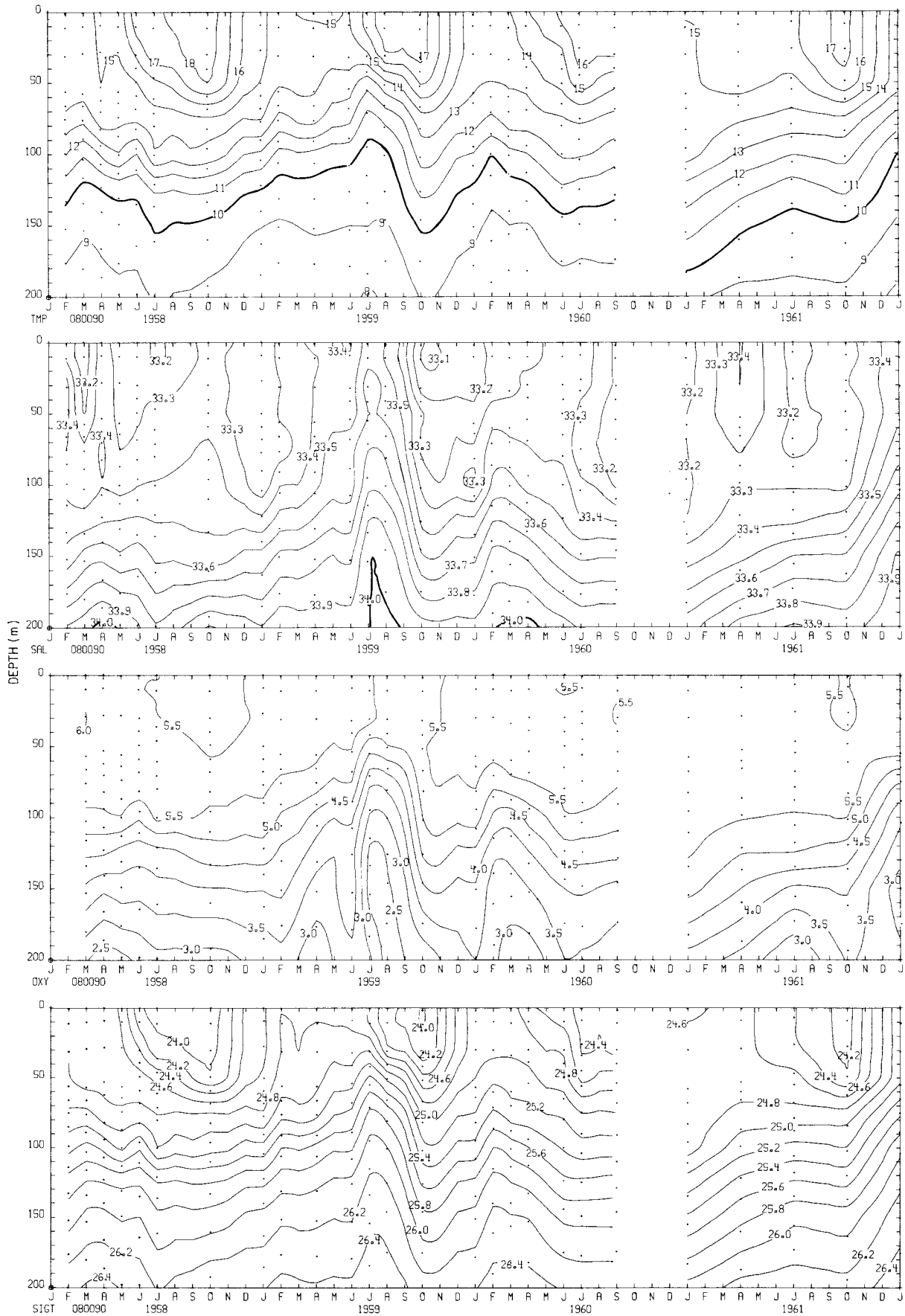


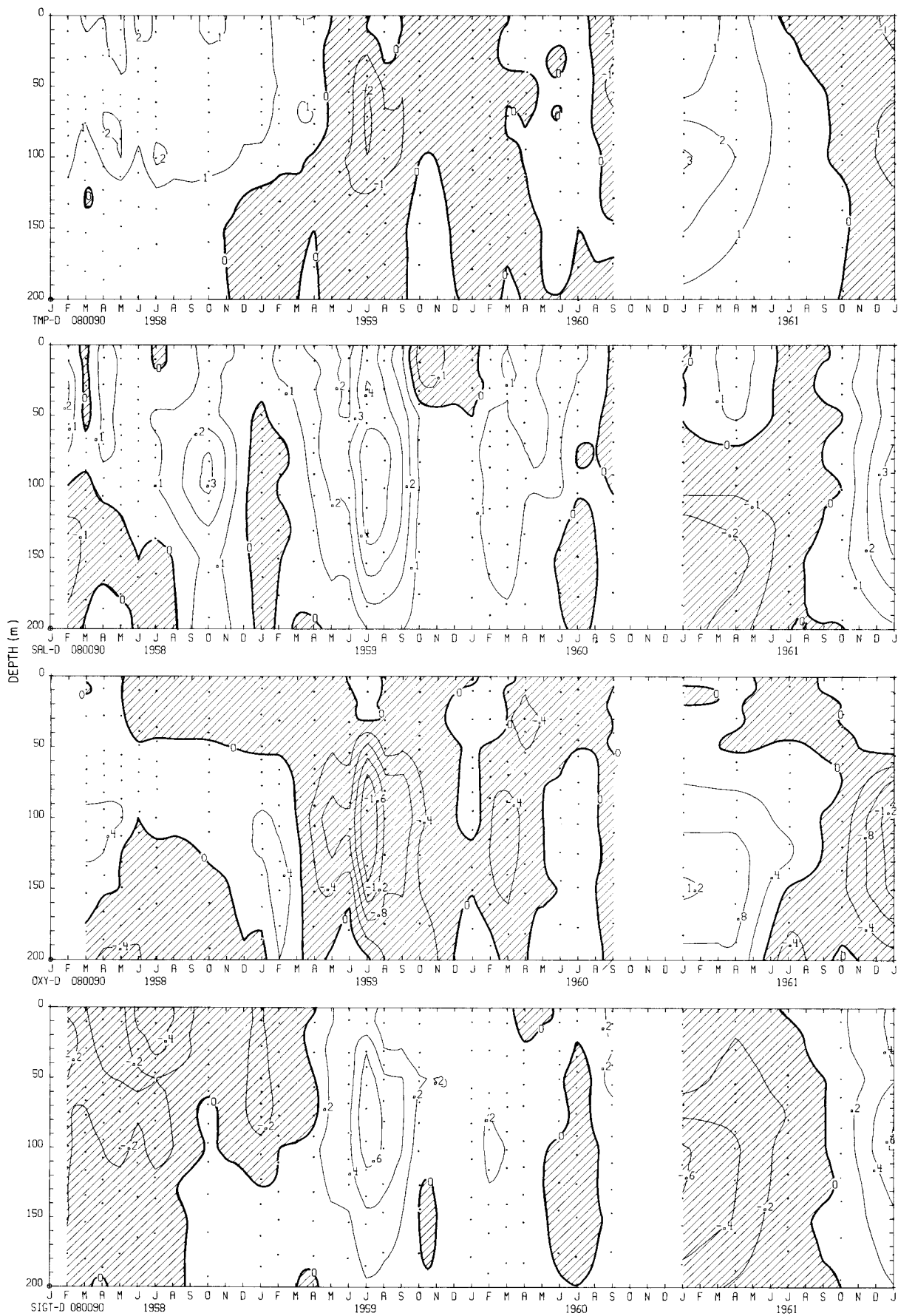


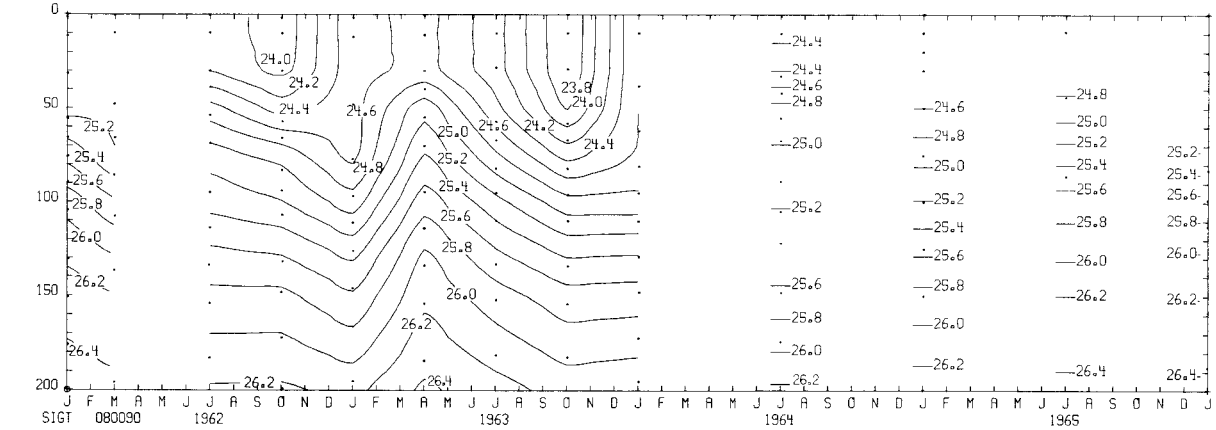
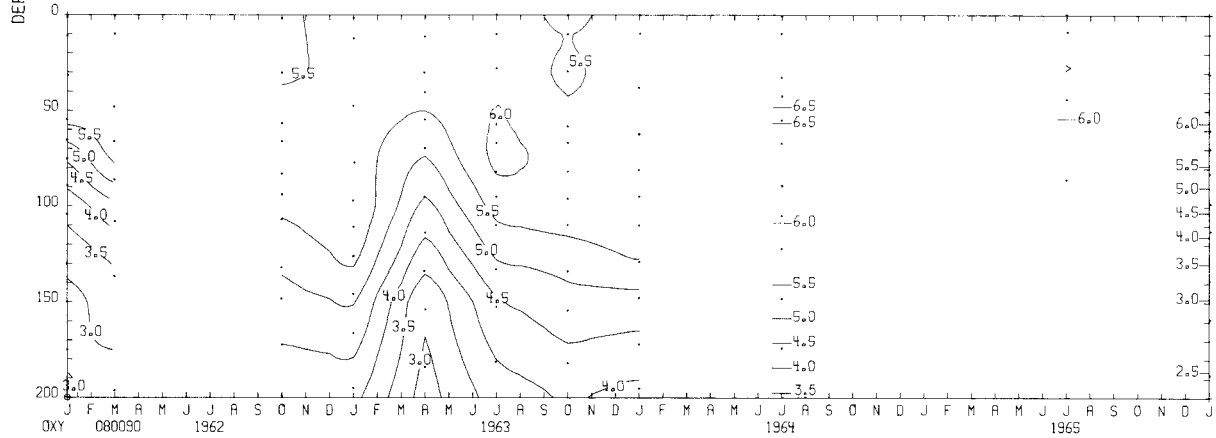
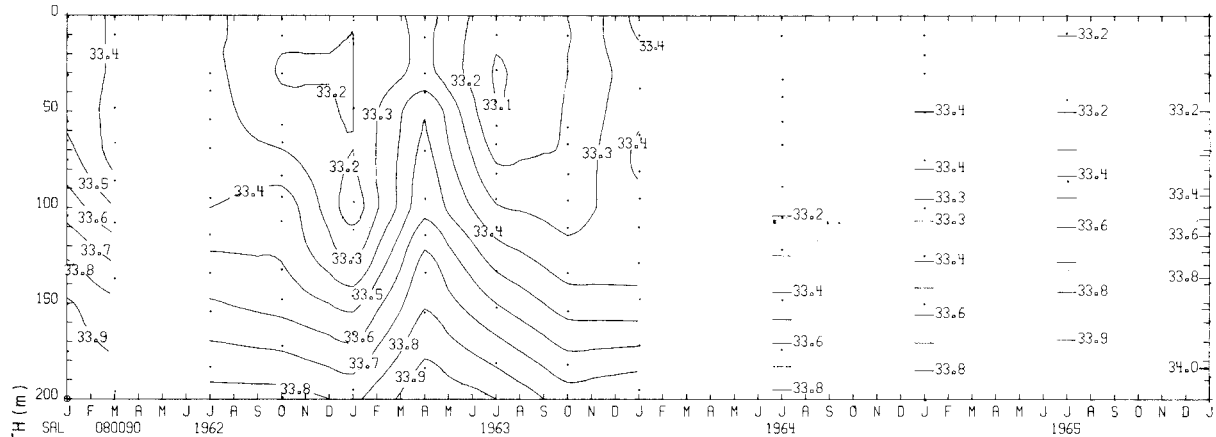
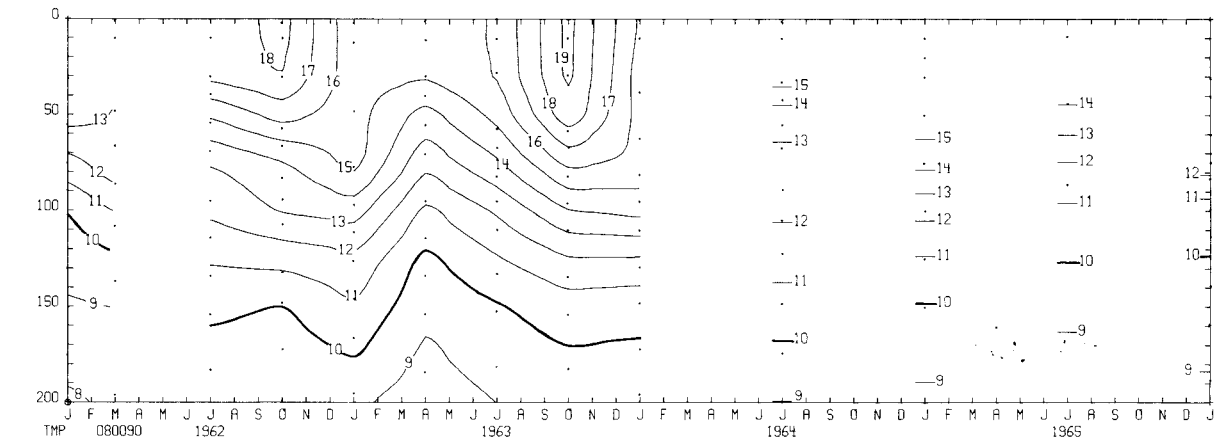


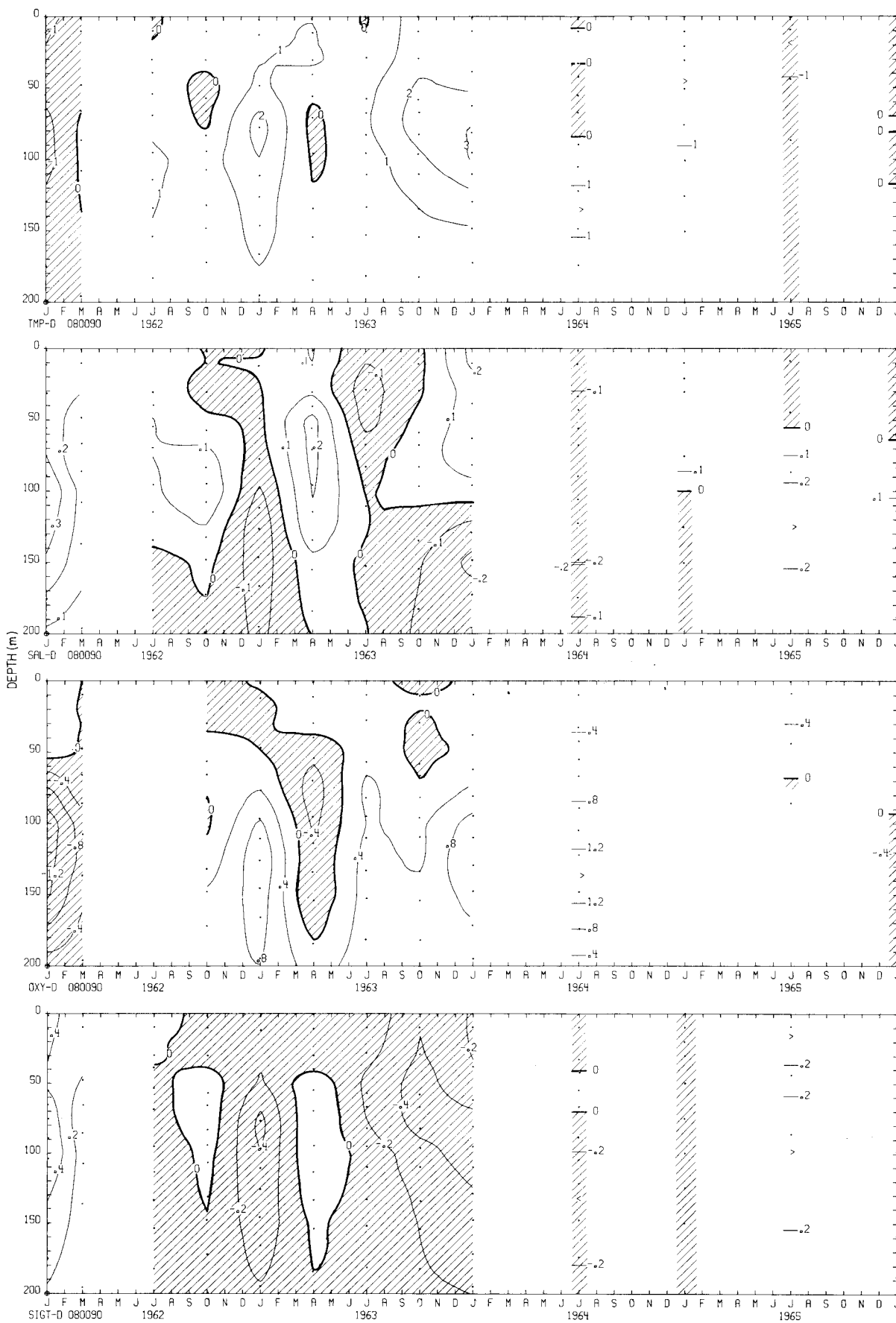


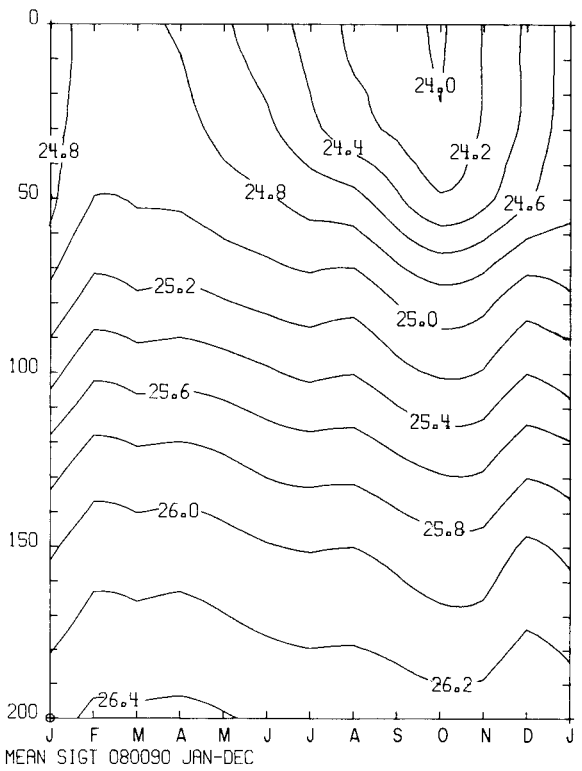
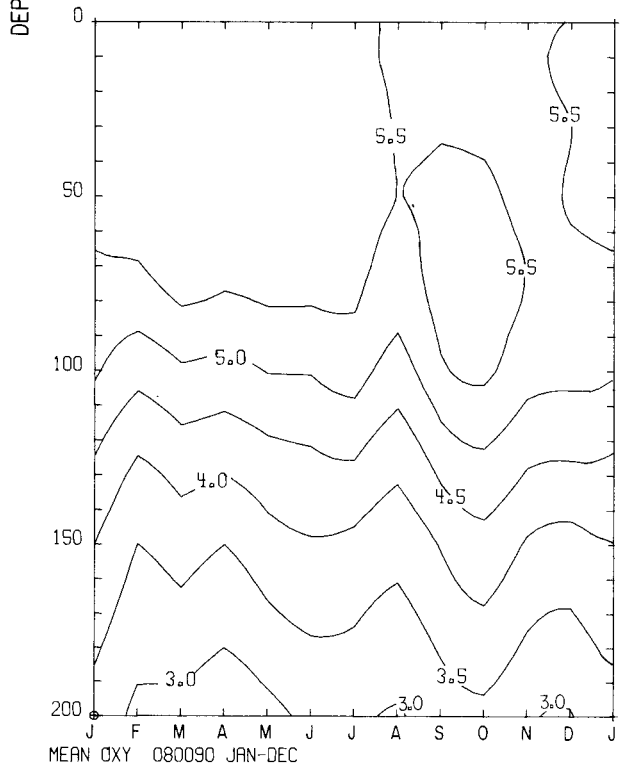
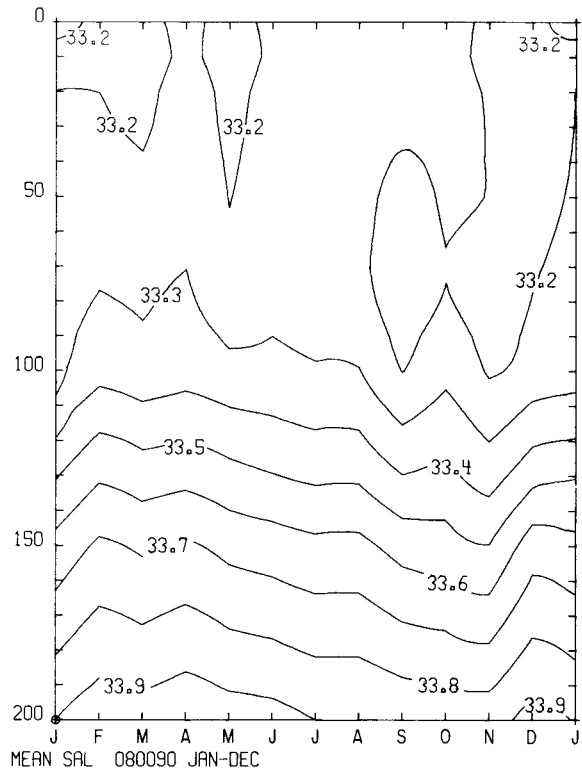
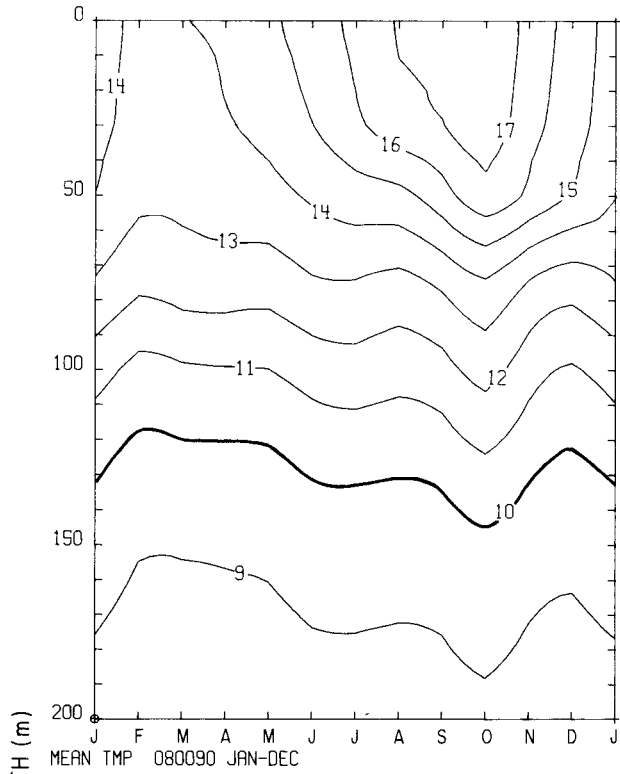


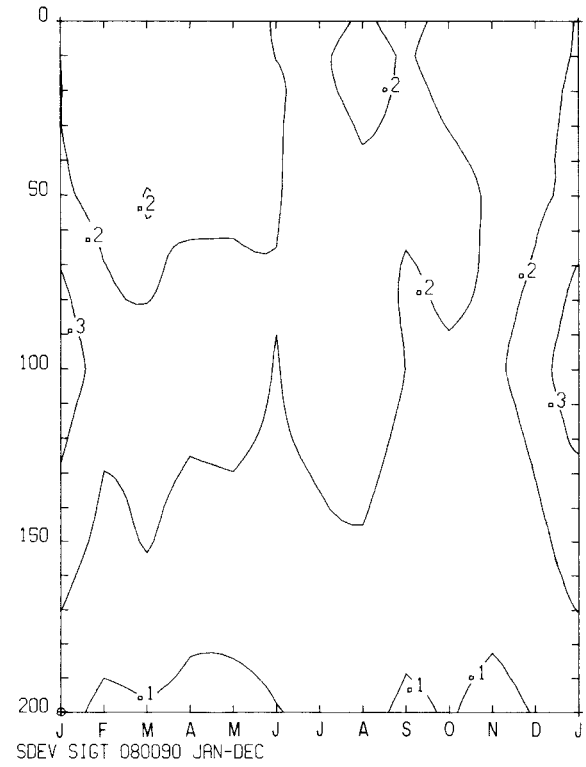
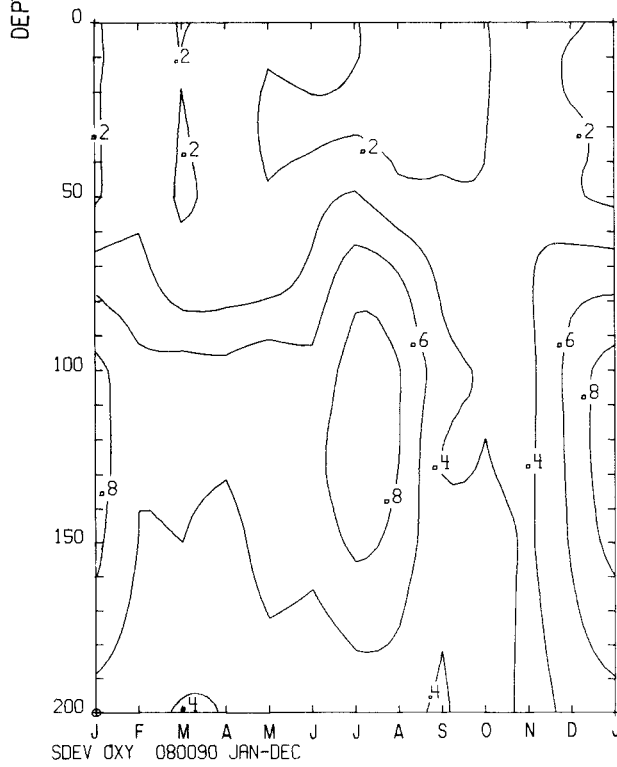
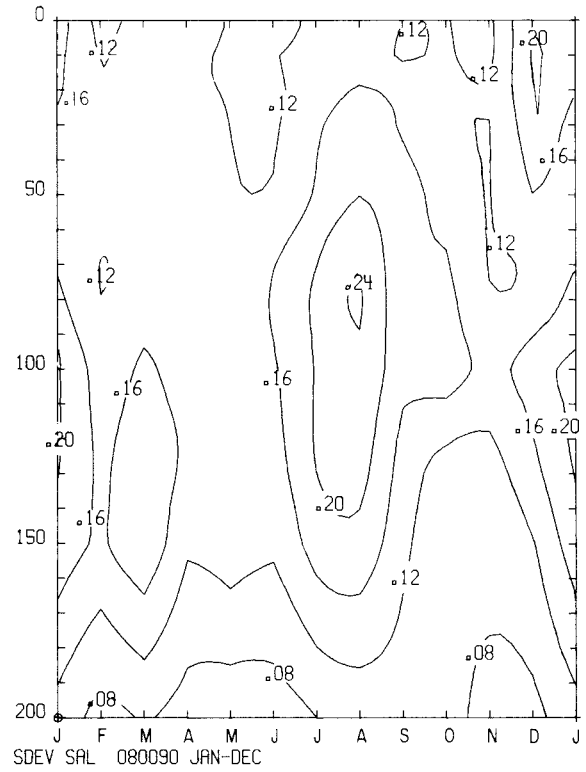
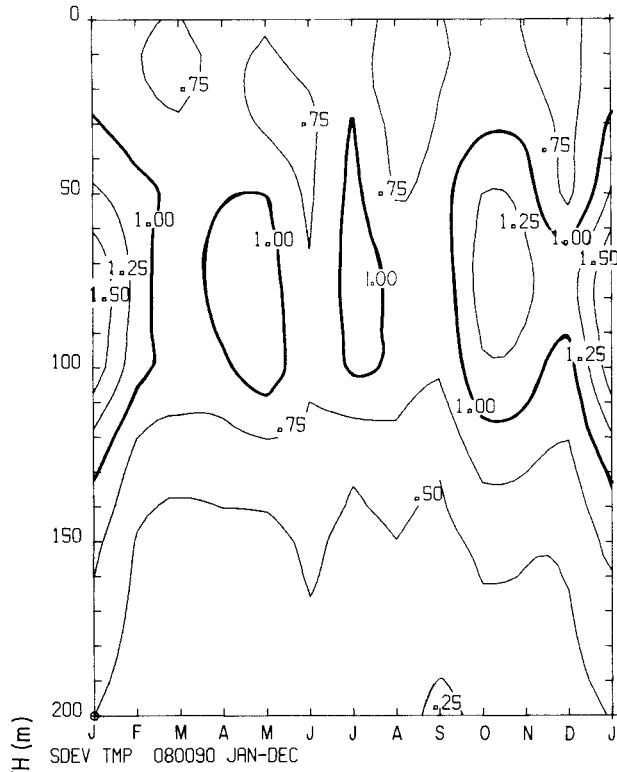




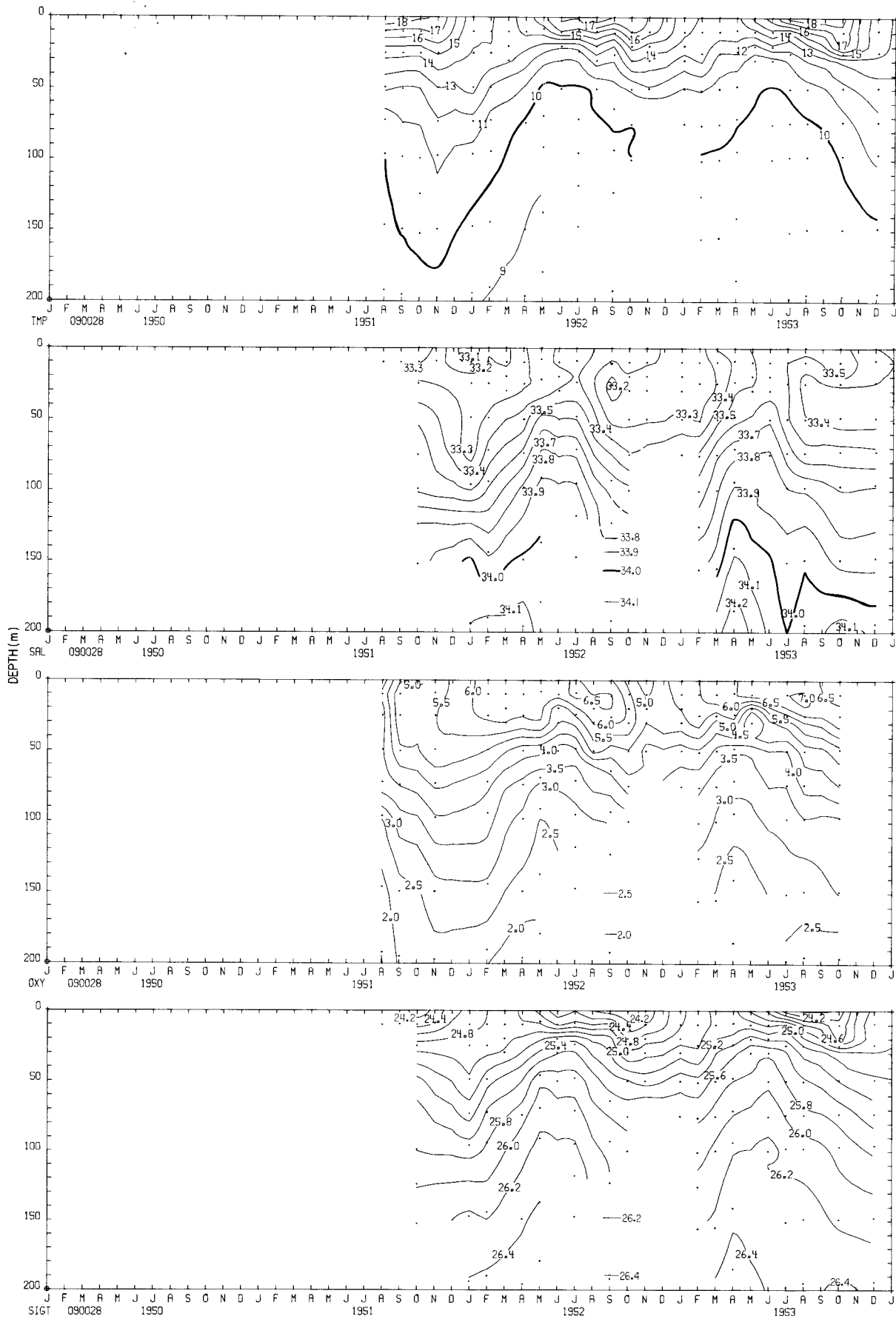


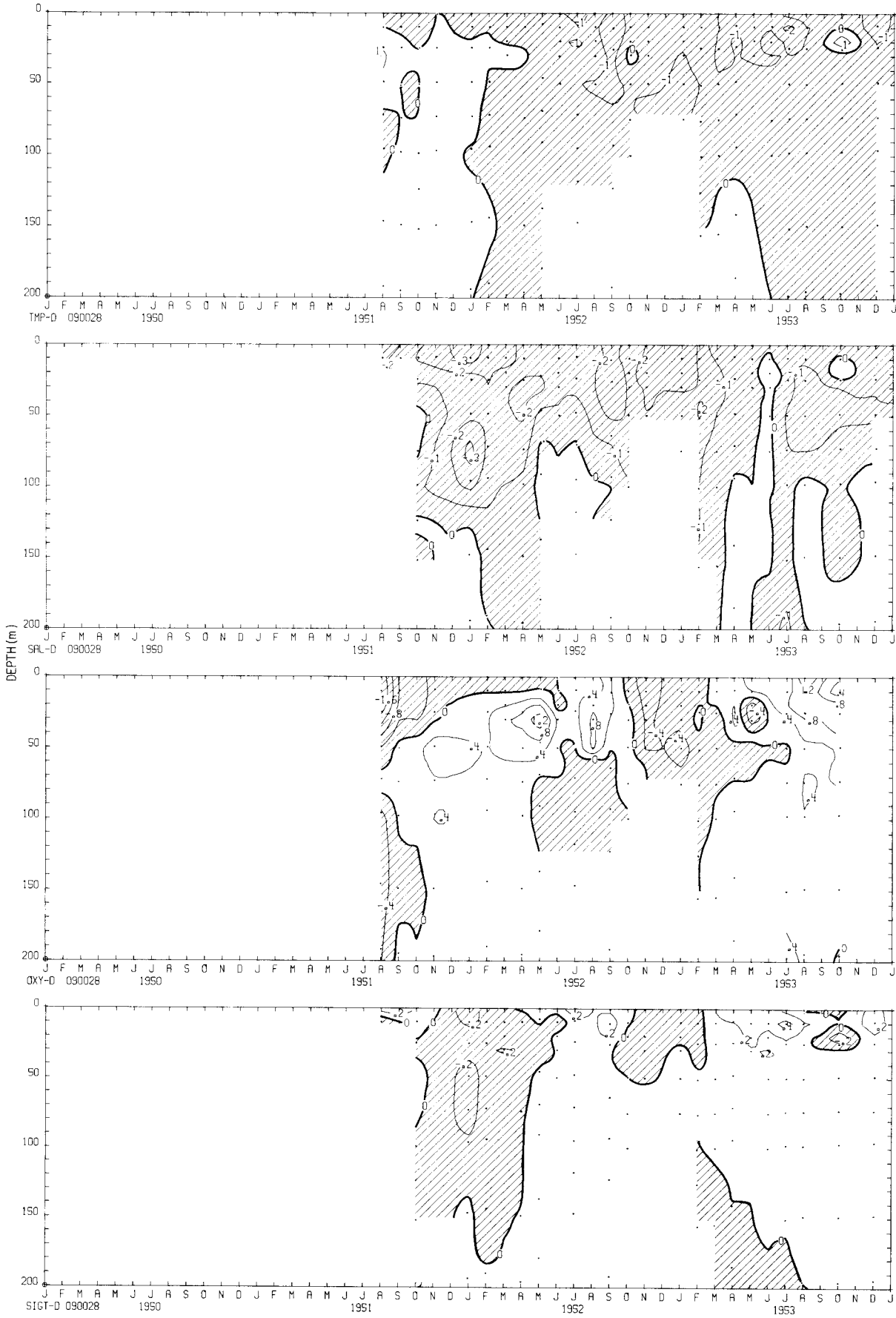


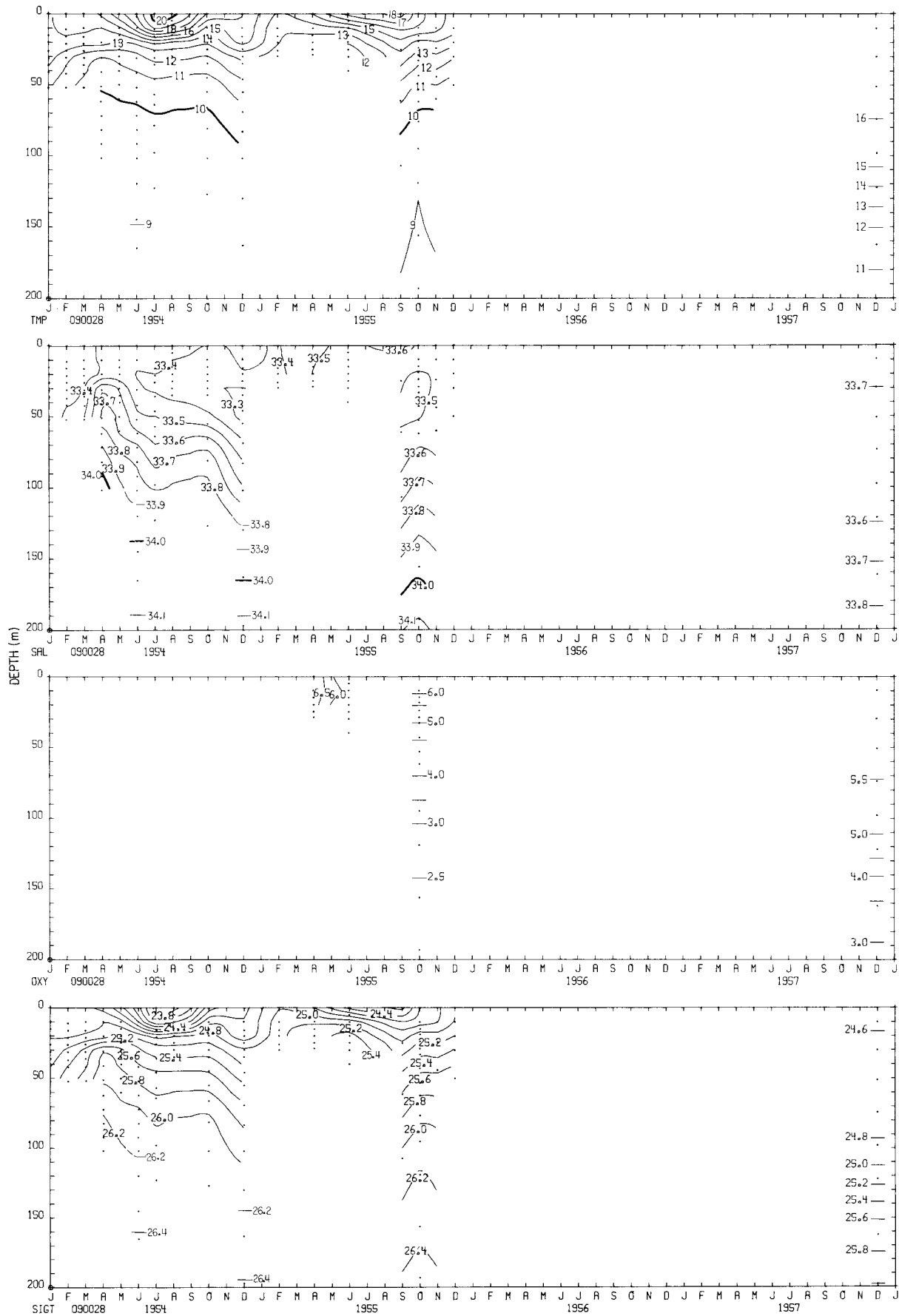


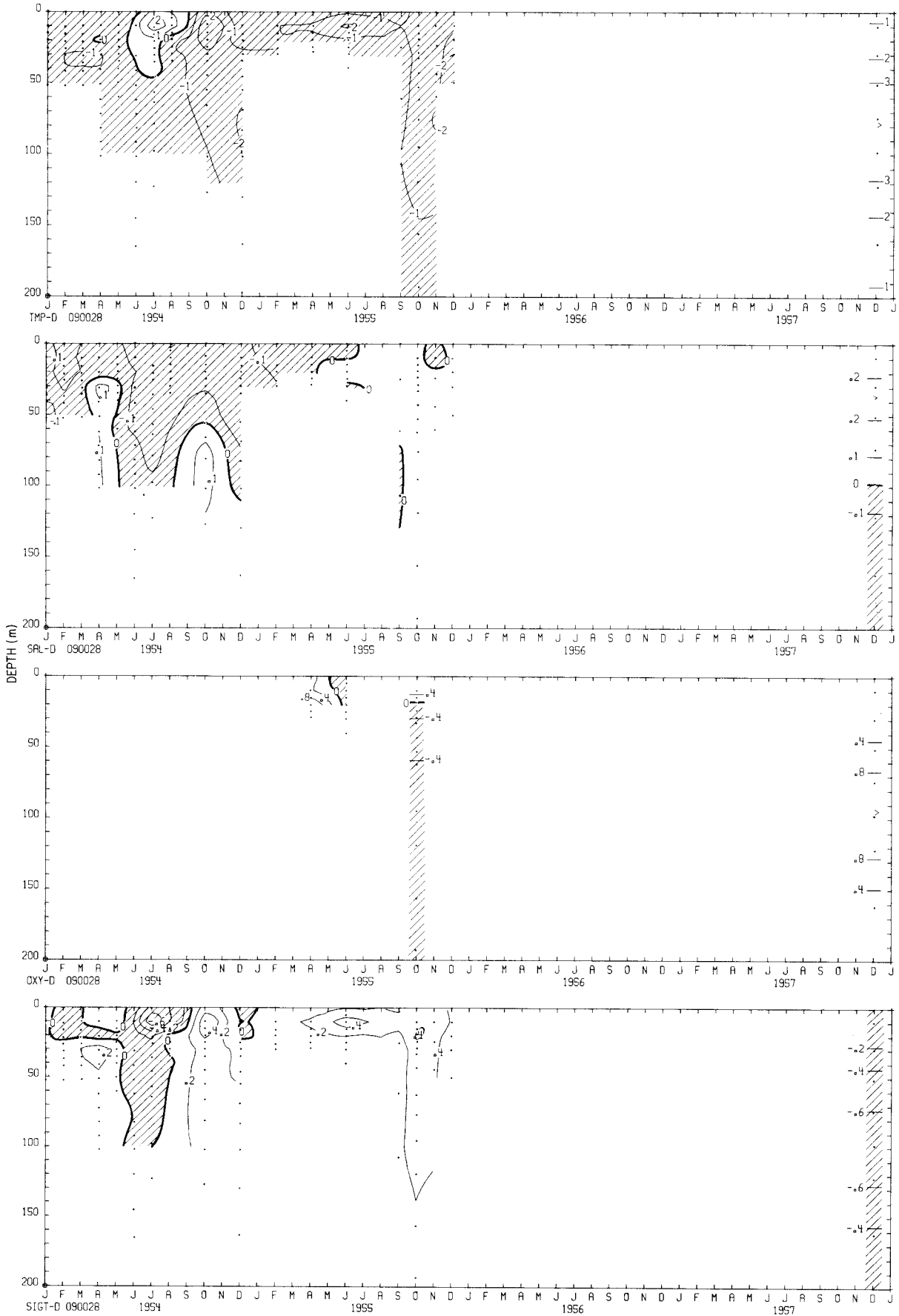


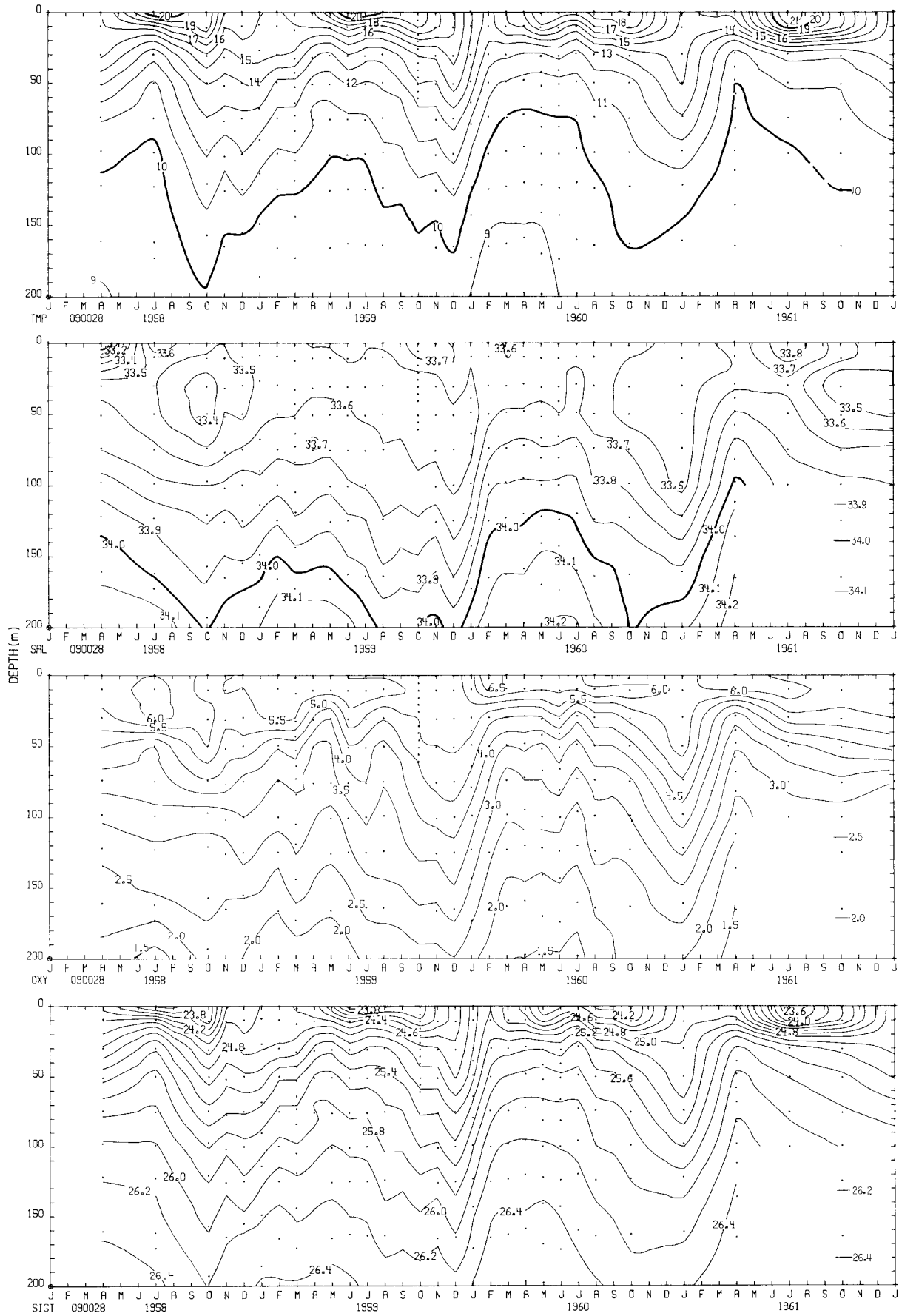


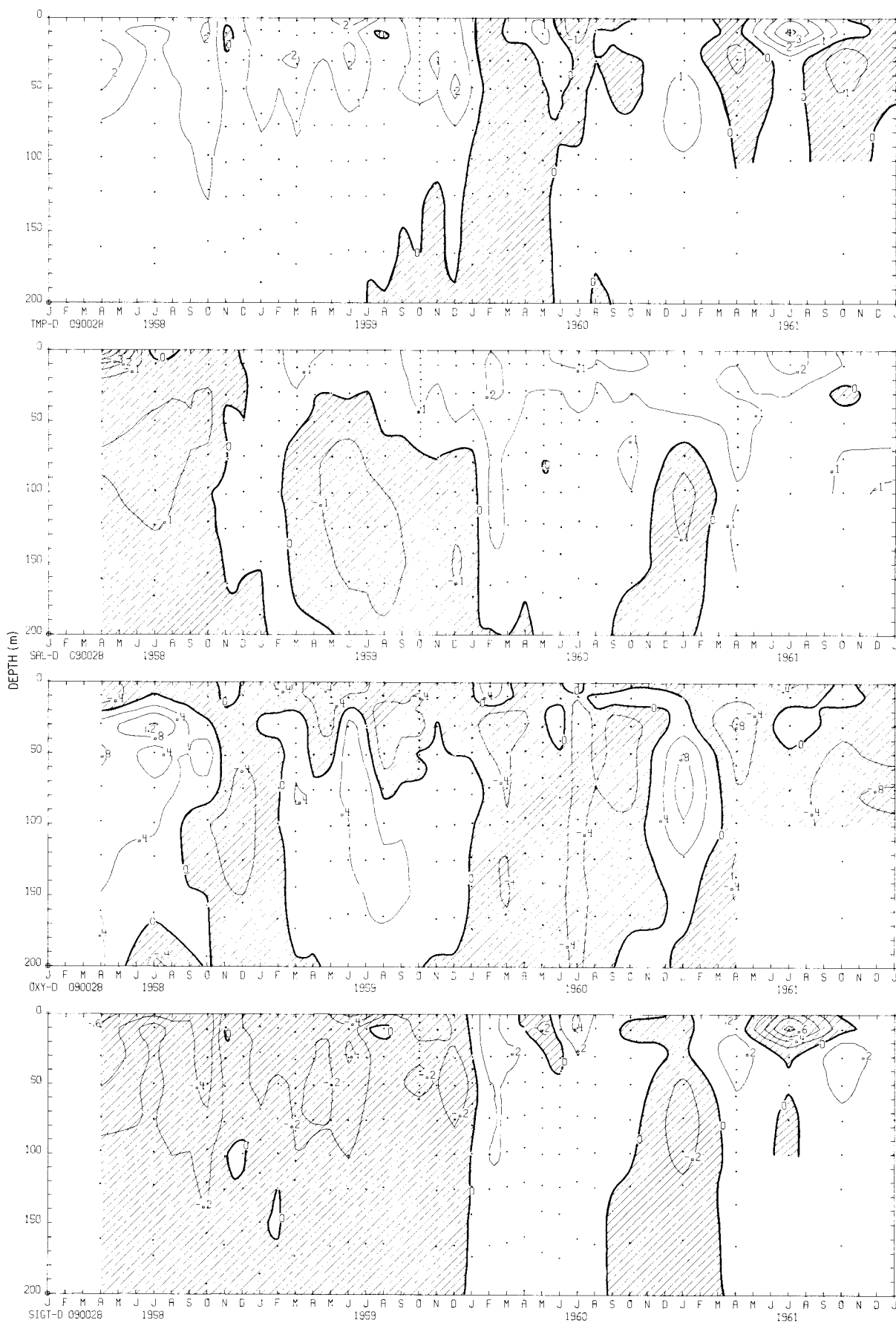


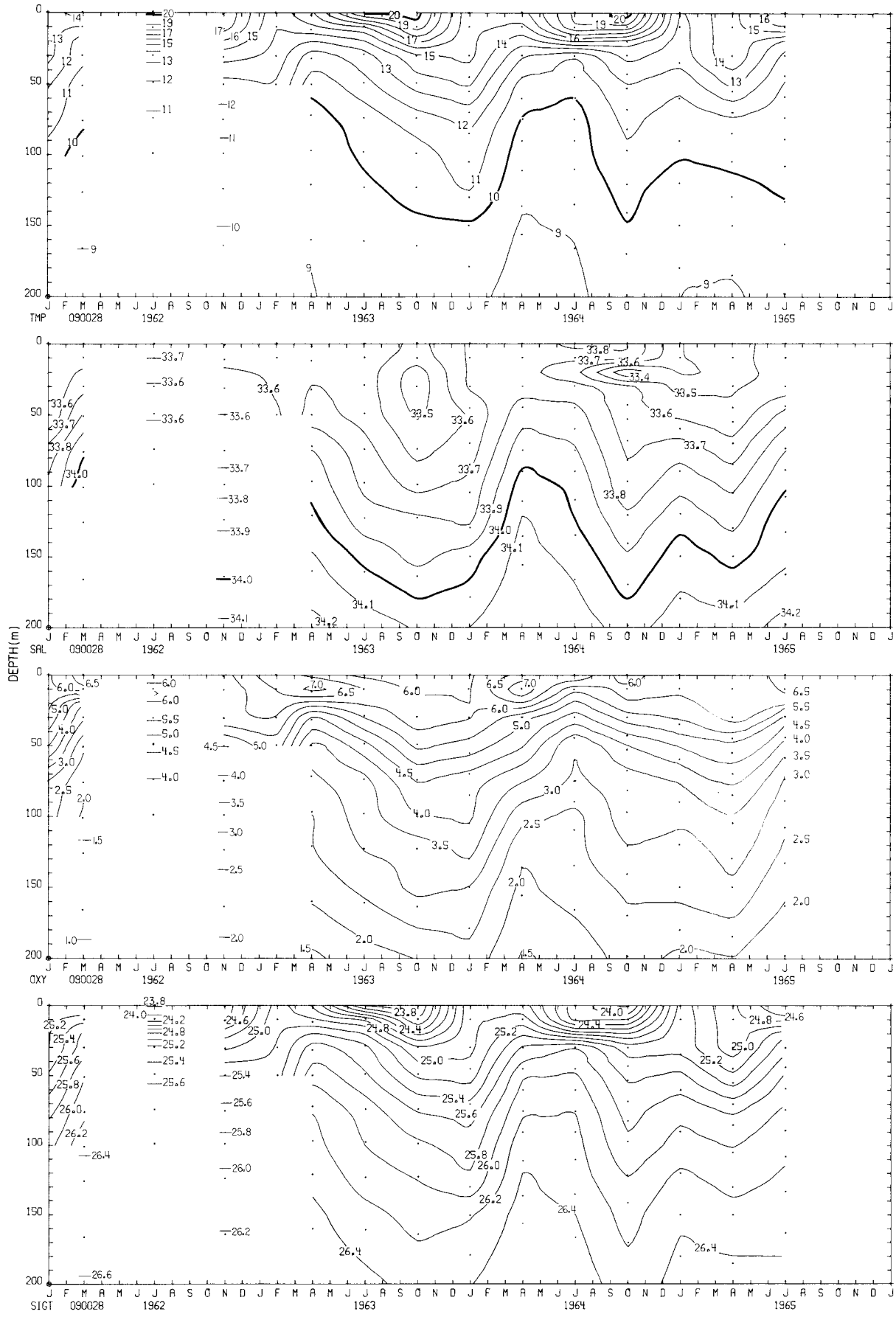


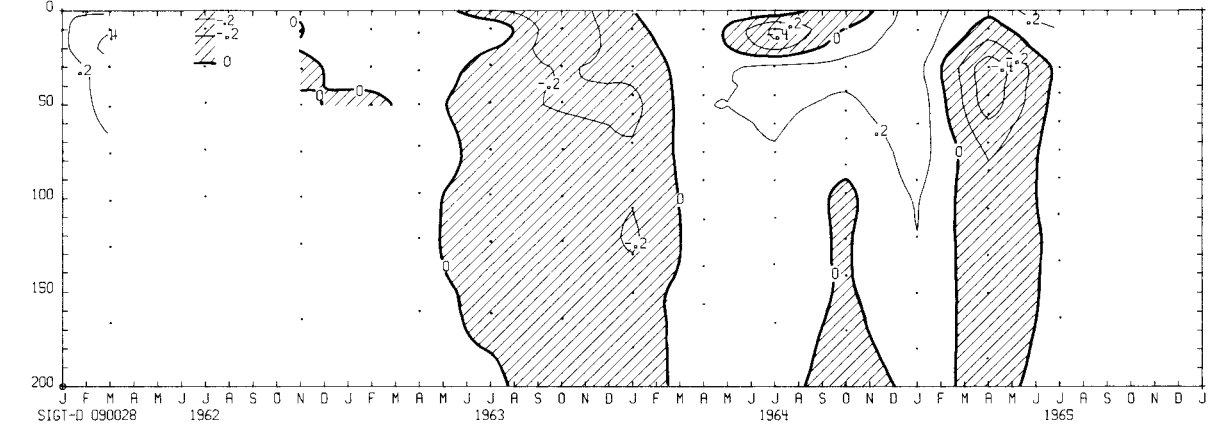
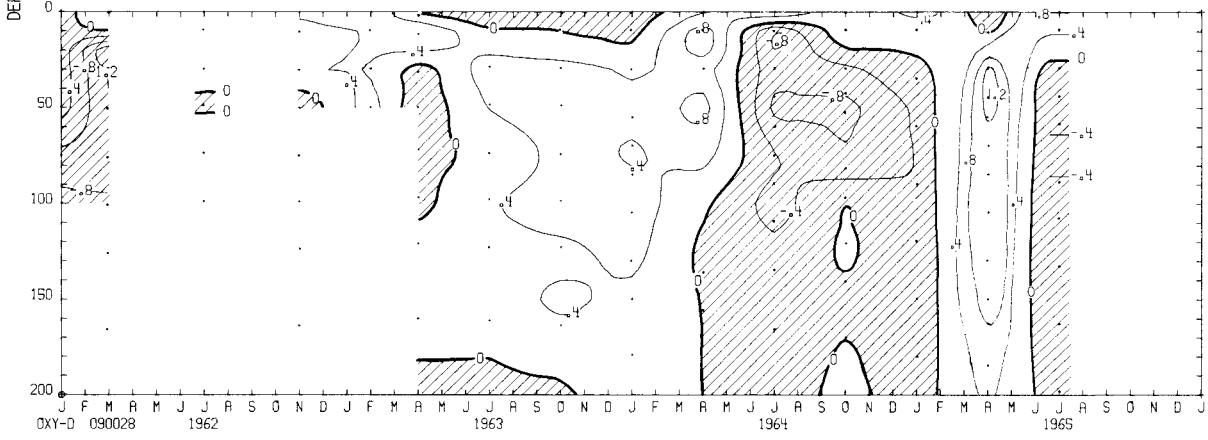
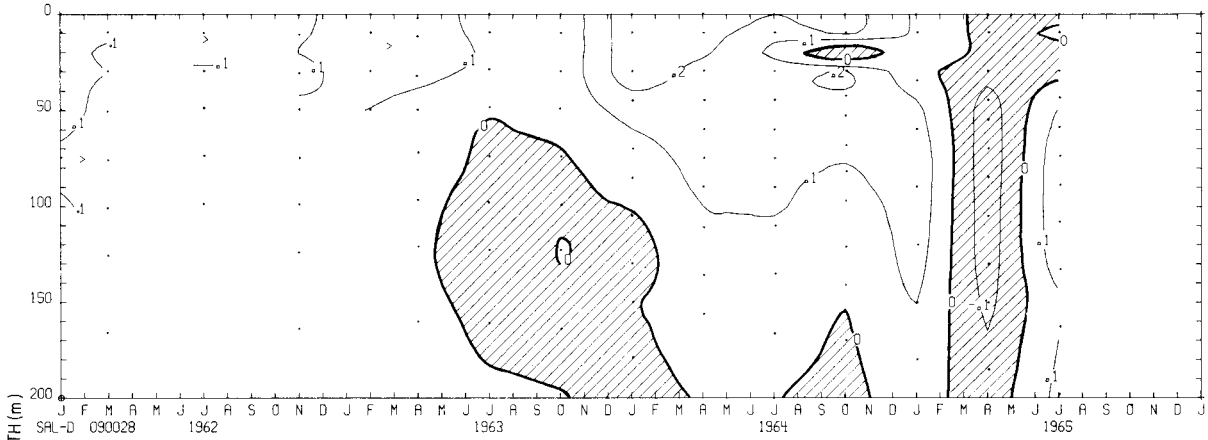
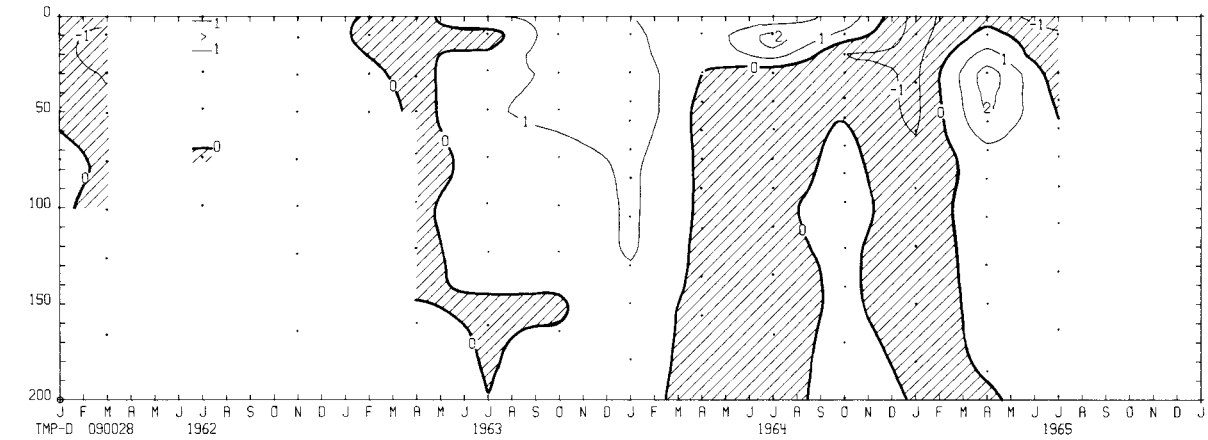




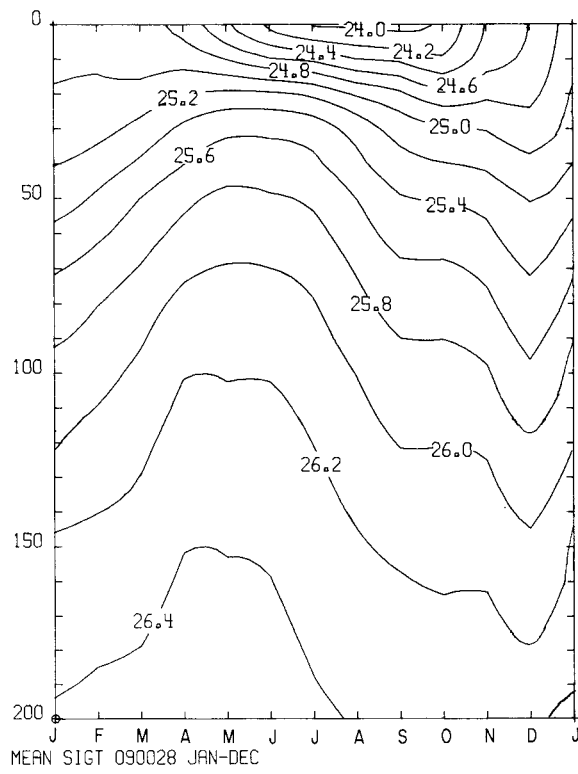
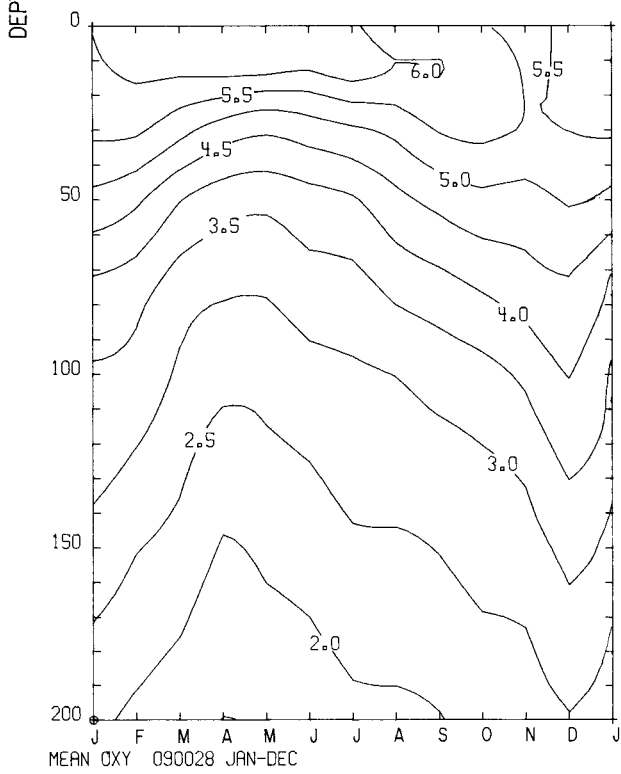
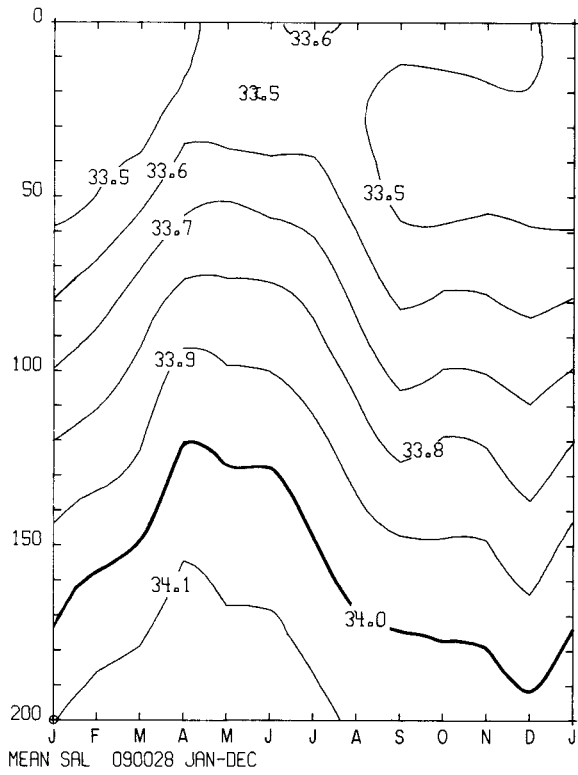
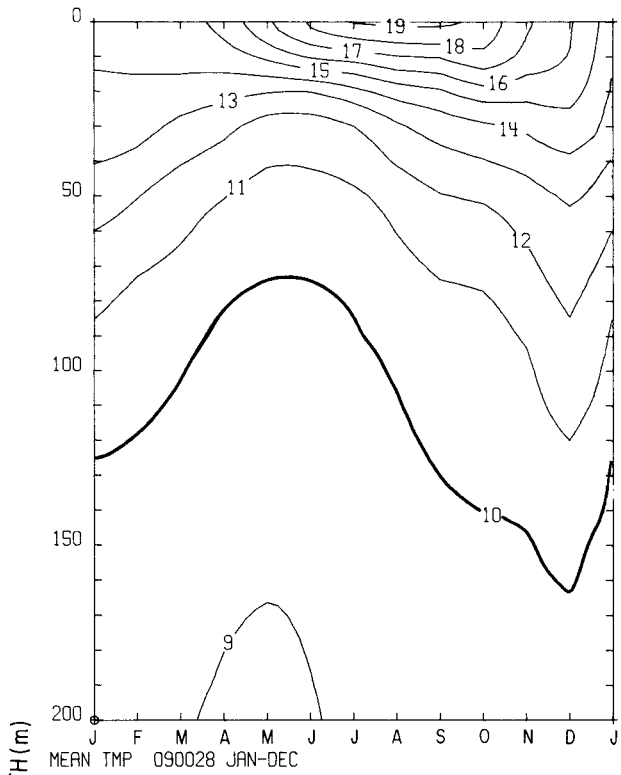


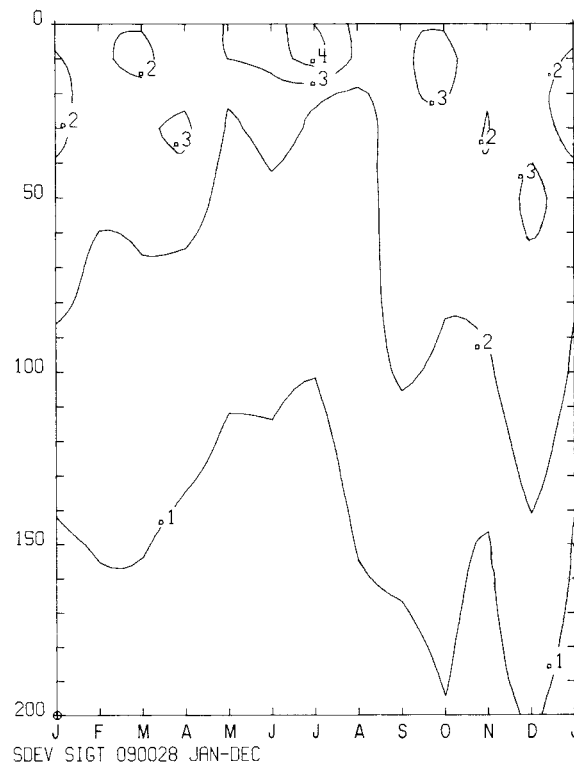
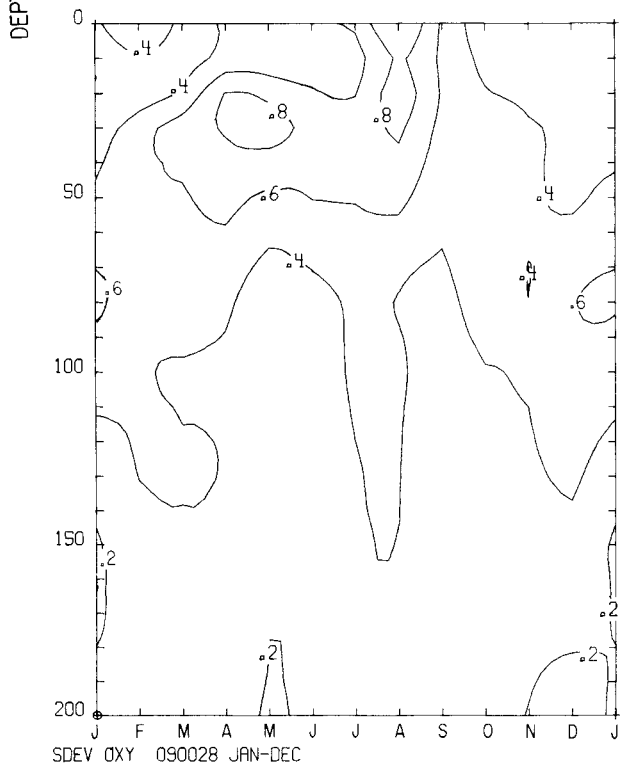
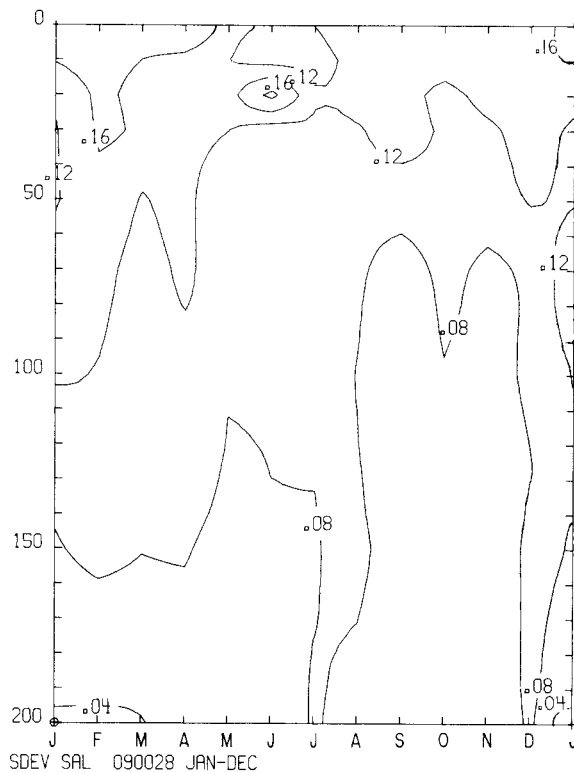
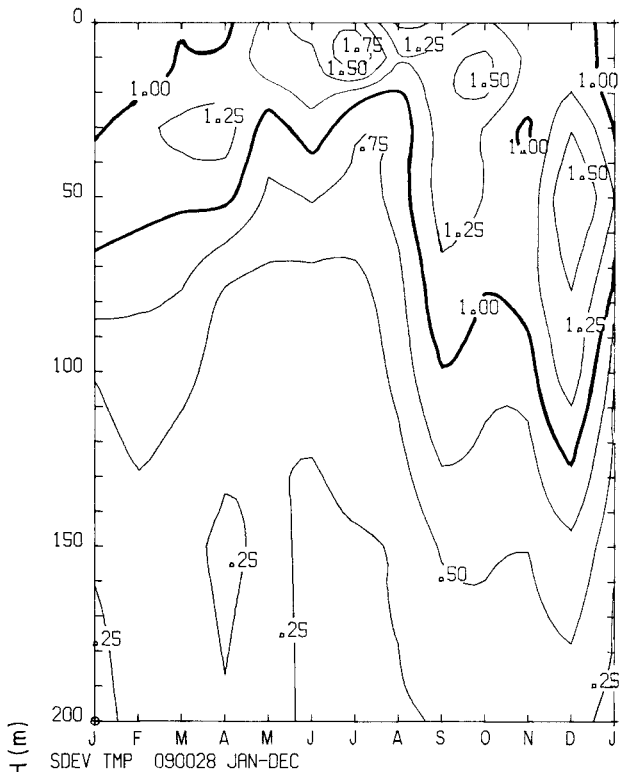


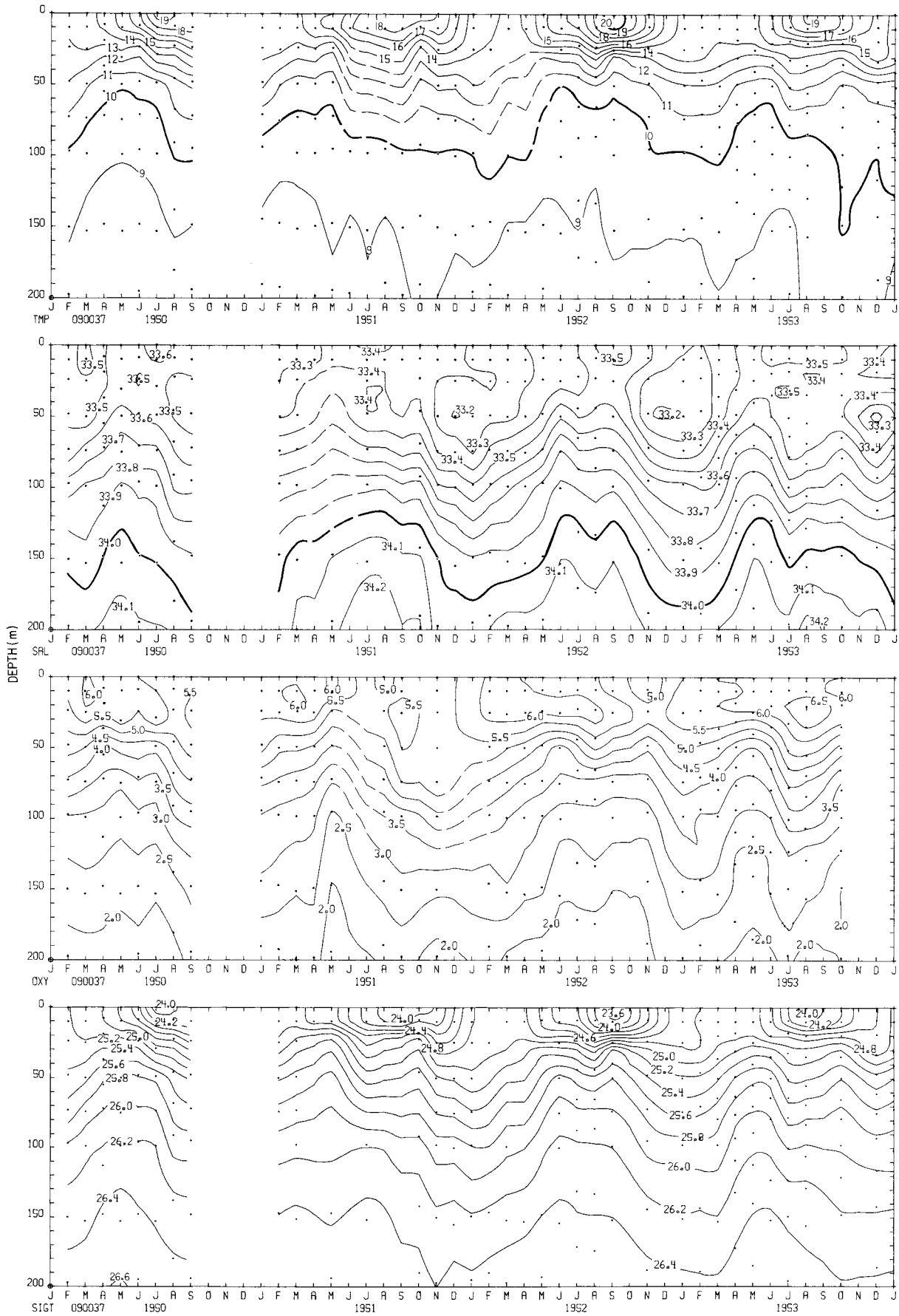


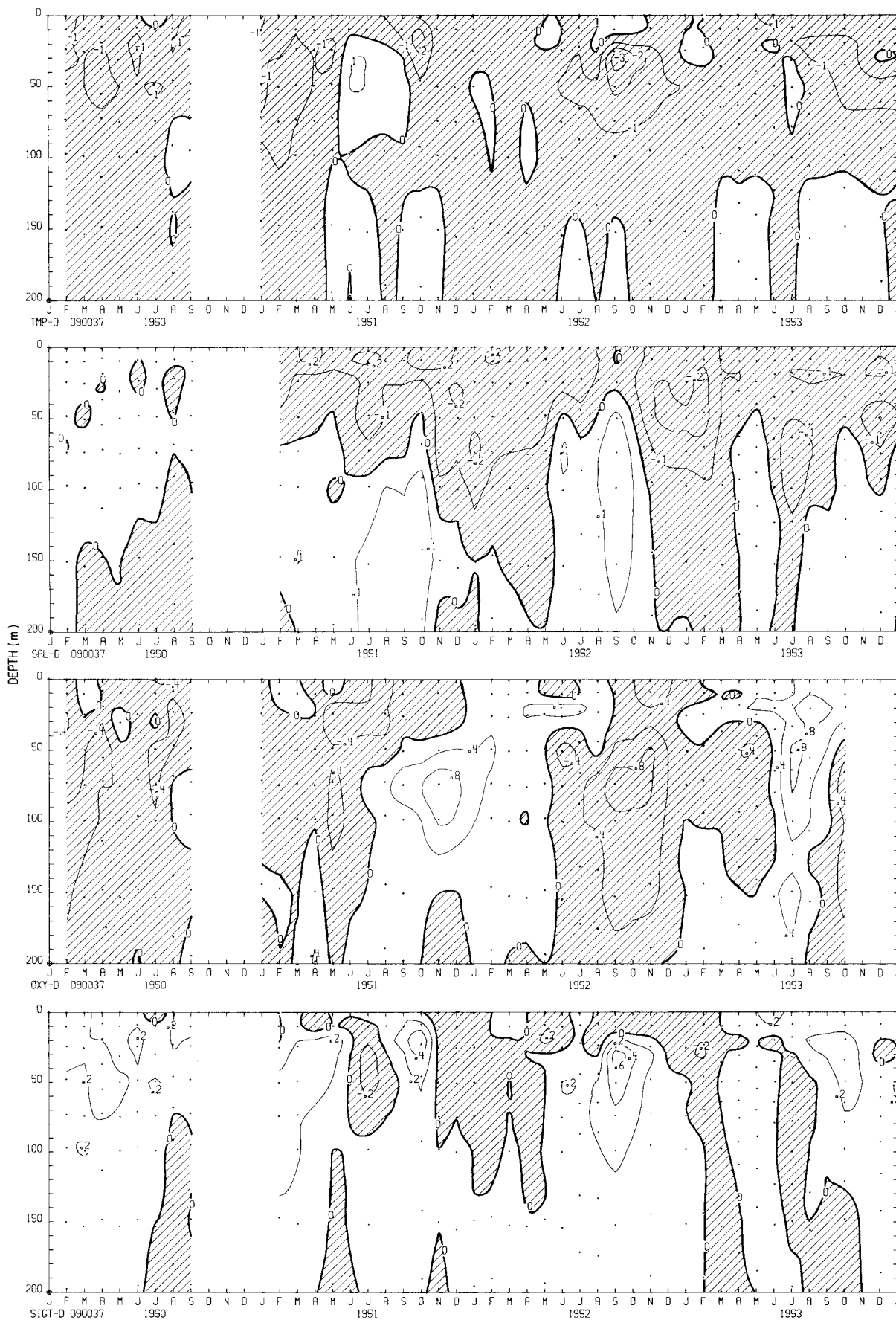


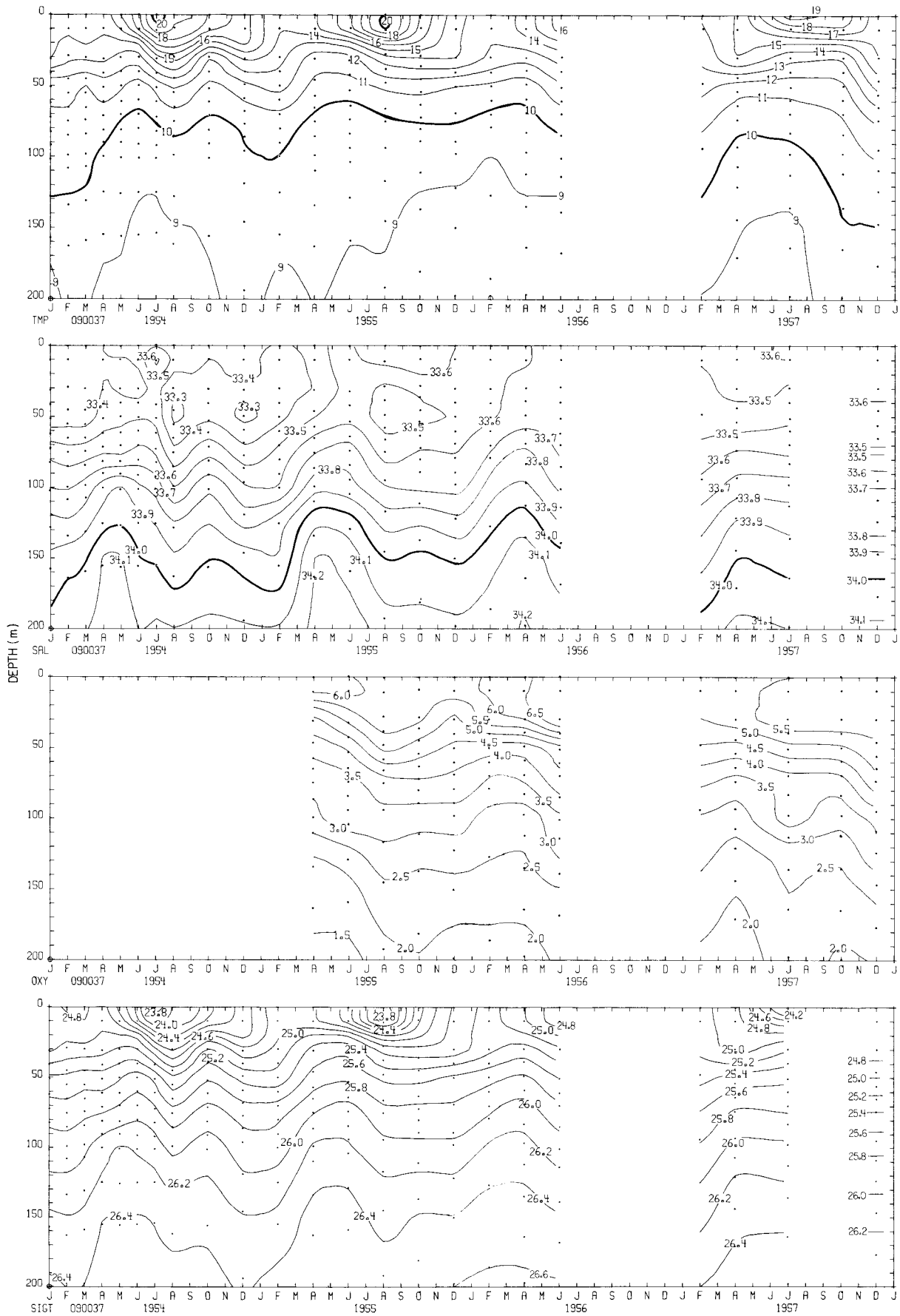


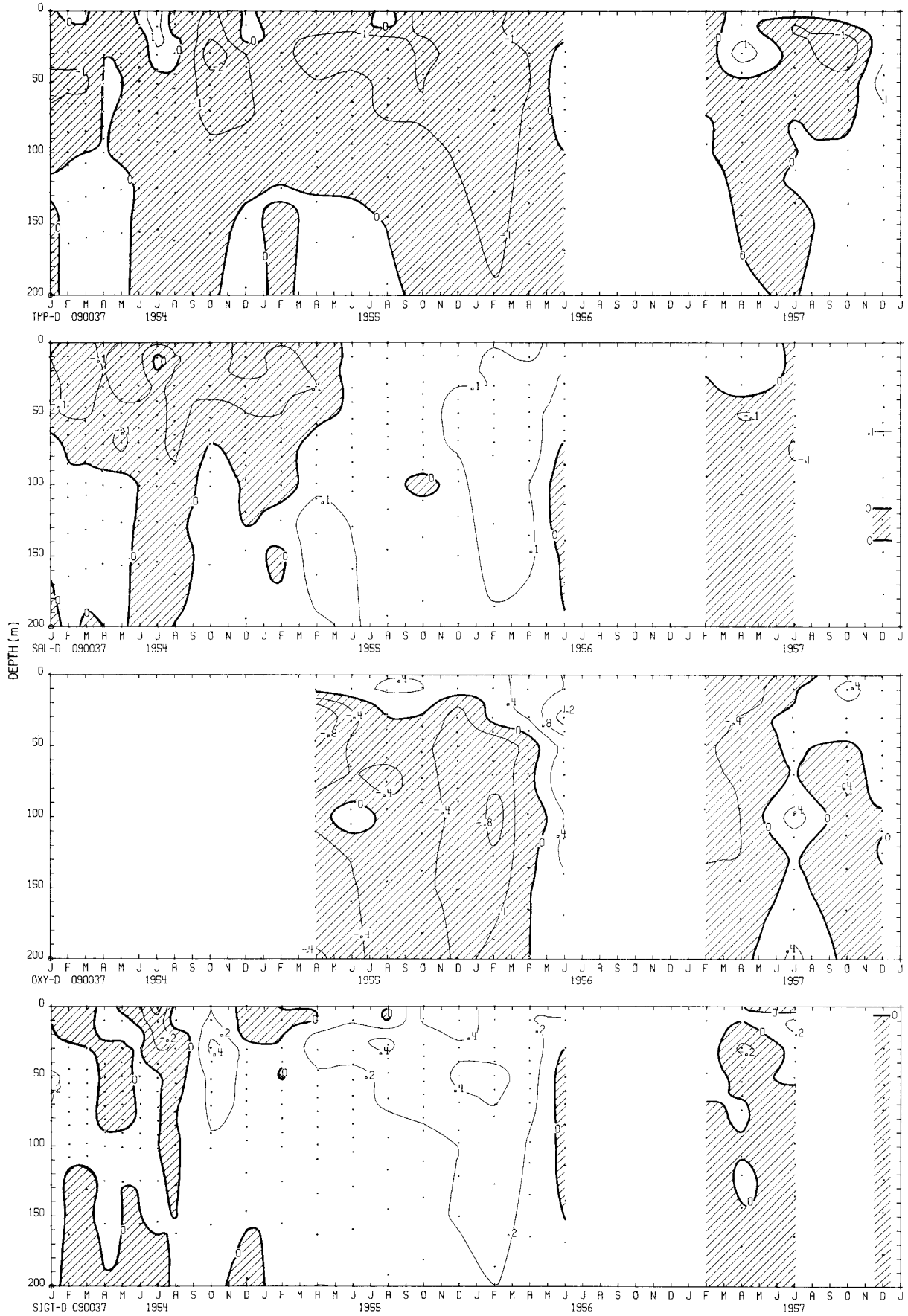


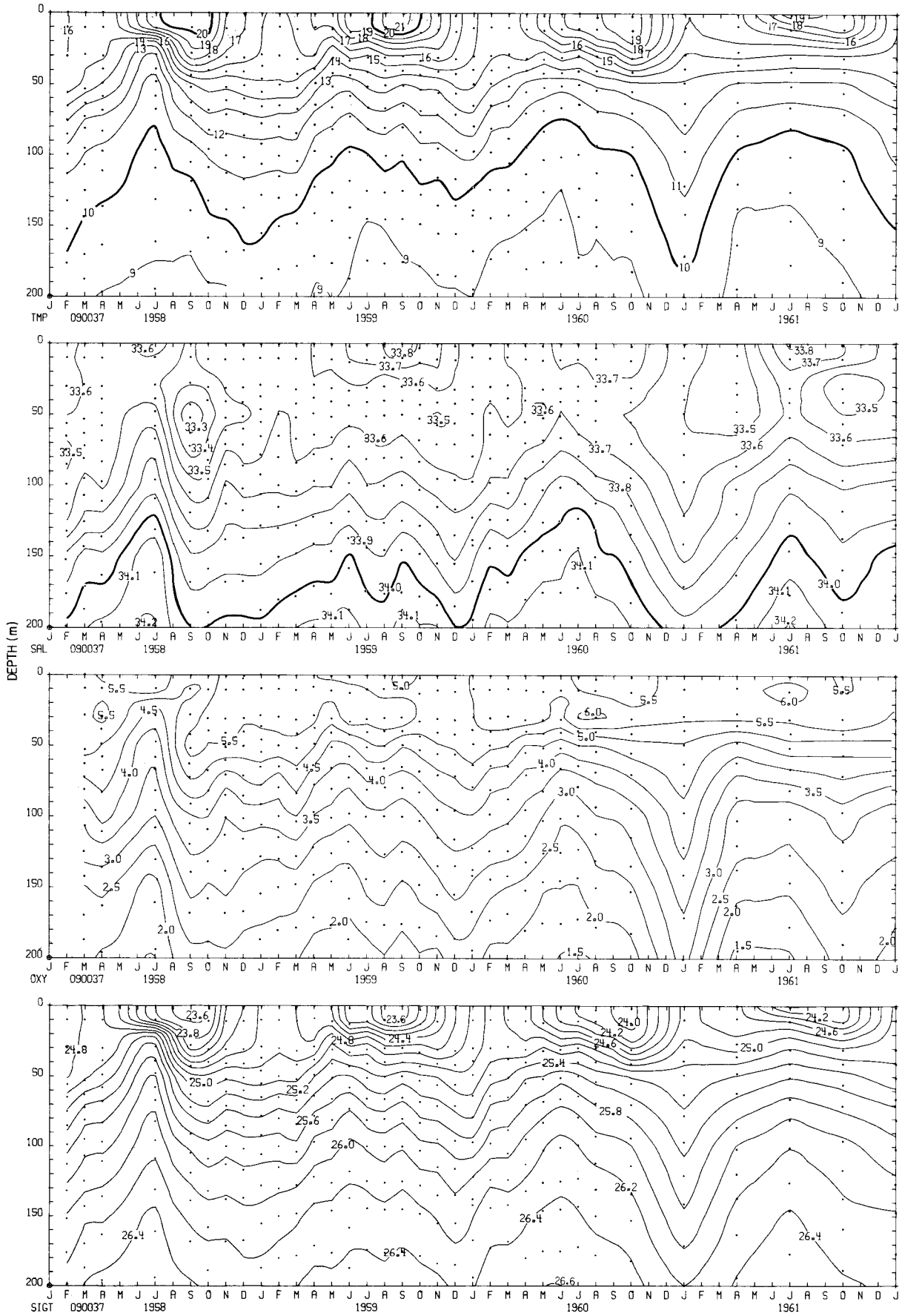


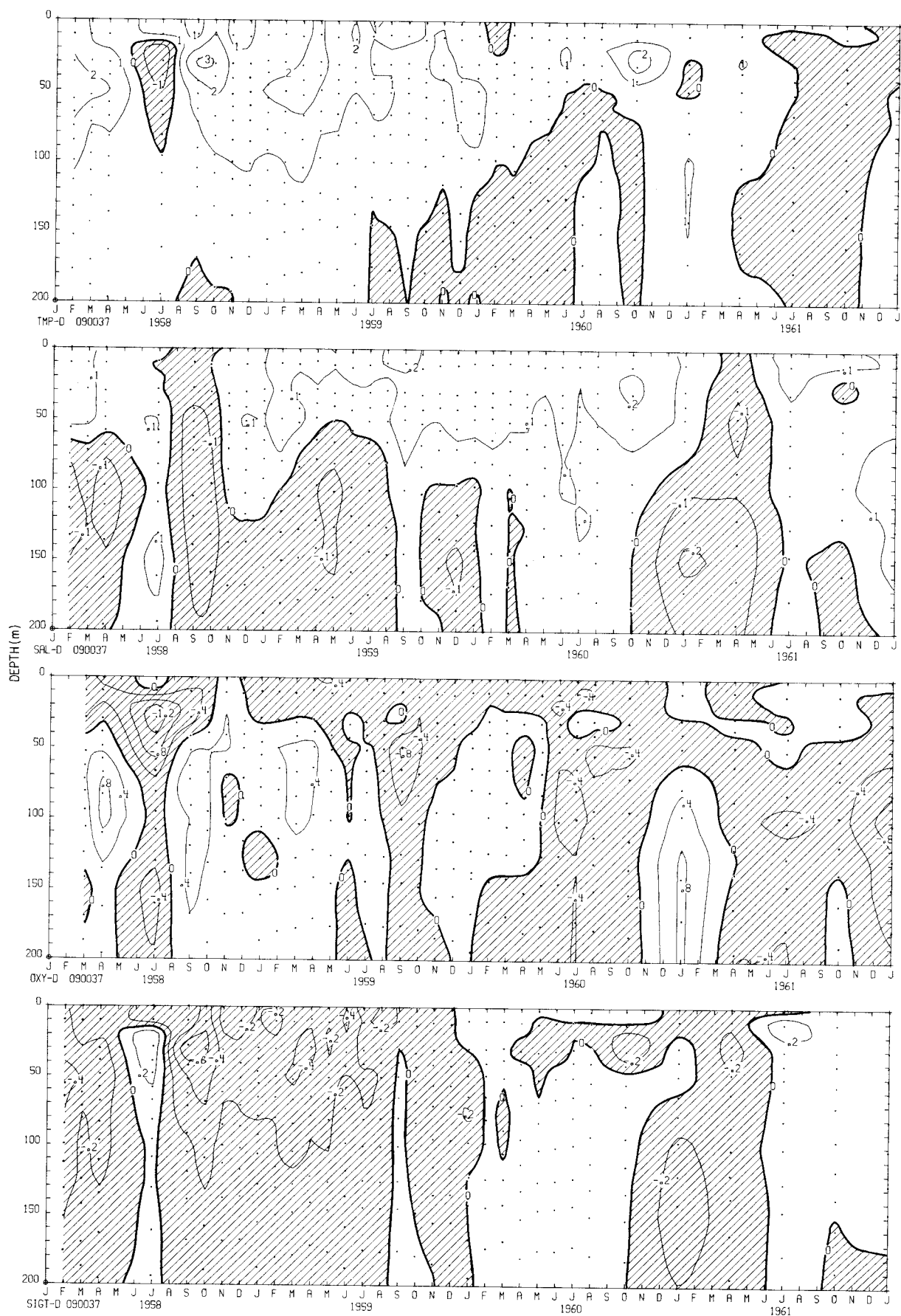




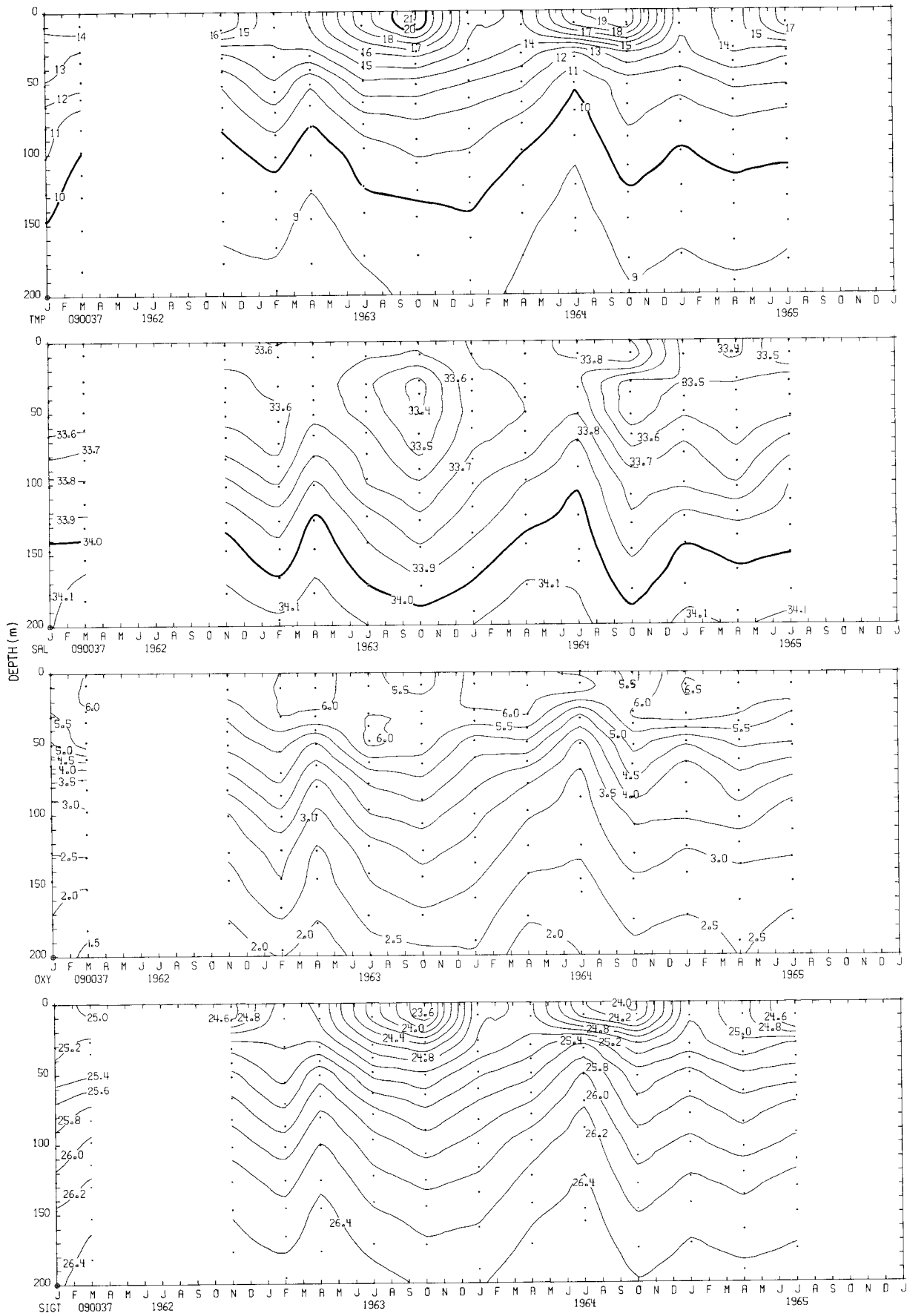


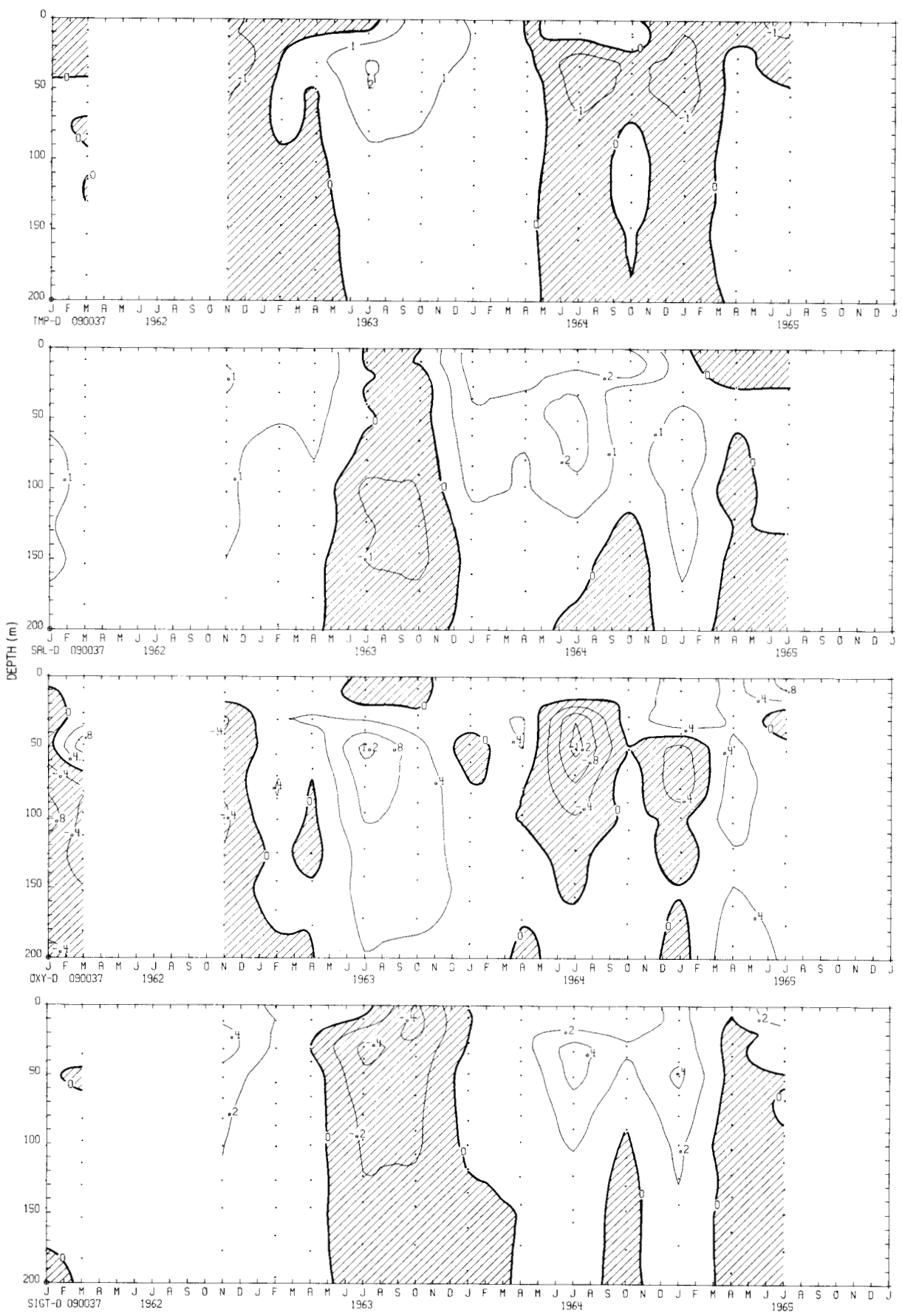


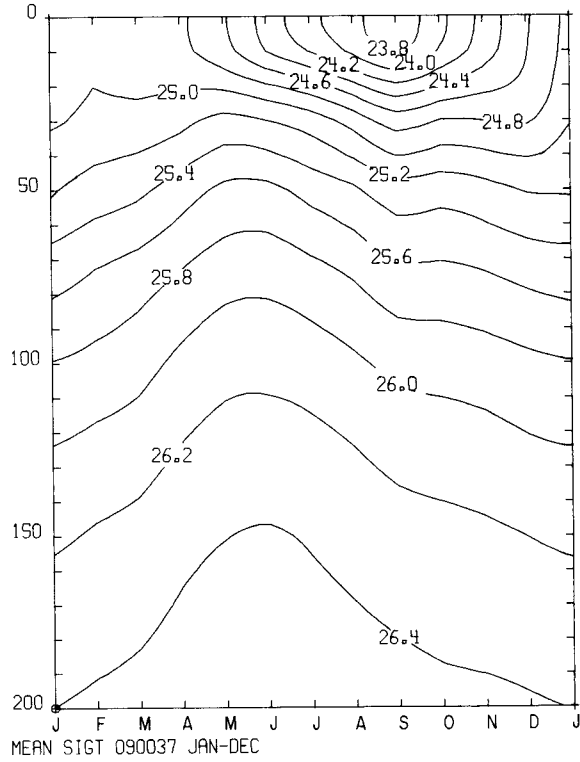
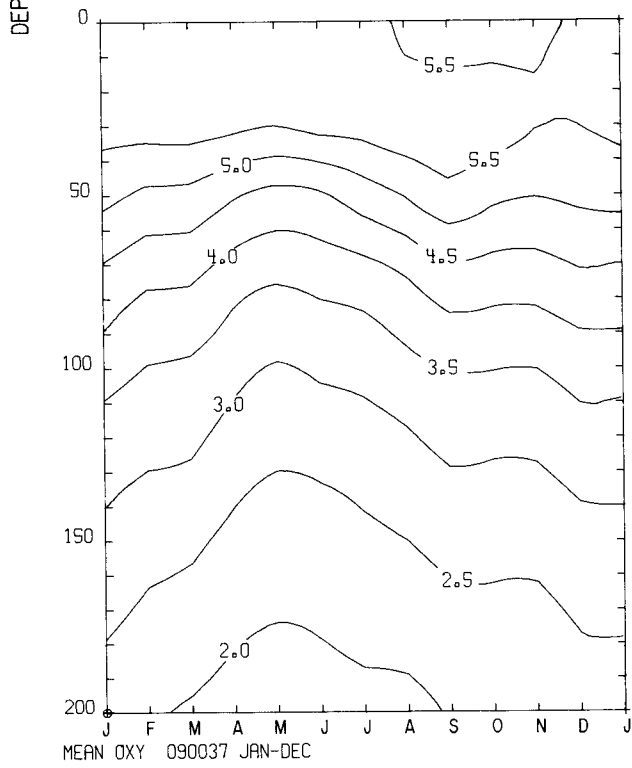
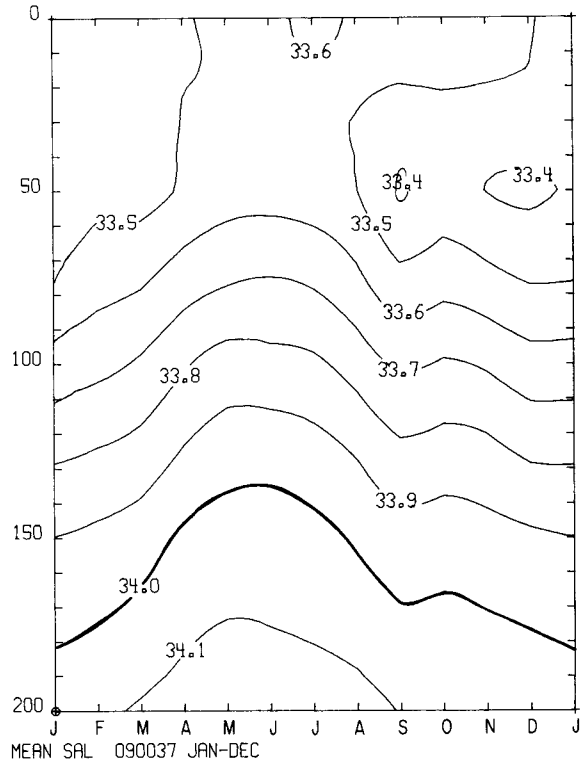
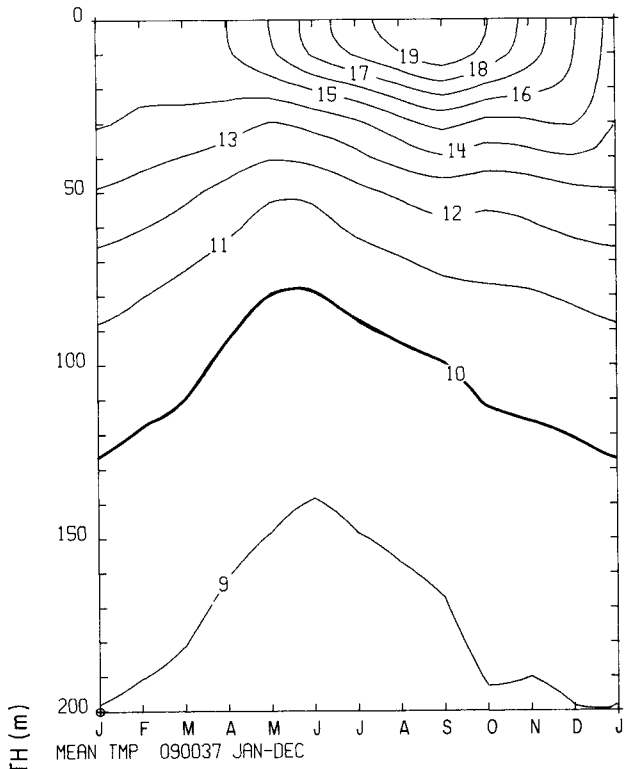


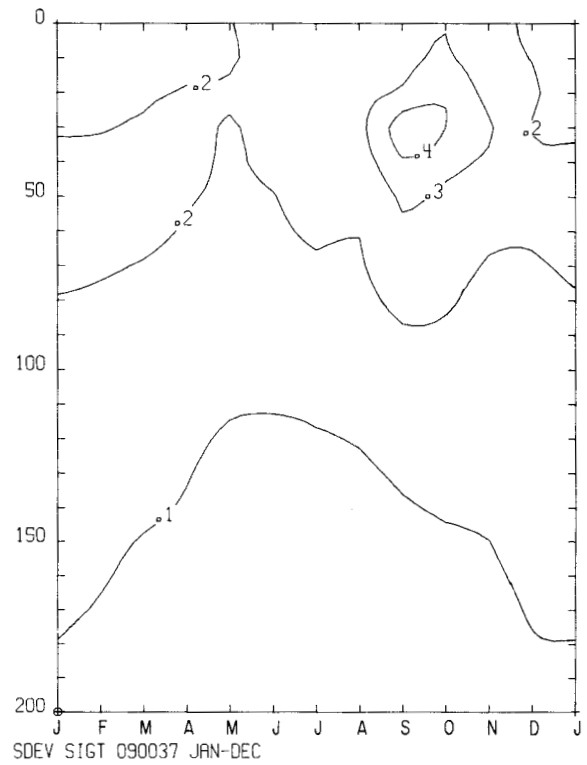
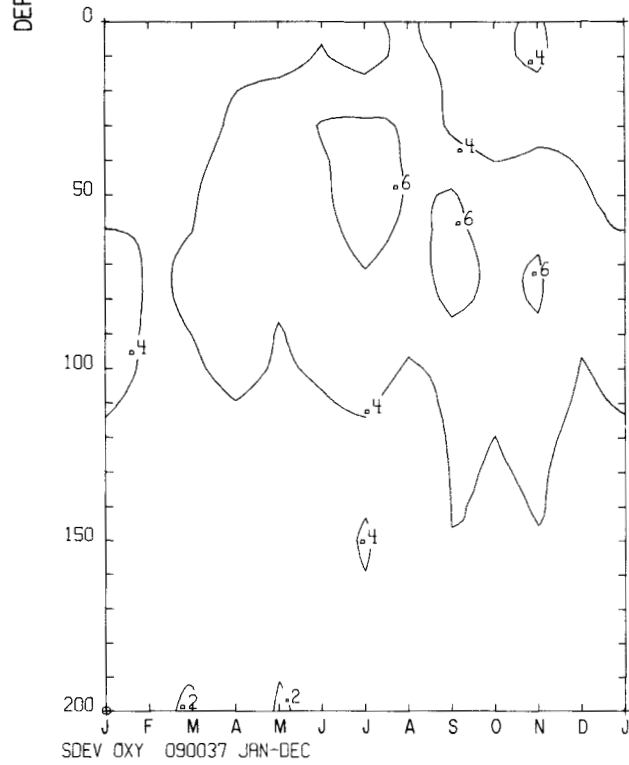
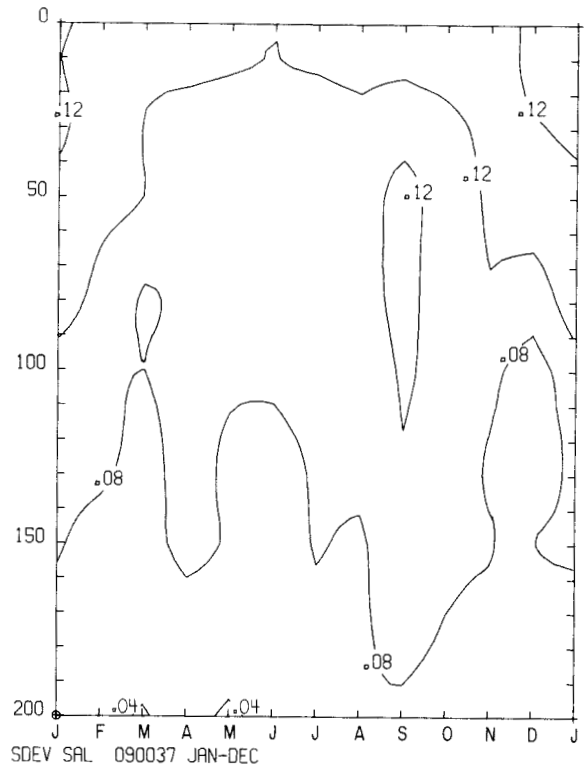
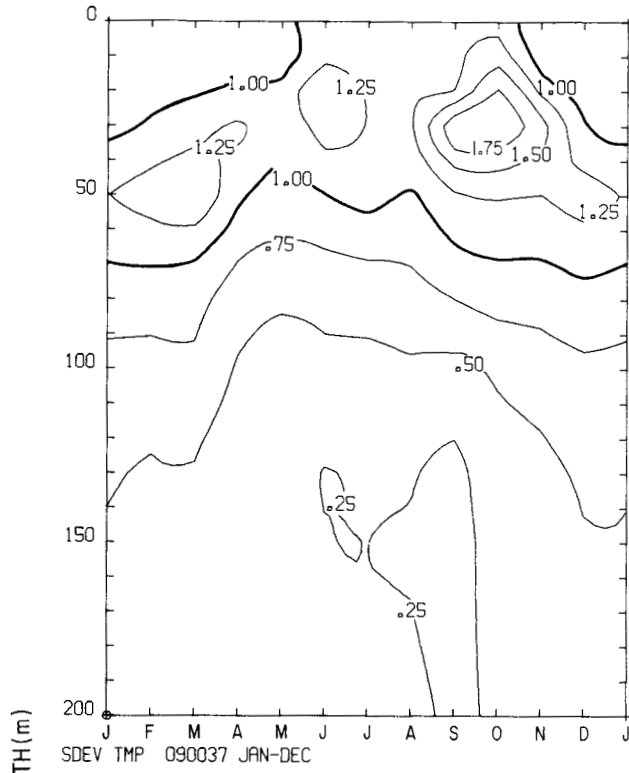


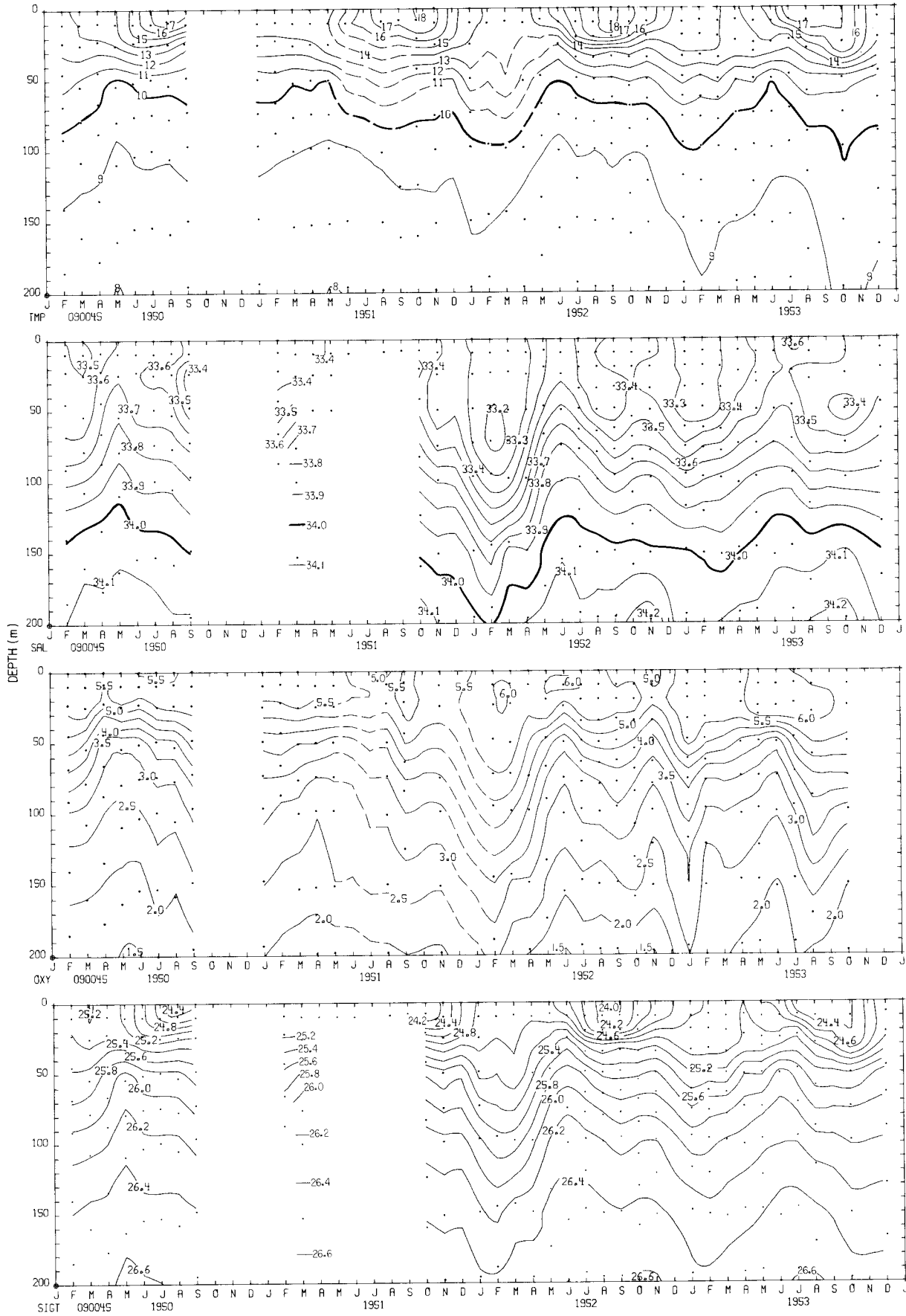


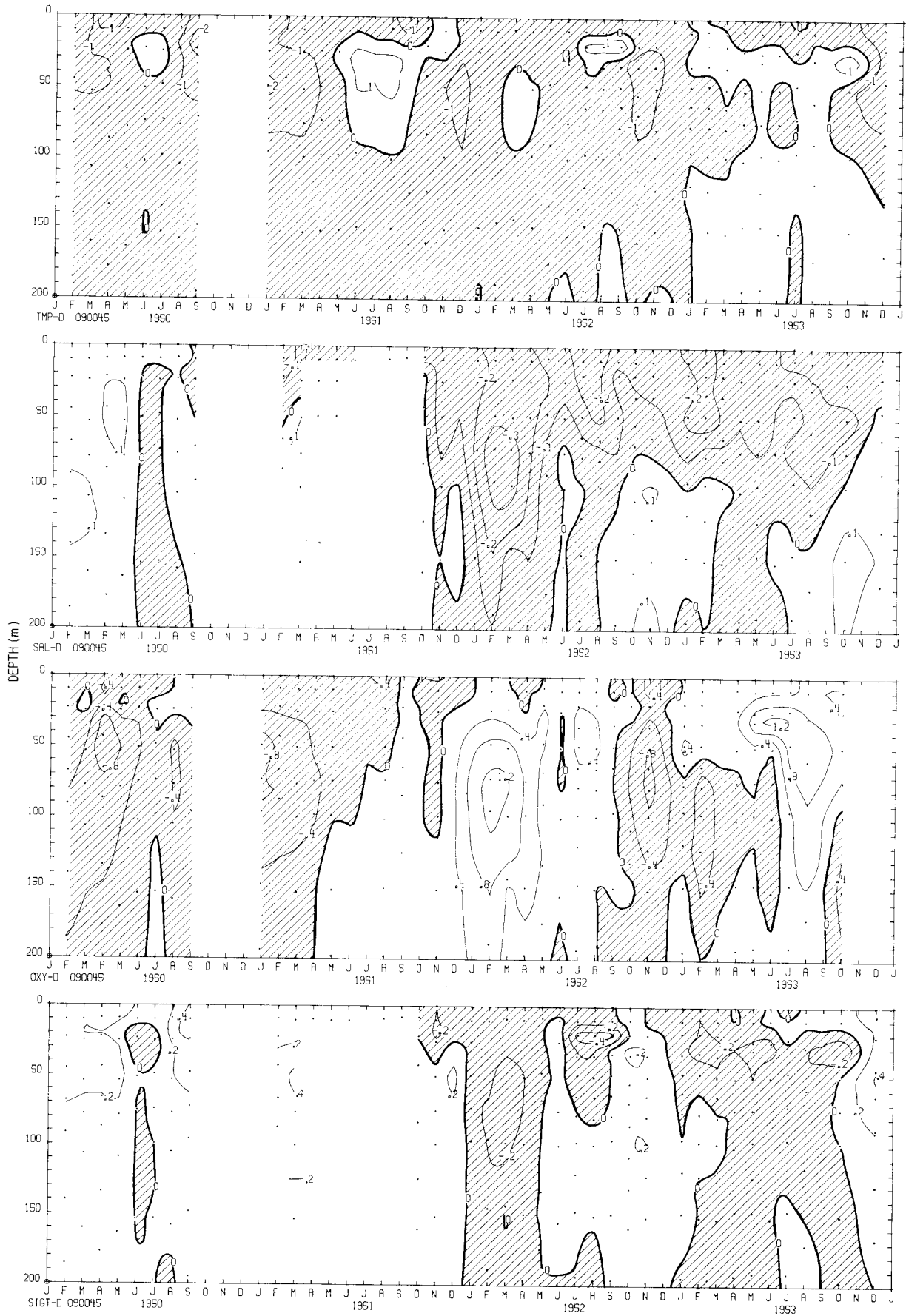


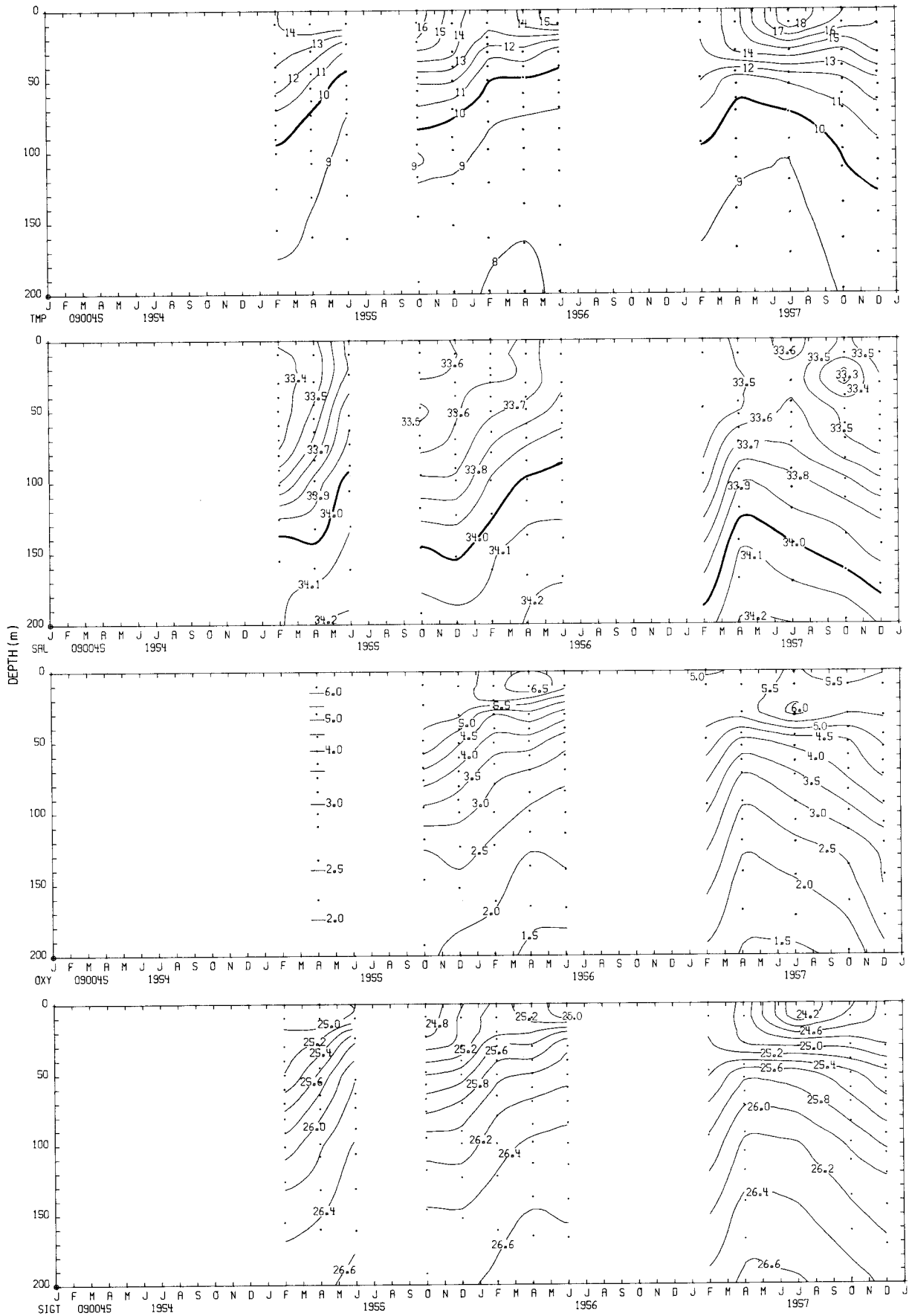


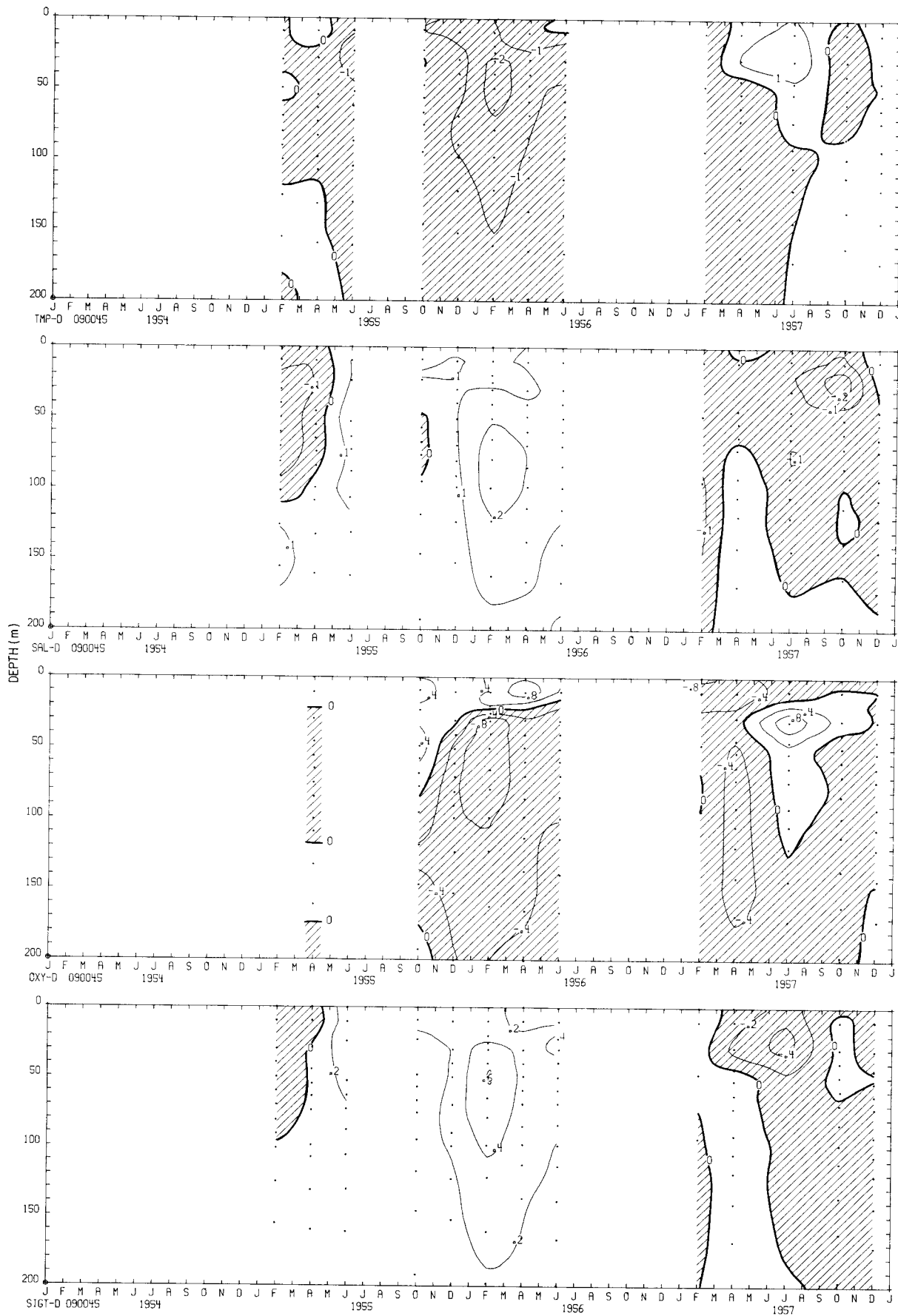




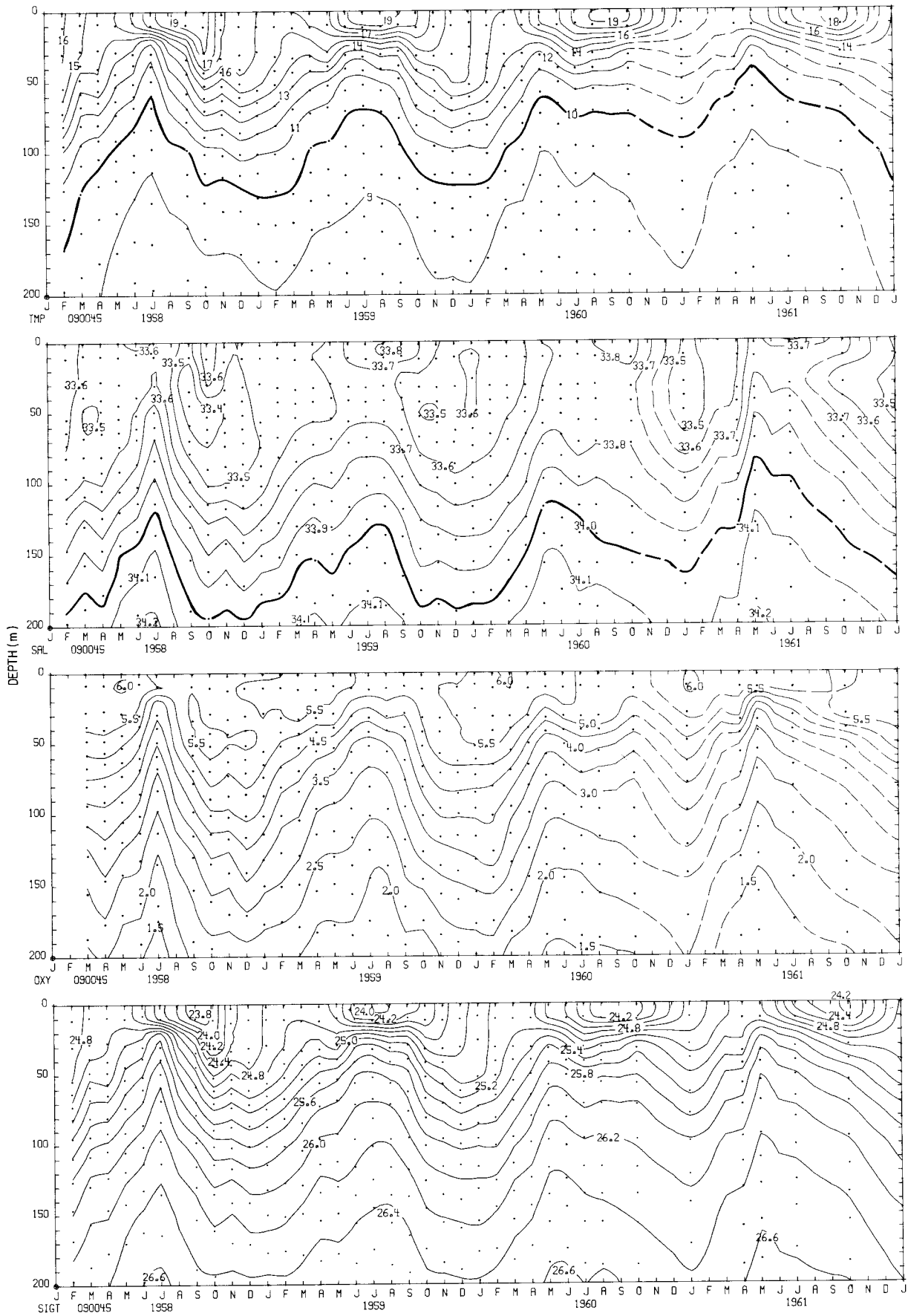


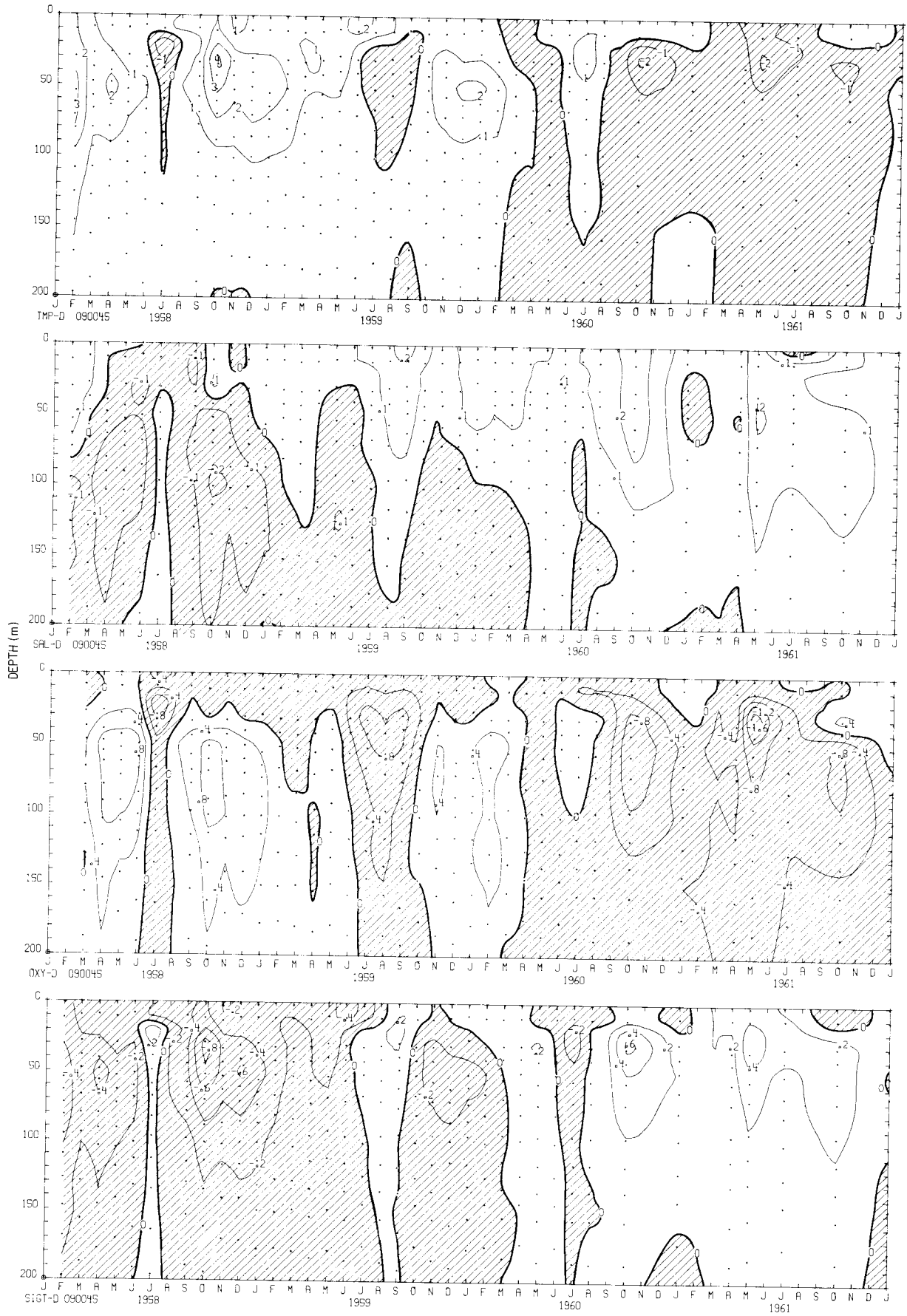


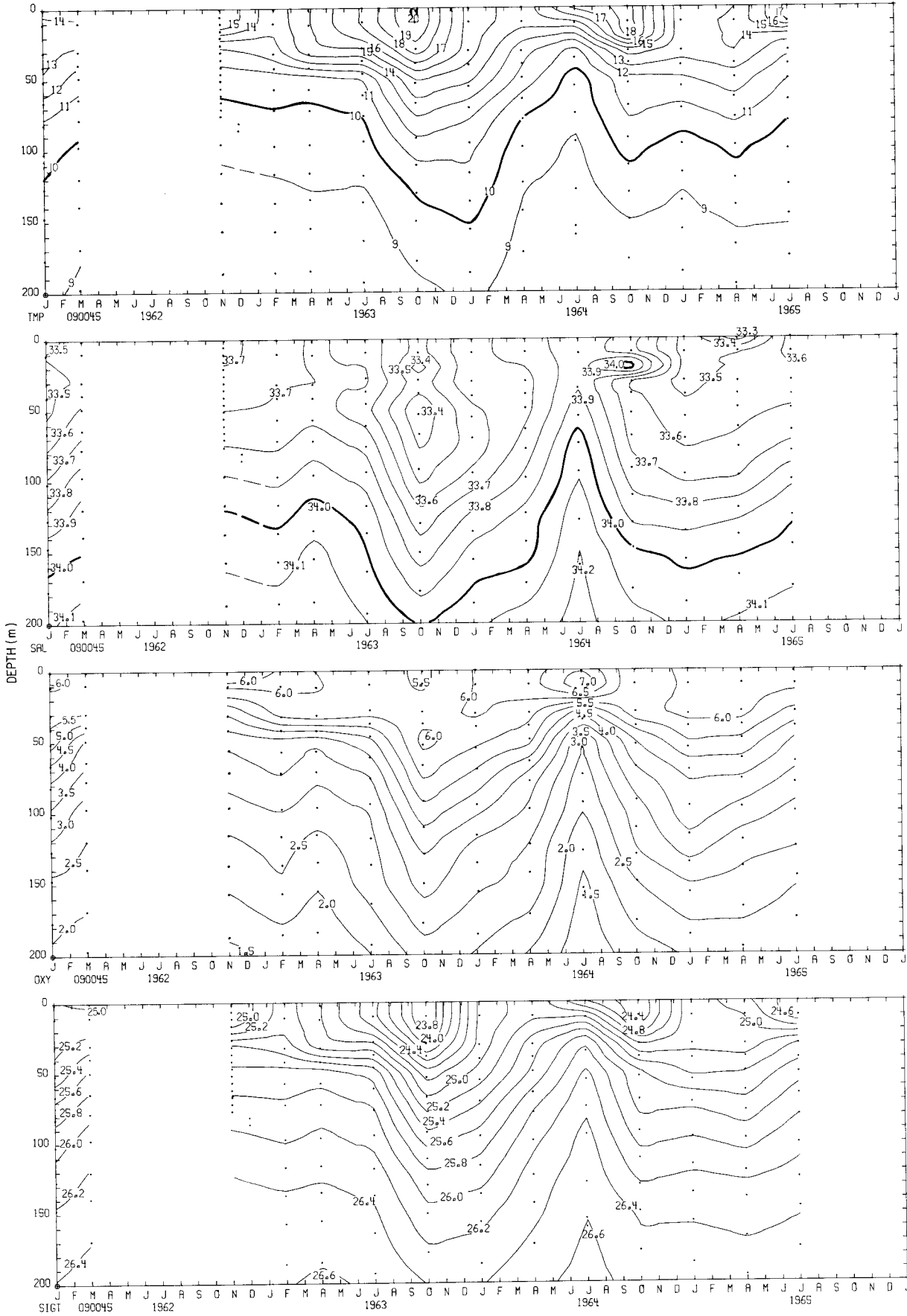


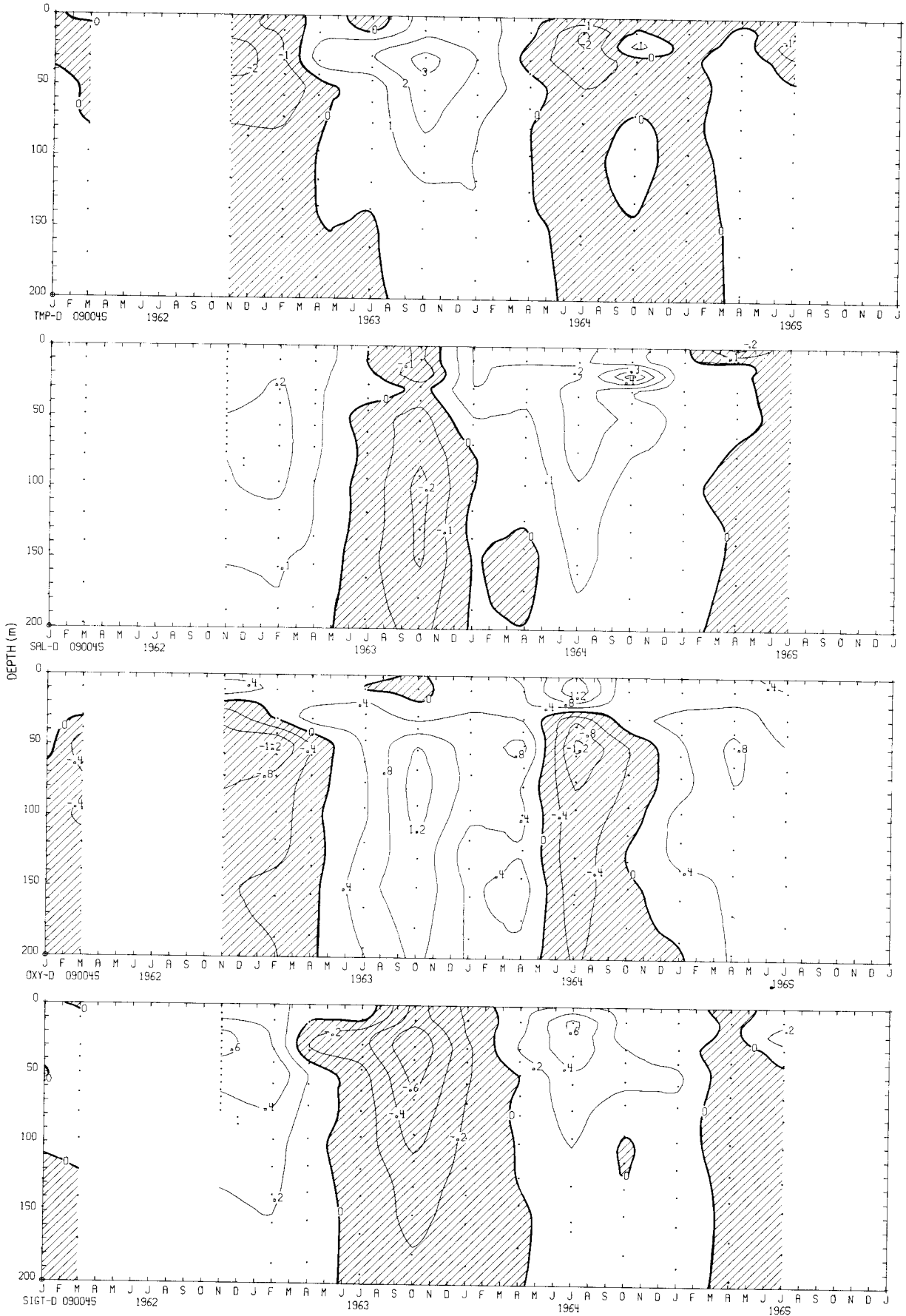


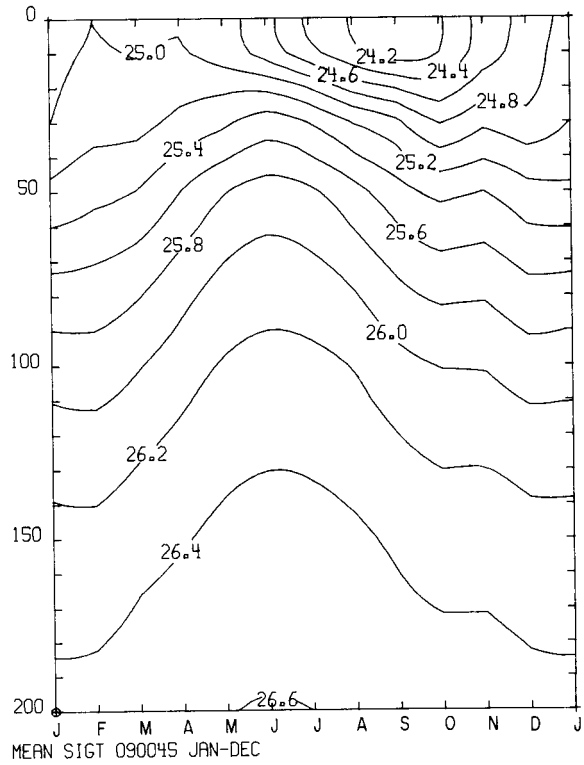
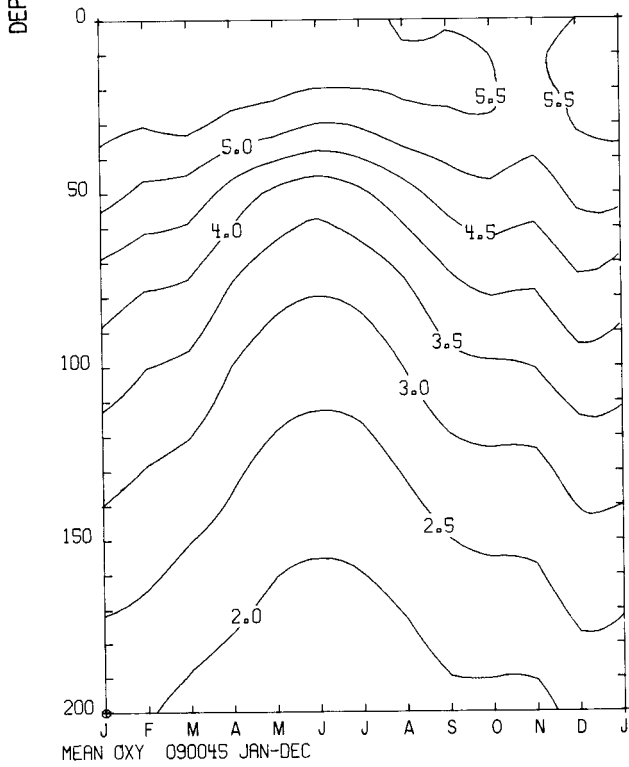
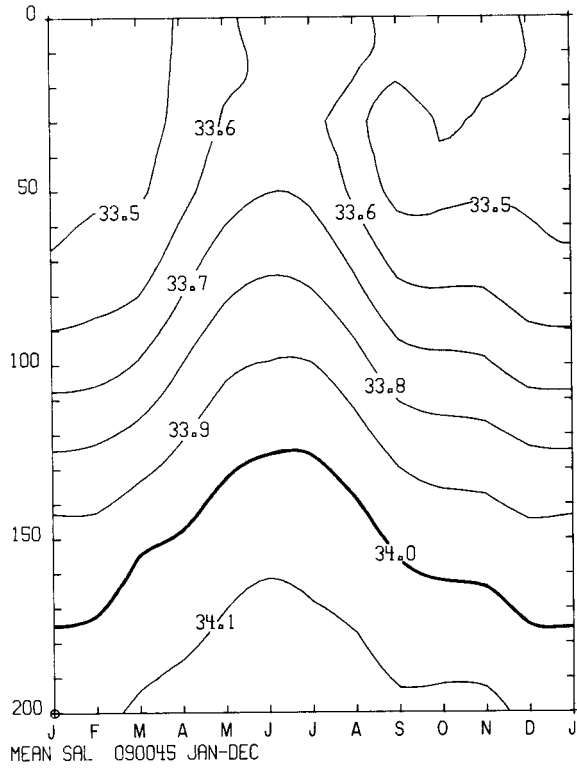
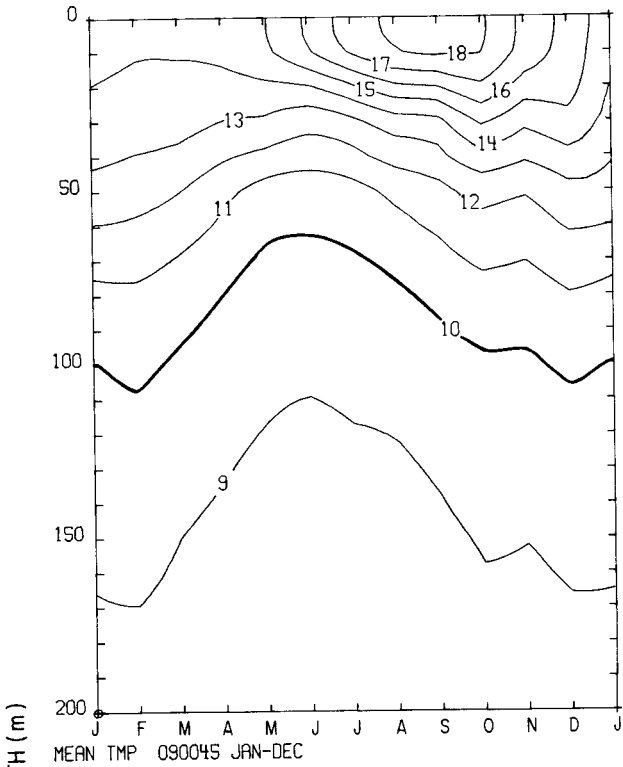


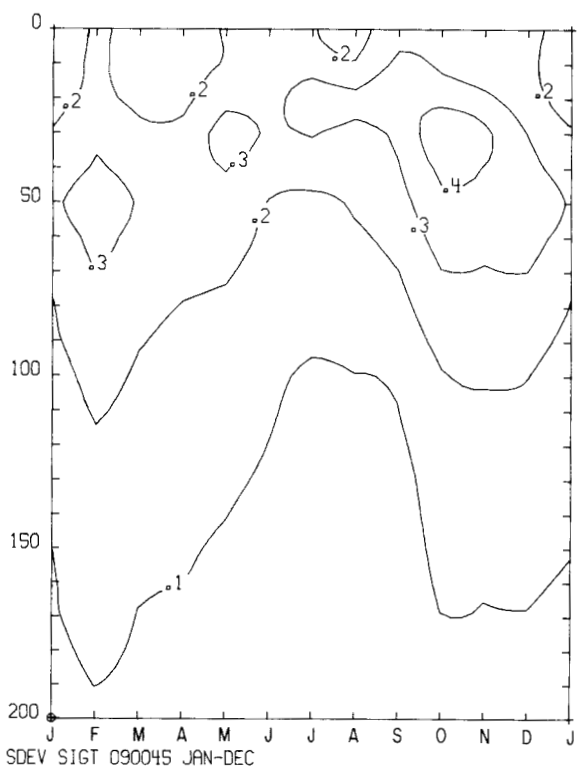
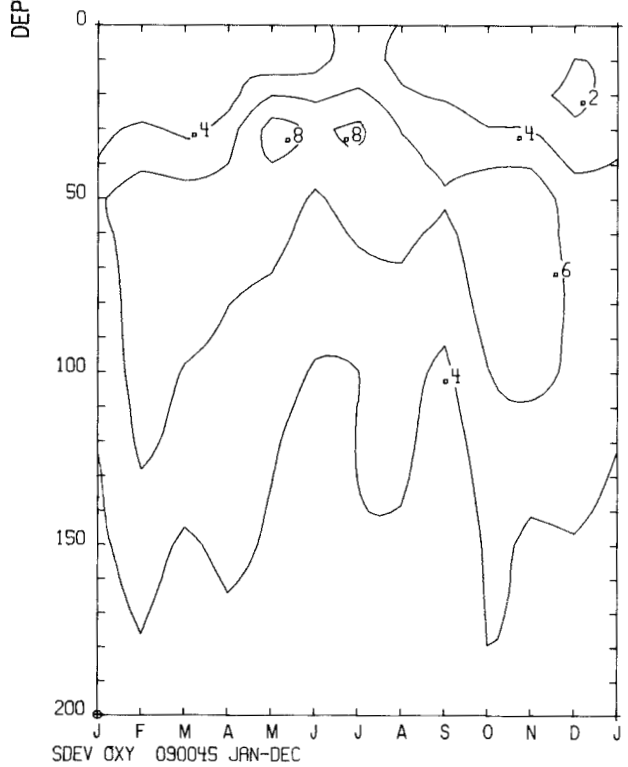
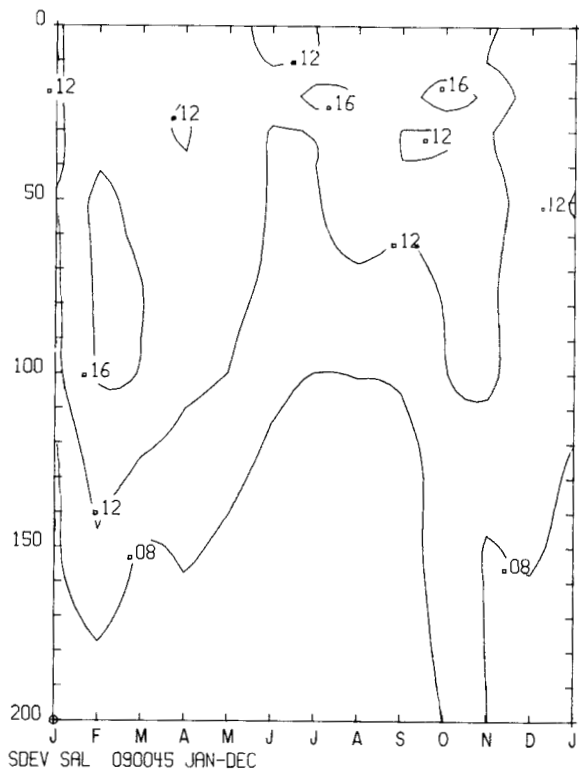
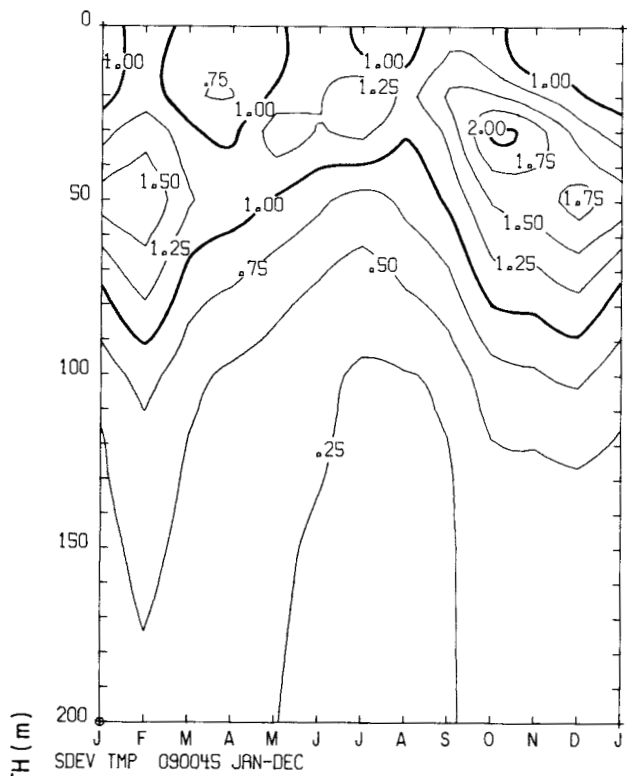


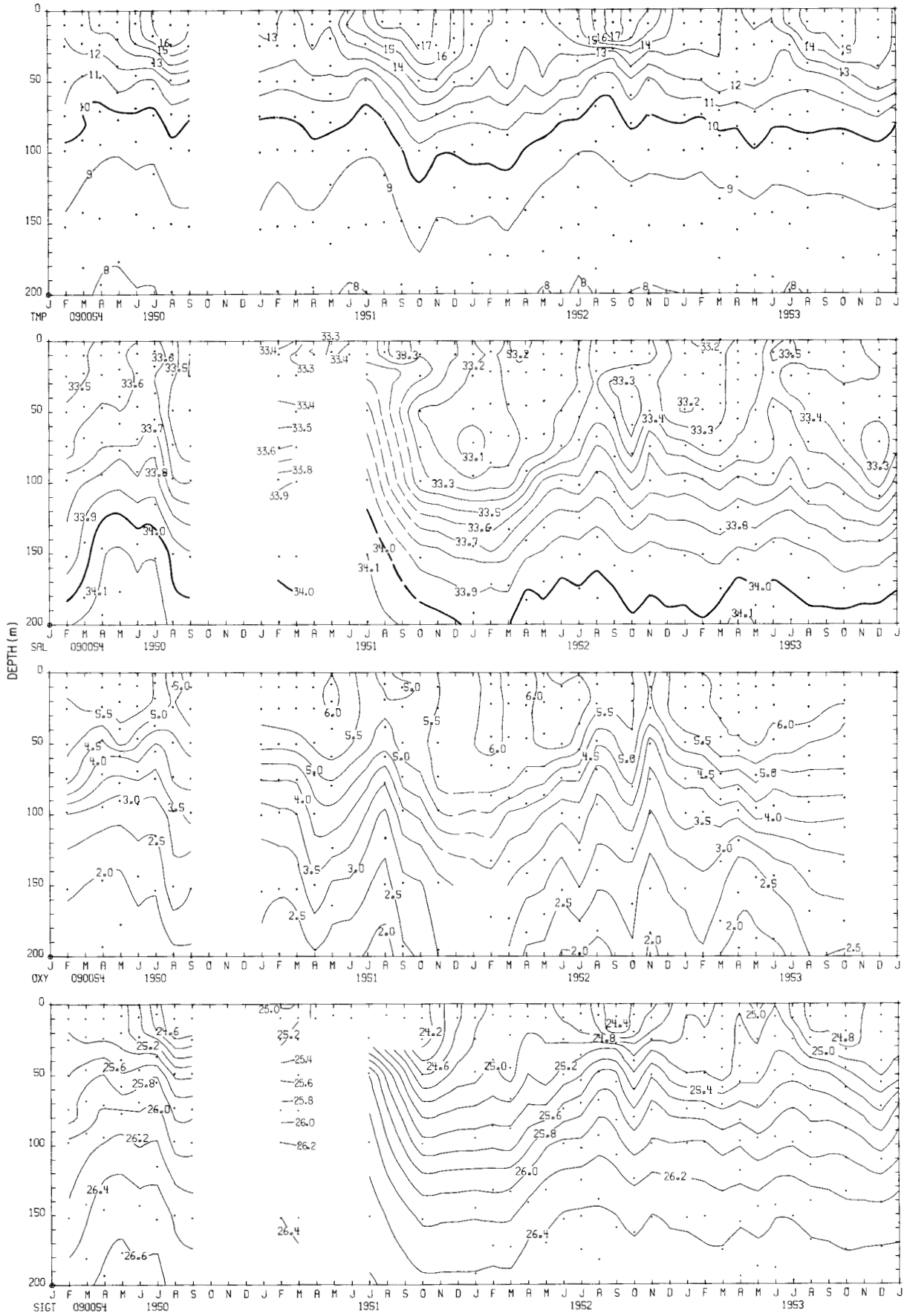


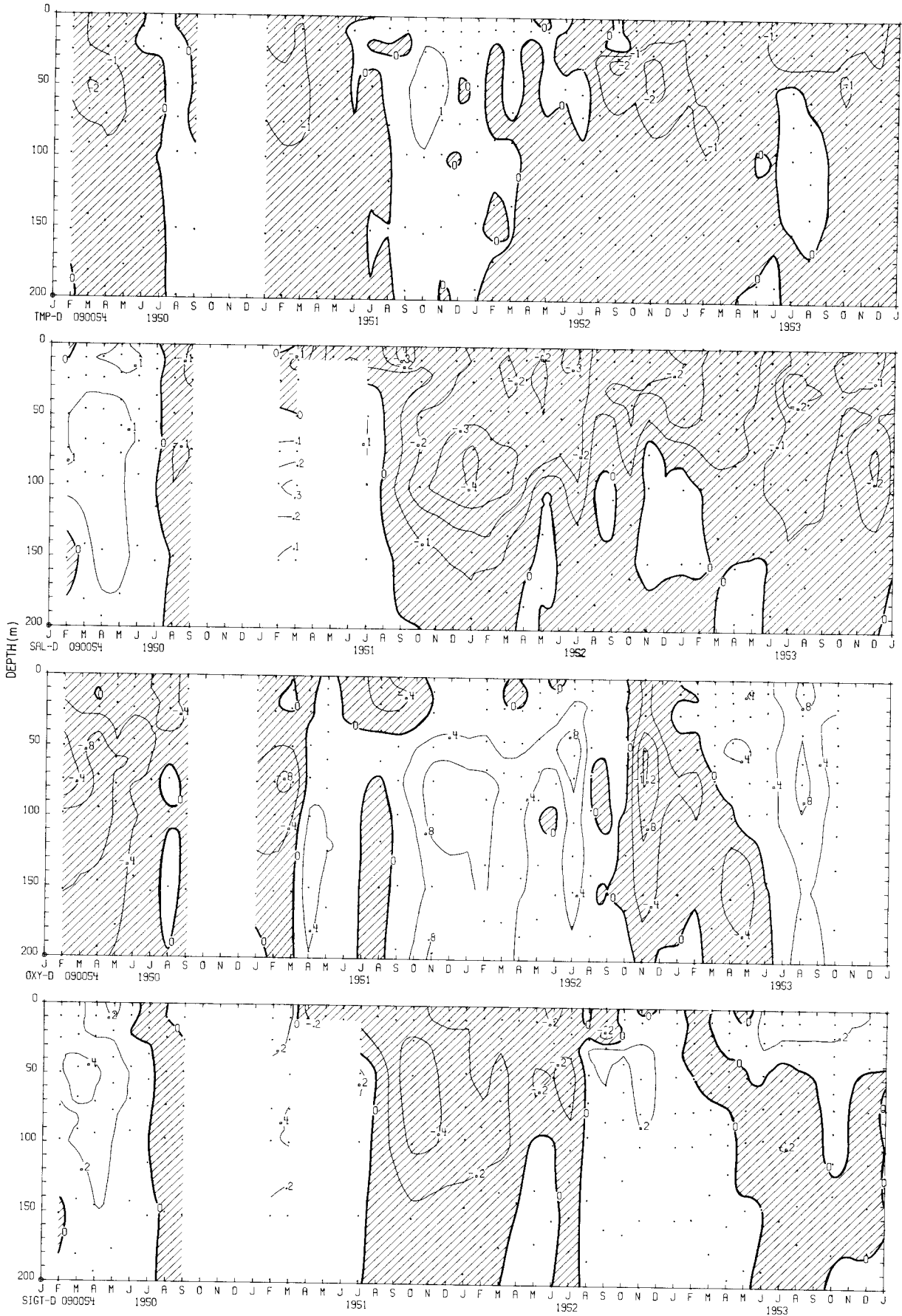




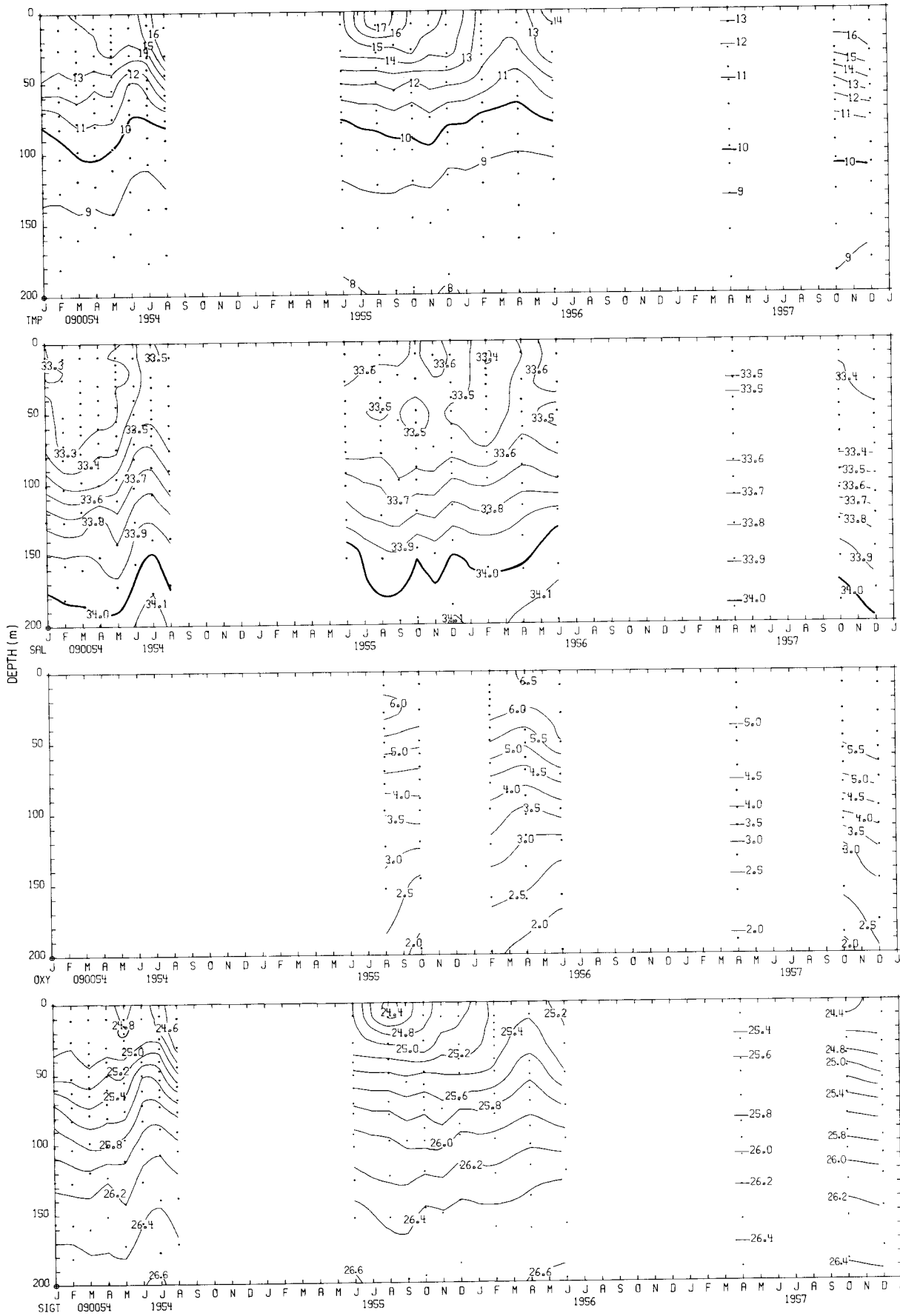


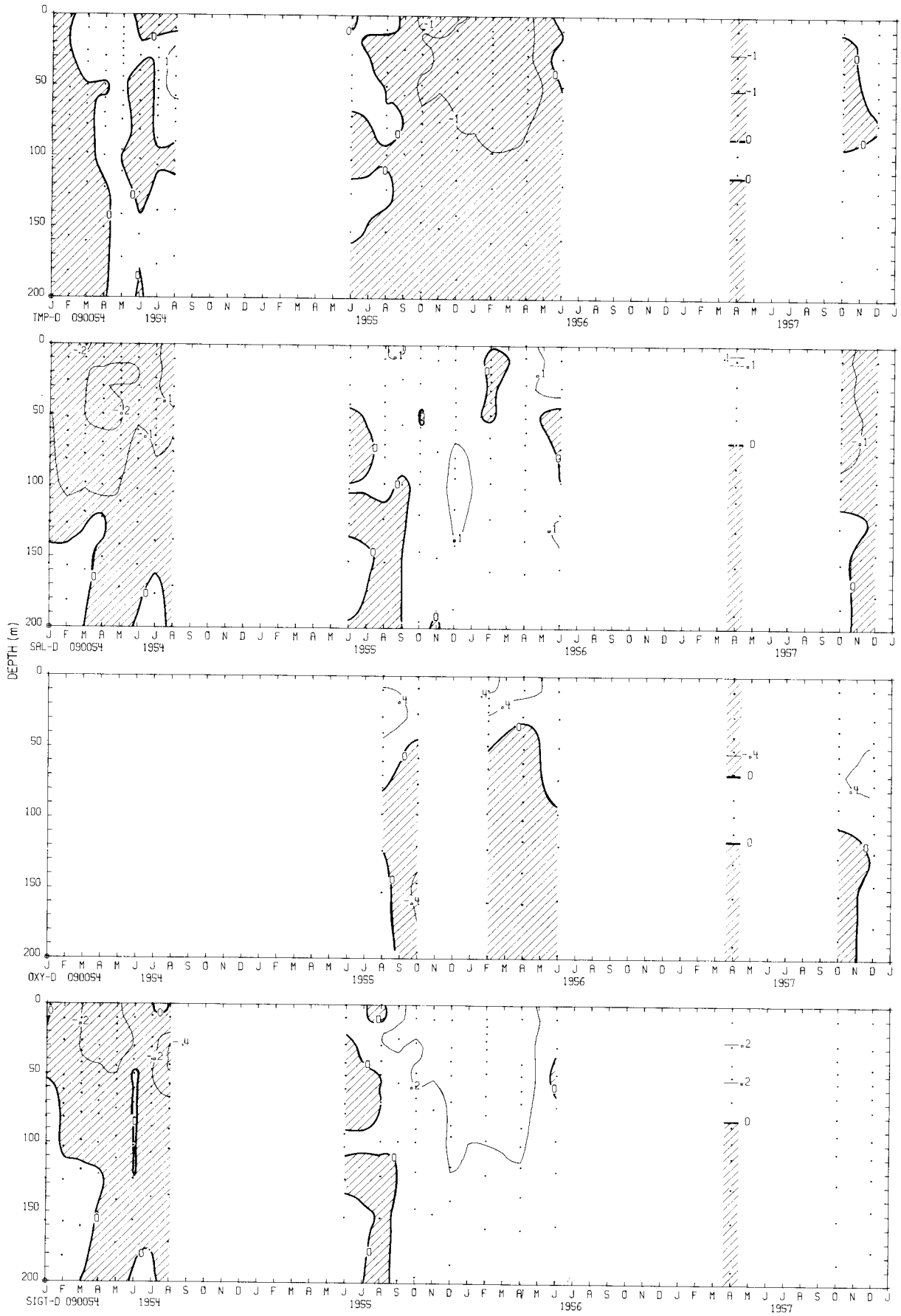


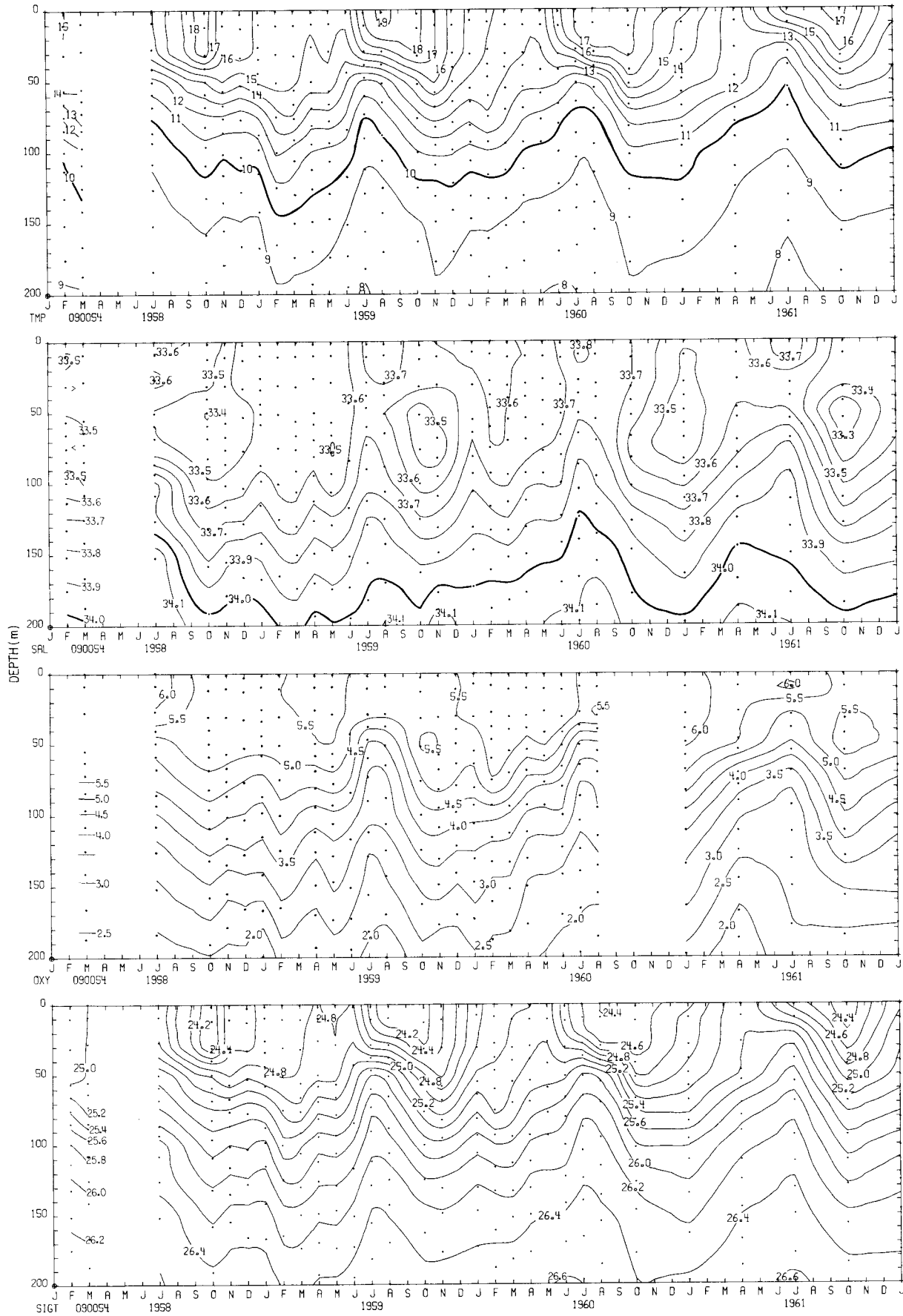


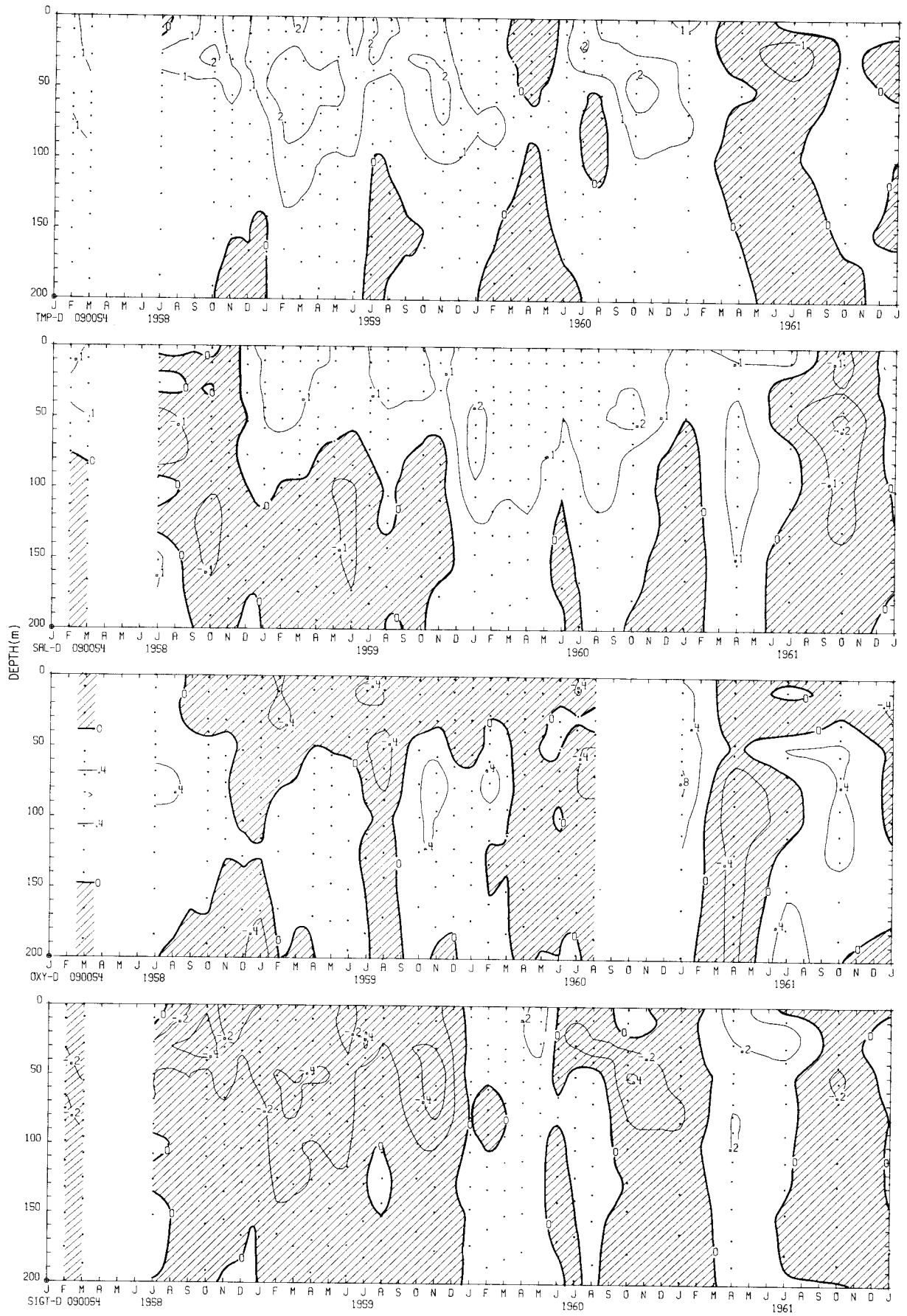


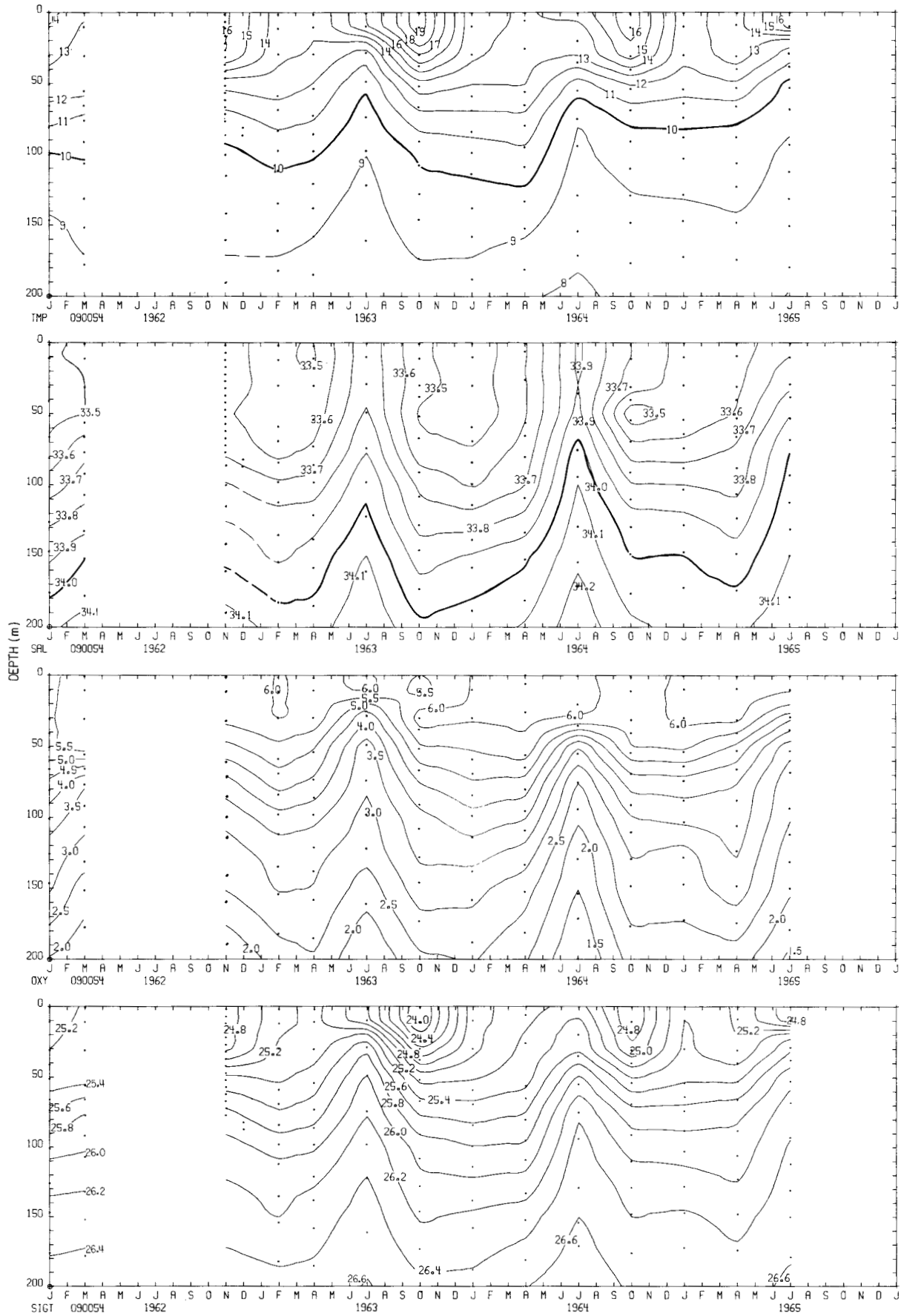


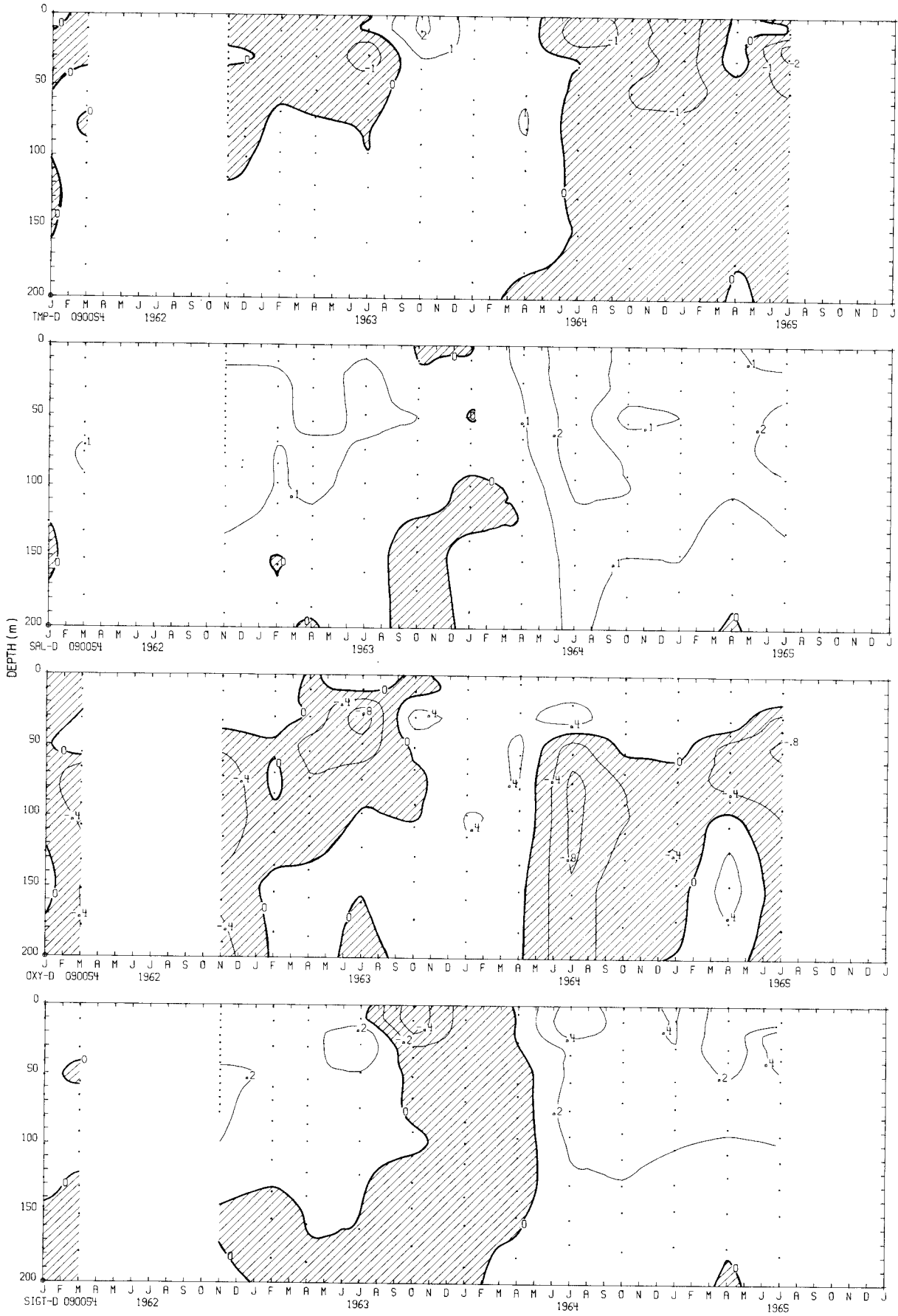


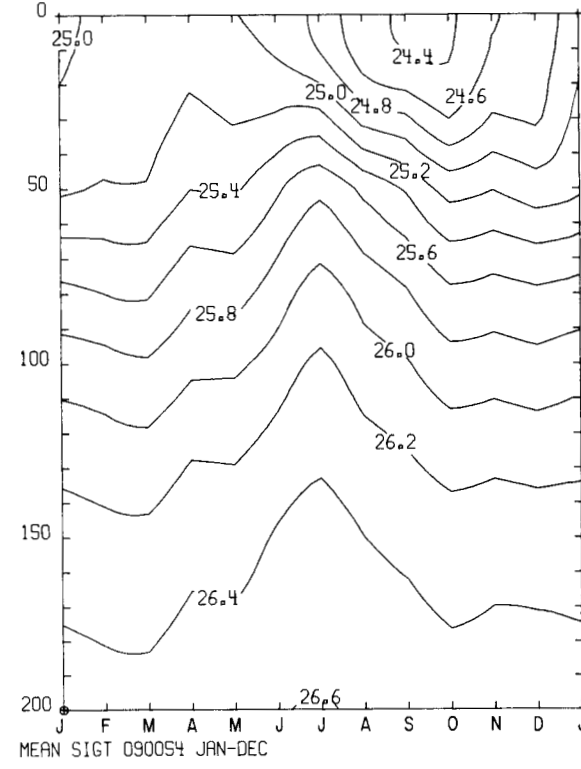
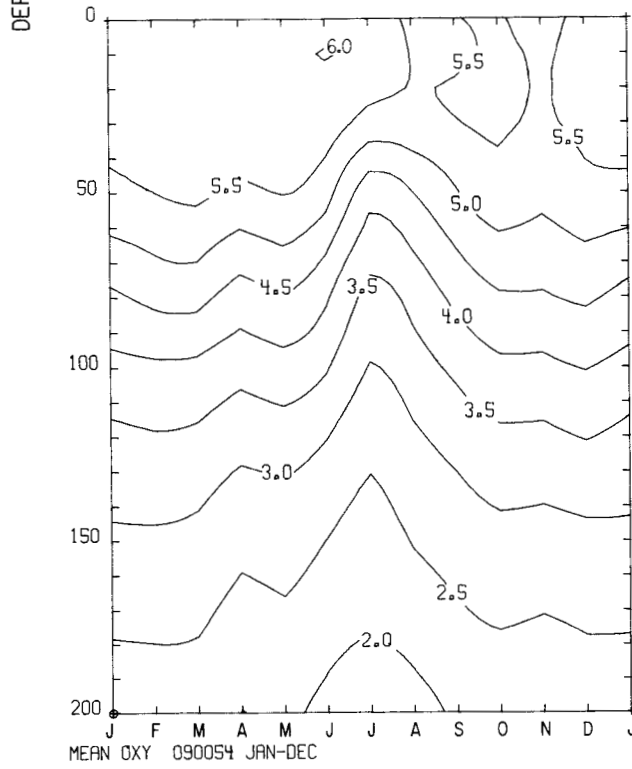
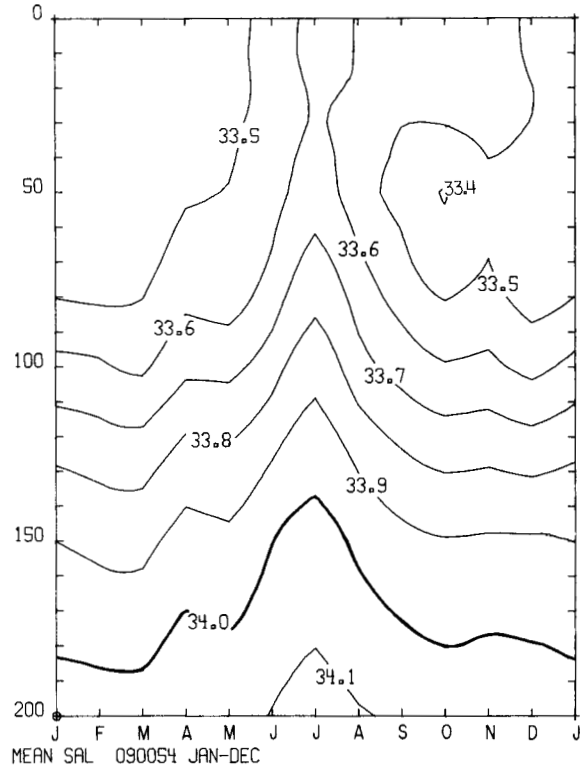
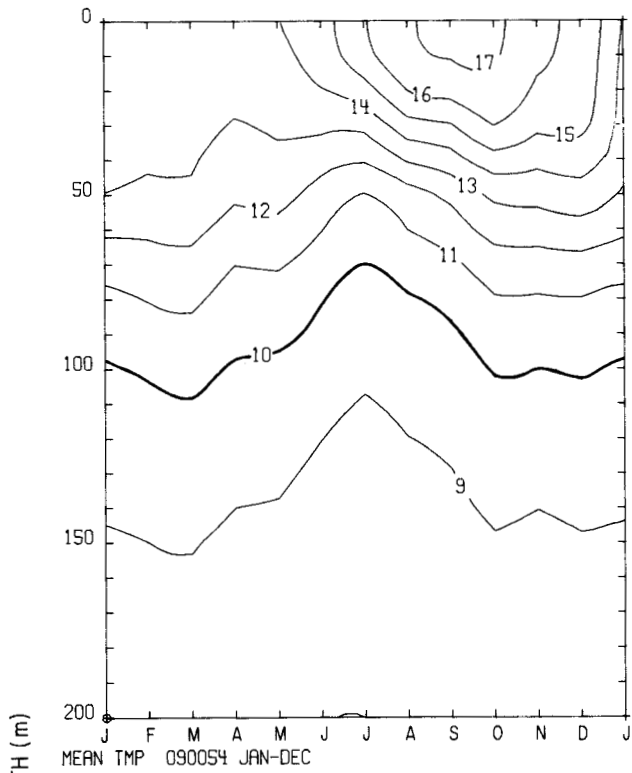


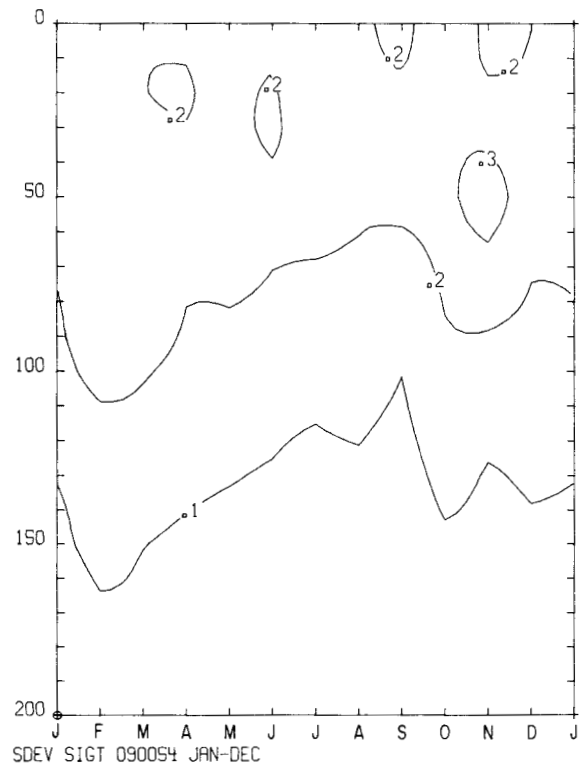
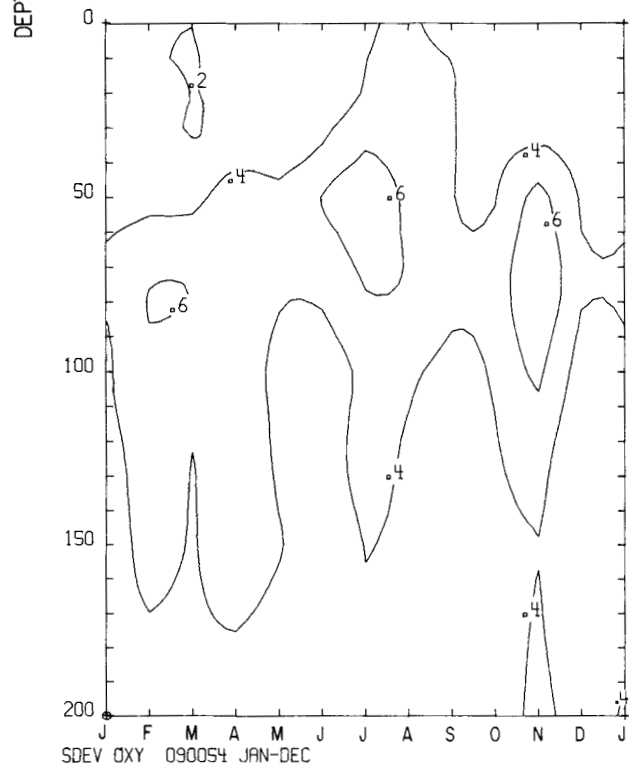
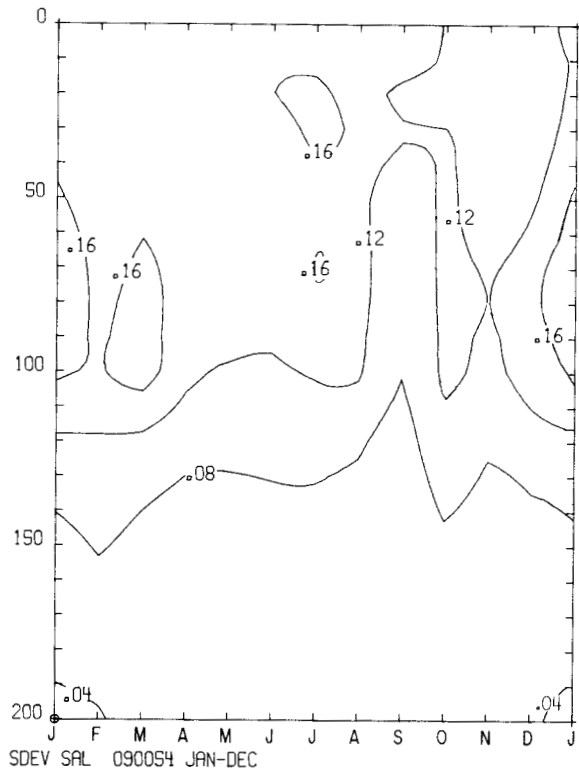
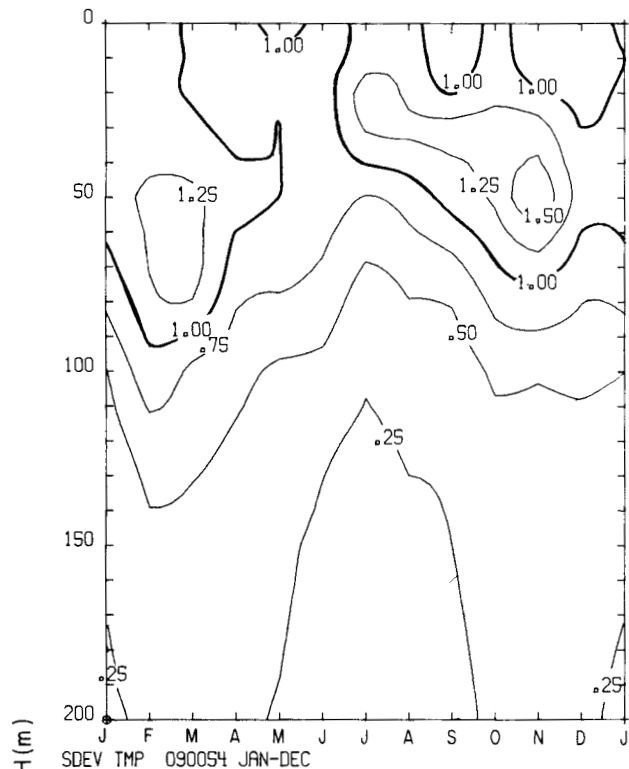




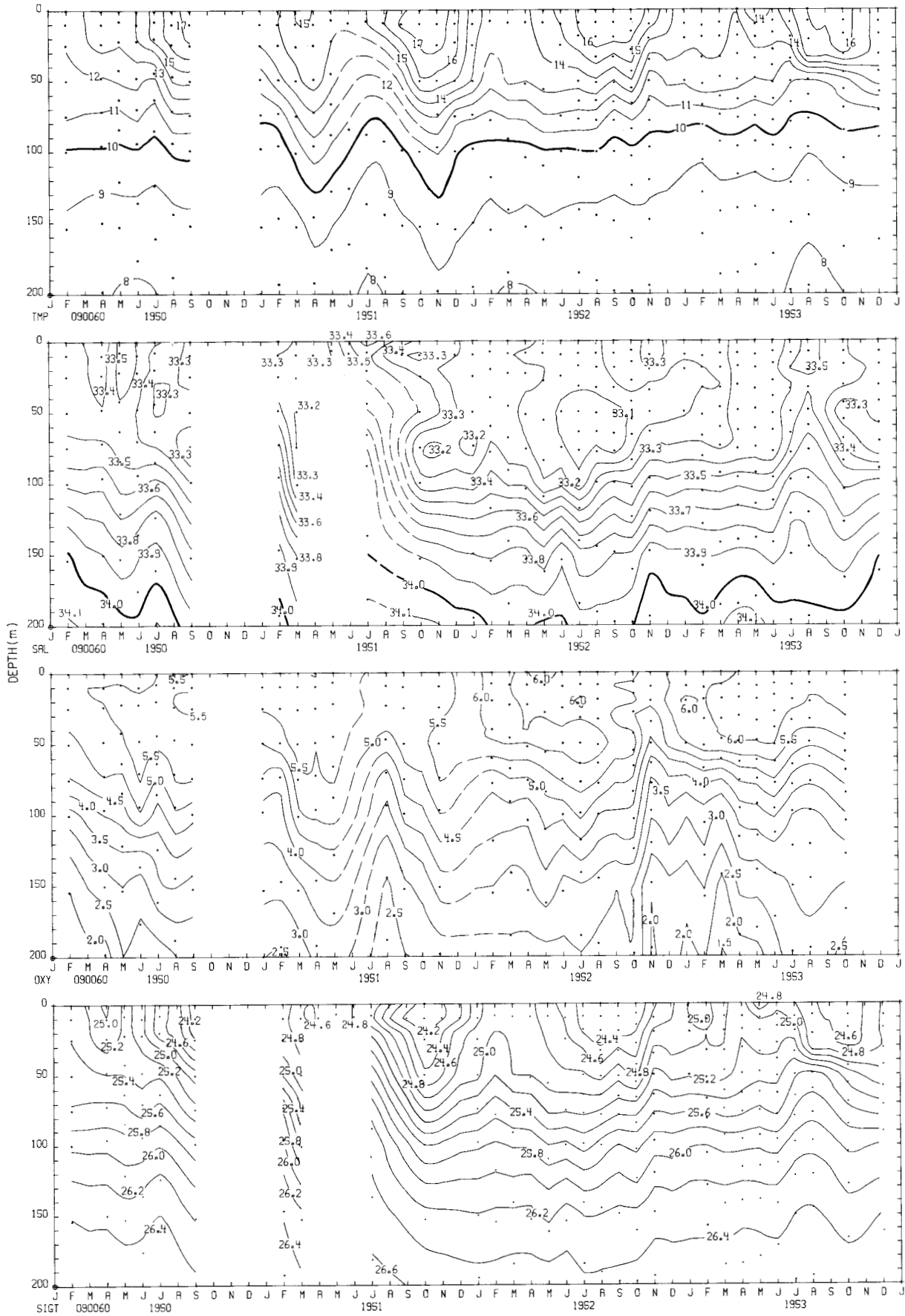


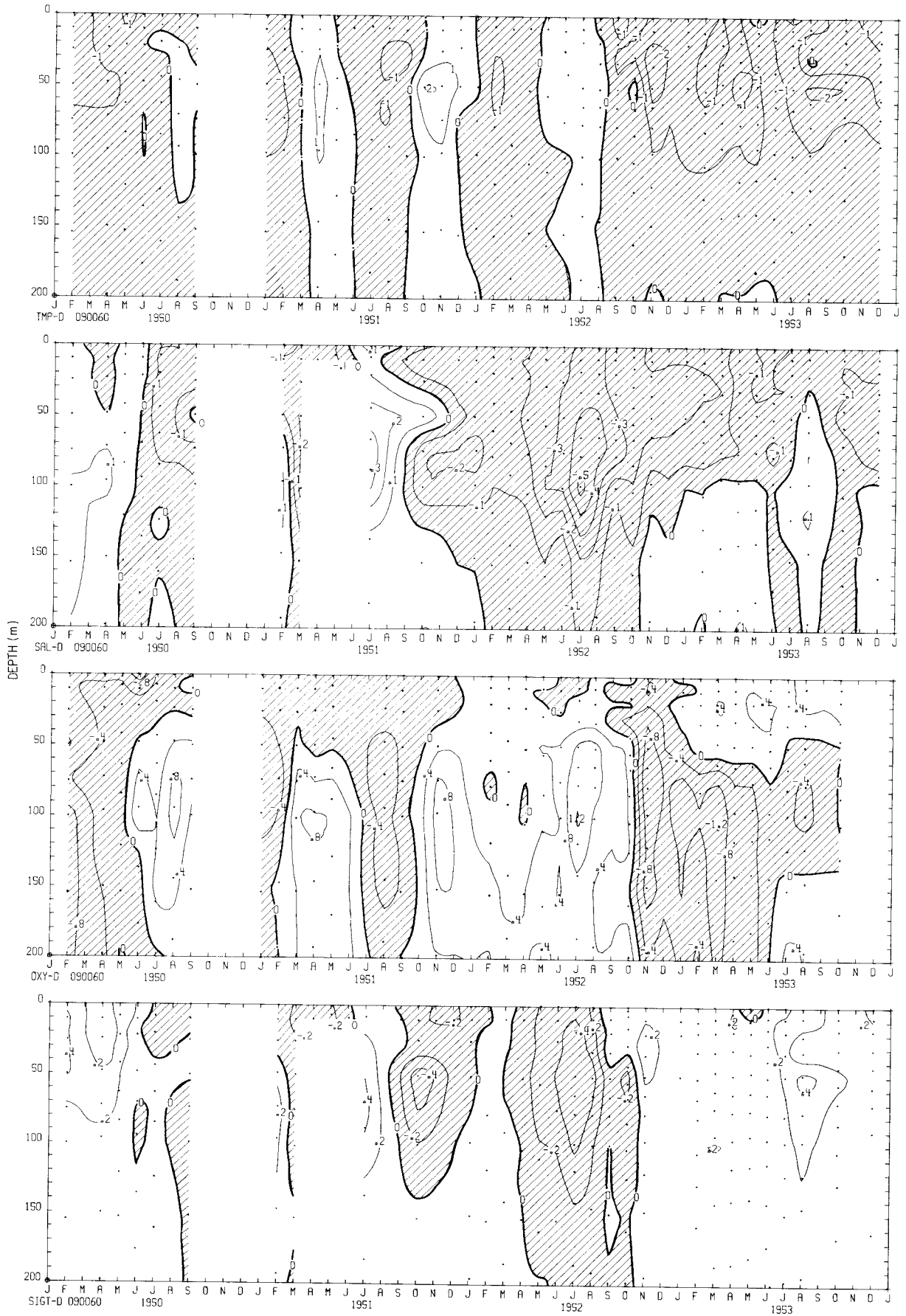


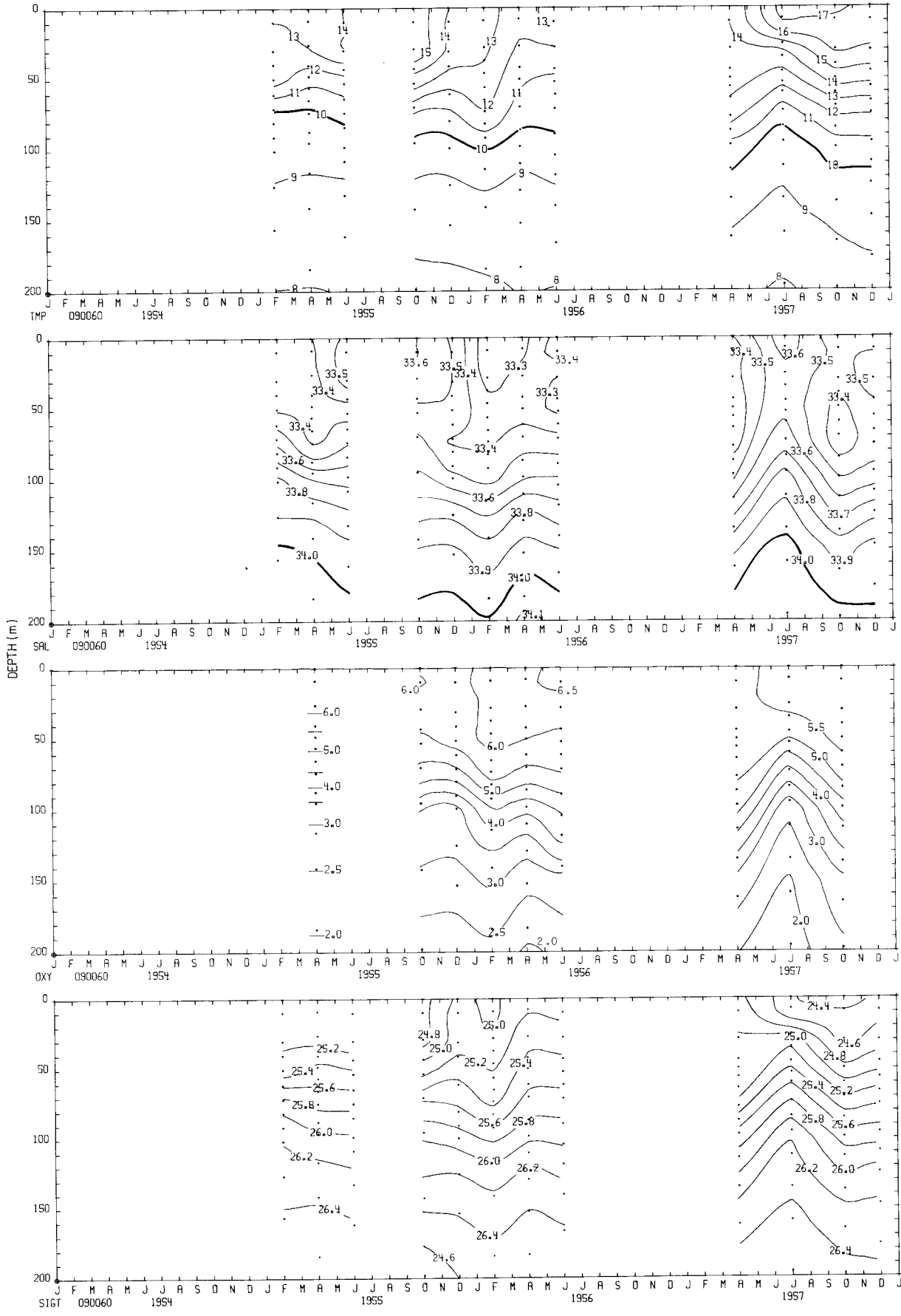


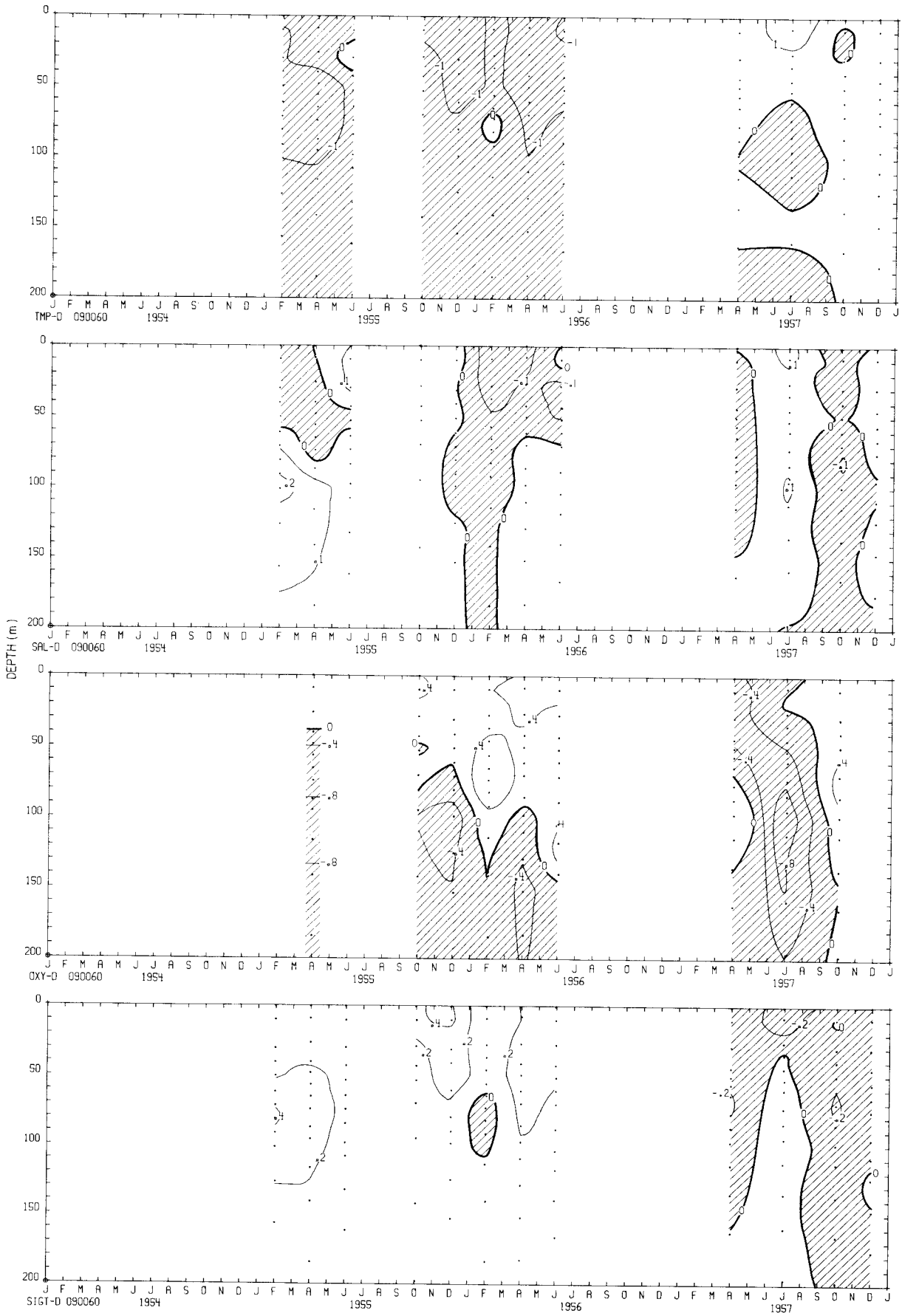


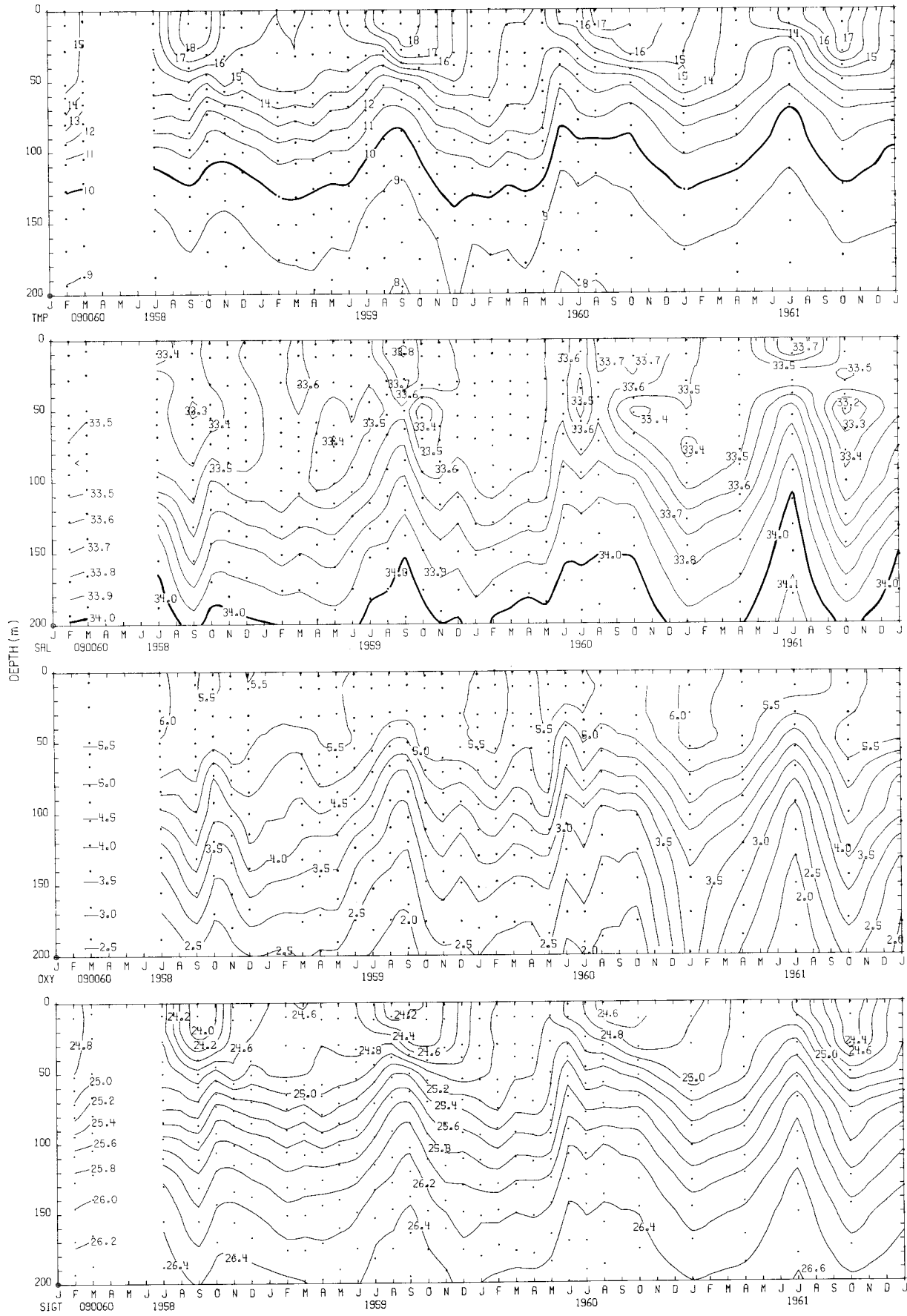


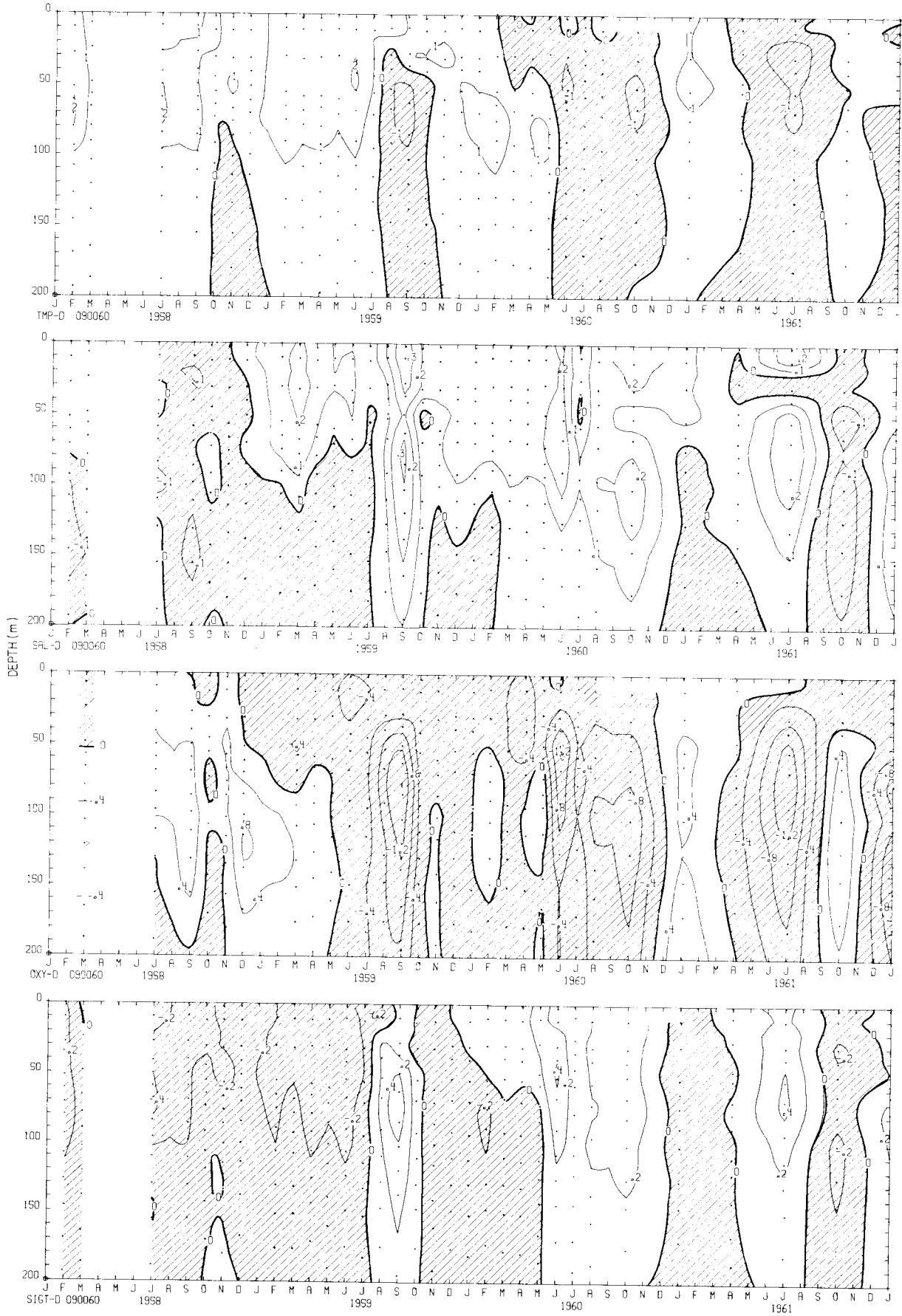


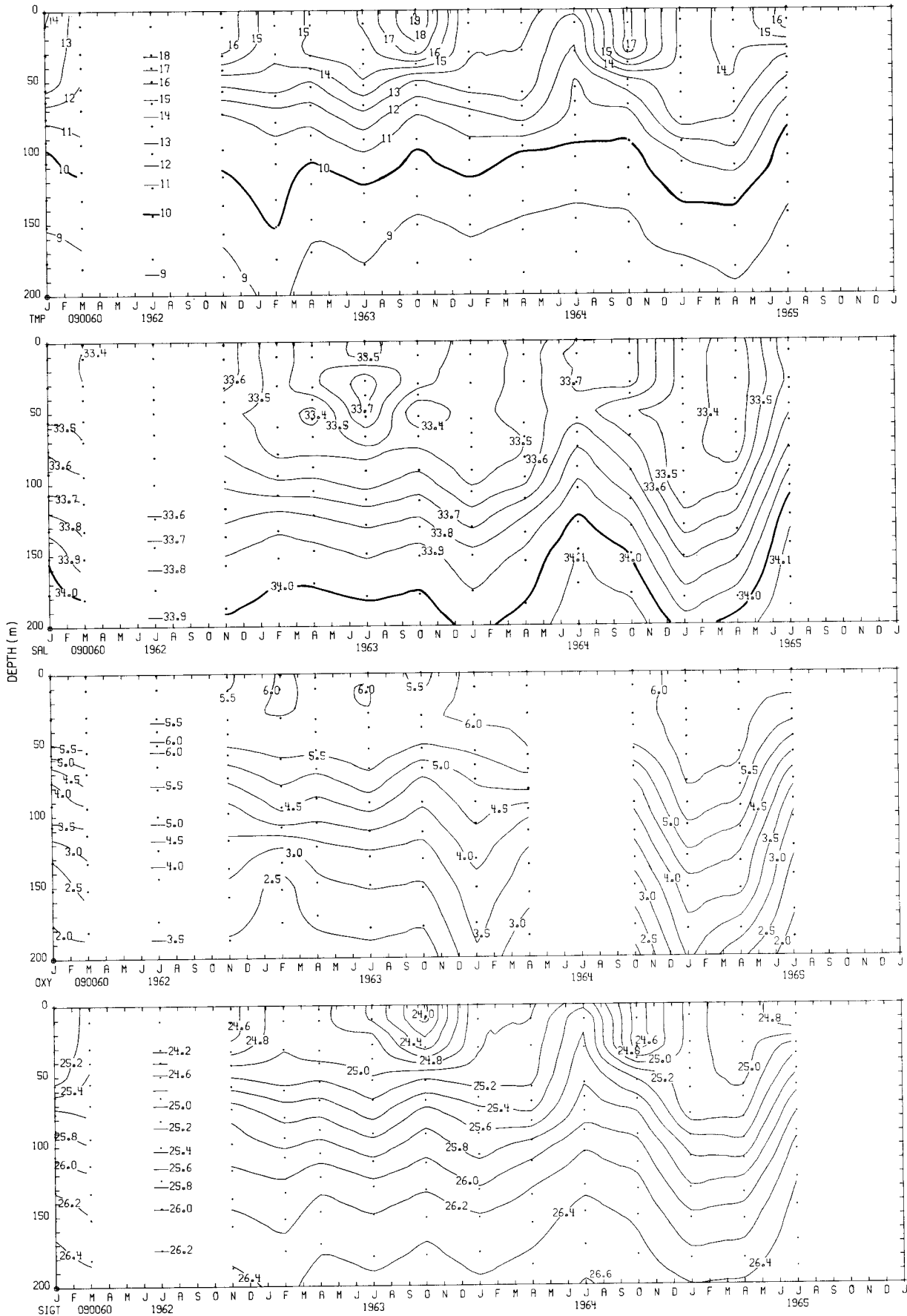


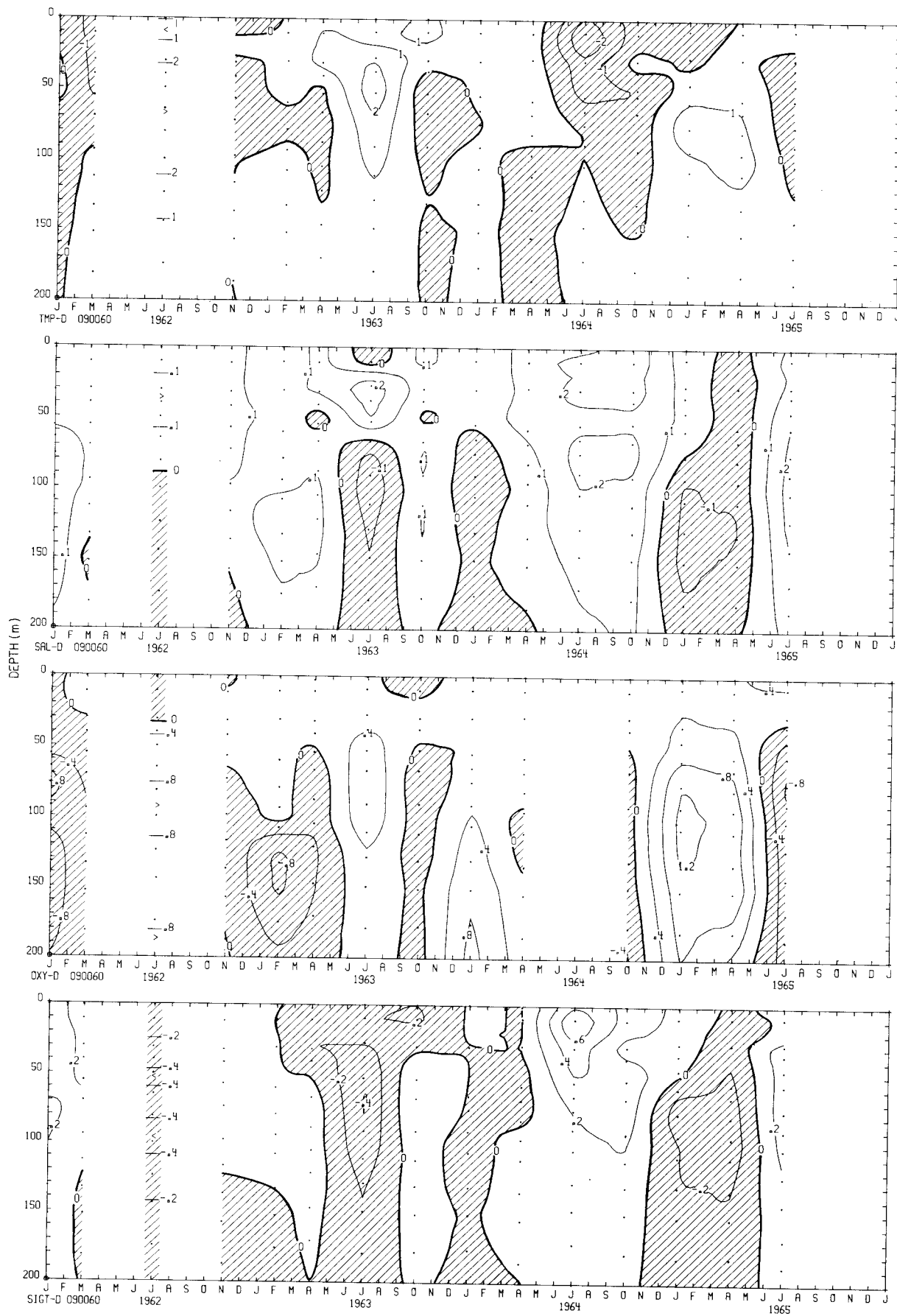




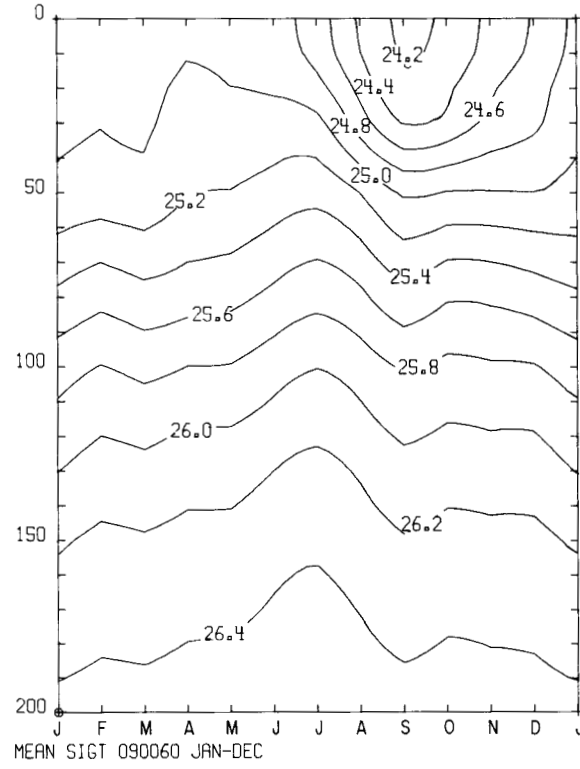
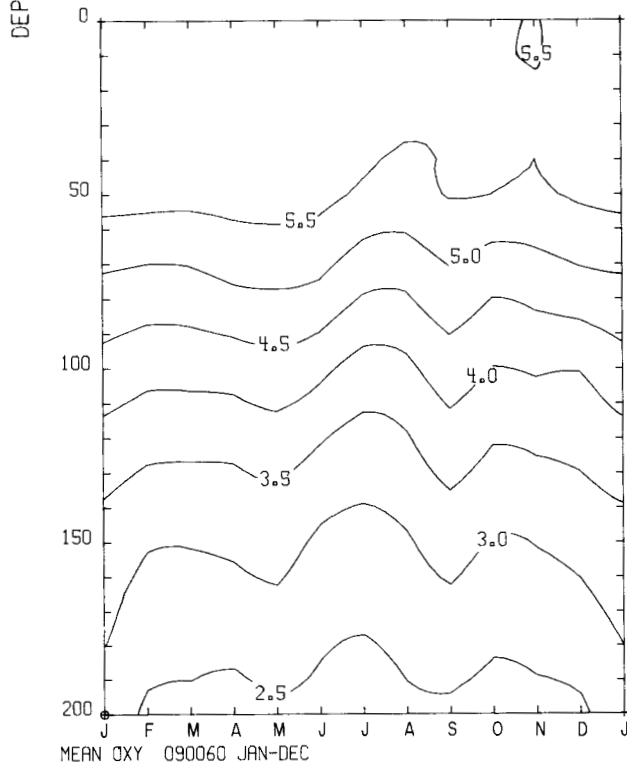
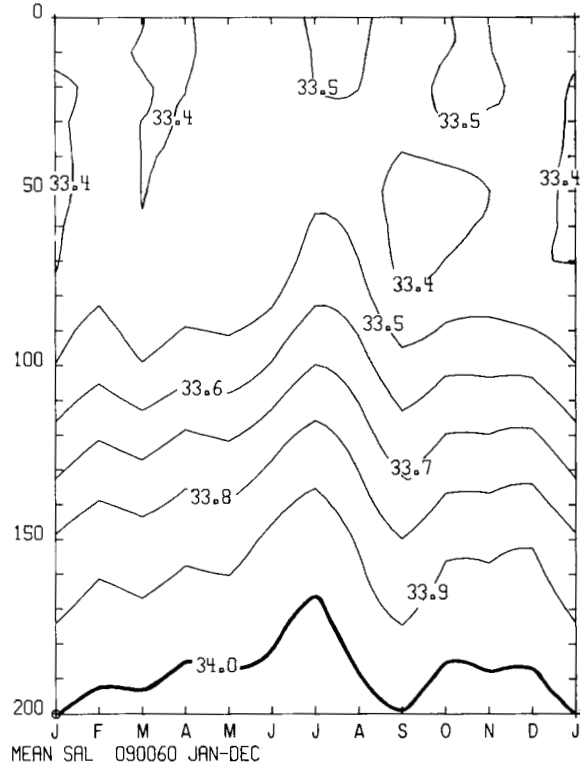
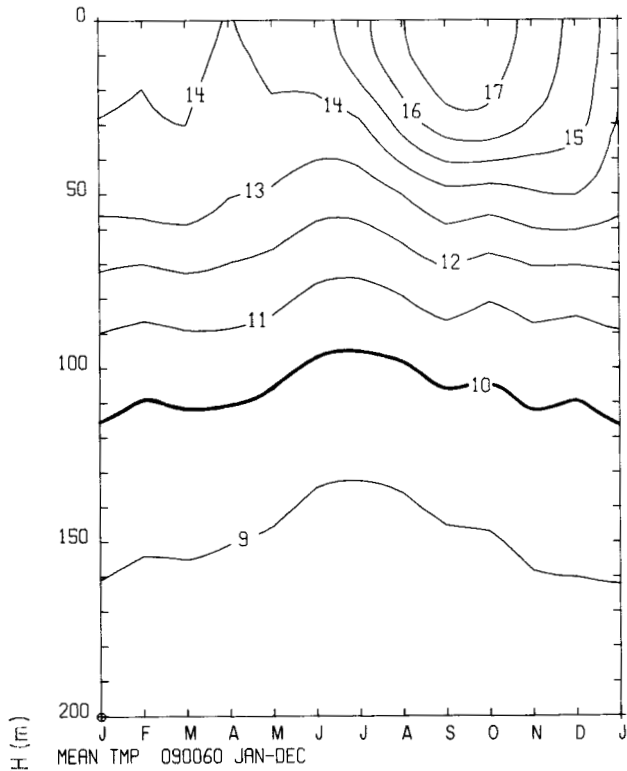


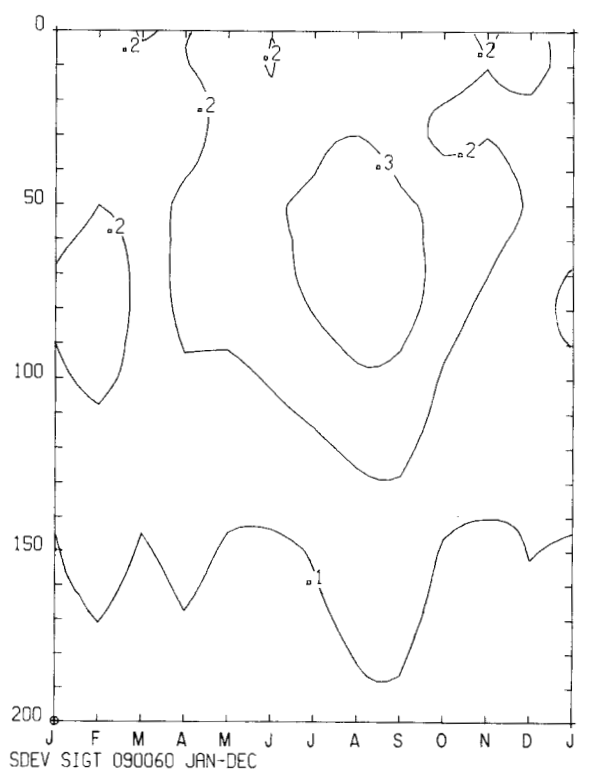
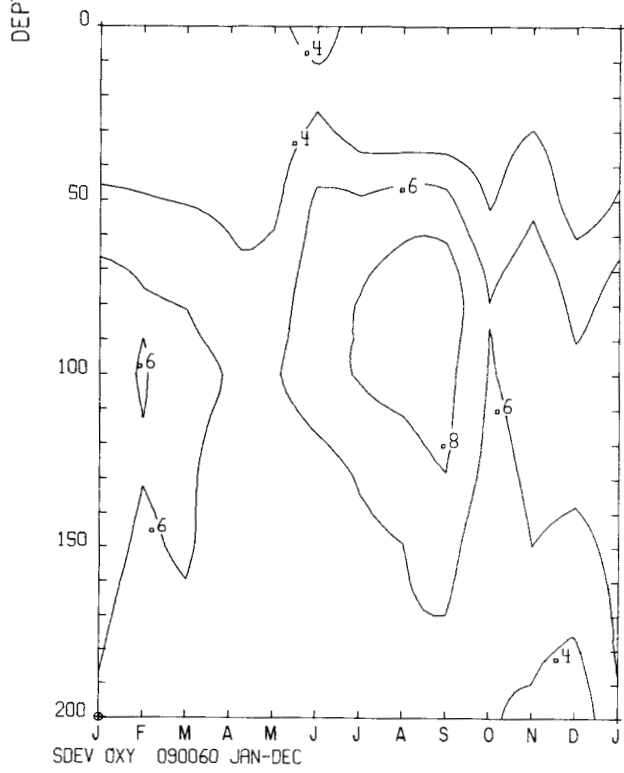
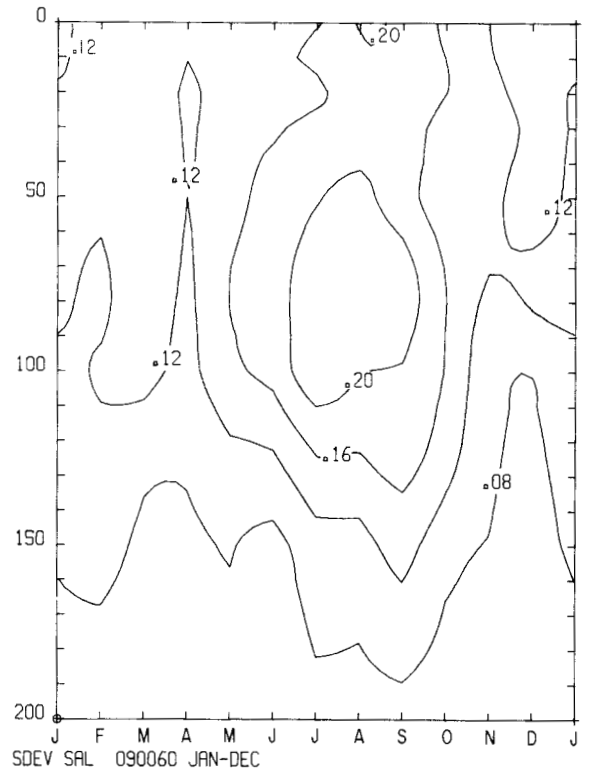
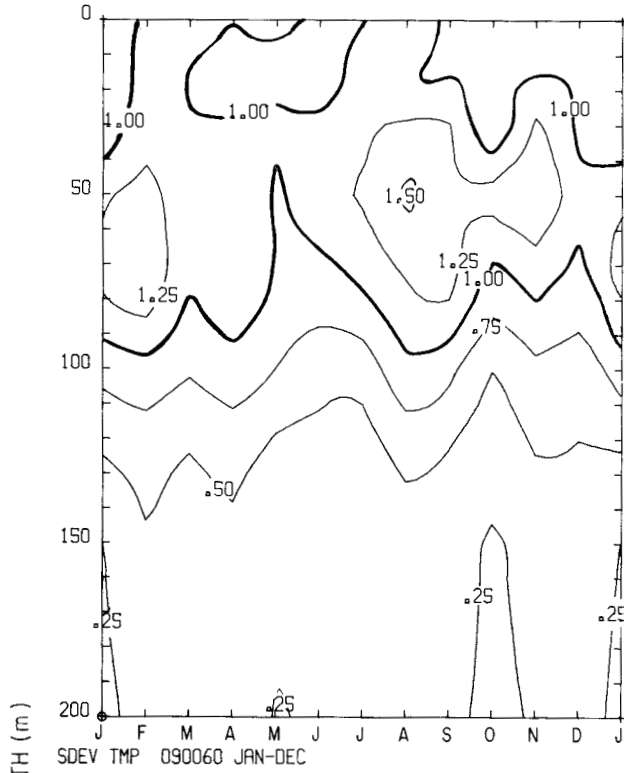


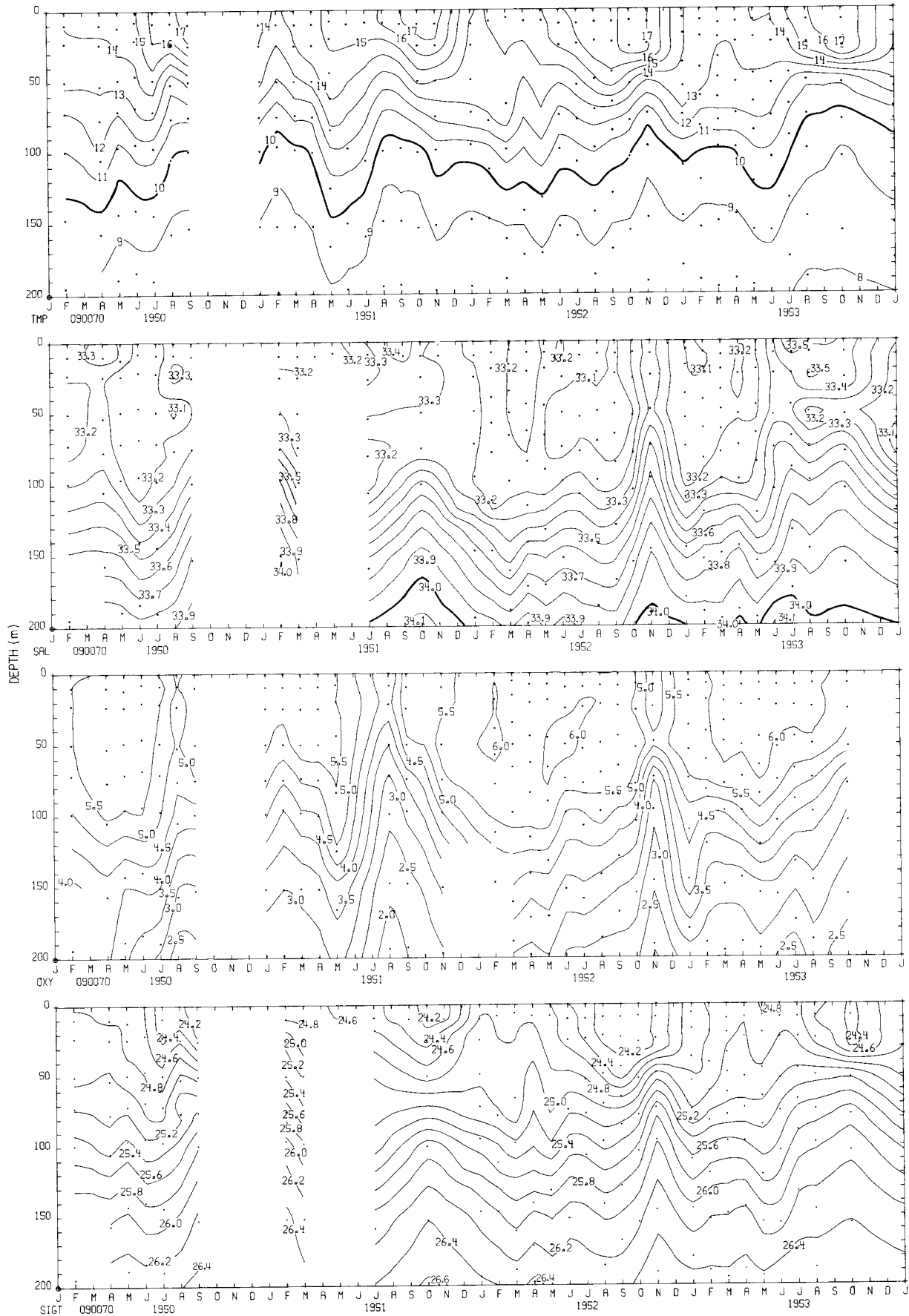


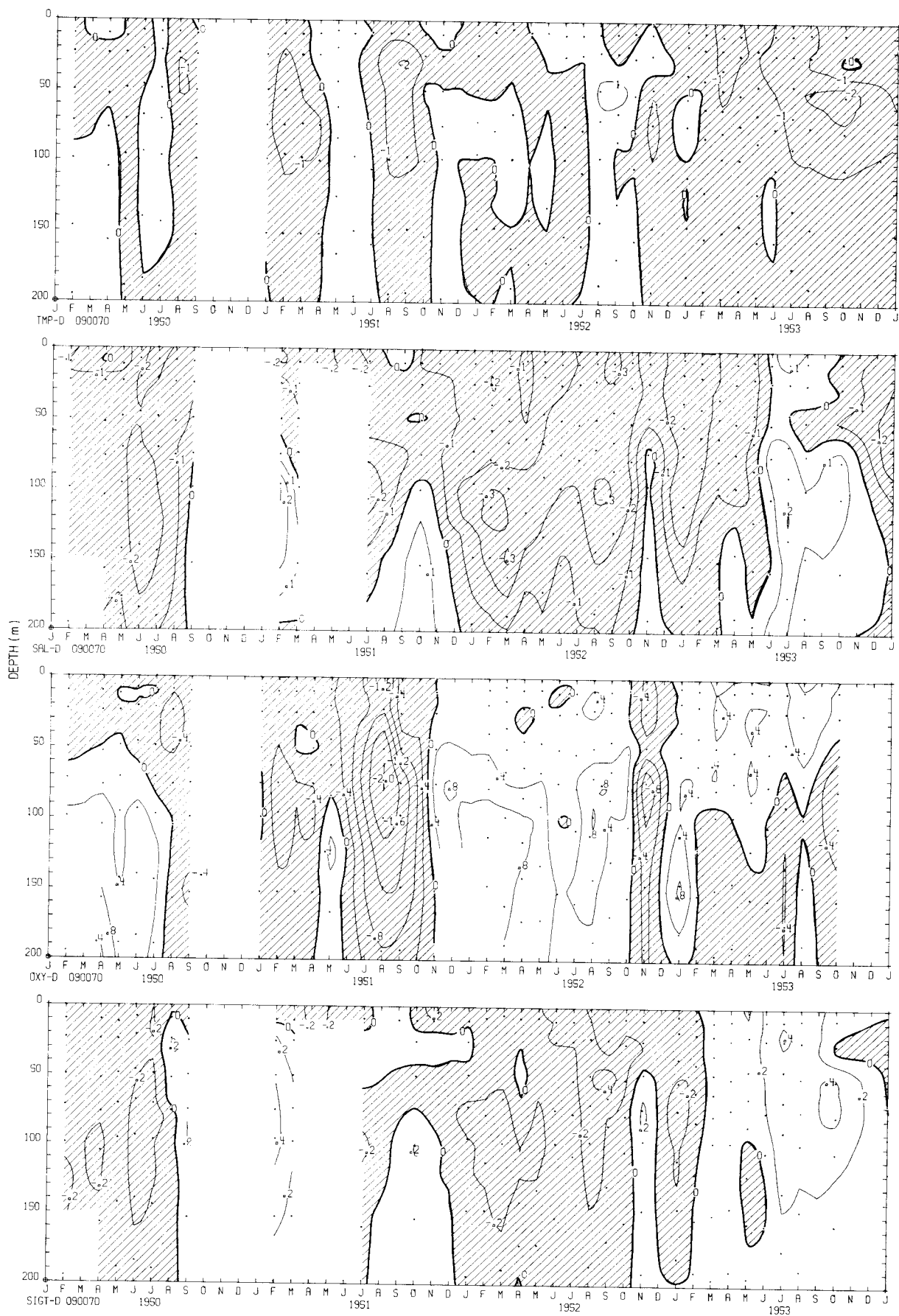


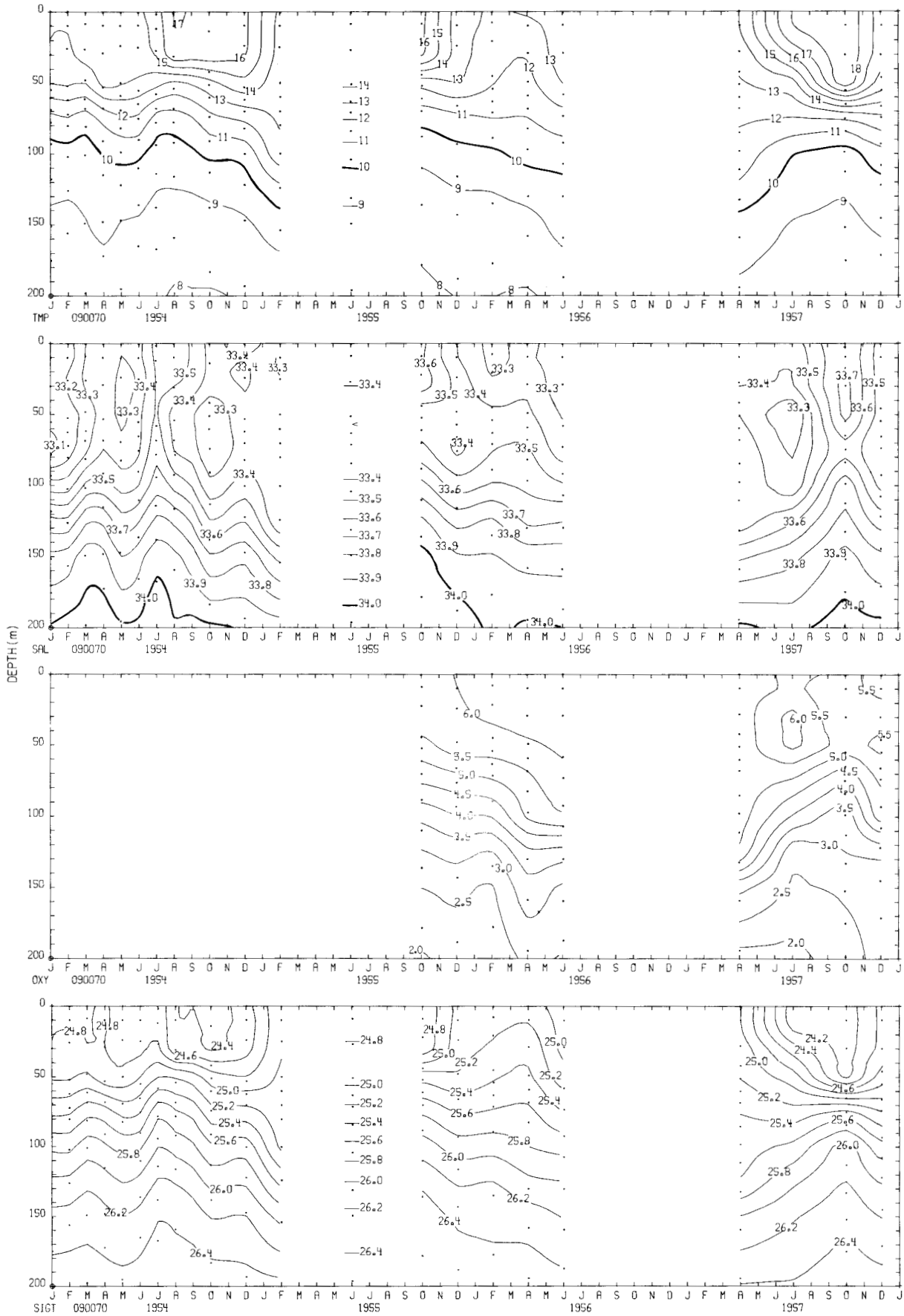


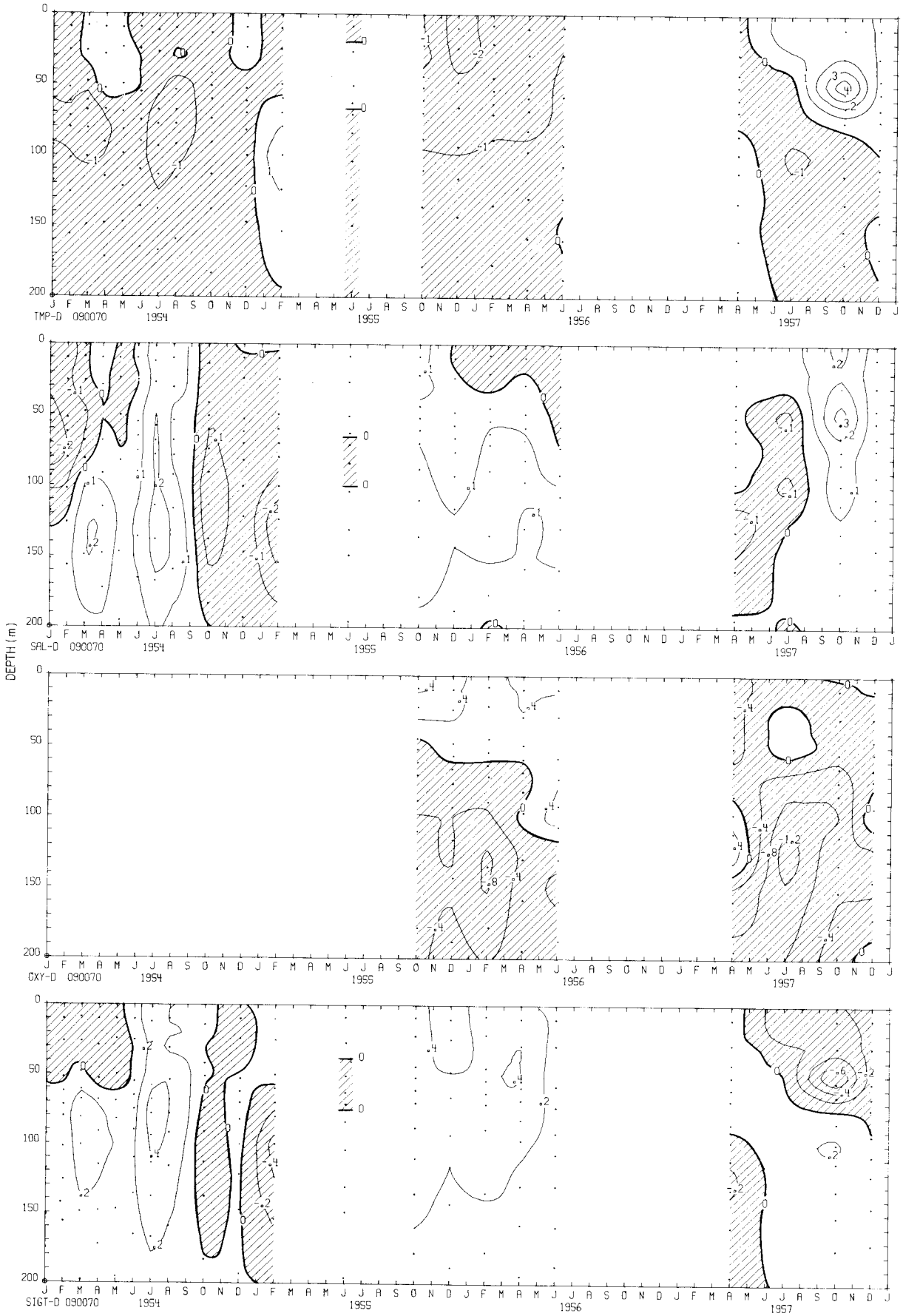


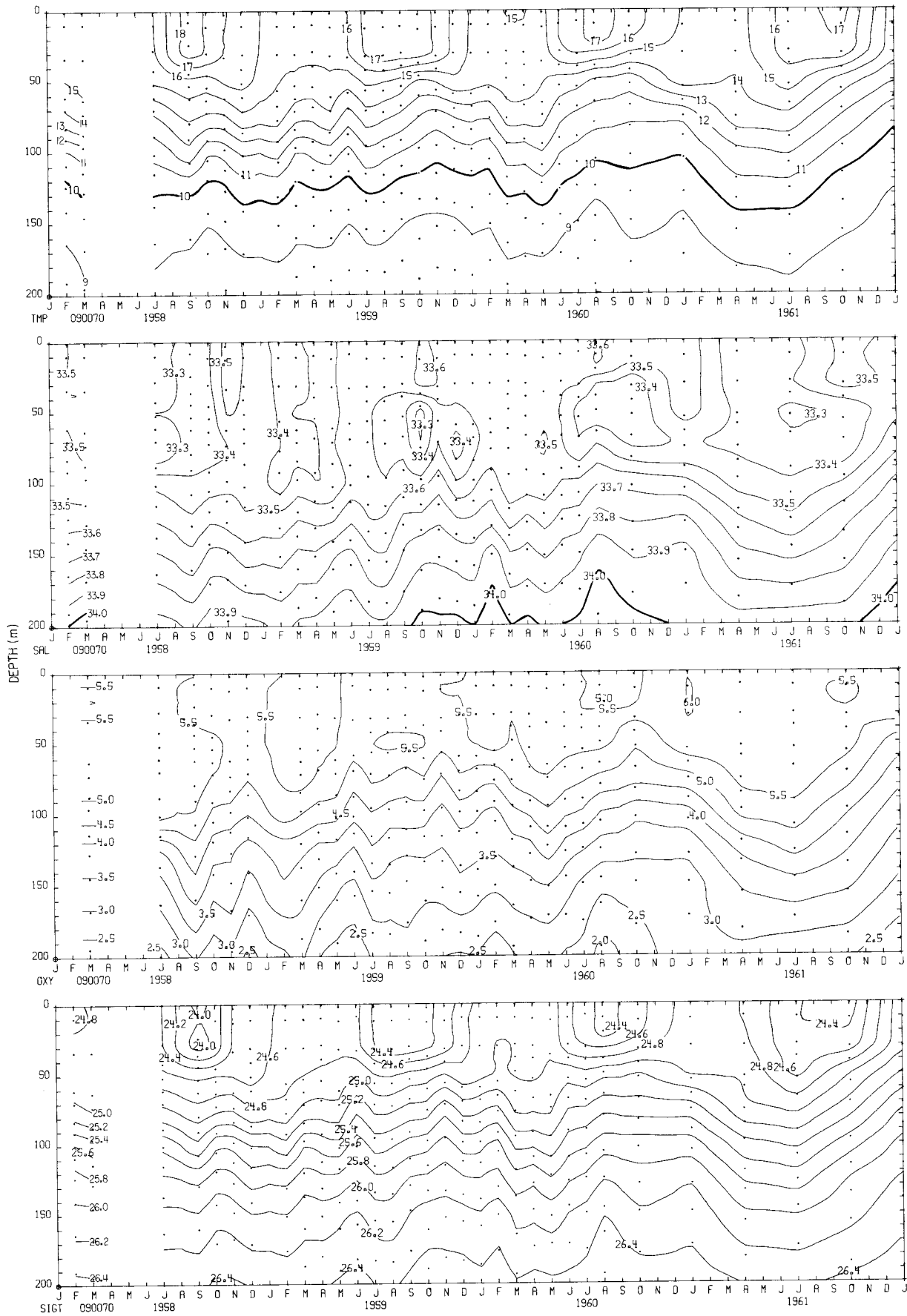


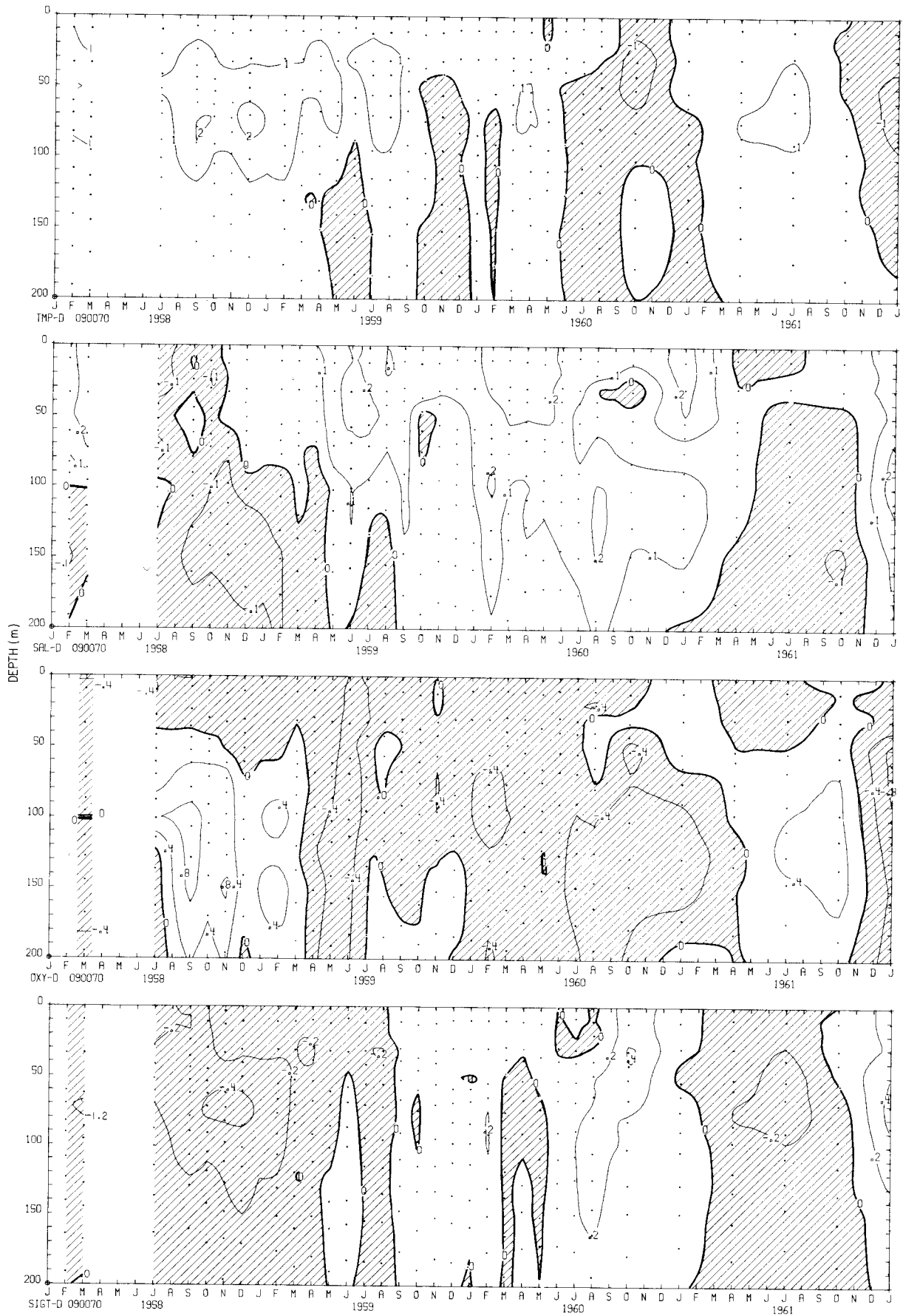




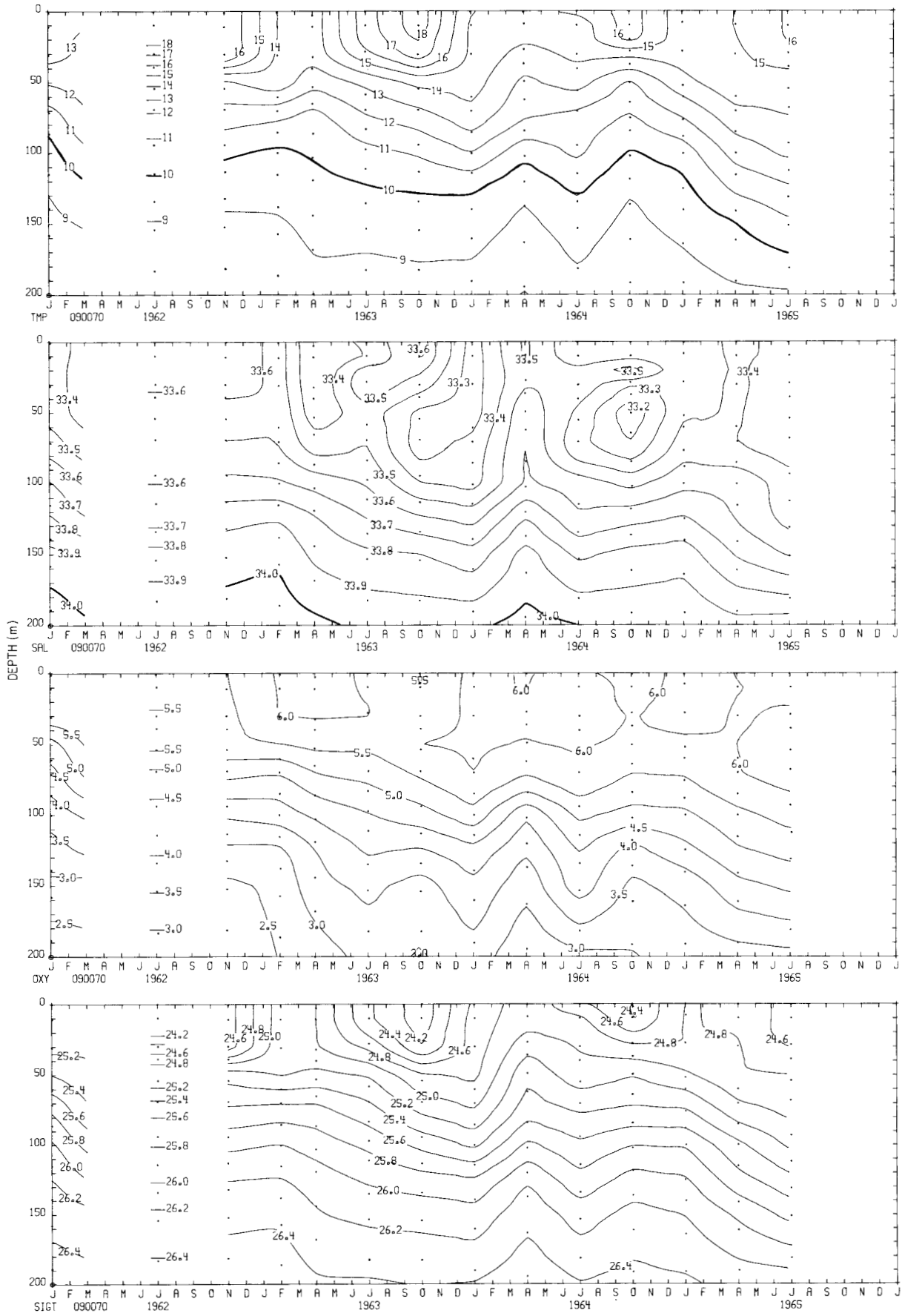


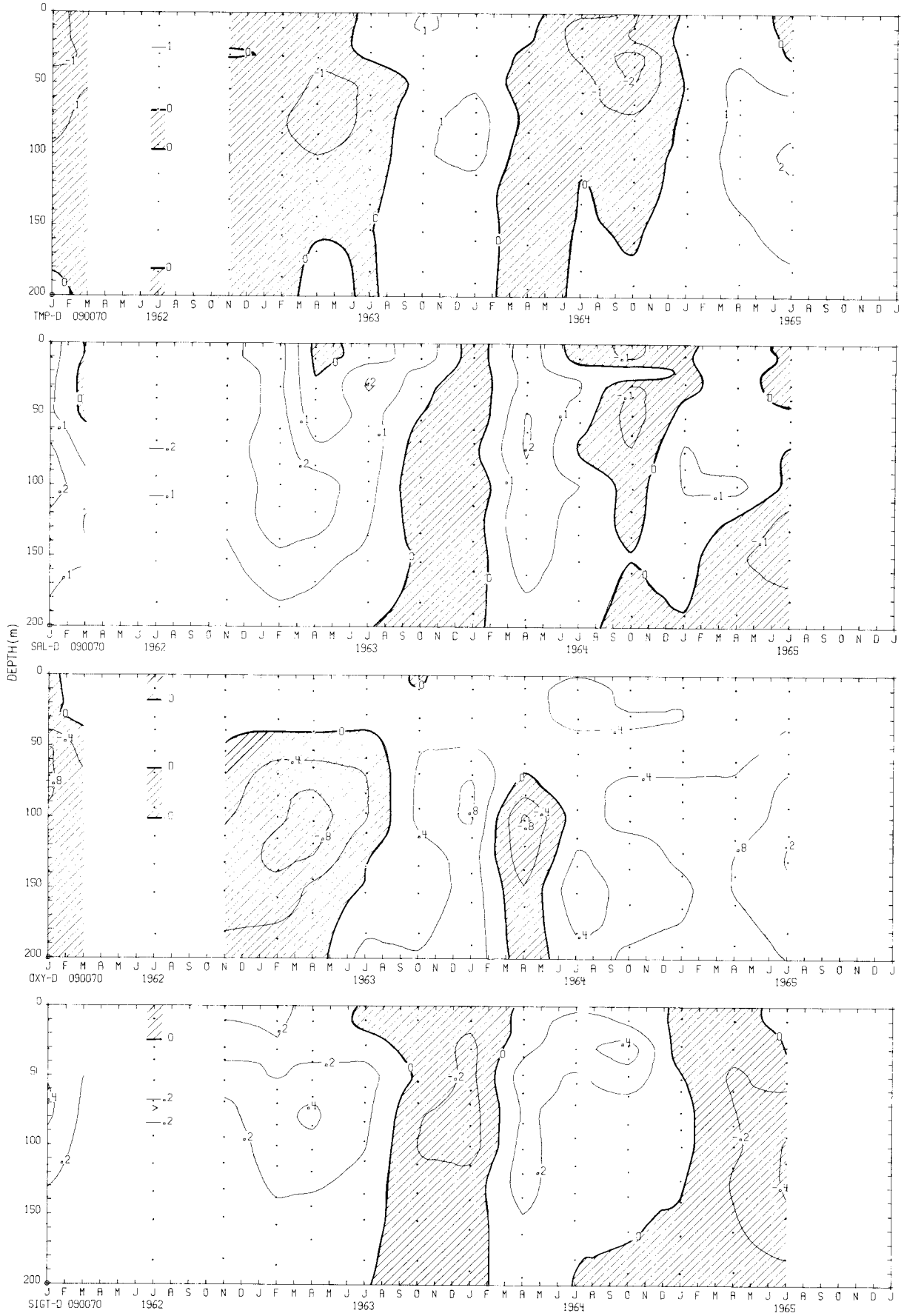


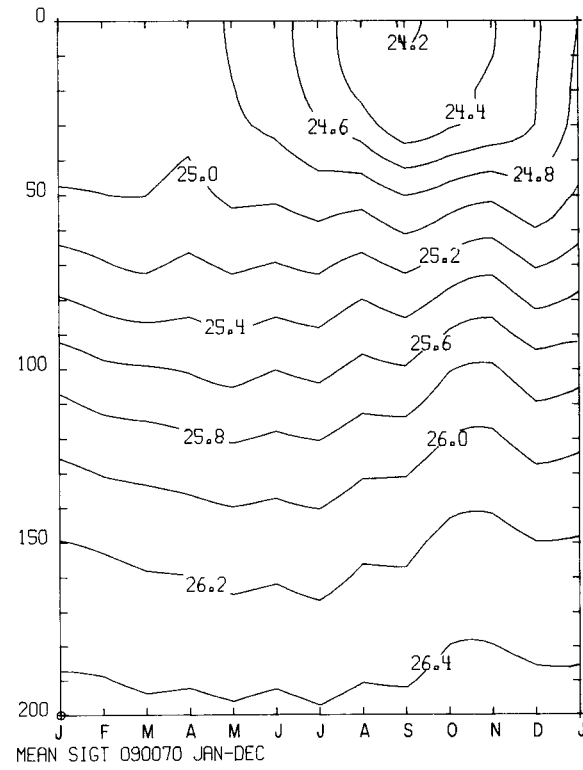
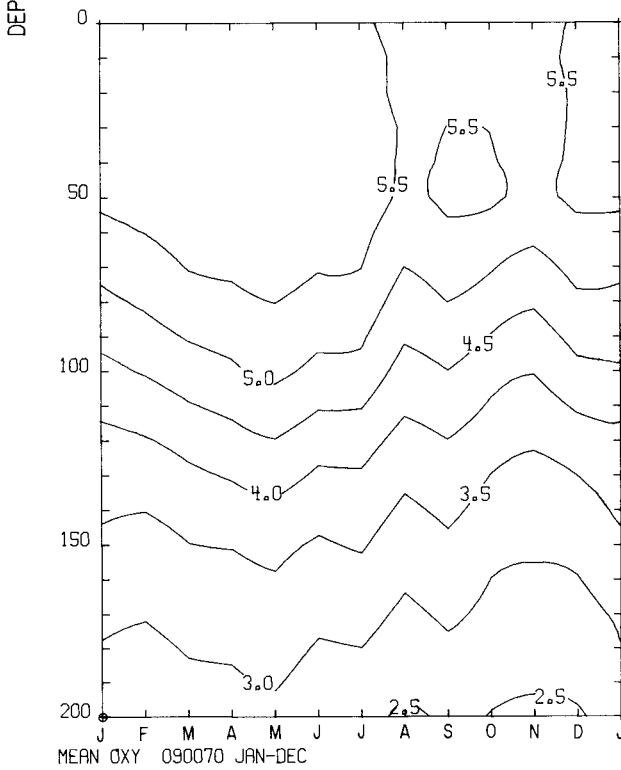
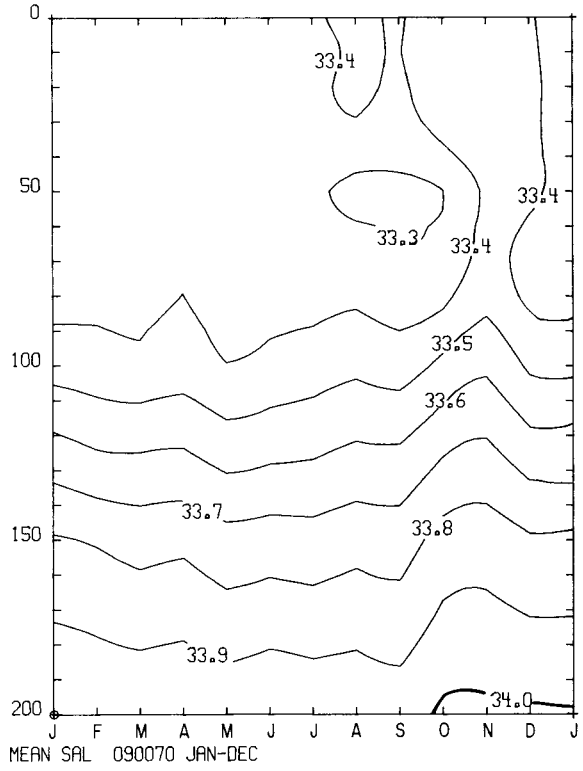
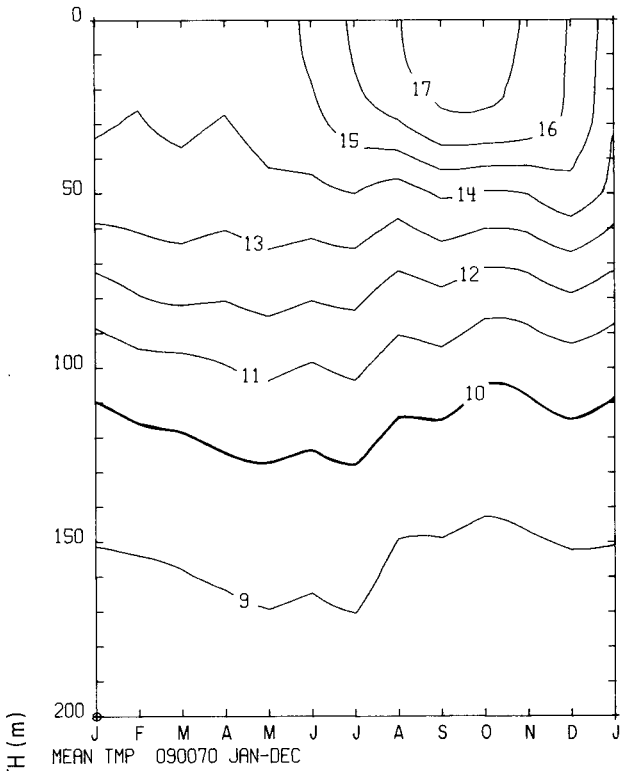


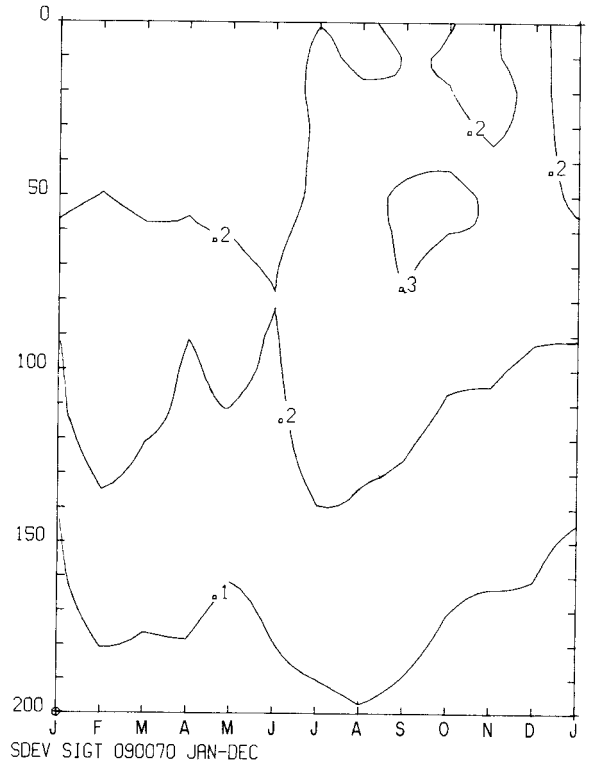
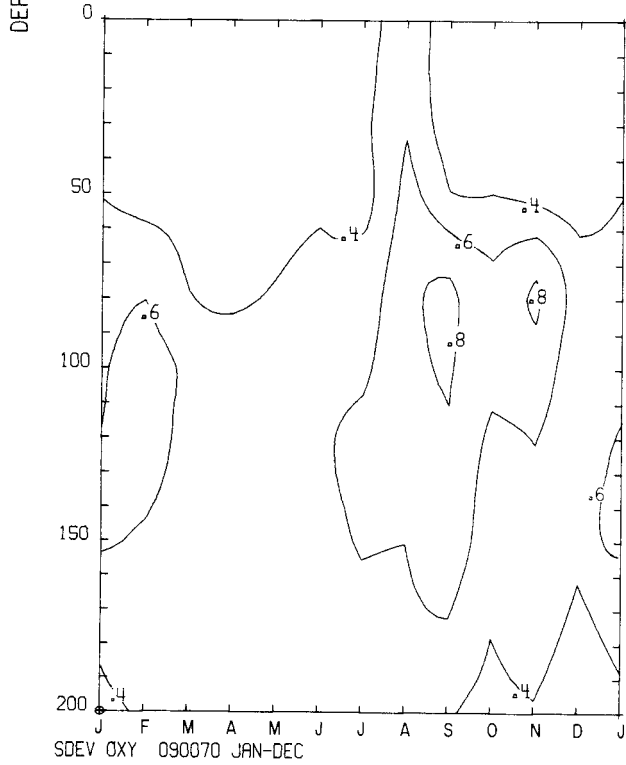
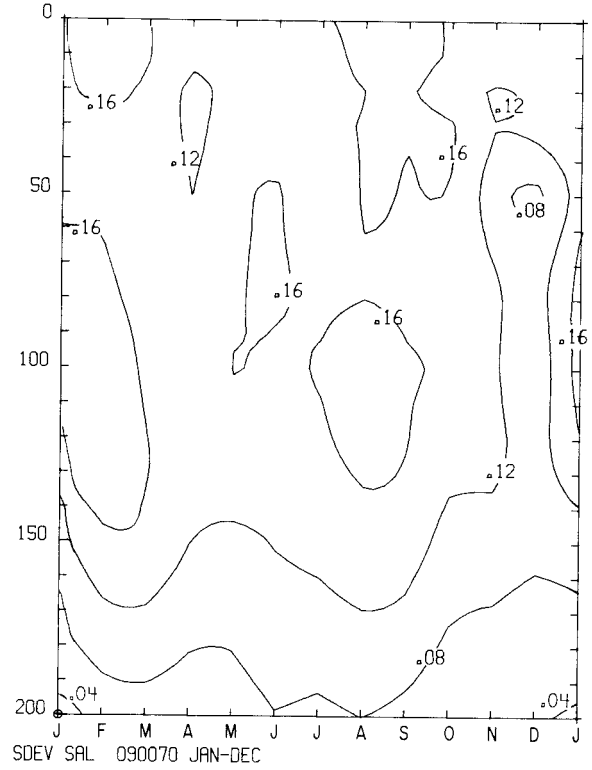
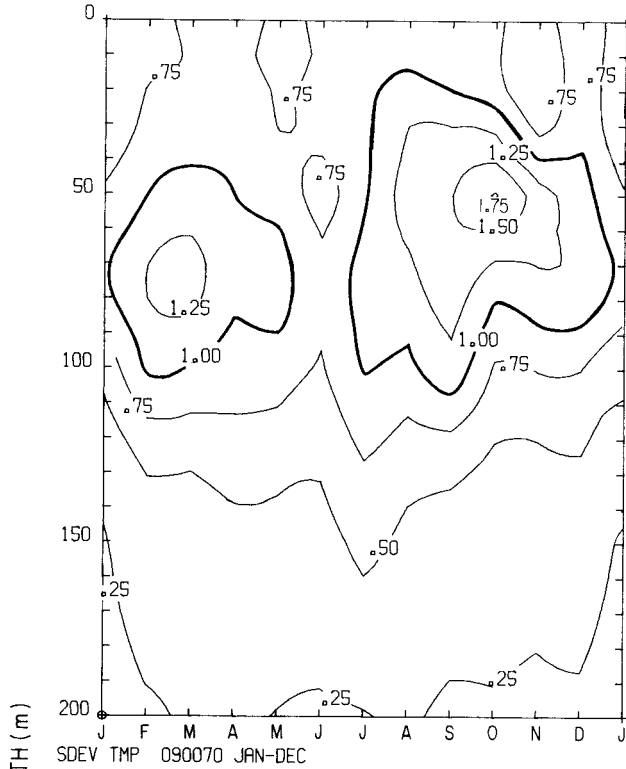


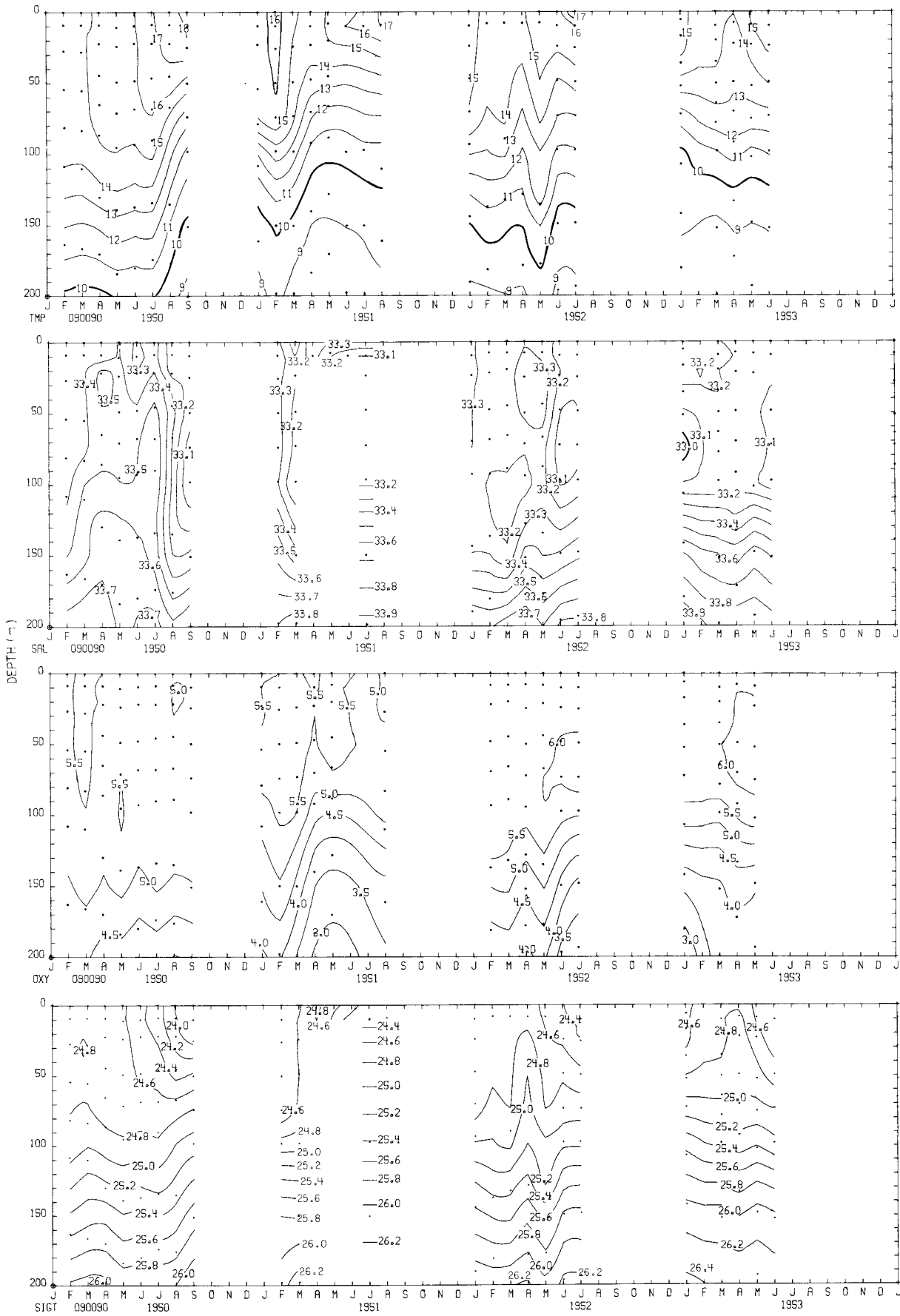


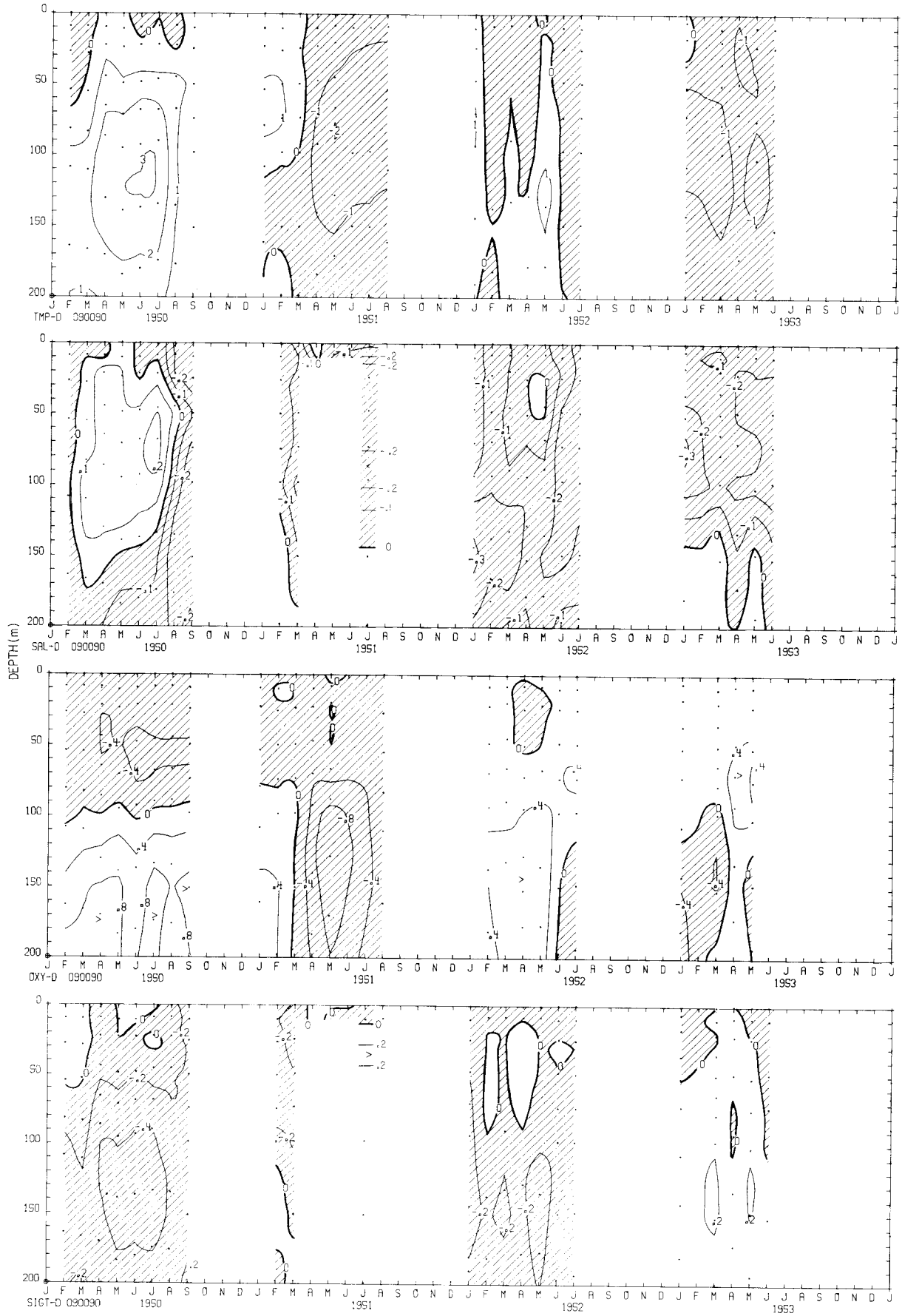


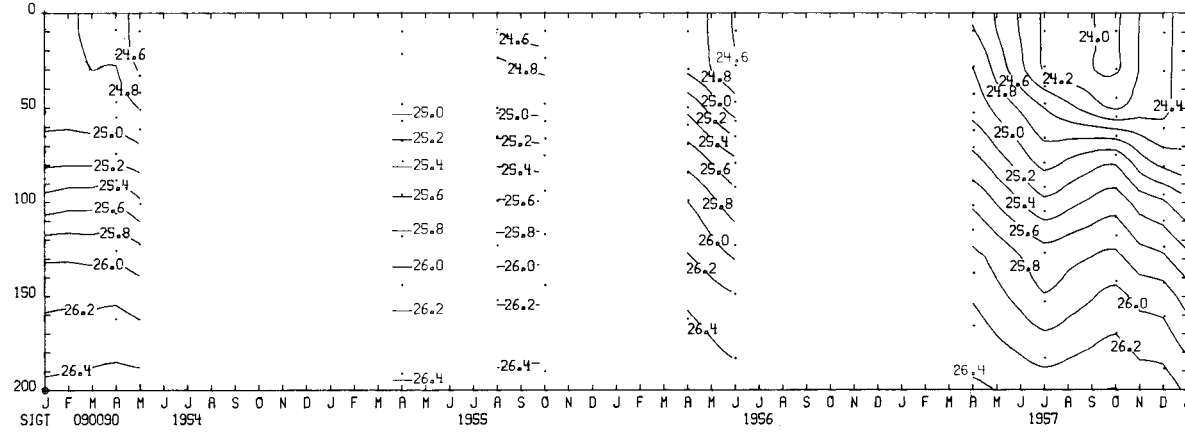
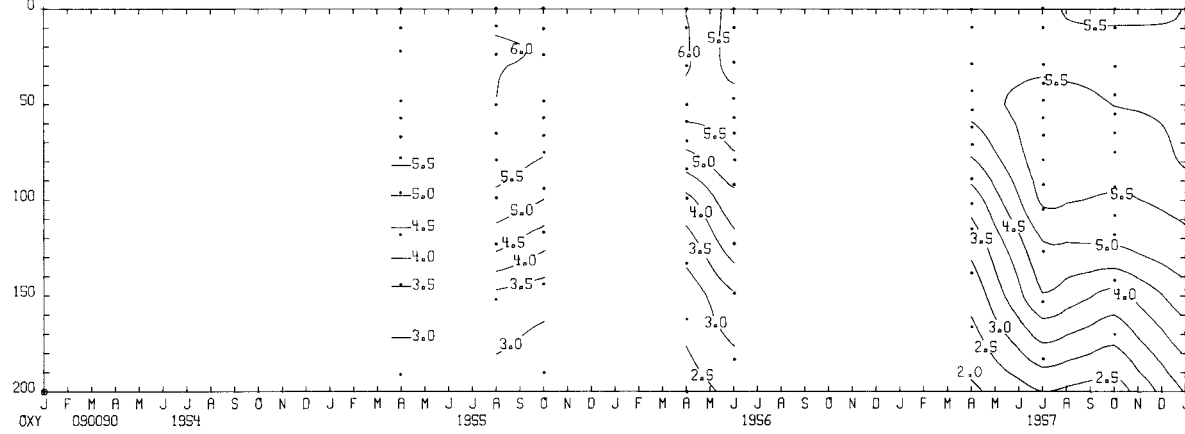
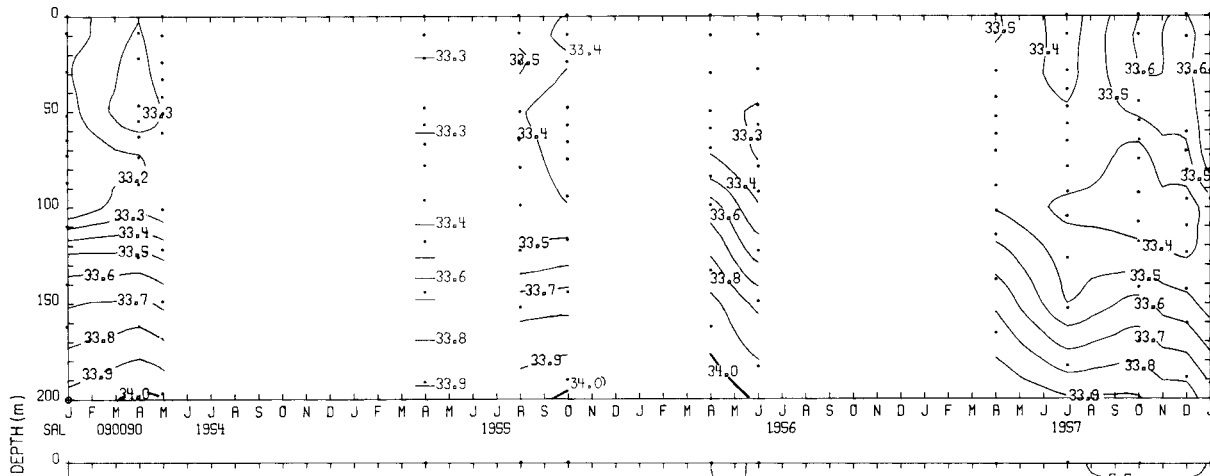
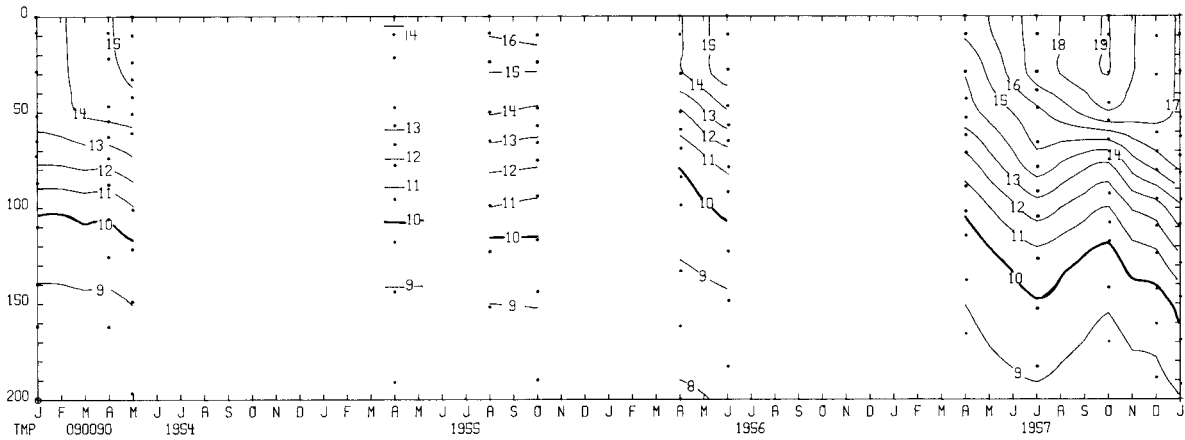


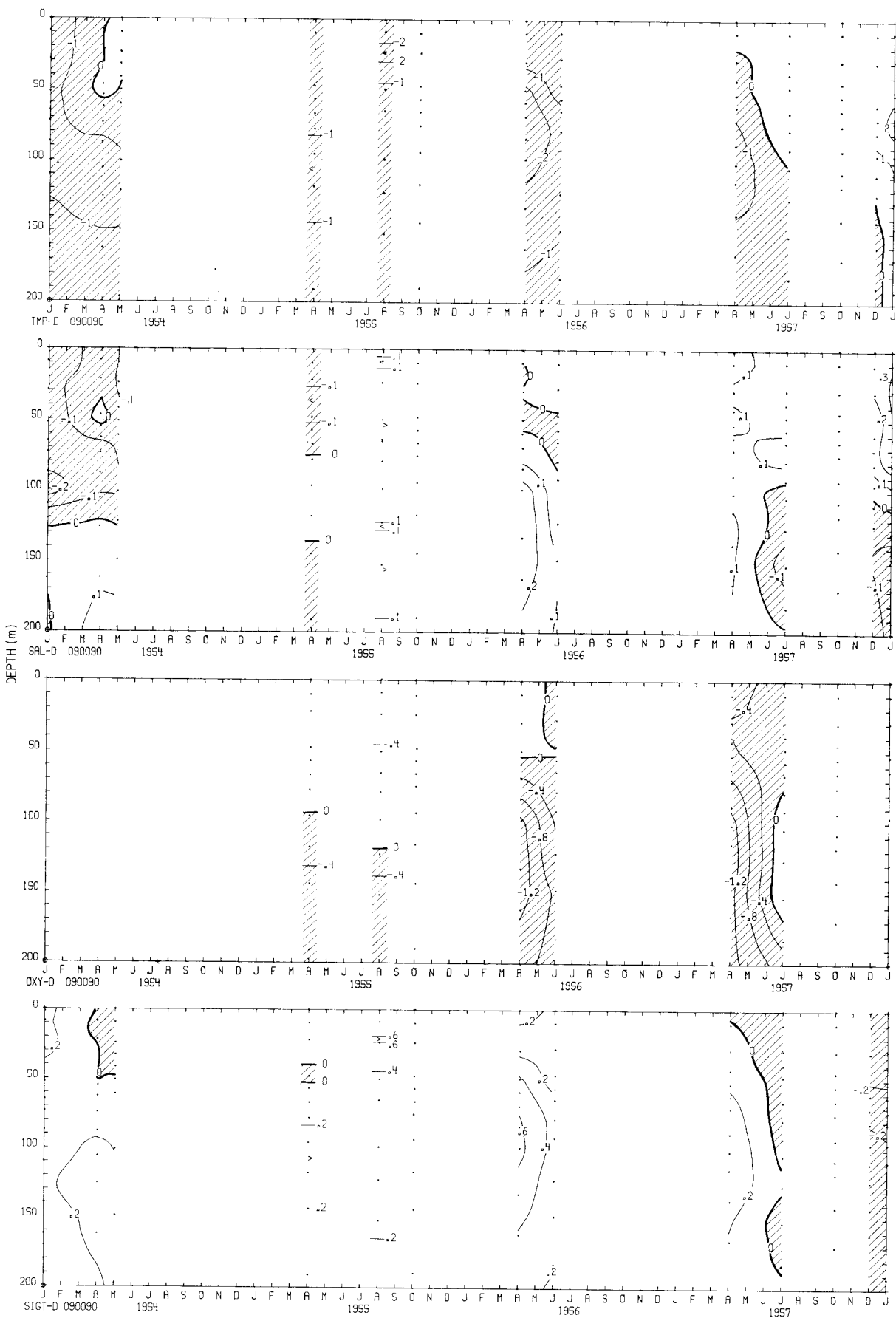




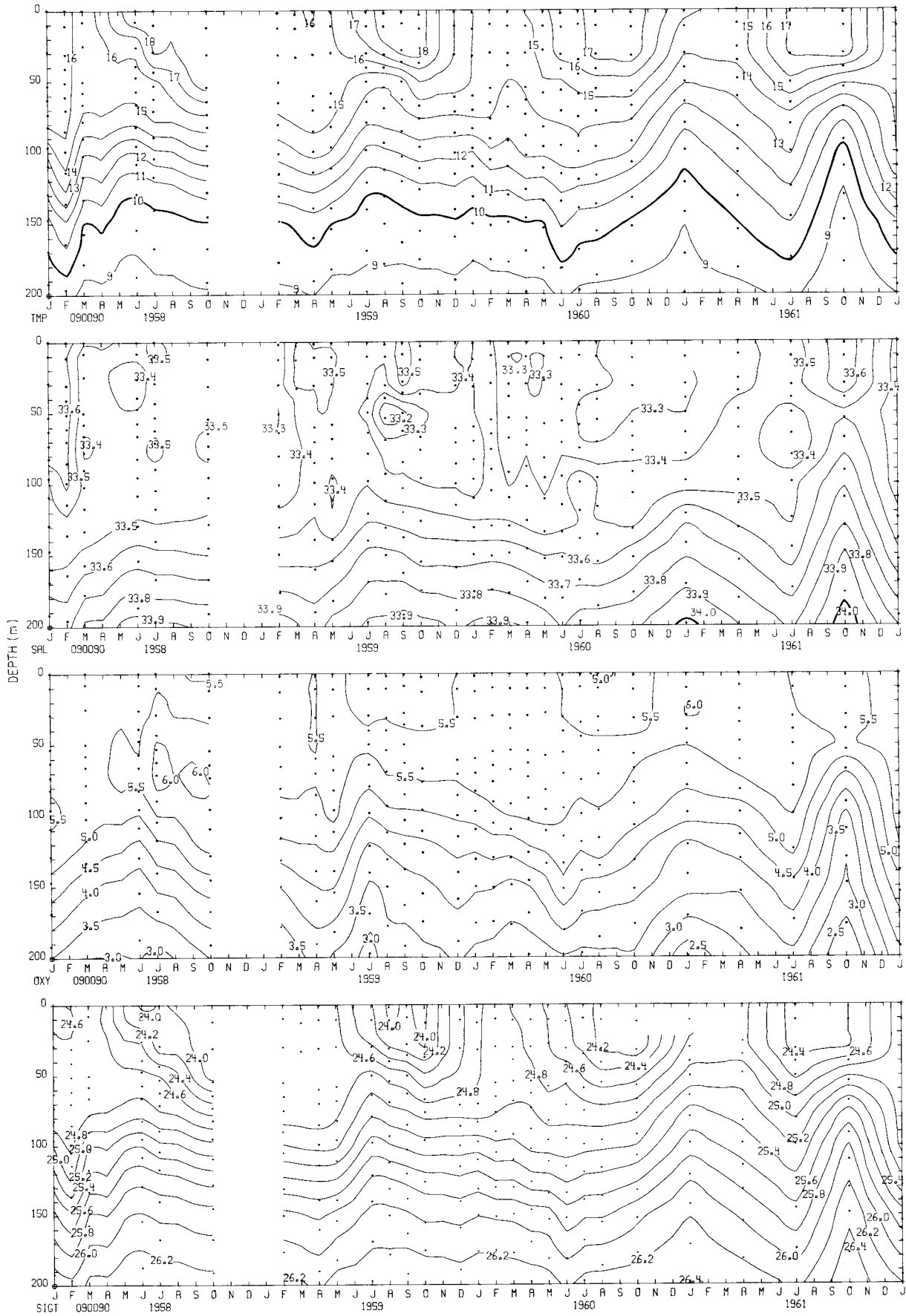


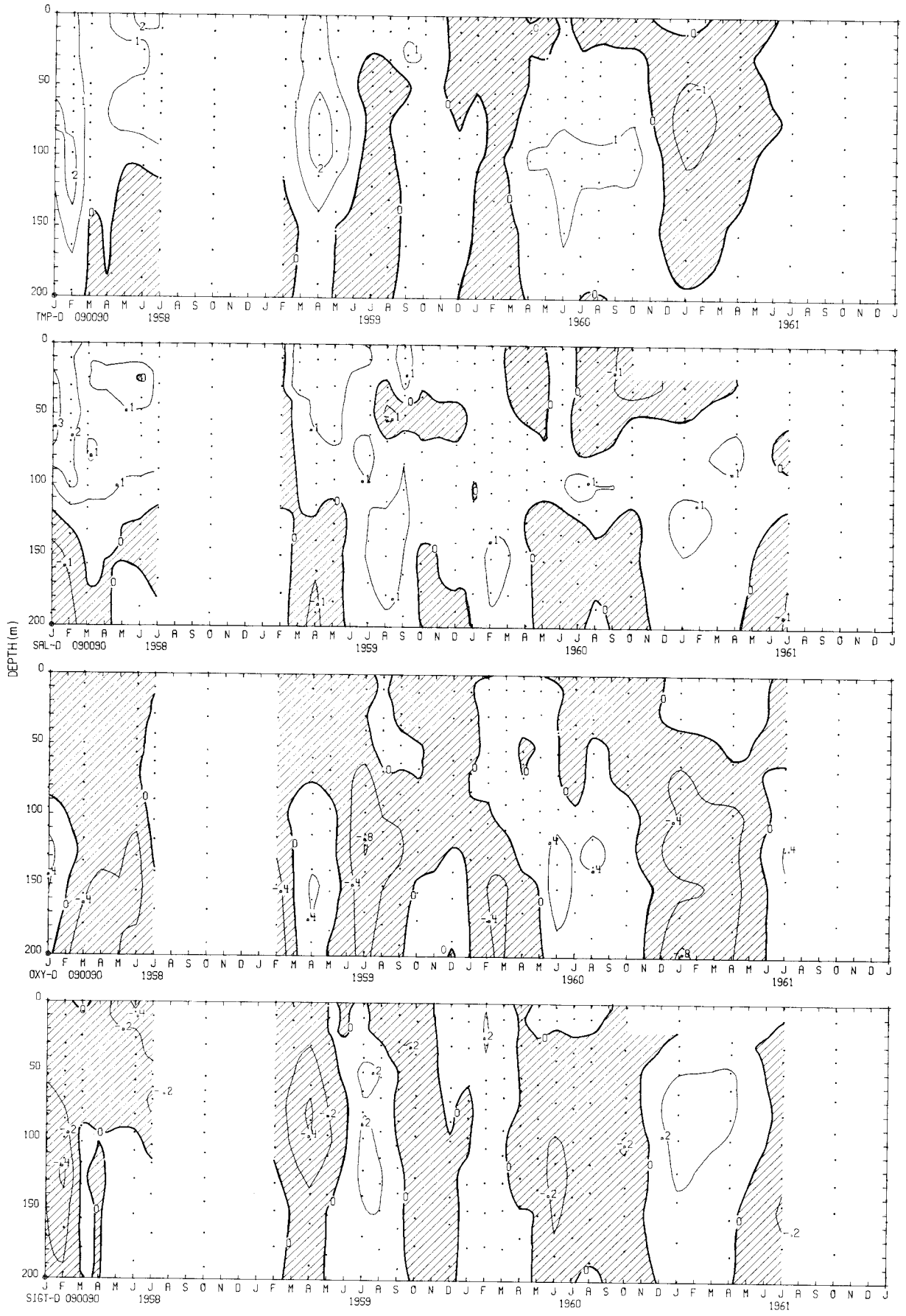


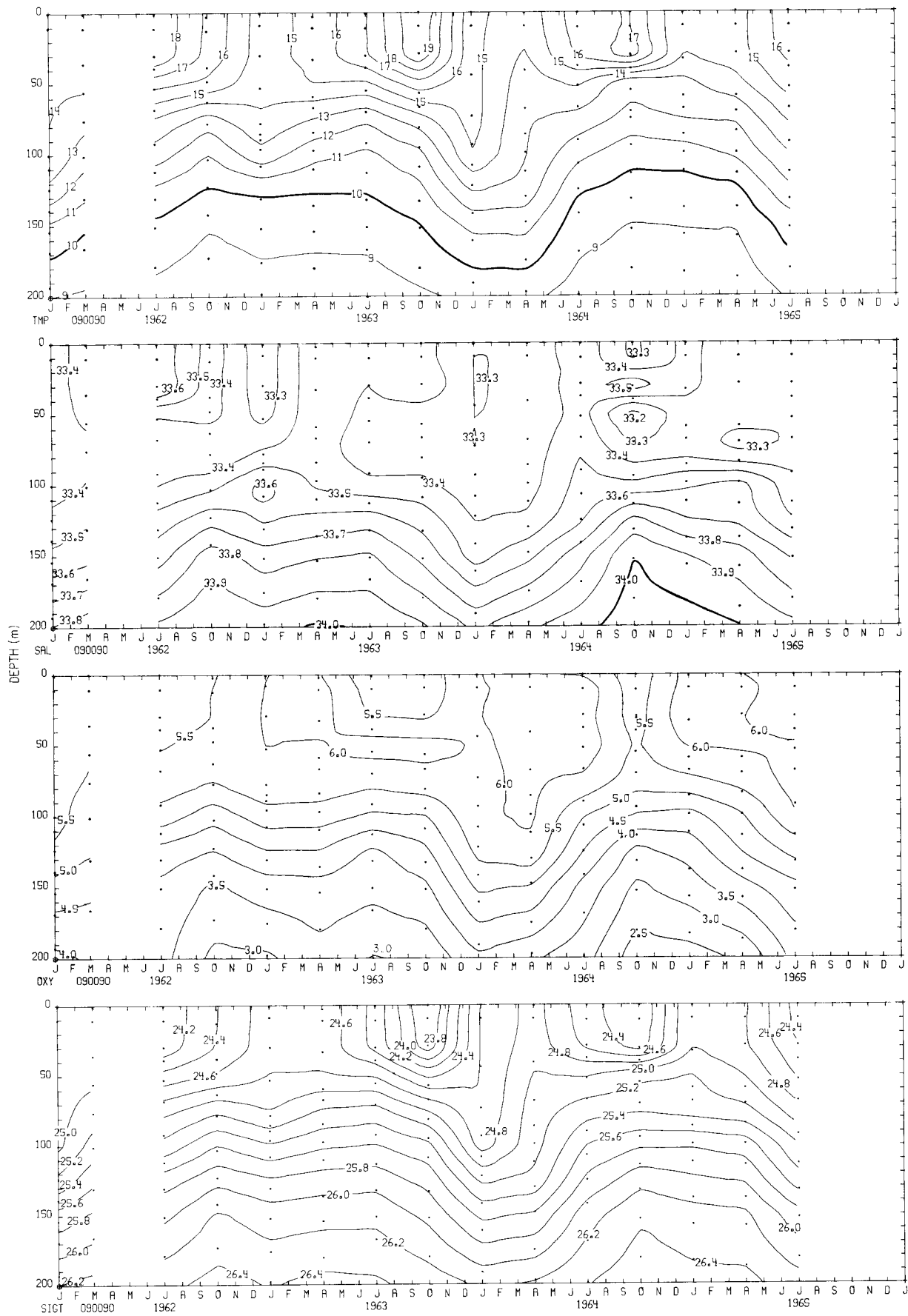


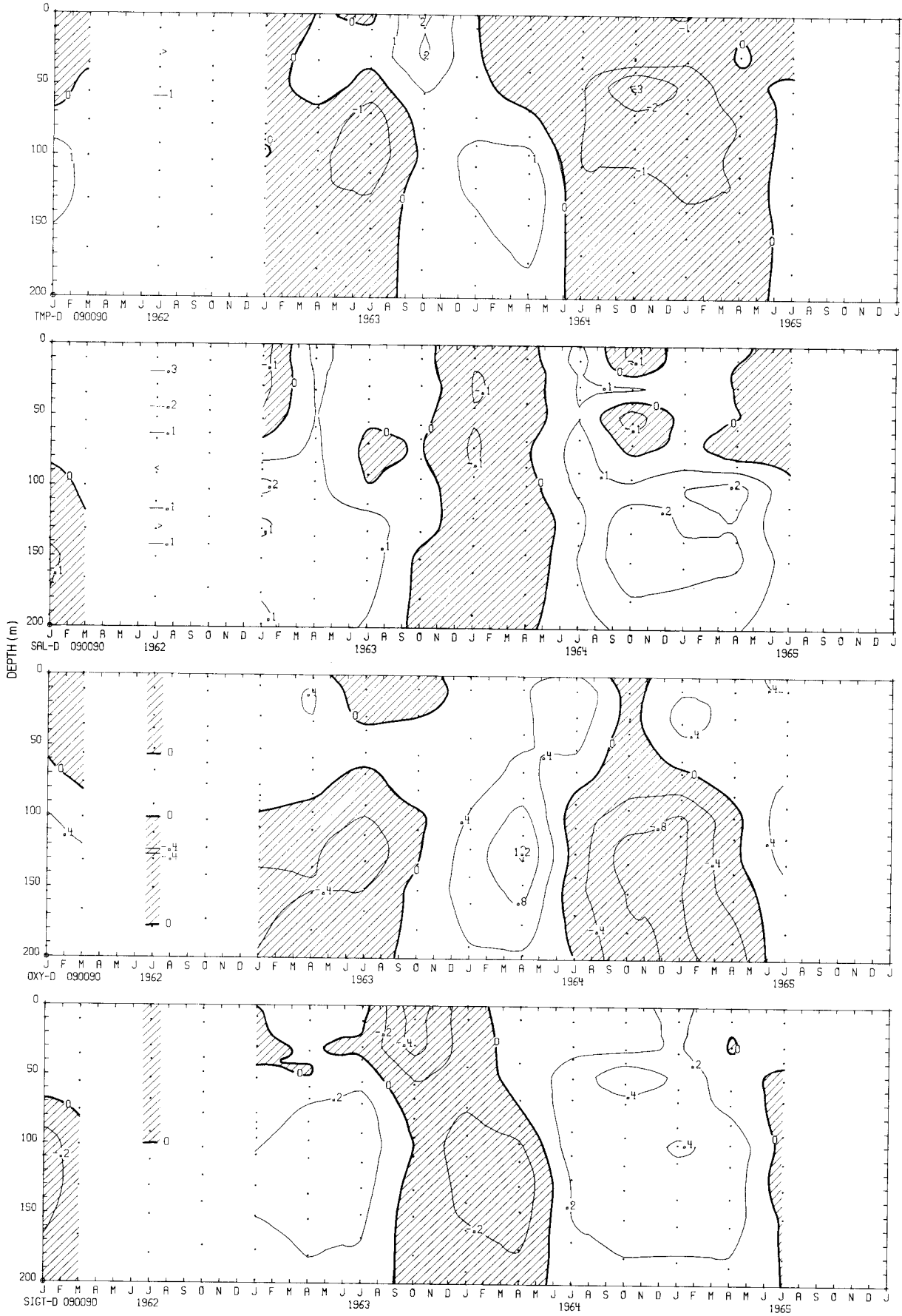


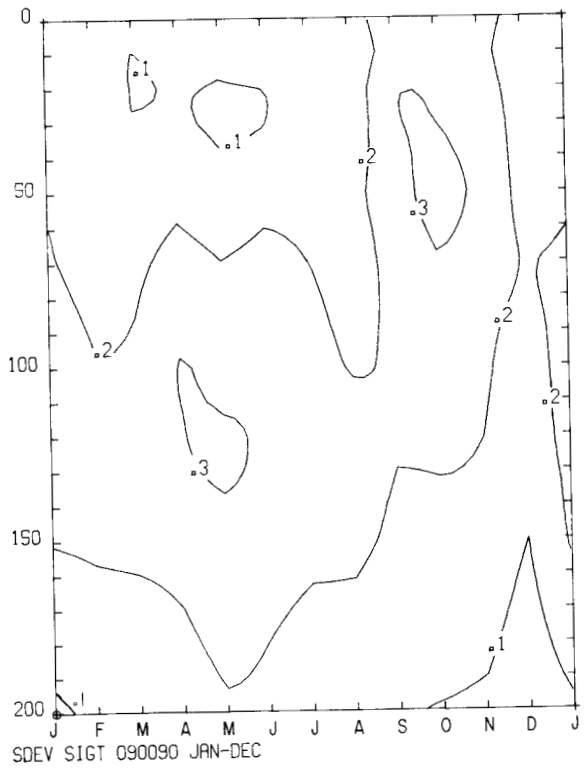
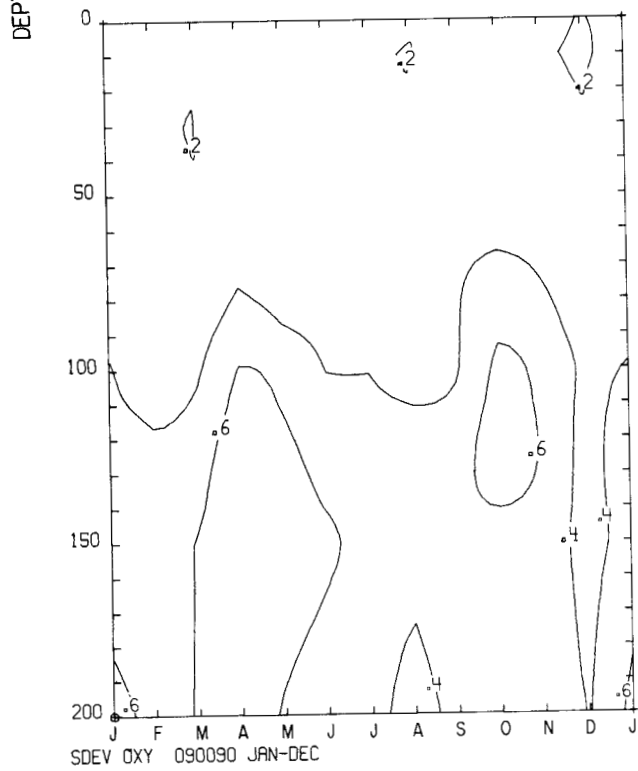
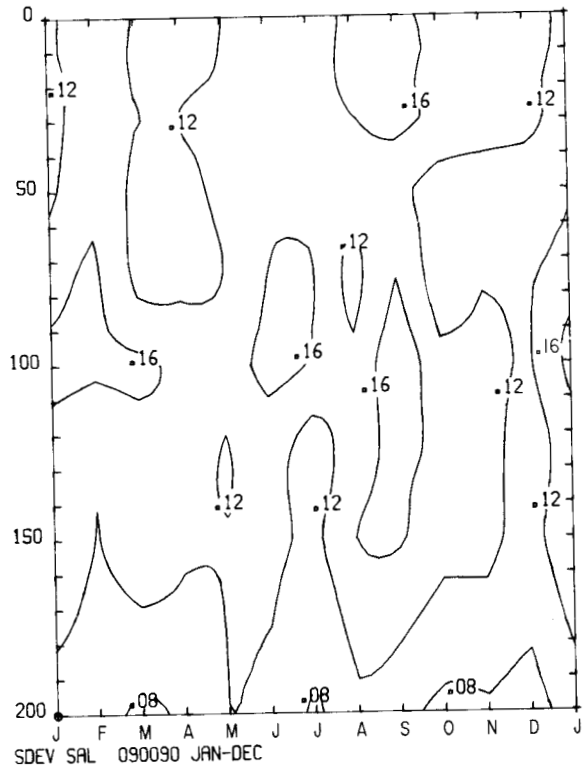
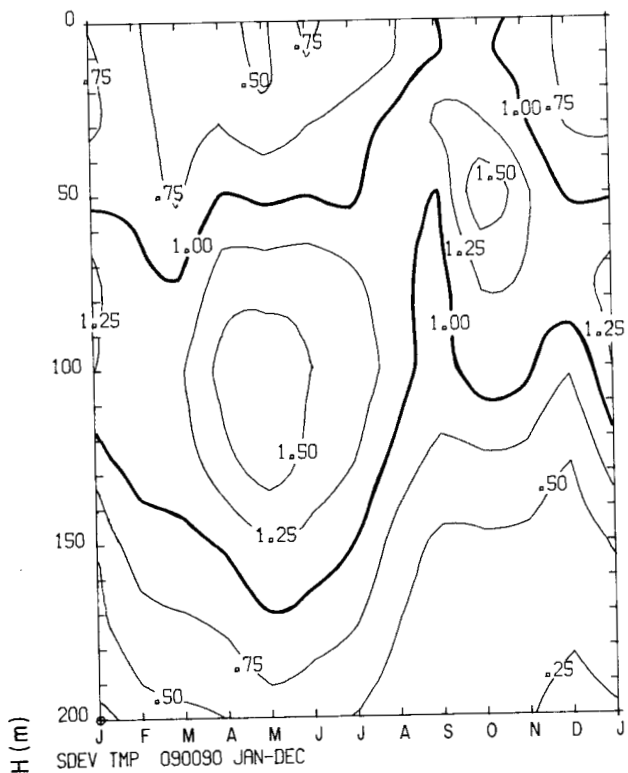


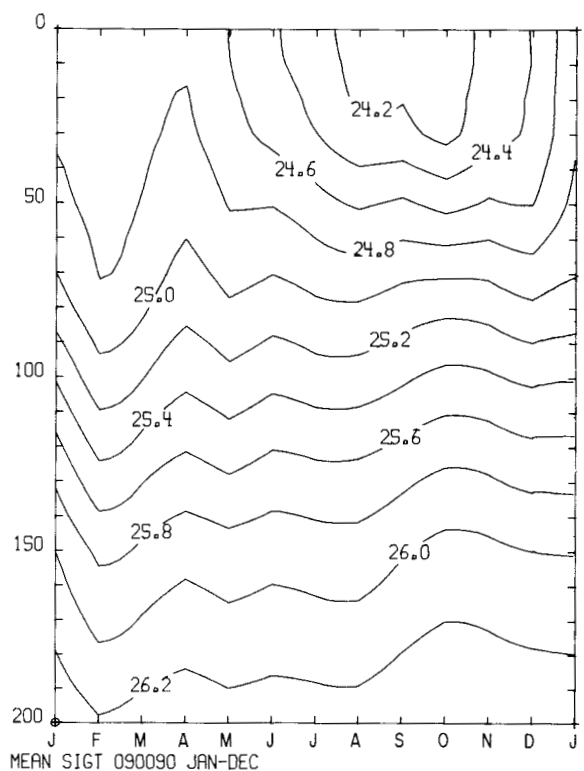
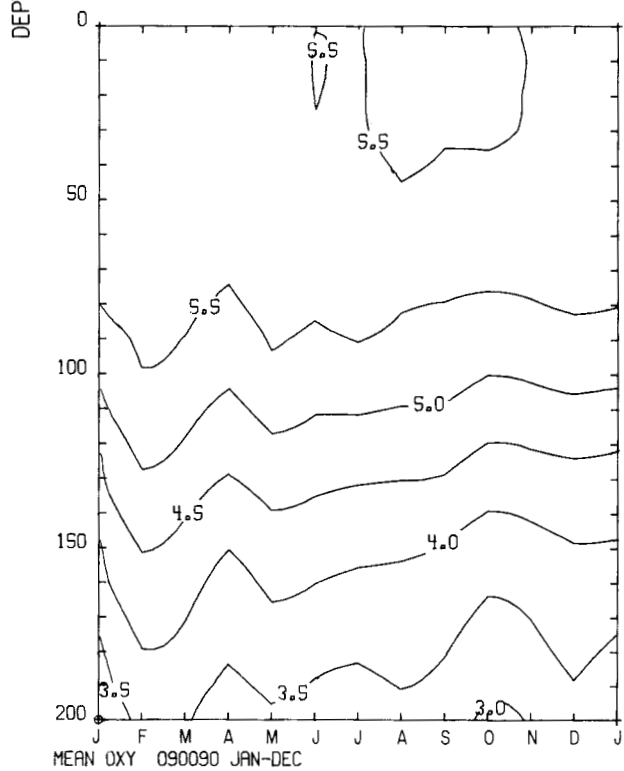
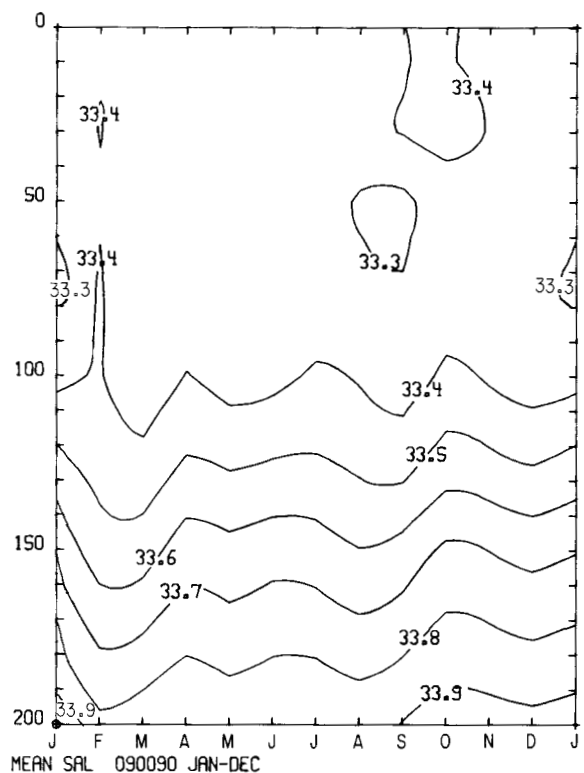
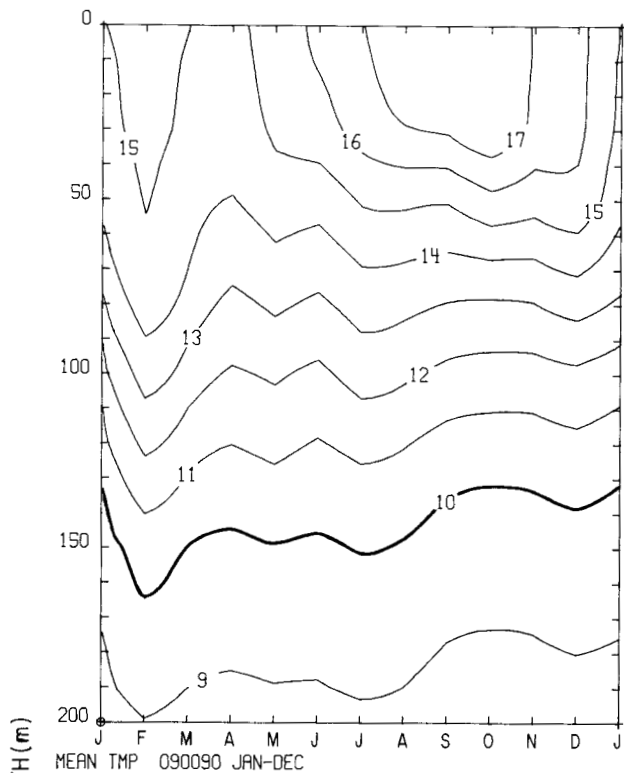


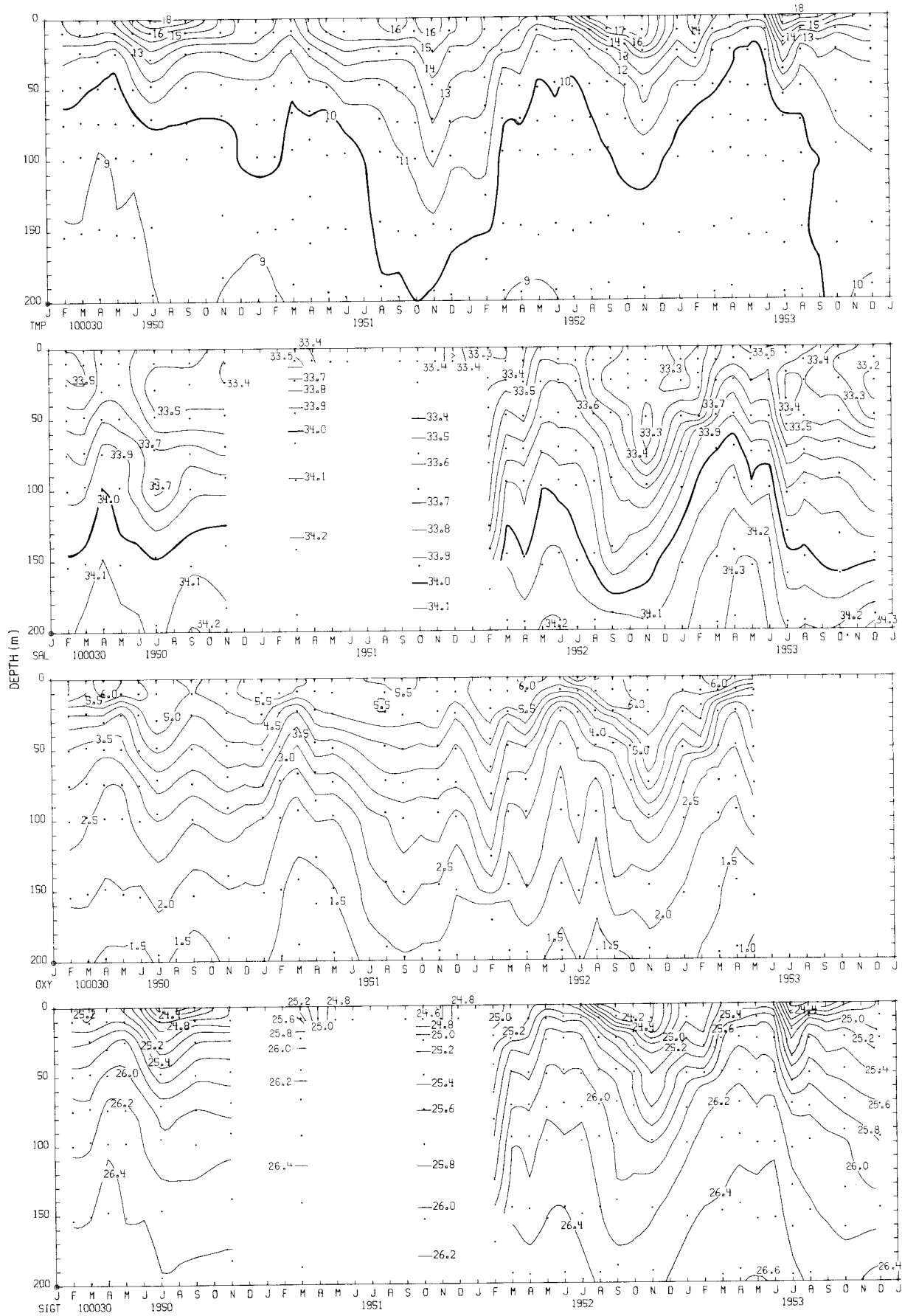


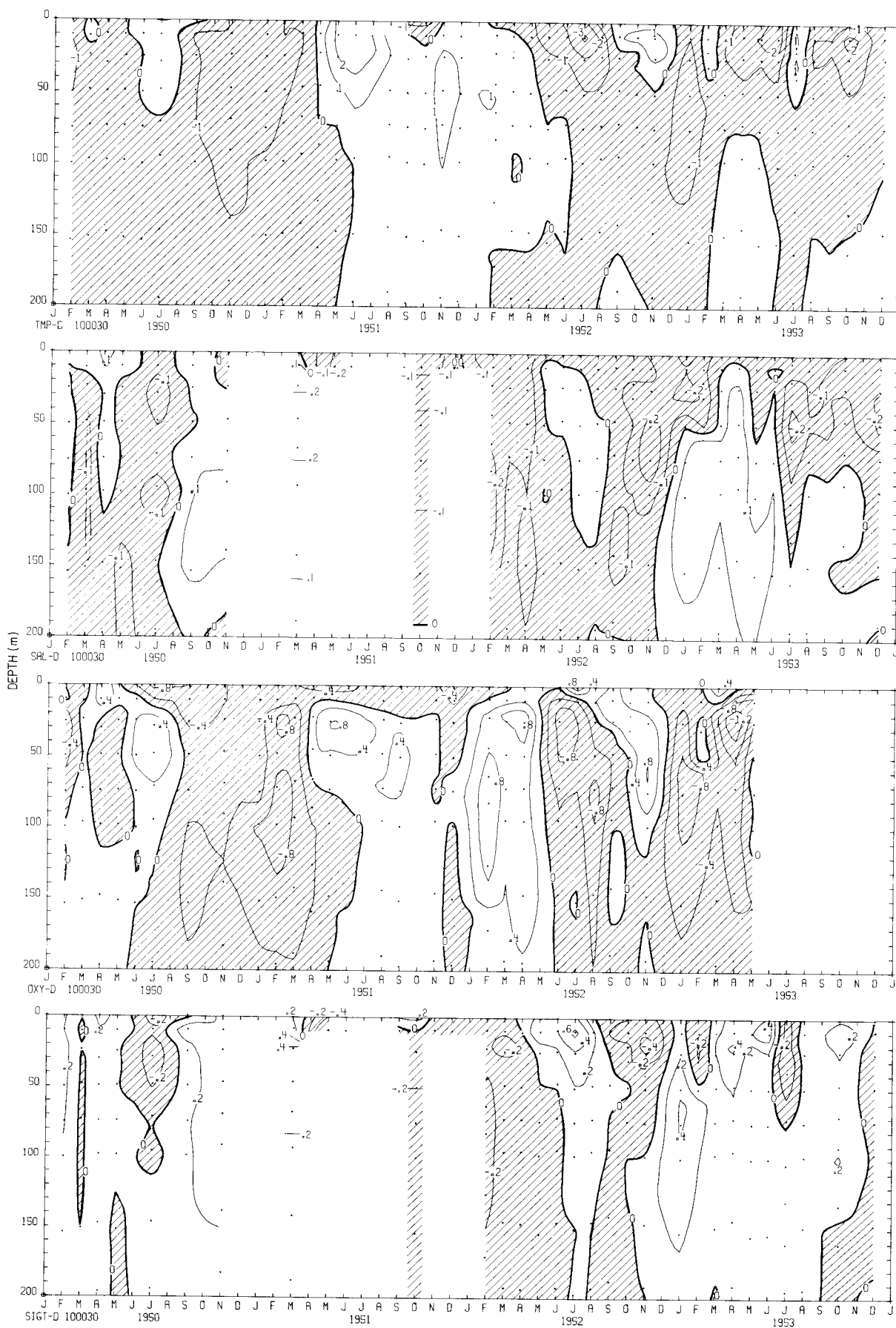




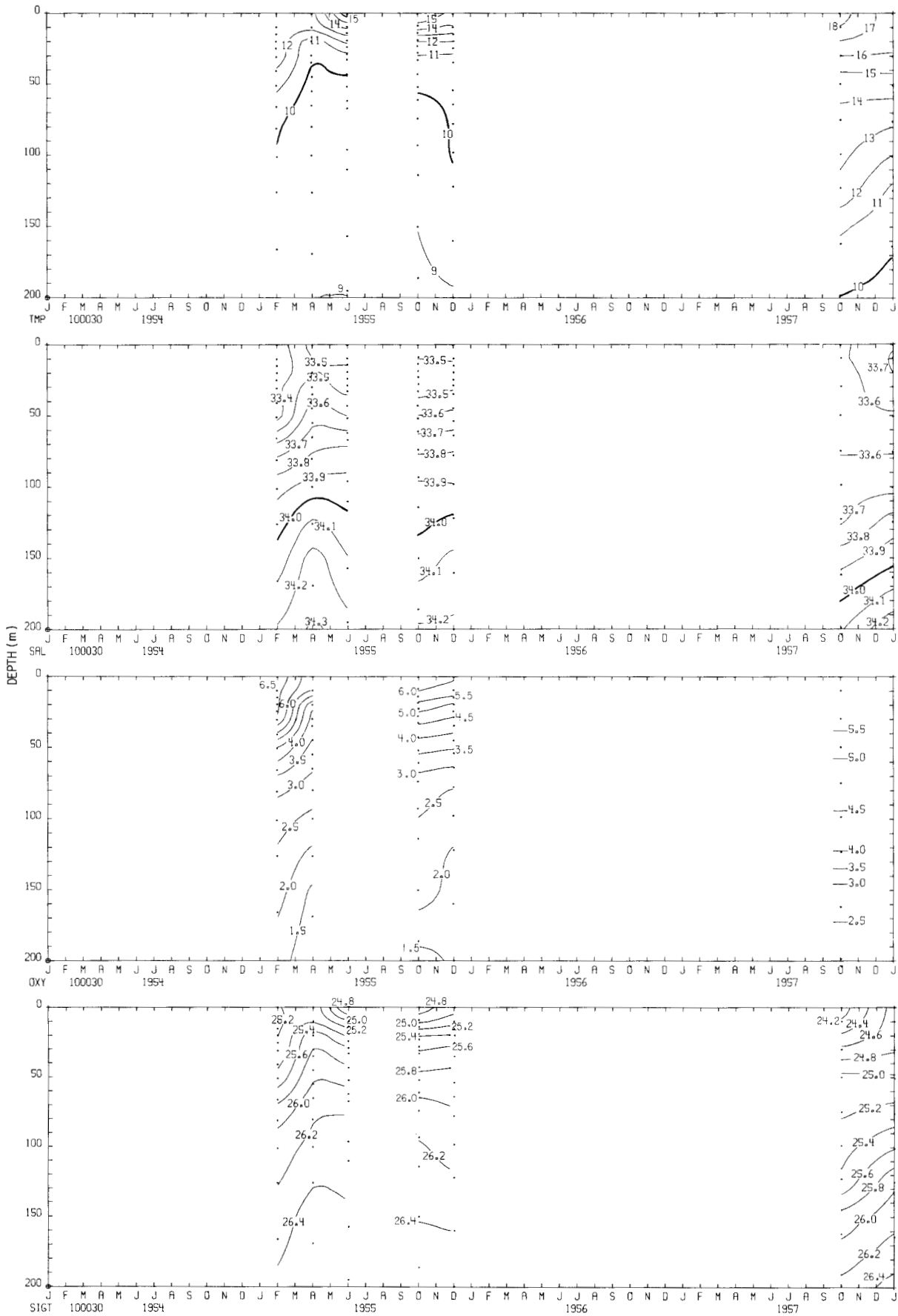


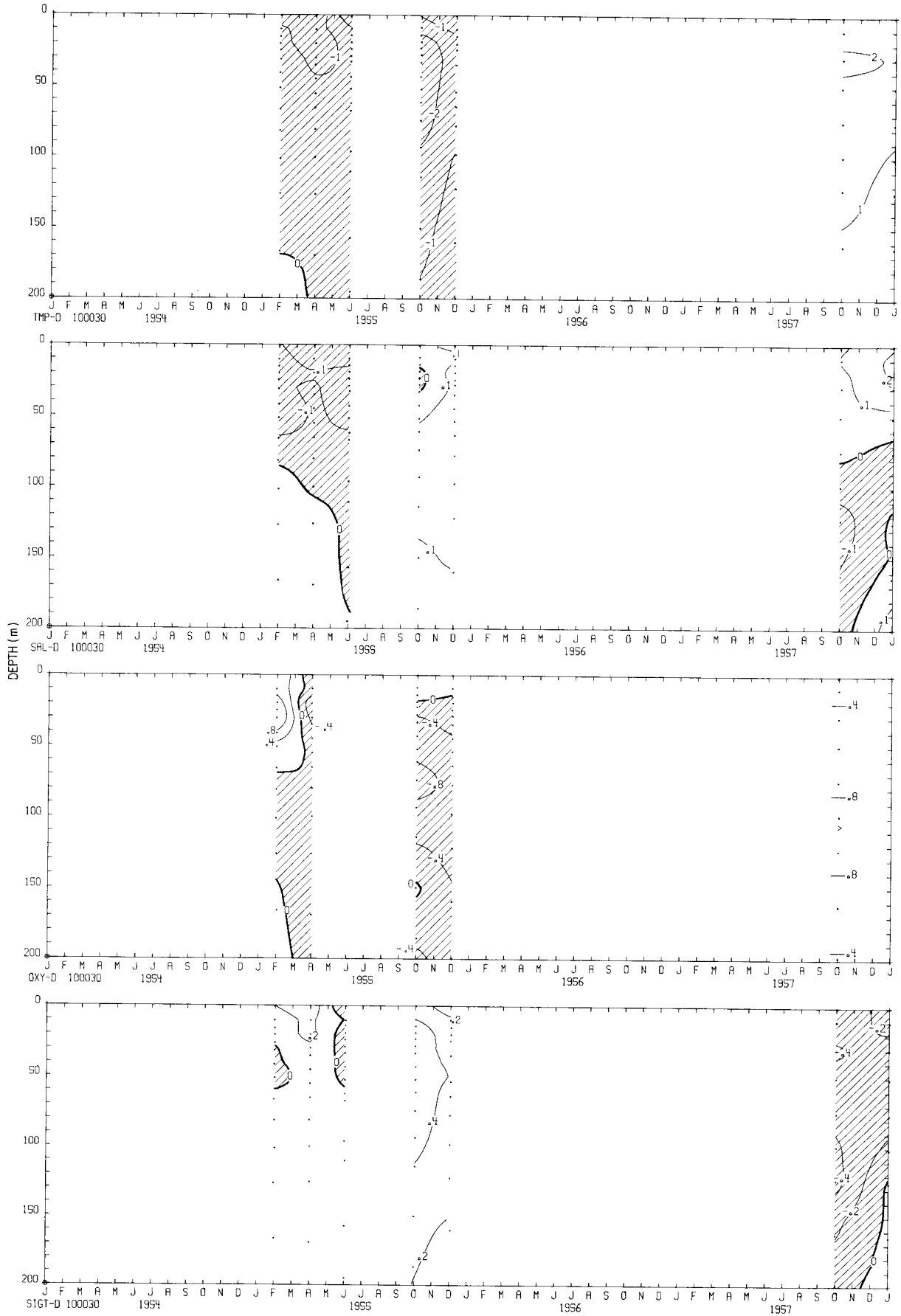


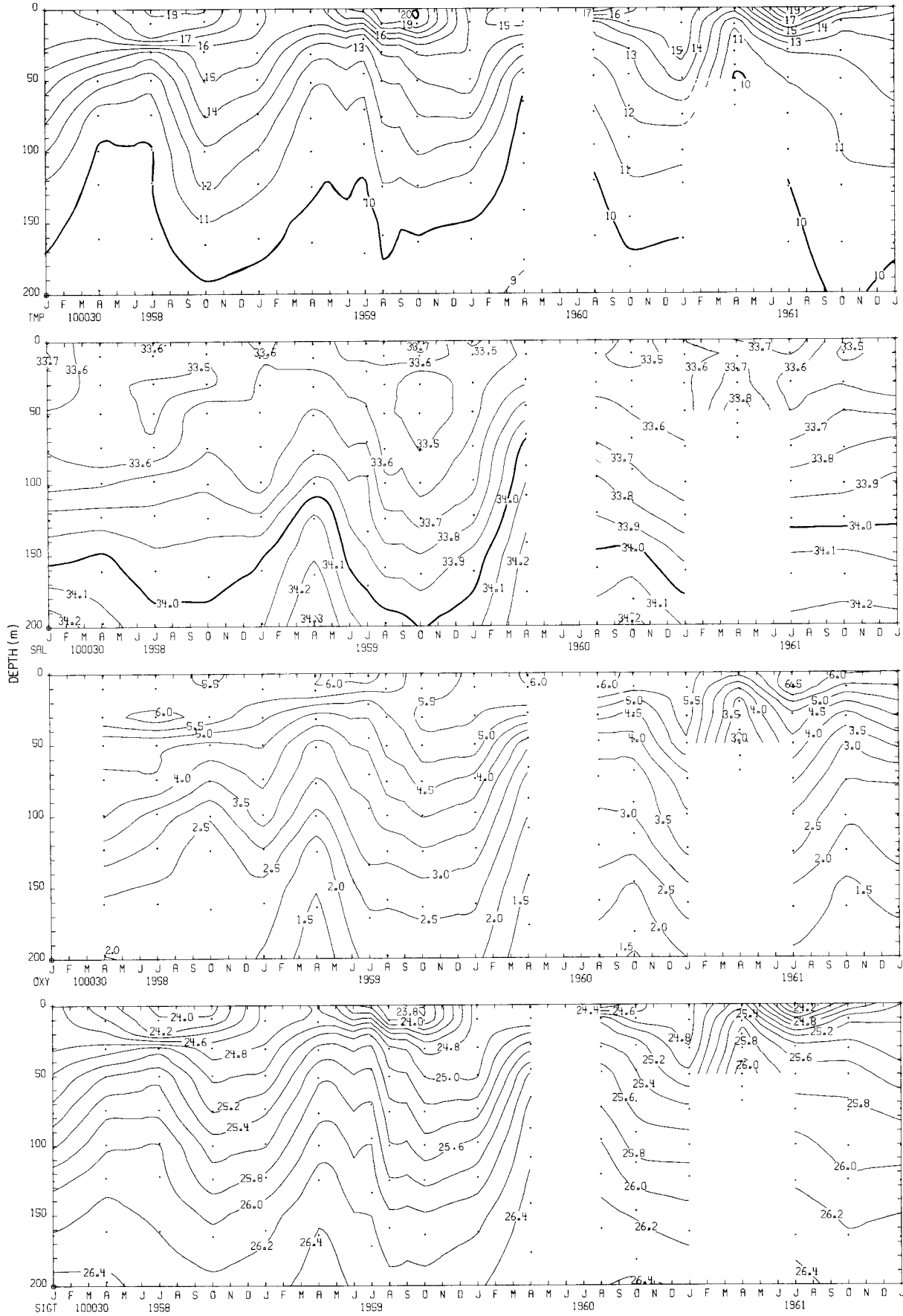


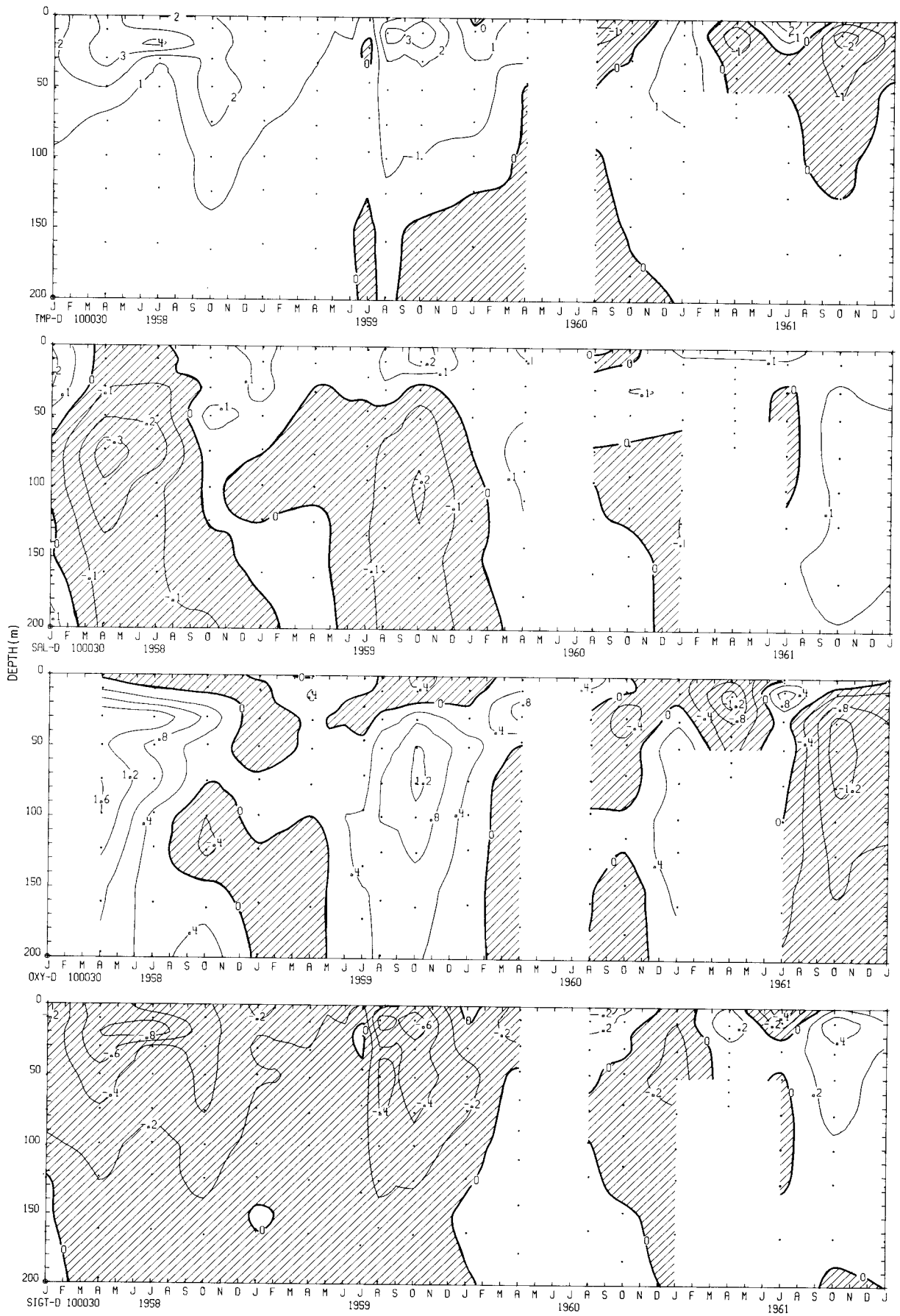


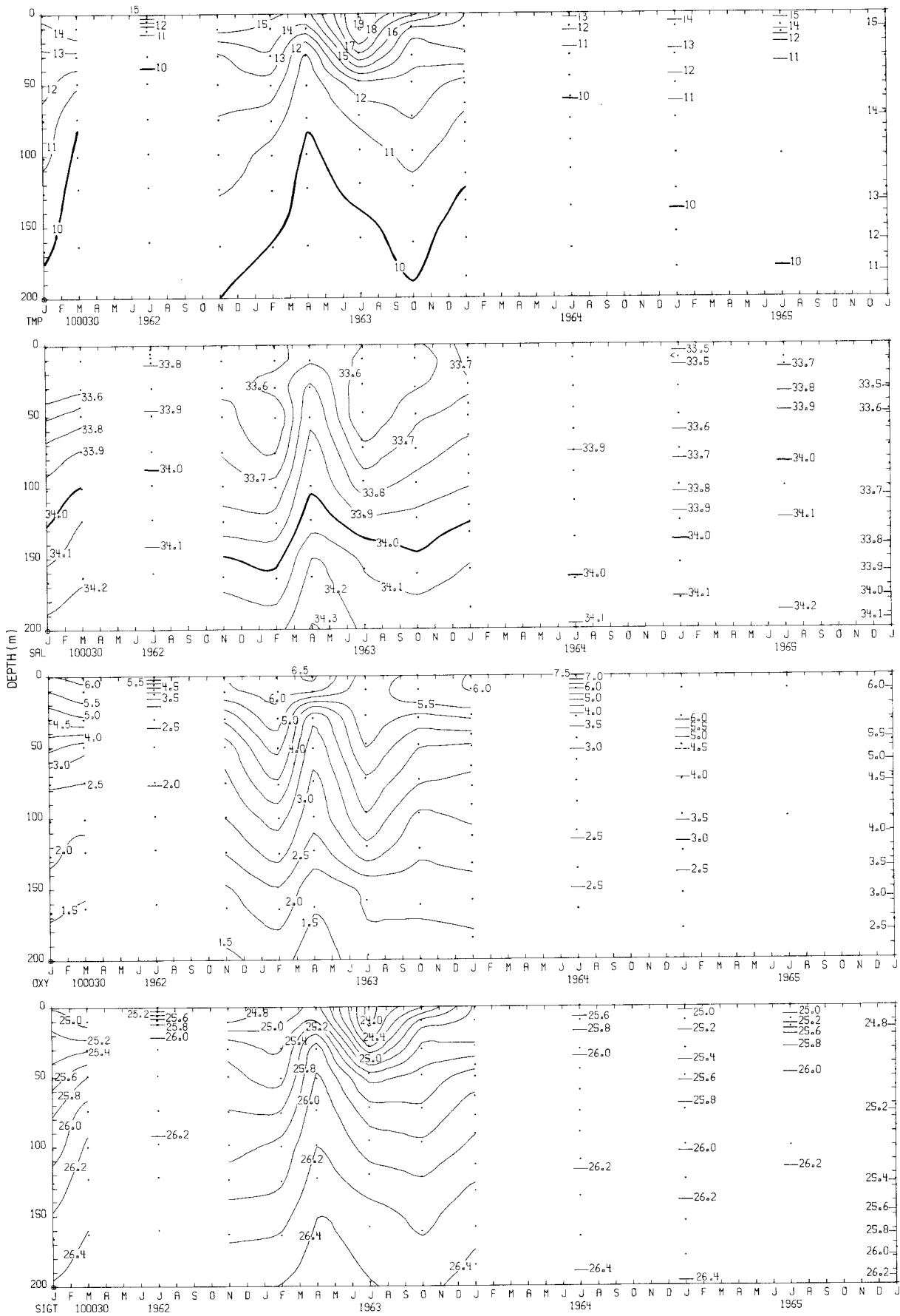


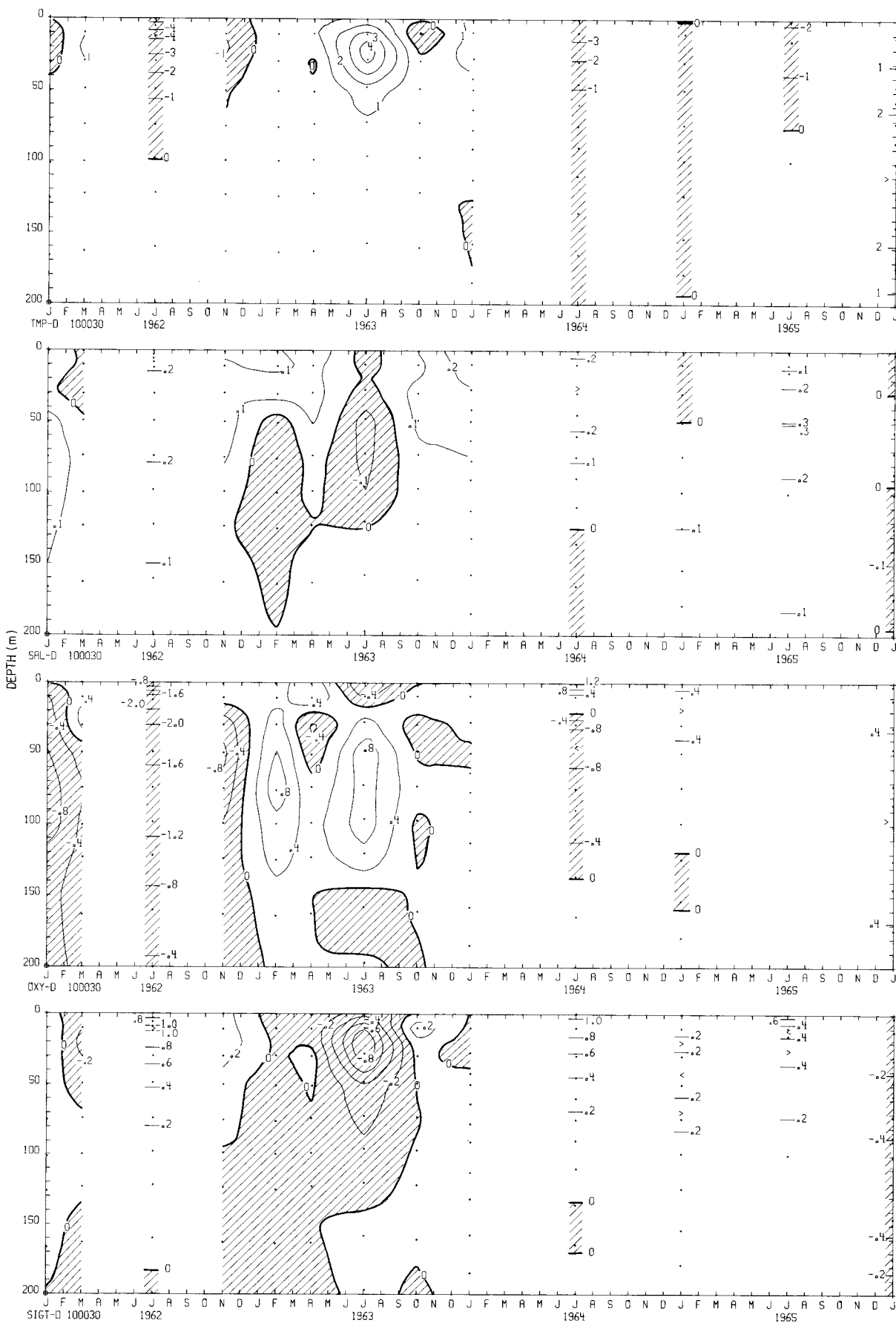


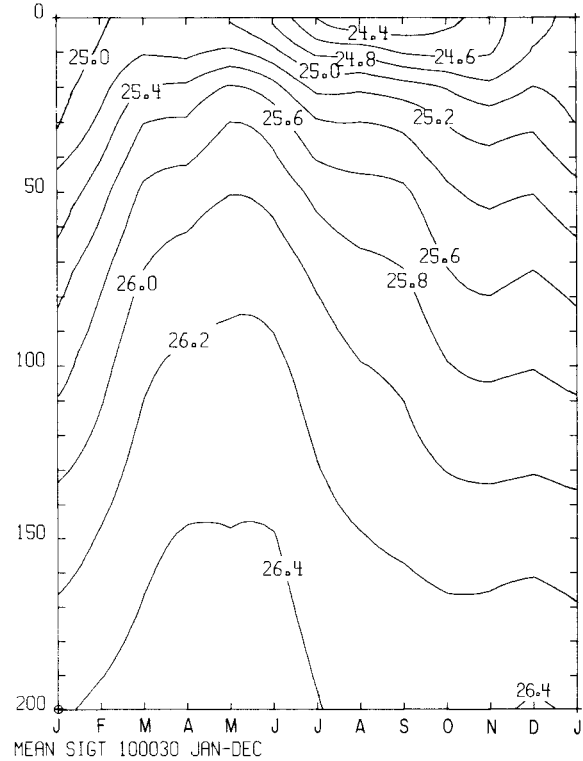
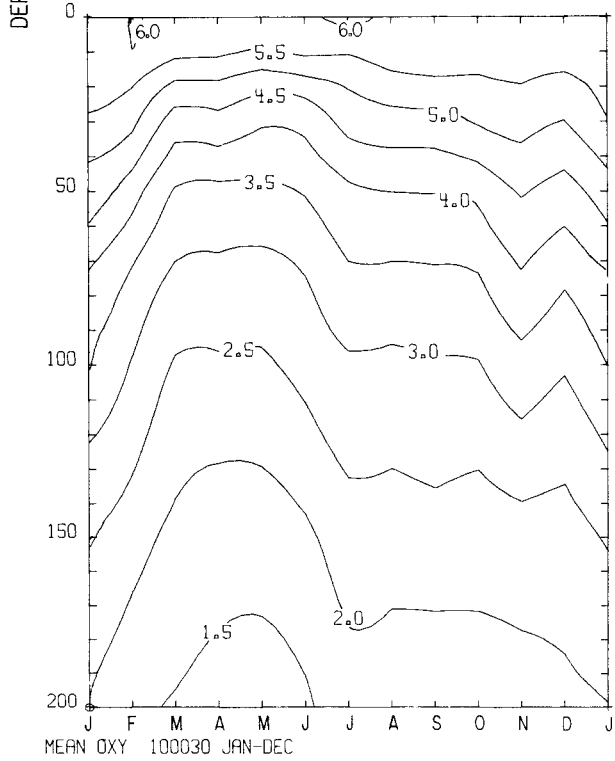
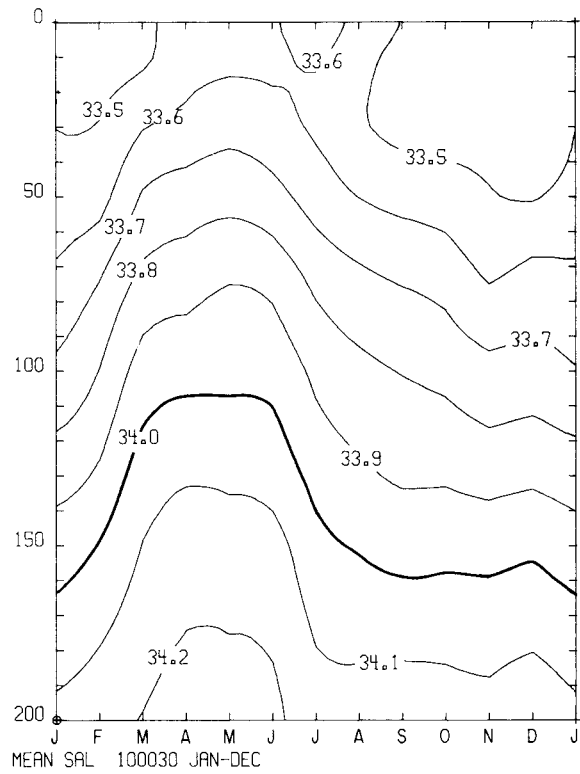
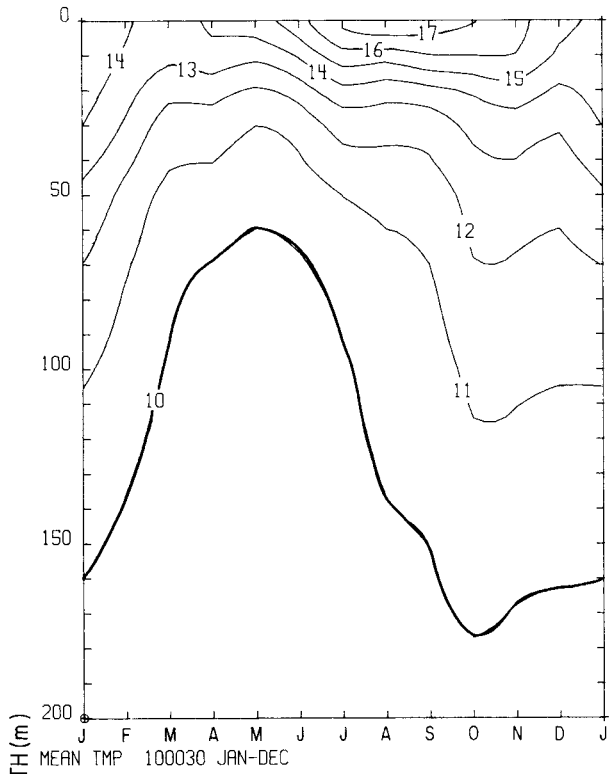


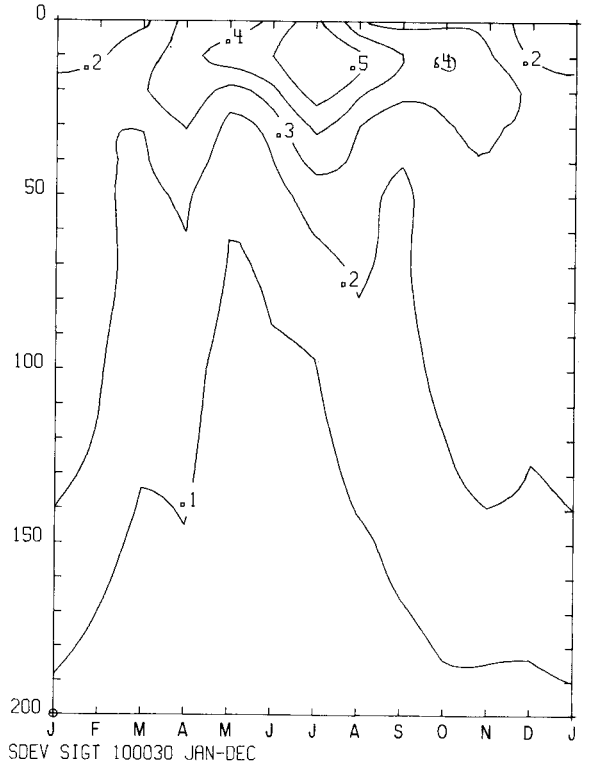
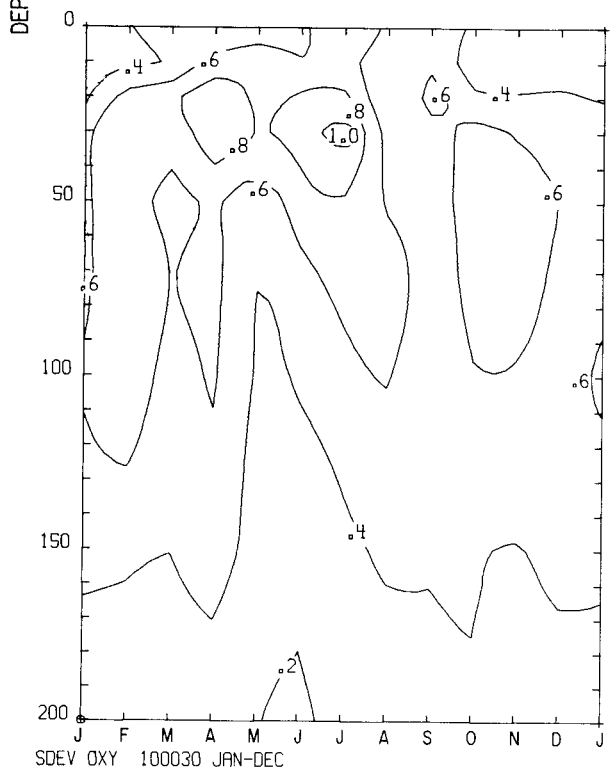
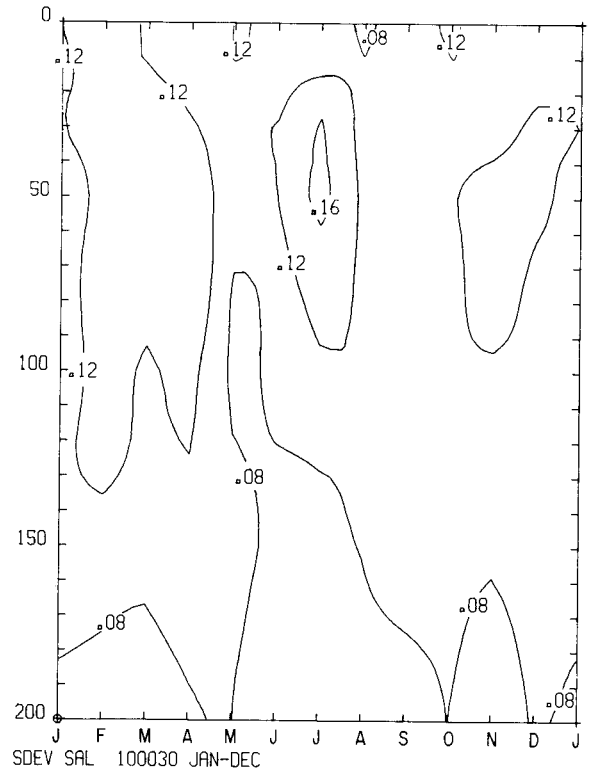
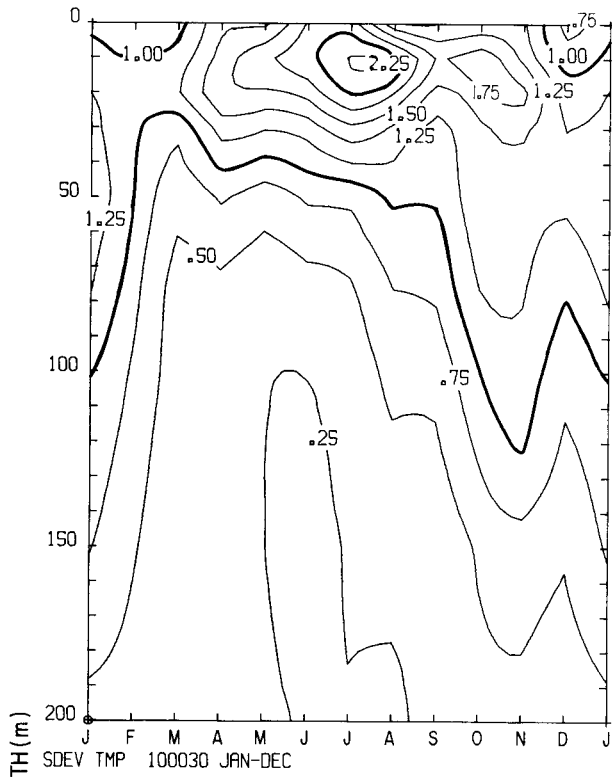




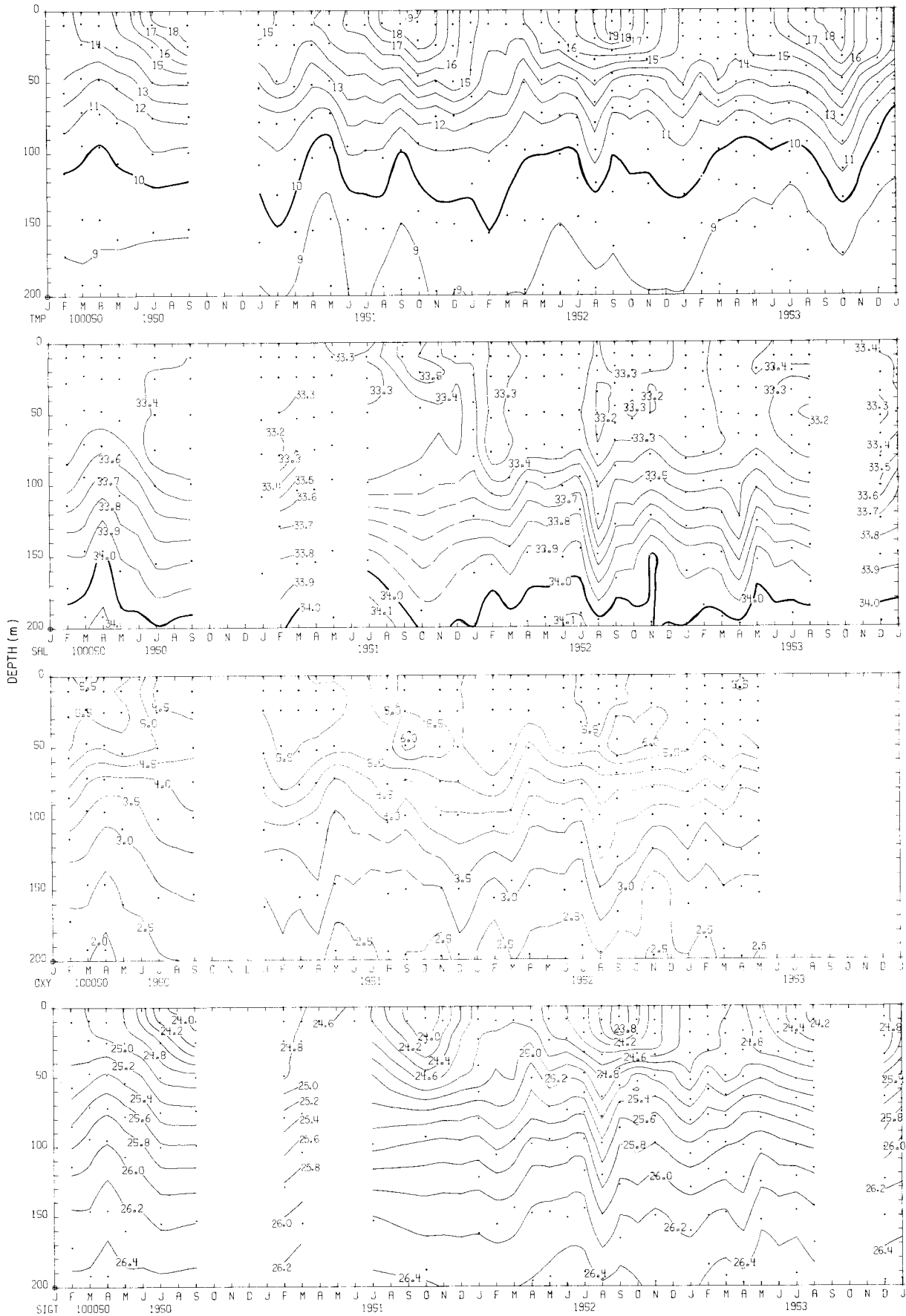


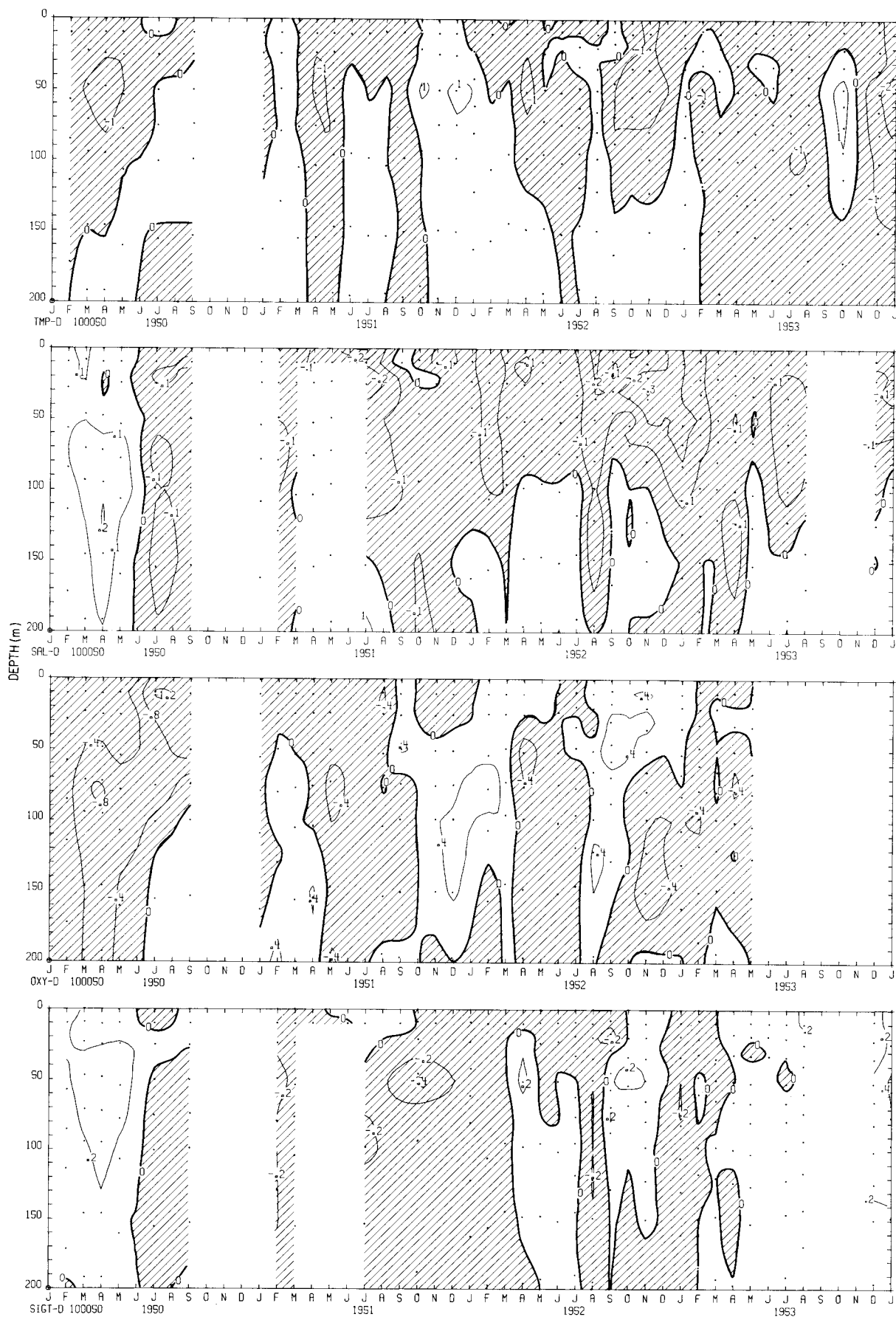


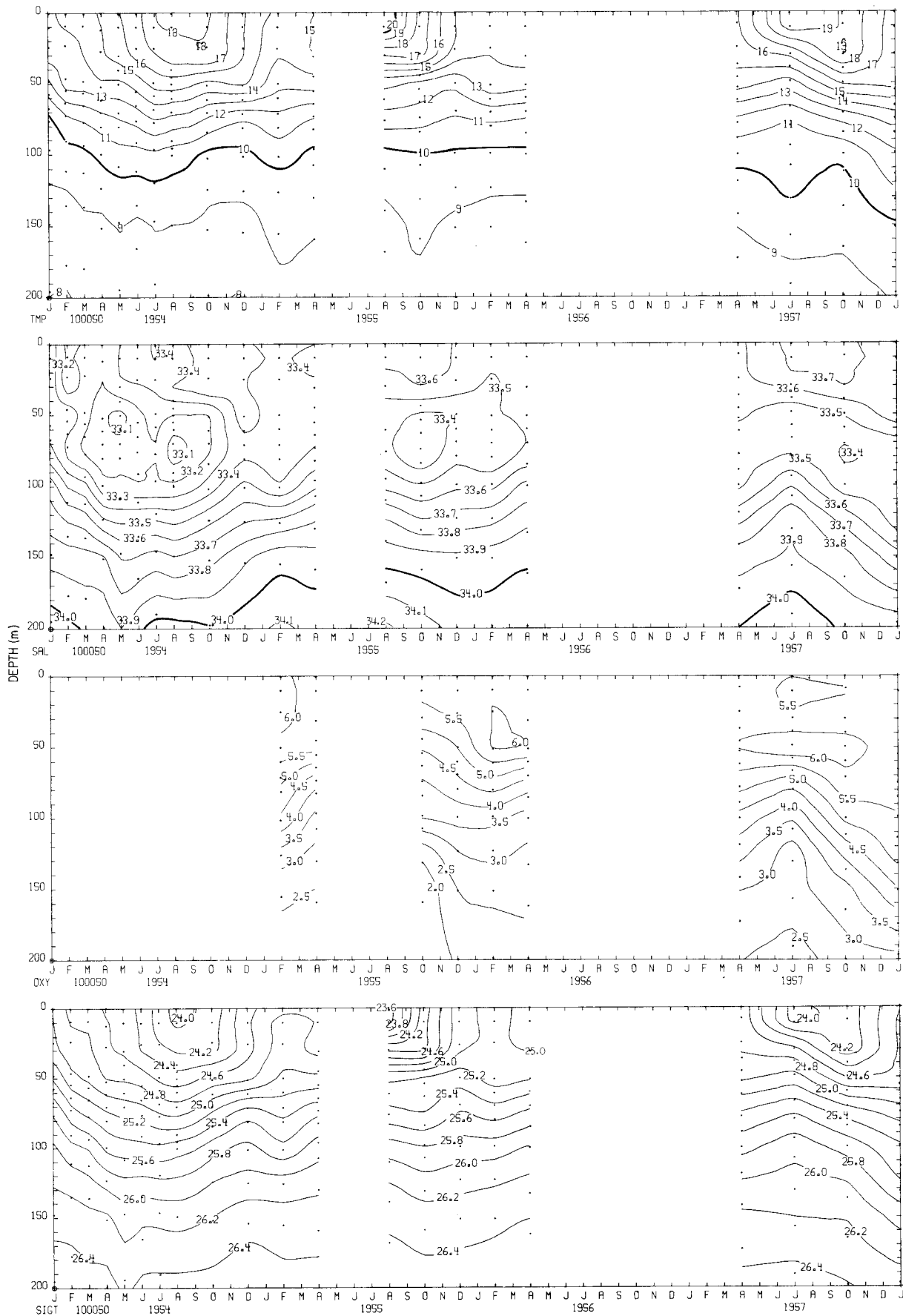


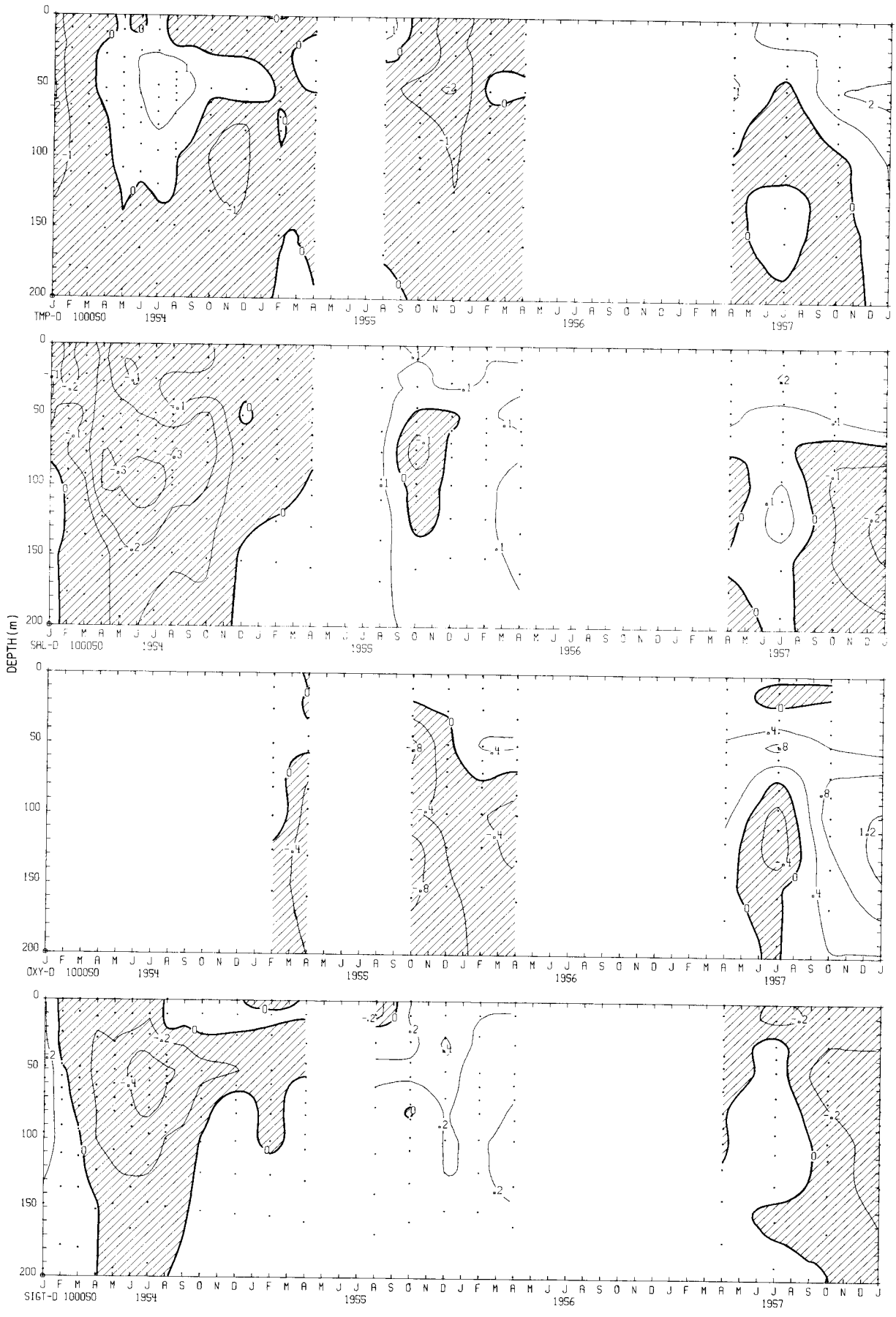


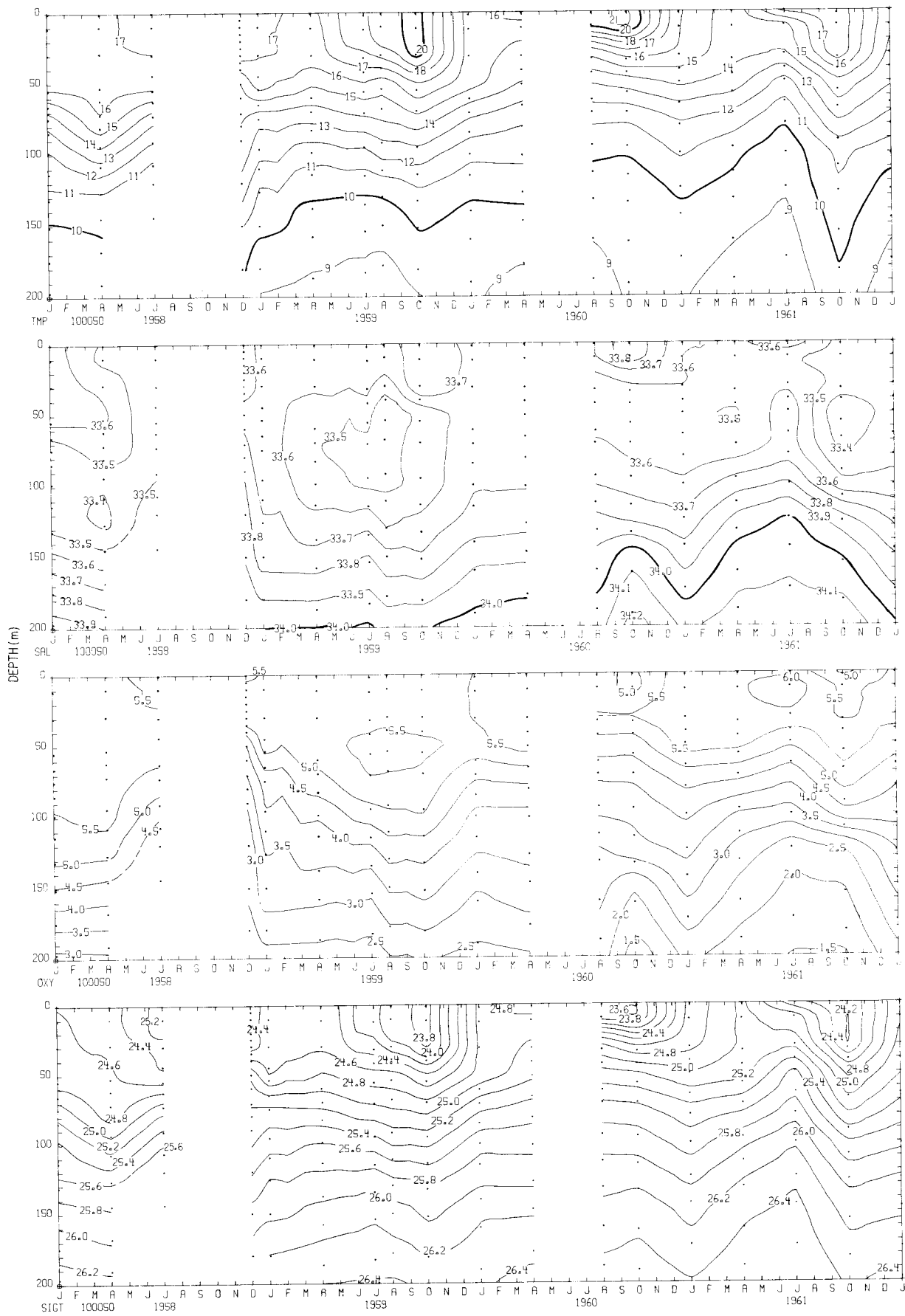


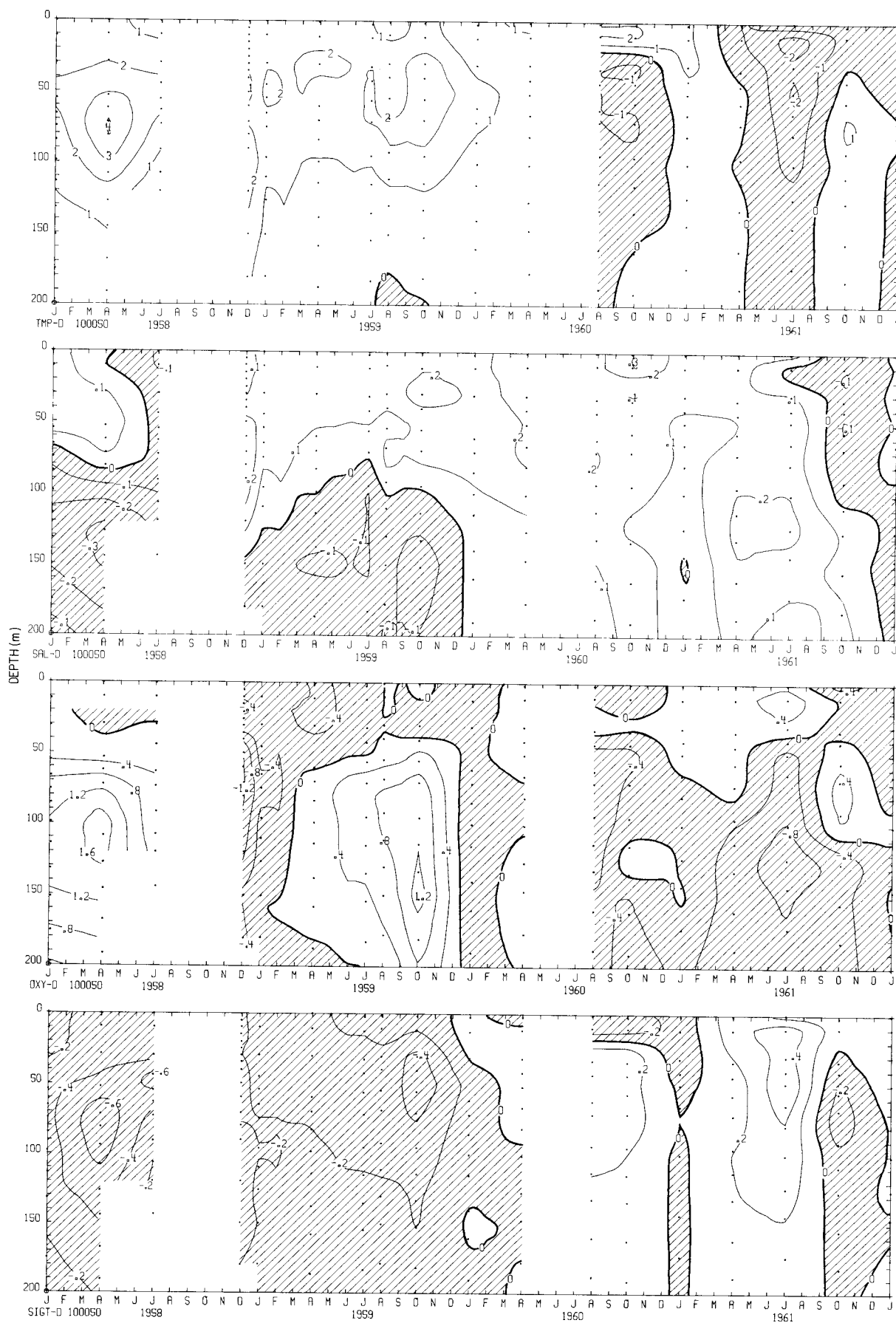


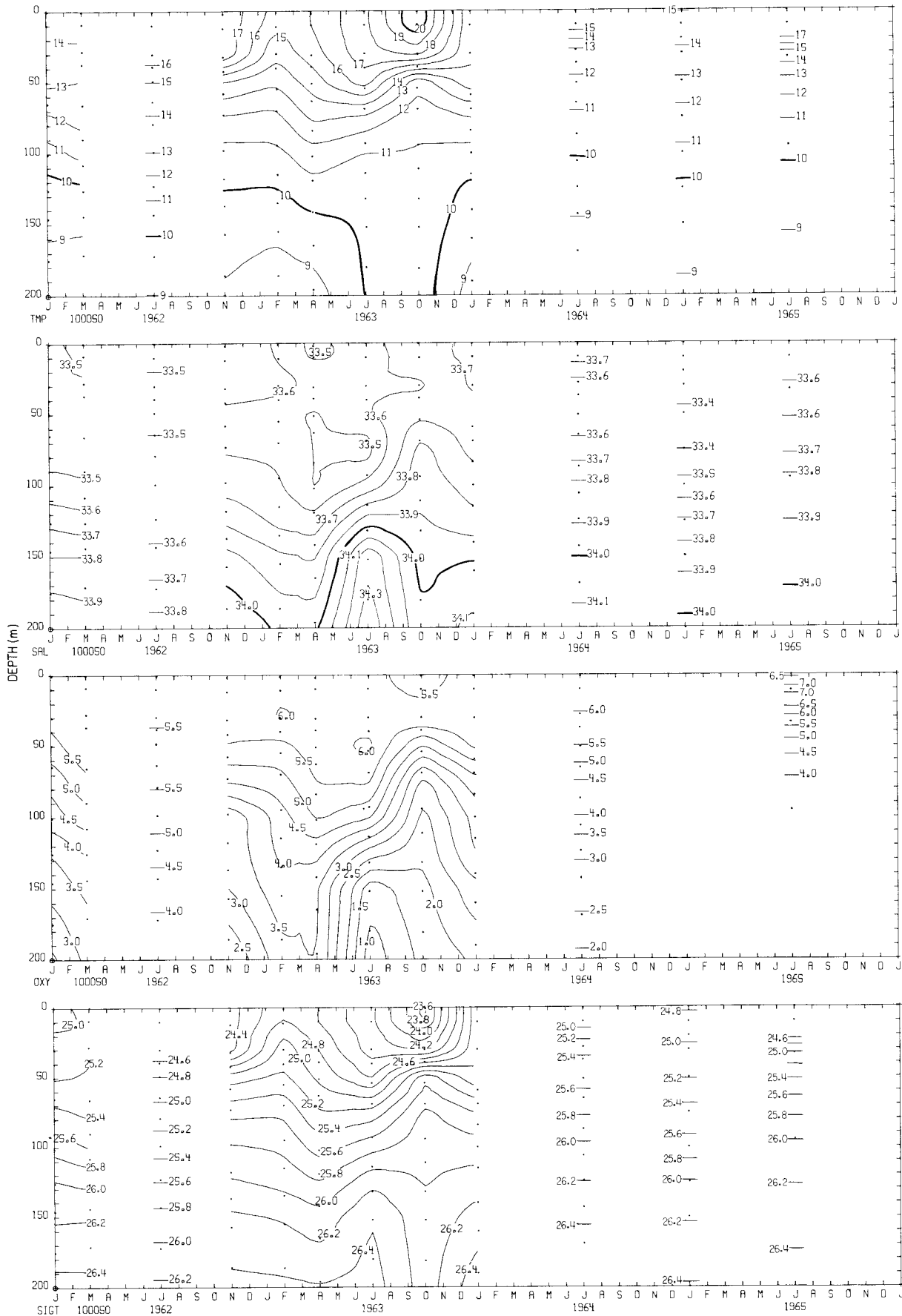


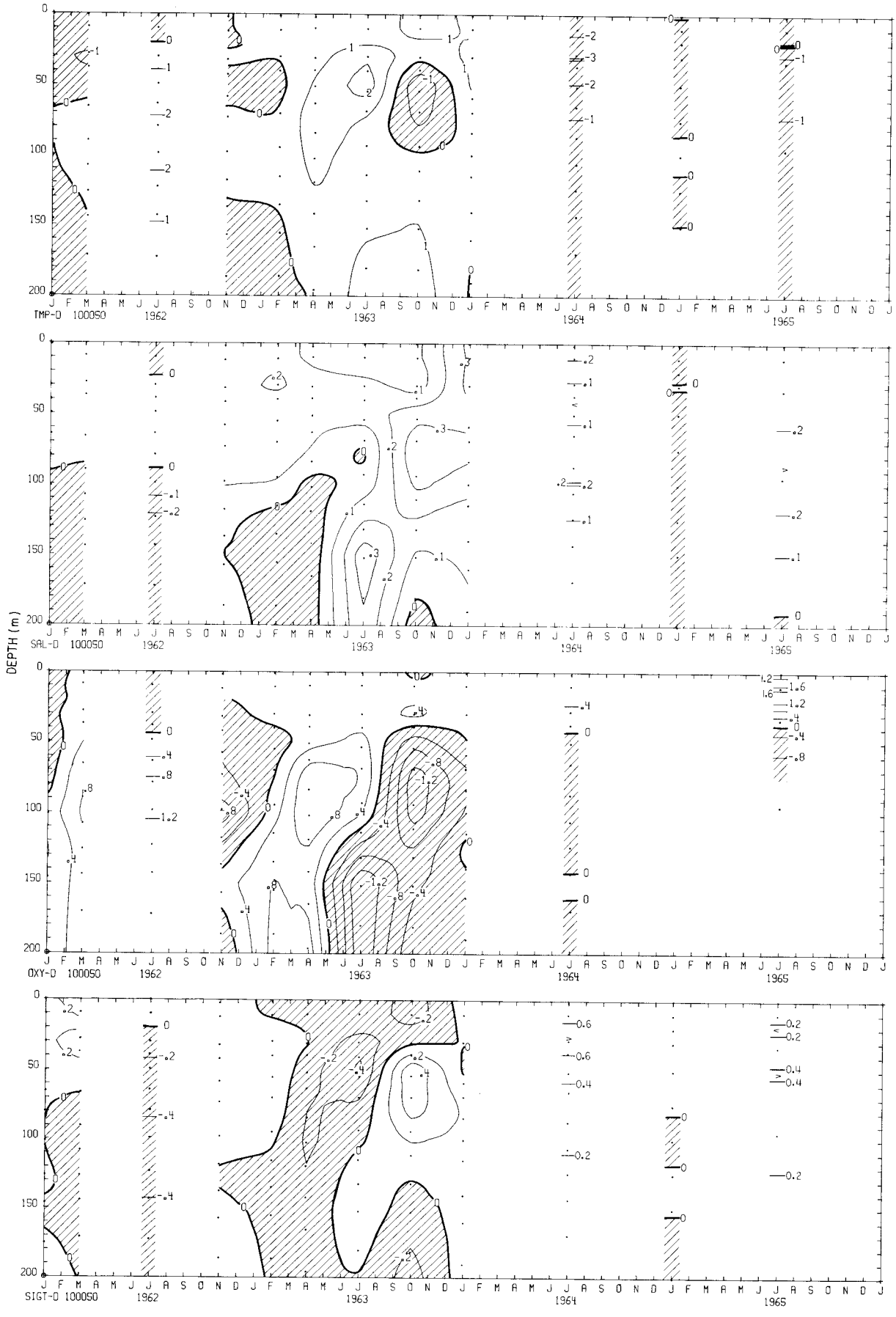




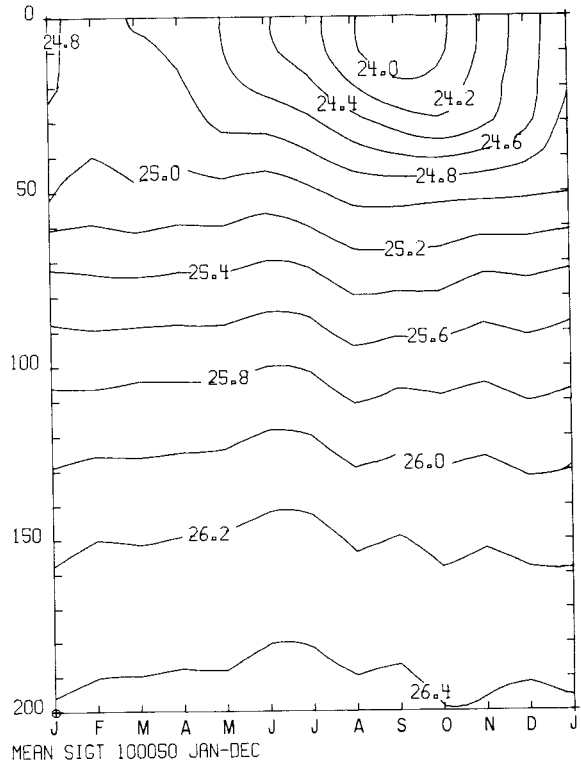
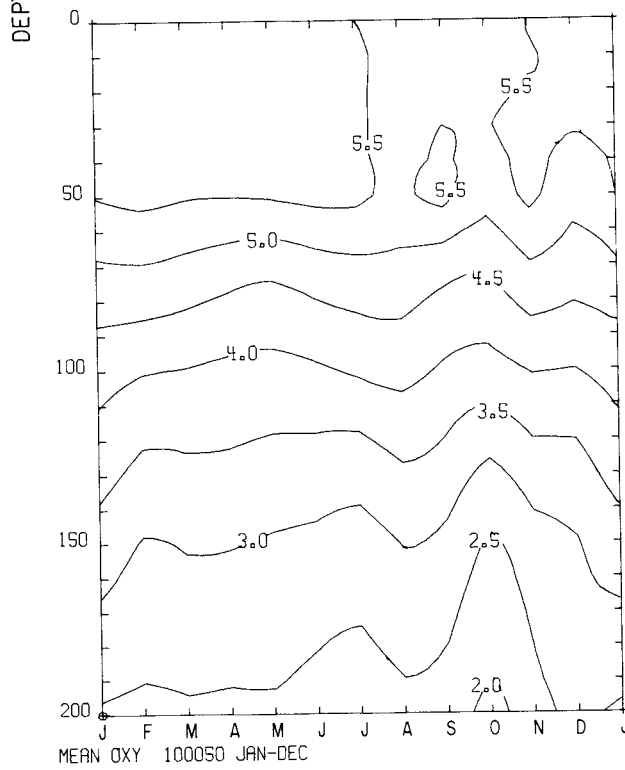
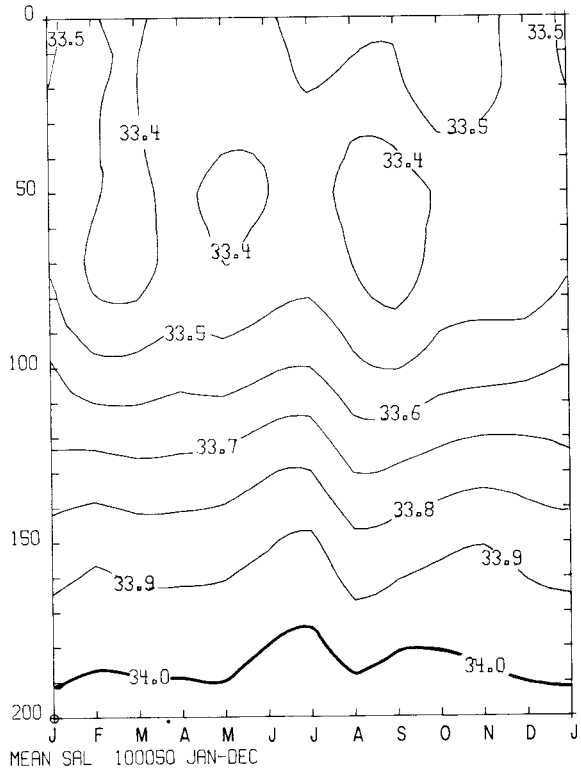
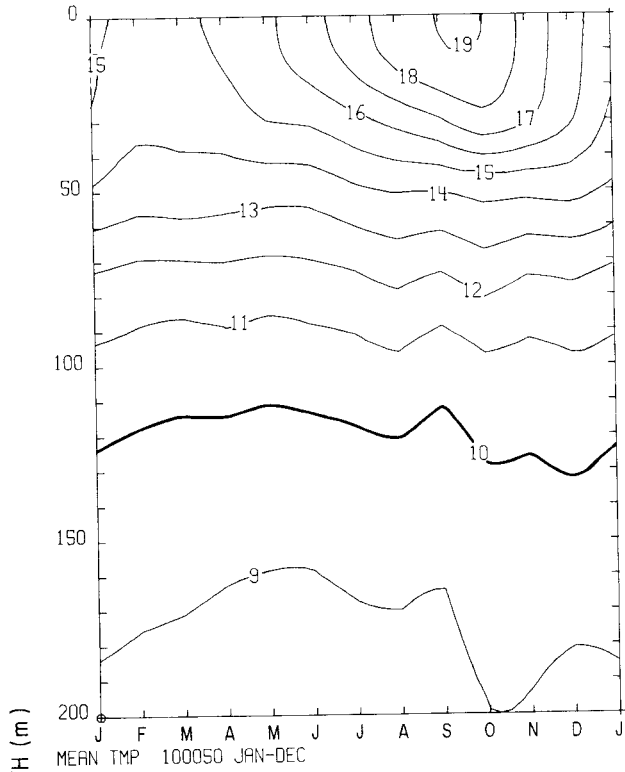


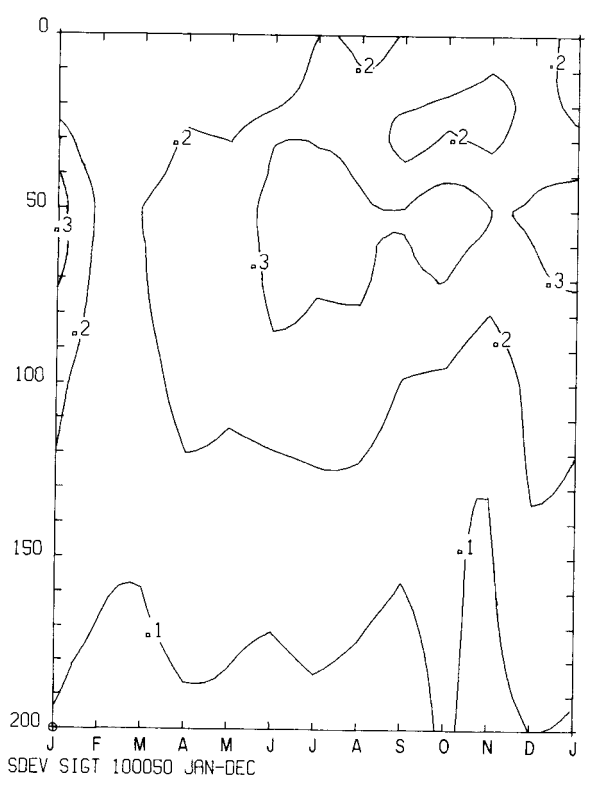
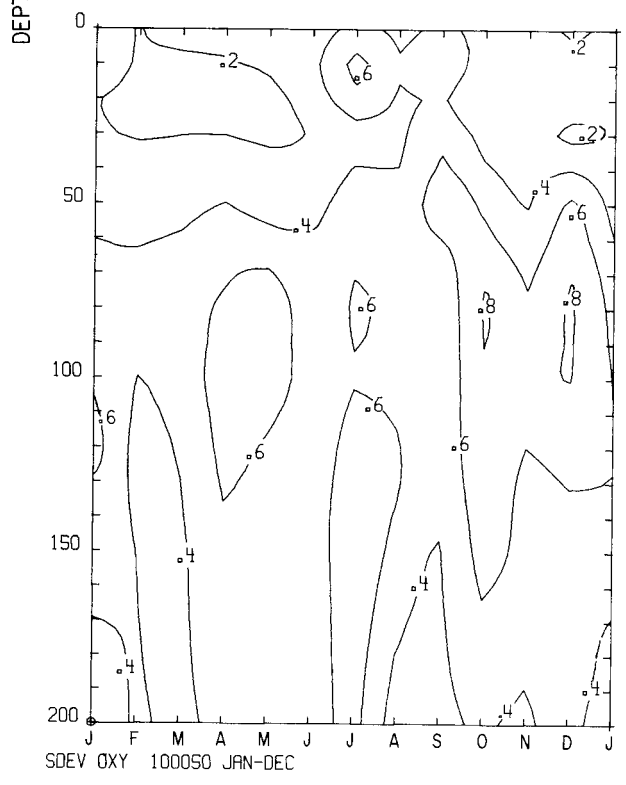
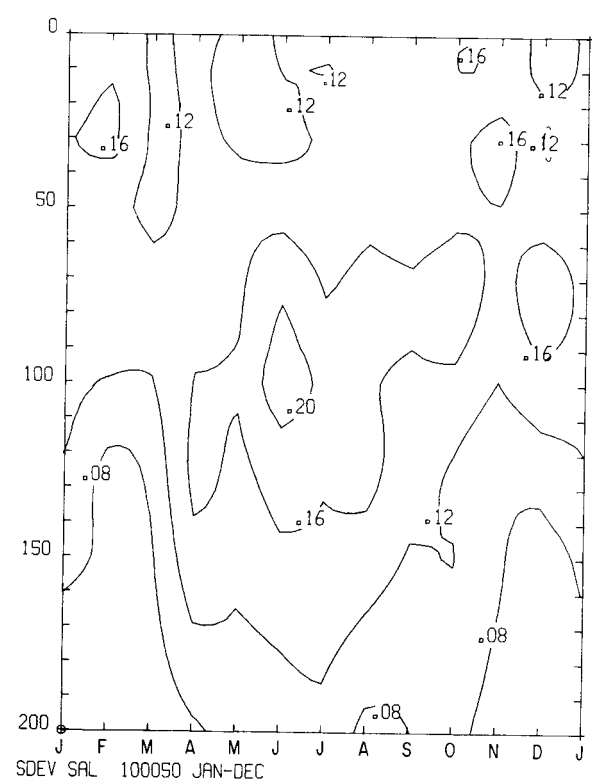
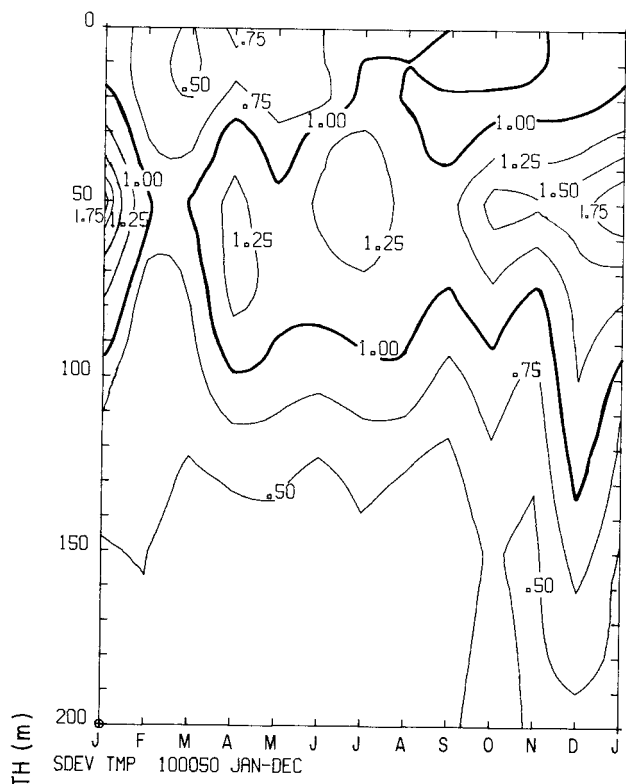


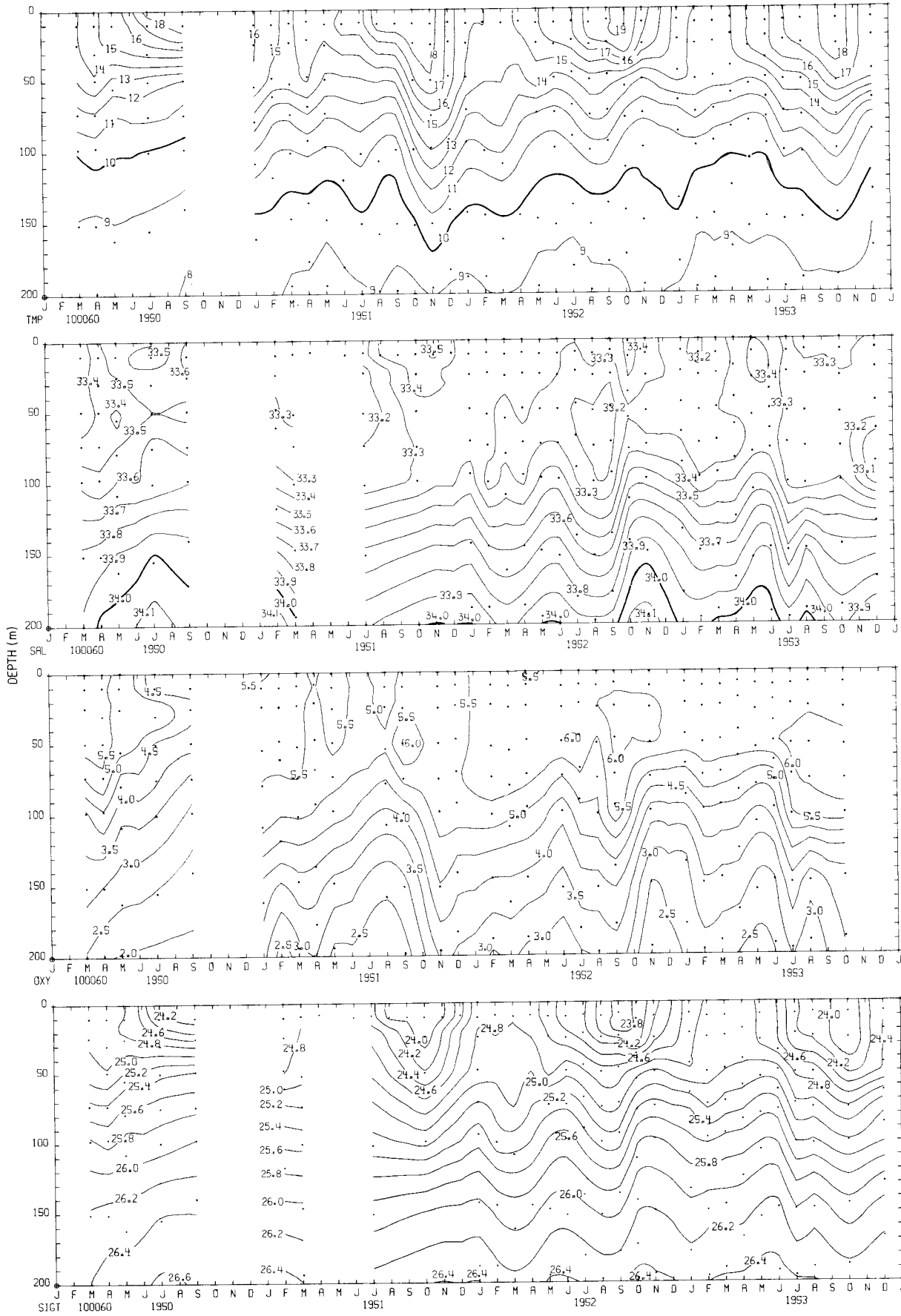


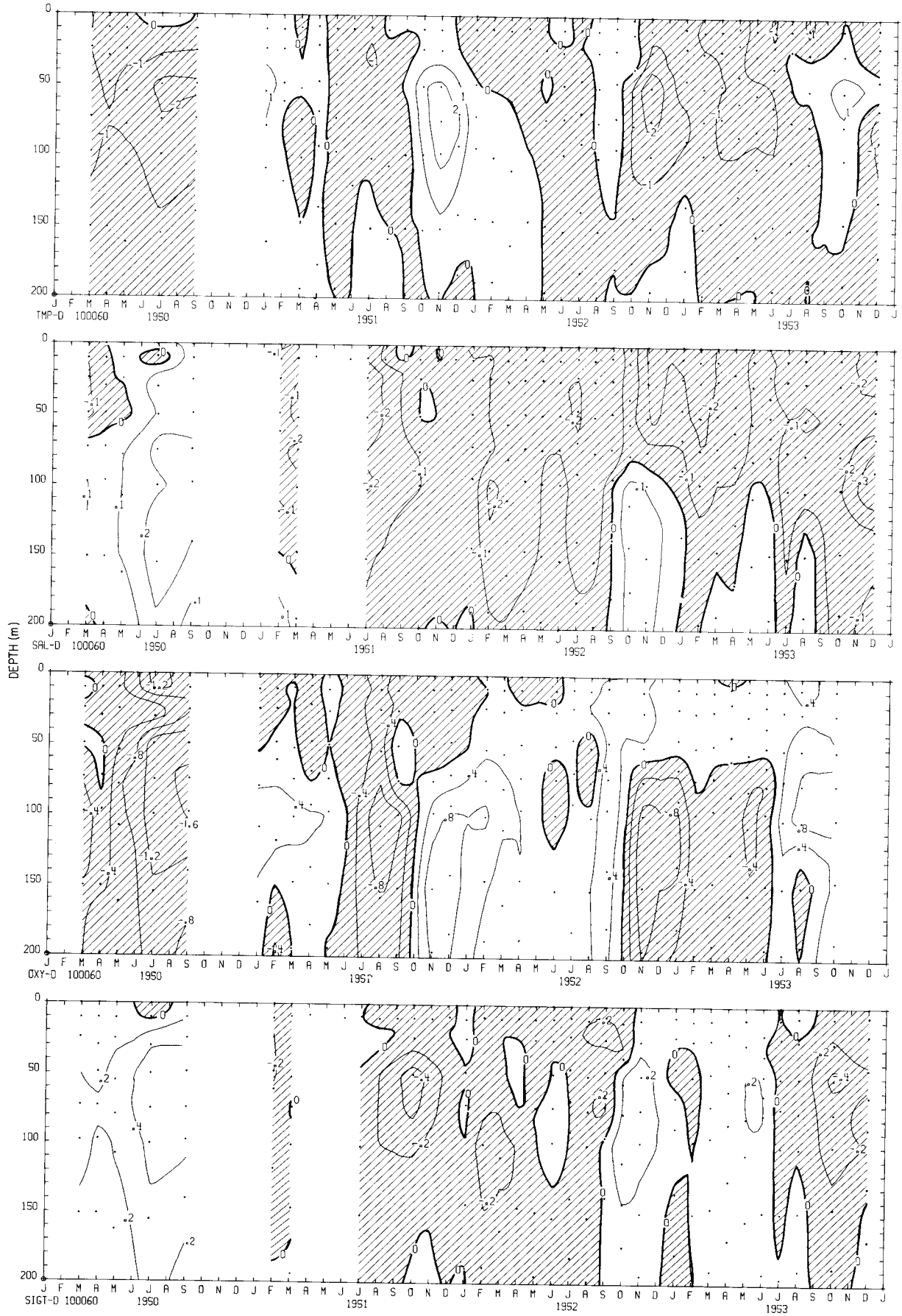


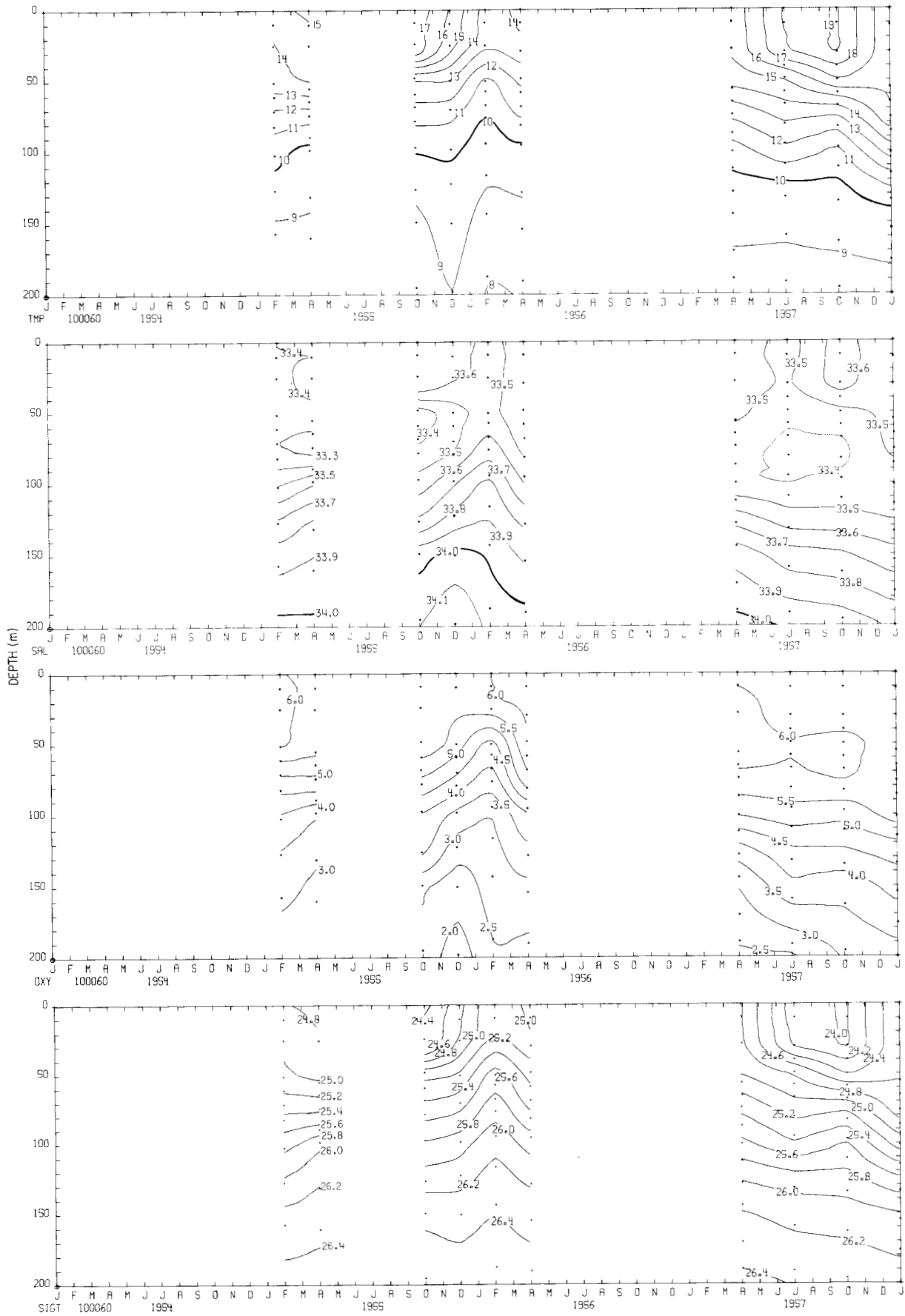


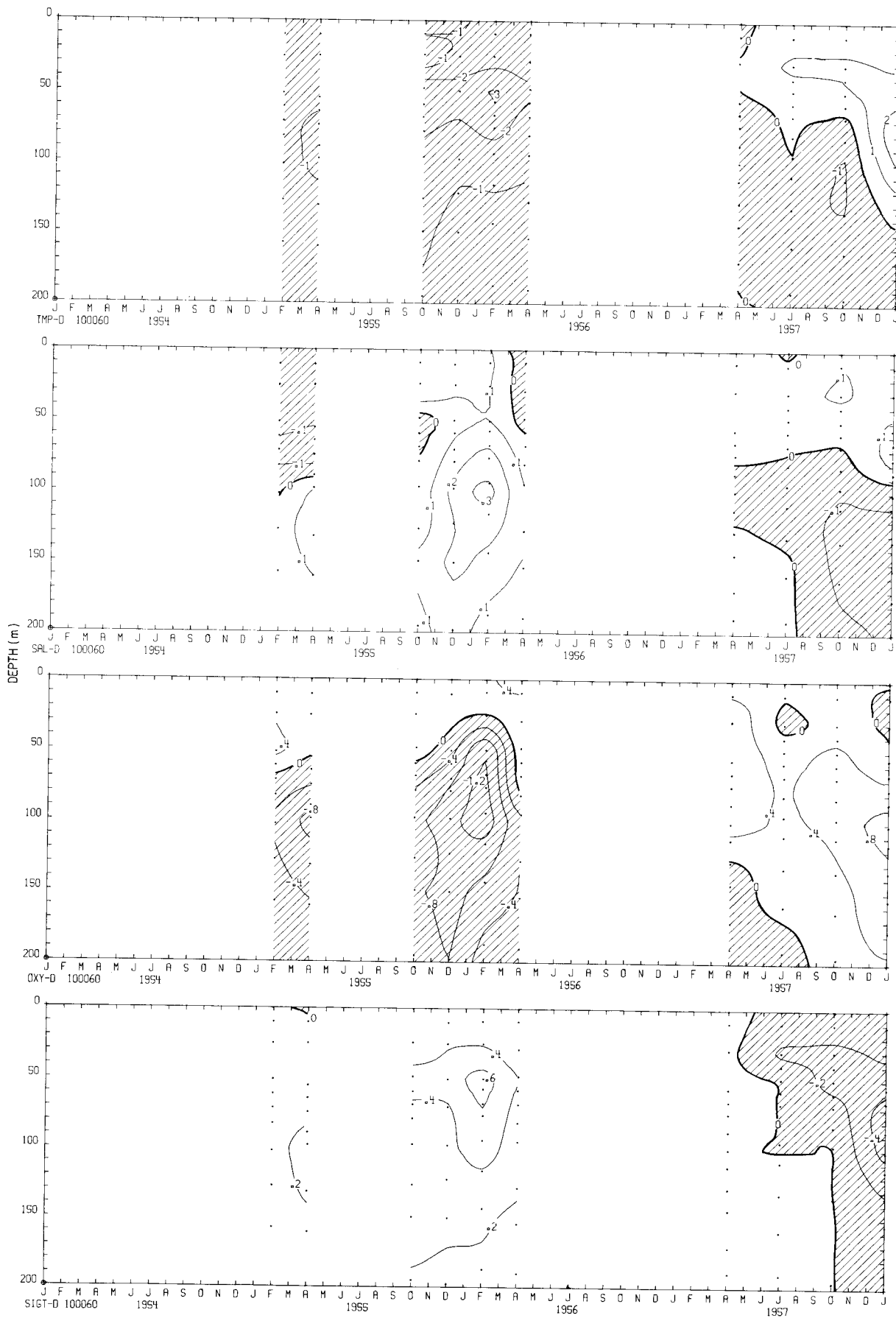


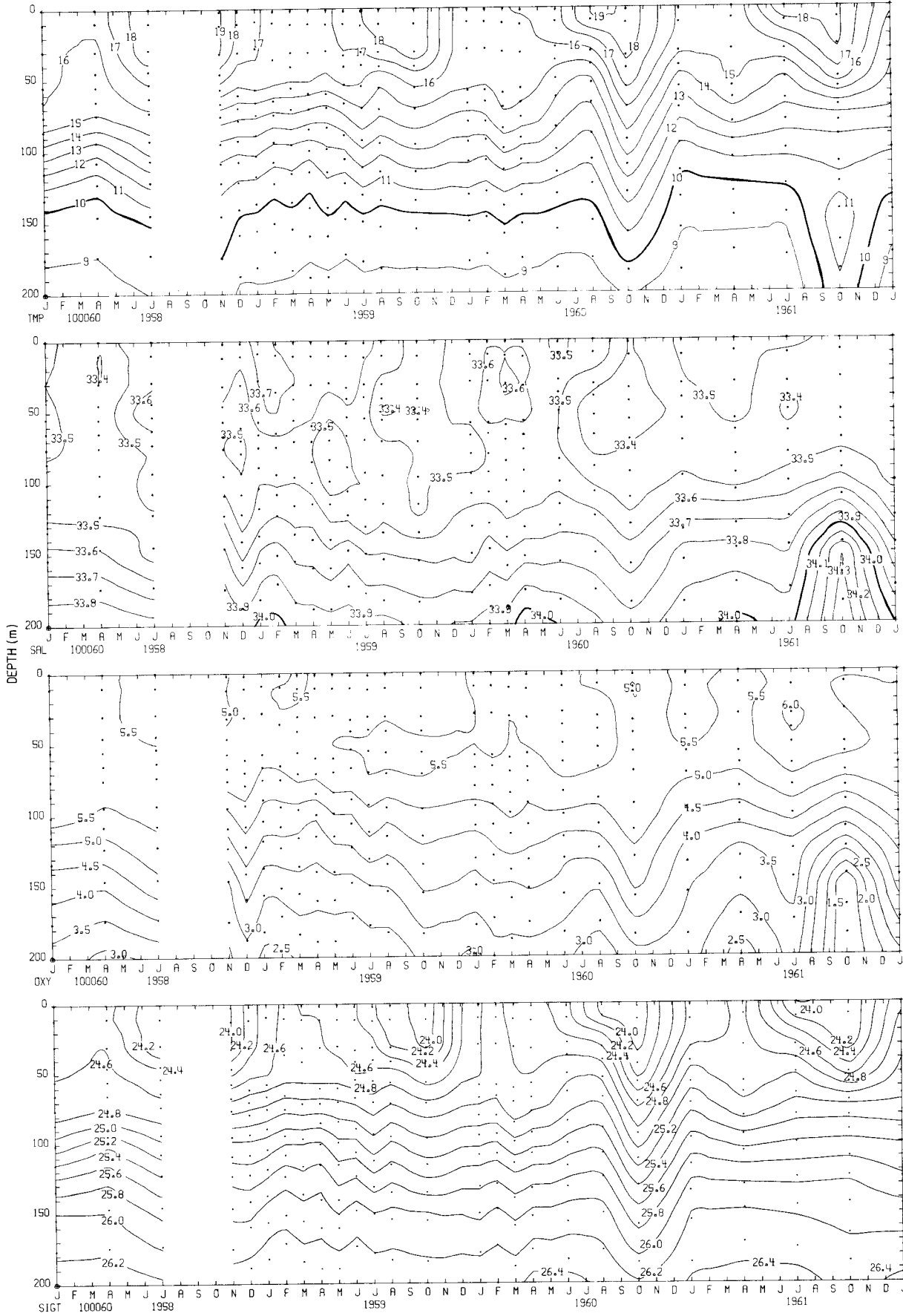


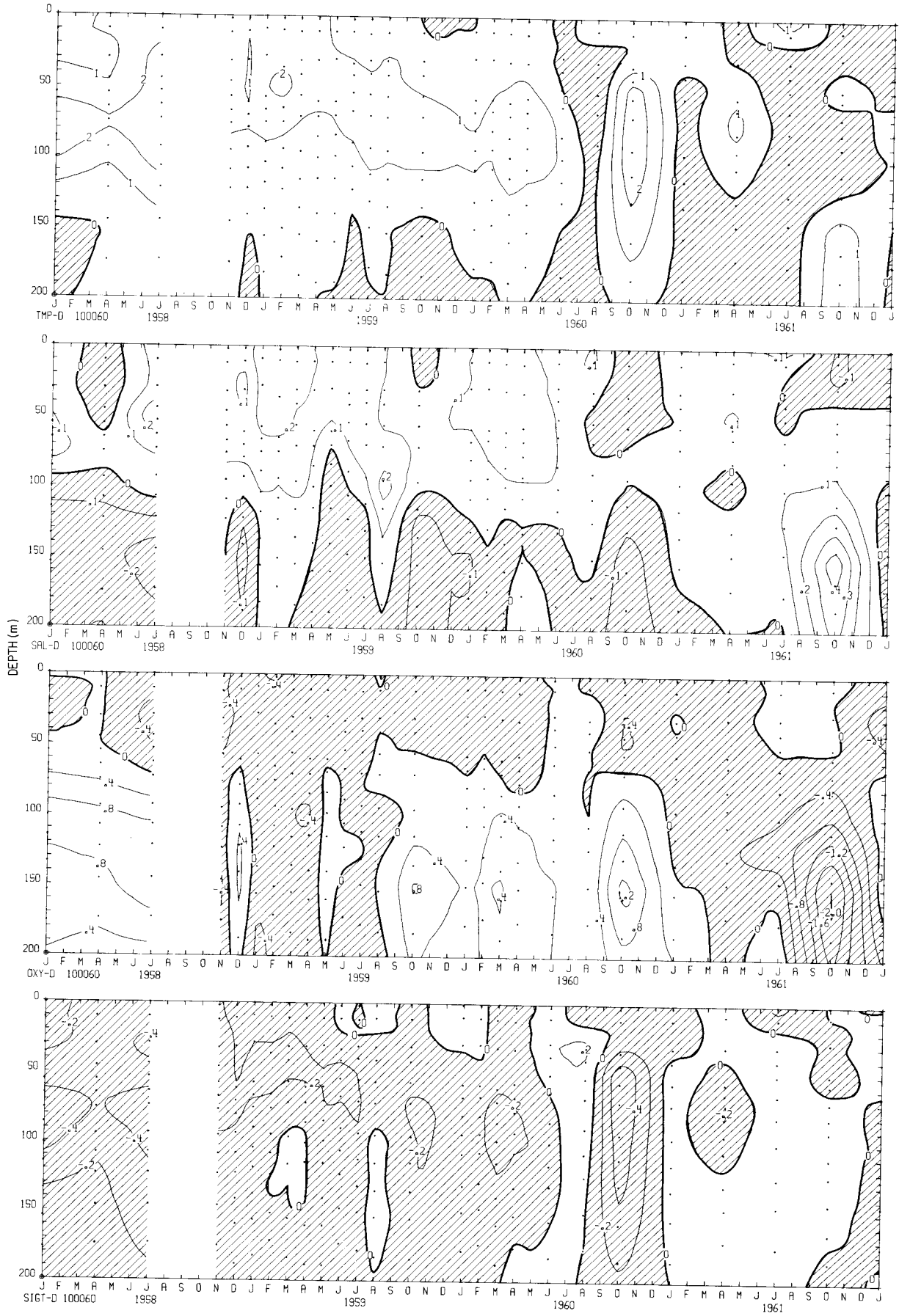




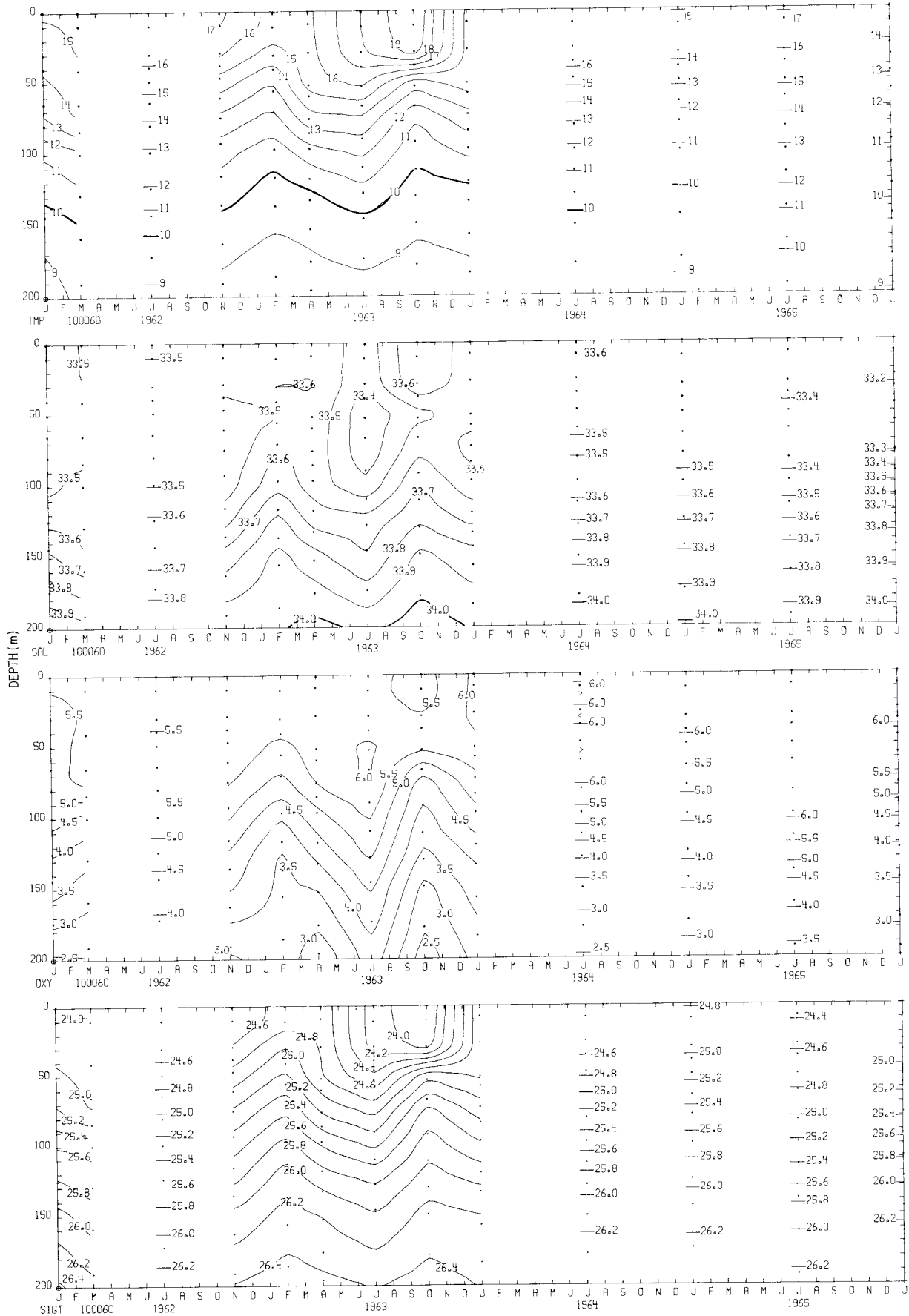


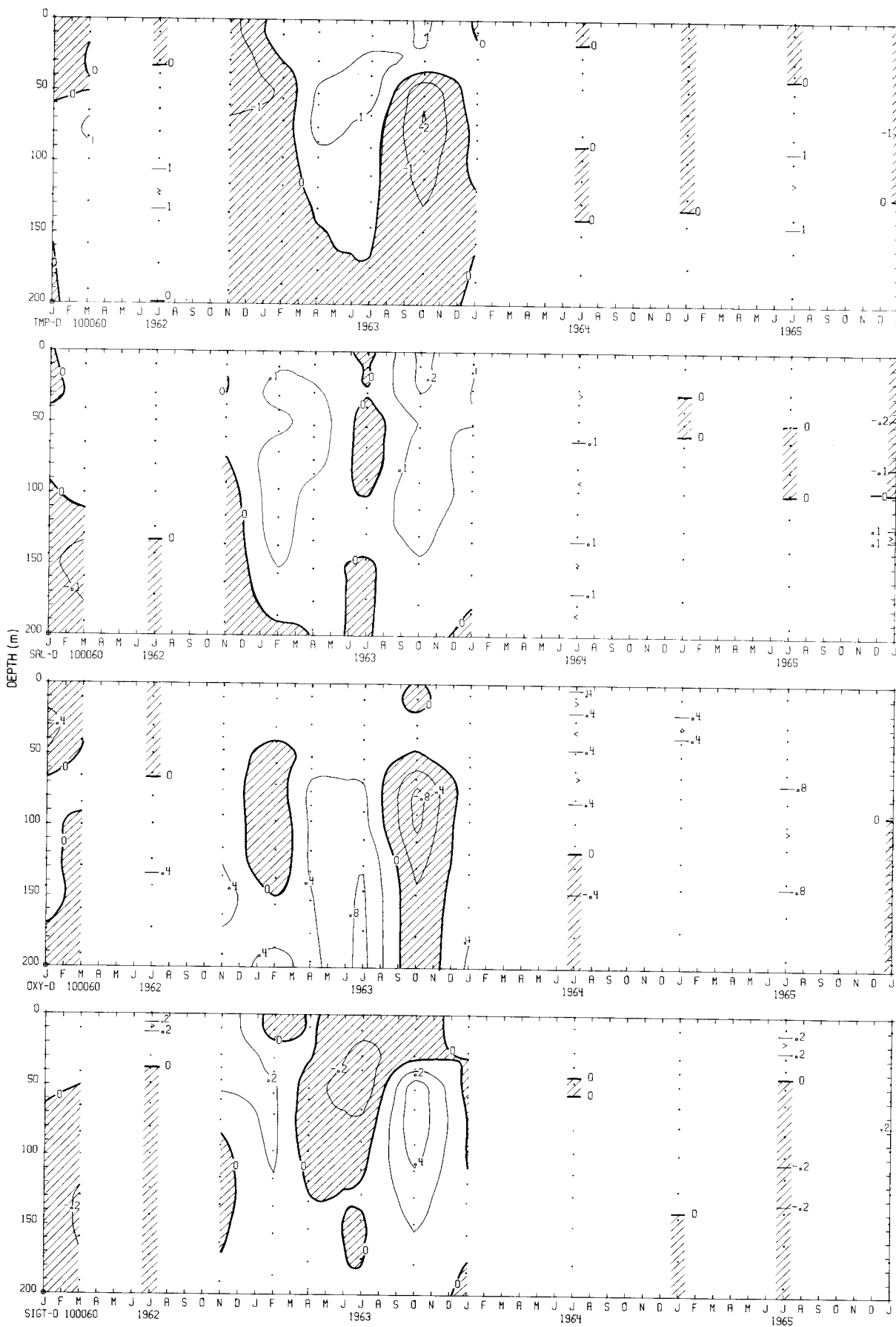


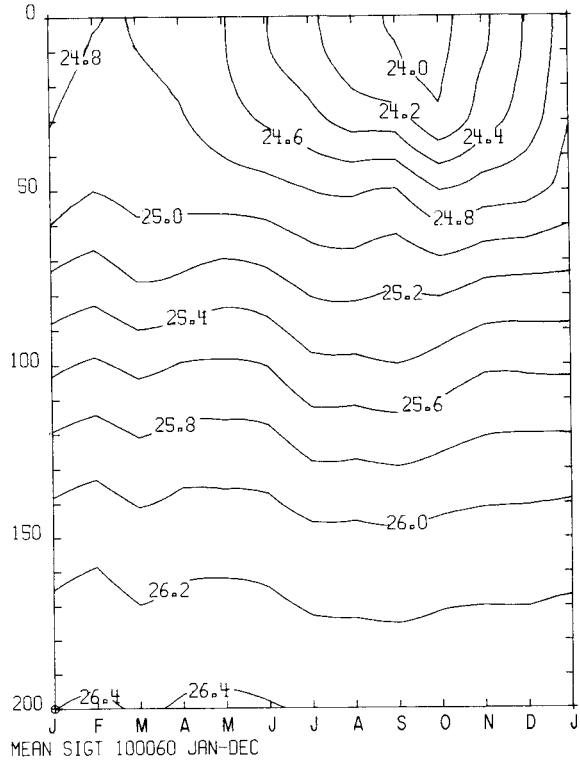
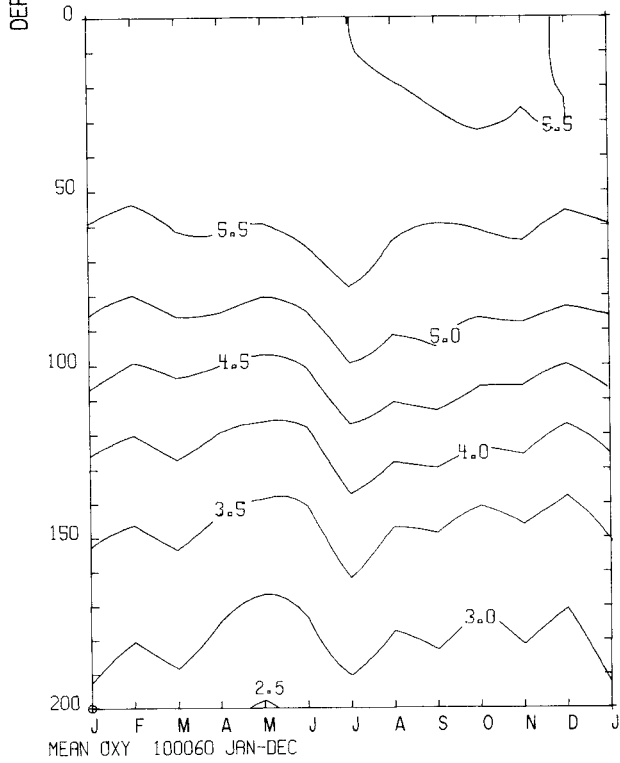
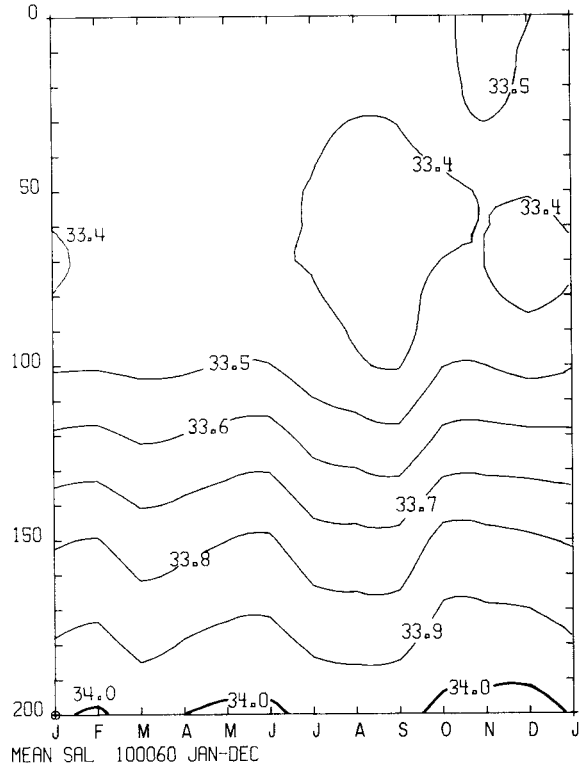
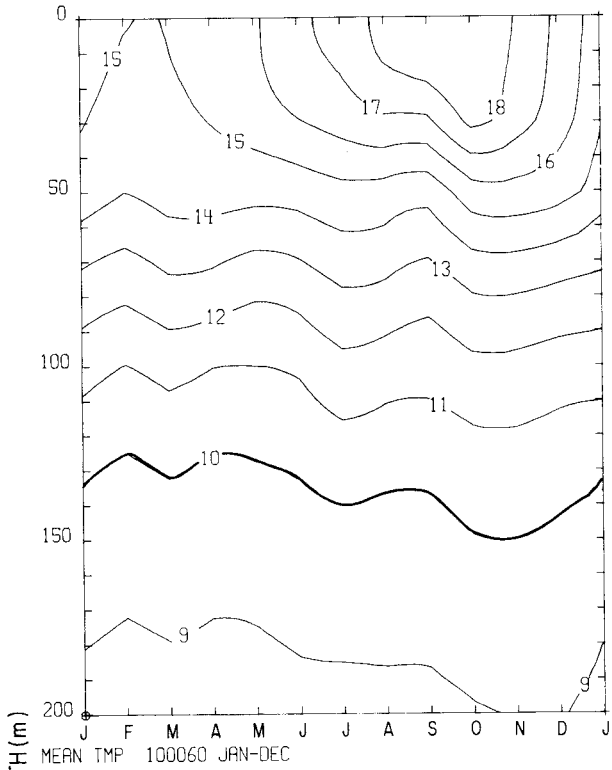


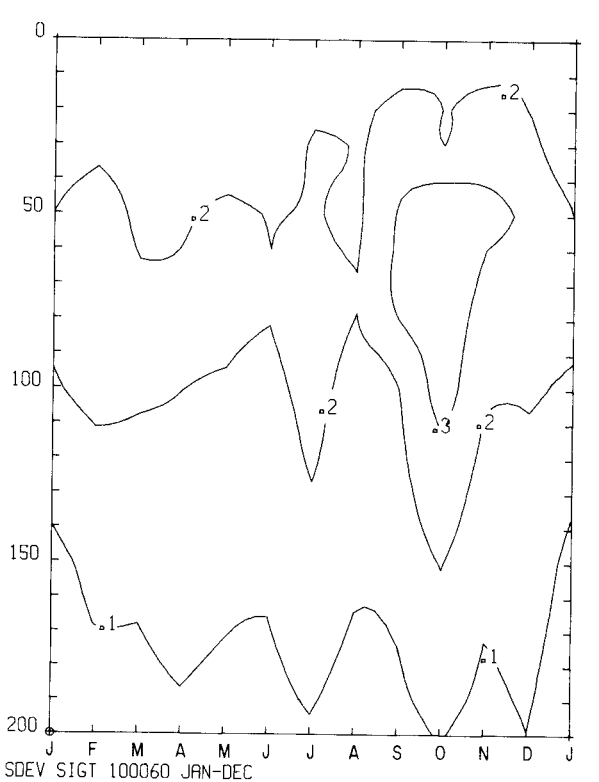
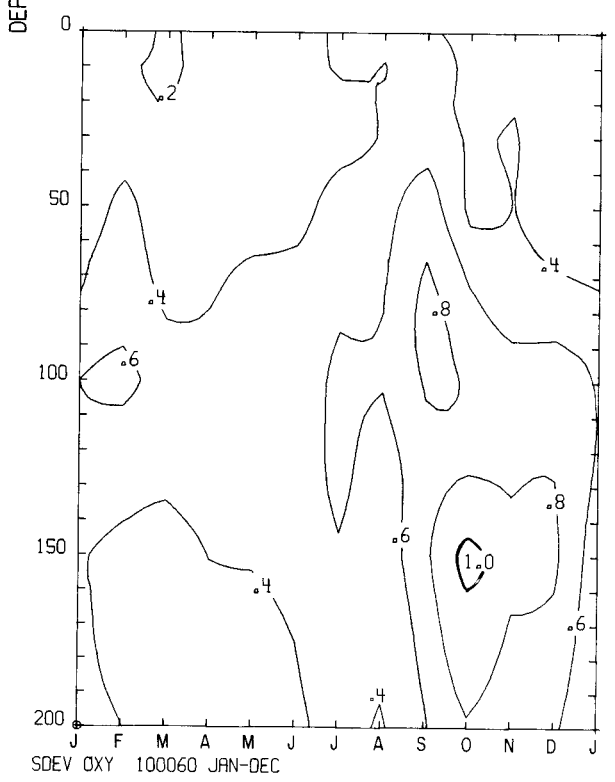
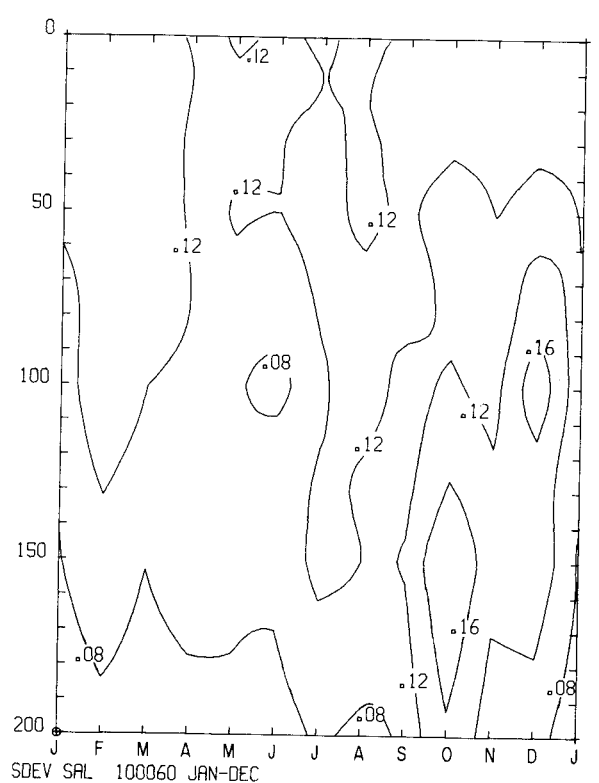
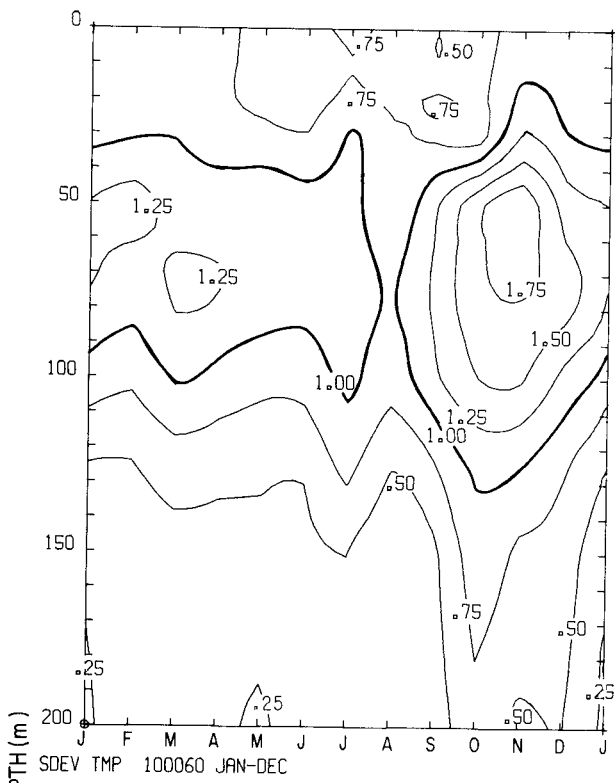


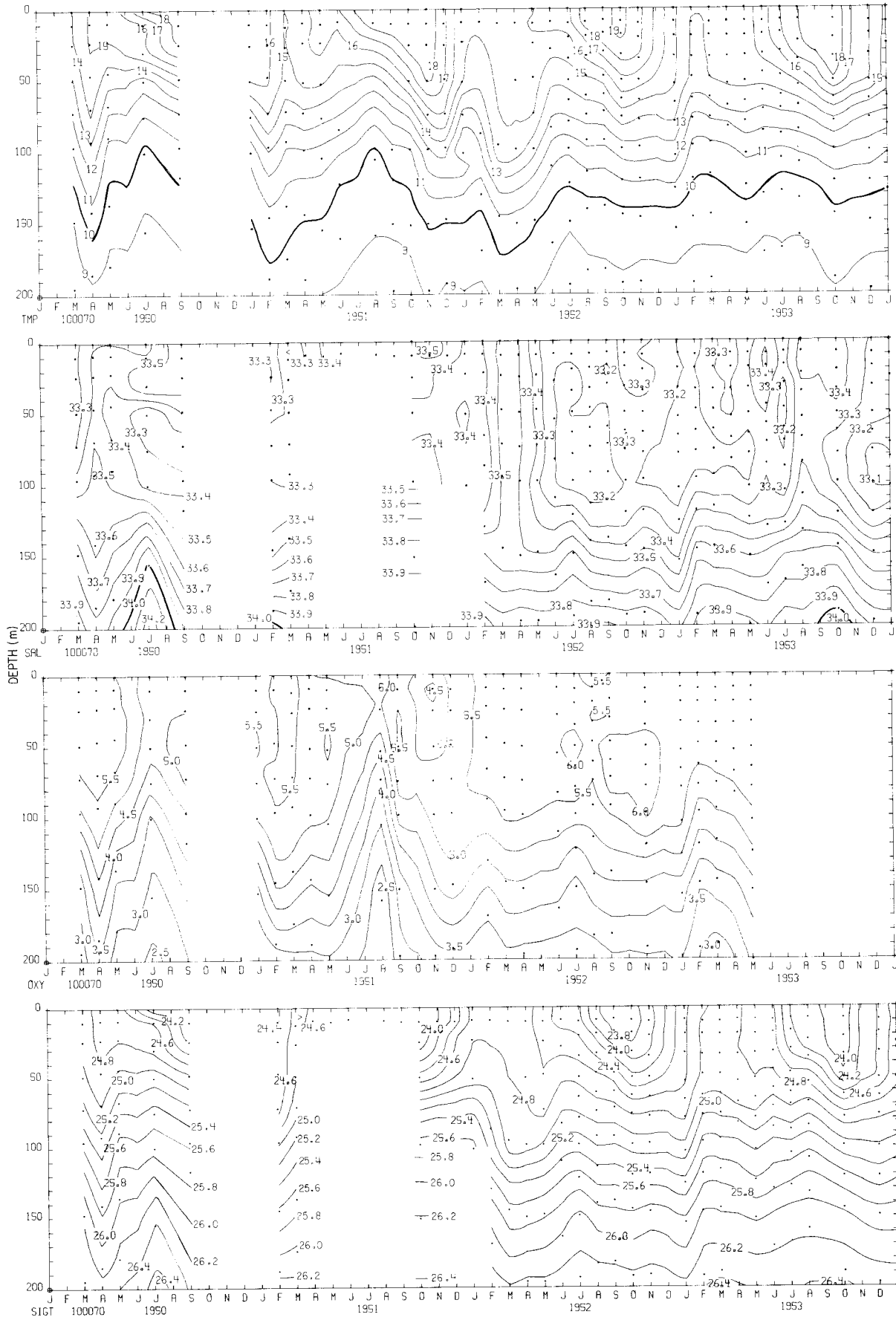


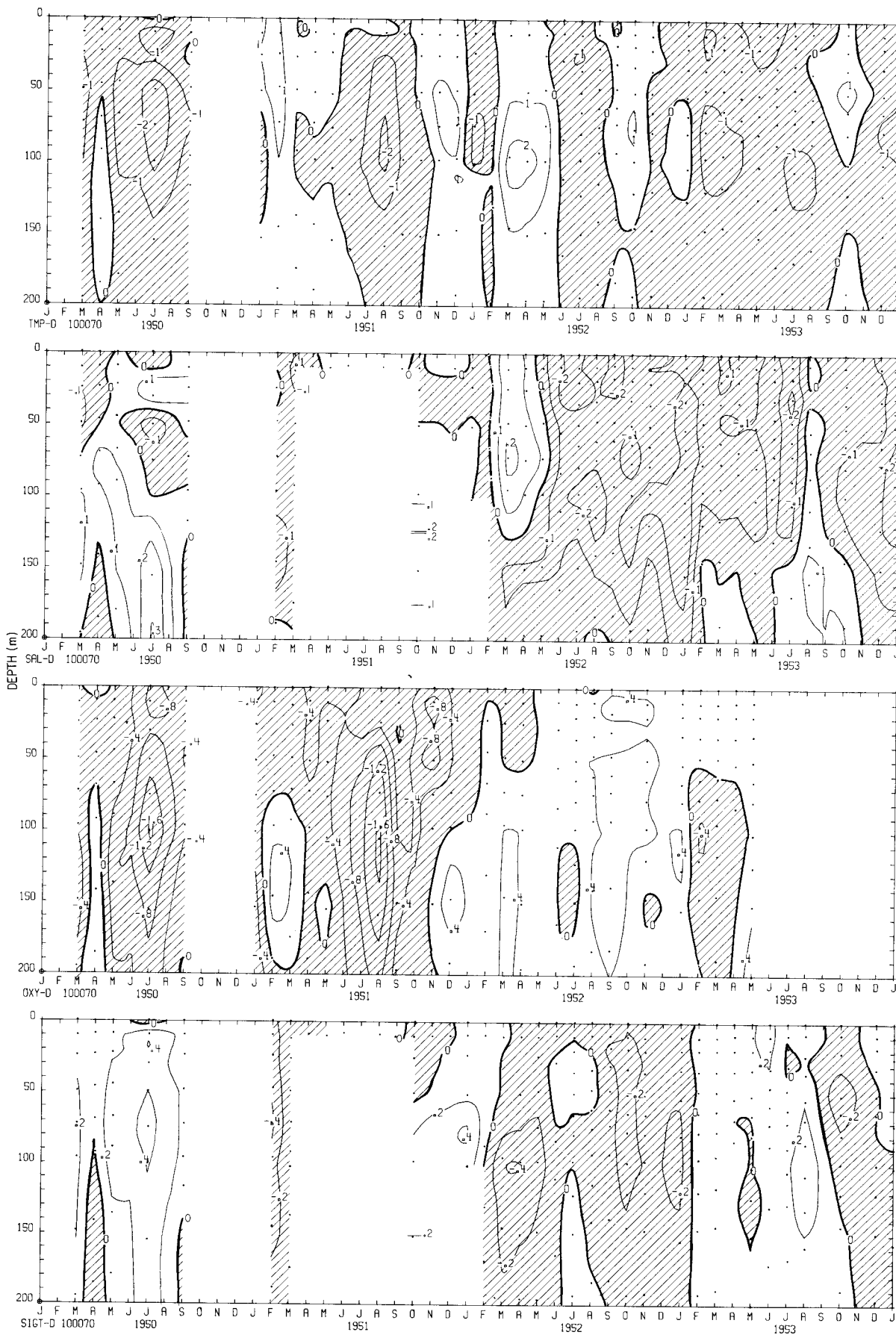


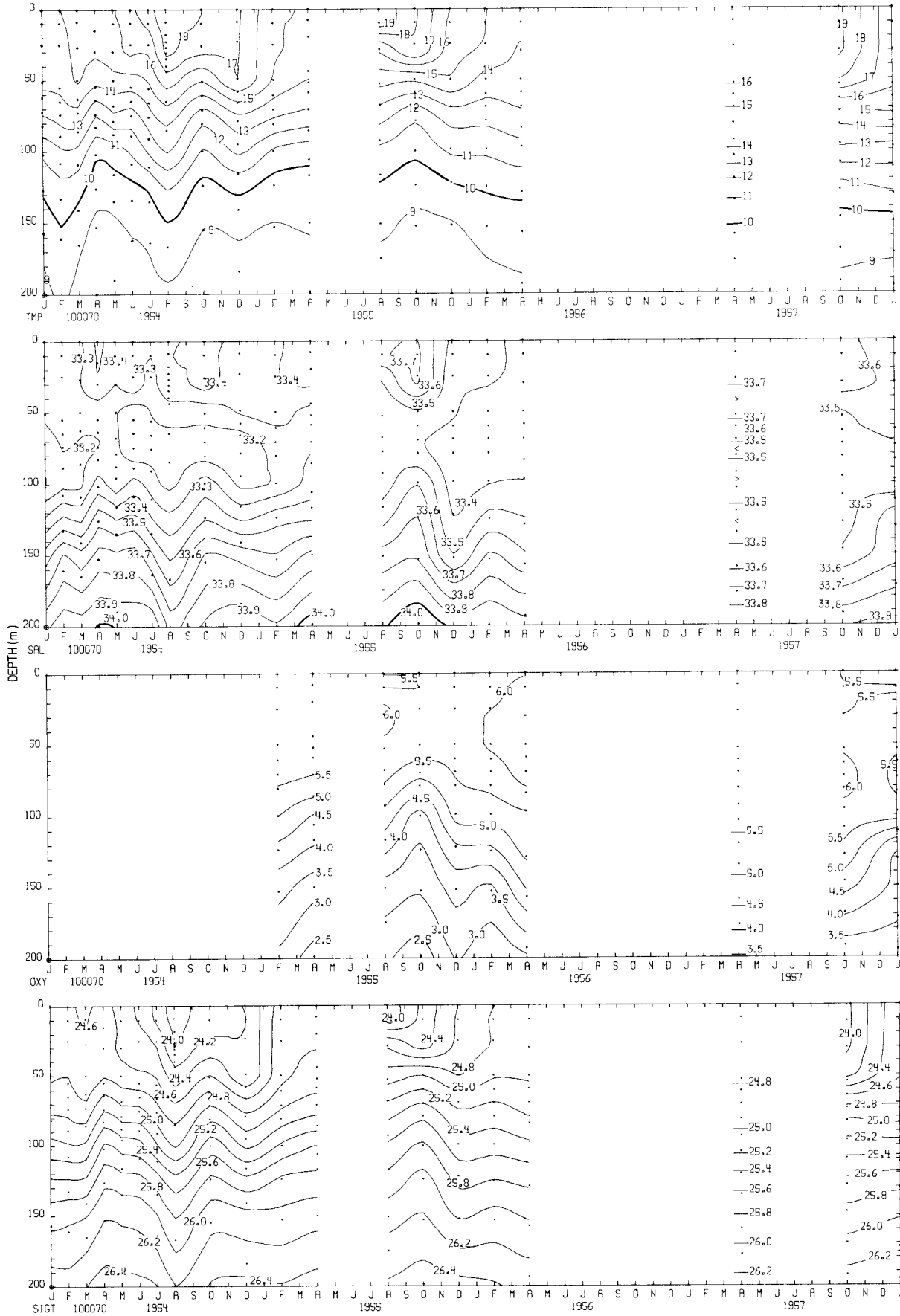


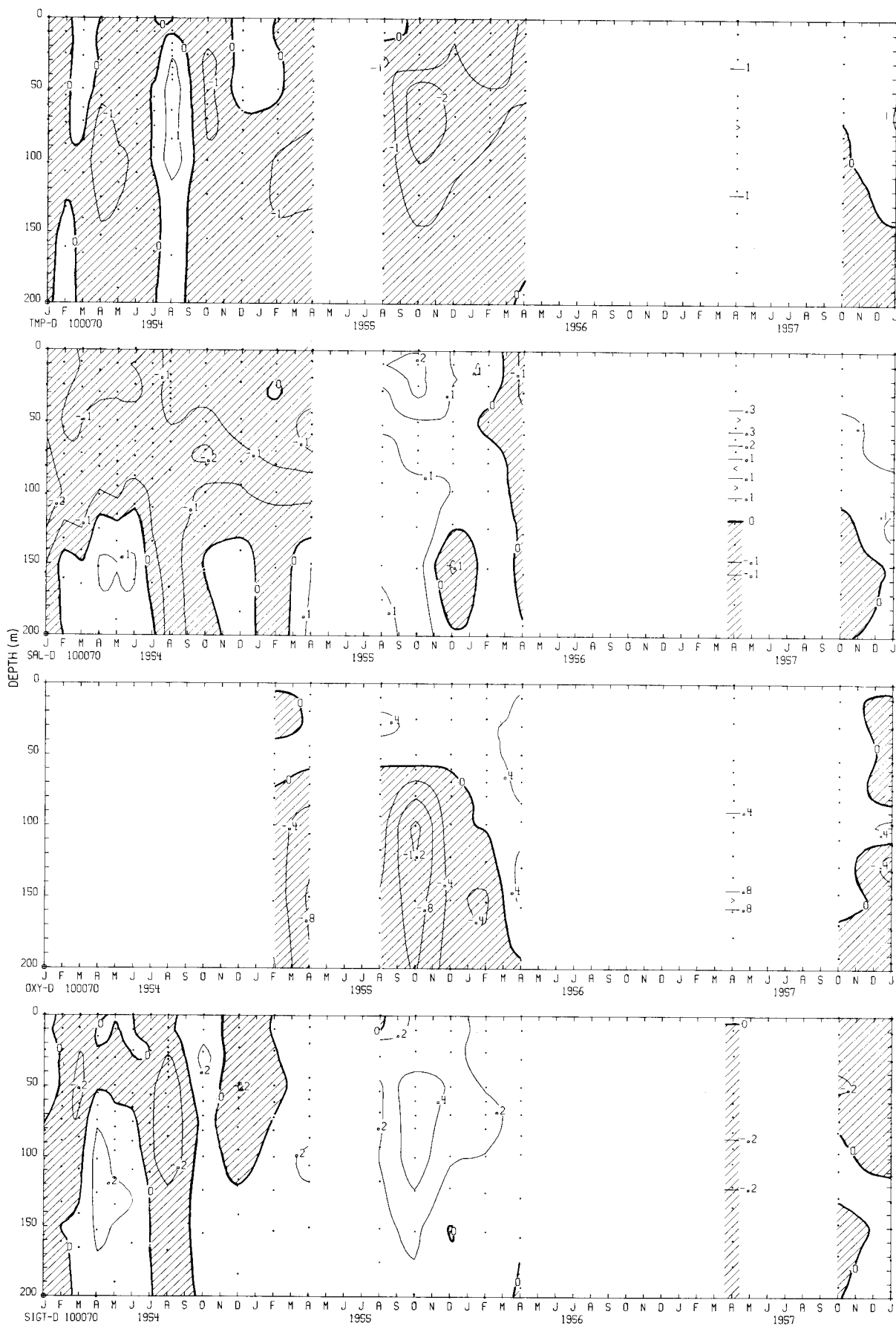




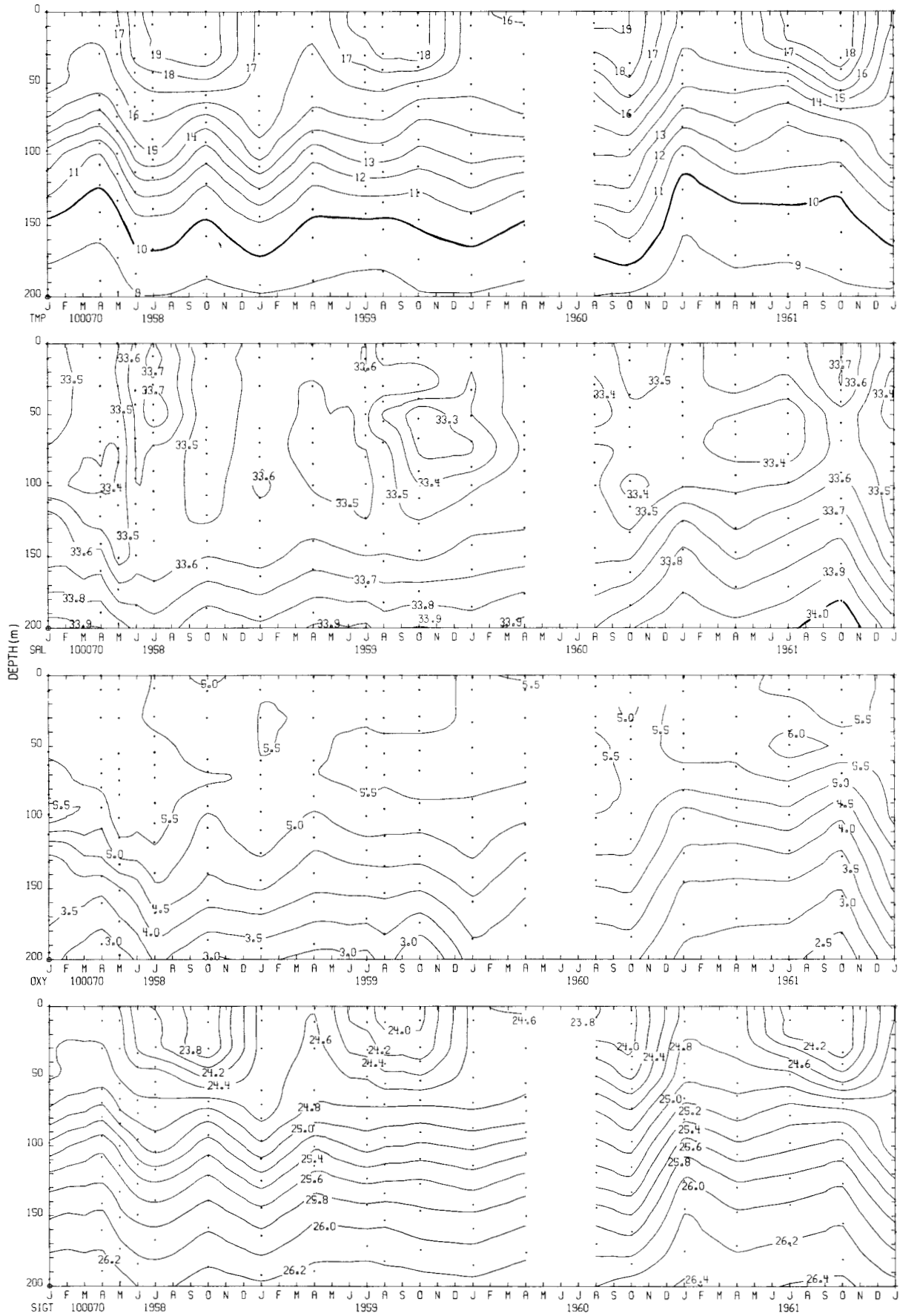


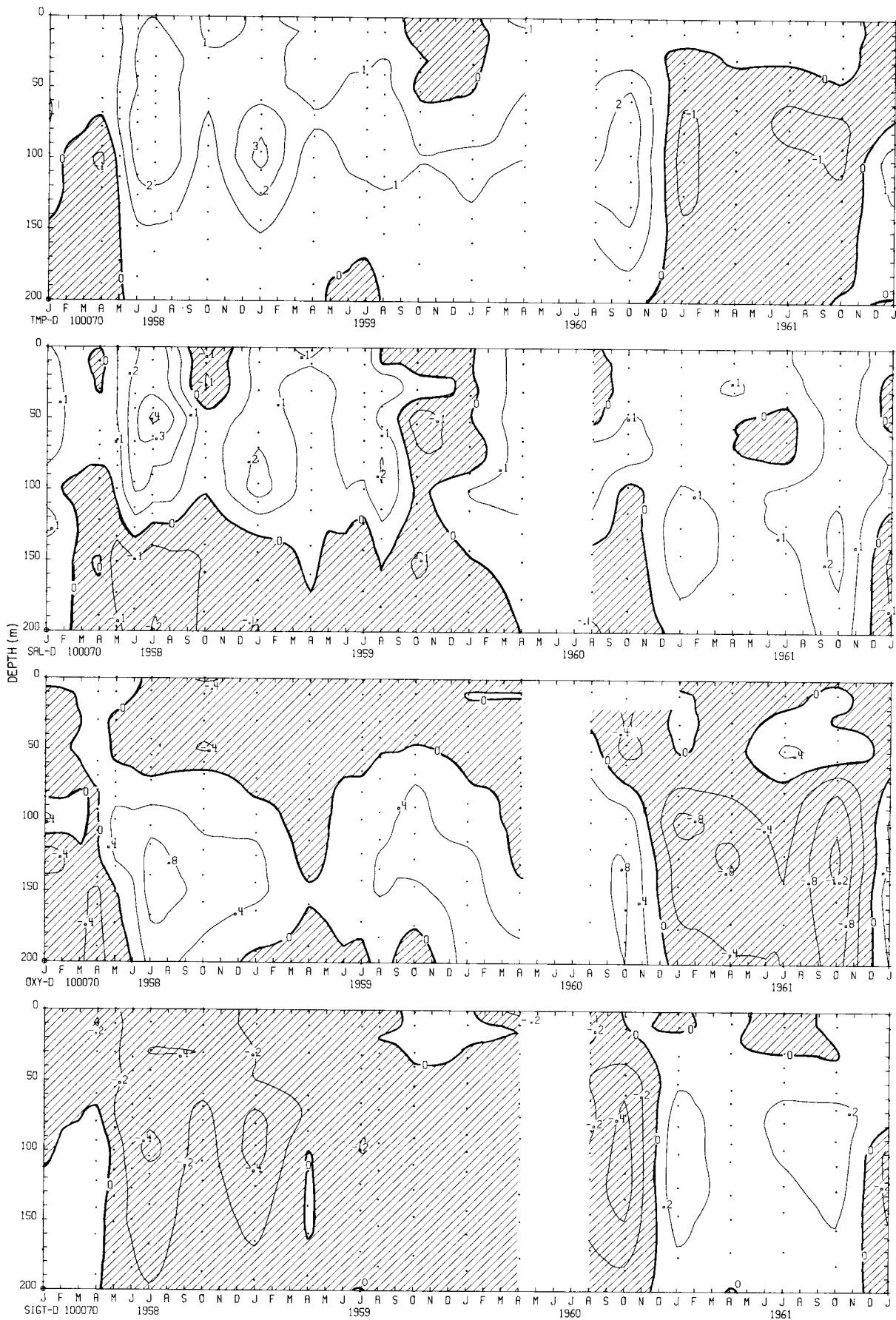


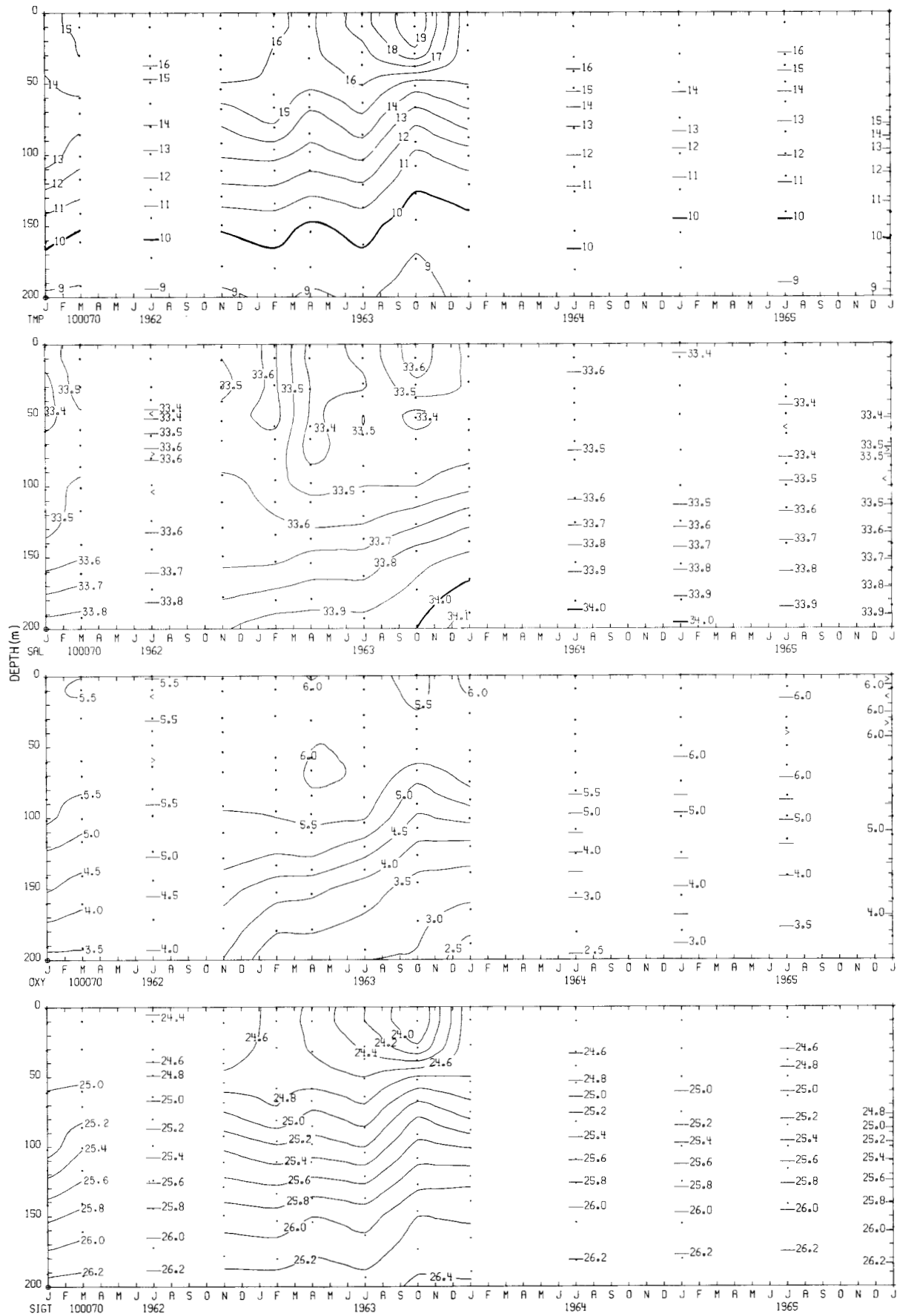


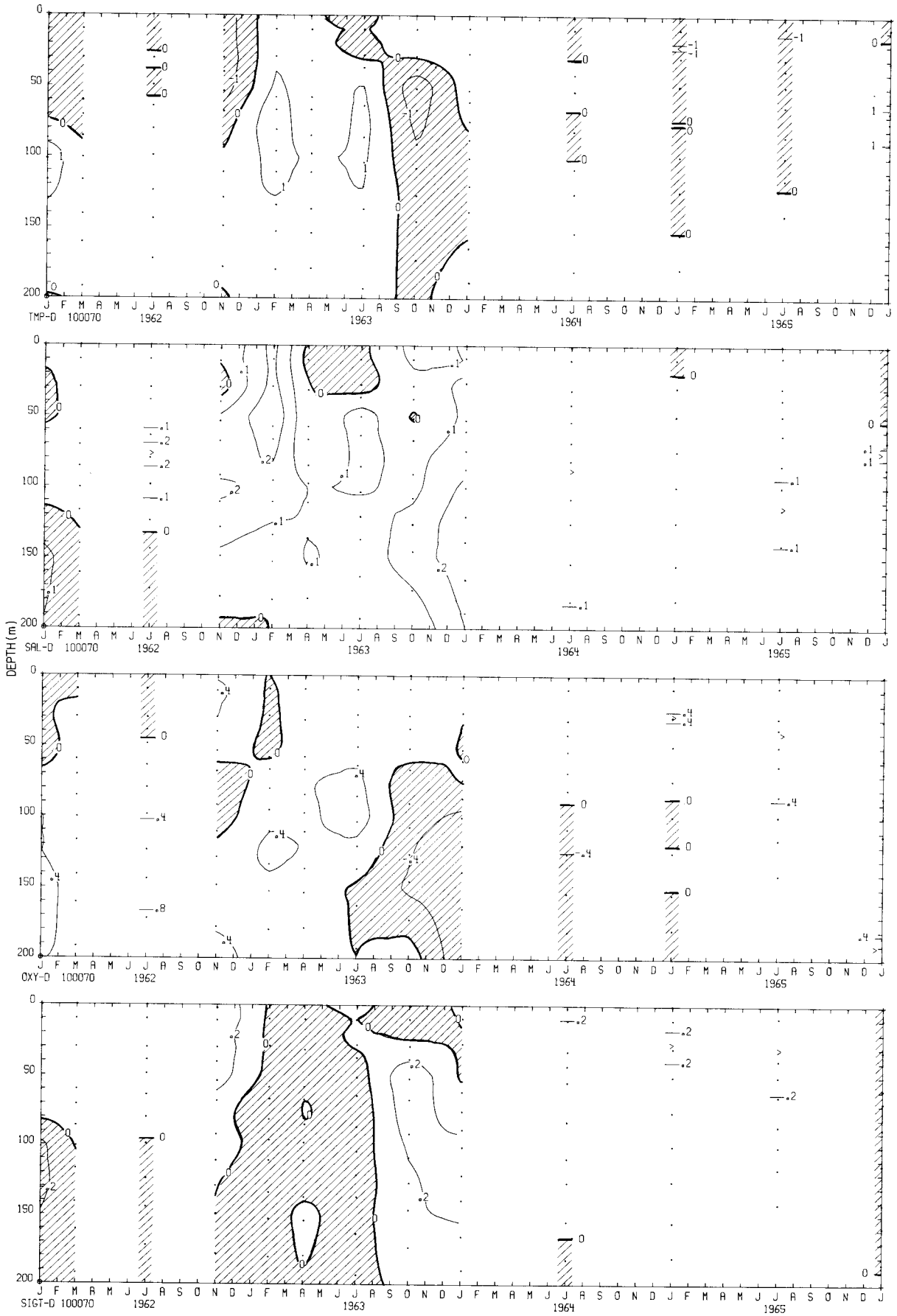


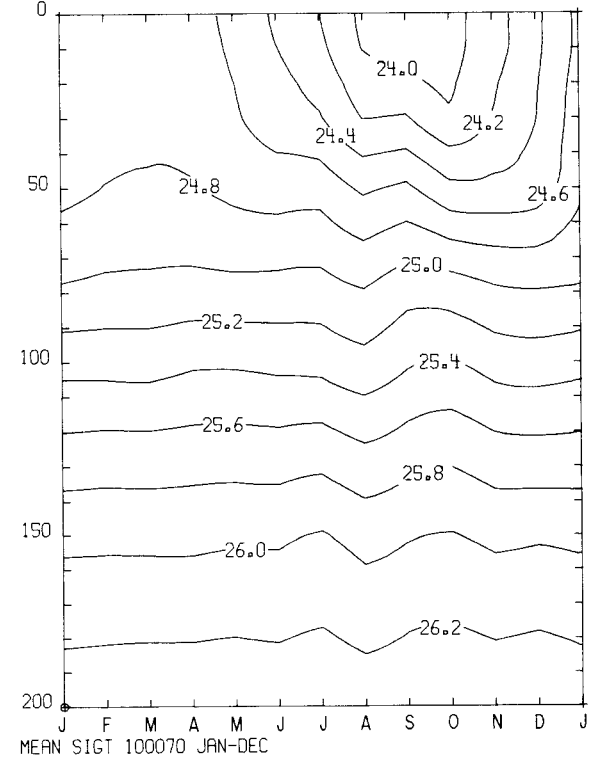
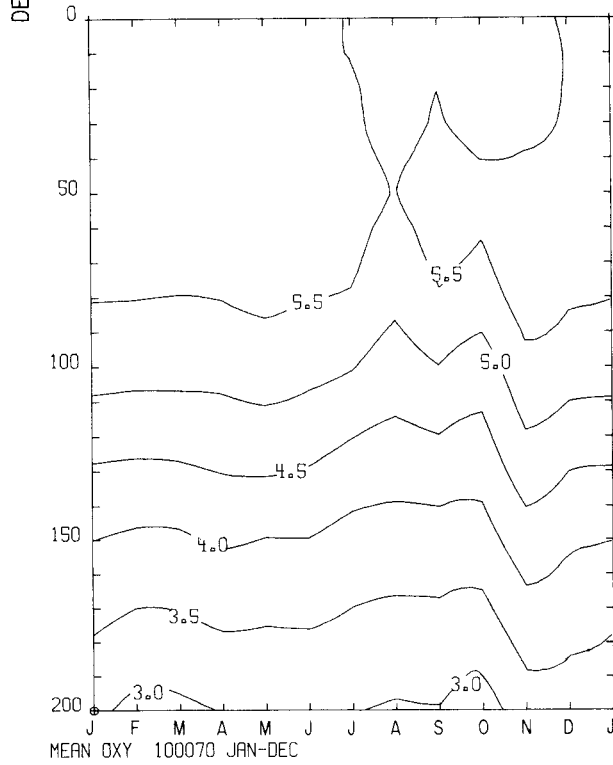
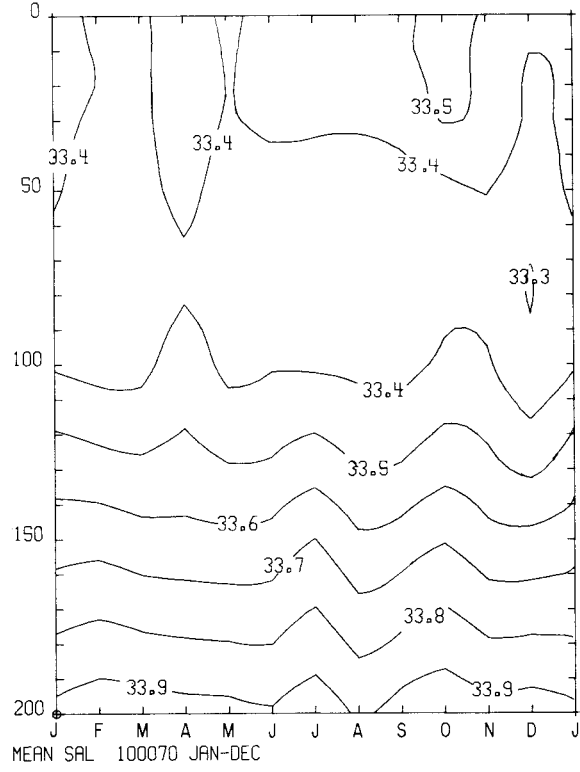
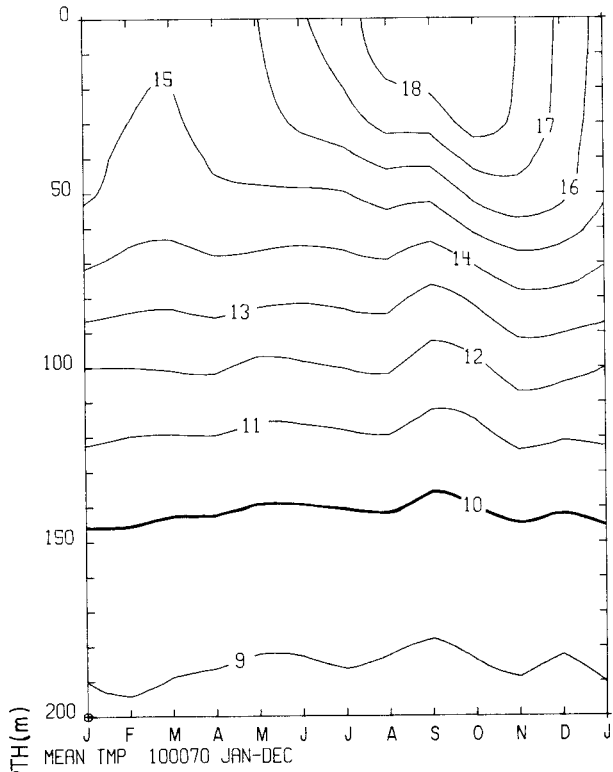


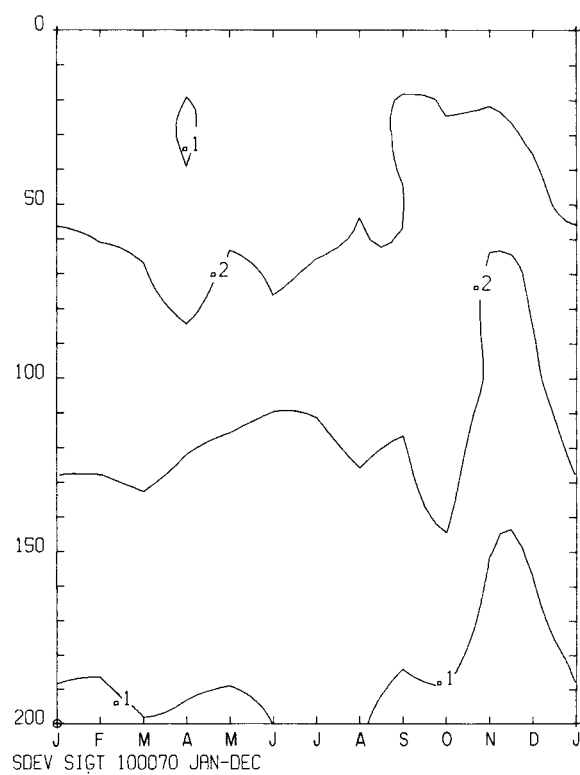
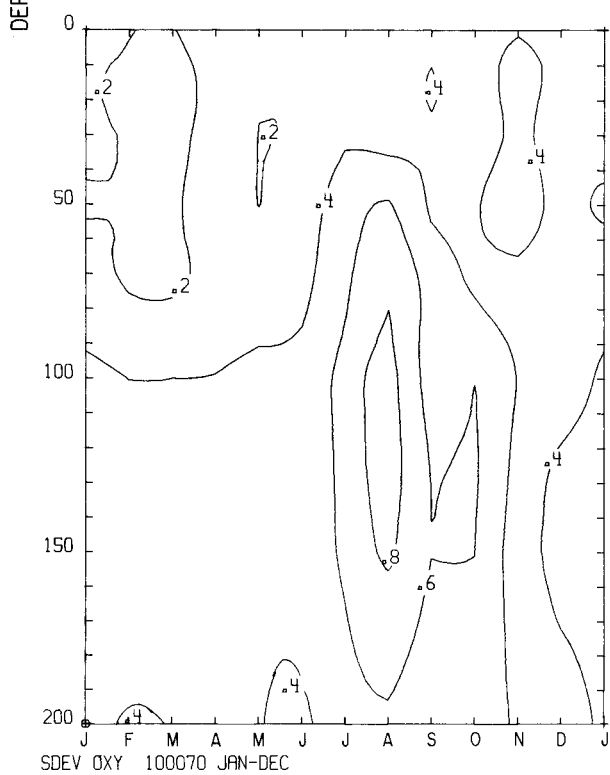
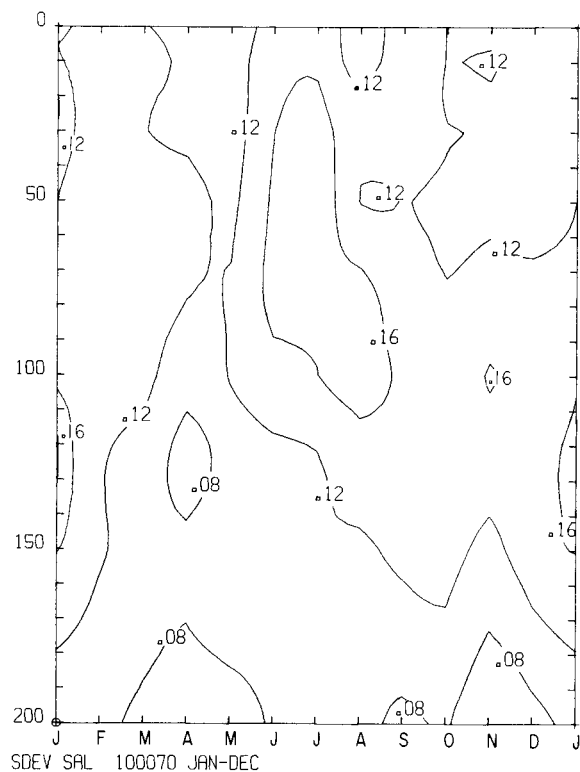
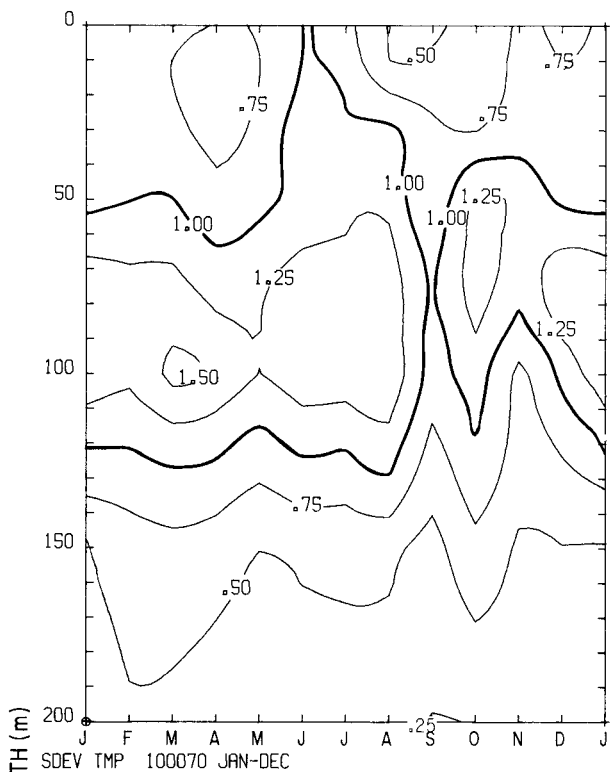


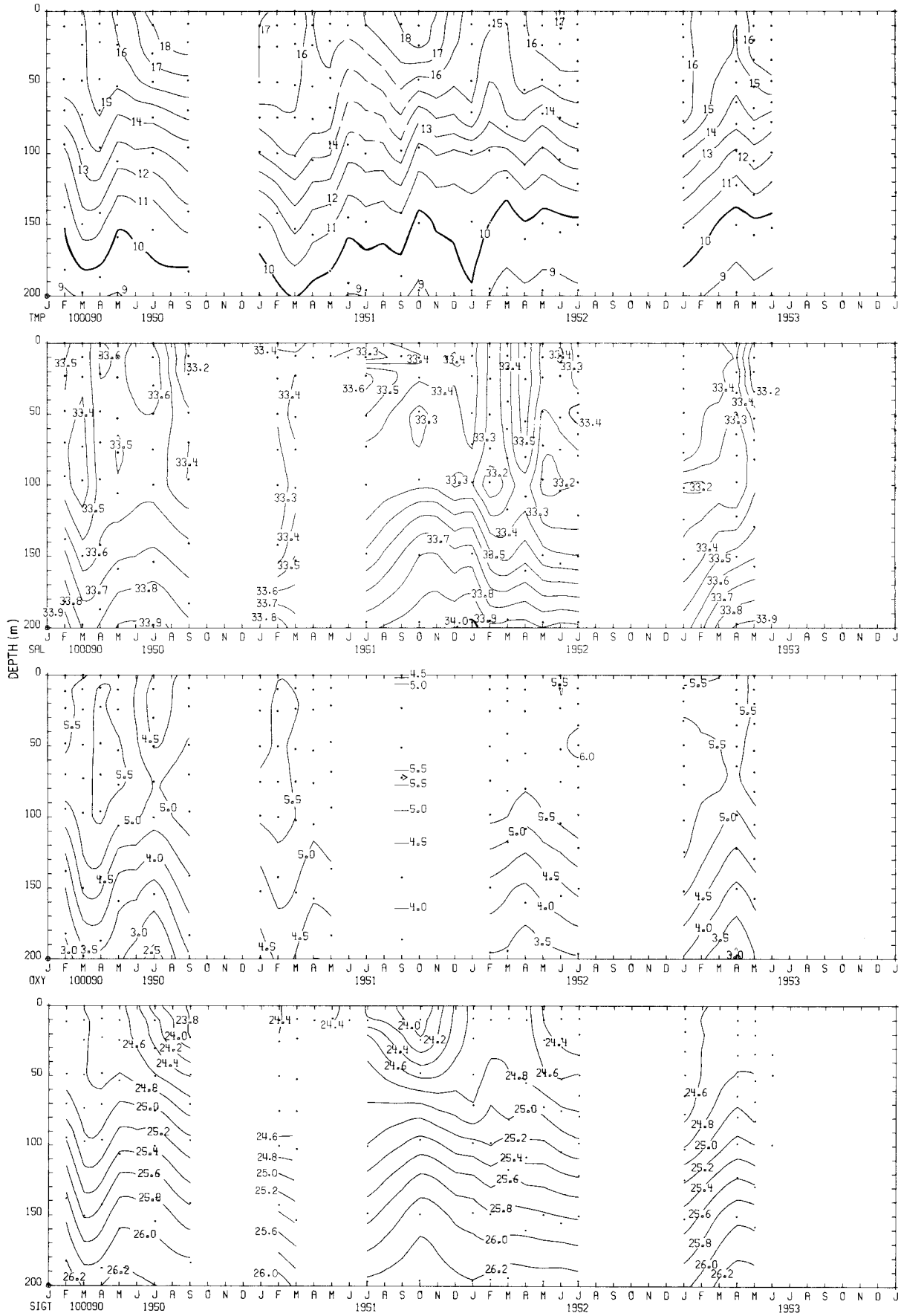


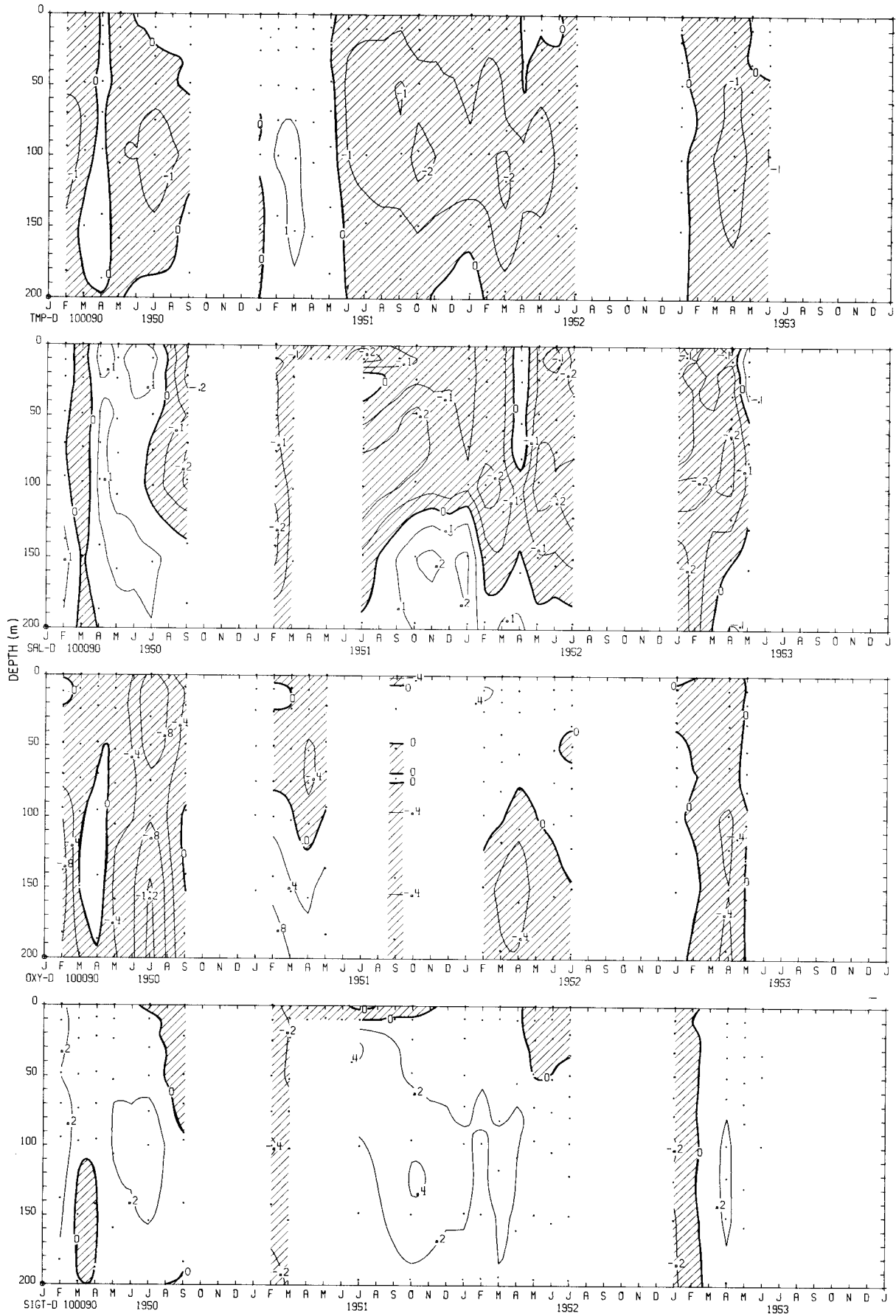




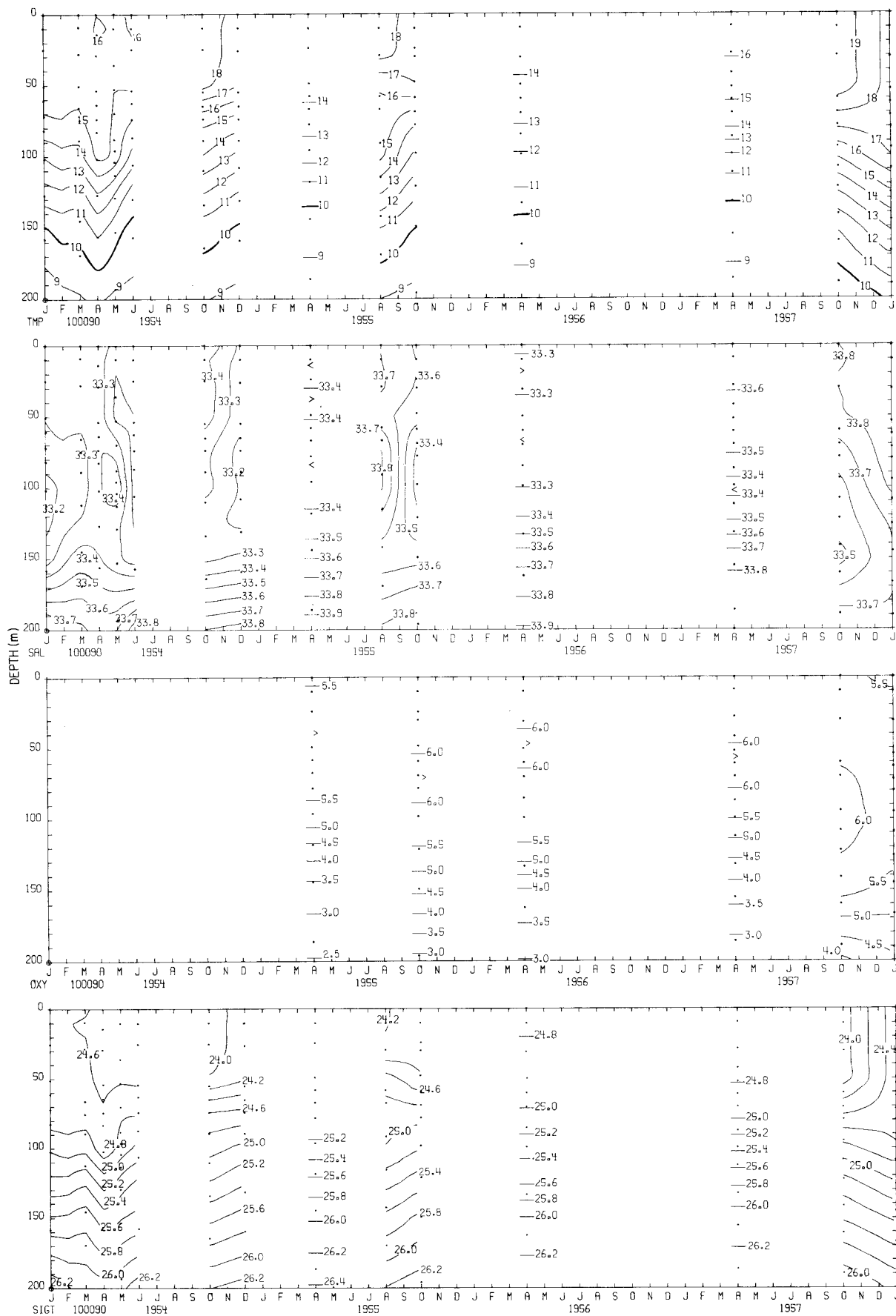


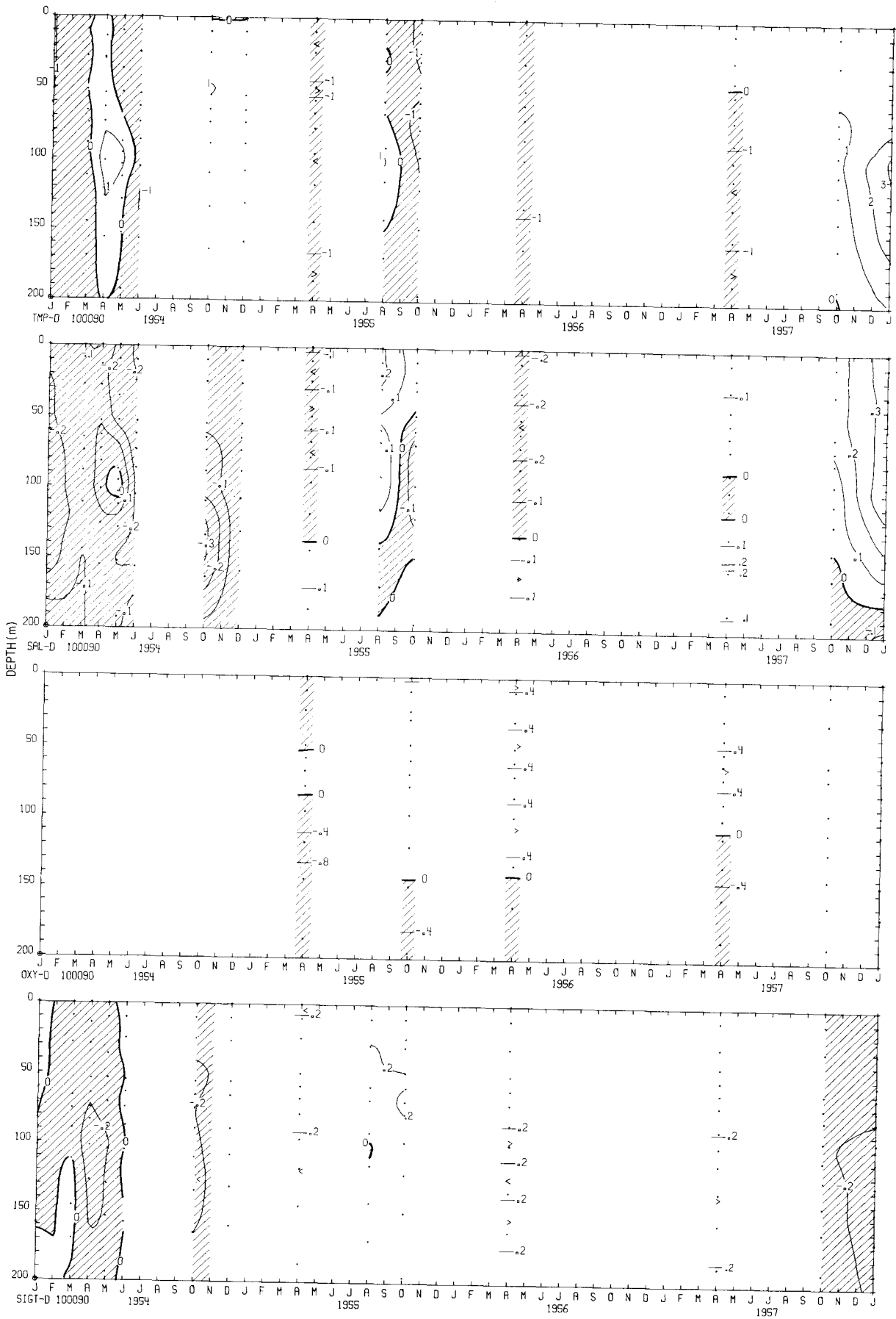


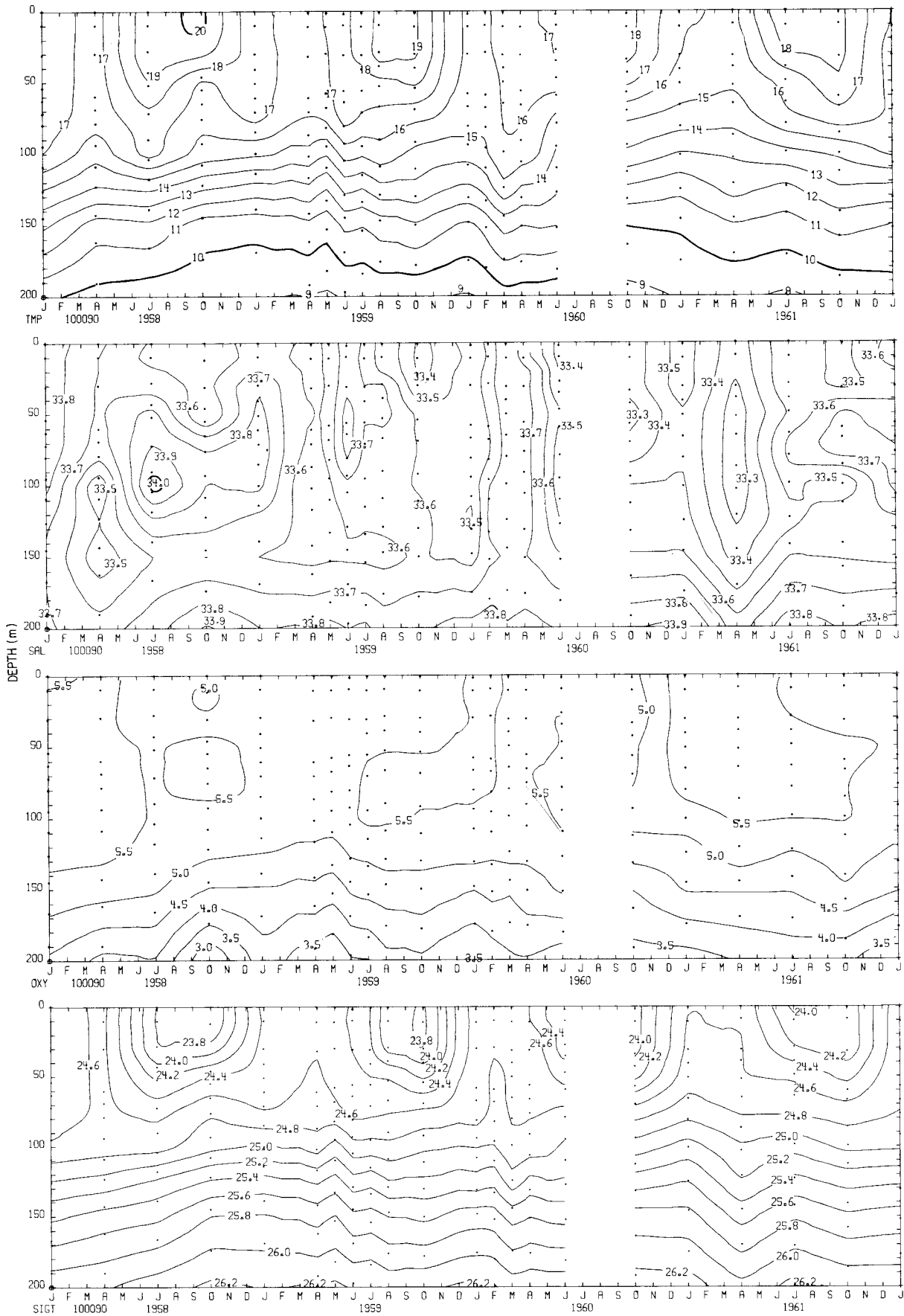


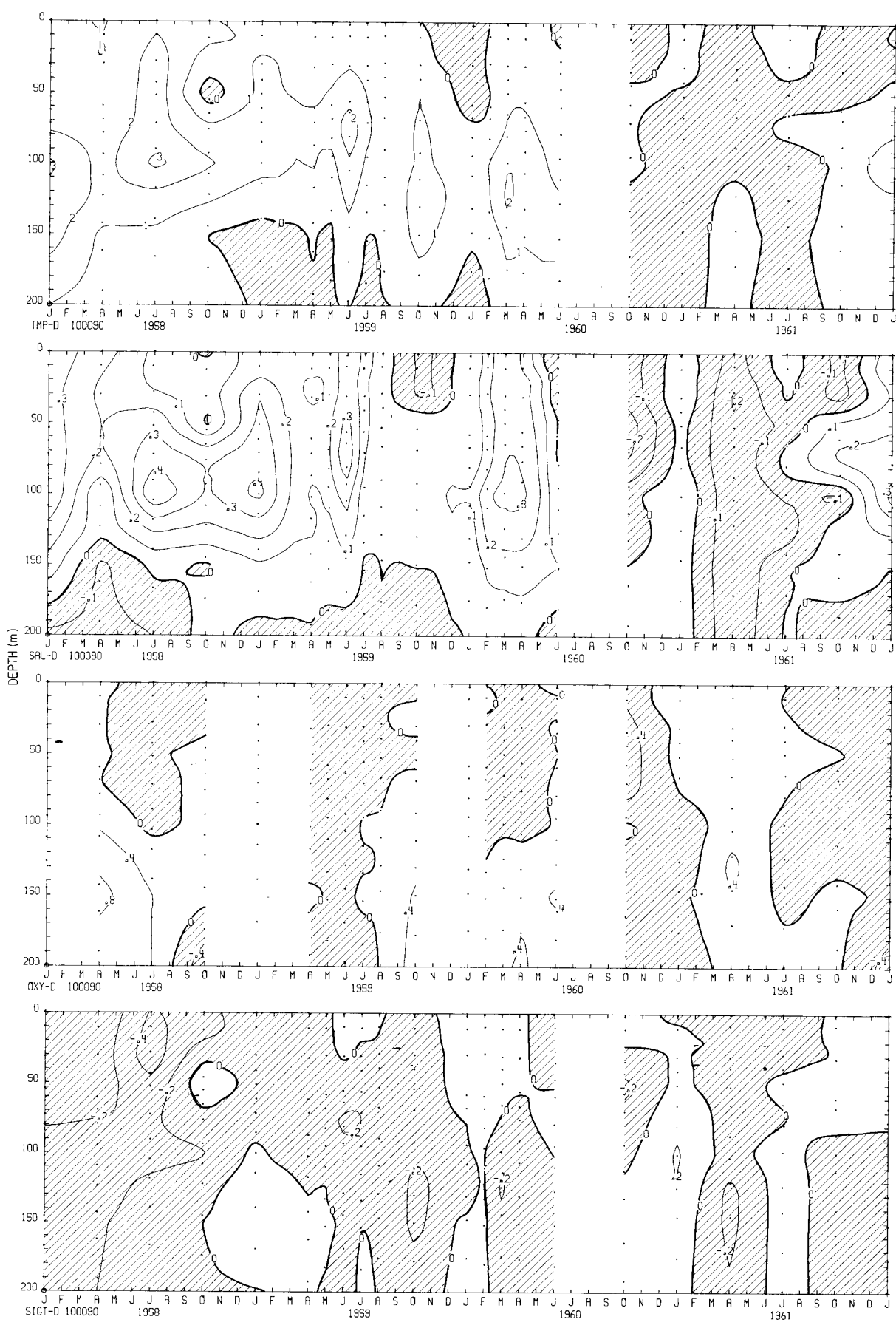


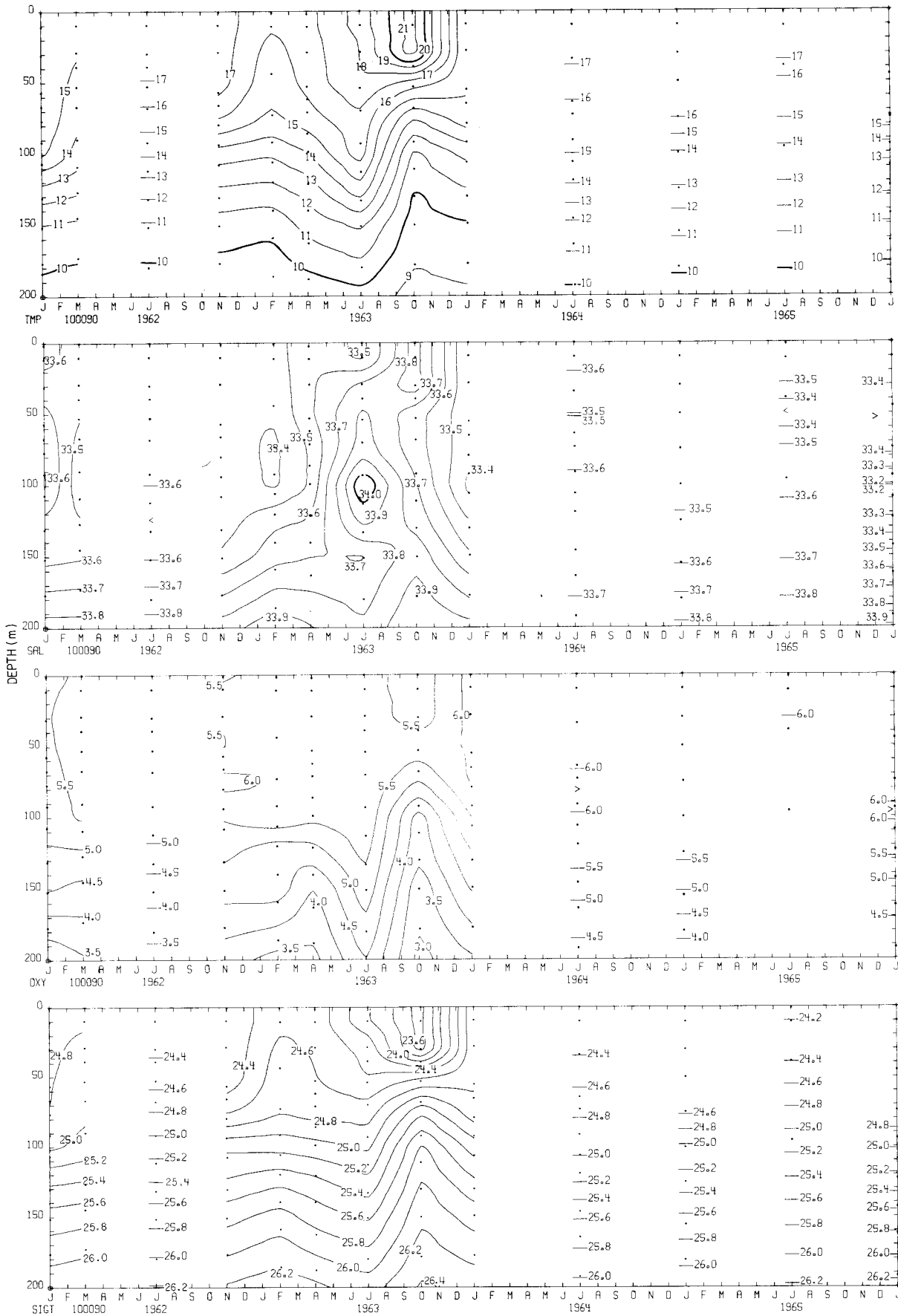


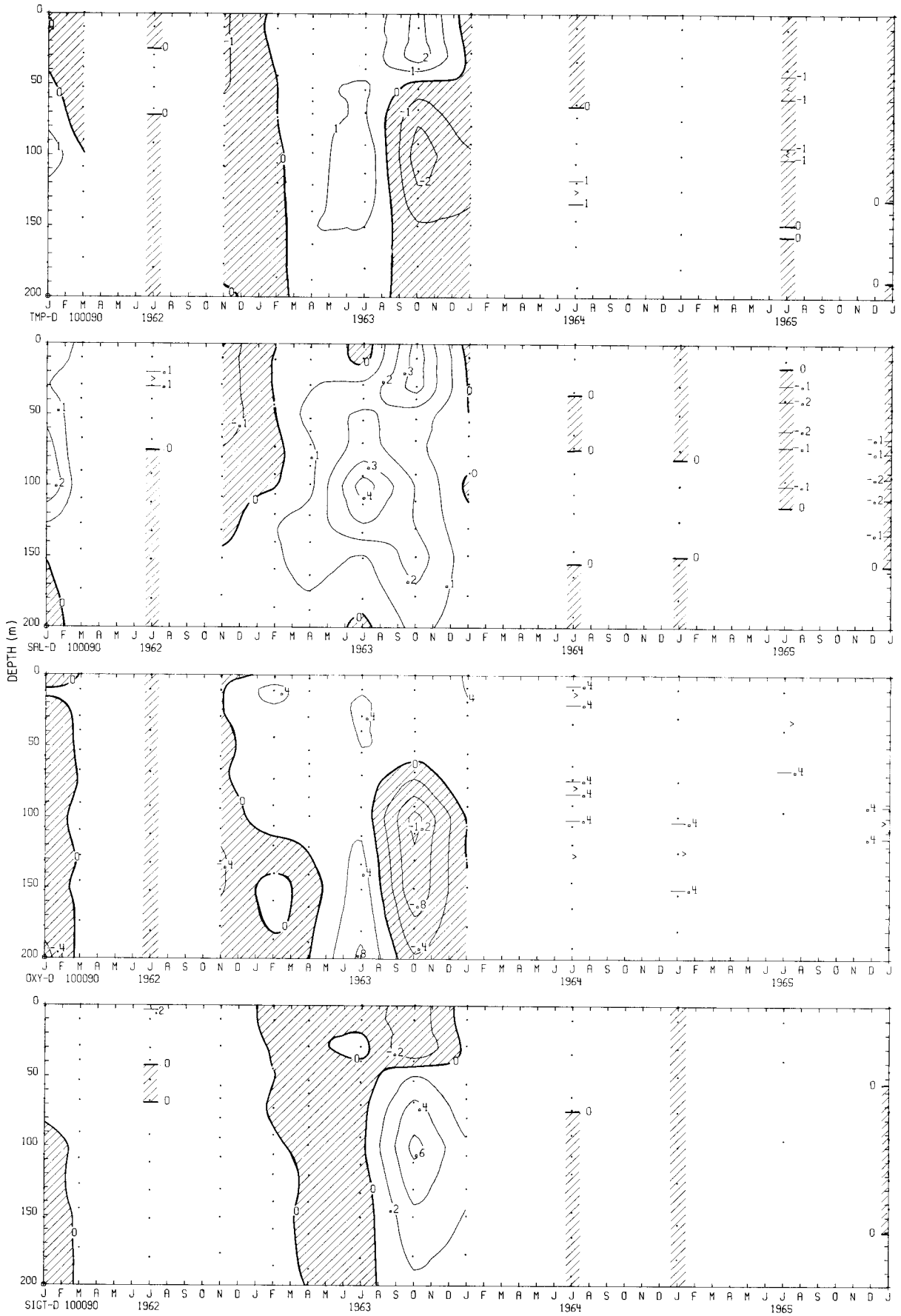


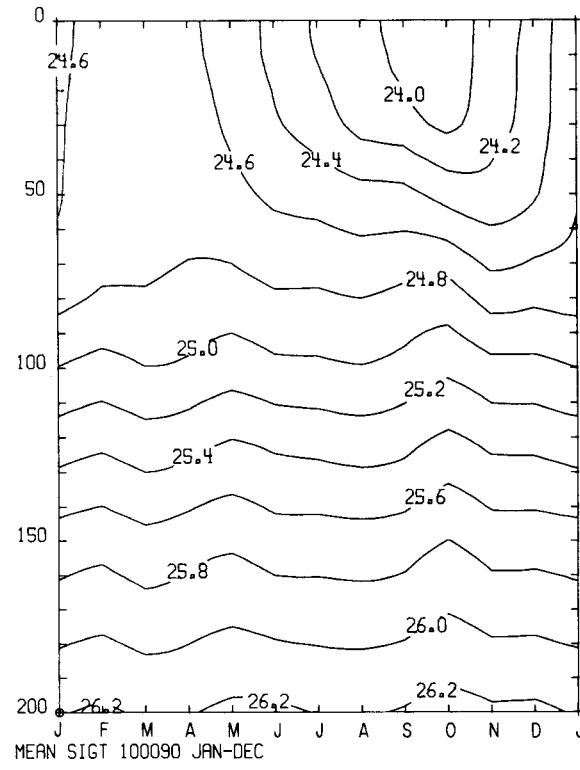
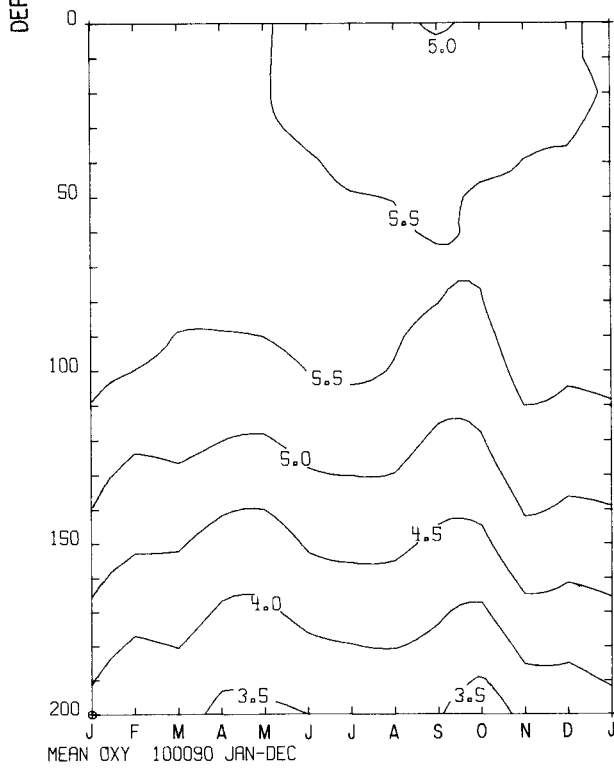
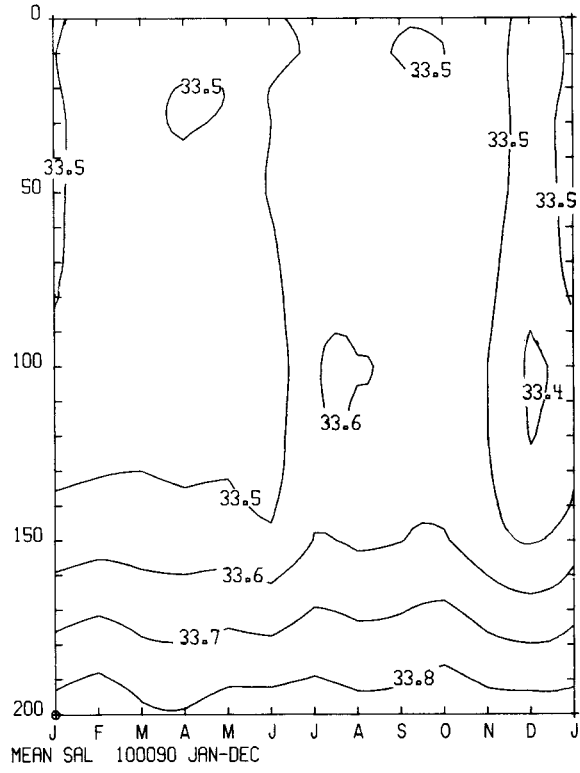
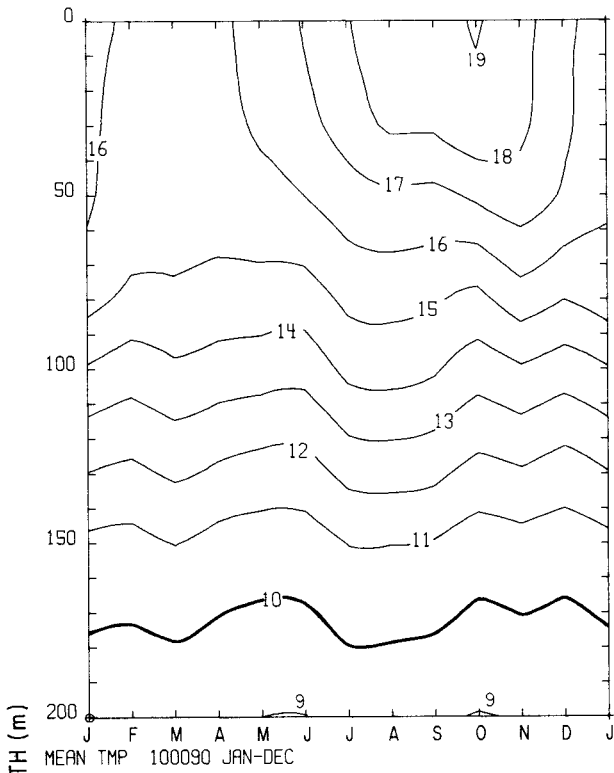


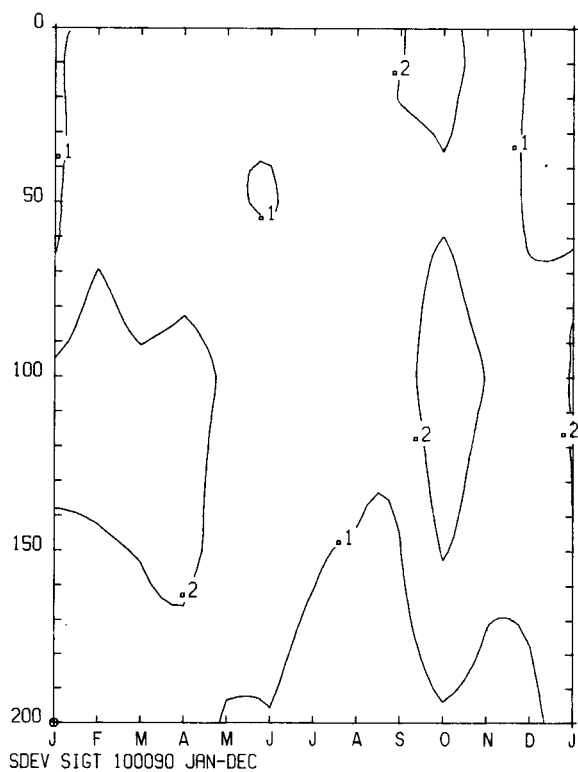
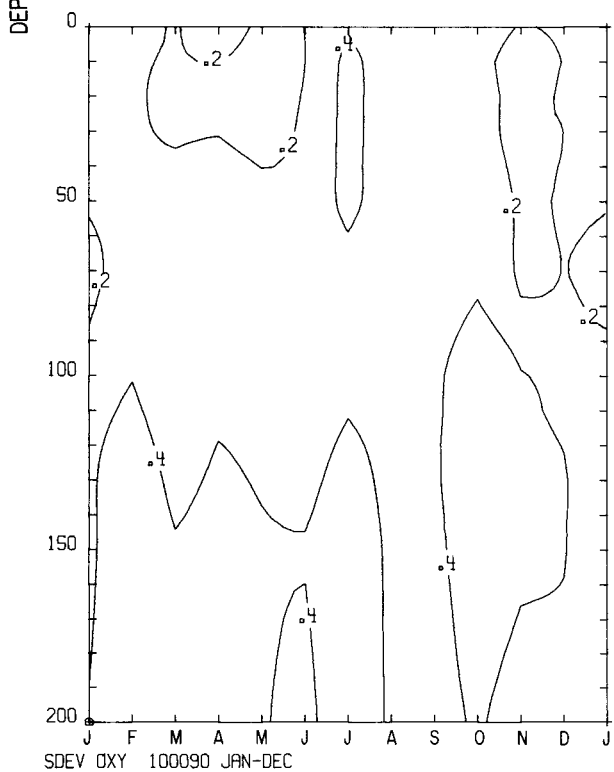
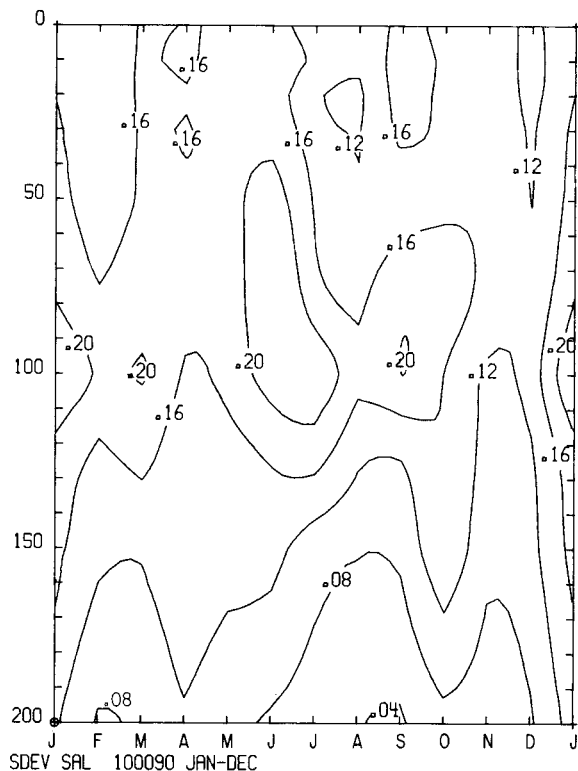
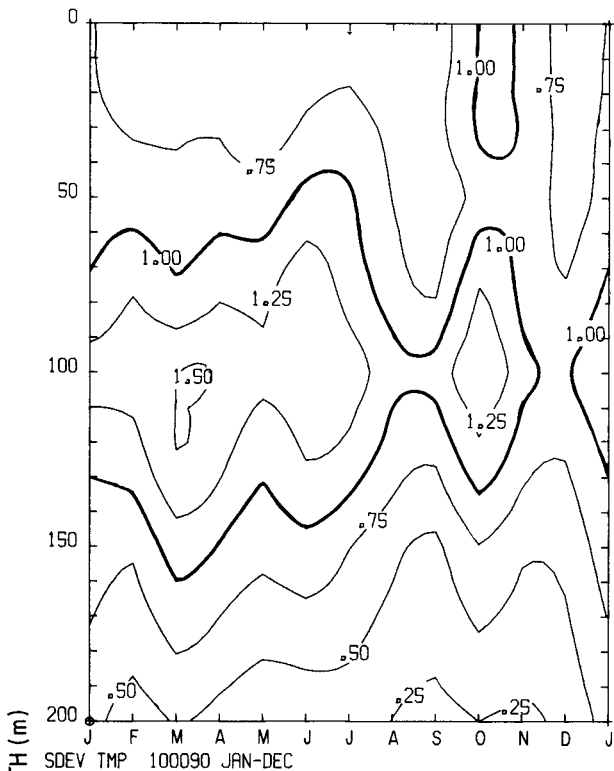




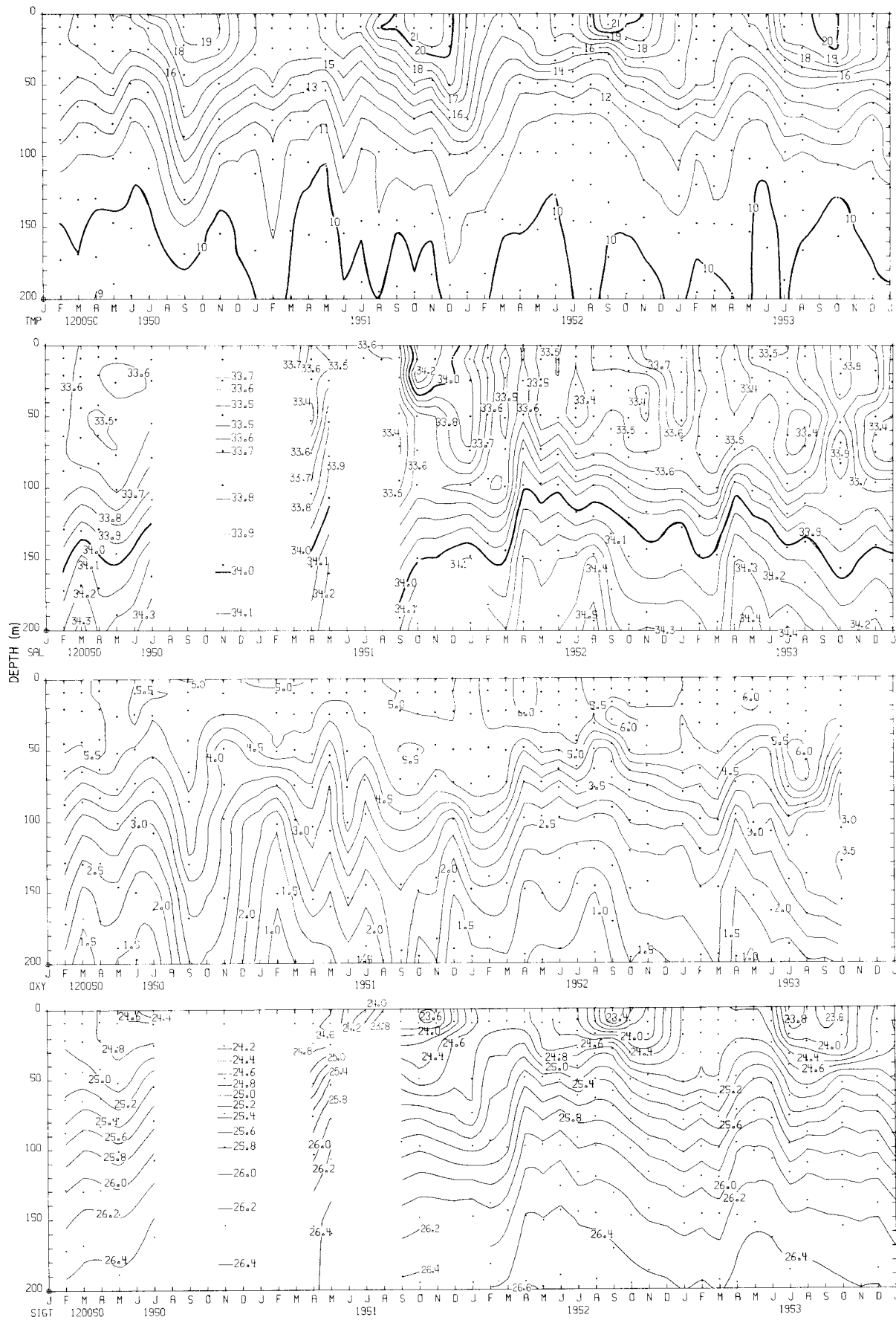


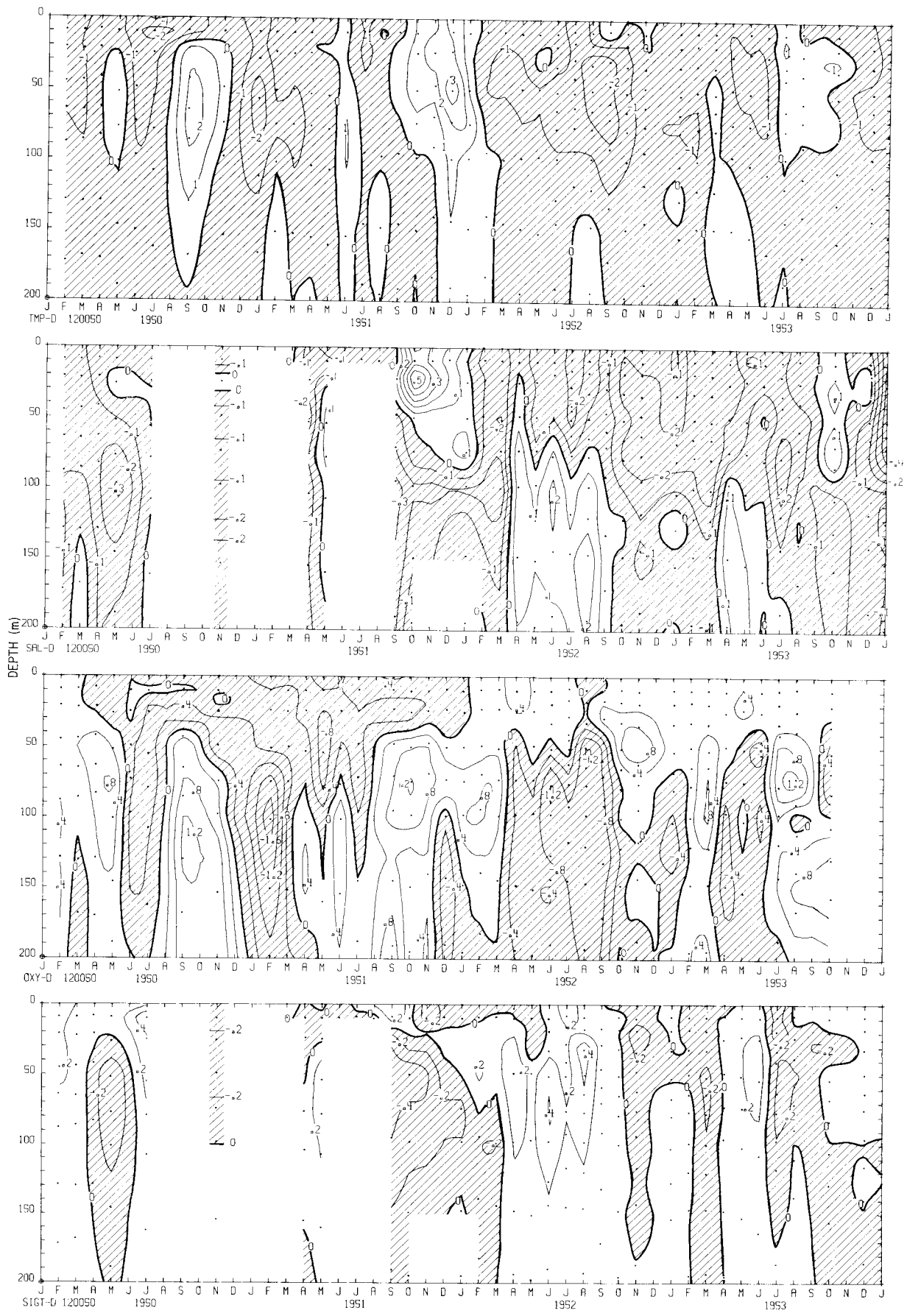


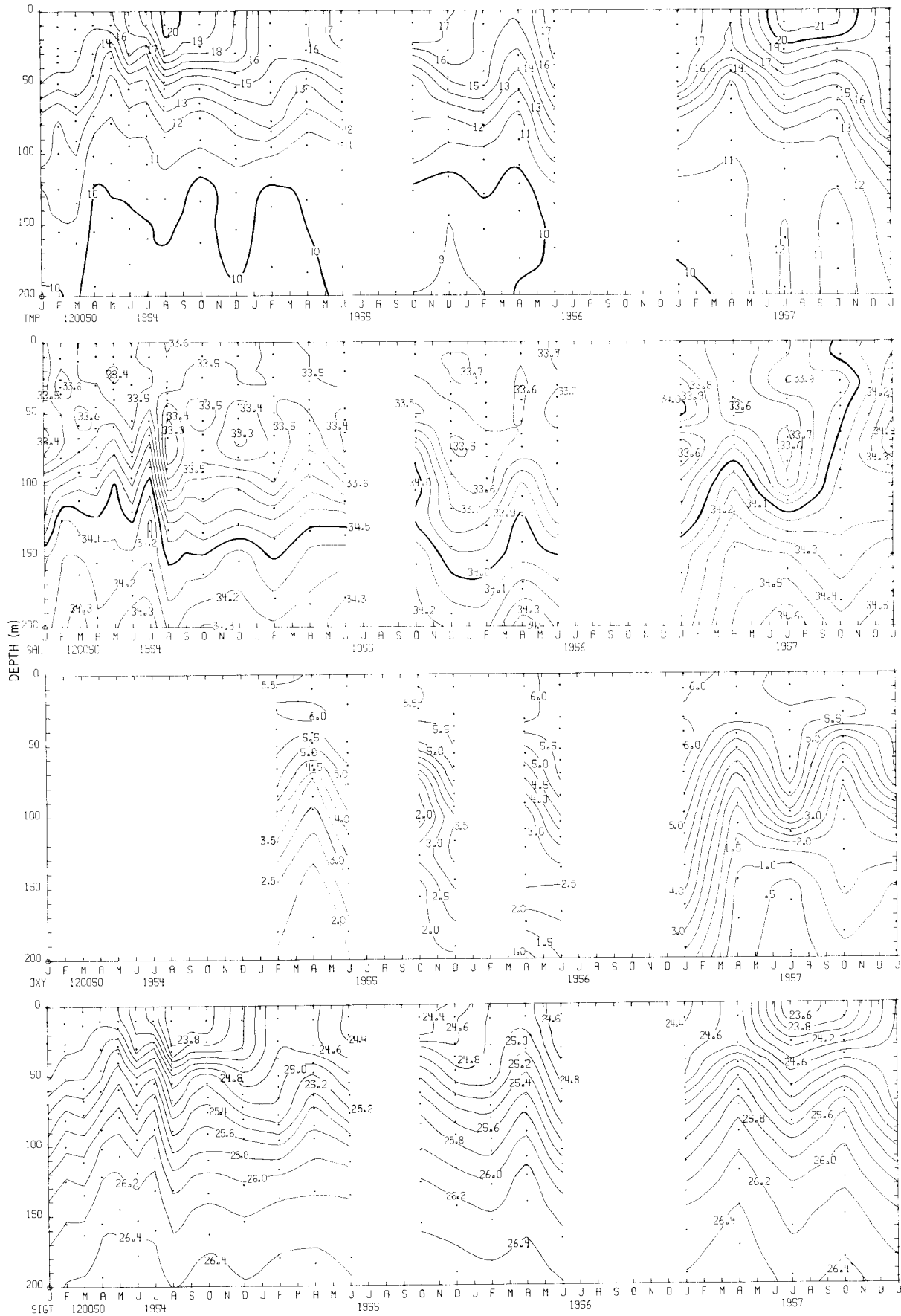


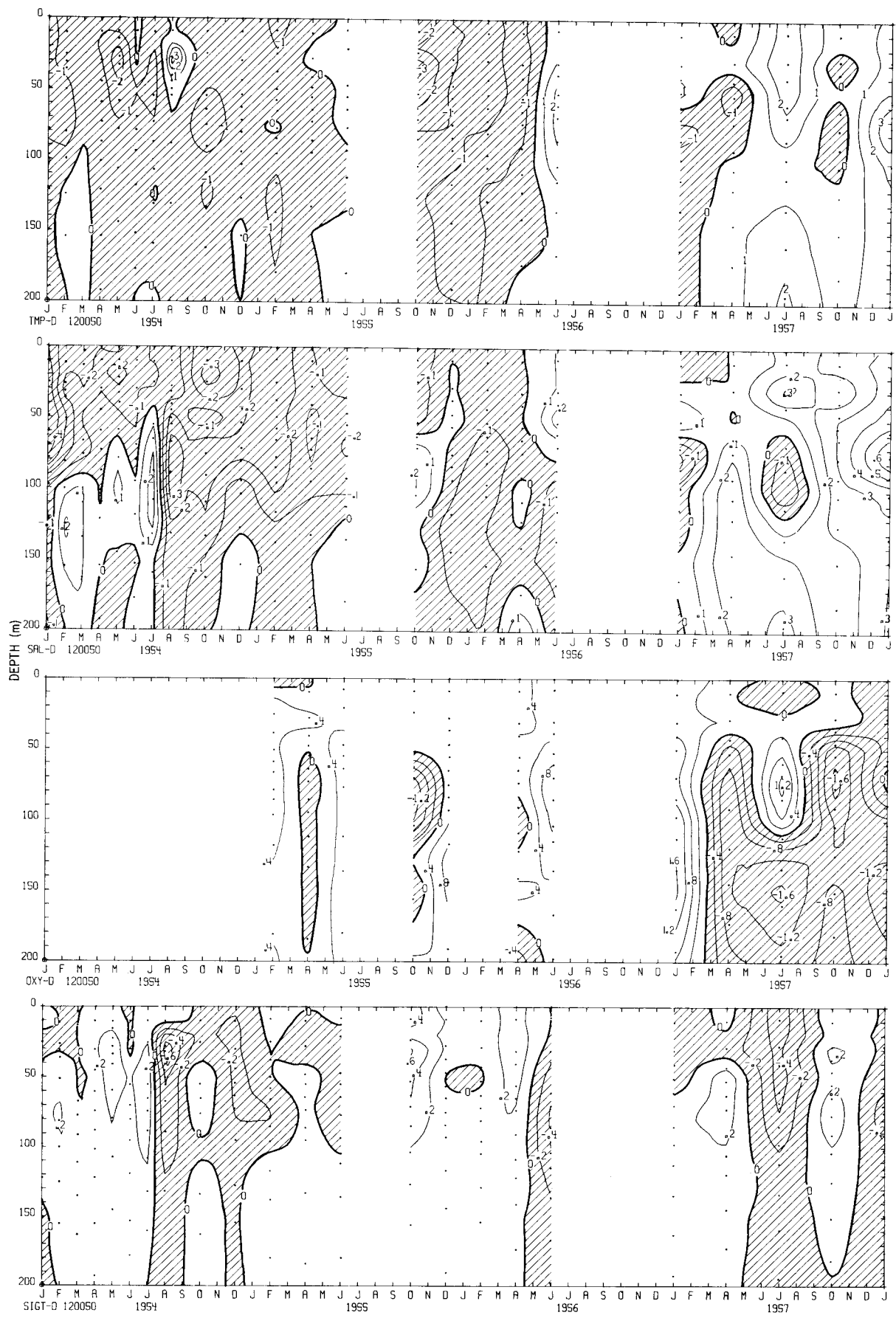


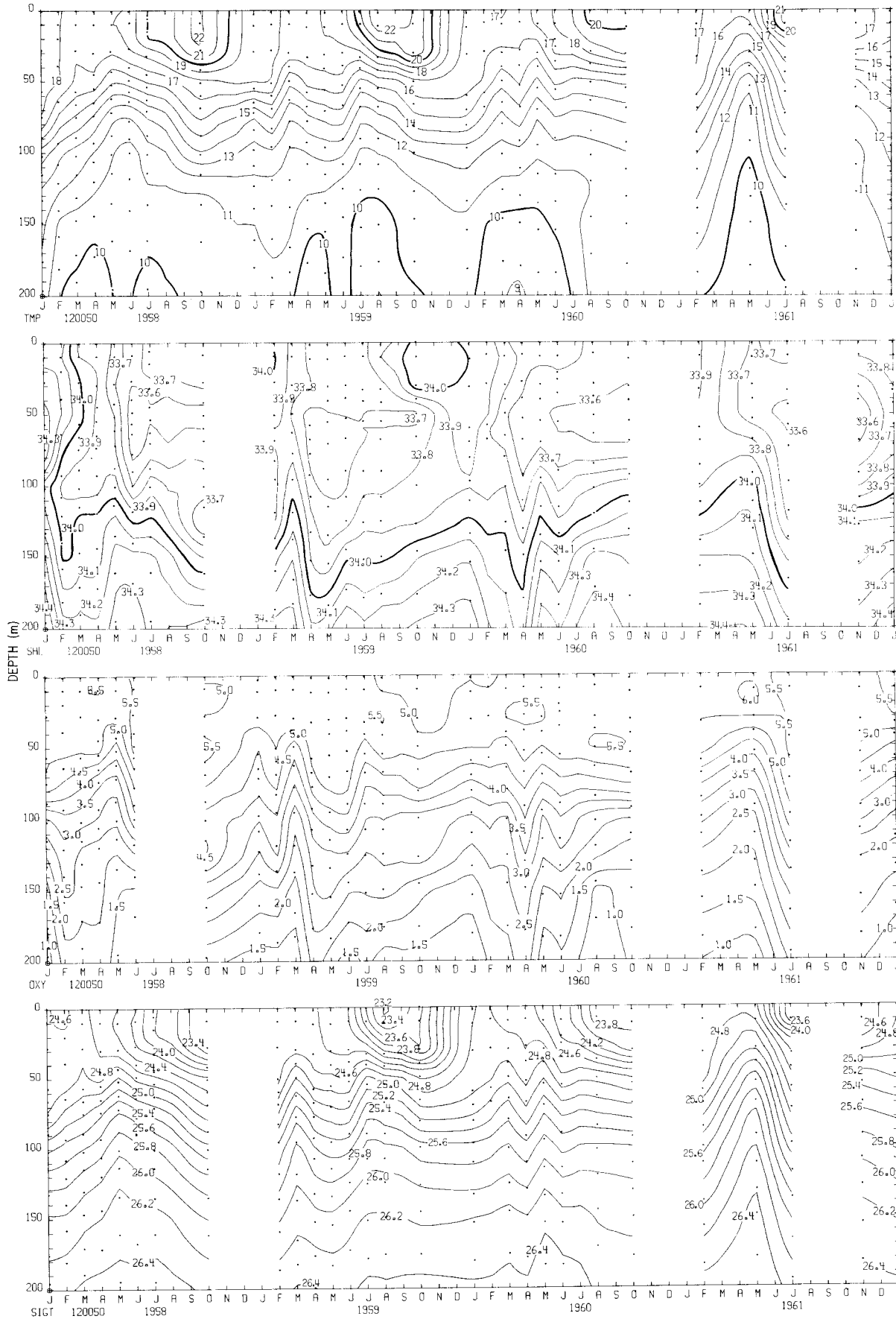


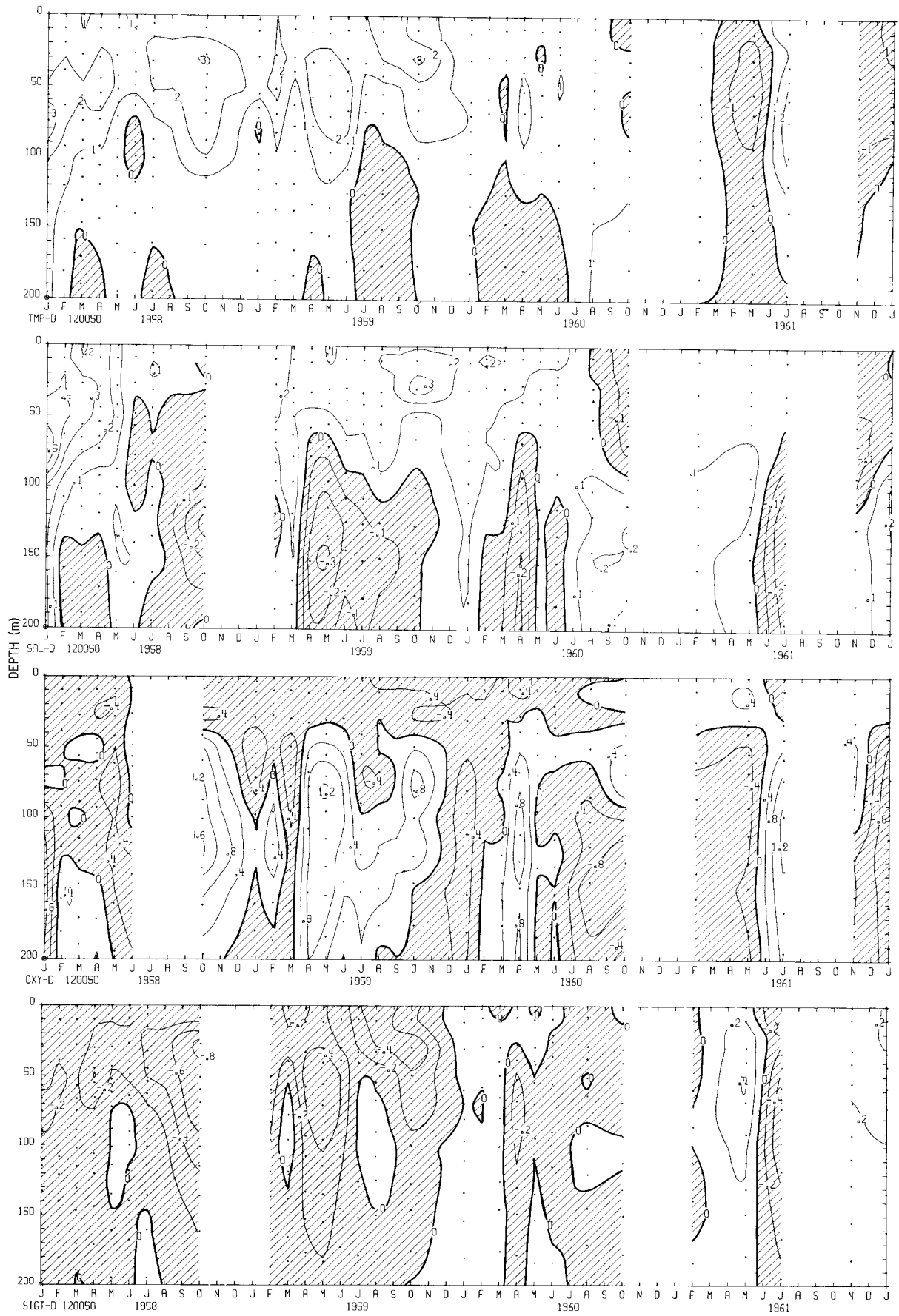


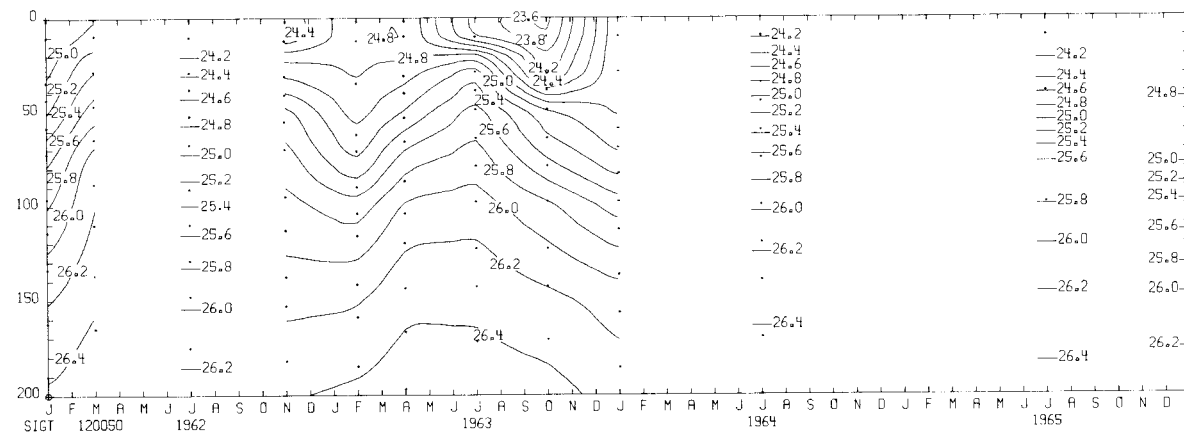
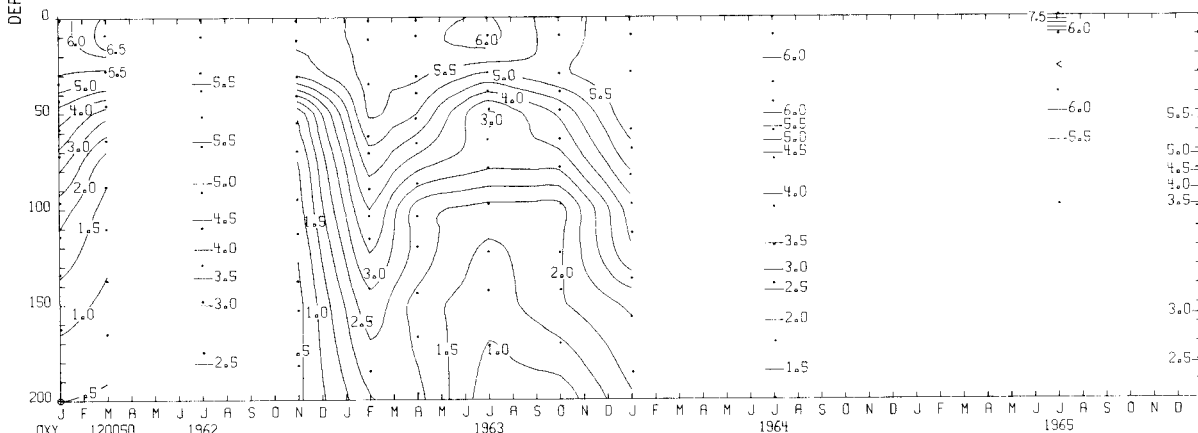
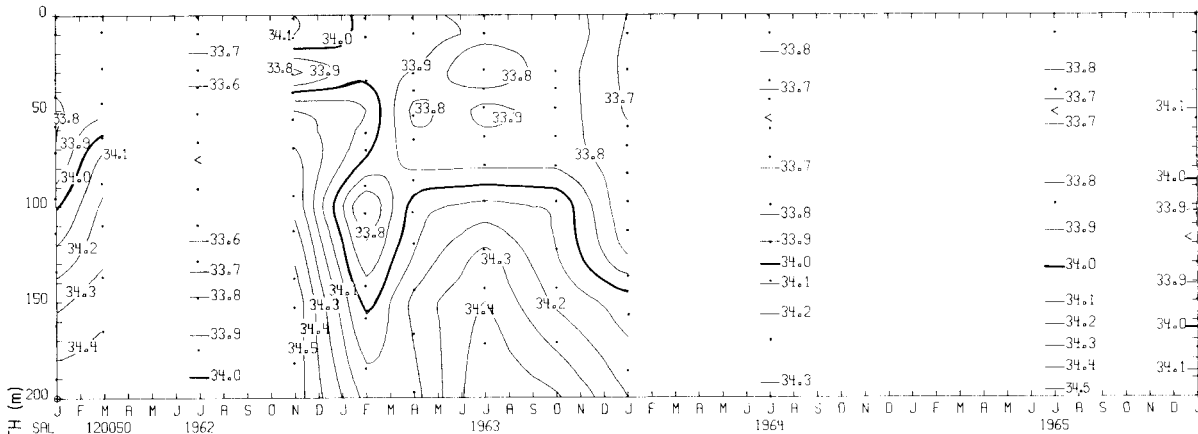
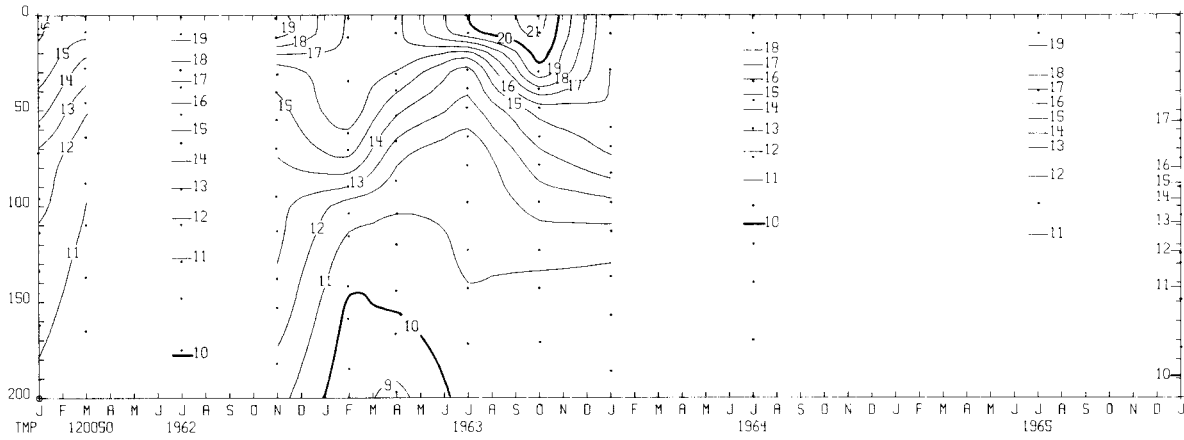


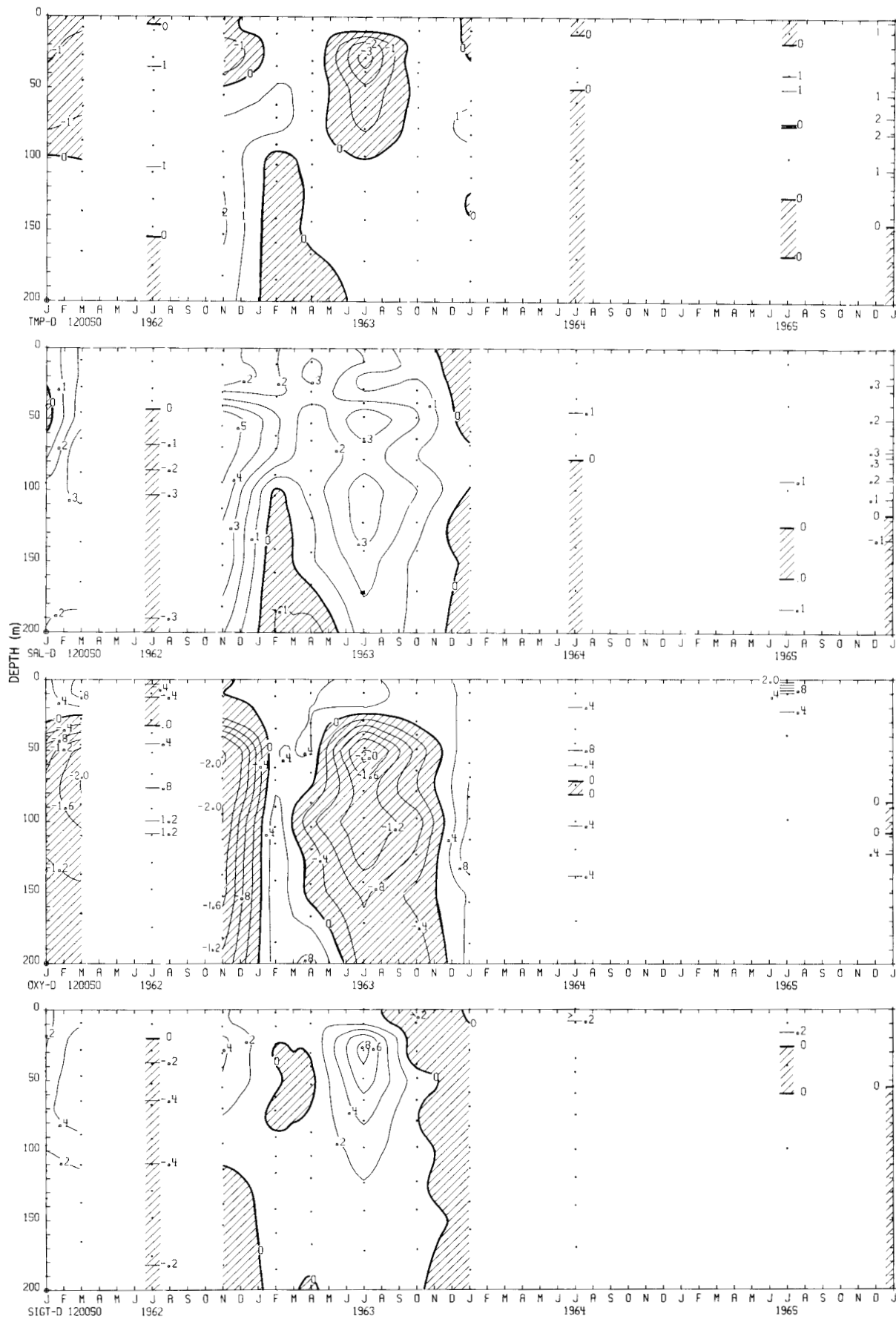




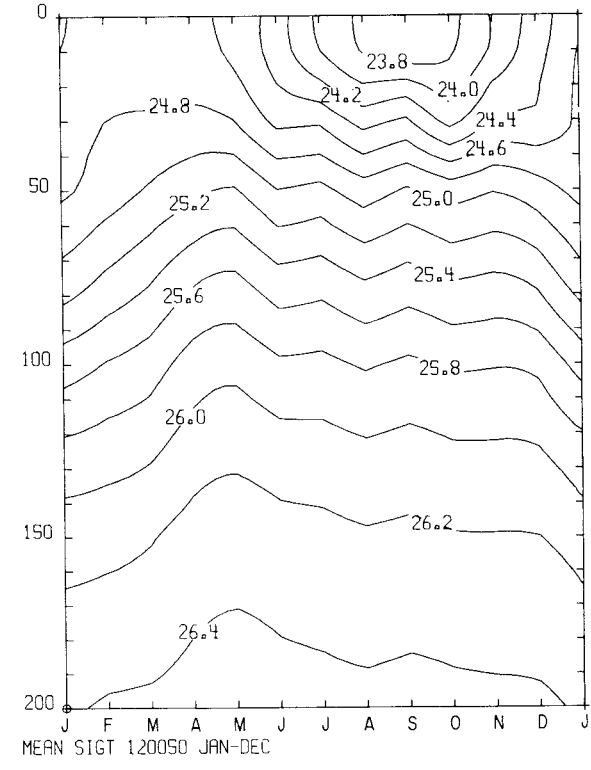
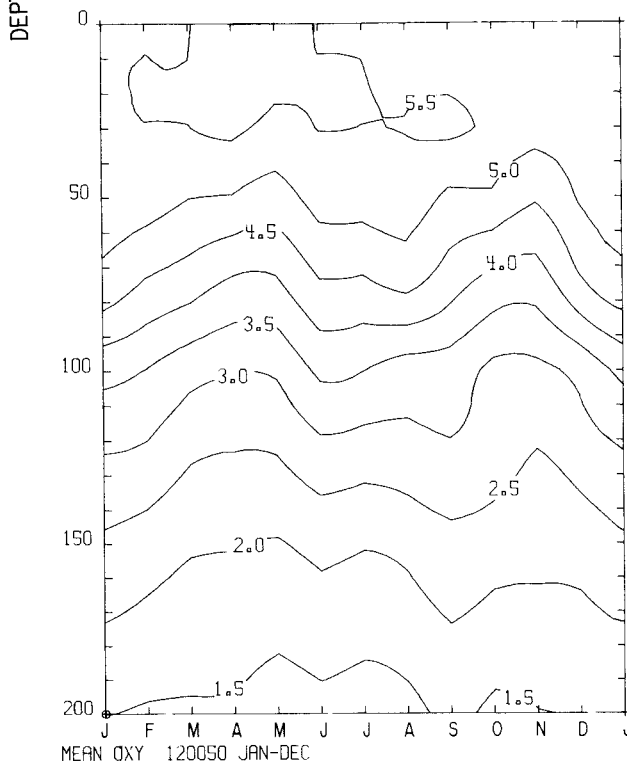
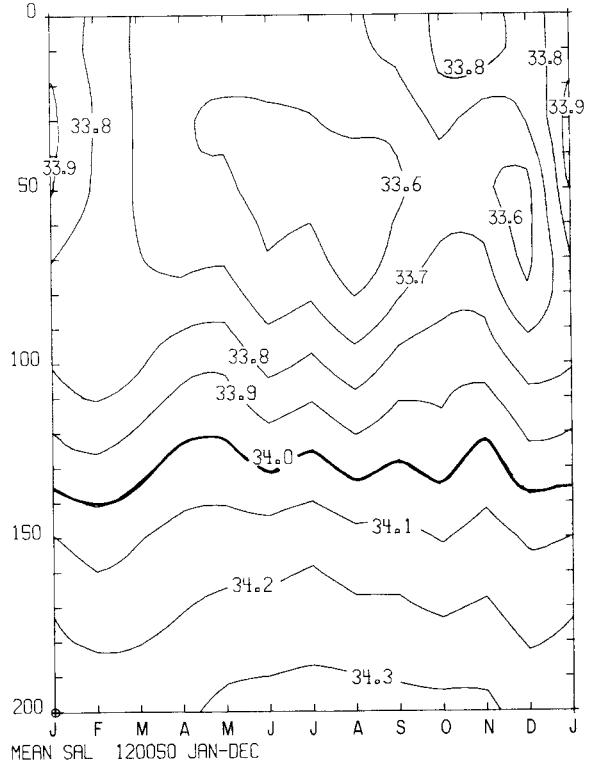
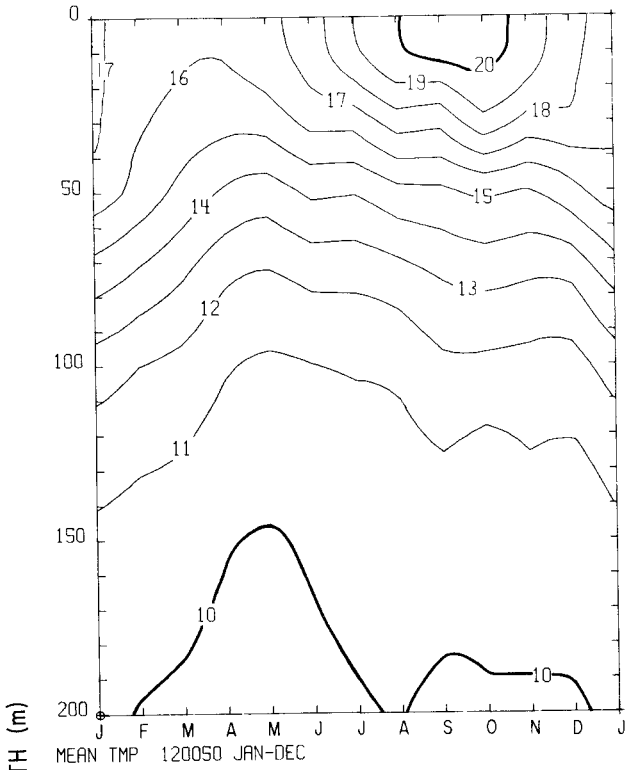


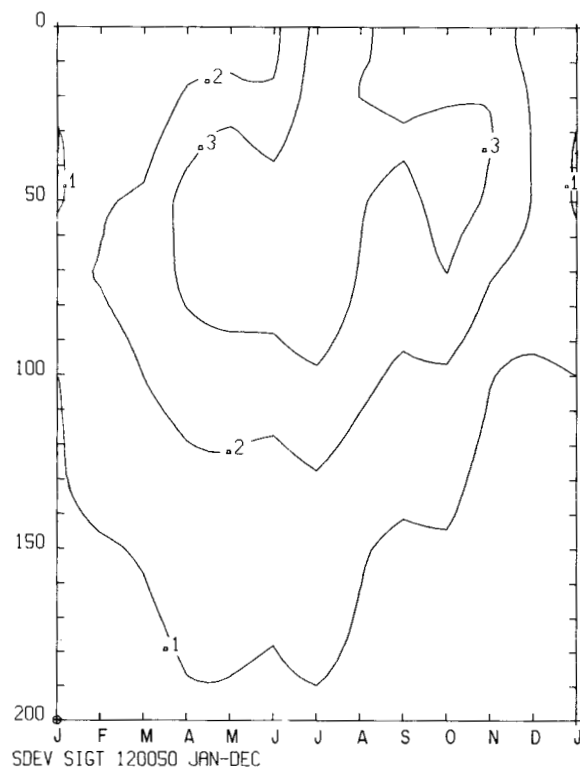
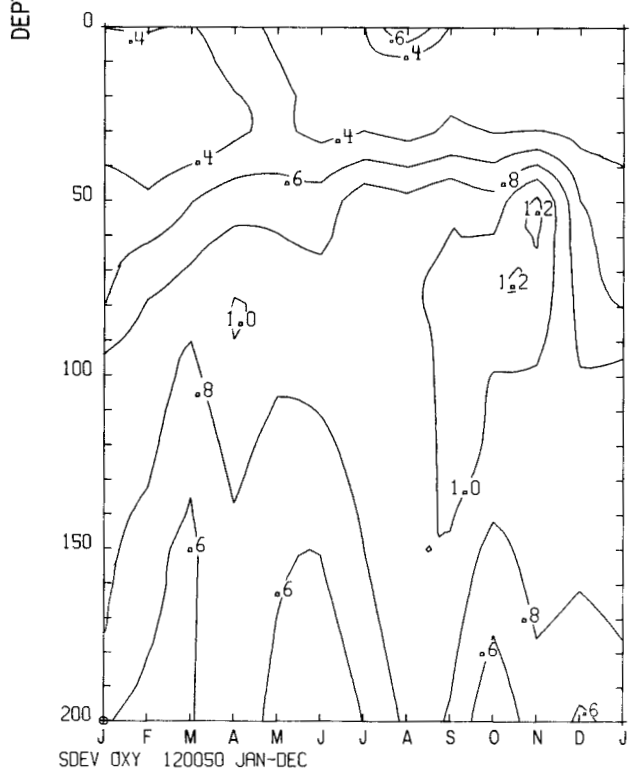
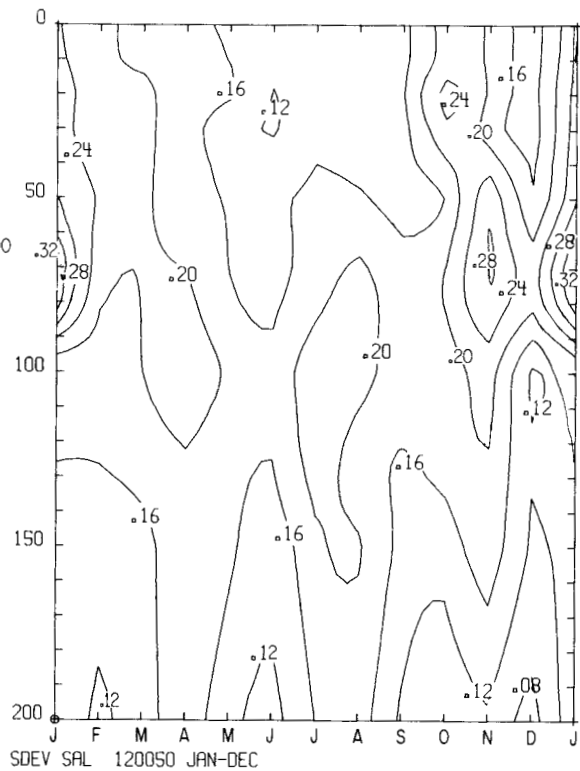
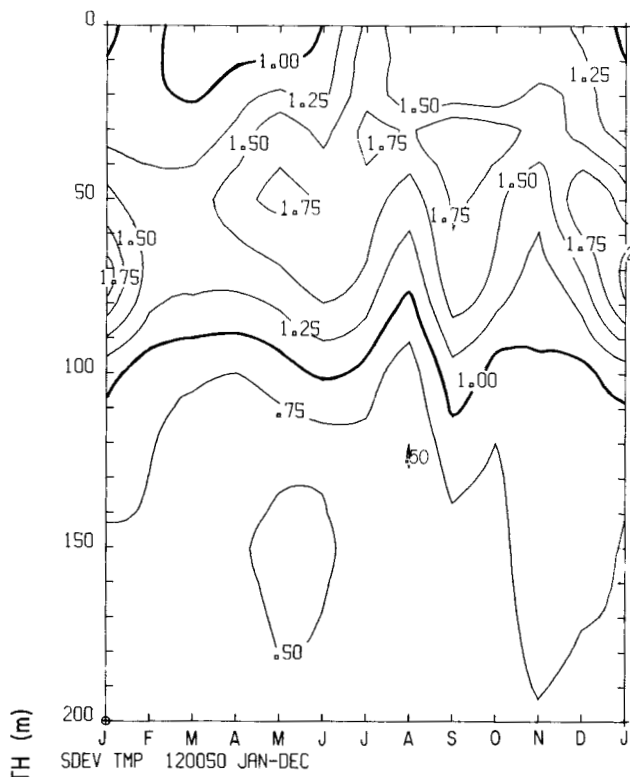


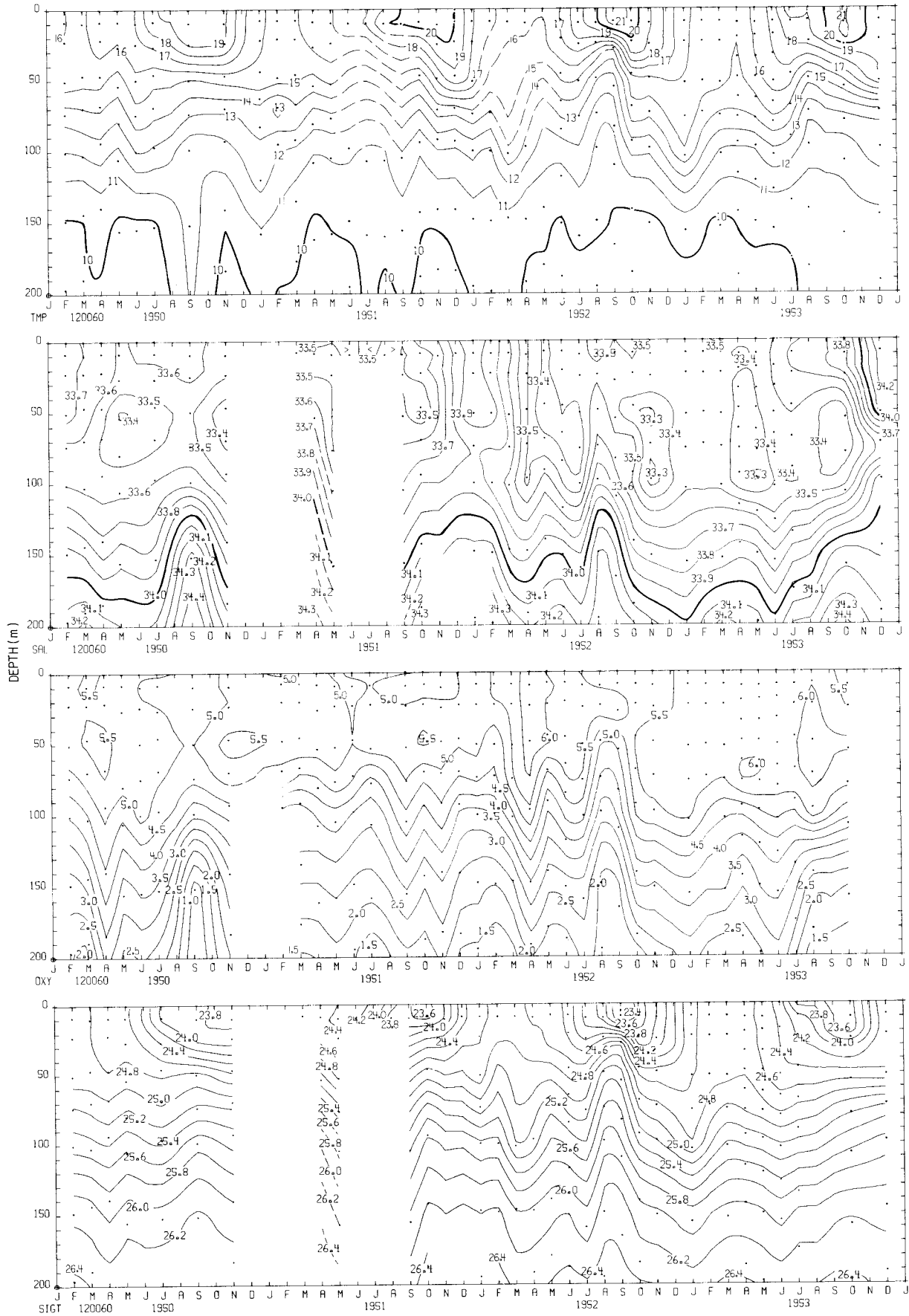


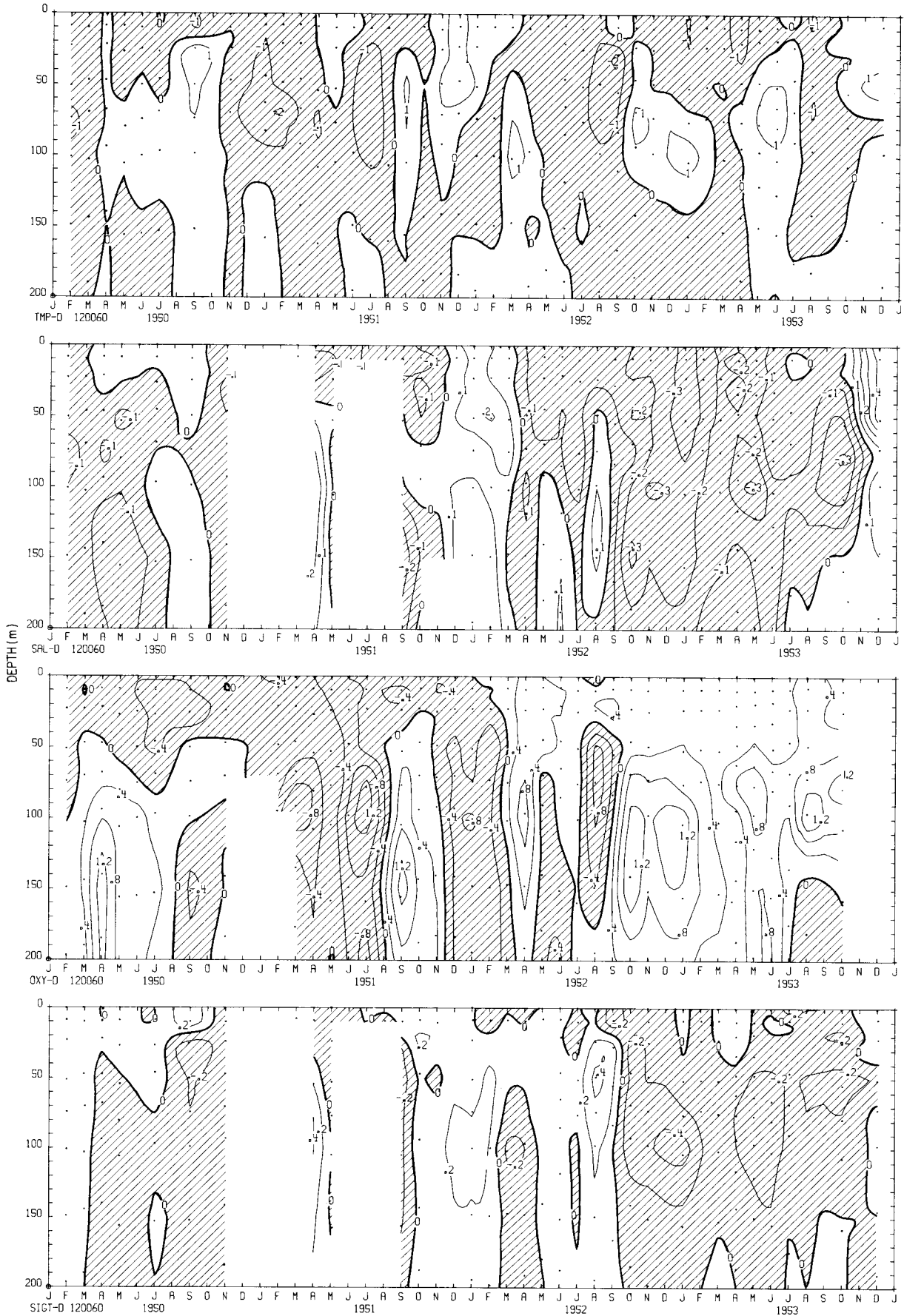


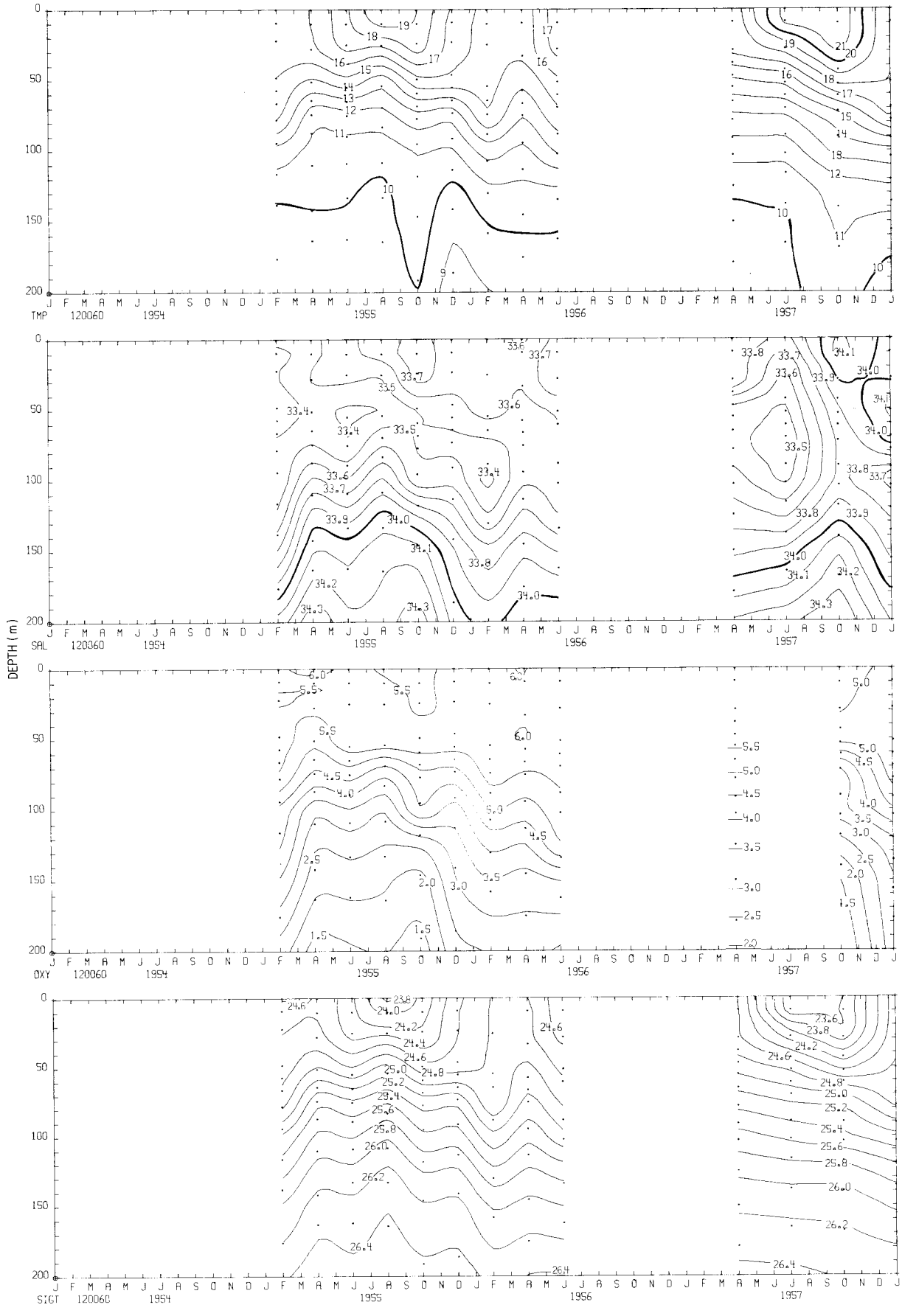


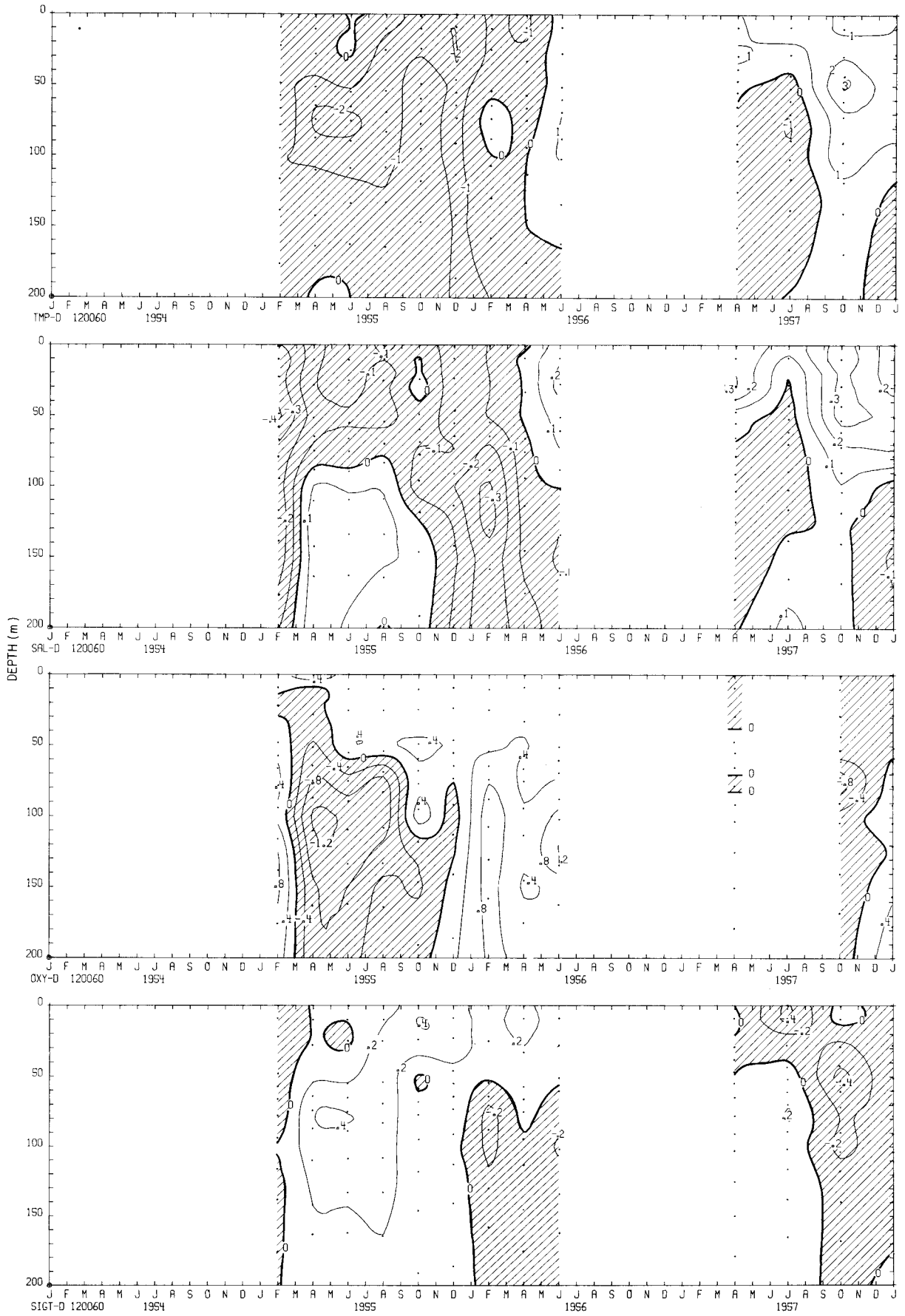


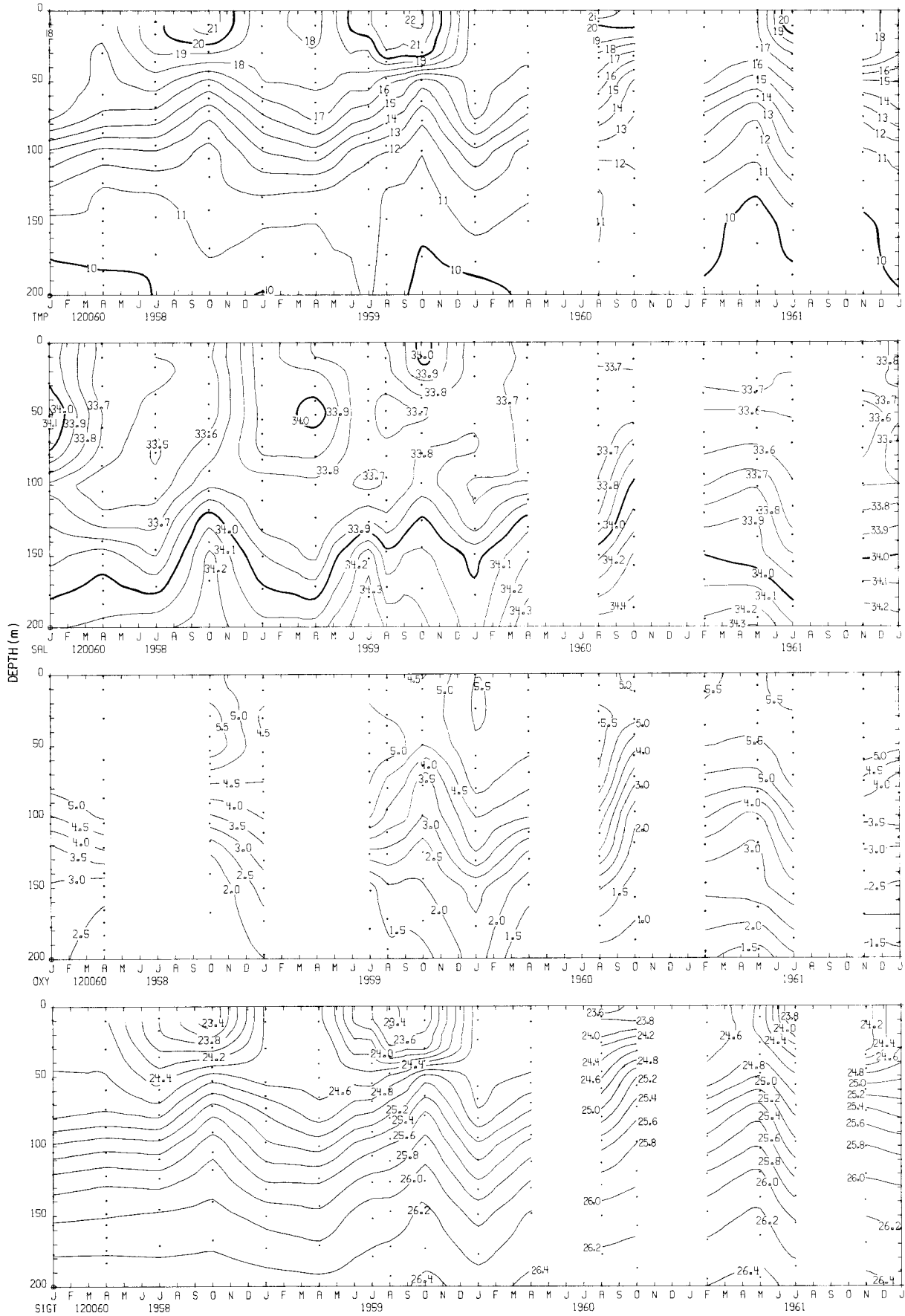


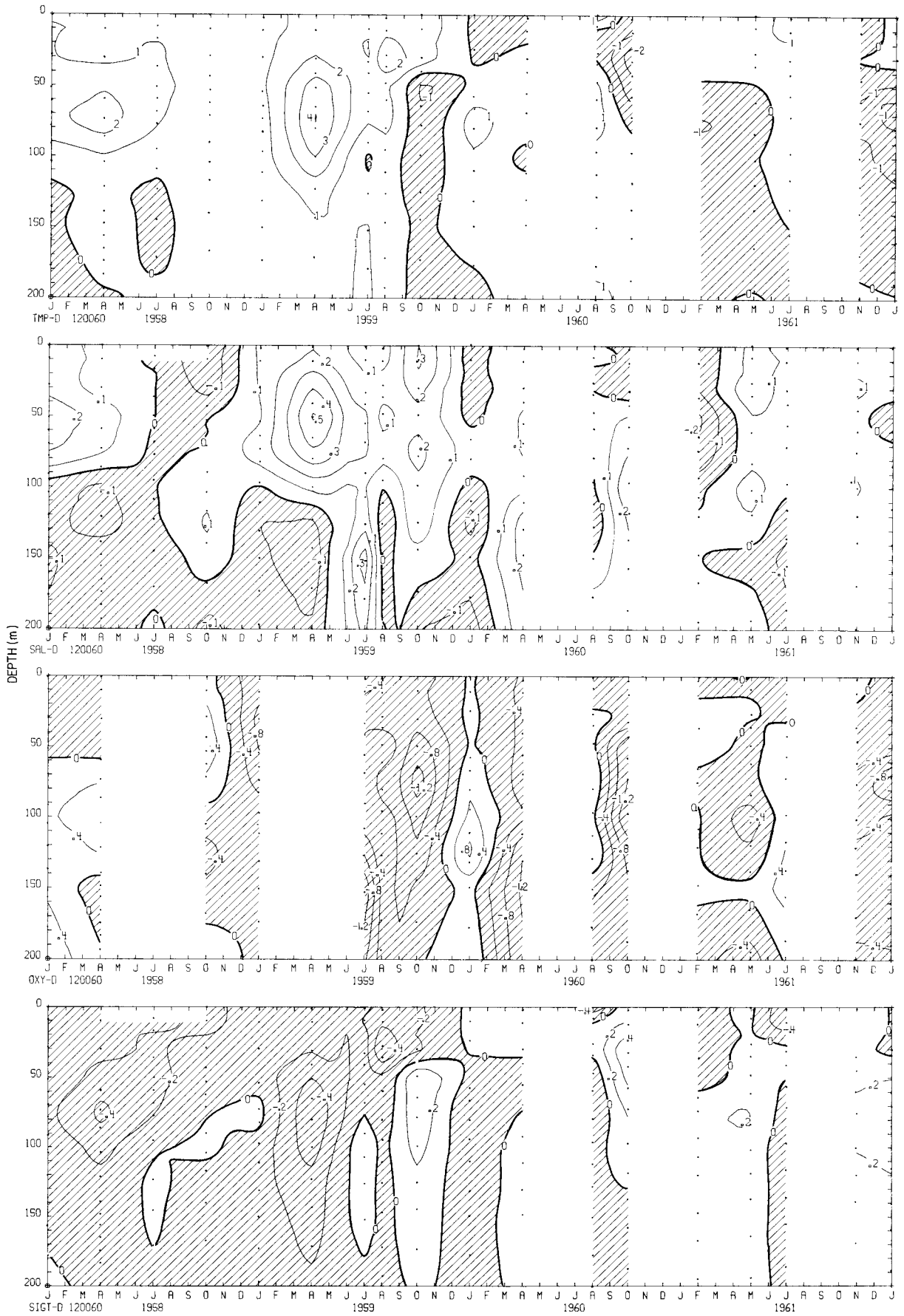




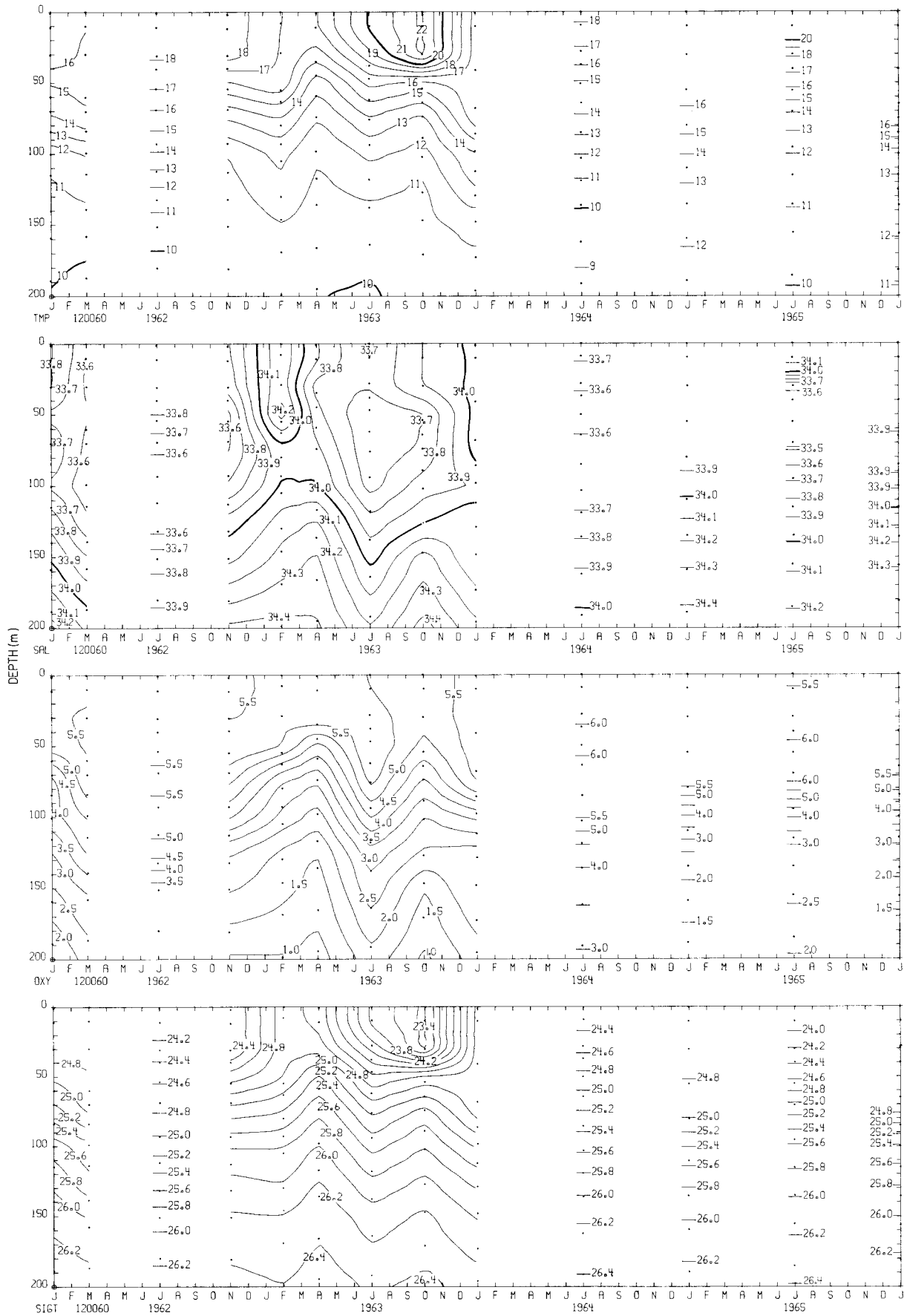


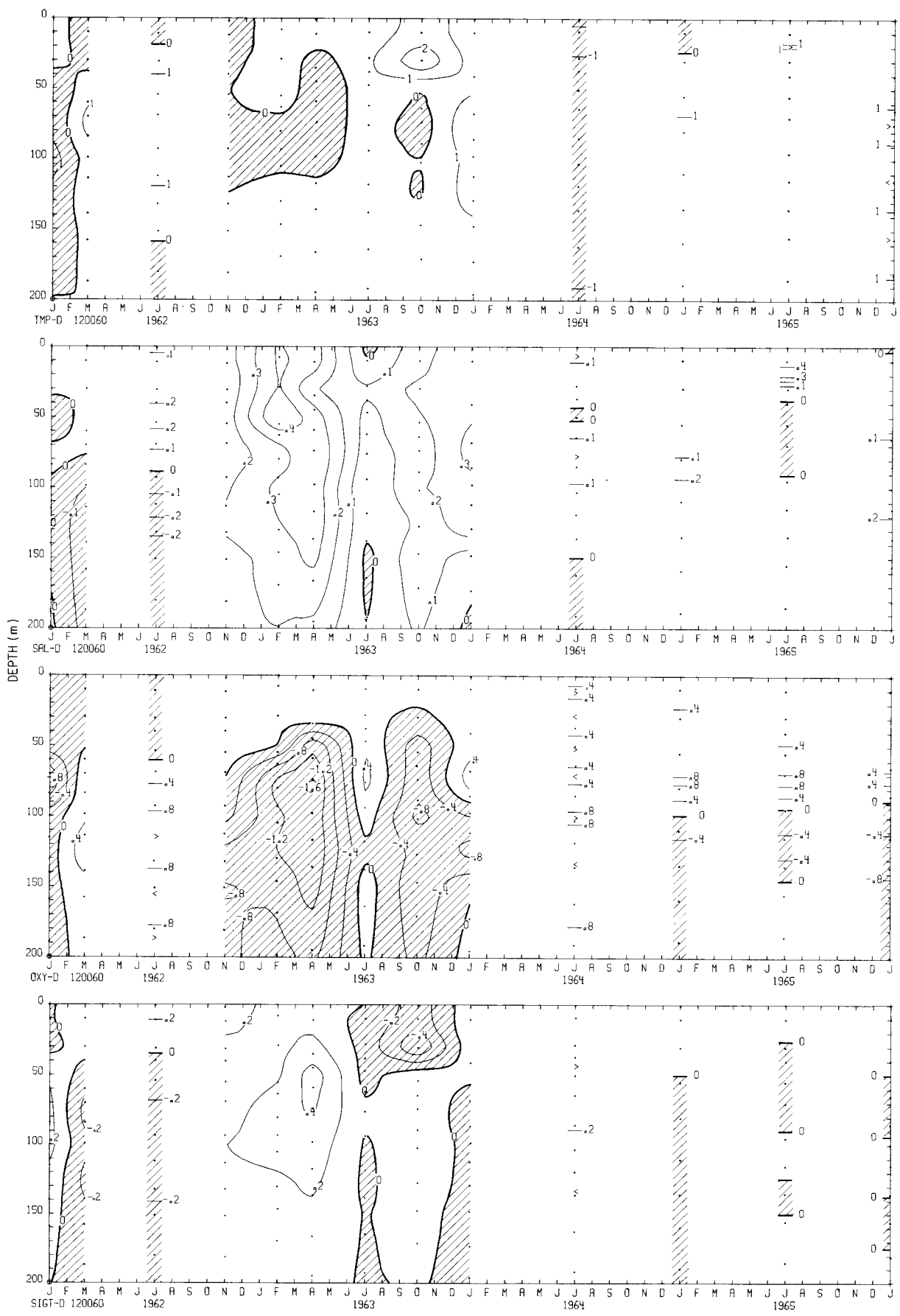


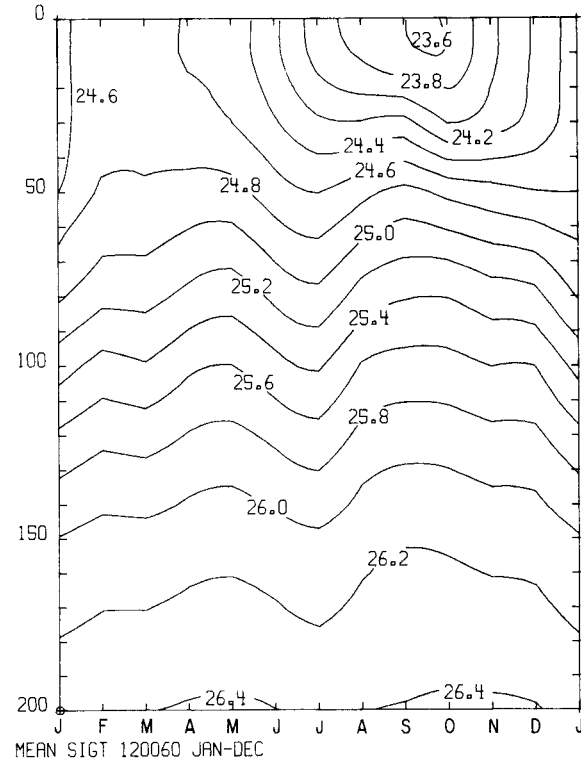
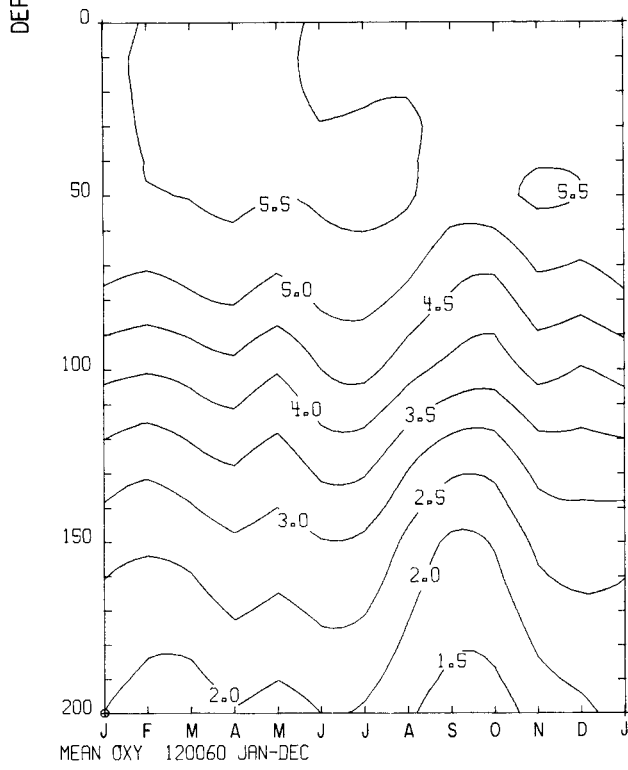
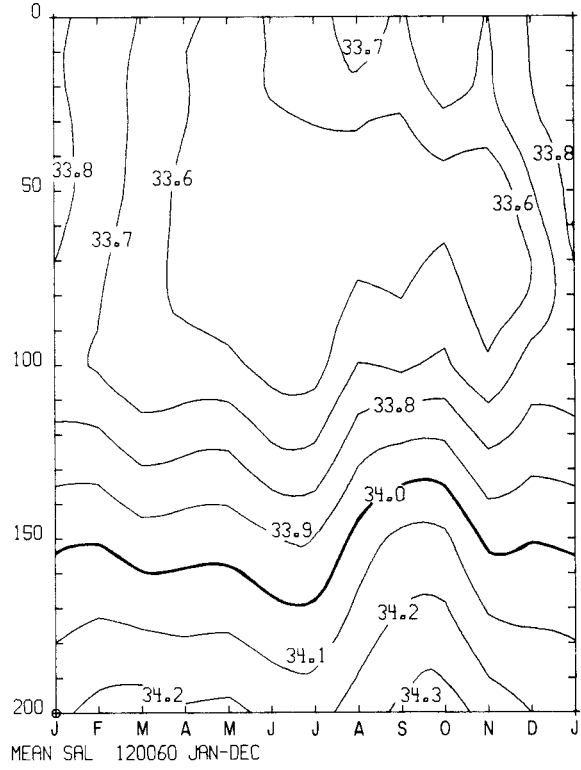
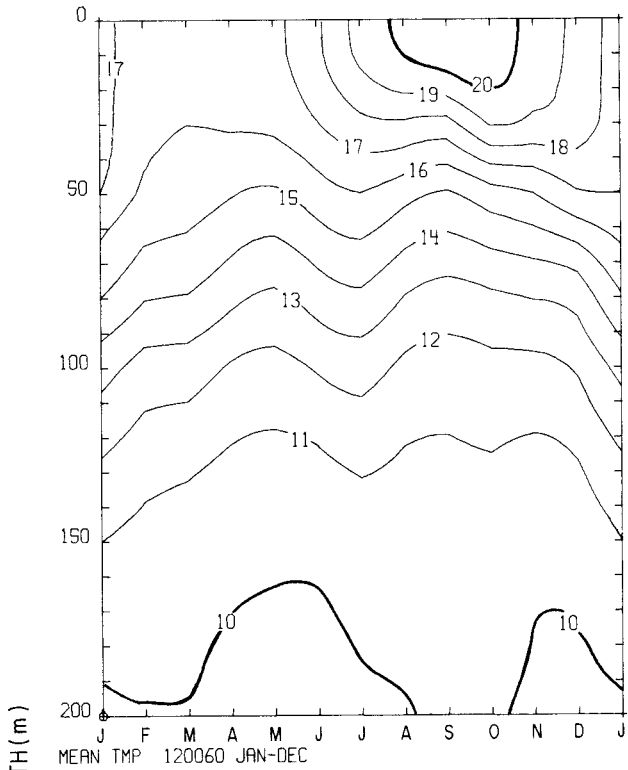


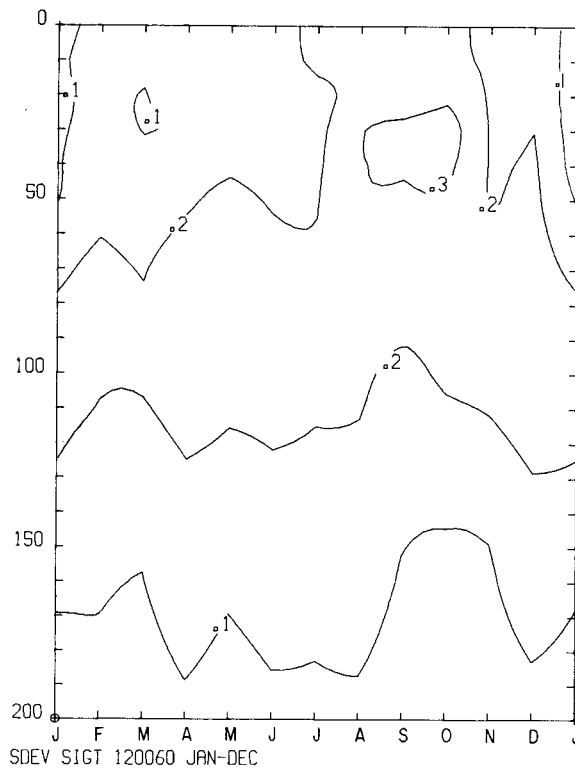
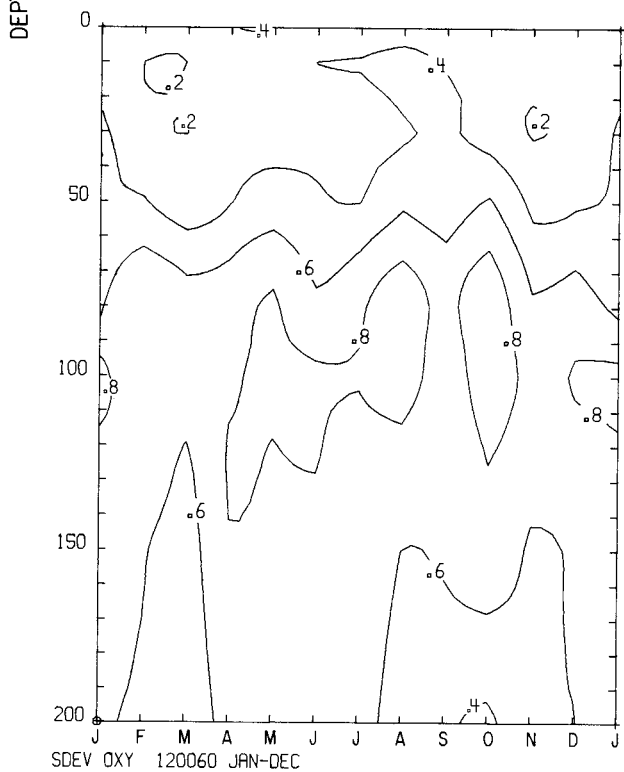
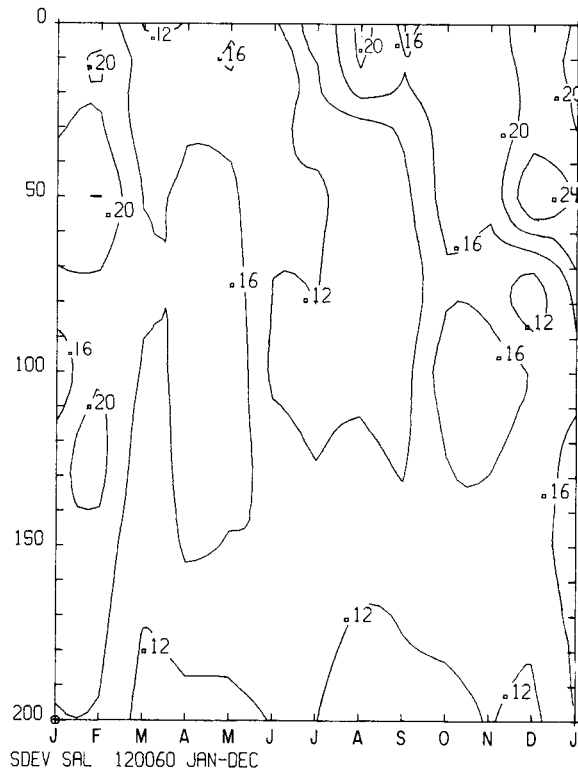
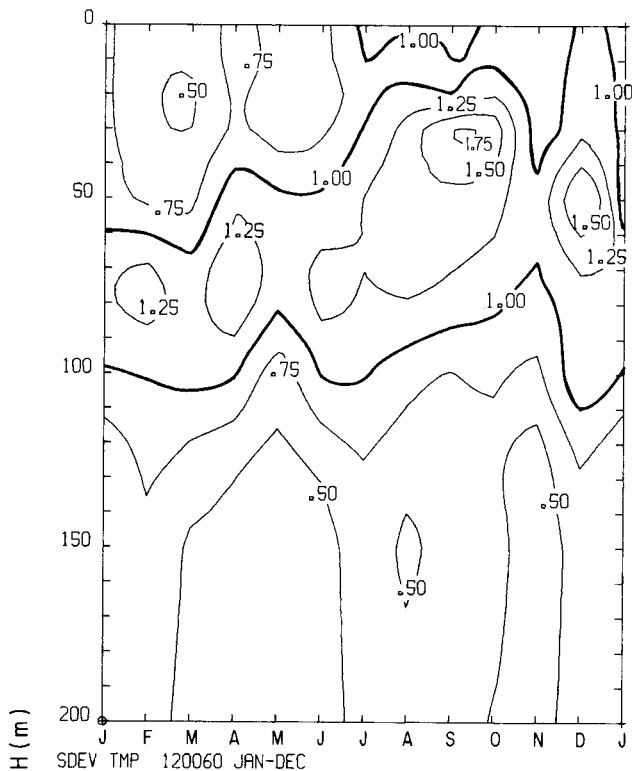


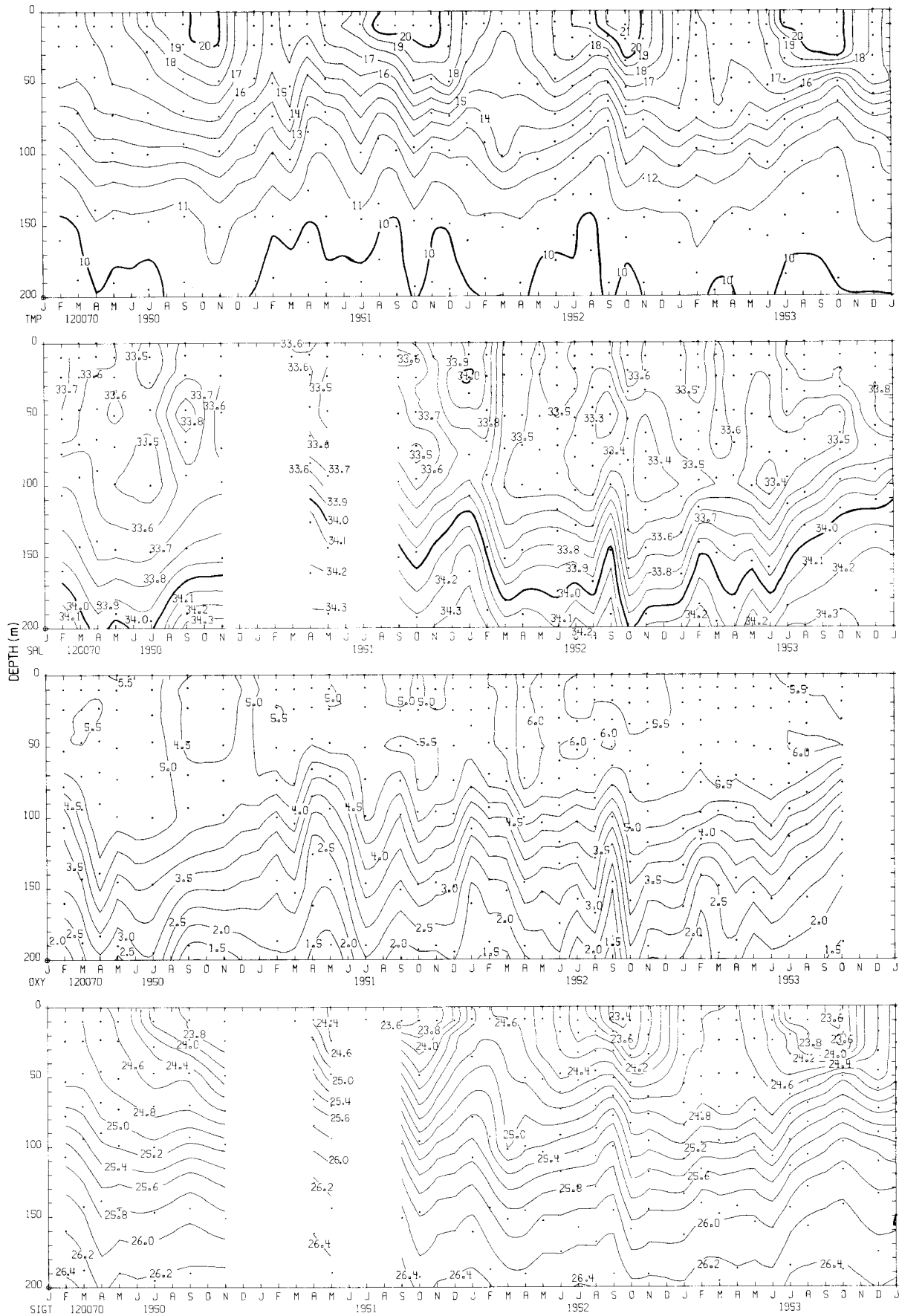


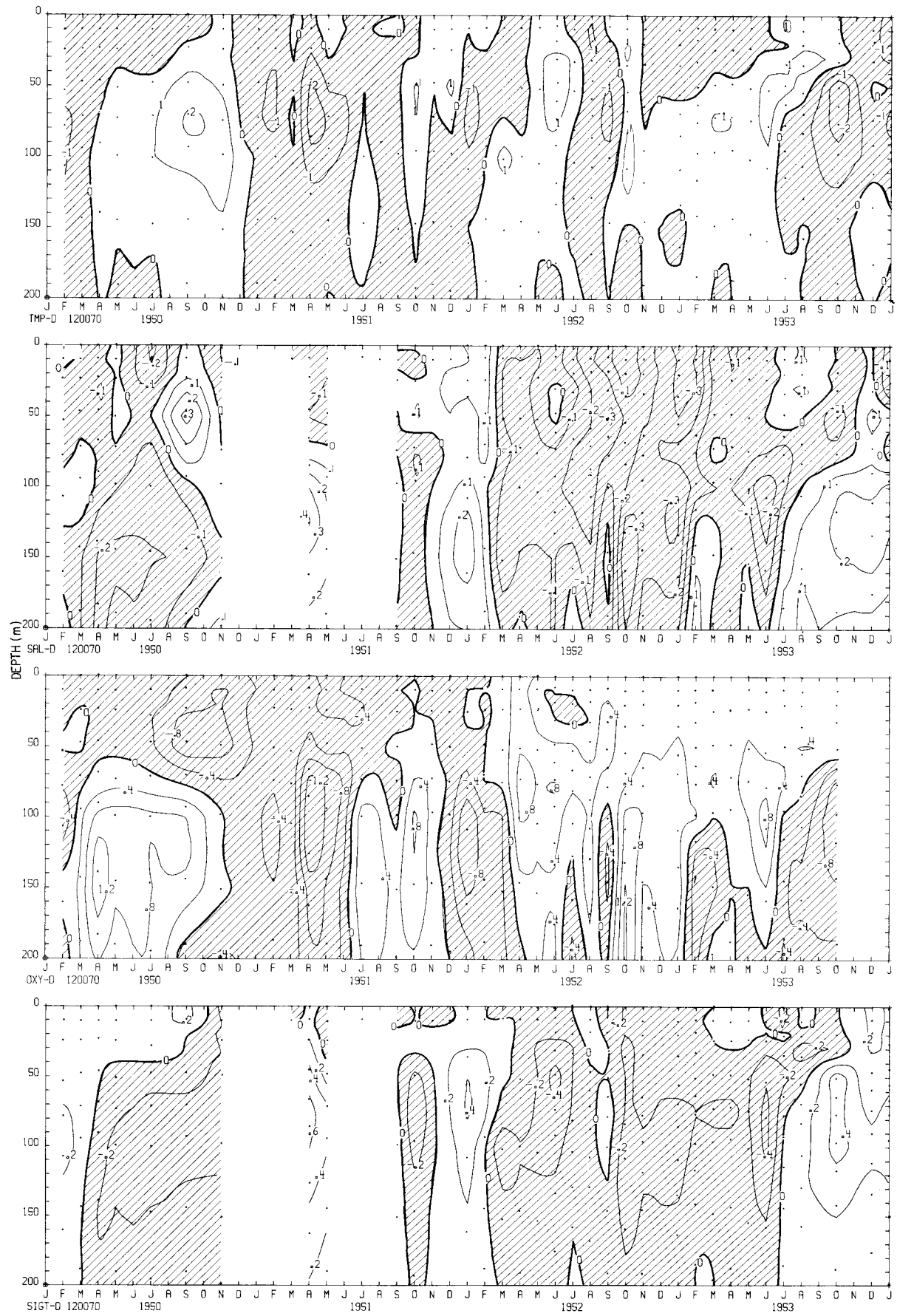


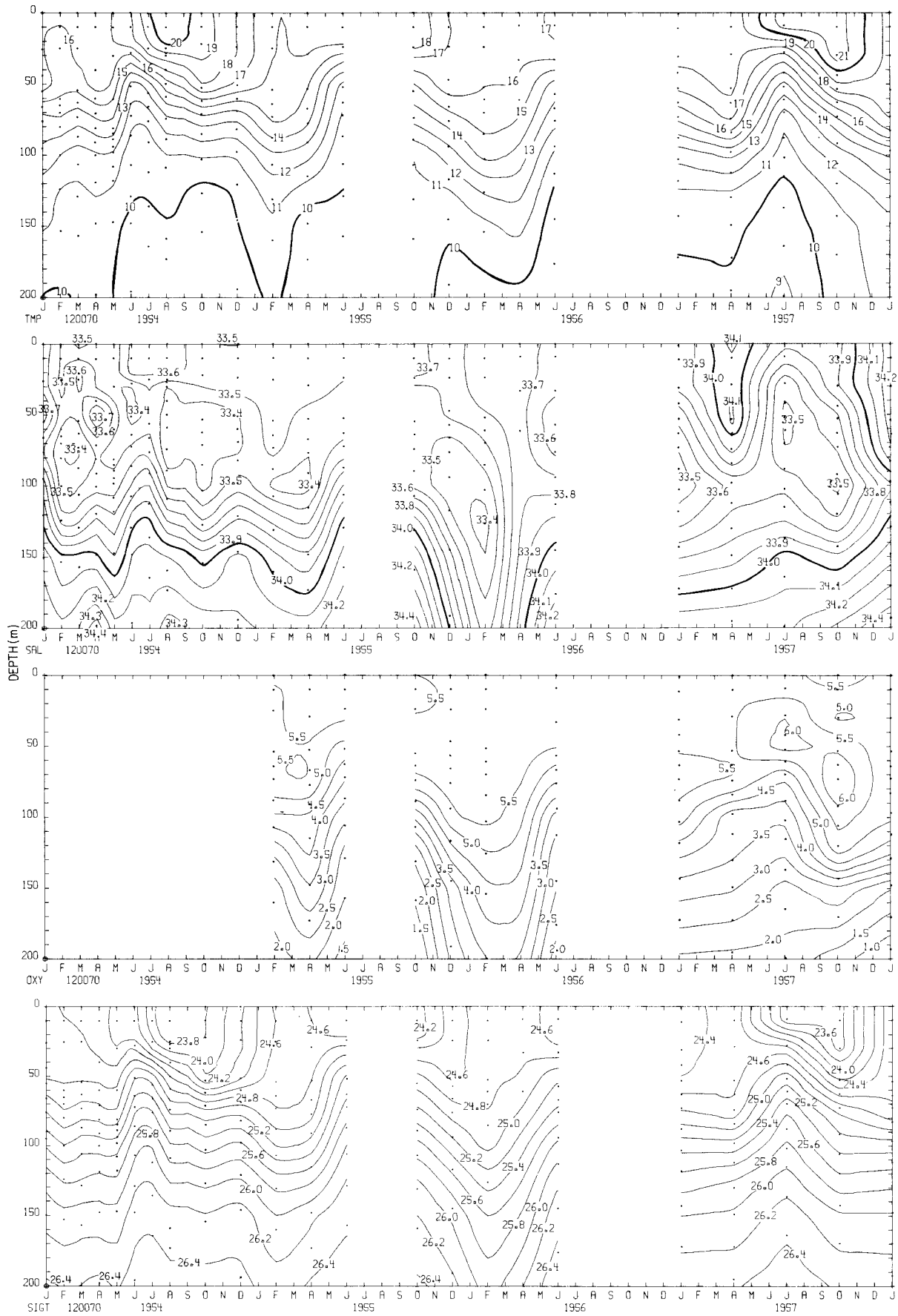


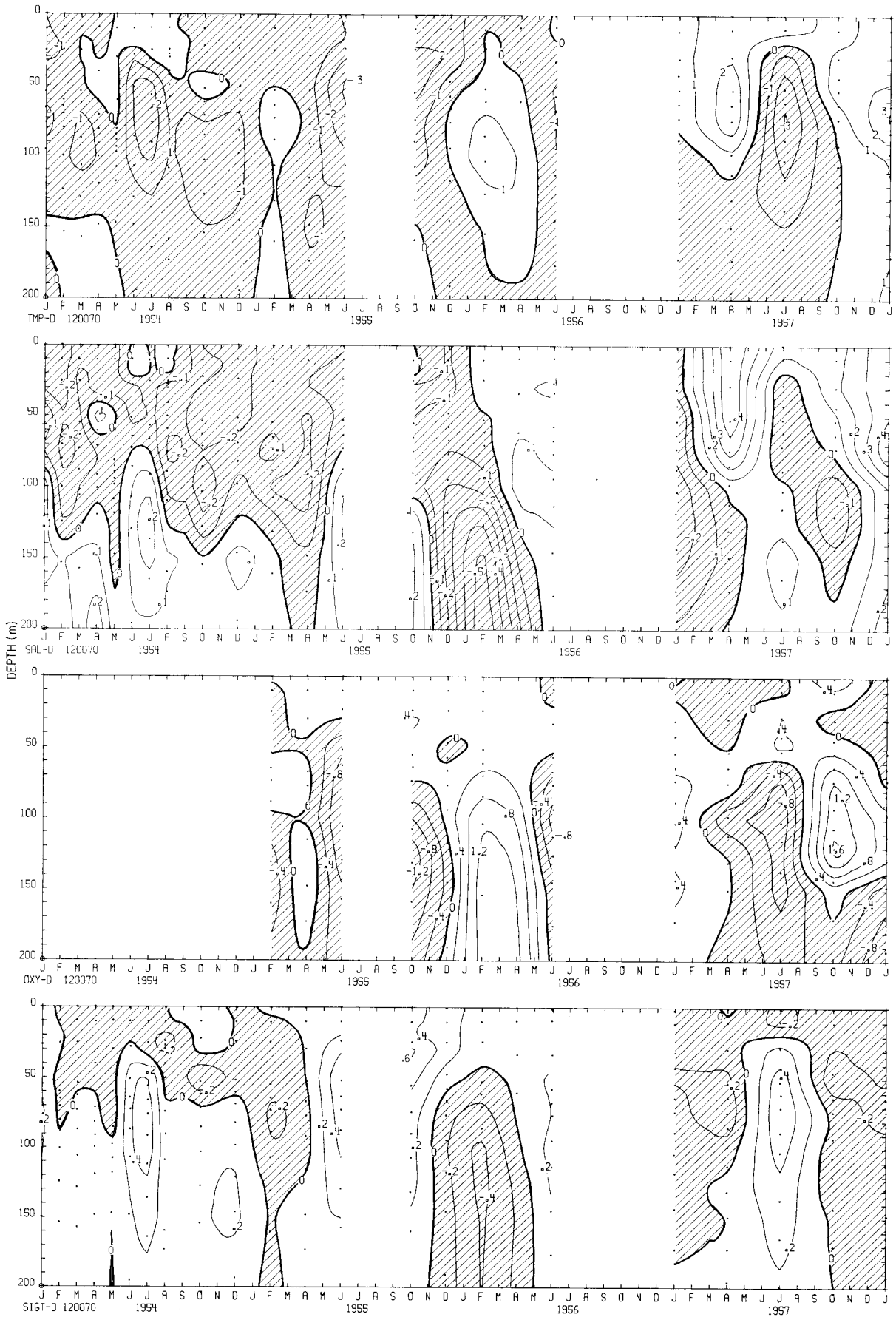




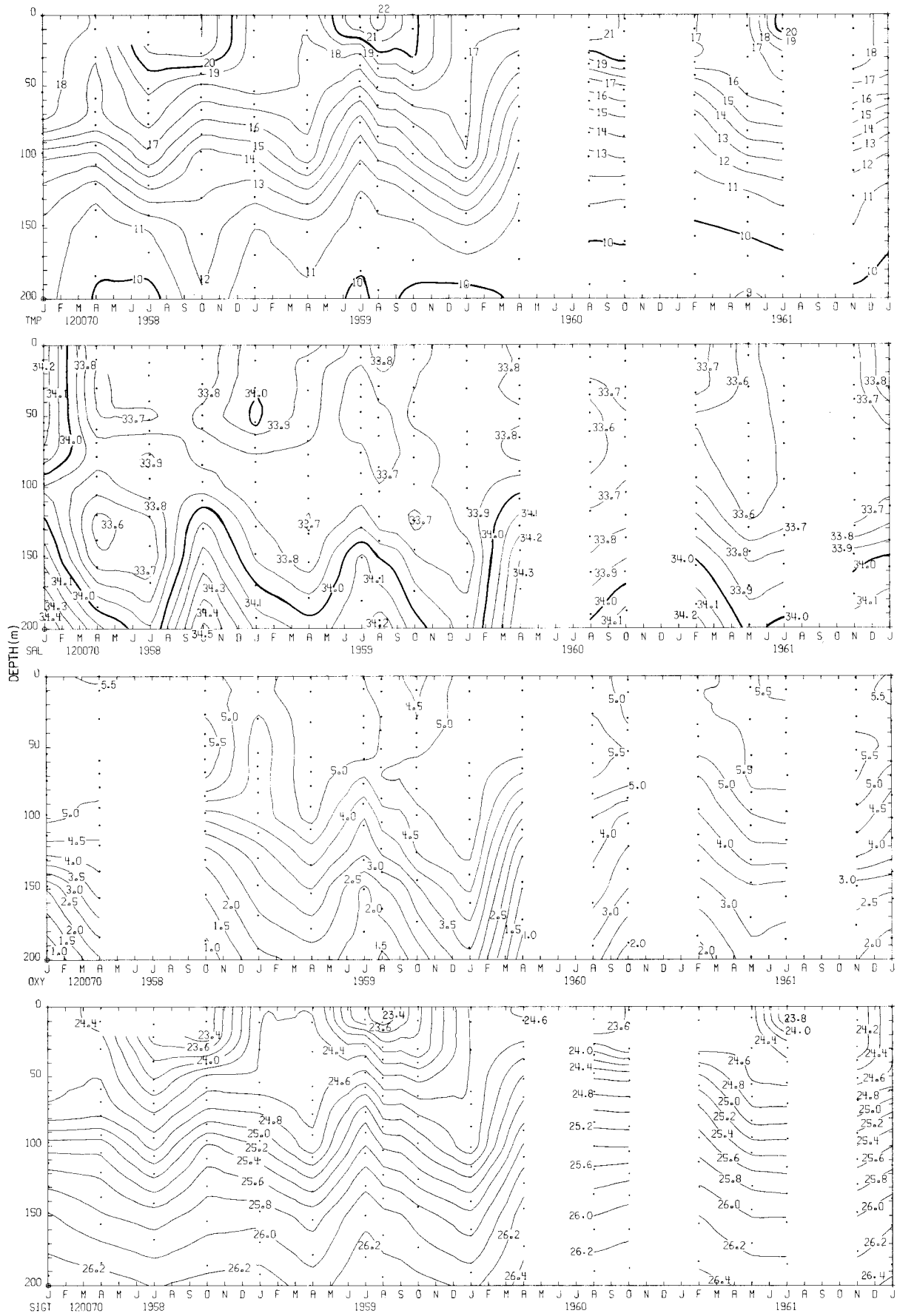


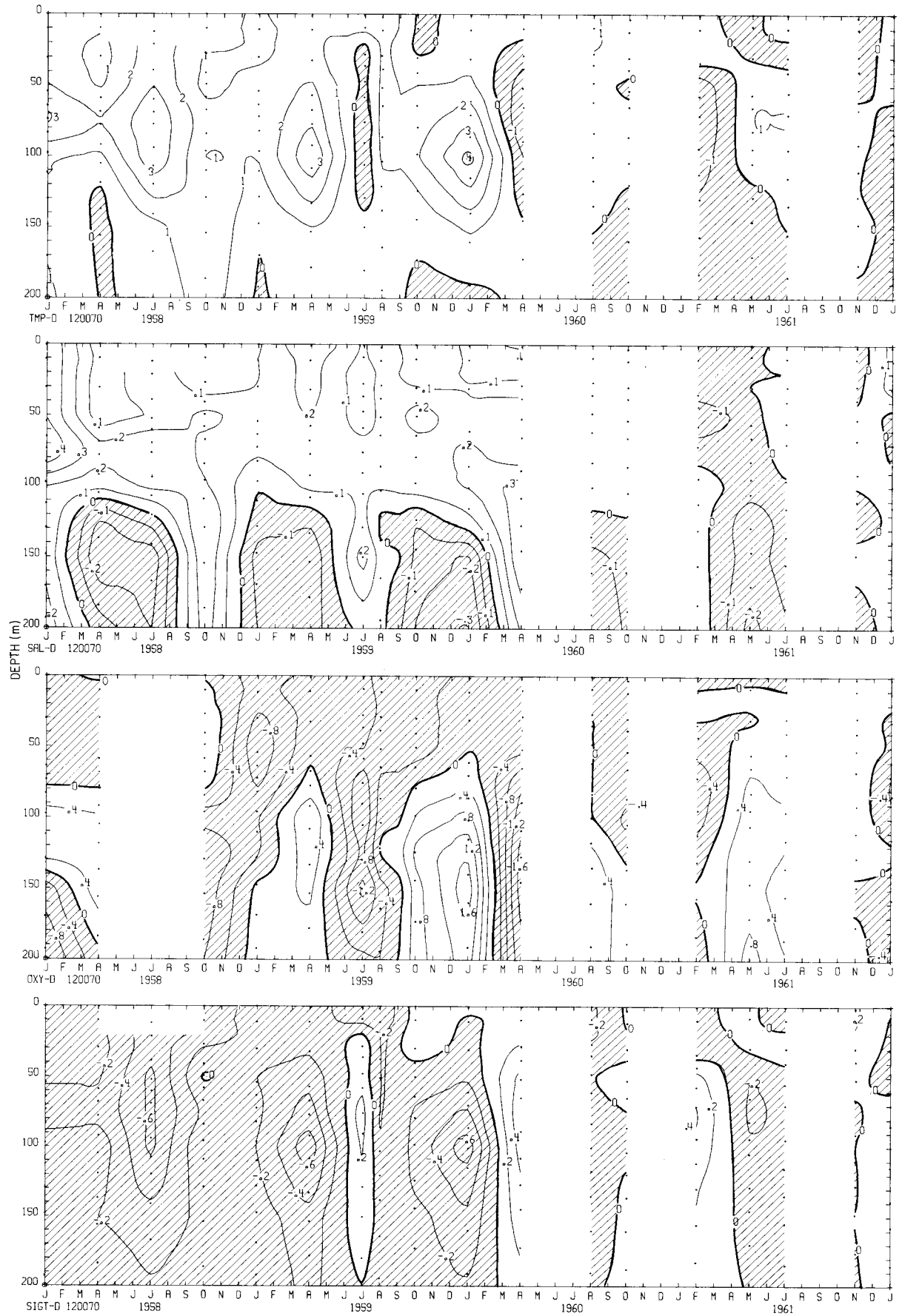


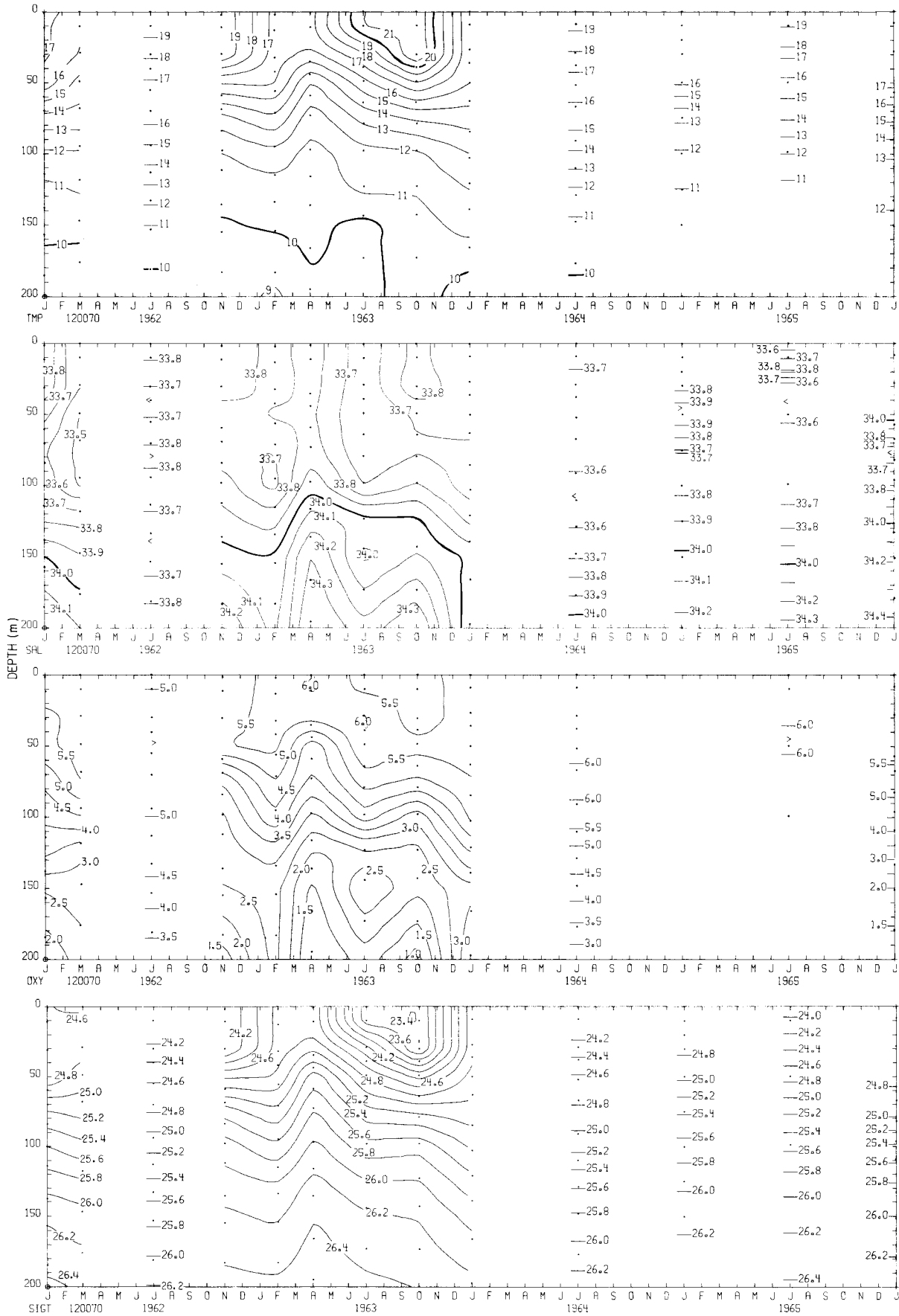


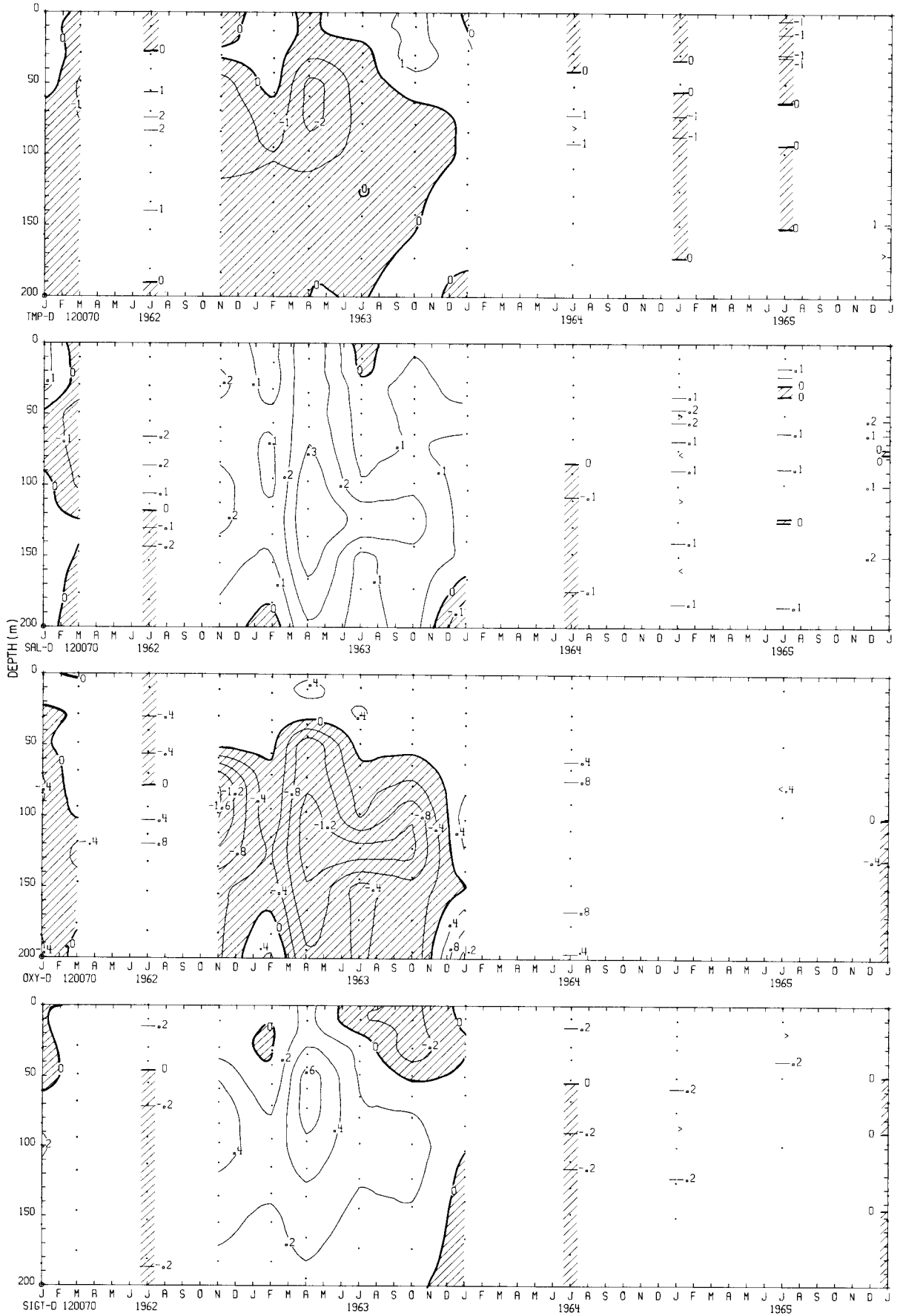


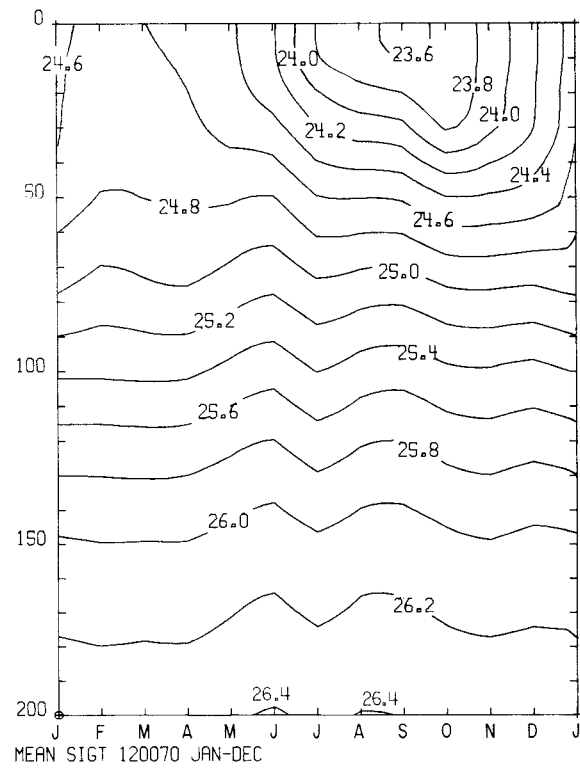
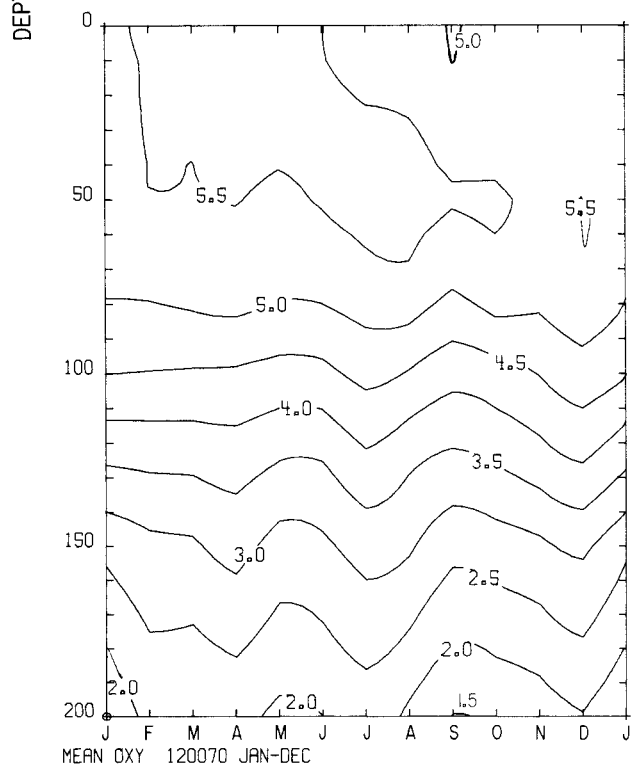
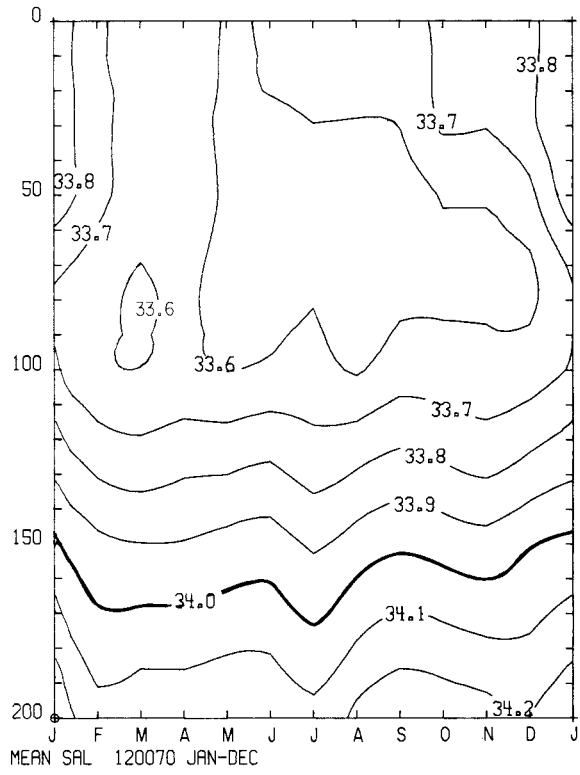
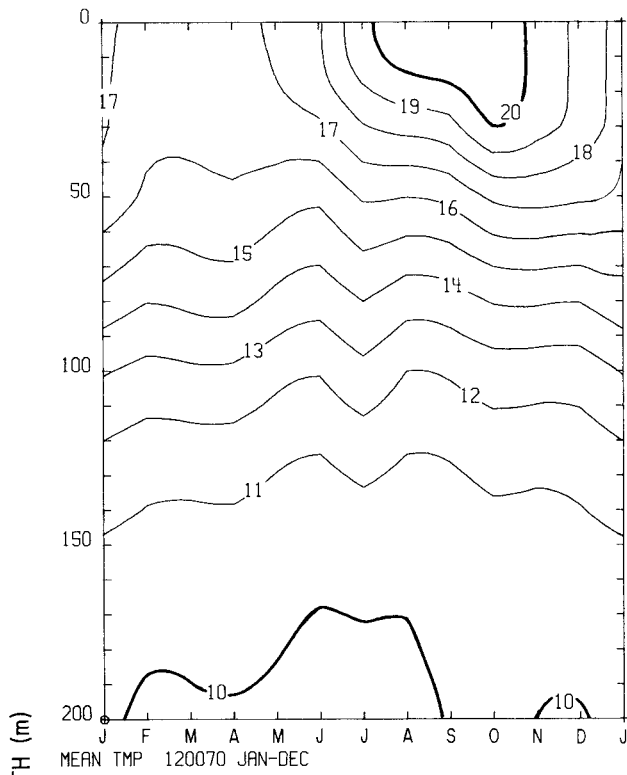


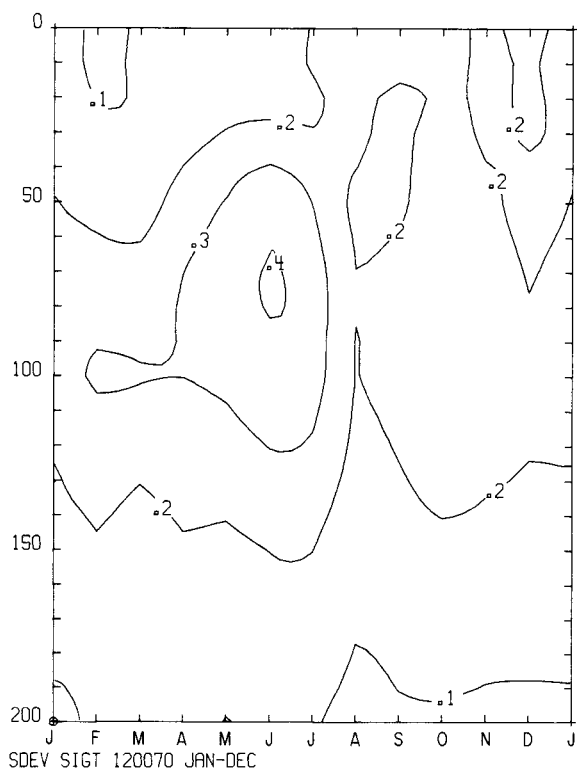
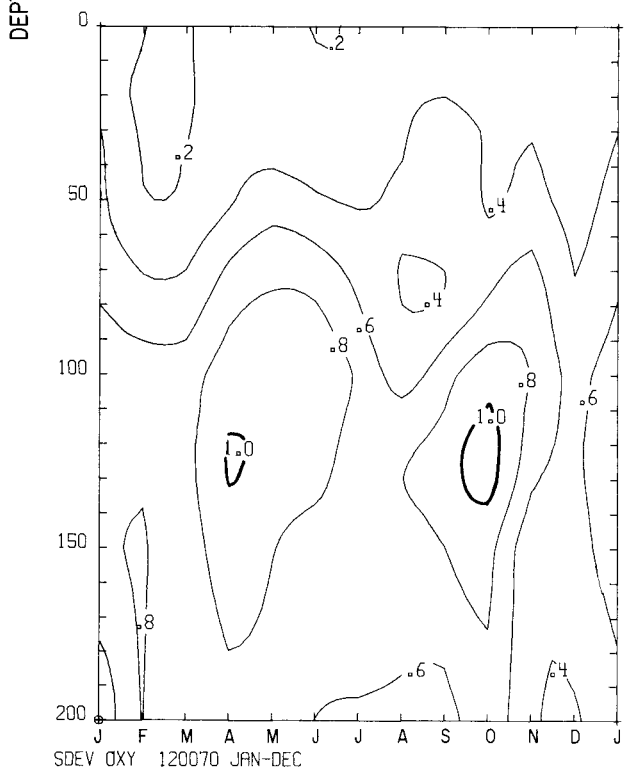
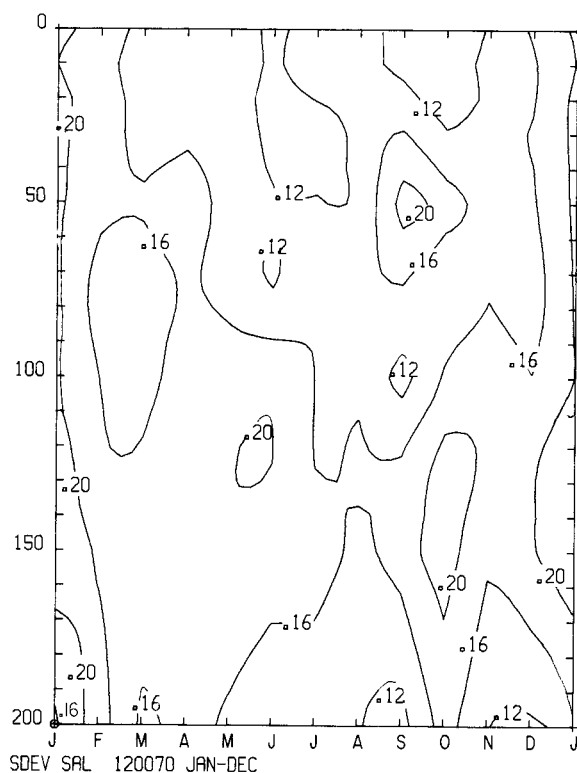
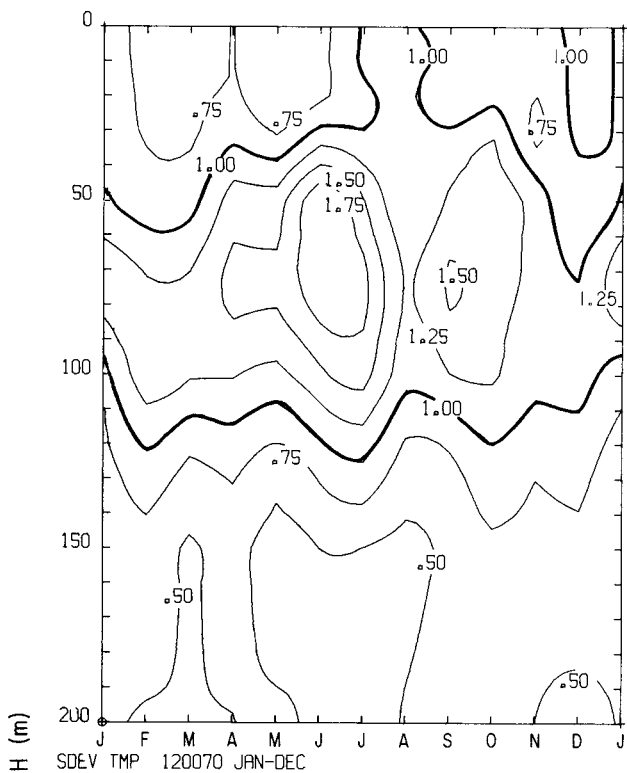


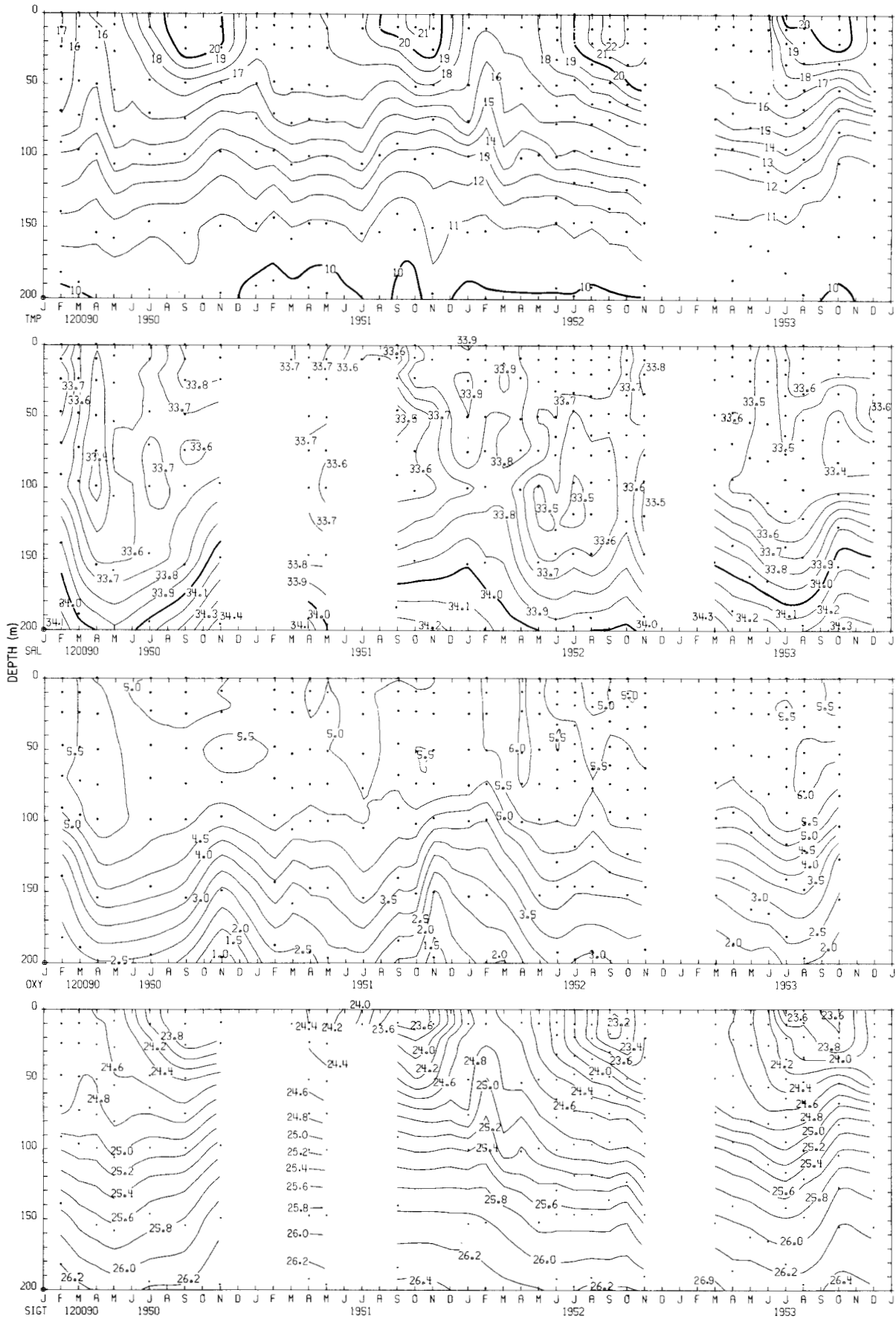


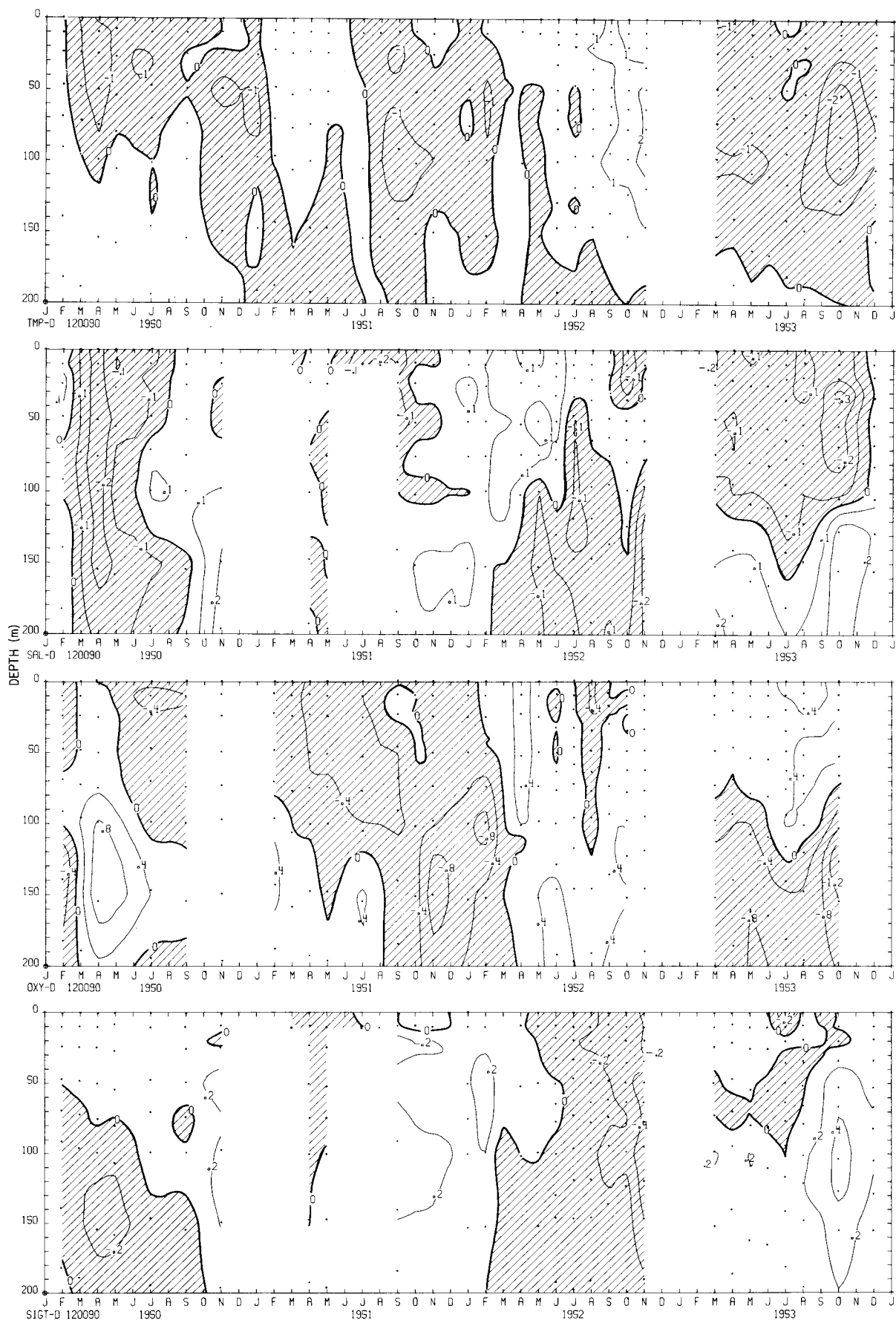




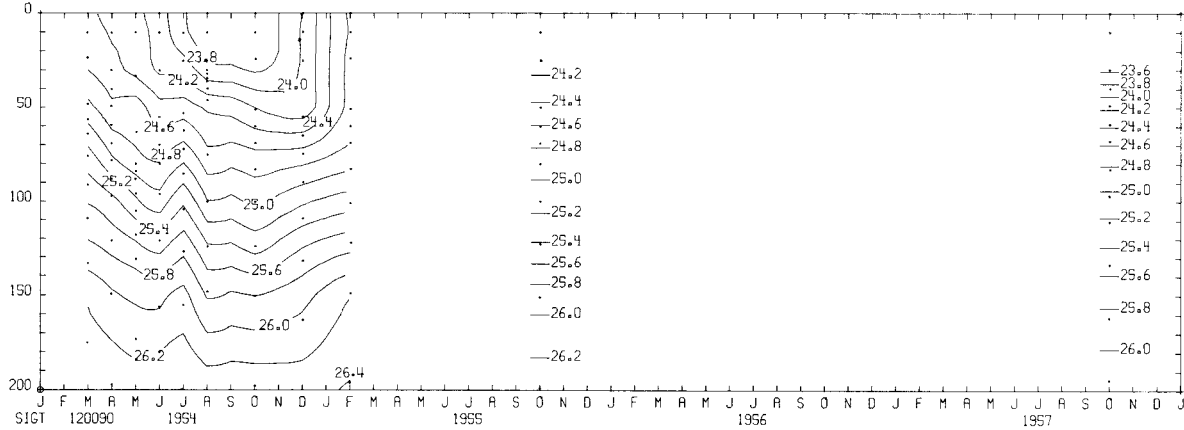
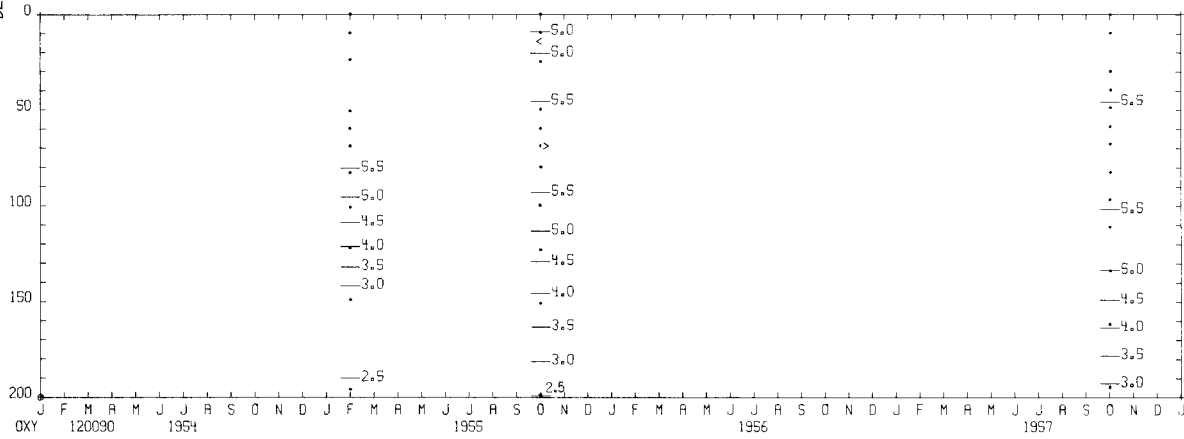
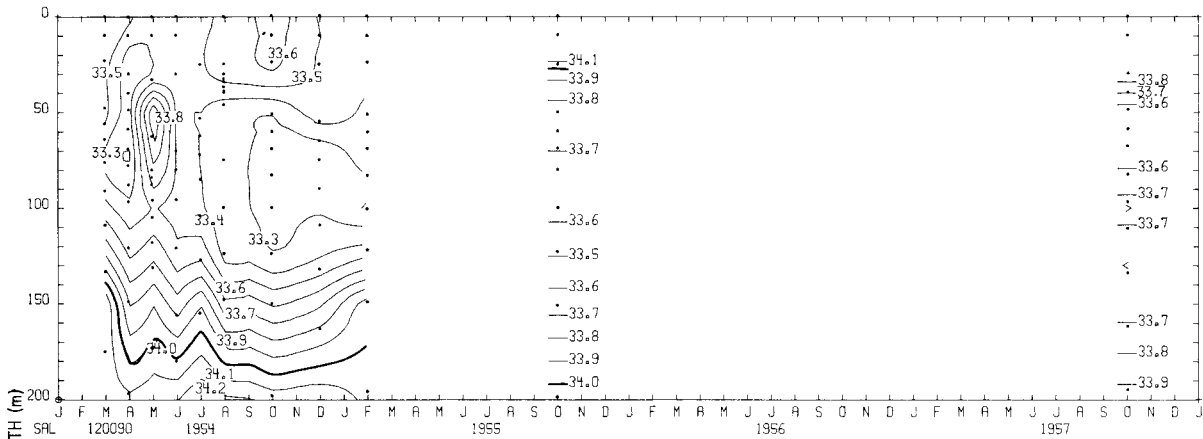
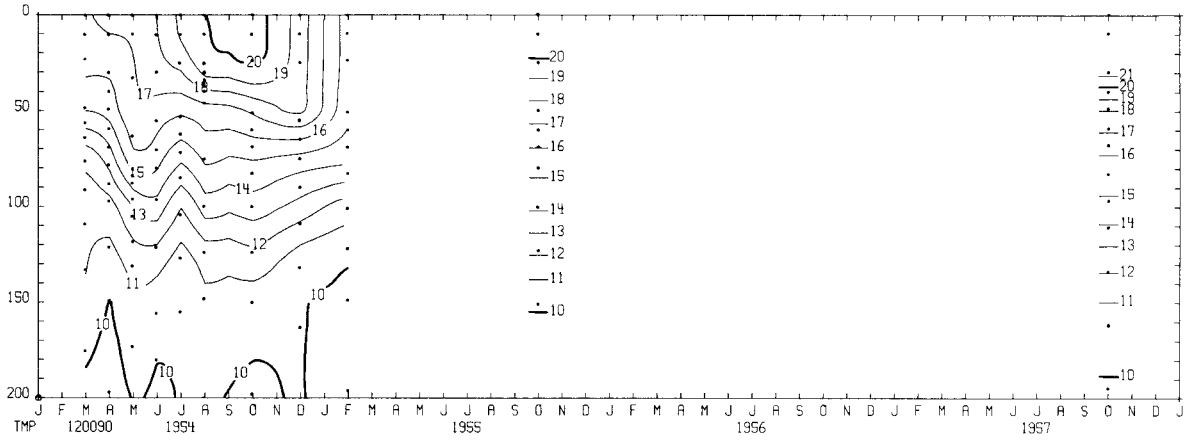


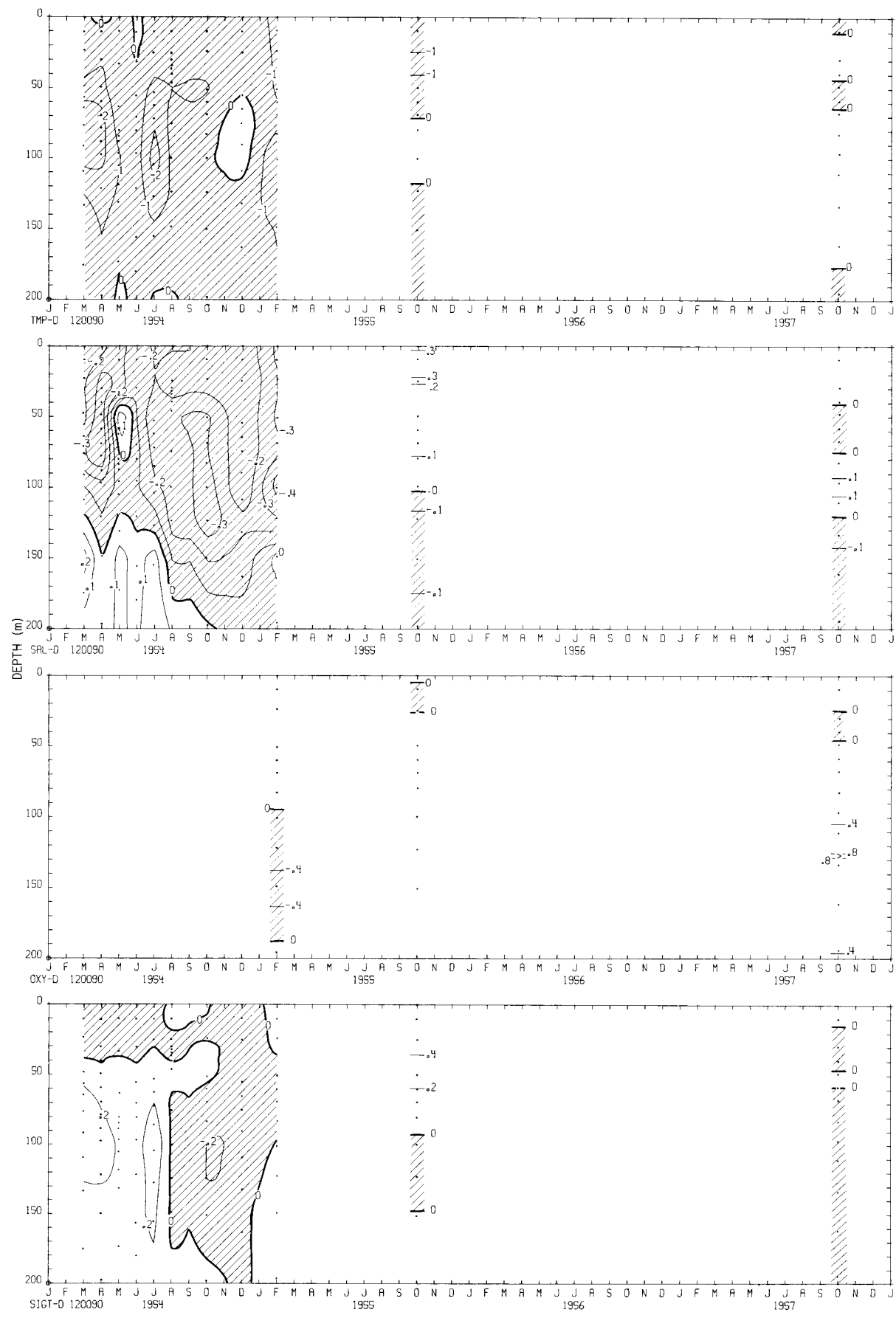


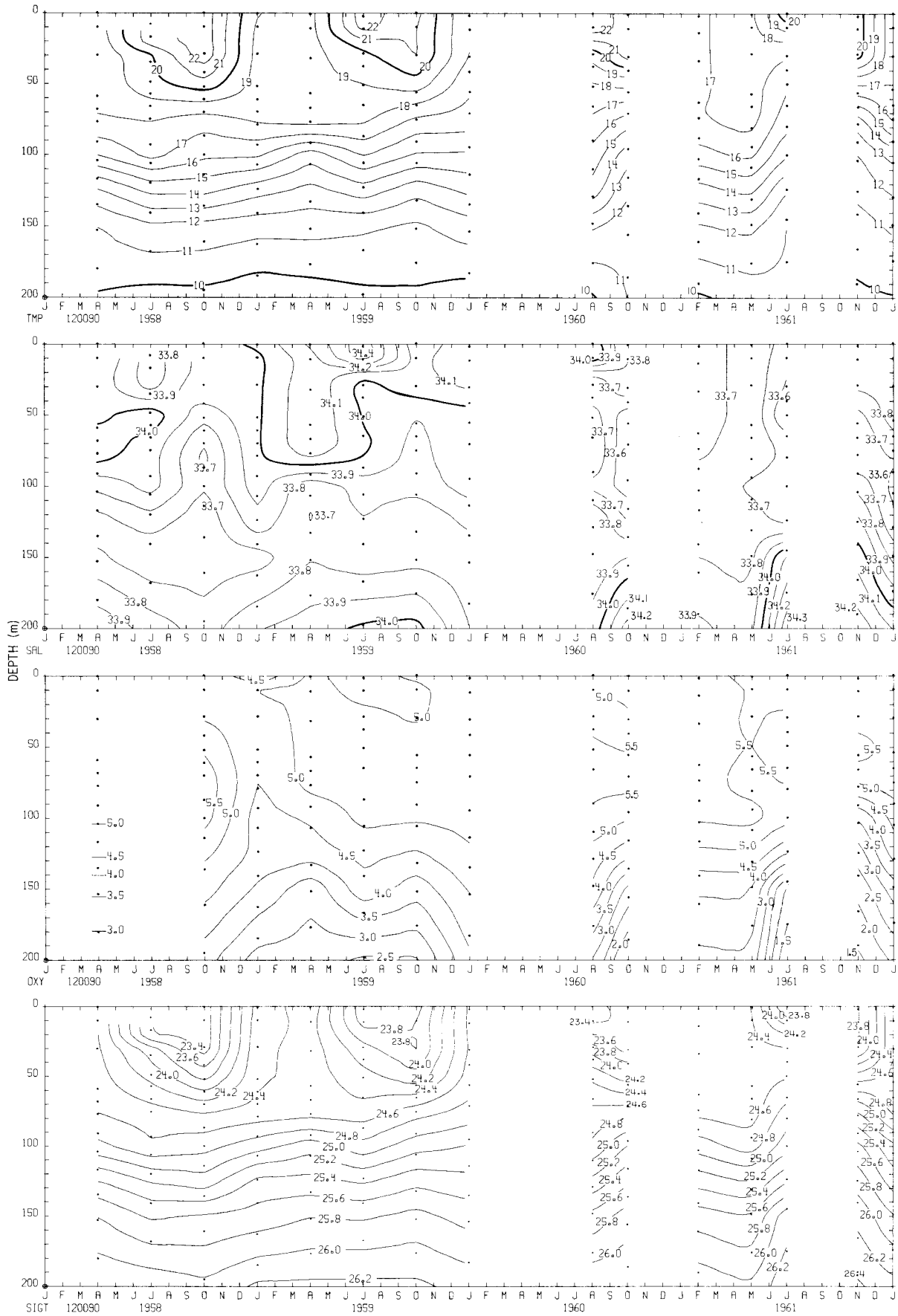


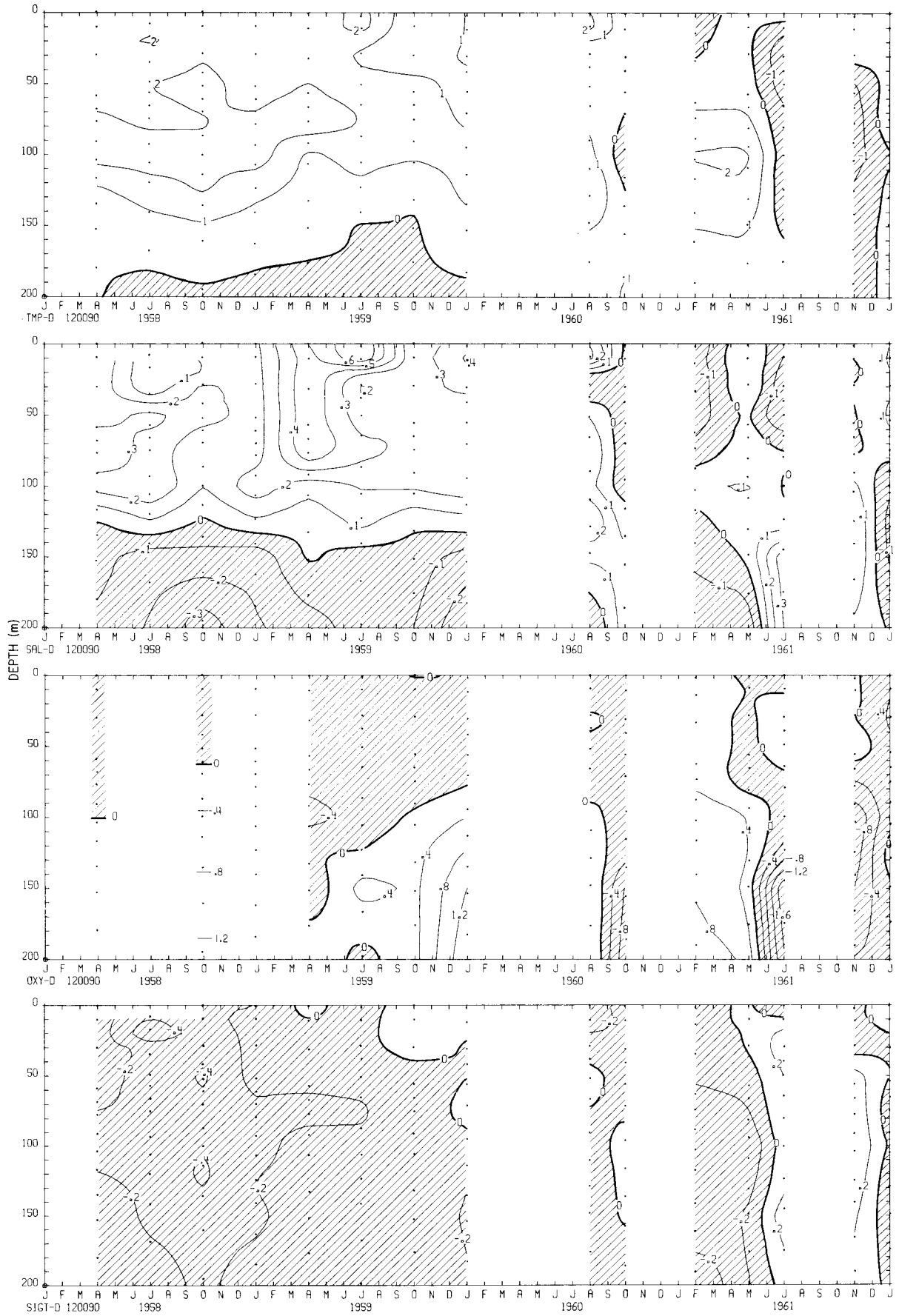


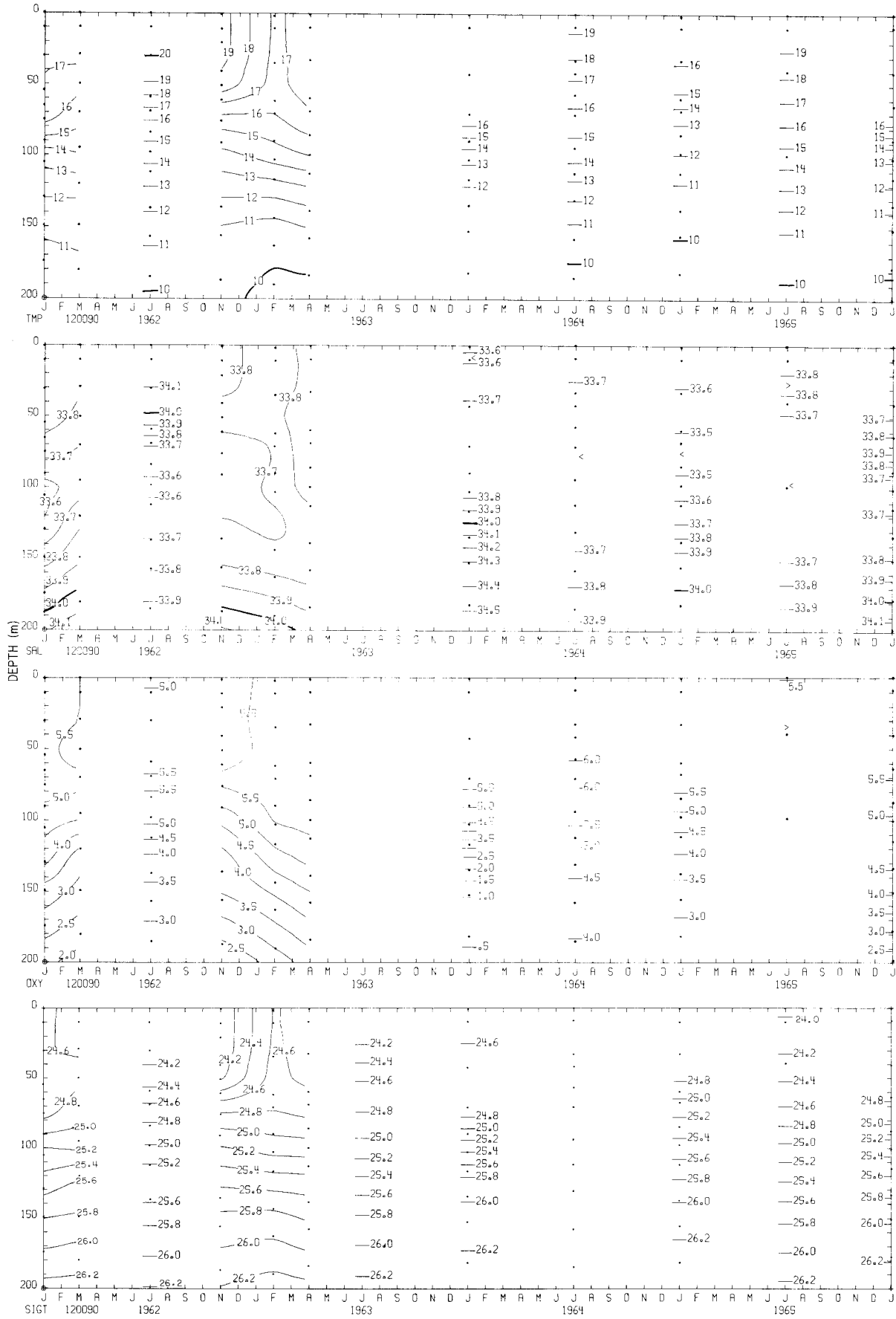


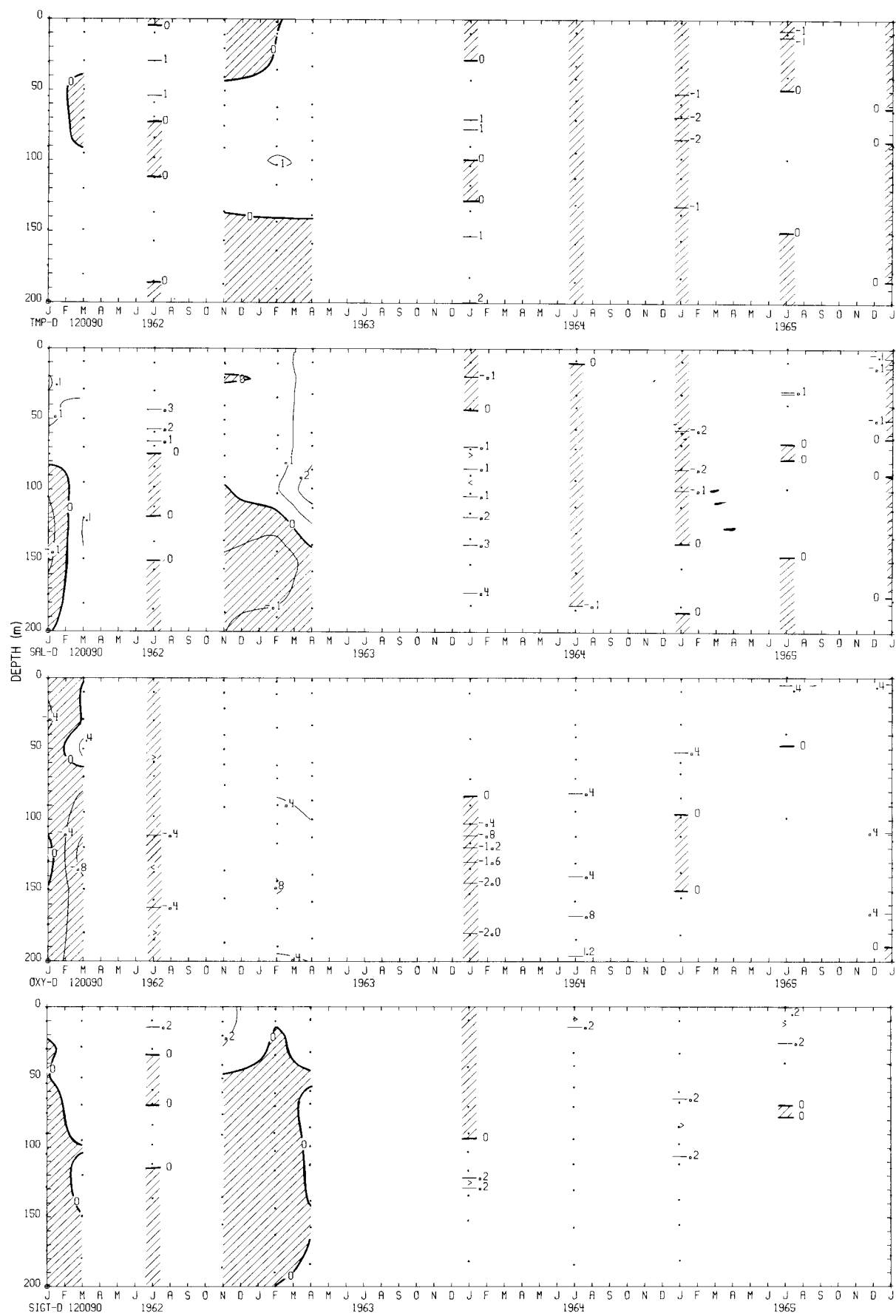


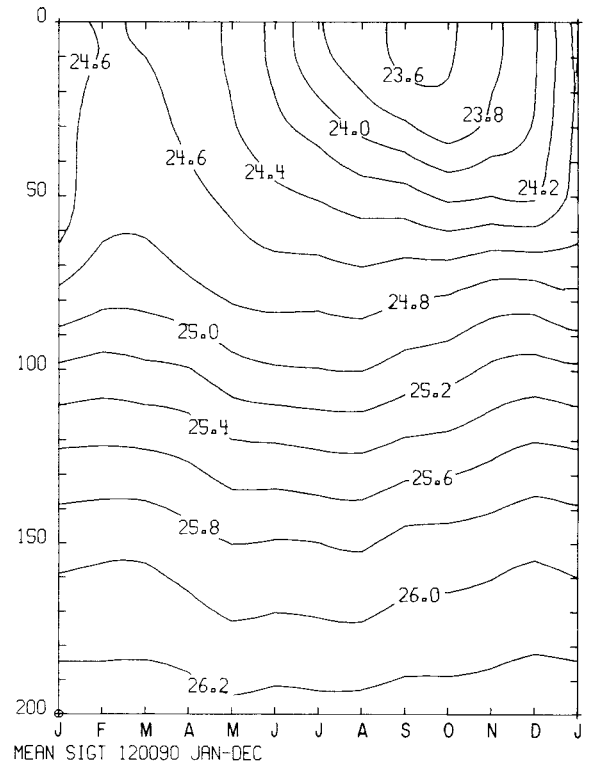
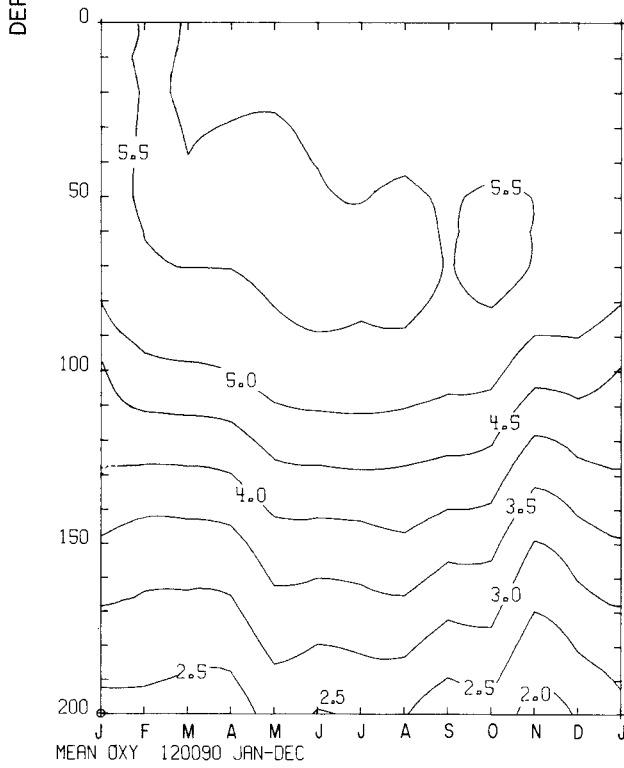
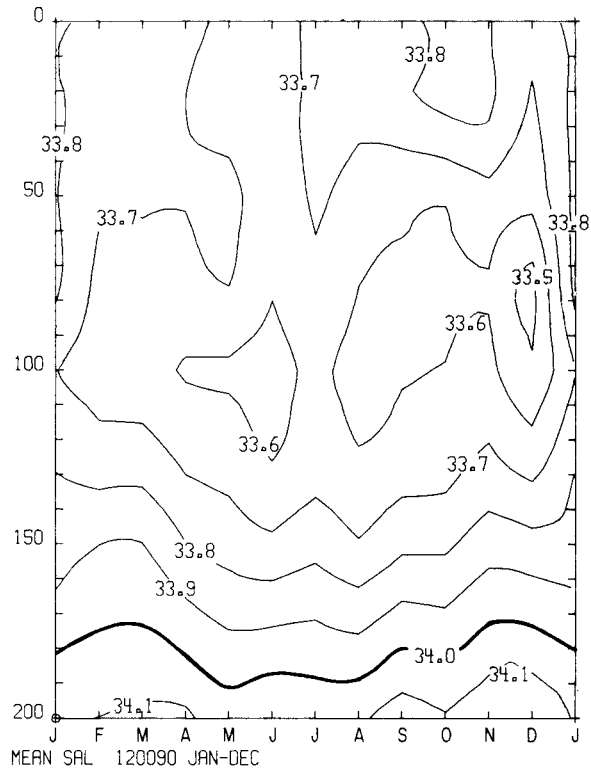
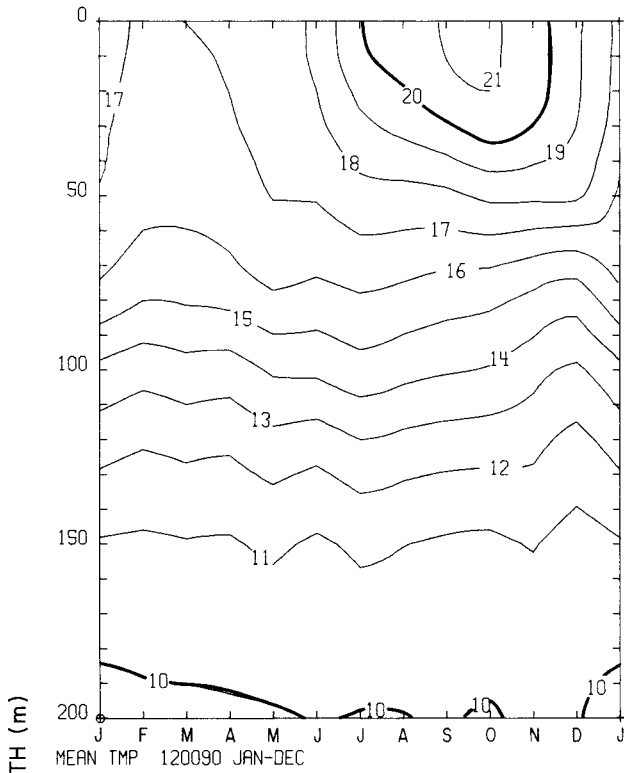


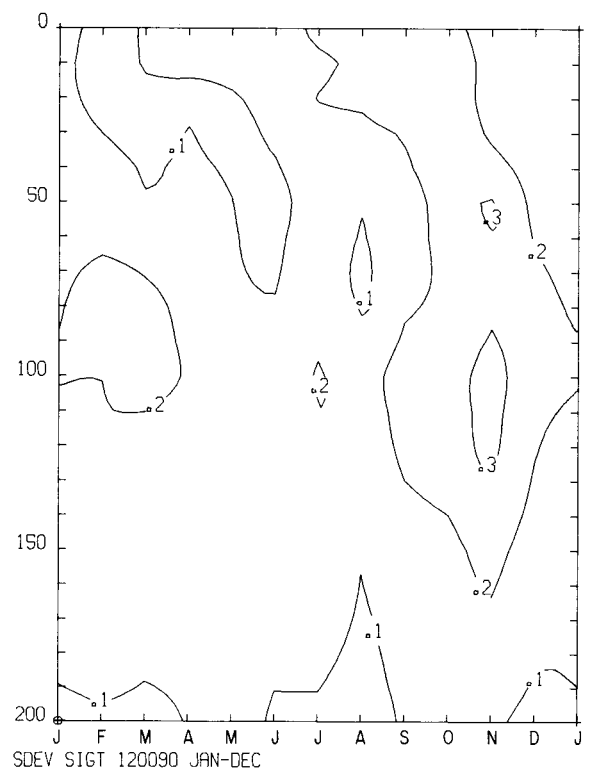
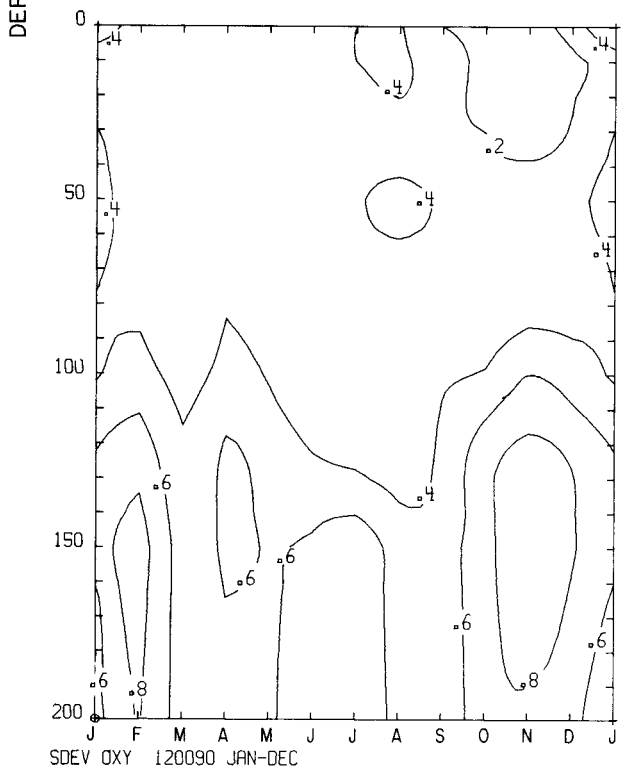
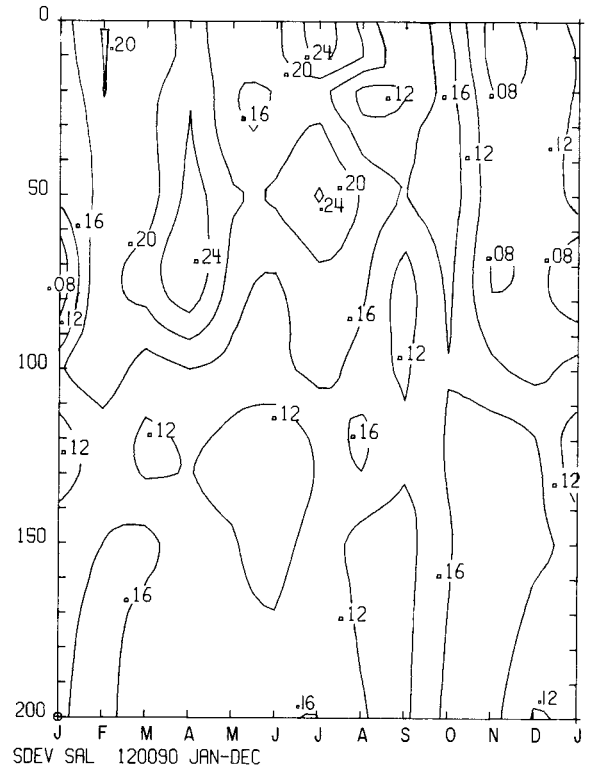
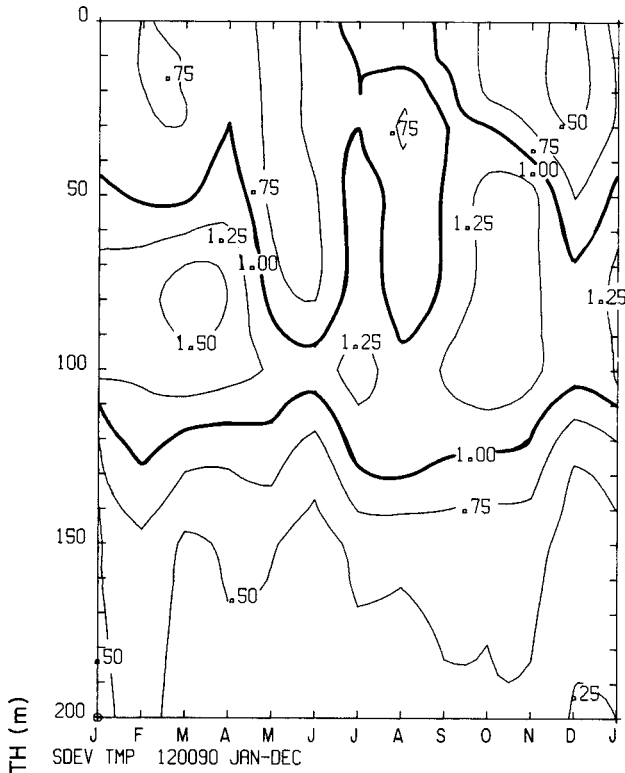




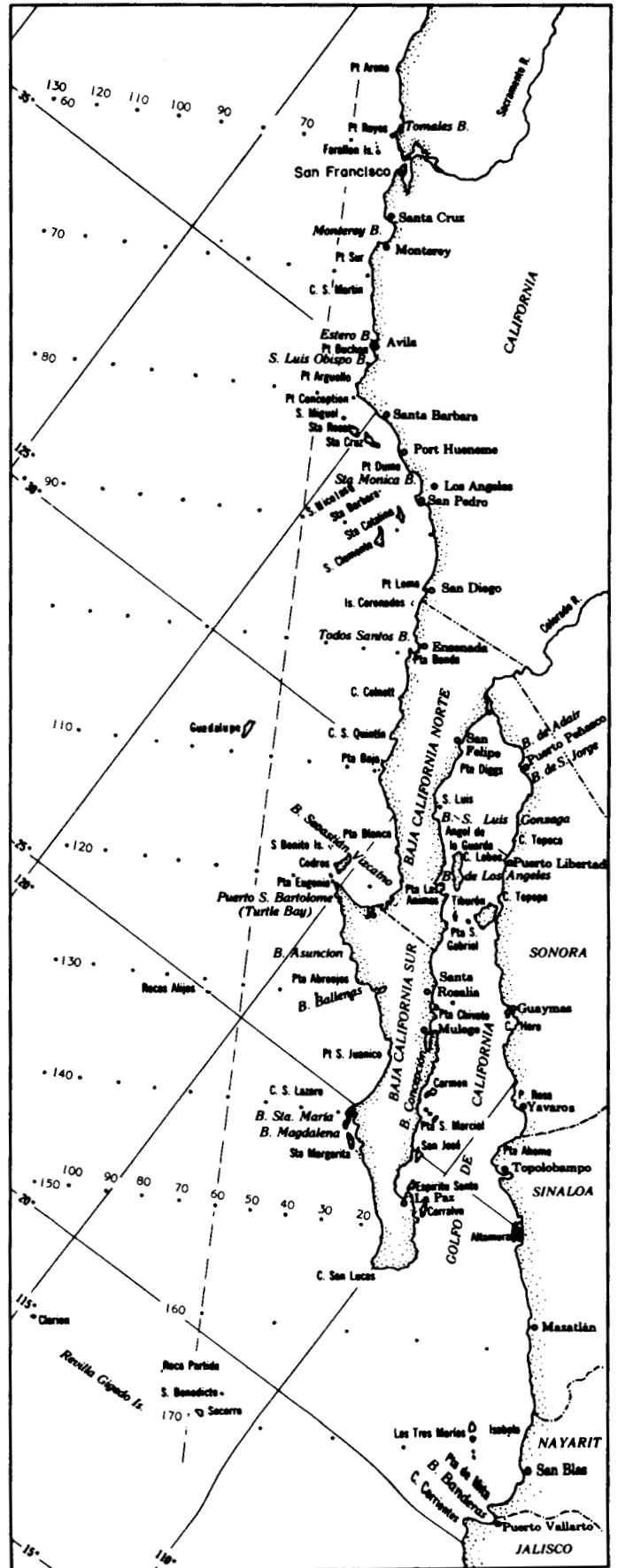
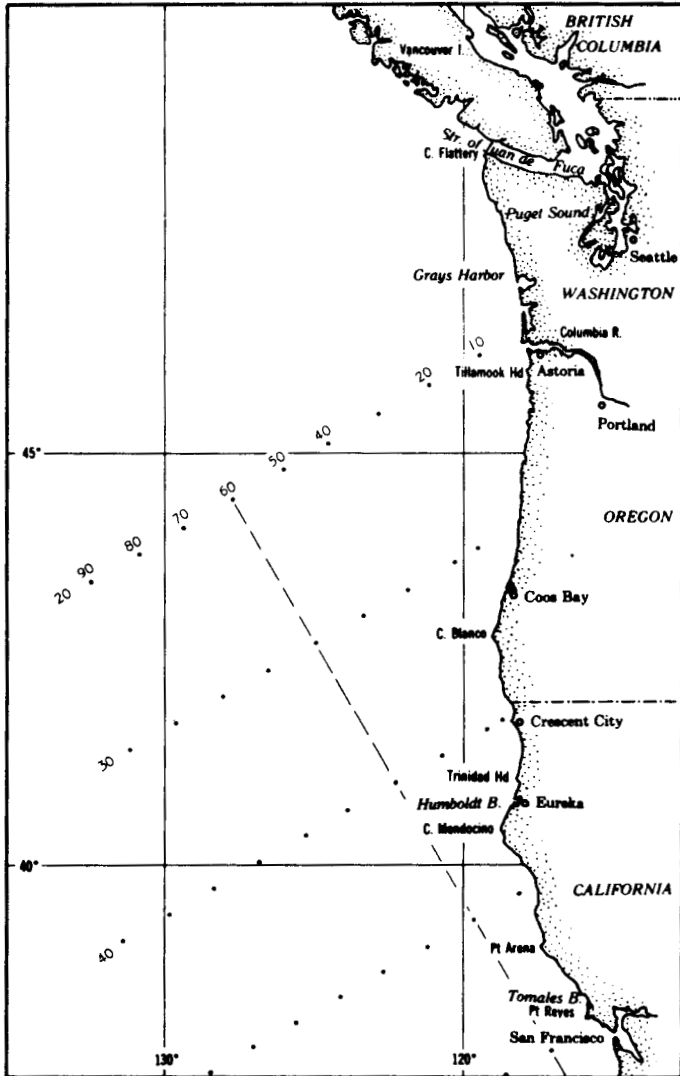












These maps are designed to show essential details of the area most intensively studied by the California Cooperative Oceanic Fisheries Investigations. This is approximately the same area as is shown in color on the front cover. Geographical place names are those most commonly used in the various publications emerging from the research. The cardinal station lines extending southwestward from the coast are shown. They are 120 miles apart. Additional lines are utilized as needed and can be as closely spaced as 12 miles apart and still have individual numbers. The stations along the lines are numbered with respect to the station 60 line, the numbers increasing to the west and decreasing to the east. Most of them are 40 miles apart, and are numbered in groups of 10. This permits adding stations as close as 4 miles apart as needed. An example of the usual identification is 120.65. This station is on line 120, 20 nautical miles southwest of station 60.

The projection of the front cover is Lambert's Azimuthal Equal Area Projection. The detail maps are a Mercator projection.

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