I.O.S.

REPORT ON SEA LEVEL DATA COLLECTED DURING THE MEDALPAX EXPERIMENT FROM SEPTEMBER 1981 – SEPTEMBER 1982

BY
L.J. RICKARDS

REPORT NO. 209
1985

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

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BIDSTON

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FOREWORD BY DIRECTOR, PSMSL

In 1975 the Intergovernmental Oceanographic Commission (IOC) at its Ninth Session, decided to support the development of an oceanographic programme in the Mediterranean Sea during the GARP Alpine Experiment (ALPEX). The main aim which led to the undertaking of MEDALPEX was to understand the effect of wind forcing on the dynamics of the western part of the Mediterranean.

Specific Scientific objectives of the proposed studies included:

1. The inter-relationship between the general circulation and meso-scale eddies.
2. Offshore dynamic response mechanisms under severe weather conditions.
3. Storm surges and coastal piling up.

For all of these studies it was considered that measurements of sea level would be an important component of the observation programme. The Permanent Service for Mean Sea Level (PSMSL) was asked by IOC to fulfil the role of Responsible National Oceanographic Data Centre for MEDALPEX sea level data. PSMSL, and the Bidston Laboratory of the Institute of Oceanographic Sciences (IOS) from which PSMSL operates on behalf of the ICSU Federation of Astronomical and Geophysical Services, have considerable experience of handling long-term sea level data sets. It was appropriate that we should undertake this work, both because of its immediate importance and also because the experience gained would be relevant to the potential demand for sea level data management in association with the World Climate Research Programme and its related experiments. The results are also relevant to the UNESCO/ICSU International Geophysical Correlation Programme - Project 200 (IGCP-200) on sea level changes.

The work was undertaken by the IOS Marine Information and Advisory Service (MIAS) which operates as the UK's National Oceanographic Data Centre. The collection and publication of data in a systematic way is not a trivial matter: it requires careful advance planning, the cooperation of tide gauge authorities in several countries for the measurement and initial analysis, and considerable determination and enthusiasm from the Data Centre in encouraging the participants to contribute their results in a uniform and timely way. The co-operation of all the participants, who are acknowledged in this report, is very much appreciated.

Although, due to practical constraints, the amount of sea level data finally collected was less than that envisaged during the planning stage of MEDALPEX, it is obvious that a substantial and valuable body of data has been collected. These data are archived on the MIAS data base and are available to potential users on request, either as computer listings or on magnetic tape in the standard IOC GF-3 Format. Enquiries should be directed in the first instance to PSMSL at Bidston.

D.T. Pugh
Director, PSMSL
17 May, 1985

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ABSTRACT

The Mediterranean Alpine Experiment (MEDALPEX) was undertaken to investigate the role of atmospheric forcing on the dynamics of the Western Mediterranean. Hourly values of sea level were collected from 29 sites in the region over the period September 1981 to September 1982. The management, quality control and analysis of these data were carried out by the U.K. Marine Information and Advisory Service (MIAS) on behalf of the Permanent Service for Mean Sea Level (PSMSL).

The report describes the methods used to compile the MEDALPEX data into a uniform data set and includes a comprehensive collection of data analysis presentations. The data were both tidally analysed and low pass filtered, and non-tidal fluctuations were investigated using principal component analysis. The low pass filtered data show a fairly good correlation with the passage of meteorological events particularly the Adriatic Sea data. Principal components analysis suggests that the non-tidal variations in sea level in the Western Mediterranean and the Adriatic Sea were decoupled over the period of the MEDALPEX Experiment.

A magnetic tape copy of the data set, including documentation, is available from PSMSL in the GF-3 format, the IOC's general format for the exchange of oceanographic data.

INTRODUCTION

The Mediterranean Alpine Experiment (MEDALPEX) formed an additional part of the Global Atmospheric Research Programme (GARP) sub-programme on the airflow over and around mountains. MEDALPEX ran concurrently with the GARP Alpine Experiment (ALPEX), that is over the year from 1 September 1981 to 30 September 1982 with a special observation period (SOP) from 15 February 1982 to 30 April 1982. The main aim of ALPEX was to study processes such as lee cyclogenesis and severe local winds (for example the Mistral and the Bora), which have two frequency peaks during the year, one in November and the other in April. This was one of the reasons for the SOP in April.

The ALPEX area covered an inner experiment area of 38°N to 50°N, 5°W to 30°E, centred over the Alps in which all the special observing systems dedicated to ALPEX were installed. This was surrounded by a larger experimental area (30°N - 60°N, 30°W - 37°E) which served to describe the large scale flow in which the orographically disturbed air is embedded. The MEDALPEX area included the Ligurian Sea, the Adriatic Sea and the Western Mediterranean in general (35°N - 45°N, 3°W - 20°E) - see Figure 1.

The Mediterranean is a deep enclosed sea where tides are small and motion is essentially due to atmospheric forcing. Oceanographic experiments with simultaneous meteorological data collection are necessary for a better understanding of the dynamics of the Mediterranean and for setting up well calibrated models. The Mediterranean may also be regarded as a small scale model of the ocean. Thus studies on the dynamics of gyres, fronts, baroclinic instabilities, eddies, turbulent dissipation and intermittancy, especially during storm conditions, can contribute to the understanding of energy transfers in the ocean and its boundaries. The mesoscale eddies and meanders which play an essential role in this circulation, forming the summer thermocline and winter convection may also be studied. All of the above rely heavily on the spatial and temporal aspects of meteorological processes.

The primary function of MEDALPEX was to study the response of the western part of the Mediterranean to wind forcing. The experiments which took place, often as part of an individual country's oceanographic research programme, were designed with the intention of increasing understanding of the general problem of meteorological and oceanographic interaction. Specific topics under investigation included:

i) the interrelationship between the general circulation and mesoscale eddies

ii) offshore dynamic response mechanisms under severe weather conditions. The behaviour of the Mediterranean under severe weather conditions when oceanographic ships cannot operate has, until now, yielded only limited information. MEDALPEX sought to collect data (especially during the SOP) to give more complete information during periods of bad weather

iii) storm surges and coastal piling up - for the Adriatic Sea, more detailed verification of storm surge models can be carried out with improved wind field data. The Ligurian Sea has very small tides but sea level rises and coastal waves during cyclogenesis damage the coastline. With good wind field, wave and sea level data a model may be developed to simulate this

MEDALPEX was a multinational programme with participants from seven countries (Belgium, France, Italy, Spain, U.K., U.S.S.R. and Yugoslavia). A wide range of oceanographic data, including data from tide gauges, current meters, thermistor chains, waverider buoys, CTD's and XBT's was collected. Classical and synoptic meteorological measurements were made and remote sensing techniques used. The data resulting from MEDALPEX were to be forwarded to the Responsible National Oceanographic Data Centre (RNODC) - in this case World Data Centre B (Oceanography) in Moscow - with the exception of the sea level data. The Permanent Service for Mean Sea Level (PSMSL) undertook to act as the Sea Level Data Centre for MEDALPEX; the data management and banking was carried out by the

Marine Information and Advisory Service (MIAS). This report is a compilation of the data received, together with statistical summaries, compiled by MIAS.

DATA MANAGEMENT, VALIDATION AND PROCESSING

At the start of the MEDALPEX year six countries had agreed to send hourly values of sea level from ports around the Mediterranean. The commitment was as follows: Belgium - 1 site (SOP only), France - 7 sites (1 for SOP only), Italy - 12 sites, Spain - 7 to 9 sites, Yugoslavia - 8 sites and U.K. - 1 site; a total of 36 to 38 sites.

In the event MIAS received data from 29 sites as shown in Figure 1 and Table 1; including data from Belgium (1), France (4), Monaco (1), Italy (6), Spain (8), Yugoslavia (8) and U.K. (1). The coastal sites were instrumented with conventional stilling wells, and at the offshore site off the coast of Corsica data were collected by an Aanderaa Water Level Recorder. A bar chart illustrating the duration of the data from each site may be found in Figure 2. This shows that 19 sites cover all or most of the whole ALPEX/ MEDALPEX observation period, 2 sites cover considerably less than the whole year, and 8 sites have data for the SOP only. Tide gauges were not installed at Rosas or Blanes.

Most of the sea level data were received by MIAS on 9 track magnetic tape in the form of hourly values of sea surface elevation (in units of mm or cm) - data from Marseilles was submitted in the form of daily means. Usually local time was quoted for the data values. Some data arrived in the form of listings which were then punched onto cards, and one data set was received on a floppy disk.

One data set was sent as raw digitized data from charts so extensive processing had to be carried out in order to convert the data to time and elevation. The time values thus derived were irregularly sampled, and further processing was necessary to convert the series to hourly values. If all of the data had been received in this form it may not have been possible to deal with the extra work involved. In general, quite adequate documentation accompanied the data sets.

The data series were translated to a common format, and the elevation values converted from centimetres and millimetres to metres. The time zone was standardised to G.M.T. The data were then plotted in the form of a time series plot for each site to enable checks to be carried out. The time series were inspected for gaps or constant values, spikes, spurious data or punching errors. Where gaps occurred, these were flagged as null data and documented. Spikes were flagged as suspect data, but no attempt was made to alter any data value unless instructed to do so by the data originator. No interpolation of gaps was carried out. The approximate tidal range of each site was compared with a tidal atlas, and data from nearby sites were compared. A check was also carried out on the periodicity to ensure that the correct interval between data values had been quoted. Time series presentations of the data are found in Appendix 1. Tabulated values of daily mean sea level at Marseilles may be found at the end of this section. In addition to screening the data cycles, the series header qualifying information was also checked for irregularities and inconsistencies, for example the site position, start and end of the data series and number of data cycles were checked at this stage and inconsistencies resolved. Other relevant information included with the data was stored in the form of plain language documentation linked to the appropriate data series. A document typically contained information about the tide gauge site, the position of the tide gauge benchmarks and their heights, a list of gaps in the data series, any problems encountered with the instrument, in addition to any other relevant site specific information. The documentation accompanying the data from each site may be found in Appendix 2.

Tidal analysis of each data series was carried out using the Institute of Oceanographic Sciences Tidal Institute Recursive Analysis (TIRA) package which utilises the harmonic method of analysis (Murray 1963, Webb 1982). Where possible, the analysis was carried out over a year of data; this produces 63 constituents. If less than 1 year of data was available the tidal analysis was carried out over 58 days which gives 29 constituents. For these shorter series some of the longer period constituents are not separable from the major harmonic constituents, hence they have been calculated by relating them to the constituents of the equilibrium tide. The TIRA package requires the data to be blocked because of computer core limitations. This facility allows for the use of data containing gaps. The blocks may be arranged such that one block ends at the start of a gap in the data and the next block commences at the end of the same gap. The package also calculates the mean and standard deviation of the data series. The time zone is G.M.T. throughout. Tabulated values of the amplitude (m) and phase (^{o}) of the harmonic constituents at each site can be found in Appendix 3. The residuals produced by the removal of the tidal effects have been plotted for the SOP and the plots stacked by month (see Appendix 4).

The data have also been filtered using a low pass filter. Figure 3 shows the frequency response of the filter; the half power point occurs at 47 hours. This effectively removes the tidal signal leaving events due to meteorological forcing.

The filtered data have been plotted as time series; the plots have again been stacked by month and visually inspected for correlation with meteorological events and with each other. These may be found in Appendix 5.

DISCUSSION

The tides of the western Mediterranean are small in range (Maloney and Burns 1959, Purga et al 1979). The mean spring tidal range declines rapidly from 1m around Gibraltar to 0.5m at Malaga. The Liguro-Provencal basin sites have mean spring ranges of only 0.3m. The tidal regime is predominantly semi diurnal except in the northern part of the Adriatic where diurnal tides are important. Figures 4 and 5 show the M_2 and S_2 amplitude and phase from the tidal analysis, and Figure 6 the M_2 amplitude and phase.

The equilibrium tide, produced by the gravitational effects of the moon and sun on the Earth, has amplitudes of the constituents proportional to the forces on their respective bodies. The ratio of these tide generating forces (i.e. the equilibrium ratio, S_2/M_2) is

0.47. However, the ratio may differ from the equilibrium value because of the size and shape of the basin. Table 2 lists the M_2 and S_2 amplitudes and S_2/M_2 ratios for the MEDALPEX sea level sites; the latter are also shown in Figure 7. In the western Mediterranean, including the Liguro-Provençal basin, the average value for the S_2/M_2 ratio is 0.39 (0.84 of the equilibrium ratio), and for the Adriatic Sea S_2/M_2 is 0.59 (1.2 times the equilibrium value).

The time delay between new of full moon and the maximum spring tidal range, known as the age of the tide, is given by the following equation:

$$\frac{\text{phase of } S_2 - \text{phase of } M_2}{\text{speed of } S_2 - \text{speed of } M_2}$$

This also will be a function of the size and shape of the basin. The values for the age of the tide in the MEDALPEX region appear to become smaller as one moves from west to east. At the western end of the Mediterranean the age of the tide is approximately 25 hours, decreasing to between 18 to 10 hours in the Liguro-Provençal basin. In the Adriatic Sea, where some values are negative, the average value for the age of the tide is approximately 4 hours (Table 3, Figure 8).

In general the harmonic constants produced by the tidal analysis are in reasonably good agreement with other published values, for example those in the International Hydrographic Bureau (IHB) library. Inspection of the residuals produced by the tidal analysis suggests that some of the tidal signal has not been removed by the analysis. This may be because the equilibrium constants used in the prediction part of the analysis may not be a good representation of the Mediterranean tides, or there may be site specific problems. For example there could be timing problems with the chart recorder or errors arising from the digitization of the data. Problems of this type appear to have occurred at Genova for a few days near the beginning of November 1981, just after the tide gauge had been out of operation for a few days, and also at Cadiz, in this case at various times throughout the MEDALPEX year.

It is possible to look at the variance of a data series before and after tidal analysis (i.e. the original data and the residuals) with a view to assessing how well the predictions fit the data (Table 4). However, when the tidal range is relatively large, for example around the Straits of Gibraltar, a large proportion of the variance in the data series is due to the tidal signal; when the tidal range is small (i.e. in the Liguro-Provençal basin) the variance of the residuals is quite large, and may even be comparable with the variance of the tidal signal.

The residuals, plotted as time series for the SOP (Appendix 4), show a number of interesting features. The sites in the Adriatic Sea show an event between 11-13 March which seems to increase in amplitude as one moves northward. This may be due to a wave disturbance over the Adriatic on 11 March which then moved rapidly south east. The residuals from the Adriatic Sea sites all show a similar pattern but this is not reflected in the residuals from the Western Mediterranean and Liguro-Provençal basin, which show a different pattern. The probable timing problems associated with Cadiz are evident from the residuals for April (the gauge was not operational during March) and some spikes are visible, for example Almeria - 20 and 23 April, Koper - 3 April and Zadar - 11 April.

Although it is possible to tie in meteorological events with the residuals from the tidal analysis, it is probably better to compare the events with the filtered data (Appendix 5). The following cyclogenesis events were noted during the SOP:

2- 3 Mar	Medium intensity, fast moving lee cyclone
4- 5 Mar	Strong lee cyclogenesis associated with well defined cold front
11 Mar	Wave disturbance over Adriatic moves quickly south east to become full fledged cyclone over Greece
13 Mar	Weak, but weather intensive lee cyclone. Fast movement towards Greece, secondary centre moving north east

20-21 Mar Deep cyclogenesis over Italy accompanied by approach of intense jet streak. Slow south eastward movement

30-31 Mar Shallow cyclone originating near Balearic Islands possibly reinforced by intense upper air vortex hovering over south eastern France

13-14 Apr Shallow cyclone drifting towards Italy in conjunction with eastward displacement of upper air low previously stationed off coast of Monaco

24-25 Apr Deep, moderately strong lee cyclogenesis fed by intense mesoscale upper level disturbance embedded in general northerly air flow

30 Apr Deep moderately strong lee cyclogenesis, upper level flow configuration similar to 24 April

Inspection of the time series plots of filtered data shows that, in some cases, a slight increase in sea level occurs in conjunction with the cyclogenesis events. Higher atmospheric pressure depresses sea level while lower pressure causes a rise in sea level. The Adriatic sea sites show most of the events quite clearly, whereas the Western Mediterranean does not appear to reflect a lot of the meteorology. This is probably because the cyclones formed further to the east of the Western Mediterranean basin. Similar occurrences are visible during other months. Some good examples of increases in sea level seemingly associated with meteorological events are found on 28 September 1981, 27 October 1981, 18-19 December 1981 and 22 December 1981.

A preliminary investigation of the non-tidal sea level fluctuations was carried out on the data set. The correlation coefficient between each pair of stations was calculated from the hourly residuals produced by the tidal analysis. This showed that sites from Algeciras to Toulon are highly correlated, and sites from within the Adriatic have a high correlation with each other, with the exception of Zadar, but the Adriatic sites have low correlation coefficients with the Mediterranean sites. Palma de Mallorca does not correlate well with any of the other sites and Nice shows negative correlation coefficients with the Western Mediterranean sites. This simple analysis suggests that the Western Mediterranean and Adriatic sites are responding to different events.

To investigate this further the hourly residuals were analysed using Principal Components Analysis (PCA). If sea level is observed at N sites then the total variance within the dataset is the sum of individual variances at each site. PCA is a data transformation technique (**Morrison 1967**) which attempts to simplify the N degrees of freedom in the raw data by as few functions as possible. For example, if all stations fluctuate together then only one common function would be required to describe the entire dataset. Formally PCA determines the eigenvalues and eigenvectors of a symetric N x N matrix whose elements are the correlation coefficients between pairs of station sea level records. Each eigenvalue (λ_j) then measures the amount of variance accounted for by each eigenmode, j , and the variance at each station associated with eigenmode, j , is given by

$$\sigma^2_{ji} = \lambda_j \, B^2_{ji}$$

where the B_{ji} (i = 1,N) forms the j-th eigenvector.

If all stations fluctuate together then all components of B_{ji}, the first most energetic eigenmode, will have the same sign. PCA can be based on either the correlation or alternatively the variance - covariance matrix. The analysis used for the MEDALPEX data was based on the former; this ensures that each station's sea level record contributes equally to the total variance (i.e. no weighting is introduced). If the variances of the station records are approximately equal, the two analyses should give similar results. However, if some of the stations have considerably larger variances than others, they will dominate the results from the variance - covariance but not the correlation based analysis.

The PCA took place in several stages. Data from 20 sites, selected to give a good spatial coverage of the area of interest, were analysed for the SOP. This period was chosen in order to allow the inclusion of the Yugoslavian sites. The sites chosen were Algeciras, Ceuta, Malaga, Palma de Mallorca, Alicante, Port Vendres, Toulon, Nice, Ajaccio, Napoli, Ancona, Venezia, Koper, Rovinj, Bakar, Zadar, Novalja, Split, Dubrovnik and Bar (i.e. 4, 5, 7, 10, 11, 14, 17, 18, 21, 28, 30, 32-40 on Figure 1).

The first eigenmode produced by the analysis accounted for 36% of the total variance. The eigenvector coefficients (B_{1i}) for the Adriatic sites were all the same sign and similar magnitude (Figure 9), whereas the sites from the Western Mediterranean, including the Liguro-Provençal basin, were all much smaller in magnitude. However, the Liguro-Provençal values are larger than the Western Mediterranean sites. The second eigenmode accounted for 28% of the variance and the distribution of eigenvector coefficients (B_{2i}) show almost the reversed pattern. The Adriatic sites coefficients were all quite close to zero, except Zadar, whereas sites in the Western Mediterranean had all approximately the same sign and magnitude, except for Palma de Mallorca and Nice, which were of the opposite sign. The analysis was repeated replacing Nice by nearby Monaco; this produced similar results except that the coefficient for Monaco was of the same sign as the other sites except Palma de Mallorca. This suggested that either local conditions at Nice - maybe introducing some sort of time lag into the data - or some problem within the data produced this result. No nearby station was available to replace Palma de Mallorca, but similar problems may occur there, although, of course, the differences may be genuine.

The j-th 'principal component' ($PC_j(t)$) is defined by the scalar product of the j-th eigenvector and the normalised data at time t:

$$PC_j(t) = \sum_i B_{ji} \, h'_i(t)$$

and

$$h'(t) = (h_i(t) - \bar{h}_i) / \sigma_i$$

where $h_i(t)$ is sea level at station i at time t and σ_i^2 is the sea level variance for that station. Defined in this way, each PC_j is a dimensionless variable which measures the time dependence of the spatial patterns described by the eigenvector B_{ji}.

The first and second principal components for the above analysis have been compared (Figure 11) and they show quite different patterns; this may have been inferred from a close inspection of the time series plots of the residuals (Appendix 4). (Zero hours on Figure 11 is 0000h 1 March 1982).

The ten Adriatic sites were then studied in a separate PCA analysis; 68% of the total variance was accounted for by the first eigenmode and all the eigenvector coefficients associated with it were of the same sign and magnitude (Figure 12), except that Zadar was smaller in magnitude. The first component was very similar to that produced by the analysis of all twenty sites (Figure 11). In addition, the ten Western Mediterranean sites were also analysed separately; 52% of the variance was accounted for by the first eigenmode, with all the eigenvector coefficients being the same sign, with the exception of Palma de Mallorca and Nice. Replacing Nice with Monaco had the same effect as in the previous analysis. The magnitude of the eigenvector coefficient for the Liguro-Provençal sites was slightly smaller than the Western Mediterranean sites. The first component in this case was very similar to the second component produced from the analysis of all twenty sites (Figure 11). The correlation coefficient between the Western Mediterranean first component and the Adriatic first component is very close to zero ($r = 0.07$); suggesting that sea level variations in the Adriatic Sea and the Western Mediterranean basin are decoupled over this time scale.

The monthly mean values of sea level were calculated for the sites with data for the full MEDALPEX year (Table 5, Figure **14**). All sites show a slight increase in sea level in April 1982, and most of the sites from Almeria eastward around the tide gauge network show a peak around December 1981/January 1982. The sites west of Almeria in general show little variation at this time. Annual mean sea levels were also calculated and are given in Table 6.

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LIST OF TABLES

SITE NO.*	SITE	LATITUDE	LONGITUDE	START DATE	SERIES DURATION	CYCLE INTERVAL
		DDD MM.MH	DDD MM.MH	DD/MM/YY	WEEKS	SECS
1	CADIZ	36 32.0N	6 17.0W	01/09/81	56	3600
2	TARIFA	36 0.0N	5 36.0W	01/09/81	56	3600
3	GIBRALTAR	36 8.0N	5 21.0W	01/09/81	56	3600
4	CEUTA	35 54.0N	5 19.0W	01/09/81	56	3600
5	ALGECIRAS	36 7.0N	5 26.0W	01/09/81	56	3600
6	PUERTO BANUS	36 37.0N	4 55.0W		NO DATA	
7	MALAGA	36 43.0N	4 25.0W	01/09/81	56	3600
8	ALMERIA	36 49.7N	2 29.2W	14/08/81	58	3600
9	CARTEGENA	37 36.0N	0 59.0W		NO DATA	
10	ALICANTE I	38 20.3N	0 30.4W	23/08/81	60	3600
10	ALICANTE III	38 20.3N	0 30.7W	28/08/81	60	3600
11	PALMA DE MALLORCA	39 33.0N	2 38.0E	01/09/81	56	3600
12	BLANES	41 41.0N	2 48.0E		NO TIDE GAUGE	
13	ROSAS	42 15.0N	3 11.0E		NO TIDE GAUGE	
14	PORT VENDRES	42 31.0N	3 6.0E	28/12/81	39	3600
15	SETE	43 25.0N	3 43.0E		NO DATA	
16	FOS	43 25.0N	4 46.0E		NO DATA	
17	TOULON	43 7.0N	5 55.0E	30/08/81	56	3600
18	NICE	43 42.0N	7 16.0E	03/07/81	68	3600
19	MONACO	43 44.0N	7 25.0E	29/06/81	69	3600
20	OFFSHORE NEAR CALVI	42 34.8N 42 34.8N	8 44.0E 8 44.0E	06/04/82 29/07/82	18 9	1800 1800
21	AJACCIO	41 55.0N	8 43.0E	30/08/81	49	3600
22	CAGLIARI	39 13.0N	9 8.0E		NO DATA	
23	SAVONA	44 18.0N	8 28.0E		NO DATA	
24	GENOVA	44 24.0N	8 54.0E	31/08/81	58	3600
25	LA SPEZIA	44 7.0N	9 48.0E		NO DATA	
26	LIVORNO	43 33.2N	10 18.2E	31/08/81	49	3600
27	CIVITAVECCHIA	42 5.7N	11 47.4E	25/08/81	22	3600
28	NAPOLI	40 50.4N	14 16.2E	31/08/81	56	3600
29	PALERMO	38 8.0N	13 23.0E		NO DATA	
30	ANCONA	43 37.0N	13 31.0E	01/09/81	56	3600
31	PTO CORSINI	44 35.0N	12 20.0E		NO DATA	
32	VENEZIA	45 26.0N	12 20.0E	01/01/81	104	3600
33	KOPER	45 33.0N	13 44.0E	28/02/82	9	3600
34	ROVINJ	45 5.0N	13 38.0E	28/02/82	9	3600
35	BAKAR	45 18.0N	14 32.0E	28/02/82	9	3600
36	ZADAR	44 5.4N	15 16.3E	28/02/82	9	3600
37	NOVALJA	44 33.3N	14 13.2E	28/02/82	9	3600
38	SPLIT	43 30.0N	16 26.0E	28/02/82	9	3600
39	DUBROVNIK	42 40.0N	18 4.0E	28/02/82	9	3600
40	BAR	42 5.0N	19 5.0E	28/02/82	9	3600

*The site number provides the key to site names on Figure 1

TABLE 1 INVENTORY OF DATA RECEIVED
BY MEDALPEX SEA LEVEL DATA CENTRE

Site	Amplitude of M_2 (mm)	Amplitude of S_2 (mm)	Amplitude Ratio S_2/M_2
Cadiz	1040.9	372.2	0.357
Tarifa	414.2	158.0	0.381
Gibraltar	316.3	118.8	0.376
Ceuta	295.4	114.4	0.387
Algeciras	322.6	114.7	0.355
Malaga	185.1	70.7	0.382
Almeria	93.3	38.0	0.407
Alicante	17.2	10.0	0.581
Palma de Mallorca	25.6	9.4	0.367
Port Vendres	50.2	18.5	0.368
Toulon	30.6	12.2	0.399
Nice	71.2	28.6	0.402
Monaco	42.6	17.8	0.418
Ajaccio	65.7	26.9	0.409
Genova	73.9	27.6	0.374
Livorno	82.3	30.9	0.375
Civitavecchia	107.5	42.4	0.394
Napoli	112.3	39.4	0.351
Ancona	65.9	35.2	0.535
Venezia	234.2	140.6	0.600
Koper	260.5	156.9	0.602
Rovinj	183.6	110.9	0.604
Bakar	107.6	55.7	0.517
Zadar	56.8	25.7	0.452
Novalja	79.6	41.8	0.525
Split	80.7	58.6	0.726
Dubrovnik	90.6	58.7	0.648
Bar	90.4	55.9	0.618

TABLE 2

AMPLITUDE OF M_2 (mm) AND S_2 (mm) AND S_2/M_2 RATIO

FOR MEDALPEX SEA LEVEL SITES

Site	Phase of M_2 ($^{\circ}$)	Phase of S_2 ($^{\circ}$)	$\frac{\text{Phase } S_2 - \text{Phase } M_2}{\text{Speed } S_2 - \text{Speed } M_2}$ (hrs)
Cadiz	59.7	84.0	23.9
Tarifa	41.5	67.7	25.8
Gibraltar	48.5	75.3	26.4
Ceuta	42.9	69.9	26.7
Algeciras	49.3	74.0	24.3
Malaga	55.7	79.0	22.9
Almeria	51.2	78.9	27.3
Alicante	60.0	78.5	18.2
Palma de Mallorca	207.8	223.3	15.3
Port Vendres	288.2	300.0	11.6
Toulon	266.5	275.7	9.1
Nice	244.5	253.9	9.3
Monaco	259.2	259.3	0.1
Ajaccio	249.8	283.9	33.6
Genova	264.1	272.4	8.3
Livorno	228.1	245.6	17.2
Civitavecchia	224.5	244.5	19.7
Napoli	227.1	246.1	18.7
Ancona	305.6	319.6	13.7
Venice	258.8	264.4	5.8
Koper	249.3	256.2	6.8
Rovinj	241.9	248.6	6.6
Bakar	225.1	226.5	1.4
Zadar	210.6	203.8	-6.7
Novalja	208.9	206.5	-2.4
Split	87.9	91.0	3.1
Dubrovnik	80.2	85.2	4.9
Bar	75.4	80.7	5.2

TABLE 3

PHASE OF M_2 ($^{\circ}$) AND S_2 ($^{\circ}$) AND THE AGE OF THE TIDE,

$\frac{\text{PHASE } S_2 - \text{PHASE } M_2}{\text{SPEED } S_2 - \text{SPEED } M_2}$ (hrs), FOR MEDALPEX SEA LEVEL SITES

Site	SD1 (m)	SD2 (m)	$\frac{(SD1^2 - SD2^2)}{SD1^2} \times 100$
Cadiz	0.8279	0.1385	97
Tarifa	0.3394	0.0669	96
Gibraltar	0.2600	0.0702	93
Ceuta	0.2512	0.0730	92
Algeciras	0.2663	0.0781	91
Malaga	0.1694	0.0732	81
Almeria	0.1080	0.0690	60
Alicante	0.0894	0.0735	32
Palma de Mallorca	0.0995	0.0663	56
Port Vendres	0.1143	0.0846	45
Toulon	0.0495	0.0373	43
Nice	0.1143	0.0781	53
Monaco	0.0724	0.0547	43
Ajaccio	0.1059	0.0723	53
Genova	0.1351	0.1030	42
Livorno	0.1123	0.0795	50
Civitavecchia	0.1283	0.0926	48
Napoli	0.1338	0.0764	67
Ancona	0.1444	0.0893	62
Venezia 1981	0.2838	0.1412	75
Venezia 1982	0.2812	0.1249	80
Koper	0.2744	0.1023	86
Rovinj	0.2095	0.0930	80
Bakar	0.1537	0.0921	64
Zadar	0.1368	0.0994	47
Novalja	0.1321	0.0837	60
Split	0.1229	0.0757	62
Dubrovnik	0.1171	0.0692	65
Bar	0.1189	0.0744	61

SD1 - Standard deviation of data prior to tidal analysis

SD2 - Standard deviation of residuals (i.e. after tidal analysis)

$SD1^2$ - Variance of data $SD2^2$ - Variance of residuals

TABLE 4

PROPORTION OF VARIANCE IN THE DATA SERIES ACCOUNTED FOR BY TIDAL ANALYSIS

Site	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Relative to
CADIZ	1924	1928	1967	1875	1920	1902	-	2096	1823	1838	1778	1881	1984	TGZ
TARIFA	1062	1087	1073	1045	1053	1018	989	998	930	912	911	956	1020	TGZ
GIBRALTAR	519	527	528	477	492	448	438	541	467	452	458	491	574	TGZ
CEUTA	1017	1041	993	1021	1020	957	922	1026	945	971	990	995	1045	TGZ
ALGECIRAS	855	875	871	811	807	792	781	902	824	806	795	839	927	TGZ
MALAGA	941	940	916	867	873	846	827	938	882	873	884	874	961	TGZ
ALMERIA	488	487	439	503	413	409	-	459	393	412	449	455	515	TGZ
ALICANTE I	504	521	459	551	524	456	395	509	432	493	568	559	589	TGZ
ALICANTE III	513	530	459	516	490	427	372	472	395	451	522	515	550	TGZ
PALMA DE MALLORCA	1048	1095	983	-	964	926	867	950	865	963	998	997	1065	TGZ
PORT VENDRES	-	-	-	-	514	419	318	431	334	389	449	412	449	CD
TOULON	385	380	322	390	369	354	323	363	313	331	362	344	347	CD
MARSEILLES	-	143	40	230	159	49	11	83	3	56	117	91	118	
NICE	475	511	361	536	452	331	299	393	308	389	442	439	434	TGZ
MONACO	522	558	421	519	-	481	440	484	440	460	507	504	500	TGZ
AJACCIO	403	454	359	492	416	345	290	375	304	384	419	439	450	CD
GENOVA	1831	1894	1731	1927	1839	1710	1672	1760	1684	1762	1801	1788	1809	500cm below TG plaque
LIVORNO	1231	1254	1125	1316	1192	1108	1135	1228	1153	1228	1250	1286	-	401cm below Benchmark
CIVITAVECCHIA	1353	1392	1268	1461	1421	-	-	-	-	-	-	-	-	517cm below Benchmark
NAPOLI	574	622	514	712	634	484	470	523	443	495	548	548	566	316cm below Benchmark
ANCONA	4	95	-68	241	-34	-131	-89	-52	-149	-55	-53	-30	-43	Ancona zero
VENEZIA	241	346	104	440	196	63	120	181	81	172	185	175	190	TGZ

TABLE 5 MONTHLY VALUES OF MEAN SEA LEVEL (mm) DURING MEDALPEX

TGZ Tide gauge zero
CD Chart datum

Site	Mean sea level during MEDALPEX (mm)	Relative to
Cadiz	1904	TGZ
Tarifa	1003	TGZ
Gibraltar	487	TGZ
Ceuta	992	TGZ
Algeciras	832	TGZ
Malaga	890	TGZ
Almeria	446	TGZ
Alicante I	494	TGZ
Palma de Mallorca	967	TGZ
Port Vendres	416	CD
Toulon	353	CD
Marseilles	91	
Nice	410	TGZ
Monaco	486	TGZ
Ajaccio	393	CD
Genova	1783	500cm below TG plaque
Livorno	1206	401cm below Benchmark
Civitavecchia	1376	517cm below Benchmark
Napoli	552	316cm below Benchmark
Ancona	-73	Ancona zero
Venezia	200	TGZ
Koper	2085*	TGZ
Rovinj	909*	TGZ
Bakar	672*	TGZ
Zadar	717*	TGZ
Novalja	696*	TGZ
Split	553*	TGZ
Dubrovnik	1078*	TGZ
Bar	914*	TGZ

* Mean sea level for Special Observation period only

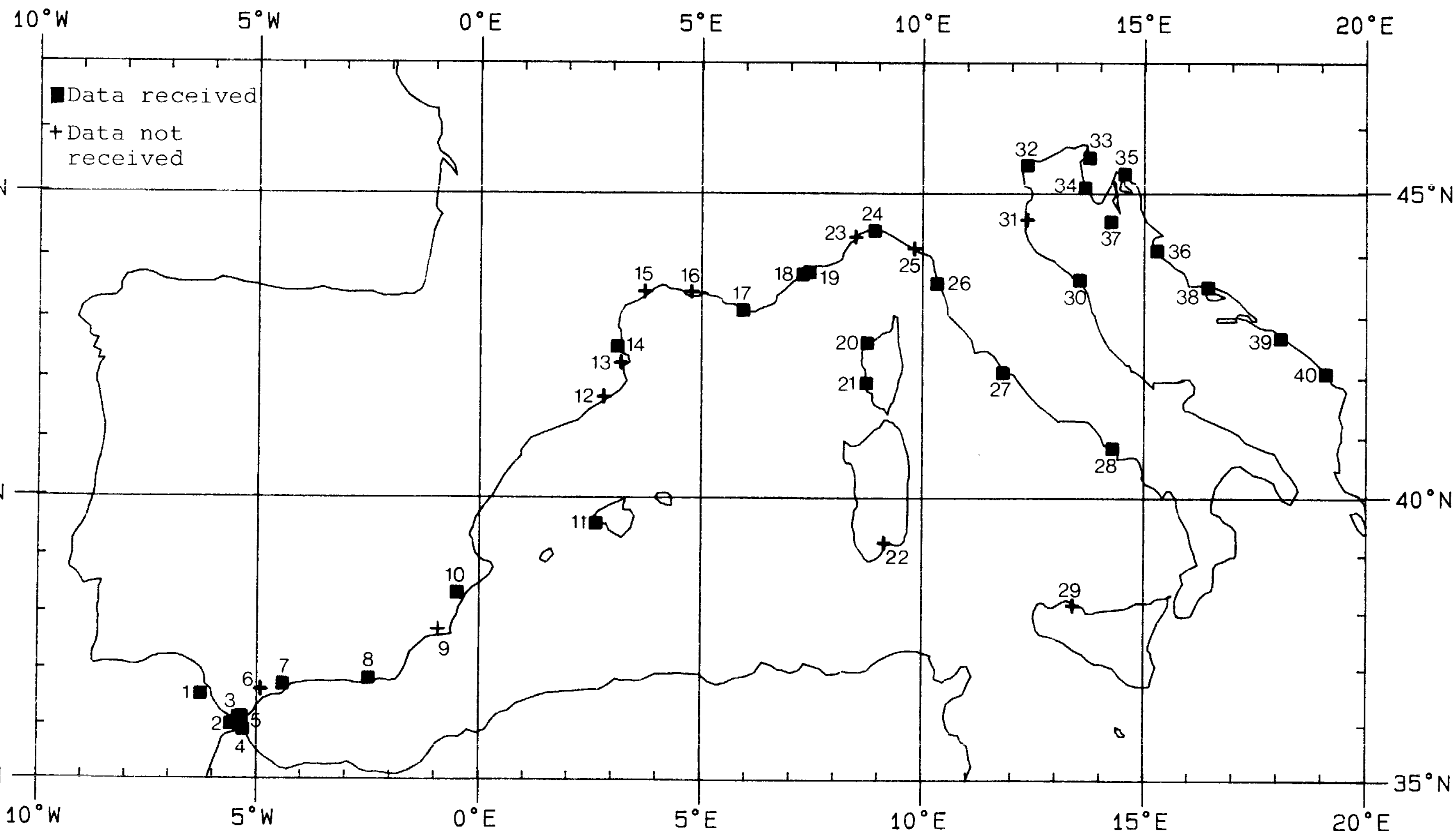
TGZ Tide gauge zero

CD Chart datum

TABLE 6

MEAN SEA LEVELS AT MEDALPEX SITES
DURING MEDALPEX OBSERVATION PERIOD

LIST OF FIGURES



see Table 1 for key to site numbers

FIGURE 1 MEDALPEX SEA LEVEL SITES

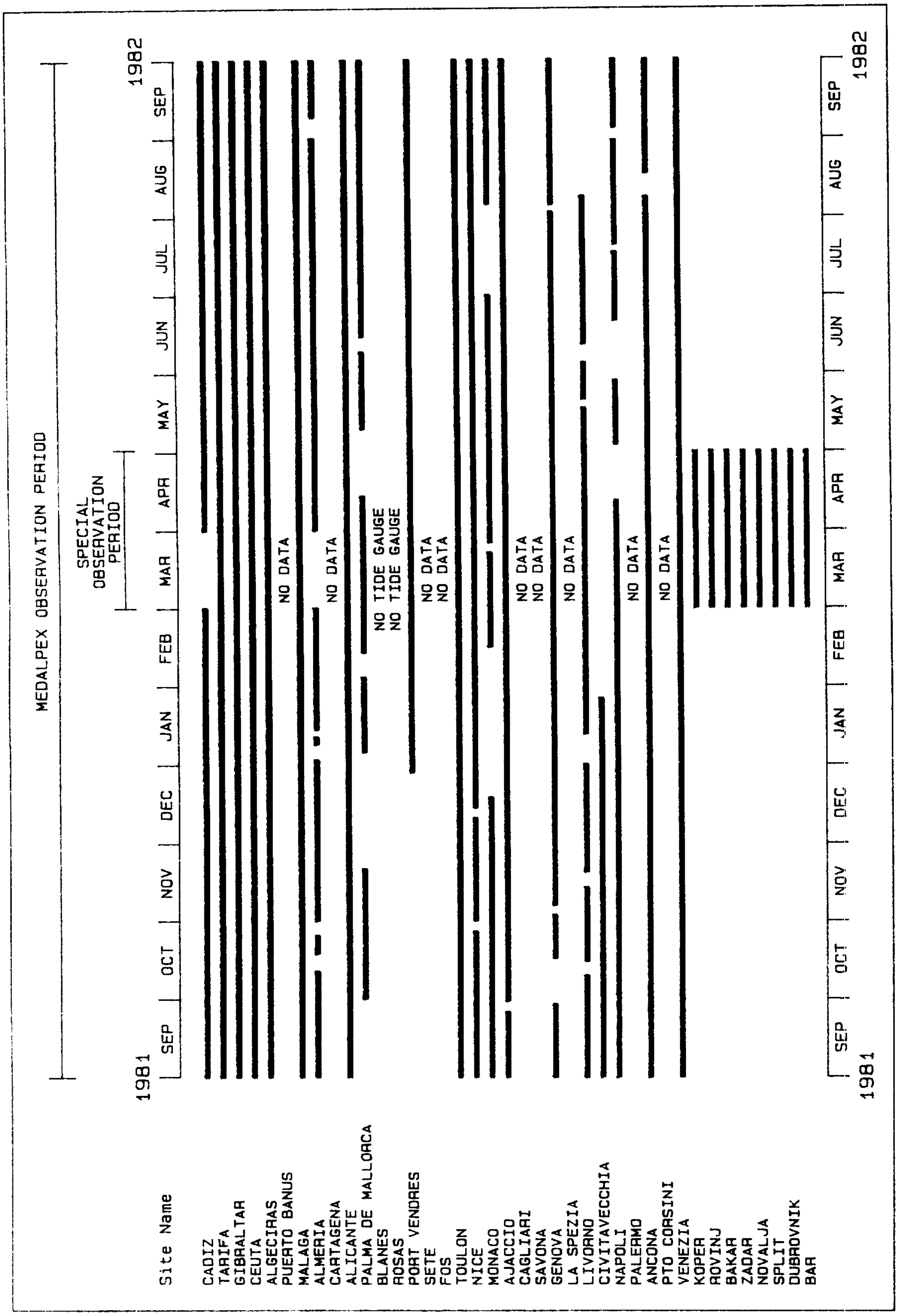


FIGURE 2 Bar Chart Showing Duration of Data Collected at Sea Level Sites

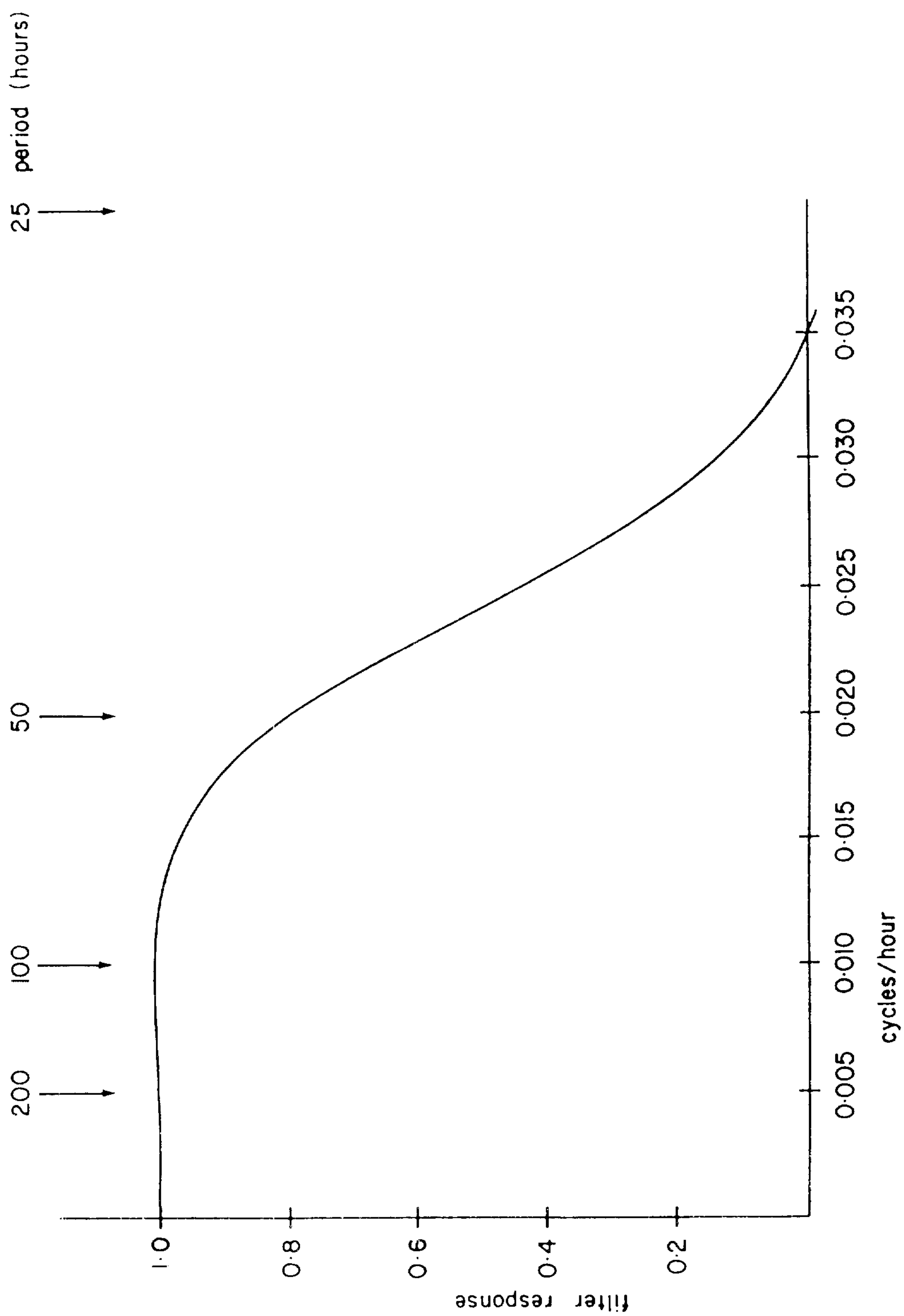


FIGURE 3 GRAPH SHOWING FREQUENCY RESPONSE OF LOWPASS FILTER

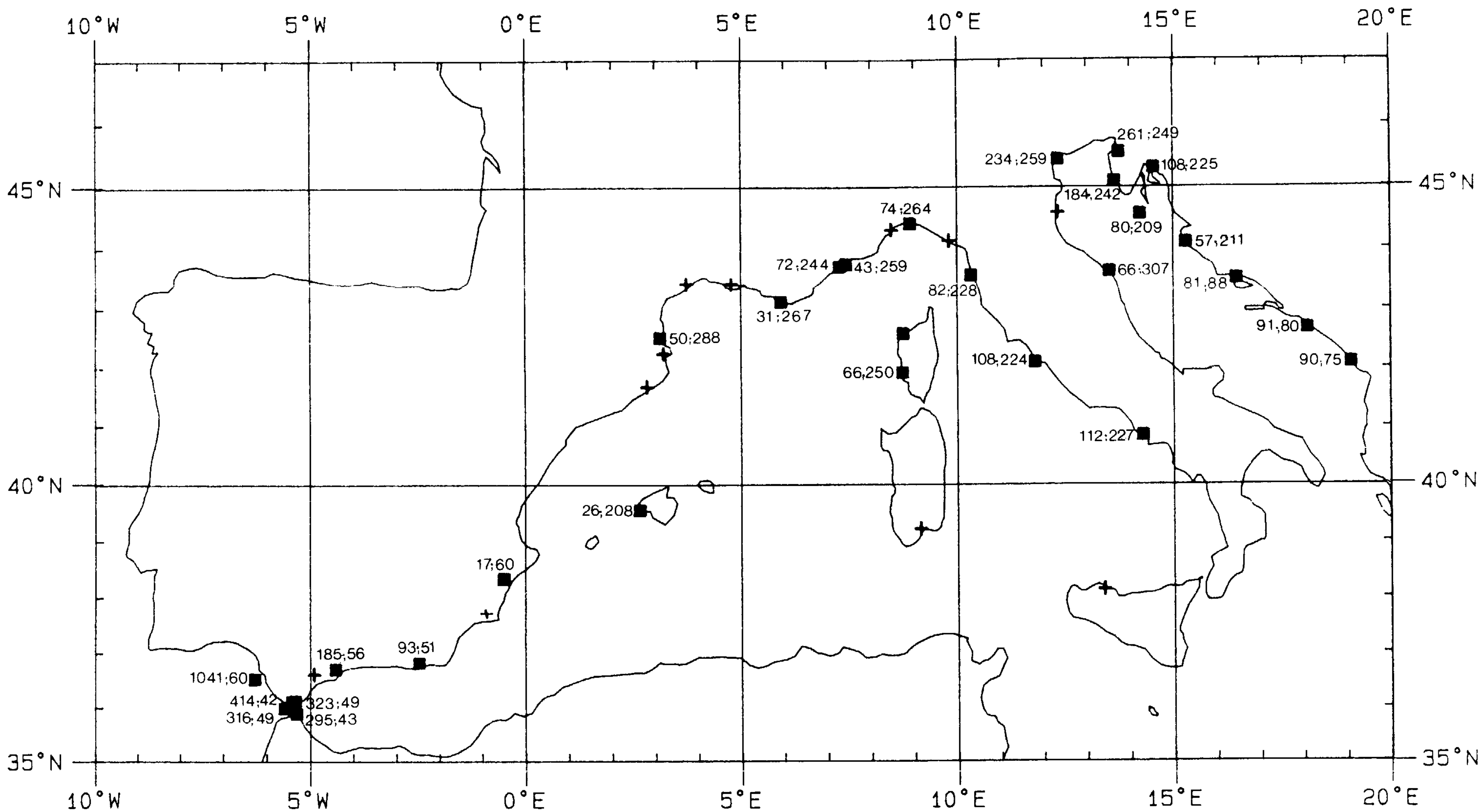


FIGURE 4 MAP OF M_2 AMPLITUDE (mm) AND PHASE (°)

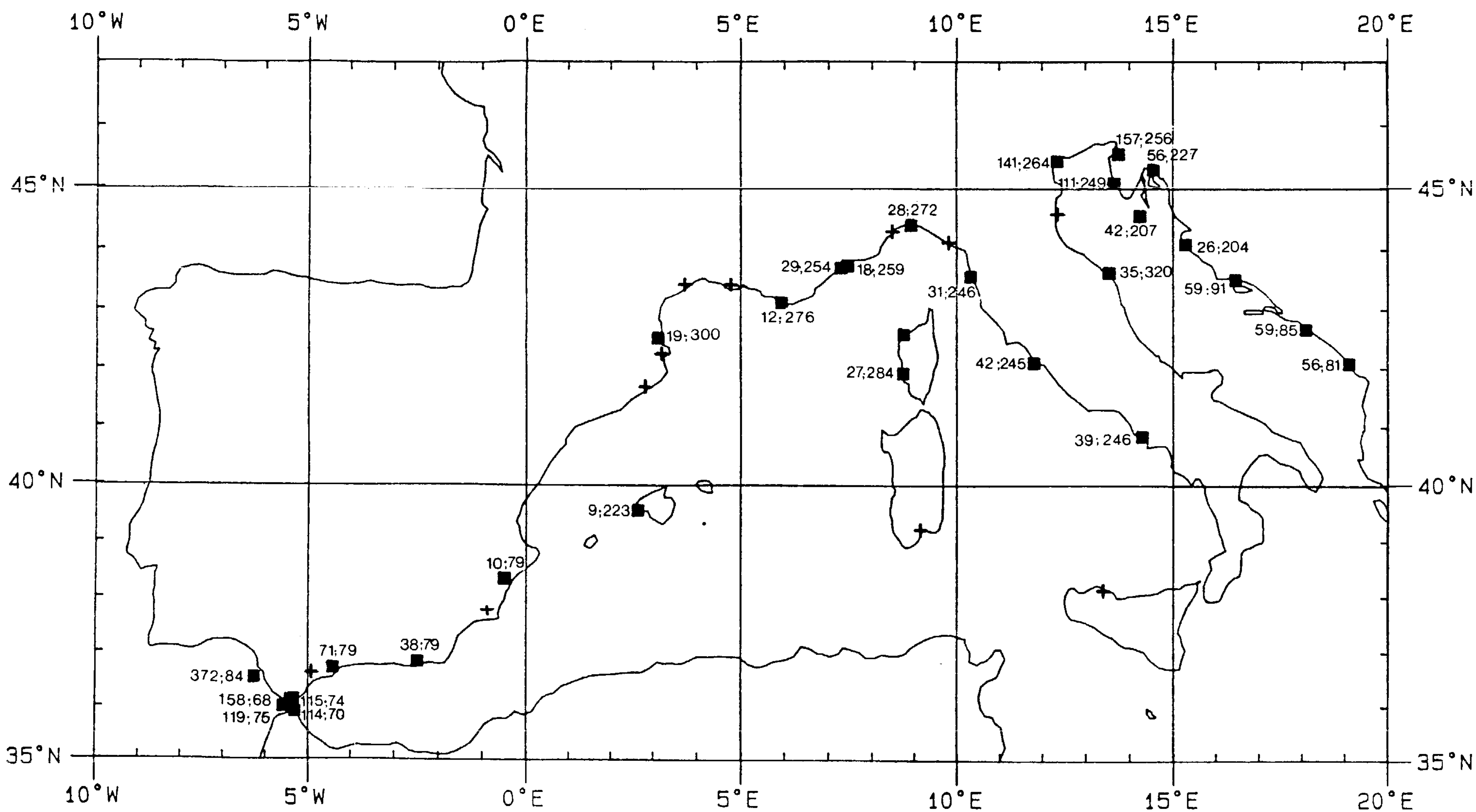


FIGURE 5 MAP OF S_2 AMPLITUDE (mm) AND PHASE (°)

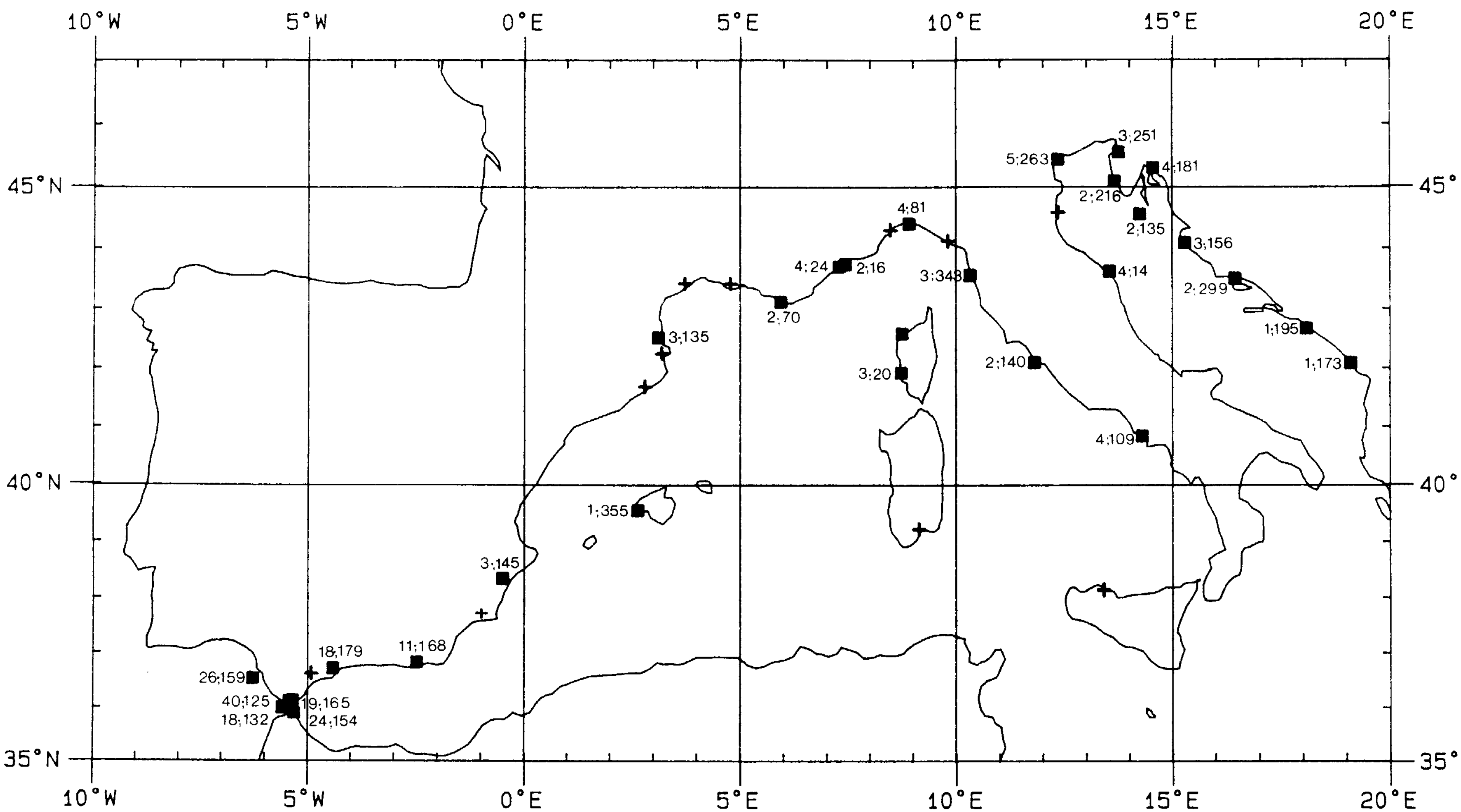


FIGURE 6 MAP OF M_4 AMPLITUDE (mm) AND PHASE (°)

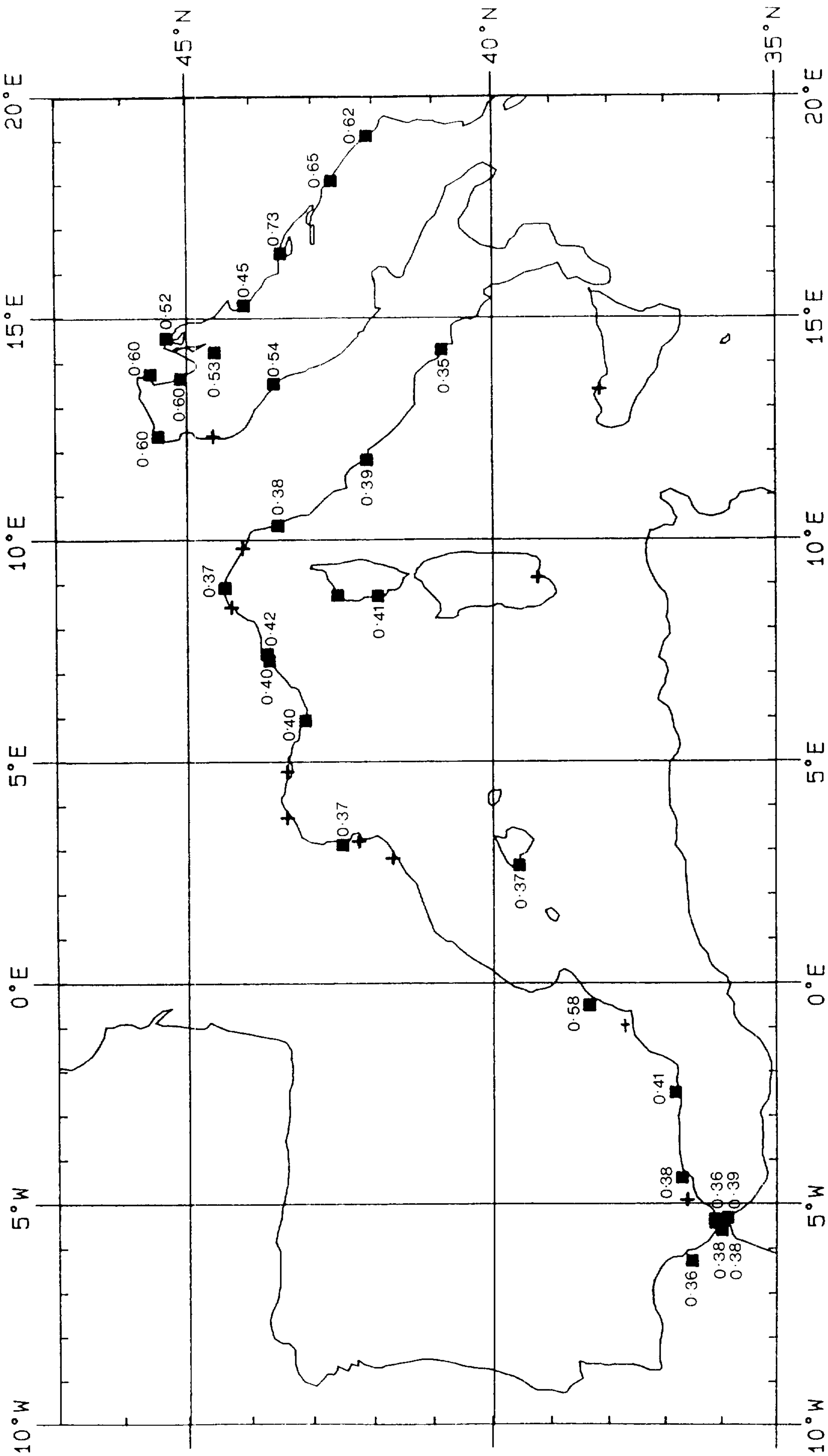


FIGURE 7 MAP OF S_2/M_2 RATIO FOR THE MEDALPEX REGION

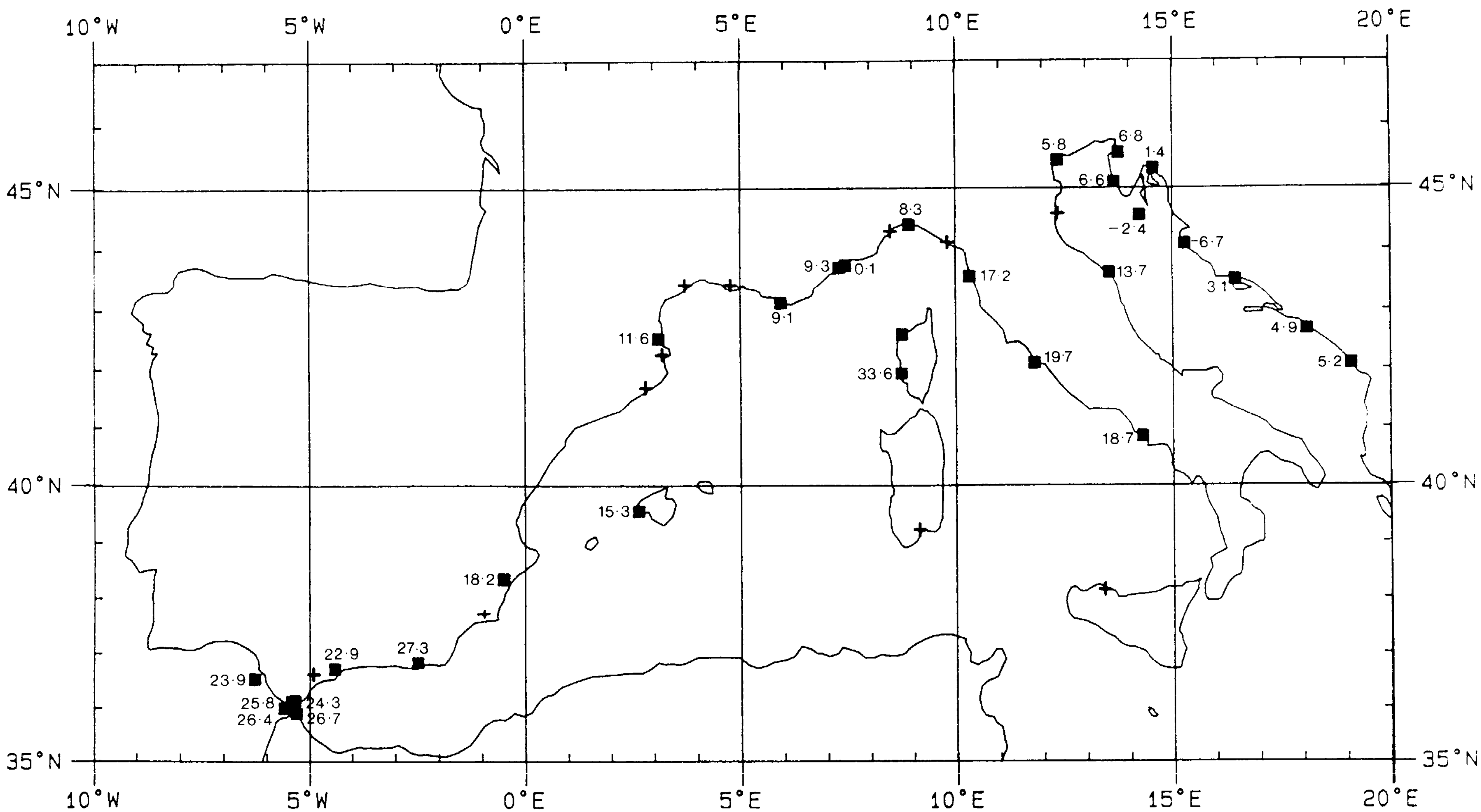


FIGURE 8 MAP OF 'AGE OF THE TIDE' I.E. $\frac{\text{PHASE OF } S_2 - \text{PHASE OF } M_2}{\text{SPEED OF } S_2 - \text{SPEED OF } M_2}$ (hrs) FOR THE MEDALPEX REGION

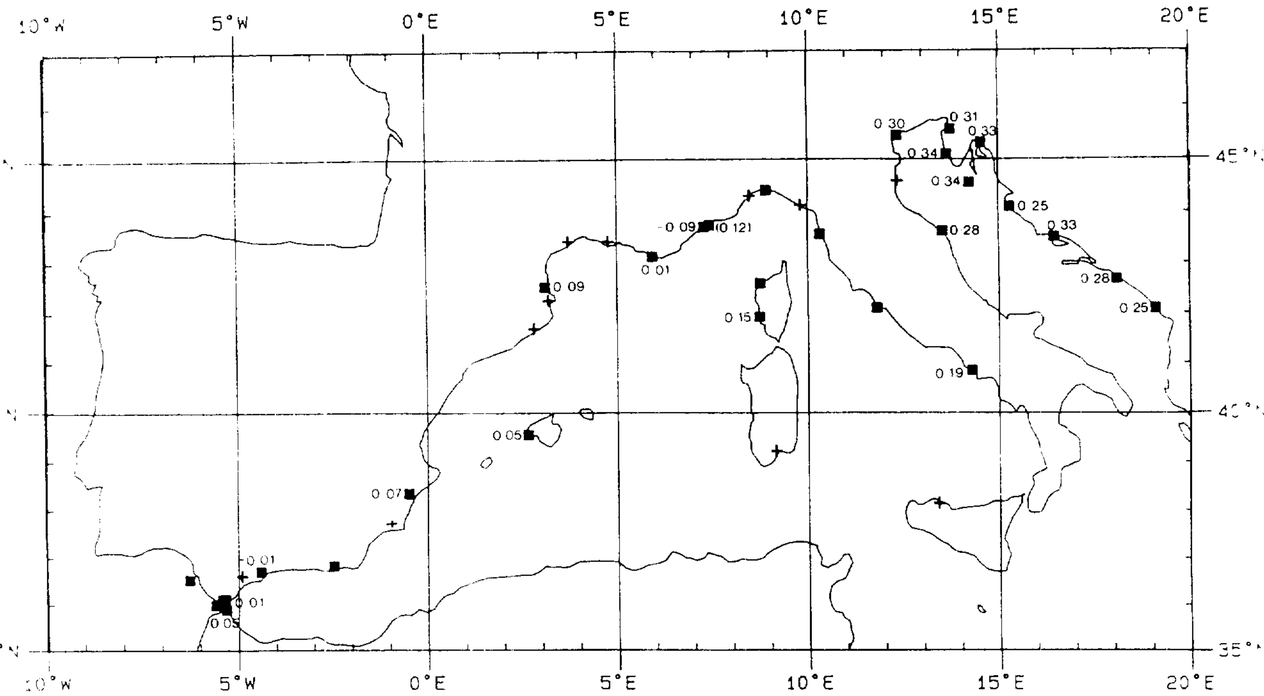


FIGURE 9 FIRST EIGENVECTOR COEFFICIENT FROM PRINCIPAL COMPONENTS ANALYSIS OF WESTERN MEDITERRANEAN AND ADRIATIC SEA

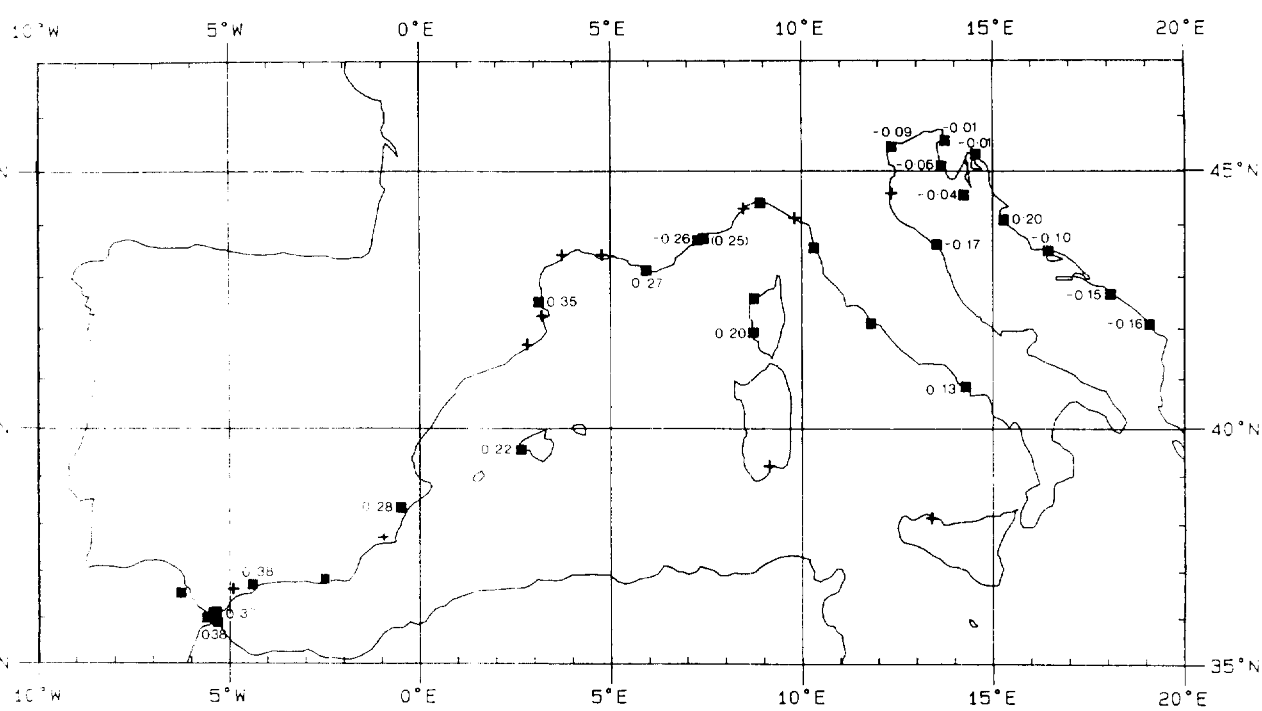


FIGURE 10 SECOND EIGENVECTOR COEFFICIENT FROM PRINCIPAL COMPONENTS ANALYSIS OF WESTERN MEDITERRANEAN AND ADRIATIC SEA

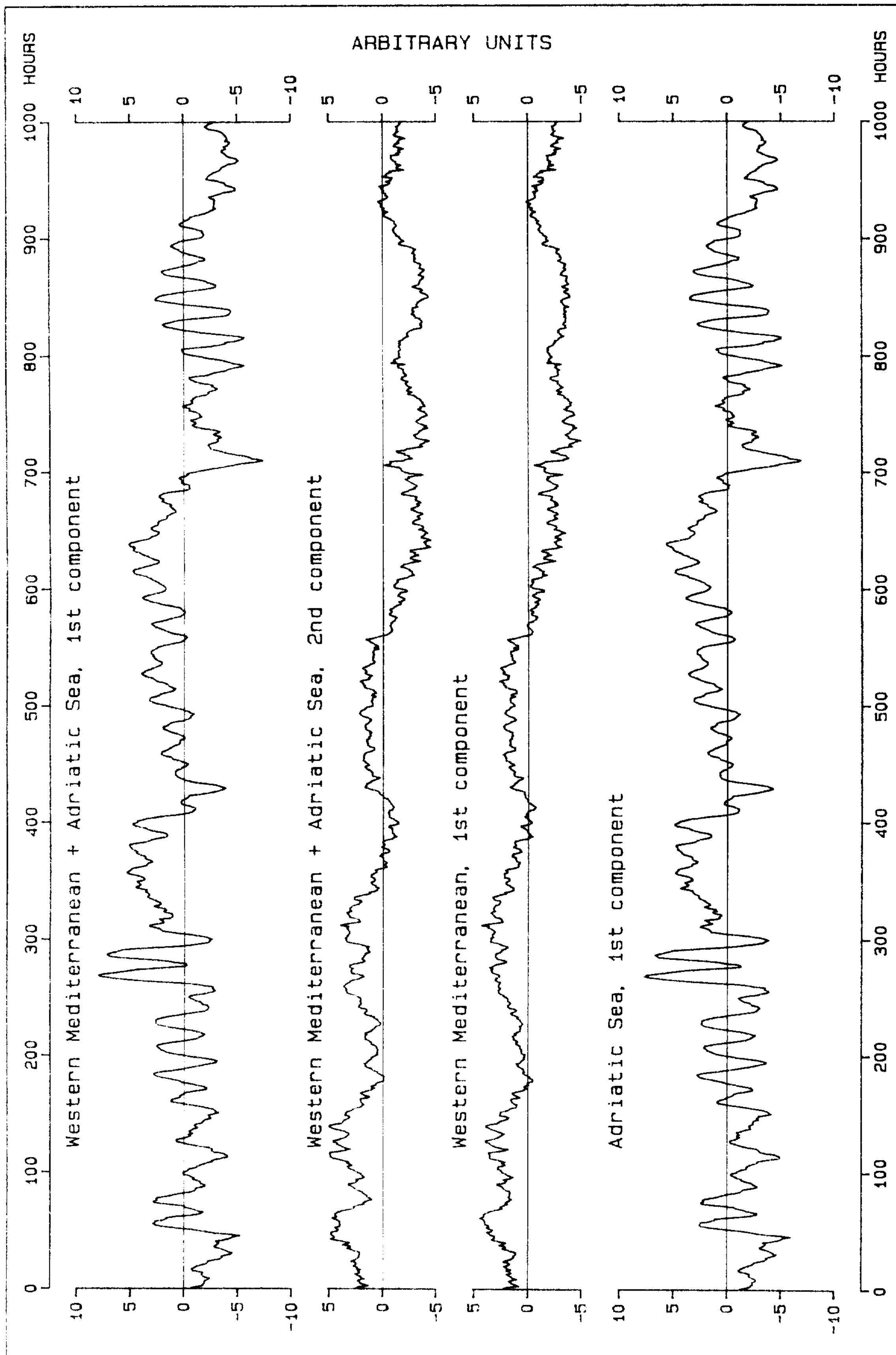


FIGURE 11 Principal Components Analysis

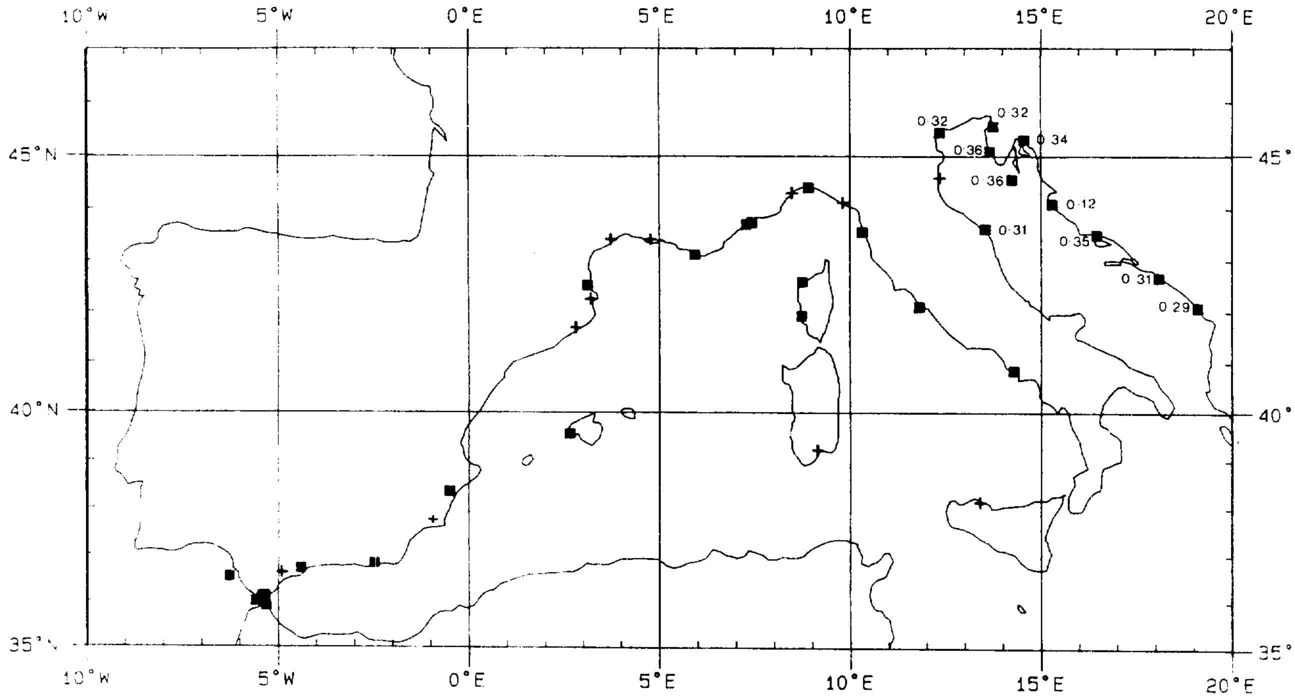


FIGURE 12 FIRST EIGENVECTOR COEFFICIENT FROM PRINCIPAL COMPONENTS ANALYSIS OF ADRIATIC SEA

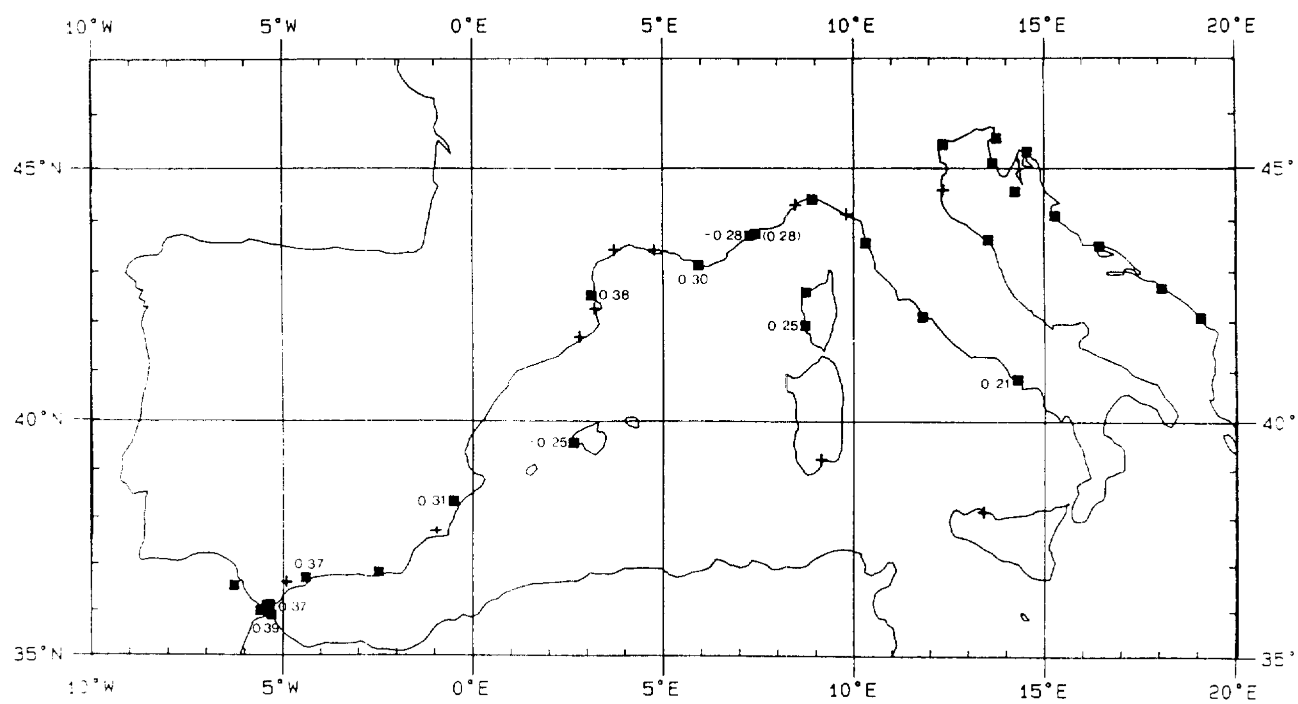


FIGURE 13 FIRST EIGENVECTOR COEFFICIENT FROM PRINCIPAL COMPONENTS ANALYSIS OF WESTERN MEDITERRANEAN

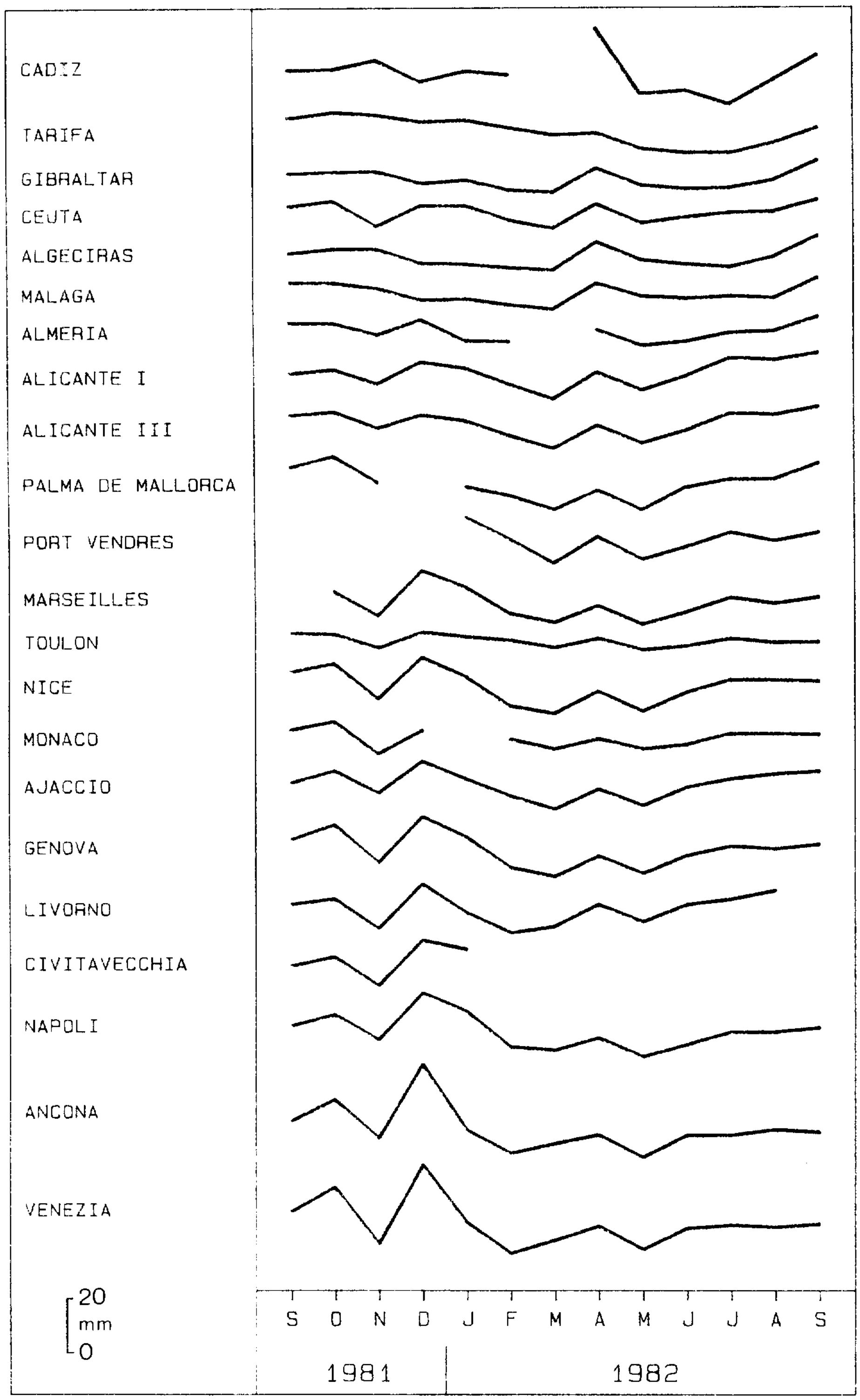
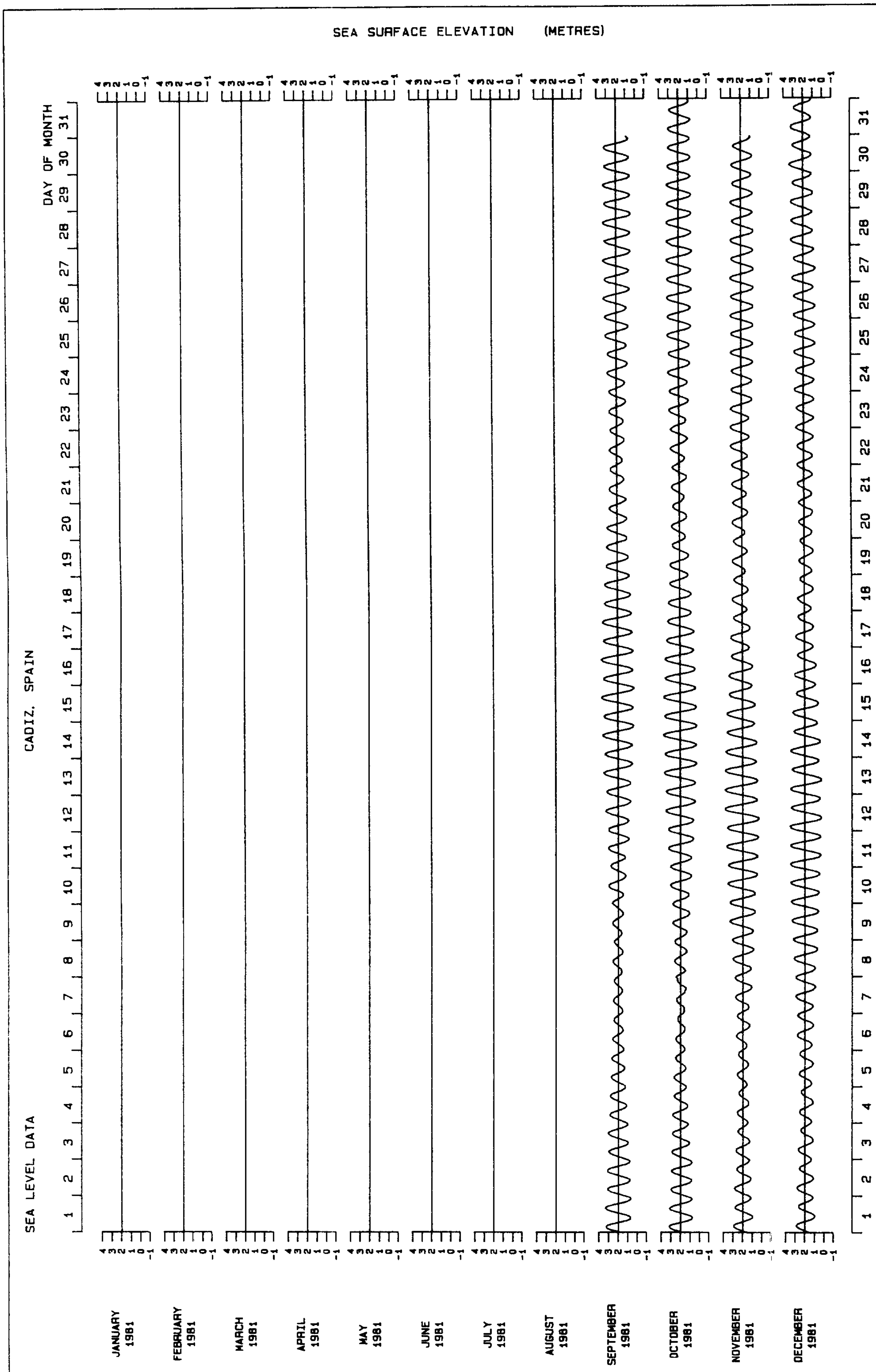


FIGURE 14 Monthly Mean Sea Level

APPENDIX 1

TIME SERIES PLOT PRESENTATIONS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DAY OF MONTH
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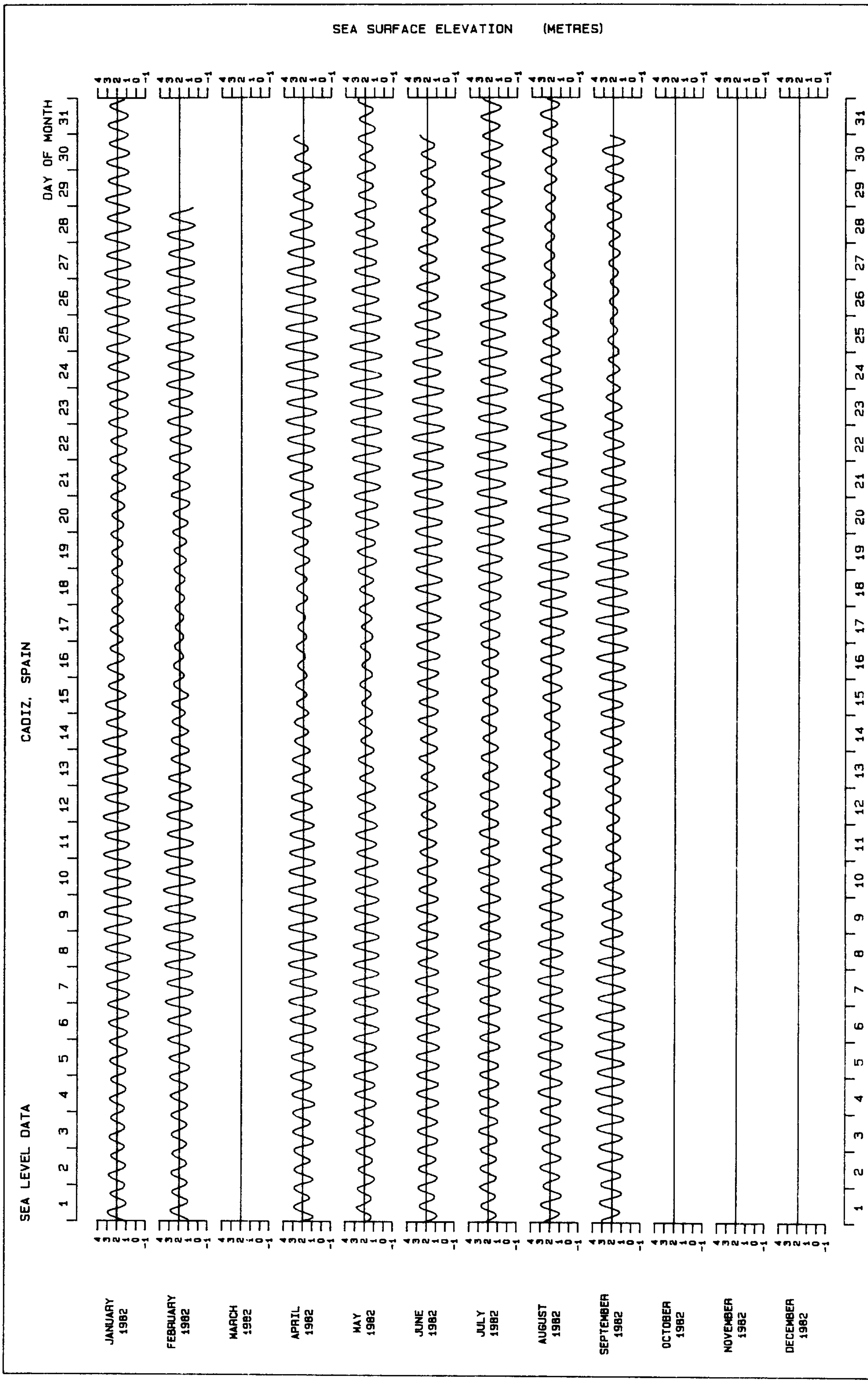
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981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SEA LEVEL DATA
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DAY OF MONTH
JANUARY 1982
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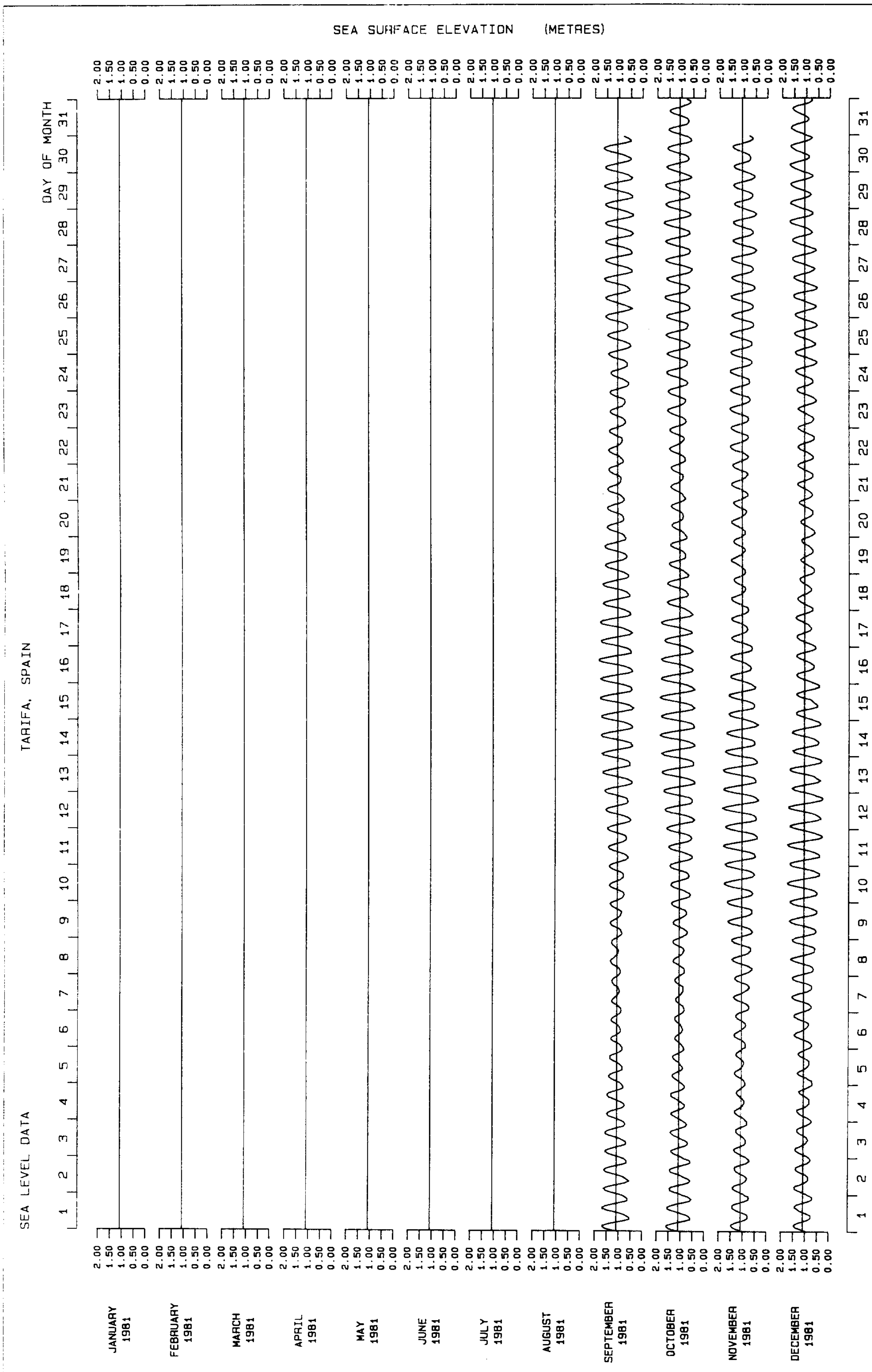
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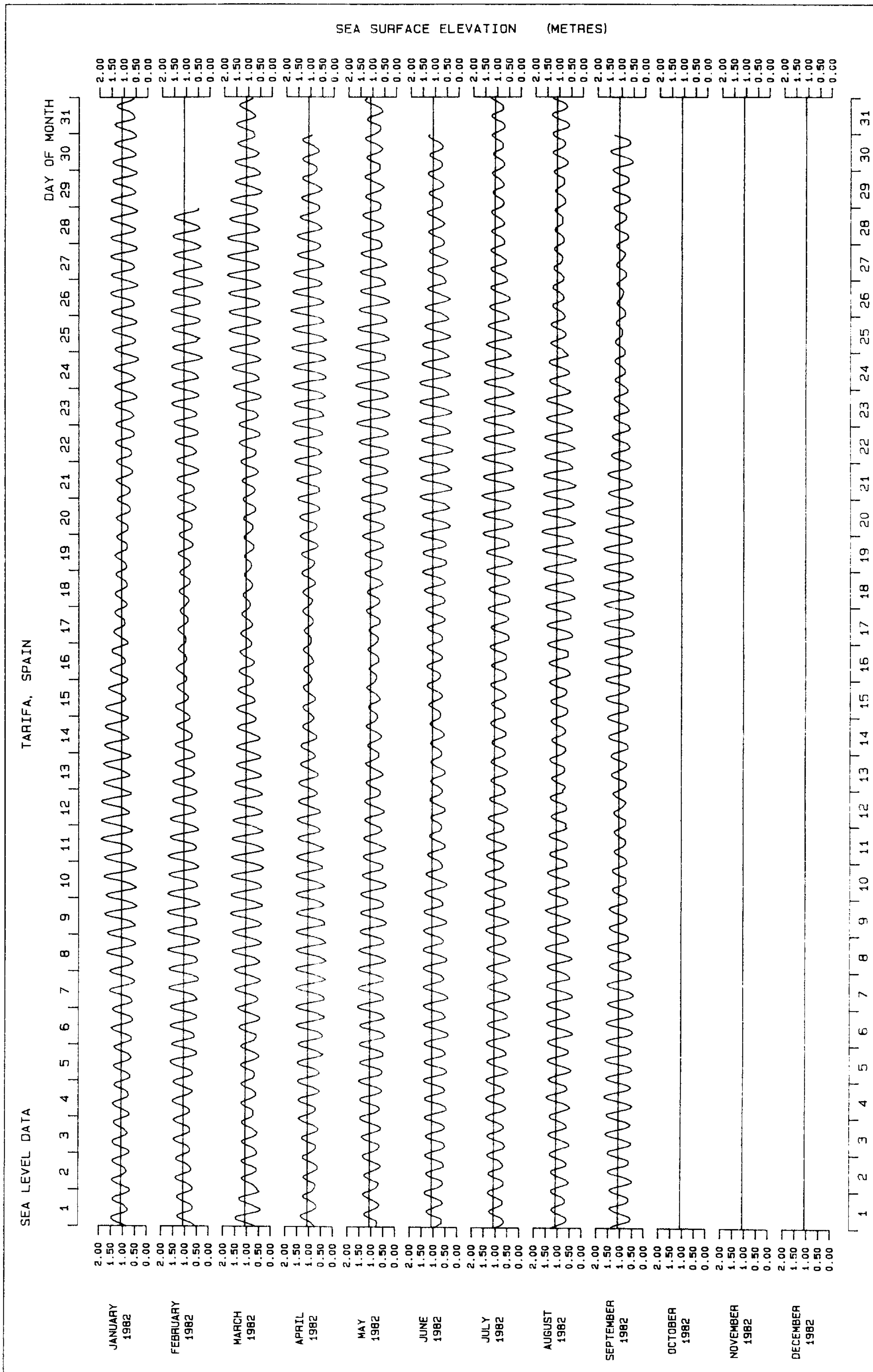
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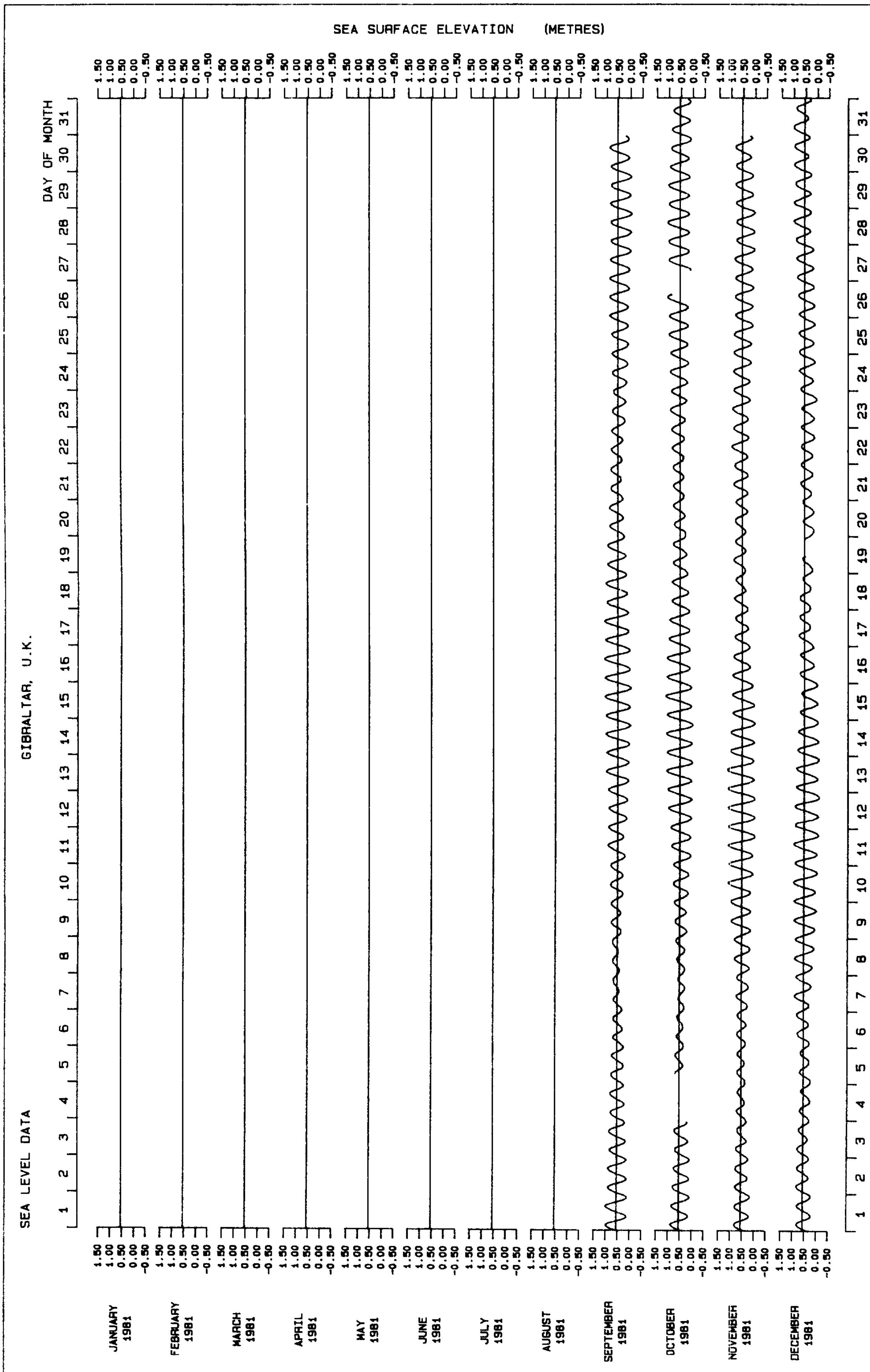
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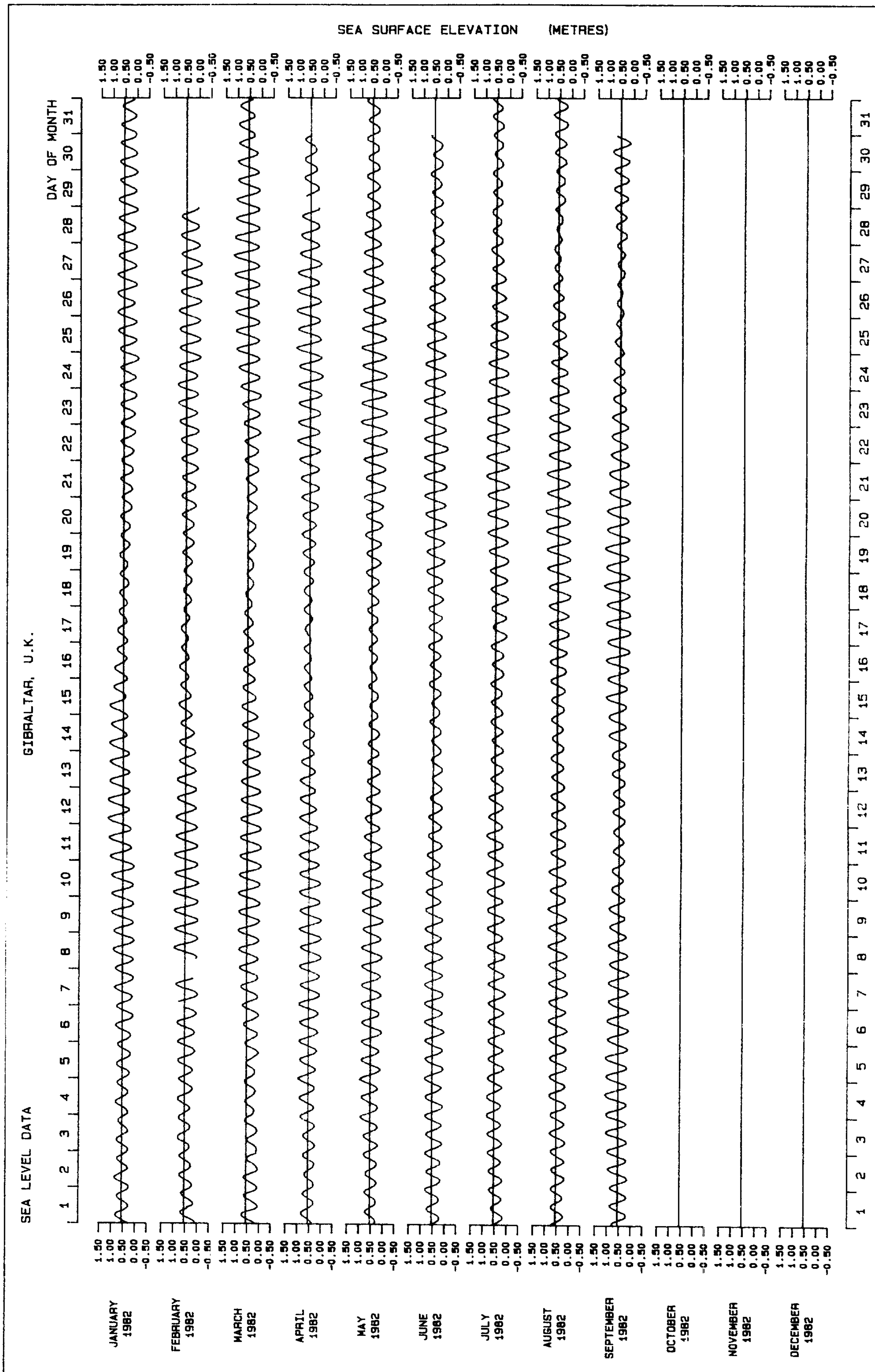
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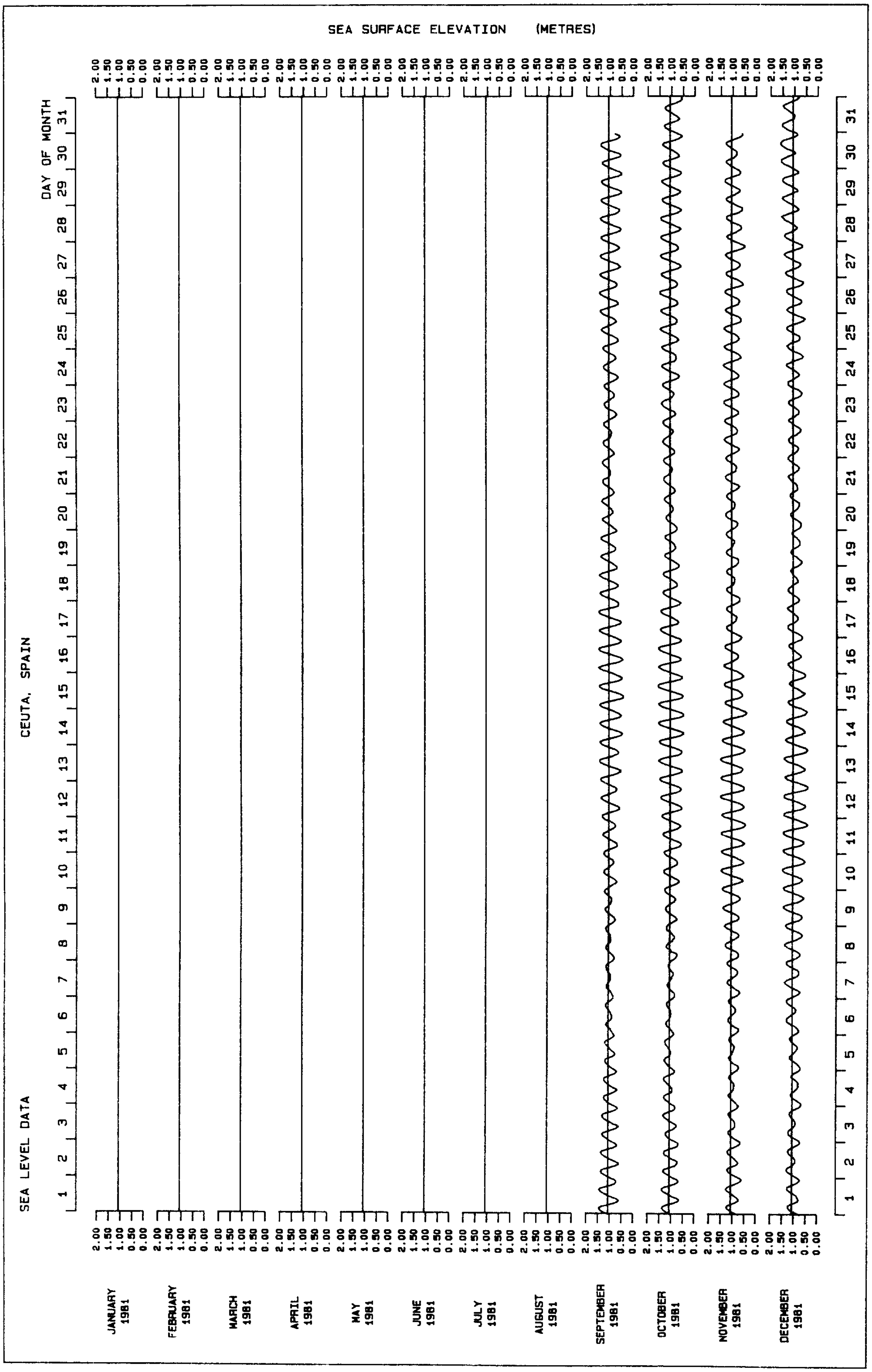
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JANUARY 1981
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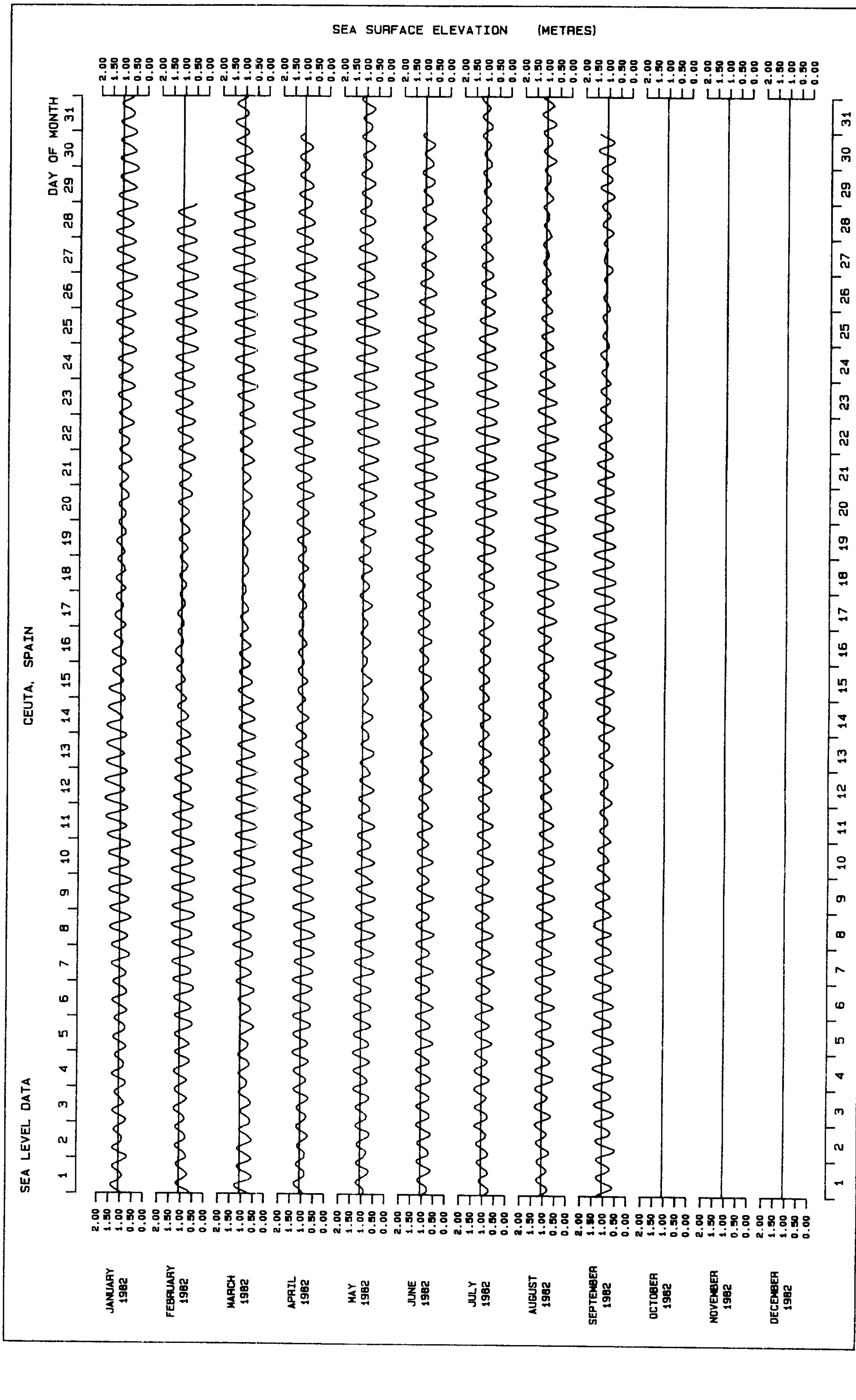
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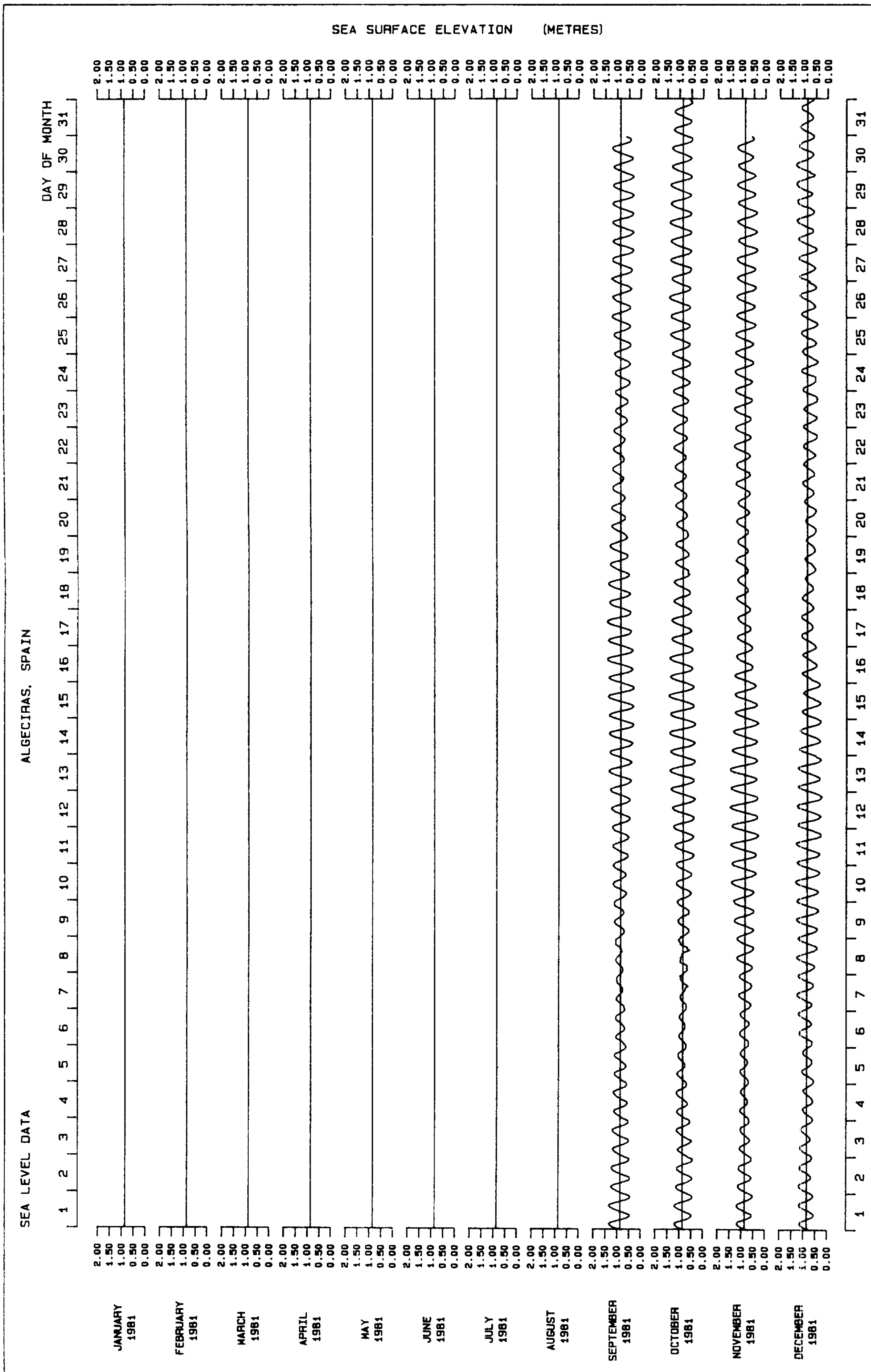
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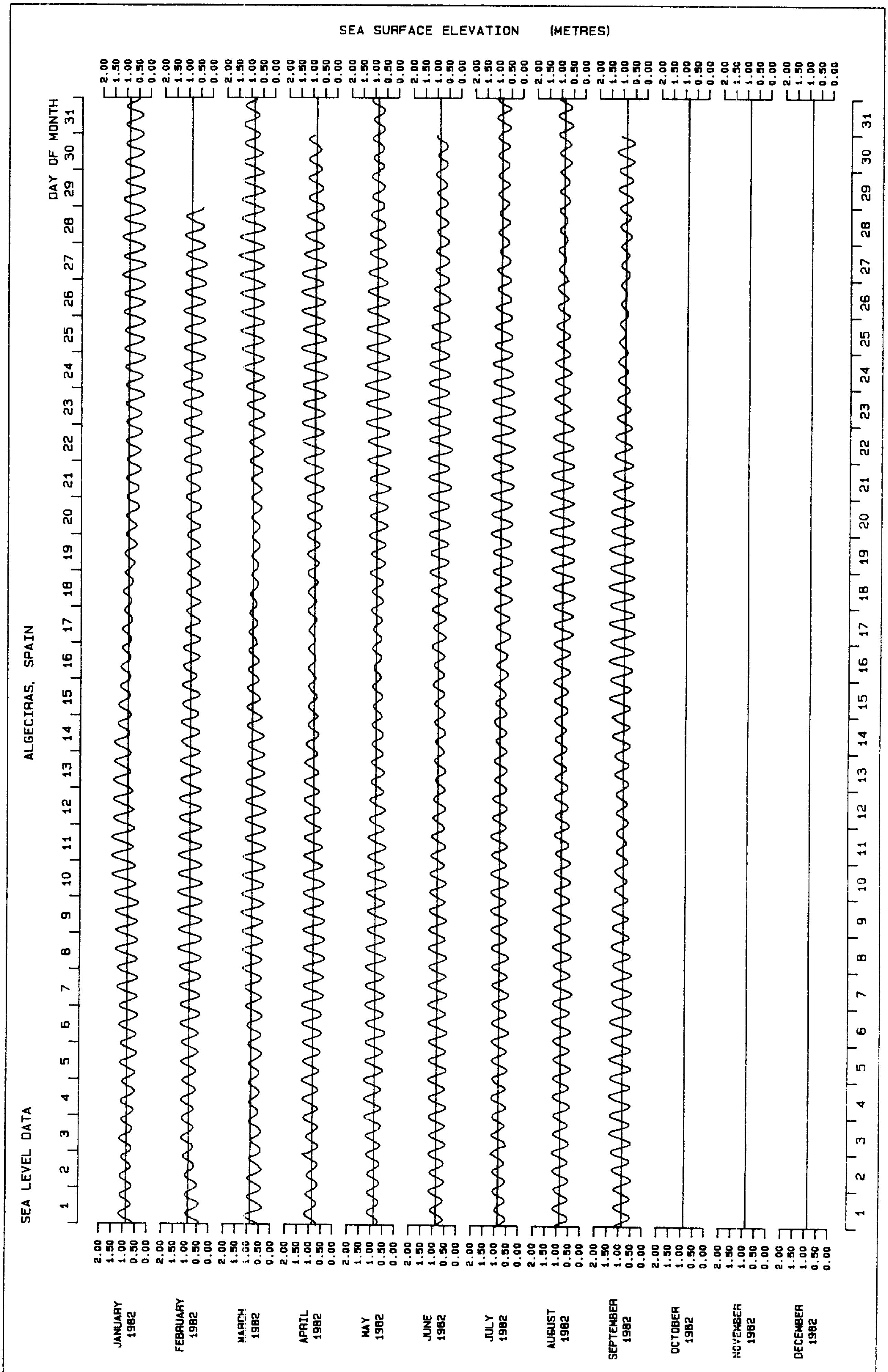
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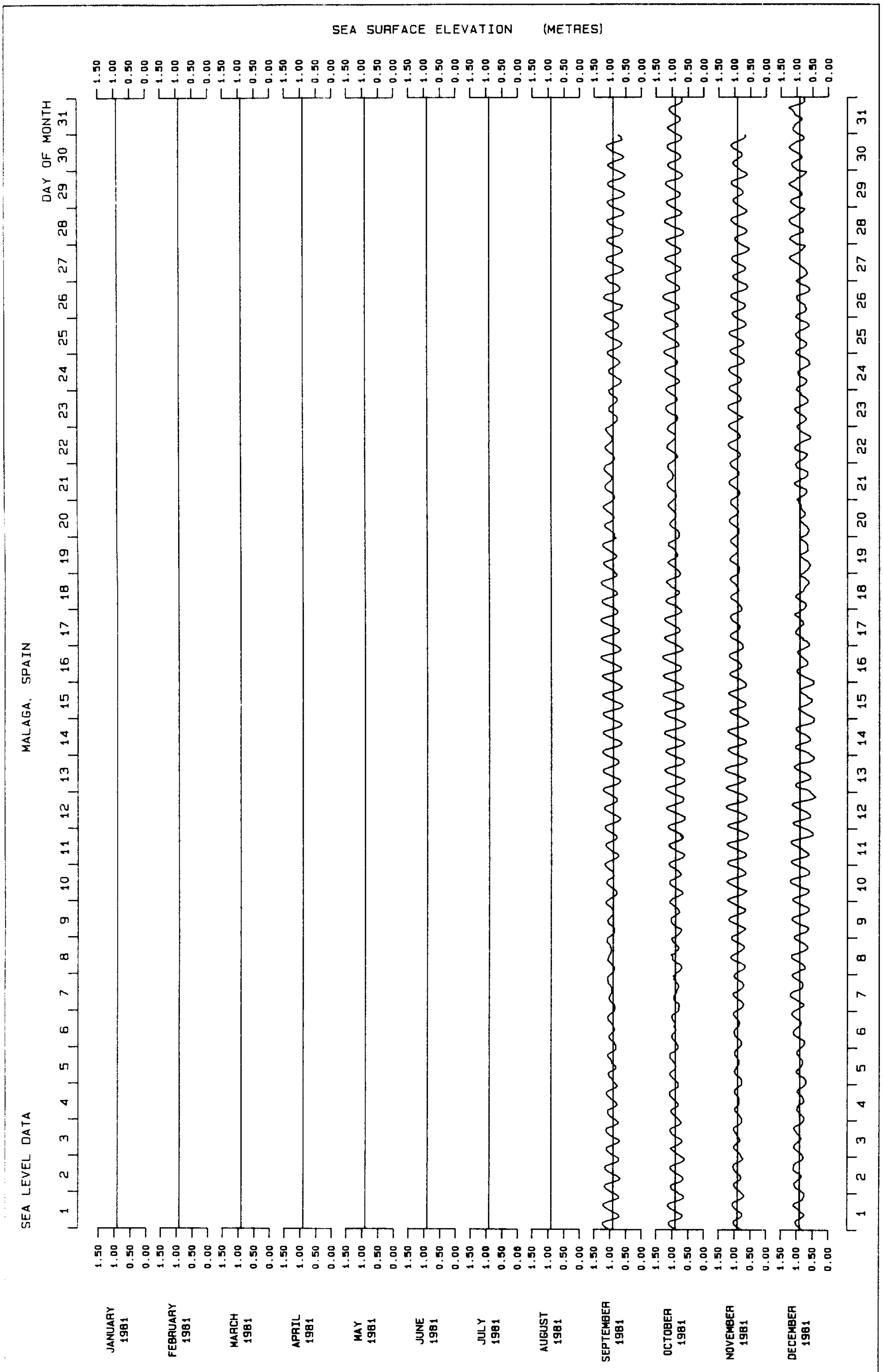
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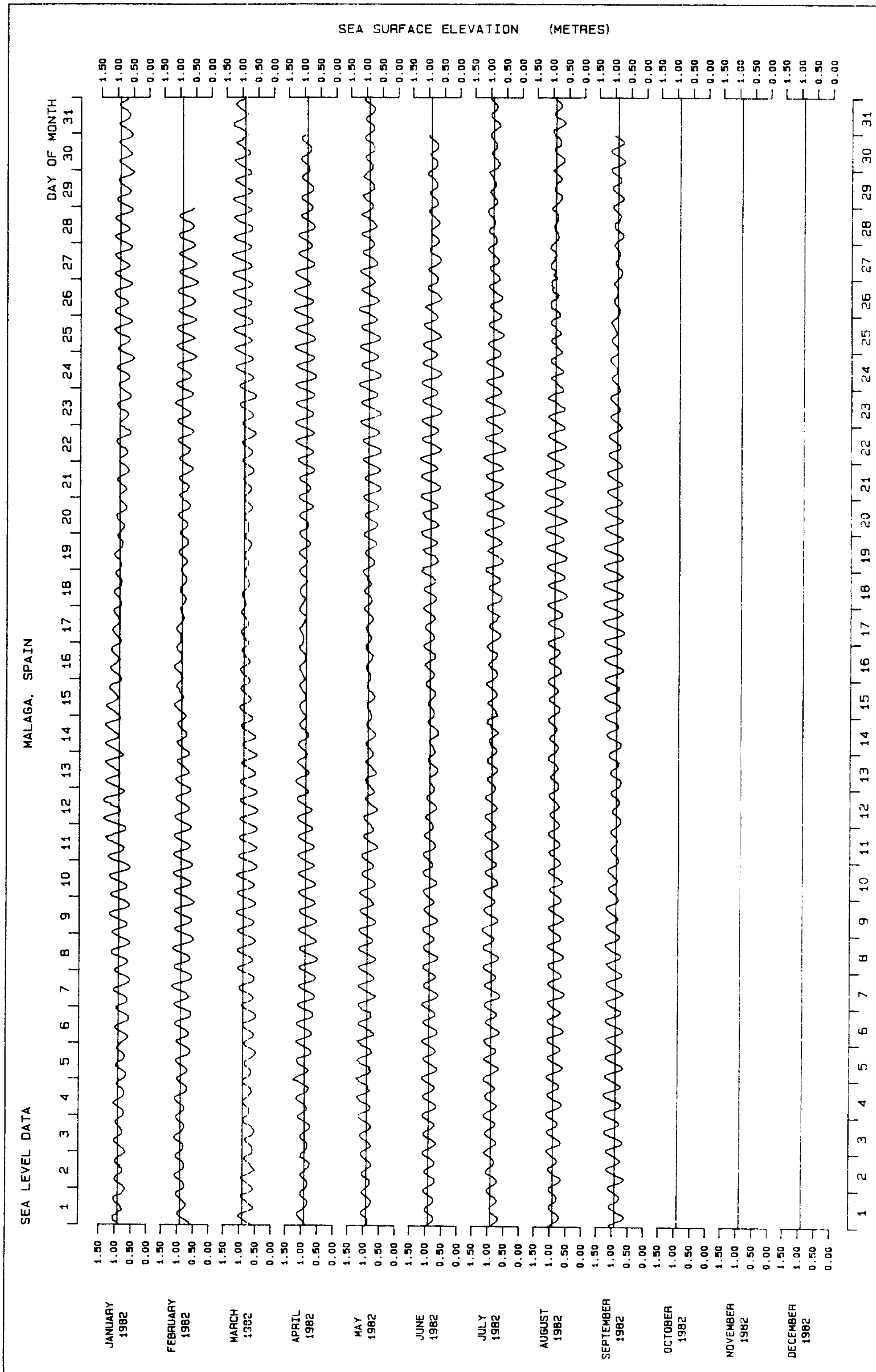
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DAY OF MONTH
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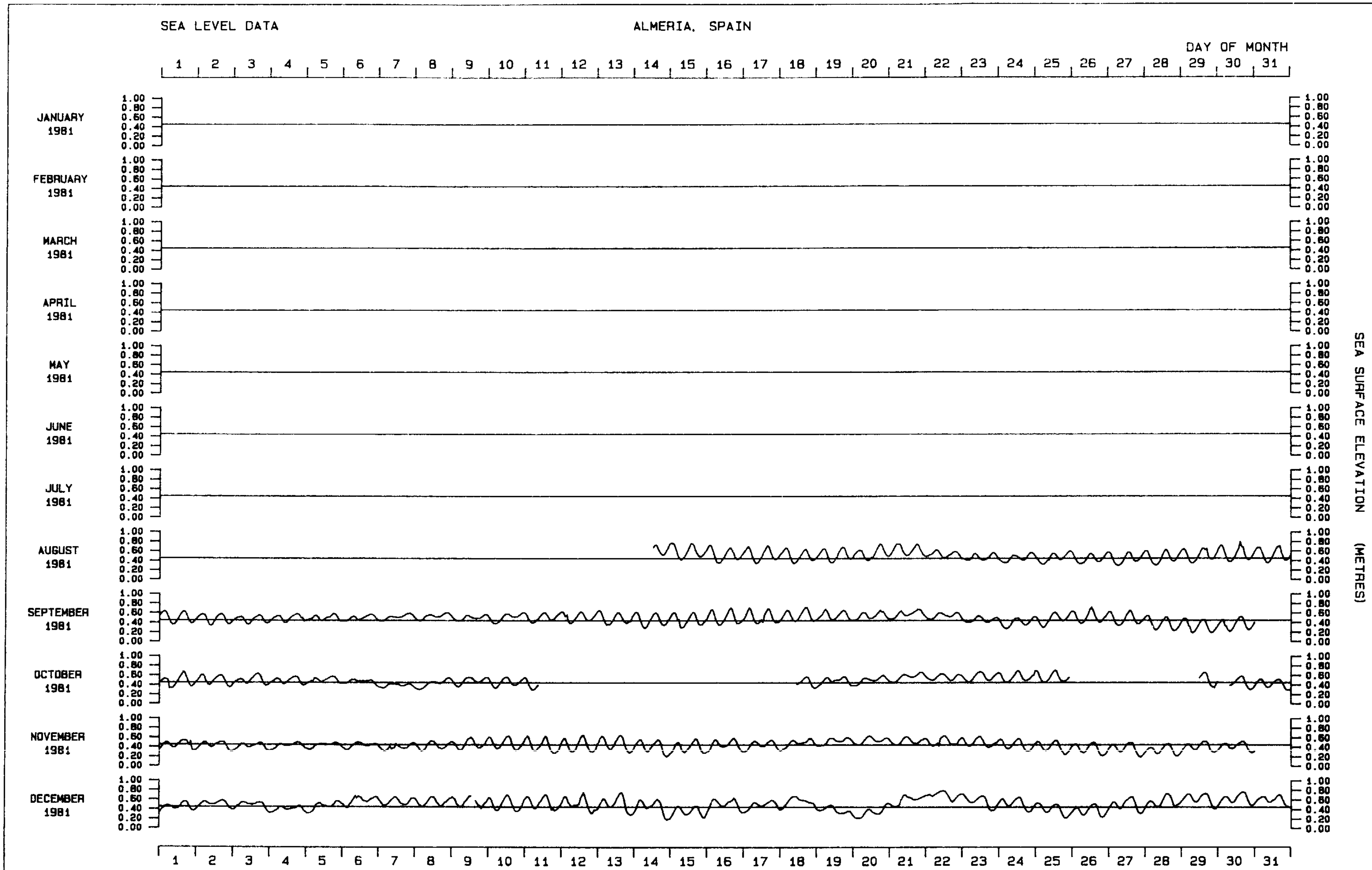
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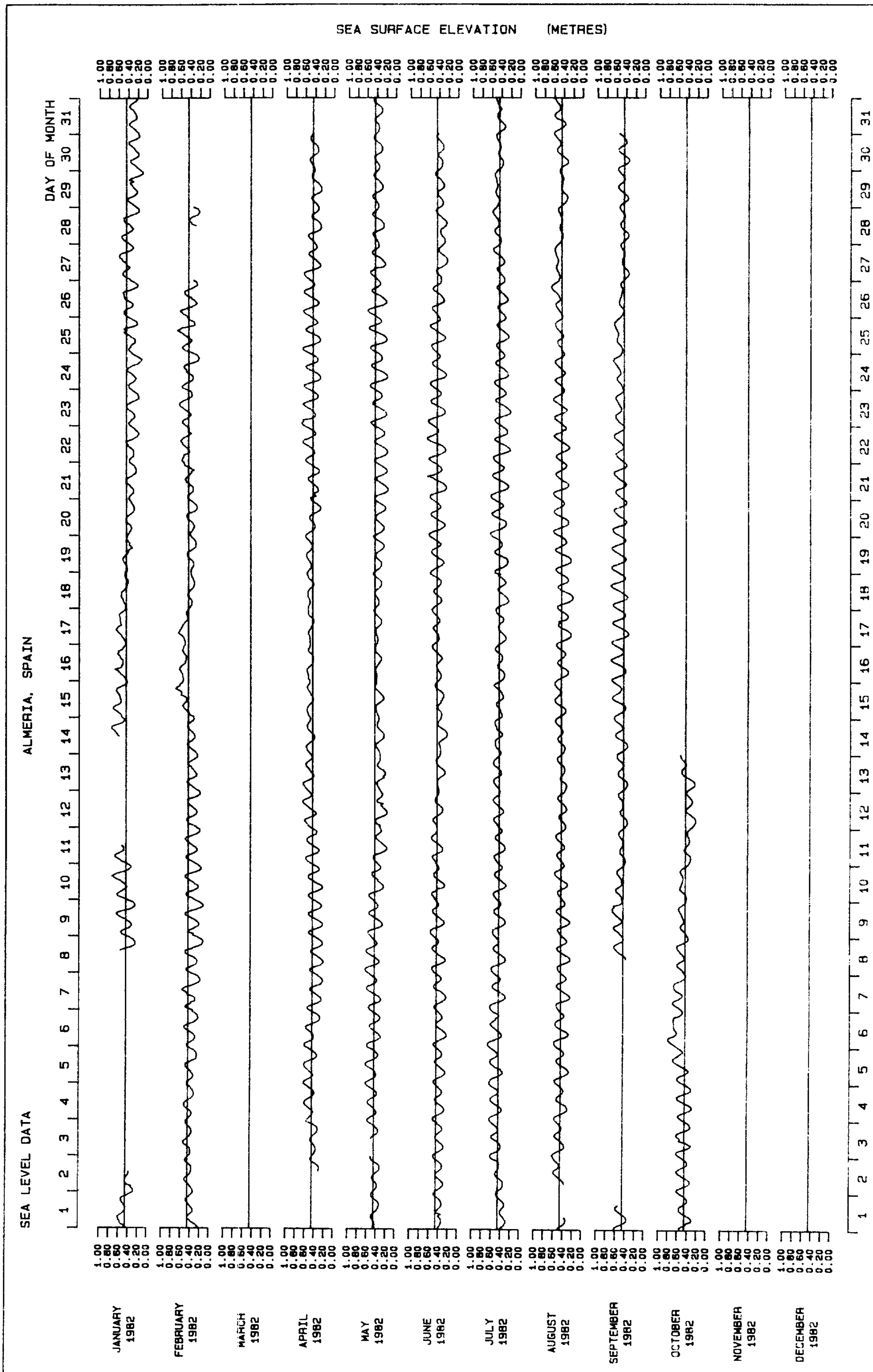
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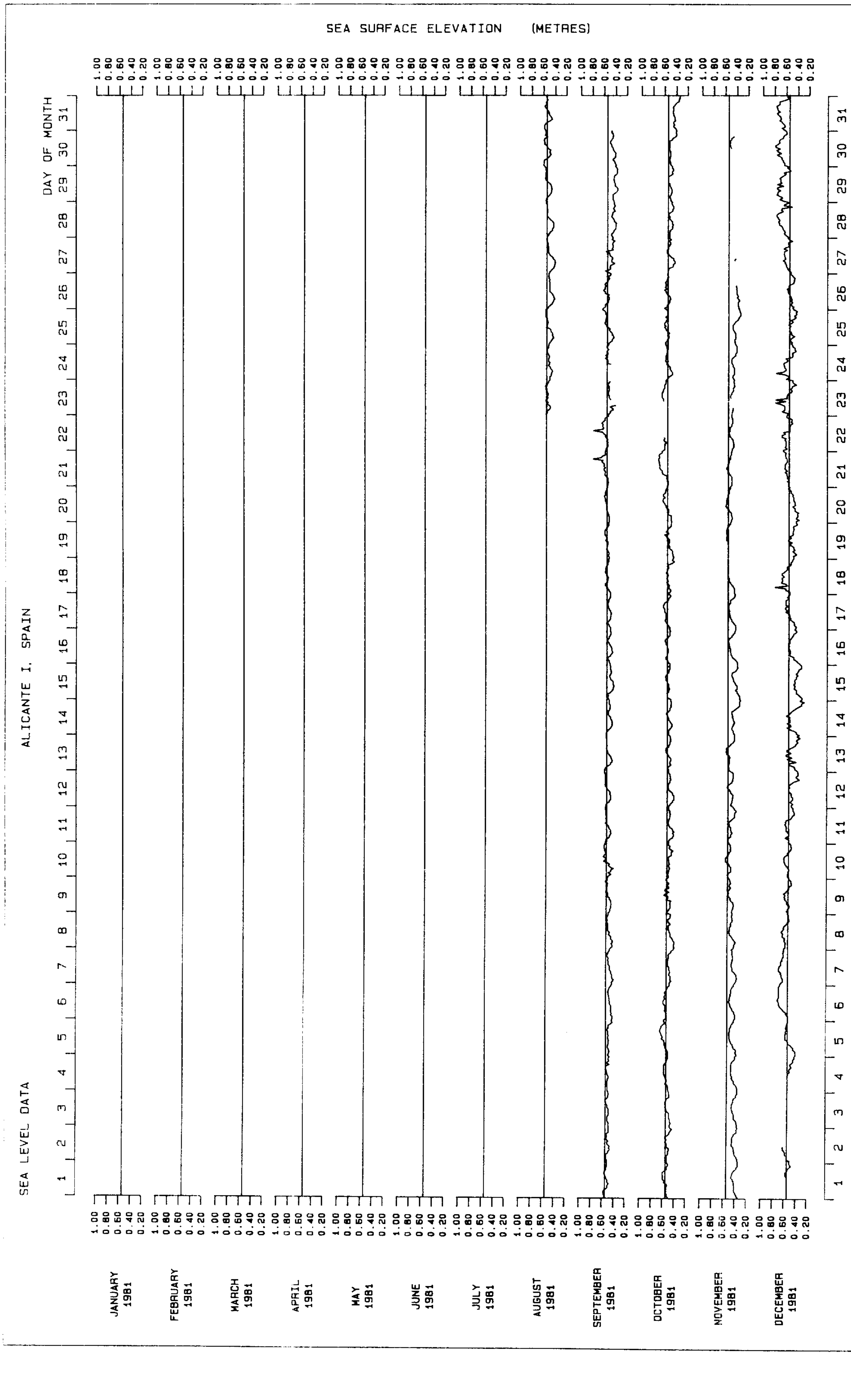
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DAY OF MONTH
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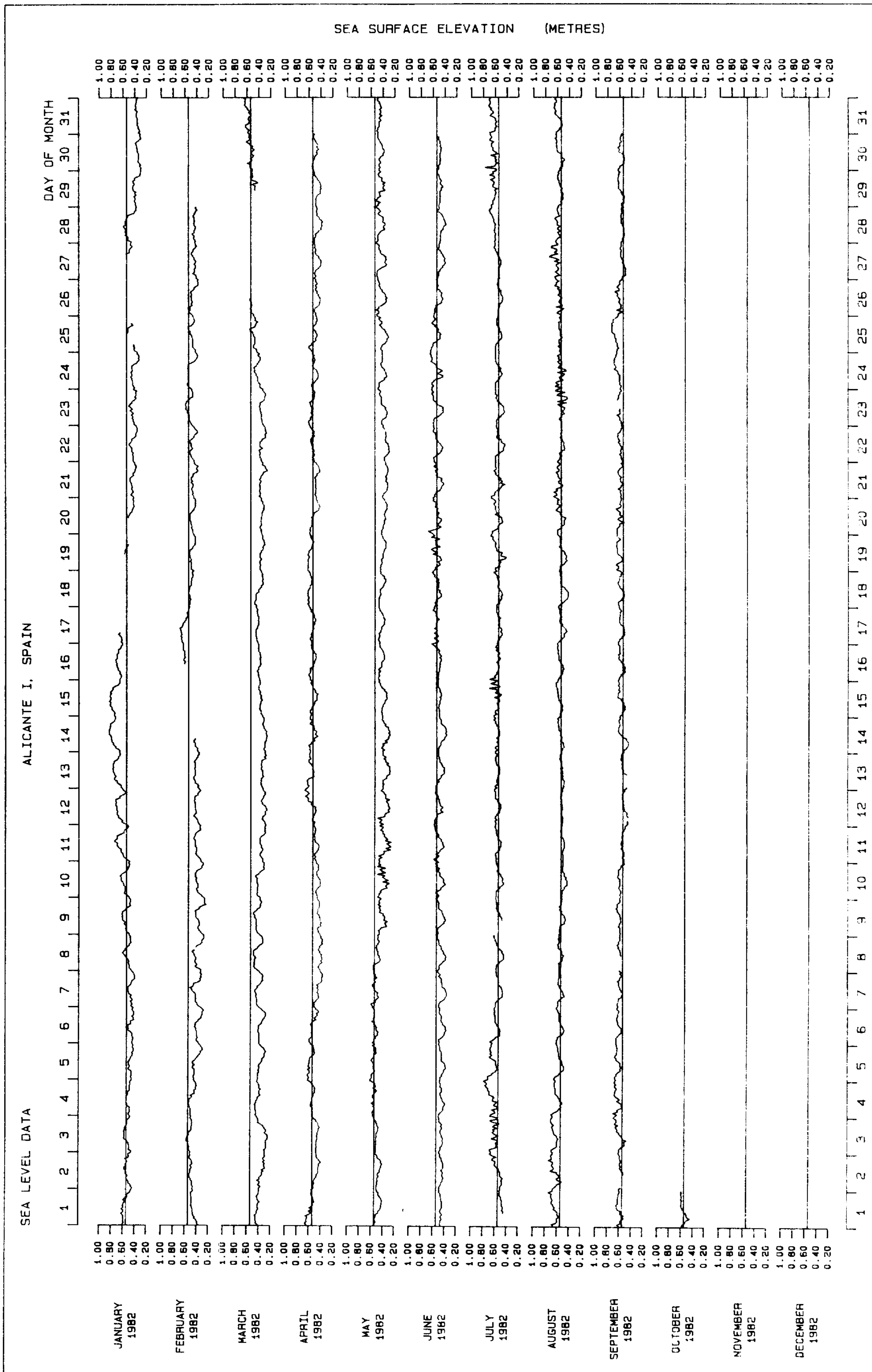
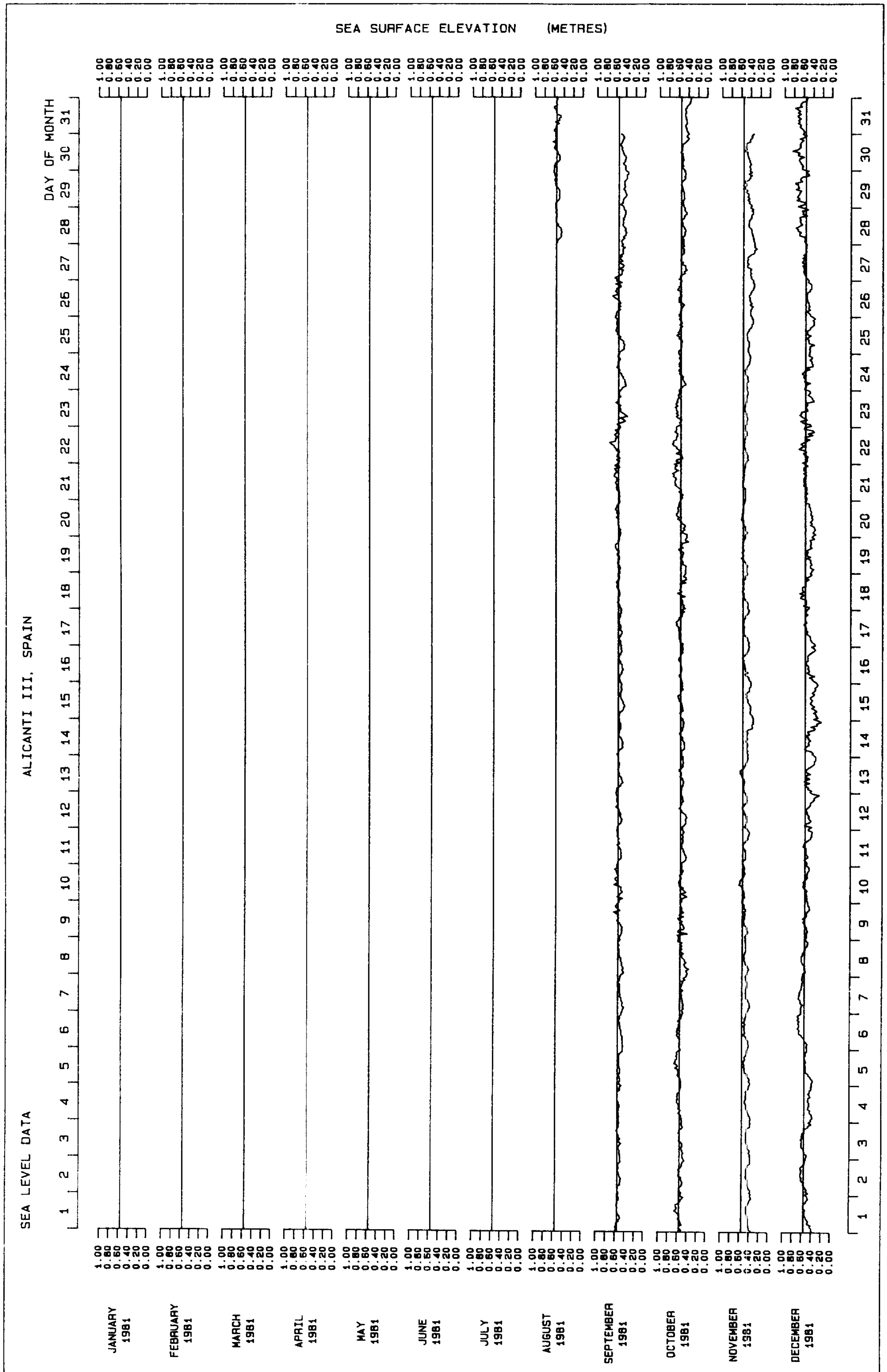
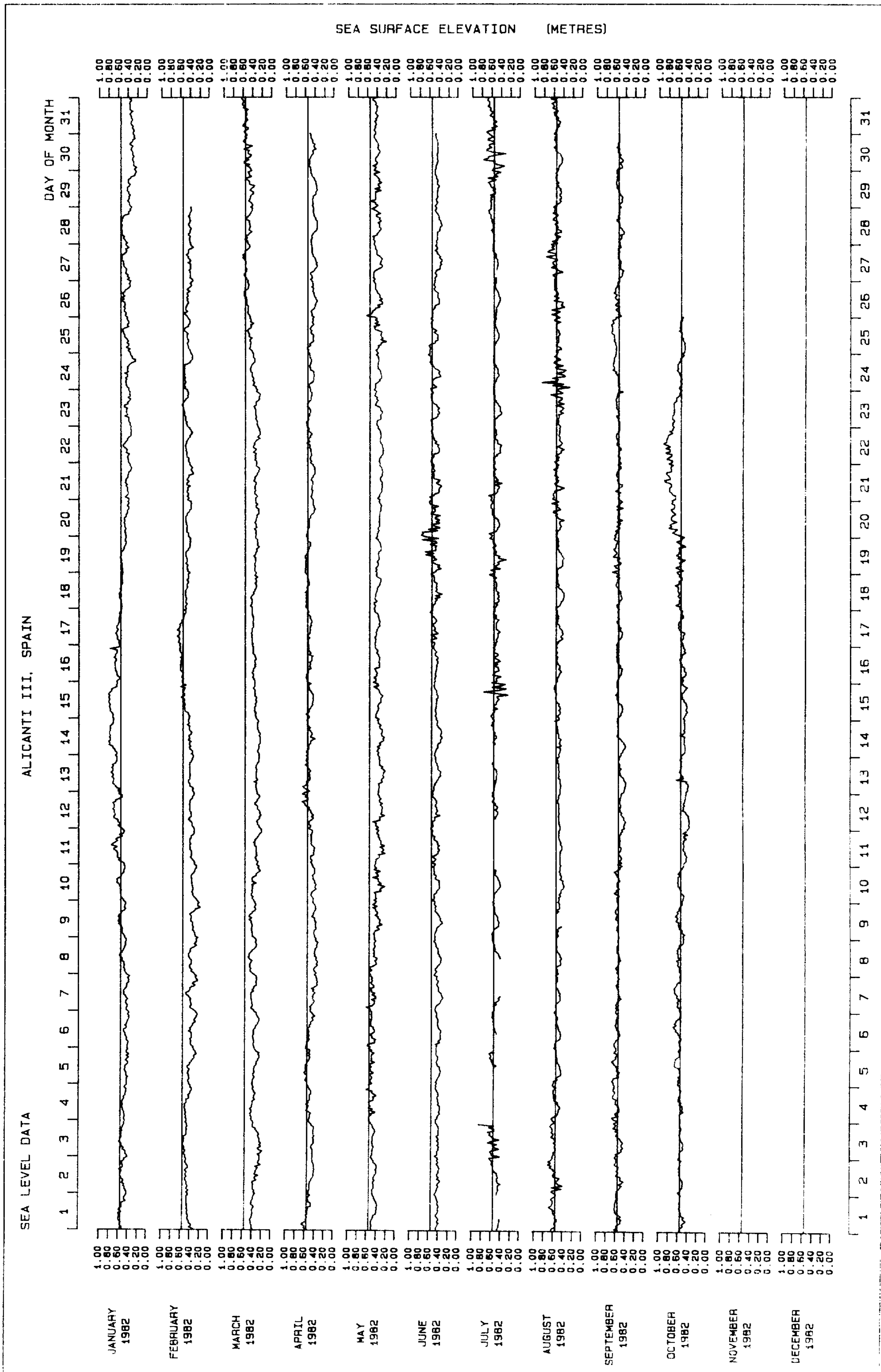
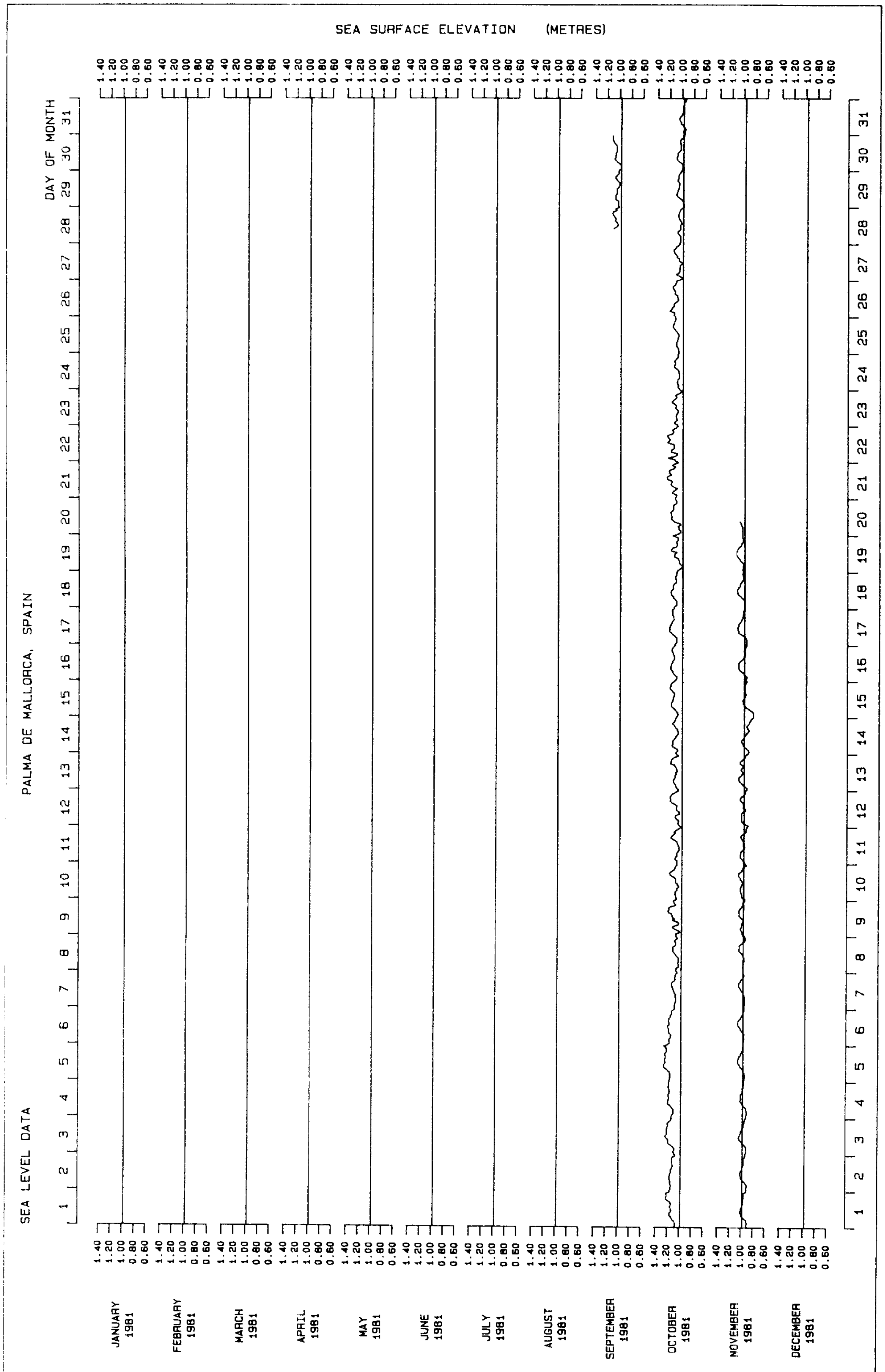
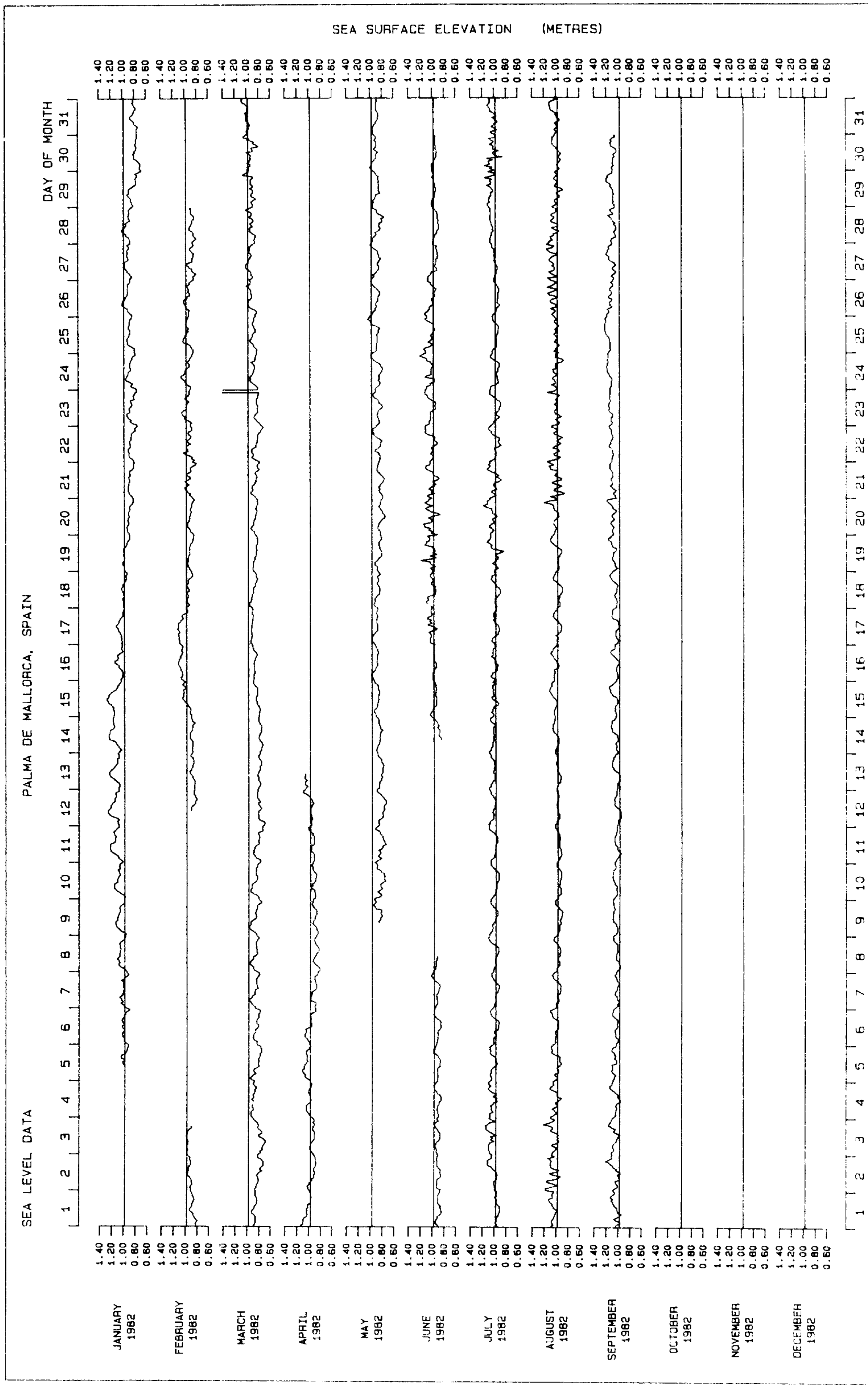
NOVEMBER 1981
DECEMBER 1981

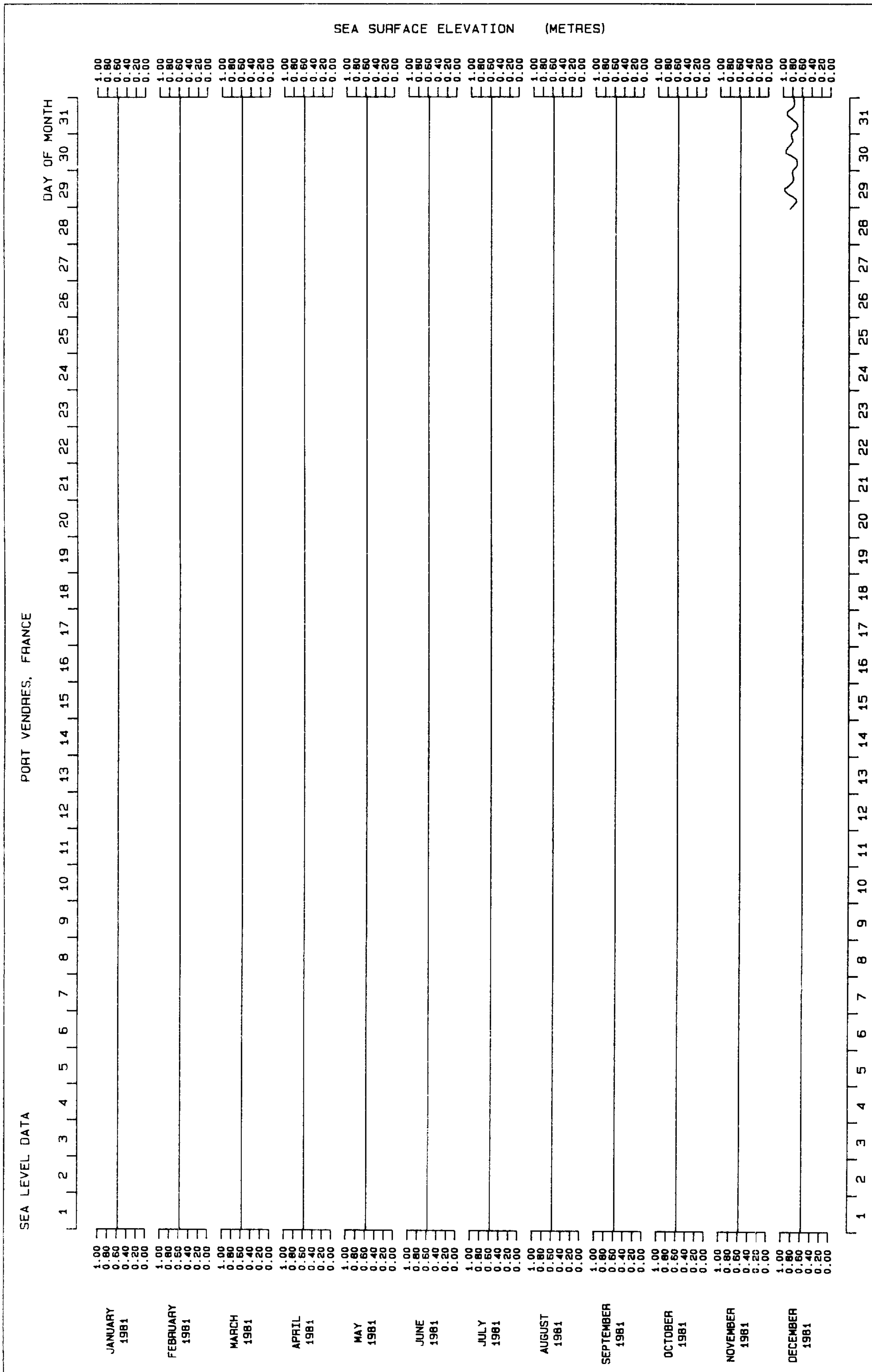

SEA LEVEL DATA
ALICANTE I, SPAIN
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1.00 0.80 0.60 0.40 0.20
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

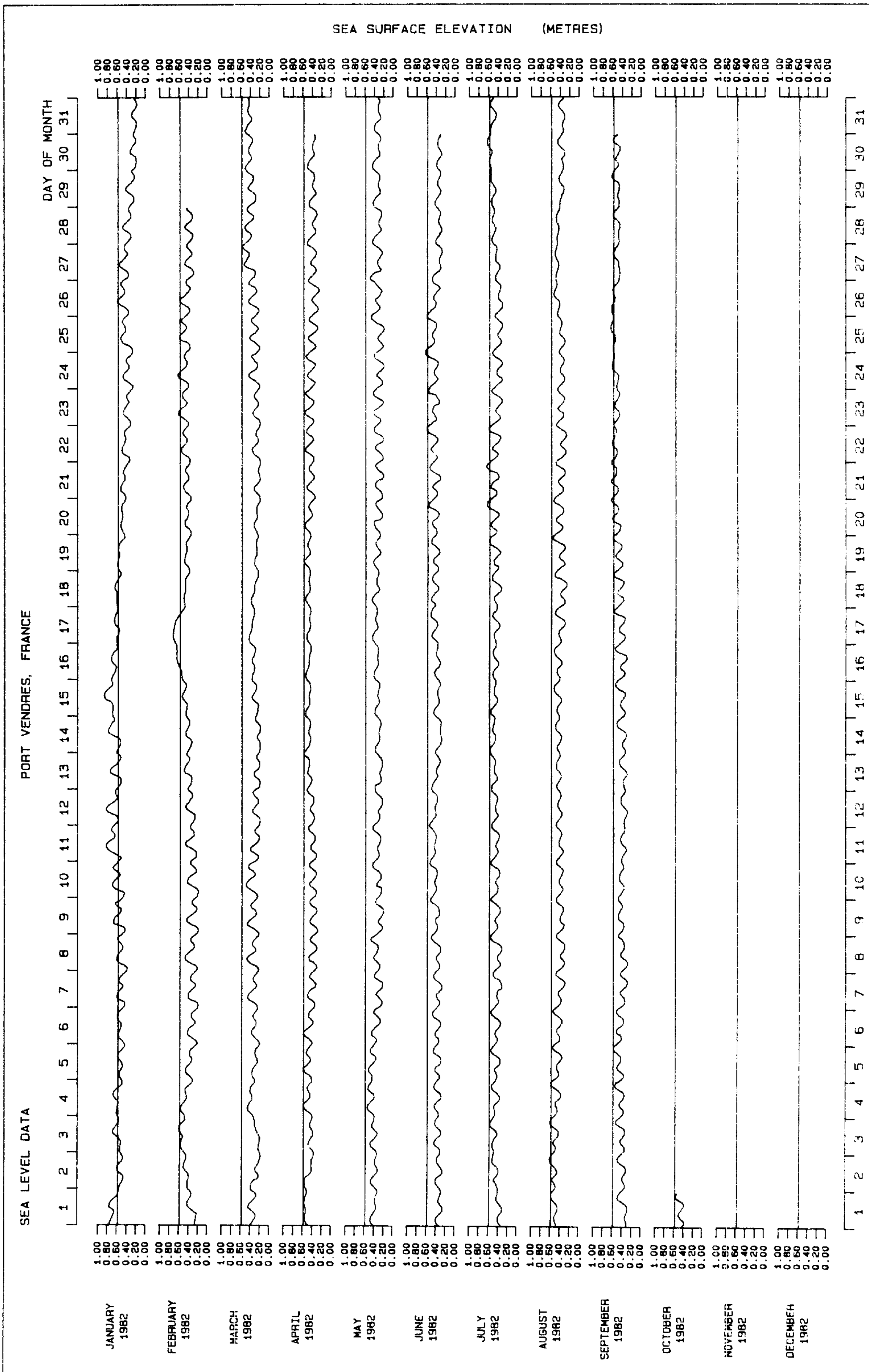

SEA LEVEL DATA
ALICANTI III, SPAIN
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1.00 0.80 0.60 0.40 0.20 0.00
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

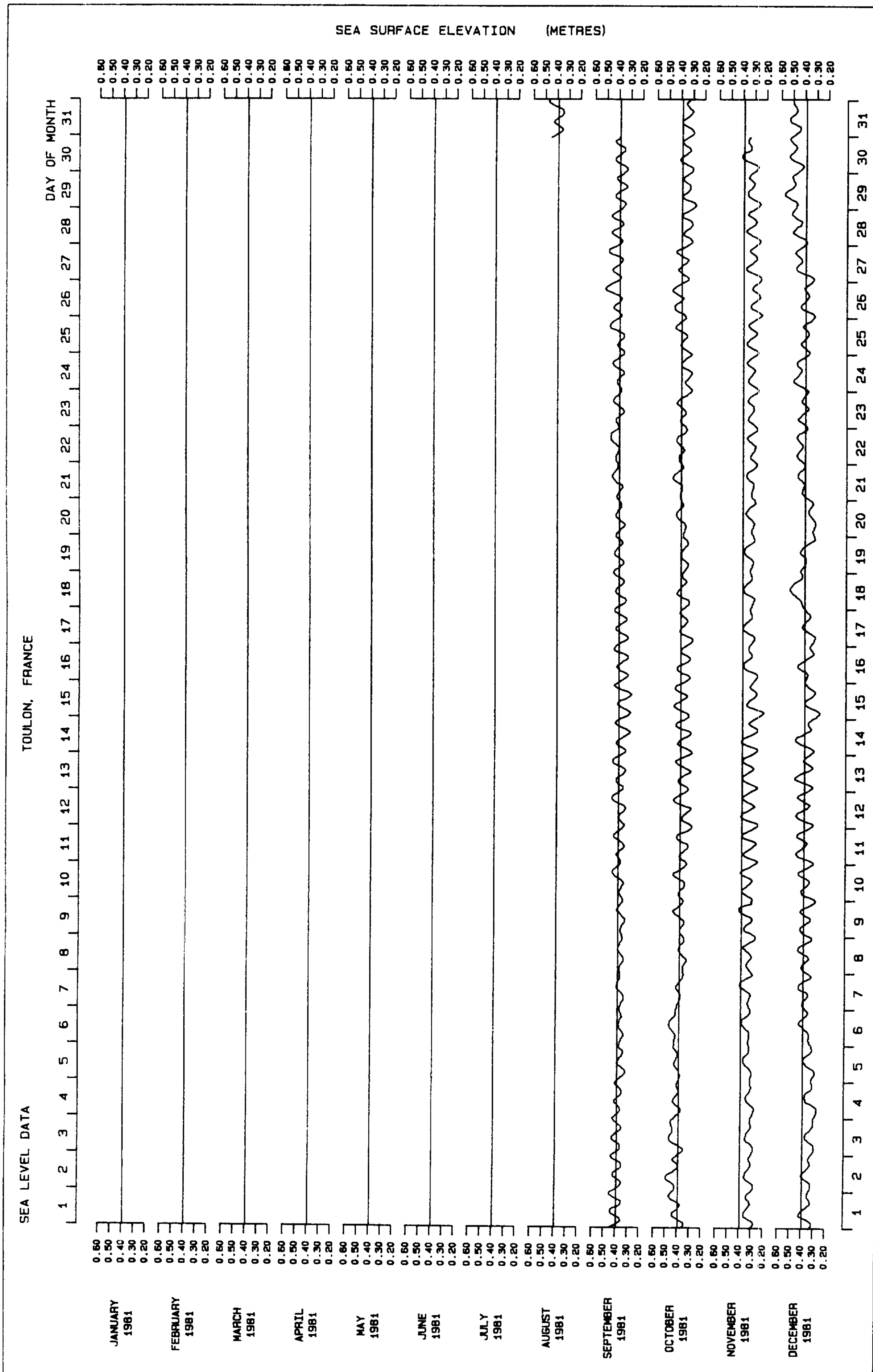

SEA LEVEL DATA
ALICANTI III, SPAIN
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

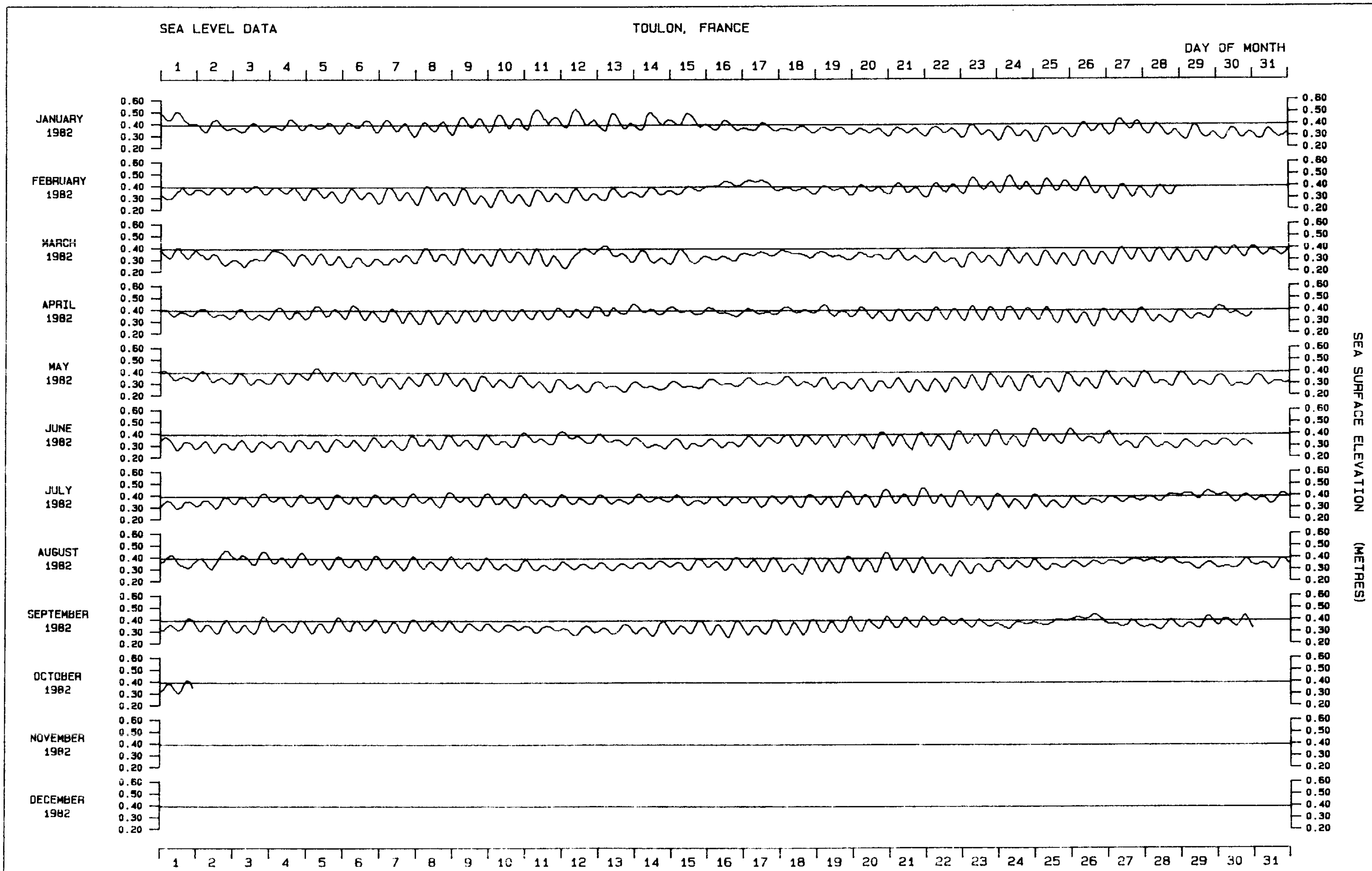

SEA LEVEL DATA
PALMA DE MALLORCA, SPAIN
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

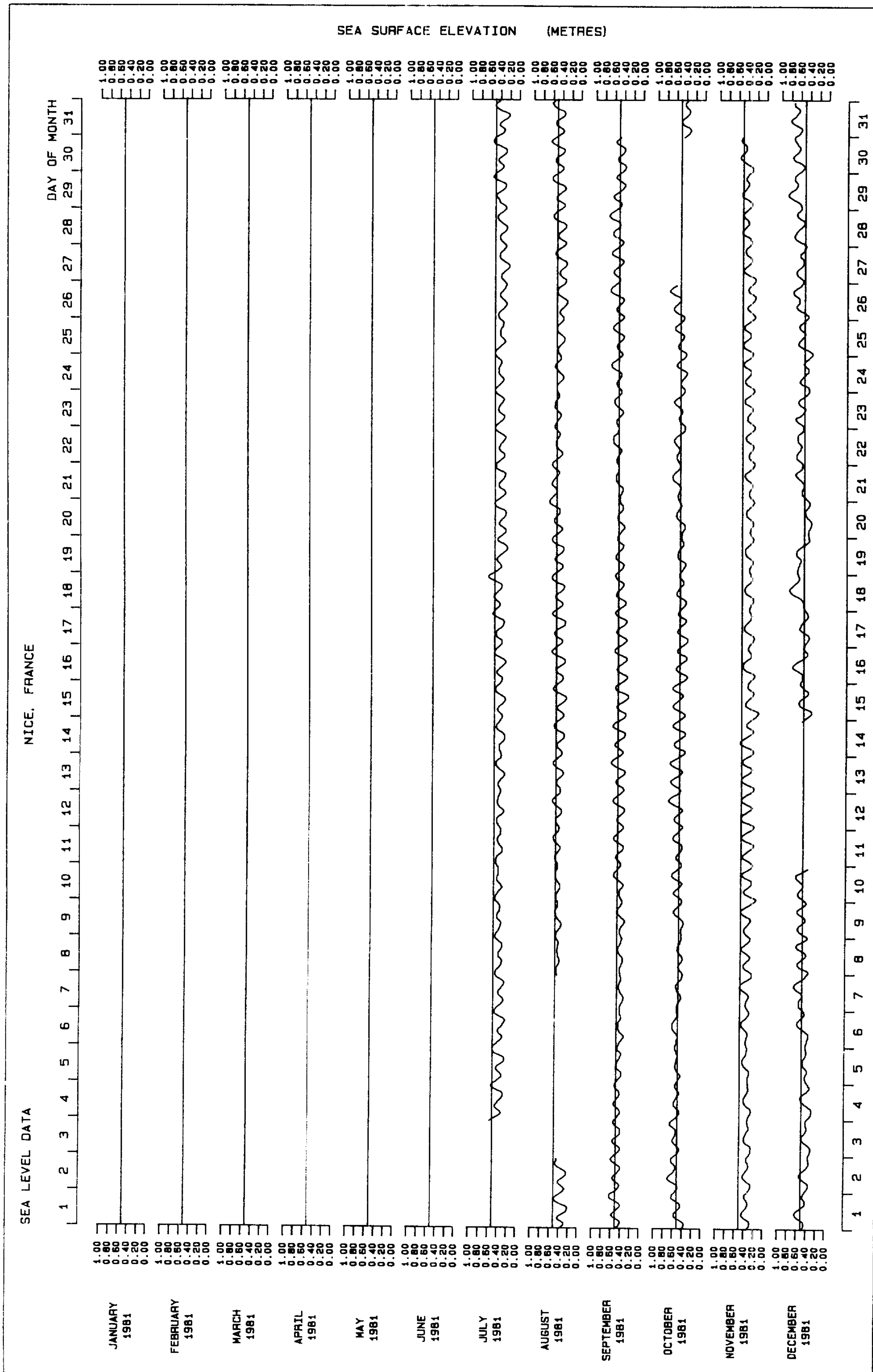

SEA LEVEL DATA
PALMA DE MALLORCA, SPAIN
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1.40 1.20 1.00 0.80 0.60
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

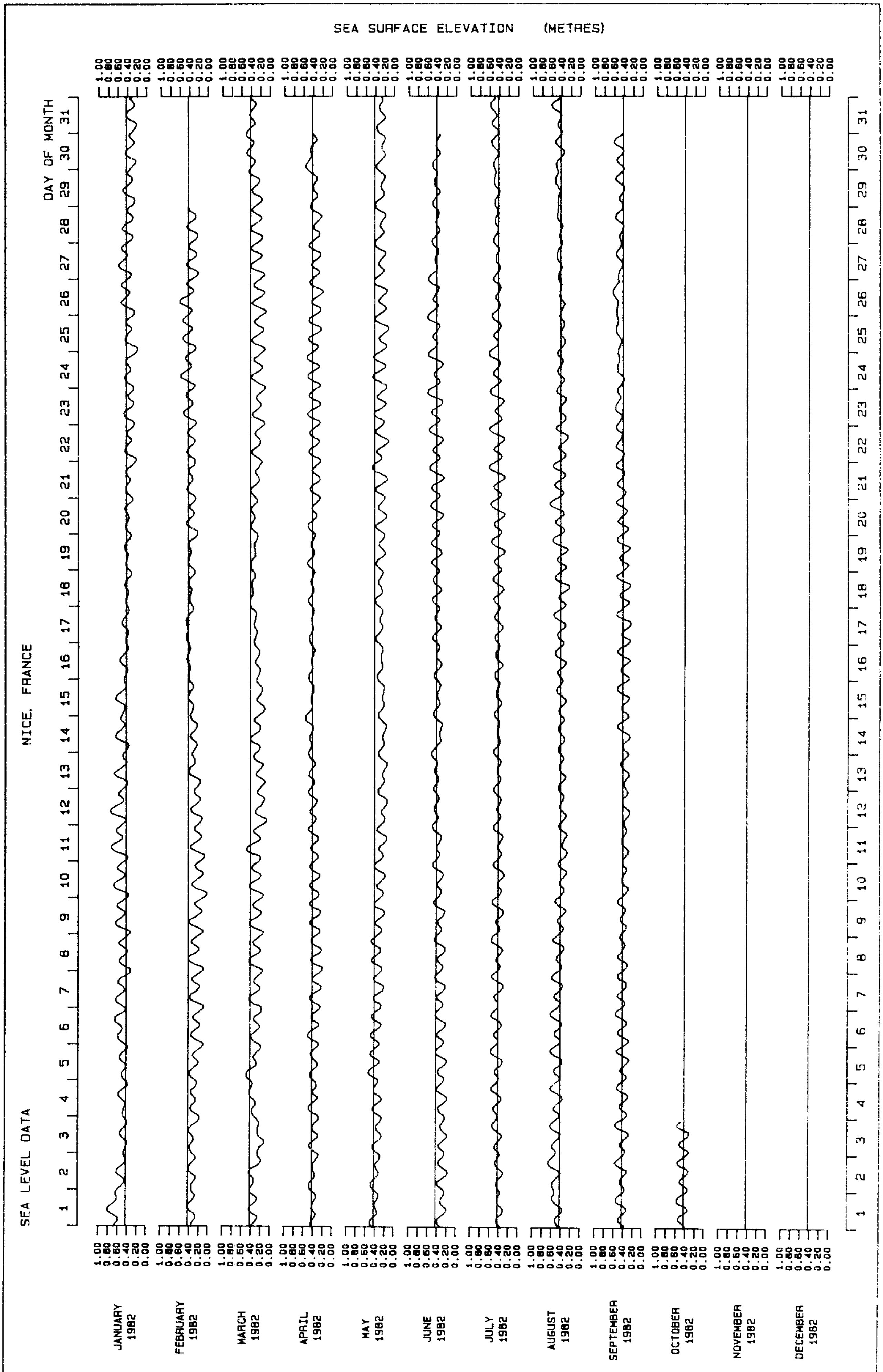

SEA LEVEL DATA
PORT VENDRES, FRANCE
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

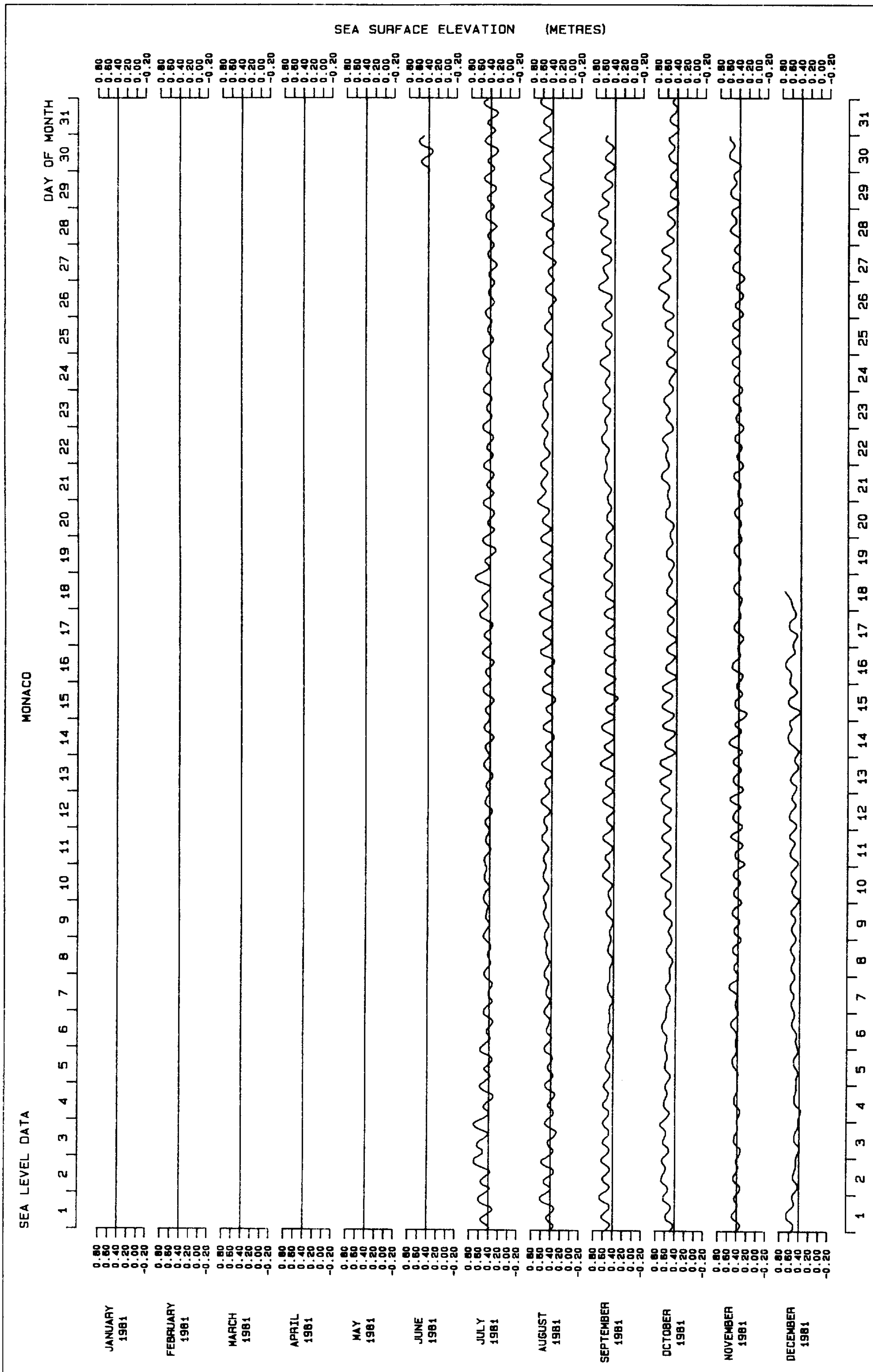

SEA LEVEL DATA
PORT VENDRES, FRANCE
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1.00 0.80 0.60 0.40 0.20 0.00
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

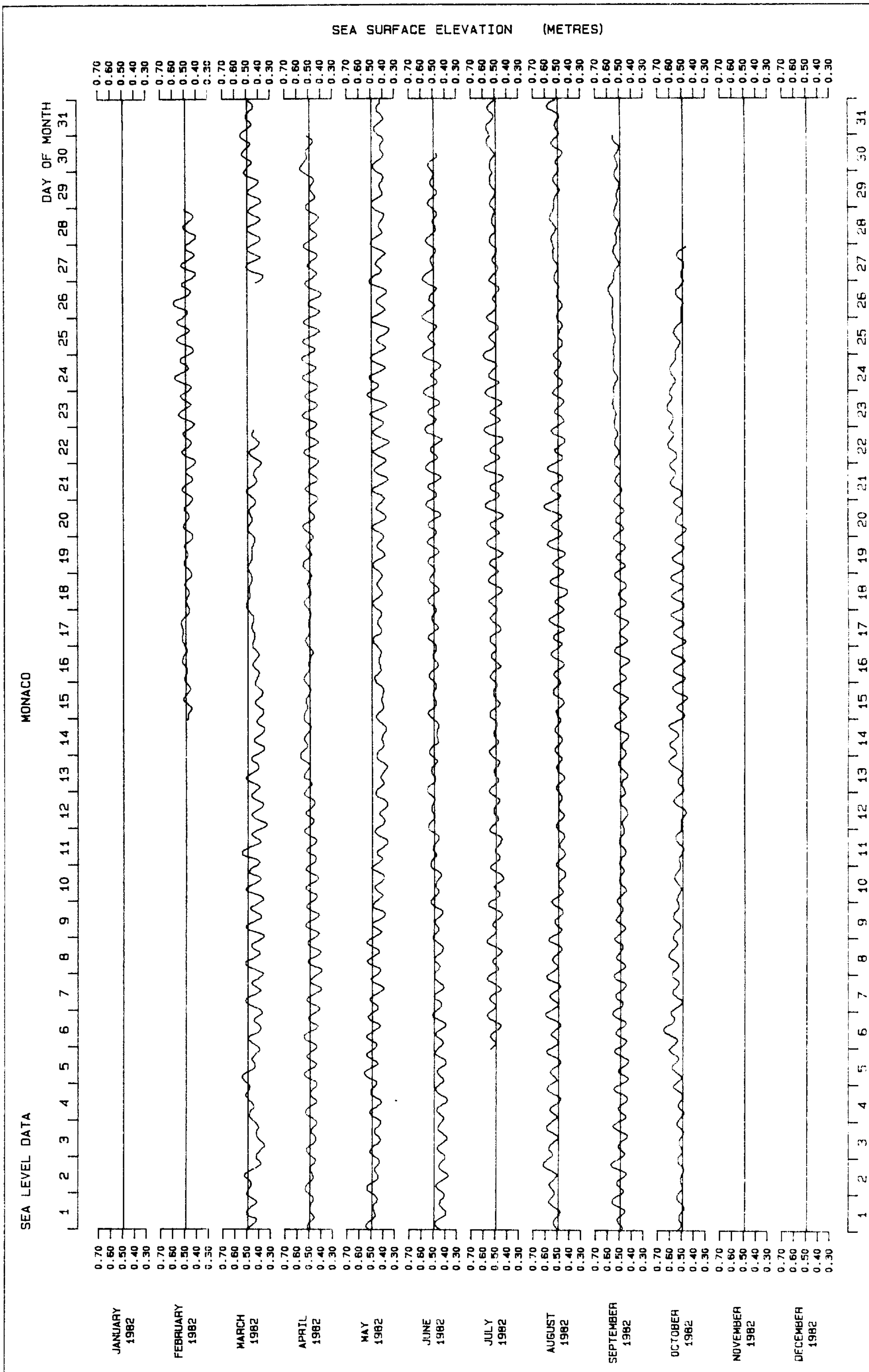

SEA LEVEL DATA
TOULON, FRANCE
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
0.60 0.50 0.40 0.30 0.20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

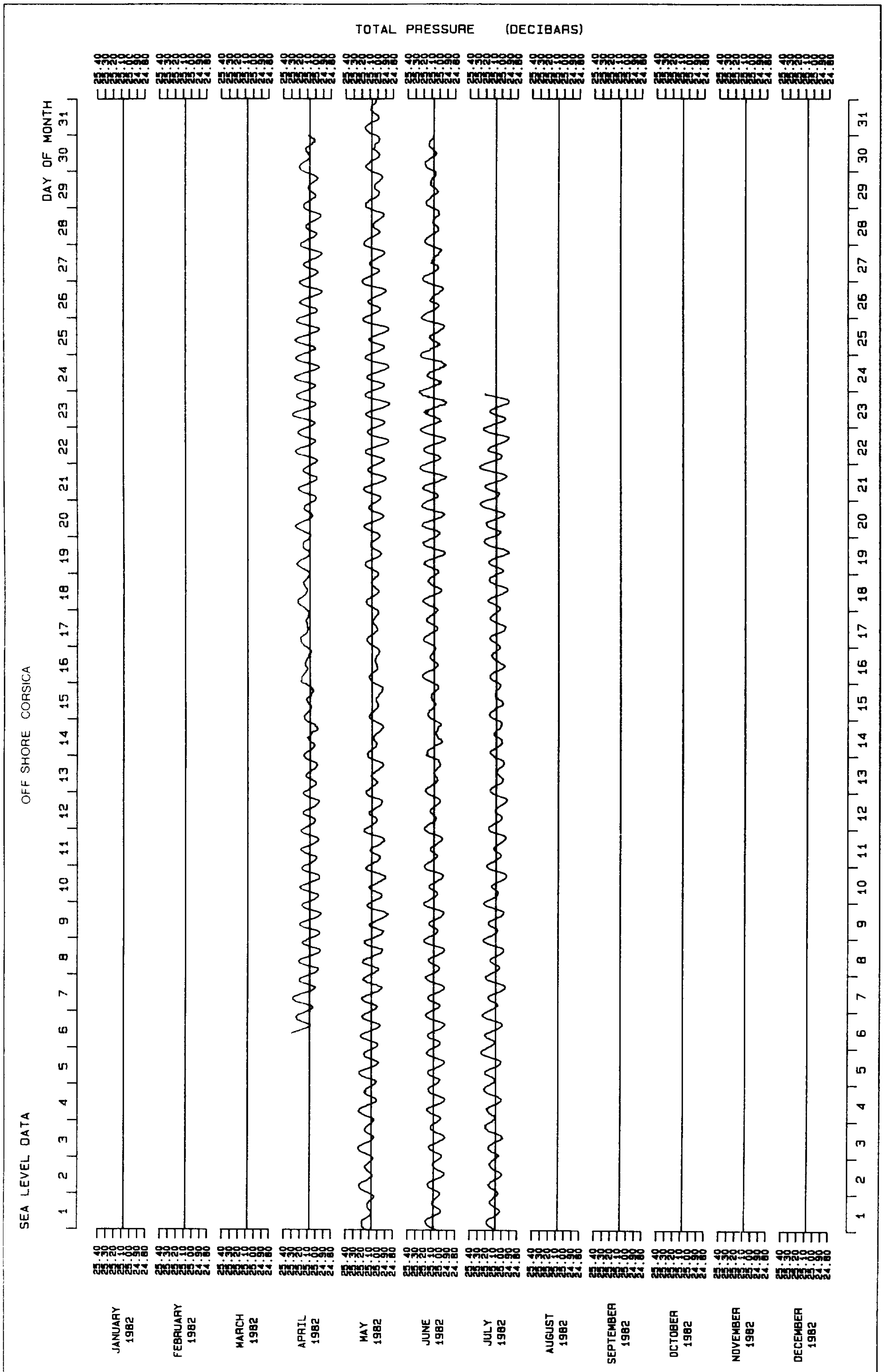

SEA LEVEL DATA
TOULON, FRANCE
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
SEA SURFACE ELEVATION (METRES)
0.60 0.50 0.40 0.30 0.20
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

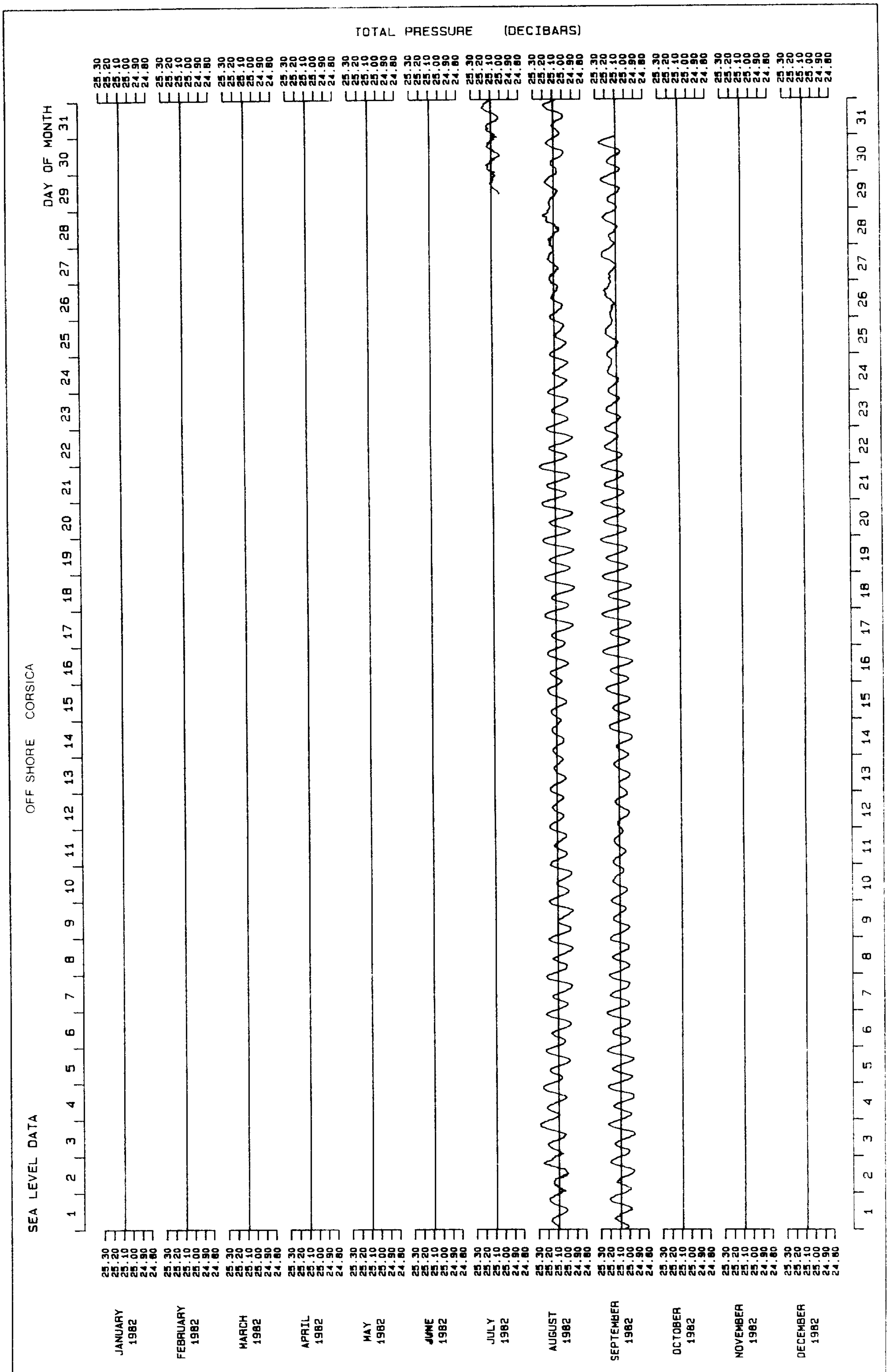

SEA LEVEL DATA
NICE, FRANCE
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1.00 0.80 0.60 0.40 0.20 0.00
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

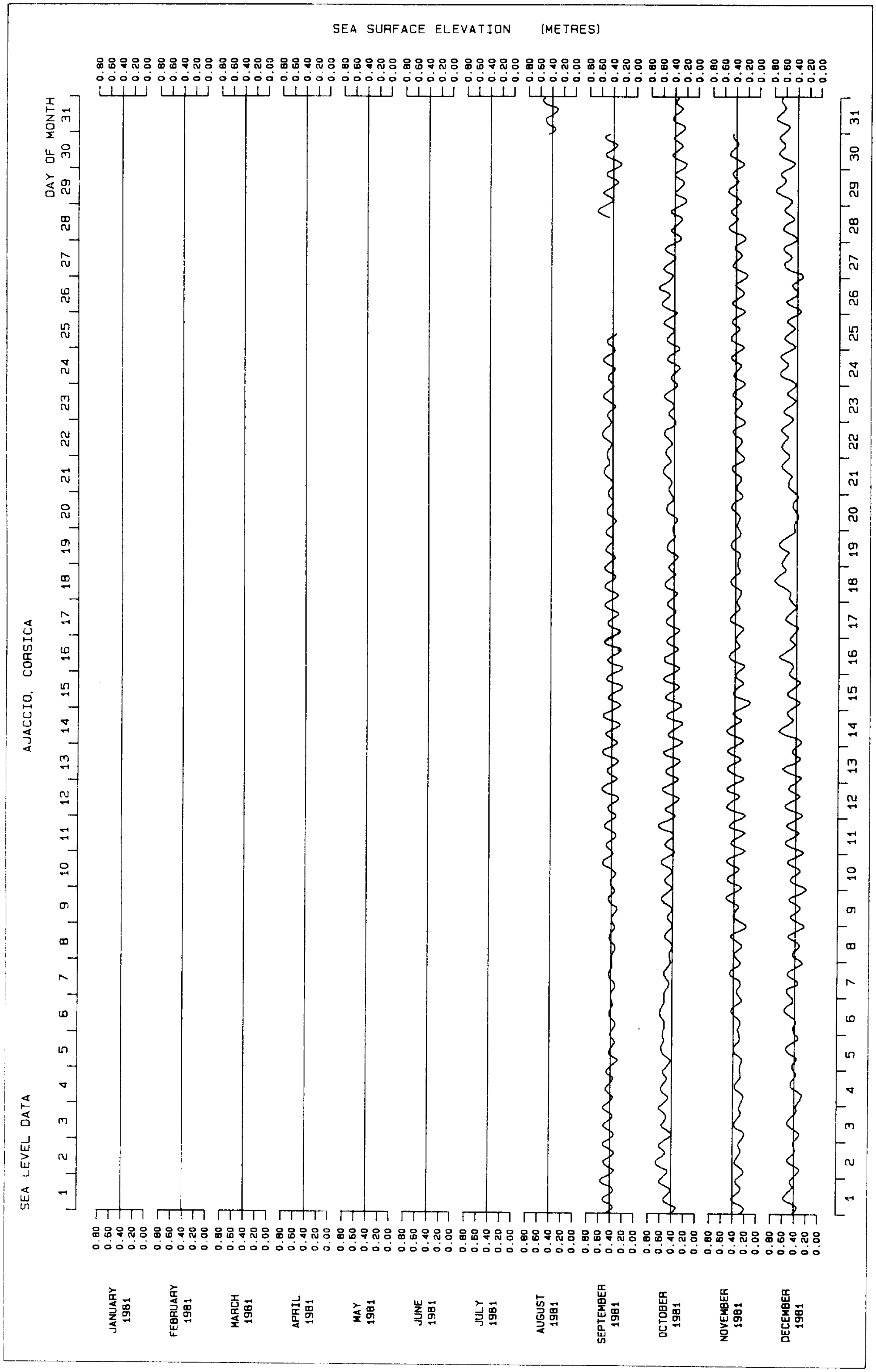

SEA LEVEL DATA
NICE, FRANCE
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1.00 0.80 0.60 0.40 0.20 0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

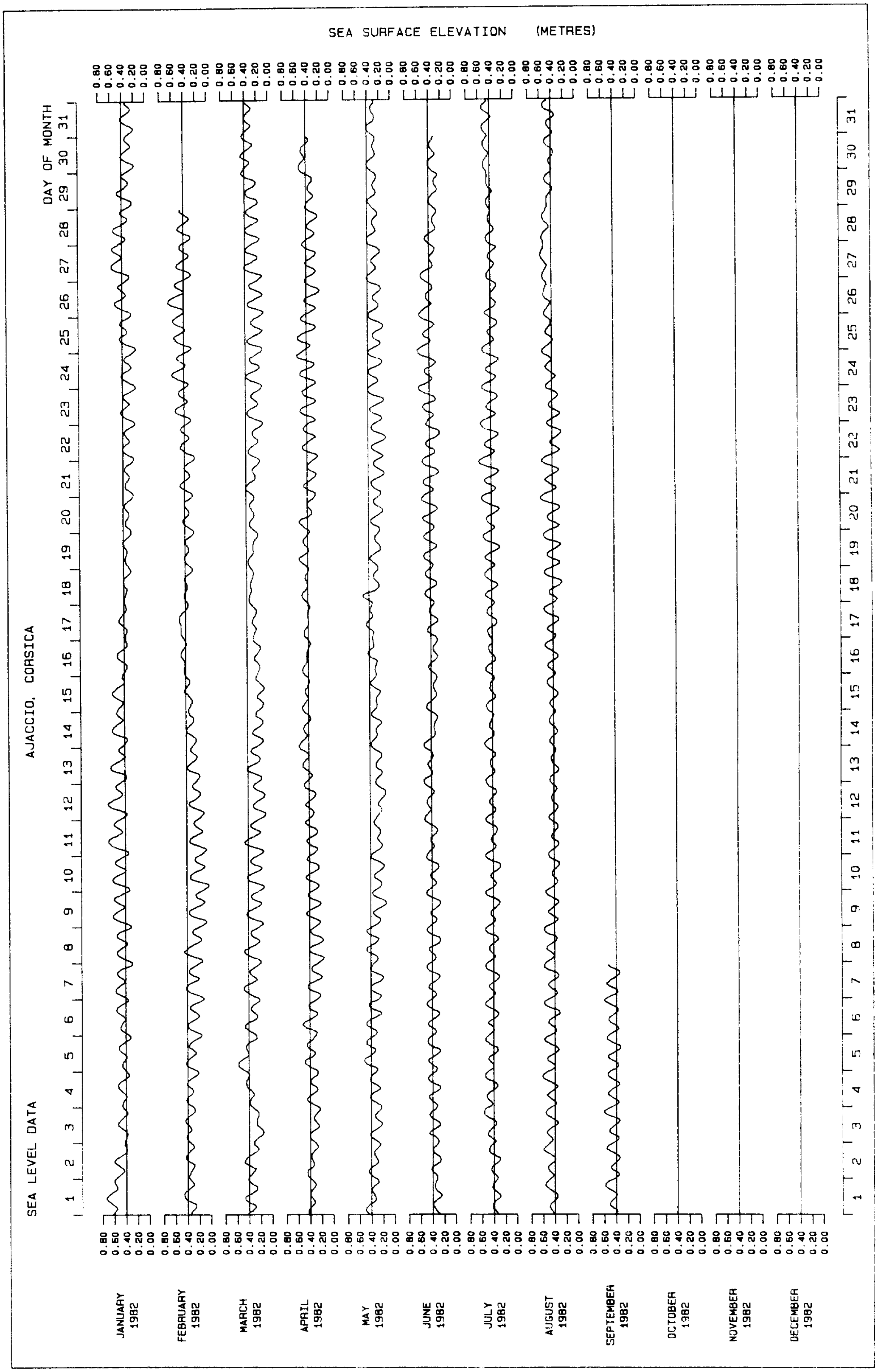

SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
MONACO
DAY OF MONTH
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981


SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
MONACO
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
0.70 0.60 0.50 0.40 0.30
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
OFF SHORE CORSICA
TOTAL PRESSURE (DECIBARS)
DAY OF MONTH
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
OFF SHORE CORSICA
DAY OF MONTH
TOTAL PRESSURE (DECIBARS)
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
AJACCIO, CORSICA
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
0.80 0.60 0.40 0.20 0.00
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981


SEA LEVEL DATA
AJACCIO, CORSICA
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
0.80 0.60 0.40 0.20 0.00
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
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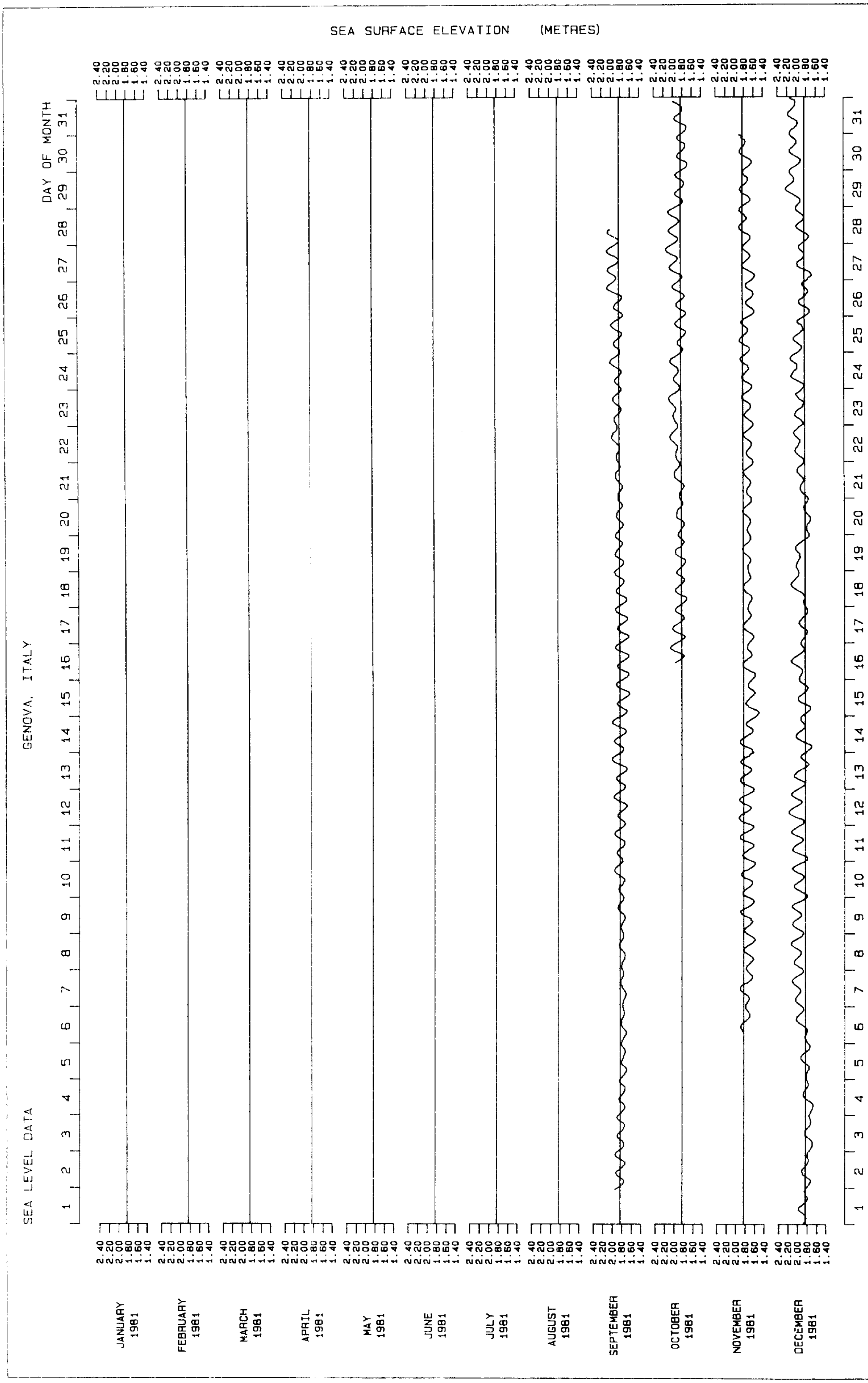
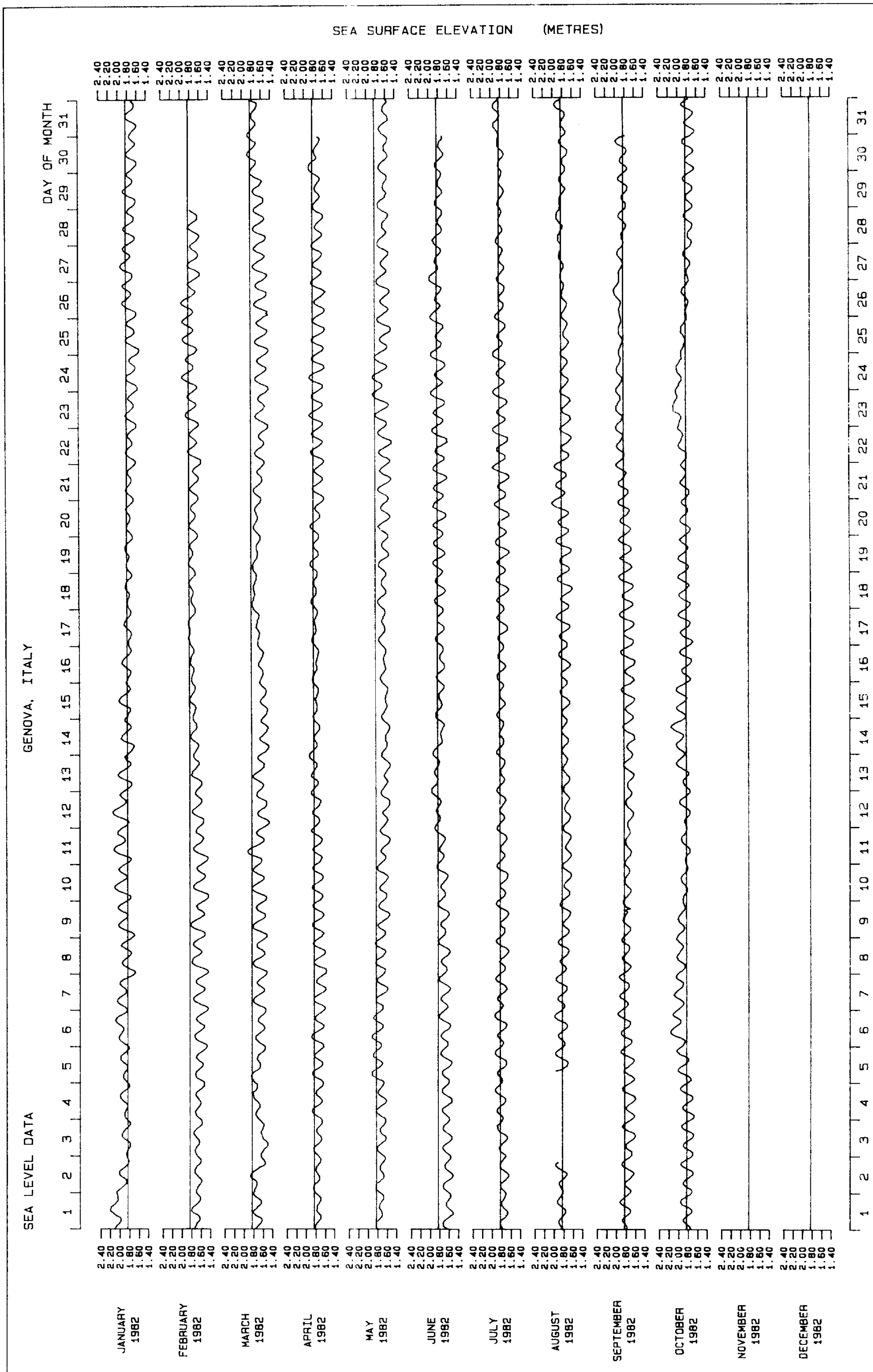
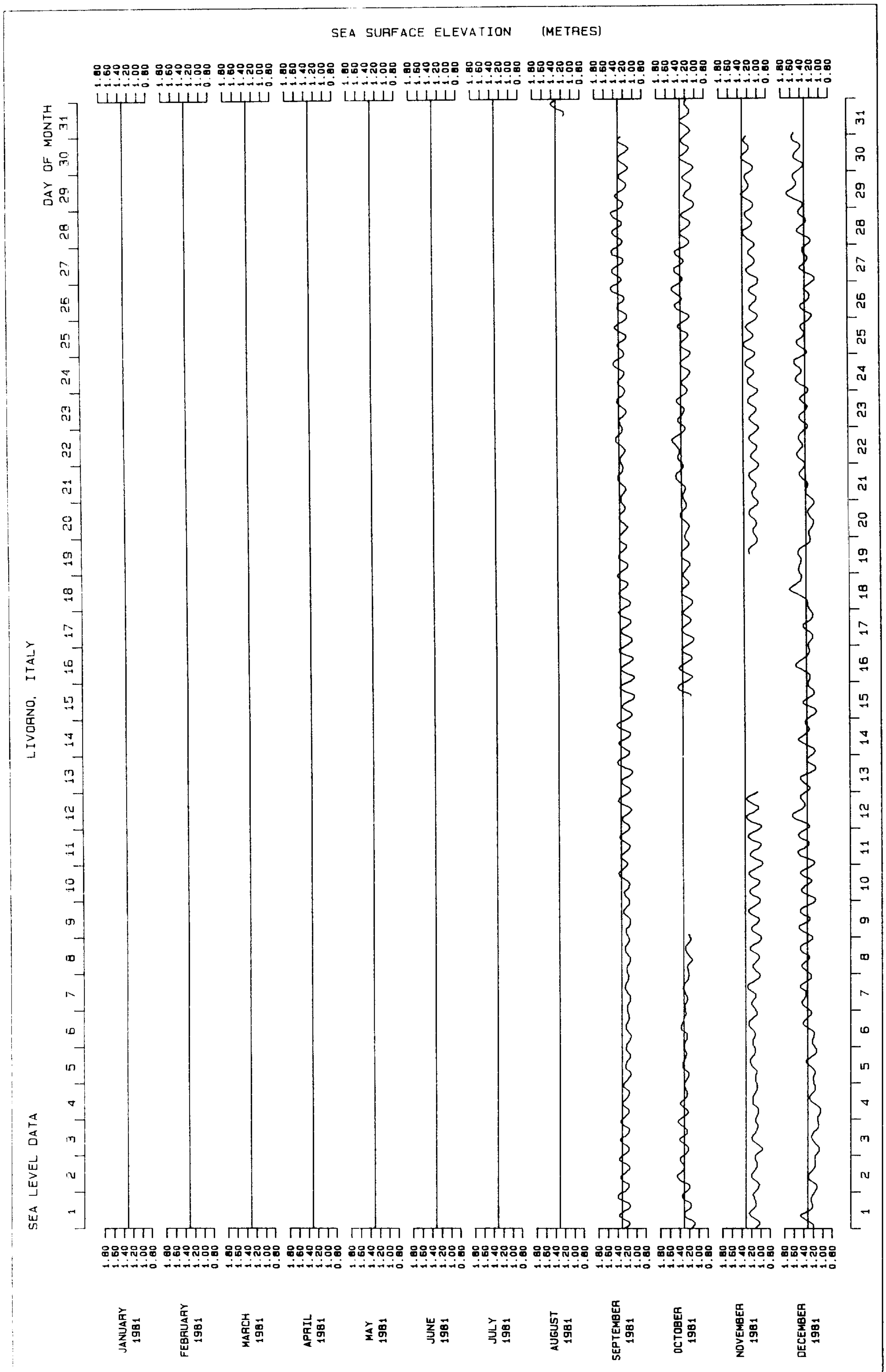
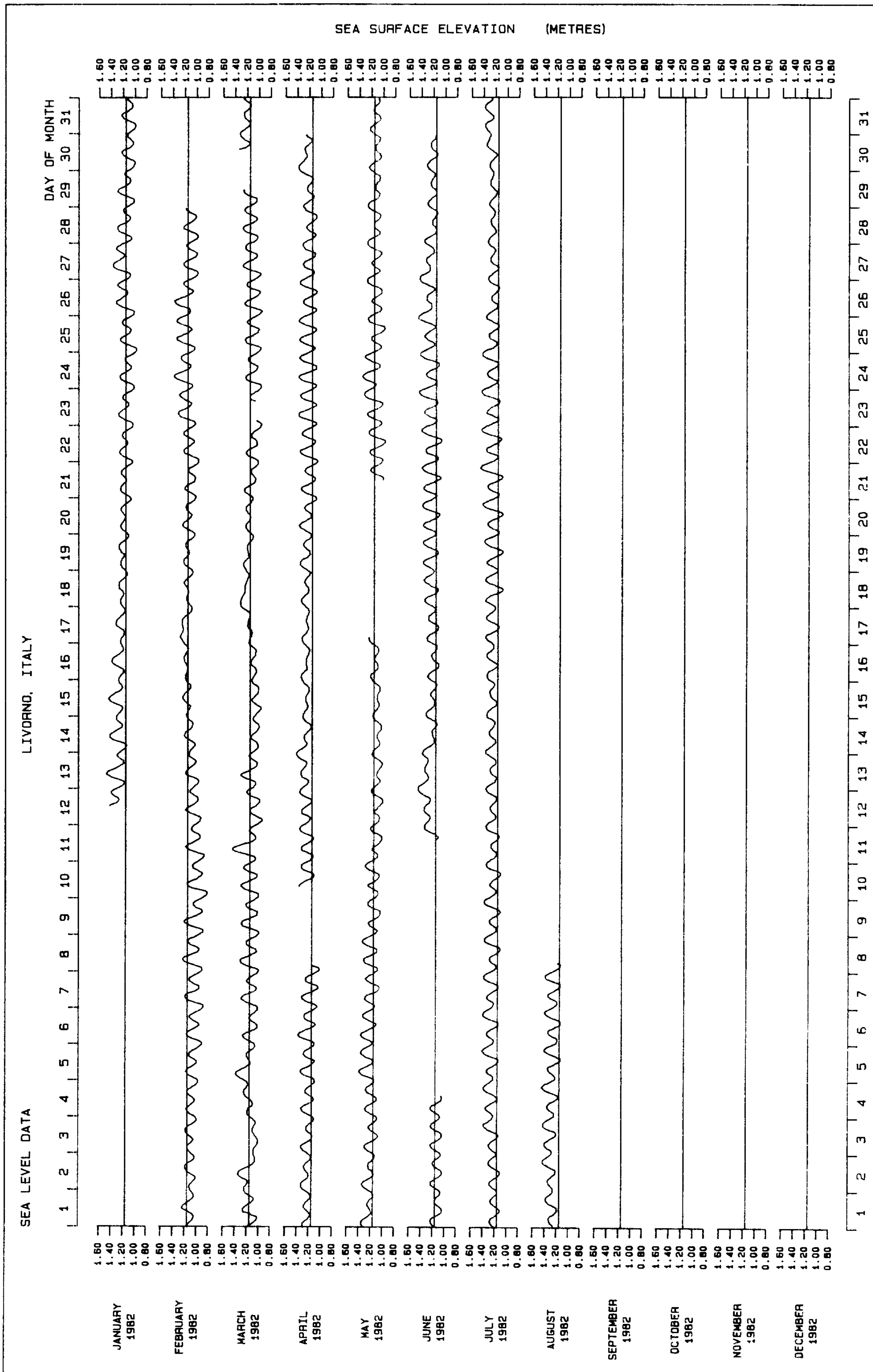
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

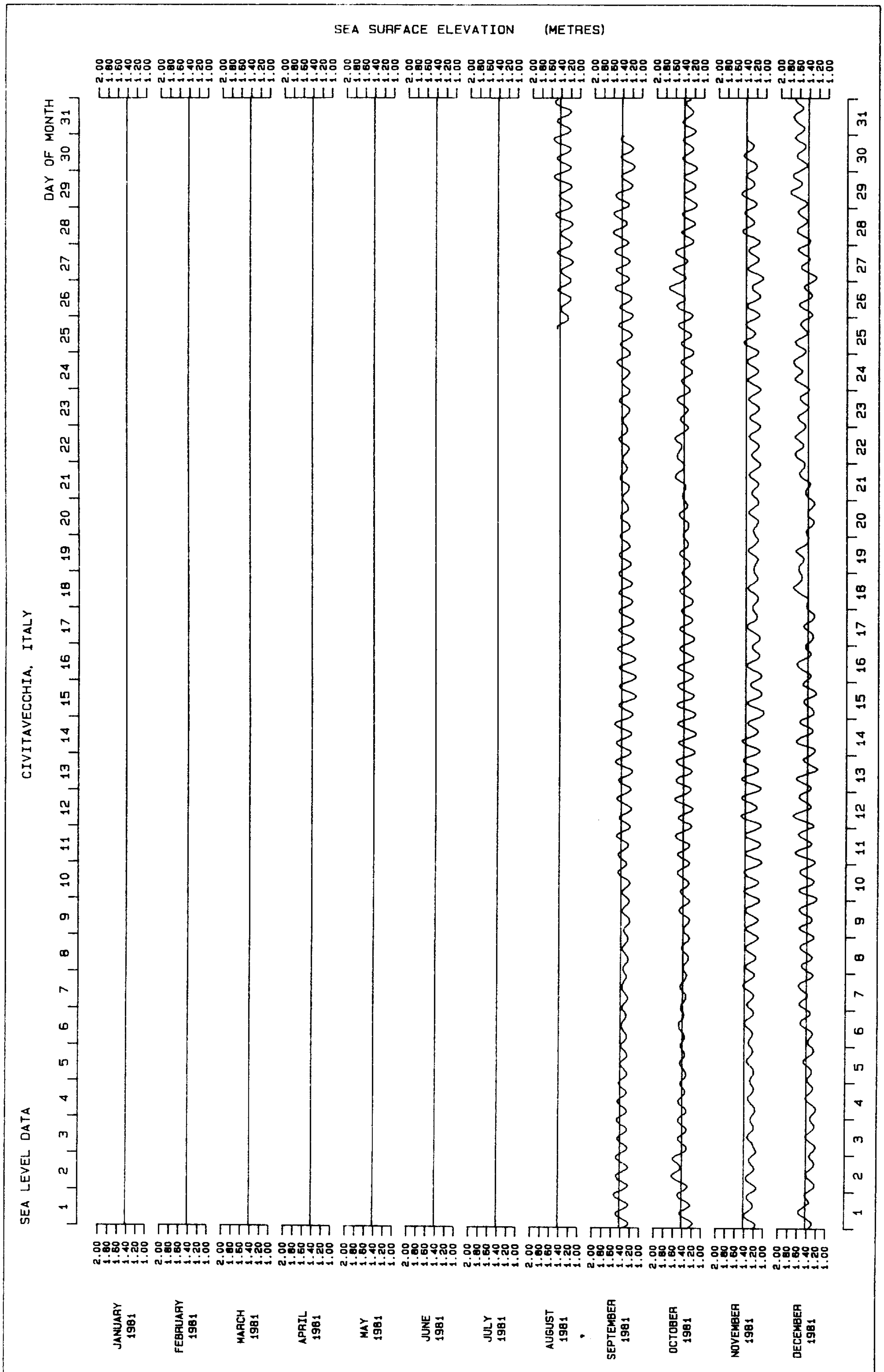

SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
GENOVA, ITALY
DAY OF MONTH
2.40 2.20 2.00 1.80 1.60 1.40
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

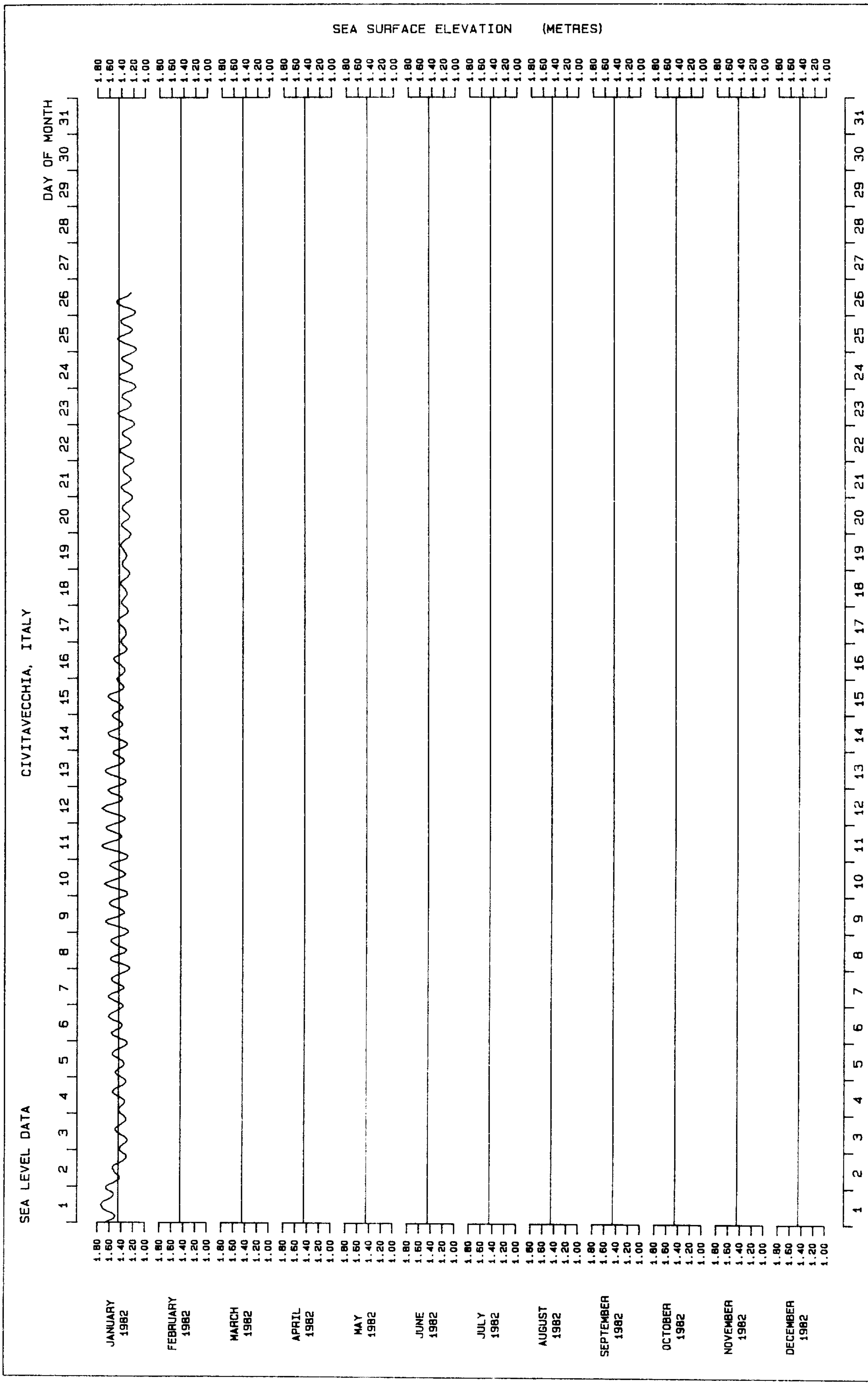

SEA LEVEL DATA
GENOVA, ITALY
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
2.40 2.20 2.00 1.80 1.60 1.40
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

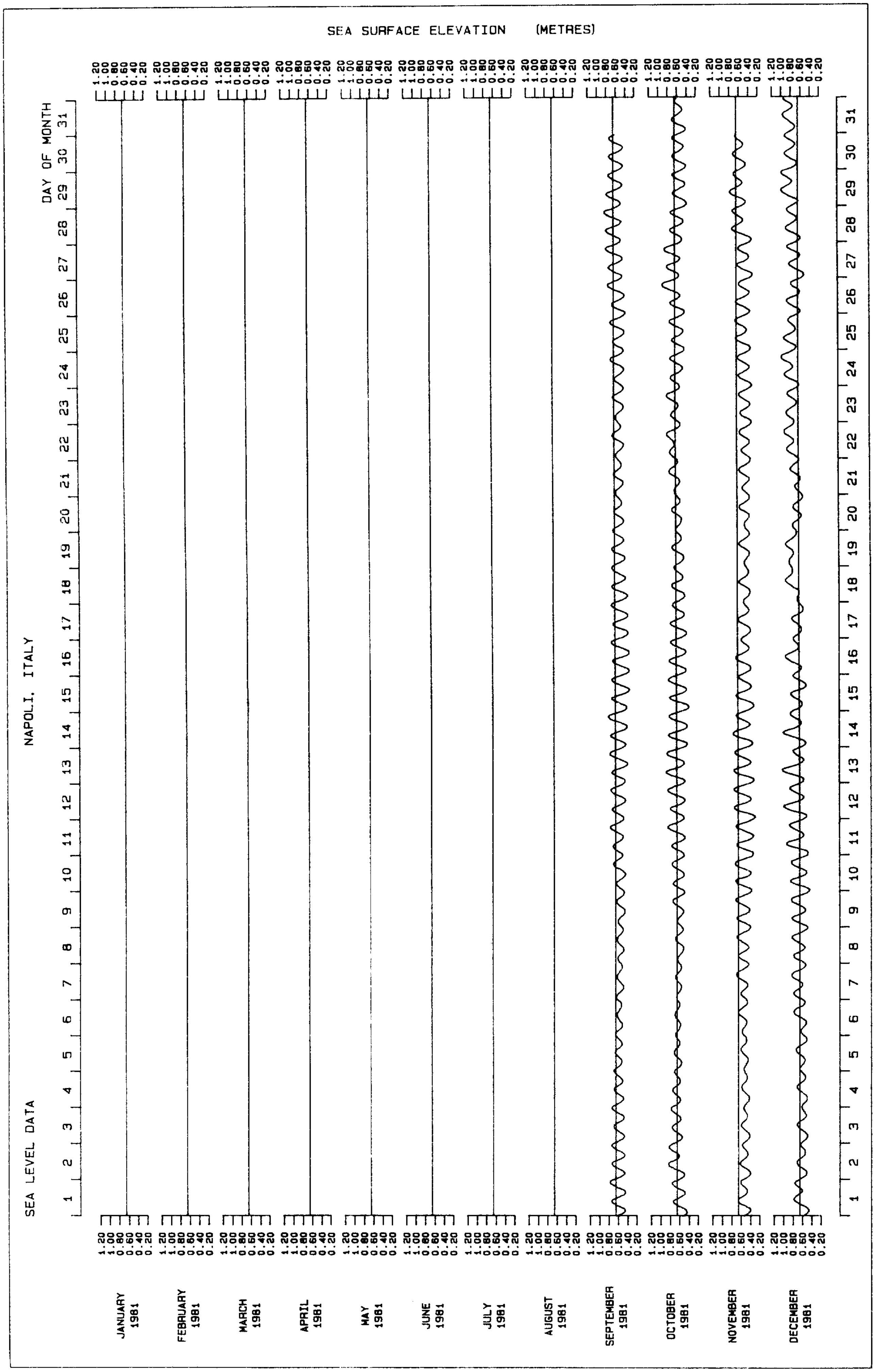

SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
LIVORNO, ITALY
DAY OF MONTH
1.80 1.60 1.40 1.20 1.00 0.80
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

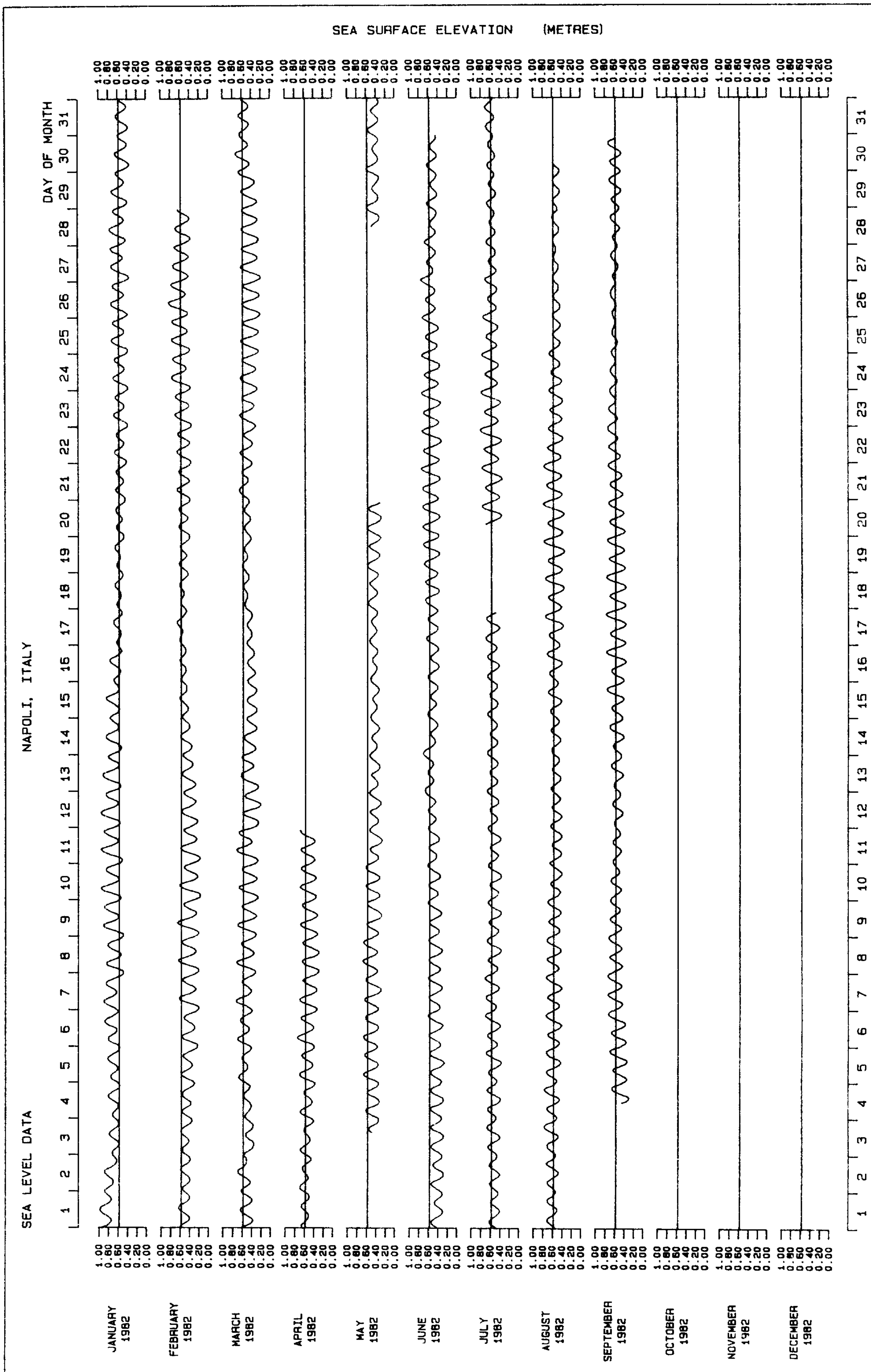


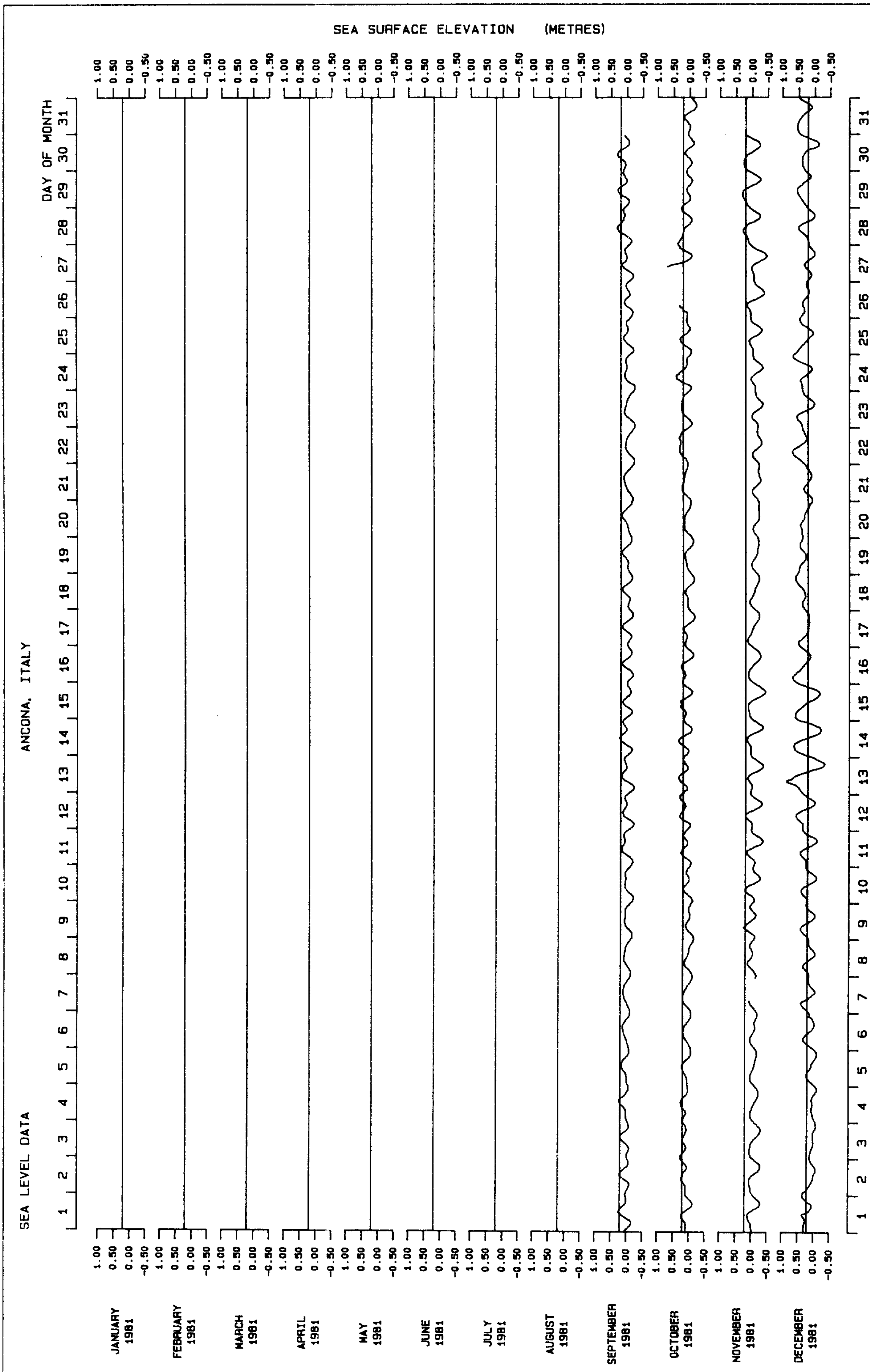
SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
LIVORNO, ITALY
DAY OF MONTH
1.60 1.40 1.20 1.00 0.80
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

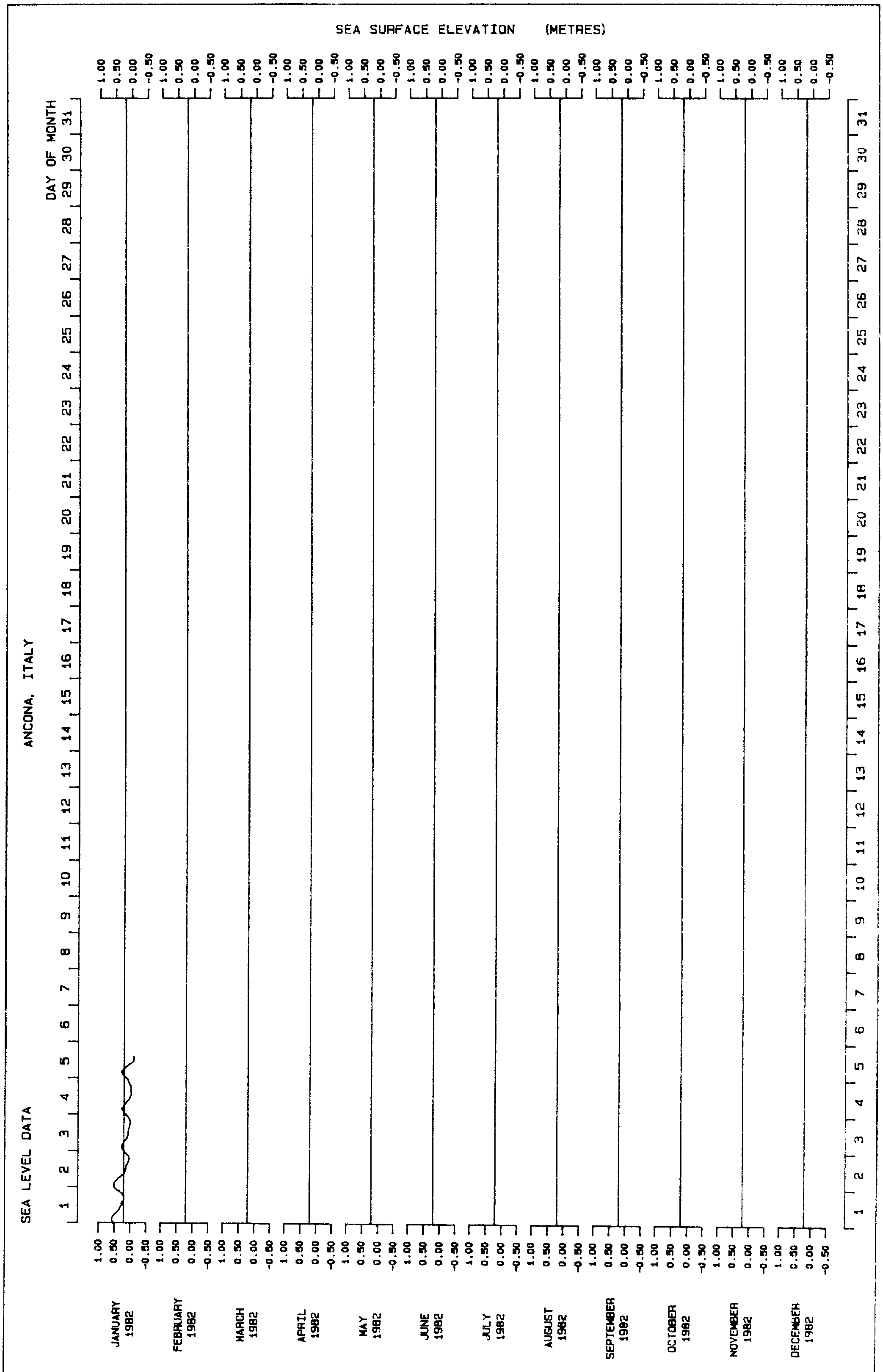

SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
CIVITAVECCHIA, ITALY
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
2.00 1.80 1.60 1.40 1.20 1.00
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981

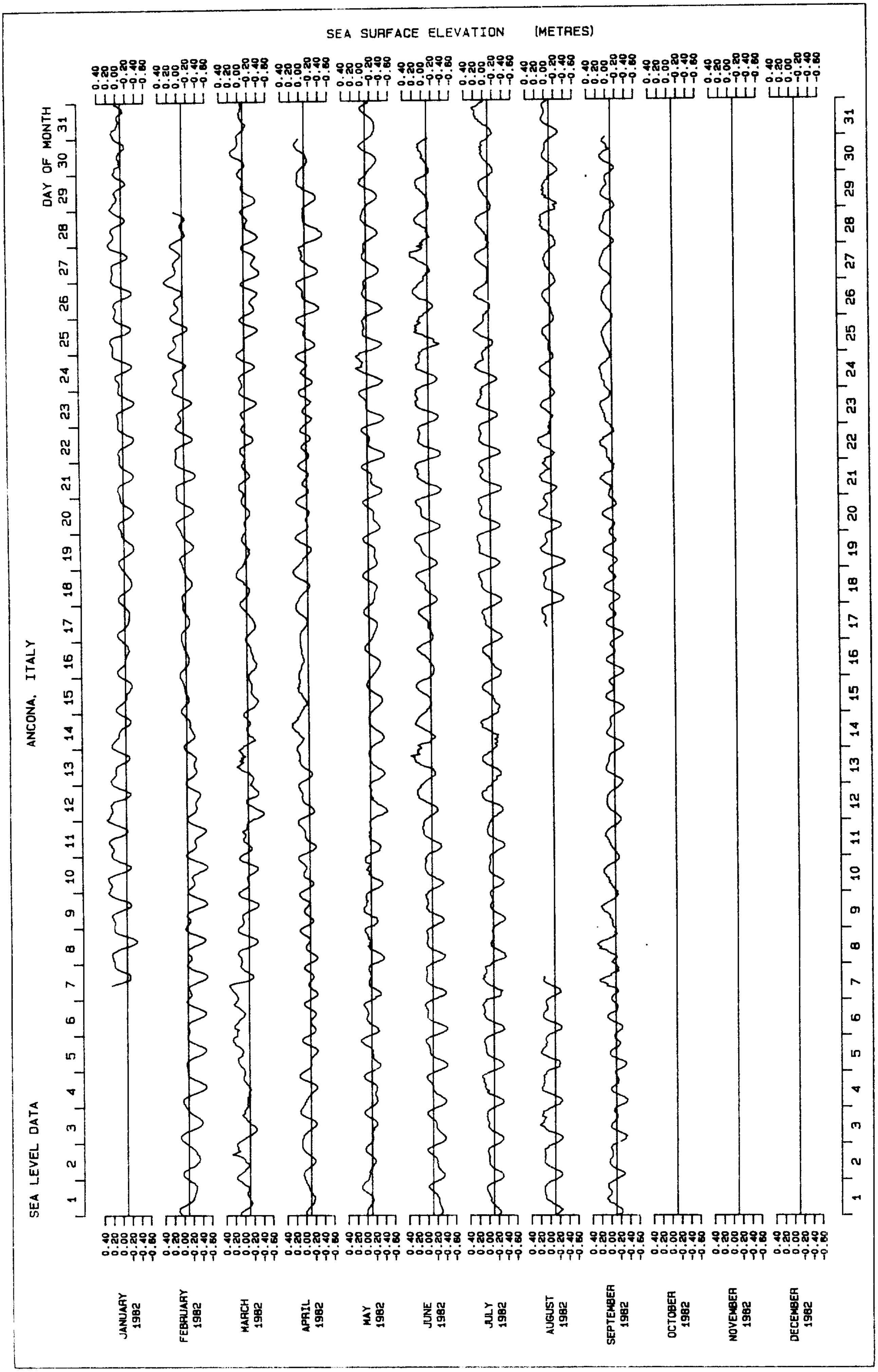

SEA LEVEL DATA
CIVITAVECCHIA, ITALY
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1.80 1.60 1.40 1.20 1.00
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
NAPOLI, ITALY
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1.20
1.00
0.80
0.60
0.40
0.20
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981


SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
NAPOLI, ITALY
DAY OF MONTH
1.00 0.80 0.60 0.40 0.20 0.00
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
ANCONA, ITALY
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1.00 0.50 0.00 -0.50
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981


SEA LEVEL DATA
ANCONA, ITALY
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1.00 0.50 0.00 -0.50
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
ANCONA, ITALY
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
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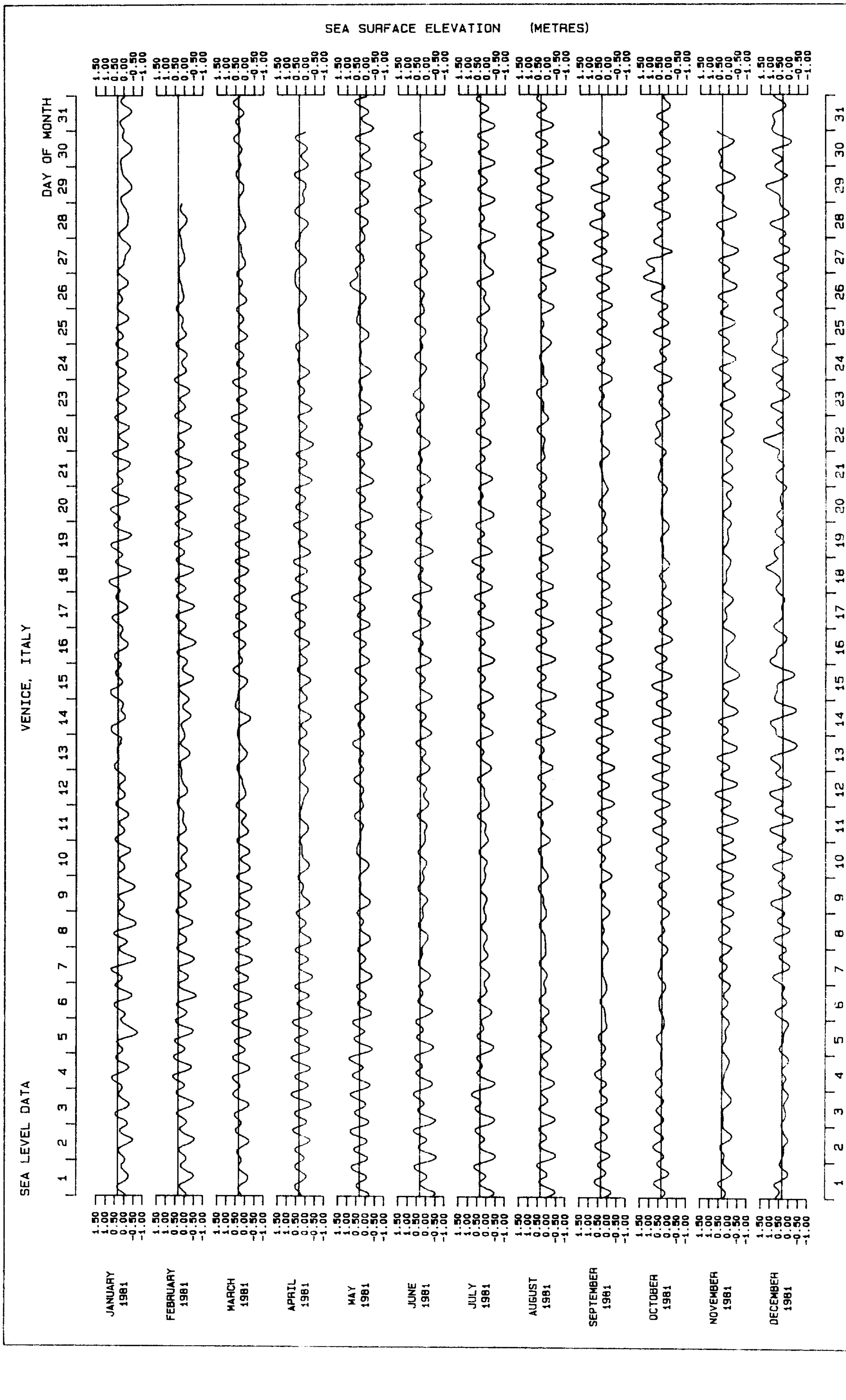
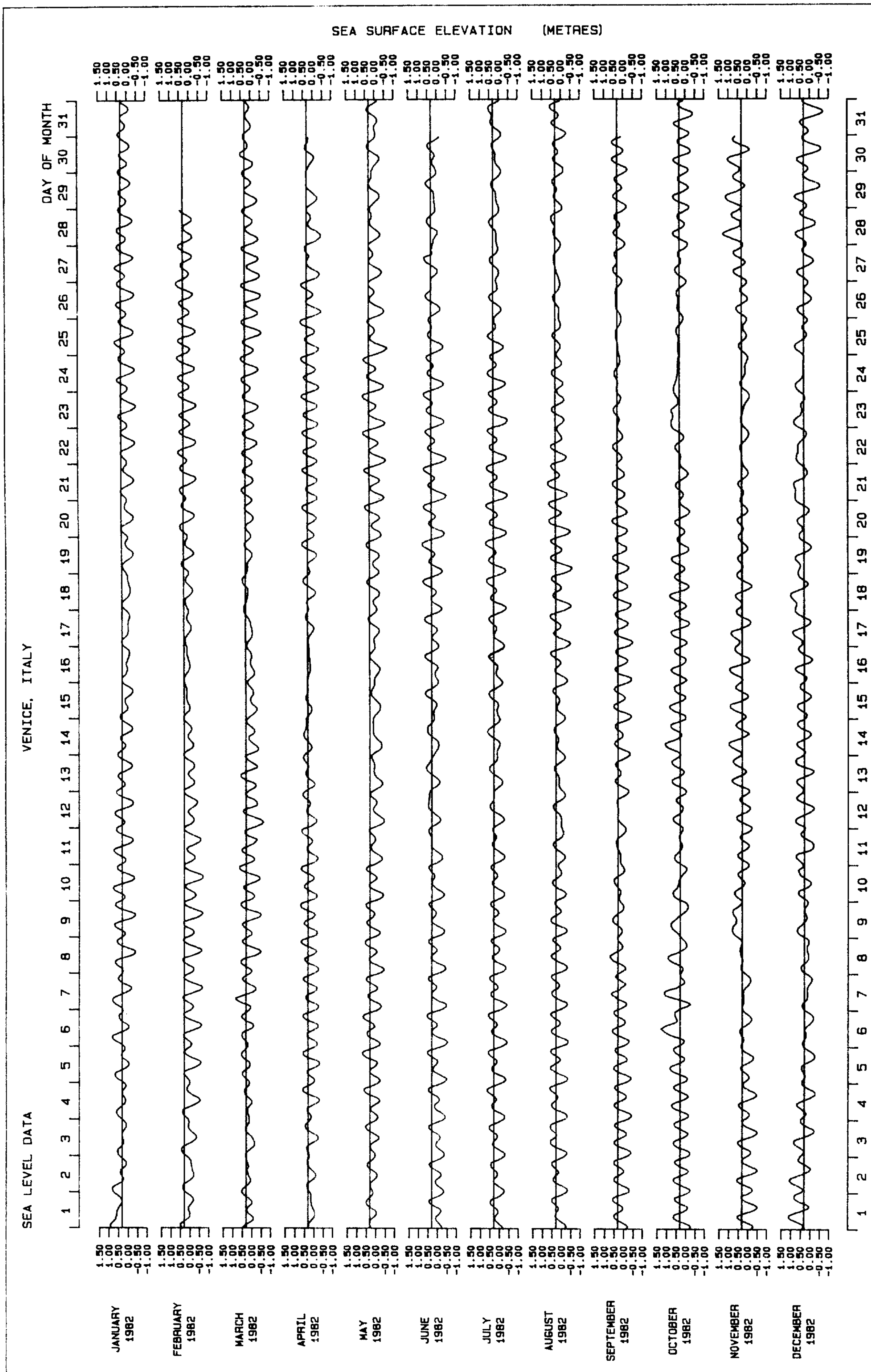
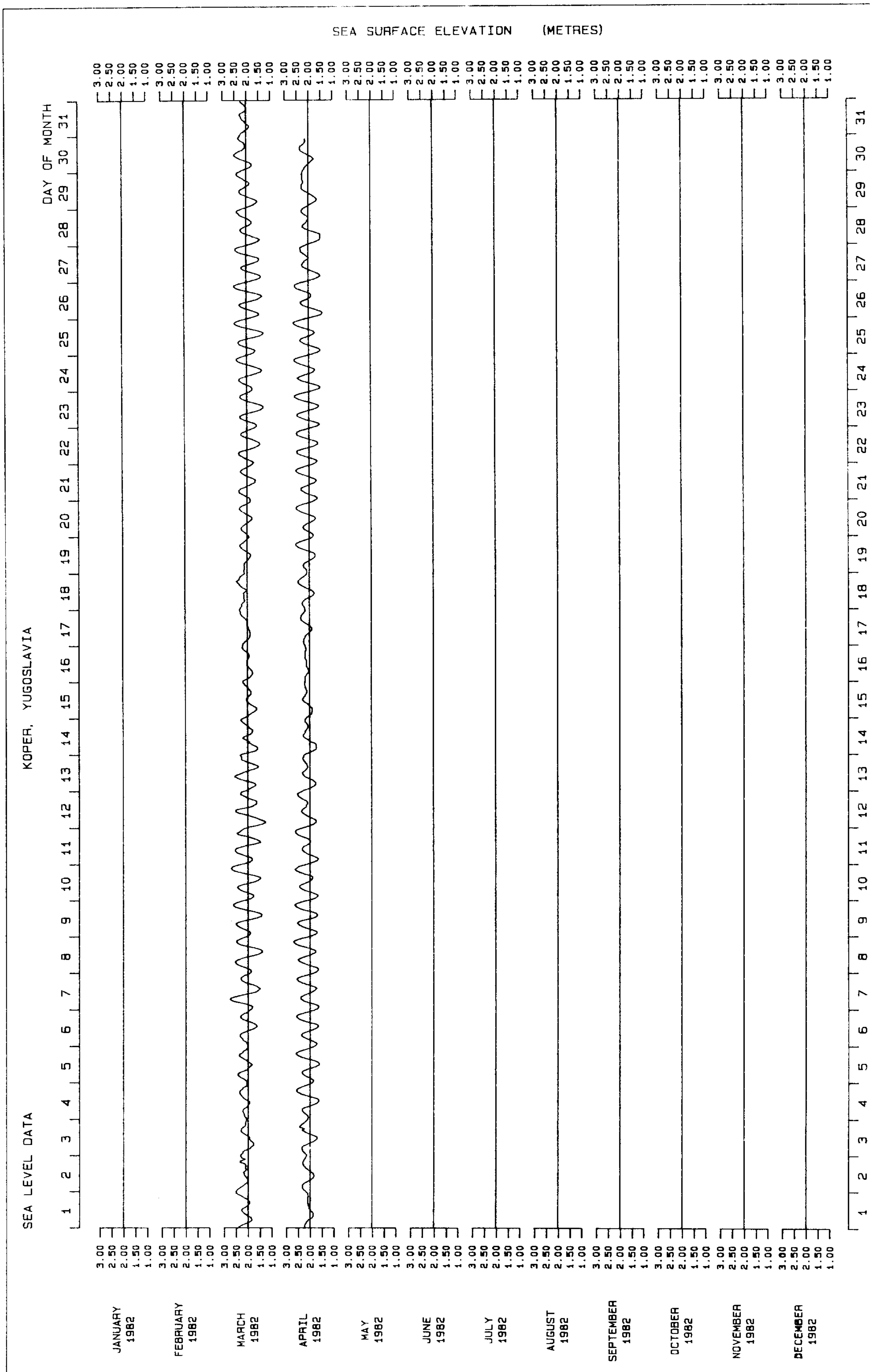
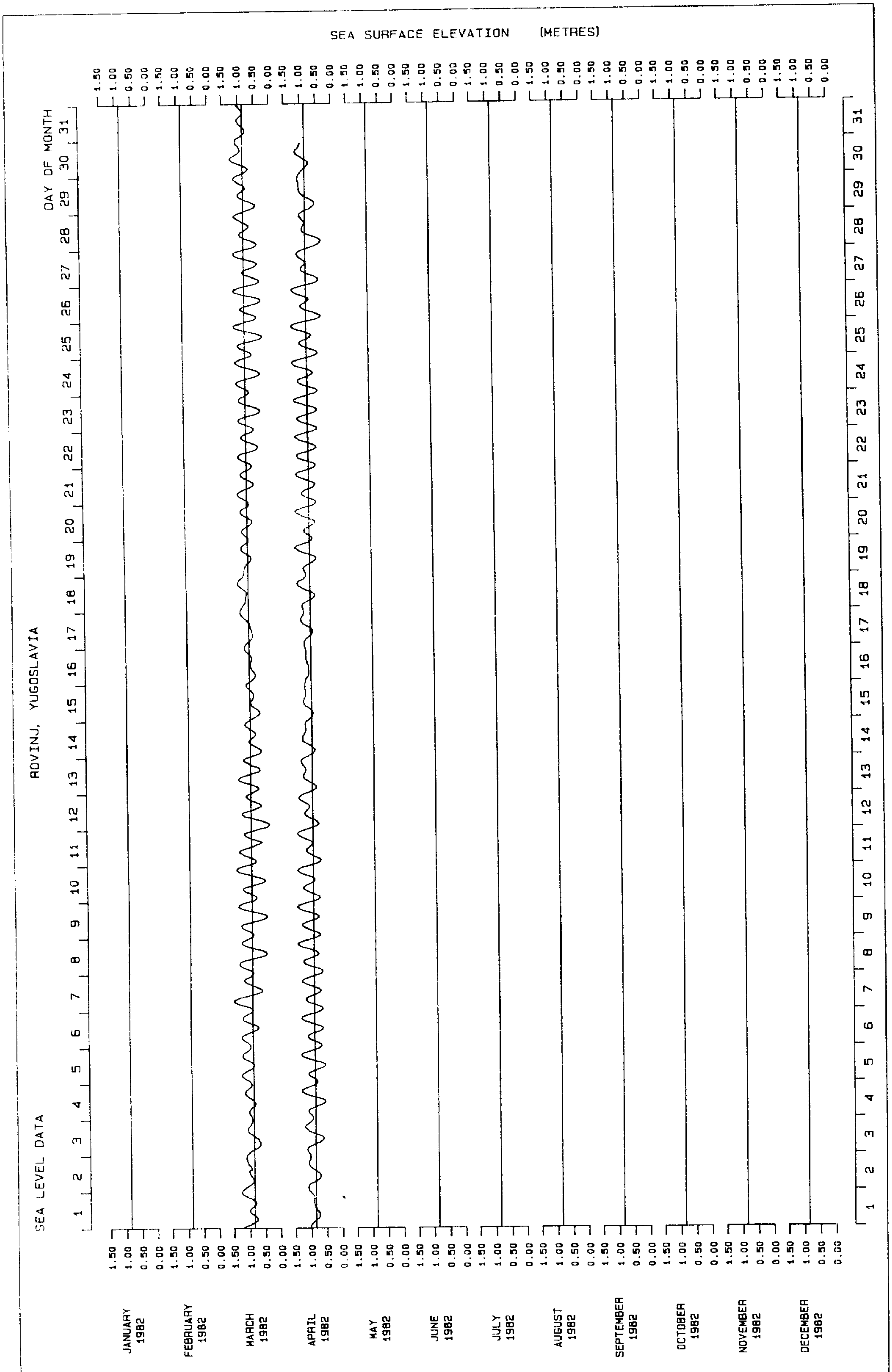
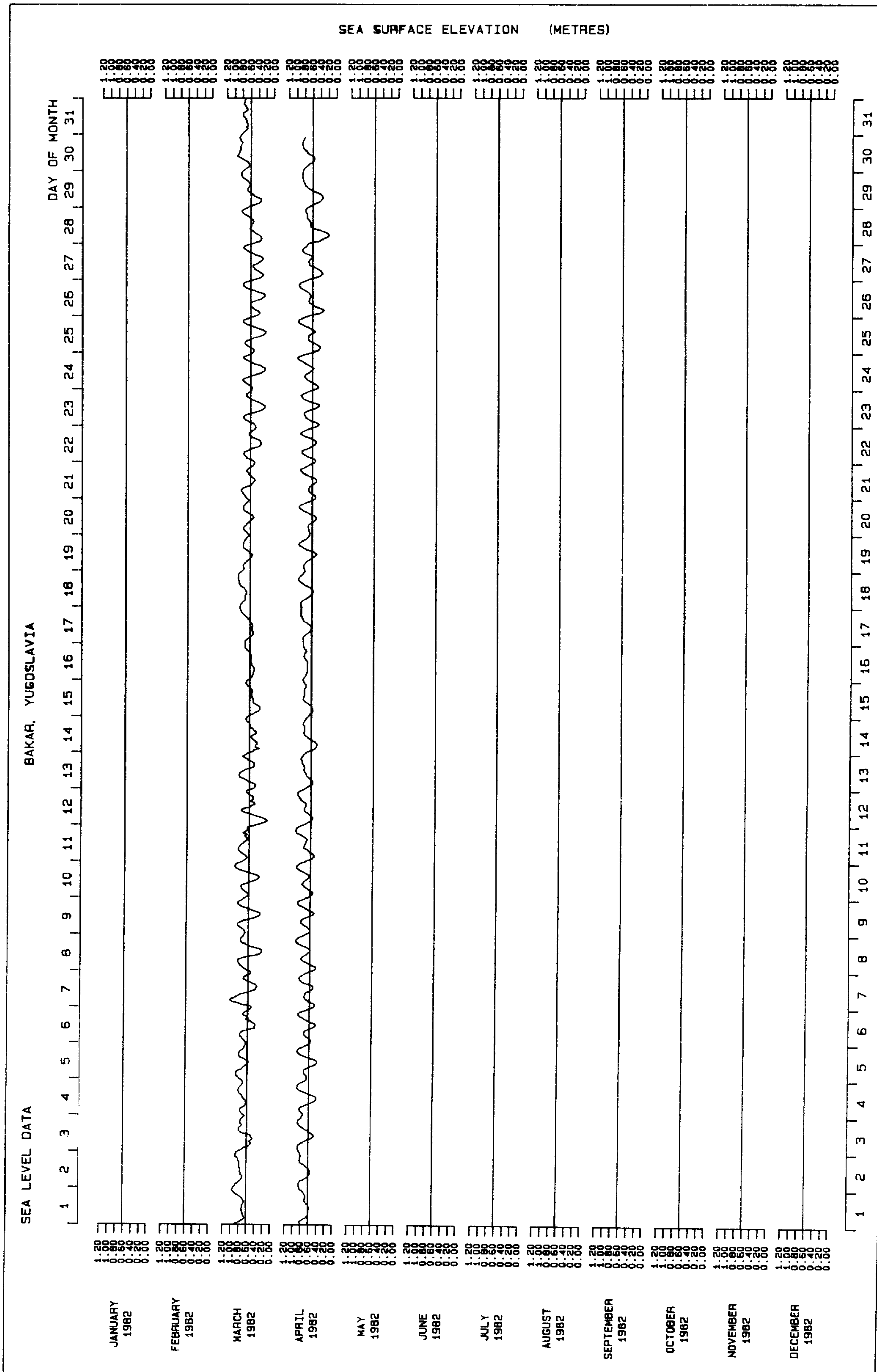
DECEMBER 1982

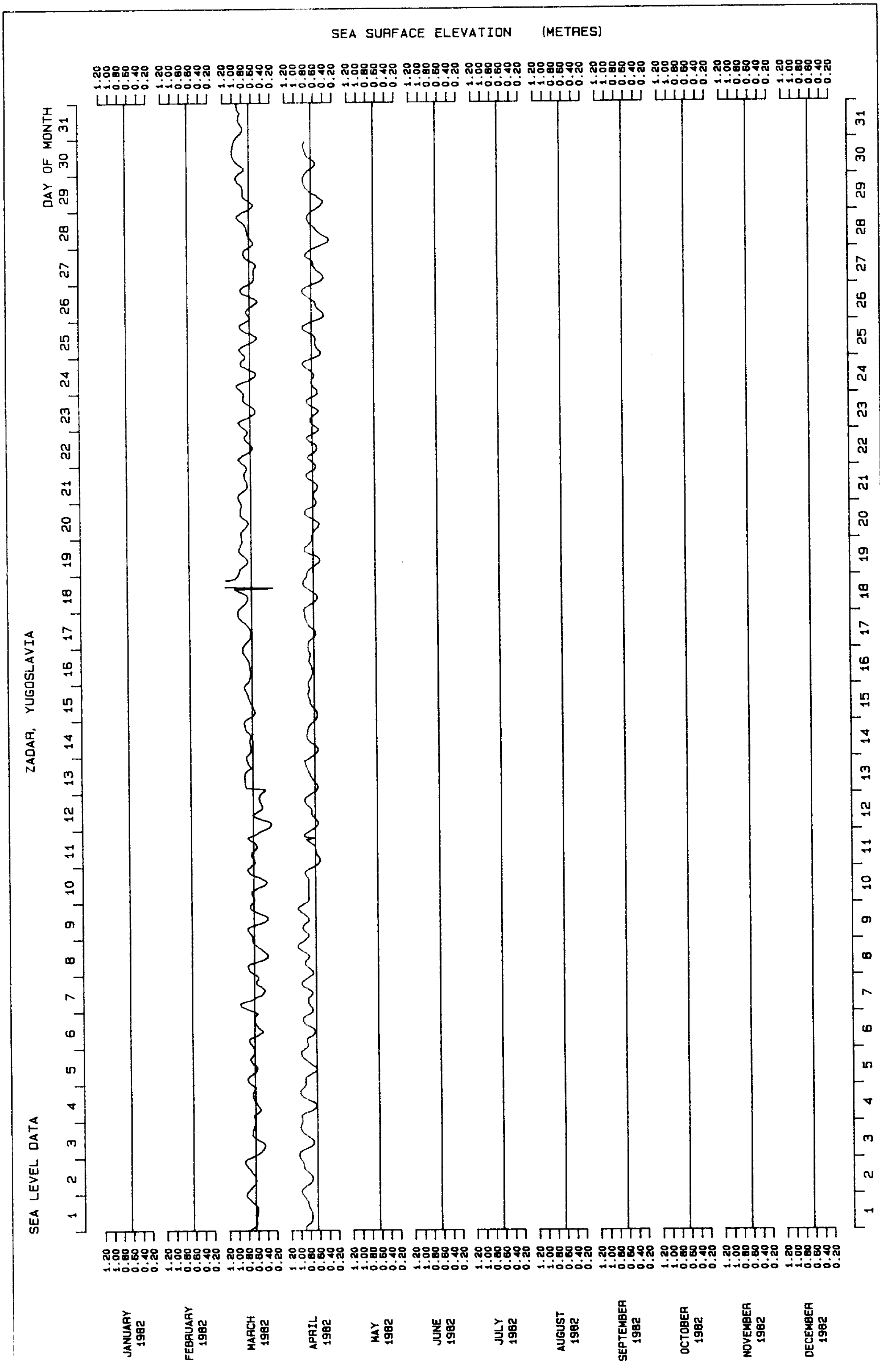

SEA LEVEL DATA
VENICE, ITALY
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
JANUARY 1981
FEBRUARY 1981
MARCH 1981
APRIL 1981
MAY 1981
JUNE 1981
JULY 1981
AUGUST 1981
SEPTEMBER 1981
OCTOBER 1981
NOVEMBER 1981
DECEMBER 1981


SEA LEVEL DATA
VENICE, ITALY
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
KOPER, YUGOSLAVIA
DAY OF MONTH
3.00 2.50 2.00 1.50 1.00
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
ROVINJ, YUGOSLAVIA
DAY OF MONTH
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
BAKAR, YUGOSLAVIA
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA SURFACE ELEVATION (METRES)
SEA LEVEL DATA
ZADAR, YUGOSLAVIA
DAY OF MONTH
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
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JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
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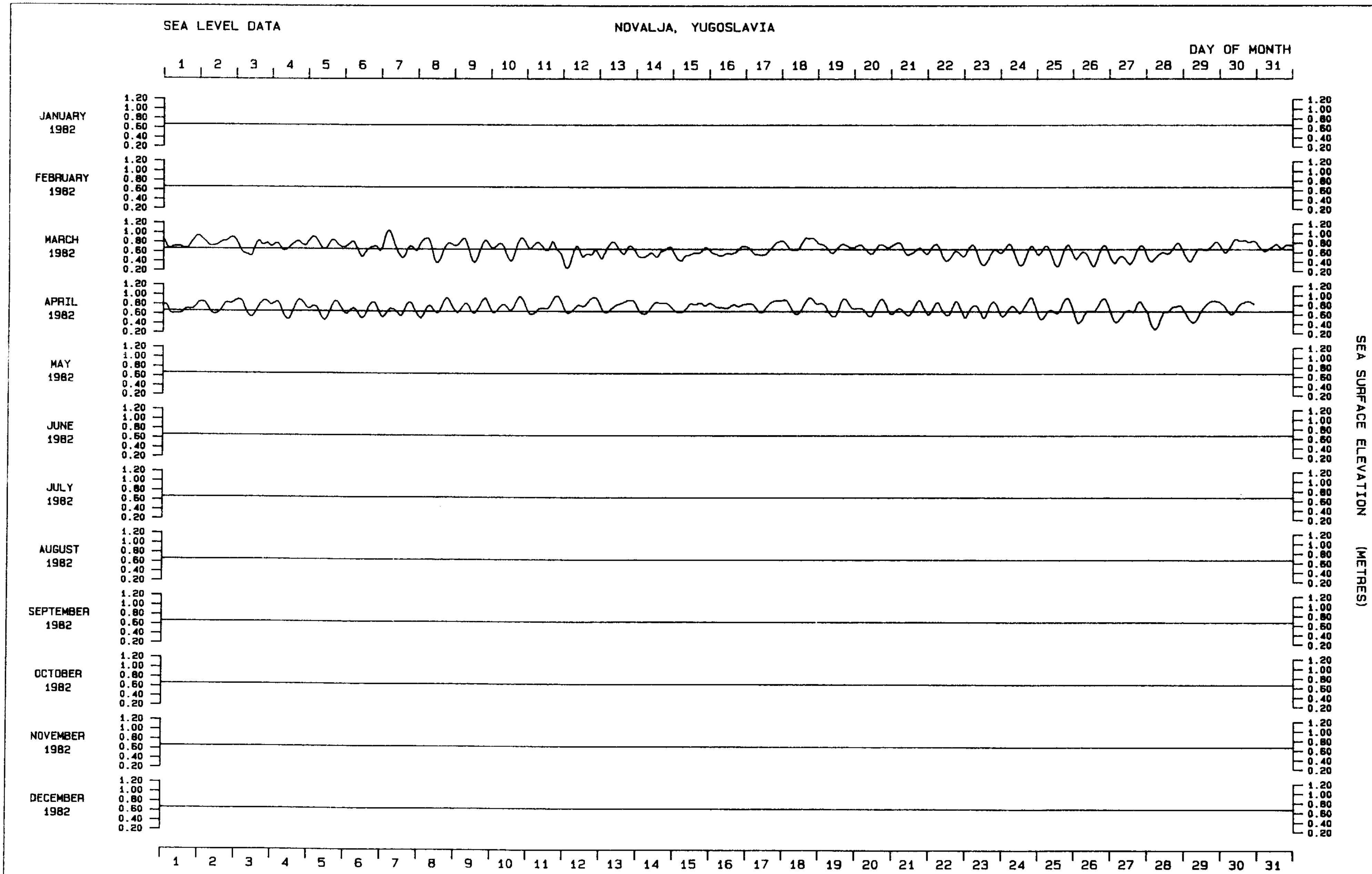
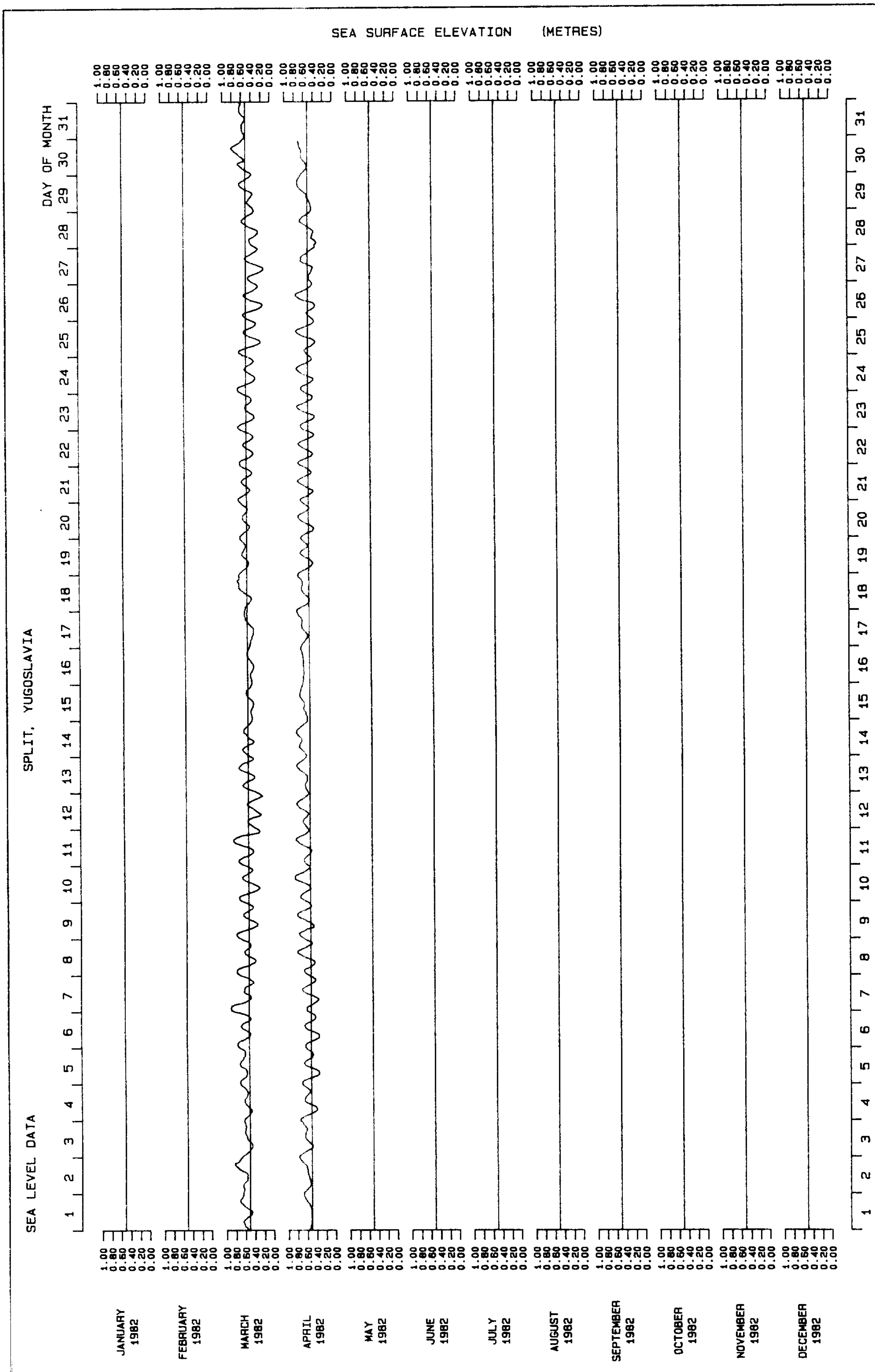
DECEMBER 1982


SEA LEVEL DATA
NOVALJA, YUGOSLAVIA
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982
1.20
1.00
0.80
0.60
0.40
0.20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SPLIT, YUGOSLAVIA
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
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JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982
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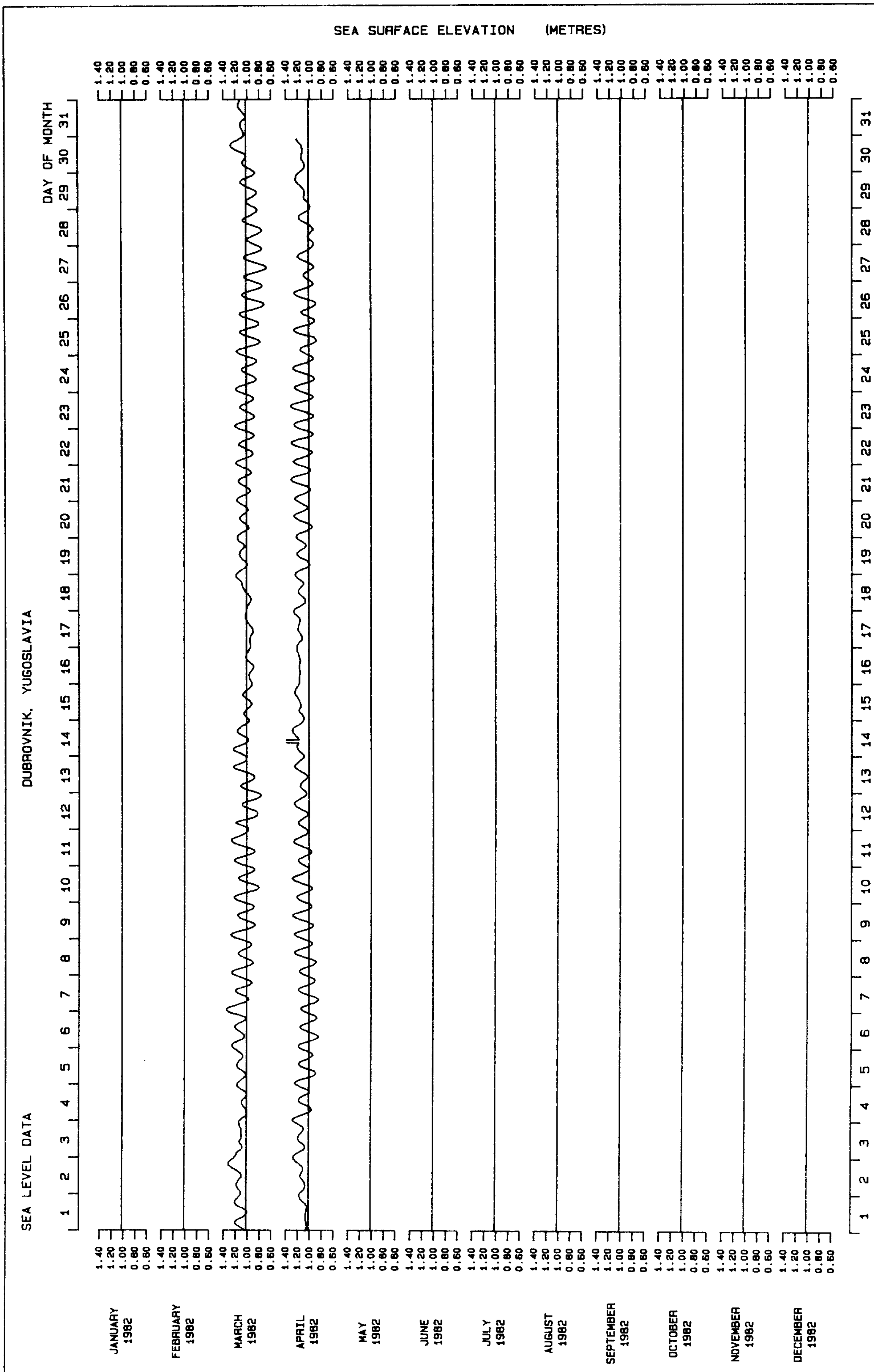
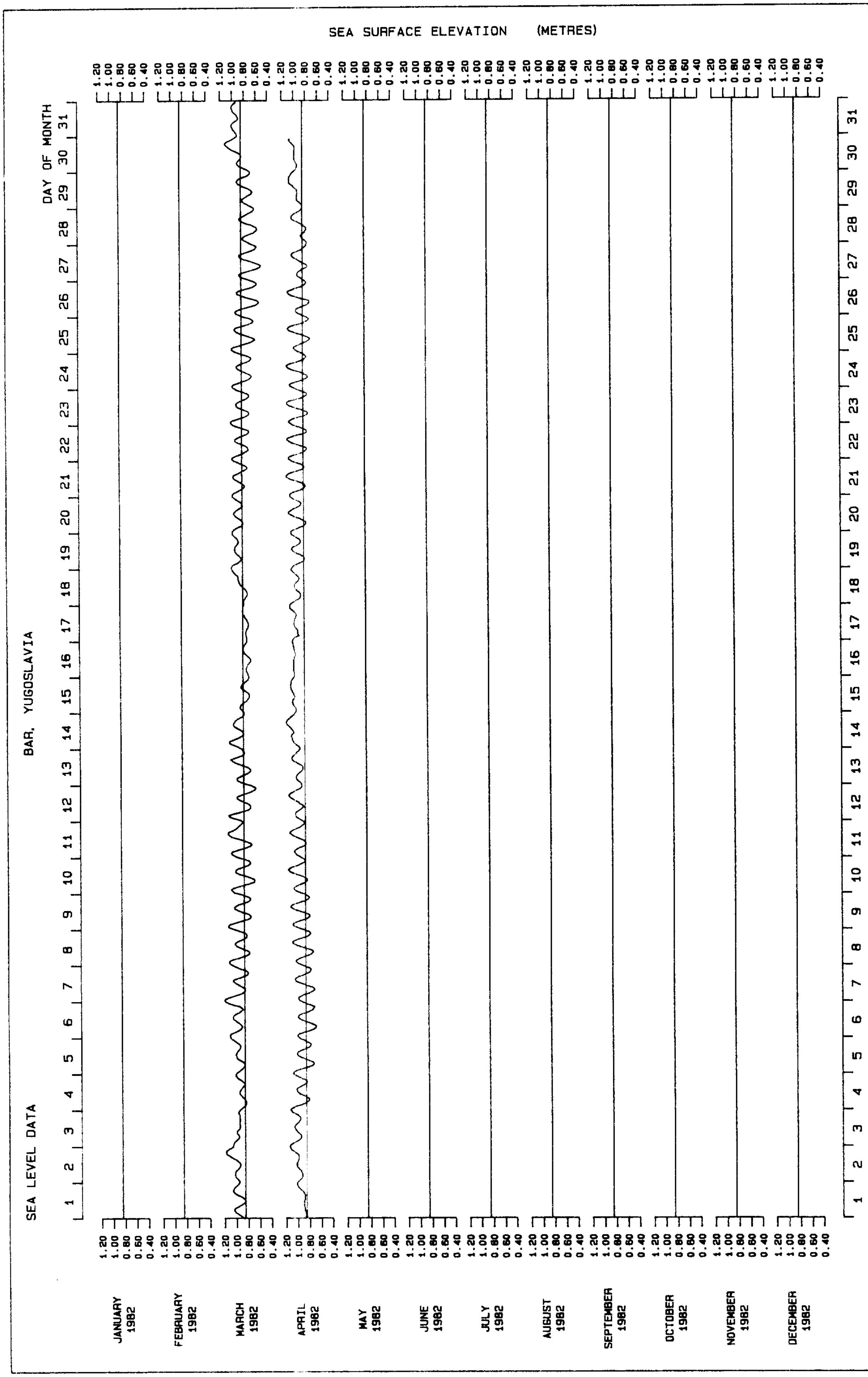

SEA LEVEL DATA
DUBROVNIK, YUGOSLAVIA
SEA SURFACE ELEVATION (METRES)
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1.40 1.20 1.00 0.80 0.60
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982


SEA LEVEL DATA
BAR, YUGOSLAVIA
DAY OF MONTH
SEA SURFACE ELEVATION (METRES)
1.20
1.00
0.80
0.60
0.40
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
JANUARY 1982
FEBRUARY 1982
MARCH 1982
APRIL 1982
MAY 1982
JUNE 1982
JULY 1982
AUGUST 1982
SEPTEMBER 1982
OCTOBER 1982
NOVEMBER 1982
DECEMBER 1982

	1981			1982									
	October	November	December	January	February	March	April	May	June	July	August	September	October
1	0.1009	0.0313	0.1559	0.4184	0.0417	0.0604	0.1045	0.0741	-0.0201	0.0250	0.1702	0.0839	0.1565
2	0.2490	0.0058	0.0656	0.2418	0.0603	0.0476	0.1153	0.1006	-0.0280	0.0378	0.1673	0.0731	0.1310
3	0.2334	0.0058	0.0784	0.1555	0.0868	-0.0593	0.0731	0.0731	-0.0142	0.0957	0.2006	0.0692	0.1349
4	0.3628	0.0215	0.0440	0.2026	0.0996	0.0231	0.0819	0.0760	0.0074	0.1231	0.1604	0.0878	0.1310
5	0.2245	0.0401	0.0941	0.1633	0.0378	0.1113	0.0888	0.1349	0.0093	0.1094	0.1408	0.1163	0.1702
6	0.2500	0.0646	0.0676	0.1614	-0.0289	0.0152	0.0996	0.0907	0.0172	0.1055	0.1094	0.1555	0.2350
7	0.2294	0.0607	0.1961	0.1918	-0.0544	0.0309	0.0544	0.0348	0.0270	0.1035	0.1064	0.1202	0.2506
8	0.1313	0.0705	0.1804	0.1192	-0.0436	0.0172	0.0270	0.0221	0.0427	0.0917	0.1064	0.0672	0.2016
9	0.1353	0.0636	0.1980	0.1653	-0.0446	-0.0172	0.0309	0.0515	0.0486	0.1192	0.0790	0.0849	0.1408
10	0.1725	0.1048	0.1794	0.2036	-0.0947	-0.0034	0.0250	0.0034	0.0682	0.1251	0.0741	0.07995	0.0957
11	0.1647	0.0803	0.1941	0.2546	-0.0682	0.0868	0.0338	-0.0005	0.1015	0.1212	0.0476	0.0643	0.0662
12	0.1274	0.0607	0.2598	0.2968	-0.0397	-0.0780	0.0564	-0.0378	0.1300	0.1359	0.0486	0.0525	0.0466
13	0.1470	0.0509	0.2490	0.2251	-0.0025	-0.0123	0.0947	-0.0711	0.0947	0.1378	0.0692	0.0456	0.0780
14	0.0764	0.0421	0.2284	0.1898	0.0358	-0.0711	0.1349	-0.0780	0.0692	0.1604	0.0986	0.0544	0.2448
15	0.0989	-0.0374	0.2373	0.2624	0.0486	-0.0799	0.1172	-0.0652	0.0378	0.1486	0.0976	0.0741	0.1996
16	0.1196	0.0509	0.2265	0.2418	0.1123	-0.0054	0.1290	-0.0358	0.0358	0.1251	0.1045	0.0800	0.0809
17	0.0872	0.0597	0.1931	0.1702	0.1898	0.0427	0.1025	-0.0015	0.0476	0.1143	0.0996	0.0780	0.1310
18	0.1039	0.0607	0.2618	0.1525	0.1310	0.0603	0.1192	0.0015	0.0947	0.1153	0.0466	0.0996	0.1771
19	0.1097	0.0627	0.3354	0.1212	0.0976	0.0319	0.1319	-0.0005	0.0849	0.1221	0.0525	0.1104	0.1957
20	0.1009	0.0430	0.1186	0.1015	0.0800	0.0123	0.1182	-0.0309	0.0800	0.1575	0.0898	0.1359	0.1447
21	0.1706	0.0313	0.1941	0.0711	0.0809	0.0191	0.0760	-0.0309	0.0682	0.1810	0.0790	0.1771	0.1781
22	0.1666	0.0195	0.2804	0.0898	0.0662	-0.0221	0.0760	-0.0407	0.0623	0.1731	0.0280	0.2036	0.3056
23	0.1313	0.0254	0.2392	0.0947	0.1319	-0.0652	0.0957	-0.0211	0.1064	0.1192	0.0034	0.1781	0.3537
24	0.0754	0.0499	0.2490	0.0672	0.1359	-0.0191	0.0986	0.0211	0.0996	0.0976	0.0280	0.1378	0.3125
25	0.0705	0.0352	0.3138	0.0417	0.1055	-0.0231	0.0692	-0.0378	0.1113	0.0682	0.0564	0.1810	0.1751
26	0.1657	-0.0374	0.1205	0.0799	0.1216	-0.0221	0.0603	-0.0358	0.1251	0.0270	0.0613	0.2497	0.1241
27	0.1902	0.0116	0.1784	0.1368	0.0486	0.0015	0.0515	-0.0201	0.0947	0.0486	0.1270	0.2016	0.1398
28	0.0872	0.0293	0.2961	0.1476	0.0476	0.0858	0.0564	-0.0181	0.0368	0.0917	0.1496	0.1437	0.1074
29	0.0352	0.0401	0.5100	0.0917		0.0191	0.0584	-0.0064	0.0211	0.1190	0.1045	0.1310	0.1113
30	0.0489	0.0470	0.5747	0.0456		0.0623	0.1006	-0.0181	0.0250	0.1957	0.0476	0.1996	0.1006
31	0.0607		0.6071	0.0358		0.1006		-0.0299		0.2389	0.0731		0.1025

Daily mean values of sea level (m) at Marseilles (supplied by CNRS, Paris, France)

APPENDIX 2

DATA DOCUMENTATION

Gibraltar, U.K.
The tide gauge, a conventional stilling well, is situated in Gibraltar harbour at the north end of the main wharf, close to the dockyard offices and the Tower (Grid ref. 8812 0133). The data were supplied by the Hydrographic Department, Ministry of Defence, Taunton. All times are GMT.

Ordnance benchmark 18 (Grid ref. TF8835 0123), on SW face of North Jumpers Bastion 3.7m E of projection of W face wall.
Height of benchmark 3.726m (Chart Datum)

Ordnance benchmark AP (Grid ref. TF8812 0132), on bolt on coping of wharf 19m W of west angle of tide gauge hut.
Height of benchmark 3.221m (Chart Datum)

Ordnance benchmark AO (Grid ref. TF8828 0136), flush bracket 10962 on NE angle of Naval Stores building SE side of road, close to the Tower.
Height of benchmark 3.810m (Chart Datum)

Ordnance benchmark NAPH108 (Grid ref. TF8886 0392), bolt on verandah of Customs House on border at Gibraltar end of neutral territory.
Height of benchmark 3.558m (Chart Datum)

Alicante Datum 0.248m (Chart Datum)

Spanish benchmark NP1 (Alicante) 3.658m (Chart Datum)

R EUN Datum (NAP Amsterdam) 0.331m (Chart Datum)

Chart datum refers to the lowest astronomical tide. Tide gauge zero is chart datum, and data are quoted relative to this. Data Originator comments: Check sheets which accompanied the data were generally unsatisfactory so it was not possible to check a report by a naval ship that tide gauge zero was 0.03m below Chart Datum in 1981. However the mean of the values between September 1981 and September 1982 (inclusive) indicate that the gauge was correctly set.

The following gaps occur in the data:

0000h 04 Oct 1981 - 0600h 05 Oct 1981
1600h 26 Oct 1981 - 0600h 27 Oct 1981
1200h 19 Dec 1981 - 2100h 19 Dec 1981
0000h 07 Feb 1982 - 0200h 07 Feb 1982
1900h 07 Feb 1982 - 0600h 08 Feb 1982
0000h 29 Apr 1982 - 0600h 29 Apr 1982

Algeciras, Spain
Data were supplied by the Instituto Espanol de Oceanografia, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to tide gauge benchmark -3.34m

Tarifa, Spain
Data were supplied by the Instituto Espanol de Oceanografia, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to tide gauge benchmark -3.40m

Cadiz, Spain
Data were supplied by the Instituto Espanol de Oceanografia, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to tide gauge benchmark -5.35m

The following gap occurs in the data:
0000h 01 Mar 1982 - 2300h 31 Mar 1982

Ceuta, Spain
Data were supplied by the Instituto Espanol de Oceanografia, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to tide gauge benchmark -3.29m

Malaga, Spain
Data were supplied by the Instituto Espanol de Oceanografia, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to tide gauge benchmark -2.00m

Palma de Mallorca, Spain
Data were supplied by the Instituto Espanol de Oceanografia, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to tide gauge benchmark -0.95m

The following gaps occur in the data:

1000h 20 Nov 1981 - 0900h 05 Jan 1982
1900h Oe Feb 1982 - 0900h 12 Feb 1982
1100h 13 Apr 1982 - 0900h 09 May 1982
1100h 08 Jun 1982 - 0800h 14 Jun 1982

Almeria, Spain
Data supplied by the Instituto Geografico Nacional, Madrid, Spain as part of the Mediterranean Slpine Experiment (MEDALPEX). All times are GMT. The tide gauge is situated at the southern end of the jetty at the east end of Almeria harbour. The tide gauge benchmark (TGBM) is situated in the tide gauge building and is 1.460m above the Spanish datum. Data are referred to tide gauge zero (TGZ).

The following table gives the mean monthly values of sea level relative to TGZ, and the height of the TGBM relative to mean monthly sea level:

Month	Mean Sea Level (m)	Height of TGBM above monthly mean sea level (m)
Sep	0.488	1.428
Oct	0.487	1.435
Nov	0.439	1.479
Dec	0.503	1.417
Jan	0.413	1.508
Feb	0.409	1.504
Mar	-	-
Apr	0.459	1.468
May	0.393	1.533
Jun	0.412	1.508
Jul	0.449	1.474
Aug	0.455	1.466
Sep	0.515	1.402

The following gaps occur in the data:

1000h 11 Oct 1981 - 1000h 18 Oct 1981
2300h 25 Oct 1981 - 1100h 29 Oct 1981
0100h 30 Oct 1981 - 0700h 30 Oct 1981
1400h 09 Dec 1981 - 1500h 09 Dec 1981
1400h 02 Jan 1982 - 1400h 08 Jan 1982
1300h 11 Jan 1982 - 1100h 14 Jan 1982
0100h 27 Feb 1982 - 1100h 28 Feb 1982
0100h 01 Mar 1982 - 1300h 02 Apr 1982
0100h 03 May 1982 - 1100h 03 May 1982
0900h 01 Aug 1982 - 0500h 02 Aug 1982
1700h 01 Sep 1982 - 0900h 08 Sep 1982

Alicante, Spain - Gauge I
Data supplied by the Instituto Geografico Nacional, Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT. The tide gauge is situated on the east limb of the inner harbour at the western end. It is known as Alicante I. The tide gauge benchmark (TGBM) is situated on the harbour wall by the tide gauge hut. It is 1.245m above the Spanish datum. Data are referred to tide gauge zero (TGZ).

The following table gives the mean monthly values of sea level relative to TGZ, and the height of the TGBM relative to mean monthly sea level:

Month	Mean Sea Level (m)	Height of TGBM above monthly mean sea level (m)
Sep	0.504	1.216
Oct	0.521	1.199
Nov	0.459	1.263
Dec	0.551	1.213
Jan	0.524	1.236
Feb	0.456	1.303
Mar	0.395	1.366
Apr	0.509	1.251
May	0.432	1.325
Jun	0.493	1.264
Jul	0.568	1.190
Aug	0.559	1.199
Sep	0.589	1.170

The following gaps occur in the data:

0800h 23 Sep 1981 - 1000h 23 Sep 1981
0000h 24 Sep 1981 - 1000h 24 Sep 1981
1000h 22 Oct 1981 - 0900h 23 Oct 1981
1600h 18 Nov 1981 - 1100h 19 Nov 1981
0600h 23 Nov 1981 - 1100h 23 Nov 1981
1700h 26 Nov 1981 - 0800h 27 Nov 1981
1100h 27 Nov 1981 - 1100h 28 Nov 1981
1300h 28 Nov 1981 - 1100h 30 Nov 1981
2100h 30 Nov 1981 - 1200h 01 Dec 1981
1200h 02 Dec 1981 - 1100h 04 Dec 1981
0800h 17 Jan 1982 - 1000h 19 Jan 1982
1800h 19 Jan 1982 - 1000h 20 Jan 1982
0600h 25 Jan 1982 - 1200h 25 Jan 1982
2000h 25 Jan 1982 - 1600h 27 Jan 1982
1500h 08 Feb 1982
1000h 14 Feb 1982 - 1000h 16 Feb 1982
1200h 26 Mar 1982 - 1100h 27 Mar 1982
1300h 27 Mar 1982 - 1000h 29 Mar 1982
2300h 30 Jun 1982 - 0800h 01 Jul 1982
0100h 09 Jul 1982 - 0900h 09 Jul 1982
0300h 02 Sep 1982 - 1000h 02 Sep 1982
1000h 07 Sep 1982
0200h 08 Sep 1982 - 1000h 08 Sep 1982
0400h 12 Sep 1982 - 0500h 12 Sep 1982
0200h 13 Sep 1982 - 0900h 13 Sep 1982
1200h 23 Sep 1982 - 1600h 23 Sep 1982
1100h 01 Oct 1982

Alicante, Spain - Gauge III

Data supplied by the Instituto Geografico Nacional Madrid, Spain as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT. The tide gauge is situated on the east side of the east limb of Alicante harbour wall. It is known as Alicante III. The tide gauge benchmark (TGBM) is situated in the tide gauge hut. It is 2.134m above the Spanish datum. Data are referred to tide gauge zero (TGZ).

The following table gives the mean monthly values of sea level relative to TGZ, and the height of the TGBM relative to mean monthly sea level:

Month	Mean Sea Level (m)	Height of TGBM above monthly mean sea level (m)
Sep	0.513	2.038
Oct	0.530	2.021
Nov	0.459	2.090
Dec	0.516	2.037
Jan	0.490	2.060
Feb	0.427	2.121
Mar	0.372	2.178
Apr	0.472	2.080
May	0.395	2.154
Jun	0.451	2.102
Jul	0.522	2.031
Aug	0.515	2.040
Sep	0.550	2.004

The following gaps occur in the data:

1200h 02 Jan 1982
0900h 01 Jul 1982 - 2300h 01 Jul 1982
2300h 03 Jul 1982 - 1100h 05 Jul 1982
2300h 05 Jul 1982 - 0900h 06 Jul 1982
1100h 07 Jul 1982 - 1000h 08 Jul 1982
2200h 10 Jul 1982 - 0600h 12 Jul 1982
2100h 13 Jul 1982 - 0600h 14 Jul 1982
0300h 27 Jul 1982 - 0600h 27 Jul 1982
0900h 09 Aug 1982 - 1600h 09 Aug 1982

Monaco

Data were supplied by the Service Hydrographique et Oceanographique de la Marine, Brest, France as part of the Mediterranean Alpine Experiment (MEDALPEX). All times have been converted from UT + 1 to GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to zero hydrographique -0.097m
(Zero hydrographique is equivalent to chart datum)

The following gaps occur in the data:

1700h 18 Dec 1981 - 2200h 14 Feb 1982
2300h 22 Mar 1982 - 2200h 26 Mar 1982
2300h 30 Jun 1982 - 2200h 05 Jul 1982

Nice, France
Data were supplied by the Service Hydrographique et Oceanographique de la Marine, Brest, France as part of the Mediterranean Alpine Experiment (MEDALPEX). All times have been converted from UT + 1 to GMT.

Data are quoted relative to tide gauge zero.

Height of tide gauge zero relative to zero hydrographique +0.014m
(Zero hydrographique is equivalent to chart datum)

The following gaps occur in the data:
2300h 02 Aug 1981 - 2200h 07 Aug 1981
2300h 26 Oct 1981 - 2200h 30 Oct 1981
2300h 10 Dec 1981 - 2200h 14 Dec 1981

Port Vendres, France
Data were supplied by the Service Hydrographique et Oceanographique de la Marine, Brest, France as part of the Mediterranean Alpine Experiment (MEDALPEX). All times have been converted from UT + 1 to GMT.

Data are quoted relative to zero hydrographique. (Zero hydrographique is equivalent to chart datum)

Toulon, France
Data were supplied by the Service Hydrographique et Oceanographique de la Marine, Brest, France as part of the Mediterranean Alpine Experiment (MEDALPEX). All times have been converted from UT + 1 to GMT.

Data are quoted relative to zero hydrographique. (Zero hydrographique is equivalent to chart datum)

Ajaccio, Corsica
Data were supplied by the Service Hydrographique et Oceanographique de la Marine, Brest, France as part of the Mediterranean Alpine Experiment (MEDALPEX). All times have been converted from UT + 1 to GMT.

Data are quoted relative to zero hydrographique. (Zero hydrographique is equivalent to chart datum)

The following gap occurs in the data:
1100h 25 Sep 1981 - 1200h 29 Sep 1981

Genova, Italy

The tide gauge is situated on the Ponte Morosini, near to the Strada Sopraelevata. The tide gauge is a conventional stilling well and chart recorder. Approximately ten well soundings are made every month to calculate the tide gauge constant. These data were supplied by the Istituto Idrografica della Marina, Genova, Italy, as part of the Mediterranean Alpine Experiment (MEDALPEX). All times have been converted to GMT.

Data are referred to an arbitrary zero 5.0m below the tide gauge plaque. The tide gauge plaque is 3.249m above mean sea level as of 1 Jan 1942.

The following gaps occur in the data:

1000h 28 Sep 1981 - 1000h 16 Oct 1981
2200h 31 Oct 1981 - 0700h 06 Nov 1981
2100h 02 Aug 1982 - 0700 05 Aug 1982

Note:
1. These data have been processed by MIAS from irregularly sampled data to hourly values.
2. Usually 10 or 11 well soundings are carried out each month to determine the tide gauge constant, but only 5 were carried out during October 1981, some of which appear to be anomalous.

Livorno, Italy

The tide gauge is situated in the south west corner of the maritime dockyard on the Calata Lucca. The instrument is a model 450 stilling well which began operating on 4 Feb 1950. No modifications have been made to the instrument. Maintenance is carried out at irregular intervals. The chart is changed weekly and the timing checked. The organisation responsible for operating the tide gauge is the Sezione del Genio Civile OO MM di Livorno. These data were supplied by the Istituto per lo Studio della Dinamica della Grande Masse as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Tide Gauge Benchmark (TGBM) (above Italian Datum)	2.743m
Data are relative to an arbitrary zero 4.01m below the TGBM	

Auxilliary benchmarks (heights given are relative to Italian datum)	
CO, at the base of the wall of the canteen	1.534m
	1.779m
CV, on the wall of the Genio Civile offices, facing the canal	4.365m
CO1, to the right of the door of the embarkation offices	1.572m
	1.815m
CV1, on the wall above CO1	4.323m

The last precision levelling was carried out on 31 Mar 1953 by the Istituto Geografico Militare di Firenzo.

The following gaps occur in the data:

0300h 09 Oct 1981 - 1400h 15 Oct 1981
0100h 13 Nov 1981 - 1200h 19 Nov 1981
0200h 31 Dec 1981 - 1200h 12 Jan 1982
0400h 23 Mar 1982 - 1500h 23 Mar 1982
1200h 29 Mar 1982 - 1300h 30 Mar 1982

0500h 08 Apr 1982 - 0900h 10 Apr 1982
0500h 17 May 1982 - 1100h 21 May 1982
1500h 04 Jun 1982 - 1400h 11 Jun 1982

Civitavecchia, Italy

The tide gauge is situated at the northern end of the Darsena Romana. The instrument is a model 450 stilling well which began operating in 1950. No modifications have been made to the instrument. Maintenance is carried out at irregular intervals. The chart is changed weekly and the timing checked. The organisation responsible for operating the tide gauge is the Servizio Tecnico Centrale del Ministero LL PP Roma. These data were supplied by the Istituto per lo Studio della Dinamica della Grande Masse as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Tide Gauge Benchmark (TGBM) (above Italian Datum) 3.793m
Data are relative to an arbitrary zero 5.17m below the TGBM

Auxilliary Benchmarks (heights are quoted relative to the Italian Datum)

CO1, at the base of the wall, on the right of the door of the tide gauge hut	2.531m
CO2, at the base of the second spur, to the left of the exit of the Bastione del San Gallio	2.929m
CO3, at the base of the rampart of Sta Barbara	2.789m
CV3, installed over CO3	4.876m
CV1, on the wall above CO1	4.767m
CV2, on an internal wall of the tide gauge hut, near the door	4.756m

Naples, Italy

The tide gauge is situated on the south east corner of the Bacino Pisacane, between the two arms of the jetty, Molo Martello and Molo del Carmine. The instrument is a model 450 stilling well which began operating on 15 Oct 1949. No modifications have been made to the instrument. Maintenance is carried out at irregular intervals. The chart is changed weekly and the timing checked. The organisation responsible for operating the tide gauge is the Ufficio del Genio Civile OO MM of Naples. These data were supplied by the Istituto per lo Studio della Dinamica della Grande Masse as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Tide Gauge Benchmark (TGBM) (above Italian Datum) 2.494m
(above mean sea level) 2.737m
Data are relative to an arbitrary zero 3.16m below the TGBM

Auxilliary Benchmarks

CO1, an iron rivet on the quay, beside the tide gauge hut	1.494m
CO2, a cross shaped incision on the first step of the last flight of steps on the Molo Masaniello	1.632m
CV, on the right hand side high above the door of the tide gauge hut	3.149m

Date of last precision levelling:- 16 June 1959, carried out by the Istituto Geografico Militare di Firenze.

The following gaps occur in the data:
2300h 11 Apr 1982 - 1400h 03 May 1982
1100h 28 May 1982 - 2300h 20 Jun 1982
2200h 17 Jul 1982 - 0700h 20 Jul 1982
0600h 30 Aug 1982 - 1000h 04 Sep 1982

Venice, Italy
Data were supplied by the Istituto per lo studio della dinamica delle grande Masse, San Polo, Venice, Italy as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

The tide gauge is situated at the edge of the Venice lagoon. Tide gauge zero is the standard Venice reference, 0.23m below the Italian reference. Data are quoted relative to tide gauge zero.

Ancona, Italy - Gauge A
The tide gauge is situated on the quay on the northern side of the Mole Vanvitelliana. The instrument is a standard stilling well and chart recorder. The data were supplied by the Istituto di Ricerche sulla Pesca Marittima as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Tide Gauge Benchmark (TGBM) (metal disk near to tide gauge hut) (relative to Italian Datum) 1.719m
Zero idrometrico (i.e. chart datum) is 0.994m below the TGBM

Auxiliary benchmarks (heights are relative to the Italian Datum)
CO, 34.70m from the tide gauge hut 1.699m
CV, on the wall of the Mole Vanvitelliana 3.570m

The data are relative to the historical zero of Ancona

The following gaps occur in the data:
0900h 26 Oct 1981 - 0900h 27 Oct 1981
0900h 07 Nov 1981 - 2200h 07 Nov 1981

Ancona, Italy - Gauge B
The tide gauge is situated a short distance to the right of the Pontile Luigi Rizzo, at the northern end of the Darsena San Primiano. The instrument is a model 450 stilling well. No modifications have been made to the instrument. Maintenance is carried out at 6 monthly intervals. The chart is changed weekly and the timing checked. The organisation responsible for the operation of the tide gauge is the Ufficio Idrografico del Magistrato alle Acque di Venezia. These data were supplied by the Istituto di Ricerche sulla Pesca Marittima as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Tide Gauge Benchmark (TGBM) (above Italian Datum)	1.56m
Auxiliary benchmark, CO (above Italian Datum)	3.387m

Precision levelling was last carried out on 31 Jul 1954.

The data are relative to the historical zero of Ancona.

The following gap occurs in the data:
1600h 08 Aug 1982 - 0800h 17 Aug 1982

Koper, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 4.036m below benchmark BM R5486. The benchmark is located on the Hotel Triglav.

Rovinj, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 5.820m below the basic benchmark.

Bakar, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 3.373m below the benchmark on the Harbour Masters Office. The benchmark is 2.773m above the zero of the Yugoslavian precision levelling. The tide gauge is situated on Marjan point approximately 3km west of Split.

Novalja, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 3.163m below the basic benchmark.

Zadar, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 3.738m below the basic benchmark.

Split harbour, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 3.923m below benchmark BM 165.

Dubrovnik, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 5.333m below the basic benchmark.

Bar, Yugoslavia
Data were supplied by the Institute for Oceanography and Fisheries, Split, Yugoslavia as part of the Mediterranean Alpine Experiment (MEDALPEX). All times are GMT.

Data are quoted relative to tide gauge zero. Tide gauge zero is 4.277m below the basic benchmark.

APPENDIX 3

MAJOR CONSTITUENTS FROM TIDAL ANALYSIS

T I D A L   A N A L Y S I S   O F

C A D I Z

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	1.9125	0.
2	SA	0.04	0.0480	311.7
3	SSA	0.08	0.0708	27.0
4	MM	0.54	0.0113	239.3
5	MSF	1.02	0.0168	165.0
6	MF	1.10	0.0219	208.1
7	2QF	12.85	0.0013	128.8
8	SIG1	12.93	0.0014	253.9
9	Q1	13.40	0.0178	265.9
10	RO1	13.47	0.0039	260.5
11	O1	13.94	0.0742	303.4
12	MP1	14.03	0.0026	151.3
13	M1	14.49	0.0037	203.4
14	CHI1	14.57	0.0030	241.2
15	PI1	14.92	0.0046	28.7
16	P1	14.96	0.0199	41.8
17	S1	15.00	0.0048	85.3
18	K1	15.04	0.0649	42.9
19	PSI1	15.08	0.0022	68.7
20	PHI1	15.12	0.0050	50.2
21	TH1	15.51	0.0027	134.7
22	J1	15.59	0.0036	99.3
23	SO1	16.06	0.0027	186.2
24	OO1	16.14	0.0017	213.8
25	OQ2	27.34	0.0081	93.8
26	MNS2	27.42	0.0109	342.3
27	2N2	27.90	0.0365	61.2
28	MU2	27.97	0.0378	4.5
29	N2	28.44	0.2206	44.4
30	NU2	28.51	0.0473	27.0
31	OP2	28.90	0.0334	336.3
32	M2	28.98	1.0409	59.7
33	MKS2	29.07	0.0241	163.2
34	LAM2	29.46	0.0069	155.1
35	L2	29.53	0.0368	58.5
36	T2	29.96	0.0226	58.1
37	S2	30.00	0.3722	84.0
38	R2	30.04	0.0159	229.7
39	K2	30.08	0.1157	81.0
40	MSN2	30.54	0.0065	12.5
41	KJ2	30.63	0.0053	185.1
42	2SM2	31.02	0.0054	198.5
43	MO3	42.93	0.0022	194.9
44	M3	43.48	0.0009	186.1
45	SO3	43.94	0.0044	357.4
46	MK3	44.03	0.0043	348.8
47	SK3	45.04	0.0048	336.1
48	MN4	57.42	0.0117	128.4
49	M4	57.97	0.0259	159.0
50	SN4	58.44	0.0004	106.0
51	MS4	58.98	0.0094	240.4
52	MK4	59.07	0.0063	237.3
53	S4	60.00	0.0039	28.1
54	SK4	60.08	0.0024	51.2
55	2MN6	86.41	0.0017	342.8
56	M6	86.95	0.0025	59.3
57	MSN6	87.42	0.0013	27.7
58	2MS6	87.97	0.0013	83.5
59	2MK6	88.05	0.0005	235.4
60	2SM6	88.98	0.0027	4.6
61	MSK6	89.07	0.0011	316.6
62	MA2	28.94	0.0335	333.4
63	MB2	29.03	0.0144	161.9

T I D A L   A N A L Y S I S   O F

T A R I F A

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	1.0027	0.
2	SA	0.04	0.0770	252.0
3	SSA	0.08	0.0291	40.9
4	MM	0.54	0.0046	136.9
5	MSF	1.02	0.0158	134.4
6	MF	1.10	0.0073	356.5
7	2QF	12.85	0.0016	162.3
8	SIG1	12.93	0.0053	188.2
9	Q1	13.40	0.0032	190.8
10	RO1	13.47	0.0004	112.3
11	O1	13.94	0.0065	124.1
12	MP1	14.03	0.0027	269.5
13	M1	14.49	0.0033	209.0
14	CHI1	14.57	0.0013	324.5
15	PI1	14.92	0.0016	162.3
16	P1	14.96	0.0079	158.3
17	S1	15.00	0.0038	81.2
18	K1	15.04	0.0257	133.4
19	PSI1	15.08	0.0007	328.4
20	PHI1	15.12	0.0024	164.1
21	TH1	15.51	0.0013	273.3
22	J1	15.59	0.0002	279.8
23	SO1	16.06	0.0014	311.1
24	OO1	16.14	0.0012	317.5
25	OQ2	27.34	0.0007	104.4
26	MNS2	27.42	0.0038	12.6
27	2N2	27.90	0.0102	11.3
28	MU2	27.97	0.0178	12.3
29	N2	28.44	0.0891	27.7
30	NU2	28.51	0.0144	24.3
31	OP2	28.90	0.0033	323.0
32	M2	28.98	0.4142	41.5
33	MKS2	29.07	0.0077	39.0
34	LAM2	29.46	0.0014	284.7
35	L2	29.53	0.0088	29.2
36	T2	29.96	0.0098	56.5
37	S2	30.00	0.1580	67.7
38	R2	30.04	0.0025	79.6
39	K2	30.08	0.0479	68.3
40	MSN2	30.54	0.0035	144.7
41	KJ2	30.63	0.0029	245.8
42	2SM2	31.02	0.0023	148.8
43	MO3	42.93	0.0093	271.6
44	M3	43.48	0.0009	186.1
45	SO3	43.94	0.0044	357.4
46	MK3	44.03	0.0076	2.2
47	SK3	45.04	0.0026	26.9
48	MN4	57.42	0.0182	97.6
49	M4	57.97	0.0405	124.7
50	SN4	58.44	0.0031	125.0
51	MS4	58.98	0.0188	171.3
52	MK4	59.07	0.0086	158.8
53	S4	60.00	0.0006	162.9
54	SK4	60.08	0.0016	157.0
55	2MN6	86.41	0.0046	341.4
56	M6	86.95	0.0079	11.5
57	MSN6	87.42	0.0033	20.1
58	2MS6	87.97	0.0073	41.0
59	2MK6	88.05	0.0038	31.5
60	2SM6	88.98	0.0015	80.9
61	MSK6	89.07	0.0020	82.4
62	MA2	28.94	0.0041	62.0
63	MB2	29.03	0.0053	106.0

T I D A L   A N A L Y S I S   O F

G I B R A L T A R

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.4873	0.
2	SA	0.04	0.0242	205.6
3	SSA	0.08	0.0282	64.1
4	MM	0.54	0.0032	114.8
5	MSF	1.02	0.0142	153.2
6	MF	1.10	0.0047	314.0
7	2QF	12.85	0.0003	312.4
8	SIG1	12.93	0.0010	156.1
9	Q1	13.40	0.0032	176.6
10	RO1	13.47	0.0012	237.8
11	O1	13.94	0.0066	159.6
12	MP1	14.03	0.0012	23.7
13	M1	14.49	0.0005	176.0
14	CHI1	14.57	0.0010	150.8
15	PI1	14.92	0.0005	78.9
16	P1	14.96	0.0068	131.8
17	S1	15.00	0.0022	34.0
18	K1	15.04	0.0223	126.7
19	PSI1	15.08	0.0011	234.6
20	PHI1	15.12	0.0005	77.5
21	TH1	15.51	0.0010	243.6
22	J1	15.59	0.0019	129.8
23	SO1	16.06	0.0005	251.2
24	OO1	16.14	0.0019	82.0
25	OQ2	27.34	0.0007	120.1
26	MNS2	27.42	0.0029	20.6
27	2N2	27.90	0.0090	22.6
28	MU2	27.97	0.0090	7.9
29	N2	28.44	0.0656	33.6
30	NU2	28.51	0.0121	35.4
31	OP2	28.90	0.0022	86.2
32	M2	28.98	0.3163	48.5
33	MKS2	29.07	0.0098	67.0
34	LAM2	29.46	0.0035	5.2
35	L2	29.53	0.0093	57.1
36	T2	29.96	0.0091	53.8
37	S2	30.00	0.1188	75.3
38	R2	30.04	0.0049	112.0
39	K2	30.08	0.0362	78.1
40	MSN2	30.54	0.0017	269.9
41	KJ2	30.63	0.0008	258.9
42	2SM2	31.02	0.0024	264.5
43	MO3	42.93	0.0020	120.0
44	M3	43.48	0.0043	186.5
45	SO3	43.94	0.0010	252.8
46	MK3	44.03	0.0029	142.5
47	SK3	45.04	0.0015	148.3
48	MN4	57.42	0.0088	118.0
49	M4	57.97	0.0195	160.3
50	SN4	58.44	0.0030	173.0
51	MS4	58.98	0.0126	221.1
52	MK4	59.07	0.0035	193.2
53	S4	60.00	0.0010	91.9
54	SK4	60.08	0.0009	143.5
55	2MN6	86.41	0.0004	110.7
56	M6	86.95	0.0004	209.5
57	MSN6	87.42	0.0008	175.5
58	2MS6	87.97	0.0010	207.7
59	2MK6	88.05	0.0006	248.9
60	2SM6	88.98	0.0004	229.0
61	MSK6	89.07	0.0003	298.9
62	MA2	28.94	0.0059	105.4
63	MB2	29.03	0.0097	176.8

T I D A L   A N A L Y S I S   O F

C E U T A

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.9917	0.
2	SA	0.04	0.0304	209.3
3	SSA	0.08	0.0097	117.5
4	MM	0.54	0.0069	115.4
5	MSF	1.02	0.0124	170.4
6	MF	1.10	0.0038	205.4
7	2QF	12.85	0.0008	249.5
8	SIG1	12.93	0.0038	194.7
9	Q1	13.40	0.0018	118.1
10	RO1	13.47	0.0015	333.6
11	O1	13.94	0.0197	95.1
12	MP1	14.03	0.0016	356.1
13	M1	14.49	0.0023	217.5
14	CHI1	14.57	0.0011	149.6
15	PI1	14.92	0.0014	129.9
16	P1	14.96	0.0081	144.9
17	S1	15.00	0.0052	54.5
18	K1	15.04	0.0356	140.4
19	PSI1	15.08	0.0018	283.6
20	PHI1	15.12	0.0018	288.8
21	TH1	15.51	0.0016	352.4
22	J1	15.59	0.0004	237.7
23	SO1	16.06	0.0029	325.9
24	OO1	16.14	0.0019	195.4
25	OQ2	27.34	0.0004	114.3
26	MNS2	27.42	0.0021	339.1
27	2N2	27.90	0.0072	358.5
28	MU2	27.97	0.0136	14.1
29	N2	28.44	0.0577	29.4
30	NU2	28.51	0.0170	21.0
31	OP2	28.90	0.0221	252.2
32	M2	28.98	0.2954	42.9
33	MKS2	29.07	0.0207	165.4
34	LAM2	29.46	0.0054	35.9
35	L2	29.53	0.0057	39.0
36	T2	29.96	0.0134	145.5
37	S2	30.00	0.1144	69.9
38	R2	30.04	0.0131	336.1
39	K2	30.08	0.0296	73.0
40	MSN2	30.54	0.0010	92.5
41	KJ2	30.63	0.0004	335.7
42	2SM2	31.02	0.0027	149.4
43	MO3	42.93	0.0078	292.3
44	M3	43.48	0.0045	126.7
45	SO3	43.94	0.0021	353.1
46	MK3	44.03	0.0062	25.8
47	SK3	45.04	0.0024	60.1
48	MN4	57.42	0.0083	106.5
49	M4	57.97	0.0237	154.0
50	SN4	58.44	0.0029	186.9
51	MS4	58.98	0.0156	213.9
52	MK4	59.07	0.0071	235.3
53	S4	60.00	0.0007	1.7
54	SK4	60.08	0.0006	326.9
55	2MN6	86.41	0.0007	263.1
56	M6	86.95	0.0004	120.8
57	MSN6	87.42	0.0004	327.5
58	2MS6	87.97	0.0009	137.2
59	2MK6	88.05	0.0002	62.5
60	2SM6	88.98	0.0003	348.0
61	MSK6	89.07	0.0002	170.3
62	MA2	28.94	0.0337	214.2
63	MB2	29.03	0.0437	48.3

T I D A L A N A L Y S I S O F

A L G E C I R A S

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.8314	0.
2	SA	0.04	0.0223	182.0
3	SSA	0.08	0.0389	67.1
4	MM	0.54	0.0116	57.2
5	MSF	1.02	0.0095	145.8
6	MF	1.10	0.0057	284.3
7	2QF	12.85	0.0008	150.1
8	SIG1	12.93	0.0017	185.2
9	Q1	13.40	0.0025	208.6
10	RO1	13.47	0.0013	217.5
11	O1	13.94	0.0067	152.1
12	MP1	14.03	0.0009	88.7
13	M1	14.49	0.0017	181.2
14	CHI1	14.57	0.0002	316.6
15	PI1	14.92	0.0007	47.4
16	P1	14.96	0.0059	137.5
17	S1	15.00	0.0031	62.0
18	K1	15.04	0.0234	126.4
19	PSI1	15.08	0.0007	149.7
20	PHI1	15.12	0.0013	8.2
21	TH1	15.51	0.0004	354.1
22	J1	15.59	0.0014	78.0
23	SO1	16.06	0.0011	179.7
24	OO1	16.14	0.0014	64.9
25	OQ2	27.34	0.0017	1.5
26	MNS2	27.42	0.0027	342.0
27	2N2	27.90	0.0089	23.1
28	MU2	27.97	0.0073	7.0
29	N2	28.44	0.0631	36.9
30	NU2	28.51	0.0072	25.4
31	OP2	28.90	0.0057	114.4
32	M2	28.98	0.3226	49.3
33	MKS2	29.07	0.0129	16.8
34	LAM2	29.46	0.0048	314.0
35	L2	29.53	0.0126	53.5
36	T2	29.96	0.0081	74.7
37	S2	30.00	0.1147	74.0
38	R2	30.04	0.0047	106.9
39	K2	30.08	0.0356	82.4
40	MSN2	30.54	0.0024	48.6
41	KJ2	30.63	0.0019	233.1
42	2SM2	31.02	0.0013	225.4
43	MO3	42.93	0.0030	143.4
44	M3	43.48	0.0029	214.7
45	SO3	43.94	0.0011	233.4
46	MK3	44.03	0.0012	178.0
47	SK3	45.04	0.0005	99.6
48	MN4	57.42	0.0084	120.4
49	M4	57.97	0.0185	165.3
50	SN4	58.44	0.0032	184.4
51	MS4	58.98	0.0138	221.8
52	MK4	59.07	0.0034	230.5
53	S4	60.00	0.0006	146.8
54	SK4	60.08	0.0011	57.1
55	2MN6	86.41	0.0001	149.2
56	M6	86.95	0.0008	211.9
57	MSN6	87.42	0.0007	162.3
58	2MS6	87.97	0.0008	154.2
59	2MK6	88.05	0.0008	247.8
60	2SM6	88.98	0.0007	216.9
61	MSK6	89.07	0.0005	294.4
62	MA2	28.94	0.0121	189.6
63	MB2	29.03	0.0126	91.1

TIDAL ANALYSIS OF MALAGA

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.8891	0.
2	SA	0.04	0.0275	171.9
3	SSA	0.08	0.0320	70.2
4	MM	0.54	0.0018	136.8
5	MSF	1.02	0.0154	155.7
6	MF	1.10	0.0003	270.4
7	2QF	12.85	0.0009	212.6
8	SIG1	12.93	0.0015	181.9
9	Q1	13.40	0.0023	117.3
10	RO1	13.47	0.0002	338.9
11	O1	13.94	0.0175	126.0
12	MP1	14.03	0.0003	103.2
13	M1	14.49	0.0003	186.2
14	CHI1	14.57	0.0011	192.9
15	PI1	14.92	0.0002	296.1
16	P1	14.96	0.0097	155.1
17	S1	15.00	0.0044	63.8
18	K1	15.04	0.0313	155.6
19	PSI1	15.08	0.0003	14.4
20	PHI1	15.12	0.0008	134.3
21	TH1	15.51	0.0009	151.9
22	J1	15.59	0.0020	154.3
23	SO1	16.06	0.0013	247.2
24	OO1	16.14	0.0017	72.5
25	OQ2	27.34	0.0013	316.0
26	MNS2	27.42	0.0015	11.5
27	2N2	27.90	0.0066	16.2
28	MU2	27.97	0.0088	19.9
29	N2	28.44	0.0410	42.0
30	NU2	28.51	0.0082	79.9
31	OP2	28.90	0.0020	253.2
32	M2	28.98	0.1851	55.7
33	MKS2	29.07	0.0059	78.3
34	LAM2	29.46	0.0055	349.8
35	L2	29.53	0.0060	46.2
36	T2	29.96	0.0036	13.9
37	S2	30.00	0.0707	79.0
38	R2	30.04	0.0042	112.2
39	K2	30.08	0.0248	78.4
40	MSN2	30.54	0.0010	199.1
41	KJ2	30.63	0.0013	351.3
42	2SM2	31.02	0.0020	233.7
43	MO3	42.93	0.0027	235.5
44	M3	43.48	0.0031	184.9
45	SO3	43.94	0.0010	276.9
46	MK3	44.03	0.0004	48.7
47	SK3	45.04	0.0004	69.8
48	MN4	57.42	0.0077	141.4
49	M4	57.97	0.0177	178.7
50	SN4	58.44	0.0025	208.0
51	MS4	58.98	0.0118	241.3
52	MK4	59.07	0.0052	229.5
53	S4	60.00	0.0005	89.0
54	SK4	60.08	0.0005	142.3
55	2MN6	86.41	0.0003	234.0
56	M6	86.95	0.0005	276.7
57	MSN6	87.42	0.0006	278.2
58	2MS6	87.97	0.0006	283.2
59	2MK6	88.05	0.0004	280.4
60	2SM6	88.98	0.0004	292.4
61	MSK6	89.07	0.0006	331.5
62	MA2	28.94	0.0070	7.5
63	MB2	29.03	0.0049	257.1

T I D A L   A N A L Y S I S   O F

A L M E R I A

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.4453	0.
2	SA	0.04	0.0310	208.8
3	SSA	0.08	0.0094	29.1
4	MM	0.54	0.0042	130.2
5	MSF	1.02	0.0090	223.1
6	MF	1.10	0.0012	112.1
7	2QF	12.85	0.0015	138.1
8	SIG1	12.93	0.0002	209.2
9	Q1	13.40	0.0027	92.2
10	RO1	13.47	0.0011	99.7
11	O1	13.94	0.0201	118.7
12	MP1	14.03	0.0017	79.4
13	M1	14.49	0.0001	337.6
14	CHI1	14.57	0.0009	291.9
15	PI1	14.92	0.0008	163.2
16	P1	14.96	0.0105	165.5
17	S1	15.00	0.0064	57.7
18	K1	15.04	0.0348	157.5
19	PSI1	15.08	0.0011	289.9
20	PHI1	15.12	0.0007	91.8
21	TH1	15.51	0.0013	171.9
22	J1	15.59	0.0020	228.8
23	SO1	16.06	0.0007	210.6
24	OO1	16.14	0.0005	171.1
25	OQ2	27.34	0.0006	133.9
26	MNS2	27.42	0.0005	294.7
27	2N2	27.90	0.0036	59.0
28	MU2	27.97	0.0025	17.9
29	N2	28.44	0.0188	38.3
30	NU2	28.51	0.0004	69.6
31	OP2	28.90	0.0047	190.1
32	M2	28.98	0.0933	51.2
33	MKS2	29.07	0.0050	289.6
34	LAM2	29.46	0.0007	250.5
35	L2	29.53	0.0030	23.0
36	T2	29.96	0.0023	85.5
37	S2	30.00	0.0380	77.9
38	R2	30.04	0.0008	7.9
39	K2	30.08	0.0093	55.8
40	MSN2	30.54	0.0017	164.7
41	KJ2	30.63	0.0015	278.4
42	2SM2	31.02	0.0010	173.8
43	MO3	42.93	0.0022	218.7
44	M3	43.48	0.0021	168.9
45	SO3	43.94	0.0002	279.9
46	MK3	44.03	0.0005	249.3
47	SK3	45.04	0.0005	126.1
48	MN4	57.42	0.0048	122.6
49	M4	57.97	0.0111	166.7
50	SN4	58.44	0.0014	161.0
51	MS4	58.98	0.0083	225.0
52	MK4	59.07	0.0029	196.1
53	S4	60.00	0.0006	45.9
54	SK4	60.08	0.0002	100.0
55	2MN6	86.41	0.0002	212.7
56	M6	86.95	0.0006	263.3
57	MSN6	87.42	0.0004	103.3
58	2MS6	87.97	0.0002	287.3
59	2MK6	88.05	0.0001	252.1
60	2SM6	88.98	0.0004	132.6
61	MSK6	89.07	0.0002	83.3
62	MA2	28.94	0.0021	307.2
63	MB2	29.03	0.0004	27.1

TIDAL ANALYSIS OF

ALICANTE I

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.4978	0.
2	SA	0.04	0.0402	174.8
3	SSA	0.08	0.0310	221.7
4	MM	0.54	0.0053	119.7
5	MSF	1.02	0.0094	220.6
6	MF	1.10	0.0065	254.6
7	2QF	12.85	0.0013	132.3
8	SIG1	12.93	0.0008	216.6
9	Q1	13.40	0.0029	68.3
10	RO1	13.47	0.0000	197.6
11	O1	13.94	0.0235	109.1
12	MP1	14.03	0.0002	231.4
13	M1	14.49	0.0002	248.9
14	CHI1	14.57	0.0016	221.8
15	PI1	14.92	0.0010	117.1
16	P1	14.96	0.0130	160.8
17	S1	15.00	0.0033	62.2
18	K1	15.04	0.0369	162.7
19	PSI1	15.08	0.0002	289.4
20	PHI1	15.12	0.0005	327.1
21	TH1	15.51	0.0007	225.6
22	J1	15.59	0.0019	197.5
23	SO1	16.06	0.0018	174.5
24	OO1	16.14	0.0006	20.3
25	OQ2	27.34	0.0004	239.7
26	MNS2	27.42	0.0006	34.5
27	2N2	27.90	0.0003	32.5
28	MU2	27.97	0.0007	71.8
29	N2	28.44	0.0031	51.5
30	NU2	28.51	0.0005	68.1
31	OP2	28.90	0.0007	180.3
32	M2	28.98	0.0172	60.1
33	MKS2	29.07	0.0007	119.6
34	LAM2	29.46	0.0007	173.8
35	L2	29.53	0.0002	262.0
36	T2	29.96	0.0005	146.5
37	S2	30.00	0.0100	78.5
38	R2	30.04	0.0003	285.5
39	K2	30.08	0.0021	64.0
40	MSN2	30.54	0.0003	178.9
41	KJ2	30.63	0.0004	300.7
42	2SM2	31.02	0.0003	311.8
43	MO3	42.93	0.0019	213.4
44	M3	43.48	0.0018	159.5
45	SO3	43.94	0.0010	299.3
46	MK3	44.03	0.0006	7.4
47	SK3	45.04	0.0006	105.0
48	MN4	57.42	0.0013	118.0
49	M4	57.97	0.0032	144.5
50	SN4	58.44	0.0005	192.8
51	MS4	58.98	0.0023	217.9
52	MK4	59.07	0.0011	197.8
53	S4	60.00	0.0003	77.6
54	SK4	60.08	0.0002	51.4
55	2MN6	86.41	0.0004	274.4
56	M6	86.95	0.0008	285.0
57	MSN6	87.42	0.0006	317.8
58	2MS6	87.97	0.0006	345.5
59	2MK6	88.05	0.0002	239.7
60	2SM6	88.98	0.0003	309.0
61	MSK6	89.07	0.0000	217.7
62	MA2	28.94	0.0001	324.6
63	MB2	29.03	0.0003	281.5

T I D A L A N A L Y S I S O F
P A L M A D E M A L L O R C A

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.9694	0.
2	SA	0.04	0.0902	195.0
3	SSA	0.08	0.0028	205.3
4	MM	0.54	0.0177	87.6
5	MSF	1.02	0.0034	271.7
6	MF	1.10	0.0086	199.5
7	2QF	12.85	0.0007	228.2
8	SIG1	12.93	0.0012	105.0
9	Q1	13.40	0.0037	64.6
10	RO1	13.47	0.0009	330.9
11	O1	13.94	0.0208	105.6
12	MP1	14.03	0.0003	141.3
13	M1	14.49	0.0023	25.8
14	CHI1	14.57	0.0027	206.1
15	PI1	14.92	0.0011	95.7
16	P1	14.96	0.0114	166.0
17	S1	15.00	0.0010	345.3
18	K1	15.04	0.0357	168.4
19	PSI1	15.08	0.0013	100.8
20	PHI1	15.12	0.0003	131.4
21	TH1	15.51	0.0007	43.7
22	J1	15.59	0.0019	113.5
23	SO1	16.06	0.0023	202.2
24	OO1	16.14	0.0017	46.7
25	OQ2	27.34	0.0003	351.5
26	MNS2	27.42	0.0006	359.4
27	2N2	27.90	0.0011	172.9
28	MU2	27.97	0.0009	235.4
29	N2	28.44	0.0057	189.9
30	NU2	28.51	0.0017	222.9
31	OP2	28.90	0.0014	0.9
32	M2	28.98	0.0256	207.8
33	MKS2	29.07	0.0014	59.9
34	LAM2	29.46	0.0005	132.8
35	L2	29.53	0.0012	283.3
36	T2	29.96	0.0011	136.1
37	S2	30.00	0.0094	223.3
38	R2	30.04	0.0010	281.2
39	K2	30.08	0.0021	236.2
40	MSN2	30.54	0.0004	255.8
41	KJ2	30.63	0.0007	287.7
42	2SM2	31.02	0.0008	83.7
43	MO3	42.93	0.0011	217.7
44	M3	43.48	0.0015	171.8
45	SO3	43.94	0.0005	261.6
46	MK3	44.03	0.0005	139.2
47	SK3	45.04	0.0006	118.9
48	MN4	57.42	0.0008	292.4
49	M4	57.97	0.0013	355.3
50	SN4	58.44	0.0000	250.5
51	MS4	58.98	0.0016	69.1
52	MK4	59.07	0.0007	6.4
53	S4	60.00	0.0007	95.5
54	SK4	60.08	0.0004	255.3
55	2MN6	86.41	0.0006	258.5
56	M6	86.95	0.0003	338.0
57	MSN6	87.42	0.0004	328.1
58	2MS6	87.97	0.0007	354.4
59	2MK6	88.05	0.0003	270.2
60	2SM6	88.98	0.0000	205.3
61	MSK6	89.07	0.0002	359.6
62	MA2	28.94	0.0039	204.9
63	MB2	29.03	0.0045	25.0

TIDAL ANALYSIS OF PORT VENDRES

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.4596	0.
2	SA	0.04	0.1176	236.9
3	SSA	0.08	0.0606	148.1
4	MM	0.54	0.0121	173.0
5	MSF	1.02	0.0133	171.8
6	MF	1.10	0.0113	183.7
7	2QF	12.85	0.0040	324.6
8	SIG1	12.93	0.0019	287.1
9	Q1	13.40	0.0029	305.6
10	RO1	13.47	0.0018	148.8
11	O1	13.94	0.0133	327.5
12	MP1	14.03	0.0062	182.6
13	M1	14.49	0.0011	57.6
14	CHI1	14.57	0.0018	238.4
15	PI1	14.92	0.0096	187.6
16	P1	14.96	0.0076	157.7
17	S1	15.00	0.0194	2.4
18	K1	15.04	0.0139	11.6
19	PSI1	15.08	0.0180	224.1
20	PHI1	15.12	0.0110	70.5
21	TH1	15.51	0.0008	138.0
22	J1	15.59	0.0015	56.7
23	SO1	16.06	0.0015	313.6
24	OO1	16.14	0.0024	338.5
25	OQ2	27.34	0.0002	11.8
26	MNS2	27.42	0.0006	203.0
27	2N2	27.90	0.0015	292.5
28	MU2	27.97	0.0043	227.2
29	N2	28.44	0.0111	291.8
30	NU2	28.51	0.0042	278.6
31	OP2	28.90	0.0088	156.9
32	M2	28.98	0.0502	288.2
33	MKS2	29.07	0.0089	48.1
34	LAM2	29.46	0.0004	195.0
35	L2	29.53	0.0017	239.9
36	T2	29.96	0.0040	143.8
37	S2	30.00	0.0185	300.0
38	R2	30.04	0.0032	88.2
39	K2	30.08	0.0045	316.1
40	MSN2	30.54	0.0009	329.9
41	KJ2	30.63	0.0017	202.7
42	2SM2	31.02	0.0019	227.3
43	MO3	42.93	0.0002	158.5
44	M3	43.48	0.0017	117.2
45	SO3	43.94	0.0008	111.3
46	MK3	44.03	0.0013	26.5
47	SK3	45.04	0.0006	331.8
48	MN4	57.42	0.0015	76.0
49	M4	57.97	0.0029	134.8
50	SN4	58.44	0.0002	65.5
51	MS4	58.98	0.0024	212.4
52	MK4	59.07	0.0005	274.1
53	S4	60.00	0.0005	350.7
54	SK4	60.08	0.0010	225.6
55	2MN6	86.41	0.0002	60.9
56	M6	86.95	0.0003	17.3
57	MSN6	87.42	0.0003	36.9
58	2MS6	87.97	0.0001	41.8
59	2MK6	88.05	0.0002	193.9
60	2SM6	88.98	0.0003	251.4
61	MSK6	89.07	0.0002	7.2
62	MA2	28.94	0.0099	235.6
63	MB2	29.03	0.0064	131.5

TIDAL ANALYSIS OF TOULON

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.3529	0.
2	SA	0.04	0.0182	226.3
3	SSA	0.08	0.0089	284.9
4	MM	0.54	0.0025	168.1
5	MSF	1.02	0.0021	135.5
6	MF	1.10	0.0046	216.0
7	2QF	12.85	0.0001	182.7
8	SIG1	12.93	0.0004	55.8
9	Q1	13.40	0.0013	280.6
10	RO1	13.47	0.0003	223.6
11	O1	13.94	0.0075	318.2
12	MP1	14.03	0.0023	283.4
13	M1	14.49	0.0009	179.5
14	CHI1	14.57	0.0012	6.6
15	PI1	14.92	0.0015	57.1
16	P1	14.96	0.0085	9.9
17	S1	15.00	0.0041	112.2
18	K1	15.04	0.0136	23.5
19	PSI1	15.08	0.0031	100.7
20	PHI1	15.12	0.0029	210.4
21	TH1	15.51	0.0013	341.2
22	J1	15.59	0.0005	74.1
23	SO1	16.06	0.0007	63.9
24	OO1	16.14	0.0003	197.5
25	OQ2	27.34	0.0011	45.9
26	MNS2	27.42	0.0014	214.1
27	2N2	27.90	0.0014	243.2
28	MU2	27.97	0.0022	215.2
29	N2	28.44	0.0067	264.1
30	NU2	28.51	0.0014	195.2
31	OP2	28.90	0.0063	317.5
32	M2	28.98	0.0306	266.5
33	MKS2	29.07	0.0029	191.9
34	LAM2	29.46	0.0001	123.1
35	L2	29.53	0.0017	323.2
36	T2	29.96	0.0033	213.5
37	S2	30.00	0.0122	275.7
38	R2	30.04	0.0011	335.9
39	K2	30.08	0.0049	255.9
40	MSN2	30.54	0.0007	19.8
41	KJ2	30.63	0.0017	101.1
42	2SM2	31.02	0.0005	218.4
43	MO3	42.93	0.0004	102.8
44	M3	43.48	0.0004	101.3
45	SO3	43.94	0.0005	141.6
46	MK3	44.03	0.0003	73.5
47	SK3	45.04	0.0003	359.7
48	MN4	57.42	0.0008	36.6
49	M4	57.97	0.0017	69.6
50	SN4	58.44	0.0001	61.2
51	MS4	58.98	0.0010	107.1
52	MK4	59.07	0.0005	91.3
53	S4	60.00	0.0003	33.3
54	SK4	60.08	0.0001	51.5
55	2MN6	86.41	0.0002	109.7
56	M6	86.95	0.0002	117.6
57	MSN6	87.42	0.0001	230.8
58	2MS6	87.97	0.0002	132.2
59	2MK6	88.05	0.0001	152.4
60	2SM6	88.98	0.0001	67.7
61	MSK6	89.07	0.0001	185.0
62	MA2	28.94	0.0069	288.1
63	MB2	29.03	0.0056	71.0

TIDAL ANALYSIS OF

NICE

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.4100	0.
2	SA	0.04	0.0705	202.5
3	SSA	0.08	0.0231	216.0
4	MM	0.54	0.0057	203.2
5	MSF	1.02	0.0013	217.3
6	MF	1.10	0.0086	239.8
7	2QF	12.85	0.0012	215.9
8	SIG1	12.93	0.0015	226.4
9	Q1	13.40	0.0011	270.5
10	RO1	13.47	0.0003	250.9
11	O1	13.94	0.0062	353.1
12	MP1	14.03	0.0016	48.9
13	M1	14.49	0.0014	137.8
14	CHI1	14.57	0.0016	291.2
15	PI1	14.92	0.0069	178.0
16	P1	14.96	0.0036	265.5
17	S1	15.00	0.0246	26.6
18	K1	15.04	0.0049	75.4
19	PSI1	15.08	0.0214	162.8
20	PHI1	15.12	0.0026	332.2
21	TH1	15.51	0.0024	138.7
22	J1	15.59	0.0012	245.0
23	SO1	16.06	0.0009	328.4
24	OO1	16.14	0.0010	296.5
25	OQ2	27.34	0.0008	216.3
26	MNS2	27.42	0.0024	149.7
27	2N2	27.90	0.0016	221.4
28	MU2	27.97	0.0021	172.2
29	N2	28.44	0.0151	231.9
30	NU2	28.51	0.0034	238.7
31	OP2	28.90	0.0017	193.7
32	M2	28.98	0.0712	244.5
33	MKS2	29.07	0.0036	253.3
34	LAM2	29.46	0.0011	213.2
35	L2	29.53	0.0019	245.9
36	T2	29.96	0.0060	208.9
37	S2	30.00	0.0286	253.9
38	R2	30.04	0.0058	293.5
39	K2	30.08	0.0089	256.2
40	MSN2	30.54	0.0001	358.4
41	KJ2	30.63	0.0004	8.1
42	2SM2	31.02	0.0011	113.4
43	MO3	42.93	0.0006	103.1
44	M3	43.48	0.0007	60.8
45	SO3	43.94	0.0007	92.7
46	MK3	44.03	0.0006	20.8
47	SK3	45.04	0.0001	66.2
48	MN4	57.42	0.0019	339.6
49	M4	57.97	0.0044	24.0
50	SN4	58.44	0.0004	55.3
51	MS4	58.98	0.0033	71.9
52	MK4	59.07	0.0010	63.1
53	S4	60.00	0.0002	329.4
54	SK4	60.08	0.0004	283.6
55	2MN6	86.41	0.0002	102.2
56	M6	86.95	0.0004	142.8
57	MSN6	87.42	0.0003	128.6
58	2MS6	87.97	0.0004	167.5
59	2MK6	88.05	0.0002	210.4
60	2SM6	88.98	0.0001	342.5
61	MSK6	89.07	0.0001	272.8
62	MA2	28.94	0.0174	269.8
63	MB2	29.03	0.0171	34.0

T I D A L   A N A L Y S I S   O F

M O N A C O

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.4817	0.
2	SA	0.04	0.0299	171.9
3	SSA	0.08	0.0149	333.4
4	MM	0.54	0.0031	58.7
5	MSF	1.02	0.0069	3.1
6	MF	1.10	0.0063	232.6
7	2QF	12.85	0.0023	232.6
8	SIG1	12.93	0.0011	287.8
9	Q1	13.40	0.0004	17.8
10	RO1	13.47	0.0019	40.2
11	O1	13.94	0.0024	314.3
12	MP1	14.03	0.0010	292.0
13	M1	14.49	0.0032	139.1
14	CHI1	14.57	0.0016	176.6
15	PI1	14.92	0.0105	58.7
16	P1	14.96	0.0103	355.8
17	S1	15.00	0.0097	196.1
18	K1	15.04	0.0126	12.1
19	PSI1	15.08	0.0121	54.1
20	PHI1	15.12	0.0047	237.5
21	TH1	15.51	0.0034	318.6
22	J1	15.59	0.0015	37.7
23	SO1	16.06	0.0013	72.0
24	OO1	16.14	0.0021	272.9
25	OQ2	27.34	0.0021	329.7
26	MNS2	27.42	0.0013	207.3
27	2N2	27.90	0.0016	299.4
28	MU2	27.97	0.0017	137.8
29	N2	28.44	0.0086	232.9
30	NU2	28.51	0.0011	221.0
31	OP2	28.90	0.0175	11.9
32	M2	28.98	0.0426	259.2
33	MKS2	29.07	0.0105	155.0
34	LAM2	29.46	0.0018	270.9
35	L2	29.53	0.0020	270.4
36	T2	29.96	0.0049	307.8
37	S2	30.00	0.0178	259.3
38	R2	30.04	0.0018	357.4
39	K2	30.08	0.0054	224.3
40	MSN2	30.54	0.0019	151.5
41	KJ2	30.63	0.0006	142.5
42	2SM2	31.02	0.0003	186.0
43	MO3	42.93	0.0002	230.6
44	M3	43.48	0.0004	357.0
45	SO3	43.94	0.0009	49.5
46	MK3	44.03	0.0012	41.0
47	SK3	45.04	0.0005	255.5
48	MN4	57.42	0.0007	335.5
49	M4	57.97	0.0021	15.7
50	SN4	58.44	0.0004	3.3
51	MS4	58.98	0.0014	79.4
52	MK4	59.07	0.0009	4.5
53	S4	60.00	0.0004	319.2
54	SK4	60.08	0.0003	193.6
55	2MN6	86.41	0.0003	118.9
56	M6	86.95	0.0001	214.1
57	MSN6	87.42	0.0000	19.1
58	2MS6	87.97	0.0001	341.6
59	2MK6	88.05	0.0003	198.2
60	2SM6	88.98	0.0004	202.9
61	MSK6	89.07	0.0002	358.5
62	MA2	28.94	0.0141	28.9
63	MB2	29.03	0.0031	160.6

T I D A L   A N A L Y S I S   O F

A J A C C I O

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.3922	0.
2	SA	0.04	0.0567	201.1
3	SSA	0.08	0.0260	219.1
4	MM	0.54	0.0066	238.1
5	MSF	1.02	0.0070	205.5
6	MF	1.10	0.0112	247.0
7	2QF	12.85	0.0010	109.5
8	SIG1	12.93	0.0013	336.1
9	Q1	13.40	0.0026	213.9
10	RO1	13.47	0.0010	33.4
11	O1	13.94	0.0107	305.1
12	MP1	14.03	0.0048	316.9
13	M1	14.49	0.0013	45.0
14	CHI1	14.57	0.0018	92.5
15	PI1	14.92	0.0061	353.3
16	P1	14.96	0.0144	351.0
17	S1	15.00	0.0103	91.4
18	K1	15.04	0.0230	48.3
19	PSI1	15.08	0.0111	121.7
20	PHI1	15.12	0.0109	256.2
21	TH1	15.51	0.0017	235.4
22	J1	15.59	0.0012	135.5
23	SO1	16.06	0.0017	17.6
24	OO1	16.14	0.0012	174.2
25	OQ2	27.34	0.0021	152.7
26	MNS2	27.42	0.0000	192.5
27	2N2	27.90	0.0033	203.8
28	MU2	27.97	0.0027	277.1
29	N2	28.44	0.0144	234.4
30	NU2	28.51	0.0069	320.7
31	OP2	28.90	0.0056	300.3
32	M2	28.98	0.0657	249.8
33	MKS2	29.07	0.0132	174.4
34	LAM2	29.46	0.0058	199.6
35	L2	29.53	0.0036	245.3
36	T2	29.96	0.0100	242.6
37	S2	30.00	0.0269	283.9
38	R2	30.04	0.0054	301.2
39	K2	30.08	0.0094	250.6
40	MSN2	30.54	0.0024	162.1
41	KJ2	30.63	0.0009	212.8
42	2SM2	31.02	0.0011	91.4
43	MO3	42.93	0.0009	39.6
44	M3	43.48	0.0008	65.4
45	SO3	43.94	0.0002	123.2
46	MK3	44.03	0.0007	88.3
47	SK3	45.04	0.0006	67.6
48	MN4	57.42	0.0016	343.5
49	M4	57.97	0.0030	19.7
50	SN4	58.44	0.0007	76.4
51	MS4	58.98	0.0020	87.6
52	MK4	59.07	0.0015	45.2
53	S4	60.00	0.0004	55.3
54	SK4	60.08	0.0008	107.7
55	2MN6	86.41	0.0002	344.0
56	M6	86.95	0.0001	274.8
57	MSN6	87.42	0.0000	300.4
58	2MS6	87.97	0.0002	52.2
59	2MK6	88.05	0.0001	122.1
60	2SM6	88.98	0.0002	127.2
61	MSK6	89.07	0.0000	66.5
62	MA2	28.94	0.0222	285.3
63	MB2	29.03	0.0171	38.3

T I D A L   A N A L Y S I S   O F

G E N O V A

CONSTITUENT NO.	CONSTITUENT NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	1.7795	0.
2	SA	0.04	0.0797	217.6
3	SSA	0.08	0.0259	164.3
4	MM	0.54	0.0026	107.4
5	MSF	1.02	0.0104	151.7
6	MF	1.10	0.0074	135.3
7	2QF	12.85	0.0032	131.6
8	SIG1	12.93	0.0043	192.4
9	Q1	13.40	0.0054	331.1
10	RO1	13.47	0.0048	20.3
11	O1	13.94	0.0052	299.8
12	MP1	14.03	0.0030	343.3
13	M1	14.49	0.0028	33.4
14	CHI1	14.57	0.0079	65.9
15	PI1	14.92	0.0102	289.7
16	P1	14.96	0.0058	290.9
17	S1	15.00	0.0102	50.6
18	K1	15.04	0.0121	39.9
19	PSI1	15.08	0.0199	147.6
20	PHI1	15.12	0.0062	297.9
21	TH1	15.51	0.0036	45.2
22	J1	15.59	0.0060	93.1
23	SO1	16.06	0.0032	280.3
24	OO1	16.14	0.0035	116.1
25	OQ2	27.34	0.0009	321.2
26	MNS2	27.42	0.0009	313.3
27	2N2	27.90	0.0022	217.5
28	MU2	27.97	0.0028	248.9
29	N2	28.44	0.0120	229.1
30	NU2	28.51	0.0043	358.9
31	OP2	28.90	0.0019	172.8
32	M2	28.98	0.0739	264.1
33	MKS2	29.07	0.0063	176.8
34	LAM2	29.46	0.0066	250.4
35	L2	29.53	0.0051	235.0
36	T2	29.96	0.0067	309.7
37	S2	30.00	0.0276	272.4
38	R2	30.04	0.0081	242.2
39	K2	30.08	0.0069	242.9
40	MSN2	30.54	0.0013	71.1
41	KJ2	30.63	0.0014	149.6
42	2SM2	31.02	0.0016	151.2
43	MO3	42.93	0.0014	69.3
44	M3	43.48	0.0004	298.6
45	SO3	43.94	0.0013	75.9
46	MK3	44.03	0.0009	114.6
47	SK3	45.04	0.0011	104.3
48	MN4	57.42	0.0013	339.2
49	M4	57.97	0.0043	81.4
50	SN4	58.44	0.0004	264.6
51	MS4	58.98	0.0031	124.0
52	MK4	59.07	0.0009	64.7
53	S4	60.00	0.0003	92.1
54	SK4	60.08	0.0005	299.7
55	2MN6	86.41	0.0004	144.1
56	M6	86.95	0.0005	350.3
57	MSN6	87.42	0.0006	146.6
58	2MS6	87.97	0.0006	9.6
59	2MK6	88.05	0.0005	258.9
60	2SM6	88.98	0.0006	11.1
61	MSK6	89.07	0.0007	236.2
62	MA2	28.94	0.0145	317.6
63	MB2	29.03	0.0194	350.8

TIDAL ANALYSIS OF

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CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	1.2083	0.
2	SA	0.04	0.0413	169.7
3	SSA	0.08	0.0233	184.5
4	MM	0.54	0.0081	119.0
5	MSF	1.02	0.0009	67.6
6	MF	1.10	0.0131	202.2
7	2QF	12.85	0.0007	327.7
8	SIG1	12.93	0.0003	273.0
9	Q1	13.40	0.0026	19.7
10	RO1	13.47	0.0007	85.0
11	O1	13.94	0.0155	104.0
12	MP1	14.03	0.0003	343.6
13	M1	14.49	0.0016	25.8
14	CHI1	14.57	0.0014	193.1
15	PI1	14.92	0.0027	217.2
16	P1	14.96	0.0117	170.2
17	S1	15.00	0.0059	352.9
18	K1	15.04	0.0341	181.9
19	PSI1	15.08	0.0024	14.9
20	PHI1	15.12	0.0006	232.7
21	TH1	15.51	0.0010	135.9
22	J1	15.59	0.0032	217.9
23	SO1	16.06	0.0002	91.3
24	OO1	16.14	0.0010	273.3
25	OQ2	27.34	0.0008	278.5
26	MNS2	27.42	0.0018	182.0
27	2N2	27.90	0.0016	196.3
28	MU2	27.97	0.0027	218.4
29	N2	28.44	0.0189	209.6
30	NU2	28.51	0.0037	231.0
31	OP2	28.90	0.0113	106.2
32	M2	28.98	0.0823	228.1
33	MKS2	29.07	0.0085	41.8
34	LAM2	29.46	0.0008	113.5
35	L2	29.53	0.0023	286.0
36	T2	29.96	0.0055	236.1
37	S2	30.00	0.0309	245.6
38	R2	30.04	0.0057	297.9
39	K2	30.08	0.0063	240.3
40	MSN2	30.54	0.0015	169.9
41	KJ2	30.63	0.0012	40.0
42	2SM2	31.02	0.0008	89.8
43	MO3	42.93	0.0010	156.3
44	M3	43.48	0.0007	66.4
45	SO3	43.94	0.0007	293.6
46	MK3	44.03	0.0005	337.3
47	SK3	45.04	0.0006	52.0
48	MN4	57.42	0.0013	297.3
49	M4	57.97	0.0034	343.4
50	SN4	58.44	0.0011	1.9
51	MS4	58.98	0.0021	48.9
52	MK4	59.07	0.0009	4.7
53	S4	60.00	0.0004	233.5
54	SK4	60.08	0.0006	291.5
55	2MN6	86.41	0.0004	117.8
56	M6	86.95	0.0007	82.0
57	MSN6	87.42	0.0001	145.9
58	2MS6	87.97	0.0004	93.3
59	2MK6	88.05	0.0005	53.5
60	2SM6	88.98	0.0003	111.1
61	MSK6	89.07	0.0002	95.2
62	MA2	28.94	0.0097	301.5
63	MB2	29.03	0.0125	12.5

T I D A L   A N A L Y S I S   O F

C I V I T A V E C C H I A

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0005	179.0
2	P1	K1	14.96	0.0090	179.0
3	PSI1	K1	15.08	0.0002	179.0
4	PHI1	K1	15.12	0.0004	179.0
5	2N2	N2	27.90	0.0031	211.5
6	NU2	N2	28.51	0.0046	211.5
7	T2	S2	29.96	0.0025	244.5
8	K2	S2	30.08	0.0115	244.5

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	1.3764	0.
2	MM	0.54	0.0046	78.2
3	MSF	1.02	0.0074	63.3
4	Q1	13.40	0.0035	355.7
5	O1	13.94	0.0116	96.2
6	M1	14.49	0.0008	322.5
7	K1	15.04	0.0272	179.0
8	J1	15.59	0.0026	203.0
9	OO1	16.14	0.0018	238.5
10	MU2	27.97	0.0022	199.8
11	N2	28.44	0.0237	211.5
12	M2	28.98	0.1075	224.5
13	L2	29.53	0.0017	213.1
14	S2	30.00	0.0424	244.5
15	2SM2	31.02	0.0020	298.5
16	MO3	42.93	0.0049	35.6
17	M3	43.48	0.0029	329.9
18	MK3	44.03	0.0006	6.8
19	MN4	57.42	0.0010	89.2
20	M4	57.97	0.0019	139.7
21	SN4	58.44	0.0004	132.0
22	MS4	58.98	0.0017	202.3
23	2MN6	86.41	0.0001	224.3
24	M6	86.95	0.0001	314.7
25	MSN6	87.42	0.0002	293.8
26	2MS6	87.97	0.0005	300.9
27	2SM6	88.98	0.0004	355.8

TIDAL ANALYSIS OF

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CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.5447	0.
2	SA	0.04	0.0804	230.1
3	SSA	0.08	0.0398	213.4
4	MM	0.54	0.0034	268.5
5	MSF	1.02	0.0032	33.9
6	MF	1.10	0.0079	249.2
7	2QF	12.85	0.0008	317.6
8	SIG1	12.93	0.0018	103.5
9	Q1	13.40	0.0027	28.5
10	RO1	13.47	0.0003	53.9
11	O1	13.94	0.0113	101.2
12	MP1	14.03	0.0014	252.9
13	M1	14.49	0.0012	18.2
14	CHI1	14.57	0.0014	184.1
15	PI1	14.92	0.0012	49.6
16	P1	14.96	0.0124	187.8
17	S1	15.00	0.0030	344.4
18	K1	15.04	0.0270	198.1
19	PSI1	15.08	0.0018	162.5
20	PHI1	15.12	0.0037	235.5
21	TH1	15.51	0.0011	80.7
22	J1	15.59	0.0018	188.1
23	SO1	16.06	0.0013	155.3
24	OO1	16.14	0.0014	283.4
25	OQ2	27.34	0.0018	138.2
26	MNS2	27.42	0.0010	210.6
27	2N2	27.90	0.0025	169.1
28	MU2	27.97	0.0050	185.8
29	N2	28.44	0.0239	212.3
30	NU2	28.51	0.0026	254.5
31	OP2	28.90	0.0166	263.2
32	M2	28.98	0.1123	227.1
33	MKS2	29.07	0.0187	223.7
34	LAM2	29.46	0.0046	207.6
35	L2	29.53	0.0046	252.2
36	T2	29.96	0.0062	217.8
37	S2	30.00	0.0394	246.1
38	R2	30.04	0.0040	38.9
39	K2	30.08	0.0175	249.2
40	MSN2	30.54	0.0018	113.9
41	KJ2	30.63	0.0033	114.3
42	2SM2	31.02	0.0008	203.6
43	MO3	42.93	0.0047	25.4
44	M3	43.48	0.0039	334.2
45	SO3	43.94	0.0013	81.8
46	MK3	44.03	0.0005	289.0
47	SK3	45.04	0.0016	294.2
48	MN4	57.42	0.0015	73.4
49	M4	57.97	0.0035	107.3
50	SN4	58.44	0.0005	281.2
51	MS4	58.98	0.0020	145.6
52	MK4	59.07	0.0018	160.0
53	S4	60.00	0.0007	97.7
54	SK4	60.08	0.0006	134.8
55	2MN6	86.41	0.0000	190.6
56	M6	86.95	0.0005	340.7
57	MSN6	87.42	0.0004	182.1
58	2MS6	87.97	0.0002	56.5
59	2MK6	88.05	0.0005	55.9
60	2SM6	88.98	0.0001	96.5
61	MSK6	89.07	0.0005	85.3
62	MA2	28.94	0.0113	208.3
63	MB2	29.03	0.0112	136.9

T I D A L   A N A L Y S I S   O F

A N C O N A   1 9 8 1

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0025	78.3
2	P1	K1	14.96	0.0433	78.3
3	PSI1	K1	15.08	0.0010	78.3
4	PHI1	K1	15.12	0.0018	78.3
5	2N2	N2	27.90	0.0014	304.1
6	NU2	N2	28.51	0.0020	304.1
7	T2	S2	29.96	0.0020	323.6
8	K2	S2	30.08	0.0091	323.6

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.0746	0.
2	MM	0.54	0.0111	170.6
3	MSF	1.02	0.0225	48.4
4	Q1	13.40	0.0054	54.6
5	O1	13.94	0.0410	72.1
6	M1	14.49	0.0111	54.1
7	K1	15.04	0.1309	78.3
8	J1	15.59	0.0183	115.5
9	OO1	16.14	0.0080	261.2
10	MU2	27.97	0.0084	325.2
11	N2	28.44	0.0105	304.1
12	M2	28.98	0.0659	309.0
13	L2	29.53	0.0046	236.9
14	S2	30.00	0.0333	323.6
15	2SM2	31.02	0.0026	147.9
16	MO3	42.93	0.0012	301.2
17	M3	43.48	0.0029	313.3
18	MK3	44.03	0.0005	49.8
19	MN4	57.42	0.0005	132.1
20	M4	57.97	0.0006	112.7
21	SN4	58.44	0.0007	79.2
22	MS4	58.98	0.0003	82.3
23	2MN6	86.41	0.0007	195.0
24	M6	86.95	0.0003	250.2
25	MSN6	87.42	0.0005	249.1
26	2MS6	87.97	0.0005	243.8
27	2SM6	88.98	0.0003	257.6

T I D A L   A N A L Y S I S   O F

A N C O N A   1 9 8 2

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0025	71.6
2	P1	K1	14.96	0.0431	71.6
3	PSI1	K1	15.08	0.0010	71.6
4	PHI1	K1	15.12	0.0018	71.6
5	2N2	N2	27.90	0.0017	297.0
6	NU2	N2	28.51	0.0025	297.0
7	T2	S2	29.96	0.0021	315.5
8	K2	S2	30.08	0.0098	315.5

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	-0.0729	0.
2	MM	0.54	0.0044	316.8
3	MSF	1.02	0.0081	167.4
4	Q1	13.40	0.0071	45.0
5	O1	13.94	0.0417	61.2
6	M1	14.49	0.0042	147.7
7	K1	15.04	0.1303	71.6
8	J1	15.59	0.0124	75.4
9	OO1	16.14	0.0154	68.7
10	MU2	27.97	0.0014	296.2
11	N2	28.44	0.0130	297.0
12	M2	28.98	0.0659	302.2
13	L2	29.53	0.0016	314.3
14	S2	30.00	0.0362	315.5
15	2SM2	31.02	0.0006	179.1
16	MO3	42.93	0.0012	338.4
17	M3	43.48	0.0027	326.7
18	MK3	44.03	0.0004	173.7
19	MN4	57.42	0.0003	338.9
20	M4	57.97	0.0004	13.8
21	SN4	58.44	0.0005	43.4
22	MS4	58.98	0.0003	139.2
23	2MN6	86.41	0.0003	88.2
24	M6	86.95	0.0000	192.9
25	MSN6	87.42	0.0004	201.0
26	2MS6	87.97	0.0005	96.4
27	2SM6	88.98	0.0002	32.5

T I D A L   A N A L Y S I S   O F

V E N I C E   1 9 8 1

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.2075	0.
2	SA	0.04	0.0428	207.4
3	SSA	0.08	0.0453	98.6
4	MM	0.54	0.0107	188.4
5	MSF	1.02	0.0049	306.7
6	MF	1.10	0.0233	325.6
7	2QF	12.85	0.0048	293.9
8	SIG1	12.93	0.0021	32.7
9	Q1	13.40	0.0085	40.2
10	RO1	13.47	0.0051	350.1
11	O1	13.94	0.0564	49.9
12	MP1	14.03	0.0012	164.9
13	M1	14.49	0.0079	76.4
14	CHI1	14.57	0.0059	47.3
15	PI1	14.92	0.0039	66.8
16	P1	14.96	0.0571	57.4
17	S1	15.00	0.0108	71.4
18	K1	15.04	0.1786	61.0
19	PSI1	15.08	0.0060	126.0
20	PHI1	15.12	0.0054	71.0
21	TH1	15.51	0.0031	42.9
22	J1	15.59	0.0134	69.5
23	SO1	16.06	0.0105	134.7
24	OO1	16.14	0.0087	169.8
25	OQ2	27.34	0.0005	49.0
26	MNS2	27.42	0.0006	267.7
27	2N2	27.90	0.0055	264.0
28	MU2	27.97	0.0041	262.8
29	N2	28.44	0.0408	255.7
30	NU2	28.51	0.0099	265.1
31	OP2	28.90	0.0009	93.7
32	M2	28.98	0.2343	259.3
33	MKS2	29.07	0.0023	174.4
34	LAM2	29.46	0.0043	245.4
35	L2	29.53	0.0061	254.2
36	T2	29.96	0.0077	285.1
37	S2	30.00	0.1415	264.8
38	R2	30.04	0.0027	299.4
39	K2	30.08	0.0441	262.3
40	MSN2	30.54	0.0021	132.3
41	KJ2	30.63	0.0034	100.4
42	2SM2	31.02	0.0014	74.1
43	MO3	42.93	0.0029	256.5
44	M3	43.48	0.0064	174.1
45	SO3	43.94	0.0031	354.1
46	MK3	44.03	0.0038	26.0
47	SK3	45.04	0.0039	99.1
48	MN4	57.42	0.0018	261.5
49	M4	57.97	0.0047	263.4
50	SN4	58.44	0.0008	258.7
51	MS4	58.98	0.0053	260.9
52	MK4	59.07	0.0027	276.6
53	S4	60.00	0.0018	267.7
54	SK4	60.08	0.0010	308.8
55	2MN6	86.41	0.0005	211.6
56	M6	86.95	0.0011	214.3
57	MSN6	87.42	0.0004	232.6
58	2MS6	87.97	0.0016	207.7
59	2MK6	88.05	0.0011	221.7
60	2SM6	88.98	0.0004	242.5
61	MSK6	89.07	0.0010	216.6
62	MA2	28.94	0.0025	115.5
63	MB2	29.03	0.0002	244.6

T I D A L   A N A L Y S I S   O F

V E N I C E   1 9 8 2

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.1933	0.
2	SA	0.04	0.0915	219.9
3	SSA	0.08	0.0477	125.1
4	MM	0.54	0.0120	252.3
5	MSF	1.02	0.0121	217.5
6	MF	1.10	0.0107	172.3
7	2QF	12.85	0.0008	52.9
8	SIG1	12.93	0.0027	53.8
9	Q1	13.40	0.0074	31.2
10	RO1	13.47	0.0047	16.0
11	O1	13.94	0.0522	53.1
12	MP1	14.03	0.0036	85.7
13	M1	14.49	0.0093	131.1
14	CHI1	14.57	0.0039	114.7
15	PI1	14.92	0.0084	15.0
16	P1	14.96	0.0596	58.1
17	S1	15.00	0.0124	33.2
18	K1	15.04	0.1737	62.4
19	PSI1	15.08	0.0037	260.9
20	PHI1	15.12	0.0042	274.8
21	TH1	15.51	0.0045	133.7
22	J1	15.59	0.0212	59.3
23	SO1	16.06	0.0057	149.6
24	OO1	16.14	0.0151	64.8
25	OQ2	27.34	0.0016	242.7
26	MNS2	27.42	0.0009	79.6
27	2N2	27.90	0.0062	260.8
28	MU2	27.97	0.0047	249.0
29	N2	28.44	0.0413	255.1
30	NU2	28.51	0.0054	262.9
31	OP2	28.90	0.0020	283.1
32	M2	28.98	0.2340	258.4
33	MKS2	29.07	0.0020	217.4
34	LAM2	29.46	0.0018	186.2
35	L2	29.53	0.0065	272.6
36	T2	29.96	0.0050	280.1
37	S2	30.00	0.1397	264.1
38	R2	30.04	0.0030	263.1
39	K2	30.08	0.0428	260.0
40	MSN2	30.54	0.0015	68.5
41	KJ2	30.63	0.0028	103.3
42	2SM2	31.02	0.0028	67.9
43	MO3	42.93	0.0019	221.4
44	M3	43.48	0.0058	176.6
45	SO3	43.94	0.0033	1.2
46	MK3	44.03	0.0031	34.3
47	SK3	45.04	0.0043	106.7
48	MN4	57.42	0.0020	253.9
49	M4	57.97	0.0038	263.0
50	SN4	58.44	0.0006	304.6
51	MS4	58.98	0.0044	273.8
52	MK4	59.07	0.0020	272.0
53	S4	60.00	0.0010	342.0
54	SK4	60.08	0.0011	286.9
55	2MN6	86.41	0.0003	140.3
56	M6	86.95	0.0007	232.5
57	MSN6	87.42	0.0004	205.3
58	2MS6	87.97	0.0012	206.6
59	2MK6	88.05	0.0010	212.9
60	2SM6	88.98	0.0008	209.3
61	MSK6	89.07	0.0006	211.9
62	MA2	28.94	0.0015	106.0
63	MB2	29.03	0.0013	176.1

T I D A L   A N A L Y S I S   O F

K O P E R

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0028	57.7
2	P1	K1	14.96	0.0485	57.7
3	PSI1	K1	15.08	0.0012	57.7
4	PHI1	K1	15.12	0.0021	57.7
5	2N2	N2	27.90	0.0068	234.2
6	NU2	N2	28.51	0.0099	234.2
7	T2	S2	29.96	0.0093	256.2
8	K2	S2	30.08	0.0427	256.2

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	2.0849	0.
2	MM	0.54	0.0261	91.3
3	MSF	1.02	0.0474	212.8
4	Q1	13.40	0.0121	0.5
5	O1	13.94	0.0523	39.4
6	M1	14.49	0.0120	123.4
7	K1	15.04	0.1465	57.7
8	J1	15.59	0.0109	78.1
9	OO1	16.14	0.0442	60.6
10	MU2	27.97	0.0092	252.6
11	N2	28.44	0.0511	234.2
12	M2	28.98	0.2605	249.3
13	L2	29.53	0.0202	258.3
14	S2	30.00	0.1569	256.2
15	2SM2	31.02	0.0037	38.3
16	MO3	42.93	0.0008	163.2
17	M3	43.48	0.0082	124.1
18	MK3	44.03	0.0053	117.6
19	MN4	57.42	0.0007	201.4
20	M4	57.97	0.0027	251.2
21	SN4	58.44	0.0009	248.0
22	MS4	58.98	0.0031	319.1
23	2MN6	86.41	0.0009	217.6
24	M6	86.95	0.0008	327.8
25	MSN6	87.42	0.0018	24.7
26	2MS6	87.97	0.0032	43.5
27	2SM6	88.98	0.0008	75.0

T I D A L   A N A L Y S I S   O F

R O V I N J

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0024	56.2
2	P1	K1	14.96	0.0424	56.2
3	PSI1	K1	15.08	0.0010	56.2
4	PHI1	K1	15.12	0.0018	56.2
5	2N2	N2	27.90	0.0044	227.3
6	NU2	N2	28.51	0.0064	227.3
7	T2	S2	29.96	0.0065	248.6
8	K2	S2	30.08	0.0302	248.6

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.9091	0.
2	MM	0.54	0.0194	106.6
3	MSF	1.02	0.0510	221.5
4	Q1	13.40	0.0120	342.2
5	O1	13.94	0.0483	37.7
6	M1	14.49	0.0100	118.7
7	K1	15.04	0.1280	56.2
8	J1	15.59	0.0151	65.1
9	OO1	16.14	0.0357	56.2
10	MU2	27.97	0.0046	243.0
11	N2	28.44	0.0332	227.3
12	M2	28.98	0.1836	241.9
13	L2	29.53	0.0029	243.8
14	S2	30.00	0.1109	248.6
15	2SM2	31.02	0.0027	44.5
16	MO3	42.93	0.0011	187.6
17	M3	43.48	0.0038	115.9
18	MK3	44.03	0.0018	58.2
19	MN4	57.42	0.0008	137.8
20	M4	57.97	0.0022	216.3
21	SN4	58.44	0.0010	236.5
22	MS4	58.98	0.0023	240.4
23	2MN6	86.41	0.0004	330.7
24	M6	86.95	0.0008	311.1
25	MSN6	87.42	0.0002	37.4
26	2MS6	87.97	0.0009	312.5
27	2SM6	88.98	0.0004	335.1

T I D A L A N A L Y S I S O F

B A K A R

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0022	56.3
2	P1	K1	14.96	0.0379	56.3
3	PSI1	K1	15.08	0.0009	56.3
4	PHI1	K1	15.12	0.0016	56.3
5	2N2	N2	27.90	0.0028	218.2
6	NU2	N2	28.51	0.0041	218.2
7	T2	S2	29.96	0.0033	226.5
8	K2	S2	30.08	0.0152	226.5

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.6717	0
2	MM	0.54	0.0175	89.6
3	MSF	1.02	0.0516	209.5
4	Q1	13.40	0.0098	339.4
5	O1	13.94	0.0438	33.4
6	M1	14.49	0.0109	123.1
7	K1	15.04	0.1144	56.3
8	J1	15.59	0.0140	69.6
9	OO1	16.14	0.0318	55.0
10	MU2	27.97	0.0104	251.5
11	N2	28.44	0.0213	218.2
12	M2	28.98	0.1076	225.1
13	L2	29.53	0.0022	234.7
14	S2	30.00	0.0557	226.5
15	2SM2	31.02	0.0037	40.2
16	MO3	42.93	0.0028	126.4
17	M3	43.48	0.0029	38.9
18	MK3	44.03	0.0034	44.3
19	MN4	57.42	0.0026	232.5
20	M4	57.97	0.0038	180.5
21	SN4	58.44	0.0017	290.1
22	MS4	58.98	0.0059	238.3
23	2MN6	86.41	0.0005	132.2
24	M6	86.95	0.0007	325.7
25	MSN6	87.42	0.0004	66.4
26	2MS6	87.97	0.0010	264.4
27	2SM6	88.98	0.0016	352.6

T I D A L   A N A L Y S I S   O F

Z A D A R

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0020	54.3
2	P1	K1	14.96	0.0348	54.3
3	PSI1	K1	15.08	0.0008	54.3
4	PHI1	K1	15.12	0.0015	54.3
5	2N2	N2	27.90	0.0024	204.4
6	NU2	N2	28.51	0.0034	204.4
7	T2	S2	29.96	0.0015	203.8
8	K2	S2	30.08	0.0070	203.8

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.7183	0.
2	MM	0.54	0.0300	147.0
3	MSF	1.02	0.0549	228.0
4	Q1	13.40	0.0104	355.3
5	O1	13.94	0.0418	32.3
6	M1	14.49	0.0102	84.6
7	K1	15.04	0.1051	54.3
8	J1	15.59	0.0107	57.7
9	OO1	16.14	0.0290	53.2
10	MU2	27.97	0.0058	269.4
11	N2	28.44	0.0177	204.4
12	M2	28.98	0.0568	210.6
13	L2	29.53	0.0070	223.6
14	S2	30.00	0.0257	203.8
15	2SM2	31.02	0.0033	323.7
16	MO3	42.93	0.0016	22.3
17	M3	43.48	0.0036	30.7
18	MK3	44.03	0.0009	7.7
19	MN4	57.42	0.0011	218.0
20	M4	57.97	0.0018	160.7
21	SN4	58.44	0.0005	28.3
22	MS4	58.98	0.0016	216.0
23	2MN6	86.41	0.0008	56.8
24	M6	86.95	0.0003	158.0
25	MSN6	87.42	0.0002	121.4
26	2MS6	87.97	0.0009	234.5
27	2SM6	88.98	0.0006	327.1

T I D A L   A N A L Y S I S   O F

N O V A L J A

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0020	51.8
2	P1	K1	14.96	0.0354	51.8
3	PSI1	K1	15.08	0.0009	51.8
4	PHI1	K1	15.12	0.0015	51.8
5	2N2	N2	27.90	0.0020	207.4
6	NU2	N2	28.51	0.0029	207.4
7	T2	S2	29.96	0.0025	206.5
8	K2	S2	30.08	0.0114	206.5

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.6963	0.
2	MM	0.54	0.0177	100.7
3	MSF	1.02	0.0491	216.0
4	Q1	13.40	0.0095	349.0
5	O1	13.94	0.0416	31.9
6	M1	14.49	0.0088	128.2
7	K1	15.04	0.1070	51.8
8	J1	15.59	0.0128	65.6
9	OO1	16.14	0.0282	50.7
10	MU2	27.97	0.0027	251.5
11	N2	28.44	0.0150	207.4
12	M2	28.98	0.0796	208.9
13	L2	29.53	0.0006	220.6
14	S2	30.00	0.0418	206.5
15	2SM2	31.02	0.0012	288.6
16	MO3	42.93	0.0011	175.8
17	M3	43.48	0.0026	354.6
18	MK3	44.03	0.0025	347.9
19	MN4	57.42	0.0011	188.0
20	M4	57.97	0.0027	155.8
21	SN4	58.44	0.0015	291.3
22	MS4	58.98	0.0023	212.6
23	2MN6	86.41	0.0000	201.8
24	M6	86.95	0.0005	263.7
25	MSN6	87.42	0.0008	277.4
26	2MS6	87.97	0.0011	271.0
27	2SM6	88.98	0.0010	214.7

T I D A L   A N A L Y S I S   O F

S P L I T

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0014	32.1
2	P1	K1	14.96	0.0240	32.1
3	PSI1	K1	15.08	0.0006	32.1
4	PHI1	K1	15.12	0.0010	32.1
5	2N2	N2	27.90	0.0017	80.5
6	NU2	N2	28.51	0.0024	80.5
7	T2	S2	29.96	0.0035	91.0
8	K2	S2	30.08	0.0159	91.0

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	ZO	0.	0.5529	0.
2	MM	0.54	0.0223	121.5
3	MSF	1.02	0.0475	223.4
4	Q1	13.40	0.0049	10.0
5	O1	13.94	0.0272	21.4
6	M1	14.49	0.0043	117.0
7	K1	15.04	0.0727	32.1
8	J1	15.59	0.0077	59.0
9	OO1	16.14	0.0187	34.3
10	MU2	27.97	0.0029	48.6
11	N2	28.44	0.0126	80.5
12	M2	28.98	0.0807	87.9
13	L2	29.53	0.0048	92.3
14	S2	30.00	0.0586	91.0
15	2SM2	31.02	0.0038	282.8
16	MO3	42.93	0.0035	334.8
17	M3	43.48	0.0029	328.0
18	MK3	44.03	0.0006	246.7
19	MN4	57.42	0.0008	11.5
20	M4	57.97	0.0018	299.0
21	SN4	58.44	0.0006	163.3
22	MS4	58.98	0.0016	332.2
23	2MN6	86.41	0.0007	285.5
24	M6	86.95	0.0016	217.6
25	MSN6	87.42	0.0009	30.5
26	2MS6	87.97	0.0022	266.9
27	2SM6	88.98	0.0003	92.2

T I D A L A N A L Y S I S O F

D U B R O V N I K

RELATED CONSTITUENTS

NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0009	37.7
2	P1	K1	14.96	0.0150	37.7
3	PSI1	K1	15.08	0.0004	37.7
4	PHI1	K1	15.12	0.0006	37.7
5	2N2	N2	27.90	0.0023	74.3
6	NU2	N2	28.51	0.0033	74.3
7	T2	S2	29.96	0.0035	85.2
8	K2	S2	30.08	0.0160	85.2

MAJOR CONSTITUENTS

CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	1.0782	0.
2	MM	0.54	0.0132	134.6
3	MSF	1.02	0.0466	228.7
4	Q1	13.40	0.0023	43.0
5	O1	13.94	0.0162	24.8
6	M1	14.49	0.0024	82.0
7	K1	15.04	0.0454	37.7
8	J1	15.59	0.0043	84.3
9	OO1	16.14	0.0098	52.5
10	MU2	27.97	0.0025	126.0
11	N2	28.44	0.0171	74.3
12	M2	28.98	0.0906	80.2
13	L2	29.53	0.0031	83.4
14	S2	30.00	0.0587	85.2
15	2SM2	31.02	0.0022	217.5
16	MO3	42.93	0.0003	52.9
17	M3	43.48	0.0007	172.2
18	MK3	44.03	0.0008	162.6
19	MN4	57.42	0.0003	330.8
20	M4	57.97	0.0010	195.4
21	SN4	58.44	0.0006	46.6
22	MS4	58.98	0.0010	244.8
23	2MN6	86.41	0.0002	328.1
24	M6	86.95	0.0002	144.2
25	MSN6	87.42	0.0002	220.7
26	2MS6	87.97	0.0006	217.4
27	2SM6	88.98	0.0002	177.8

T I D A L   A N A L Y S I S   O F

B A R

RELATED CONSTITUENTS

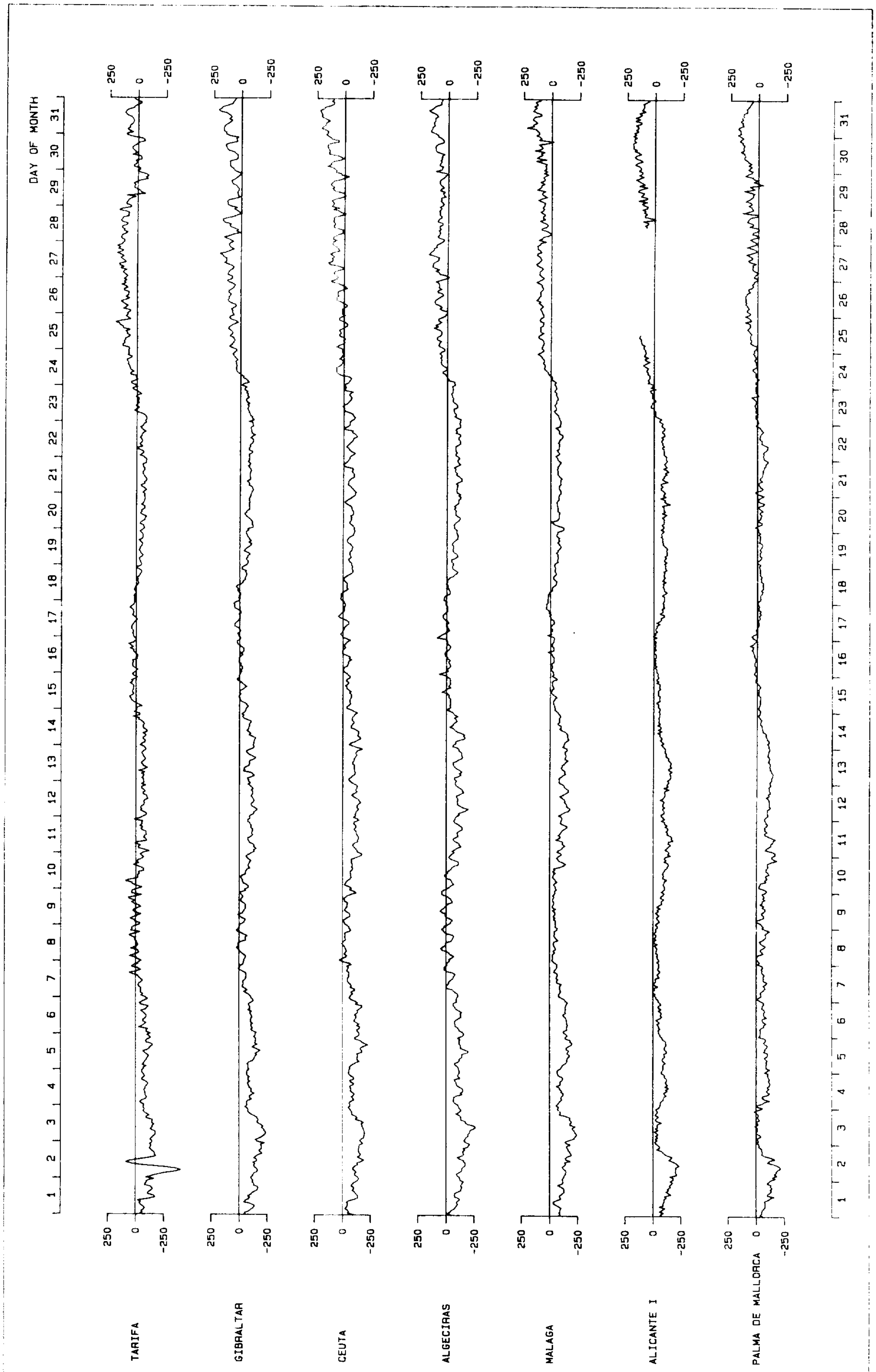
NO.	RELATED CONSTITUENT	REFERENCE CONSTITUENT	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	PI1	K1	14.92	0.0008	34.0
2	P1	K1	14.96	0.0147	34.0
3	PSI1	K1	15.08	0.0004	34.0
4	PHI1	K1	15.12	0.0006	34.0
5	2N2	N2	27.90	0.0023	61.7
6	NU2	N2	28.51	0.0033	61.7
7	T2	S2	29.96	0.0033	80.7
8	K2	S2	30.08	0.0152	80.7

MAJOR CONSTITUENTS

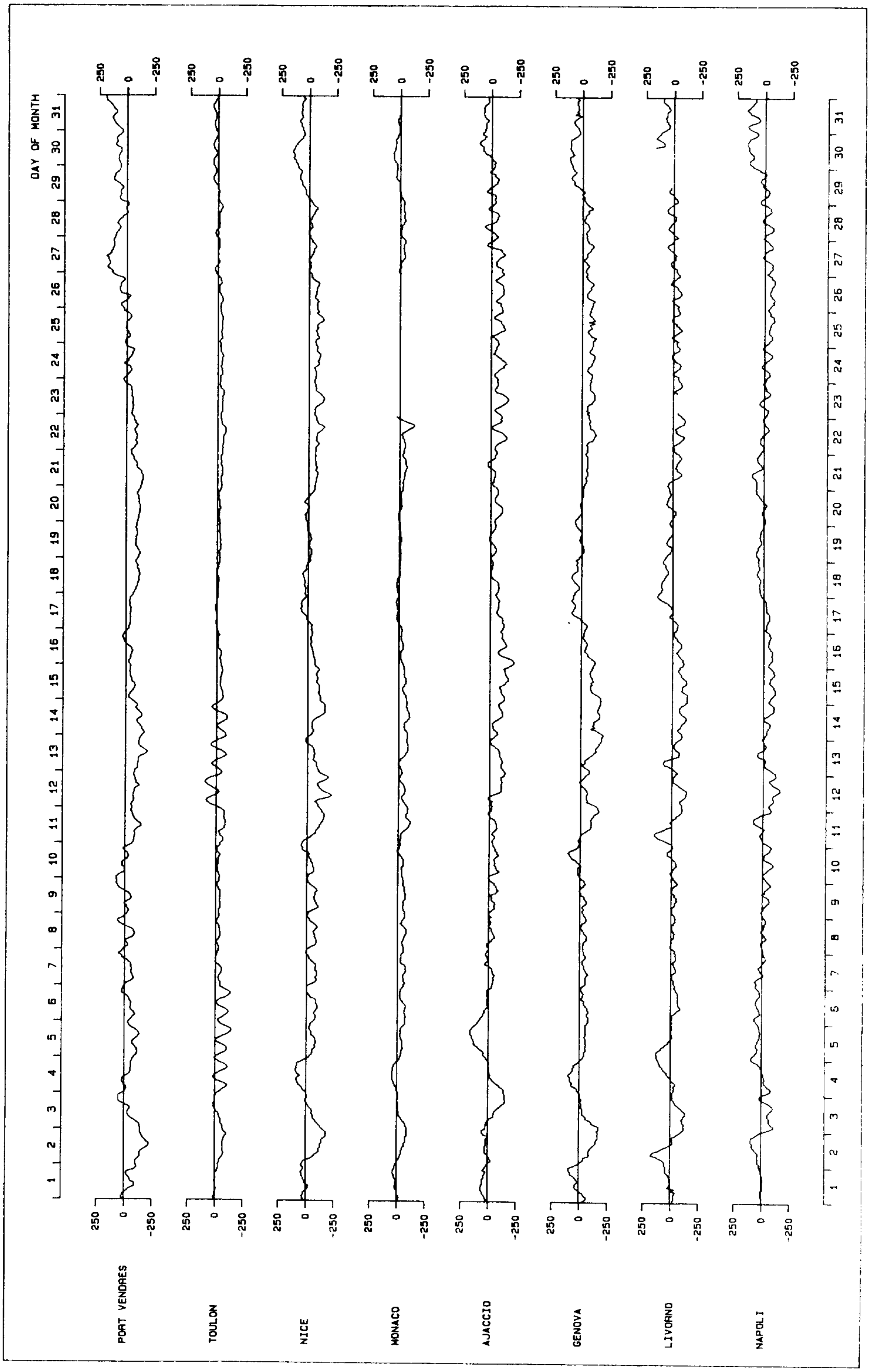
CONSTITUENT NO.	NAME	CONSTITUENT SPEED (deg/hr)	AMPLITUDE (metres)	PHASE (deg)
1	Z0	0.	0.9144	0.
2	MM	0.54	0.0145	131.3
3	MSF	1.02	0.0471	225.7
4	Q1	13.40	0.0024	337.2
5	O1	13.94	0.0140	21.8
6	M1	14.49	0.0007	68.7
7	K1	15.04	0.0443	34.0
8	J1	15.59	0.0036	47.3
9	OO1	16.14	0.0083	46.8
10	MU2	27.97	0.0022	48.9
11	N2	28.44	0.0171	61.7
12	M2	28.98	0.0904	75.5
13	L2	29.53	0.0048	124.6
14	S2	30.00	0.0559	80.7
15	2SM2	31.02	0.0018	270.5
16	MO3	42.93	0.0001	119.4
17	M3	43.48	0.0012	169.8
18	MK3	44.03	0.0010	174.7
19	MN4	57.42	0.0004	302.0
20	M4	57.97	0.0011	173.1
21	SN4	58.44	0.0007	5.8
22	MS4	58.98	0.0012	233.8
23	2MN6	86.41	0.0005	358.9
24	M6	86.95	0.0003	252.6
25	MSN6	87.42	0.0004	281.9
26	2MS6	87.97	0.0006	201.6
27	2SM6	88.98	0.0007	275.0

APPENDIX 4

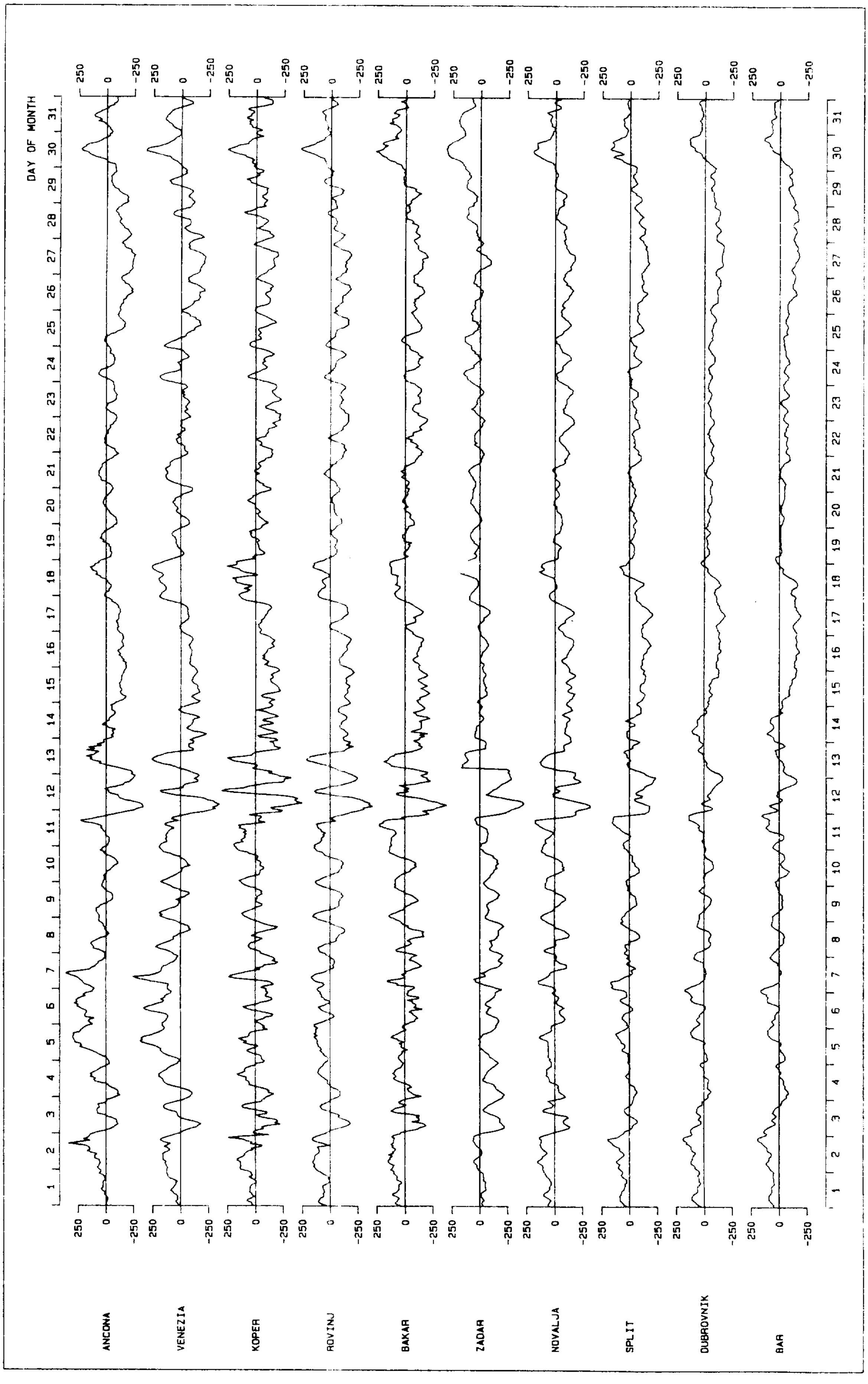
TIME SERIES PLOTS OF RESIDUALS DURING SPECIAL OBSERVATION PERIOD



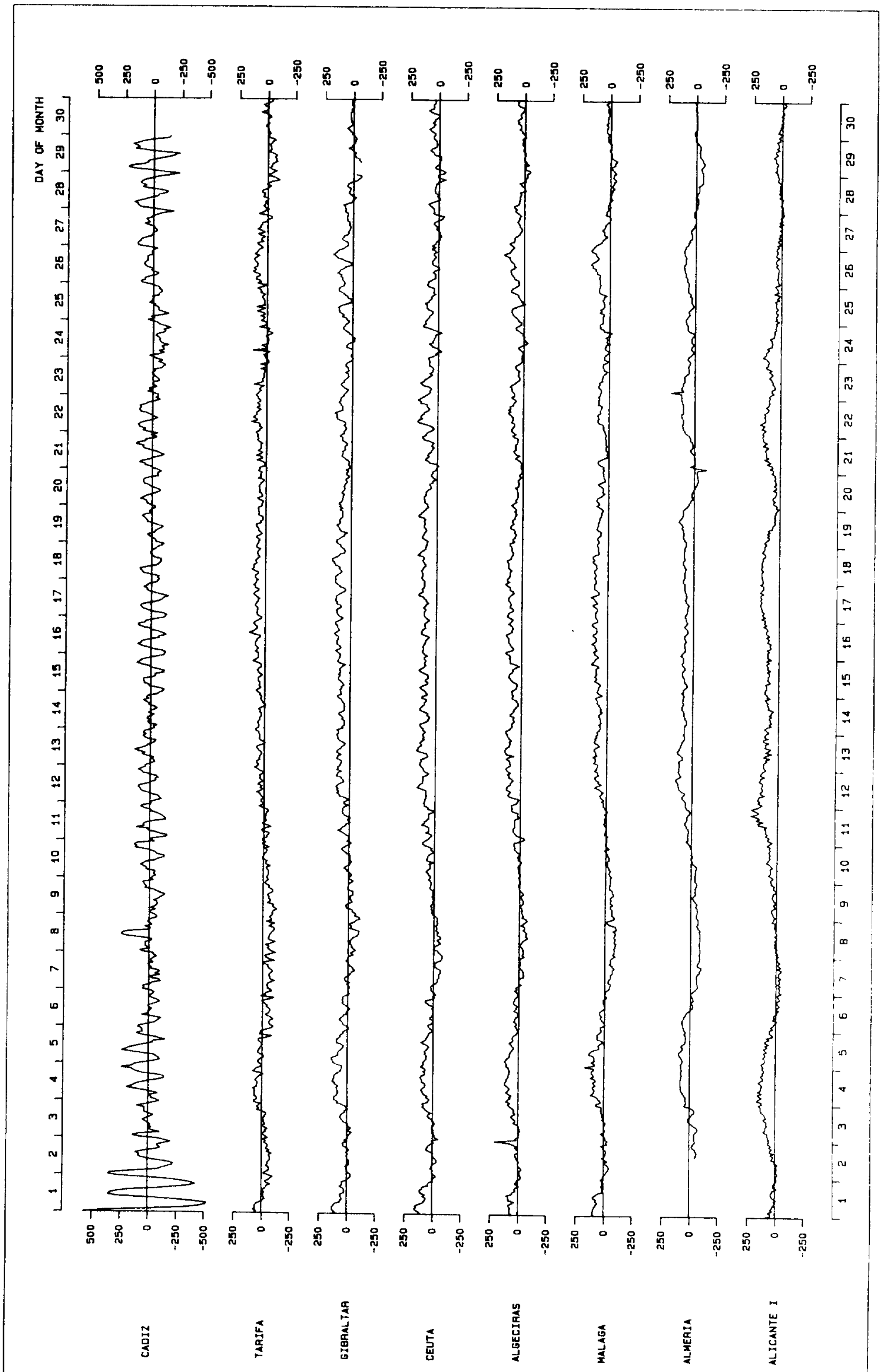
RESIDUALS (mm) FROM TIDAL ANALYSIS - MARCH 1982



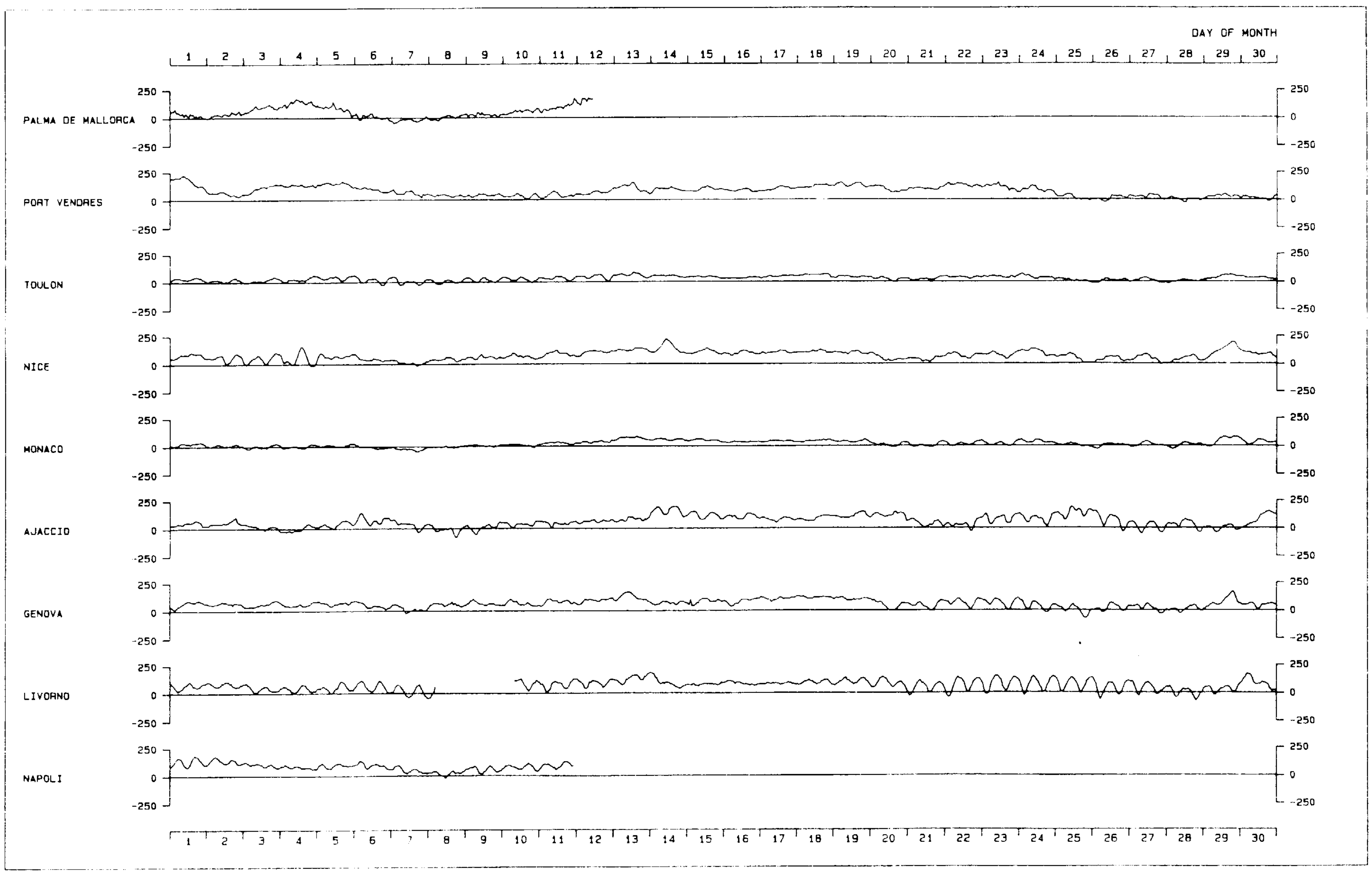
RESIDUALS (mm) FROM TIDAL ANALYSIS - MARCH 1982



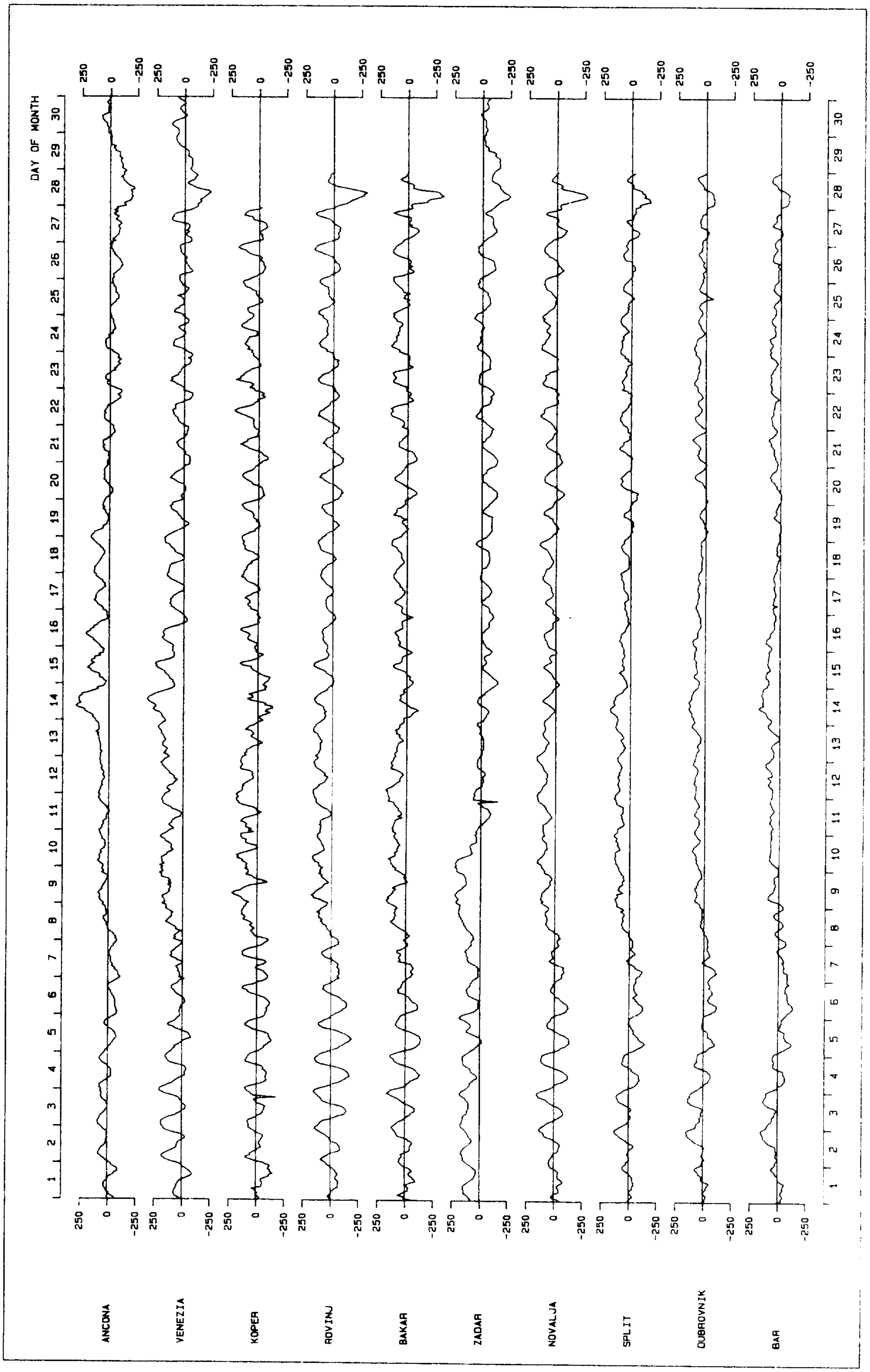
RESIDUALS (mm) FROM TIDAL ANALYSIS - MARCH 1982



RESIDUALS (mm) FROM TIDAL ANALYSIS - APRIL 1982



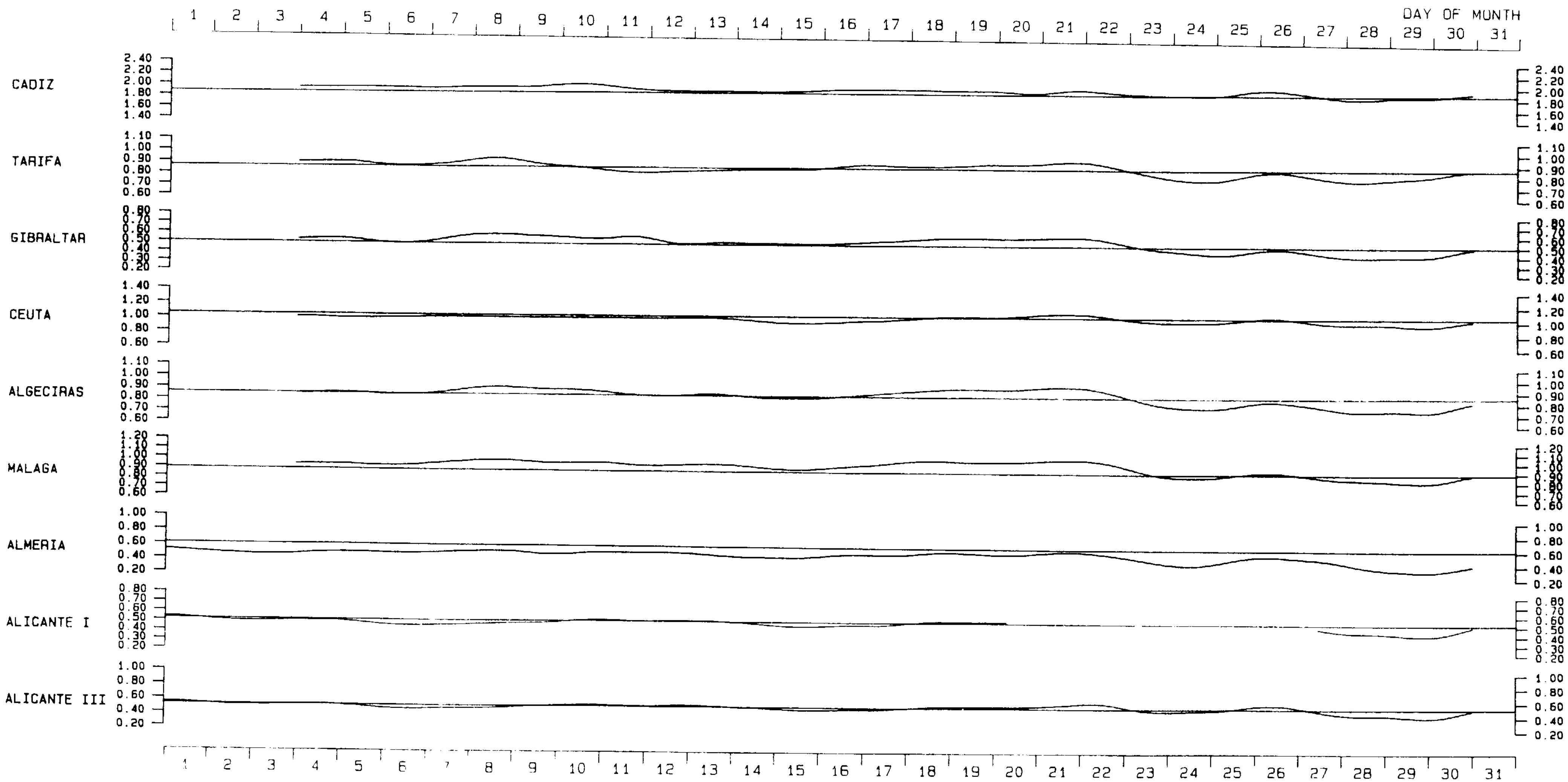
RESIDUALS (mm) FROM TIDAL ANALYSIS - APRIL 1982



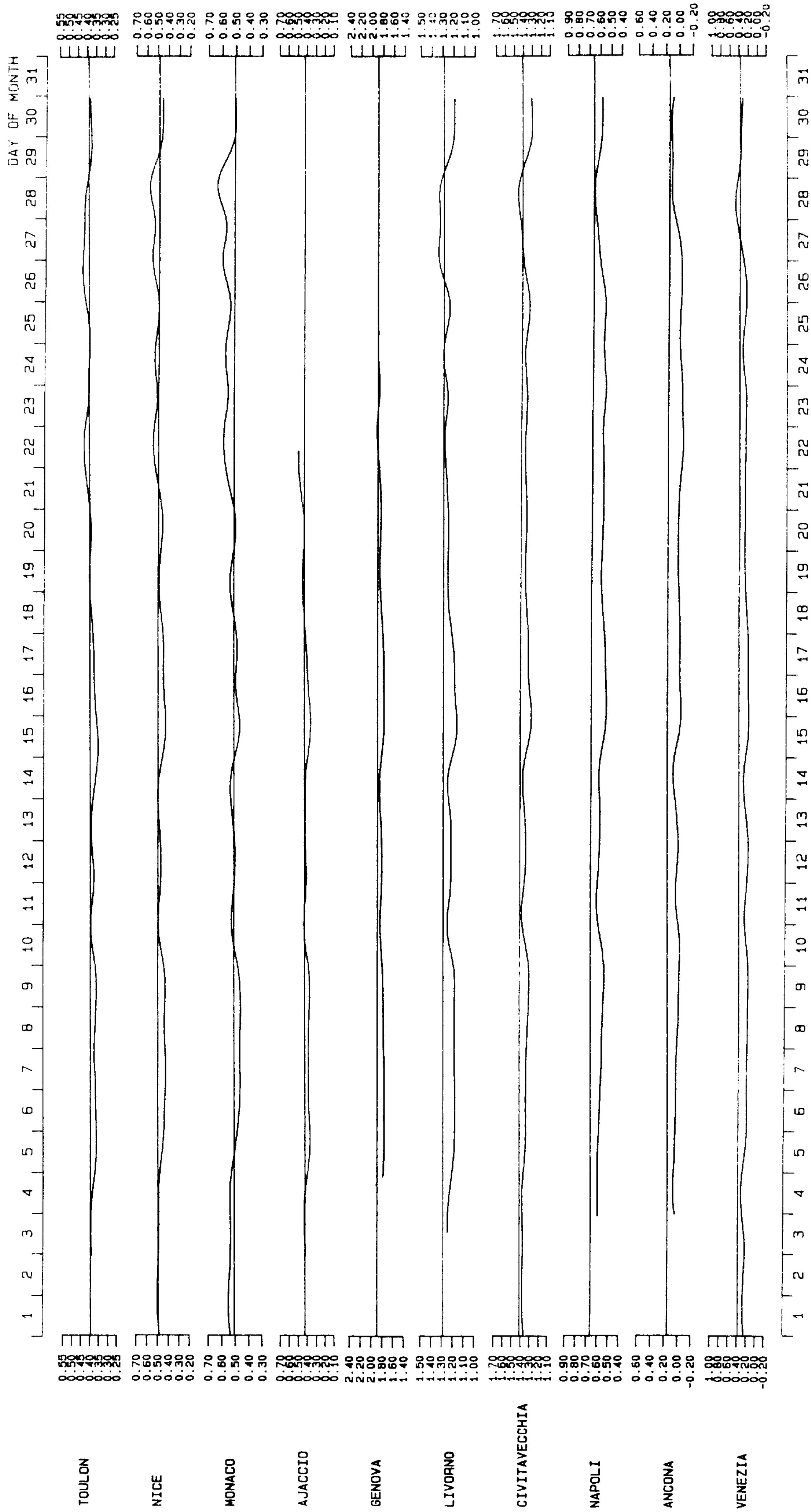
RESIDUALS (mm) FROM TIDAL ANALYSIS - APRIL 1982

APPENDIX 5

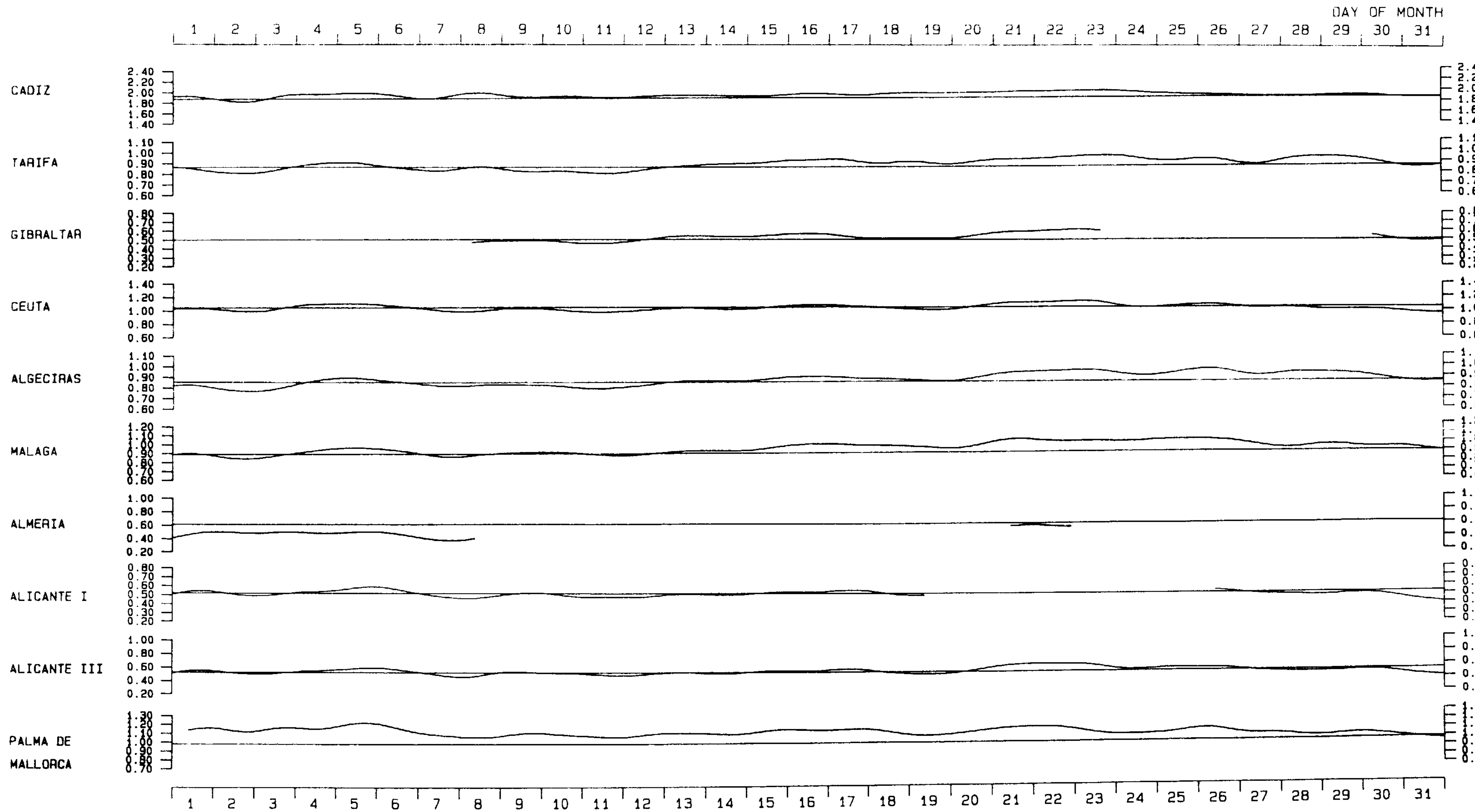
TIME SERIES PLOTS OF FILTERED DATA



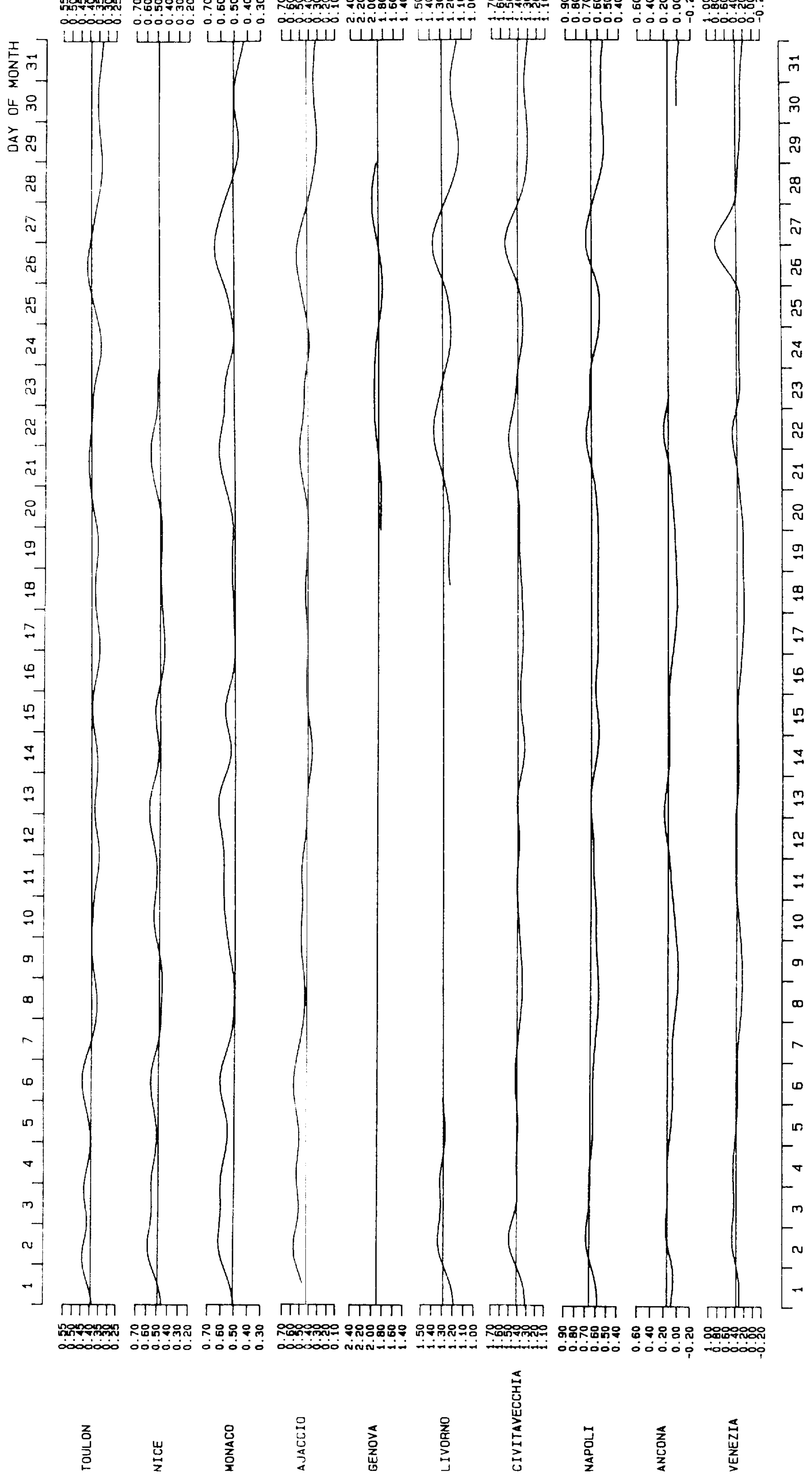
FILTERED DATA (metres) - SEPTEMBER 1981



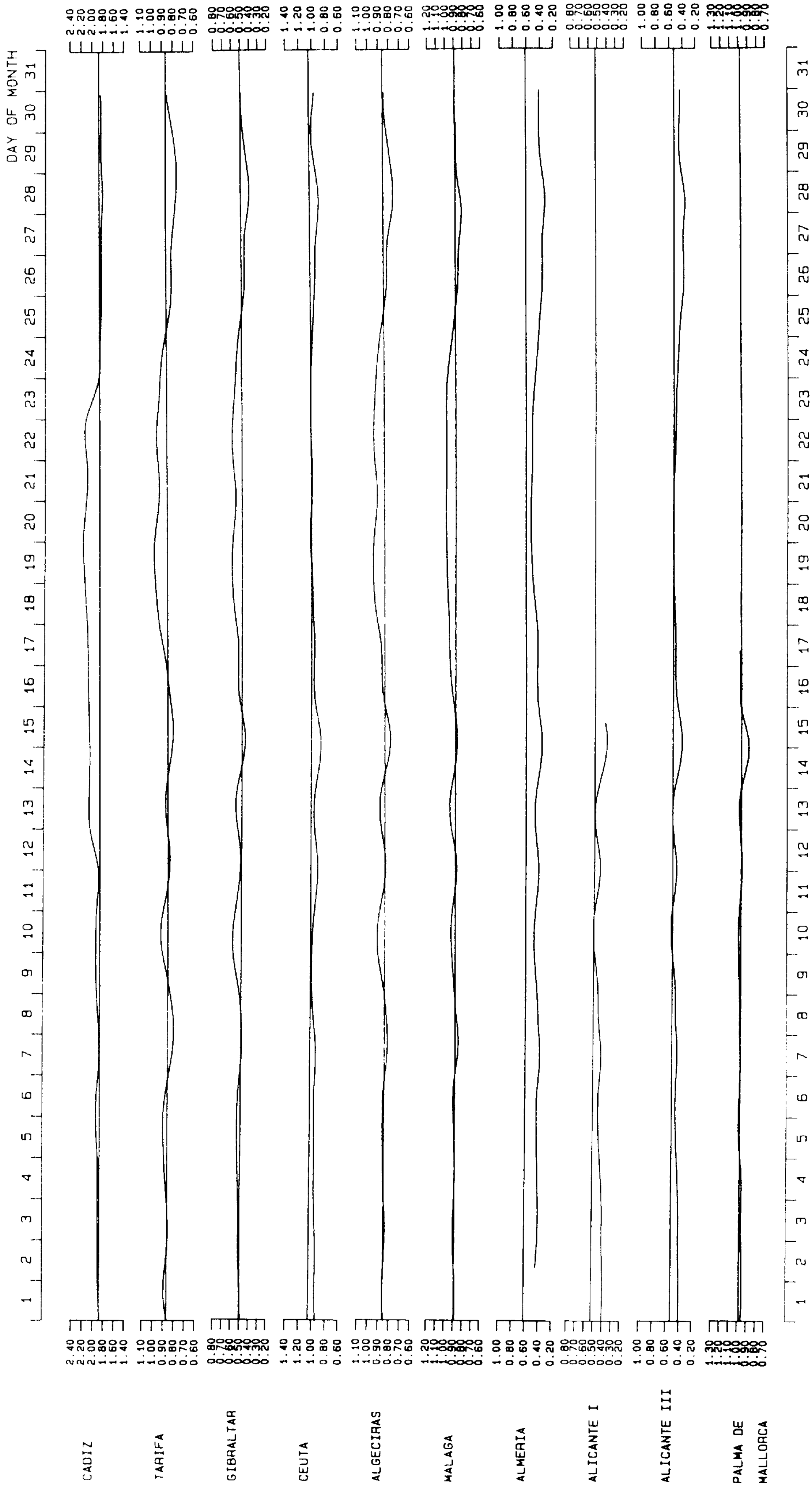
FILTERED DATA (metres) - SEPTEMBER 1981



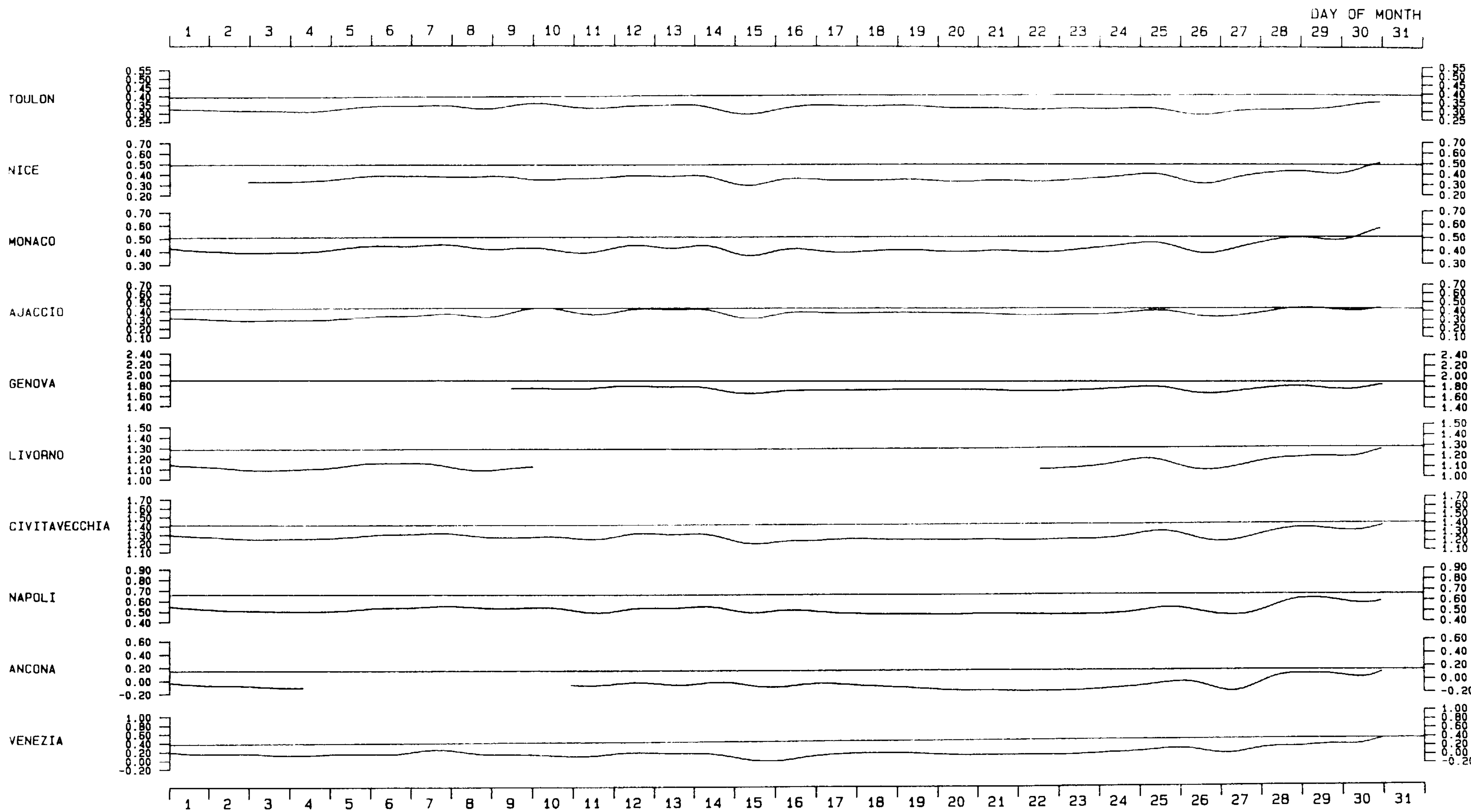
FILTERED DATA (metres) - OCTOBER 1981



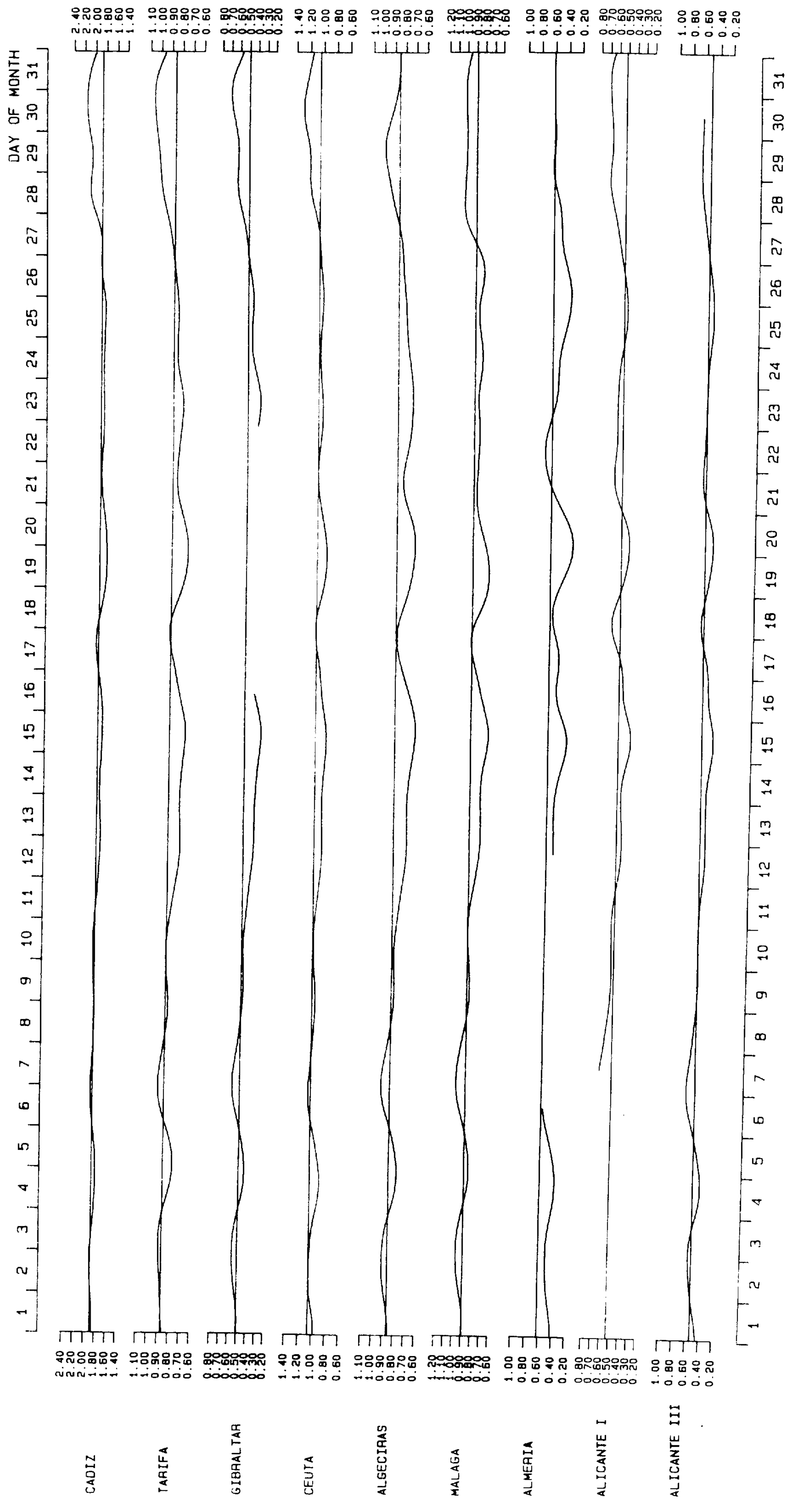
FILTERED DATA (metres) - OCTOBER 1981



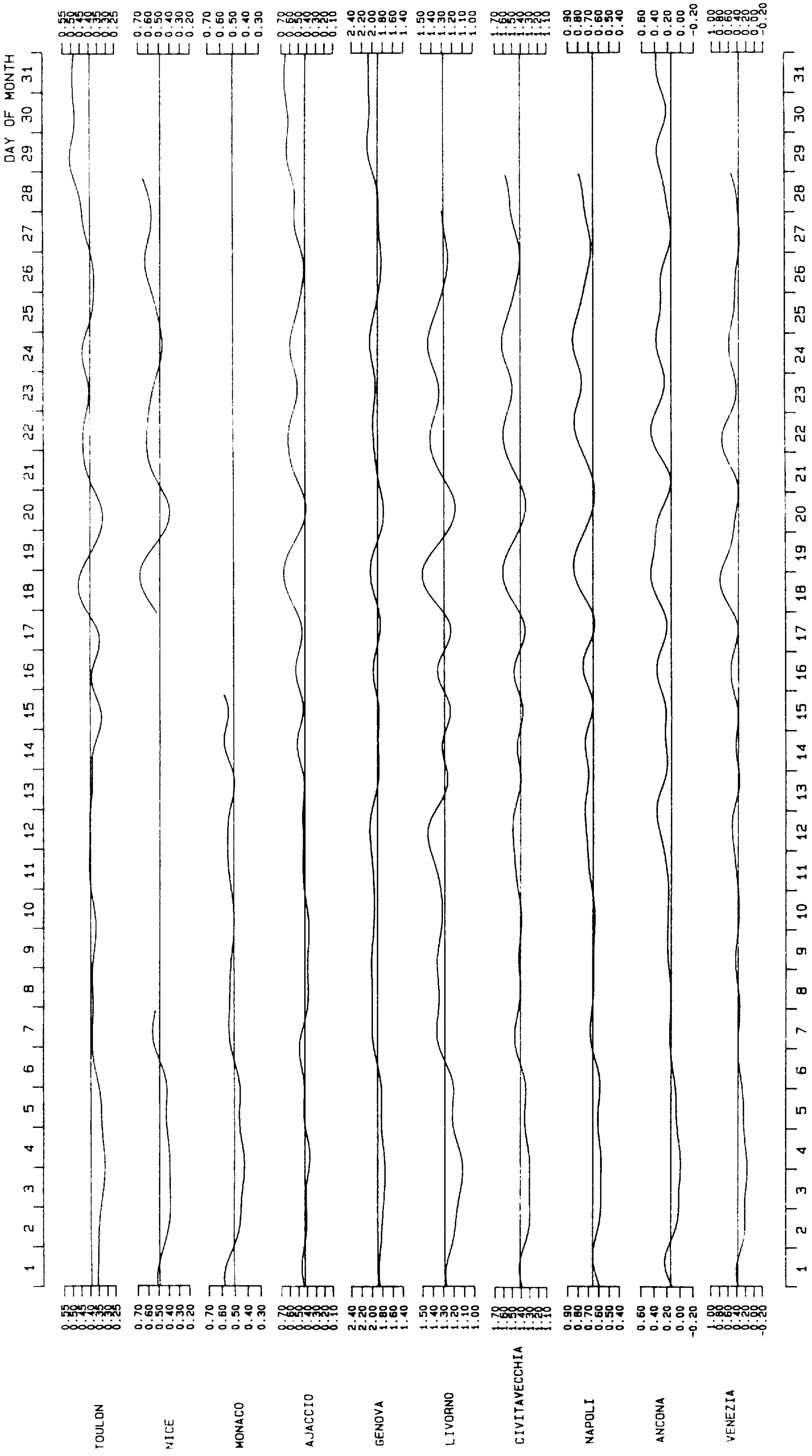
FILTERED DATA (metres) - NOVEMBER 1981



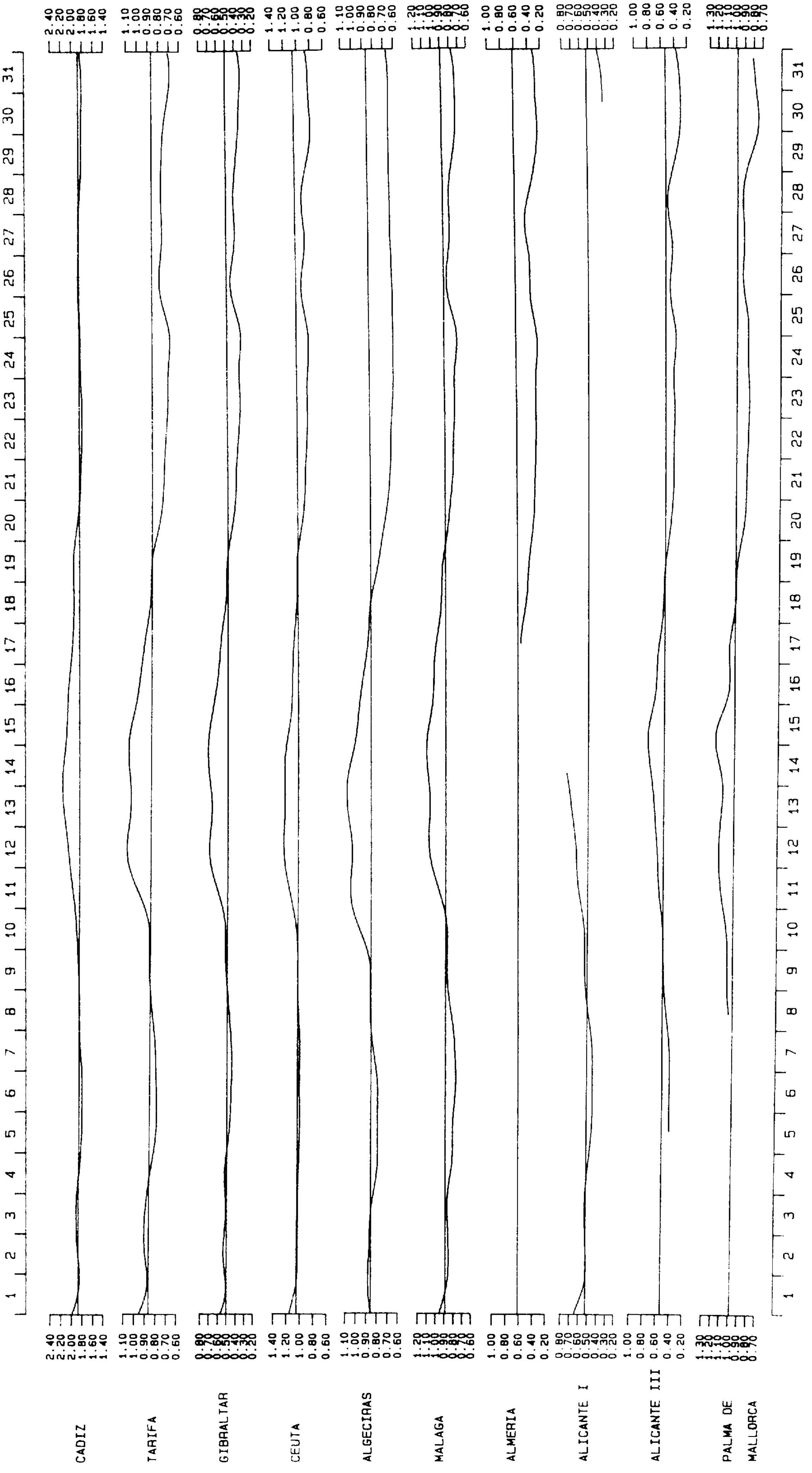
FILTERED DATA (metres) - NOVEMBER 1981



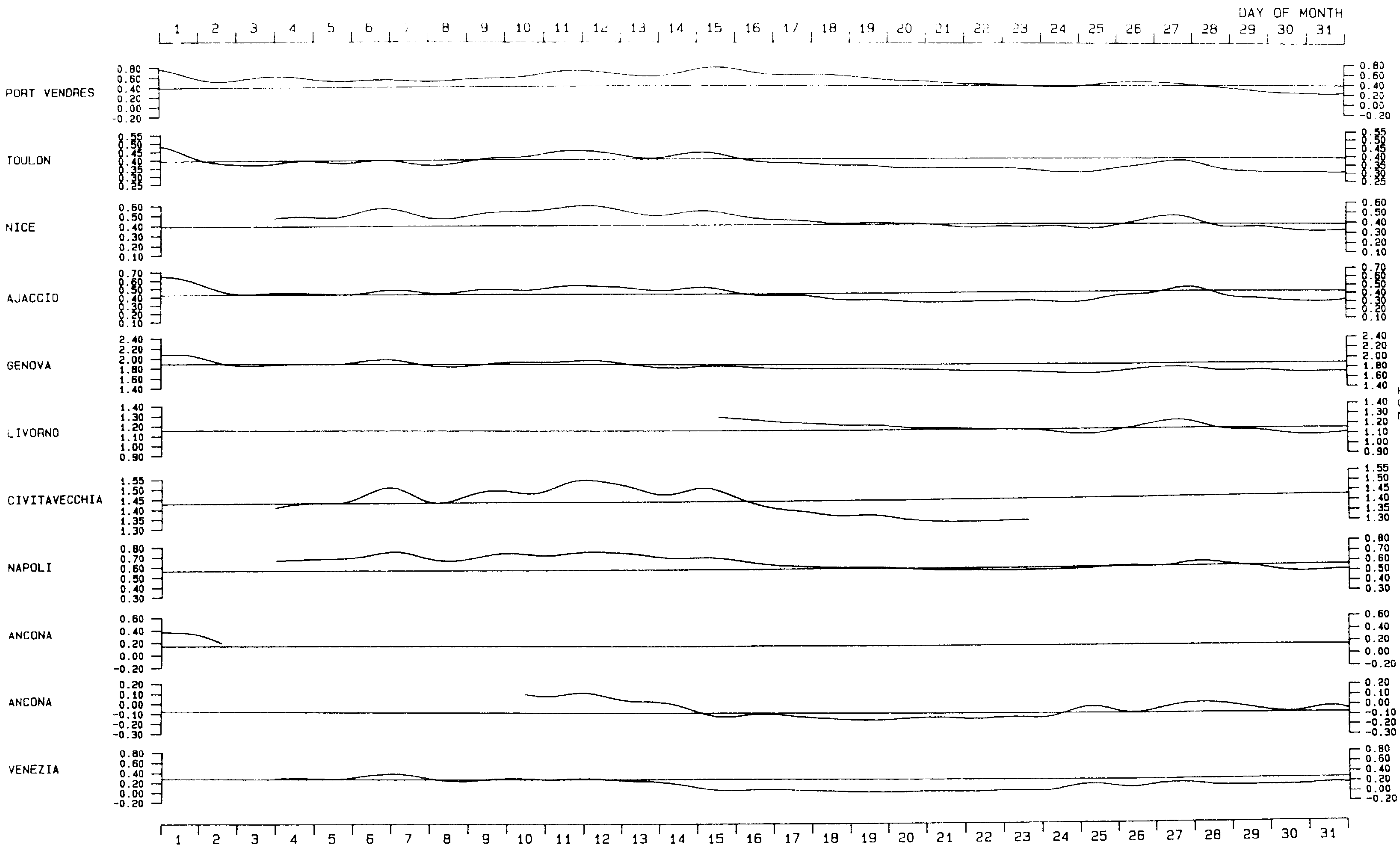
FILTERED DATA (metres) - DECEMBER 1981



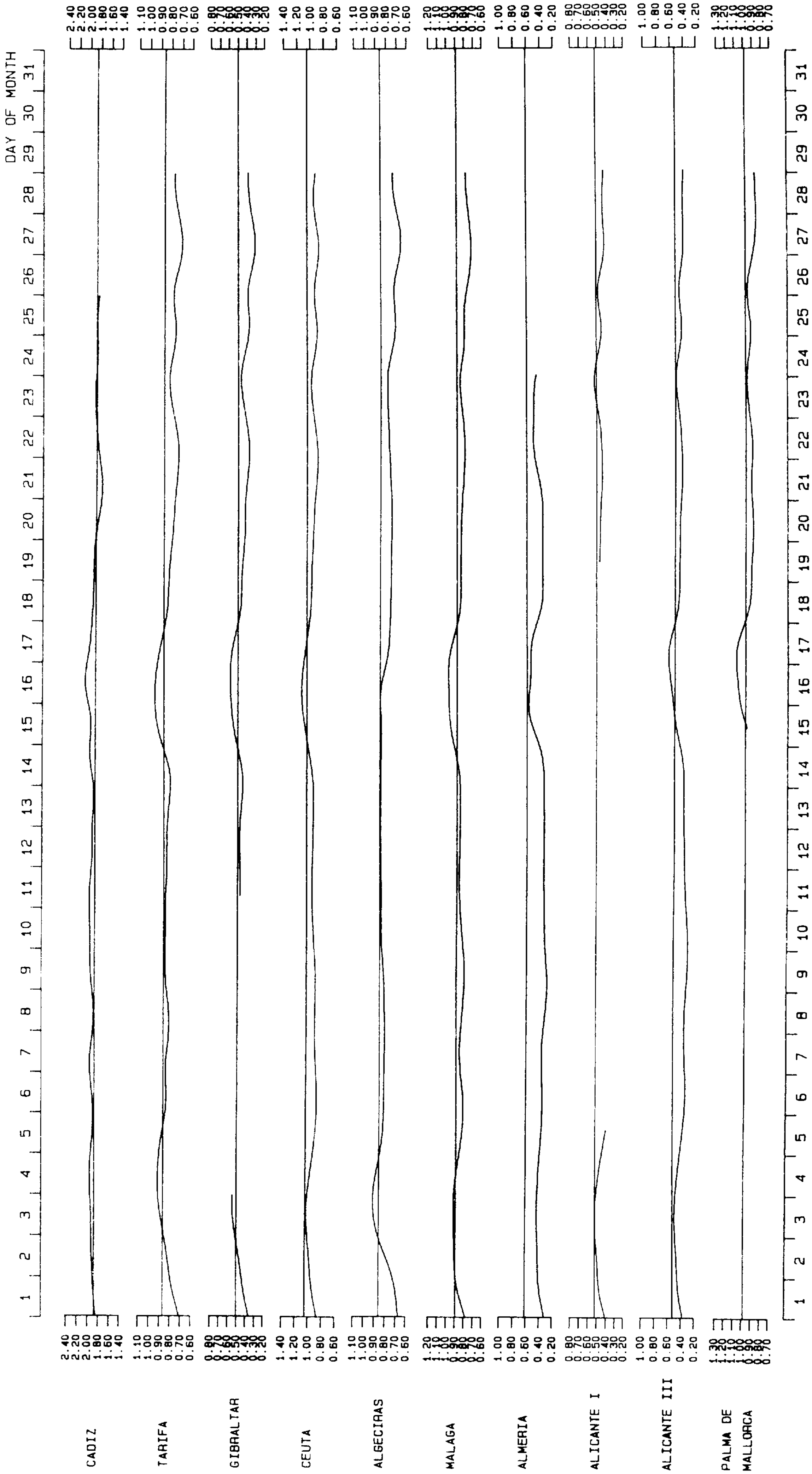
FILTERED DATA (metres) - DECEMBER 1981



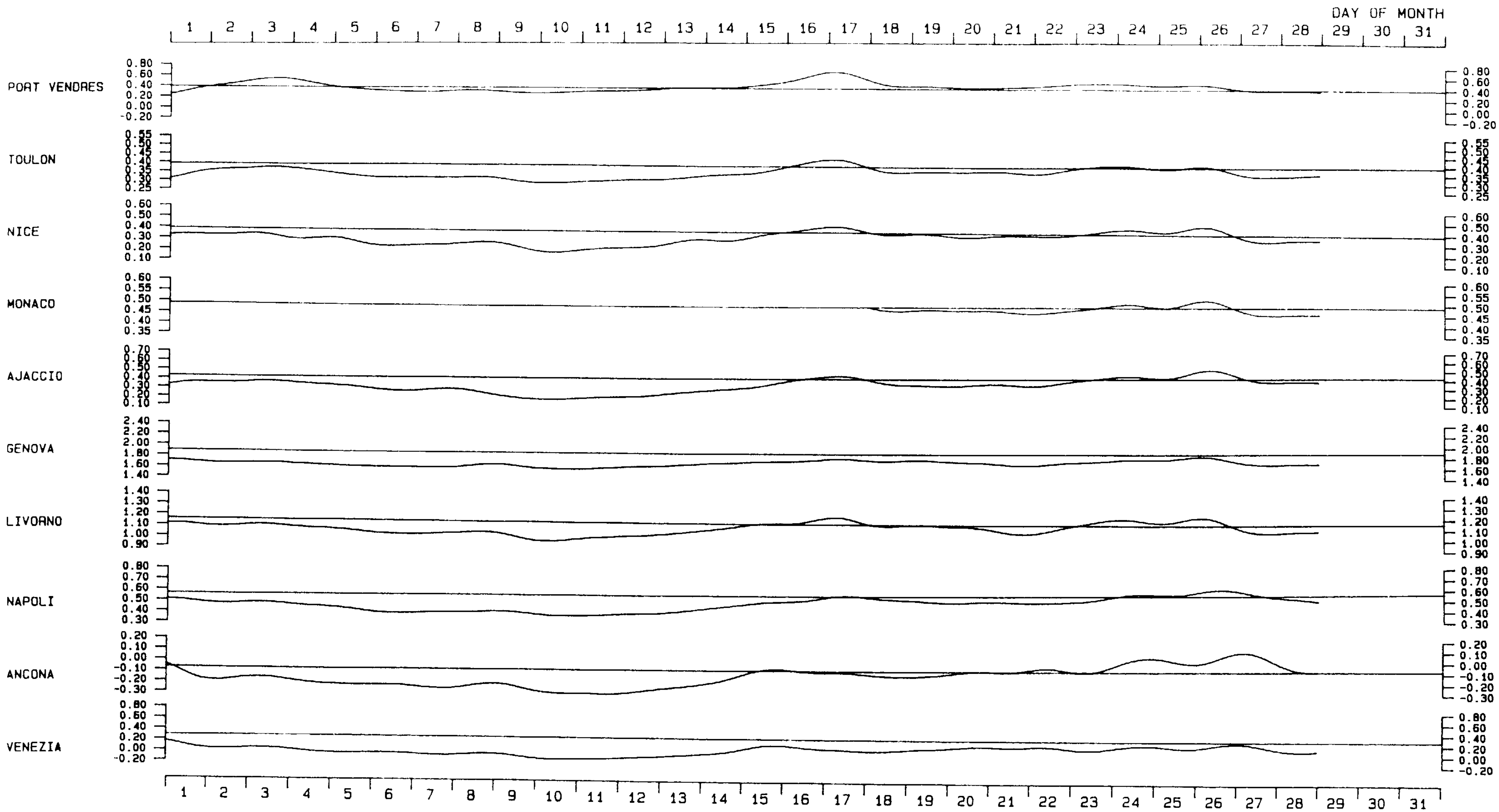
FILTERED DATA (metres) - JANUARY 1982



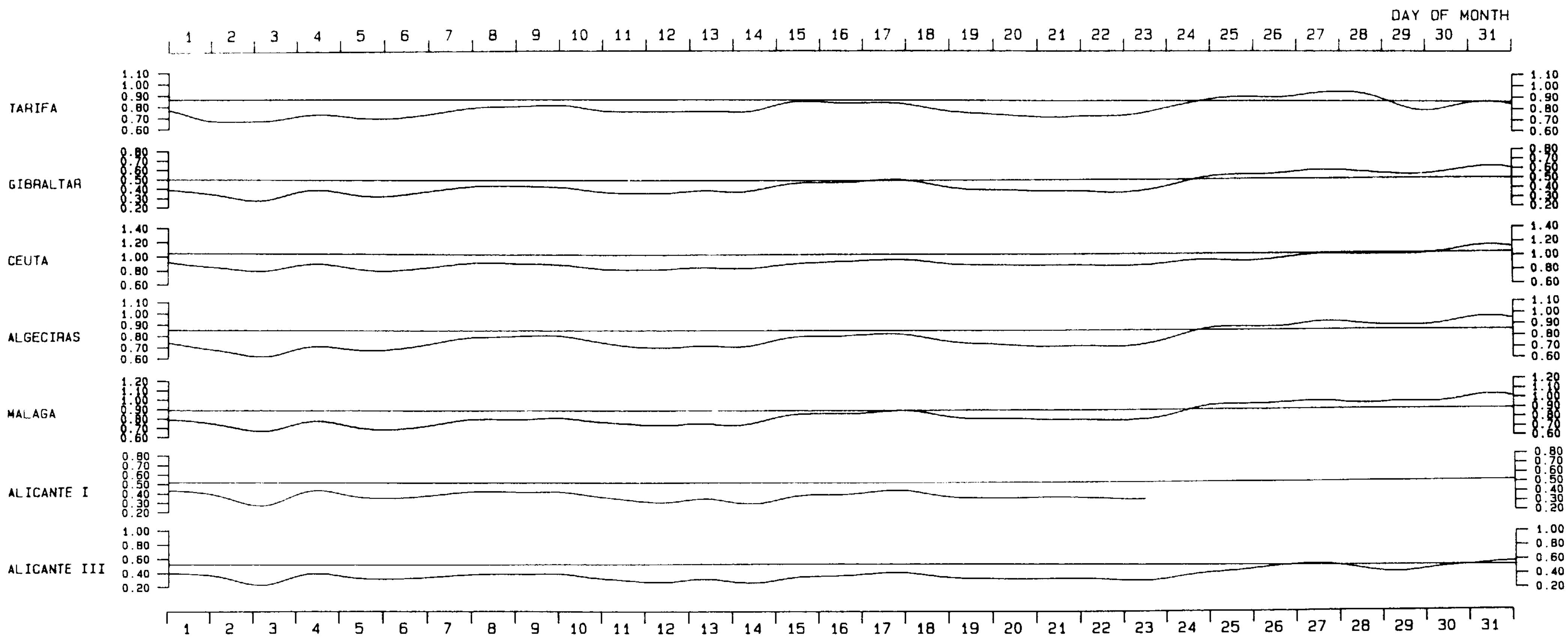
FILTERED DATA (metres) - JANUARY 1982



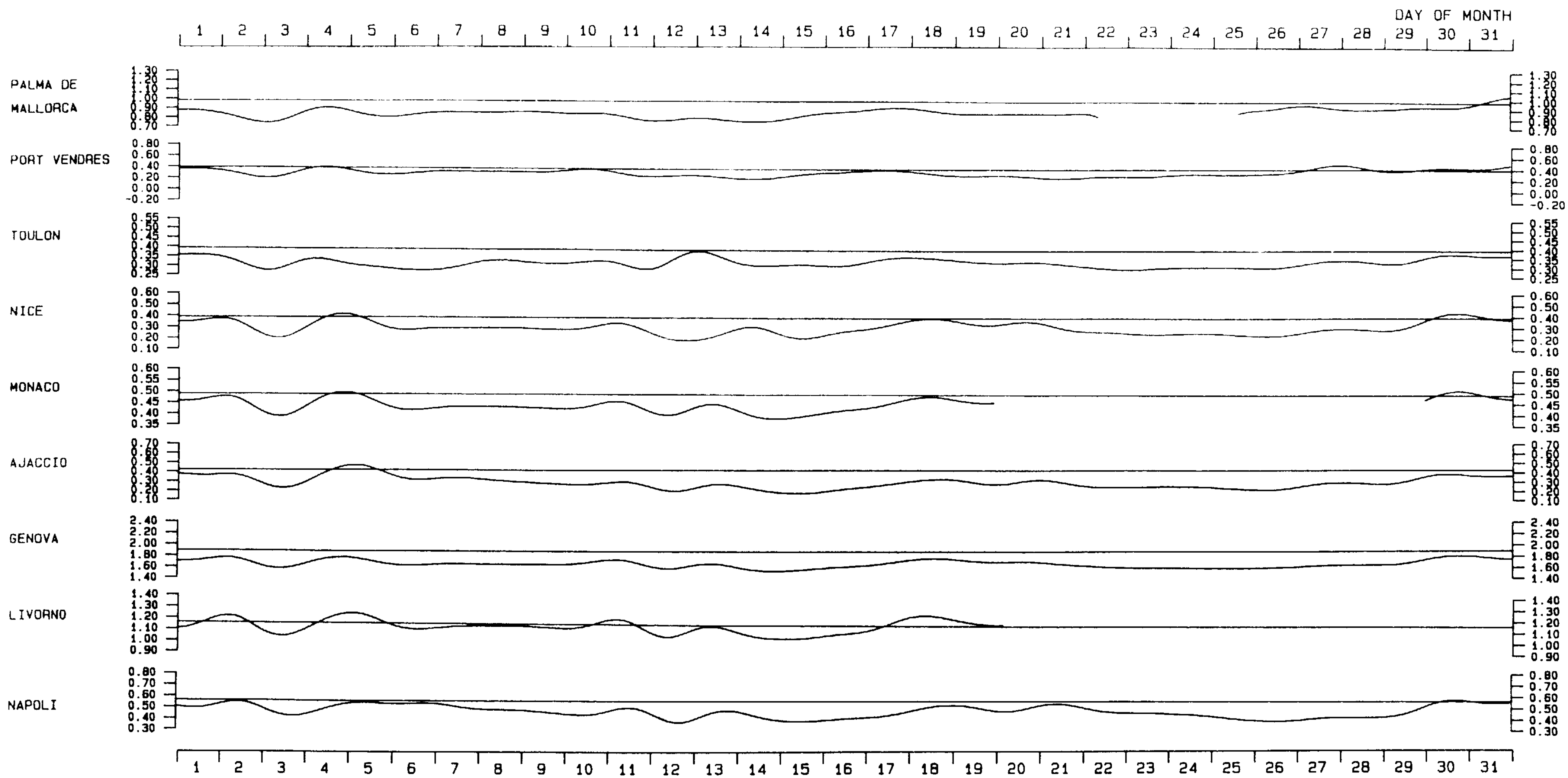
FILTERED DATA (metres) - FEBRUARY 1982



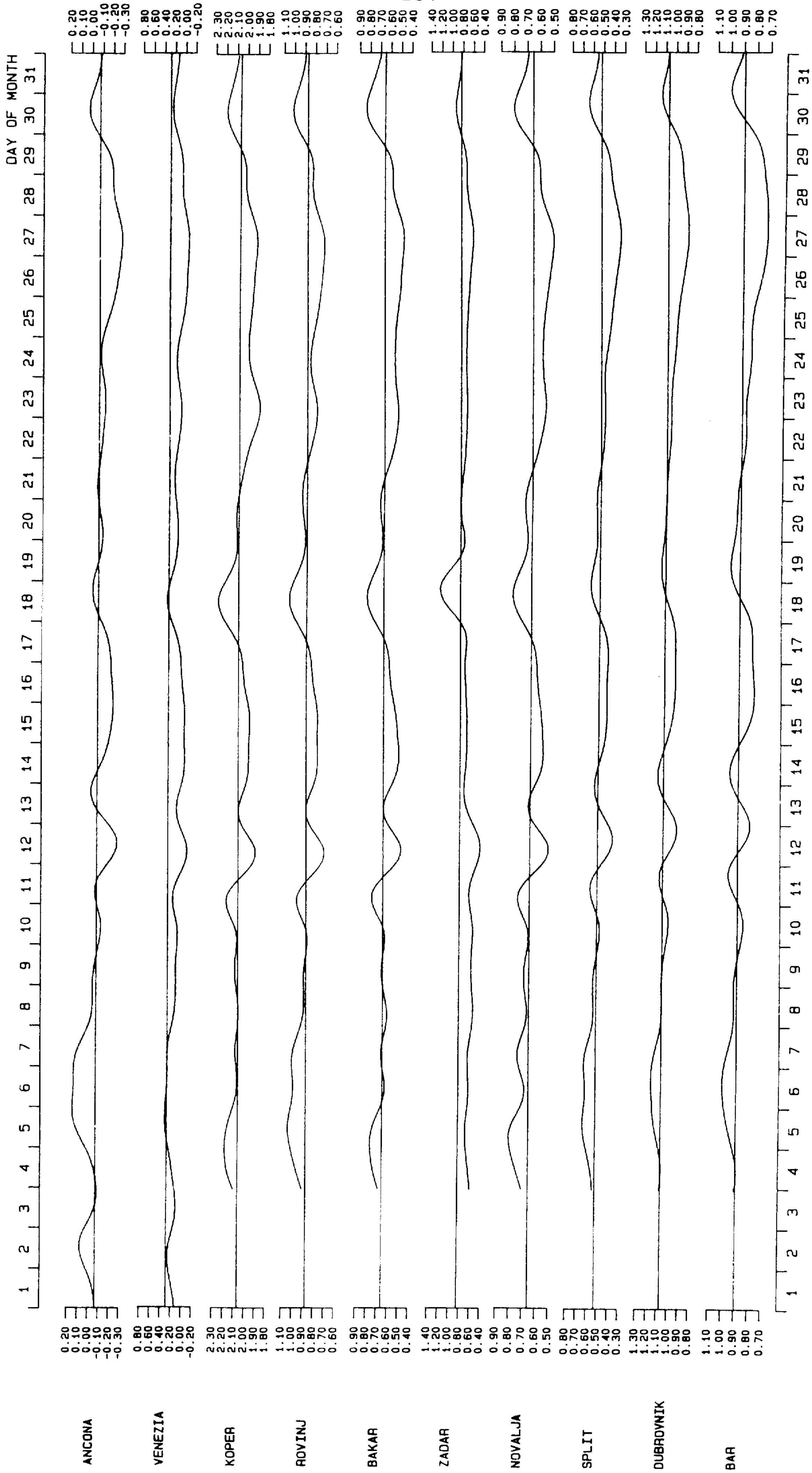
FILTERED DATA (metres) - FEBRUARY 1982



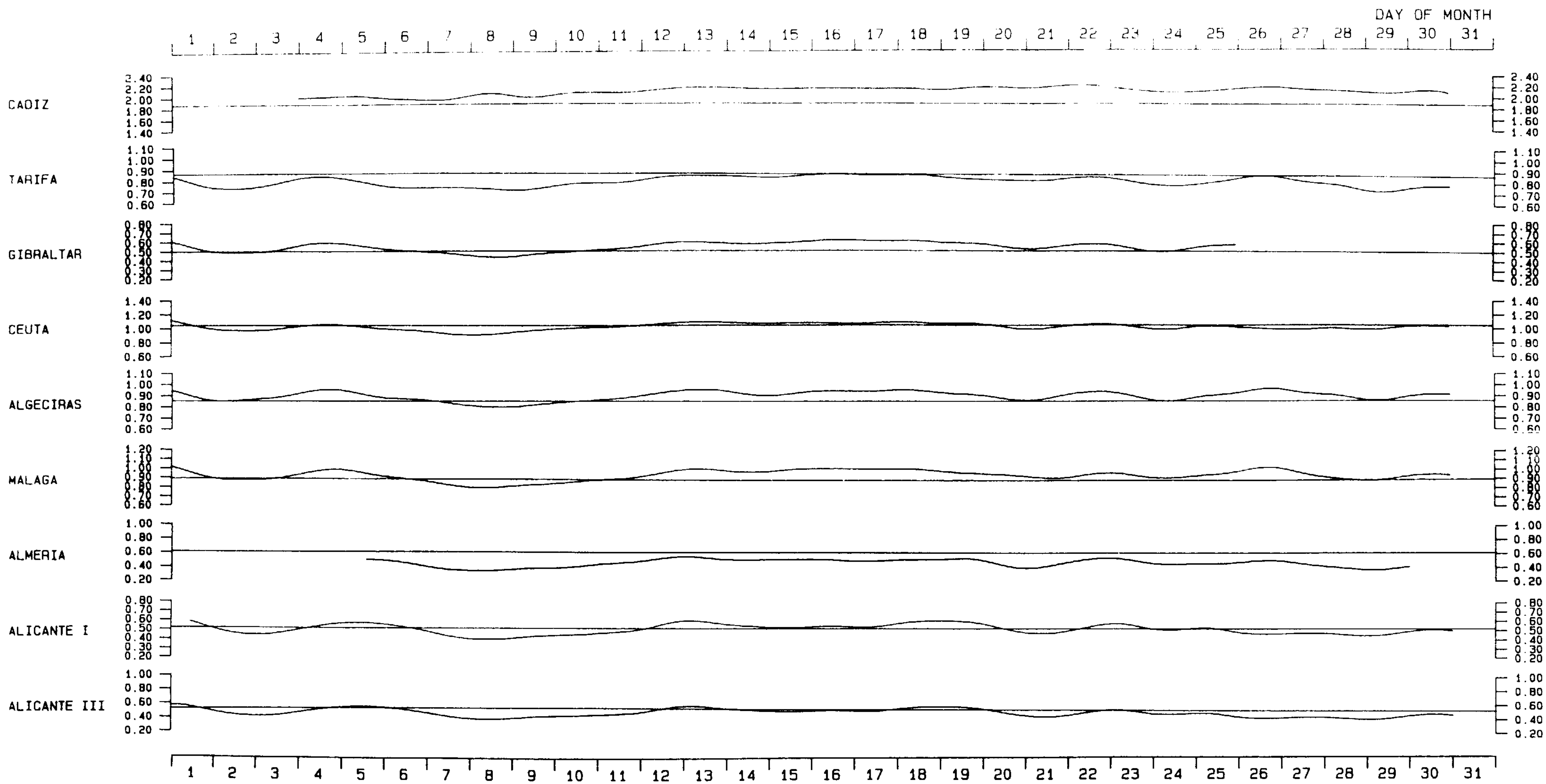
FILTERED DATA (metres) - MARCH 1982



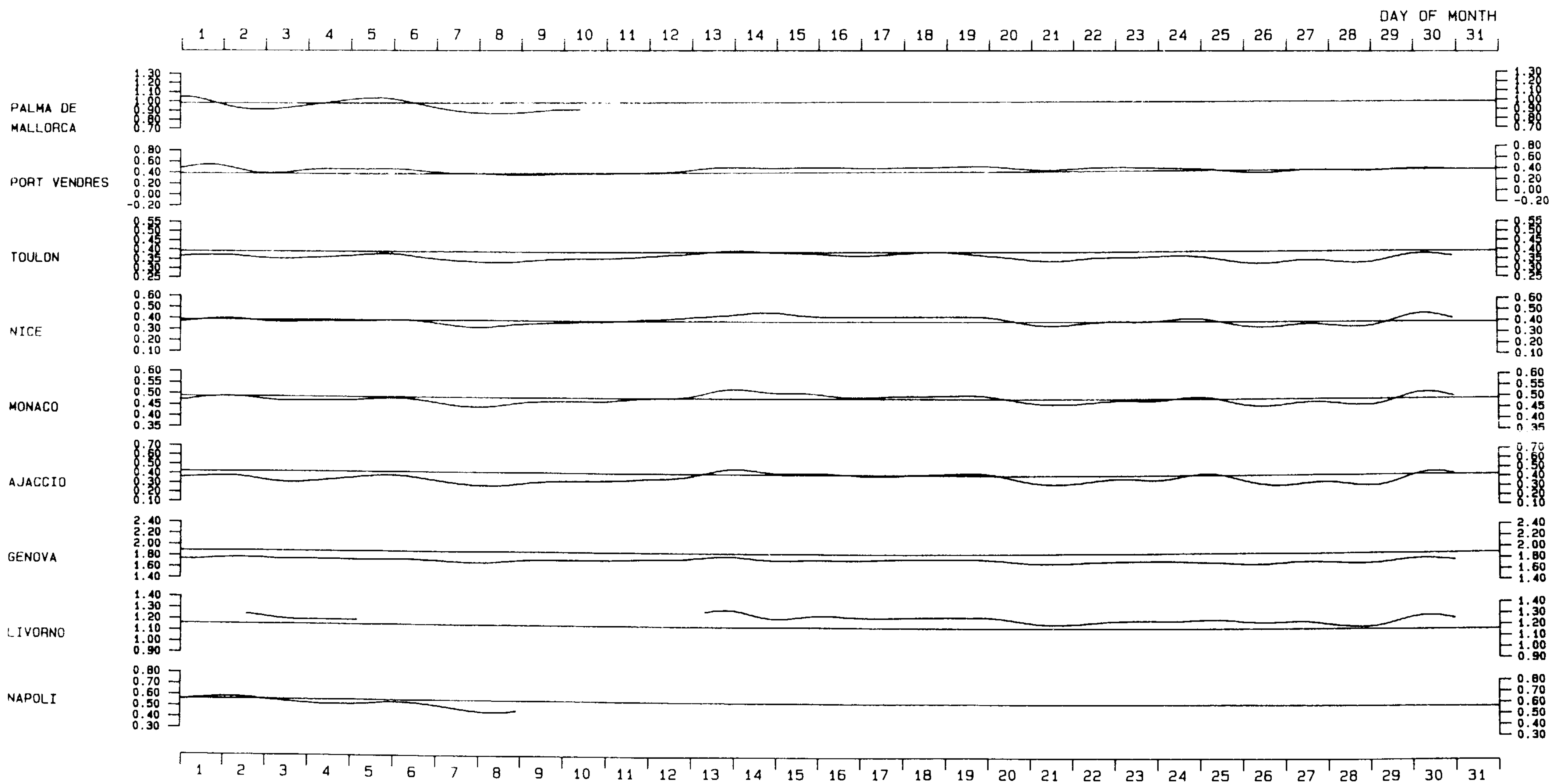
FILTERED DATA (metres) - MARCH 1982



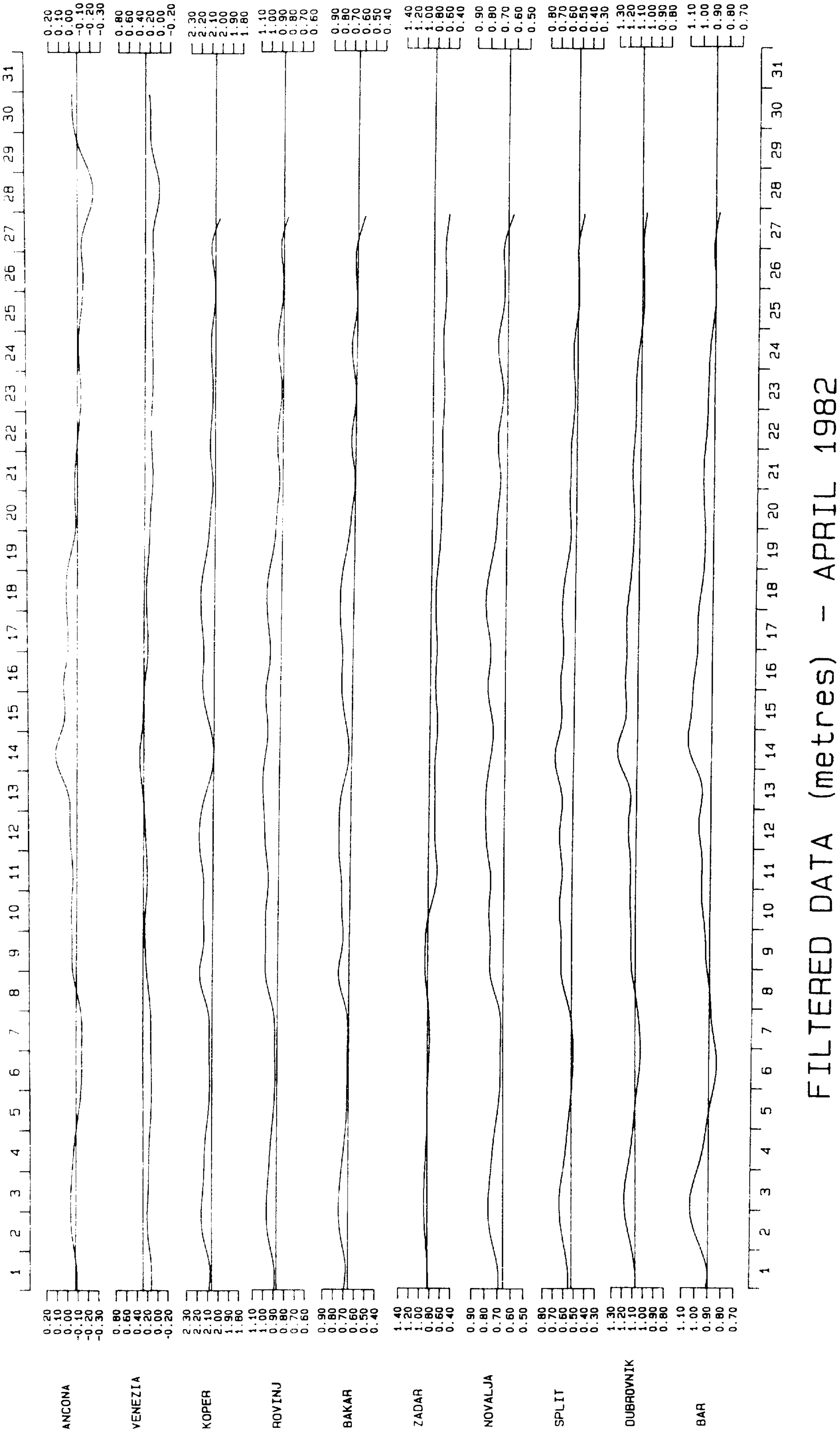
FILTERED DATA (metres) - MARCH 1982

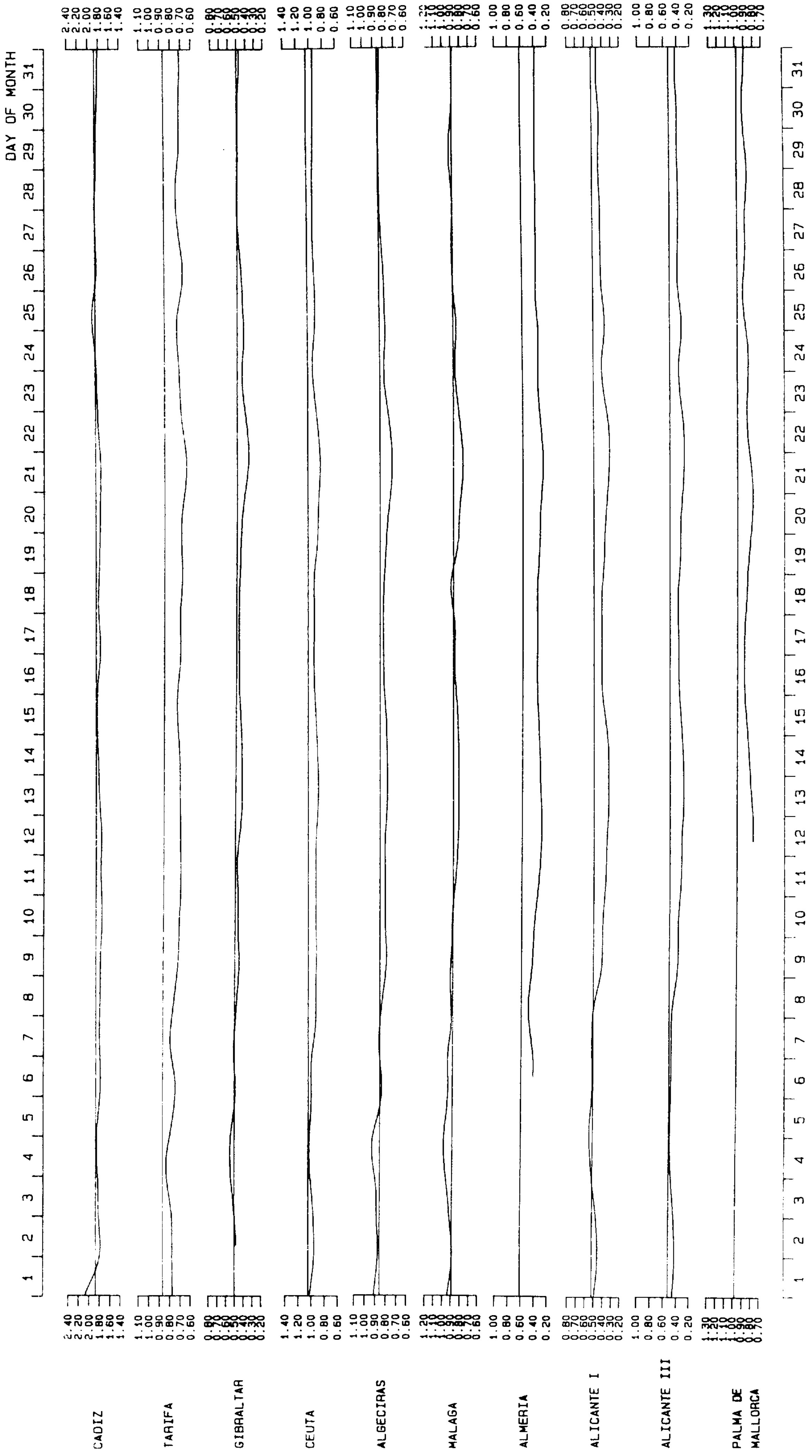


FILTERED DATA (metres) - APRIL 1982

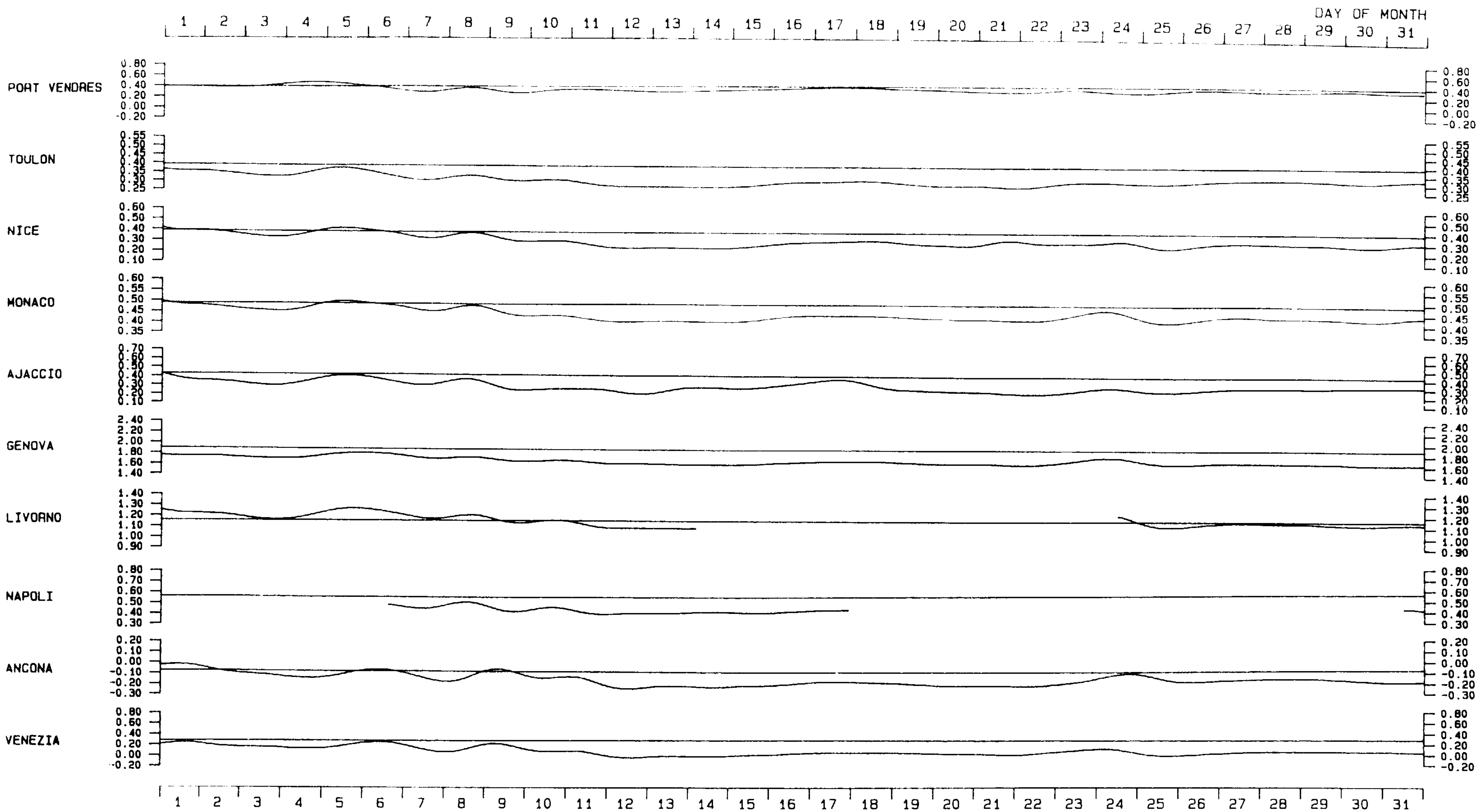


FILTERED DATA (metres) - APRIL 1982

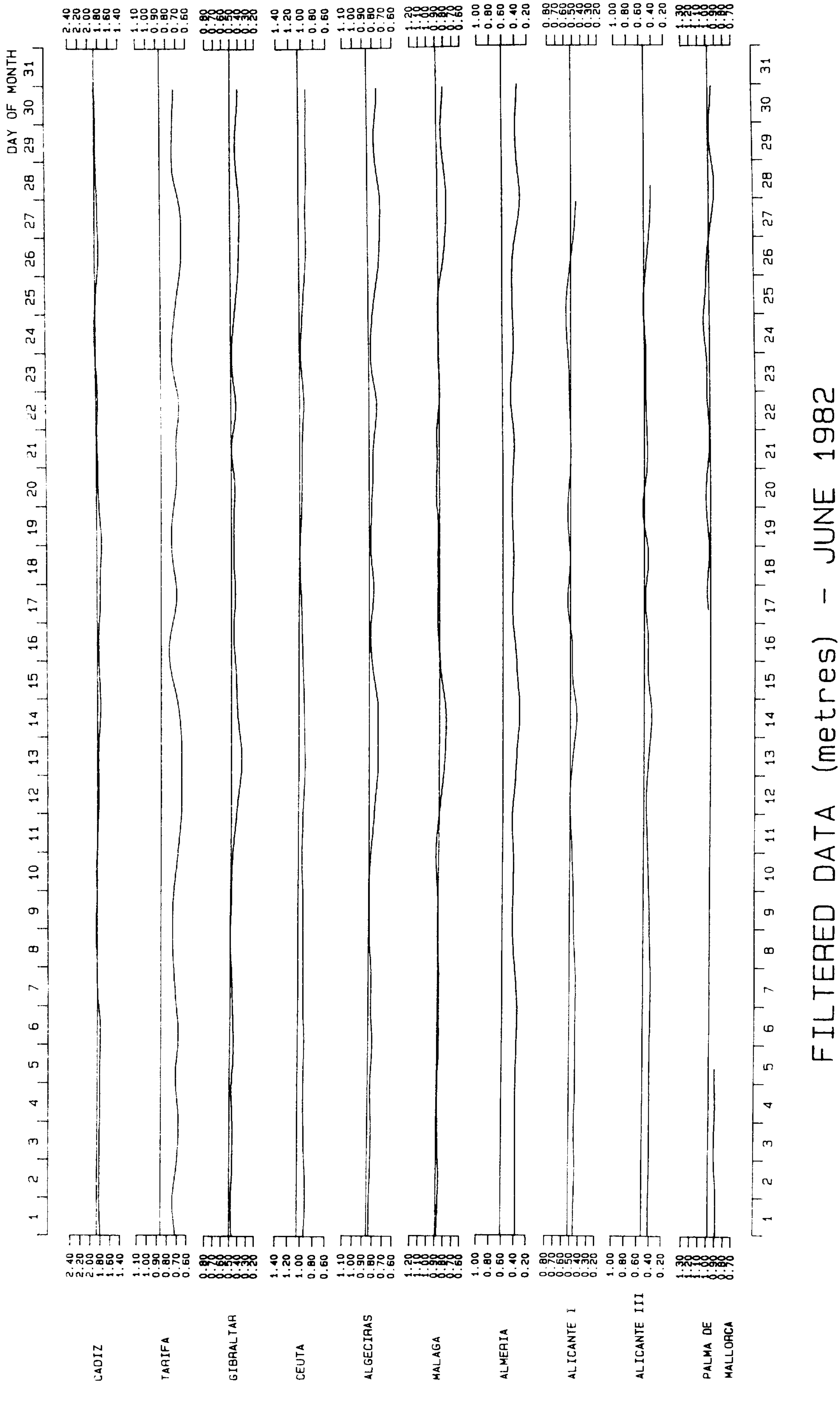

FILTERED DATA (metres) - APRIL 1982
DAY OF MONTH
ANCONA
VENEZIA
KOPER
ROVINJ
BAKAR
ZADAR
NOVALJA
SPLIT
DUBROVNIK
BAR

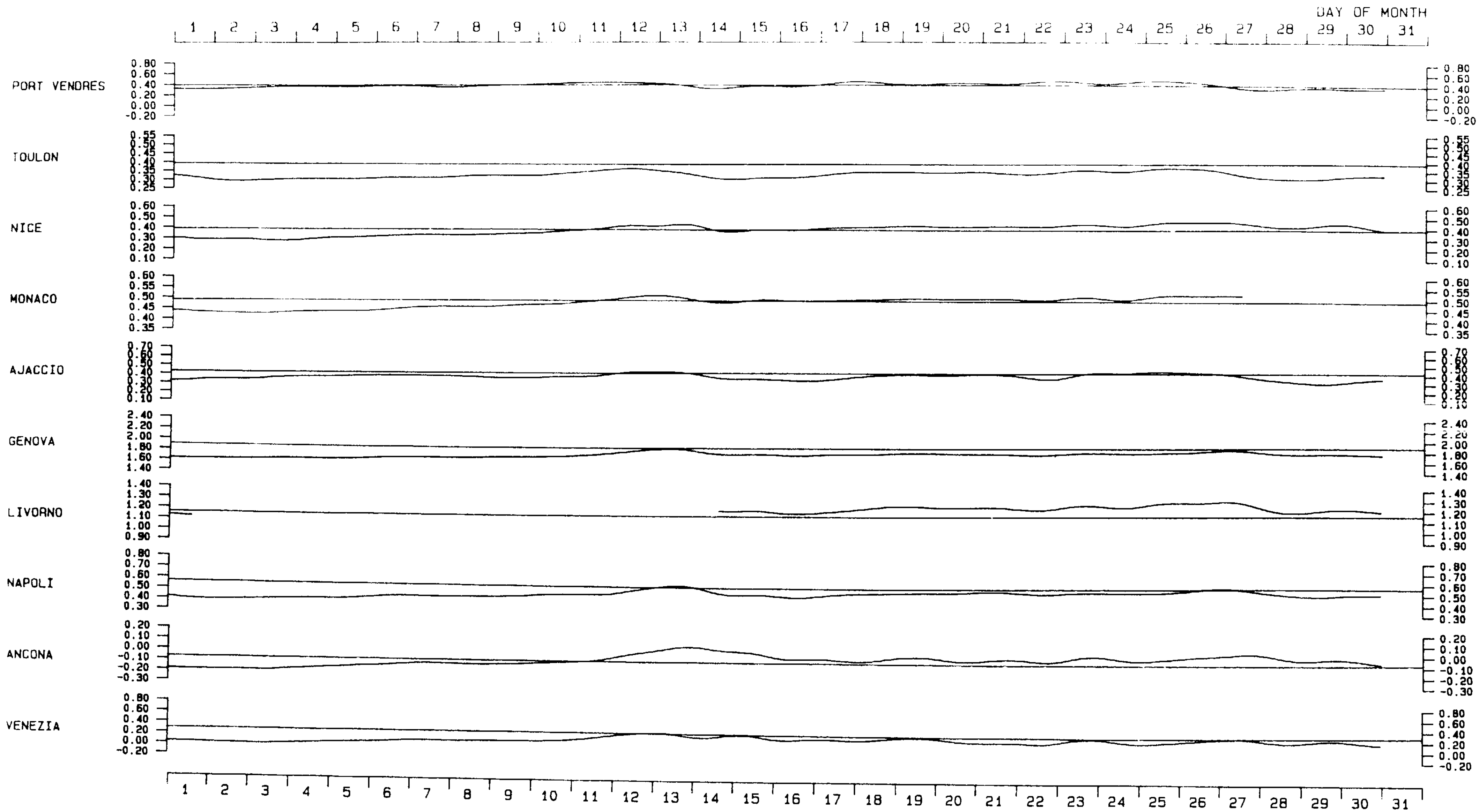


FILTERED DATA (metres) - MAY 1982

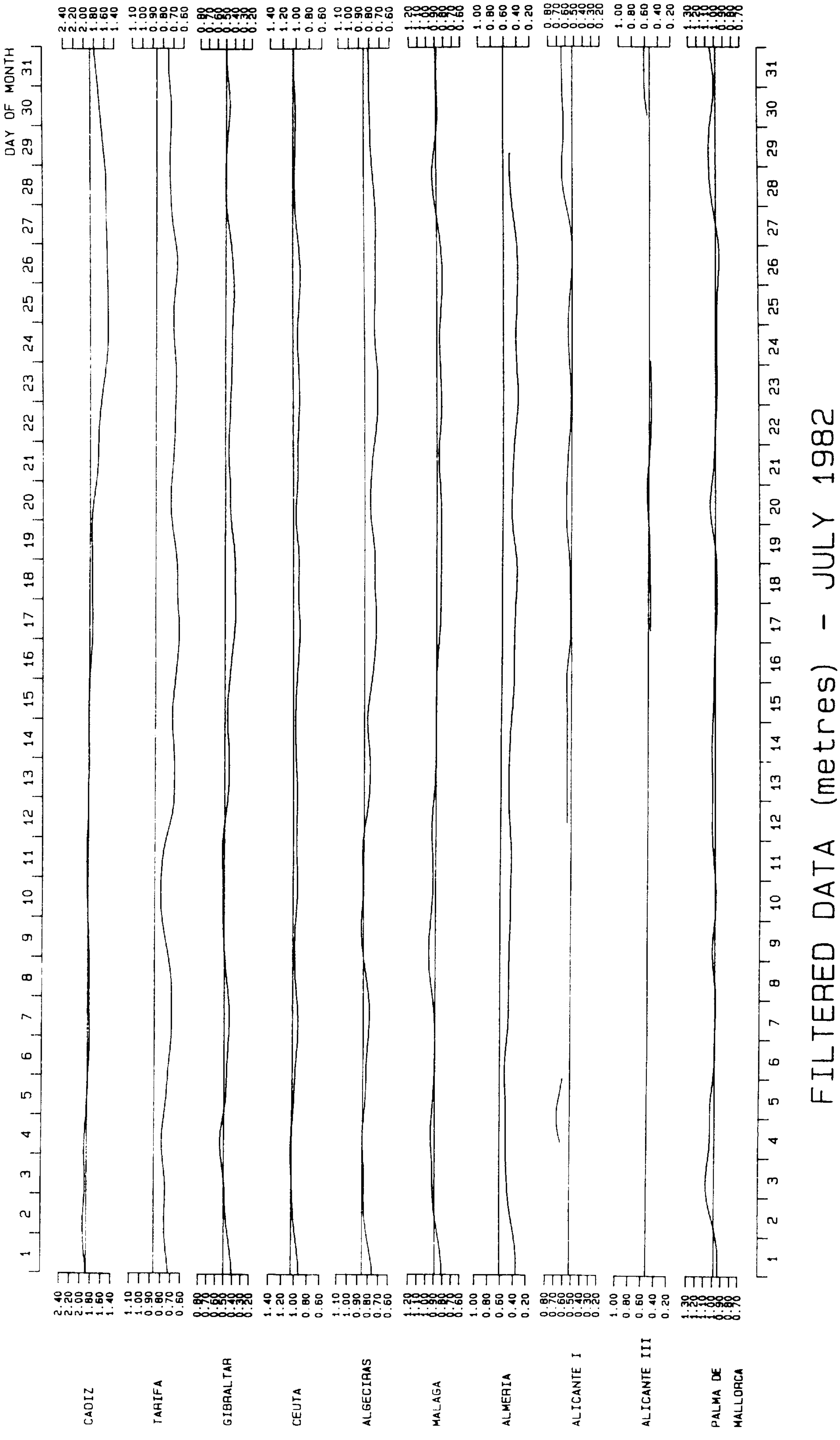


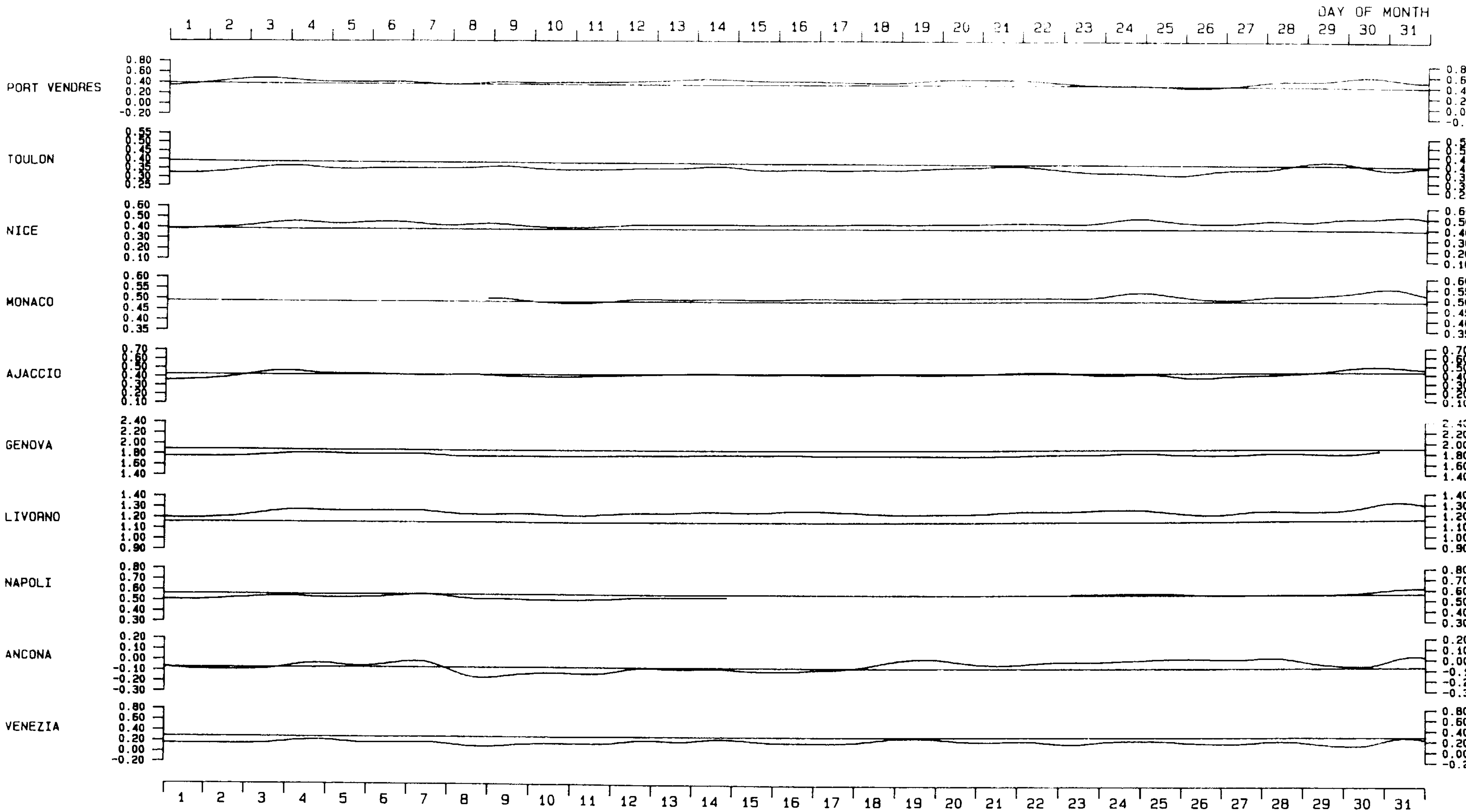
FILTERED DATA (metres) - MAY 1982


FILTERED DATA (metres) - JUNE 1982
DAY OF MONTH
CADIZ
TARIFA
GIBRALTAR
CEUTA
ALGECIRAS
MALAGA
ALMERIA
ALICANTE I
ALICANTE III
PALMA DE MALLORCA

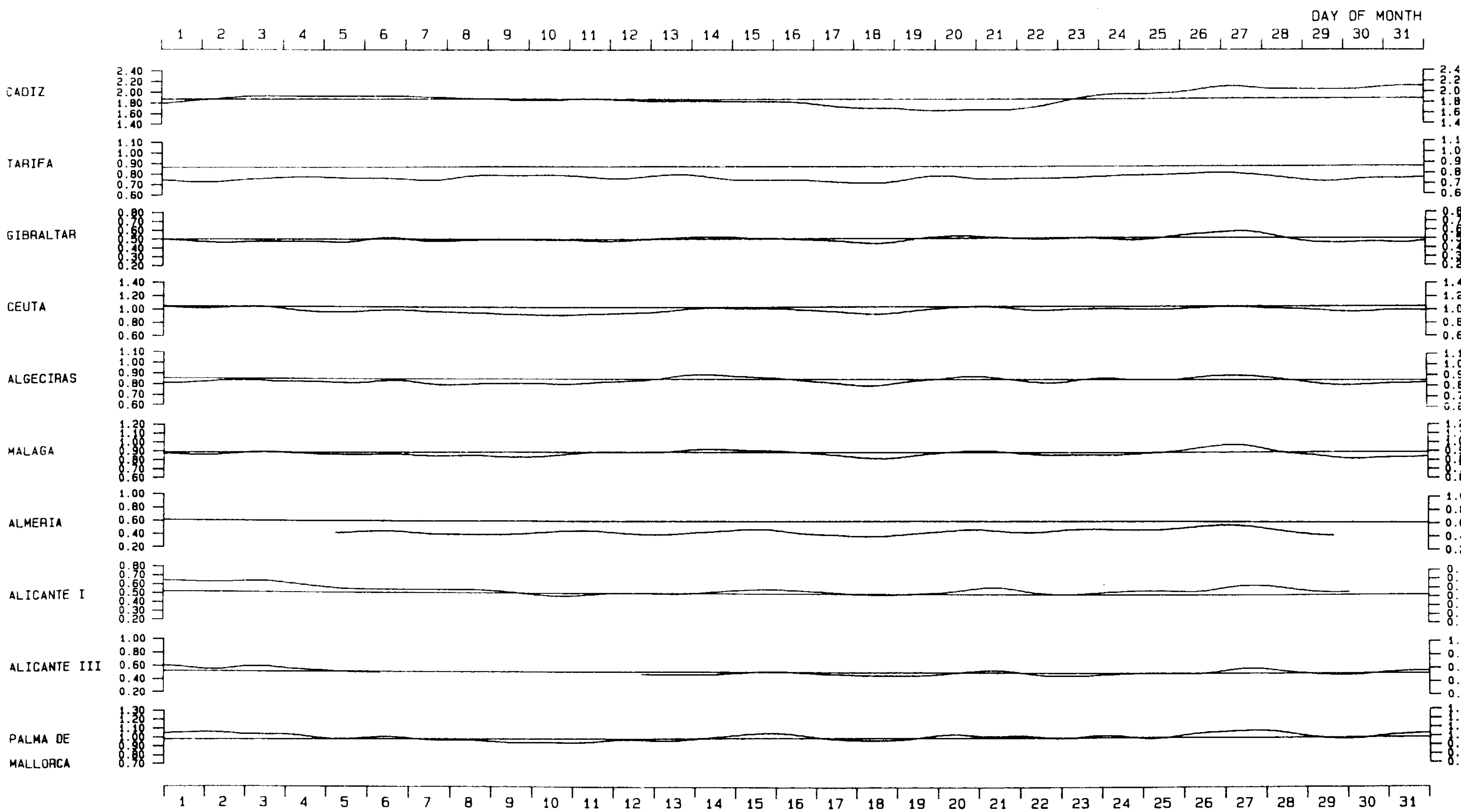


FILTERED DATA (metres) - JUNE 1982

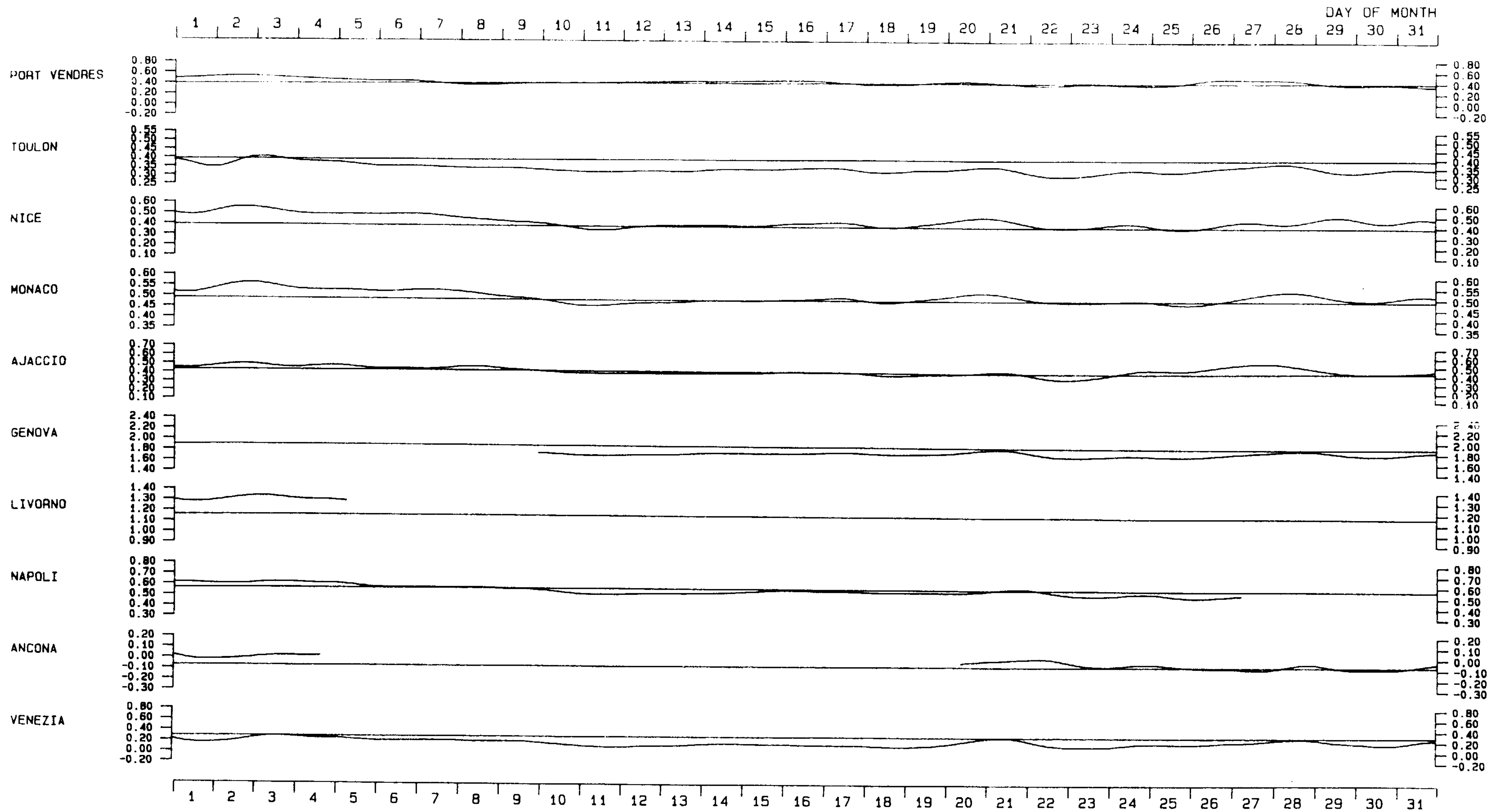

FILTERED DATA (metres) - JULY 1982
DAY OF MONTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
CADIZ
TARIFA
GIBRALTAR
CEUTA
ALGECIRAS
MALAGA
ALMERIA
ALICANTE I
ALICANTE III
PALMA DE MALLORCA



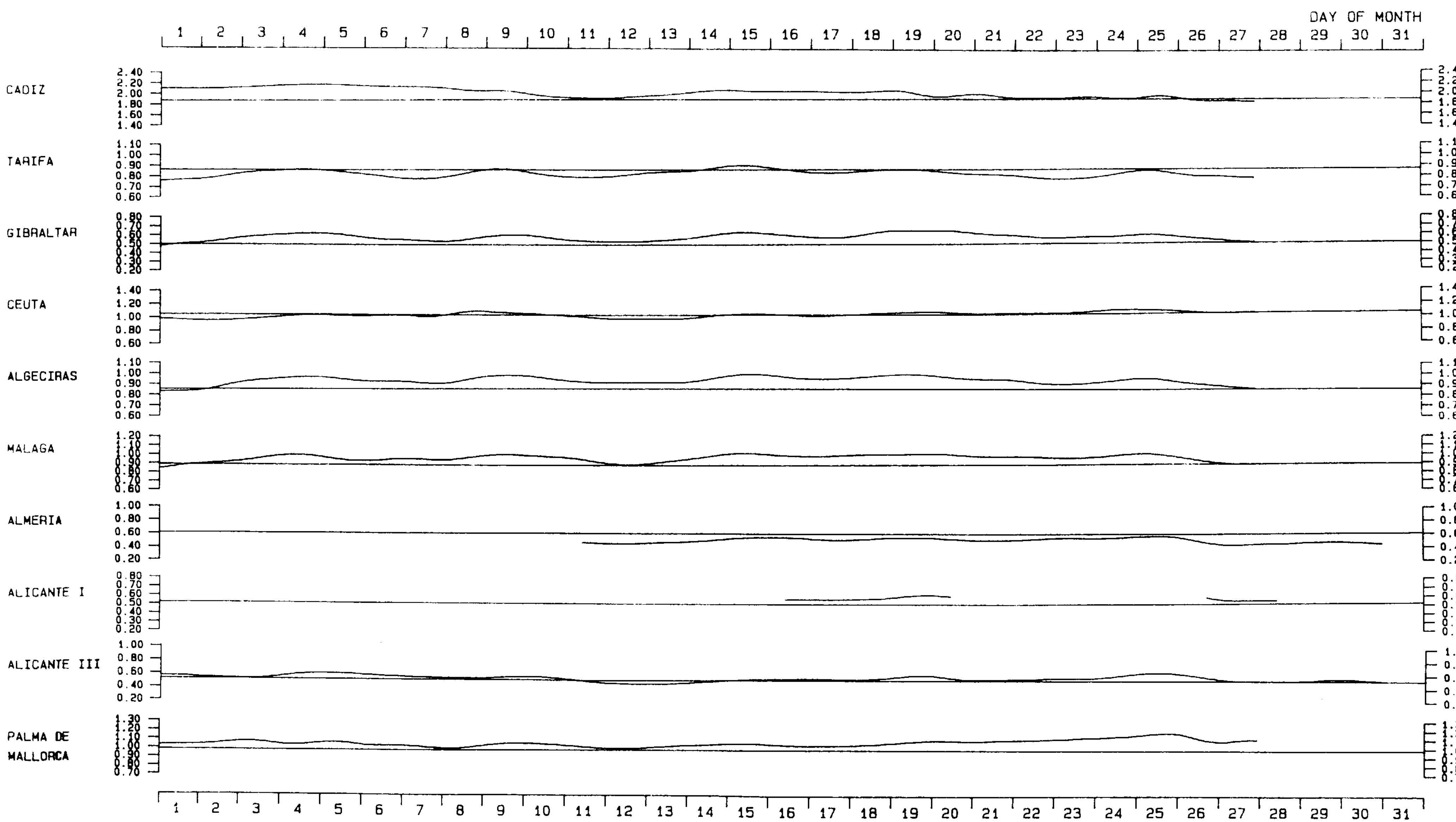
FILTERED DATA (metres) - JULY 1982



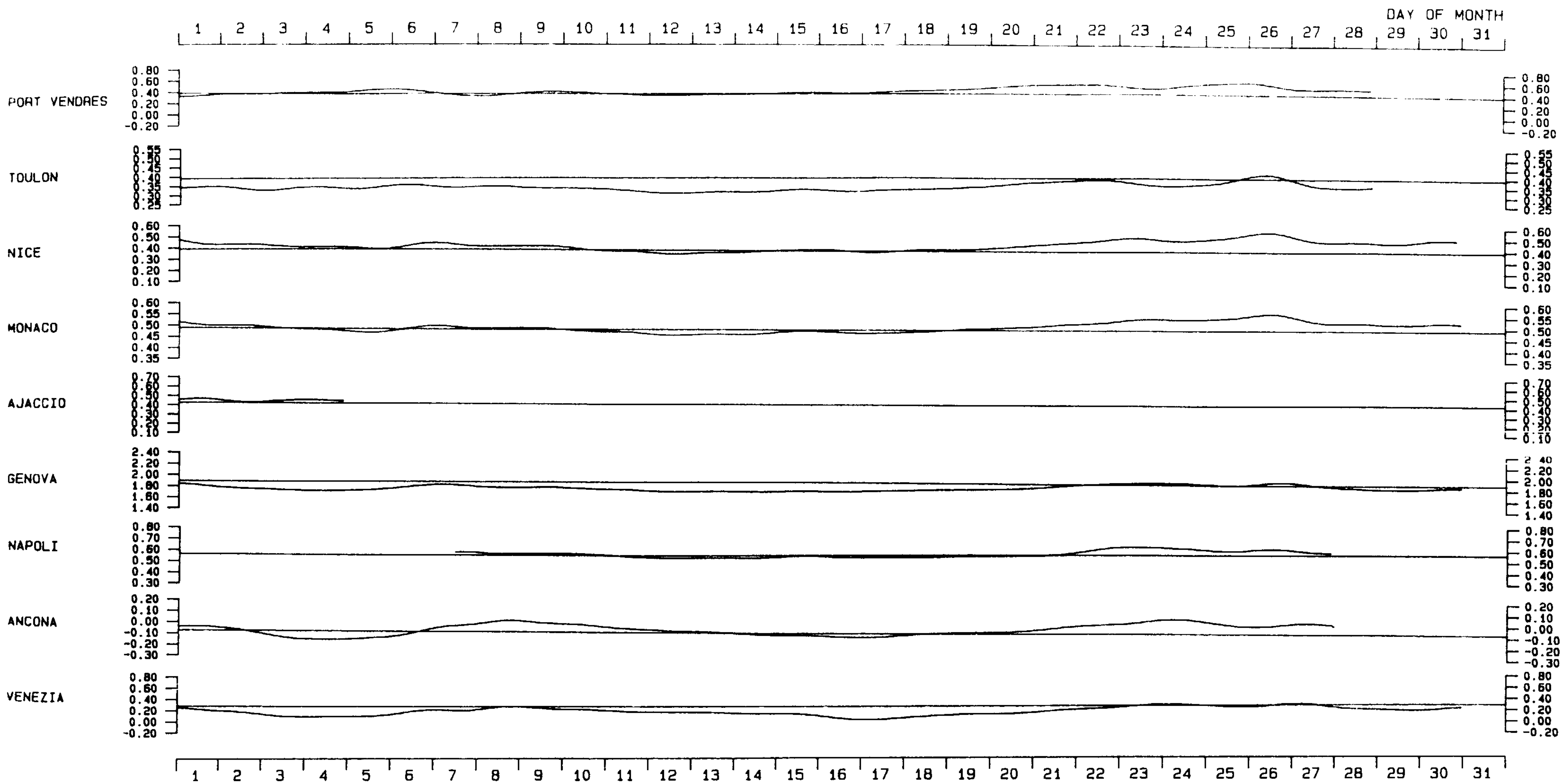
FILTERED DATA (metres) - AUGUST 1982



FILTERED DATA (metres) - AUGUST 1982



FILTERED DATA (metres) - SEPTEMBER 1982



FILTERED DATA (metres) - SEPTEMBER 1982