NOAA Technical Memorandum ERL PMEL-98

MEAN SEASONAL CYCLES AND INTERANNUAL VARIATIONS AT 0°, 165°E DURING 1986-1992

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Mean Seasonal Cycles and Interannual Variations at 0°, 165°E during 1986–1992

M. E. McCarty[1] and M. J. McPhaden[2]

Abstract. This report summarizes current meter mooring data at 0°, 165°E in terms of multi-year monthly mean time series and mean seasonal cycles. Data span the years 1986–1992. The measurements consist of surface winds, air temperatures, ocean currents in the upper 300 m and ocean temperatures in the upper 500 m. Supplemental wind data are included from Nauru (0° 32'S, 166° 54'E) for the same time period.

1. INTRODUCTION

Wind, air temperature, ocean temperature and current measurements have been made in the vicinity of 0°, 165°E since the early 1986 from surface moorings deployed as part of the Tropical Ocean-Global Atmosphere (TOGA) program. The mooring site is situated in the western equatorial Pacific warm pool where sea surface temperatures are the highest in the world ocean, and where low frequency zonal current variations are important in displacing the warm pool on time scales relevant to El Niño and the Southern Oscillation (e.g. McPhaden and Picaut, 1990). Portions of the data presented in this report have appeared in previous journal publications and technical reports (e.g. McPhaden *et al.*, 1988; McPhaden and Hayes, 1991; Feng *et al.*, 1991; McPhaden *et al.*, 1992). The purpose of this report is to summarize the time series in terms of monthly means and mean seasonal cycles for the full record length available.

We expect that the analyzed monthly mean data set will be useful for validating ocean general circulation models under development for short term climate prediction. The data should also be valuable as background information for past and future field programs in the western equatorial Pacific, e.g. TOGA-COARE (Webster and Lukas, 1992). In addition, as part of the TOGA Observing Array (National Academy of Science, 1990), a program was begun in 1990 to measure and transmit in real-time moored velocity measurements along the Pacific equator using acoustic Doppler current profilers (McPhaden *et al.*, 1990). It is therefore appropriate to summarize the long records of mechanical current meter data collected in the western equatorial Pacific at this point of technological transition in TOGA mooring programs.

This report complements an earlier report summarizing decadal-long time series at 0°, 110°W and 0°, 140°W (McPhaden and McCarty, 1992). For comparison, record lengths are shorter and interannual variations in some variables are more pronounced at 165°E. Thus, in not all cases will mean seasonal cycles estimated in this report be representative of those based on data from other time periods.

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2. INSTRUMENTATION AND DATA PROCESSING

2.1 Moored Measurements

The moored time series used in this study consist of current, temperature and wind data from a nominal location of 0°, 165°E. The moorings were taut-line surface moorings deployed in depths of about 4400 m. Mooring recoveries and deployments were made at roughly 6 month intervals. The lengths of the moored time series and the depths instrumented are shown in Figure 1. The time series are gappy because of occasional instrument failures. There was no mooring deployed at the site between July 1986 and December 1986. Current velocity and temperature were measured with EG&G Vector Averaging Current Meters (VACMs) and Vector Measuring Current Meters (VMCMs) in the upper 300 m. Speed differences between VACM and VMCM measurements are generally <5 cm s^{-1} (Halpern, 1987), so for the purposes of this study they can be considered interchangeable.

Additional temperature measurements were taken in the upper 500 m using SeaData temperature recorders (TRs), SeaBird SEACATs, and mini-Temperature Recorders (MTRs). TRs were used exclusively until late 1988, at which time SEACATs were introduced at 11 m, 51 m, 101 m, and 201 m. The SEACAT at 201 m was omitted from the mooring in late 1989 and added back in early 1991, along with a SEACAT at 151 m. Each of these SEACATs was positioned 1 m below a current meter. In late 1989 the TRs at 30 m and 75 m were replaced by SEACATs. MTRs designed and built at PMEL replaced the remaining TRs in mid 1991. Instrumental accuracies for SEACAT and MTR temperatures are 0.01°C, whereas accuracy for SeaData temperatures is 0.05°C. During the time period covered by this report VACM temperatures were measured by Yellow Springs Instrument (YSI) model 44032 thermistors which were calibrated at either PMEL or Northwest Regional Calibration Center in Bellevue, Washington (Feng *et al.*, 1991). Calibration procedures did not include correction for temperature dependence of the VACM circuits as described by Trask *et al.* (1989). We have therefore revised our previously published (McPhaden and McCarty, 1992) accuracy estimates of 0.01°C for VACM temperatures to 0.05°C. Because VACM and VMCM temperatures sensors and calibration techniques are comparable we have also revised our estimate of the VMCM temperature accuracies from 0.01°C to 0.05°C.

Air temperatures and SSTs were measured either with a vector averaging wind recorder (VAWR) or an Argos Meteorological Platform (AMP). SST was measured 1 m below the surface using a YSI model 44032 temperature sensor (accuracy of 0.05°C for VAWR measurements, 0.01°C for AMP measurements). Air temperature was measured at 3 m above mean sea level using a YSI model 44032 thermistor in a multi-plated, self-aspirated radiation shield (accuracy of 0.1°C) or by a Rotronic MP-100 humidity temperature probe of similar design (accuracy of 0.2°C). Additional air temperature and SST measurements were made on most buoys by YSI 44204 thermistor networks connected to a Telonics temperature transmitter. Telonics temperatures were used only for time periods when corresponding VAWR or AMP

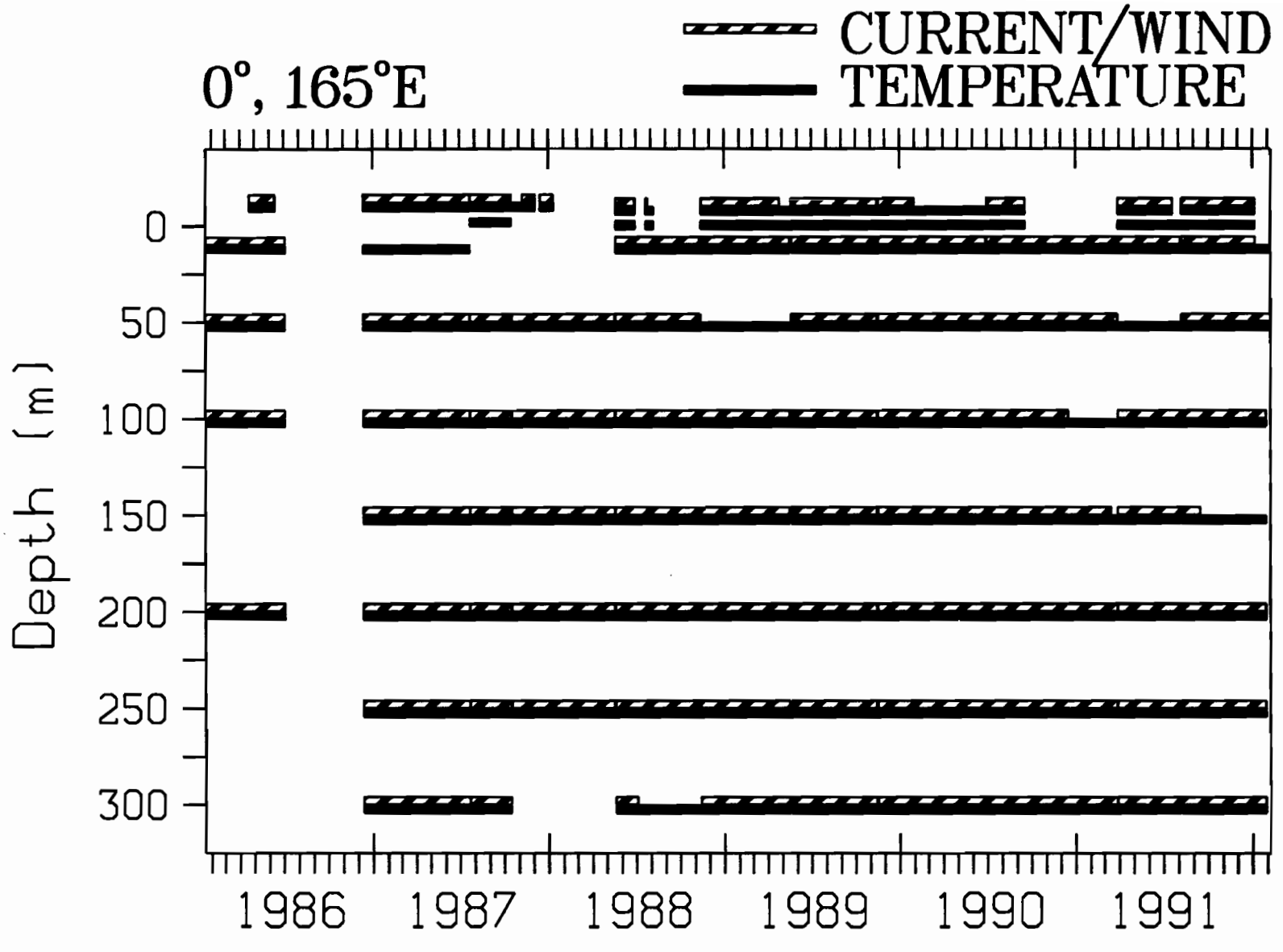

Figure 1a. Bar chart showing velocity and temperature data availability from current meters and from wind recorders as a function of depth at 0°, 165°E.

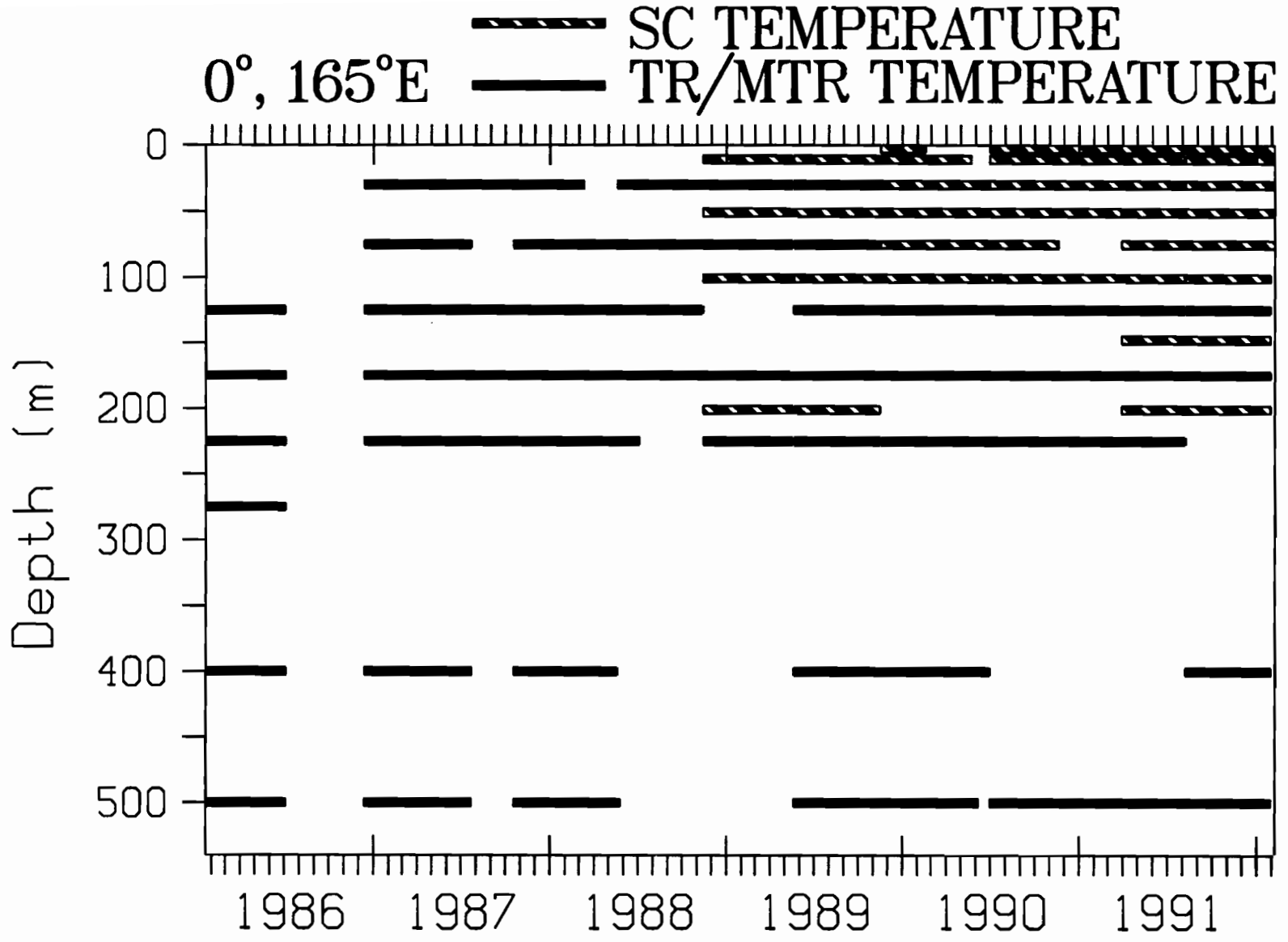

Figure 1b. Bar chart showing availability of temperature data from temperature recorders (TRs), mini-temperature recorders (MTRs), and SEACATs (SCs) at 0°, 165°E. MTRs were deployed for the period 7 August 1991–7 February 1992 at depths of 125 m, 175 m, 400 m, and 500 m.

temperatures were not recorded. In general VAWR/AMP YSI model 44032 and Telonics mean temperatures agreed within 0.1°C (Feng *et al.*, 1991).

Winds from the equatorial current meter mooring were sampled 4 m above the mean water line on the surface toroid with either a VAWR or an AMP. The VAWR is an inverted VACM equipped with a Climet cup model 011-2B three-cup anemometer and pivoted vane (Freitag *et al.*, 1989). The AMP, designed at PMEL to transmit data in real time, is equipped with an R.M. Young model 05103 propeller and vane. Predeployment and postdeployment calibrations for the VAWR and AMP indicate expected instrumental errors in wind speed of about 0.2 m s^{-1}. Comparisons of the two wind systems in a field experiment near 0°, 140°W suggest that for our purposes the cup and vane and the propeller and vane systems can be considered interchangeable (Freitag *et al.*, 1989).

Data were recorded at 15-minute to 2-hour intervals depending on the instrument, then processed to daily averages for subsequent analysis. Gaps of less than 5 days duration were then filled by linear interpolation in time. Further details on data processing procedures can be found in Feng *et al.* (1991).

2.2 Nauru Wind Measurements

Wind time series from the moorings at 0°, 165°E were gappy due to instrument failures and vandalism. Therefore, we have included in this report winds measured nearby from Nauru Island (0° 32'S, 166° 54'E). Winds were measured on the northeast side of the island between January 1986 and February 1989 and on the west side of the island from May 1988 to June 1991. In both cases the wind sensors were located within 50 m of shore. Winds on the northeast side were measured at 10 m height, and those on the west side were measured at 30 m height. Each station was equipped with an RM Young model 05103 propeller and vane. Hourly ensembles (based on 40 minutes of data within the hour) were telemetered in real-time via GOES satellite.

Monthly mean Nauru wind time series superimposed on the 165°E buoy winds for January 1986 to January 1992 (Fig. 2a) show that Nauru wind measurements from the northeast side of the island were severely biased low relative to the buoy winds during periods of westerlies. This bias was due to the presence of a 40 m hill 500 m to the west of the wind sensor (McPhaden *et al.*, 1988). However, easterlies measured from this site were unbiased and representative of open ocean conditions. The site on the west side of the island was instrumented in May 1988 to better sample periods of westerlies; however, easterlies were underestimated at this location, as can be seen from the overlapping Nauru time series between May 1988 and January 1989.

To develop a composite monthly mean Nauru wind time series using data from both sites, we first adjusted the 30 m winds to 10 m anemomenter height assuming neutral stability of the atmospheric boundary layer. This adjustment resulted in less than 10% reduction in speeds from the site on the western side of the island. Then, during periods of easterlies, both zonal and meridional wind components measured on the west side of the island were adjusted using the

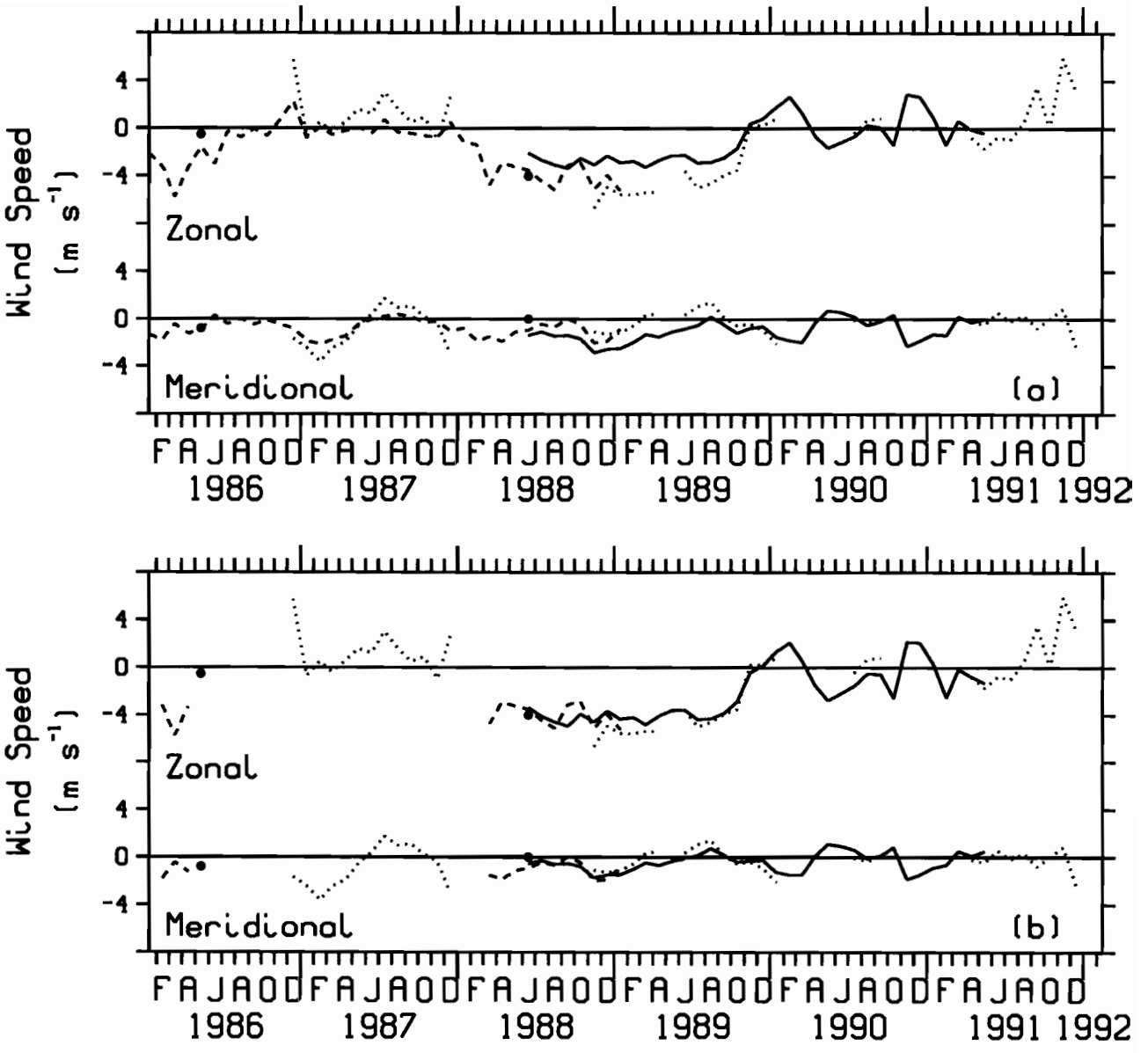

Figure 2. (a) Time series of monthly mean winds calculated from 0°, 165°E mooring data (dotted lines), from data collected on the northeast side of Nauru (dashed lines) and from data collected on the west side of Nauru (solid lines). Solid dots indicate isolated monthly mean mooring winds (May 1986 and June 1988); (b) Time series of edited and adjusted monthly mean Nauru wind time series (solid and dashed lines) superimposed on buoy winds (dotted lines). Processing of the Nauru time series in (b) is described in Section 2.2.

formula $\hat{Y} = aX+b$. The coefficients (a, b) of this equation were determined from a regression fit to daily data (X) from the northeast site during the overlapping measurement period May 1988–February 1989. No additional adjustments were made to winds measured from the west site during periods of westerlies, or from the northeast site during periods of easterlies. Conversely, given the severe topographically induced bias at the northeast site during periods of westerlies, monthly mean winds there were computed only when winds were from the east 25 days or more in a given month.

Edited and adjusted monthly mean Nauru wind time series are shown in Figure 2b. The rms differences (based on 20 months of overlapping data) between the corrected Nauru monthly mean wind time series and the 165°E buoy time series were 0.95 m s^{-1} in the zonal direction and 0.61 m s^{-1} in the meridional direction. The crosscorrelations of the overlapping time series were 0.96 for the zonal component and 0.69 for the meridional component.

3. INTERANNUAL VARIATIONS AND MEAN SEASONAL CYCLES

Daily averaged temperature (T), ocean current and wind velocity data were first block averaged into calendar month means for all months in which 15 days or more of data were available. The more accurate SEACAT temperature records were used in preference to the temperature values from current meters for times and depths where a SEACAT was positioned 1 m below a current meter. For wind speed and pseudostress, daily values were first computed before monthly averaging. Filling and filtering procedures were performed as in McPhaden and McCarty (1992) and briefly described below. Mean seasonal cycles were then calculated by averaging the filled and filtered monthly values across different years.

Estimates of mean seasonal cycles based on buoy winds alone were very noisy because of the gappiness of the buoy wind records. We therefore combined the corrected monthly mean Nauru winds and 165°E buoy winds to estimate mean seasonal cycles. Nauru winds were used only when no buoy winds were available. The resulting mean seasonal cycle calculations were noticeably improved relative to those based on only buoy data.

3.1. Filling gaps

Some data gaps in monthly mean zonal velocity and temperature records were filled by a combination of linear extrapolation and/or interpolation in depth. We used formulae of the form $\hat{Y} = aX_1 + bX_2 + c$ where $\hat{Y}$ is an estimate of the variable Y, and where time series X_1 and X_2 bracket the series Y in depth. In the case of extrapolation, b was set to zero and the coefficients a and c were determined by linear least squares orthogonal regression. For linear interpolation, c was set to zero and the coefficients a and b were weighted by vertical distance from Y. Extrapolation was required for 10 m zonal velocity and SST. Otherwise, different methods of filling were compared and the best estimator was selected for a given depth and variable.

To fill a gap by vertical interpolation or extrapolation, we required, with one exception, that the crosscorrelation of estimated monthly data ($\hat{Y}$) with actual monthly data (Y) be $\geq$0.9. For the 75 m temperature record the crosscorrelation of the estimates with the actual data was 0.8. Using the unfilled 75 m temperature record to calculate the mean seasonal cycles produced an inversion between the 50 m and 75 m values for late summer and early fall and bumpy profiles for several other months. Using the filled 75 m temperature record led to smoother, more realistic profiles. Expected errors (ε) in the estimates were determined by computing the root-mean-square (rms) deviations from measured monthly means, i.e. ε = rms ($\hat{Y}$–Y). These errors were roughly 0.1°C for temperature in the upper 30 m, 0.8°C–1.1°C for temperature between 75 m and 150 m and 0.4°C for temperature at 225 m. The expected analysis error in vertically extrapolated zonal velocities was 7–10 cm s^{-1}. For the data set as a whole, less than 10% of the monthly ocean temperature and zonal velocity estimates were filled by vertical interpolation or extrapolation. For individual depths the highest percentage of filled estimates was 28% (Table 1). Monthly mean meridional velocities were not as highly correlated vertically as temperature or zonal velocity, so no meridional velocity gaps were filled using data from neighboring depths. A one month long gap (May 1988) in the SST record was filled using linear interpolation over time. We made no attempt to interpolate in time across any record gaps longer than one month.

3.2. Filtering

The resulting filled monthly mean time series were smoothed with a 1-2-1 filter in time to eliminate the residual effects of intraseasonal fluctuations in the records. These smoothed time series were then averaged for each month for different years to produce estimates of the mean seasonal cycle. We excluded the 275 m temperature time series from the mean seasonal calculation, since this record contained only 5 months of data, and was much shorter than time series immediately above and below.

4. DATA PRESENTATION

4.1 Plots

Data are presented in the Appendix. Figures A1–A3 show the interpolated and smoothed time series of individual monthly mean ocean temperature and velocity. Dashed lines in these figures indicate values that have been interpolated from adjacent depths. Figure A4 shows corresponding time series plots for wind velocities, wind speeds, wind pseudostresses, and air temperatures. Mean seasonal temperature and velocity time series at each depth are plotted in Figures A5–A7 using cubic spline interpolation between data points; corresponding mean seasonal time series for wind velocities, wind speeds, wind pseudostresses, and air temperatures are shown in Figure A8. Estimated standard errors for each monthly mean are superimposed on these time series, assuming that monthly values from different years are independent Gaussian-distributed

Table 1. Summary of monthly mean estimates for zonal velocity and temperature at 0°, 165°E. "Months of Data" refers to monthly means based on direct measurements at the indicated depths. "Percent Filled" refers to the number of monthly estimates derived by interpolation or extrapolation from neighboring depths as discussed in Section 3.1.

Depth (m)	Number of Monthly Estimates	Months of Data	% Filled
	Zonal Velocity		
10	67	48	28
50	67	58	13
100	64	64	0
150	57	57	0
200	67	67	0
250	62	62	0
300	62	52	16
Total	**446**	**408**	**8**
	Temperature		
SST	67	62	7
10	67	57	15
30	67	59	12
50	67	67	0
75	67	55	18
100	67	67	0
125	67	60	10
150	67	62	7
175	67	67	0
200	67	67	0
225	67	57	13
250	62	62	0
300	55	55	0
400	39	39	0
500	52	52	0
Total	**945**	**888**	**6**

random variables. The standard error is defined as $\sigma/N^{1/2}$, where σ is the estimated standard deviation and N is the number of samples. Standard errors are estimated only when $N > 3$. Both σ and N are listed in Tables A6–A9. The monthly mean time series are contoured in Figure A9. Figure A10 shows climatological monthly mean vertical profiles using cubic spline interpolation between data points indicated on the right axes. Figure A11 shows the corresponding annual averages and standard deviations of the 12 monthly means.

4.2. Tables

The individual monthly means are tabulated in Tables A1–A5. Interpolated values are underlined and a data void is indicated by –999.99. The monthly mean climatologies are tabulated in Tables A6–A9. These tables list monthly means, standard deviations, minima, maxima, skew, number of monthly samples on which the statistics are based (N), and (for zonal velocity and ocean temperature) the number estimates (M) at a particular level before filling by vertical interpolation or extrapolation. Standard deviation in these tables is defined as

$$\sigma = \left[\frac{1}{N-1} \sum_{n=1}^{N} \left(X_n - \bar{X} \right)^2 \right]^{\frac{1}{2}}$$

where X is the variable in question and $\bar{X}$ is its sample mean. Skew, which provides a measure of the symmetry of the probability distribution, is defined as

$$\gamma = \frac{1}{N\sigma^3} \sum_{n=1}^{N} \left(X_n - \bar{X} \right)^3$$

Similar statistical summaries for annual means are presented in Tables A10–A11, in which N = 12 indicates that the statistics are based on the 12 monthly values from the mean seasonal cycle. NTOT in Tables A10–A11 refers to the total number of months of independent data that go into the calculation at each depth.

5. ACKNOWLEDGMENTS

Thanks are extended to Paul Freitag for information about calibration procedures and the Nauru Island wind stations. Thanks also go to Andy Shepherd for information about mooring specifics, and to Jerry Dean of WHOI for advice on the temperature dependence of VACM circuitry. The data were collected under the auspices of the U.S./People's Republic of China Bilateral Air-Sea Interaction Program (1986–1991) and later as part of a French/U.S. cooperative study for TOGA (1991–1992). Principal sponsors of the field work were NOAA's TOGA Project Office (US), the State Oceanic Administration (PRC) and the Institut Français de

Recherche Scientifique pour le Développement en Cooperation/ORSTOM (France). Production of this report was supported by the U.S. TOGA Project Office. Contribution number 218 from the Joint Institute for the Study of the Atmosphere and Ocean.

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APPENDIX

Figures and Tables

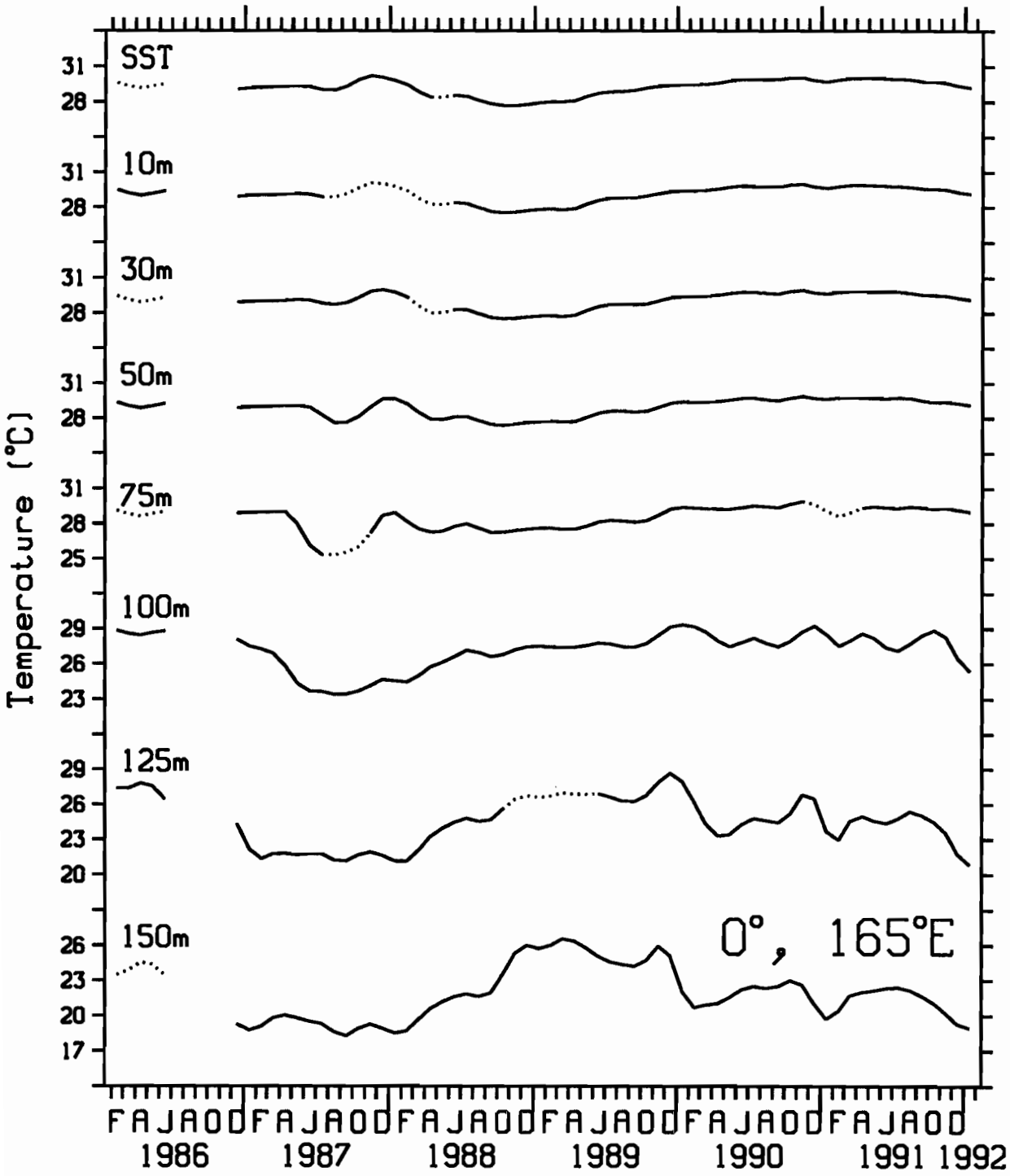

Figure A1. Time series of monthly mean temperatures (in °C) at 0°, 165°E. Dotted lines indicate data that have been filled by vertical interpolation or extrapolation.

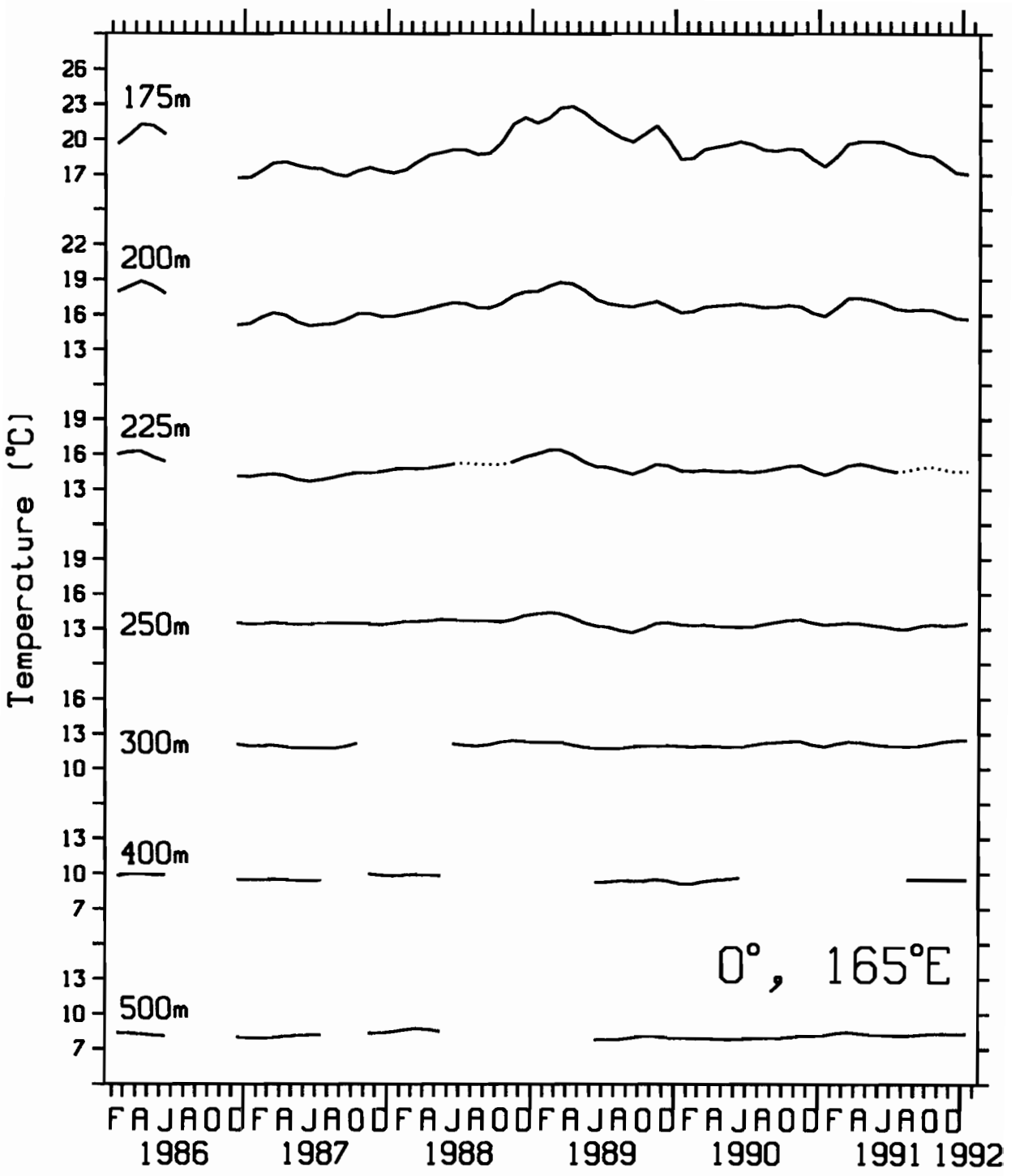

Figure A1. (continued)

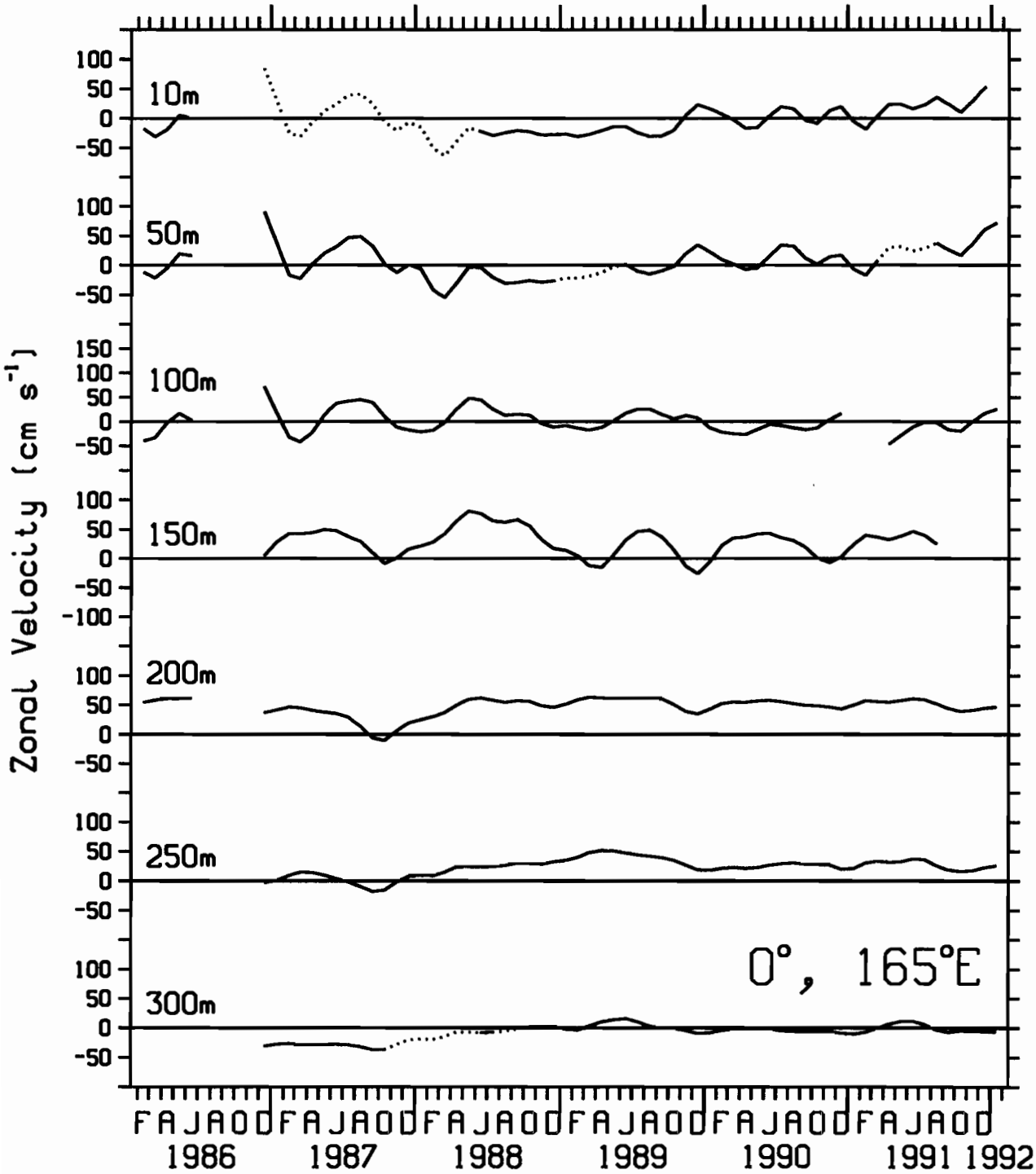

Figure A2. Time series of monthly mean zonal velocities (in cm s^{-1}) at 0°, 165°E. Dotted lines indicate data that have been filled by vertical interpolation or extrapolation.

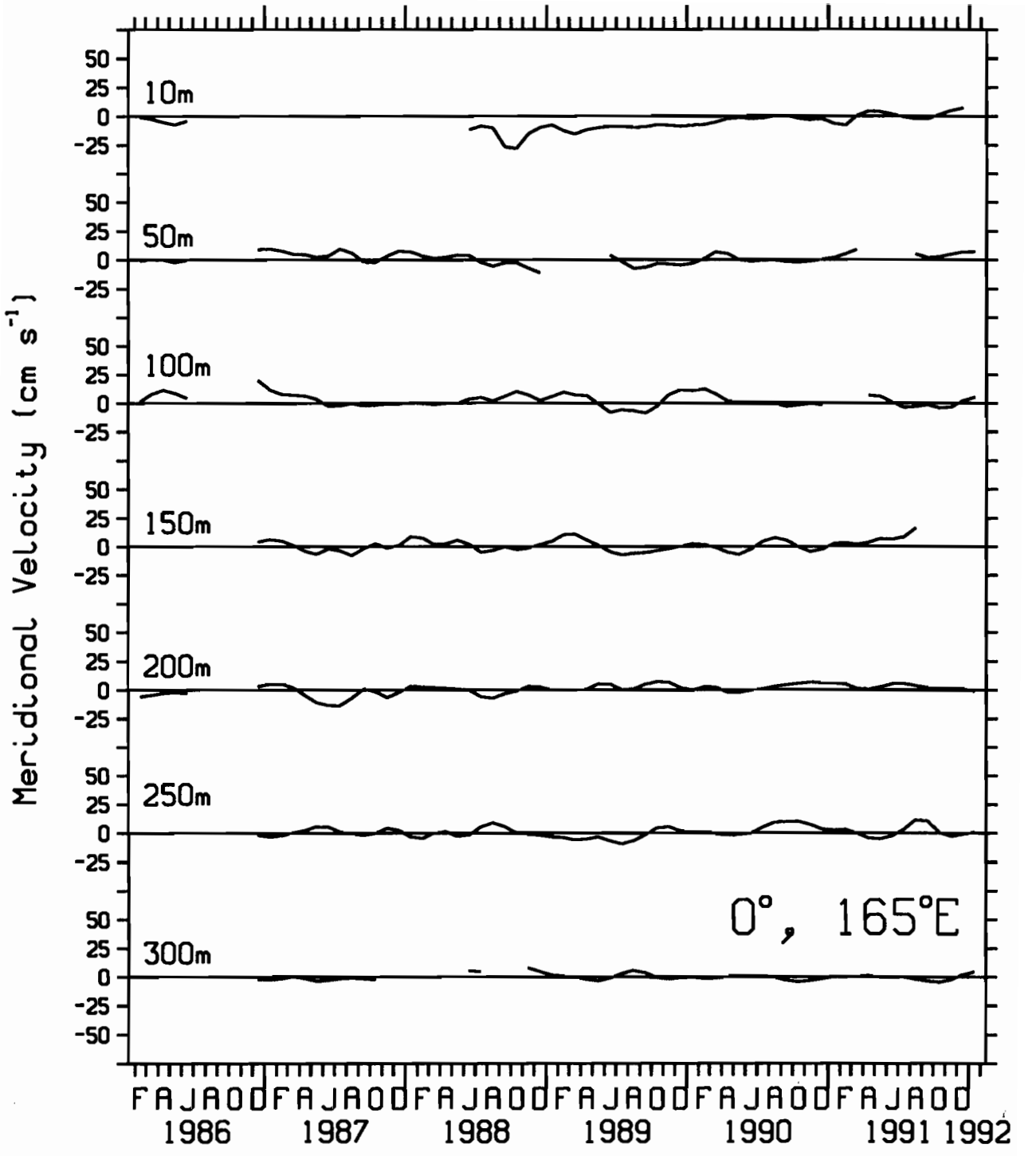

Figure A3. Time series of monthly mean meridional velocities (in cm s^{-1}) at 0°, 165°E.

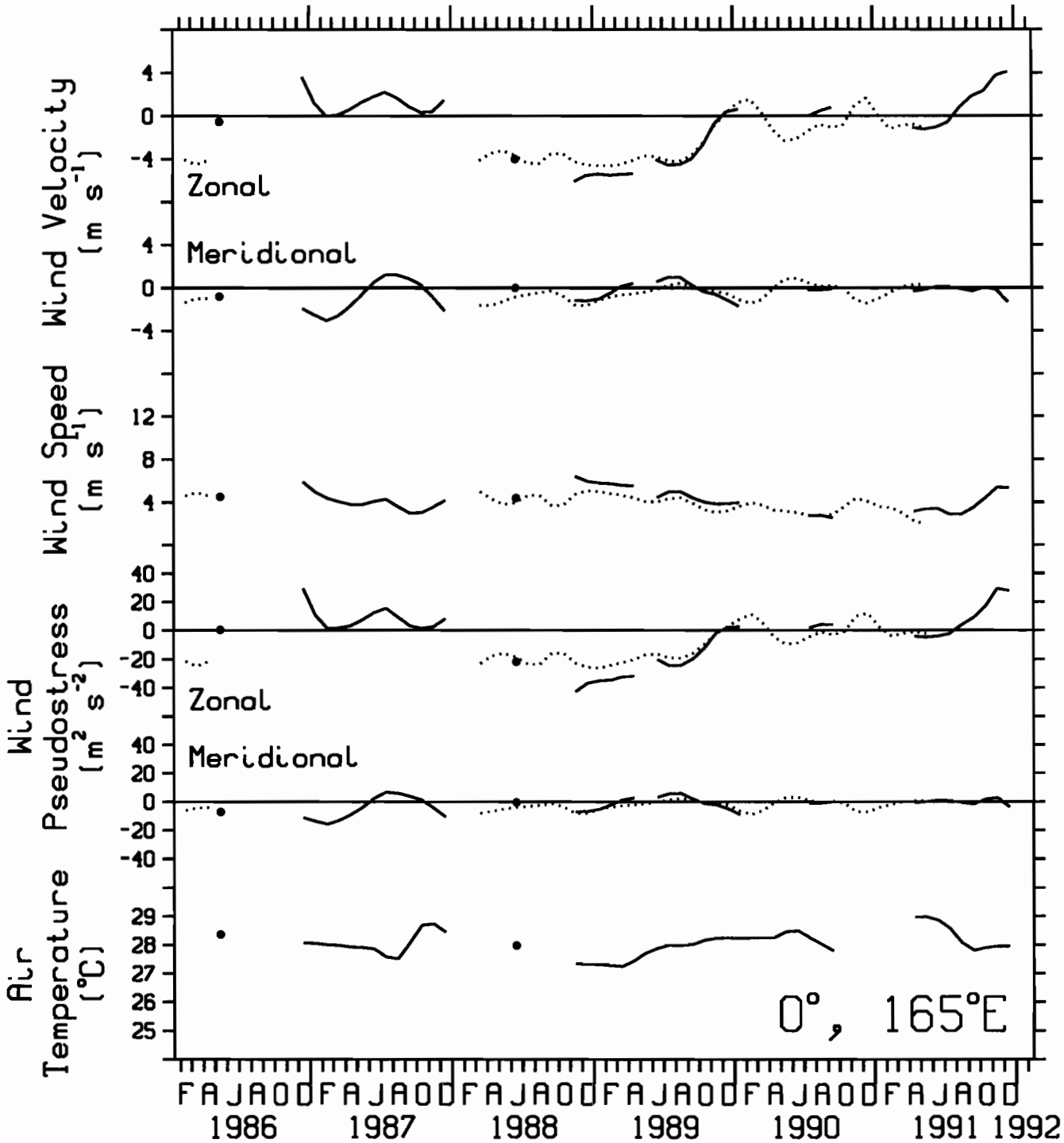

Figure A4. Time series of monthly mean winds and air temperatures at 0°, 165°E (solid) and of monthly mean winds at Nauru (dashed). Solid dots represent isolated monthly means in the 0°, 165°E record.

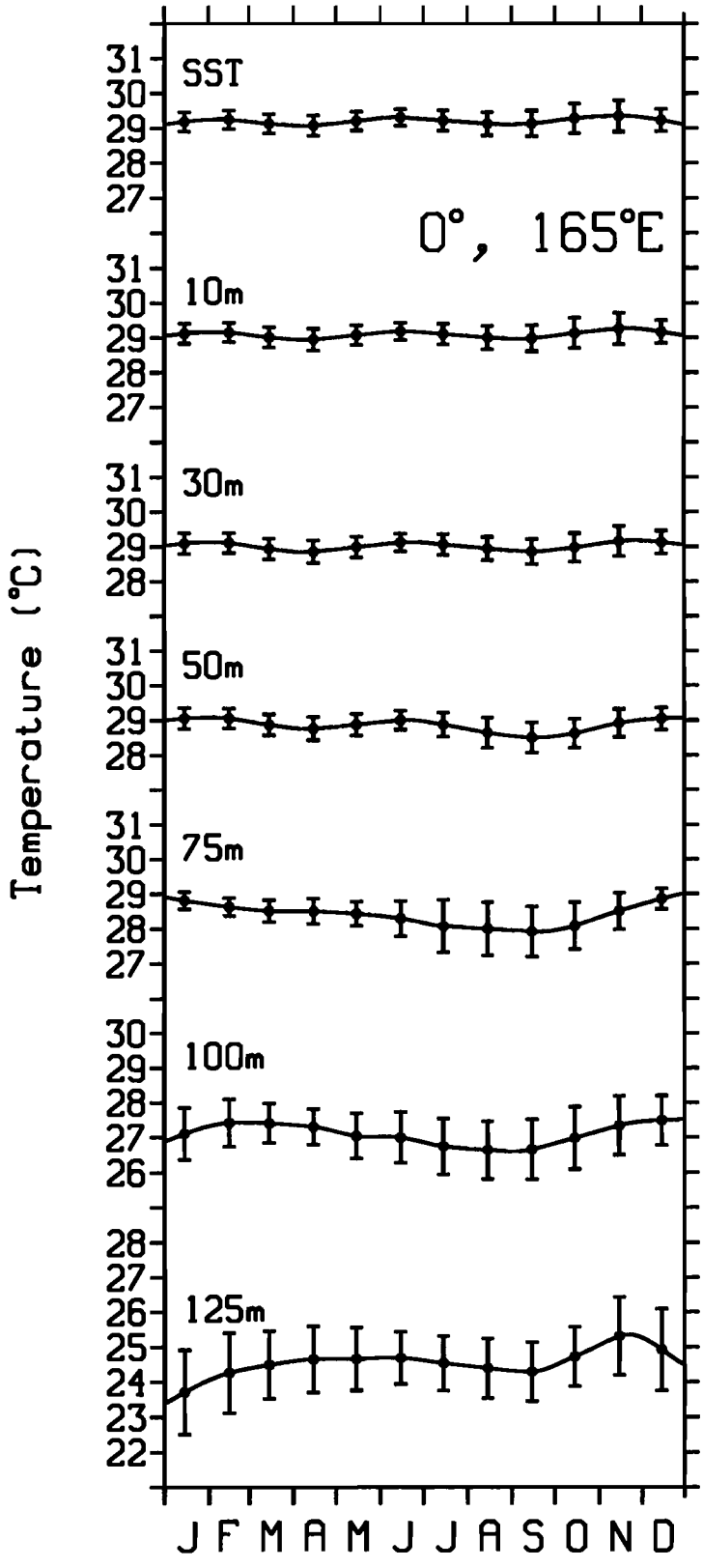

Figure A5. Time series of climatological monthly mean temperatures (in °C) at 0°, 165°E. One standard error is shown for means based on more than 3 estimates.

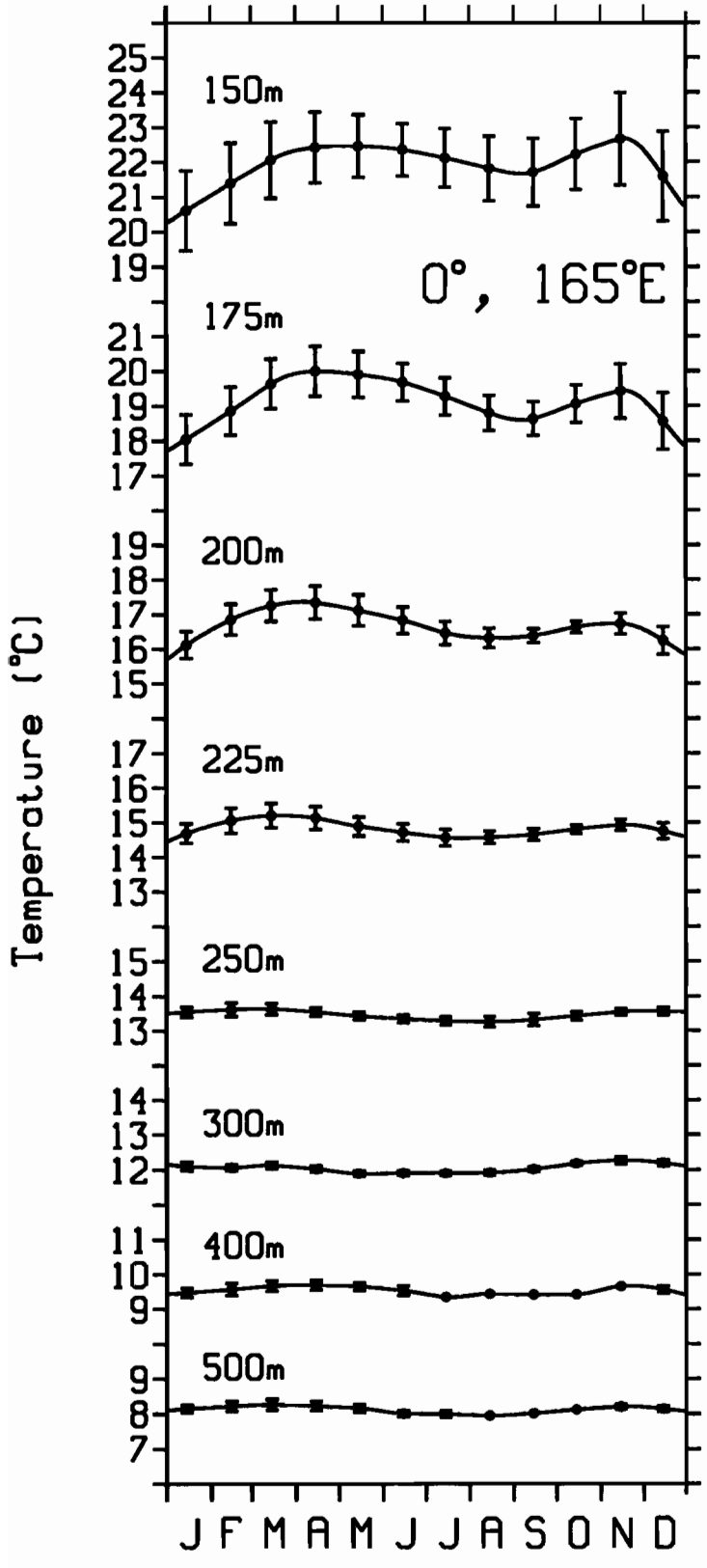

Figure A5. (continued)

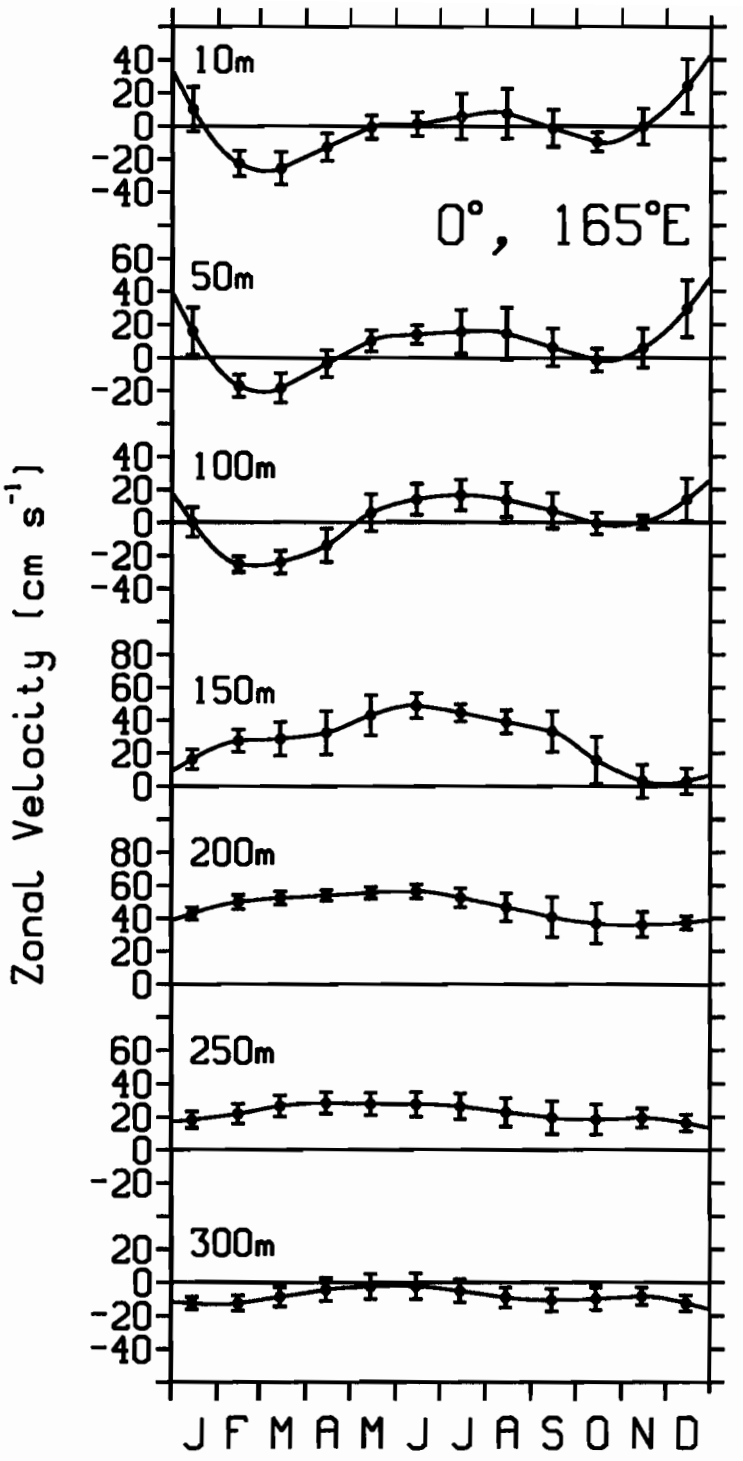

Figure A6. Time series of climatological monthly mean zonal velocities (in cm s^{-1}) at 0°, 165°E. One standard error is shown for means based on more than 3 estimates.

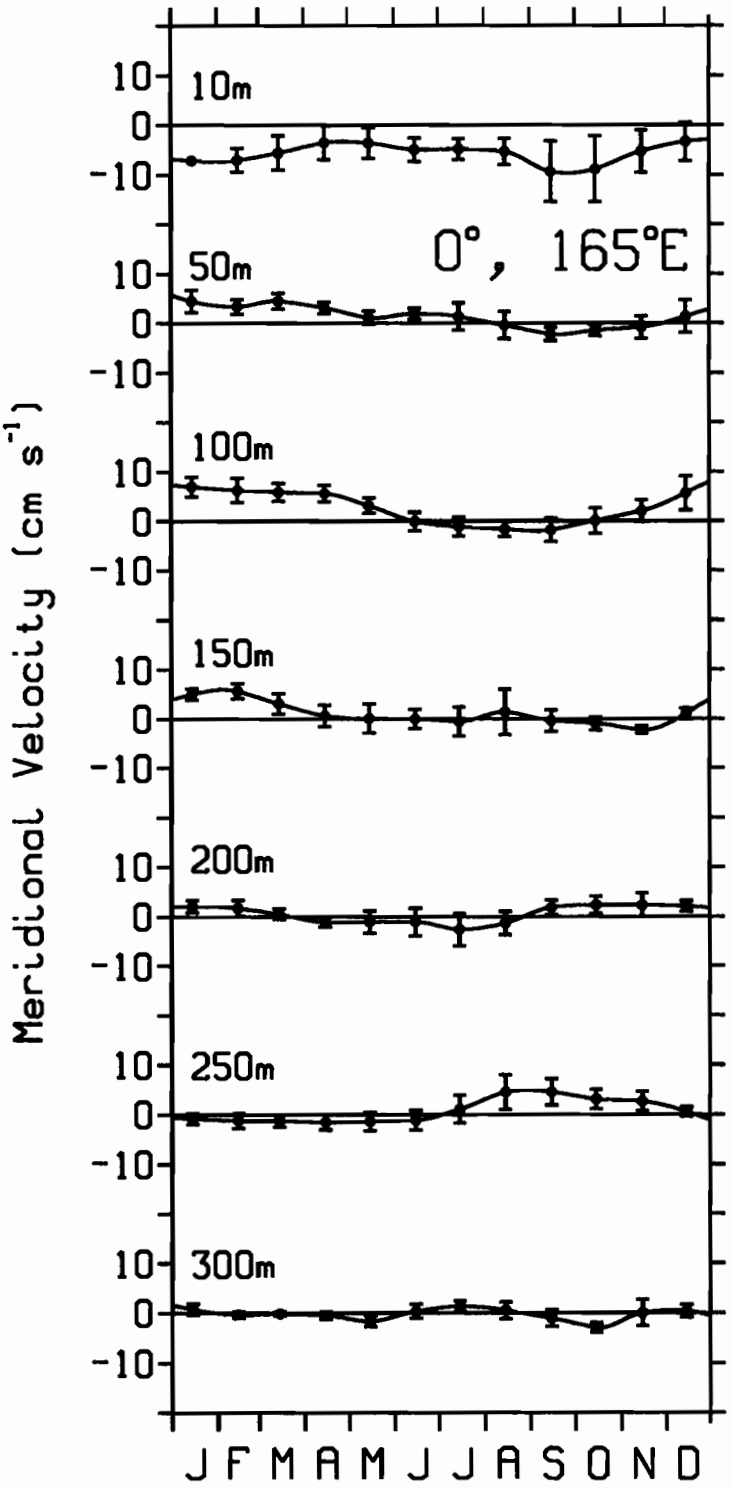

Figure A7. Time series of climatological monthly mean meridional velocities (in cm s^{-1}) at 0°, 165°E. One standard error is shown for means based on more than 3 estimates.

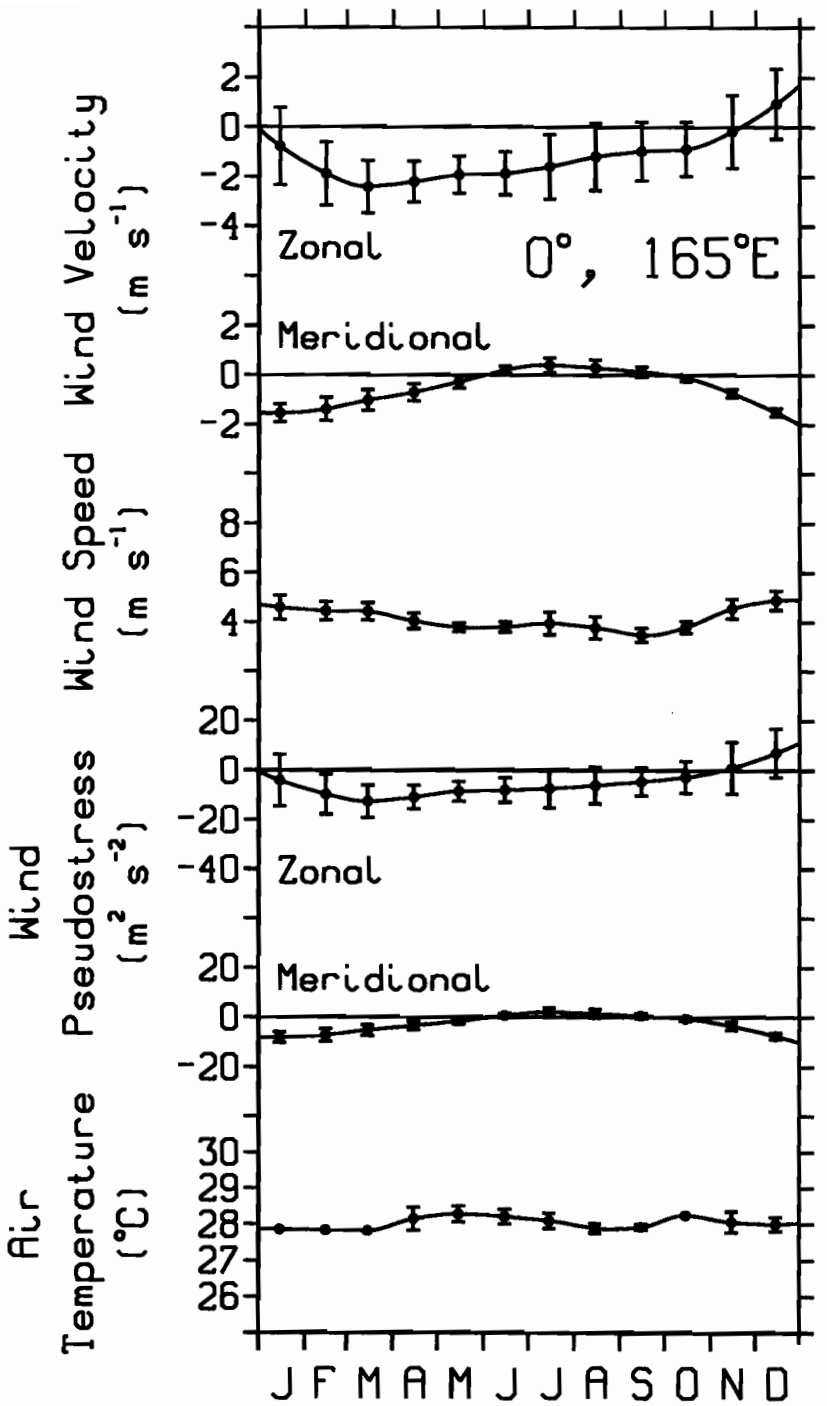

Figure A8. Time series of climatological monthly mean winds and air temperatures at 0°, 165°E. One standard error is shown for means based on more than 3 estimates.

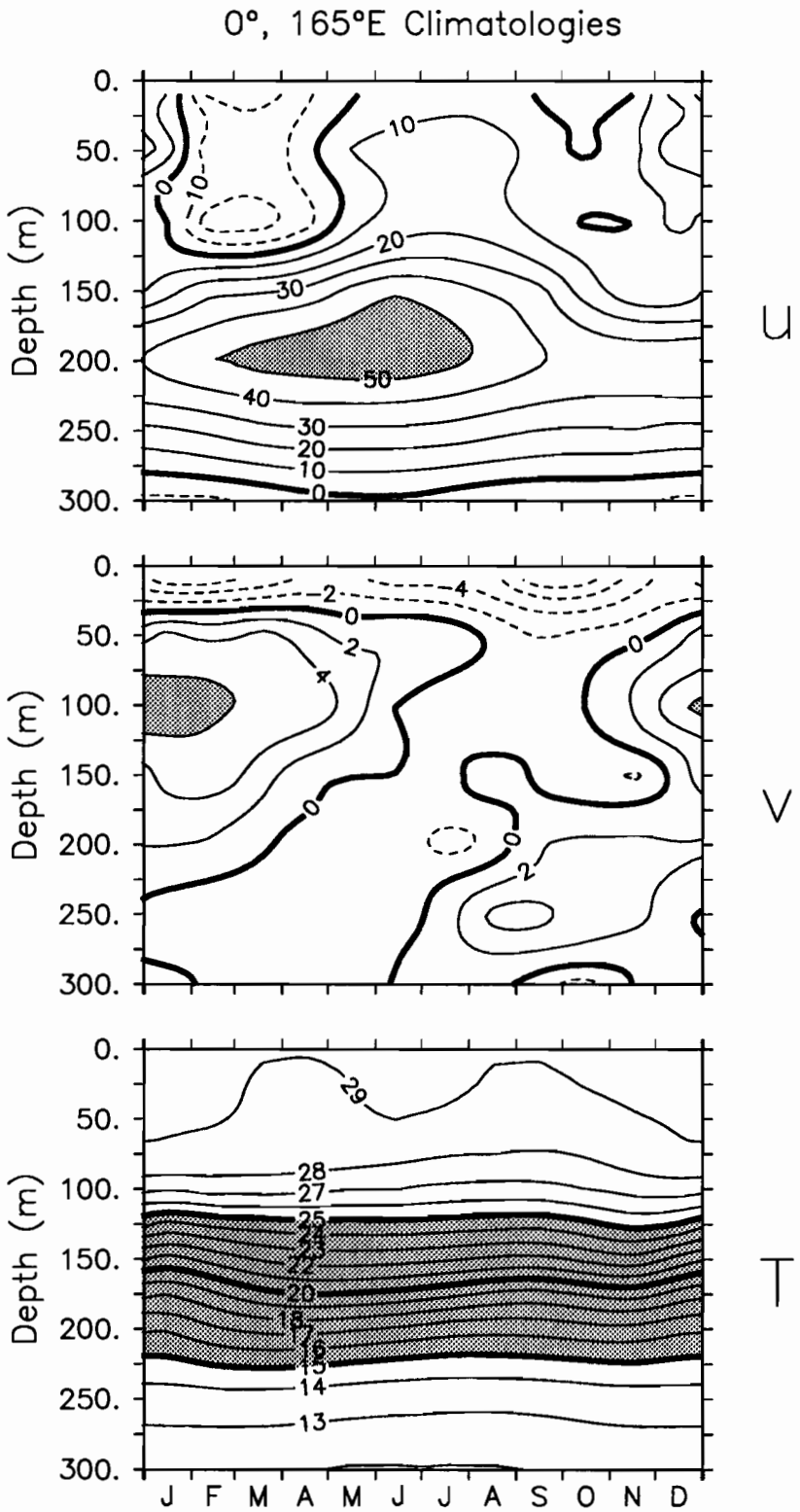

Figure A9. Contoured time series of zonal velocity (u), meridional velocity (v) and temperature (T) at 0°, 165°E. Velocities are in cm s^{-1} and temperature is in °C. Dashed contours are for westward or southward flow. Shading highlights zonal velocities >50 cm s^{-1}, meridional velocities > 6 cm s^{-1}, and temperatures between 15°–25°C.

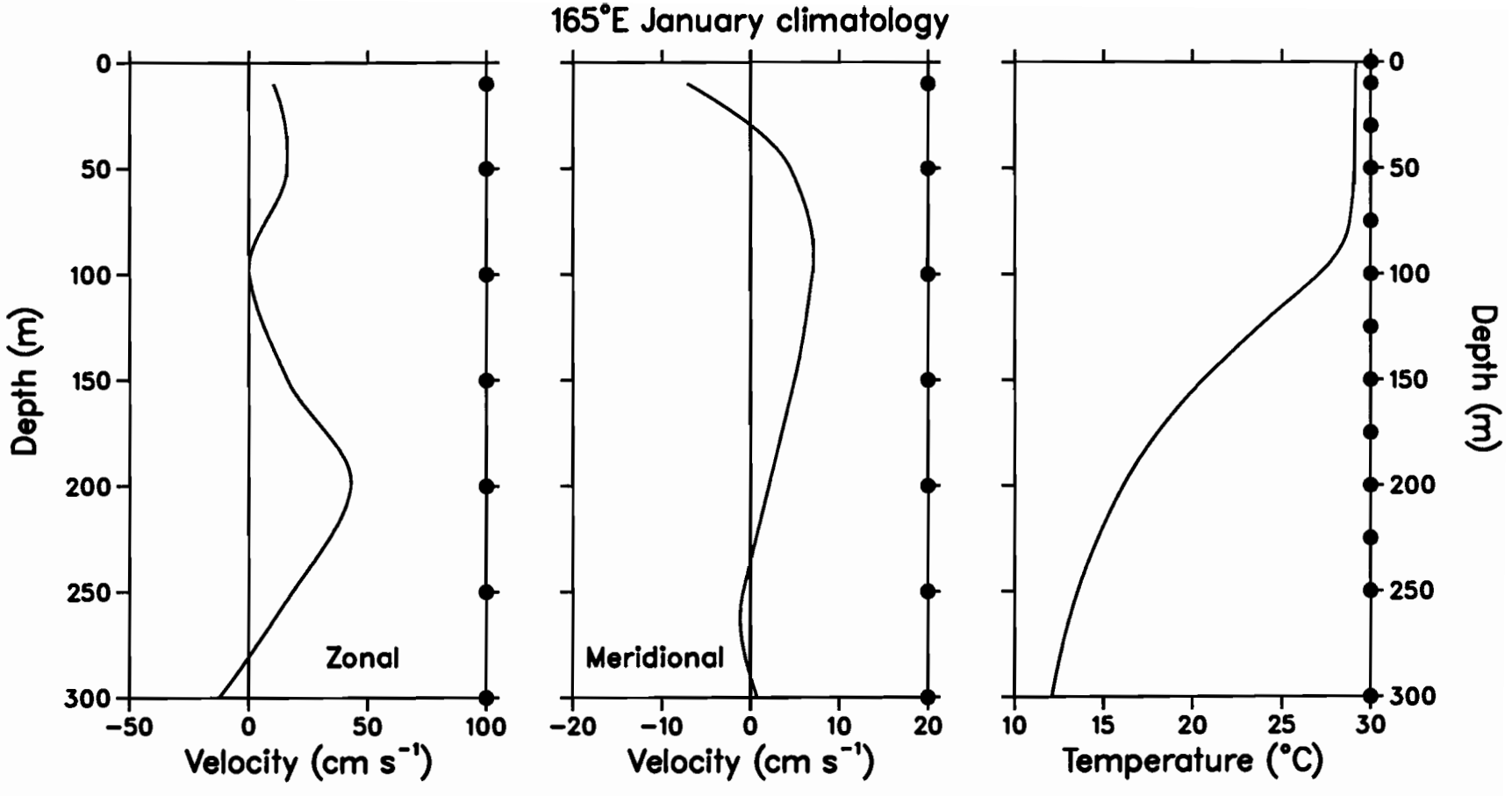

Figure A10. Climatological monthly mean profiles of zonal velocity, meridional velocity, and temperature at 0°, 165°E. Solid circles on the left axes indicate standard depths on which the profiles are based.

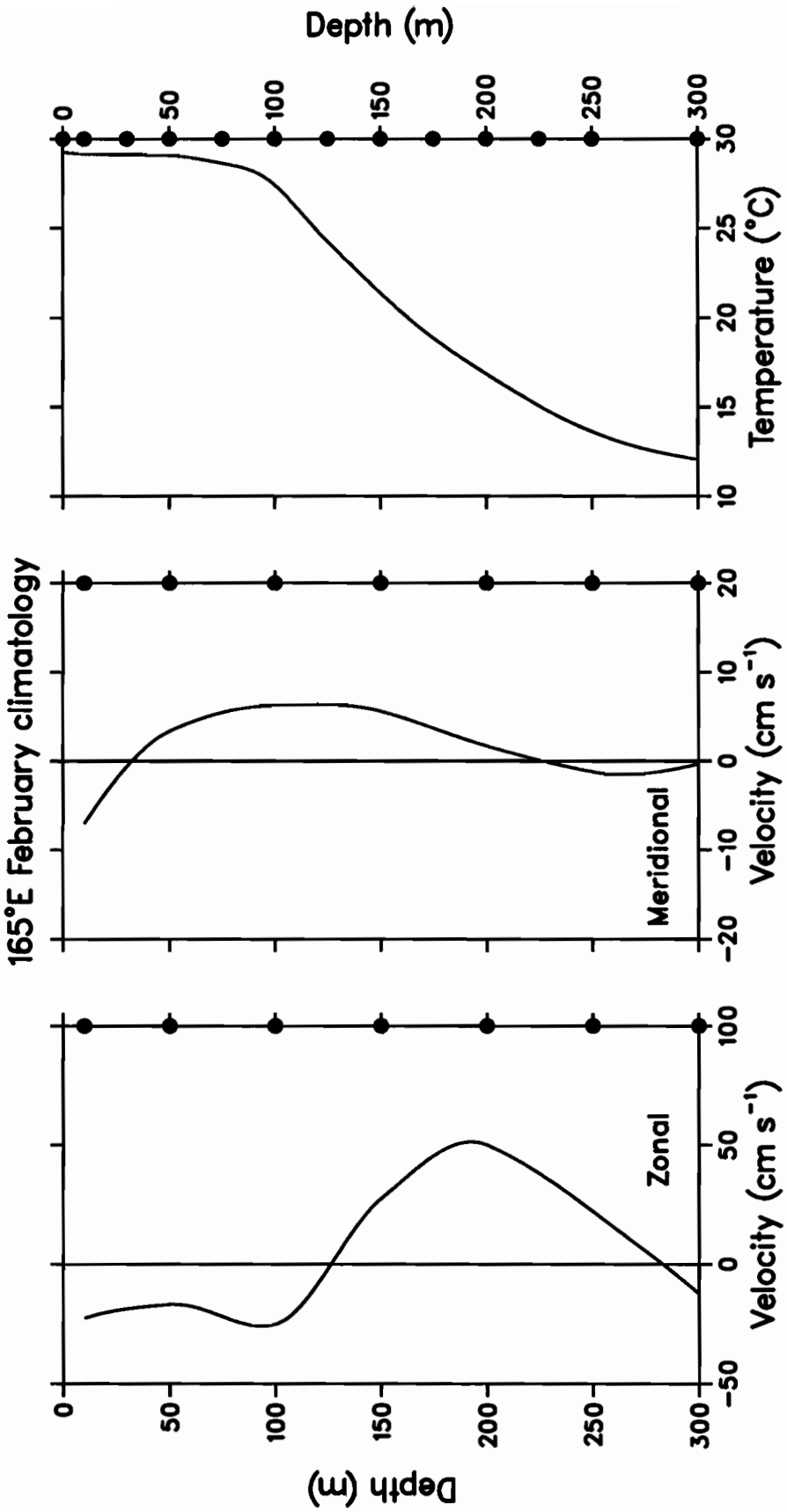

Figure A10. (continued)

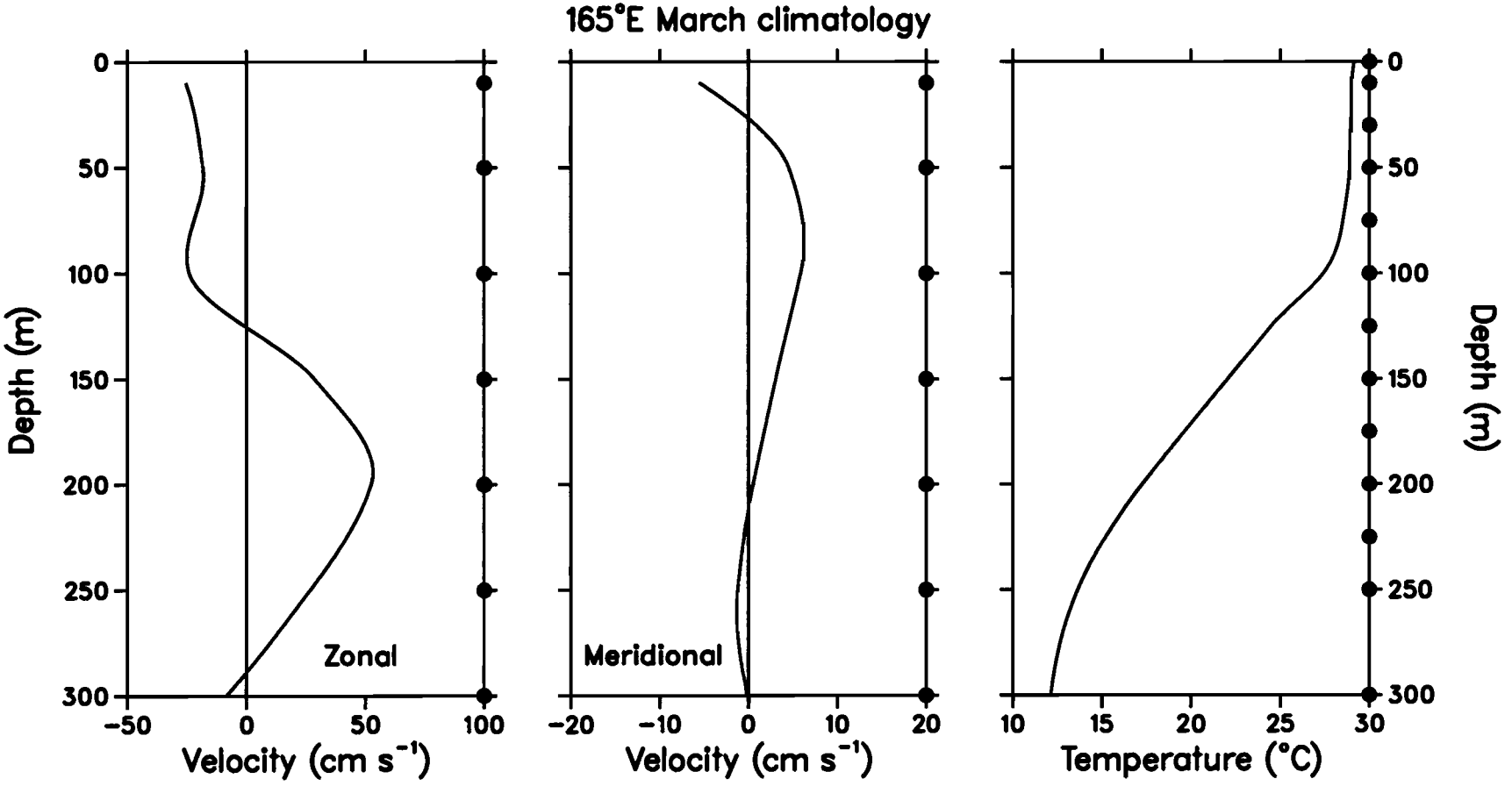

Figure A10. (continued)

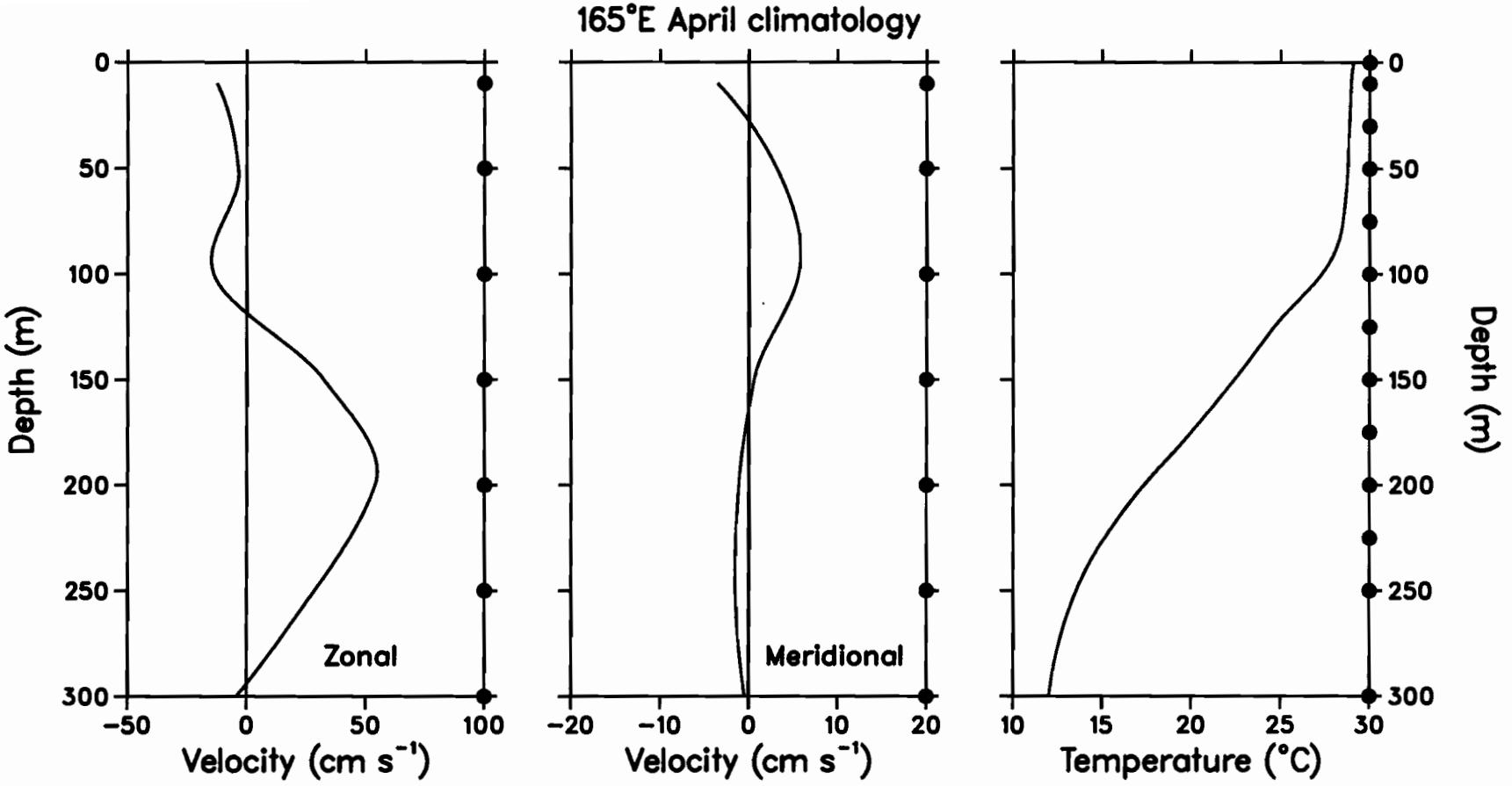

Figure A10. (continued)

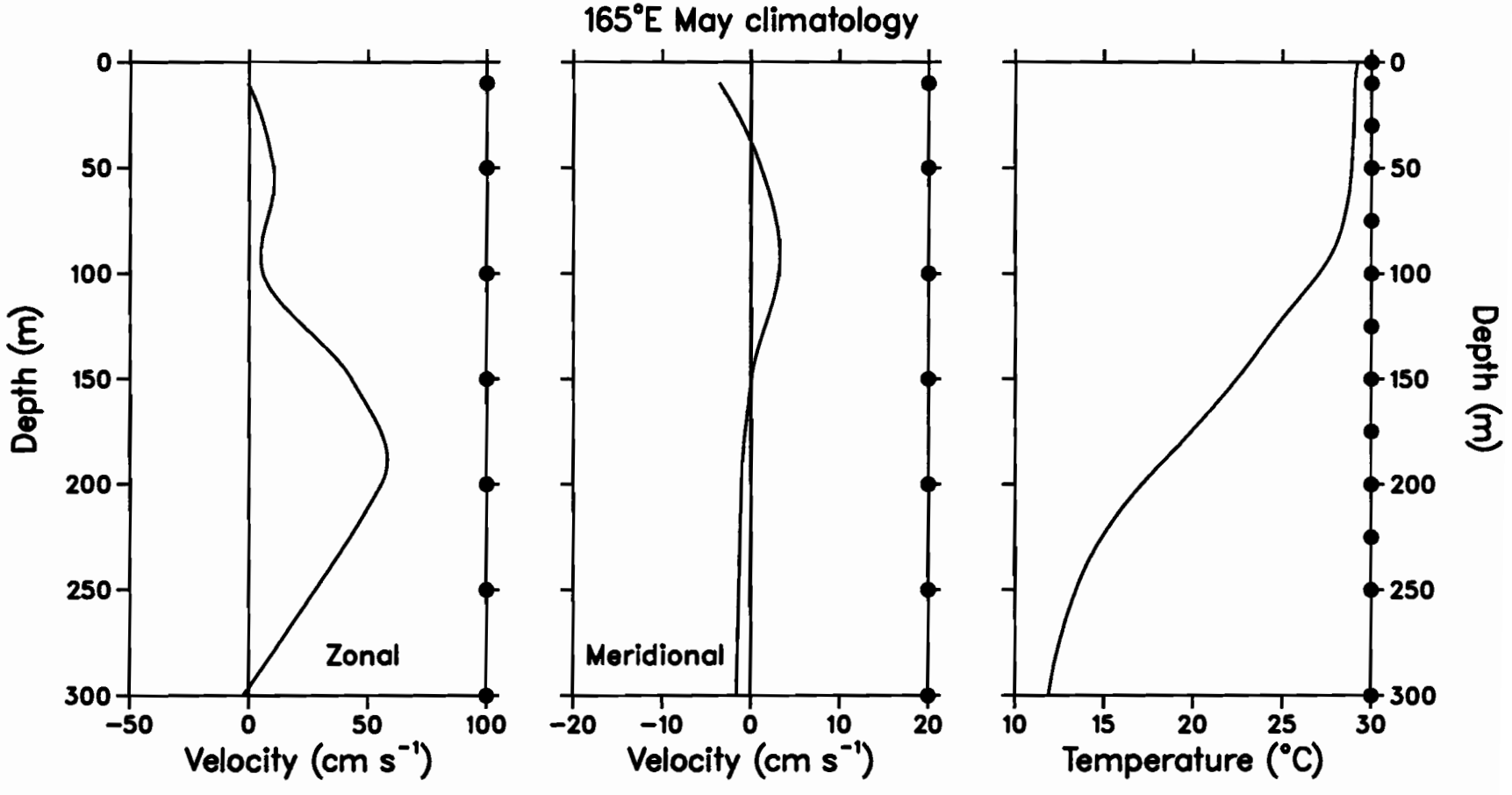

Figure A10. (continued)

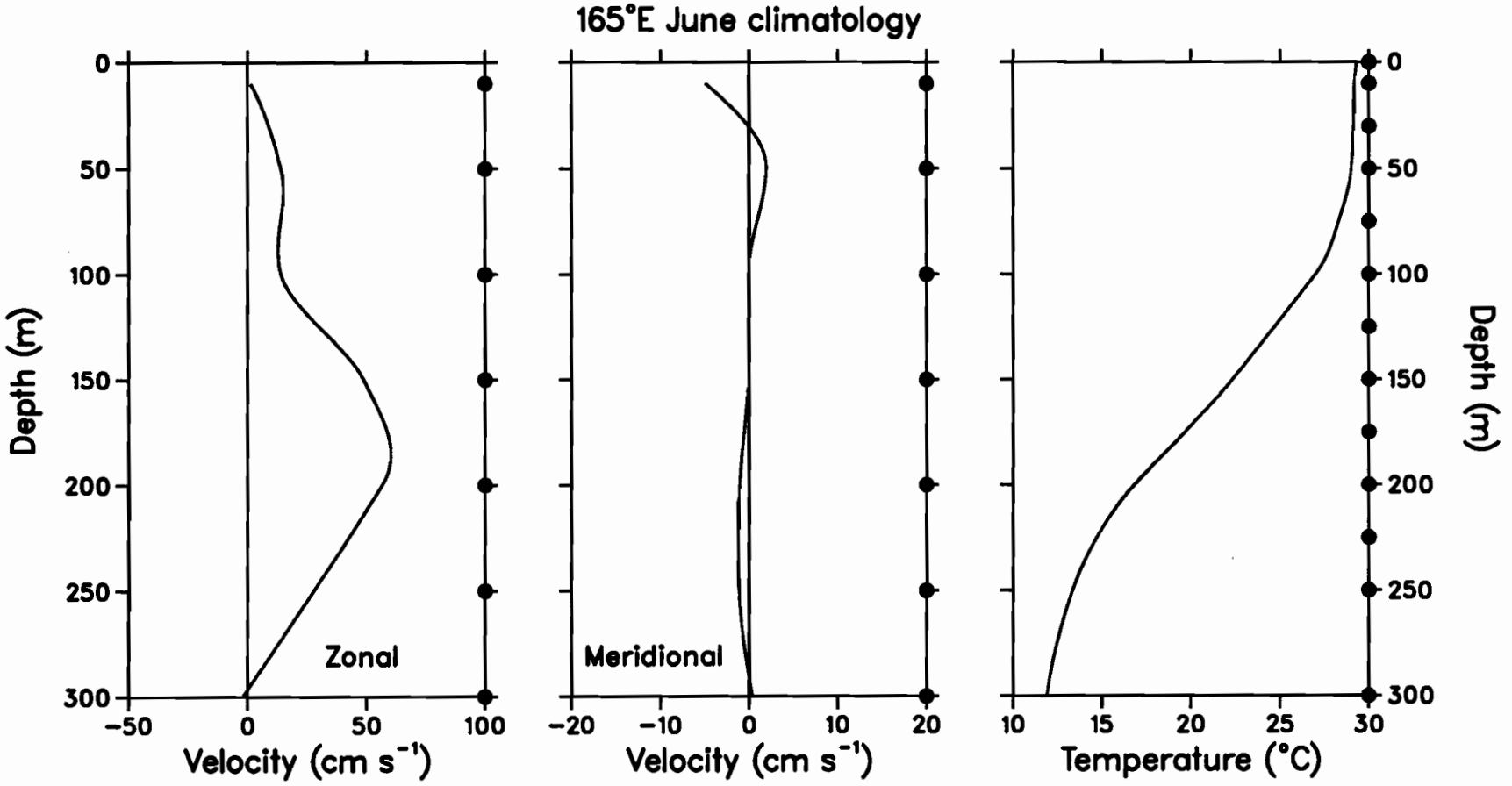

Figure A10. (continued)

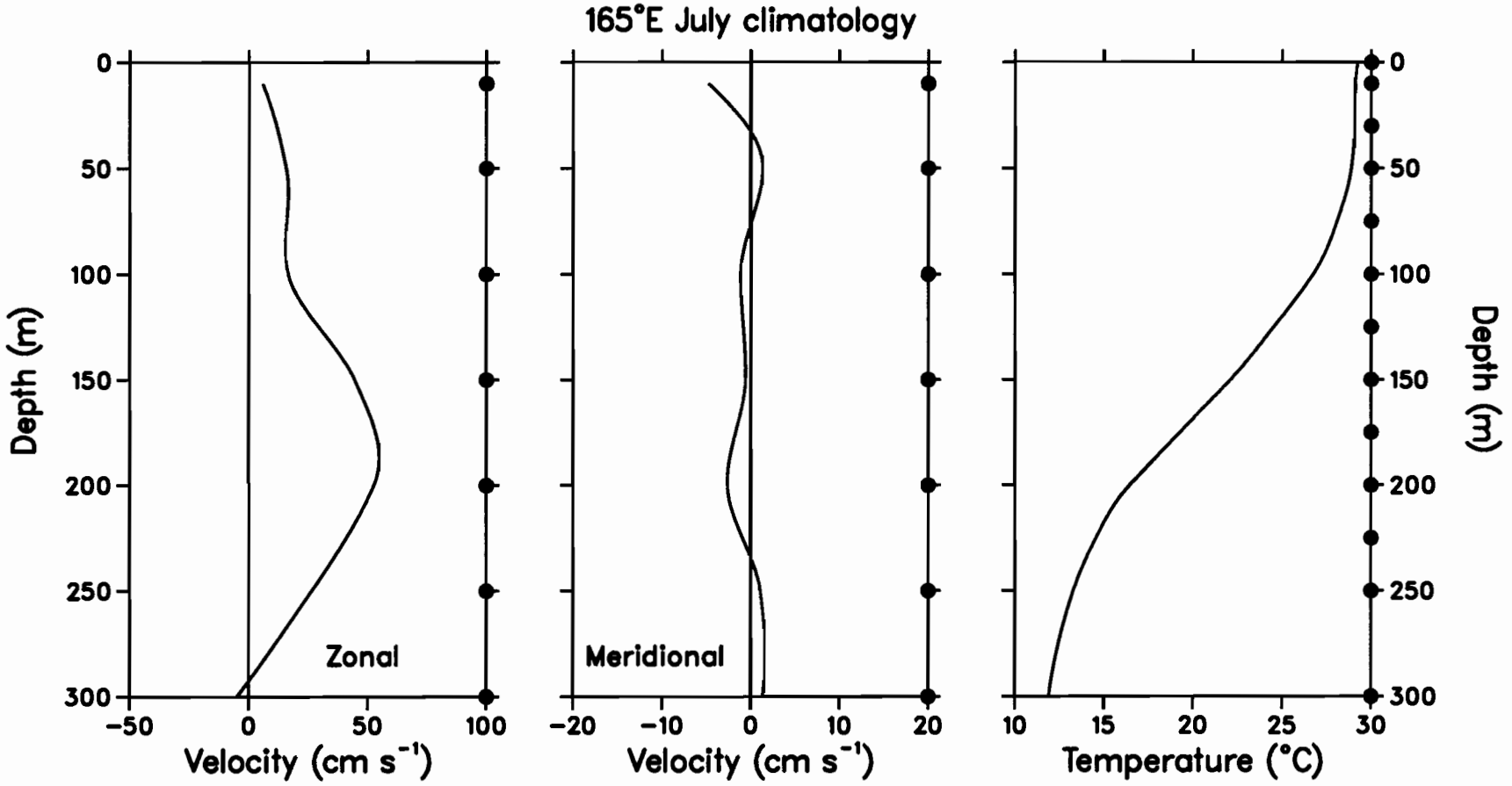

Figure A10. (continued)

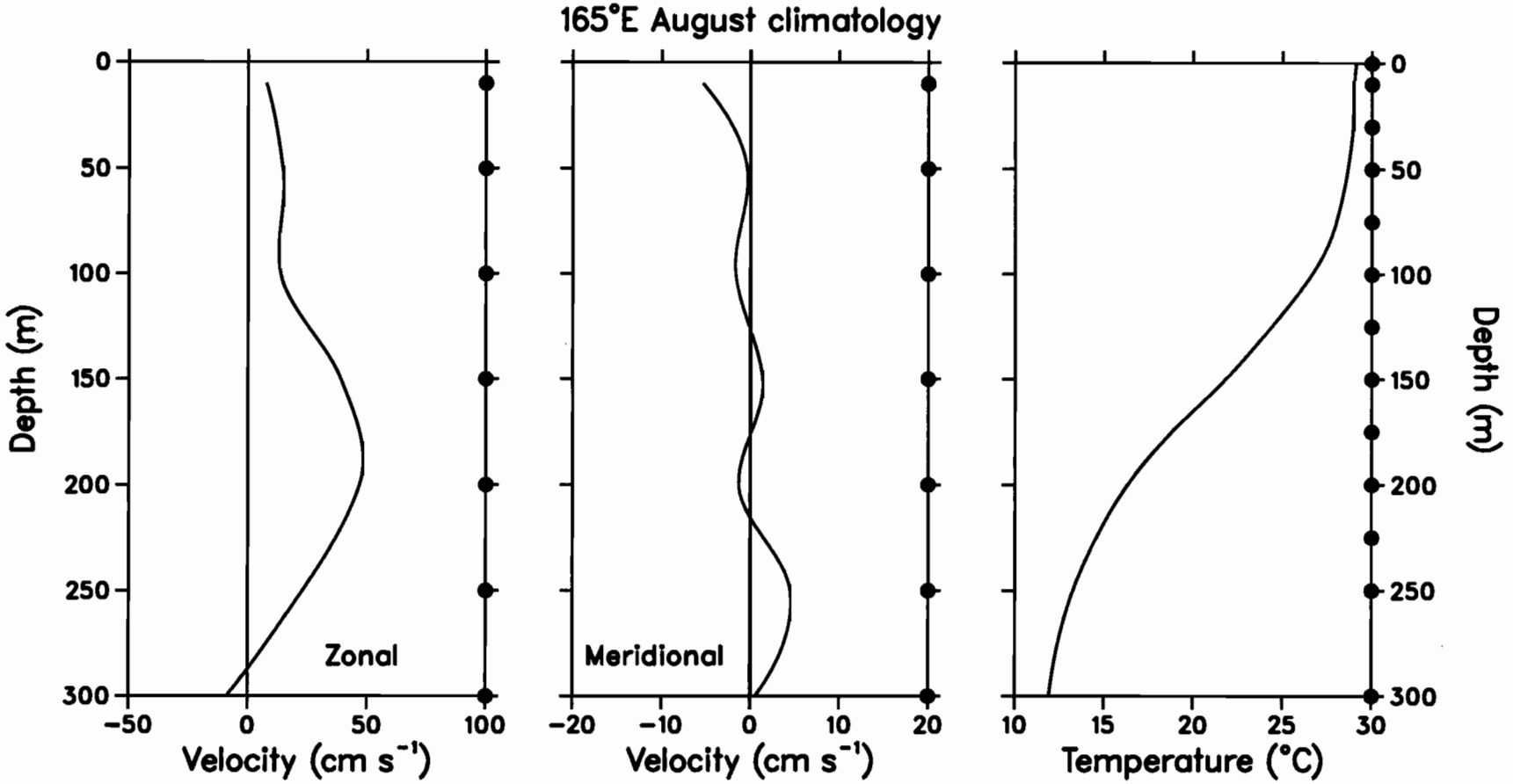

Figure A10. (continued)

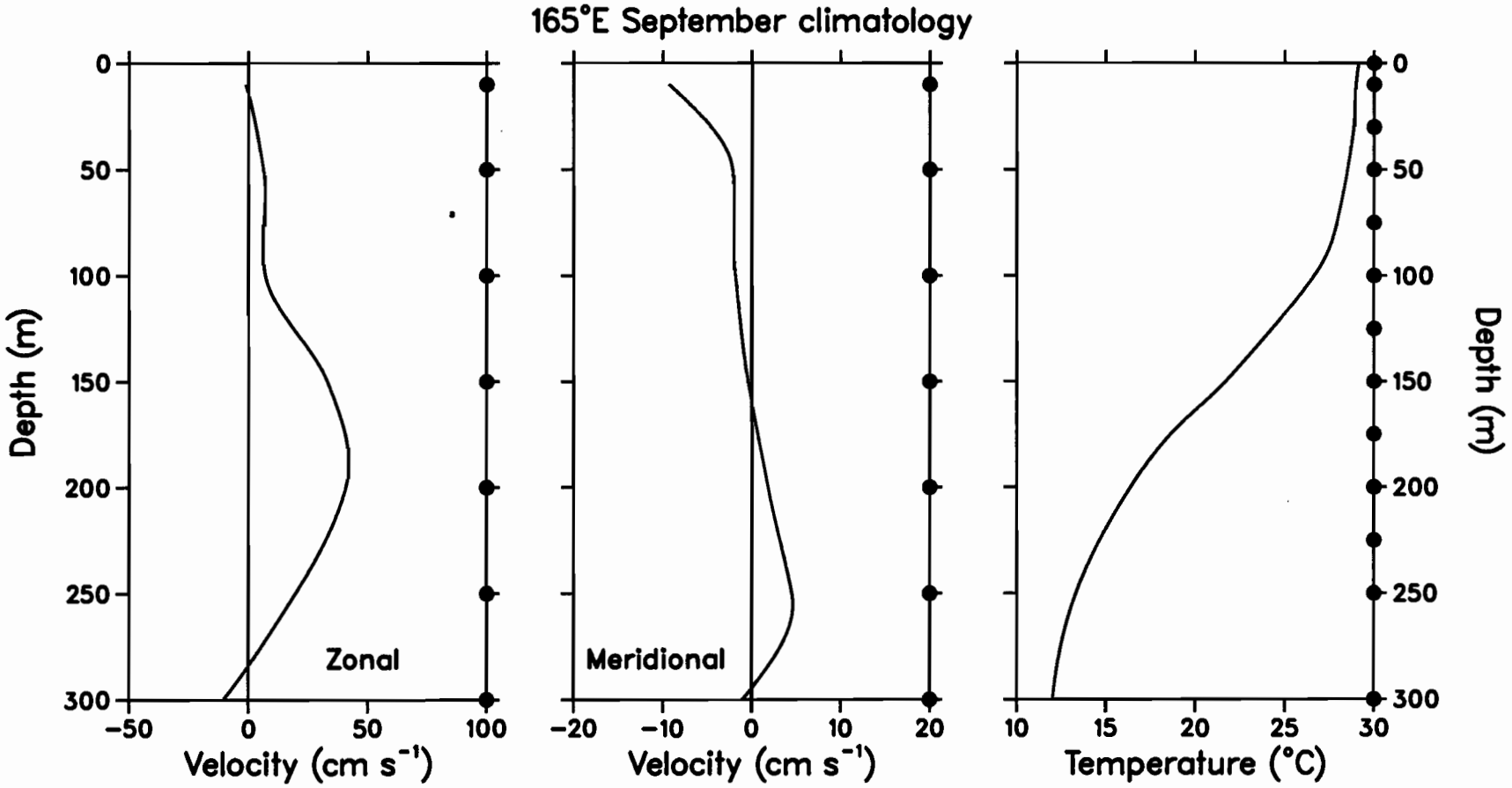

Figure A10. (continued)

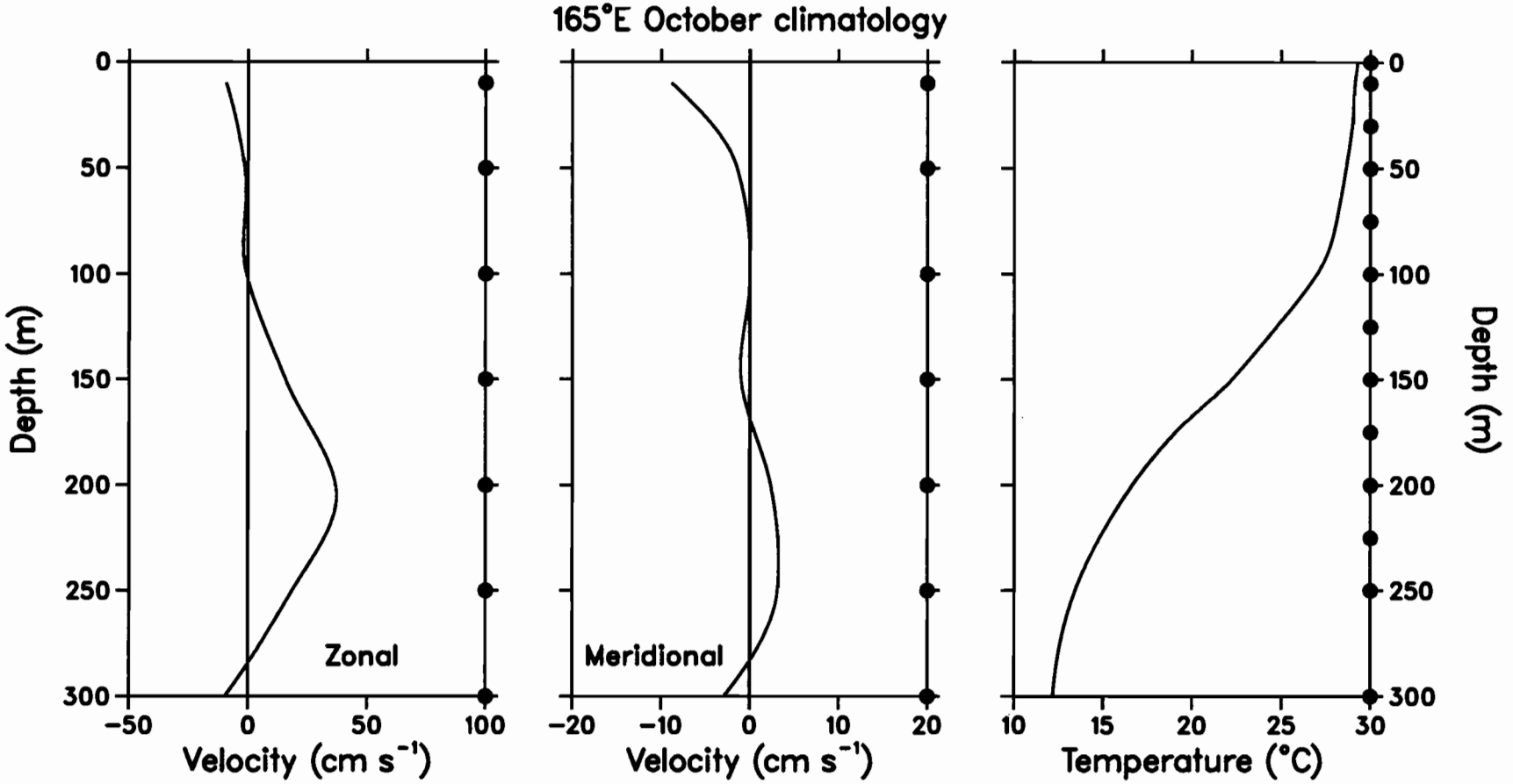

Figure A10. (continued)

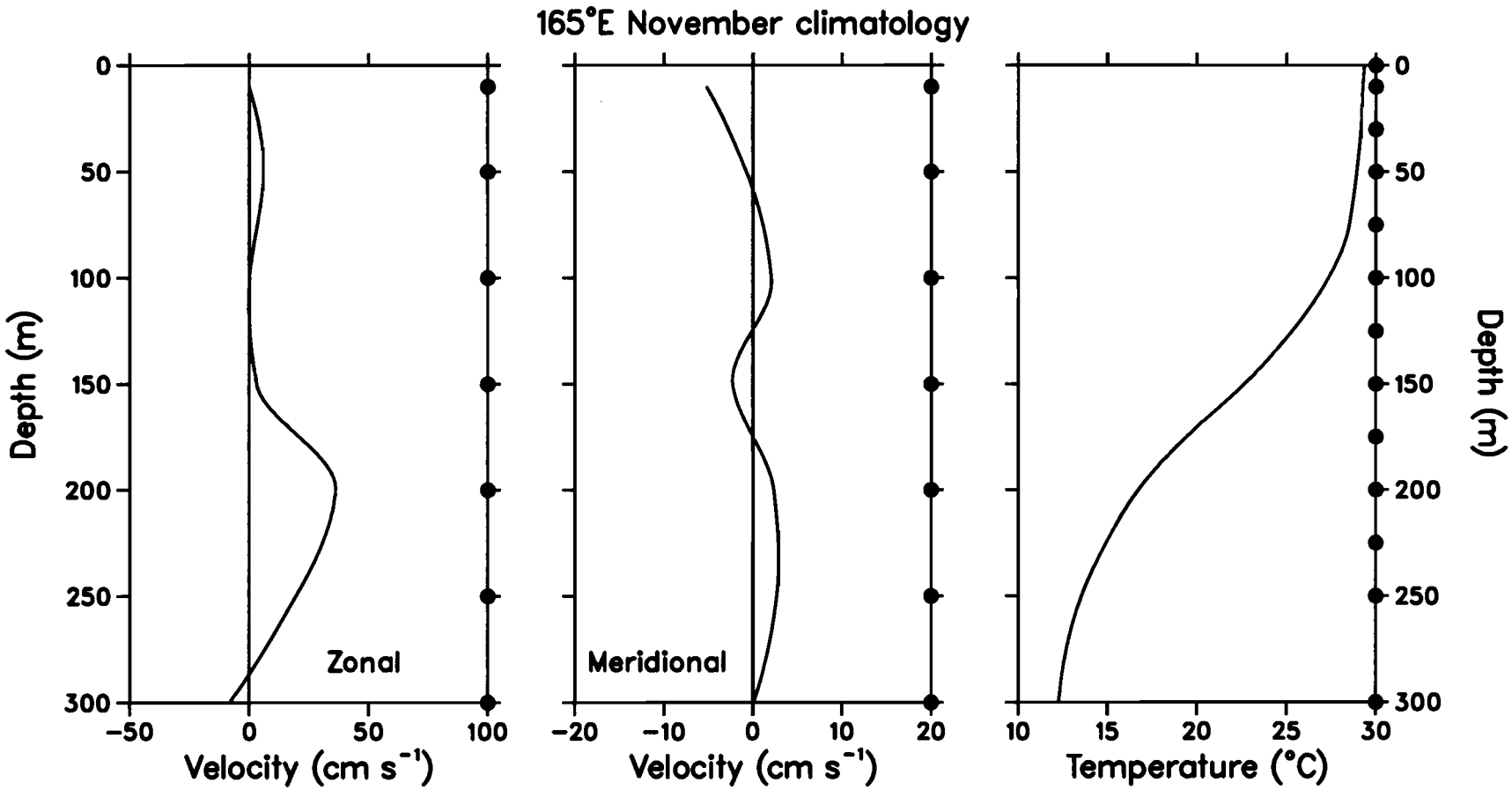

Figure A10. (continued)

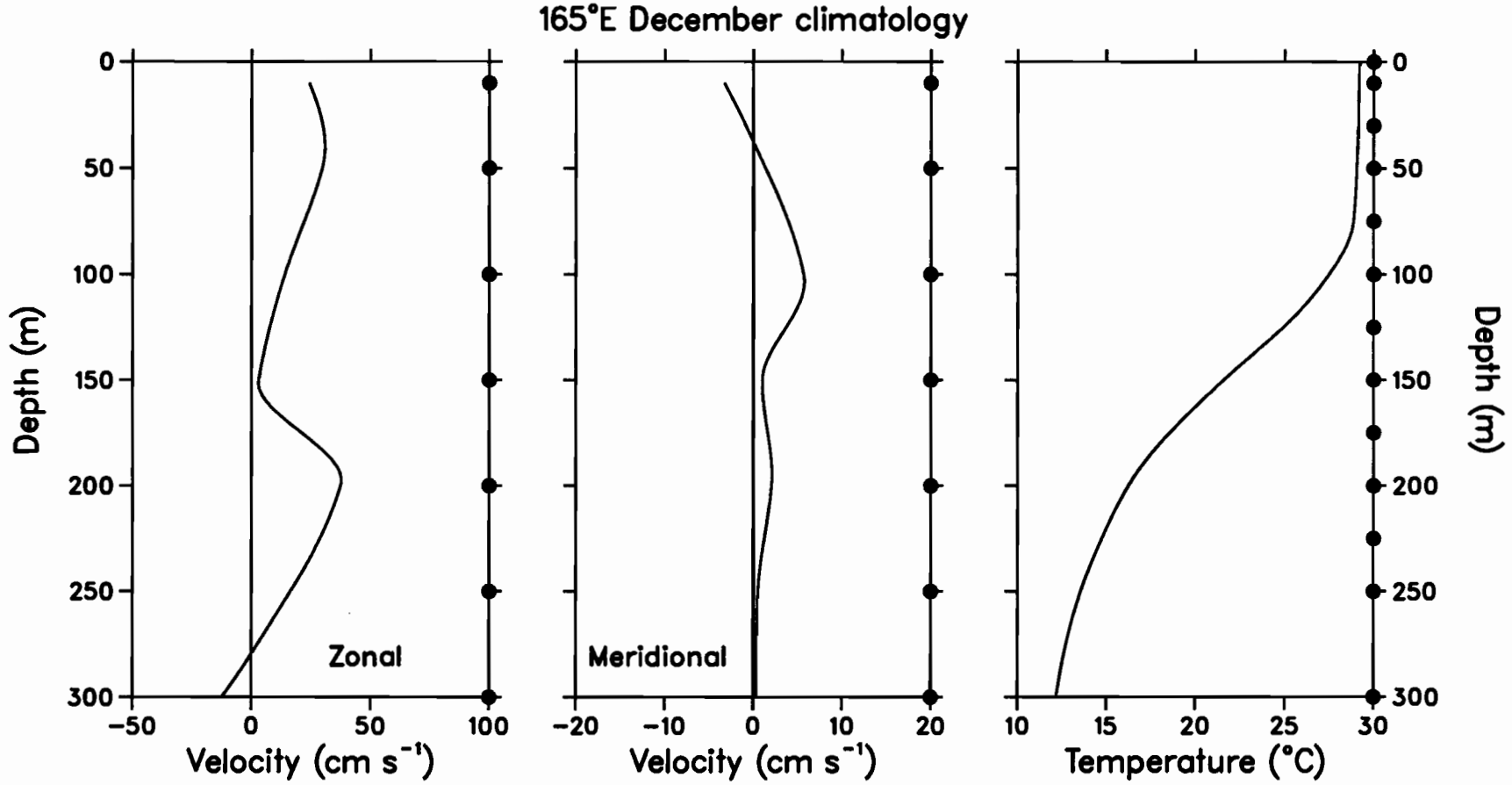

Figure A10. (continued)

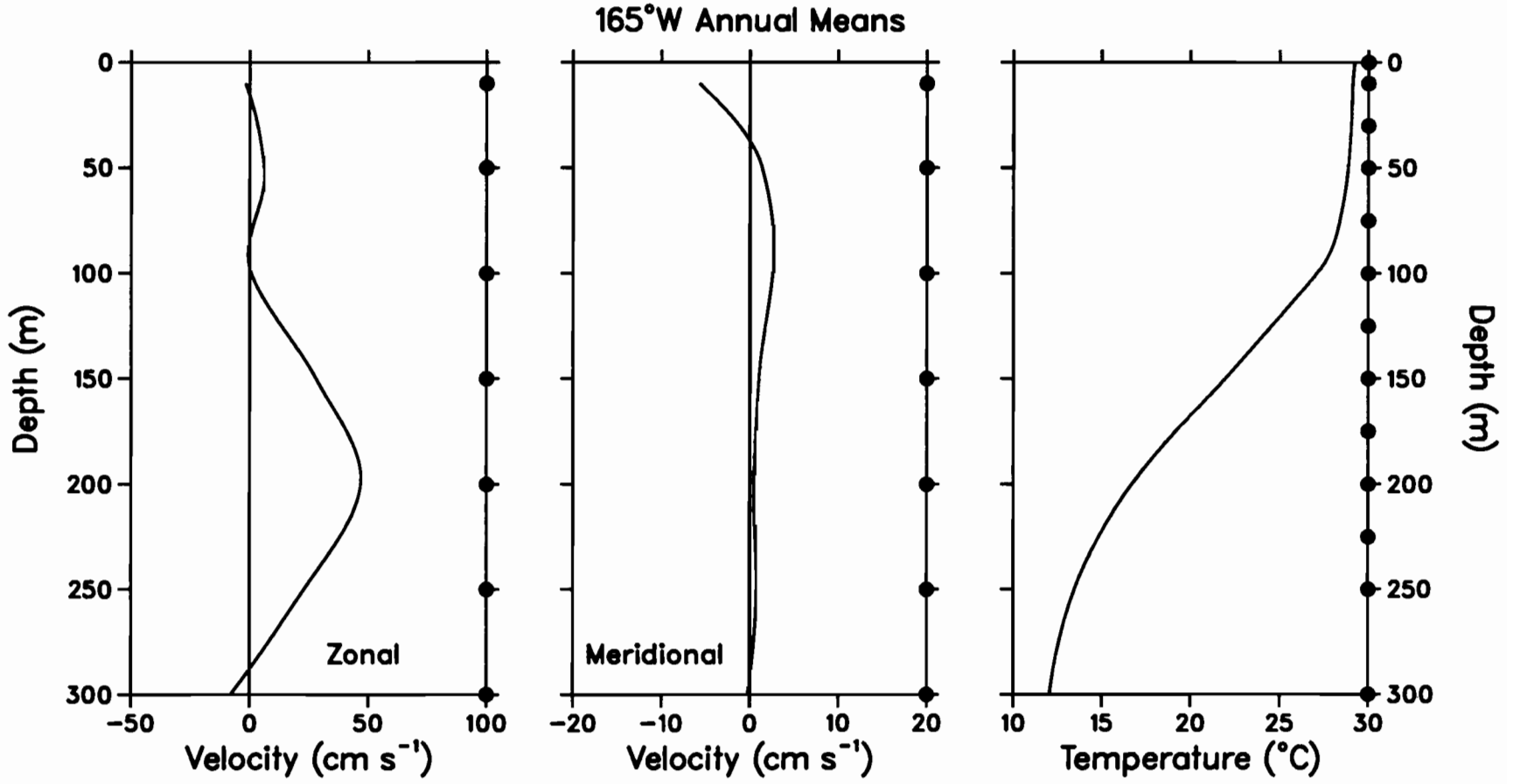

Figure A11a. Profiles of annual mean zonal velocity, meridional velocity, and temperature at 0°, 165°E. Solid circles on the left axes indicate standard depths on which the profiles are based.

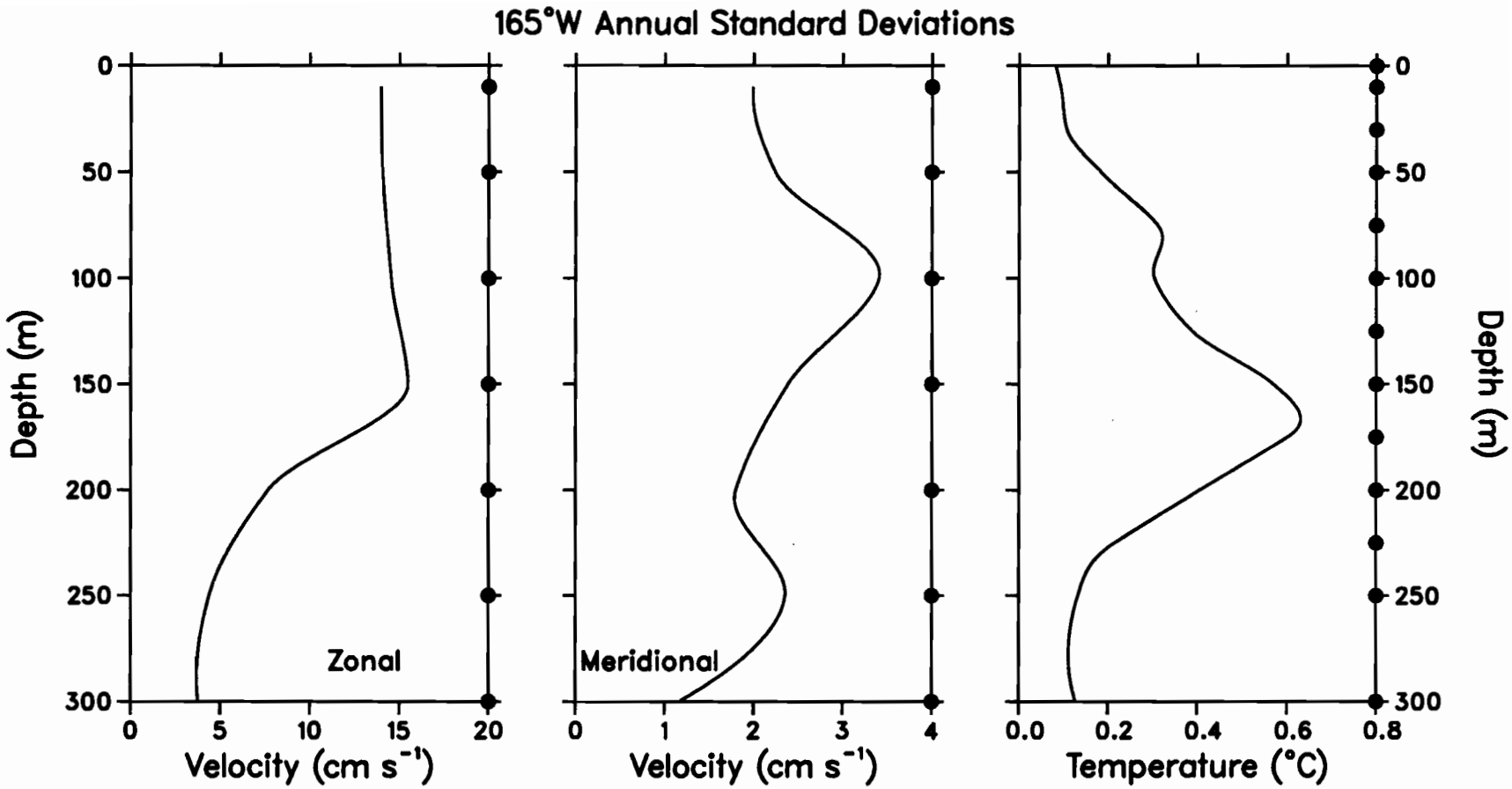

Figure A11b. Profiles of annual standard deviations of zonal velocity, meridional velocity, and temperature at 0°, 165°E. Solid circles on the left axes indicate standard depths on which the profiles are based.

Table A1. Monthly averaged temperatures (in °C) at 0°, 165°E for 1986–1992. Filled data are underlined and missing data are indicated by –999.99.

Month	SST	10 m	30 m	50 m	75 m	100 m	125 m	150 m	175 m	200 m	225 m	250 m	300 m	400 m	500 m
Feb 86	29.59	29.49	29.44	29.39	29.11	28.83	27.36	23.49	19.62	17.96	15.99	-999.99	-999.99	9.82	8.38
Mar 86	29.31	29.19	29.12	29.05	28.82	28.57	27.36	23.86	20.36	18.39	16.20	-999.99	-999.99	9.95	8.34
Apr 86	29.14	29.01	28.91	28.81	28.63	28.44	27.79	24.54	21.30	18.84	16.22	-999.99	-999.99	9.98	8.26
May 86	29.32	29.18	29.10	29.03	28.84	28.64	27.55	24.37	21.19	18.45	15.76	-999.99	-999.99	9.90	8.16
Jun 86	29.50	29.38	29.32	29.26	29.02	28.78	26.43	23.44	20.44	17.80	15.36	-999.99	-999.99	9.89	8.10
Jul 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 86	29.05	28.92	28.89	28.86	28.88	28.06	24.32	19.25	16.69	15.11	14.11	13.49	12.10	9.51	7.99
Jan 87	29.14	29.00	28.97	28.93	28.91	27.48	22.15	18.76	16.71	15.23	14.07	13.38	11.95	9.47	7.92
Feb 87	29.20	29.03	28.99	28.96	28.95	27.22	21.32	19.08	17.33	15.79	14.22	13.42	11.97	9.48	7.90
Mar 87	29.25	29.05	29.00	28.98	28.99	26.88	21.74	19.78	17.96	16.13	14.30	13.51	12.00	9.51	7.97
Apr 87	29.28	29.11	29.06	29.04	28.99	25.80	21.78	20.02	18.07	15.93	14.13	13.45	11.87	9.47	8.06
May 87	29.31	29.16	29.13	29.06	27.94	24.32	21.66	19.78	17.74	15.34	13.81	13.38	11.76	9.41	8.13
Jun 87	29.23	29.09	29.06	28.90	26.13	23.66	21.73	19.49	17.53	15.04	13.66	13.39	11.78	9.39	8.16
Jul 87	29.00	28.88	28.82	28.26	25.32	23.63	21.75	19.30	17.46	15.15	13.80	13.43	11.80	9.42	8.17
Aug 87	28.97	28.86	28.71	27.59	25.32	23.37	21.23	18.62	17.03	15.22	14.00	13.43	11.73	-999.99	-999.99
Sep 87	29.31	29.16	28.86	27.63	25.52	23.41	21.14	18.26	16.84	15.58	14.25	13.46	11.90	-999.99	-999.99
Oct 87	29.86	29.67	29.30	28.12	26.00	23.66	21.65	18.88	17.30	16.06	14.40	13.47	12.18	-999.99	-999.99
Nov 87	30.18	30.07	29.84	28.95	27.20	24.13	21.90	19.25	17.59	16.08	14.42	13.40	-999.99	9.96	8.33
Dec 87	30.03	30.01	29.96	29.64	28.69	24.64	21.62	18.91	17.31	15.82	14.49	13.34	-999.99	9.86	8.35
Jan 88	29.76	29.75	29.75	29.64	28.92	24.54	21.14	18.50	17.12	15.84	14.68	13.46	-999.99	9.81	8.44
Feb 88	29.41	29.38	29.34	29.20	28.17	24.43	21.14	18.70	17.39	16.06	14.77	13.60	-999.99	9.86	8.61
Mar 88	28.81	28.73	28.58	28.47	27.55	24.96	22.02	19.63	18.06	16.25	14.74	13.60	-999.99	9.90	8.73
Apr 88	28.36	28.24	27.99	27.89	27.27	25.73	23.23	20.59	18.66	16.54	14.83	13.67	-999.99	9.87	8.65
May 88	28.39	28.24	28.01	27.86	27.35	26.12	23.93	21.17	18.87	16.78	14.97	13.80	-999.99	9.80	8.50
Jun 88	28.55	28.39	28.28	28.10	27.76	26.61	24.45	21.61	19.13	17.01	15.14	13.78	12.13	-999.99	-999.99
Jul 88	28.44	28.29	28.26	28.10	27.96	27.13	24.78	21.83	19.11	16.94	15.22	13.68	12.02	-999.99	-999.99
Aug 88	28.08	27.93	27.91	27.76	27.60	26.94	24.52	21.62	18.73	16.60	15.14	13.69	11.96	-999.99	-999.99
Sep 88	27.80	27.62	27.60	27.44	27.24	26.59	24.66	21.92	18.80	16.57	15.12	13.67	12.07	-999.99	-999.99
Oct 88	27.67	27.52	27.50	27.37	27.25	26.77	25.56	23.48	19.73	16.94	15.10	13.57	12.29	-999.99	-999.99
Nov 88	27.66	27.59	27.55	27.48	27.41	27.18	26.42	25.30	21.31	17.62	15.34	13.78	12.40	-999.99	-999.99
Dec 88	27.76	27.72	27.66	27.59	27.52	27.43	26.71	25.98	21.87	17.94	15.75	14.12	12.34	-999.99	-999.99
Jan 89	27.92	27.81	27.73	27.69	27.60	27.47	26.59	25.72	21.40	17.97	16.01	14.28	12.24	-999.99	-999.99
Feb 89	28.00	27.84	27.76	27.73	27.61	27.41	26.71	26.01	21.87	18.45	16.34	14.38	12.28	-999.99	-999.99
Mar 89	27.98	27.78	27.70	27.65	27.53	27.38	26.96	26.54	22.70	18.75	16.35	14.28	12.27	-999.99	-999.99
Apr 89	28.10	27.89	27.81	27.70	27.53	27.39	26.87	26.35	22.81	18.62	15.94	13.96	12.04	-999.99	-999.99
May 89	28.46	28.28	28.21	28.06	27.78	27.55	26.84	25.76	22.27	18.07	15.33	13.52	11.85	-999.99	-999.99
Jun 89	28.73	28.61	28.55	28.41	28.14	27.76	26.89	25.04	21.43	17.28	14.92	13.24	11.76	9.24	7.77
Jul 89	28.83	28.77	28.71	28.60	28.28	27.67	26.61	24.57	20.78	16.93	14.86	13.14	11.72	9.28	7.77
Aug 89	28.88	28.80	28.75	28.60	28.21	27.44	26.25	24.35	20.17	16.77	14.56	12.84	11.76	9.38	7.80
Sep 89	28.97	28.82	28.70	28.50	28.13	27.42	26.24	24.20	19.80	16.67	14.29	12.66	11.87	9.36	7.93
Oct 89	29.16	28.97	28.77	28.59	28.26	27.72	26.75	24.71	20.49	16.92	14.66	13.01	11.95	9.36	8.09
Nov 89	29.31	29.17	29.03	28.93	28.73	28.44	27.89	25.93	21.18	17.13	15.14	13.47	11.96	9.49	8.07
Dec 89	29.39	29.33	29.28	29.26	29.23	29.14	28.65	25.09	19.93	16.67	15.00	13.53	11.98	9.37	7.94
Jan 90	29.43	29.40	29.39	29.39	29.39	29.32	27.91	22.04	18.31	16.15	14.57	13.34	11.92	9.13	7.90
Feb 90	29.44	29.41	29.38	29.35	29.32	29.15	26.11	20.68	18.40	16.27	14.51	13.28	11.87	9.12	7.89
Mar 90	29.48	29.46	29.42	29.36	29.26	28.71	24.32	20.89	19.15	16.64	14.62	13.31	11.94	9.32	7.87
Apr 90	29.59	29.57	29.53	29.43	29.24	27.93	23.27	21.03	19.36	16.75	14.53	13.21	11.93	9.45	7.84
May 90	29.76	29.72	29.67	29.56	29.23	27.45	23.41	21.55	19.55	16.82	14.51	13.15	11.86	9.51	7.80
Jun 90	29.89	29.82	29.77	29.69	29.36	27.83	24.29	22.22	19.82	16.91	14.53	13.13	11.86	9.61	7.82

Table A1. (continued)

Month	SST	10 m	30 m	50 m	75 m	100 m	125 m	150 m	175 m	200 m	225 m	250 m	300 m	400 m	500 m
Jul 90	29.89	29.80	29.76	29.70	29.52	28.18	24.77	22.48	19.57	16.77	14.44	13.16	12.01	-999.99	7.89
Aug 90	29.85	29.73	29.67	29.57	29.44	27.74	24.60	22.33	19.11	16.61	14.56	13.37	12.19	-999.99	7.92
Sep 90	29.87	29.74	29.62	29.49	29.35	27.44	24.41	22.48	19.02	16.65	14.76	13.56	12.25	-999.99	7.90
Oct 90	30.03	29.92	29.83	29.70	29.66	27.93	25.18	22.98	19.22	16.80	14.96	13.73	12.33	-999.99	7.97
Nov 90	30.03	29.97	29.93	29.87	29.89	28.72	26.80	22.61	19.13	16.69	15.02	13.78	12.36	-999.99	8.08
Dec 90	29.78	29.73	29.71	29.69	29.65	29.22	26.47	21.01	18.34	16.16	14.58	13.52	12.07	-999.99	8.10
Jan 91	29.69	29.63	29.62	29.61	29.05	28.48	23.65	19.71	17.70	15.86	14.23	13.33	11.90	-999.99	8.15
Feb 91	29.84	29.77	29.76	29.73	28.61	27.49	22.93	20.39	18.54	16.58	14.52	13.40	12.13	-999.99	8.33
Mar 91	29.95	29.86	29.83	29.76	28.92	27.95	24.54	21.68	19.61	17.37	15.00	13.49	12.31	-999.99	8.43
Apr 91	30.00	29.88	29.85	29.72	29.34	28.56	24.95	22.00	19.81	17.39	15.15	13.45	12.26	-999.99	8.32
May 91	29.99	29.86	29.83	29.70	29.45	28.18	24.57	22.13	19.84	17.23	14.96	13.31	12.10	-999.99	8.23
Jun 91	29.94	29.81	29.78	29.67	29.35	27.36	24.36	22.32	19.75	16.92	14.67	13.19	11.99	-999.99	8.20
Jul 91	29.94	29.79	29.78	29.73	29.31	27.11	24.77	22.39	19.45	16.50	14.49	13.01	11.96	-999.99	8.15
Aug 91	29.86	29.71	29.70	29.71	29.43	27.71	25.37	22.16	18.94	16.37	14.59	12.97	11.93	9.49	8.14
Sep 91	29.72	29.58	29.54	29.48	29.36	28.41	25.02	21.66	18.69	16.44	14.84	13.24	11.98	9.47	8.23
Oct 91	29.70	29.58	29.51	29.37	29.27	28.85	24.49	21.07	18.59	16.43	14.90	13.37	12.14	9.48	8.31
Nov 91	29.58	29.50	29.46	29.38	29.31	28.25	23.54	20.21	17.91	16.10	14.70	13.30	12.34	9.51	8.33
Dec 91	29.36	29.29	29.28	29.26	29.17	26.45	21.75	19.28	17.19	15.72	14.53	13.34	12.46	9.50	8.31
Jan 92	29.19	29.15	29.13	29.11	29.01	25.37	20.83	18.95	17.05	15.64	14.57	13.51	12.50	9.49	8.33

Table A2. Monthly averaged zonal velocity (in cm s^{-1}) at 0°, 165°E for 1986–1992. Filled data are underlined and missing data are indicated by –999.99.

Month	10 m	50 m	100 m	150 m	200 m	250 m	300 m
Feb 86	-17.96	-12.30	-39.80	-999.99	54.25	-999.99	-999.99
Mar 86	-31.01	-21.64	-33.43	-999.99	58.03	-999.99	-999.99
Apr 86	-18.16	-4.27	-2.29	-999.99	61.10	-999.99	-999.99
May 86	5.35	19.21	16.88	-999.99	61.29	-999.99	-999.99
Jun 86	-0.08	16.31	2.75	-999.99	61.93	-999.99	-999.99
Jul 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 86	84.15	90.88	71.63	5.03	36.92	-3.02	-30.96
Jan 87	29.43	36.90	17.30	28.10	41.50	0.84	-27.82
Feb 87	-25.22	-17.00	-32.27	42.94	46.50	9.34	-26.63
Mar 87	-30.85	-22.57	-41.67	42.44	45.01	14.47	-28.24
Apr 87	-5.58	2.37	-21.81	44.16	40.83	13.99	-28.97
May 87	12.66	20.36	13.87	49.53	37.99	9.74	-28.62
Jun 87	24.04	31.59	37.75	47.51	35.41	3.91	-28.19
Jul 87	39.76	47.10	42.09	37.56	29.21	-1.71	-28.98
Aug 87	41.18	48.50	45.34	29.18	13.73	-9.58	-32.06
Sep 87	24.38	31.93	39.33	9.93	-6.28	-17.83	-36.94
Oct 87	-6.20	1.76	10.22	-8.51	-10.55	-15.65	-36.98
Nov 87	-20.80	-12.64	-11.75	0.97	6.11	-2.04	-28.26
Dec 87	-6.82	1.15	-17.43	16.05	19.24	7.78	-20.82
Jan 88	-14.78	-6.70	-21.16	21.45	24.99	9.73	-19.18
Feb 88	-50.57	-42.01	-17.82	27.89	30.09	8.79	-19.97
Mar 88	-63.69	-54.96	-2.00	41.90	36.97	14.53	-15.15
Apr 88	-37.92	-29.53	26.27	64.81	49.87	23.82	-7.34
May 88	-15.57	-2.52	48.28	80.94	59.69	24.17	-7.22
Jun 88	-22.52	-4.43	44.27	76.49	62.02	23.20	-8.50
Jul 88	-29.24	-21.26	24.89	64.07	57.91	24.40	-7.59
Aug 88	-24.19	-30.72	12.85	62.12	54.48	26.19	-5.63
Sep 88	-20.67	-29.20	15.27	66.45	57.27	30.03	-2.12
Oct 88	-22.72	-25.92	13.12	55.98	56.06	29.39	0.69
Nov 88	-28.35	-28.82	-4.34	32.00	48.65	28.39	2.87
Dec 88	-27.01	-26.56	-11.44	17.16	46.07	32.29	2.15
Jan 89	-26.61	-21.64	-8.22	13.73	51.70	34.97	-2.52
Feb 89	-30.68	-22.39	-13.71	4.57	59.16	40.13	-3.91
Mar 89	-27.14	-18.90	-17.52	-12.29	63.29	47.99	3.16
Apr 89	-20.85	-12.69	-12.19	-15.09	62.33	51.52	10.13
May 89	-14.21	-2.75	1.22	5.27	60.53	50.67	13.86
Jun 89	-13.85	1.53	17.01	31.37	61.49	47.51	15.99
Jul 89	-24.31	-10.25	25.48	46.53	61.52	44.21	10.35
Aug 89	-30.64	-14.94	25.64	48.54	61.99	41.97	3.03
Sep 89	-29.66	-9.38	14.65	37.01	60.17	39.32	0.14
Oct 89	-19.92	-1.82	5.88	14.82	50.99	34.92	-0.92
Nov 89	5.57	19.75	12.53	-13.40	38.80	26.51	-4.75
Dec 89	22.97	34.50	7.48	-26.05	34.73	18.70	-9.69
Jan 90	16.24	22.36	-13.09	-5.41	43.11	18.06	-8.53
Feb 90	7.06	9.28	-22.00	22.61	52.62	21.34	-4.25
Mar 90	-1.88	2.28	-25.06	34.85	55.12	22.81	-2.01
Apr 90	-16.48	-7.28	-26.84	36.55	54.70	21.06	-2.13
May 90	-15.81	-4.70	-16.42	41.79	56.81	22.65	-1.06
Jun 90	4.03	15.11	-6.09	42.95	57.94	26.70	-1.54

Table A2. (continued)

Month	10 m	50 m	100 m	150 m	200 m	250 m	300 m
Jul 90	19.83	34.13	-8.11	35.39	55.68	29.21	-4.92
Aug 90	16.31	32.62	-13.02	30.61	52.33	30.56	-6.05
Sep 90	-3.37	12.11	-16.59	19.25	49.26	28.18	-6.55
Oct 90	-8.38	1.70	-12.97	0.42	48.43	27.72	-6.46
Nov 90	13.24	14.36	3.99	-7.12	46.22	26.89	-6.28
Dec 90	19.71	17.13	16.26	2.63	43.14	19.54	-9.27
Jan 91	-5.07	-6.74	-999.99	24.15	49.68	20.92	-10.67
Feb 91	-18.03	-17.17	-999.99	39.62	57.40	30.56	-7.38
Mar 91	2.12	5.83	-999.99	36.67	55.93	33.35	-0.97
Apr 91	23.66	29.77	-46.63	31.91	54.65	31.62	6.55
May 91	24.00	31.55	-29.03	37.92	57.36	32.29	10.73
Jun 91	16.19	23.85	-11.30	46.10	60.40	37.20	11.06
Jul 91	22.90	28.80	-1.39	39.35	58.67	35.88	5.93
Aug 91	35.68	37.28	-2.68	24.60	51.75	25.30	-3.97
Sep 91	23.59	25.87	-17.15	-999.99	43.70	18.23	-7.50
Oct 91	10.68	16.91	-19.76	-999.99	39.40	16.25	-5.11
Nov 91	29.76	36.87	-0.11	-999.99	41.06	17.36	-5.54
Dec 91	52.08	60.92	16.96	-999.99	44.56	22.48	-6.36
Jan 92	62.79	72.06	25.74	-999.99	46.94	25.78	-6.11

Table A3. Monthly averaged meridional velocity (in cm s^{-1}) at 0°, 165°E for 1986–1992. Missing data are indicated by –999.99.

Month	10 m	50 m	100 m	150 m	200 m	250 m	300 m
Feb 86	-0.83	-0.67	1.49	-999.99	-5.69	-999.99	-999.99
Mar 86	-2.30	0.46	7.83	-999.99	-4.58	-999.99	-999.99
Apr 86	-5.00	0.10	11.58	-999.99	-2.80	-999.99	-999.99
May 86	-7.13	-2.07	8.88	-999.99	-2.02	-999.99	-999.99
Jun 86	-4.09	-0.35	4.52	-999.99	-2.79	-999.99	-999.99
Jul 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 86	-999.99	9.11	20.10	4.37	3.34	-1.75	-2.08
Jan 87	-999.99	9.56	11.75	6.25	4.95	-3.12	-2.27
Feb 87	-999.99	7.73	7.80	4.92	5.10	-2.03	-1.49
Mar 87	-999.99	5.14	7.24	1.30	2.21	0.26	0.36
Apr 87	-999.99	4.69	6.50	-3.94	-4.57	2.35	-1.22
May 87	-999.99	2.30	3.59	-6.69	-10.87	5.61	-3.51
Jun 87	-999.99	3.50	-2.49	-1.96	-13.38	5.34	-2.96
Jul 87	-999.99	9.49	-2.17	-3.58	-13.60	1.18	-1.56
Aug 87	-999.99	6.02	-0.09	-7.74	-6.98	-0.67	-0.85
Sep 87	-999.99	-1.80	-2.26	-1.48	1.12	-1.79	-1.48
Oct 87	-999.99	-2.11	-1.60	2.56	-1.54	-0.03	-2.30
Nov 87	-999.99	3.40	-0.63	-1.34	-6.61	4.32	-999.99
Dec 87	-999.99	7.68	-0.61	1.06	-2.07	2.46	-999.99
Jan 88	-999.99	6.97	1.09	8.77	3.29	-3.25	-999.99
Feb 88	-999.99	3.37	-0.17	7.55	2.53	-4.51	-999.99
Mar 88	-999.99	1.30	-1.19	1.95	2.06	0.12	-999.99
Apr 88	-999.99	2.39	-0.08	2.55	1.58	1.40	-999.99
May 88	-999.99	4.28	-0.05	5.76	0.96	-2.63	-999.99
Jun 88	-11.47	3.84	3.95	2.05	-0.17	-1.55	5.59
Jul 88	-8.44	-2.22	5.06	-5.04	-5.95	5.35	4.70
Aug 88	-9.98	-5.49	2.00	-3.44	-7.16	8.96	-999.99
Sep 88	-26.56	-2.59	6.12	-0.13	-3.31	5.55	-999.99
Oct 88	-27.96	-2.58	10.35	-2.58	-0.92	0.26	-999.99
Nov 88	-15.31	-7.25	7.19	-1.24	3.01	-1.05	7.90
Dec 88	-9.65	-11.23	2.40	1.94	2.52	-1.67	4.86
Jan 89	-7.51	-999.99	5.87	4.74	-0.13	-3.20	1.67
Feb 89	-12.55	-999.99	9.67	10.41	0.61	-3.96	0.79
Mar 89	-15.42	-999.99	7.32	10.98	-0.31	-5.93	-0.11
Apr 89	-11.66	-999.99	6.69	5.83	0.48	-5.20	-2.04
May 89	-9.98	-999.99	-0.56	1.17	5.12	-3.37	-3.50
Jun 89	-8.86	3.99	-8.06	-4.63	4.95	-6.77	-1.16
Jul 89	-8.53	-1.58	-5.76	-7.23	0.11	-9.41	2.94
Aug 89	-9.65	-7.42	-6.74	-5.94	0.85	-6.68	5.56
Sep 89	-9.13	-6.57	-8.61	-5.38	4.95	-1.46	3.75
Oct 89	-7.29	-3.25	-2.68	-3.59	7.14	4.60	-0.50
Nov 89	-7.70	-3.73	7.53	-1.93	6.62	5.45	-1.83
Dec 89	-8.56	-4.57	11.59	0.31	1.86	1.79	-0.88
Jan 90	-7.70	-3.06	10.93	2.49	-0.34	1.02	-0.34
Feb 90	-7.16	1.16	12.46	1.77	2.75	1.39	-1.26
Mar 90	-5.14	6.76	8.09	-0.88	2.33	-0.60	-1.13
Apr 90	-2.05	5.37	2.02	-5.08	-2.02	-1.83	0.15
May 90	-1.20	0.08	0.88	-6.92	-2.21	-1.32	0.74
Jun 90	-2.05	-1.26	0.70	-2.26	-0.29	-0.22	0.77

Table A3. (continued)

Month	10 m	50 m	100 m	150 m	200 m	250 m	300 m
Jul 90	-1.59	-0.27	0.97	4.61	0.84	5.08	0.66
Aug 90	0.39	-0.35	-0.50	7.70	3.04	9.40	-0.49
Sep 90	0.52	-1.67	-2.86	5.35	4.47	9.82	-3.03
Oct 90	-1.72	-2.05	-1.64	-0.37	5.71	10.02	-4.29
Nov 90	-3.03	-1.16	-0.32	-4.58	6.71	7.36	-3.27
Dec 90	-2.17	0.41	-1.75	-2.60	5.88	3.49	-1.68
Jan 91	-6.23	1.97	-999.99	2.57	5.96	2.75	0.31
Feb 91	-7.61	5.28	-999.99	3.32	4.87	3.06	0.63
Mar 91	0.54	8.88	-999.99	1.93	1.37	-0.09	0.36
Apr 91	4.60	-999.99	6.97	3.66	0.52	-4.35	1.27
May 91	3.99	-999.99	6.01	6.97	2.58	-5.05	-0.20
Jun 91	1.84	-999.99	0.82	6.53	5.26	-2.45	-0.36
Jul 91	-0.60	-999.99	-3.82	8.32	5.47	3.23	-0.04
Aug 91	-2.21	5.21	-3.04	16.27	3.65	11.41	-2.04
Sep 91	-2.14	1.84	-1.54	-999.99	2.04	10.44	-3.47
Oct 91	1.61	2.74	-4.14	-999.99	1.33	0.69	-4.61
Nov 91	5.05	4.95	-3.47	-999.99	1.92	-2.82	-2.55
Dec 91	7.21	6.83	2.23	-999.99	0.76	-1.14	1.86
Jan 92	-999.99	7.03	5.17	-999.99	-1.27	0.86	4.48

Table A4. Monthly averaged winds and air temperatures at 0°, 165°E for 1986–1992. Missing data are indicated by –999.99.

Month	Wind Velocity (m/s) u	Wind Velocity (m/s) v	Wind Speed (m/s)	Wind Pseudostress (m**2/s**2) u	Wind Pseudostress (m**2/s**2) v	Air Temperature (deg C)
Feb 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Mar 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Apr 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
May 86	-0.53	-0.80	4.53	0.46	-7.28	28.36
Jun 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Jul 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 86	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 86	3.59	-1.92	5.89	29.30	-11.29	28.07
Jan 87	1.20	-2.53	4.95	10.61	-13.79	28.05
Feb 87	-0.02	-3.03	4.38	1.45	-15.71	28.00
Mar 87	0.08	-2.62	4.07	1.70	-13.33	27.98
Apr 87	0.57	-1.74	3.81	3.16	-9.19	27.92
May 87	1.23	-0.68	3.78	7.28	-4.21	27.90
Jun 87	1.76	0.48	4.08	12.48	2.46	27.85
Jul 87	2.21	1.20	4.28	15.50	6.63	27.57
Aug 87	1.68	1.19	3.61	9.38	5.84	27.51
Sep 87	0.88	0.85	2.99	3.20	3.72	28.08
Oct 87	0.34	0.29	3.02	1.53	1.08	28.69
Nov 87	0.42	-0.88	3.57	2.70	-4.63	28.73
Dec 87	1.45	-2.11	4.17	8.17	-10.69	28.45
Jan 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Feb 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Mar 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Apr 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
May 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Jun 88	-4.01	0.00	4.40	-21.90	-0.49	27.98
Jul 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 88	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 88	-6.09	-1.15	6.42	-42.68	-7.16	27.34
Dec 88	-5.53	-1.20	5.96	-36.85	-6.80	27.32
Jan 89	-5.40	-1.03	5.80	-35.15	-5.34	27.31
Feb 89	-5.51	-0.49	5.74	-34.56	-2.20	27.27
Mar 89	-5.43	0.14	5.58	-32.45	1.17	27.24
Apr 89	-5.38	0.42	5.54	-31.83	2.64	27.44
May 89	-999.99	-999.99	-999.99	-999.99	-999.99	27.71
Jun 89	-4.07	0.58	4.46	-20.24	3.15	27.88
Jul 89	-4.56	0.97	4.97	-24.51	5.52	27.99
Aug 89	-4.54	1.00	4.98	-24.30	5.77	27.98
Sep 89	-4.00	0.28	4.42	-19.88	1.89	28.02
Oct 89	-2.68	-0.34	4.01	-12.25	-1.42	28.16
Nov 89	-0.69	-0.58	3.85	-1.99	-2.31	28.23
Dec 89	0.39	-1.10	3.88	2.33	-4.99	28.24
Jan 90	0.63	-1.70	3.97	2.43	-9.00	28.22
Feb 90	-999.99	-999.99	-999.99	-999.99	-999.99	28.24
Mar 90	-999.99	-999.99	-999.99	-999.99	-999.99	28.24
Apr 90	-999.99	-999.99	-999.99	-999.99	-999.99	28.26
May 90	-999.99	-999.99	-999.99	-999.99	-999.99	28.46

Table A4. (continued)

Month	Wind Velocity (m/s) u	Wind Velocity (m/s) v	Wind Speed (m/s)	Wind Pseudostress (m**2/s**2) u	Wind Pseudostress (m**2/s**2) v	Air Temperature (deg C)
Jun 90	-999.99	-999.99	-999.99	-999.99	-999.99	28.49
Jul 90	-0.04	-0.18	2.73	1.89	-1.19	28.25
Aug 90	0.46	-0.20	2.78	4.20	-0.98	28.02
Sep 90	0.79	-0.11	2.54	4.09	-0.11	27.79
Oct 90	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 90	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 90	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Jan 91	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Feb 91	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Mar 91	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99
Apr 91	-1.09	-0.31	3.15	-4.13	-0.94	28.97
May 91	-1.23	-0.15	3.37	-4.75	-0.14	28.98
Jun 91	-1.04	0.12	3.41	-4.03	1.01	28.86
Jul 91	-0.56	0.13	2.89	-2.35	0.67	28.57
Aug 91	0.85	-0.08	2.89	3.95	-0.71	28.07
Sep 91	1.85	-0.30	3.50	9.05	-1.73	27.80
Oct 91	2.33	0.05	4.39	17.04	1.76	27.90
Nov 91	3.74	-0.15	5.39	29.36	2.66	27.95
Dec 91	4.09	-1.31	5.35	27.81	-3.75	27.95
Jan 92	-999.99	-999.99	-999.99	-999.99	-999.99	-999.99

Table A5. Monthly averaged winds at Nauru Island for 1986–1992. Missing values are indicated by –999.99.

Month	Wind Velocity (m/s) u	Wind Velocity (m/s) v	Wind Speed (m/s)	Wind Pseudostress (m**2/s**2) u	Wind Pseudostress (m**2/s**2) v
Feb 86	-4.07	-1.35	4.58	-21.61	-6.04
Mar 86	-4.53	-0.99	4.92	-24.89	-4.39
Apr 86	-4.15	-0.98	4.62	-21.39	-4.13
May 86	-999.99	-999.99	-999.99	-999.99	-999.99
Jun 86	-3.03	0.31	3.33	-12.85	1.42
Jul 86	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 86	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 86	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 86	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 86	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 86	-999.99	-999.99	-999.99	-999.99	-999.99
Jan 87	-999.99	-999.99	-999.99	-999.99	-999.99
Feb 87	-999.99	-999.99	-999.99	-999.99	-999.99
Mar 87	-999.99	-999.99	-999.99	-999.99	-999.99
Apr 87	-999.99	-999.99	-999.99	-999.99	-999.99
May 87	-999.99	-999.99	-999.99	-999.99	-999.99
Jun 87	-999.99	-999.99	-999.99	-999.99	-999.99
Jul 87	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 87	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 87	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 87	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 87	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 87	-999.99	-999.99	-999.99	-999.99	-999.99
Jan 88	-999.99	-999.99	-999.99	-999.99	-999.99
Feb 88	-999.99	-999.99	-999.99	-999.99	-999.99
Mar 88	-4.14	-1.63	4.97	-23.01	-8.07
Apr 88	-3.45	-1.60	4.26	-17.66	-6.82
May 88	-3.23	-1.25	3.78	-15.92	-5.11
Jun 88	-3.68	-0.85	3.99	-18.72	-3.96
Jul 88	-4.38	-0.63	4.63	-23.52	-3.37
Aug 88	-4.45	-0.45	4.62	-23.59	-2.58
Sep 88	-3.55	-0.28	3.68	-15.85	-1.42
Oct 88	-3.49	-0.73	3.74	-15.85	-3.69
Nov 88	-4.26	-1.59	4.74	-22.85	-8.22
Dec 88	-4.55	-1.65	5.08	-25.72	-8.21
Jan 89	-4.64	-1.15	4.99	-26.28	-5.36
Feb 89	-4.62	-0.84	4.80	-24.26	-3.80
Mar 89	-4.49	-0.66	4.66	-22.34	-2.96
Apr 89	-4.15	-0.56	4.43	-20.41	-2.30
May 89	-3.72	-0.39	4.06	-16.93	-1.37
Jun 89	-3.79	-0.12	4.04	-16.55	-0.18
Jul 89	-4.16	0.22	4.34	-19.07	1.25
Aug 89	-4.21	0.44	4.39	-19.43	2.21
Sep 89	-3.72	0.17	3.93	-16.07	1.09
Oct 89	-2.51	-0.24	3.32	-9.68	-0.60
Nov 89	-0.89	-0.32	3.05	-2.32	-0.80
Dec 89	0.32	-0.53	3.20	2.60	-2.20
Jan 90	1.24	-1.07	3.62	7.82	-6.46
Feb 90	1.54	-1.44	3.96	11.26	-9.05
Mar 90	0.45	-1.10	3.75	5.64	-6.28
Apr 90	-1.29	-0.06	3.28	-4.46	-0.61
May 90	-2.30	0.80	3.17	-9.63	2.90

Table A5. (continued)

Month	Wind Velocity (m/s) u	v	Wind Speed (m/s)	Wind Pseudostress (m**2/s**2) u	v
Jun 90	-2.16	0.88	3.03	-8.65	2.93
Jul 90	-1.44	0.50	2.79	-4.48	0.85
Aug 90	-0.78	0.12	2.73	-1.11	-0.88
Sep 90	-1.05	0.23	2.85	-3.15	0.34
Oct 90	-0.89	-0.02	3.59	-0.85	-1.45
Nov 90	0.96	-1.09	4.36	9.98	-7.12
Dec 90	1.68	-1.43	4.08	11.88	-7.27
Jan 91	0.07	-0.99	3.59	2.10	-4.01
Feb 91	-1.21	-0.43	3.48	-4.15	-1.90
Mar 91	-0.90	0.11	2.99	-2.11	-0.12
Apr 91	-0.75	0.30	2.24	-0.94	0.50
May 91	-1.13	0.36	1.96	-2.26	0.59
Jun 91	-999.99	-999.99	-999.99	-999.99	-999.99
Jul 91	-999.99	-999.99	-999.99	-999.99	-999.99
Aug 91	-999.99	-999.99	-999.99	-999.99	-999.99
Sep 91	-999.99	-999.99	-999.99	-999.99	-999.99
Oct 91	-999.99	-999.99	-999.99	-999.99	-999.99
Nov 91	-999.99	-999.99	-999.99	-999.99	-999.99
Dec 91	-999.99	-999.99	-999.99	-999.99	-999.99
Jan 92	-999.99	-999.99	-999.99	-999.99	-999.99

Table A6. Mean seasonal cycles of temperature (in °C) between the surface and 500 m at 0°, 165°E. Statistics are based on N monthly estimates, M of which are directly measured.

January

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.19	0.67	-0.95	27.92	29.76	6	6
10	29.12	0.70	-0.90	27.81	29.75	6	5
30	29.10	0.73	-0.90	27.73	29.75	6	6
50	29.06	0.73	-0.95	27.69	29.64	6	6
75	28.81	0.62	-1.10	27.60	29.39	6	5
100	27.11	1.83	-0.24	24.54	29.32	6	6
125	23.71	2.94	0.35	20.83	27.91	6	5
150	20.61	2.81	0.86	18.50	25.72	6	6
175	18.05	1.74	1.06	16.71	21.40	6	6
200	16.11	0.96	1.05	15.23	17.97	6	6
225	14.69	0.69	1.01	14.07	16.01	6	5
250	13.55	0.36	1.25	13.33	14.28	6	6
300	12.10	0.26	0.54	11.90	12.50	5	5
400	9.48	0.28	-0.04	9.13	9.81	4	4
500	8.15	0.24	0.06	7.90	8.44	5	5

February

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.25	0.65	-1.03	28.00	29.84	6	5
10	29.15	0.69	-1.02	27.84	29.77	6	5
30	29.11	0.71	-1.01	27.76	29.76	6	5
50	29.06	0.70	-0.97	27.73	29.73	6	6
75	28.63	0.64	-0.42	27.61	29.32	6	4
100	27.42	1.67	-0.67	24.43	29.15	6	6
125	24.26	2.80	-0.06	21.14	27.36	6	5
150	21.39	2.82	0.55	18.70	26.01	6	5
175	18.86	1.70	0.71	17.33	21.87	6	6
200	16.85	1.09	0.45	15.79	18.45	6	6
225	15.06	0.88	0.48	14.22	16.34	6	6
250	13.62	0.44	0.90	13.28	14.38	5	5
300	12.06	0.18	0.12	11.87	12.28	4	4
400	9.57	0.35	-0.32	9.12	9.86	4	4
500	8.22	0.32	-0.04	7.89	8.61	5	5

Table A6. (continued)

March

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.13	0.67	-0.52	27.98	29.95	6	5
10	29.01	0.71	-0.54	27.78	29.86	6	5
30	28.94	0.74	-0.47	27.70	29.83	6	4
50	28.88	0.74	-0.46	27.65	29.76	6	6
75	28.51	0.77	-0.45	27.53	29.26	6	4
100	27.41	1.39	-0.68	24.96	28.71	6	6
125	24.49	2.37	0.04	21.74	27.36	6	5
150	22.06	2.68	0.58	19.63	26.54	6	5
175	19.64	1.76	0.62	17.96	22.70	6	6
200	17.25	1.11	0.26	16.13	18.75	6	6
225	15.20	0.86	0.38	14.30	16.35	6	6
250	13.64	0.37	0.86	13.31	14.28	5	5
300	12.13	0.19	-0.02	11.94	12.31	4	4
400	9.67	0.31	-0.11	9.32	9.95	4	4
500	8.27	0.35	0.06	7.87	8.73	5	5

April

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.08	0.73	-0.17	28.10	30.00	6	5
10	28.95	0.76	-0.19	27.89	29.88	6	5
30	28.86	0.82	-0.16	27.81	29.85	6	4
50	28.76	0.82	-0.21	27.70	29.72	6	6
75	28.50	0.89	-0.39	27.27	29.34	6	5
100	27.31	1.27	-0.31	25.73	28.56	6	6
125	24.65	2.33	0.17	21.78	27.79	6	5
150	22.42	2.50	0.51	20.02	26.35	6	5
175	20.00	1.76	0.44	18.07	22.81	6	6
200	17.35	1.17	0.19	15.93	18.84	6	6
225	15.13	0.81	0.17	14.13	16.22	6	6
250	13.55	0.28	0.28	13.21	13.96	5	5
300	12.03	0.17	0.43	11.87	12.26	4	4
400	9.69	0.27	0.05	9.45	9.98	4	4
500	8.23	0.30	0.11	7.84	8.65	5	5

Table A6. (continued)

May

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.20	0.66	-0.17	28.39	29.99	6	5
10	29.07	0.69	-0.16	28.24	29.86	6	5
30	28.99	0.74	-0.21	28.01	29.83	6	4
50	28.88	0.76	-0.27	27.86	29.70	6	6
75	28.43	0.86	-0.01	27.35	29.45	6	5
100	27.04	1.58	-0.64	24.32	28.64	6	6
125	24.66	2.20	0.08	21.66	27.55	6	5
150	22.46	2.21	0.32	19.78	25.76	6	5
175	19.91	1.62	0.15	17.74	22.27	6	6
200	17.11	1.10	-0.30	15.34	18.45	6	6
225	14.89	0.67	-0.31	13.81	15.76	6	6
250	13.43	0.25	0.36	13.15	13.80	5	5
300	11.89	0.15	0.52	11.76	12.10	4	4
400	9.65	0.23	0.00	9.41	9.90	4	4
500	8.16	0.25	-0.13	7.80	8.50	5	5

June

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.31	0.58	-0.14	28.55	29.94	6	5
10	29.18	0.60	-0.13	28.39	29.82	6	6
30	29.13	0.62	-0.17	28.28	29.78	6	5
50	29.01	0.66	-0.19	28.10	29.69	6	6
75	28.29	1.25	-0.65	26.13	29.36	6	5
100	27.00	1.78	-0.90	23.66	28.78	6	6
125	24.69	1.84	-0.27	21.73	26.89	6	6
150	22.35	1.85	-0.08	19.49	25.04	6	5
175	19.68	1.31	-0.32	17.53	21.43	6	6
200	16.83	0.94	-0.95	15.04	17.80	6	6
225	14.71	0.60	-0.64	13.66	15.36	6	6
250	13.35	0.26	0.75	13.13	13.78	5	5
300	11.90	0.16	0.38	11.76	12.13	5	5
400	9.53	0.28	0.20	9.24	9.89	4	4
500	8.01	0.20	-0.24	7.77	8.20	5	5

Table A6. (continued)

July

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.22	0.67	0.09	28.44	29.94	5	5
10	29.11	0.67	0.04	28.29	29.80	5	5
30	29.07	0.68	0.07	28.26	29.78	5	5
50	28.88	0.79	0.18	28.10	29.73	5	5
75	28.08	1.68	-0.68	25.32	29.52	5	5
100	26.74	1.80	-0.91	23.63	28.18	5	5
125	24.54	1.75	-0.47	21.75	26.61	5	5
150	22.11	1.89	-0.22	19.30	24.57	5	5
175	19.27	1.19	-0.30	17.46	20.78	5	5
200	16.46	0.75	-0.93	15.15	16.94	5	5
225	14.56	0.53	-0.18	13.80	15.22	5	4
250	13.28	0.27	0.41	13.01	13.68	5	5
300	11.90	0.13	-0.34	11.72	12.02	5	5
400	9.35	0.10	0.00	9.28	9.42	2	2
500	7.99	0.20	-0.11	7.77	8.17	4	4

August

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.13	0.75	-0.19	28.08	29.86	5	5
10	29.01	0.75	-0.25	27.93	29.73	5	4
30	28.95	0.75	-0.16	27.91	29.70	5	5
50	28.65	0.99	0.02	27.59	29.71	5	5
75	28.00	1.70	-0.55	25.32	29.44	5	4
100	26.64	1.86	-1.00	23.37	27.74	5	5
125	24.39	1.90	-0.71	21.23	26.25	5	5
150	21.82	2.06	-0.37	18.62	24.35	5	5
175	18.80	1.13	-0.40	17.03	20.17	5	5
200	16.31	0.63	-0.94	15.22	16.77	5	5
225	14.57	0.40	0.00	14.00	15.14	5	3
250	13.26	0.35	-0.06	12.84	13.69	5	5
300	11.91	0.18	0.36	11.73	12.19	5	5
400	9.44	0.08	0.00	9.38	9.49	2	2
500	7.95	0.17	0.18	7.80	8.14	3	3

Table A6. (continued)

September

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.13	0.83	-0.63	27.80	29.87	5	5
10	28.98	0.84	-0.63	27.62	29.74	5	4
30	28.86	0.81	-0.47	27.60	29.62	5	5
50	28.51	0.98	-0.01	27.44	29.49	5	5
75	27.92	1.61	-0.39	25.52	29.36	5	4
100	26.65	1.92	-0.78	23.41	28.41	5	5
125	24.29	1.90	-0.69	21.14	26.24	5	5
150	21.70	2.16	-0.49	18.26	24.20	5	5
175	18.63	1.09	-0.63	16.84	19.80	5	5
200	16.38	0.46	-0.97	15.58	16.67	5	5
225	14.65	0.37	-0.01	14.25	15.12	5	3
250	13.32	0.40	-0.70	12.66	13.67	5	5
300	12.01	0.15	0.51	11.87	12.25	5	5
400	9.41	0.08	0.00	9.36	9.47	2	2
500	8.02	0.18	0.37	7.90	8.23	3	3

October

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.28	0.96	-0.80	27.67	30.03	5	5
10	29.13	0.97	-0.77	27.52	29.92	5	4
30	28.98	0.91	-0.65	27.50	29.83	5	5
50	28.63	0.94	-0.12	27.37	29.70	5	5
75	28.09	1.50	-0.25	26.00	29.66	5	4
100	26.99	2.00	-0.73	23.66	28.85	5	5
125	24.73	1.90	-0.58	21.65	26.75	5	5
150	22.22	2.28	-0.36	18.88	24.71	5	5
175	19.07	1.21	-0.28	17.30	20.49	5	5
200	16.63	0.38	-0.49	16.06	16.94	5	5
225	14.80	0.28	-0.36	14.40	15.10	5	3
250	13.43	0.27	-0.45	13.01	13.73	5	5
300	12.18	0.15	-0.41	11.95	12.33	5	5
400	9.42	0.08	0.00	9.36	9.48	2	2
500	8.12	0.17	0.18	7.97	8.31	3	3

Table A6. (continued)

November

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.35	1.01	-0.77	27.66	30.18	5	5
10	29.26	1.00	-0.75	27.59	30.07	5	4
30	29.16	0.97	-0.75	27.55	29.93	5	5
50	28.92	0.89	-0.58	27.48	29.87	5	5
75	28.51	1.17	-0.05	27.20	29.89	5	5
100	27.34	1.89	-0.85	24.13	28.72	5	5
125	25.31	2.49	-0.30	21.90	27.89	5	4
150	22.66	2.97	-0.01	19.25	25.93	5	5
175	19.42	1.76	0.09	17.59	21.31	5	5
200	16.72	0.67	0.19	16.08	17.62	5	5
225	14.92	0.37	-0.23	14.42	15.34	5	4
250	13.55	0.22	0.14	13.30	13.78	5	5
300	12.27	0.20	-0.72	11.96	12.40	4	4
400	9.65	0.27	0.38	9.49	9.96	3	3
500	8.20	0.15	-0.01	8.07	8.33	4	4

December

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
SST	29.23	0.80	-0.82	27.76	30.03	6	6
10	29.17	0.80	-0.73	27.72	30.01	6	5
30	29.13	0.81	-0.75	27.66	29.96	6	6
50	29.05	0.78	-0.94	27.59	29.69	6	6
75	28.86	0.73	-0.77	27.52	29.65	6	5
100	27.49	1.75	-0.45	24.64	29.22	6	6
125	24.92	2.86	-0.05	21.62	28.65	6	5
150	21.59	3.16	0.44	18.91	25.98	6	6
175	18.56	1.99	0.59	16.69	21.87	6	6
200	16.24	0.98	0.60	15.11	17.94	6	6
225	14.74	0.57	0.68	14.11	15.75	6	5
250	13.56	0.29	1.10	13.34	14.12	6	6
300	12.19	0.20	0.28	11.98	12.46	5	5
400	9.56	0.21	0.53	9.37	9.86	4	4
500	8.14	0.19	0.11	7.94	8.35	5	5

Table A7. Mean seasonal cycles of zonal velocity (in cm s^{-1}) between the surface and 300 m at 0°, 165°E. Statistics are based on N monthly estimates, M of which are directly measured.

			January				
Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	10.33	32.81	0.38	-26.61	62.79	6	3
50	16.04	34.84	0.43	-21.64	72.06	6	5
100	0.11	20.30	0.22	-21.16	25.74	5	5
150	16.40	13.28	-0.70	-5.41	28.10	5	5
200	42.99	9.62	-0.90	24.99	51.70	6	6
250	18.38	11.99	-0.10	0.84	34.97	6	6
300	-12.47	9.37	-0.53	-27.82	-2.52	6	5

			February				
Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-22.57	18.85	0.09	-50.57	7.06	6	4
50	-16.93	16.54	0.08	-42.01	9.28	6	5
100	-25.12	10.72	-0.26	-39.80	-13.71	5	5
150	27.53	15.29	-0.38	4.57	42.94	5	5
200	50.00	10.70	-0.91	30.09	59.16	6	6
250	22.03	13.58	0.17	8.79	40.13	5	5
300	-12.43	10.29	-0.37	-26.63	-3.91	5	4

			March				
Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-25.41	23.84	-0.28	-63.69	2.12	6	4
50	-18.33	21.82	-0.42	-54.96	5.83	6	5
100	-23.94	15.23	0.25	-41.67	-2.00	5	5
150	28.71	23.15	-1.02	-12.29	42.44	5	5
200	52.39	9.62	-0.47	36.97	63.29	6	6
250	26.63	14.23	0.45	14.47	47.99	5	5
300	-8.64	12.93	-0.50	-28.24	3.16	5	4

			April				
Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-12.55	20.59	0.59	-37.92	23.66	6	4
50	-3.61	19.59	0.43	-29.53	29.77	6	4
100	-13.91	24.71	0.32	-46.63	26.27	6	6
150	32.47	29.42	-0.57	-15.09	64.81	5	5
200	53.91	7.89	-0.45	40.83	62.33	6	6
250	28.40	14.38	0.60	13.99	51.52	5	5
300	-4.35	15.40	-0.58	-28.97	10.13	5	4

Table A7. (continued)

May

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-0.60	17.07	0.27	-15.81	24.00	6	4
50	10.19	15.44	0.18	-4.70	31.55	6	4
100	5.80	27.28	0.21	-29.03	48.28	6	6
150	43.09	27.08	0.00	5.27	80.94	5	5
200	55.61	8.81	-1.24	37.99	61.29	6	6
250	27.90	15.07	0.33	9.74	50.67	5	5
300	-2.46	16.95	-0.47	-28.62	13.86	5	4

June

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	1.30	17.58	-0.06	-22.52	24.04	6	5
50	13.99	13.48	-0.12	-4.43	31.59	6	5
100	14.07	23.06	0.20	-11.30	44.27	6	6
150	48.88	16.69	0.66	31.37	76.49	5	5
200	56.53	10.46	-1.30	35.41	62.02	6	6
250	27.70	16.35	-0.23	3.91	47.51	5	5
300	-2.24	17.48	-0.35	-28.19	15.99	5	5

July

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	5.79	30.73	-0.16	-29.24	39.76	5	4
50	15.70	29.73	-0.22	-21.26	47.10	5	4
100	16.59	20.81	-0.07	-8.11	42.09	5	5
150	44.58	11.67	0.77	35.39	64.07	5	5
200	52.60	13.24	-1.01	29.21	61.52	5	5
250	26.40	17.39	-0.60	-1.71	44.21	5	5
300	-5.04	15.30	-0.49	-28.98	10.35	5	5

August

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	7.67	33.41	-0.15	-30.64	41.18	5	4
50	14.55	35.05	-0.29	-30.72	48.50	5	5
100	13.63	23.06	0.17	-13.02	45.34	5	5
150	39.01	15.81	0.44	24.60	62.12	5	5
200	46.86	18.96	-0.94	13.73	61.99	5	5
250	22.89	19.33	-0.74	-9.58	41.97	5	5
300	-8.94	13.43	-0.86	-32.06	3.03	5	4

Table A7. (continued)

September

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-1.15	24.81	0.01	-29.66	24.38	5	4
50	6.27	25.40	-0.29	-29.20	31.93	5	5
100	7.10	24.04	0.10	-17.15	39.33	5	5
150	33.16	24.87	0.35	9.93	66.45	4	4
200	40.82	27.12	-0.92	-6.28	60.17	5	5
250	19.59	22.22	-0.78	-17.83	39.32	5	5
300	-10.59	15.06	-0.96	-36.94	0.14	5	4

October

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-9.31	13.25	0.38	-22.72	10.68	5	4
50	-1.47	15.46	-0.45	-25.92	16.91	5	5
100	-0.70	14.73	-0.28	-19.76	13.12	5	5
150	15.68	28.54	0.51	-8.51	55.98	4	4
200	36.87	27.19	-0.95	-10.55	56.06	5	5
250	18.53	20.28	-0.80	-15.65	34.92	5	5
300	-9.76	15.50	-0.98	-36.98	0.69	5	4

November

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	-0.12	24.13	-0.03	-28.35	29.76	5	4
50	5.90	26.32	-0.17	-28.82	36.87	5	5
100	0.06	9.08	0.07	-11.75	12.53	5	5
150	3.11	20.14	0.57	-13.40	32.00	4	4
200	36.17	17.26	-0.94	6.11	48.65	5	5
250	19.42	12.76	-0.81	-2.04	28.39	5	5
300	-8.39	11.70	-0.79	-28.26	2.87	5	4

December

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	M
10	24.18	39.94	0.19	-27.01	84.15	6	4
50	29.67	42.14	0.13	-26.56	90.88	6	6
100	13.91	31.66	0.76	-17.43	71.63	6	6
150	2.96	17.46	-0.73	-26.05	17.16	5	5
200	37.44	9.97	-0.82	19.24	46.07	6	6
250	16.30	12.30	-0.31	-3.02	32.29	6	6
300	-12.49	11.67	-0.36	-30.96	2.15	6	5

Table A8. Mean seasonal cycles of meridional velocity (in cm s^{-1}) between the surface and 300 m at 0°, 165°E. Statistics are based on N directly measured monthly estimates.

January

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-7.15	0.80	0.36	-7.70	-6.23	3
50	4.49	5.04	-0.45	-3.06	9.56	5
100	6.96	4.40	-0.09	1.09	11.75	5
150	4.96	2.65	0.31	2.49	8.77	5
200	2.08	3.06	0.13	-1.27	5.96	6
250	-0.82	2.68	0.15	-3.25	2.75	6
300	0.77	2.51	0.28	-2.27	4.48	5

February

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-7.04	4.80	0.16	-12.55	-0.83	4
50	3.37	3.31	0.07	-0.67	7.73	5
100	6.25	5.40	-0.11	-0.17	12.46	5
150	5.59	3.44	0.25	1.77	10.41	5
200	1.69	3.98	-0.87	-5.69	5.10	6
250	-1.21	3.32	0.21	-4.51	3.06	5
300	-0.33	1.21	-0.01	-1.49	0.79	4

March

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-5.58	6.96	-0.51	-15.42	0.54	4
50	4.51	3.58	-0.02	0.46	8.88	5
100	5.86	3.96	-1.05	-1.19	8.09	5
150	3.06	4.58	0.89	-0.88	10.98	5
200	0.51	2.68	-1.02	-4.58	2.33	6
250	-1.25	2.64	-1.03	-5.93	0.26	5
300	-0.13	0.70	-0.55	-1.13	0.36	4

April

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-3.53	6.75	0.00	-11.66	4.60	4
50	3.14	2.39	-0.25	0.10	5.37	4
100	5.61	4.12	-0.03	-0.08	11.58	6
150	0.60	4.83	-0.18	-5.08	5.83	5
200	-1.13	2.37	-0.21	-4.57	1.58	6
250	-1.53	3.36	0.06	-5.20	2.35	5
300	-0.46	1.47	0.08	-2.04	1.27	4

Table A8. (continued)

May

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-3.58	6.23	0.14	-9.98	3.99	4
50	1.15	2.75	-0.03	-2.07	4.28	4
100	3.13	3.75	0.38	-0.56	8.88	6
150	0.06	6.63	-0.09	-6.92	6.97	5
200	-1.07	5.55	-0.63	-10.87	5.12	6
250	-1.35	4.12	0.79	-5.05	5.61	5
300	-1.62	2.21	0.06	-3.51	0.74	4

June

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-4.93	5.32	-0.01	-11.47	1.84	5
50	1.94	2.54	-0.32	-1.26	3.99	5
100	-0.09	4.65	-0.58	-8.06	4.52	6
150	-0.05	4.39	0.43	-4.63	6.53	5
200	-1.07	6.82	-0.74	-13.38	5.26	6
250	-1.13	4.37	0.22	-6.77	5.34	5
300	0.38	3.22	0.61	-2.96	5.59	5

July

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-4.79	4.29	0.02	-8.53	-0.60	4
50	1.35	5.48	0.70	-2.22	9.49	4
100	-1.14	4.26	0.34	-5.76	5.06	5
150	-0.58	6.69	0.29	-7.23	8.32	5
200	-2.63	7.36	-0.38	-13.60	5.47	5
250	1.09	6.10	-0.89	-9.41	5.35	5
300	1.34	2.48	0.19	-1.56	4.70	5

August

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-5.36	5.25	0.08	-9.98	0.39	4
50	-0.41	6.08	-0.03	-7.42	6.02	5
100	-1.67	3.35	-0.41	-6.74	2.00	5
150	1.37	10.27	0.43	-7.74	16.27	5
200	-1.32	5.35	-0.21	-7.16	3.65	5
250	4.48	7.80	-0.42	-6.68	11.41	5
300	0.55	3.41	0.66	-2.04	5.56	4

Table A8. (continued)

September

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-9.33	12.19	-0.52	-26.56	0.52	4
50	-2.16	3.00	-0.16	-6.57	1.84	5
100	-1.83	5.26	0.26	-8.61	6.12	5
150	-0.41	4.44	0.19	-5.38	5.35	4
200	1.85	3.30	-0.50	-3.31	4.95	5
250	4.51	5.91	-0.10	-1.79	10.44	5
300	-1.06	3.32	0.61	-3.47	3.75	4

October

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-8.84	13.26	-0.59	-27.96	1.61	4
50	-1.45	2.39	0.96	-3.25	2.74	5
100	0.06	5.85	0.99	-4.14	10.35	5
150	-1.00	2.72	0.29	-3.59	2.56	4
200	2.34	3.91	0.18	-1.54	7.14	5
250	3.11	4.30	0.67	-0.03	10.02	5
300	-2.92	1.91	0.26	-4.61	-0.50	4

November

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-5.25	8.53	0.03	-15.31	5.05	4
50	-0.76	5.03	-0.07	-7.25	4.95	5
100	2.06	4.99	0.16	-3.47	7.53	5
150	-2.27	1.57	-0.67	-4.58	-1.24	4
200	2.33	5.43	-0.69	-6.61	6.71	5
250	2.65	4.37	-0.20	-2.82	7.36	5
300	0.06	5.26	0.72	-3.27	7.90	4

December

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N
10	-3.29	7.74	0.41	-9.65	7.21	4
50	1.37	8.06	-0.43	-11.23	9.11	6
100	5.66	8.49	0.68	-1.75	20.10	6
150	1.02	2.53	-0.11	-2.60	4.37	5
200	2.05	2.65	-0.12	-2.07	5.88	6
250	0.53	2.32	0.11	-1.75	3.49	6
300	0.42	2.92	0.51	-2.08	4.86	5

Table A9. Mean seasonal cycles of winds and air temperature at 0°, 165°E. Statistics are based on N monthly estimates, directly measured at 0°, 165°E or Nauru Island.

Zonal Wind Velocity (m/s)

Month	Mean	Std. Dev.	Skew	Min	Max	N
January	-0.79	3.12	-0.70	-5.40	1.20	4
February	-1.88	2.86	-0.14	-5.51	1.40	5
March	-2.41	2.58	0.00	-5.43	0.45	6
April	-2.20	2.02	0.02	-4.94	0.57	6
May	-1.93	1.85	0.51	-4.05	1.23	6
June	-1.87	2.12	0.54	-3.95	1.76	6
July	-1.60	2.91	0.06	-4.56	2.21	5
August	-1.20	3.04	-0.25	-4.54	1.68	5
September	-0.97	2.65	-0.16	-4.00	1.85	5
October	-0.89	2.46	0.03	-3.88	2.33	5
November	-0.17	3.29	-0.41	-5.29	3.74	5
December	0.94	3.46	-0.89	-5.53	4.09	6

Meridional Wind Velocity (m/s)

Month	Mean	Std. Dev.	Skew	Min	Max	N
January	-1.55	0.72	-0.42	-2.53	-0.99	4
February	-1.39	1.06	-0.48	-3.03	-0.43	5
March	-1.03	1.04	-0.22	-2.62	0.14	6
April	-0.70	0.84	-0.16	-1.74	0.22	6
May	-0.28	0.65	0.46	-1.02	0.80	6
June	0.20	0.39	-0.17	-0.38	0.71	6
July	0.40	0.66	0.11	-0.39	1.20	5
August	0.29	0.75	0.24	-0.45	1.19	5
September	0.13	0.47	0.41	-0.30	0.85	5
October	-0.11	0.31	-0.02	-0.50	0.29	5
November	-0.74	0.38	0.53	-1.09	-0.15	5
December	-1.51	0.41	-0.42	-2.11	-1.10	6

Wind Speed (m/s)

Month	Mean	Std. Dev.	Skew	Min	Max	N
January	4.59	0.99	0.17	3.59	5.80	4
February	4.45	0.83	0.41	3.48	5.74	5
March	4.43	0.87	-0.02	3.27	5.58	6
April	4.04	0.78	0.13	3.14	5.15	6
May	3.79	0.45	-0.12	3.17	4.38	6
June	3.81	0.52	-0.33	3.02	4.34	6
July	3.95	1.02	-0.17	2.83	4.97	5
August	3.78	1.00	0.13	2.78	4.98	5
September	3.47	0.64	0.31	2.78	4.42	5
October	3.80	0.53	-0.35	3.02	4.39	5
November	4.55	0.90	0.11	3.57	5.59	5
December	4.89	0.95	0.08	3.88	5.96	6

Table A9. (continued)

Zonal Wind Pseudo-stress (m**2/s**2)

Month	Mean	Std. Dev.	Skew	Min	Max	N
January	-4.18	20.94	-0.69	-35.15	10.61	4
February	-9.71	18.13	-0.25	-34.56	10.30	5
March	-12.58	16.09	-0.03	-32.45	5.64	6
April	-10.91	11.58	-0.19	-27.99	3.16	6
May	-8.50	9.79	0.31	-20.22	7.28	6
June	-7.98	12.11	0.47	-21.03	12.48	6
July	-7.37	17.21	0.08	-24.67	15.50	5
August	-6.07	16.46	-0.25	-24.30	9.38	5
September	-4.57	12.60	-0.19	-19.88	9.05	5
October	-2.79	14.36	0.10	-20.52	17.04	5
November	1.07	23.30	-0.36	-34.71	29.36	5
December	7.11	24.08	-0.78	-36.85	29.30	6

Meridional Wind Pseudo-stress (m**2/s**2)

Month	Mean	Std. Dev.	Skew	Min	Max	N
January	-8.12	4.41	-0.27	-13.79	-4.01	4
February	-7.20	5.82	-0.37	-15.71	-1.90	5
March	-5.20	5.31	-0.21	-13.33	1.17	6
April	-3.39	4.23	-0.14	-9.19	1.64	6
May	-1.62	3.11	0.25	-4.55	2.90	6
June	0.72	2.00	-0.41	-2.03	2.46	6
July	2.07	3.85	0.12	-2.41	6.63	5
August	1.47	4.02	0.22	-2.58	5.84	5
September	0.63	2.29	0.17	-1.73	3.72	5
October	-0.53	1.87	0.15	-2.69	1.76	5
November	-3.44	3.84	0.58	-7.12	2.66	5
December	-7.47	3.01	-0.14	-11.29	-3.75	6

Air Temperature (deg C)

Month	Mean	Std. Dev.	Skew	Min	Max	N
January	27.86	0.48	-0.33	27.31	28.22	3
February	27.84	0.51	-0.29	27.27	28.24	3
March	27.82	0.52	-0.28	27.24	28.24	3
April	28.15	0.64	0.18	27.44	28.97	4
May	28.28	0.50	0.17	27.71	28.98	5
June	28.21	0.45	0.44	27.85	28.86	5
July	28.09	0.42	-0.11	27.57	28.57	4
August	27.90	0.26	-0.70	27.51	28.07	4
September	27.92	0.15	-0.13	27.79	28.08	4
October	28.25	0.40	0.21	27.90	28.69	3
November	28.06	0.58	-0.09	27.34	28.73	4
December	28.01	0.43	-0.56	27.32	28.45	5

Table A10. Annual means for ocean temperature and velocity at 0°, 165°E. Statistics are based on N = 12 climatological monthly means as presented in Tables A5–A7. NTOT is an index showing the total number of months of directly measured data at each depth.

Zonal Currents (cm/s)

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	NTOT
10	-1.87	13.96	-0.08	-25.41	24.18	12	48
50	6.00	14.06	-0.34	-18.33	29.67	12	58
100	0.63	14.55	-0.64	-25.12	16.59	12	64
150	27.97	15.49	-0.35	2.96	48.88	12	57
200	46.85	7.67	-0.18	36.17	56.53	12	67
250	22.85	4.38	-0.01	16.30	28.40	12	62
300	-8.15	3.77	0.33	-12.49	-2.24	12	52

Meridional Currents (cm/s)

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	NTOT
10	-5.72	1.99	-0.49	-9.33	-3.29	12	48
50	1.38	2.24	-0.06	-2.16	4.51	12	58
100	2.57	3.41	-0.04	-1.83	6.96	12	64
150	1.03	2.38	0.68	-2.27	5.59	12	57
200	0.47	1.80	-0.30	-2.63	2.34	12	67
250	0.76	2.35	0.49	-1.53	4.51	12	62
300	-0.25	1.16	-0.85	-2.92	1.34	12	52

Temperature (degrees C)

Depth (m)	Mean	Std. Dev.	Skew	Min	Max	N	NTOT
SST	29.21	0.08	0.85	29.08	29.35	12	62
10	29.10	0.09	0.19	28.95	29.26	12	57
35	29.02	0.11	-0.64	28.86	29.16	12	59
50	28.86	0.18	-0.51	28.51	29.06	12	67
75	28.39	0.31	-0.05	27.92	28.86	12	55
100	27.10	0.30	-0.21	26.64	27.49	12	67
125	24.55	0.39	-0.21	23.71	25.31	12	60
150	21.95	0.57	-0.88	20.61	22.66	12	62
175	19.16	0.60	-0.19	18.05	20.00	12	67
200	16.69	0.41	0.22	16.11	17.34	12	67
225	14.83	0.21	0.39	14.56	15.20	12	57
250	13.46	0.13	-0.20	13.26	13.64	12	62
300	12.05	0.13	0.16	11.89	12.27	12	55
400	9.54	0.12	-0.07	9.35	9.69	12	39
500	8.12	0.10	-0.27	7.95	8.27	12	52

Table A11. Annual means for winds and air temperatures at 0°, 165°E. Statistics are based on N = 12 climatological monthly means as presented in Table A8. NTOT is an index showing the total number of months of data directly measured at 0°, 165°E or Nauru Island.

Air Temperature (degrees C)

	Mean	Std. Dev.	Skew	Min	Max	N	NTOT
Air T	28.03	0.17	0.10	27.82	28.28	12	47

Winds (m/s)

	Mean	Std. Dev.	Skew	Min	Max	N	NTOT
Zonal	-1.25	0.95	0.83	-2.41	0.94	12	64
Meridional	-0.52	0.73	-0.16	-1.55	0.40	12	64
Speed	4.13	0.43	0.24	3.47	4.89	12	64

Wind Pseudo-stress (m**2/s**2)

	Mean	Std. Dev.	Skew	Min	Max	N	NTOT
Zonal	-5.54	5.46	0.88	-12.58	7.11	12	64
Meridional	-2.67	3.67	-0.20	-8.12	2.07	12	64

*U.S. GOVERNMENT PRINTING OFFICE: 1993-774-025/89009