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corresponding atlas of global corange and cotidal maps is included to provide the reader with a quick general overview of the major tidal phenomena. The specifying hydrodynamical parameters of the model are listed along with quoted sources of empirical tide data, and significant tidal features are explained and discussed. As expected, since the periods of the diurnal tides P_1 (24.07 h) and K_1 (23.93 h) differ by only 0.14 h, these two tides resemble very closely each other (compare Part IV). Significant differences occur only in regions of rapid tidal variations. Of course, P_1 resembles also the diurnal O_1 tide but to a visibly lesser degree (see Part V).

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FOREWORD

In Part I of this report (Schwiderski, 1978a), a combined hydrodynamical-empirical method was introduced to compute numerically harmonic partial tides in the world oceans with an accuracy of better than 5 cm, which is needed in various military and civil applications of today. In this report, the computed diurnal principal solar tide (P_1) is displayed in an atlas of tabulated tidal charts and plotted corange and cotidal maps.

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ABSTRACT

In Part I (Schwiderski, 1978a) of this report, a unique hydrodynamical interpolation technique was introduced, extensively tested, and evaluated in order to compute partial global ocean tides in great detail and with a high degree of accuracy. This novel method has been applied to construct the diurnal principal solar (P_1) ocean tide with a relative accuracy of better than 5 cm anywhere in the open oceans. The resulting tidal amplitudes and phases are tabulated on a $1^\circ \times 1^\circ$ grid system in an atlas of $42^\circ \times 71^\circ$ overlapping charts covering the whole oceanic globe. A corresponding atlas of global corange and cotidal maps is included to provide the reader with a quick general overview of the major tidal phenomena. The specifying hydrodynamical parameters of the model are listed along with quoted sources of empirical tide data, and significant tidal features are explained and discussed. As expected, since the periods of the diurnal tides P_1 (24.07 h) and K_1 (23.93 h) differ by only 0.14 h, these two tides resemble very closely each other (compare Part IV). Significant differences occur only in regions of rapid tidal variations. Of course, P_1 resembles also the diurnal O_1 tide but to a visibly lesser degree (see Part V).

1. INTRODUCTION

Part 1 of this report (Schwiderski, 1978a) introduced a unique combination of hydrodynamical and empirical methods to model detailed ocean tides with a relative component accuracy of better than 5 cm anywhere in the open oceans. This enormous accuracy is well above minimum requirements set by, for instance, the National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD) -- to map the geoid at sea by satellite altimetry to within 10 cm. The following features of this unique hydrodynamical interpolation model made the achievement of this accuracy possible.

a. A spherically graded $1^\circ \times 1^\circ$ grid system is set up in connection with a corresponding $1^\circ \times 1^\circ$ bathymetry to assure a sufficient resolution of all important tidal phenomena.

b. The bathymetry of the gridwise, simply connected ocean basin is hydrodynamically defined (Schwiderski, 1978c) by appropriate modifications of earlier realistic depth data collections. The hydrodynamical redefinition was needed in order to model the well-known strong distortion and retardation effects of shallow continental shelves, narrow ocean ridges or island chains, and other significant bottom irregularities.

c. The Boussinesq substitution of the turbulent Reynolds stresses is applied in the form of eddy dissipation with a novel physically meaningful eddy viscosity that depends linearly on the lateral grid-cell area and, hence, directly on the ocean depth.

d. The linear law of bottom friction is introduced with a bottom-friction coefficient depending linearly on the bottom grid-cell area which is independent of the ocean depth. In boundary cells, the otherwise constant friction coefficient is subjected to an indirect cellwise adjustment in order to permit a consistent hydrodynamical interpolation (see h., below) of empirical tide data known from tide gauge stations at continental shores, islands, or other shallow-ocean bottom irregularities.

e. The effects of the terrestrial tide and the oceanic tidal load are included as simple second-order approximations in the sense of Love and Accad and Pekeris (1978).

f. The Hansen-Zahel (Zahel, 1970 and 1977; Estes, 1977) finite differencing technique is modified by a new differencing scheme in time which improved decay, dispersion, and stability characteristics of the numerical procedure and facilitates the simple indirect adjustment of the bottom-friction coefficient in the hydrodynamical interpolation technique (see d. and h.).

g. At land-ocean cell walls, the conditions of no-flow across and free-slip along the boundaries are enforced. The no-flow condition is subsequently relaxed by allowing controlled periodic inflows and outflows over the mathematically assumed boundaries. This allowance redefines indirectly more realistic shorelines in order to further improve the consistency of the hydrodynamical interpolation of empirical data (see d. and h.).

h. A unique hydrodynamical interpolation technique is introduced which incorporates into the theoretical model empirical tidal constants collected from over 2 000 tide-gauge stations around the world in a hydrodynamically consistent fashion (see d., f., and g., above).

i. A new higher order approximation of Arctic Ocean tides is used, that is described in Schwiderski (1981e).

With these features, the new model was successfully applied to chart the semidiurnal principal lunar (M_2) ocean tide with the desired accuracy. The technique and accuracy of the model were extensively described and discussed in Part I of this report as well as in subsequent publications and symposia presentations by the author (Schwiderski 1978a, b; 1979a, b, c, d, e; and 1980).

The same hydrodynamical interpolation technique has been applied to chart the diurnal principal solar (P_1) ocean tide with the same relative accuracy as M_2 . Again, it must be emphasized that the enormous accuracy achieved over all open ocean regions diminishes somewhat near coastal areas where known empirical data are marginal in quantity and/or quality.

A complete listing of all sources of empirical ocean tide data, which were interpolated into the P_1 tidal charts, is presented in Appendix A. In the meantime, Section 2 of this report lists the significant hydrodynamical input parameters that specified the constructed P_1 ocean tide. The major features of the global P_1 tide are discussed in Section 3. A complete numerical display is presented in Appendix A where all tidal amplitudes and phases are gridwise tabulated in map-like charts. Corange (equi-amplitude) and cotidal (equi-phase) maps of the P_1 ocean tide are plotted in Appendix B.

2. P_1 OCEAN-TIDE PARAMETERS

The astronomical diurnal principal solar (P_1) equilibrium tide η (or tide-generating potential $G\eta$; see Schwiderski, 1978a) at the geographical point (λ, ϕ) and instant (Y, D, t) is determined by

$$\eta = K \sin 2\phi \cos(\sigma t + \chi + \lambda) \quad (1)$$

where

$G = 9.81 \text{ m/sec}^2$ earth gravity acceleration

$\lambda =$ longitude (east in rad)

$\phi =$ latitude (north in rad)

$Y (\geq 1975) =$ year number

$D =$ day number of year Y ($D = 1$ for January 1)

$t =$ universal standard time of day D (in sec)

$K = 0.046843 \text{ m} = P_1$ equilibrium tide amplitude

$\sigma = 0.72523 \cdot 10^{-4} \text{ sec}^{-1} = P_1$ tide frequency

$\chi = -\pi (h_o + 90)/180 = P_1$ astronomical argument (in rad)

$h_o \begin{cases} = 279.69668 + 36000.768930485T + 3.03 \cdot 10^{-4} T^2 \\ = \text{mean longitude of the sun relative to Greenwich midnight of day } D \text{ (in deg)} \end{cases}$

$T = [27392.500528 + 1.000000356\bar{D}]/36525$

$\bar{D} = D + 365(Y - 1975) + \text{Int}[(Y - 1973)/4]$

$\text{Int}[x] =$ integral part of x

The corresponding instantaneous ocean partial tide (Schwiderski, 1978a) is determined by

$$\zeta = \xi \cos(\sigma t + \chi - \delta), \quad (2)$$

where the local harmonic constants

$\xi = \xi(\lambda, \phi) = P_1$ ocean tide amplitude (in m)

and

$\delta = \delta(\lambda, \phi) = P_1$ ocean tide Greenwich phase (in rad)

must be determined, say, by linear interpolation in the tidal charts of Appendix A.

A simple second-order approximation in the sense of Love and Accad and Pekeris (see Part I, Schwiderski, 1978a, 1979c, and 1980; and Accad and Pekeris, 1978) yields

$$\zeta^e \approx 0.612\eta \text{ and } \zeta^{eo} \approx -0.0667\zeta, \quad (3)$$

i.e., the corresponding terrestrial tide ζ^e and the earth dip ζ^{eo} (yielding) under the oceanic tidal load ζ , respectively. A more elaborate and probably slightly more accurate earth dip ζ^{eo} may be computed by using Farrell's Green function (see Farrell, 1972 and 1973; and Schwiderski, 1980). In linear superposition, one finds the corresponding instantaneous geocentric partial P_1 tide:

$$\zeta^g = \zeta + \zeta^e + \zeta^{eo}. \quad (4)$$

A detailed description of the hydrodynamical-empirical model to compute the ocean tidal amplitudes ξ and phases δ (listed in Appendix A) was given in Schwiderski (1978a, 1979c, d, and 1980). In particular, all model input parameters such as the dimensionless eddy coefficient ϵ (Eq's. 103 and 123), the bottom-friction parameter b (Eq's. 4a and b), and the differencing parameters κ and $\bar{\kappa}$ (Eq's. 64 and 72) were all specified in Schwiderski (1978a) (referenced equations). These parameters were determined for M_2 by extensive trial-and-error computations and remained unchanged for the construction of P_1 .

In the computation of the P_1 tide model, the following mode-dependent parameters were used (see referenced equations in Schwiderski, 1978a):

- a. The time step Δt (Eq's. 64, 123)

$$\Delta t = 180.4940 \text{ sec} \quad (5)$$

- b. The hydrodynamical interpolation control limits, k_1 , k_2 , and k_3 (Eq's. 88, 89, 94, 97, and 99)

$$k_1 = 0.025, k_2 = 0.040, k_3 = 0.5. \quad (6)$$

It may be noted that the input parameters k_1 and k_2 of Equation 6 are the same as for the diurnal O_1 and K_1 components, but differ from those values used for the semidiurnal N_2 , S_2 , and M_2 species (see Parts VI, V, IV, III, and II).

3. P_1 OCEAN-TIDE FEATURES

The entire constructed P_1 ocean tide is gridwise displayed in map-like amplitude and phase tables in Appendix A. The $42^\circ \times 71^\circ$ charts cover the whole globe north of colatitude 169° (Antarctica) in three zones: a northern zone N from 0° to 71° colatitude, a middle zone M from 48° to 118° colatitude, and a southern zone S from 98° to 168° colatitude. The overlapping geographical areas of the tidal charts have been chosen to provide a worldwide coverage for special applications and to allow the reader to scan the large amplitude and phase charts together in order to evaluate their quality and visualize the important tidal features. In addition, a generally superficial overview of some tidal features can be recognized by inspecting the more schematically plotted corange and cotidal maps provided in Appendix B.

For an easy evaluation of the tidal charts in Appendix A, all hydrodynamically interpolated empirical tidal amplitudes and phases have been visibly marked by subbars for all shore data and subbrackets for all near-shore deep-sea input constants. Furthermore, the charts display the approximate locations of distant off-shore deep-sea stations by subtildes under the computed amplitude and phase data. The corresponding empirical data, which were excluded from hydrodynamical interpolation (see Sect. 1 and Schwiderski, 1978a, 1979d, and 1980), are listed and compared with the modeled data in Tables 1, 2, and 3. Finally, the approximate geographical locations of the important amphidromic points of zero amplitudes are marked by a circled $\otimes$.

The tidal charts and maps permit the viewer to follow the tidal waves, that is the high water fronts (crests), in forward (or backward) direction, for instance, on their rotation around the amphidromic points. In the tidal phase charts of Appendix A, it is best to start from the prominently visible $0^\circ = 360^\circ$ or 100° cotidal lines. Since the Greenwich phases specify the time lags (in degrees: $15^\circ \approx 1$ hour) of the tidal crests relative to the cresting time of the corresponding equilibrium tide along Greenwich meridian, one gathers a vivid impression of the significant global and local tidal phenomena.

By following the tidal waves on their periodic rotations, one finds these waves passing through the specially marked stations in empirically correct time and with the correct height. In fact, all over the globe over 2 000 tidal phases and 2 000 amplitudes are coherently integrated. This is particularly impressive for the charts of the Pacific Ocean, where the empirical data from so many clustered and scattered island stations fit smoothly into the surrounding computed tides. From the smoothness features of erratically interpolated tidal data (see Parts I and II), one concludes that this result is not an artifact of the interpolation applied but constitutes a vivid manifestation of the excellent compatibility of both the empirical and hydrodynamical procedures combined.

On the basis of this observation, it can again (see Schwiderski, 1978a, b; 1979a, b, d, e; 1980, and 1981a, b, c, d) be estimated that the P_1 tidal charts permit a tide prediction with a uniform accuracy relative to M_2 of better than 5 cm anywhere in the open oceans. Naturally, near rough ocean basin reliefs (e.g., Arctic and Antarctic shores), where empirical tide (and depth) data

are marginal in quality and quantity, a somewhat lesser accuracy must be expected. The estimated accuracy of the computed P_1 tide is, of course, fully validated by all 32 empirical tide data from distant off-shore deep-sea tide gauge stations, which are listed along with the computed data in Tables 1, 2, and 3. The differences (not necessarily errors) range from 0 to 2 cm in amplitudes and 0° to 14° (1 hour) in phases and thus verify the estimated prediction accuracy. In this connection, one may recall the accuracy discussion of the deep-sea empirical data presented in Part IV of this report. This discussion applies particularly to the same Atlantic stations with IAPSO Nos. 1.1.33 and 1.1.34.

Table 1. North Atlantic Ocean Deep-Sea Empirical and Modeled P_1 Tides

LONG W	LAT N	EMP ξ	MOD ξ	$\Delta\xi$	EMP δ	MOD δ	$\Delta\delta$	IAPSO NR	SOURCES
13°51'	58°16'	3	3	0	131	129	-2	1.1.37	C
24°43'	62°50'	4	4	0	129	136	+7	1.1.29	C
28°46'	60°12'	3	3	0	130	138	+8	1.1.30	C
29°58'	57°01'	3	3	0	133	137	+4	1.1.31	C
30°10'	53°39'	3	2	-1	129	133	+4	1.1.32	C
25°06'	53°31'	2	2	0	142	128	+14	1.1.33	C
20°00'	53°39'	2	2	0	136	122	-14	1.1.34	C
28°11'	48°45'	2	2	0	110	114	+4	1.1.38	C
28°09'	45°21'	2	2	0	99	103	+4	1.1.39	C
27°57'	41°25'	1	1	0	85	86	+1	1.1.40	C
20°05'	37°09'	2	2	0	58	60	+2	1.1.41	C
14°15'	36°41'	2	2	0	51	50	-1	1.1.42	C
75°38'	32°42'	3	3	0	185	188	+3	1.2. 3	C, M
76°25'	30°26'	3	3	0	190	193	+3	1.2.11	C, P
76°48'	28°27'	3	3	0	195	199	+4	1.2.15	C
76°47'	28°01'	3	3	0	197	199	+2	1.2.14	C
67°32'	28°14'	2	2	0	194	197	+3	1.2. 5	C, Z
69°45'	28°08'	2	2	0	195	197	+2	1.2. 4	C, Z
69°40'	27°59'	2	2	0	194	200	+6	1.2. 8	C, Z
69°40'	27°58'	2	2	0	195	200	+5	1.2. 7	C, Z
69°20'	26°28'	2	2	0	198	203	+5	1.2.10	C, Z
69°19'	26°27'	3	2	-1	200	203	+3	1.2. 9	C, Z

ξ = Amplitudes (cm)

δ = Greenwich Phases (deg)

IAPSO = Int. Assoc. for the Phys. Sci. of the Oceans

C = Cartwright et al. (1979)

M = Mofjeld (1975)

P = Pearson (1975)

Z = Zetler et al. (1975)

Table 2. Northeastern Pacific Ocean Deep-Sea Empirical and Modeled P_1 Tides

LONG W	LAT N	EMP ξ	MOD ξ	$\Delta\xi$	EMP δ	MOD δ	$\Delta\delta$	IAPSO NR	SOURCES
144°22'	56°08'	14	14	0	262	265	+3	2.1.17	C
135°38'	53°19'	14	14	0	255	257	+2	2.1.16	C
132°47'	49°35'	14	13	-1	246	248	+2	2.1.15	C
145°00'	34°00'		7			242			-
145°00'	34°00'		7			242			-
124°26'	27°45'	10	8	-2	214	214	0	2.1.13	C, M
129°01'	24°47'	8	7	-1	221	217	-4	2.1.10	C, M

ξ = Amplitudes (cm)

δ = Greenwich Phases (deg)

IAPSO = Int. Assoc. for the Phys. Sci. of the Oceans

C = Cartwright et al. (1979)

M = Munk et al. (1970)

Table 3. Southeast Indian Ocean Deep-Sea Empirical and Modeled P_1 Tides

LONG E	LAT S	EMP ξ	MOD ξ	$\Delta\xi$	EMP δ	MOD δ	$\Delta\delta$	IAPSO NR	SOURCES
132°01'	37°01'	6	6	0	235	237	+2	4.1. 1	C, IS
132°09'	50°02'	4	4	0	235	239	+4	4.1. 2	C, IS
132°07'	60°01'	6	6	0	228	227	-1	4.1. 3	C, IS

ξ = Amplitudes (cm)

δ = Greenwich Phases (deg)

IAPSO = Int. Assoc. for the Phys. Sci. of the Oceans

C = Cartwright et al. (1979)

IS = Irish and Snodgrass (1972)

From the tidal charts and maps in Appendixes A and B, one concludes that the rotating tidal waves of the two diurnal tides P_1 and K_1 resemble each other very closely. Significant differences occur only in areas of rapid tidal variations (compare Part IV). This resemblance was to be expected, since the corresponding periods of P_1 (24.07 h) and K_1 (23.93 h) differ only by 0.14 h. Similarities between these two partial tides and the other completed tides O_1 , N_2 , S_2 and M_2 exist also, but to a visibly lesser degree (see Parts V, VI, III, and II, respectively).

4. CONCLUSIONS

The hydrodynamical interpolation technique has been applied to construct the diurnal principal solar tide (P_1) with a relative accuracy of better than 5 cm anywhere in the open oceans. The constructed tide is displayed by tabulated charts in Appendix A and by corange and cotidal maps in Appendix B. The major features of the Q_1 tide are discussed in Section 3. A comparison with the earlier computed diurnal K_1 tide reveals very close similarities.

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APPENDIX A

ATLAS OF $1^{\circ} \times 1^{\circ} P_1$ OCEAN-TIDE AMPLITUDE
AND PHASE CHARTS FOR $42^{\circ} \times 71^{\circ}$ AREAS

APPENDIX A

ATLAS OF $1^\circ \times 1^\circ$ P₁ OCEAN-TIDE AMPLITUDE AND PHASE CHARTS FOR $42^\circ \times 71^\circ$ AREAS

1. GUIDE TO TIDAL CHARTS

- M = m: Longitude Number
N = n: Colatitude Number
 λ_m = $(m - 0.5)^\circ$: Geographical Longitude East
 θ_n = $(n - 0.5)^\circ$: Geographical Colatitude
 $\xi_{m,n}$ = $\xi(\lambda_m, \theta_n)$: Amplitude (in cm)
 $\delta_{m,n}$ = $\delta(\lambda_m, \theta_n)$: Greenwich Phases (in deg.; $15^\circ \approx 1$ h)
⊗ = Amphidromic Points
— = Subbars Mark Empirical Input Data at Shore Stations
⌊ = Subbrackets Mark Empirical Input Data at Near-Shore Deep-Sea Stations
~ = Subtildes Mark Approximately Distant Offshore Deep-Sea Stations with Excluded Empirical Tide Data Listed in Tables 1, 2, and 3

2. SOURCES OF EMPIRICAL TIDE DATA

Publications:

National Ocean Survey (1942), British Admiralty (1977), International Hydrographic Bureau (1978), Defant (1961), Miyazaki et al. (1967), Nowroozi et al. (1969), Munk et al. (1970), Zahel (1970), Irish et al. (1971), Irish and Snodgrass (1972), Nowroozi (1972), Luther and Wunsch (1975), Motjeld (1975), Pearson (1975), Zetler et al. (1975), Cartwright et al. (1979), and Pugh (1979).

Private Communications:

D. C. Simpson (1977), National Ocean Survey, Rockville, Maryland; S. K. Gill and D. L. Porter (1978), National Ocean Survey, Rockville, Maryland; K. Wyrtki (1978), University of Hawaii, Honolulu, Hawaii, and D. E. Cartwright and D. Pugh (1978), Institute of Oceanographic Sciences, Bidston Observatory, U.K.

[illegible]

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[illegible]

	INDIA		PAKISTAN		WESTERN INDIA	
12	12	12	12	11	10	9
13	12	12	12	11	11	11
14	12	12	12	11	11	11
15	12	12	12	11	11	11
16	12	12	12	11	11	11
17	12	12	12	11	11	11
18	12	12	12	11	11	11
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26	12	12	12	11	11	11
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42	12	12	12	11	11	11
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74	12	12	12	11	11	11
75	12	12	12	11	11	11

[illegible]

RAM

$$\begin{array}{r} 340 \\ 340 \\ \hline 340 \end{array}$$

341	349		
340	340		
340	340	347	349
340	340	339	348
		339	344
		339	346

[illegible]

	EASTERN INDIA		BANGLADESH		SOUTHERN CHINA	
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64						
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TABLE 3N: $1^\circ \times 1^\circ$ P₁ OCEAN TIDE GREENWICH PHASES δ (DEG)[illegible]

SIBERIAN USSR

SOUTHERN CHINA

EASTERN INDIA

BANGLADESH

[illegible]

[illegible]

SEA OF JAPAN

EASTERN CHINA

DATE OF CHARGE

SOUTHEASTERN JAPAN

201	179	175	
208	191	192	
230	210		
273	251	229	200 106 150 KOREA

56	288	264	230	197	160	134
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57	300	208	165	144	117
58	358	242	131	122	111
					100

69	64	179	107	95	89
320-124	131	137	111	111	101

72 99 97 89 85

$$\begin{array}{r} 98 \\ 98 \\ \hline 196 \end{array}$$

106	97	92	89	87	85
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112 106 96 93 90 A 88 W 86

55	112	102	98	95	92	50
56			101	97	93	89
						84

60	101	31	20	67	64
67	<u>95</u>	93	91	88	85
TAIWAN					

10	31	85	86
10	16	50	38
10	76	56	90
10	95	90	06

69	<u>151</u>	94	96	91	89	87
78	164	96	97	91	89	87

1	177	95	96	93	90	86	87
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[illegible]

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[illegible]

TABLE 5N: $1^{\circ} \times 1^{\circ}$ P₁ OCEAN TIDE GREENWICH PHASES δ (DEG)

163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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TABLE 6N: 1° × 1° P, OCEAN TIDE AMPLITUDES ξ (CM)

[illegible]

TABLE 6N: $1^{\circ} \times 1^{\circ}$ P, OCEAN TIDE GREENWICH PHASES δ (DEG)[illegible]

USA

ALASKA

NORTHWESTERN CANADA

WESTERN USA

1	1	275	273	271	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
										WESTERN USA																				QUEEN CHARLOTTE																				WESTERN USA																																																																																																																																																																																																																														
1	1	275	273	271	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
2	2	270	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
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4	4	275	273	271	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5	5	270	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	1											

[illegible]

NORTH CENTRAL CANADA

CENTRAL USA

MEXICO

[illegible]

[illegible]

FRANKLIN DISTRICT

NORTH CENTRAL CANADA

CENTRAL USA

MEXICO

		MEXICO										FLORIDA										CUBA																				
		GULF OF CALIFORNIA																																								
		23	24	25	26	27	28	29	30	31	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	
9	213	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171
8	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171
7	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	
6	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171		
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1	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171							
0	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171								

TABLE 8N: 1° × 1° P, OCEAN TIDE AMPLITUDES ξ (CM)

[illegible]

[illegible][illegible]

[illegible]

TABLE 9N: 1° × 1° P, OCEAN TIDE GREENWICH PHASES δ (DEG)

[illegible]

NORTHWESTERN AFRICA

	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	32	33	34	35	36	37	38	39	40	41	42
WM	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	32	33	34	35	36	37	38	39	40	41	42

Year	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	32	33	34	35	36	37	38	39	40	41	42		
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Year	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	32	33	34	35	36	37	38	39	40	41	42
1948	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	32	33	34	35	36	37	38	39	40	41	42

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TABLE 4M: 1° × 1° P. OCEAN TIDE GREENWICH PHASES δ (DEG)

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TABLE 5M: $1^{\circ} \times 1^{\circ} P_1$ OCEAN TIDE AMPLITUDES ξ (CM)

150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201								
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100							
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155					
156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210					
211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265					
266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320					
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375					
376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430					
431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485					
486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540					
541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655					
656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712			
713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770		
771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830
831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890
891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950
951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010
1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070
1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130
1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190
1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250
1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310
1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370
1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430
1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462</																												

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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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89</											

$$\begin{array}{r} 36 \\ 30 \overline{) 1080} \\ \underline{108} \\ 0 \end{array}$$

20	23
20	22
19	20

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TABLE 6M: $1^{\circ} \times 1^{\circ} P_1$ OCEAN TIDE AMPLITUDES ξ (CM)

	USA	CALIFORNIA
200	11	11
201	11	11
202	11	11
203	11	11
204	11	11
205	11	11
206	11	11
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TABLE 6M: 1° x 1° P, OCEAN TIDE GREENWICH PHASES δ (DEG)

Lat	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241																																																																																																																																																																																																																																																																																																																																		
48	276	275	273	271	268	265	262	259	257	256	254	253	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
49	277	276	274	272	269	266	263	260	258	256	254	252	250	248	246	244	242	240	238	236	234	232	230	228	226	224	222	220	218	216	214	212	210	208	206	204	202	200	198	196	194	192	190	188	186	184	182	180	178	176	174	172	170	168	166	164	162	160	158	156	154	152	150	148	146	144	142	140	138	136	134	132	130	128	126	124	122	120	118	116	114	112	110	108	106	104	102	100	98	96	94	92	90	88	86	84	82	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	1	0	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																													
50	278	277	275	273	270	267	264	261	259	257	255	253	251	249	247	245	243	241	239	237	235	233	231	229	227	225	223	221	219	217	215	213	211	209	207	205	203	201	199	197	195	193	191	189	187	185	183	181	179	177	175	173	171	169	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139	137	135	133	131	129	127	125	123	121	119	117	115	113	111	109	107	105	103	101	99	97	95	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	0	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																													
51	279	278	276	274	271	268	265	262	259	257	255	253	251	249	247	245	243	241	239	237	235	233	231	229	227	225	223	221	219	217	215	213	211	209	207	205	203	201	199	197	195	193	191	189	187	185	183	181	179	177	175	173	171	169	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139	137	135	133	131	129	127	125	123	121	119	117	115	113	111	109	107	105	103	101	99	97	95	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	0	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																													
52	280	279	277	275	272	269	266	263	260	257	255	253	251	249	247	245	243	241	239	237	235	233	231	229	227	225	223	221	219	217	215	213	211	209	207	205	203	201	199	197	195	193	191	189	187	185	183	181	179	177	175	173	171	169	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139	137	135	133	131	129	127	125	123	121	119	117	115	113	111	109	107	105	103	101	99	97	95	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	0	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																													
53	281	280	278	276	273	270	267	264	261	258	255	253	251	249	247	245	243	241	239	237	235	233	231	229	227	225	223	221	219	217	215	213	211	209	207	205	203	201	199	197	195	193	191	189	187	185	183	181	179	177	175	173	171	169	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139	137	135	133	131	129	127	125	123	121	119	117	115	113	111	109	107	105	103	101	99	97	95	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1	0	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																													
54	282	281	279	277	274	271	268	265	262	259	256	254	252	250	248	246	244	242	240	238	236	234	232	230	228	226	224	222	220	218	216	214	212	210	208	206	204	202	200	198	196	194	192	190	188	186	184	182	180	178	176	174																																																																																																																																																																																																																																																																																																																								

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WARRANTS:[illegible]

TABLE 7M: 1° × 1° P, OCEAN TIDE GREENWICH PHASES δ (DEG)

SOUTHERN USA

[illegible]

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NORTHERN SOUTH AMERICA

TABLE 8M: 1° × 1° P. OCEAN TIDE GREENWICH PHASES δ (DEG)

279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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NORTHERN SOUTH AMERICA

TABLE 9M: 1° x 1° P, OCEAN TIDE AMPLITUDES ξ (CM)[illegible]

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274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																															

199	267	267	270	273	277	280	283	286	288	293	296	299	302	305	307	310	313	315	318	320	323	327	329	332	335	338	341	342	343	346	348	349	351	353	355	357	359	361	363	365	367	369	371	373	375	377	379	381	383	385	387	389	391	393	395	397	399	401	403	405	407	409	411	413	415	417	419	421	423	425	427	429	431	433	435	437	439	441	443	445	447	449	451	453	455	457	459	461	463	465	467	469	471	473	475	477	479	481	483	485	487	489	491	493	495	497	499	501	503	505	507	509	511	513	515	517	519	521	523	525	527	529	531	533	535	537	539	541	543	545	547	549	551	553	555	557	559	561	563	565	567	569	571	573	575	577	579	581	583	585	587	589	591	593	595	597	599	601	603	605	607	609	611	613	615	617	619	621	623	625	627	629	631	633	635	637	639	641	643	645	647	649	651	653	655	657	659	661	663	665	667	669	671	673	675	677	679	681	683	685	687	689	691	693	695	697	699	701	703	705	707	709	711	713	715	717	719	721	723	725	727	729	731	733	735	737	739	741	743	745	747	749	751	753	755	757	759	761	763	765	767	769	771	773	775	777	779	781	783	785	787	789	791	793	795	797	799	801	803	805	807	809	811	813	815	817	819	821	823	825	827	829	831	833	835	837	839	841	843	845	847	849	851	853	855	857	859	861	863	865	867	869	871	873	875	877	879	881	883	885	887	889	891	893	895	897	899	901	903	905	907	909	911	913	915	917	919	921	923	925	927	929	931	933	935	937	939	941	943	945	947	949	951	953	955	957	959	961	963	965	967	969	971	973	975	977	979	981	983	985	987	989	991	993	995	997	999	1001	1003	1005	1007	1009	1011	1013	1015	1017	1019	1021	1023	1025	1027	1029	1031	1033	1035	1037	1039	1041	1043	1045	1047	1049	1051	1053	1055	1057	1059	1061	1063	1065	1067	1069	1071	1073	1075	1077	1079	1081	1083	1085	1087	1089	1091	1093	1095	1097	1099	1101	1103	1105	1107	1109	1111	1113	1115	1117	1119	1121	1123	1125	1127	1129	1131	1133	1135	1137	1139	1141	1143	1145	1147	1149	1151	1153	1155	1157	1159	1161	1163	1165	1167	1169	1171	1173	1175	1177	1179	1181	1183	1185	1187	1189	1191	1193	1195	1197	1199	1201	1203	1205	1207	1209	1211	1213	1215	1217	1219	1221	1223	1225	1227	1229	1231	1233	1235	1237	1239	1241	1243	1245	1247	1249	1251	1253	1255	1257	1259	1261	1263	1265	1267	1269	1271	12
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WM	357	358	359	360	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	32	33	34	35	36	37	38
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160 8 8
161

39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	CHARS	72	73	74	75	76	77	78	79	80
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
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356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
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356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75	76	77	78	79	80	
356	356	356	357	359	360	1	2	3	3	4	4	5	6	7	7	8	9	10	12	14	15	16	17	18	20	22	25	28	32	36	42	51	70	73	74	75						

015 015 0

015 015 0

[illegible]

TABLE 38: $1^\circ \times 1^\circ P_1$ OCEAN TIDE GREENWICH PHASES δ (DEG)

Lat	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119				
90	132	139	145	150	153	156	158	159	160	161	162	162	163	163	164	165	165	167	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179			
89	136	143	148	152	155	158	160	161	162	163	163	164	164	165	165	166	166	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180		
88	140	146	150	153	156	158	160	161	162	163	163	164	164	165	165	166	166	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180		
87	144	149	152	155	158	160	161	162	163	163	164	164	165	165	166	166	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	
86	148	153	156	159	161	162	163	163	164	164	165	165	166	166	167	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182
85	152	157	160	162	163	164	164	165	165	166	166	167	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182	183	183	
84	156	161	164	166	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182	183	183	184	184	185	185	186	186	187	187	
83	160	165	168	170	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182	183	183	184	184	185	185	186	186	187	187	188	188	189	189	190	190	191	191	
82	164	169	172	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182	183	183	184	184	185	185	186	186	187	187	188	188	189	189	190	190	191	191	192	192	193	193	194	194
81	168	173	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182	183	183	184	184	185	185	186	186	187	187	188	188	189	189	190	190	191	191	192	192	193	193	194	194	195	195	196	196	
80	172	177	179	180	180	181	181	182	182	183	183	184	184	185	185	186	186	187	187	188	188	189	189	190	190	191	191	192	192	193	193	194	194	195	195	196	196	197	197	198	198	199	199	200	200	
79	176	181	183	184	184	185	185	186	186	187	187	188	188	189	189	190	190	191	191	192	192	193	193	194	194	195	195	196	196	197	197	198	198	199	199	200	200	201	201	202	202	203	203	204	204	
78	180	185	187	188	188	189	189	190	190	191	191	192	192	193	193	194	194	195	195	196	196	197	197	198	198	199	199	200	200	201	201	202	202	203	203	204	204	205	205	206	206	207	207	208	208	
77	184	189	191	192	192	193	193	194	194	195	195	196	196	197	197	198	198	199	199	200	200	201	201	202	202	203	203	204	204	205	205	206	206	207	207	208	208	209	209	210	210	211	211	212	212	
76	188	193	195	196	196	197	197	198	198	199	199	200	200	201	201	202	202	203	203	204	204	205	205	206	206	207	207	208	208	209	209	210	210	211	211	212	212	213	213	214	214	215	215	216	216	
75	192	197	199	200	200	201	201	202	202	203	203	204	204	205	205	206	206	207	207	208	208	209	209	210	210	211	211	212	212	213	213	214	214	215	215	216	216	217	217	218	218	219	219	220	220	
74	196	201	203	204	204	205	205	206	206	207	207	208	208	209	209	210	210	211	211	212	212	213	213	214	214	215	215	216	216	217	217	218	218	219	219	220	220	221	221	222	222	223	223	224	224	
73	200	205	207	208	208	209	209	210	210	211	211	212	212	213	213	214	214	215	215	216	216	217	217	218	218	219	219	220	220	221	221	222	222	223	223	224	224	225	225	226	226	227	227	228	228	
72	204	209	211	212	212	213	213	214	214	215	215	216	216	217	217	218	218	219	219	220	220	221	221	222	222	223	223	224	224	225	225	226	226	227	227	228	228	229	229	230	230	231	231	232	232	
71	208	213	215	216	216	217	217	218	218	219	219	220	220	221	221	222	222	223	223	224	224	225	225	226	226	227	227	228	228	229	229	230	230	231	231	232	232	233	233	234	234	235	235	236	236	
70	212	217	219	220	220	221	221	222	222	223	223	224	224	225	225	226	226	227	227	228	228	229	229	230	230	231	231	232	232	233	233	234	234	235	235	236	236	237	237	238	238	239	239	240	240	
69	216	221	223	224	224	225	225	226	226	227	227	228	228	229	229	230	230	231	231	232	232	233	233	234	234	235	235	236	236	237	237	238	238	239	239	240	240	241	241	242	242	243	243	244	244	
68	220	225	227	228	228	229	229	230	230	231	231	232	232	233	233	234	234	235	235	236	236	237	237	238	238	239	239	240	240	241	241	242	242	243	243	244	244	245	245	246	246	247	247	248	248	
67	224	229	231	232	232	233	233	234	234	235	235	236	236	237	237	238	238	239	239	240	240	241	241	242	242	243	243	244	244	245	245	246	246	247	247	248	248	249	249	250	250	251	251	252	252	
66	228	233	235	236	236	237	237	238	238	239	239	240	240	241	241	242	242	243	243	244	244	245	245	246	246	247	247	248	248	249	249	250	250	251	251	252	252	253	253	254	254	255	255	256	256	
65	232	237	239	240	240	241	241	242	242	243	243	244	244	245	245	246	246	247	247	248	248	249	249	250	250	251	251	252	252	253	253	254	254	255	255	256	256	257	257	258	258	259	259	260	260	
64	236	241	243	244	244	245	245	246	246	247	247	248	248	249	249	250	250	251	251	252	252	253	253	254	254	255	255	256	256	257	257	258	258	259	259	260	260	261	261	262	262	263	263	264	264	
63	240	245	247	248	248	249	249	250	250	251	251	252	252	253	253	254	254	255	255	256	256	257	257	258	258	259	259	260	260	261	261	262	262	263	263	264	264	265	265	266	266	267	267	268	268	
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61	248	253	255	256	256	257	257	258	258	259	259	260	260	261	261	262	262	263	263	264	264	265	265	266	266	267	267	268	268	269	269	270	270	271	271	272	272	273	273	274	274	275	275	276	276	
60	252	257	259	260	260	261	261	262	262	263	263	264	264	265	265	266	266	267	267	268	268	269	269	270	270	271	271	272	272	273	273	274	274	275	275	276	276	277	277	278	278	279	279	280	280	
59	256	261	263	264	264	265	265	266	266	267	267	268	268	269	269	270	270	271	271	272	272	273	273	274	274	275	275	276	276	277	277	278	278	279	279	280	280	281	281	282	282	283	283	284	284	
58	260	265																																												

TABLE 4S: $1^{\circ} \times 1^{\circ}$ P, OCEAN TIDE AMPLITUDES ξ (CM)

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	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																							
1	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200																																									
2	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
3	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
4	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266																																		

1	227	228	229	231	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
2	227	228	229	231	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
3	227	228	229	231	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	39								

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TABLE 5S: $1^{\circ} \times 1^{\circ}$ P₁ OCEAN TIDE GREENWICH PHASES δ (DEG)

160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711																																																																																																																																																																																																																																																																																																	

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TABLE 78: $1^\circ \times 1^\circ P_1$ OCEAN TIDE GREENWICH PHASES δ (DEG)

204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000

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[illegible]

TABLE 88: 1° × 1° P₁ OCEAN TIDE GREENWICH PHASES δ (DEG)

SOUTHERN SOUTH AMERICA									
204	205	206	207	208	209	210	211	212	213
214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233
234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253
254	255	256	257	258	259	260	261	262	263
264	265	266	267	268	269	270	271	272	273
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314	315	316	317	318	319	320	321	322	323
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354	355	356	357	358	359	360	361	362	363
364	365	366	367	368	369	370	371	372	373
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394	395	396	397	398	399	400	401	402	403
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424	425	426	427	428	429	430	431	432	433
434	435	436	437	438	439	440	441	442	443
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454	455	456	457	458	459	460	461	462	463
464	465	466	467	468	469	470	471	472	473
474	475	476	477	478	479	480	481	482	483
484	485	486	487	488	489	490	491	492	493
494	495	496	497	498	499	500	501	502	503
504	505	506	507	508	509	510	511	512	513
514	515	516	517	518	519	520	521	522	523
524	525	526	527	528	529	530	531	532	533
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544	545	546	547	548	549	550	551	552	553
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564	565	566	567	568	569	570	571	572	573
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624	625	626	627	628	629	630	631	632	633
634	635	636	637	638	639	640	641	642	643
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674	675	676	677	678	679	680	681	682	683
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744	745	746	747	748	749	750	751	752	753
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824	825	826	827	828	829	830	831	832	833
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844	845	846	847	848	849	850	851	852	853
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864	865	866	867	868	869	870	871	872	873
874	875	876	877	878	879	880	881	882	883
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974	975	976	977	978	979	980	981	982	983
984	985	986	987	988	989	990	991	992	993
994	995	996	997	998	999	1000	1001	1002	1003

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315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356								
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100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144					
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191

APPENDIX B

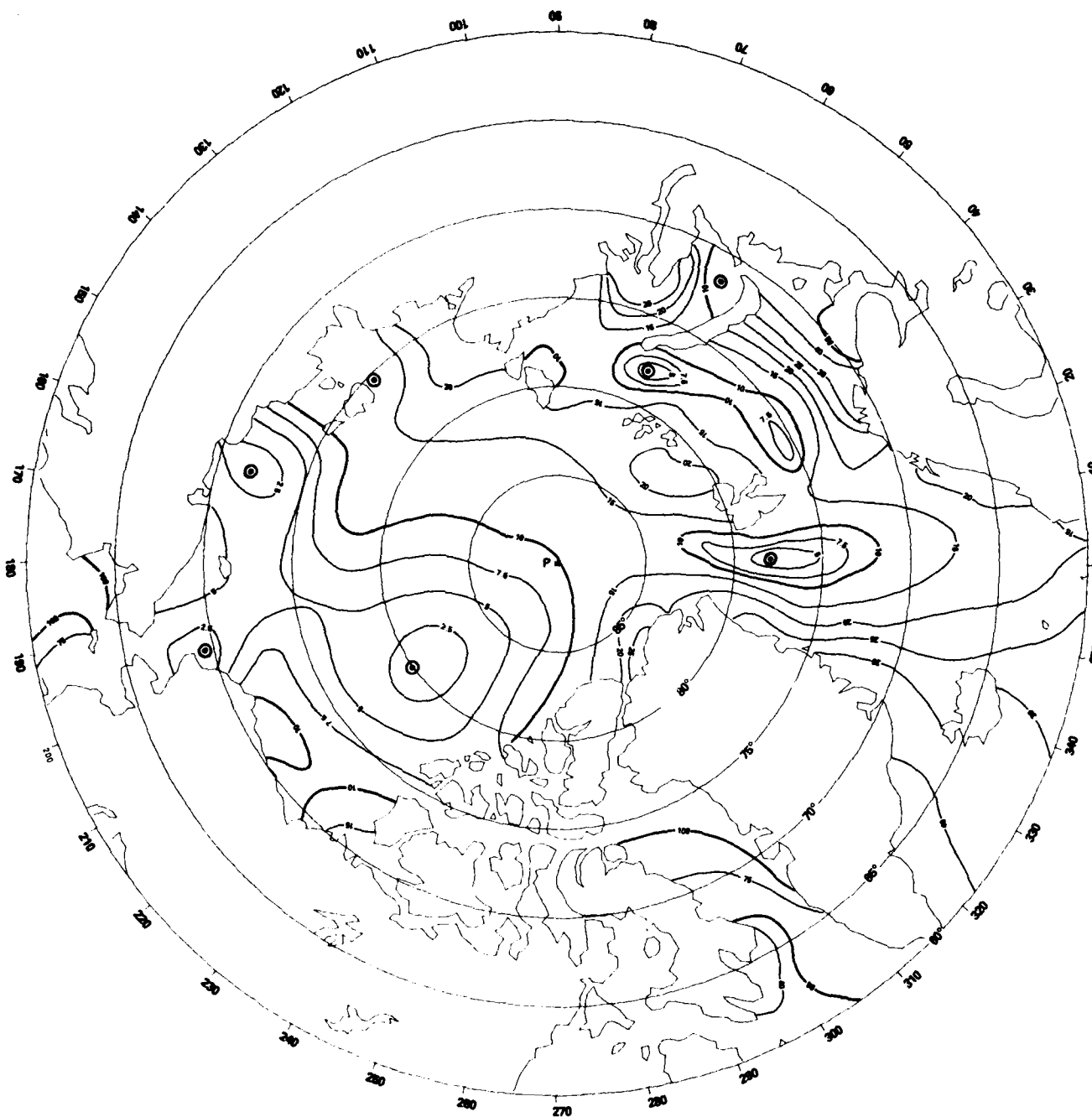
**ATLAS OF GLOBAL P_1 OCEAN-TIDE
CORANGE AND COTIDAL MAPS**

APPENDIX B

ATLAS OF CORANGE AND COTIDAL MAPS OF THE P_1 OCEAN TIDE

Amplitudes ξ of corange lines in cm.

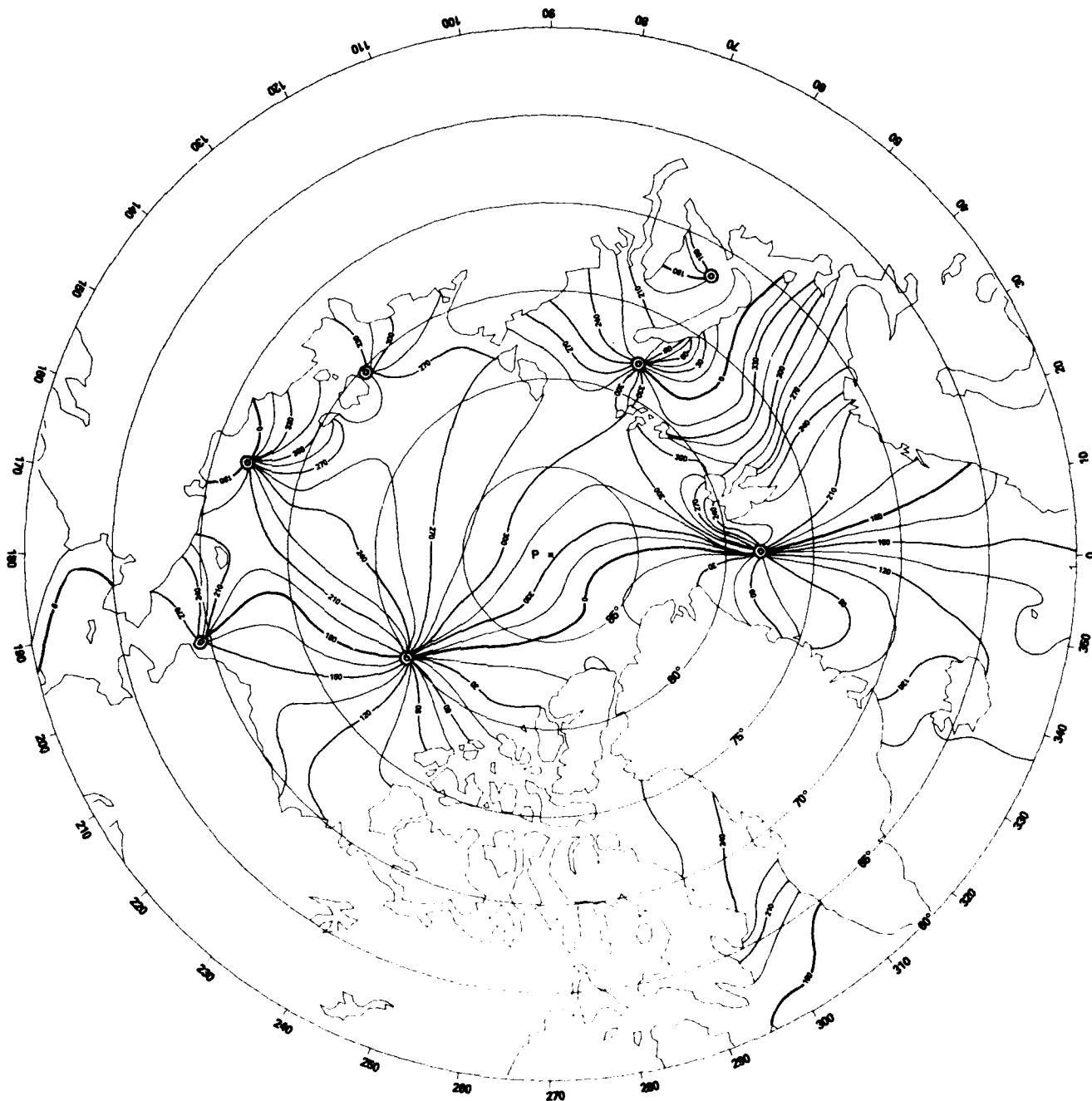
Greenwich phases δ of cotidal lines in 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, 165, 180, 195, 210, 225, 240, 255, 270, 285, 300, 315, 330, 345, 360 = 0° where $15^\circ \approx 1$ hour.



ARCTIC CORANGE MAP OF P_1 OCEAN TIDE
AMPLITUDES ξ IN MM

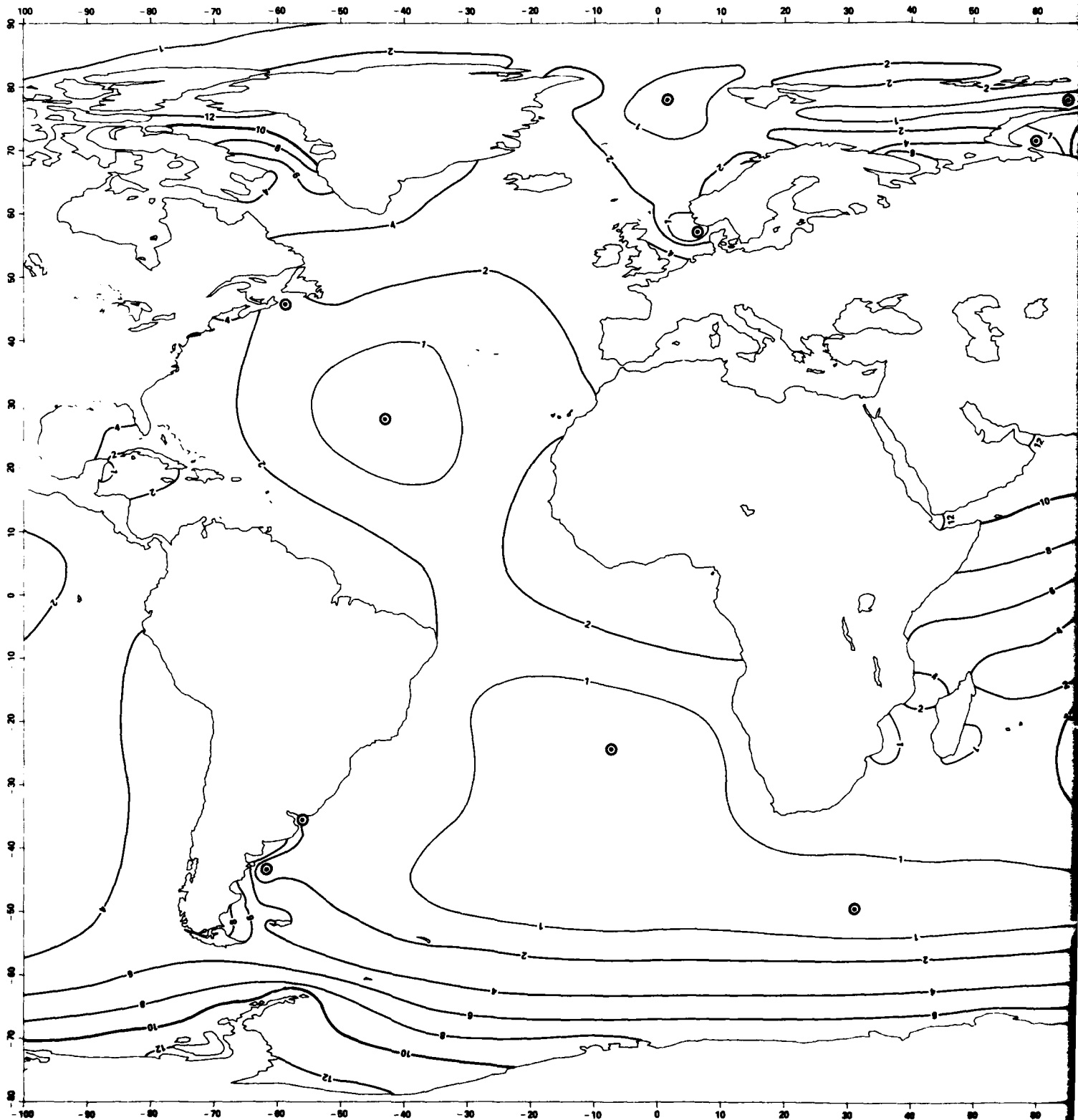
⊙ AMPHIDROMES

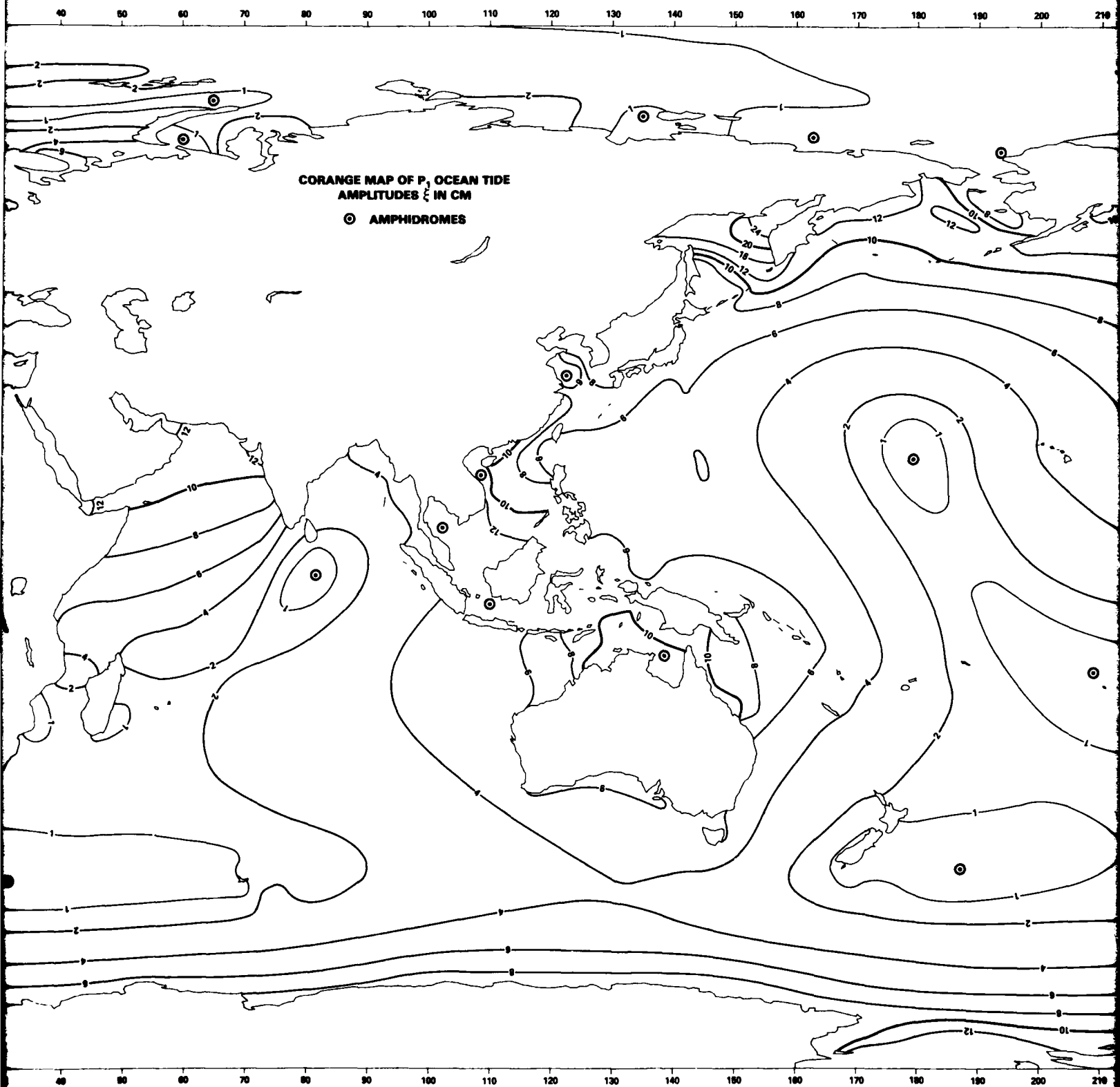
* P NORTH POLE



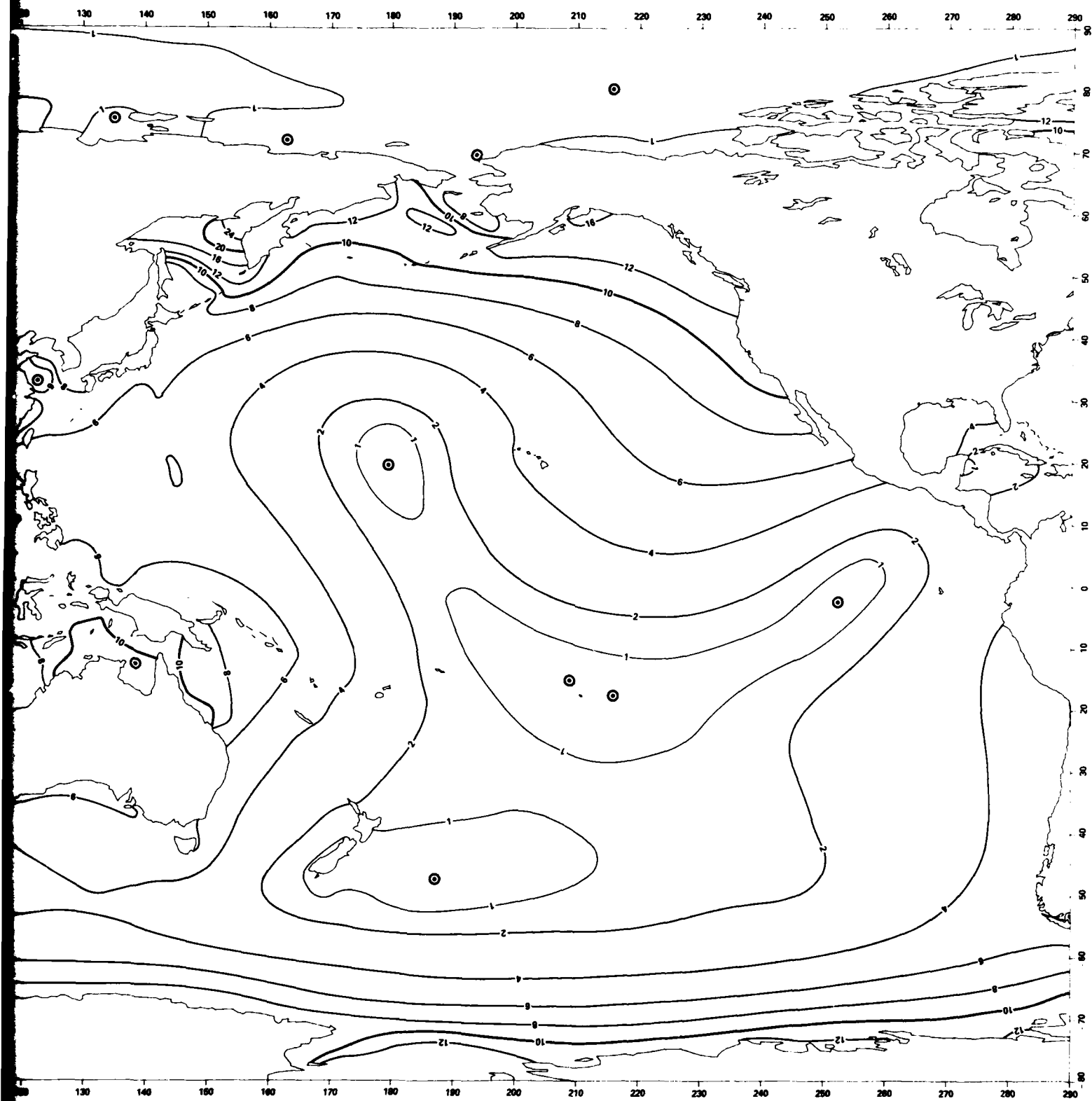
ARCTIC COTIDAL MAP OF P_1 OCEAN TIDE
 GREENWICH PHASES δ IN DEGREES
 $15^\circ \approx 1$ HOUR

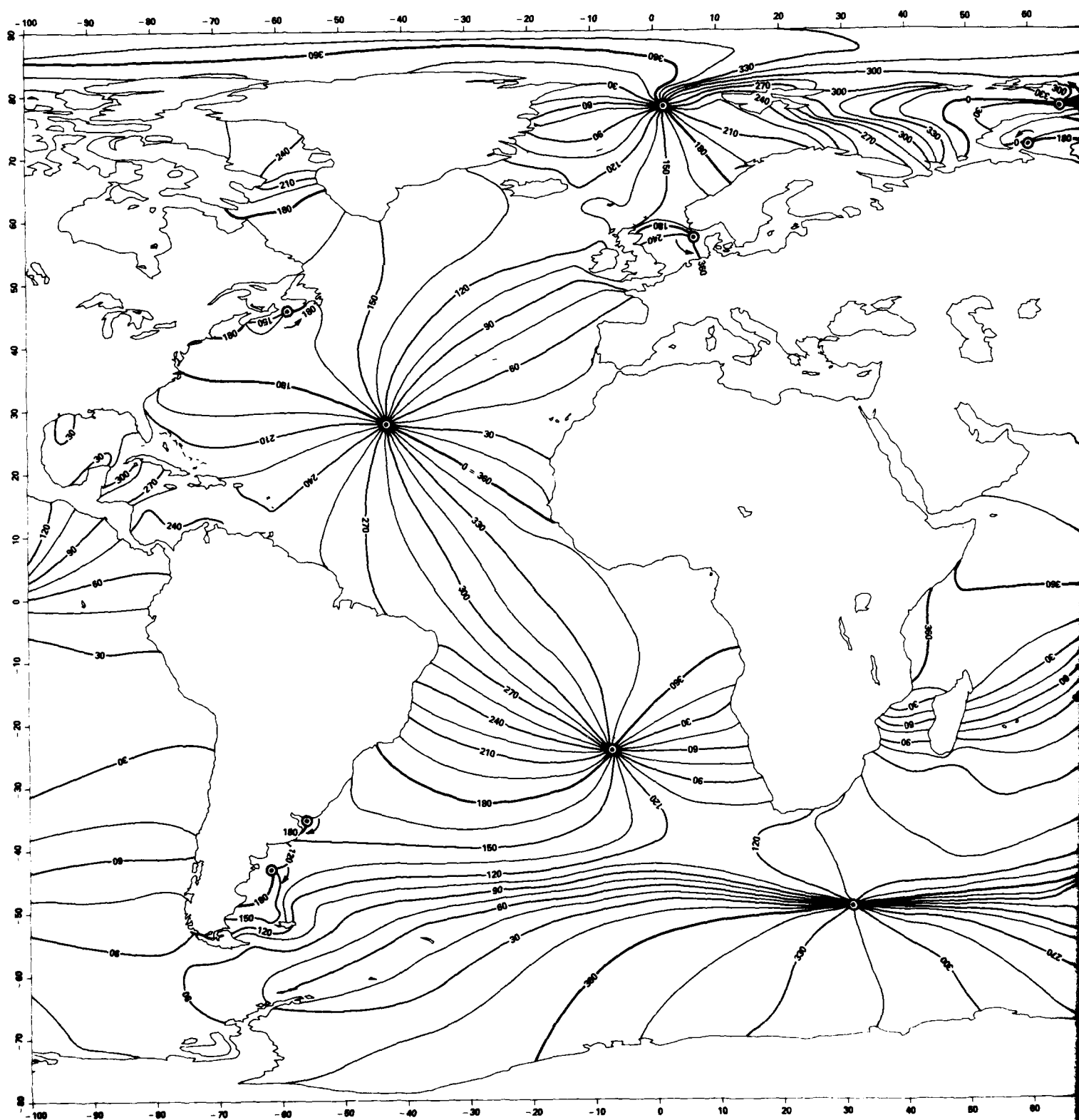
© AMPHIDROMES * P NORTH POLE



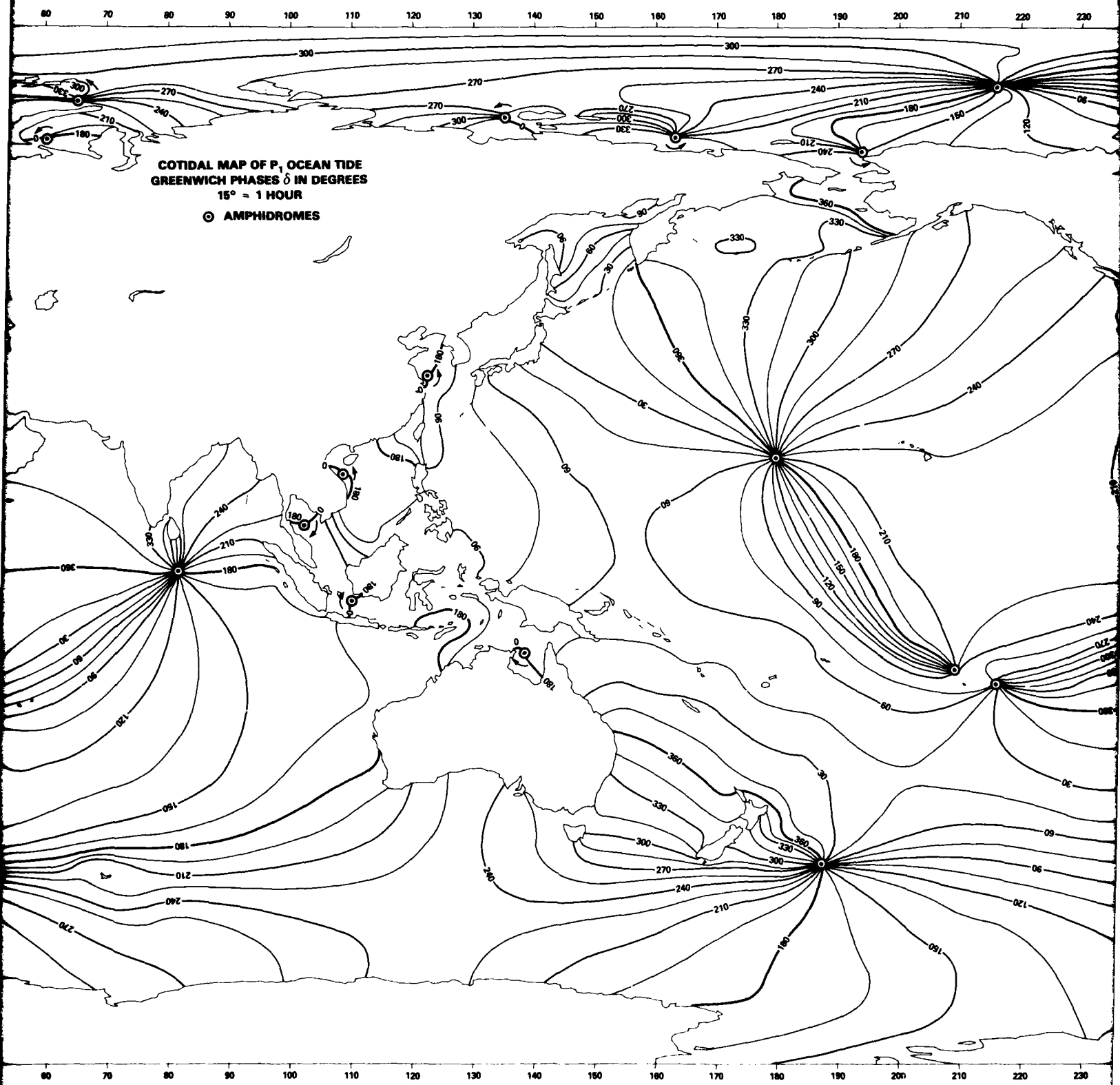


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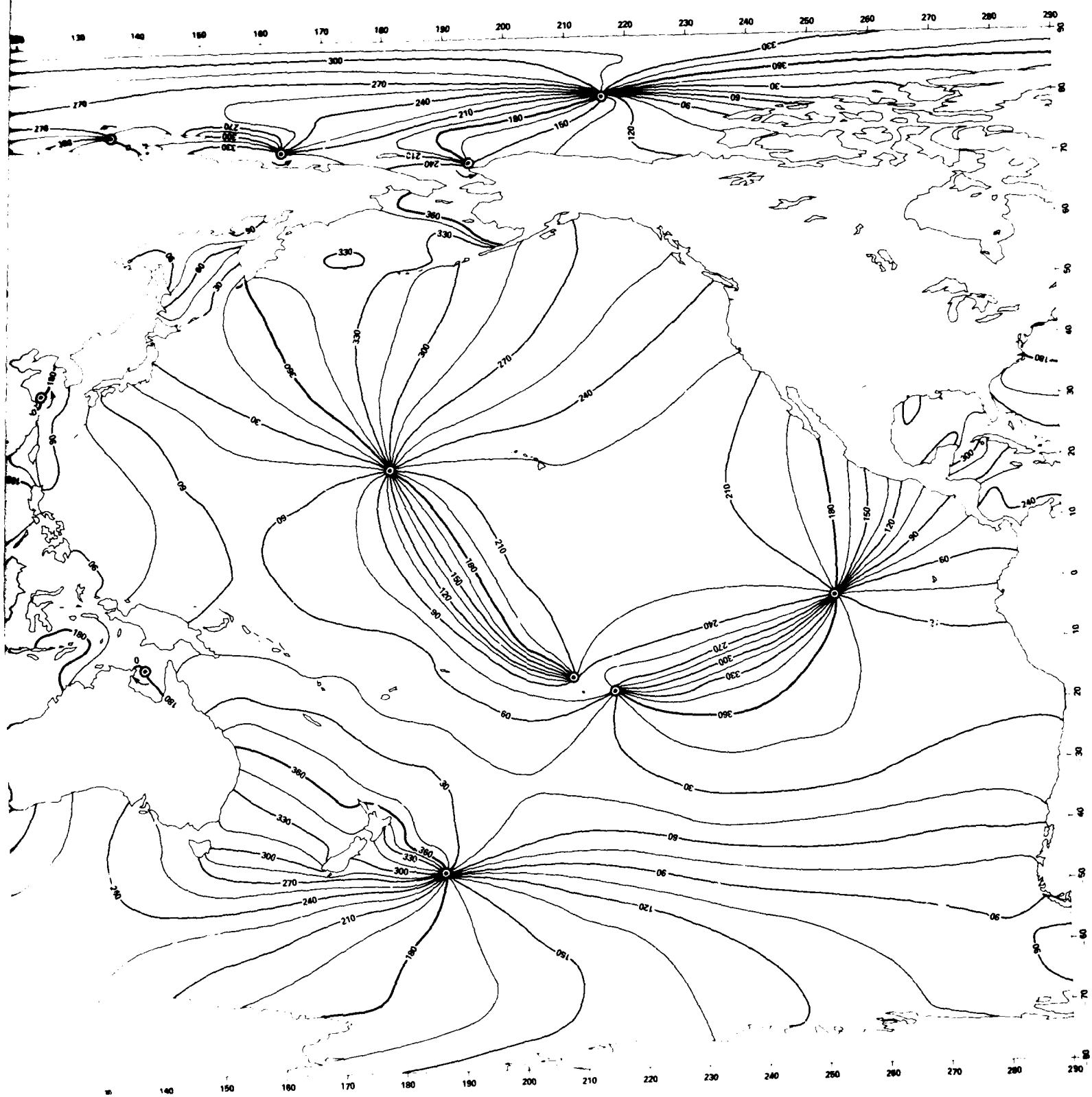




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