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भारत सरकार
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INDIA METEOROLOGICAL DEPARTMENT

MARINE CLIMATOLOGICAL ATLAS

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INSTRUCTIONS

ON USING THE CD

ISSUED BY
NATIONAL CLIMATE CENTRE
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ADDITIONAL DIRECTOR GENERAL OF METEOROLOGY (RESEARCH)
PUNE

भारत सरकार
GOVERNMENT OF INDIA
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

MARINE CLIMATOLOGICAL ATLAS

1961-1990

ISSUED BY

NATIONAL CLIMATE CENTRE
ADDITIONAL DIRECTOR GENERAL OF METEOROLOGY (RESEARCH)
PUNE

Data Compilation and Computation
Marine Climatological Section
Additional Director General of Meteorology (Research), Pune

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E-mail : imdpune@pn2.vsnl.net.in

This CD_ROM contains the following 2 directories

ATLAS_PDF : this directory contains the Marine Atlas as a PDF file. This PDF file is exactly the same as the Hard copy supplied with the CDROM.

ATLAS_DATA : this directory contains the Marine Climate Data 1961-90 used to prepare the Atlas in ASCII format. There are 15 files each for the 15 variables. The details of the files are:

AIRT61-90	: Air Temperature (AT)
SST61-90	: Sea Surface Temperature (SST)
AIRT-SST61-90	: Air Temp - ASST
DEWT61-90	: Dew Point Temperature (DPT)
MSLP61-90	: Mean Sea Level Pressure (SLP)
MWSP61-90	: Mean Wind Speed (WS)
MWDIR61-90	: Mean Wind Direction (WD)
GALEP61-90	: Percentage of Gale Winds (GW)
TOCL61-90	: Total Cloud Cover (TC)
LOCL61-90	: Low Cloud Cover (LC)
MWHT61-90	: Mean Wave Height (MWH)
WHT461-90	: Percentage of wave height More than 4.0 metre (PWH)
MAXWH61-90	: Maximum Wave Height (MAXWH)
MWP61-90	: Mean Wave Period (MWP)
VIS61-90	: Visibility(VIS)

The data are in ASCII format. Each of these files contains data for all 12 months, January to December. The data are given as a 2 Dimensional array (28 X 18) of grid with a 2.5 X 2.5 degree LatX Long resolution.
28 columns are for 28 longitudes starting from 31.25 degree East. Similarly, 18 rows are for 18 latitudes starting from 13.75 degree south.

The first data point is at -13.75 degree south and 31.25 degree East. Value -99.9 represents no data.

A sample fortran program to read the data is given below:

```
REAL SST(28,18)

OPEN (10,FILE='SST61-90.TXT', STATUS='OLD')

DO IM=1,12
READ (10,*)
DO J=1,18
READ(10,*)(SST(I,J),I=1,28)
ENDDO
ENDDO
```

Preface

Historically, marine weather and climate services were initiated by the meteorological services of coastal and maritime nations, considering the vulnerability of mariners to sea hazards. But in addition to their obvious economic importance, the oceans are also known to exert a major influence on global climate and in daily weather conditions. Thus, marine data resources are of great value to the global community.

The provision of marine weather and climate services is dependent on a steady flow of accurate and timely observations of meteorological parameters like wind, weather, waves, air and sea temperatures etc. which is accomplished by an approximate 7000 numbers of commercial ships navigating the global ocean. These ships are enrolled by the World Meteorological Organization (WMO) in its Voluntary Observing Fleet (VOF) Programme, conceptualized in 1947. Since the adoption of resolution 35(Cg IV) of the WMO in 1963, the India Meteorological Department (IMD) was assigned the responsibility of collecting and archiving marine meteorological data for the Indian Ocean. The India Meteorological Department acknowledges with deep appreciation the excellent work done by the officers and staff of the ships enrolled in the VOF. The data have been collected and compiled by the ships belonging to various nations and criss-crossing over the Indian Ocean, in true spirit of international collaboration. The data is subjected to quality control and then archived in digital format at the National Data Centre, Pune of IMD.

To fulfill its obligations, IMD decided to prepare a Marine Climatological Atlas of the Indian sea area for the 30 years period, 1961-1990. This volume is a result of this intent and will contribute significantly to advancing our understanding of atmosphere – ocean climate system over the north Indian Ocean.

The atlas was prepared under the supervision and technical guidance of Dr. M. Rajeevan, Director, Marine Climatology Section, Shri R. K. Prasad, Assistant Meteorologist Gr. I and Shri N. R. Vyas, Assistant Meteorologist Gr. II were involved in quality control and statistical analysis. Smt. K.C. Rajaguru, Shri A. K. Herode, and Shri Sunil Narke helped with typographic work and Shri A. Philipose, S. A. at the DTP unit created the graphics and the layout design. Dr..S.K.Dikshit, Additional Director General of Metoerology (Research) gave overall guidance and support for bringing out this publication I would like to express my sincere appreciation of their efforts in bringing out this informative and useful publication.

New Delhi
January 2003

R. R. Kelkar
Director General of Meteorology

Caution

This Publication is prepared and published in the interest of international collaboration for the exchange of Meteorological information. The Government of India makes no warranty, statement or representation, expressed or implied with respect to the accuracy, completeness or usefulness of the information contained herein and in so for as permitted by law, shall nor have any legal liability or responsibility (including for negligence) for any loss, damage and injury (including death) which may result, whether directly or indirectly from the supply or use of this publication.

Introduction

Since the adoption of resolution 35(Cg IV) of the World Meteorological Organization (WMO) in 1963, the India Meteorological Department (IMD) was assigned the responsibility of collecting and archiving marine meteorological data for the area north of Latitude 15^0 S & between Longitude 20^0 E to 100^0 E and publication of marine climatological summaries. To fulfill these obligations, IMD has so far published Annual Marine Climatological summaries for 17 selected regions and the Decadal Marine Climatological Summary Charts 1971-1980. IMD has now prepared this Marine Climatological Atlas for the Indian Sea area of responsibility.

1. Data Sources

The data used to prepare the Atlas were obtained from two sources:

a) Weather observations recorded in the meteorological log books by Indian Voluntary Fleet (IVOF).
b) Weather observations made by other ships in the Indian area of responsibility & sent to India by the other WMO members in the IMMT formats.

All marine observations available with IMD for the period 1961-90 have been used for the preparation of this Atlas.

2. Data Processing

Observations obtained from the meteorological logbooks of the IVOF were scrutinized to eliminate instrumental, positional & coding errors. These data together with those received from other WMO members were examined & the corrected data were assimilated into the data bank for the further processing. As per the WMO guidelines, the data have been subjected to further quality control procedures like filtration of duplicate observations, internal consistency checks, identification of extreme values and outliers etc.

The area of responsibility is divided into boxes with constant grid spacing of 2.5 degree each, in latitude and longitude. All available quality controlled observations are averaged in each box for each month during the 30 year period. The monthly mean fields were then objectively analyzed to filter out spatial noises. The objective analysis scheme used to filter out the spatial noise is an interative

difference-correction scheme with a weight function. We have used the Barnes weight function, which is defined as

$$W_i = \exp(-4r^2 R^{-2}) \text{ for } r < R,$$

Where, r is the distance between the grid point and analysis grid point. R is the radius of influence. The radius of influence is decreased with each pass in order to analyze smaller scale features with each successive iteration. Since the smallest wavelengths are noisy, the smallest radius of influence needs to be at least seven to eight times the average separation distance. The smallest radius of influence we used 1925 Km, is seven times the average separation distance of a 2.5 degree grid resolution. For the preparation of climatology, 3 passes of the analysis scheme were performed with radii of influence equal to 3000 km , 2500 km and 1925 km.

3. Data Presentation

The monthly climatology of the following 15 parameters were prepared and presented in chart form.

Air Temperature	(^{0}C)	Prevailing Wind Direction	Degrees
Sea Surface Temperature	(^{0}C)	Gale Wind	%
Dew Point Temperature	(^{0}C)	Mean Wave Height	meters
Air-Sea Surface Temperature Difference	(^{0}C)	Wave Height ≥ 4.0 m	%
Sea Level Pressure	hPa	Maximum Wave Height	meters
Wind Speed	Meter/second	Mean Wave Period	seconds
Total Cloud	%	Visibility ≥ 10 km	%
Low Cloud	%		

The charts of Air Temperature, Sea surface temperature, Dew point temperature, Air-Sea surface temperature difference, Mean sea level pressure, Wind speed, Total cloud and Low cloud are presented with isolines. The remaining elements are presented in grid format.

TABLE I : MONTHWISE DISTRIBUTION OF DATA

Year	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
1961	4492	4493	5334	4456	4702	4772	5205	4981	4592	5024	4822	4223	57096
1962	7853	8852	9788	9222	9909	9001	10250	8235	6865	7228	6693	7297	101193
1963	5936	6799	8078	7395	6666	7087	6970	7045	7008	7644	7400	7056	85084
1964	10258	9978	10561	10090	10803	10665	10143	11689	10013	10121	9269	9270	122860
1965	10004	10683	11949	10838	11633	10106	12309	12528	11051	12709	12033	11107	136950
1966	8374	11430	12882	11713	12092	11731	11103	12068	10145	10947	11077	11454	135016
1967	11518	11525	12090	11472	12081	8847	8306	8140	7621	8111	7333	7918	114962
1968	10001	7544	8841	8846	9149	8403	7852	8188	8320	7749	8238	8475	101606
1969	9437	8620	8404	7961	6945	7623	8577	8100	7437	8388	7824	7503	96819
1970	6640	6039	6345	5998	6987	7077	7171	7064	7028	7003	6420	6909	80681
1971	7847	7329	8527	7827	7897	7415	7826	8208	7533	8207	8881	8296	95793
1972	8047	7255	8340	7343	7787	7927	7960	8341	7893	8386	7584	7753	94616
1973	6439	6022	6072	5839	6815	6371	7212	7195	7507	7929	7583	4161	79145
1974	9030	8211	8568	8412	8620	8902	9122	8565	8078	8433	7475	7699	101115
1975	8162	7950	8913	8903	7526	8719	9304	9319	9044	9486	9500	9262	106088
1976	8497	8085	9671	8991	9612	8464	8352	8890	8362	8479	8879	8441	104723
1977	8548	8483	9171	7163	8292	8960	9235	8896	8871	8987	9700	9322	105628
1978	9562	8892	10885	9311	10185	10027	11120	10395	9719	9434	9601	8727	117858
1979	7994	7229	9083	9217	8809	8080	9202	8309	7792	8315	10258	9043	103331
1980	8878	9824	10444	8502	8972	9027	9025	9278	8534	8604	9083	7965	108136
1981	8656	7632	10551	8942	9778	11289	9052	9687	8368	8357	8856	7107	108275
1982	6802	6379	9091	6881	6736	7013	6929	8052	6908	7095	6882	6661	85429
1983	5286	4860	5187	4798	5308	5713	6097	6053	6124	6852	6694	6114	69086
1984	6764	6454	7359	6823	7190	7249	7261	7204	6866	7232	7418	7262	85082
1985	7372	7028	8207	7342	7391	6865	7073	7041	6334	7021	6362	6692	84728
1986	8202	7261	7458	8094	8428	8164	8353	9105	7516	8553	7753	7176	96063
1987	6129	5996	6791	6454	6615	6454	6881	6033	6968	6522	6447	6695	77985
1988	5602	6884	6169	6145	7799	8330	9358	8370	8739	9509	9322	9469	95696
1989	8102	7760	8188	8349	9007	8963	8529	9022	8023	8372	8367	8804	101486
1990	8087	7709	7817	7568	7199	7258	6823	7875	8461	7818	8204	8582	93401
Total	**238528**	**233206**	**260764**	**240895**	**250933**	**246502**	**252600**	**253876**	**237720**	**248515**	**245958**	**236443**	**2945931**

Number of Weather Observations over the

Area of Responsibility of India contributed by WMO Members

Code No. of WMO Member	Name of WMO Member	Number of Observations
00	Netherlands	575575
01	Norway	5107
02	U. S. A.	252530
03	U. K.	652142
04	France	233794
05	Denmark	971
07	India	333434
08	Hong Kong	27549
09	New Zealand	2875
10	Ireland	1305
13	Canada	15619
14	Belgium	5999
15	South Africa	1875
16	Australia	25211
17	Japan	110149
18	Pakistan	20723
20	Sweden	4055

Code of WMO Member	Name of WMO Member	Number of Observations
21	Germany	418131
23	Israel	25001
24	Malaysia	5503
25	Russia	84195
27	Korea	73
29	Portugal	14437
31	Thailand	1012
32	Yugoslavia	28371
33	Poland	56432
34	Brazil	294
35	Singapore	16367
36	Kenya	1667
37	Tanzania	576
38	Uganda	372
40	GDR	19554
41	Croatia	2391

TOTAL NUMBER OF OBSERVATIONS :- **2943457**

Other CC data :- **168** Blank CC data :- **2103**

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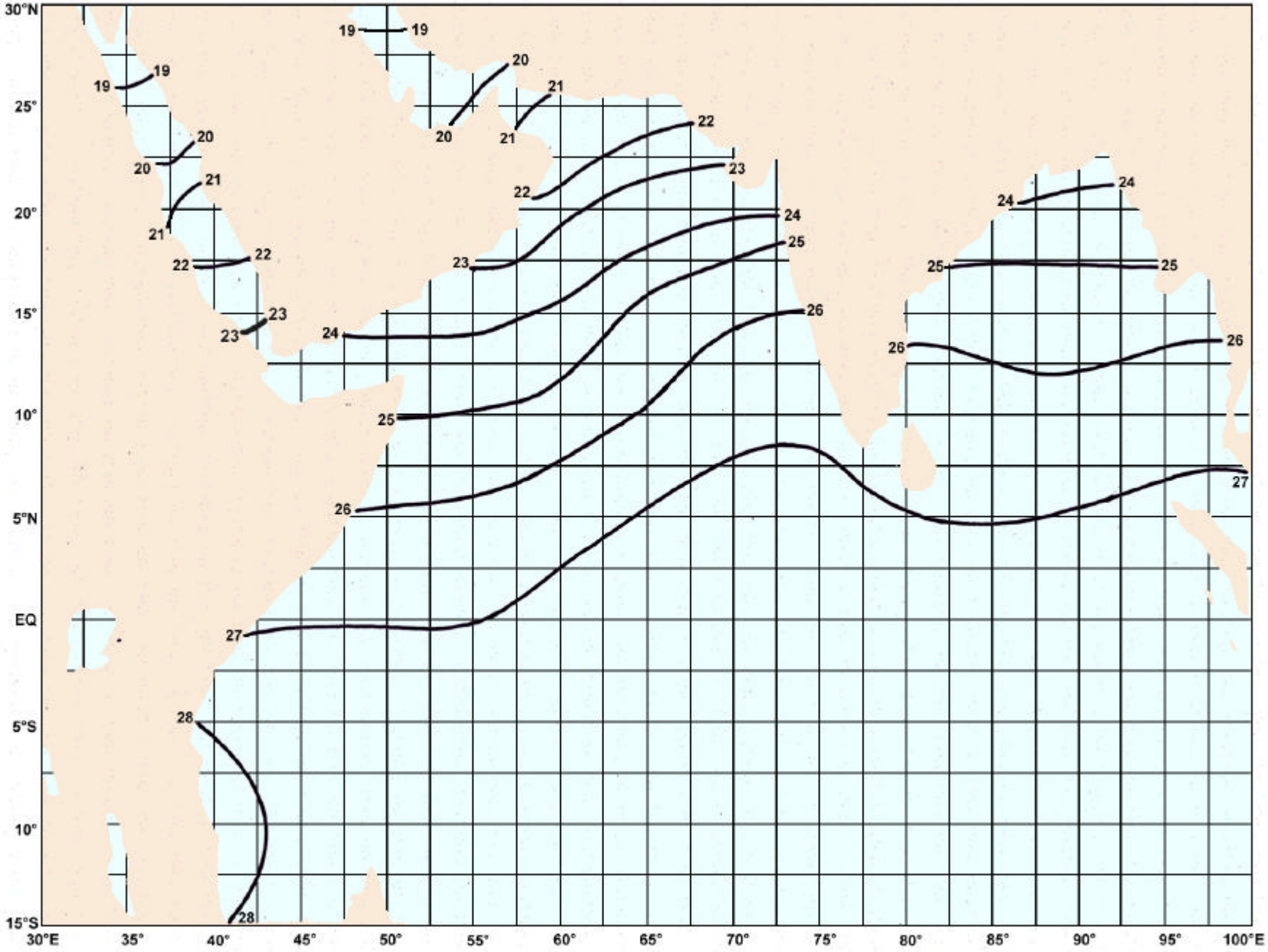

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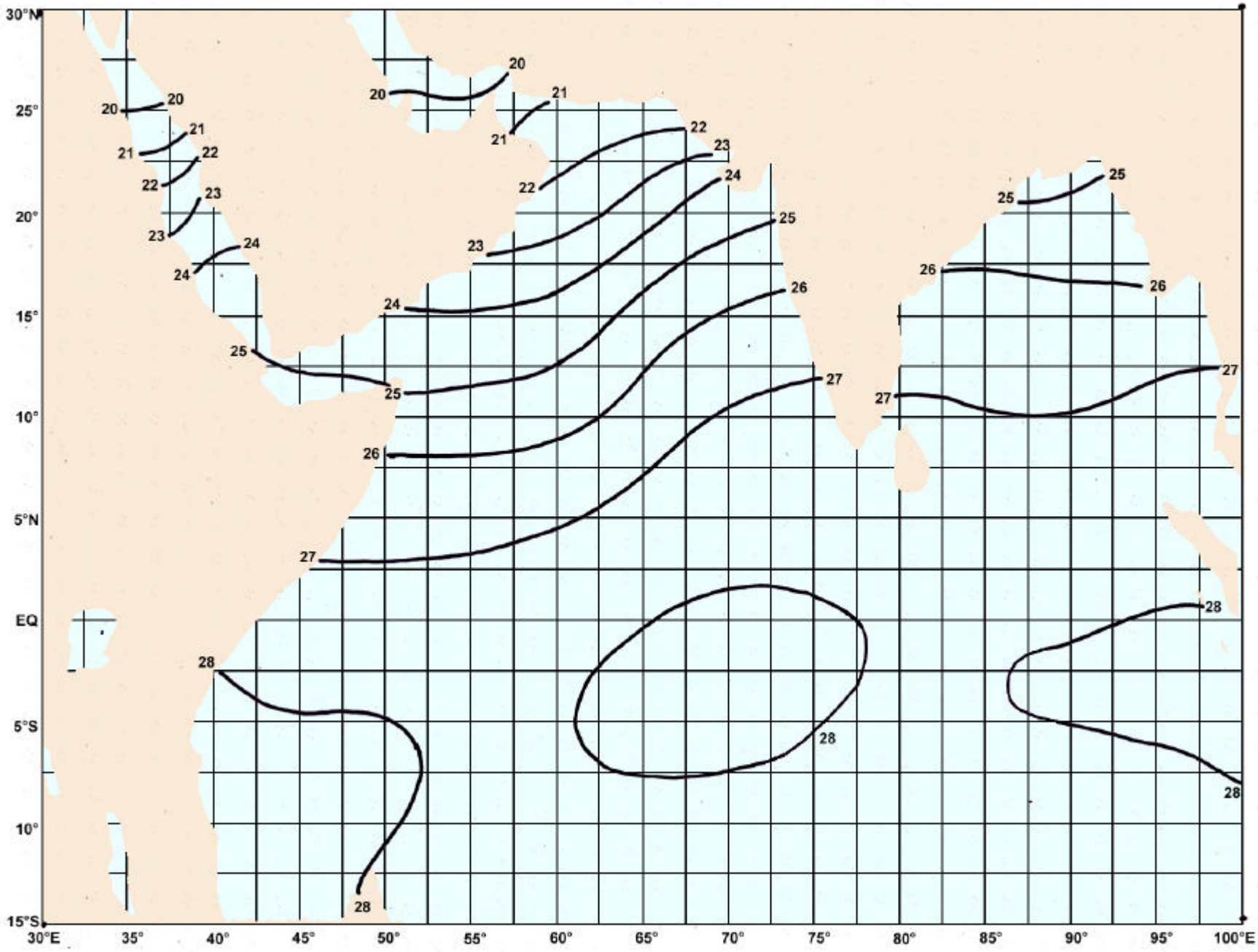

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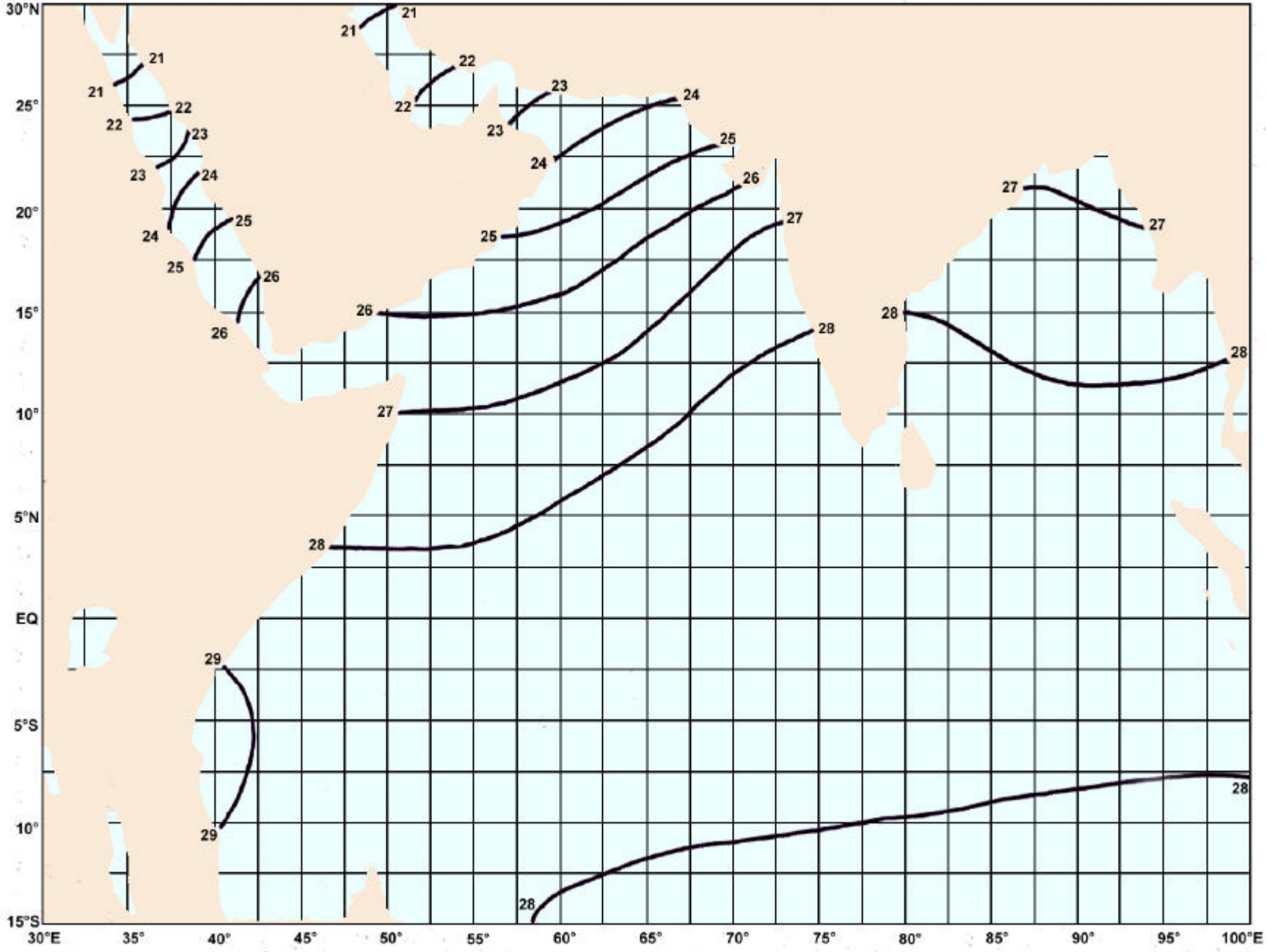

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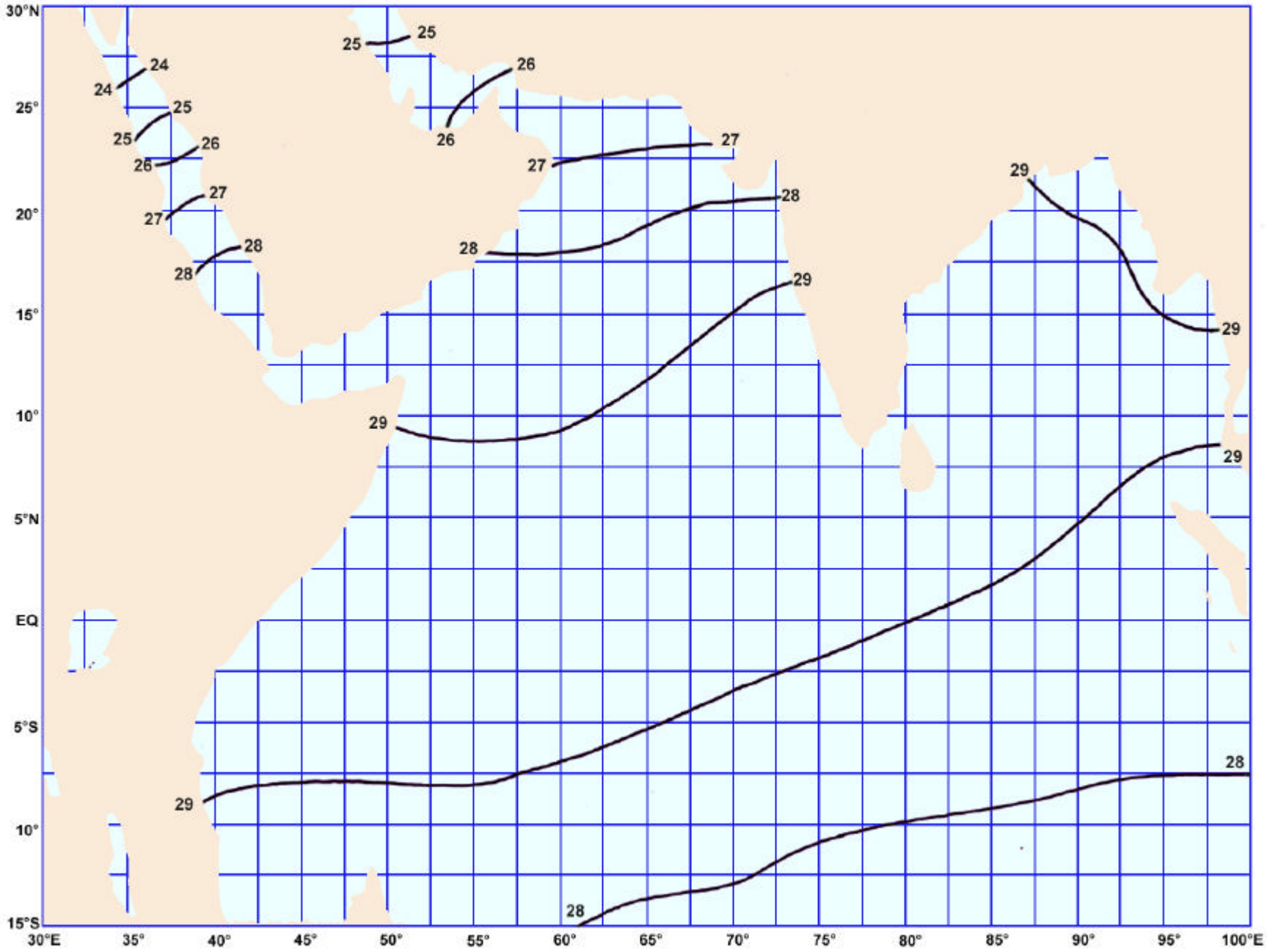

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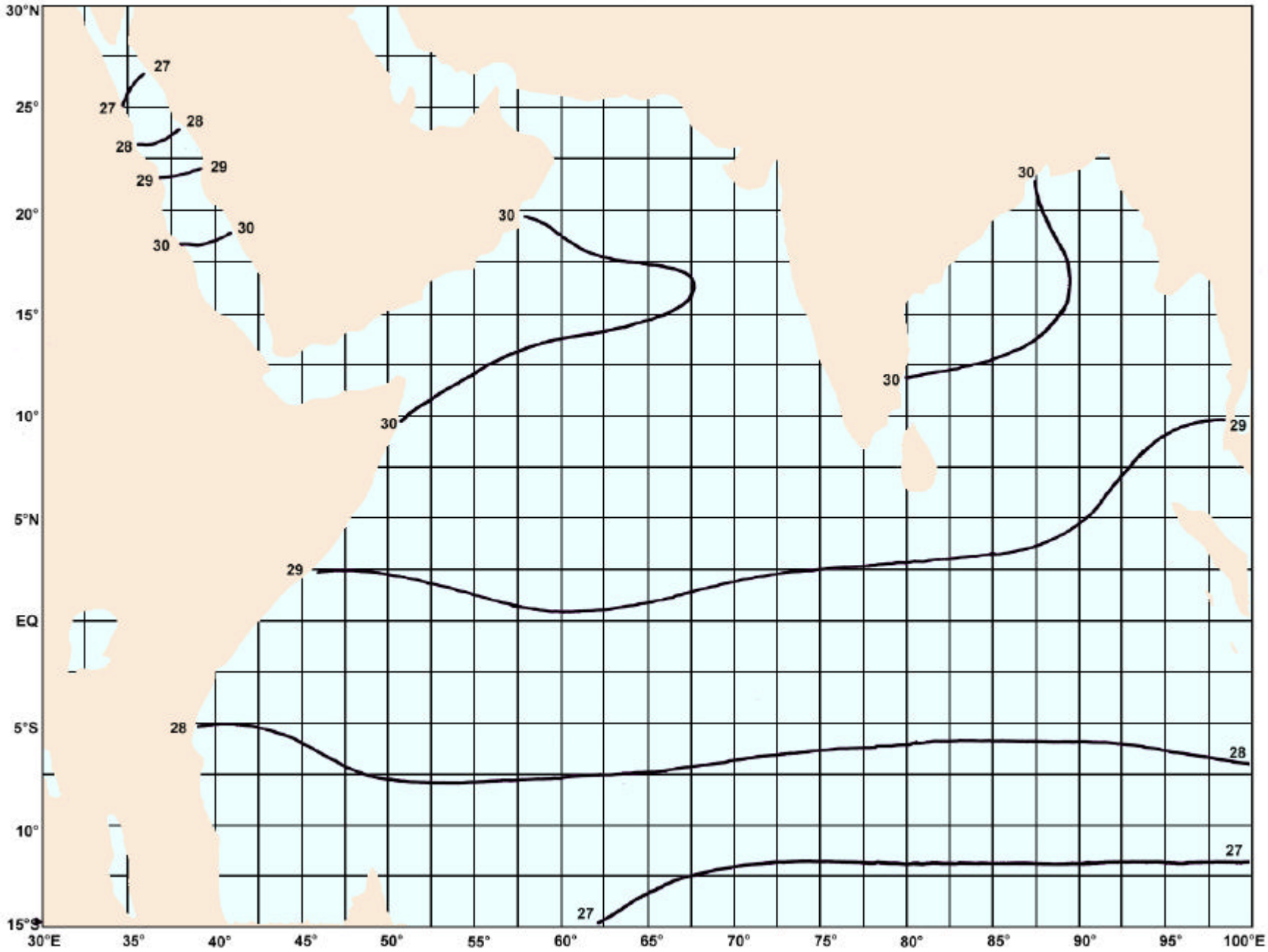

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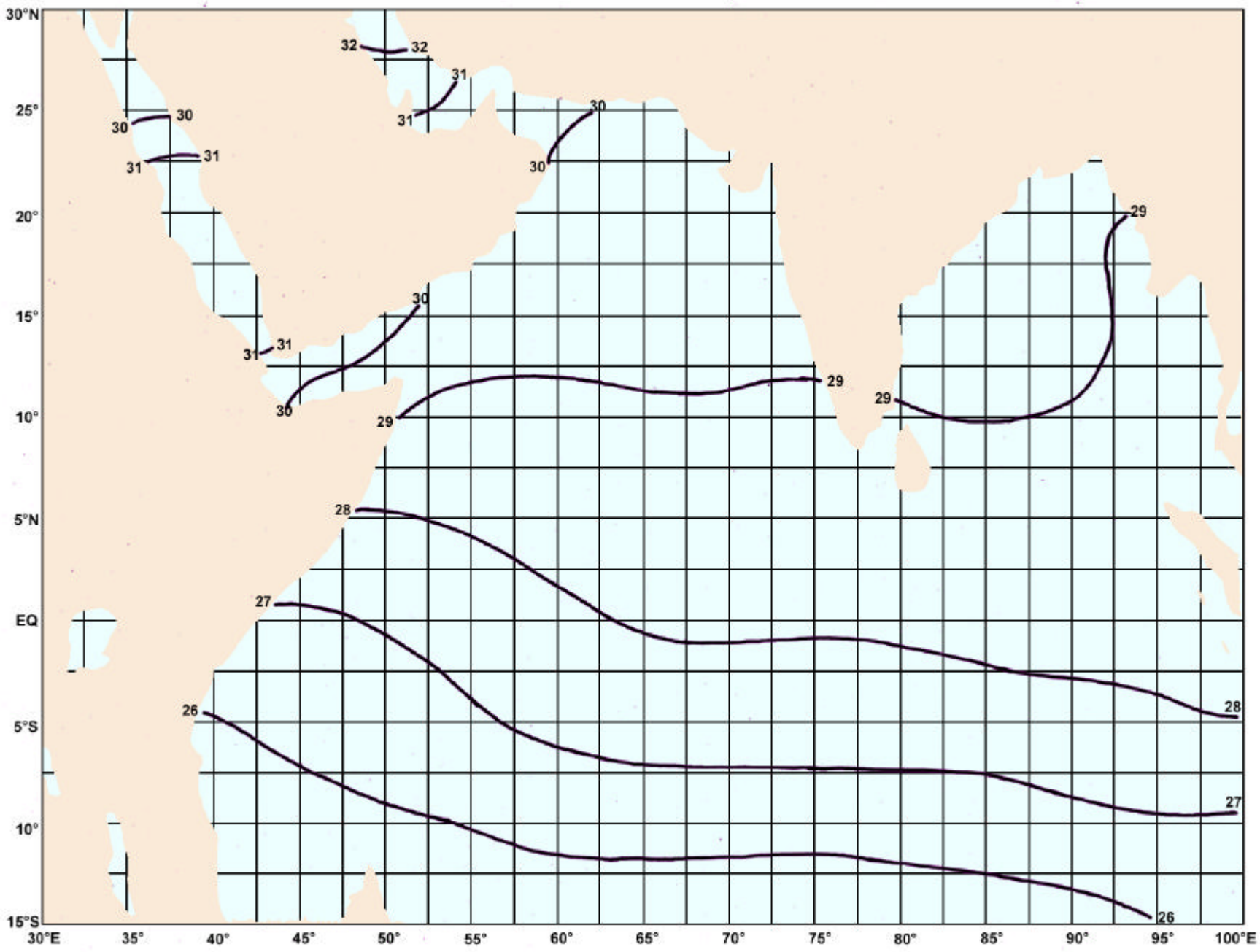

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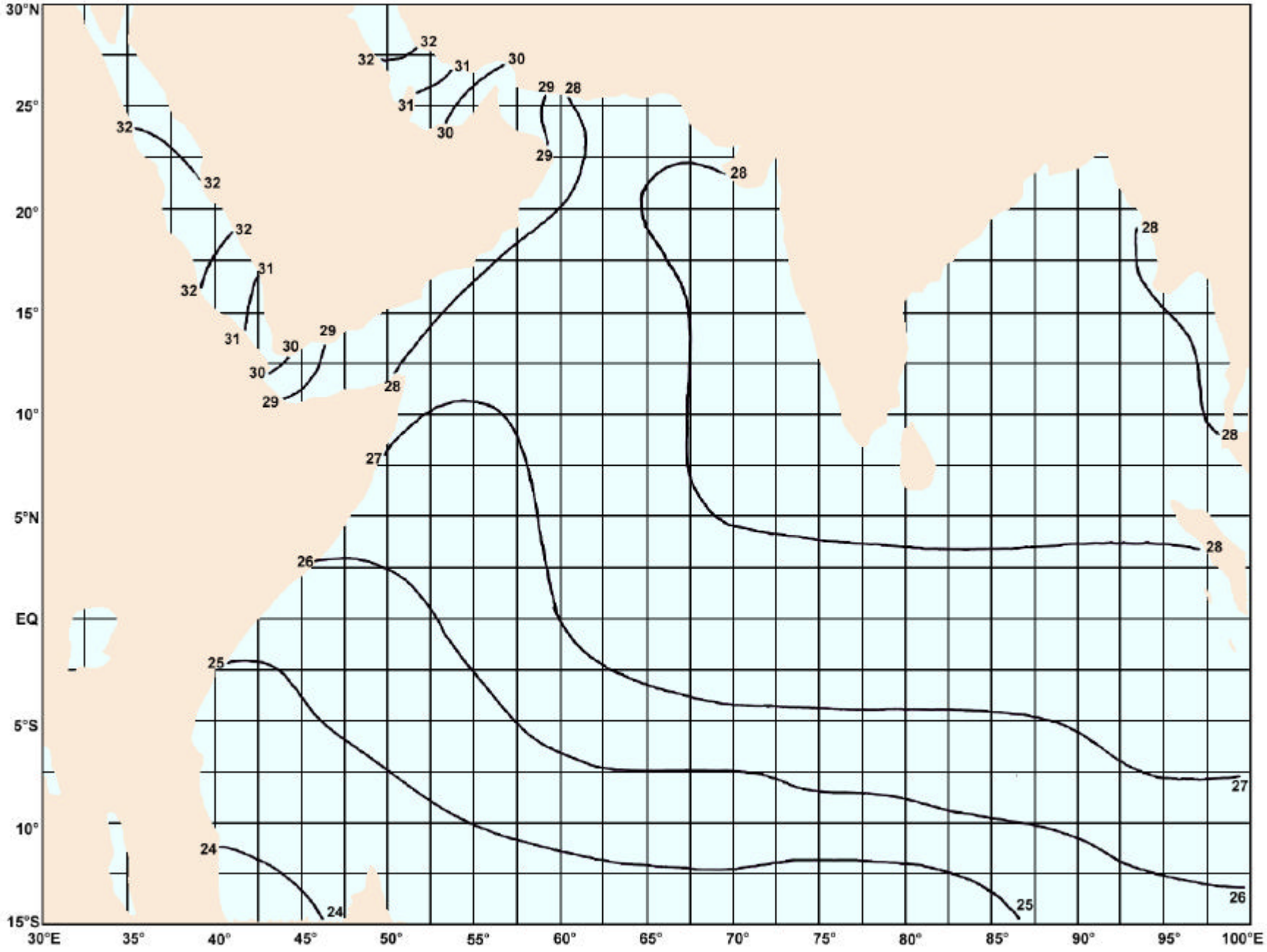

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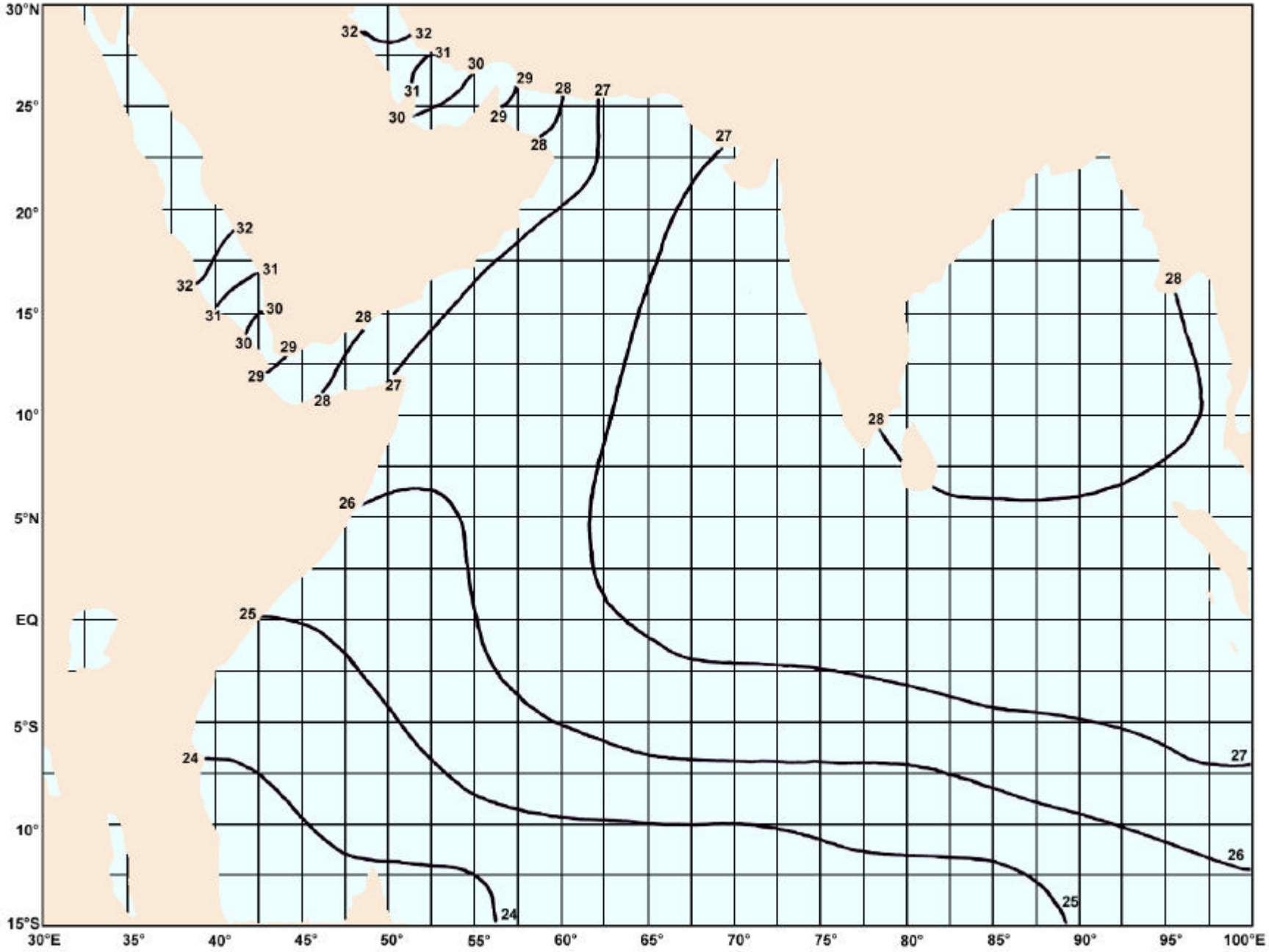

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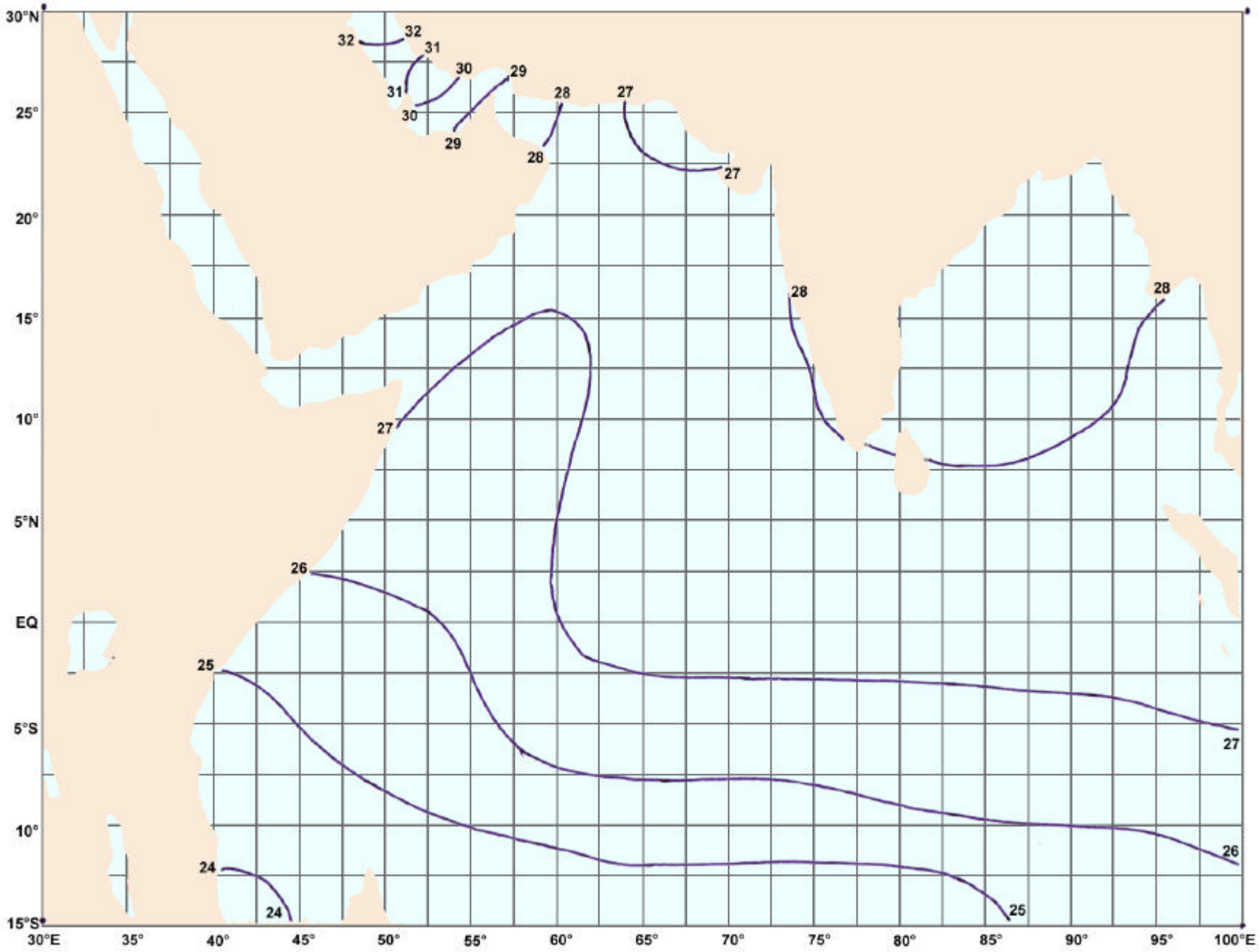

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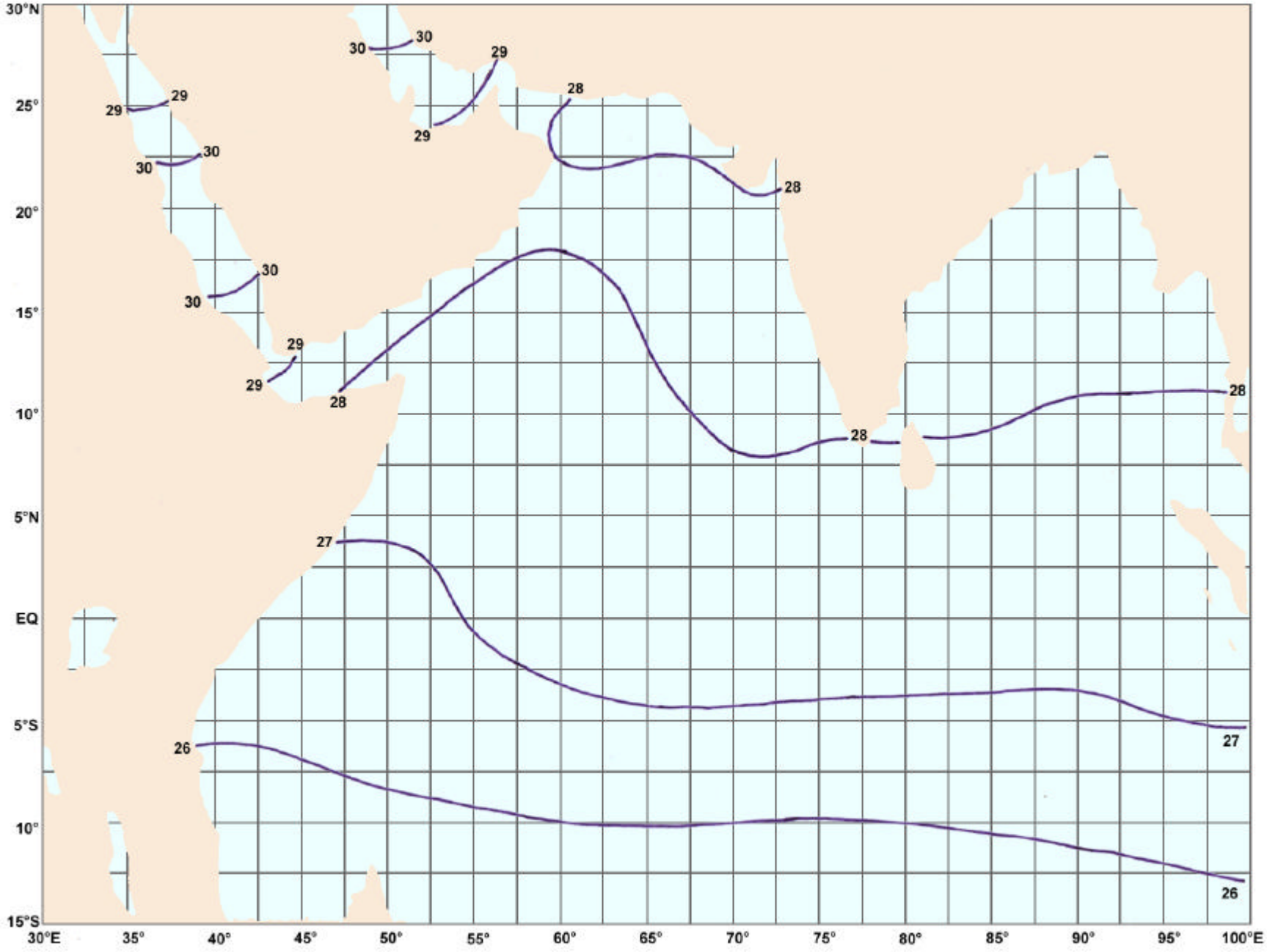
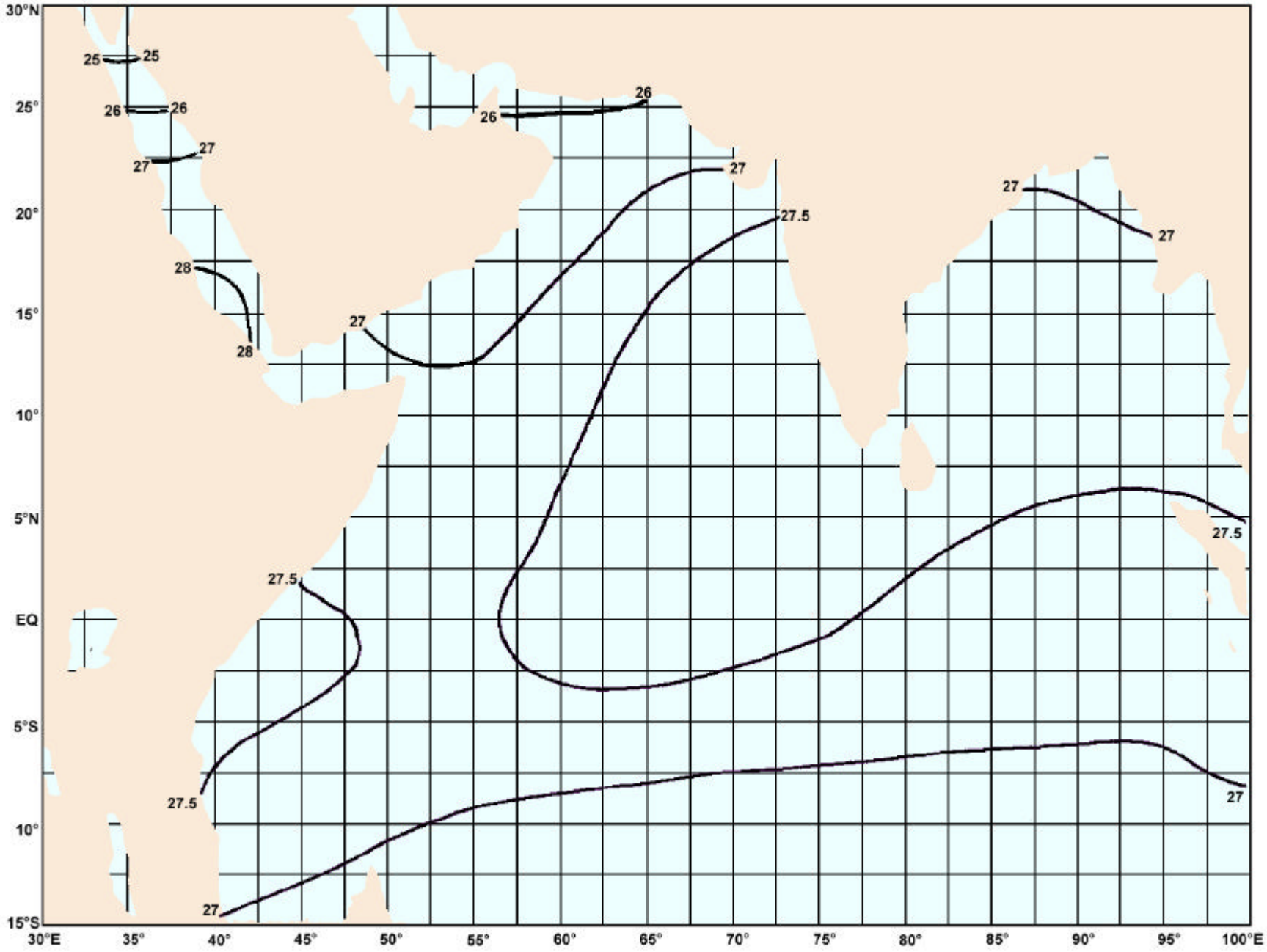


CHART No. 1.11

AIR TEMPERATURE(°C)

NOVEMBER



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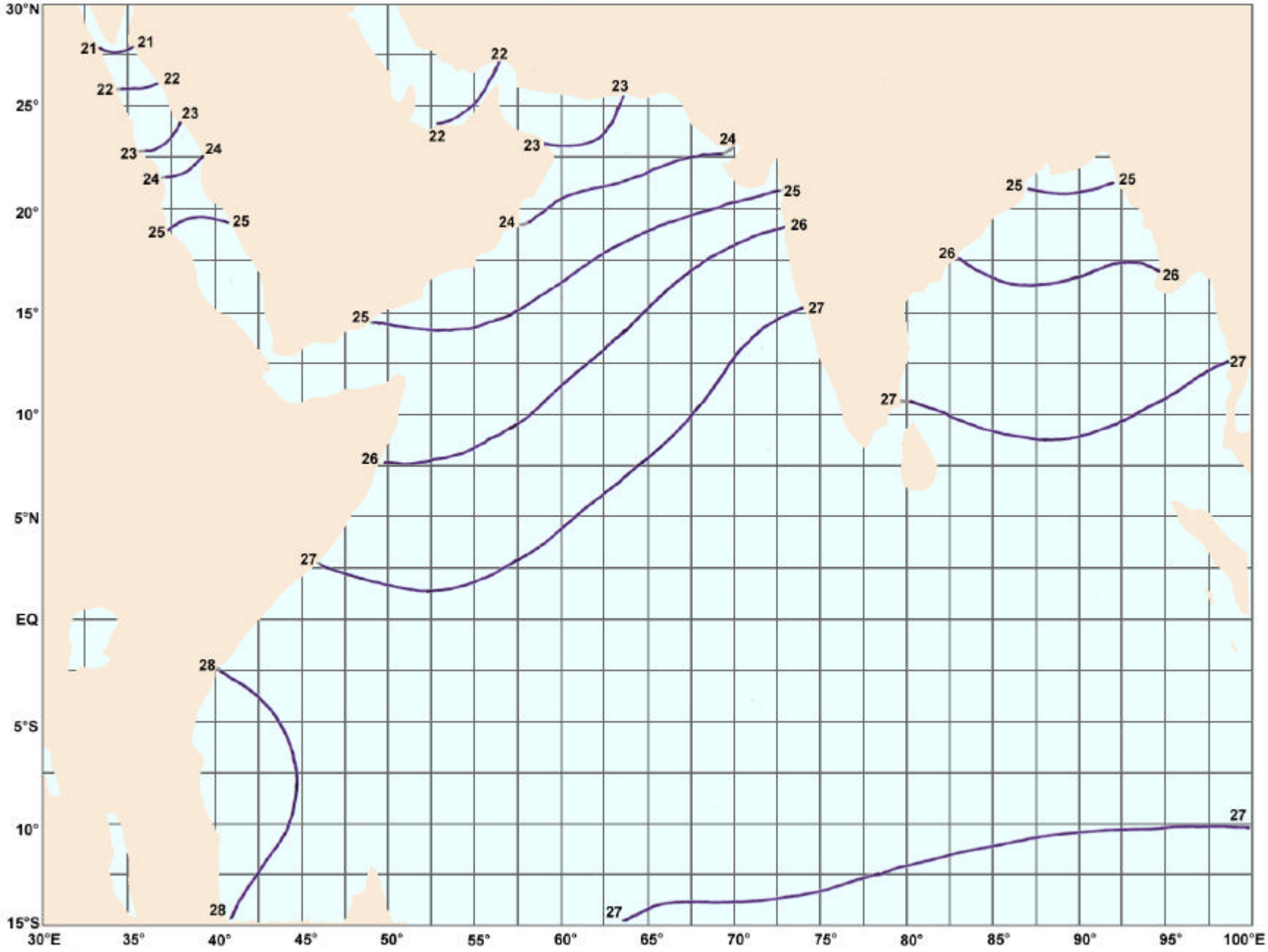

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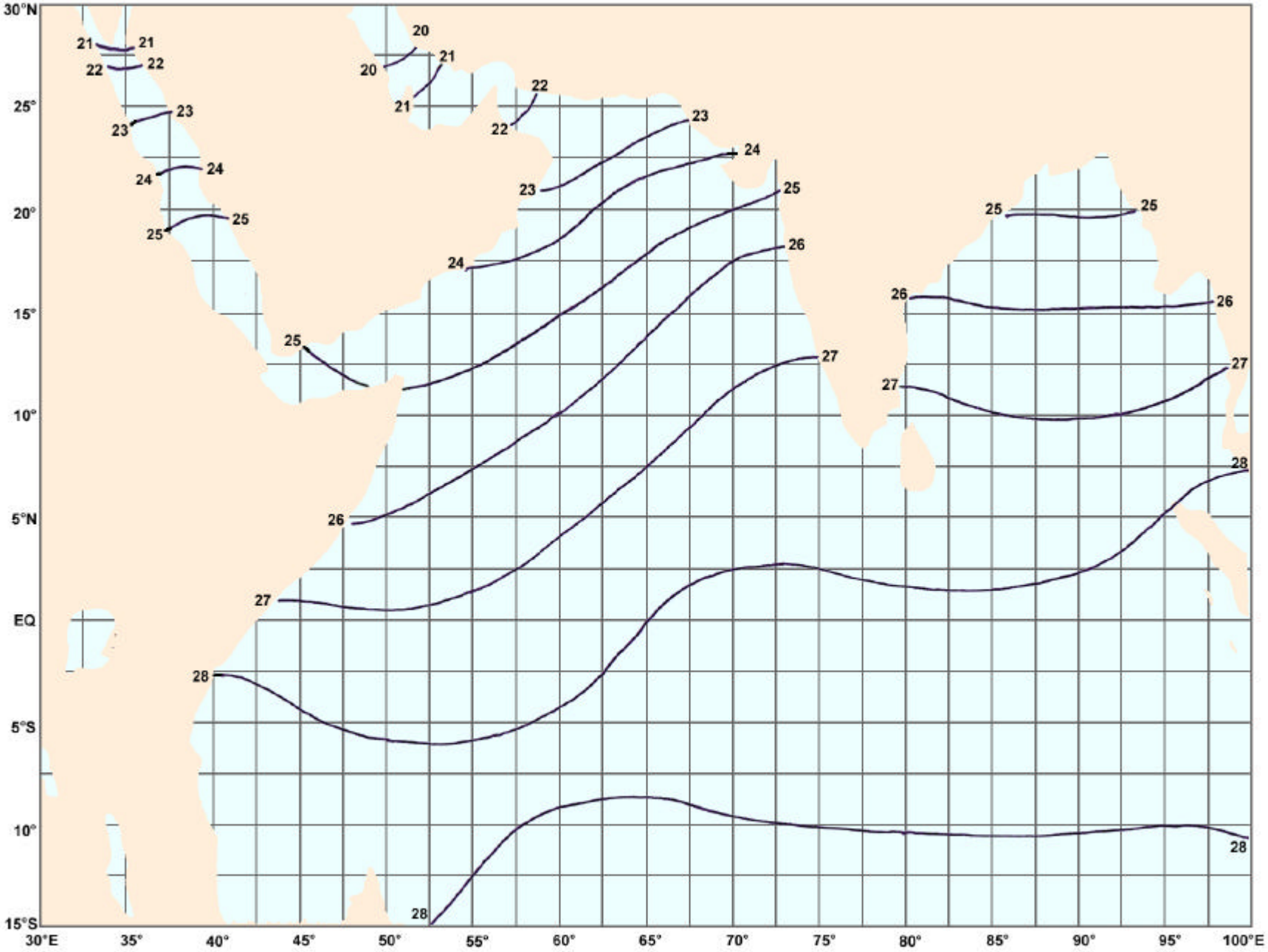

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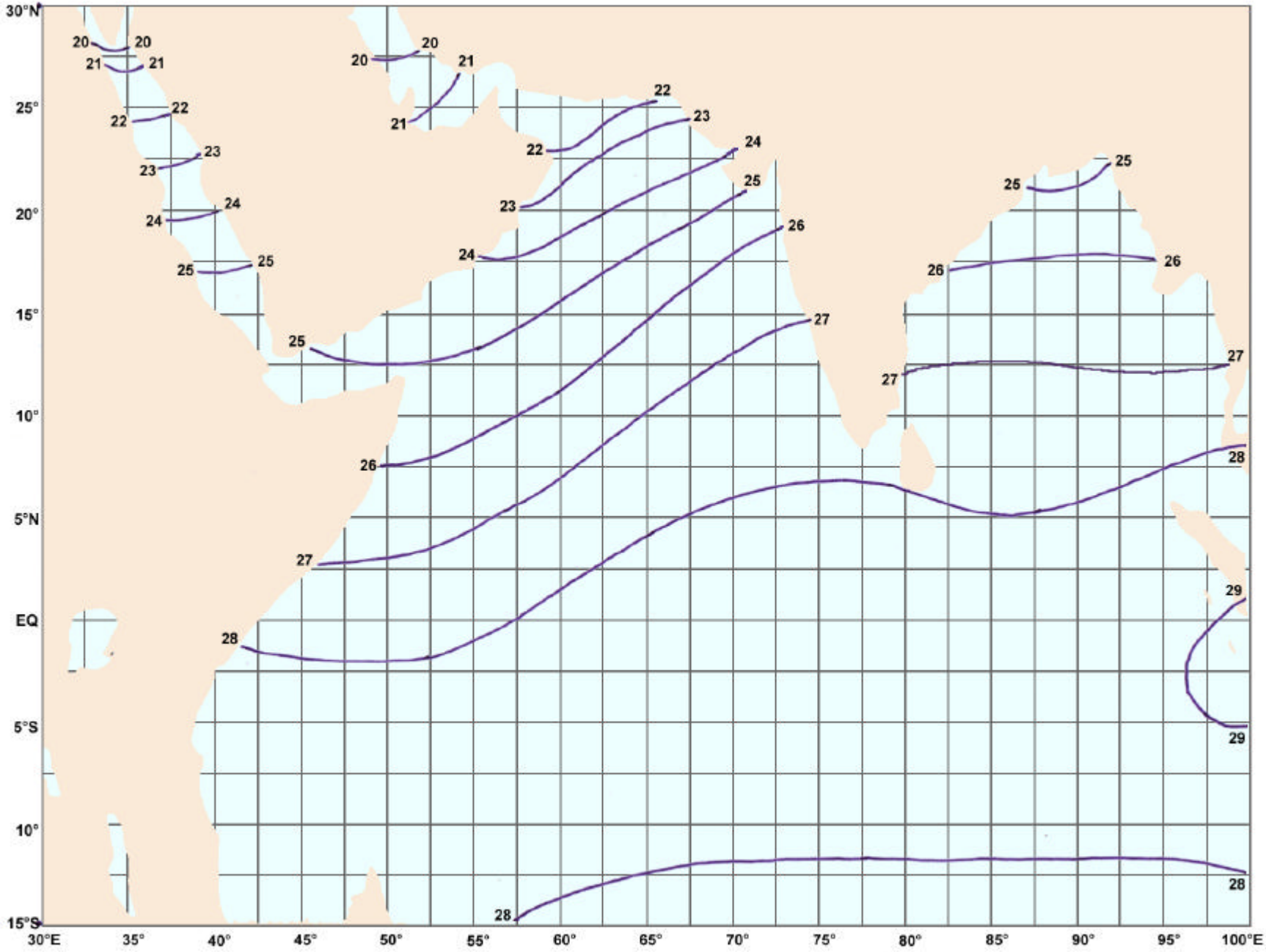

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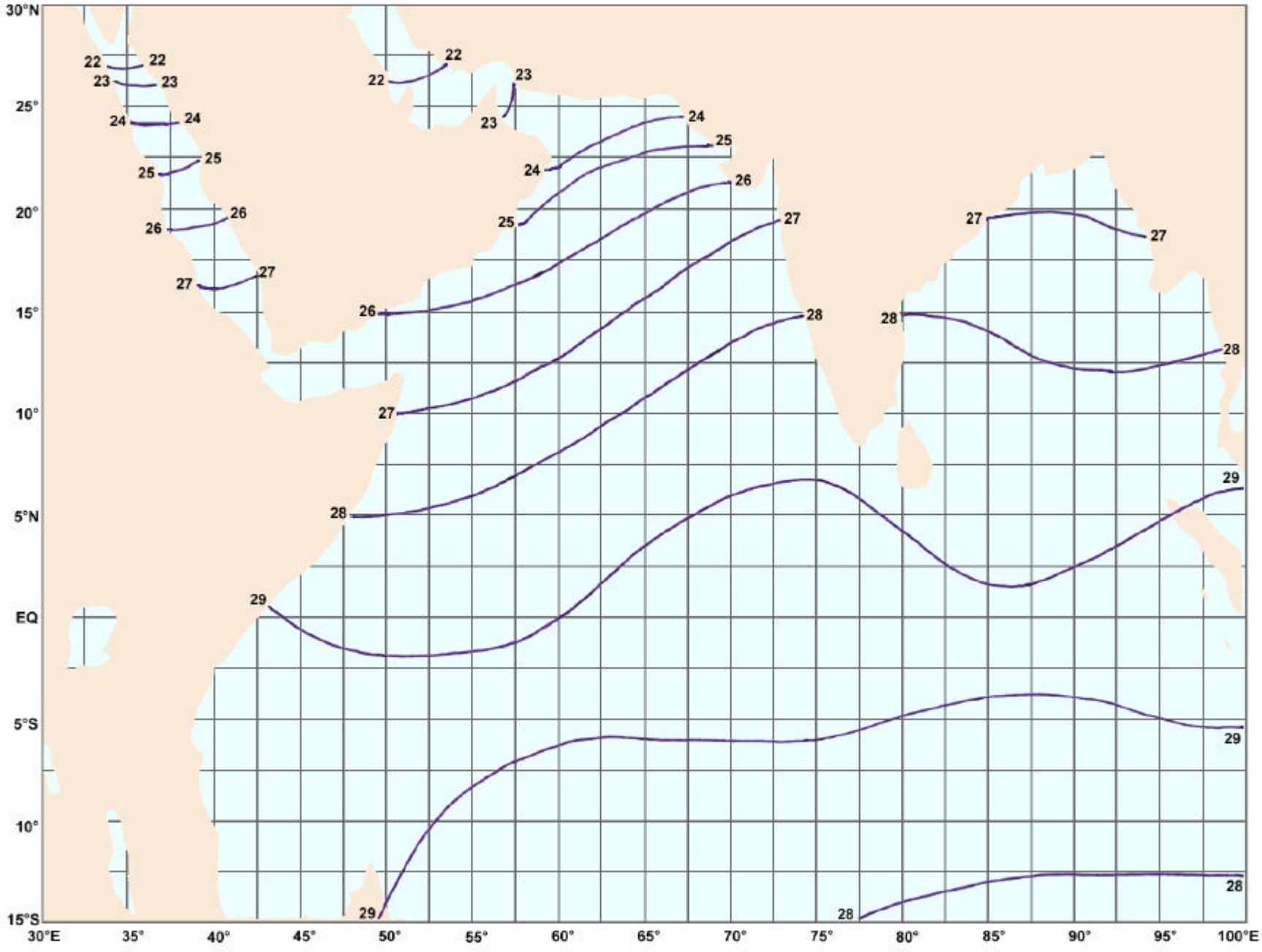

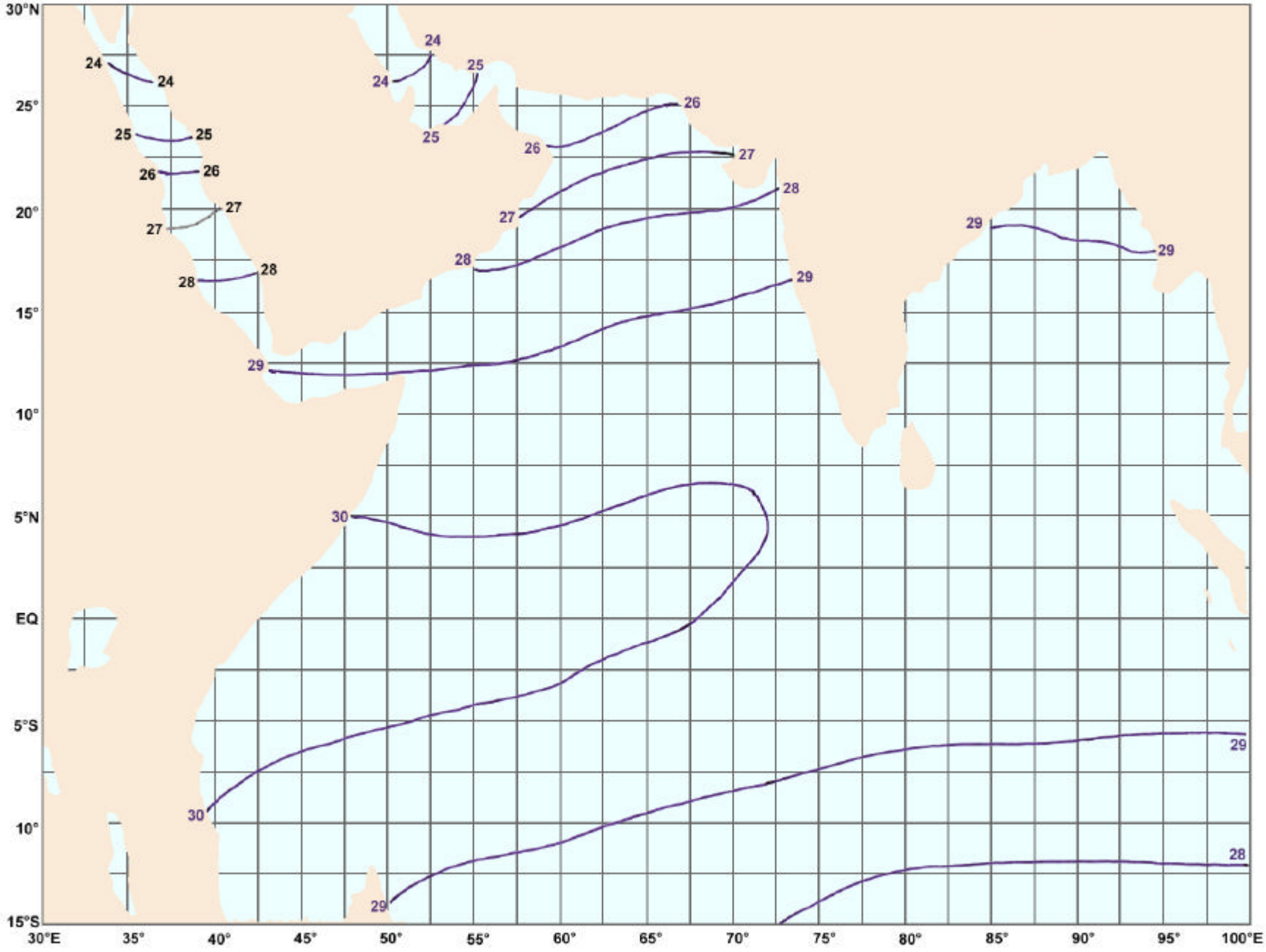
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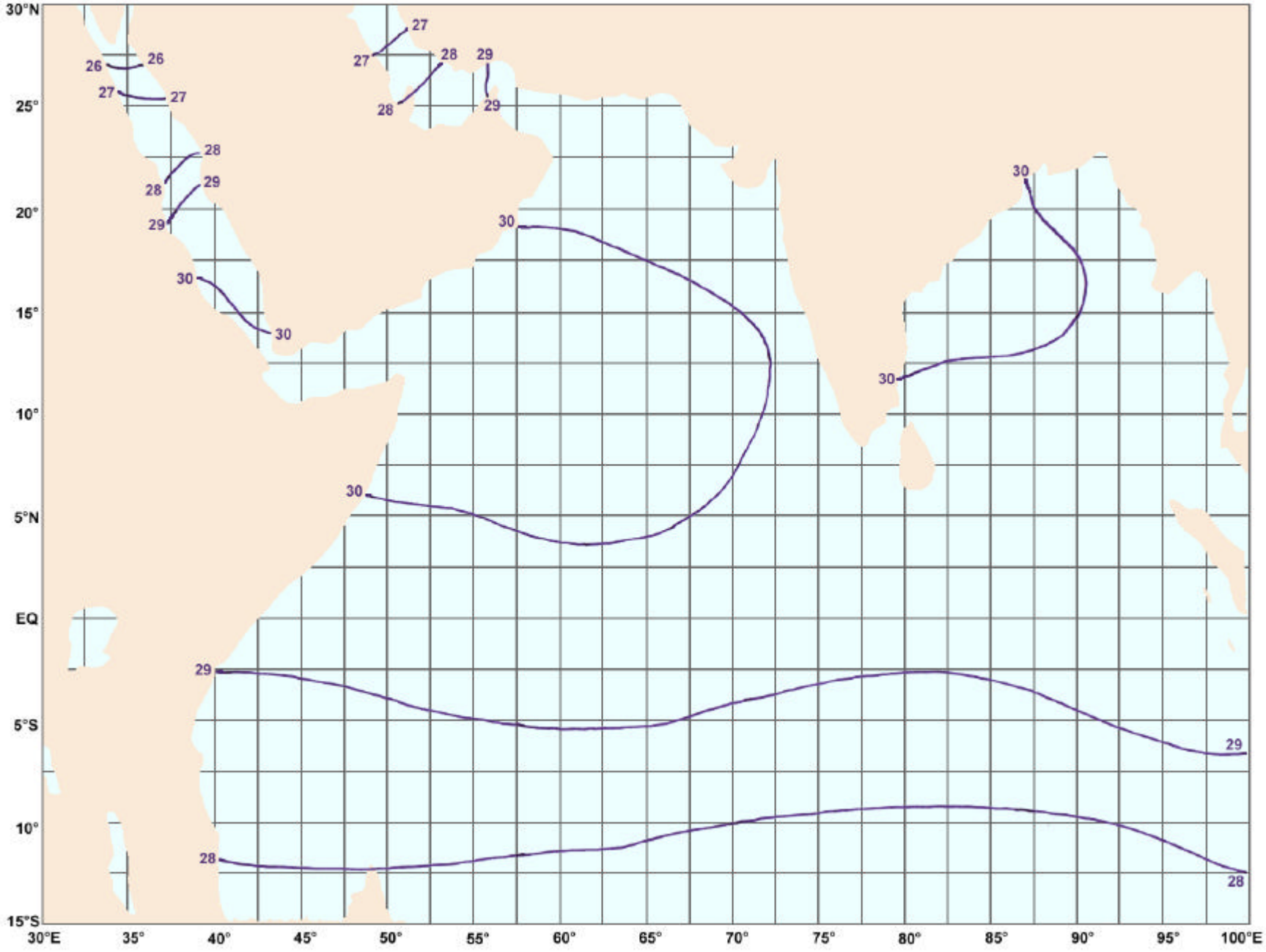

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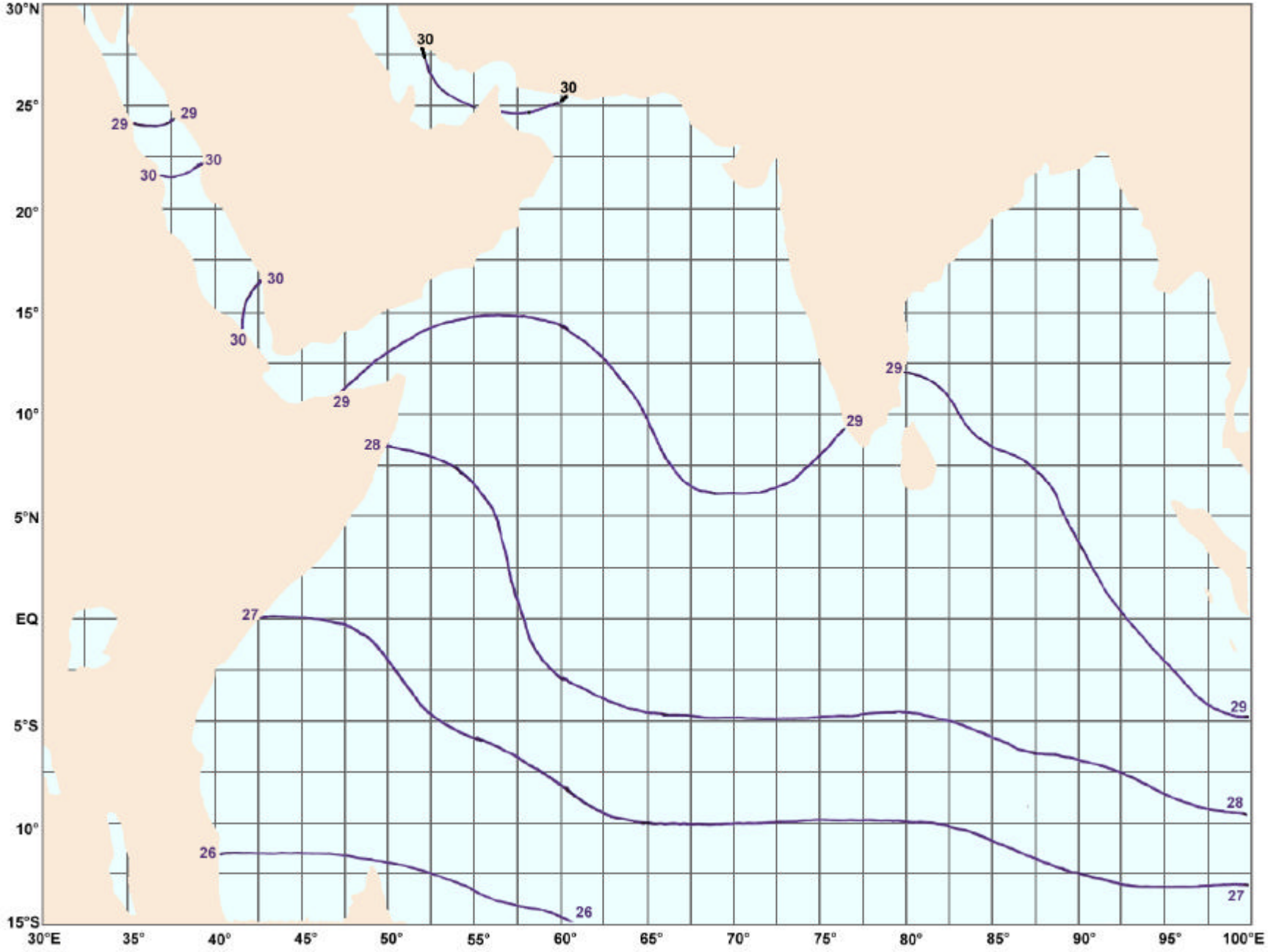
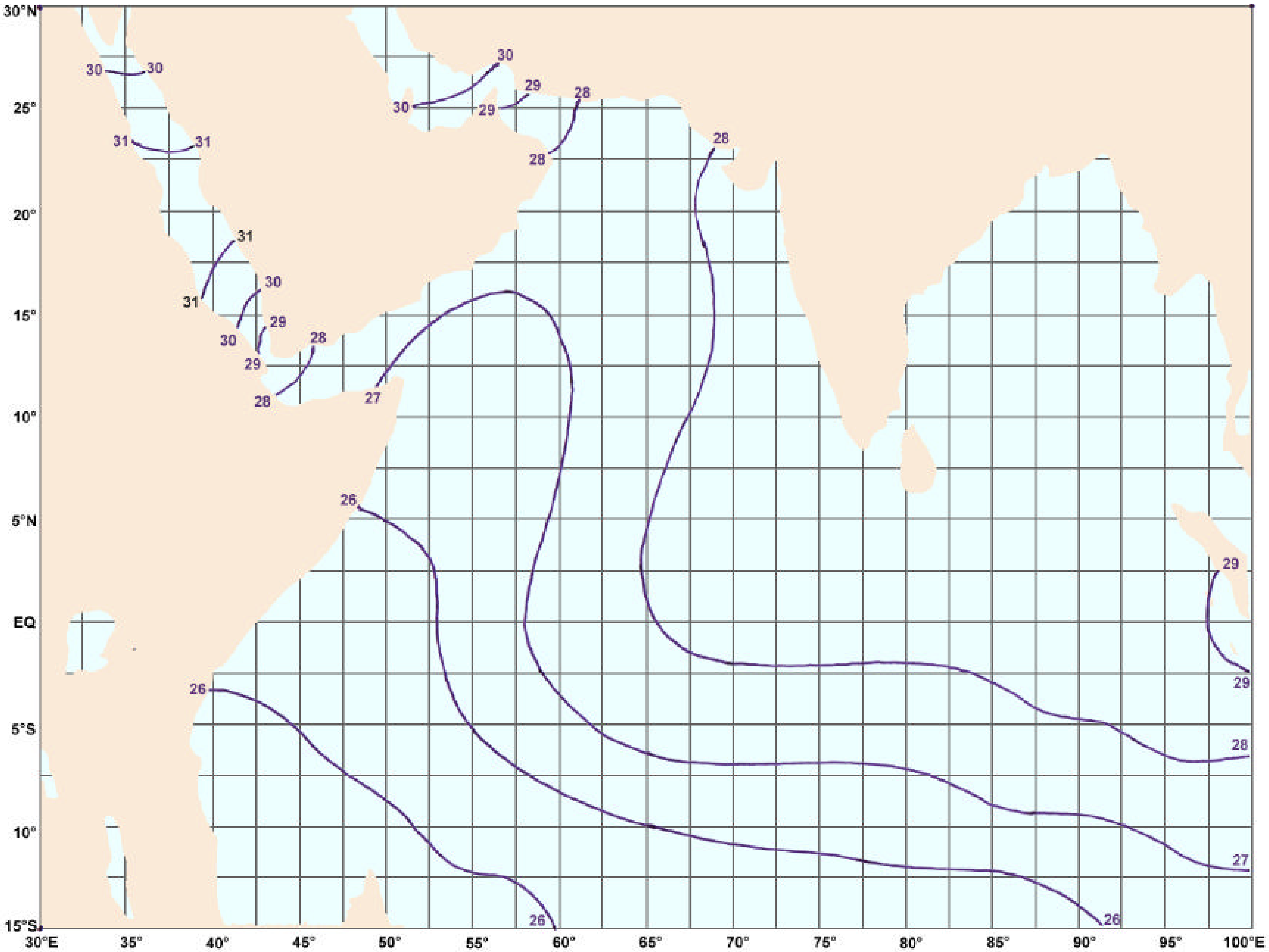


SEA SURFACE TEMPERATURE(°C)

JULY



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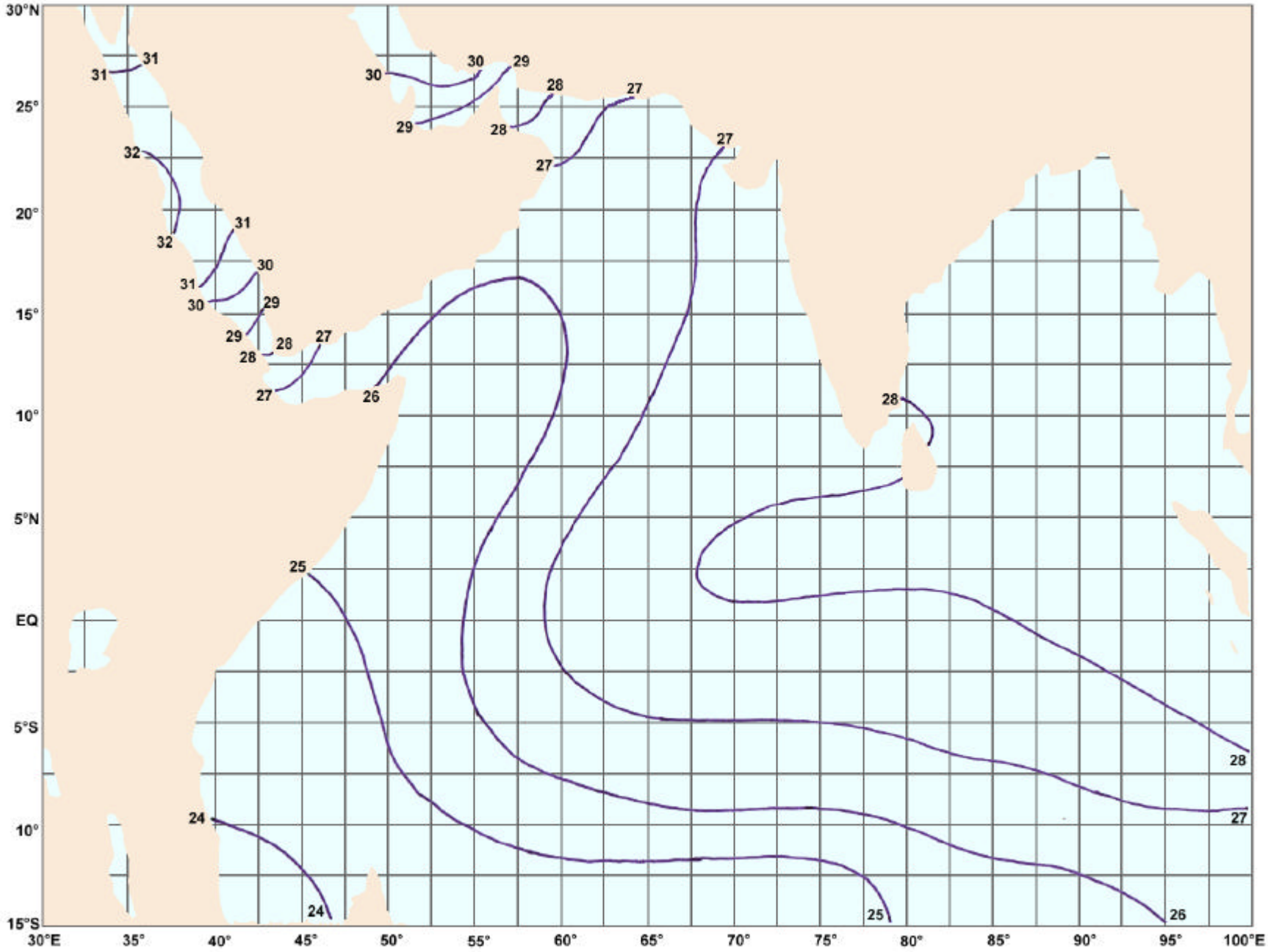

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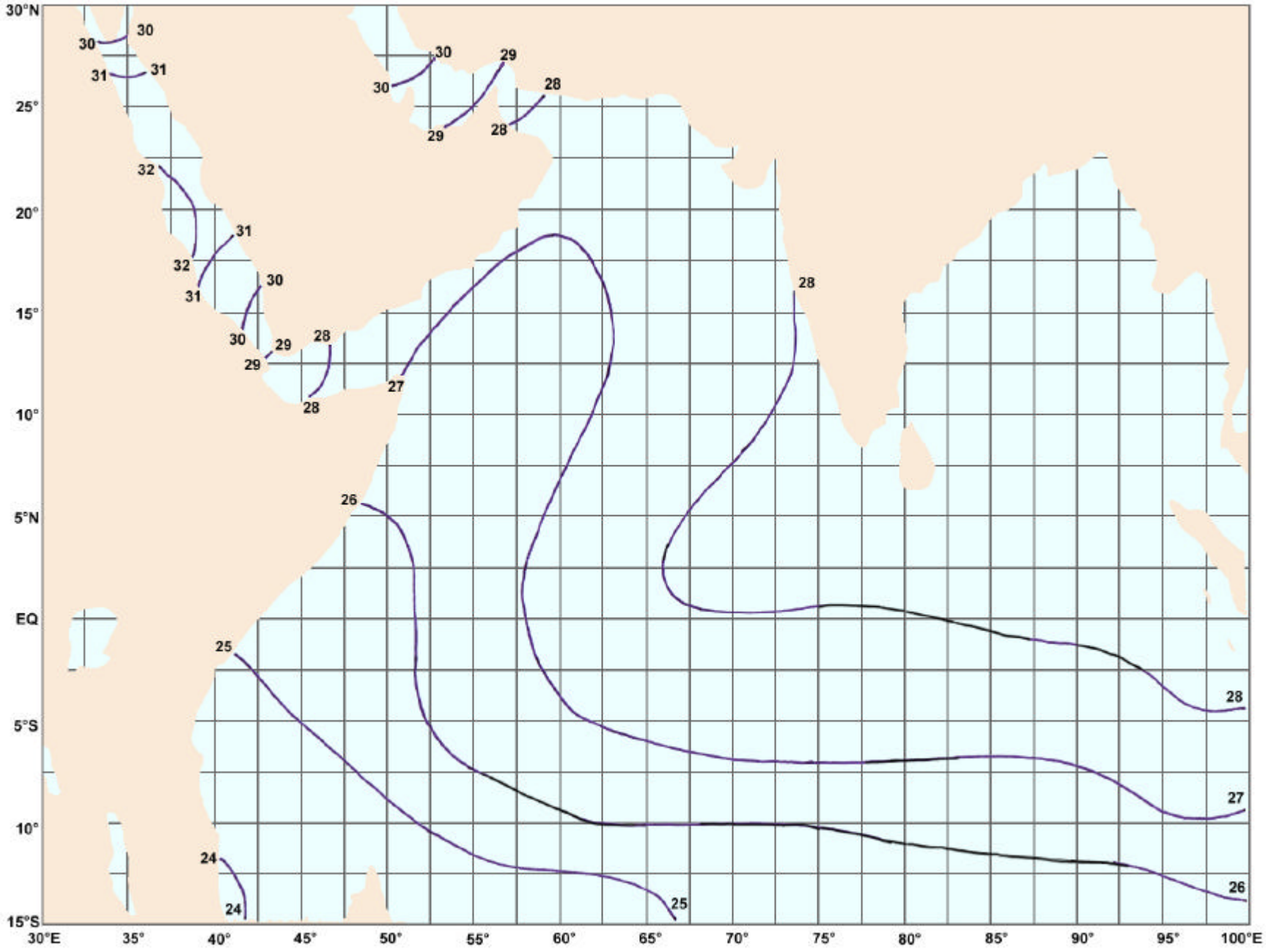

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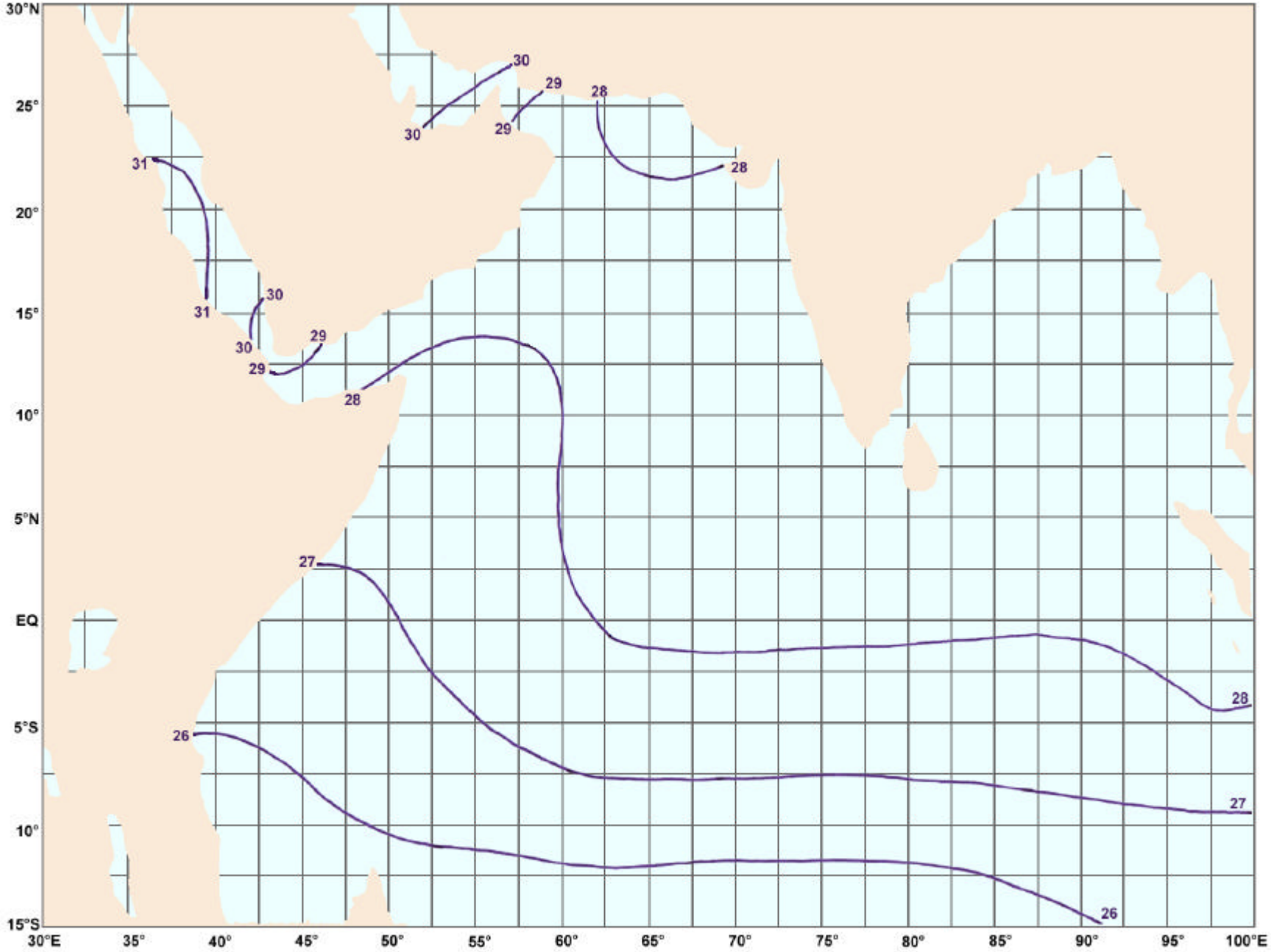

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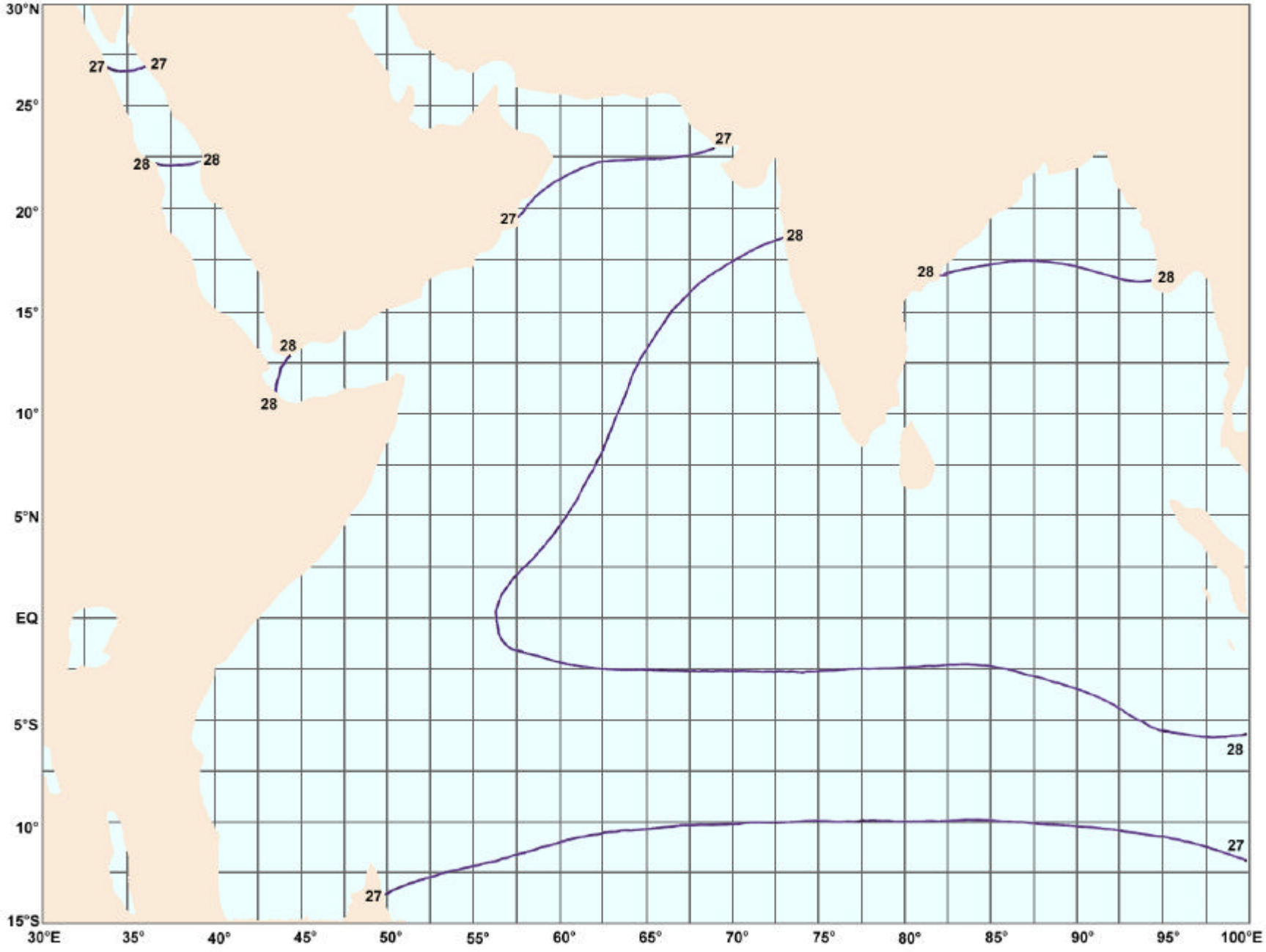

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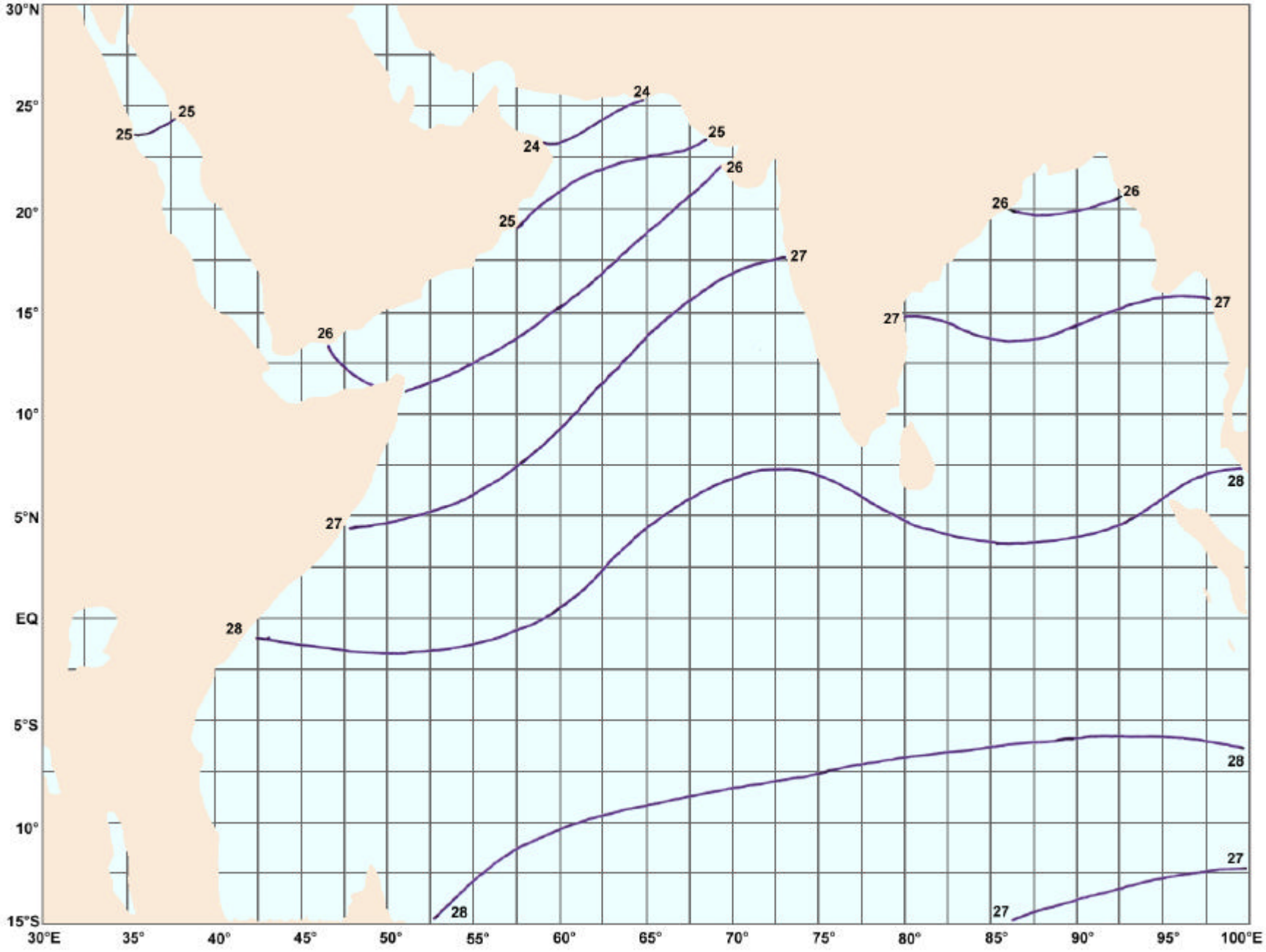

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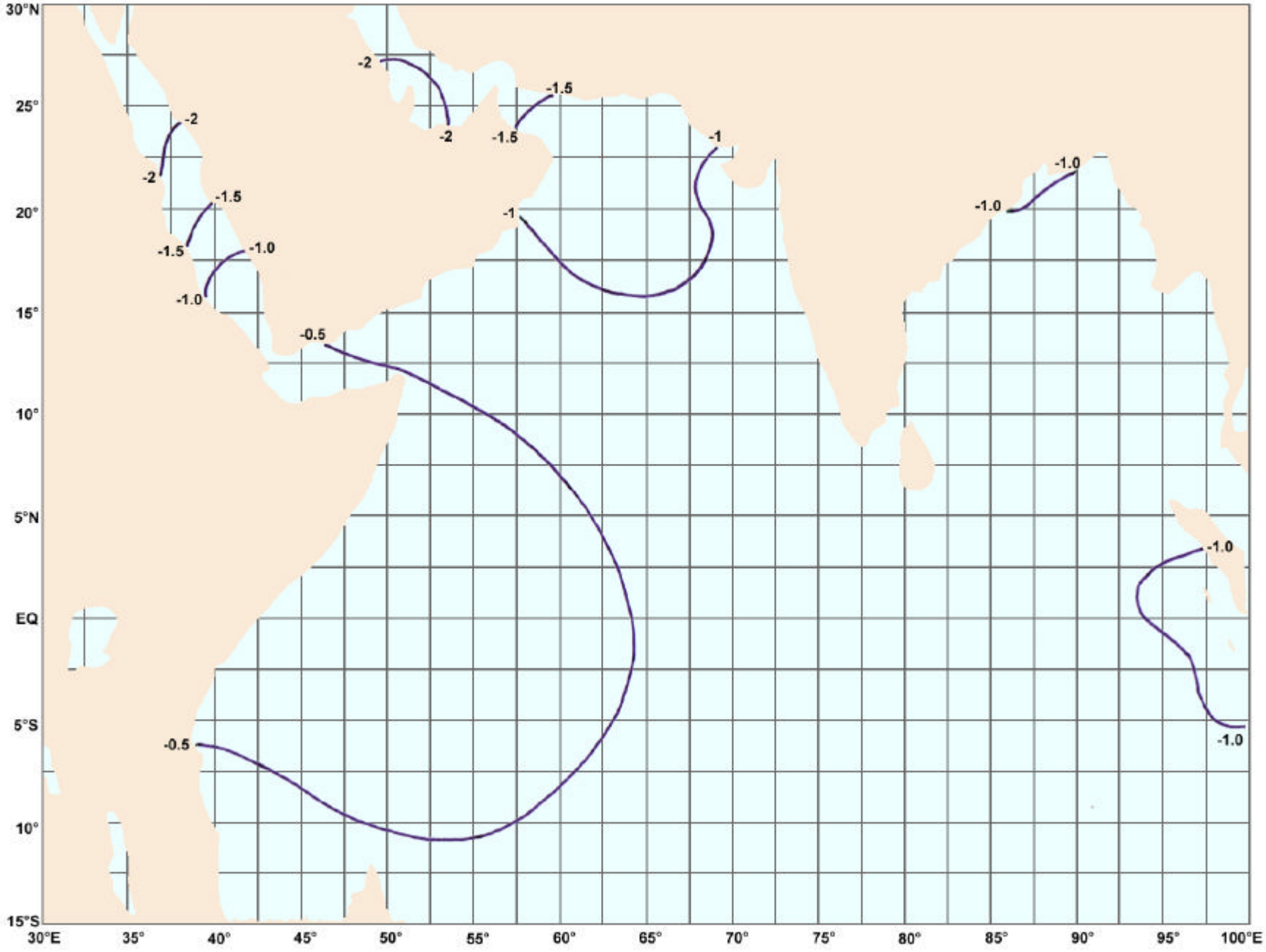


CHART NO. 3.2 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) FEBRUARY

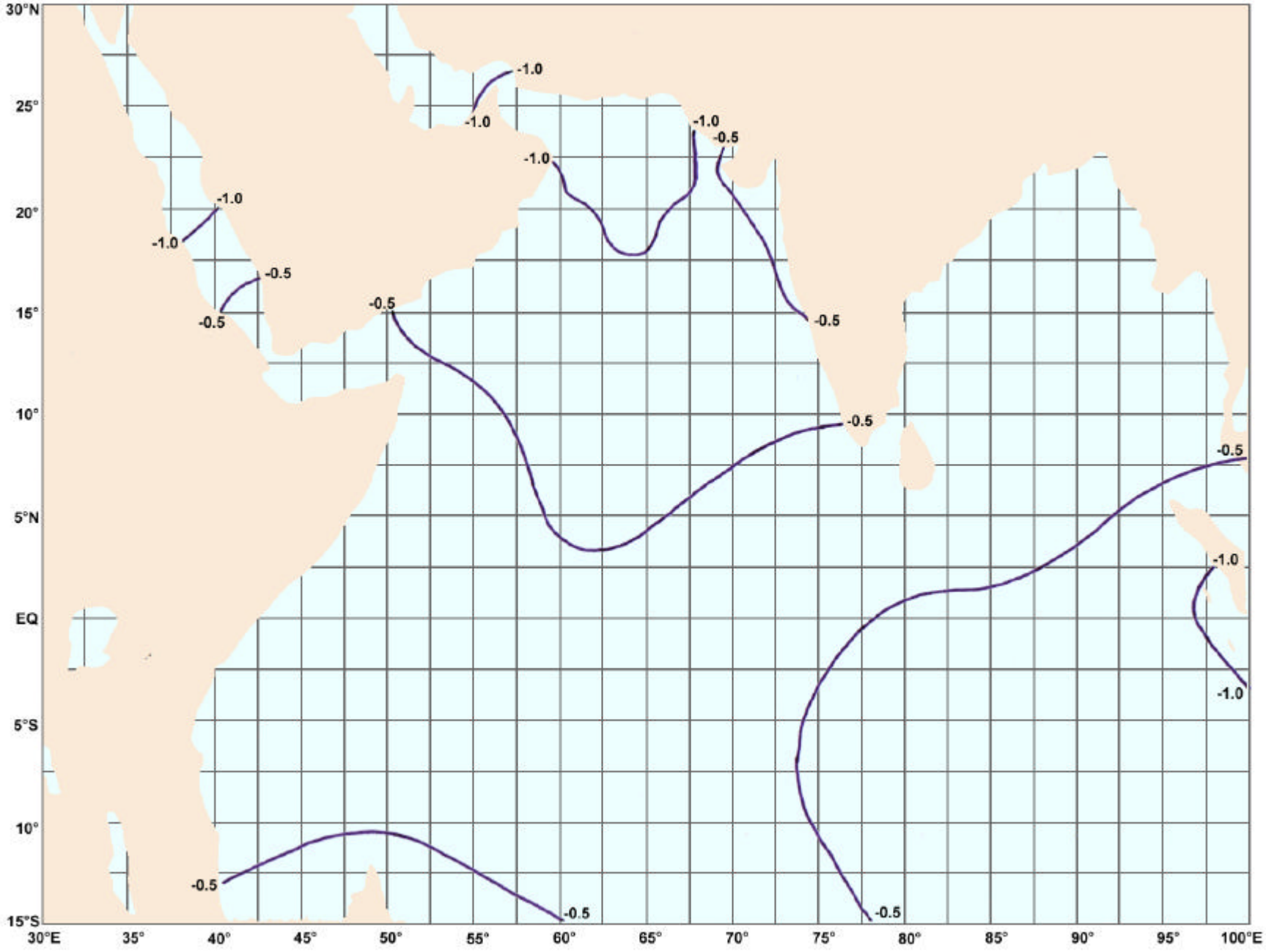


CHART NO. 3.3 AIR-SEA SURFACE TEMPERATURE DIFFERENCE(°C) MARCH

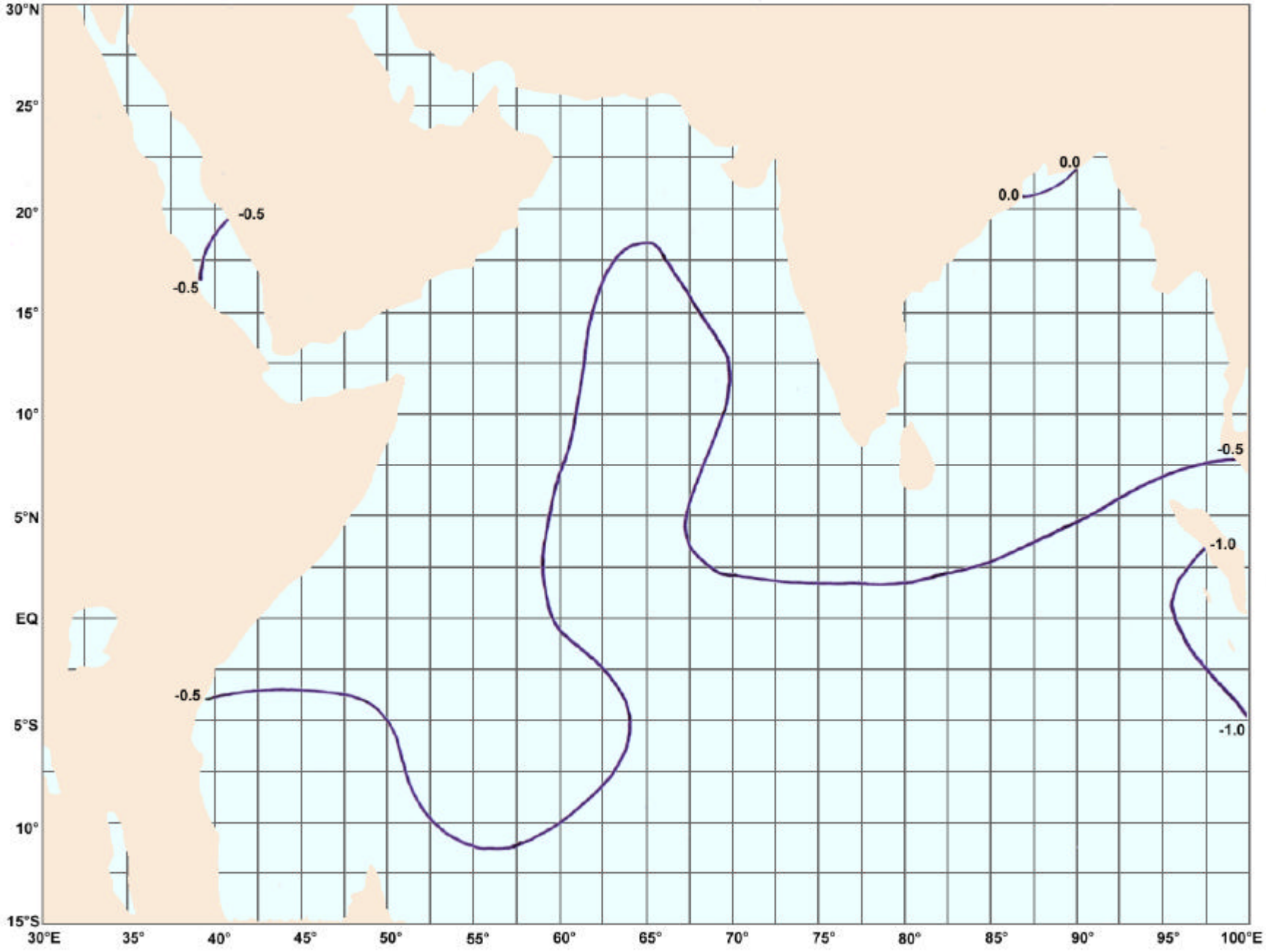


CHART NO. 3.4 AIR-SEA SURFACE TEMPERATURE DIFFERENCE(°C) APRIL

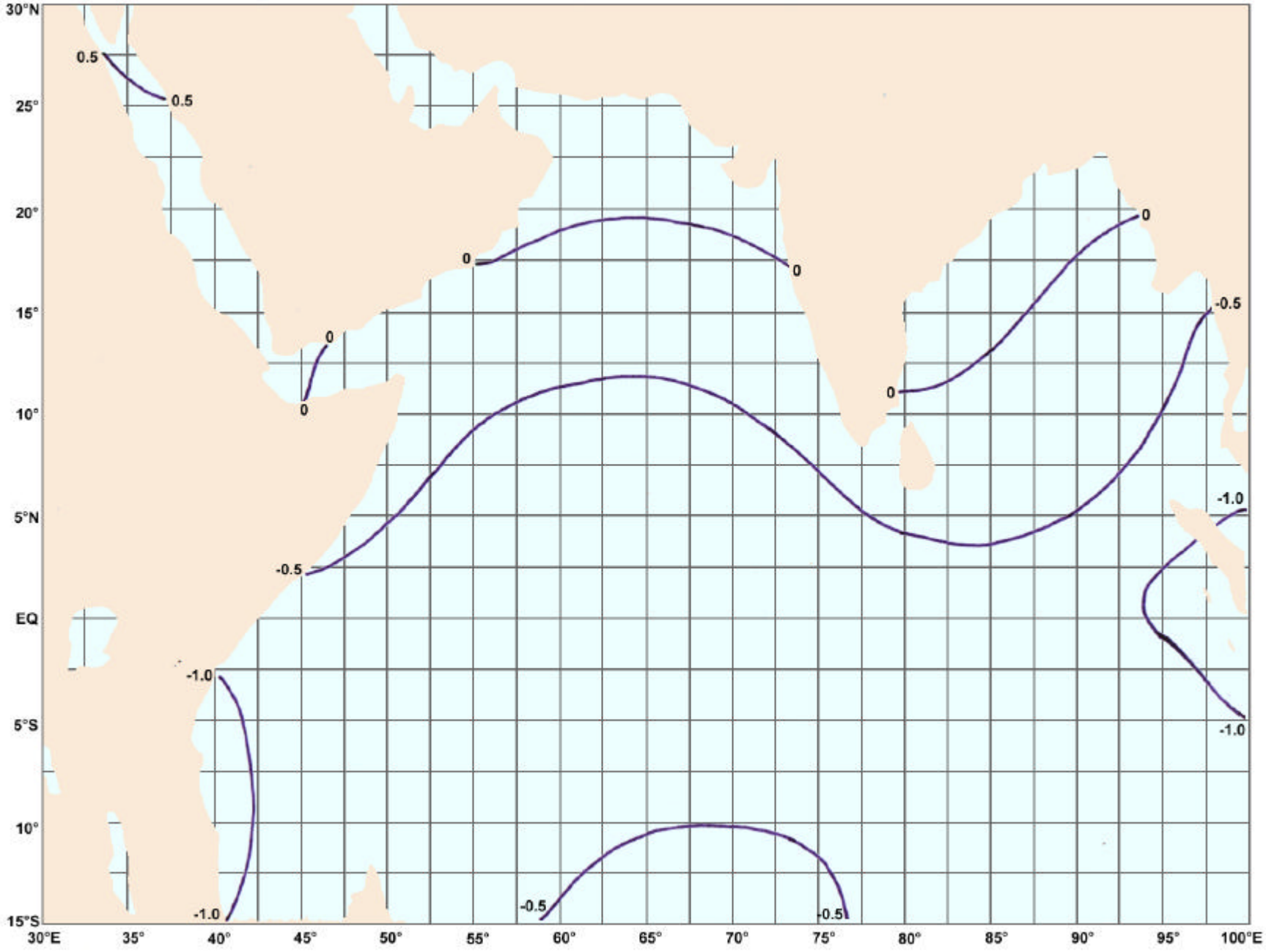


CHART NO. 3.5 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) MAY

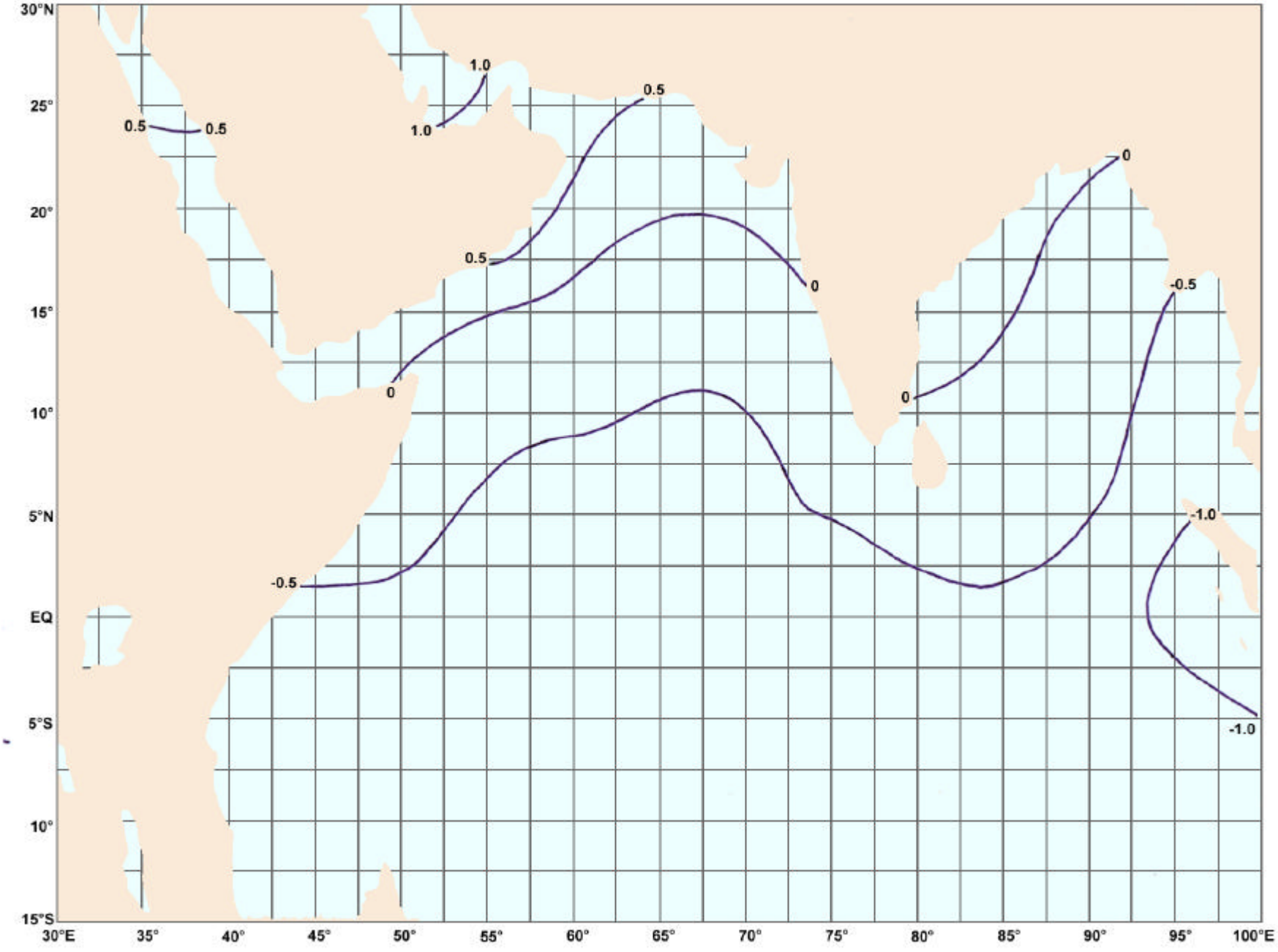


CHART NO. 3.6 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) JUNE

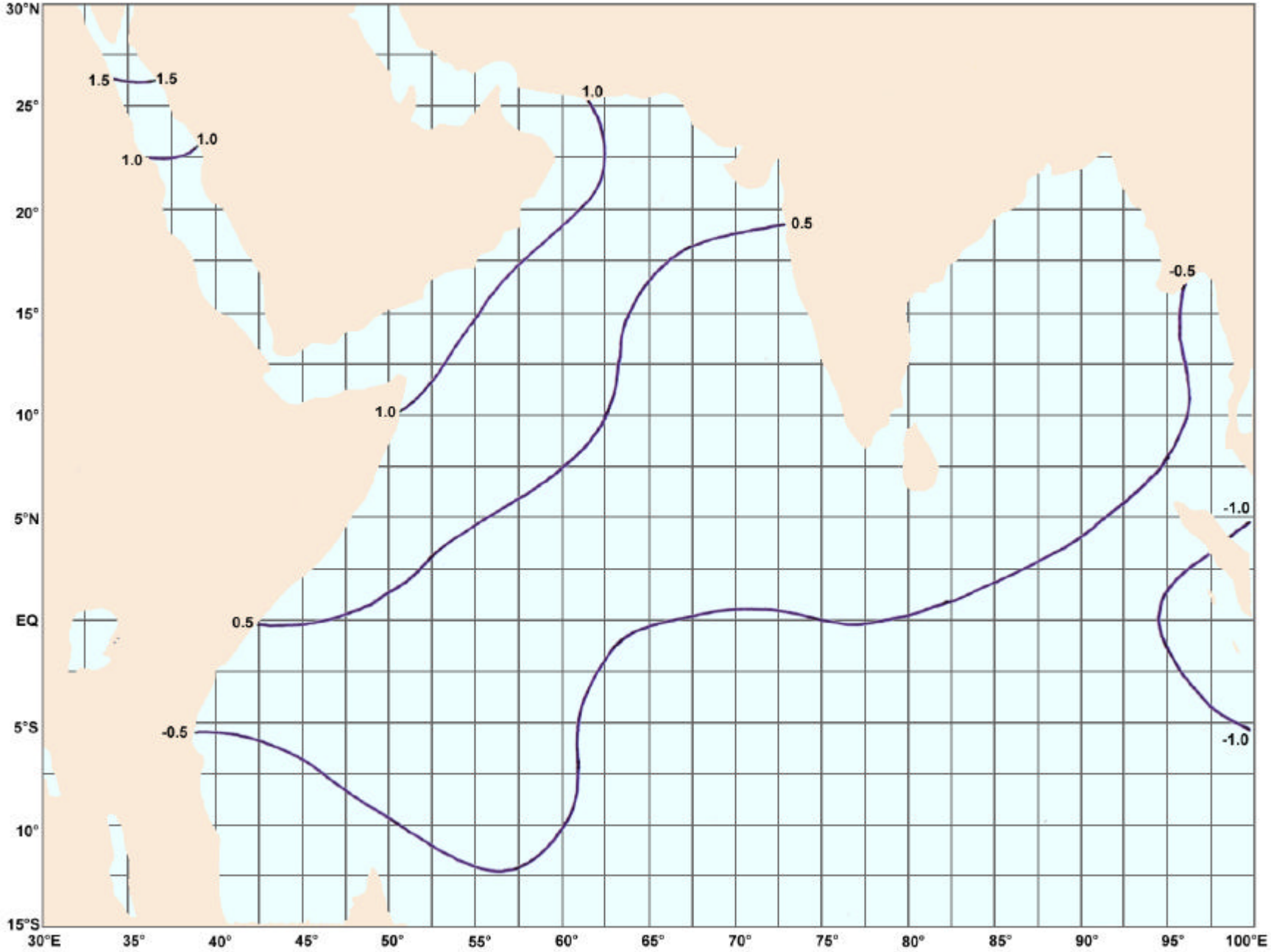


CHART NO. 3.7 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) JULY

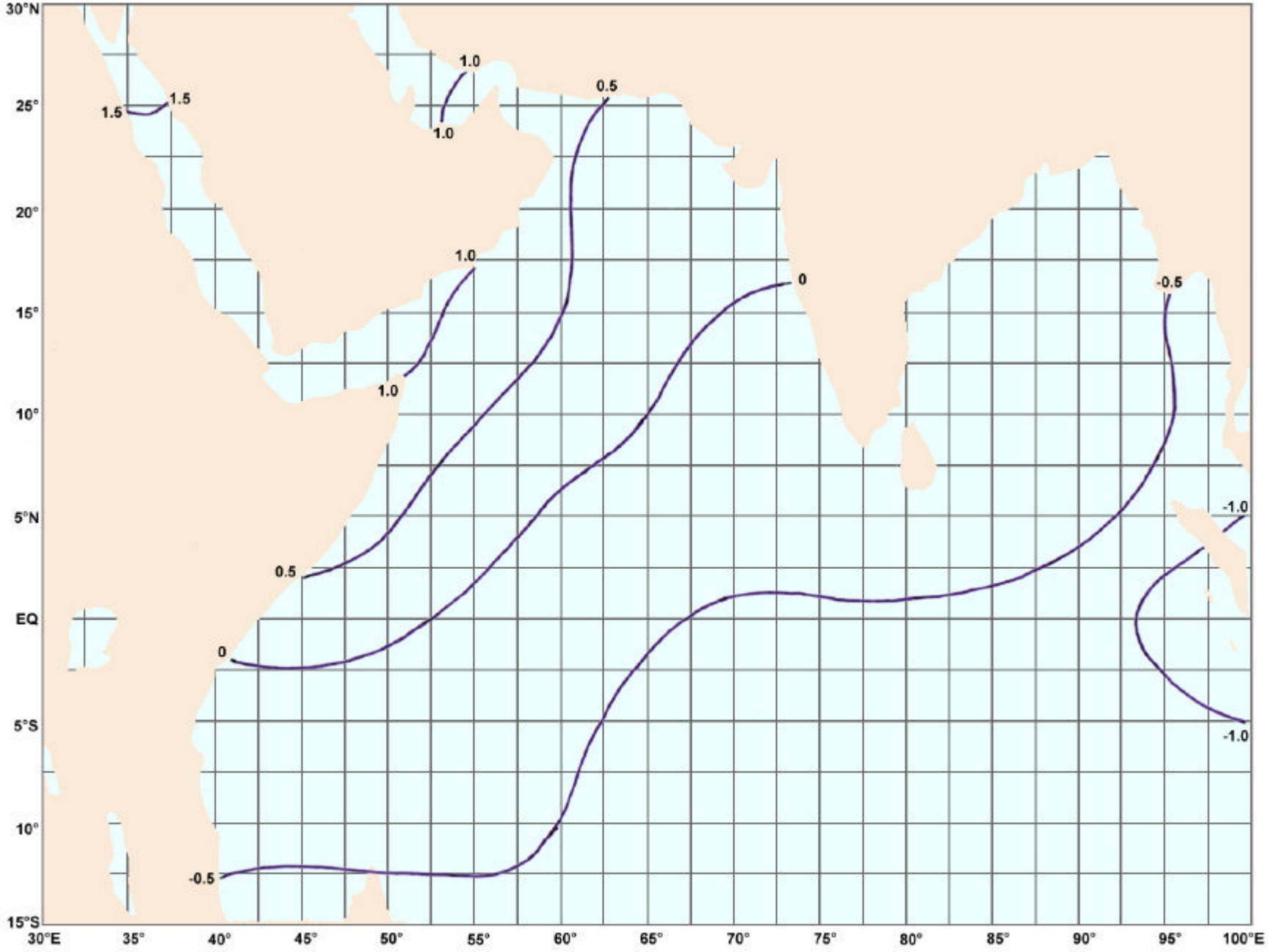


CHART NO. 3.8 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) AUGUST

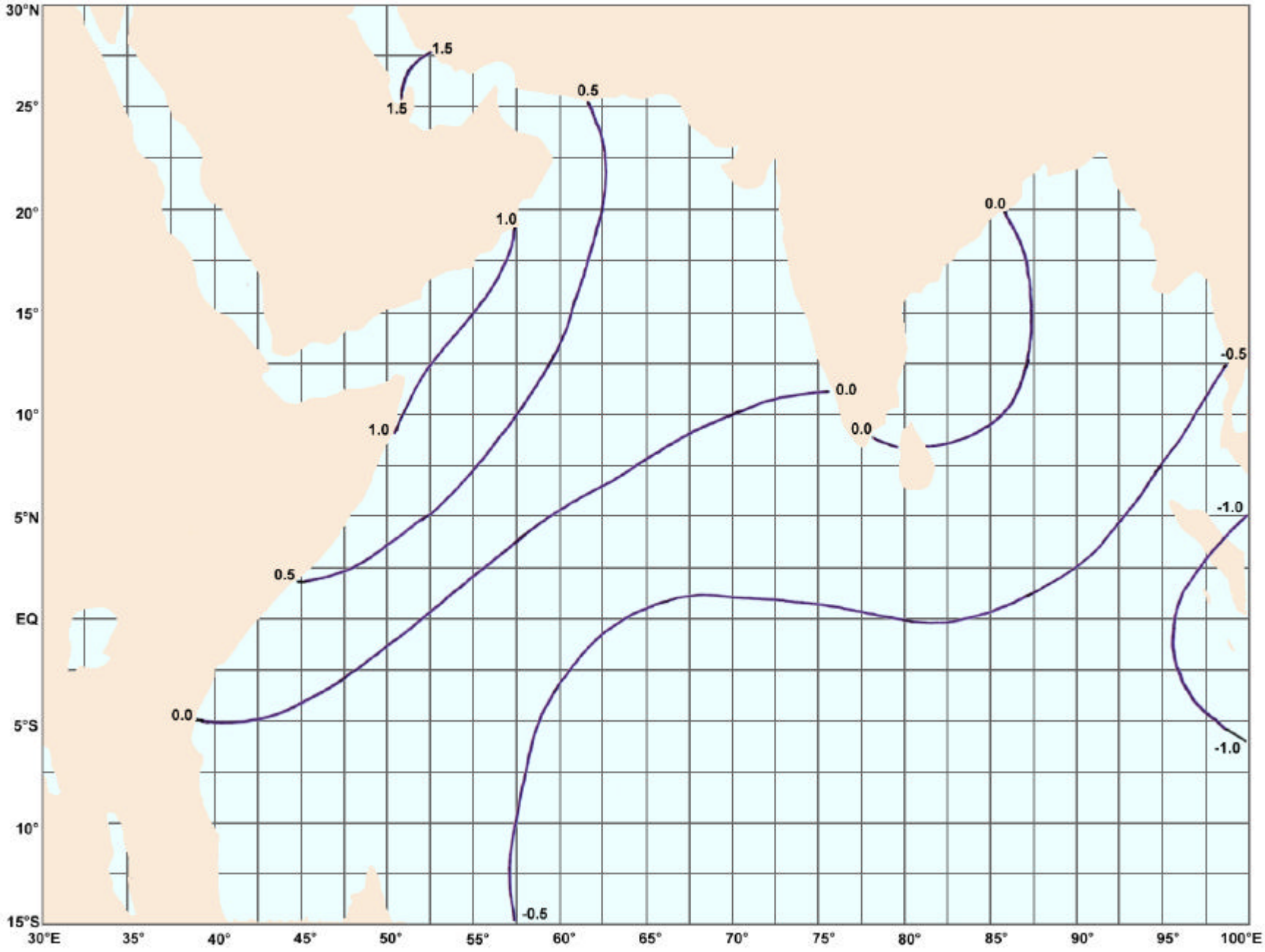


CHART NO. 3.9 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) SEPTEMBER

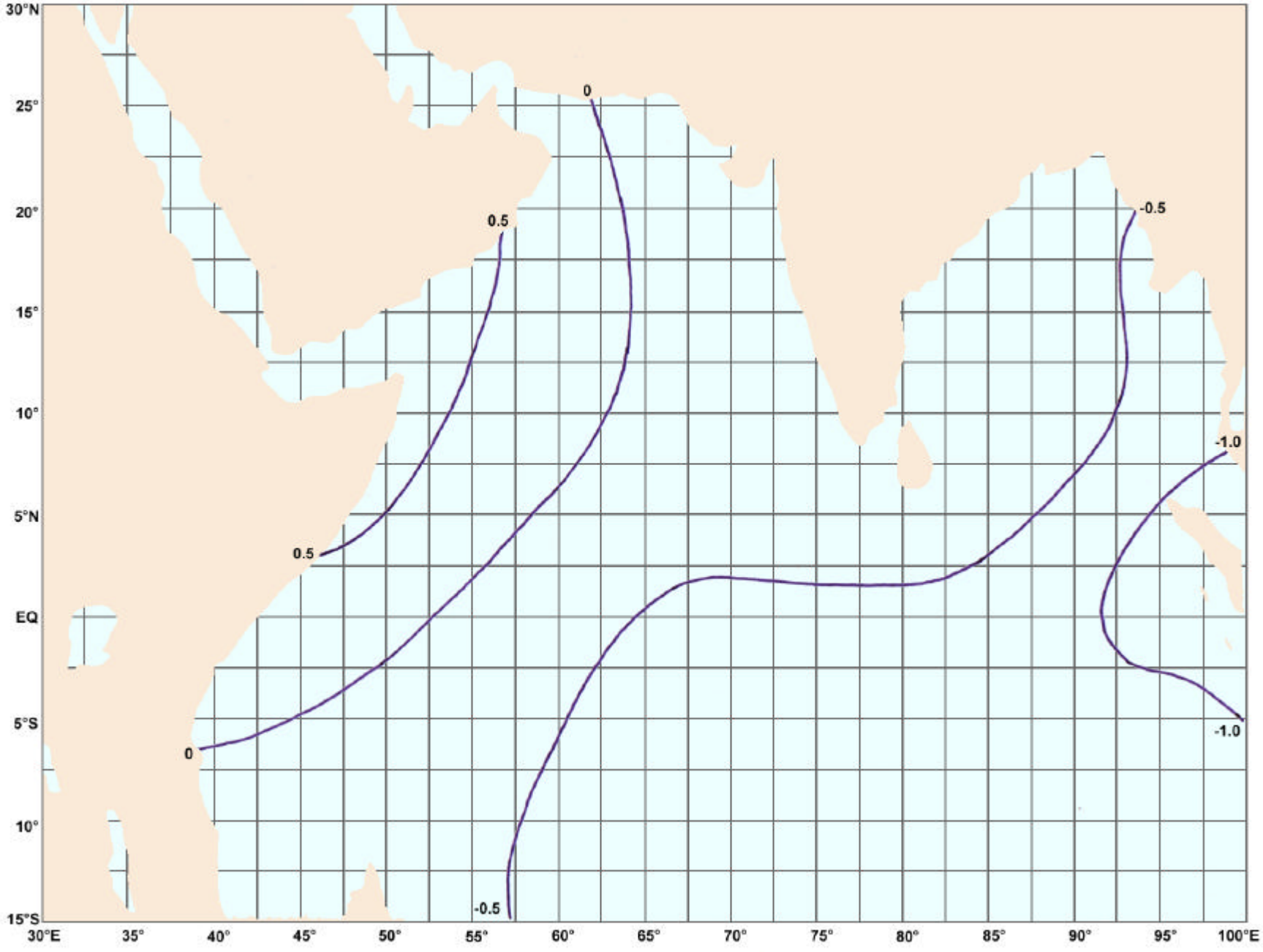


CHART NO. 3.10

AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C)

OCTOBER

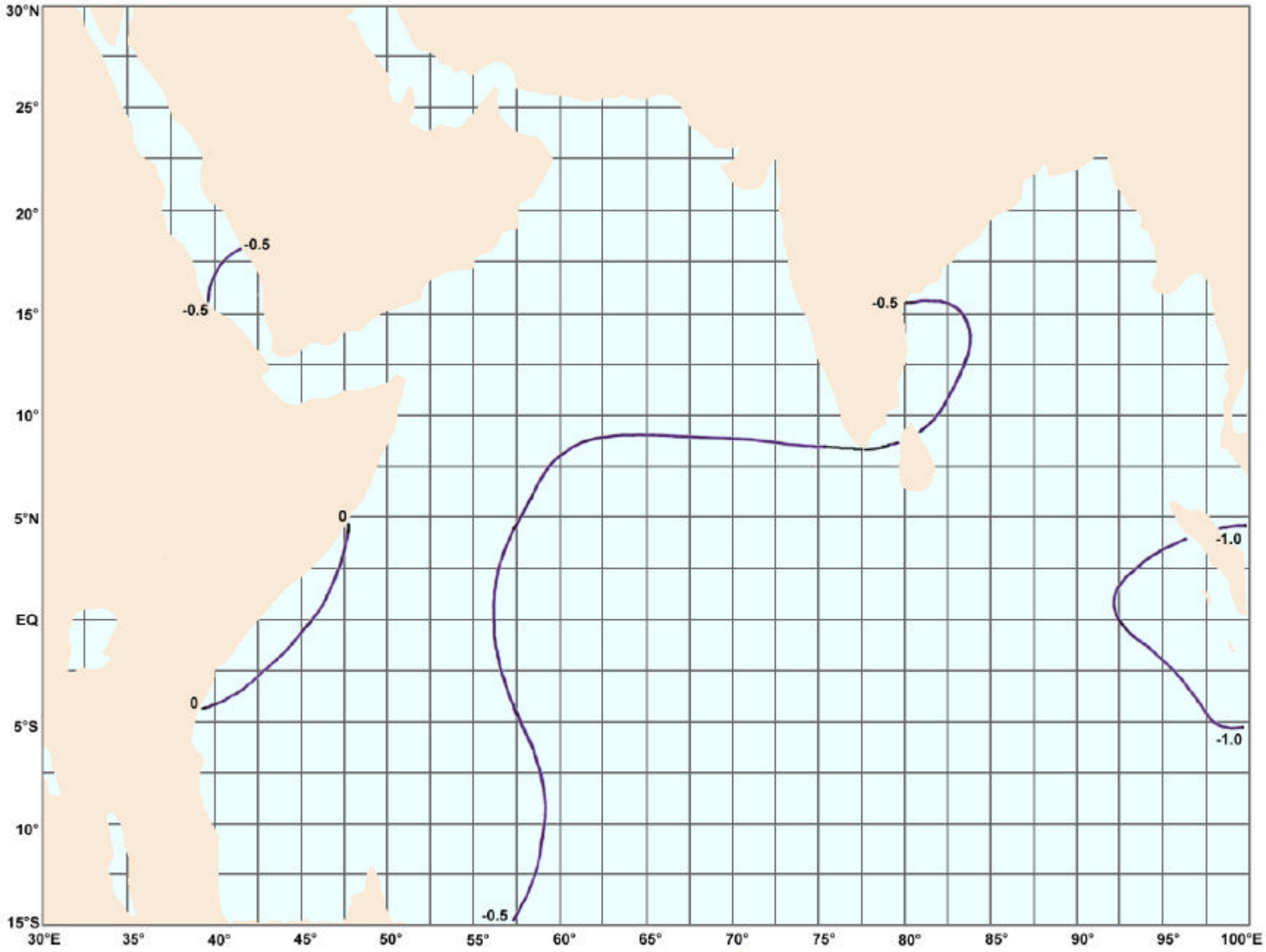


CHART NO. 3.11 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) NOVEMBER

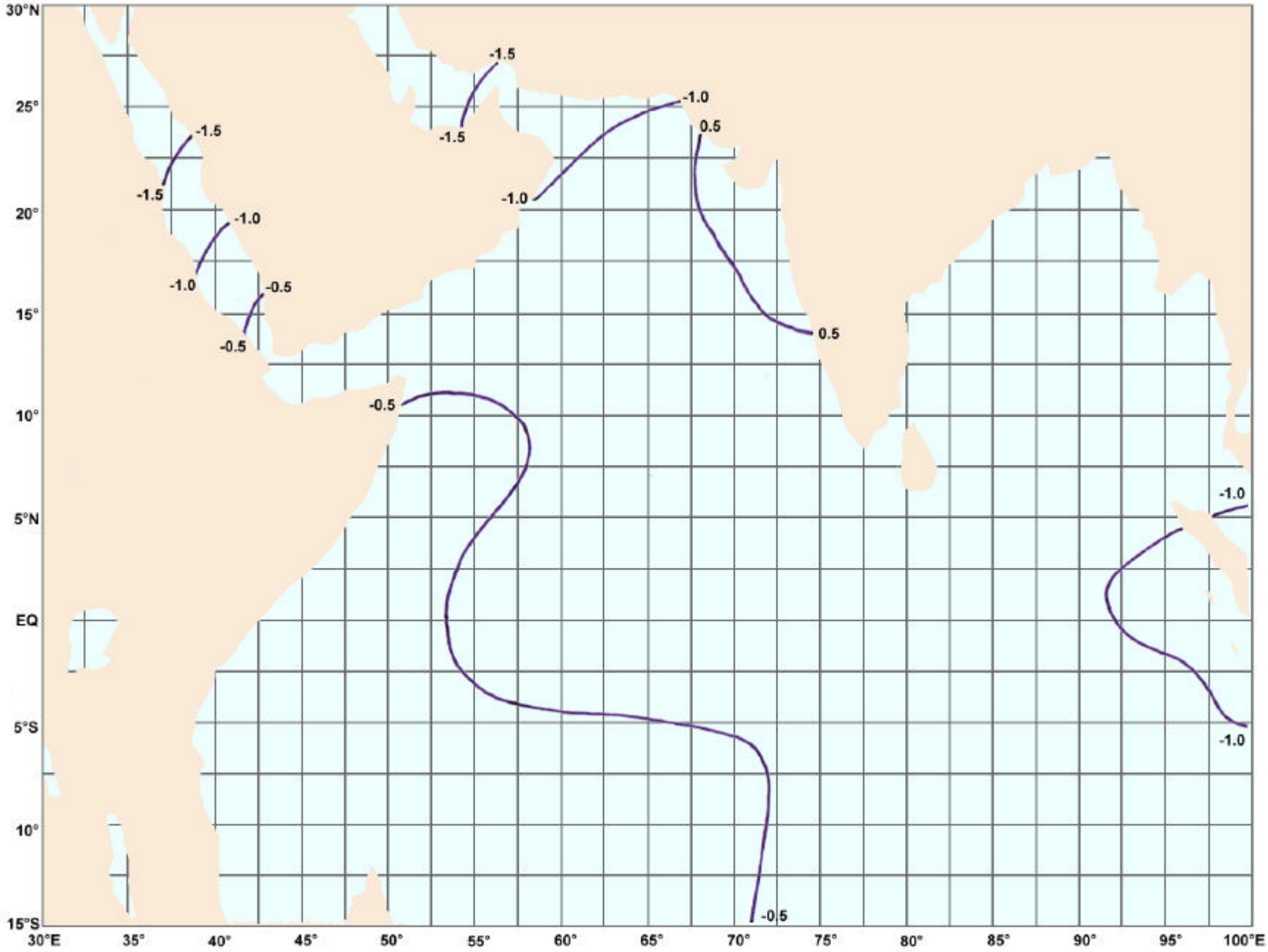


CHART NO. 3.12 AIR - SEA SURFACE TEMPERATURE DIFFERENCE (°C) DECEMBER

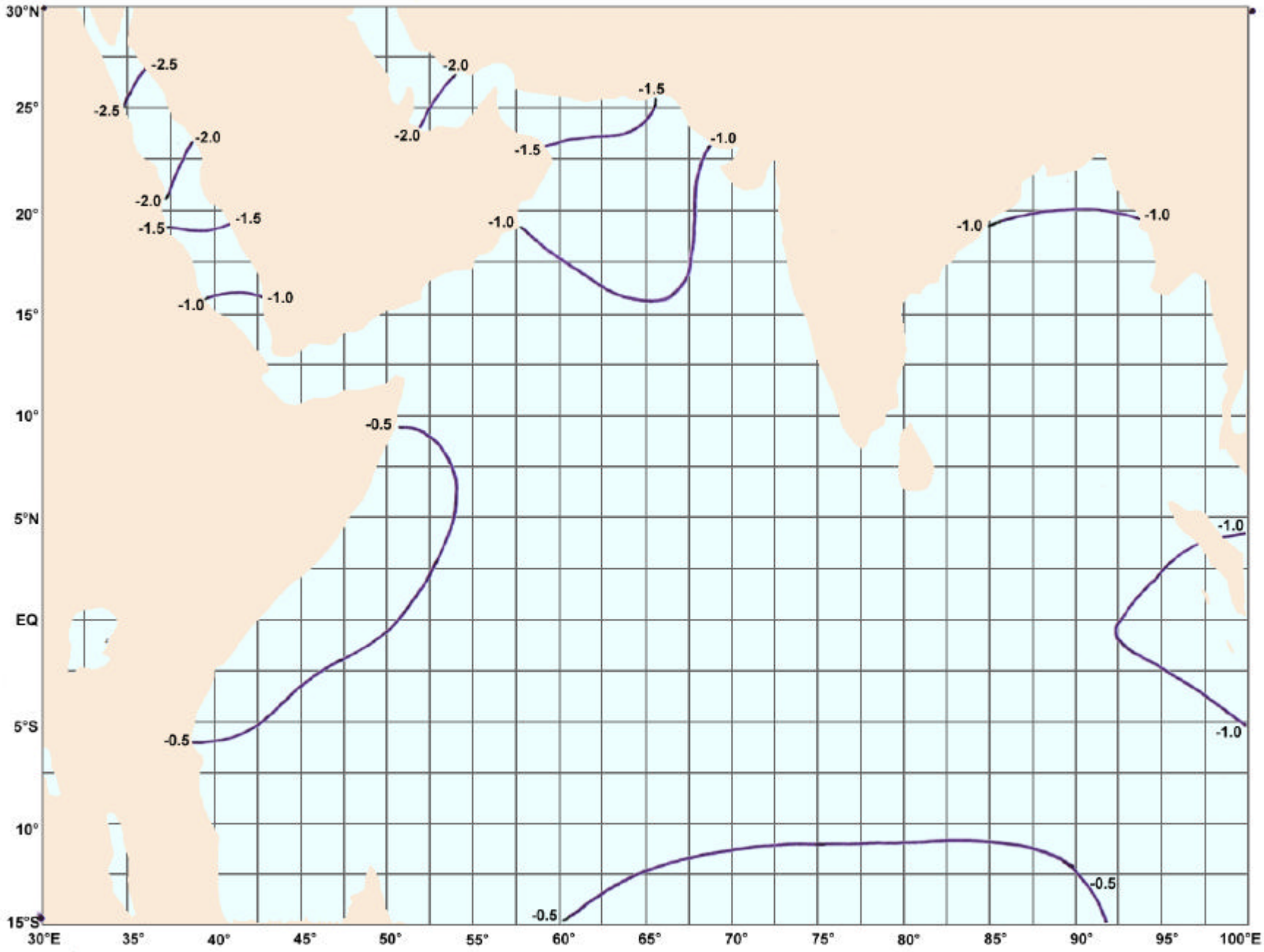


CHART NO.4.1 DEW POINT TEMPERATURE (°C) JANUARY

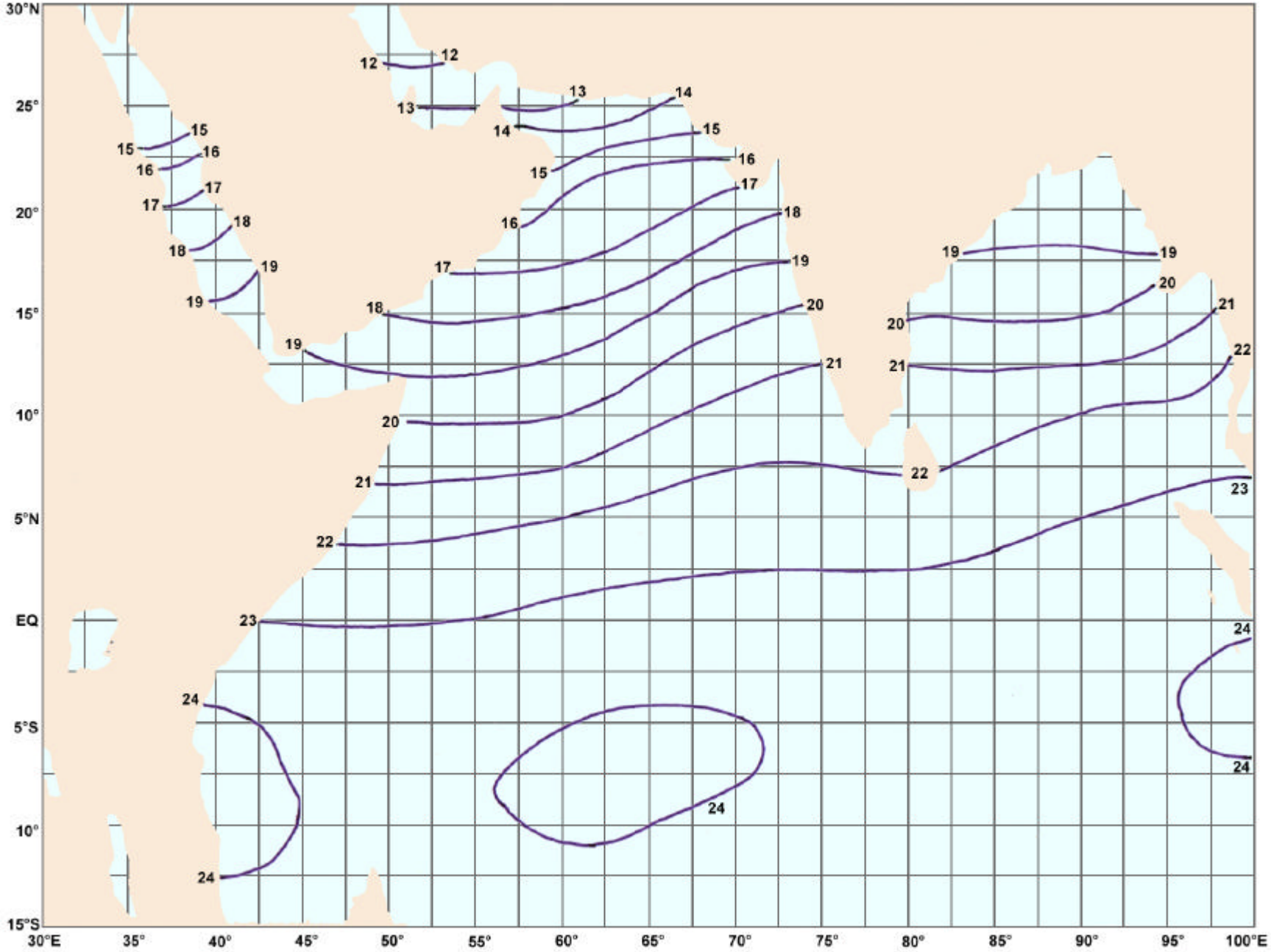


CHART NO.4.2 DEW POINT TEMPERATURE (°C) FEBRUARY

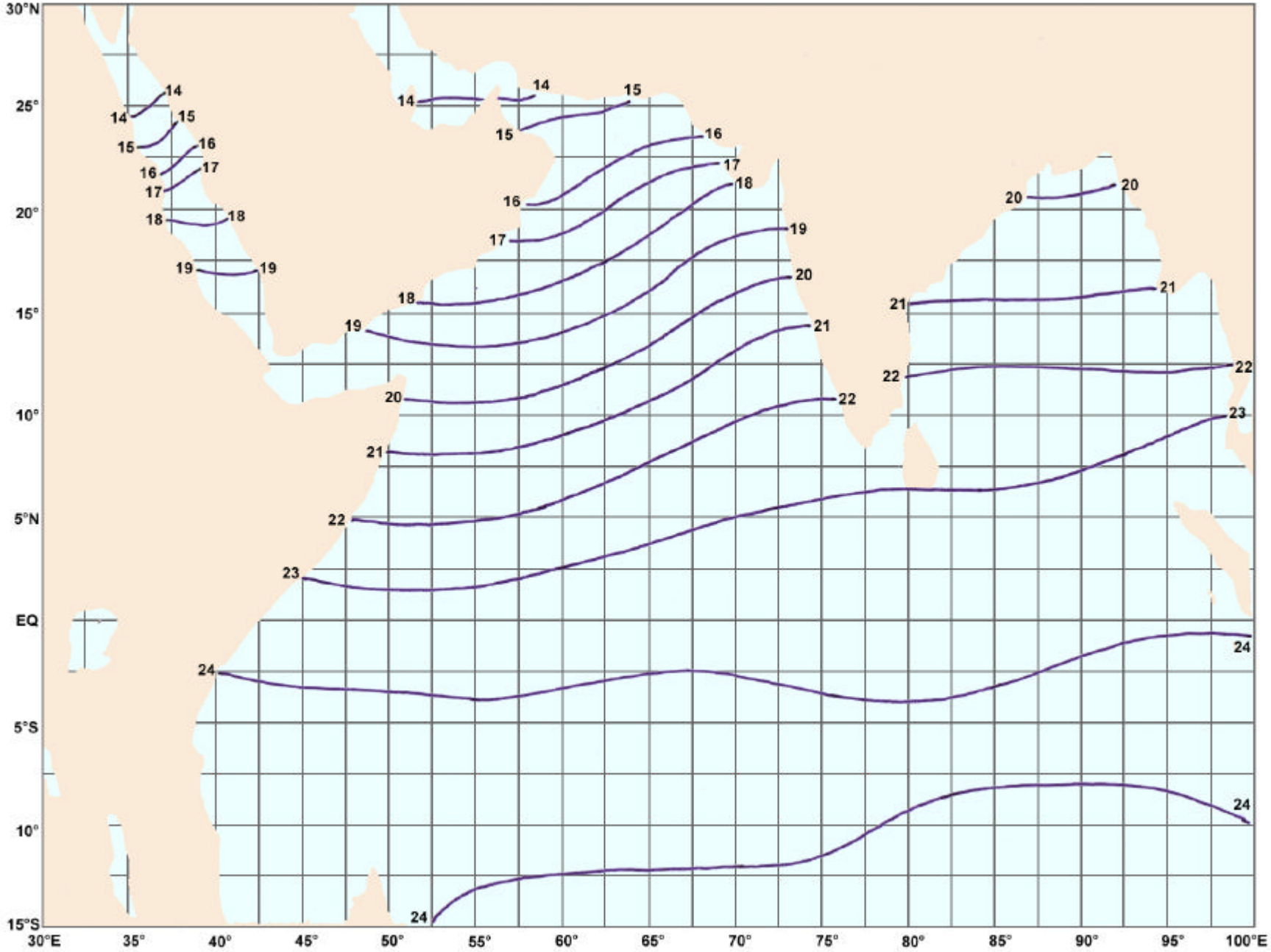


CHART NO.4.3 DEW POINT TEMPERATURE (°C) MARCH

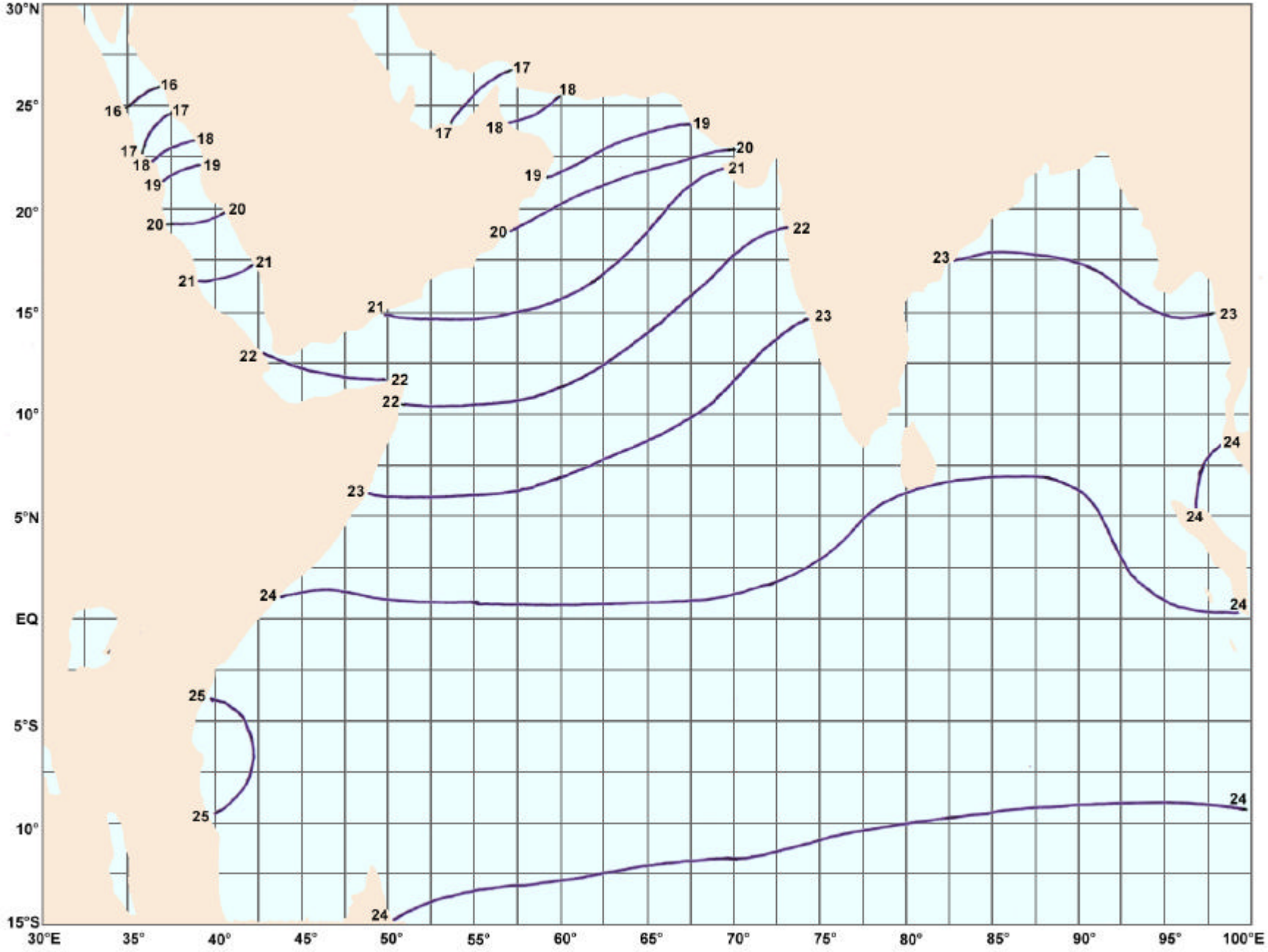
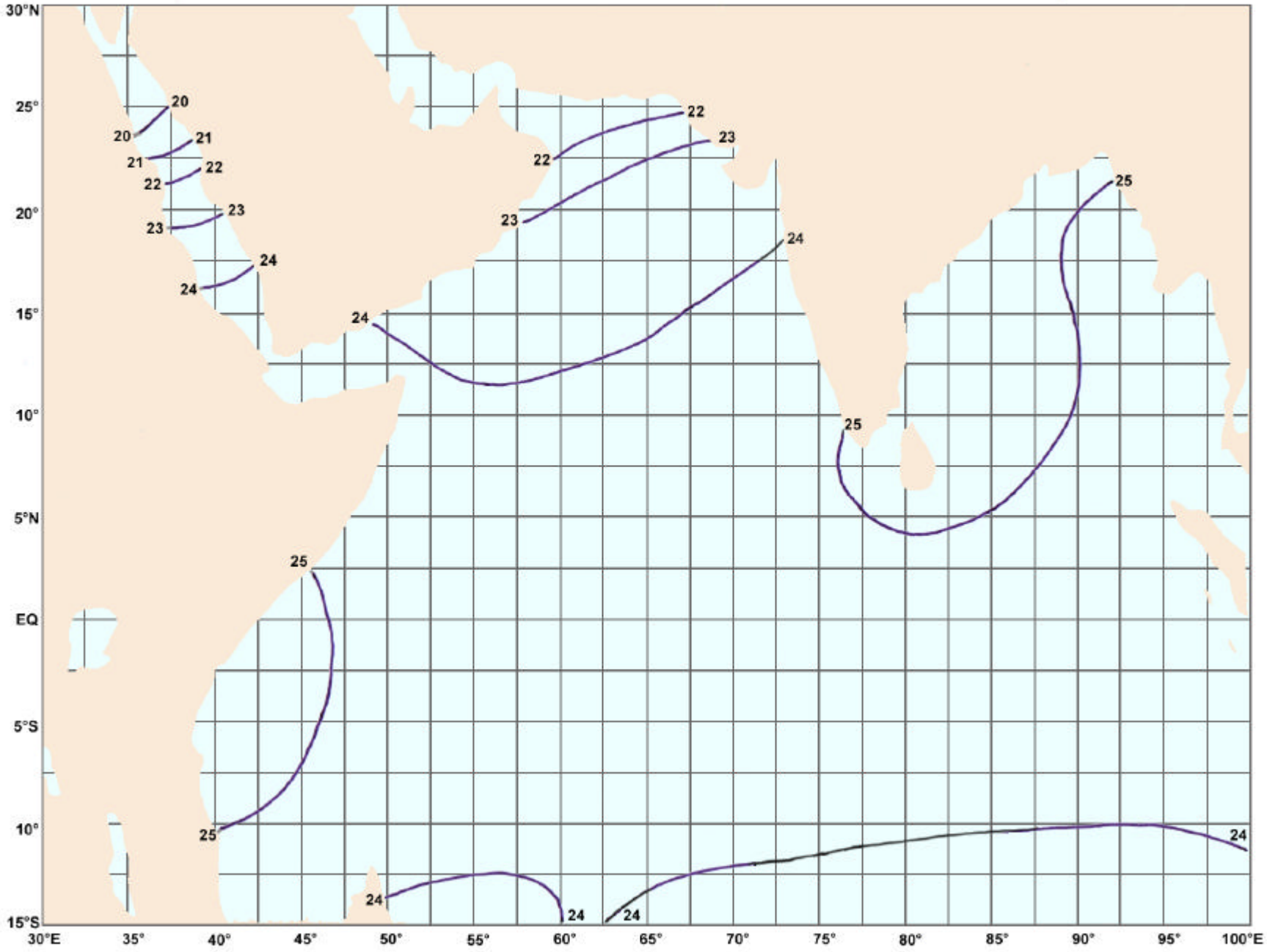


CHART NO.4.4 DEW POINT TEMPERATURE (°C) APRIL



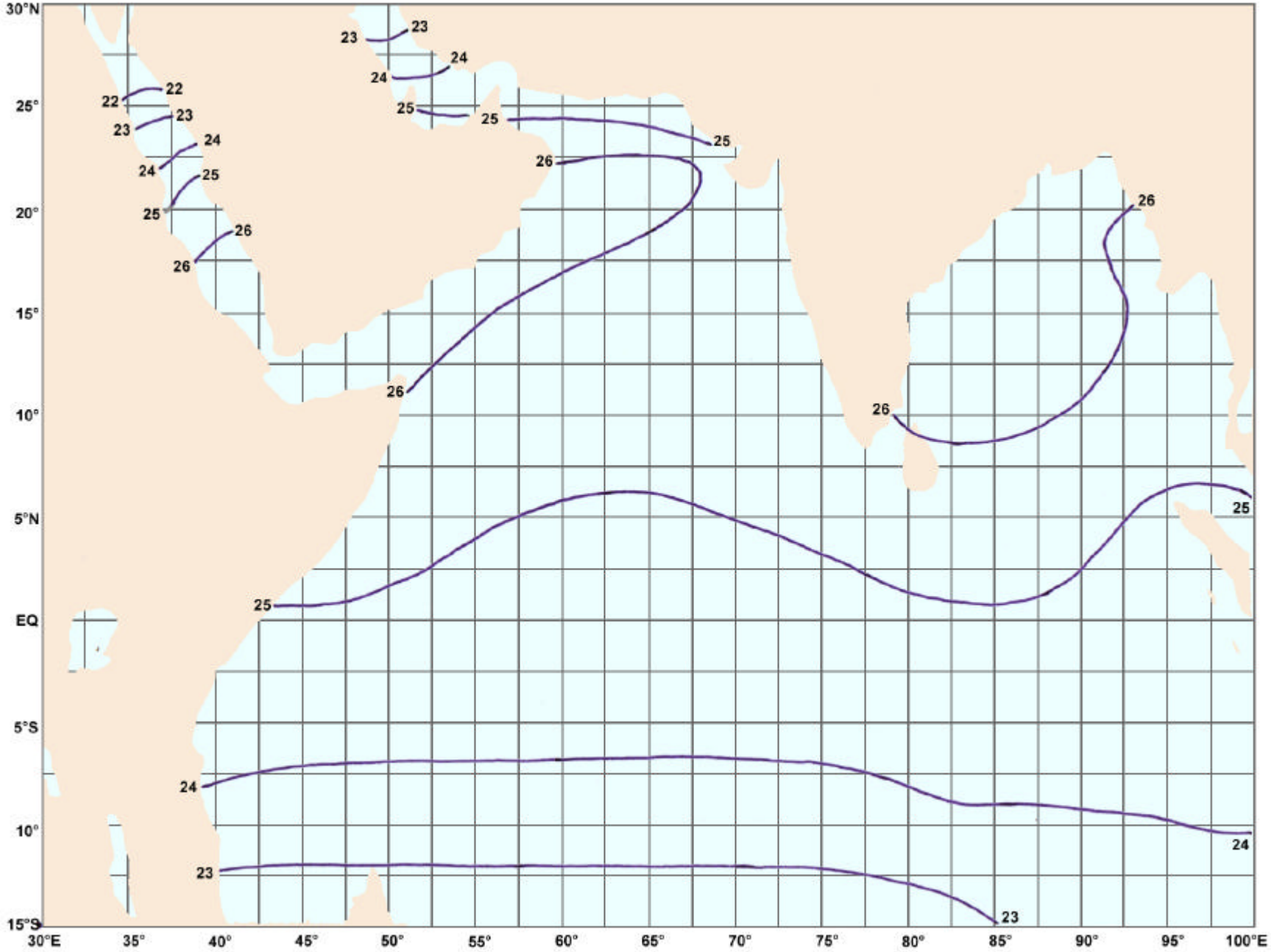

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CHART NO.4.6 DEW POINT TEMPERATURE (°C) JUNE

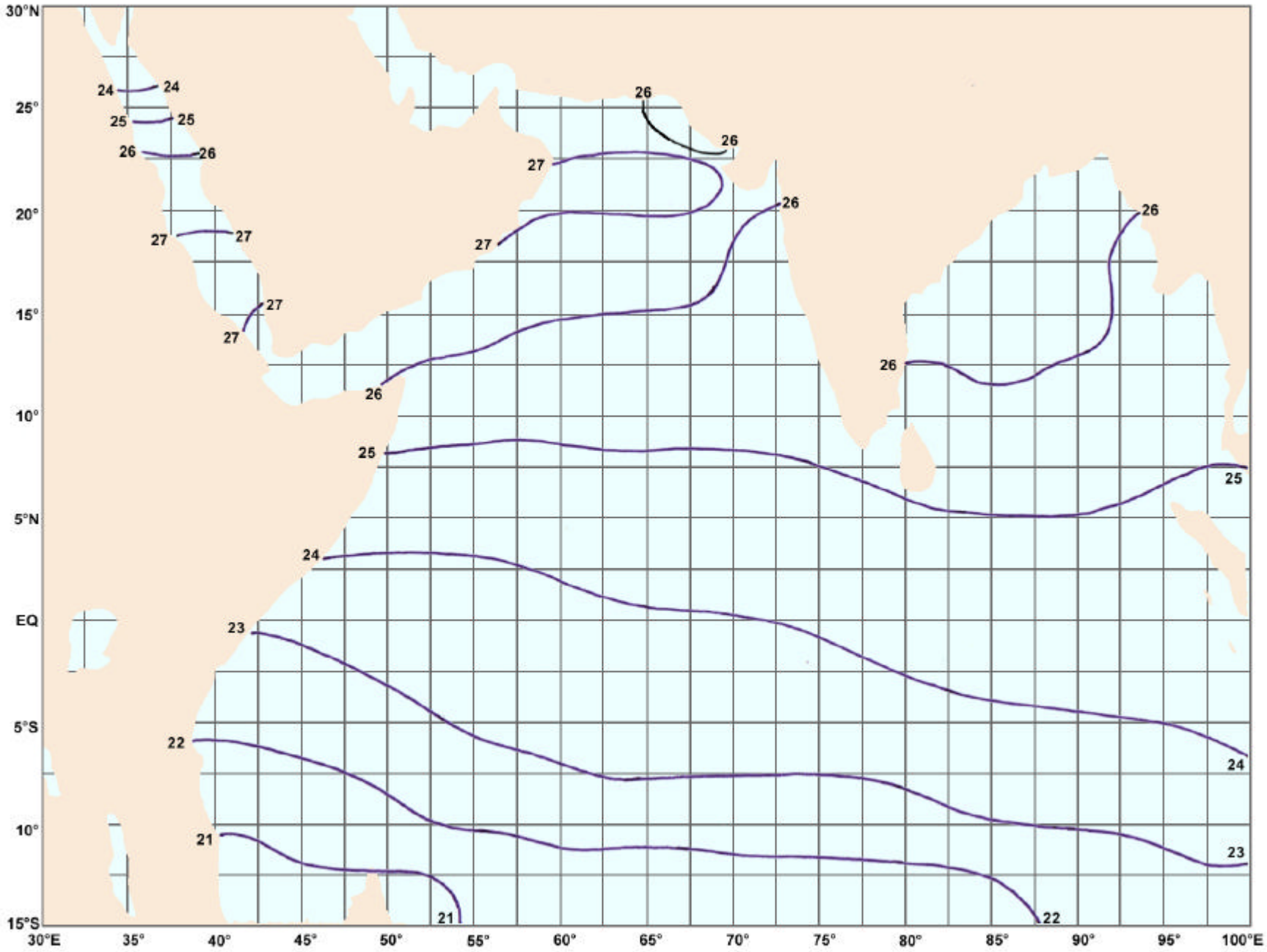
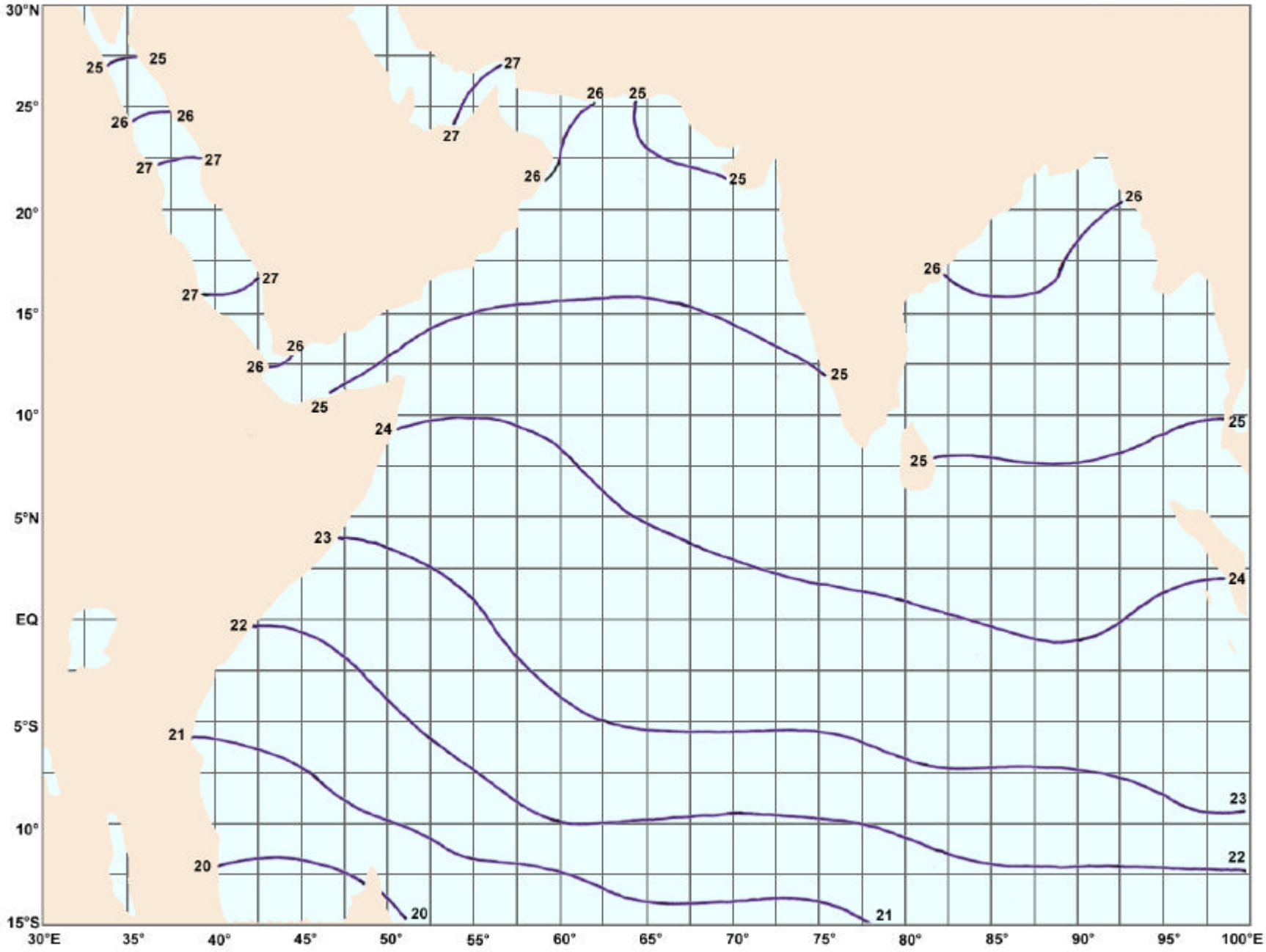


CHART NO.4.7 DEW POINT TEMPERATURE (°C) JULY



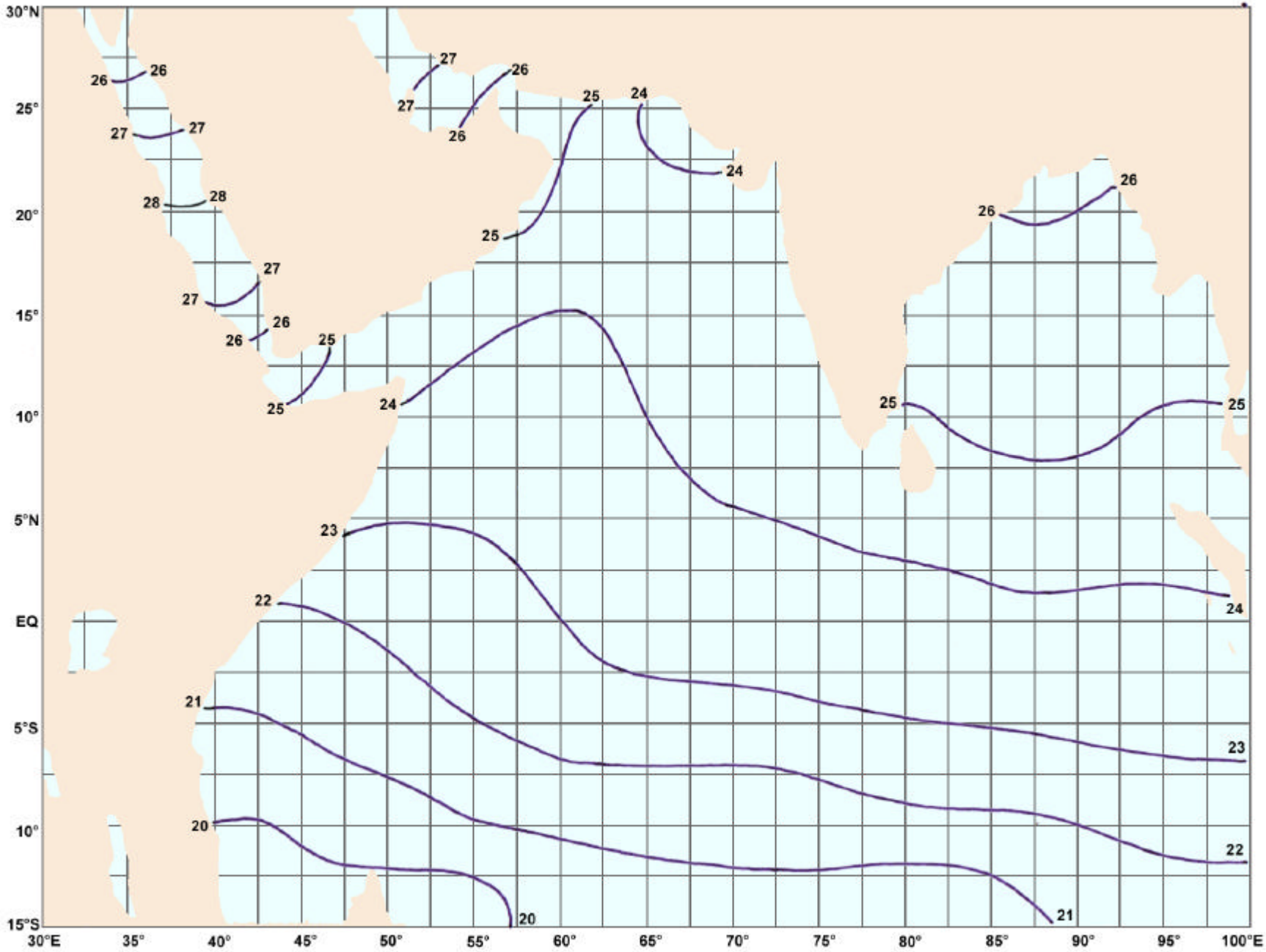

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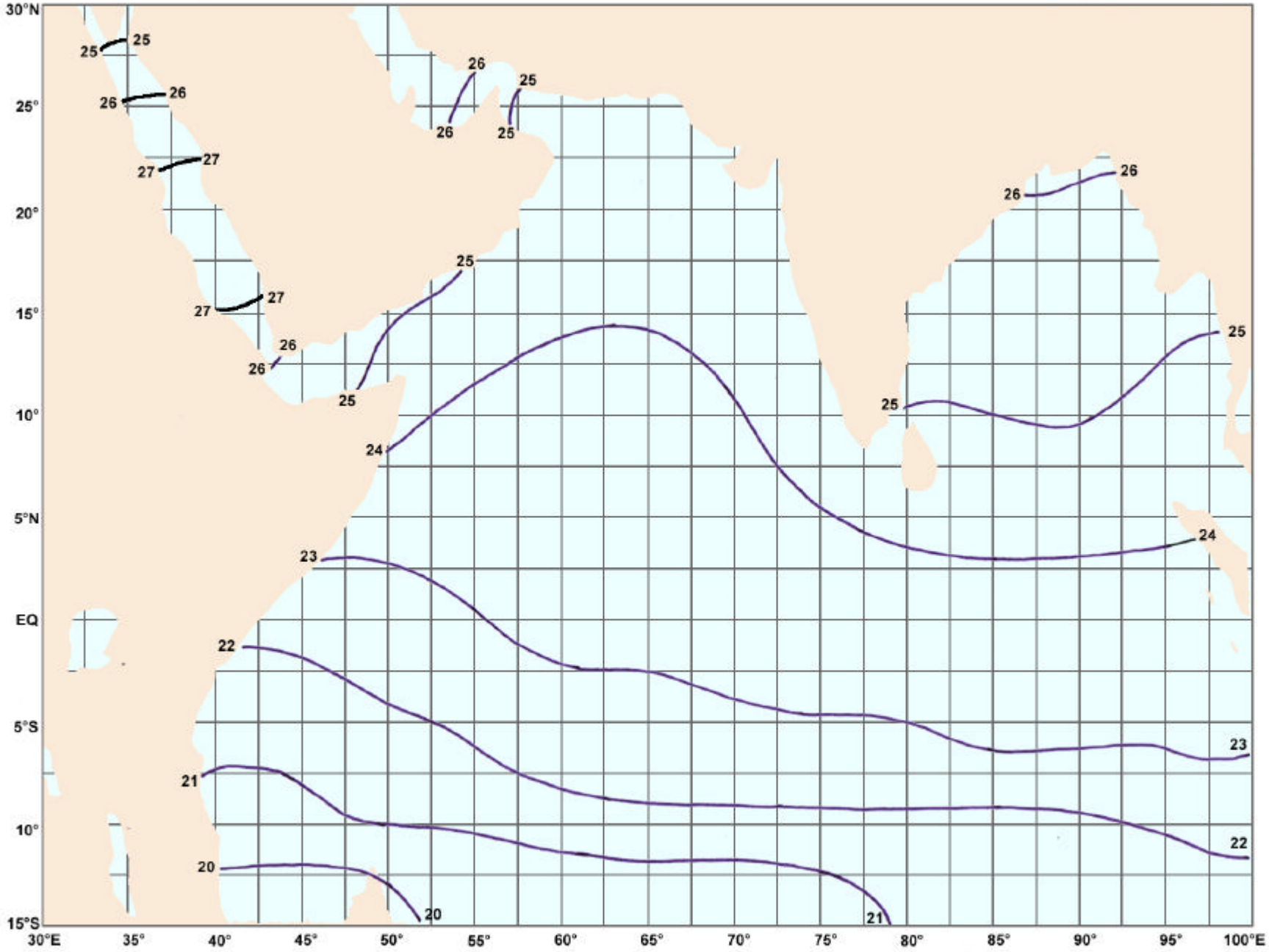
CHART NO.4.9 DEW POINT TEMPERATURE (°C) SEPTEMBER



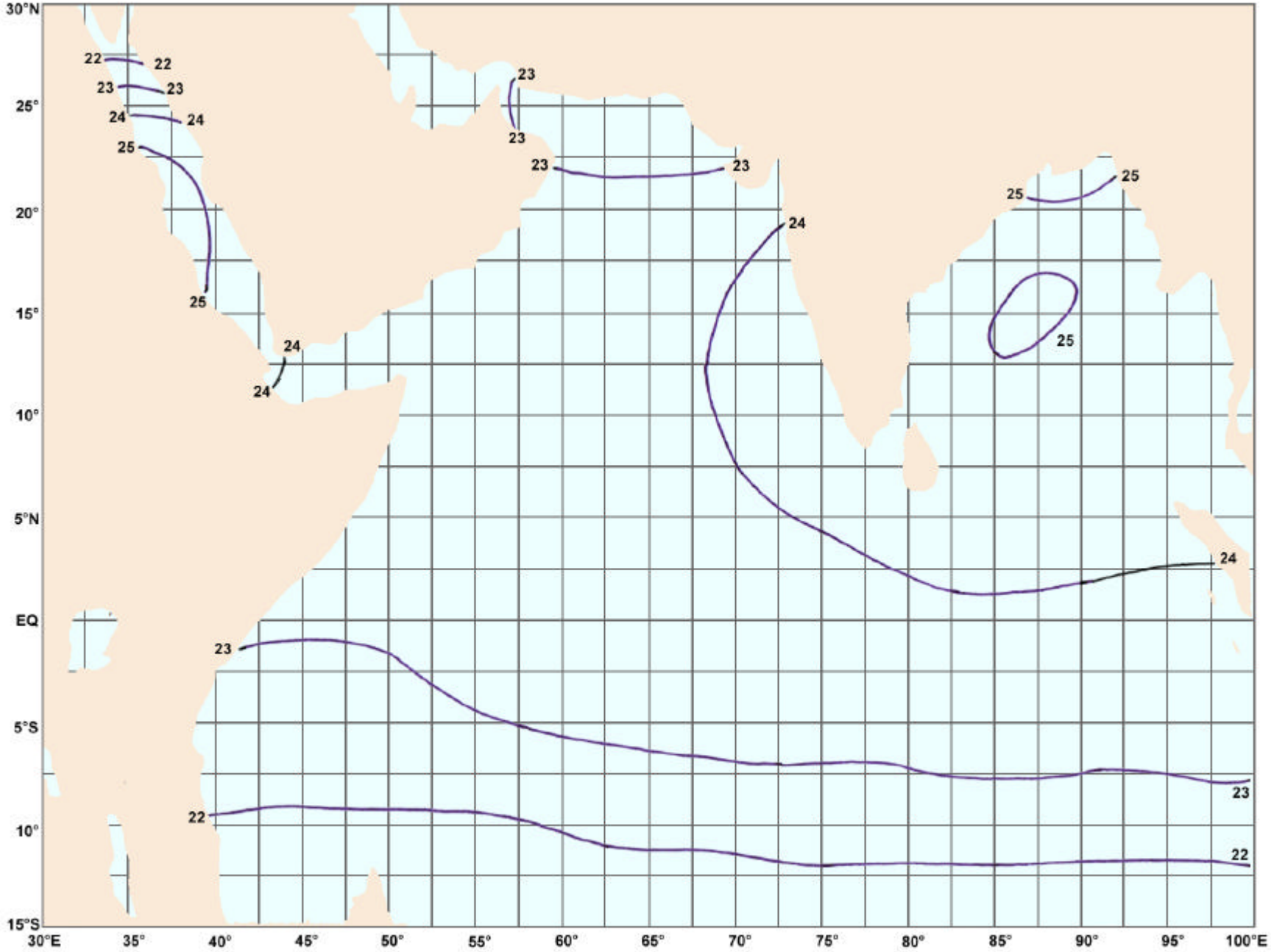

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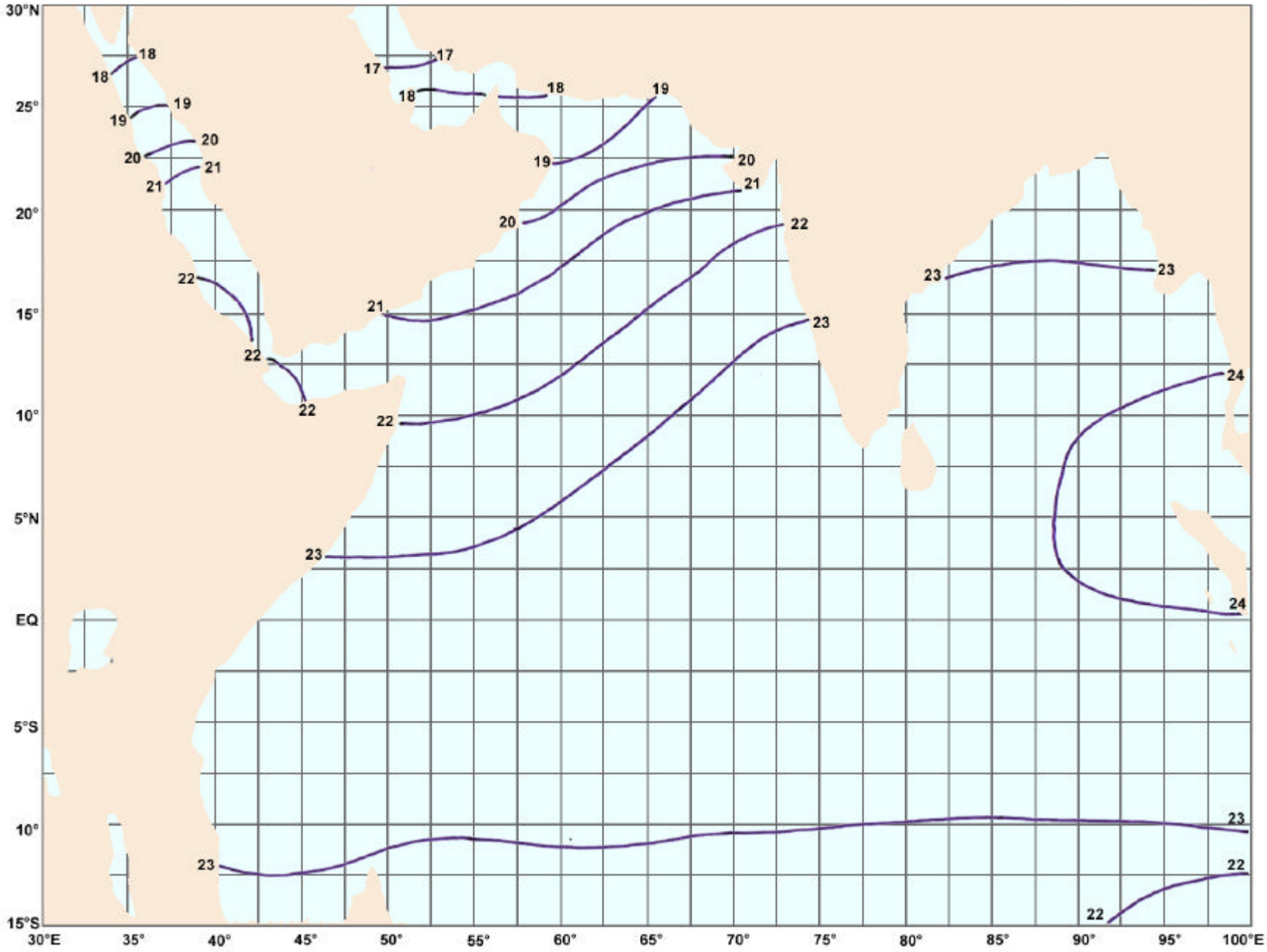
CHART NO.4.11 DEW POINT TEMPERATUR (°C) NOVEMBER



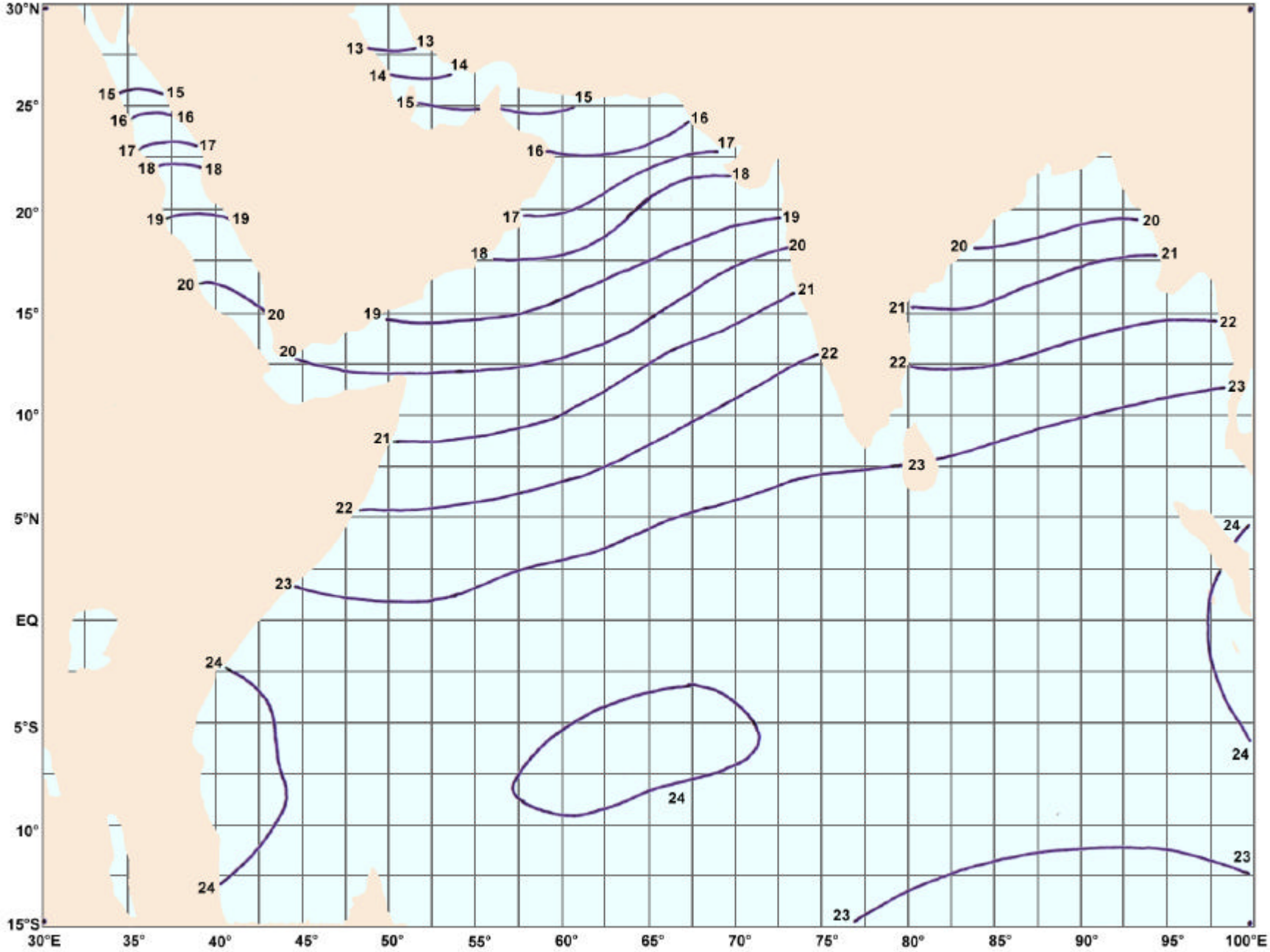

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CHART NO.5.1 SEA LEVEL PRESSURE (hPa) JANUARY

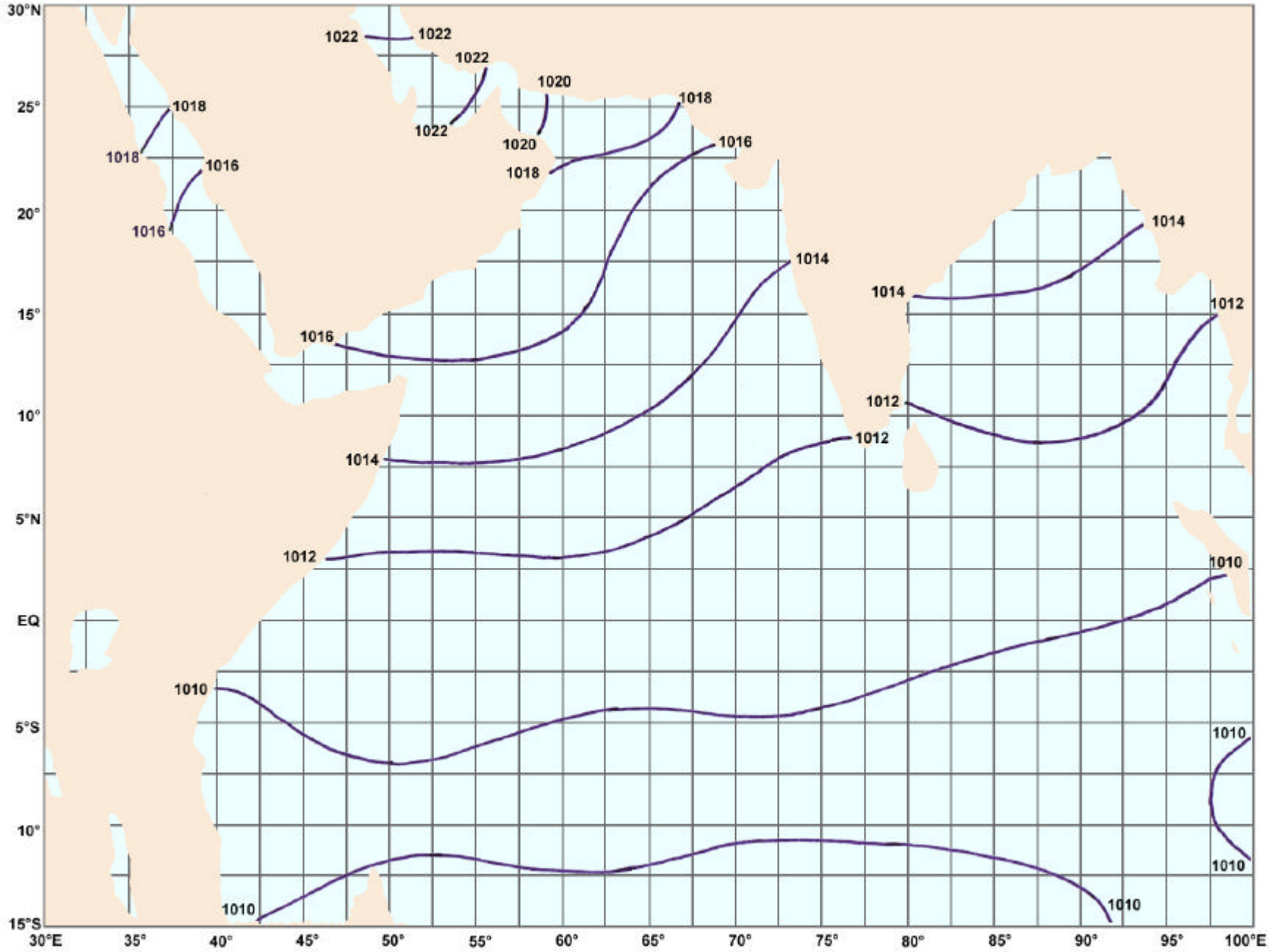


CHART NO.5.2 SEA LEVEL PRESURE (hPa) FEBRUARY

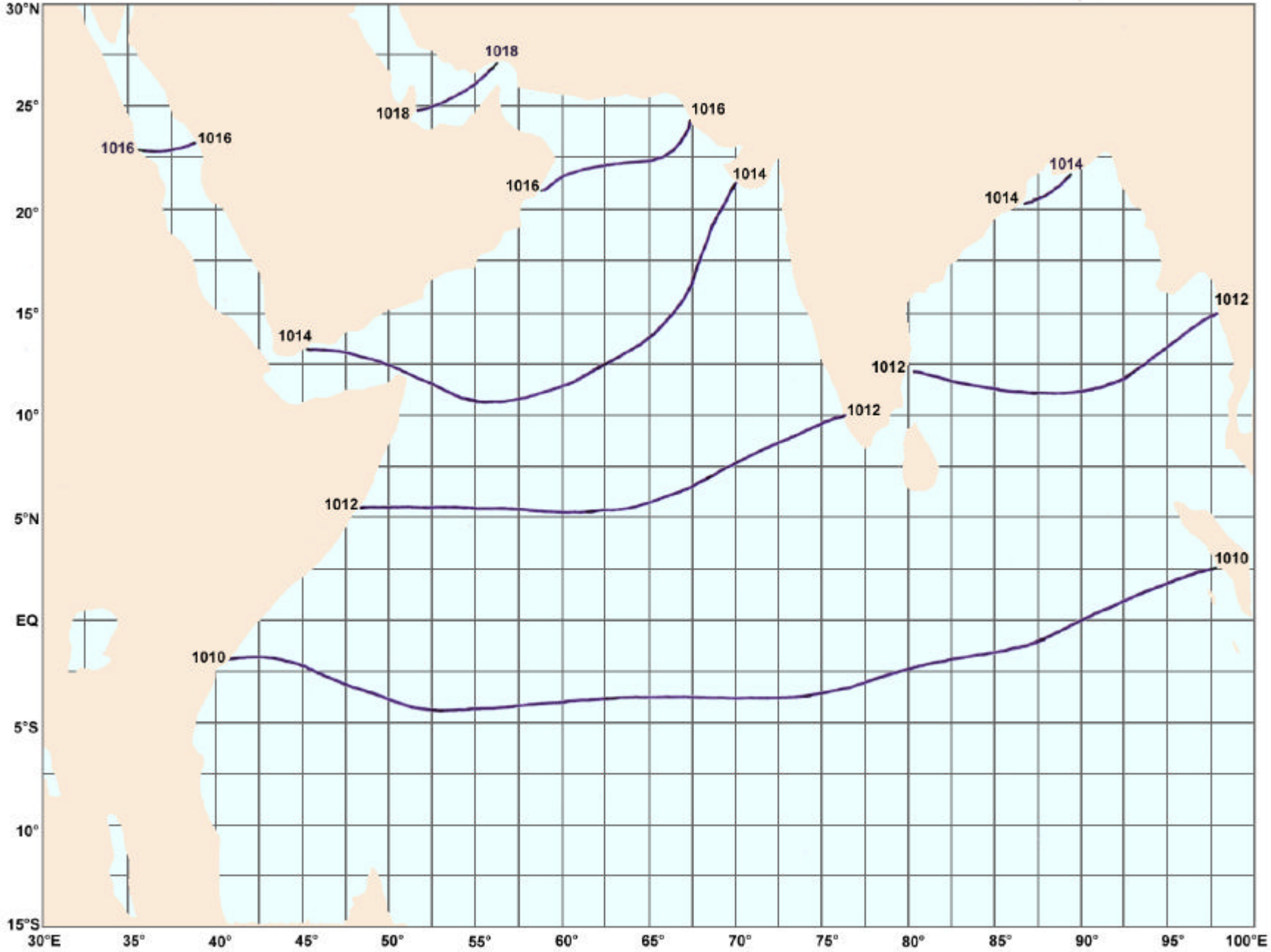


CHART NO.5.3 SEA LEVEL PRESSURE (hPa) MARCH

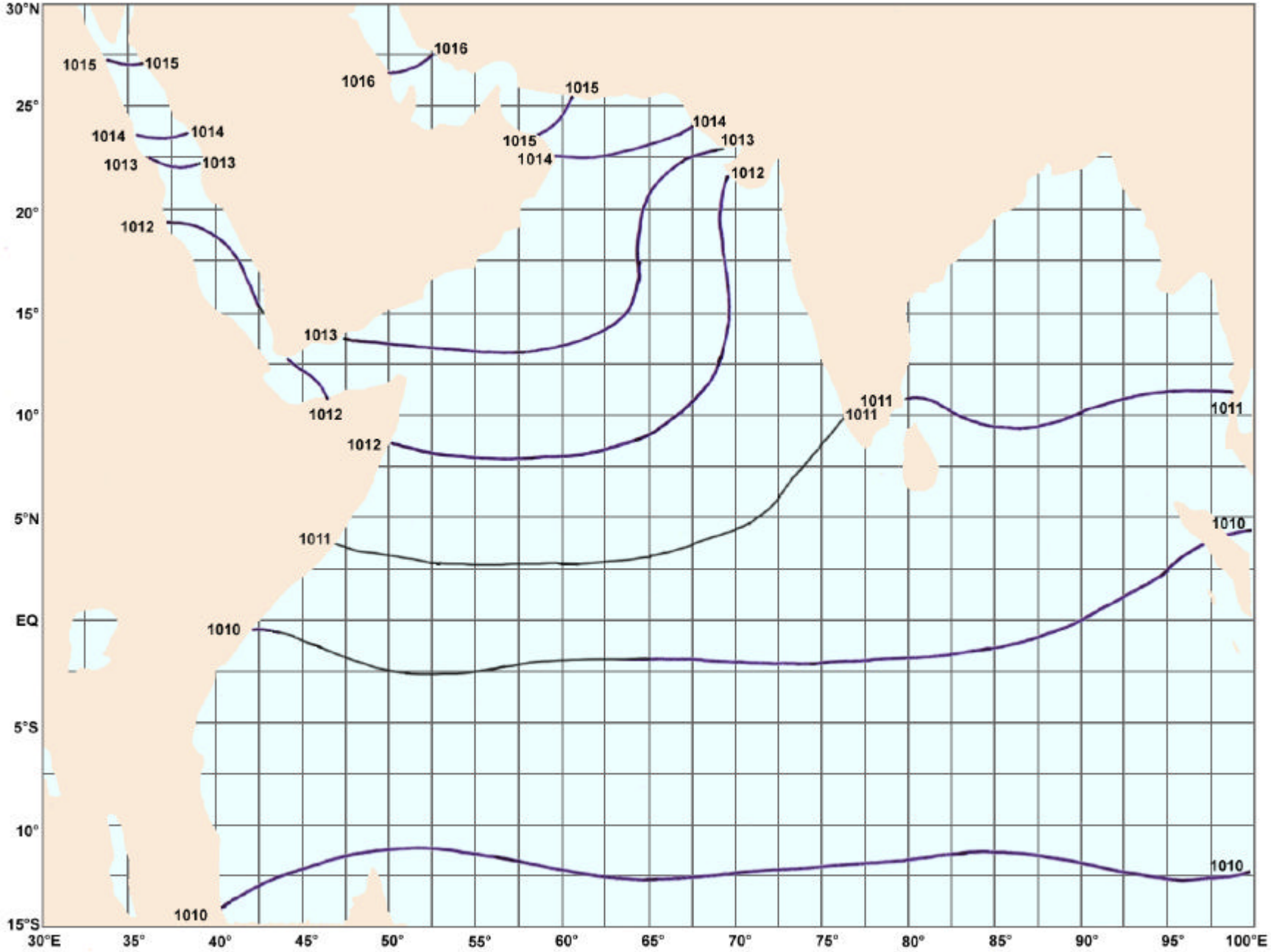


CHART NO. 5.4 SEA LEVEL PRESSURE (hPa) APRIL

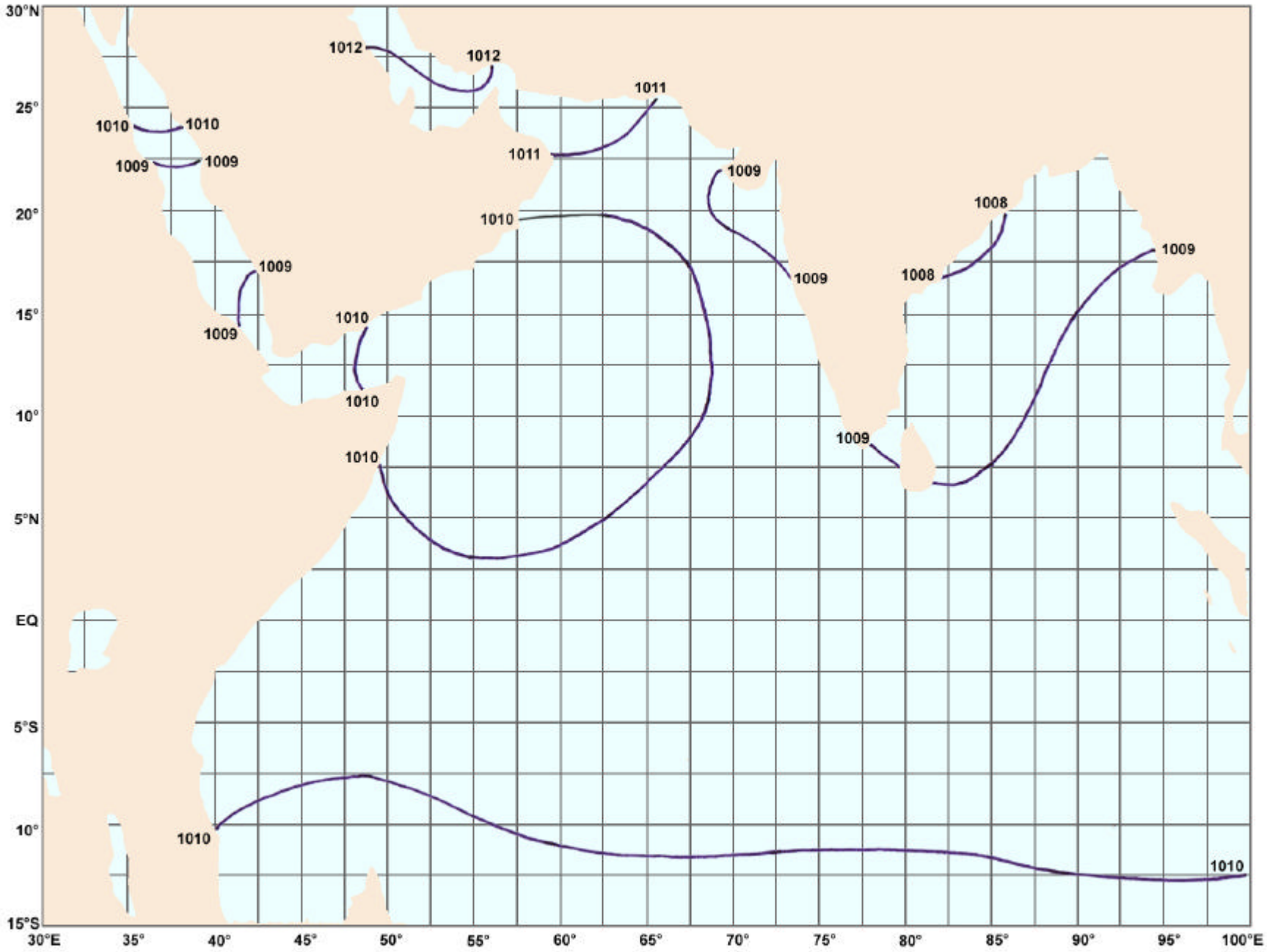


CHART NO.5.5 SEA LEVEL PRESSURE (hPa) MAY

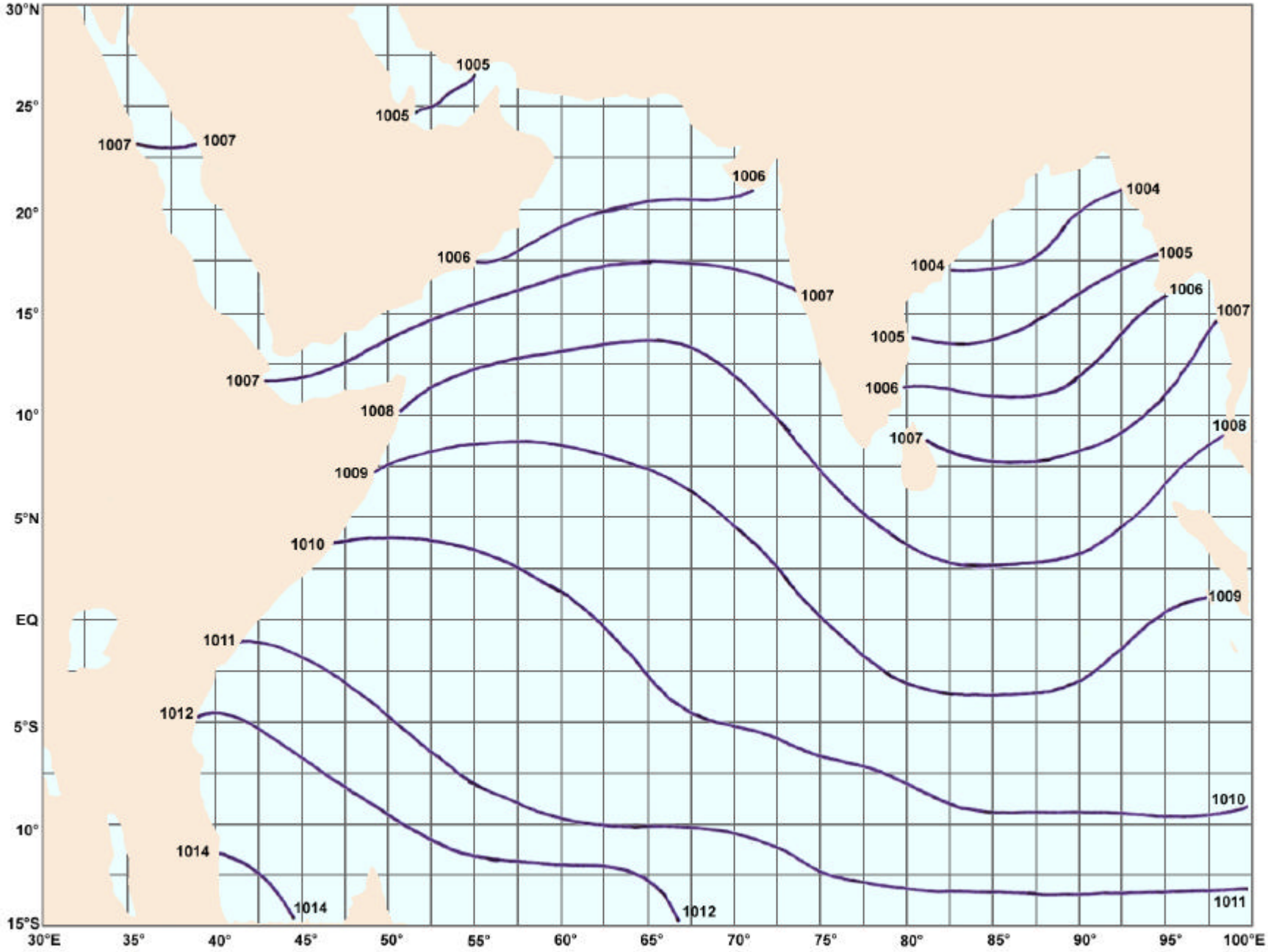


CHART NO.5.6 SEA LEVEL PRESSURE (hPa) JUNE

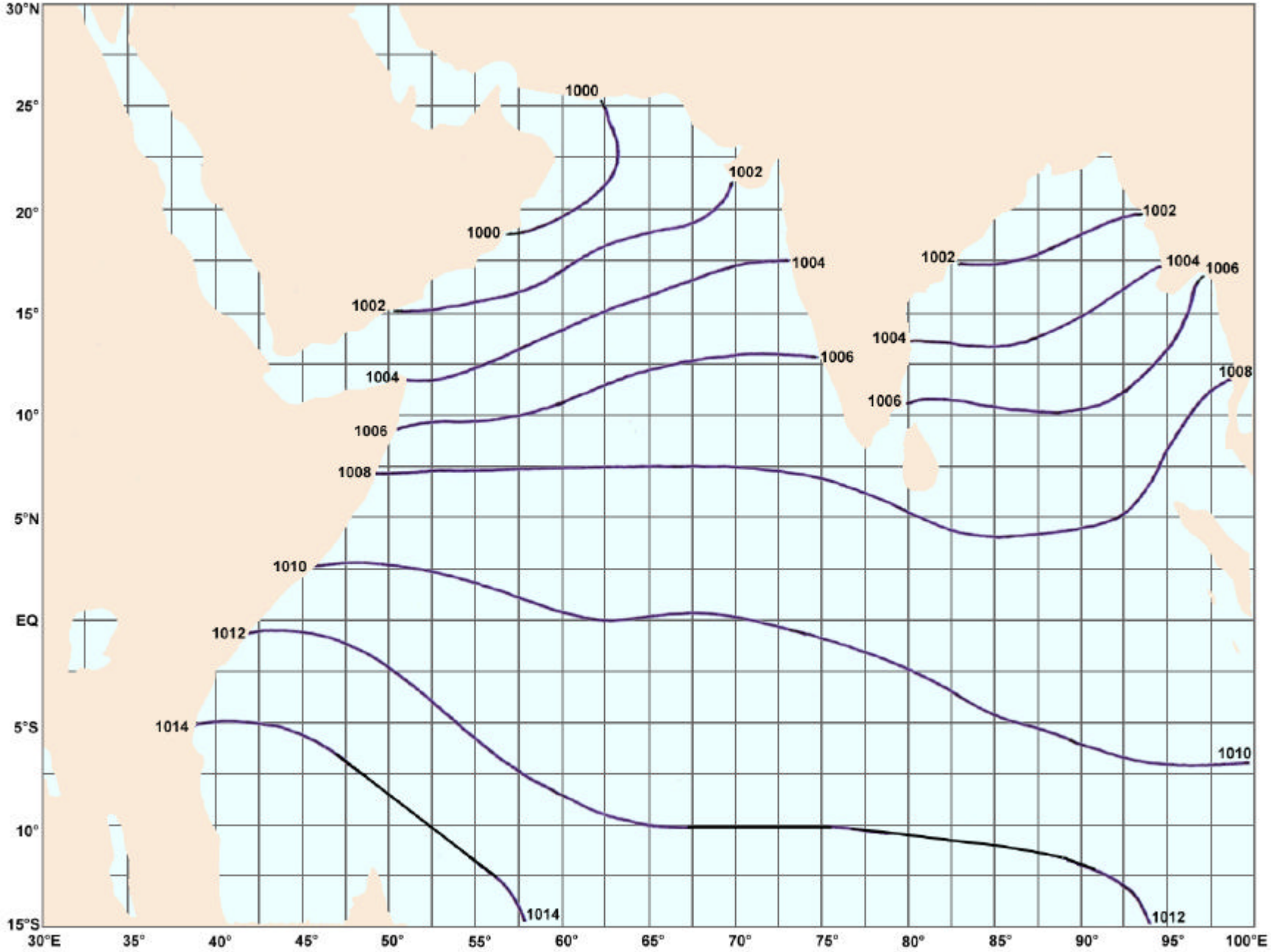
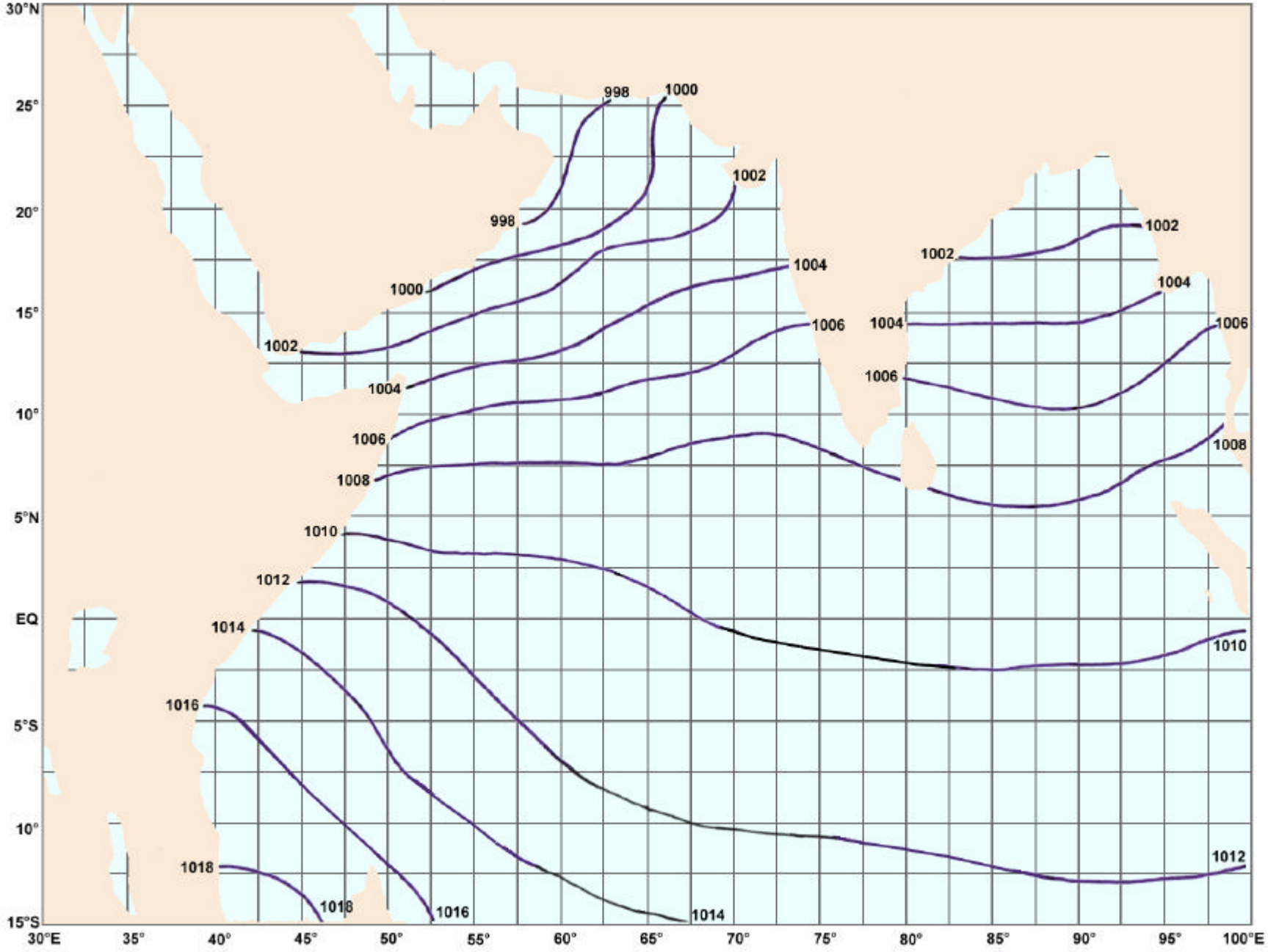


CHART NO.5.7 SEA LEVEL PRESSURE (hPa) JULY



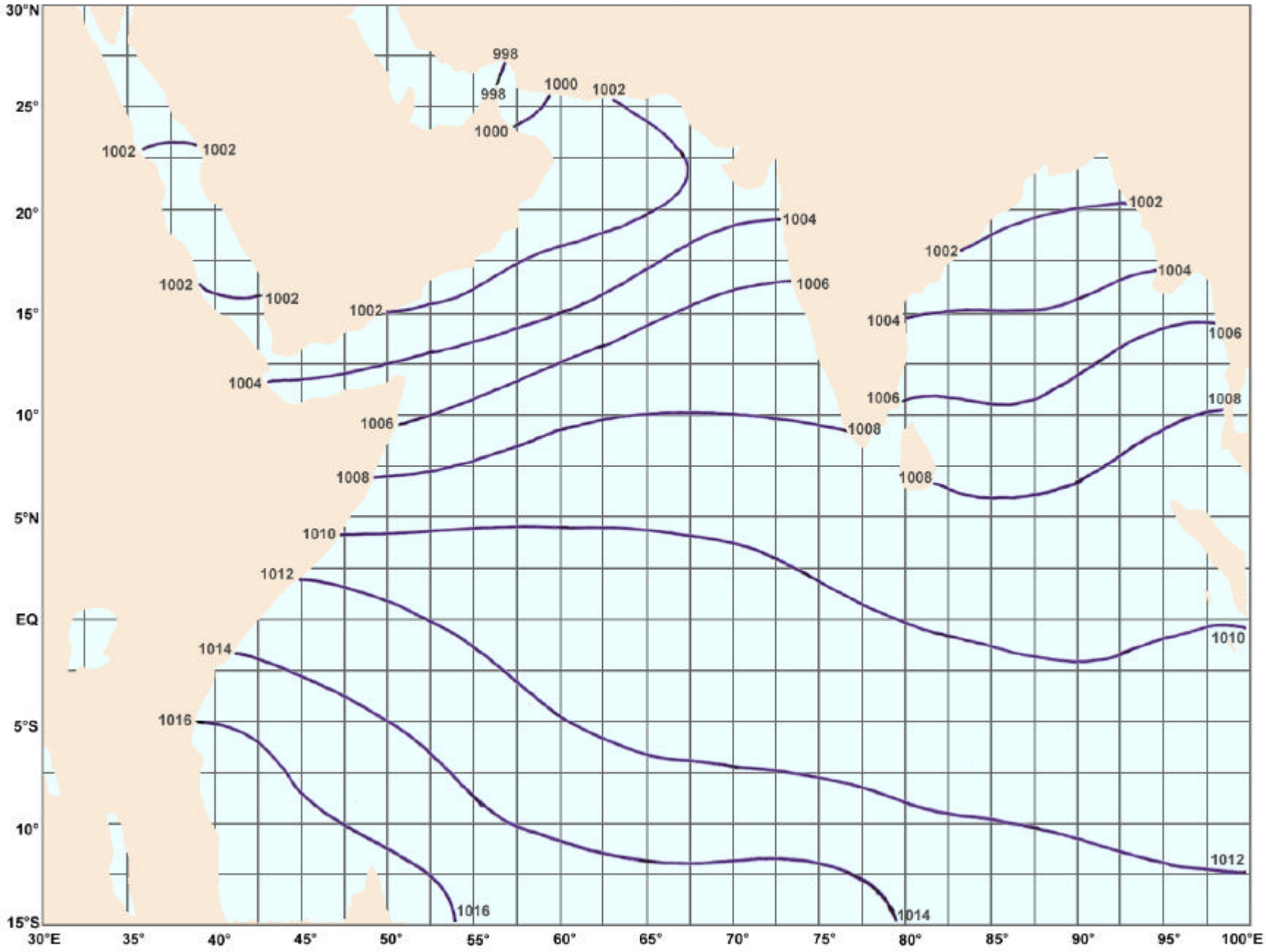

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CHART NO.5.9 SEA LEVEL PRESSURE (hPa) SEPTEMBER

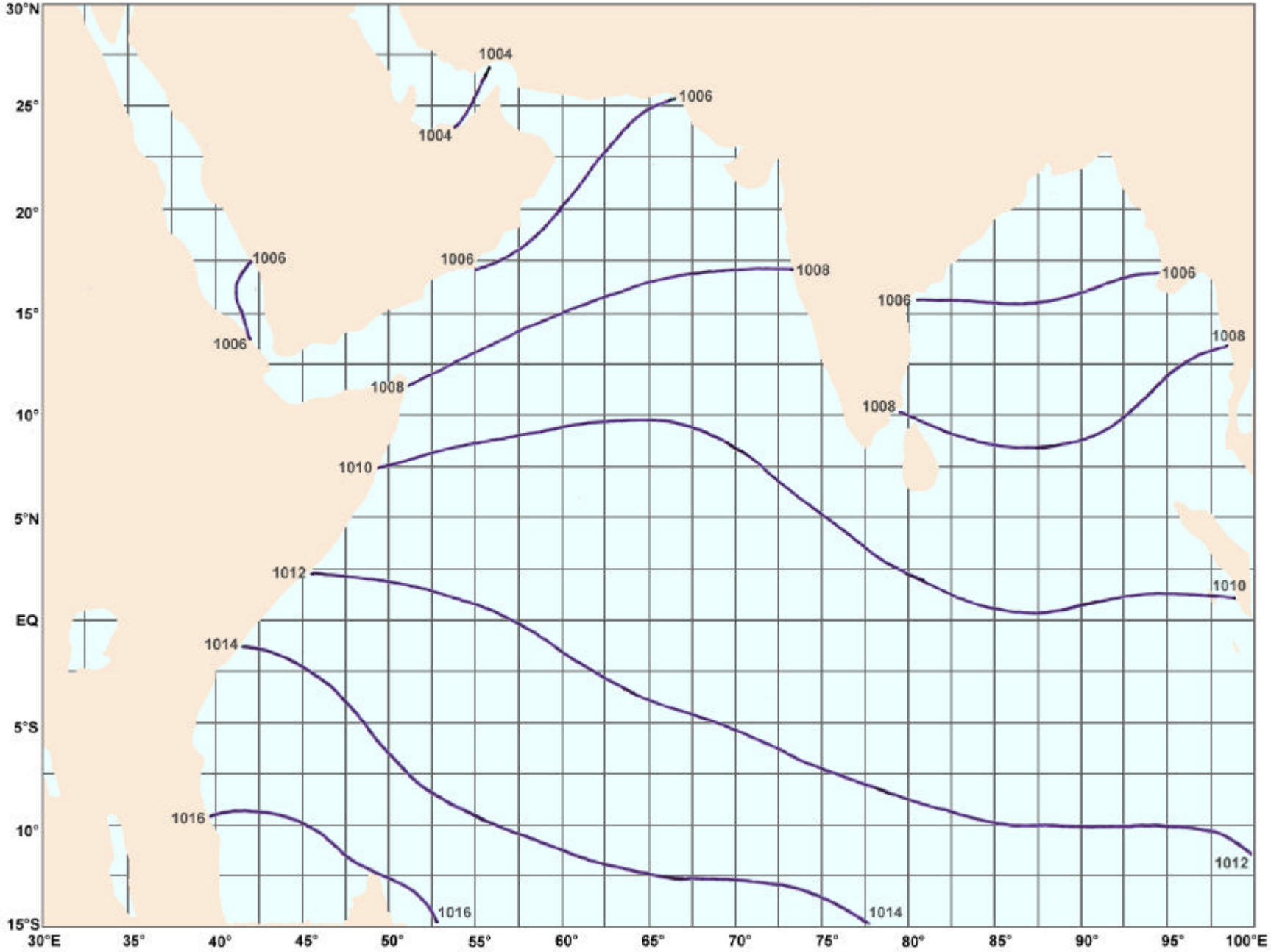
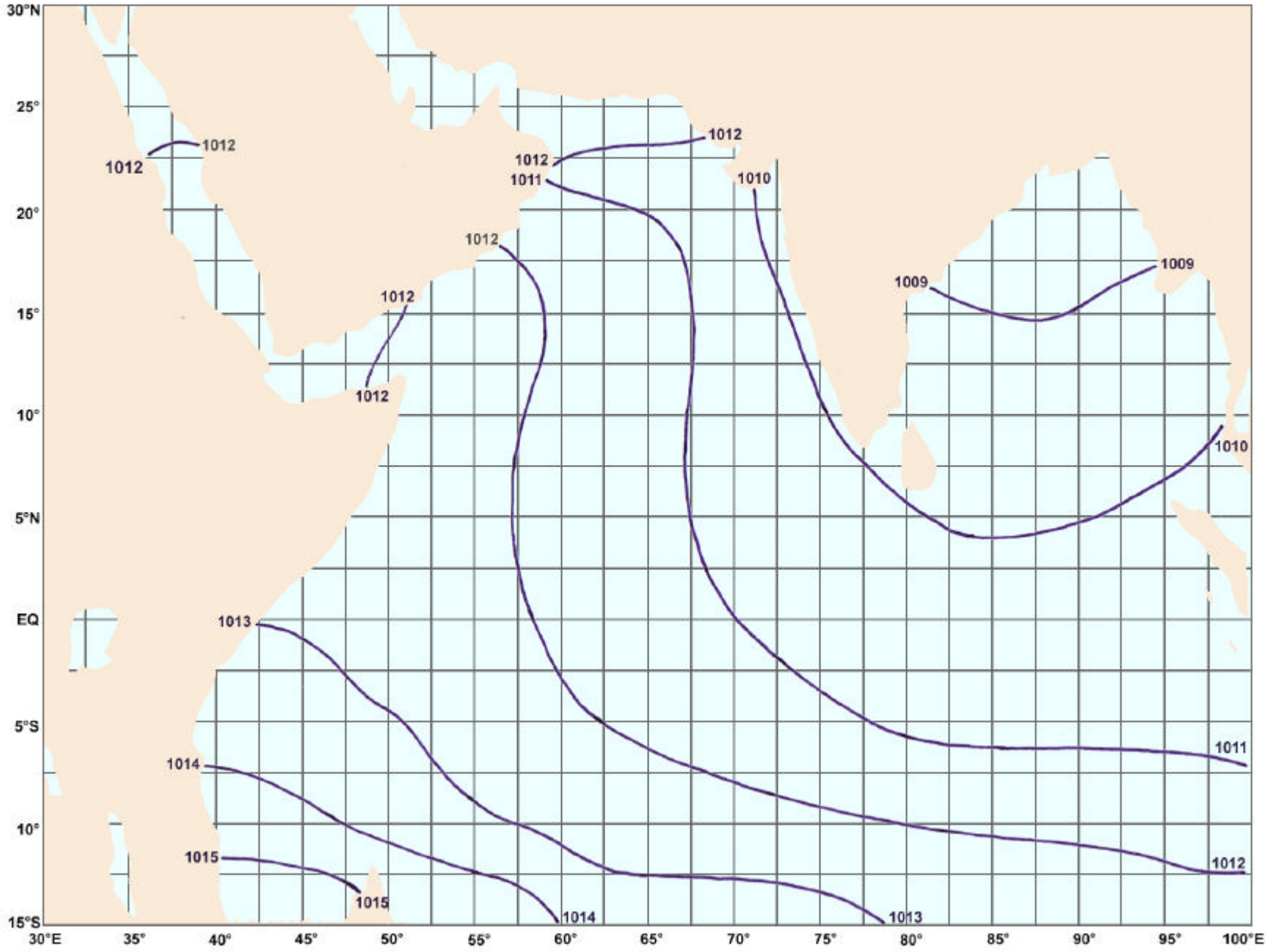
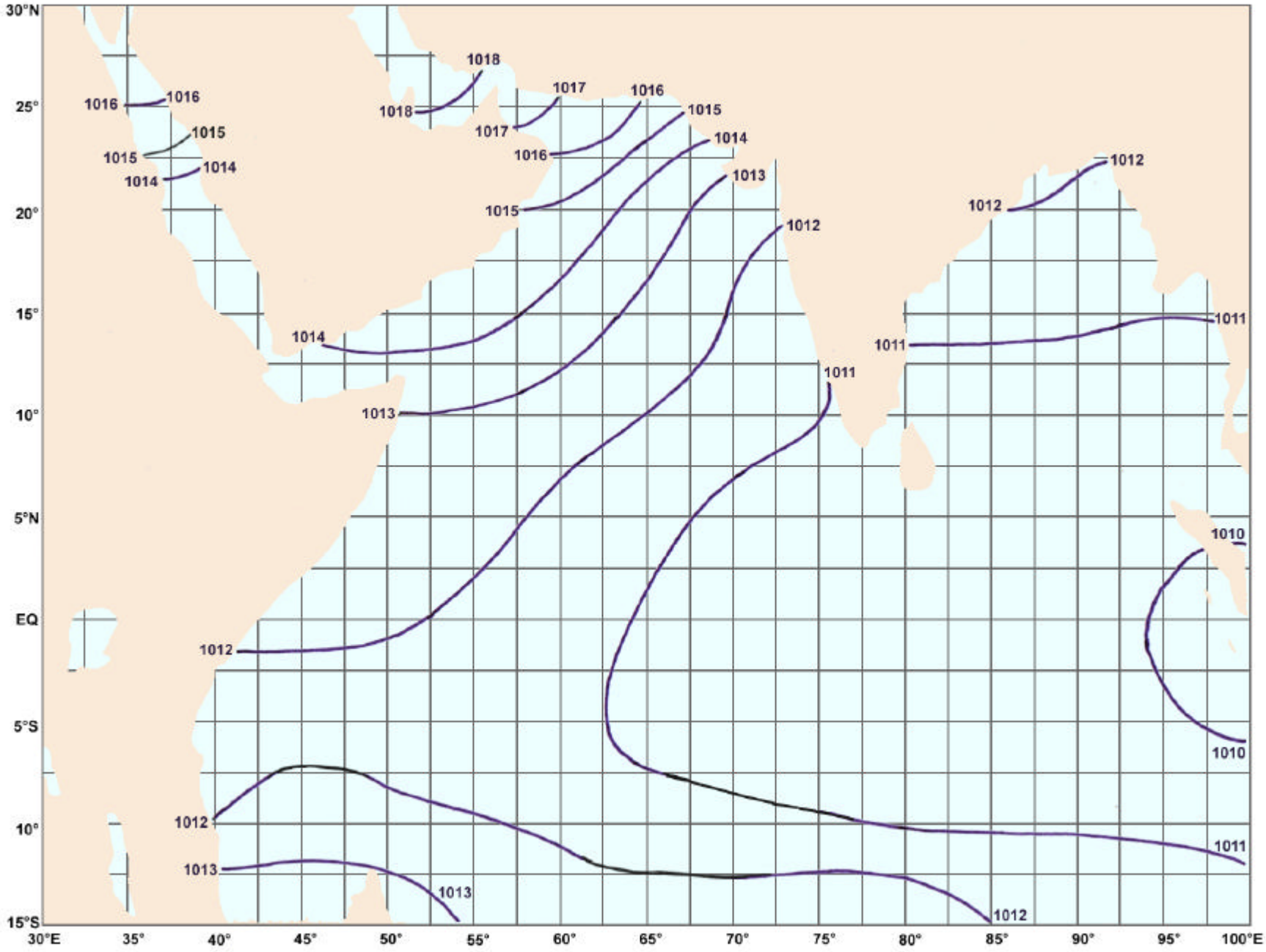


CHART NO.5.10 SEA LEVEL PRESSURE (hPa) OCTOBER

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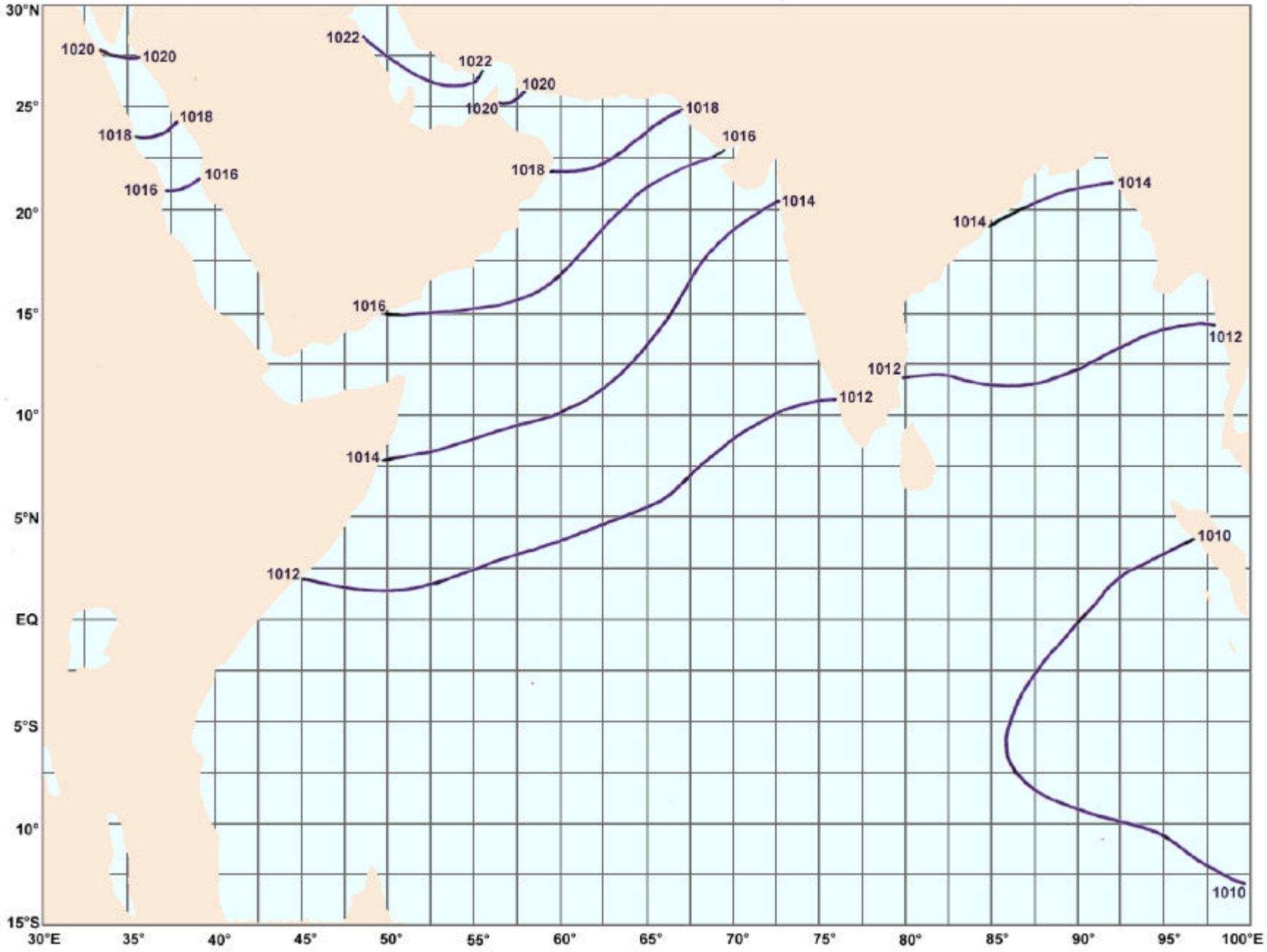
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CHART NO.6.1 WIND SPEED (m/Sec) JANUARY

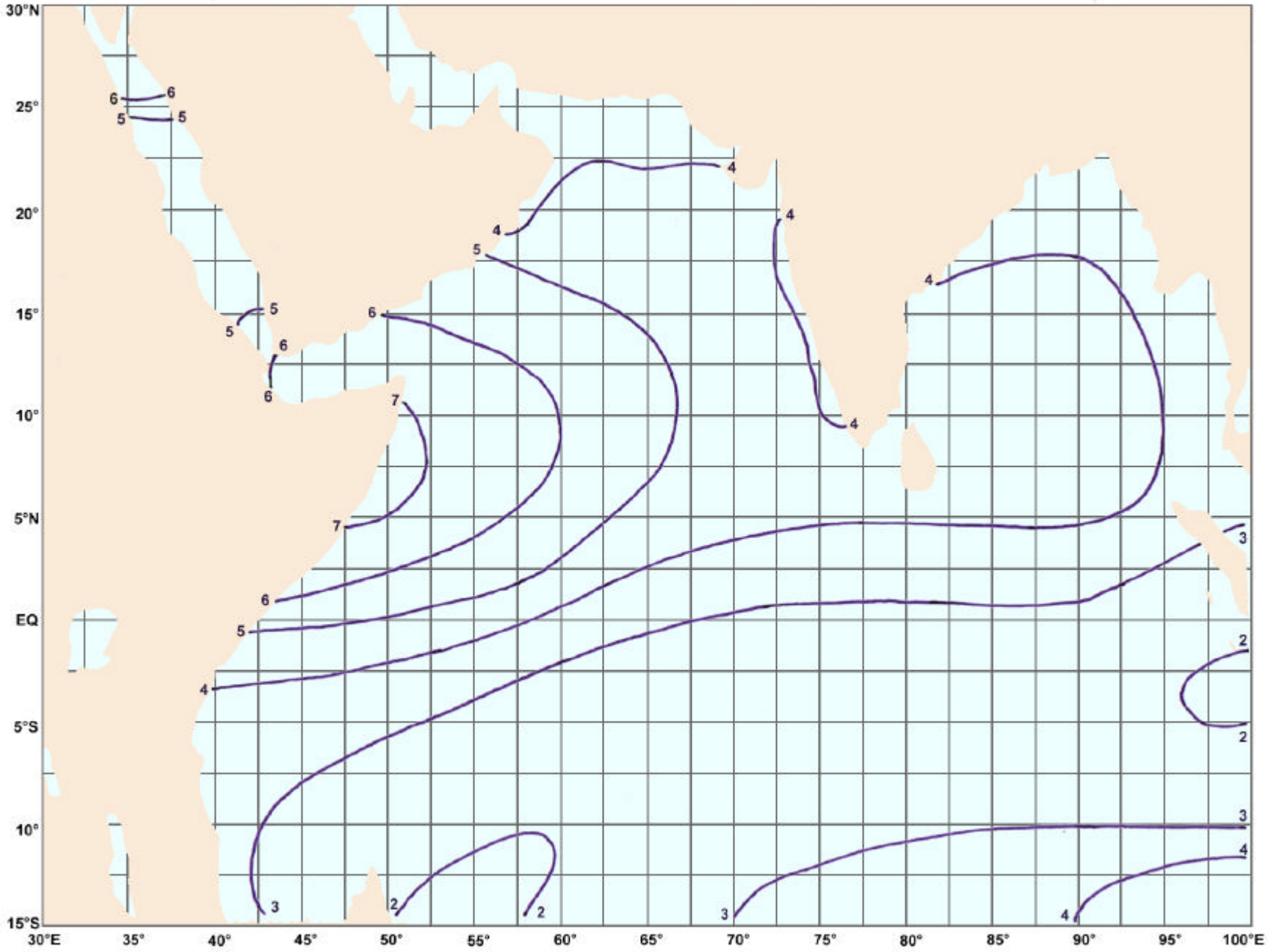


CHART NO.6.2 WIND SPEED (m/Sec) FEBRUARY

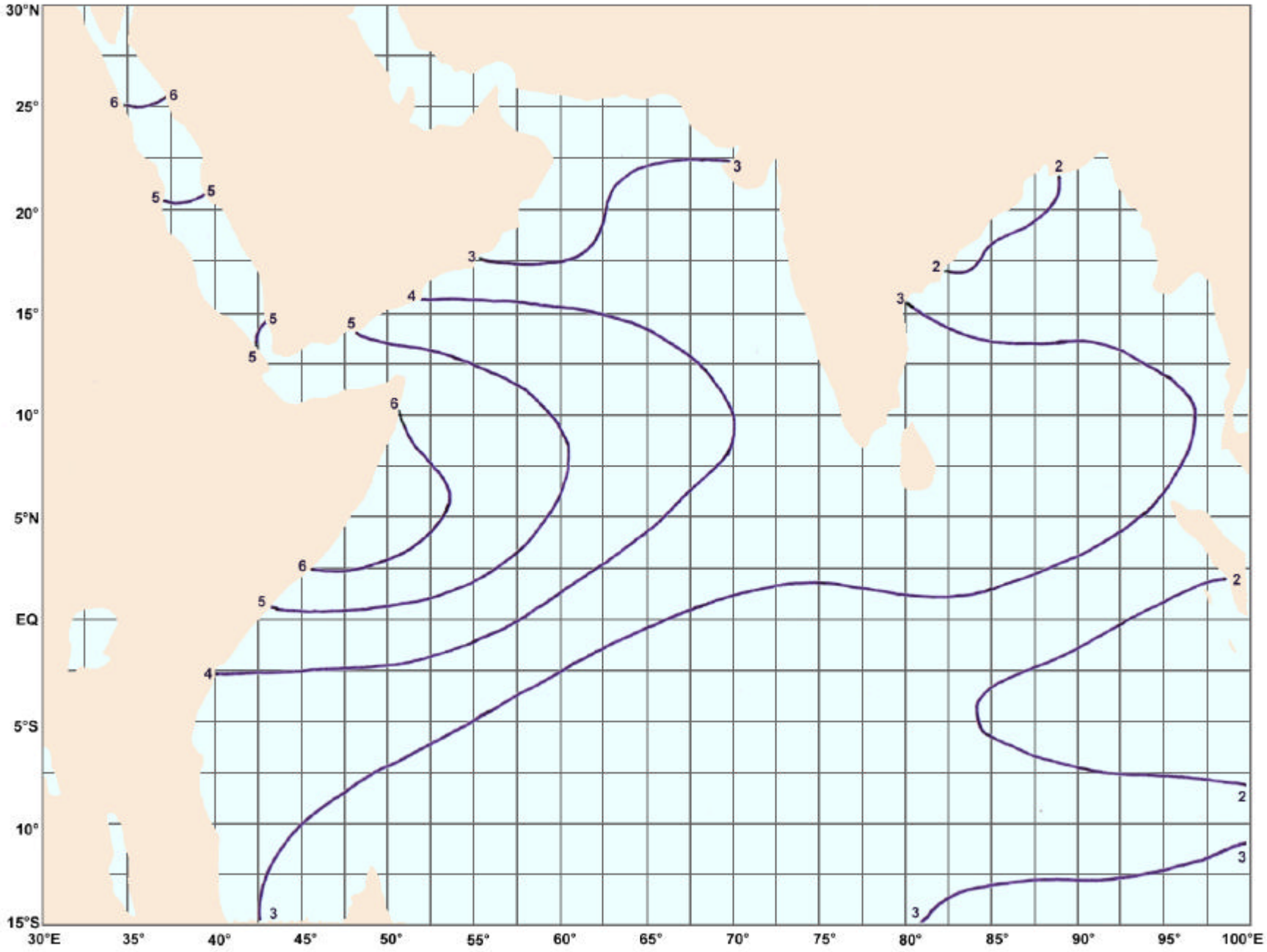


CHART NO.6.3 WIND SPEED (m/Sec) MARCH

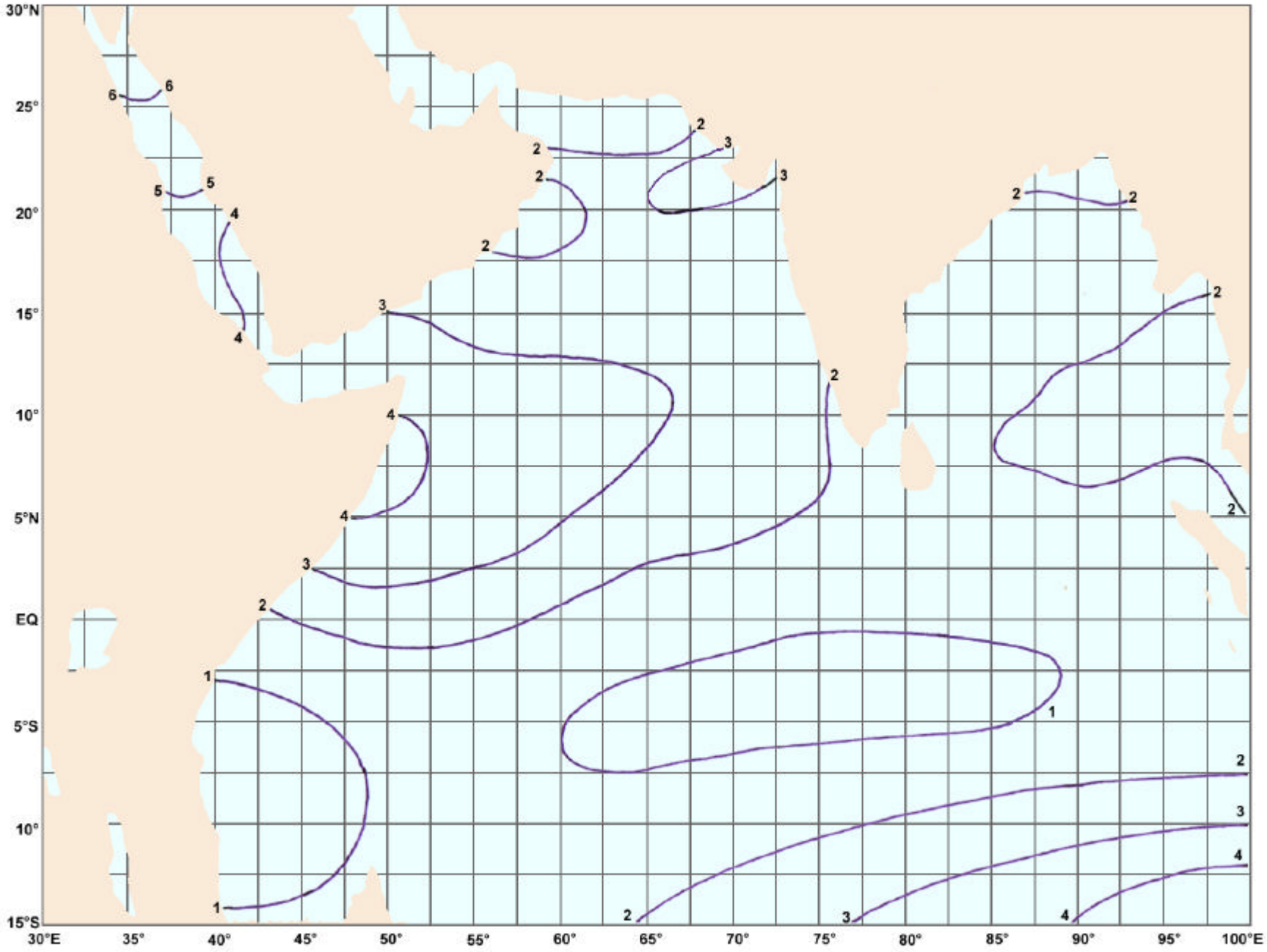


CHART NO.6.4 WIND SPEED (m/Sec) APRIL

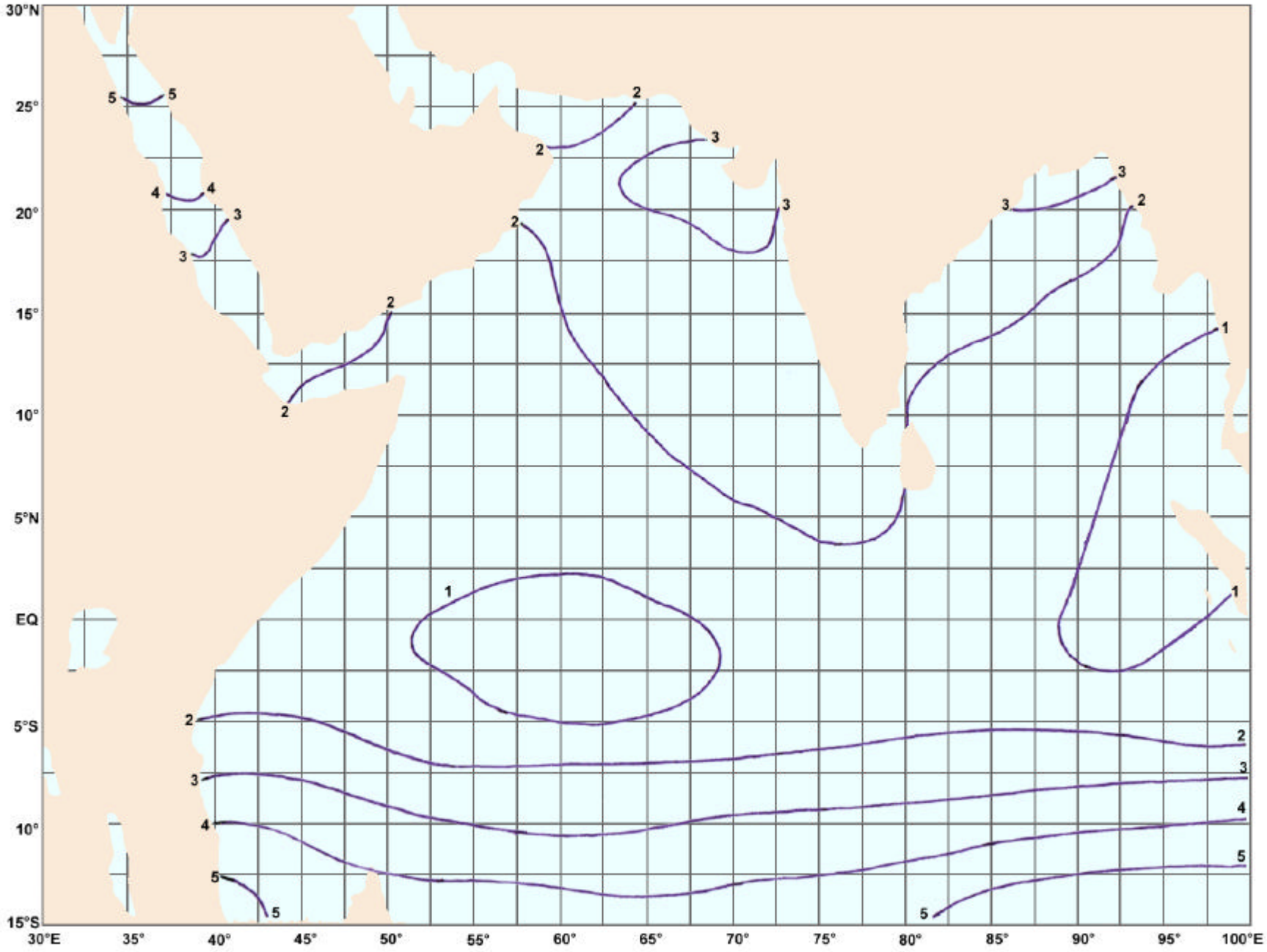
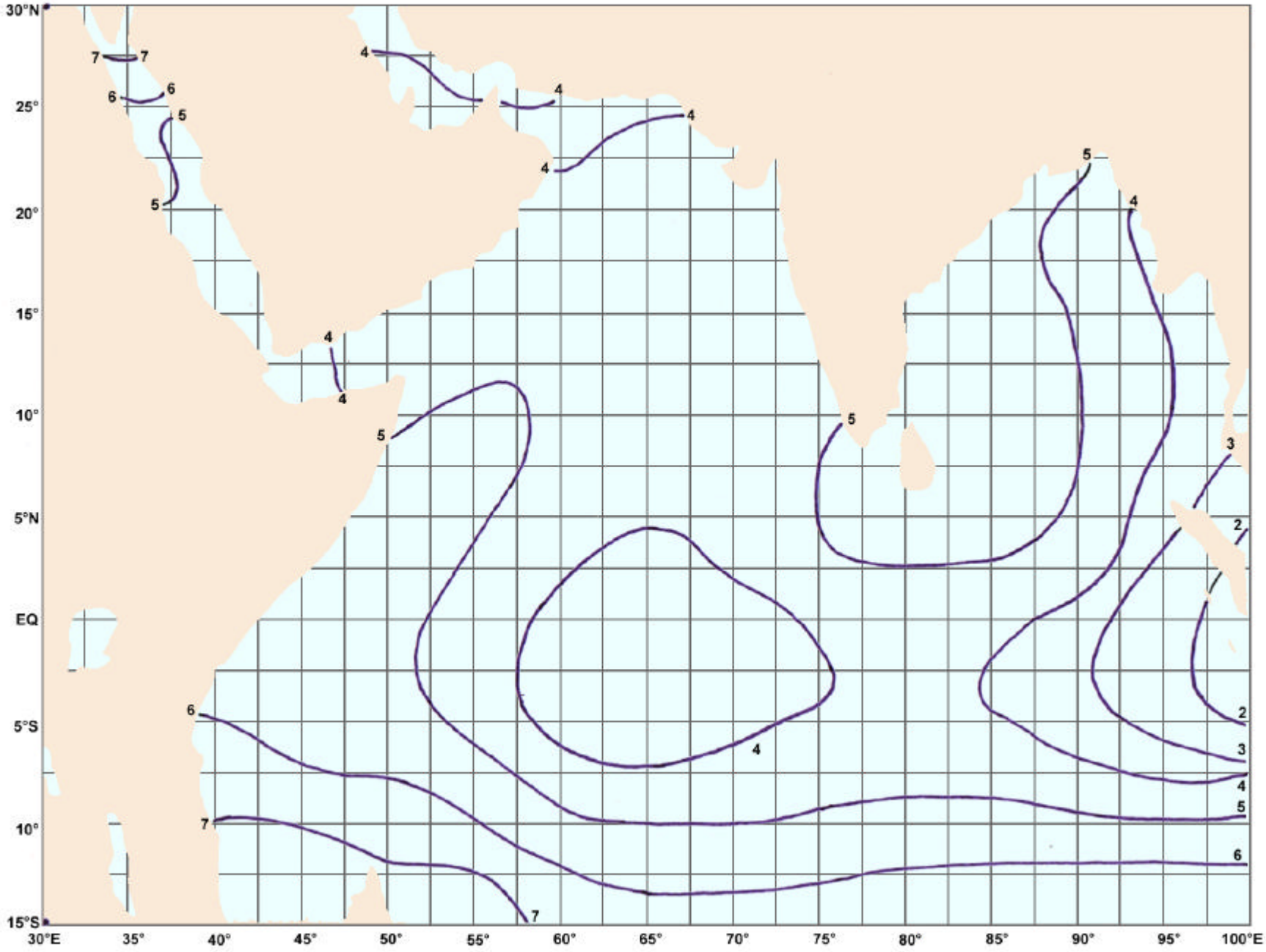


CHART NO.6.5 WIND SPEED (m/Sec) MAY



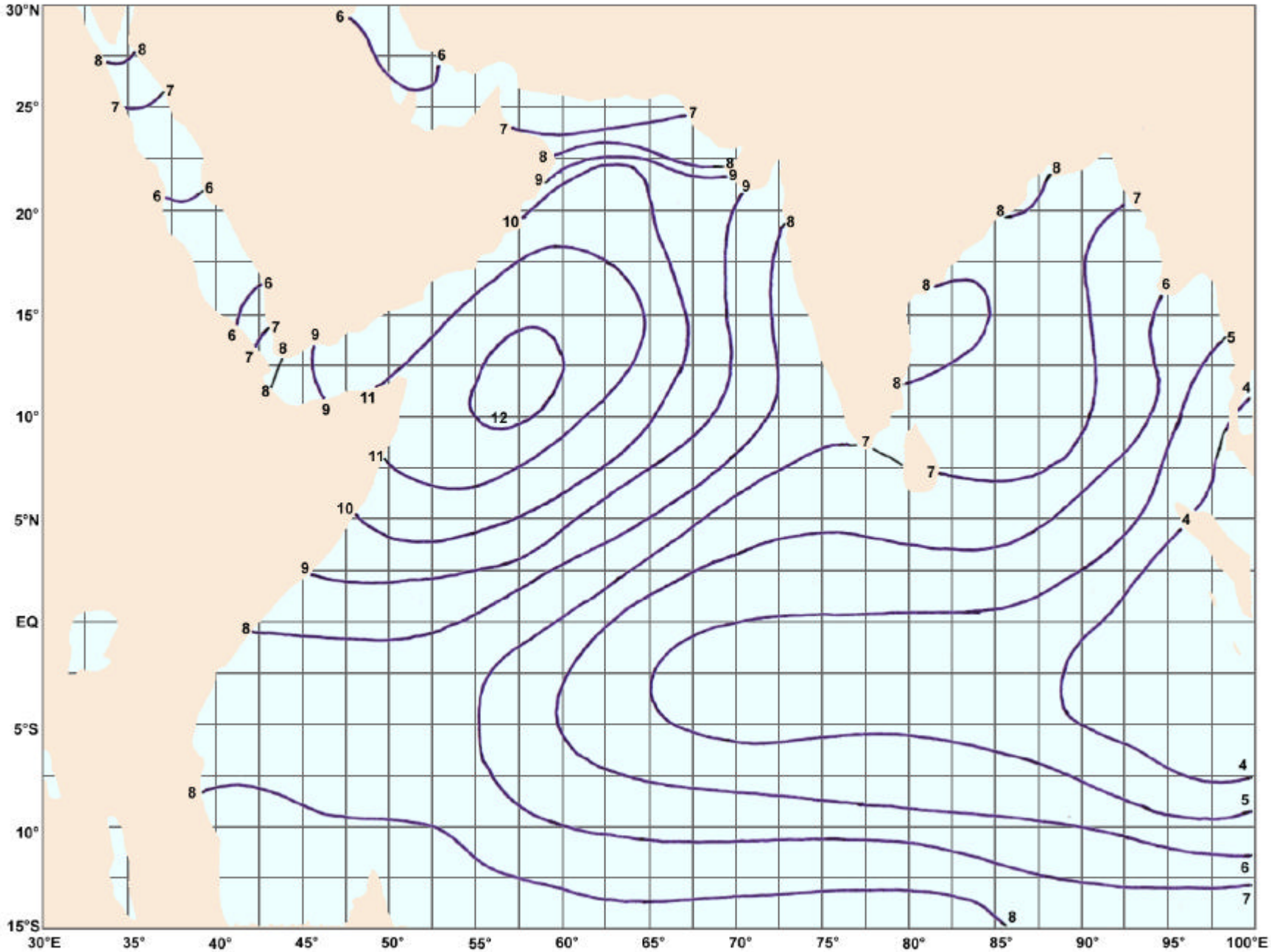

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CHART NO.6.7 WIND SPEED (m/Sec) JULY

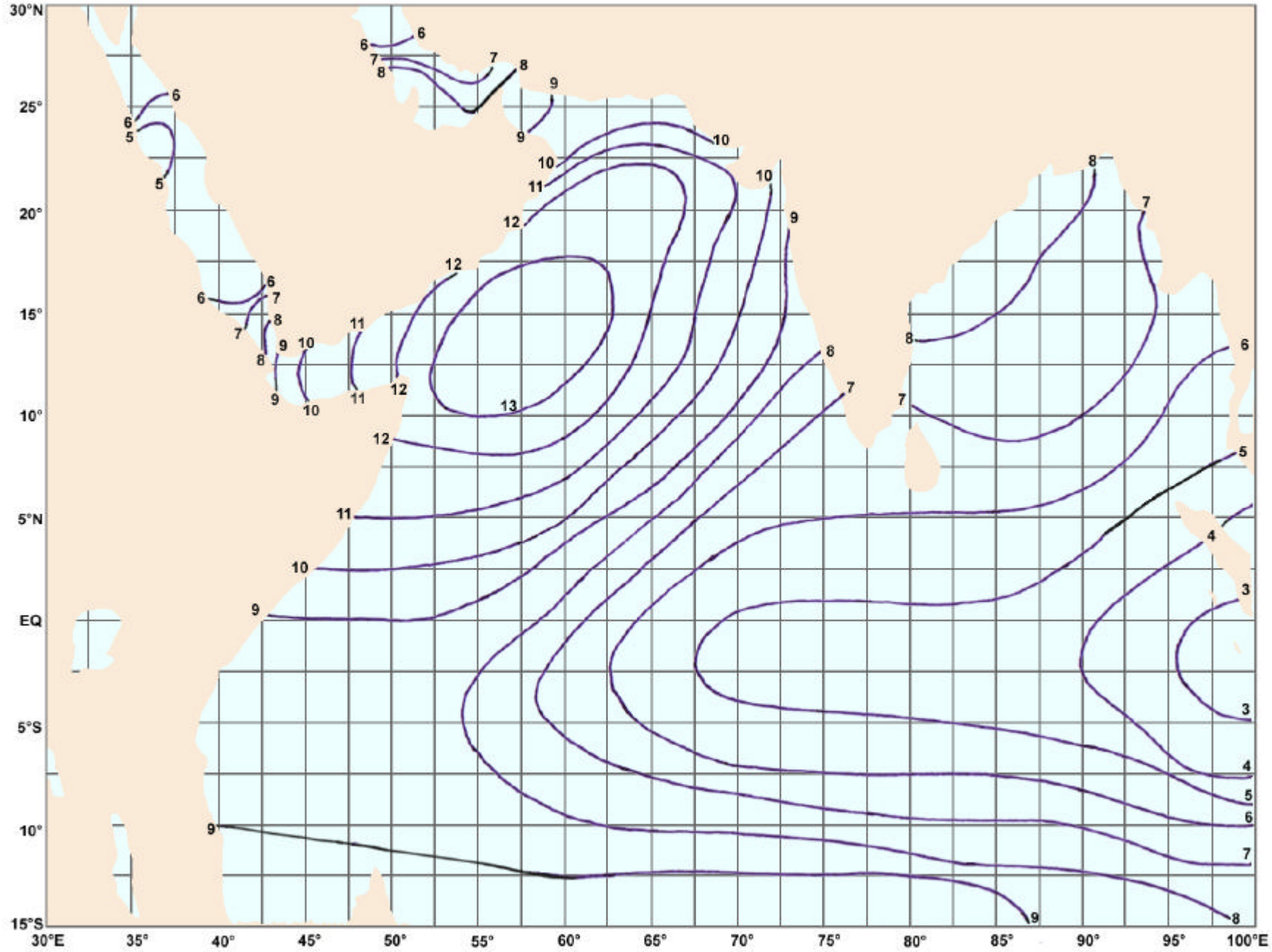


CHART NO.6.8 WIND SPEED (m/Sec) AUGUST

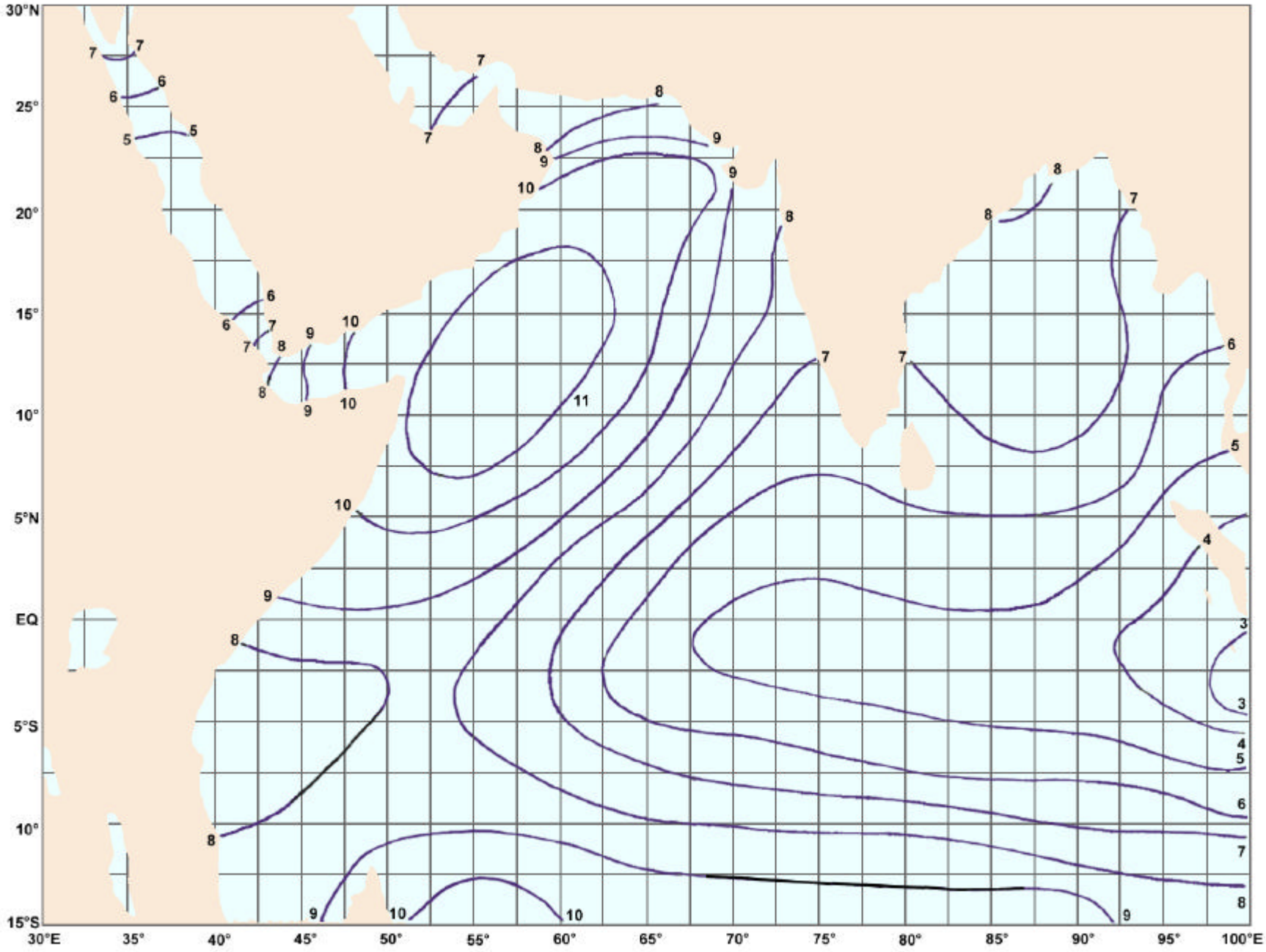
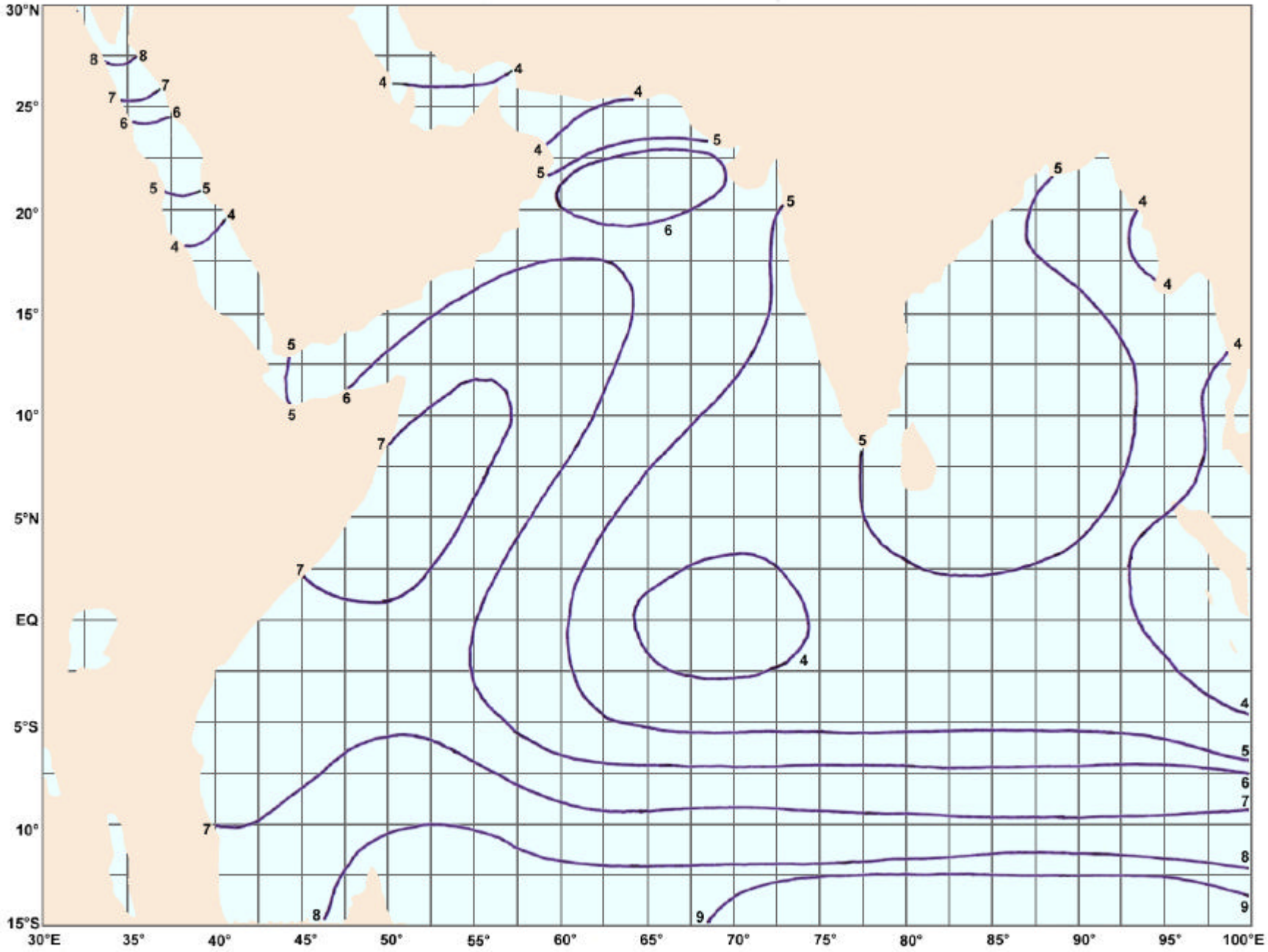


CHART NO.6.9 WIND SPEED (m/Sec) SEPTEMBER



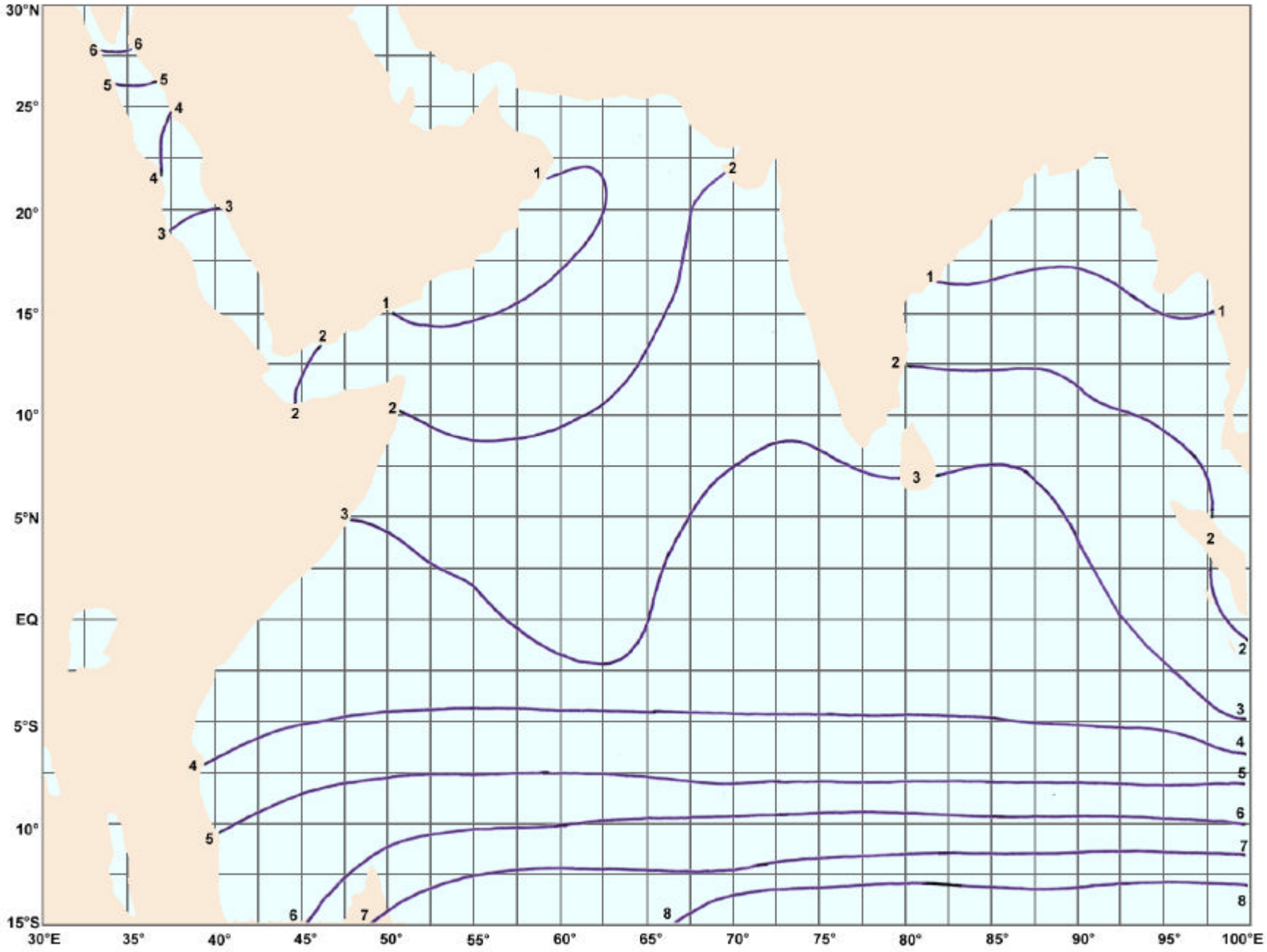

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CHART NO.6.11 WIND SPEED (m/Sec) NOVEMBER

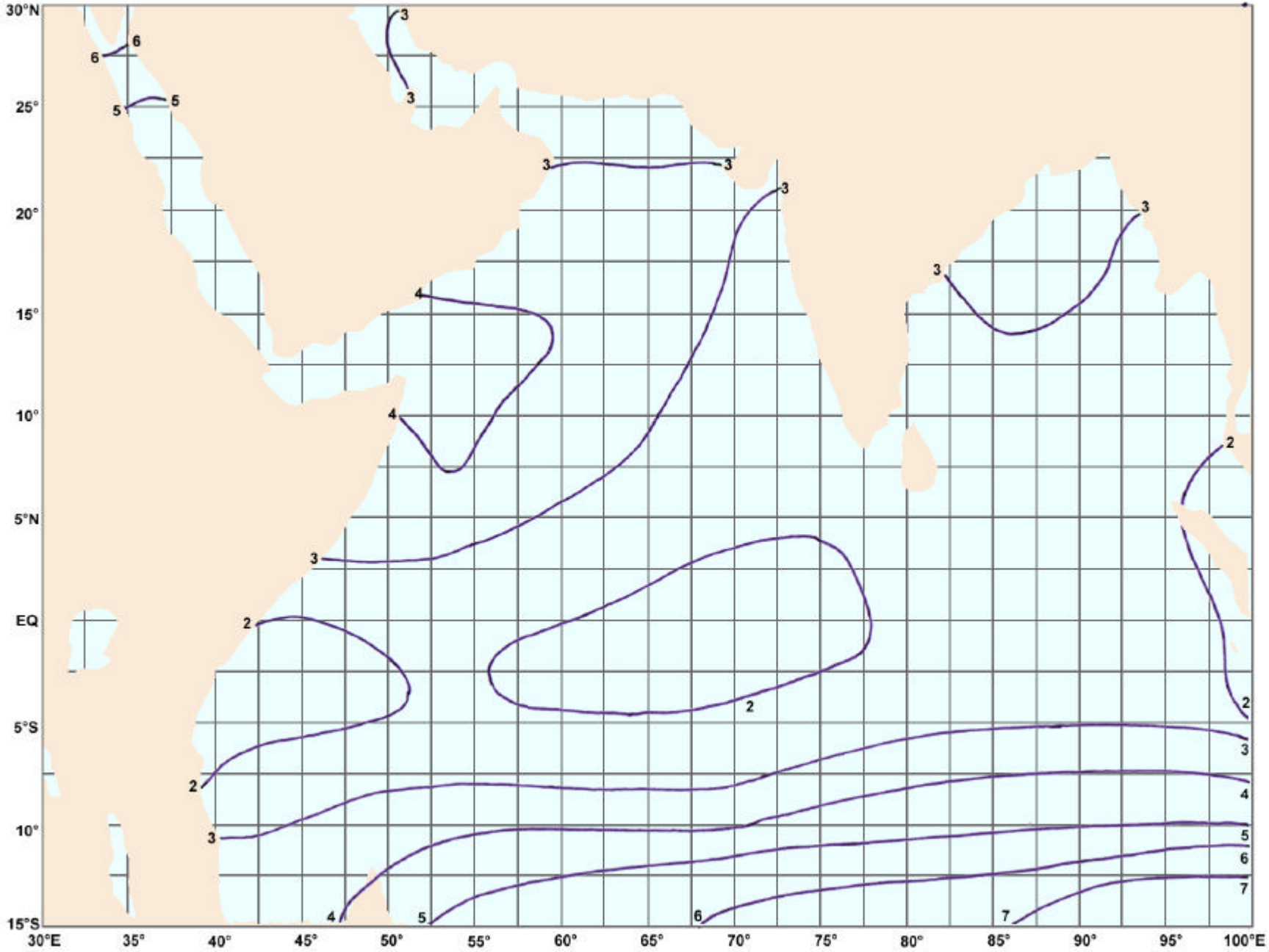


CHART NO.6.12 WIND SPEED (m/Sec) DECEMBER

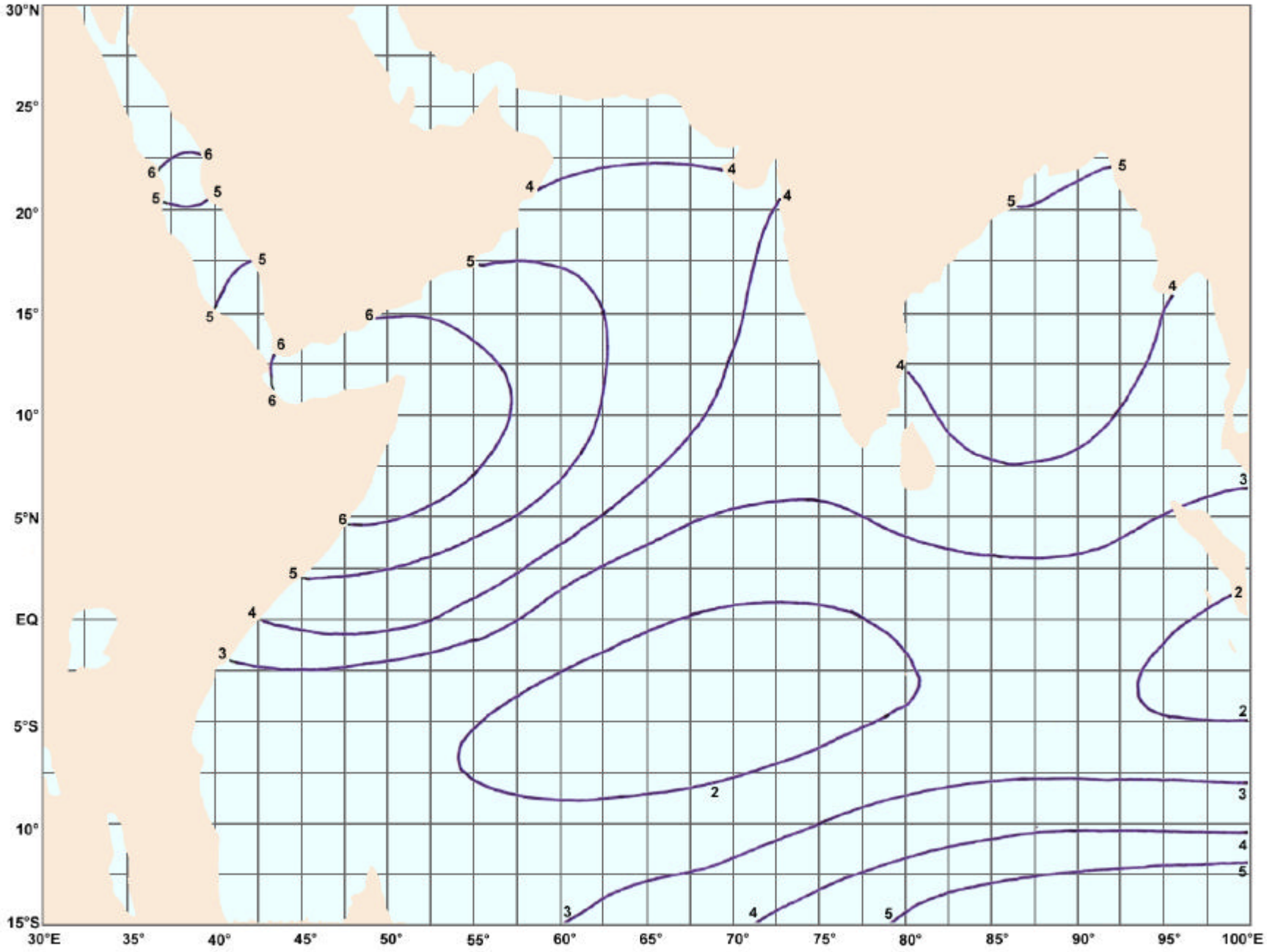


CHART NO.7.1 WIND DIRECTION (DEGREES) JANUARY

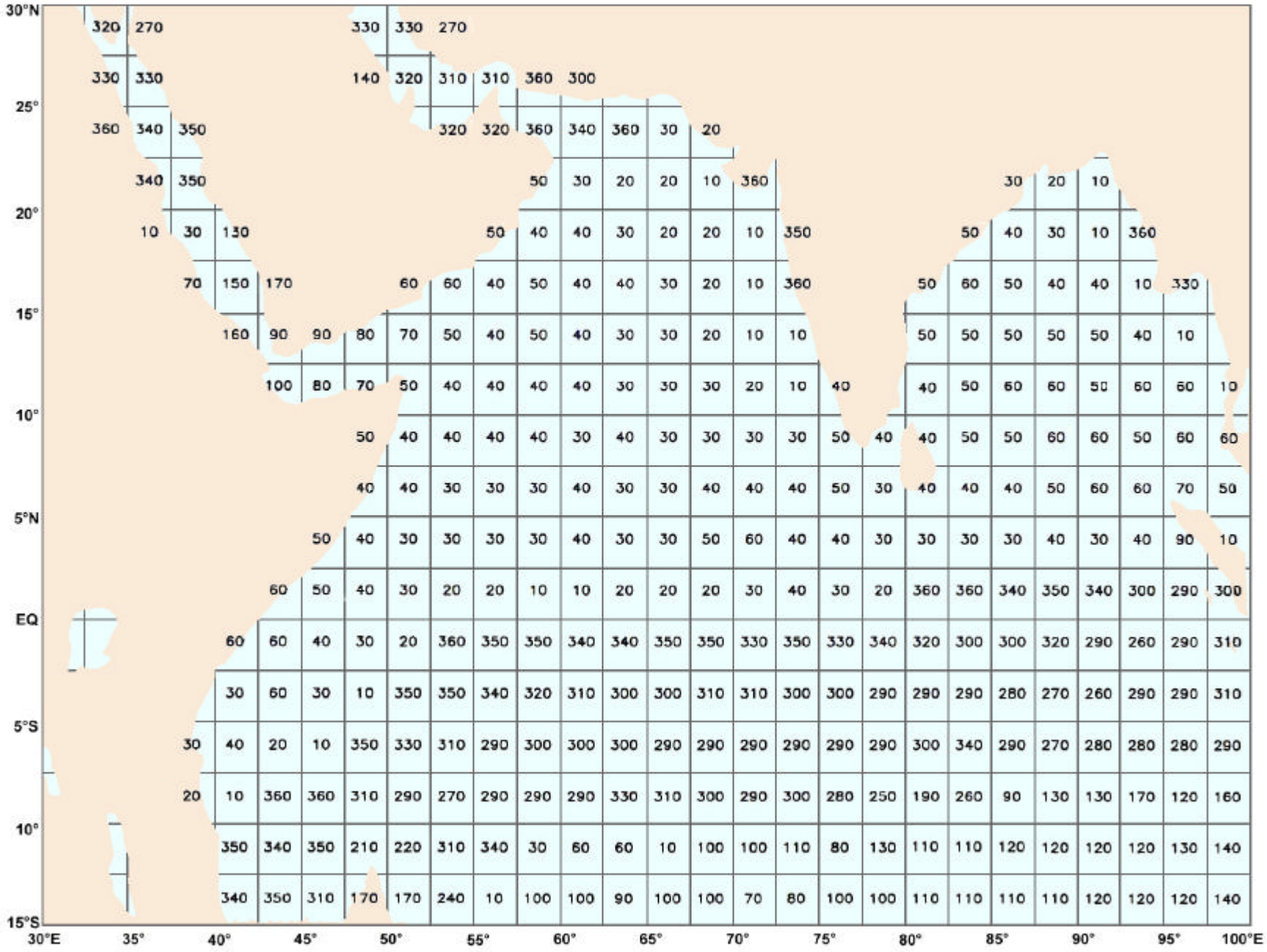
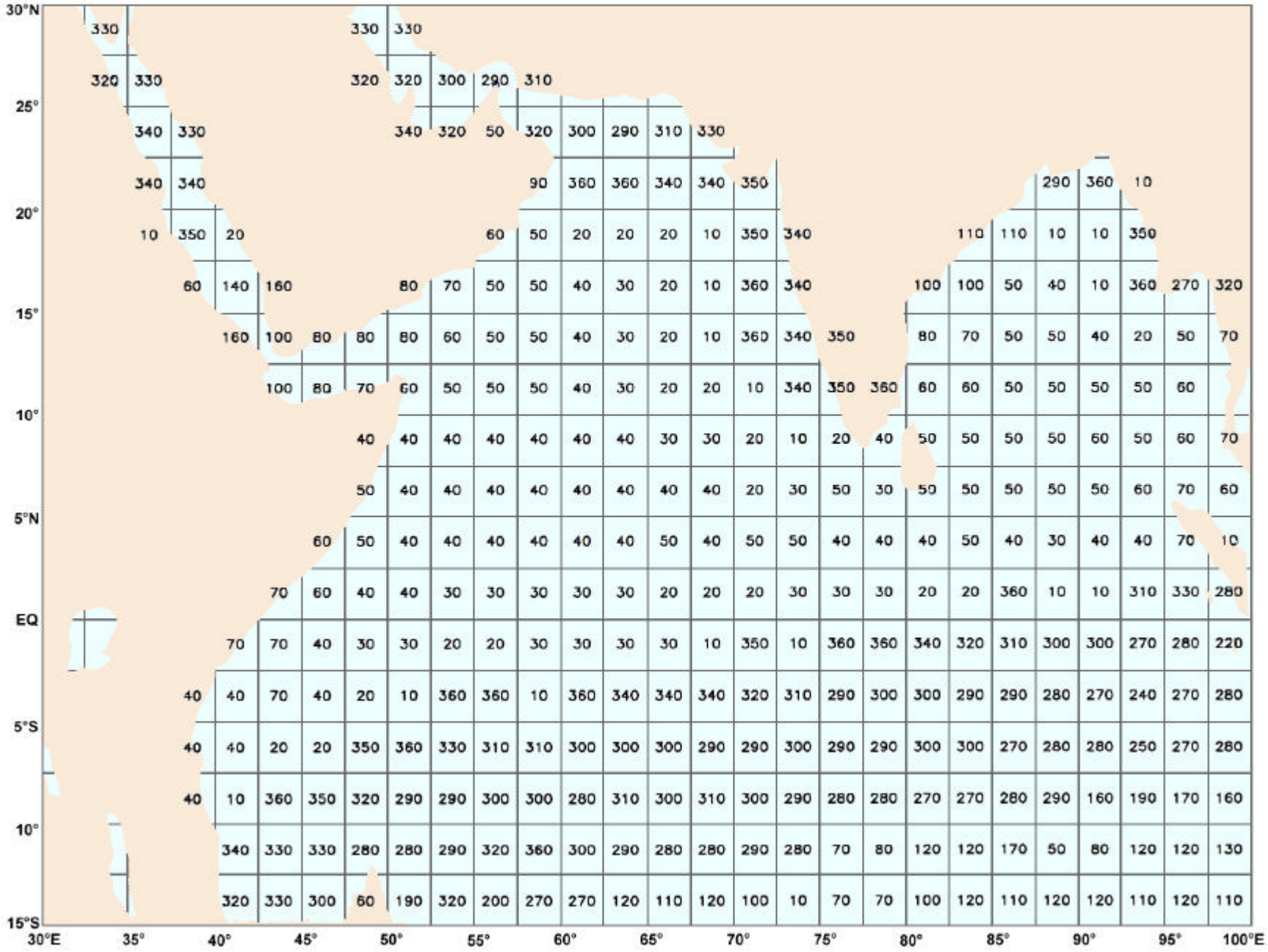
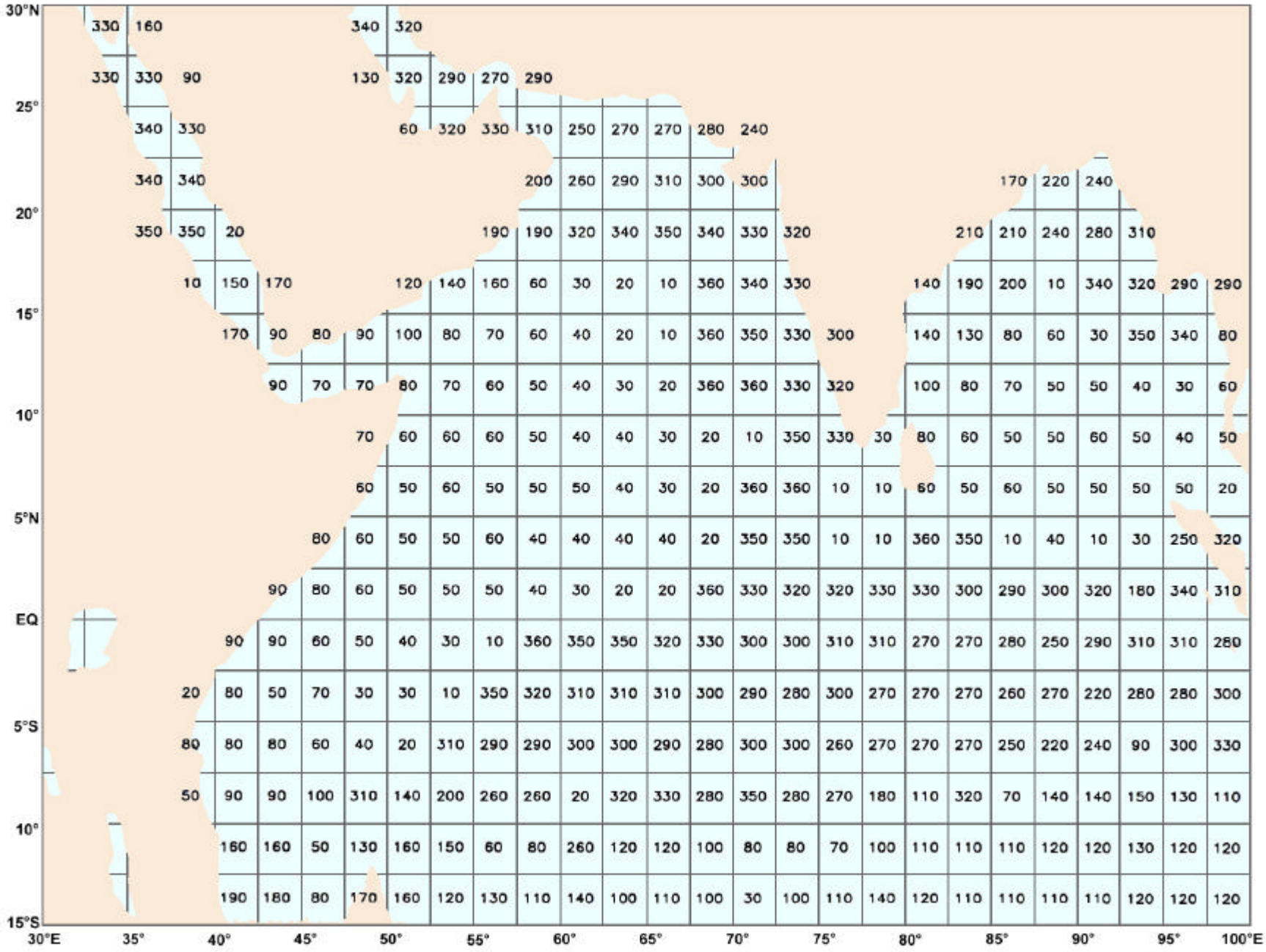


CHART NO.7.2 WIND DIRECTION (DEGREES) FEBRUARY




30°N
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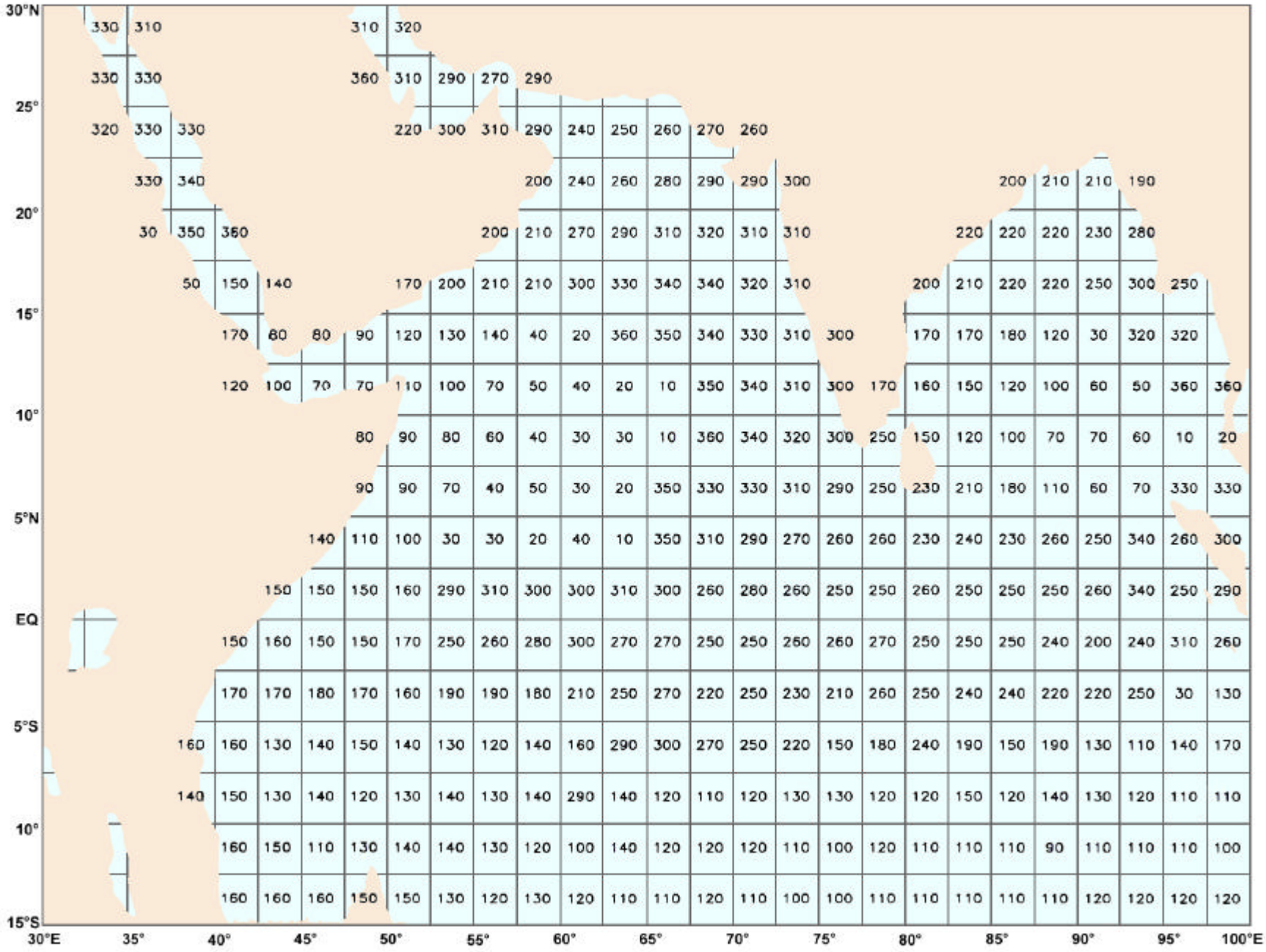
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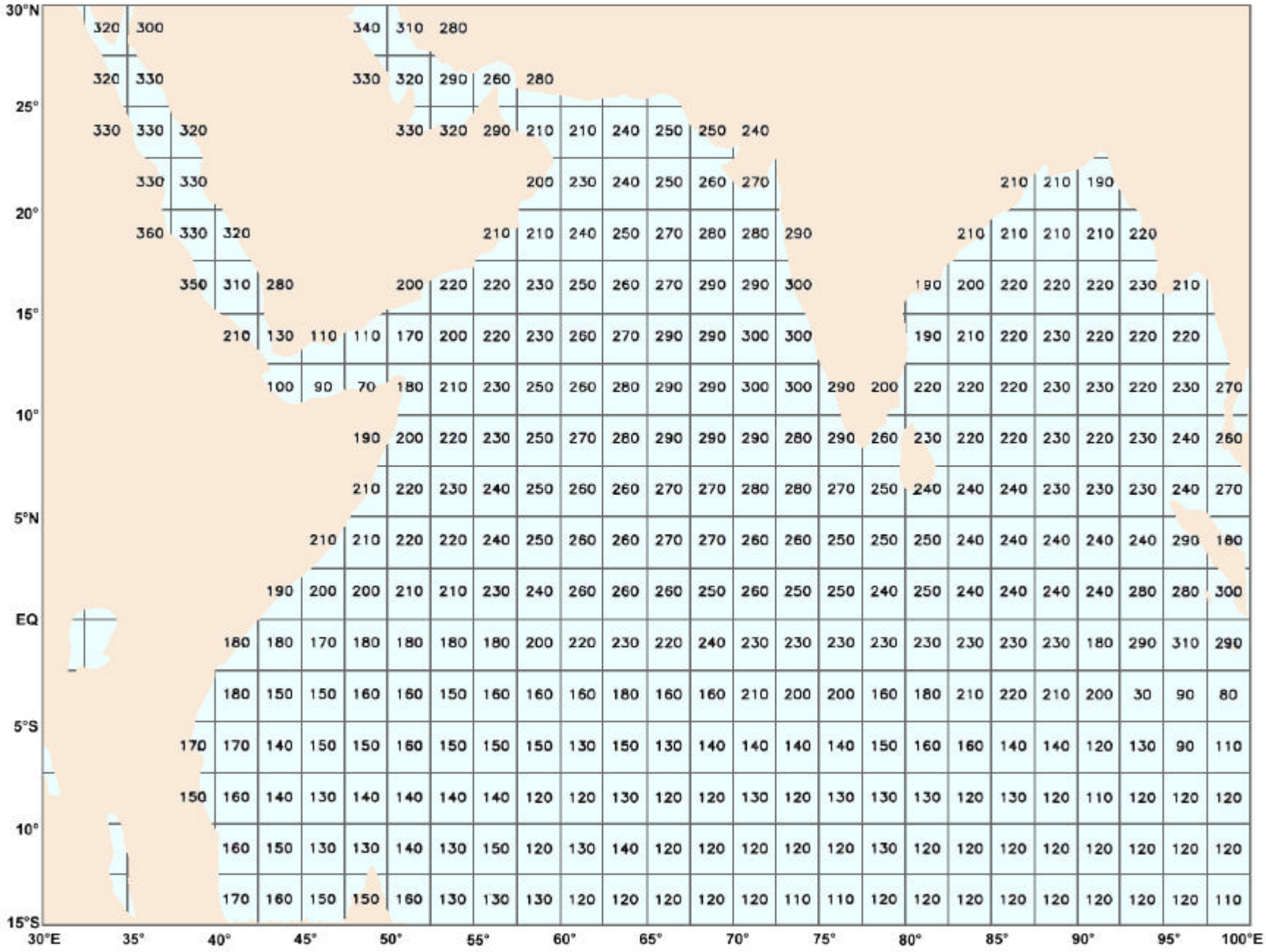
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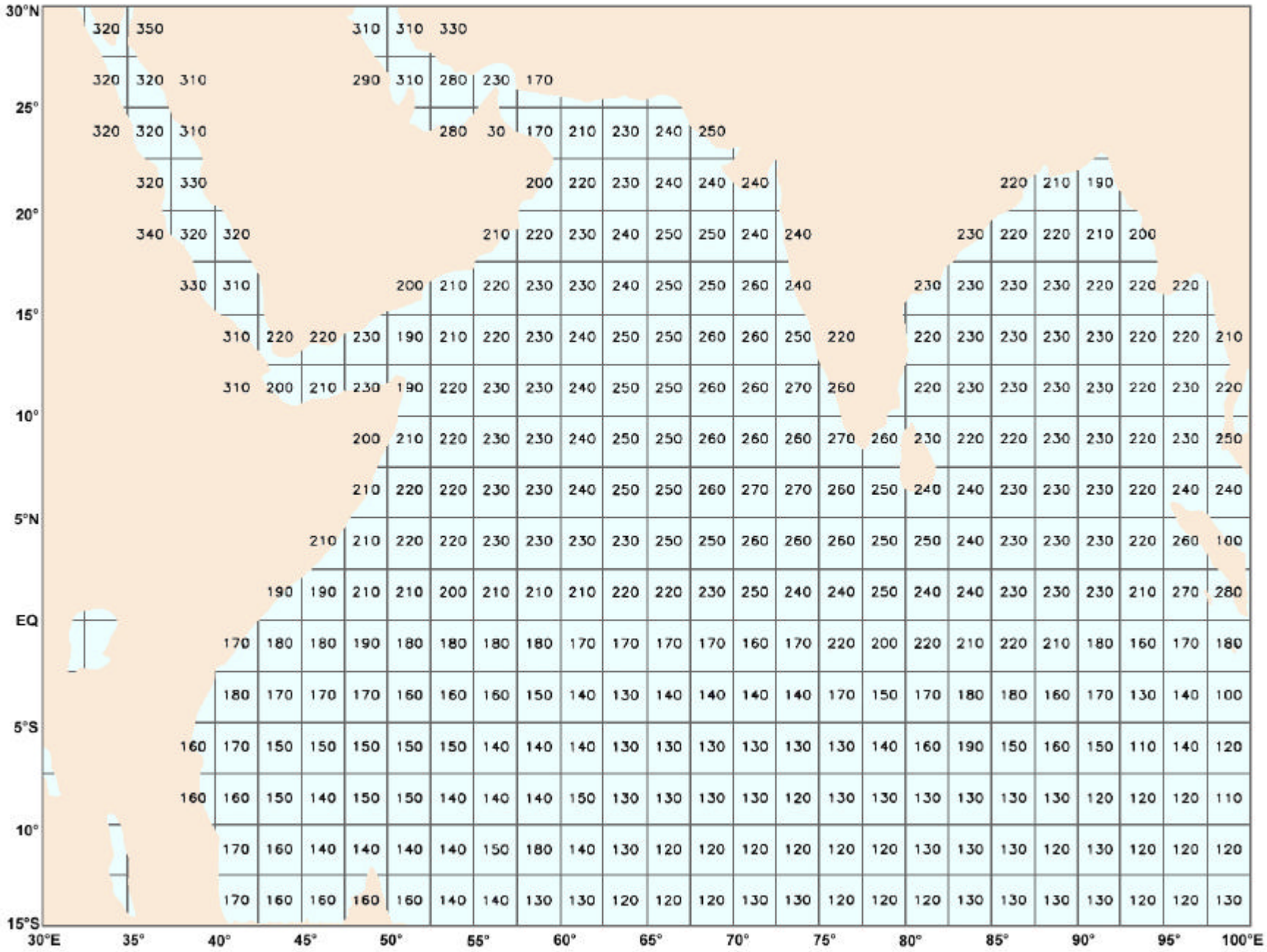
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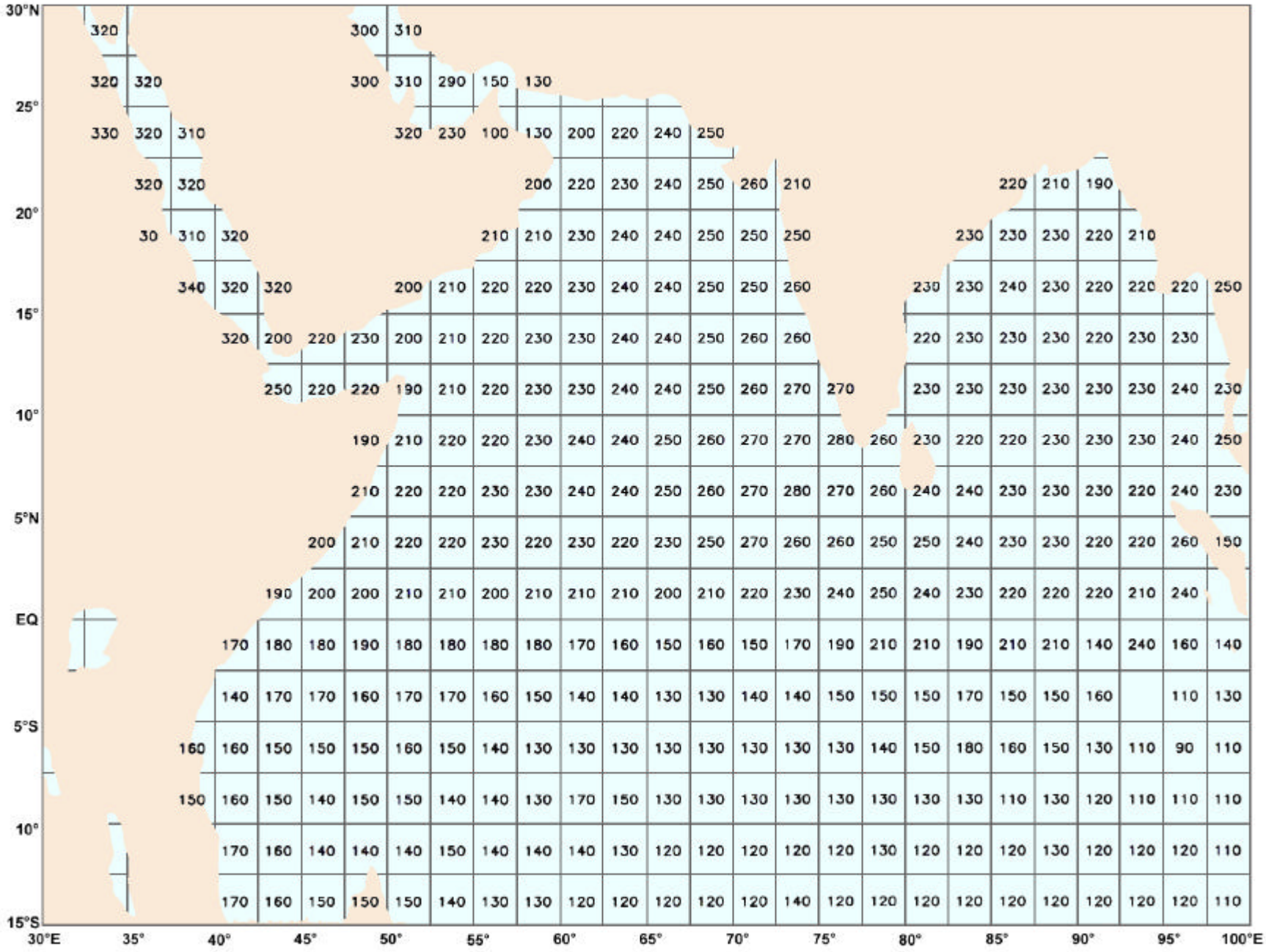
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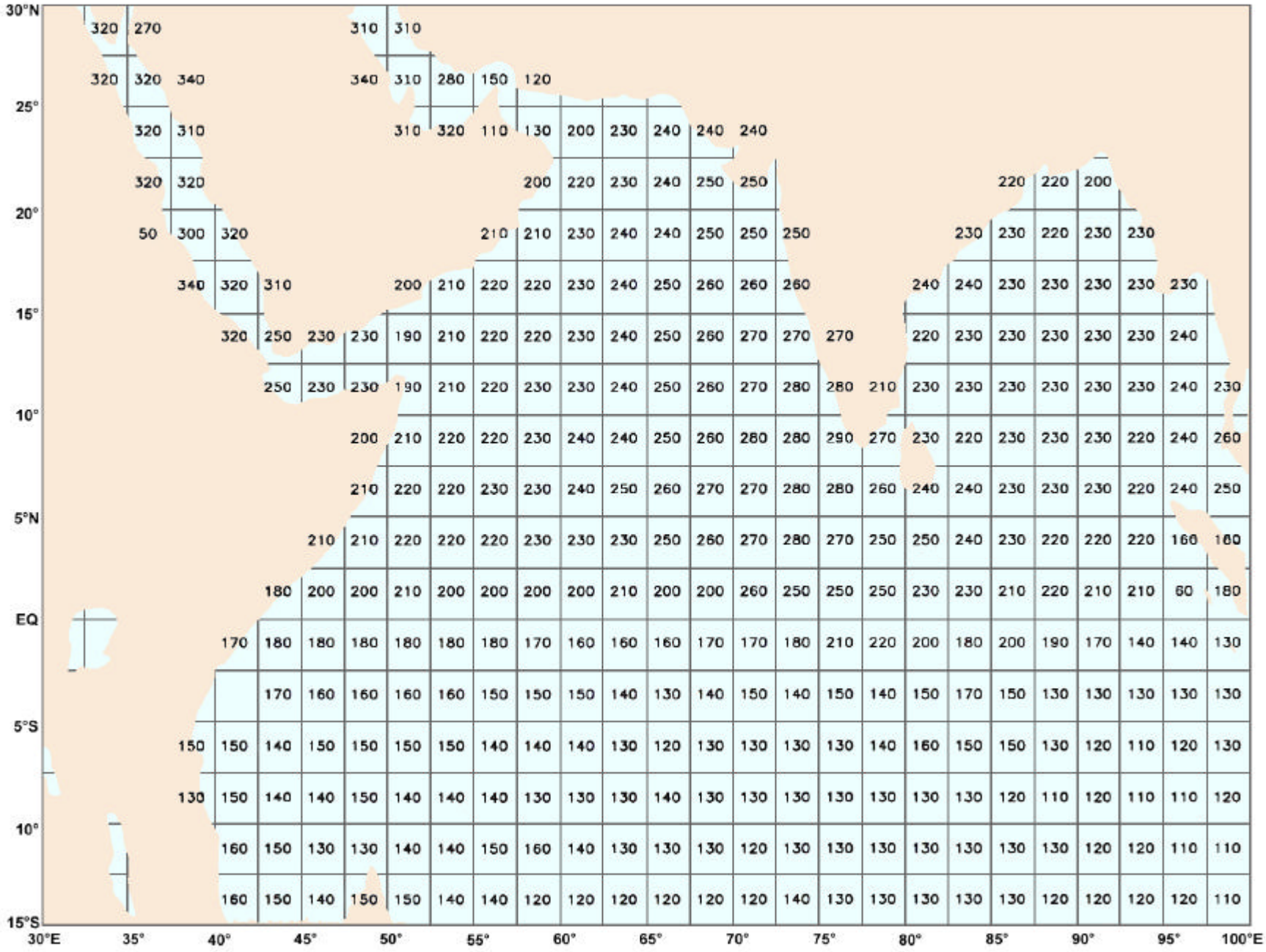
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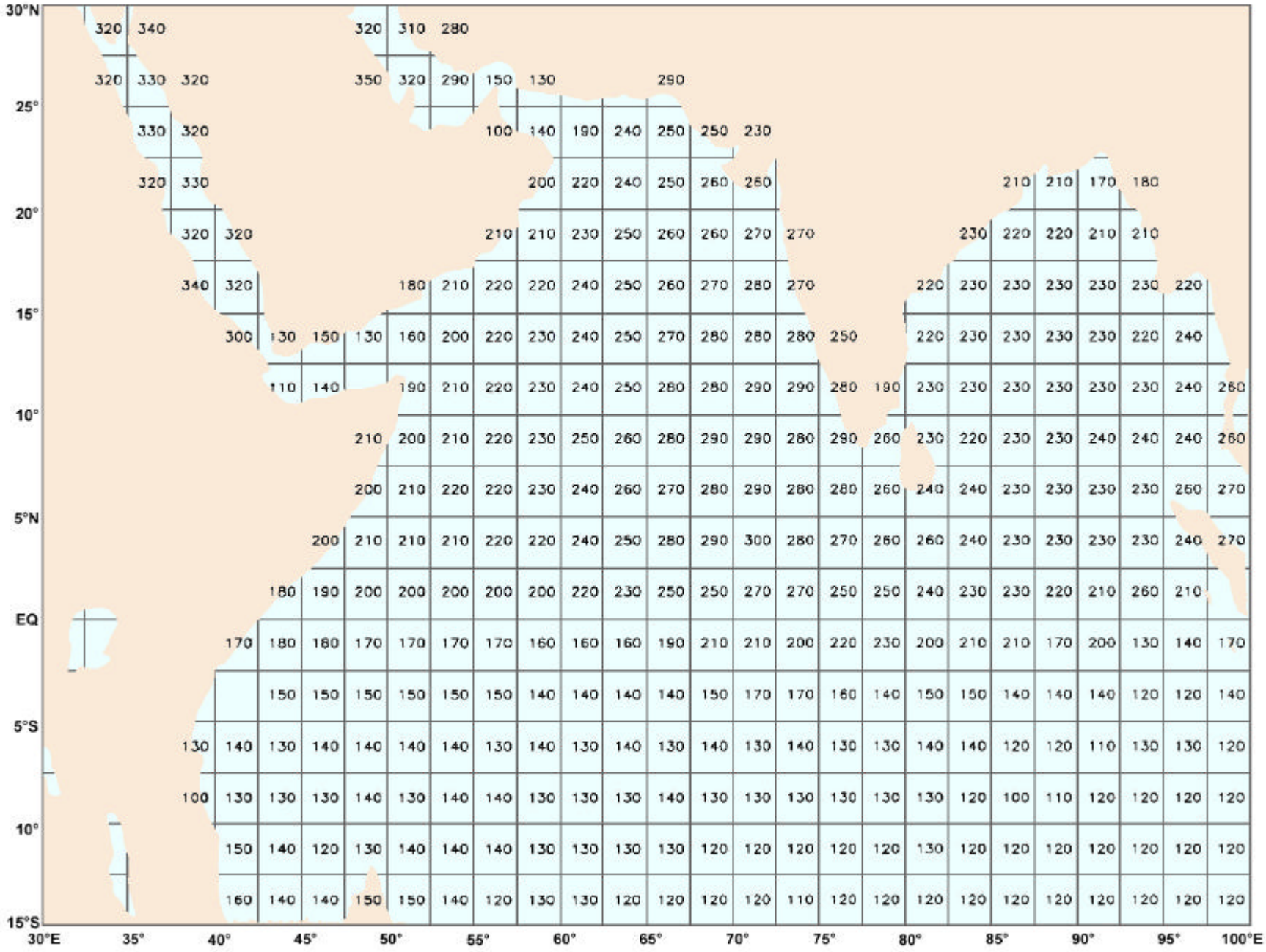
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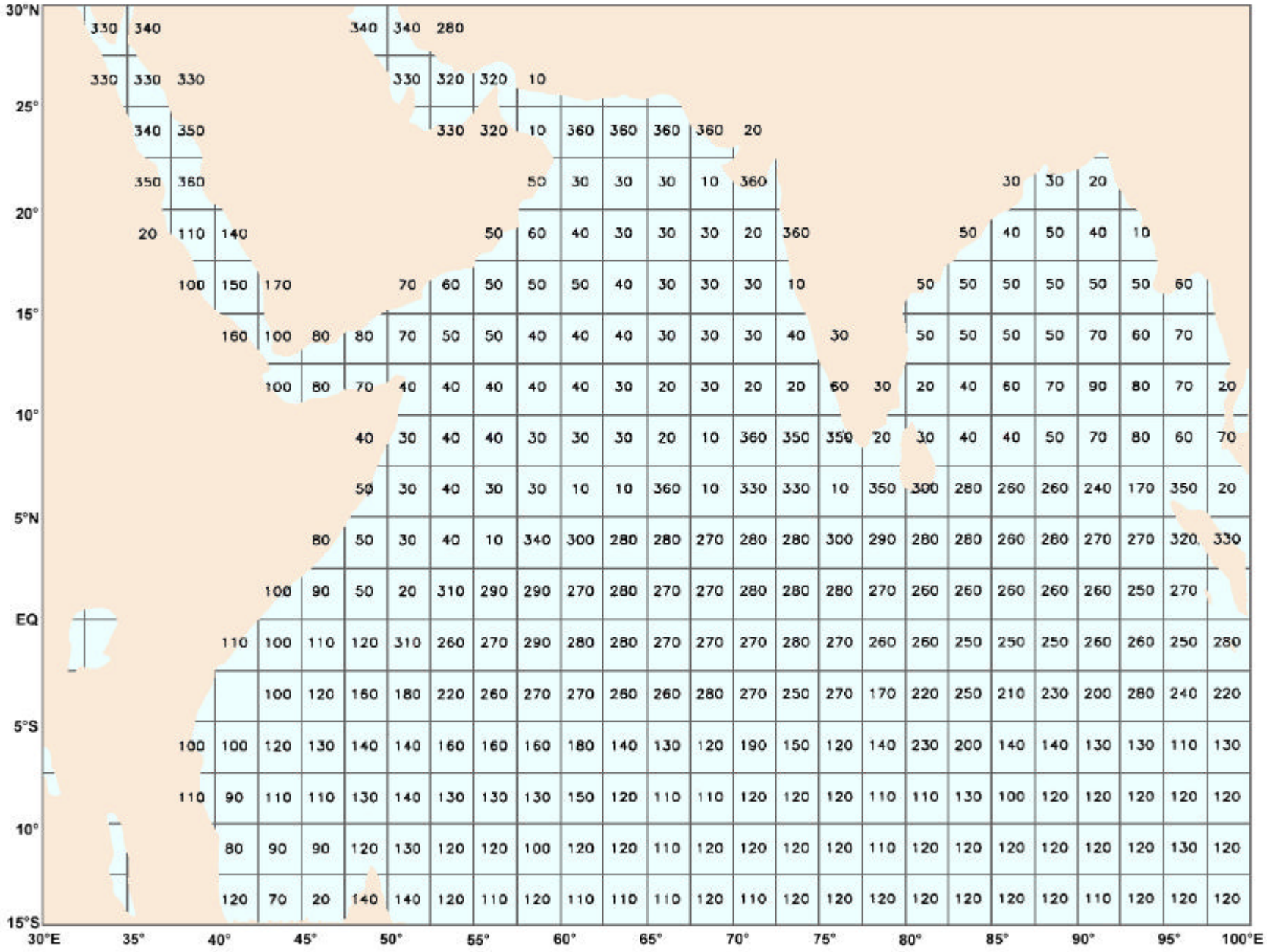
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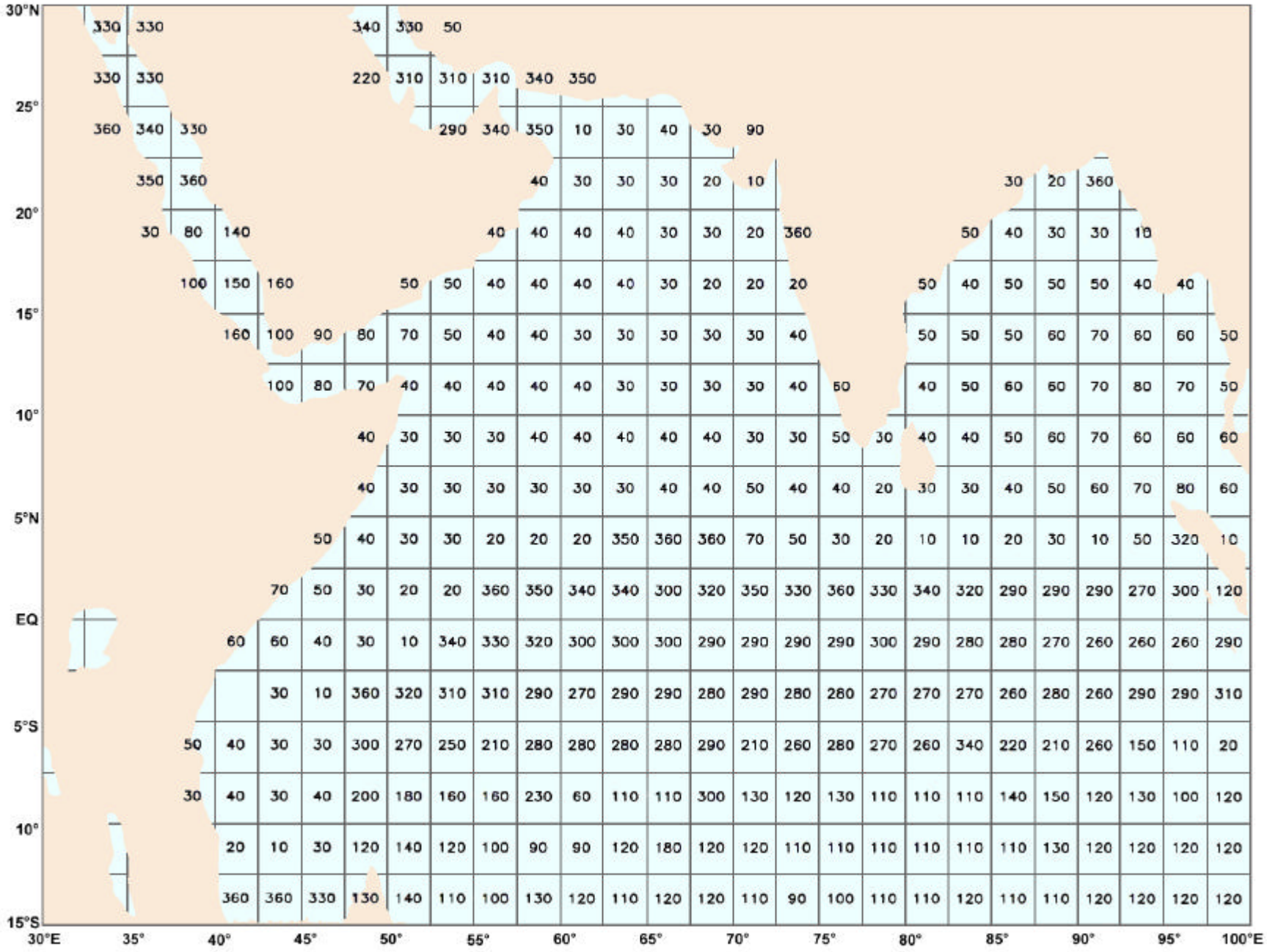
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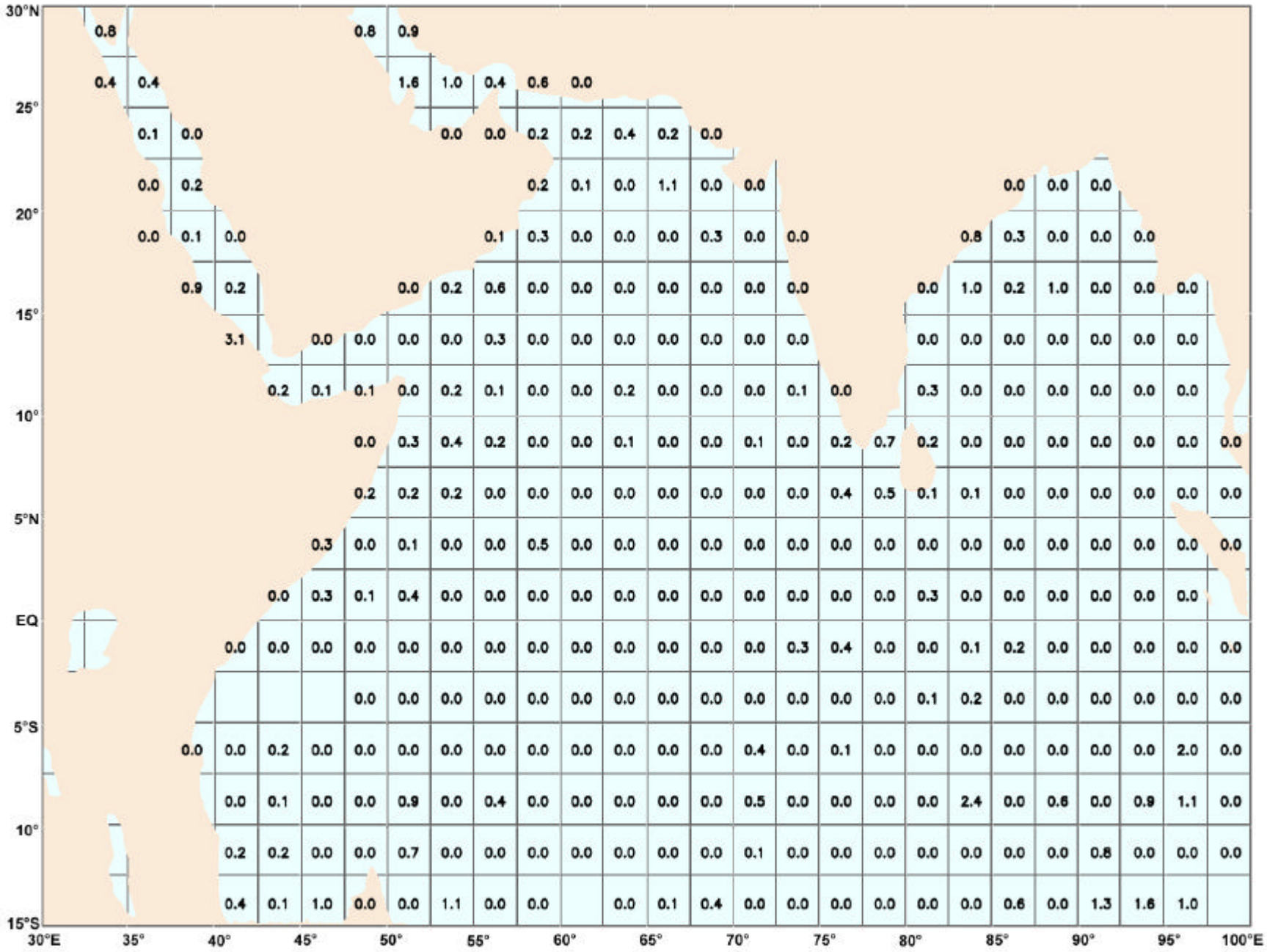
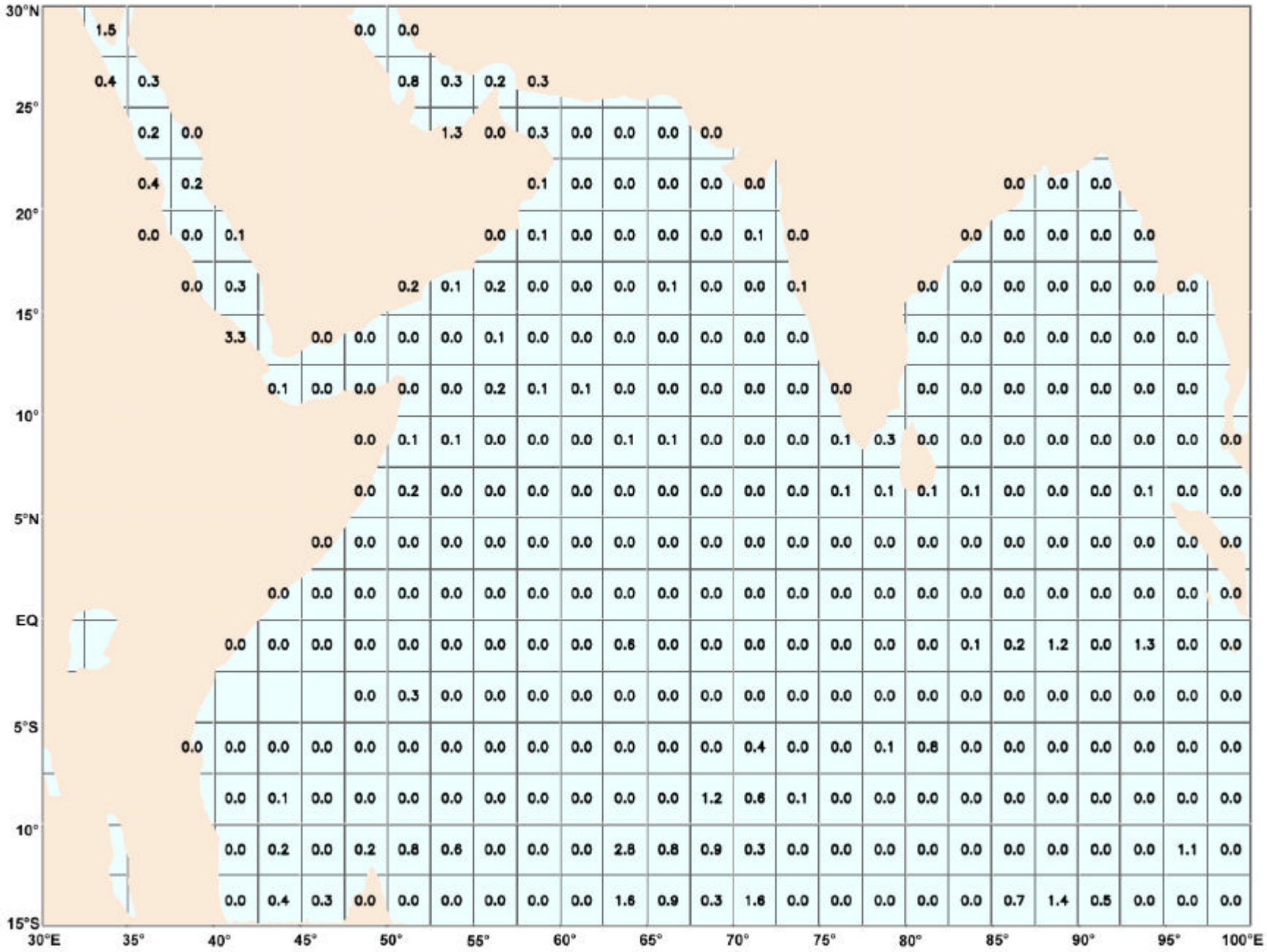
CHART NO.8.1 GALE WIND (%) JANUARY

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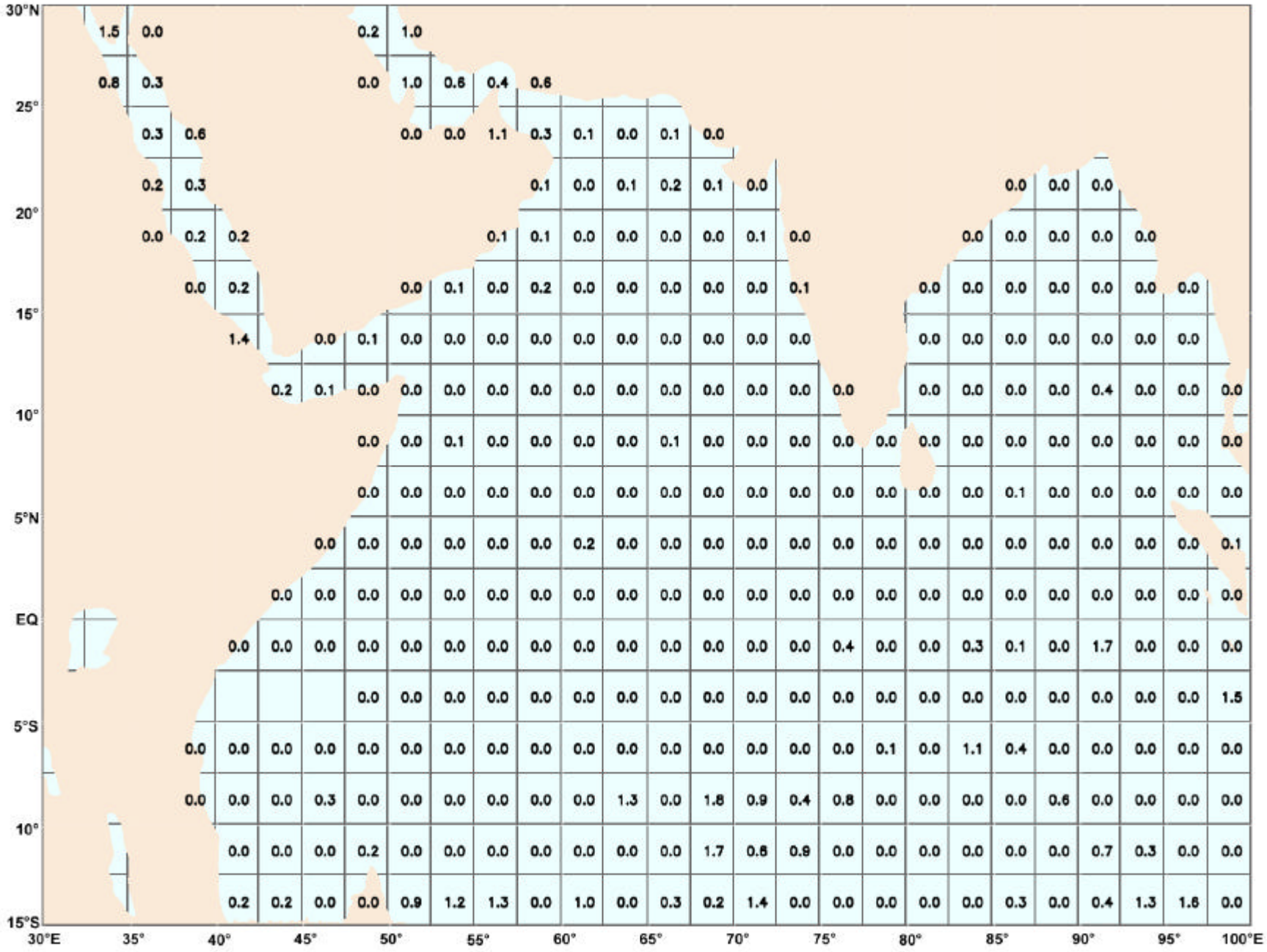
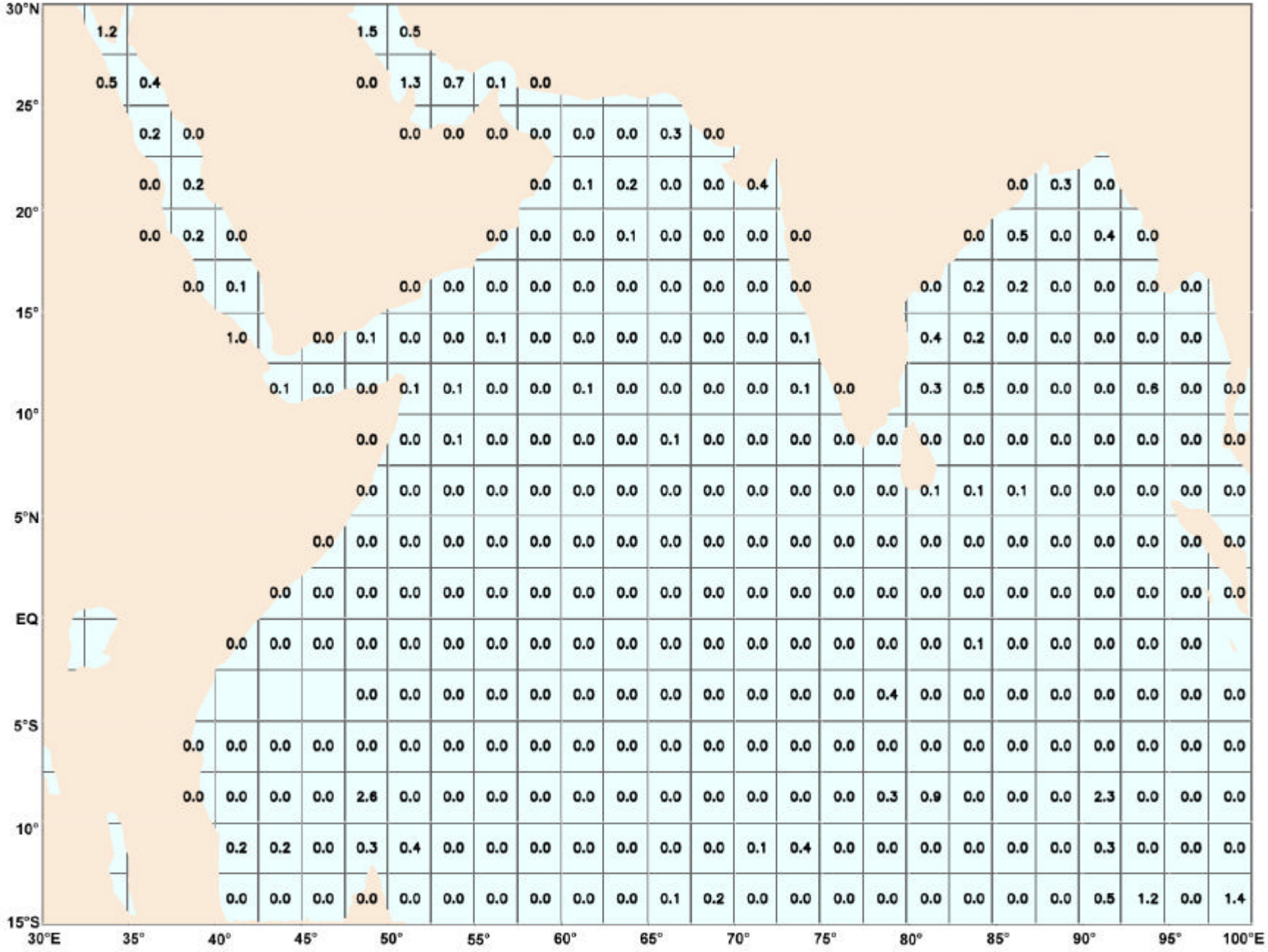
100°E

CHART NO.8.3 GALE WIND (%) MARCH

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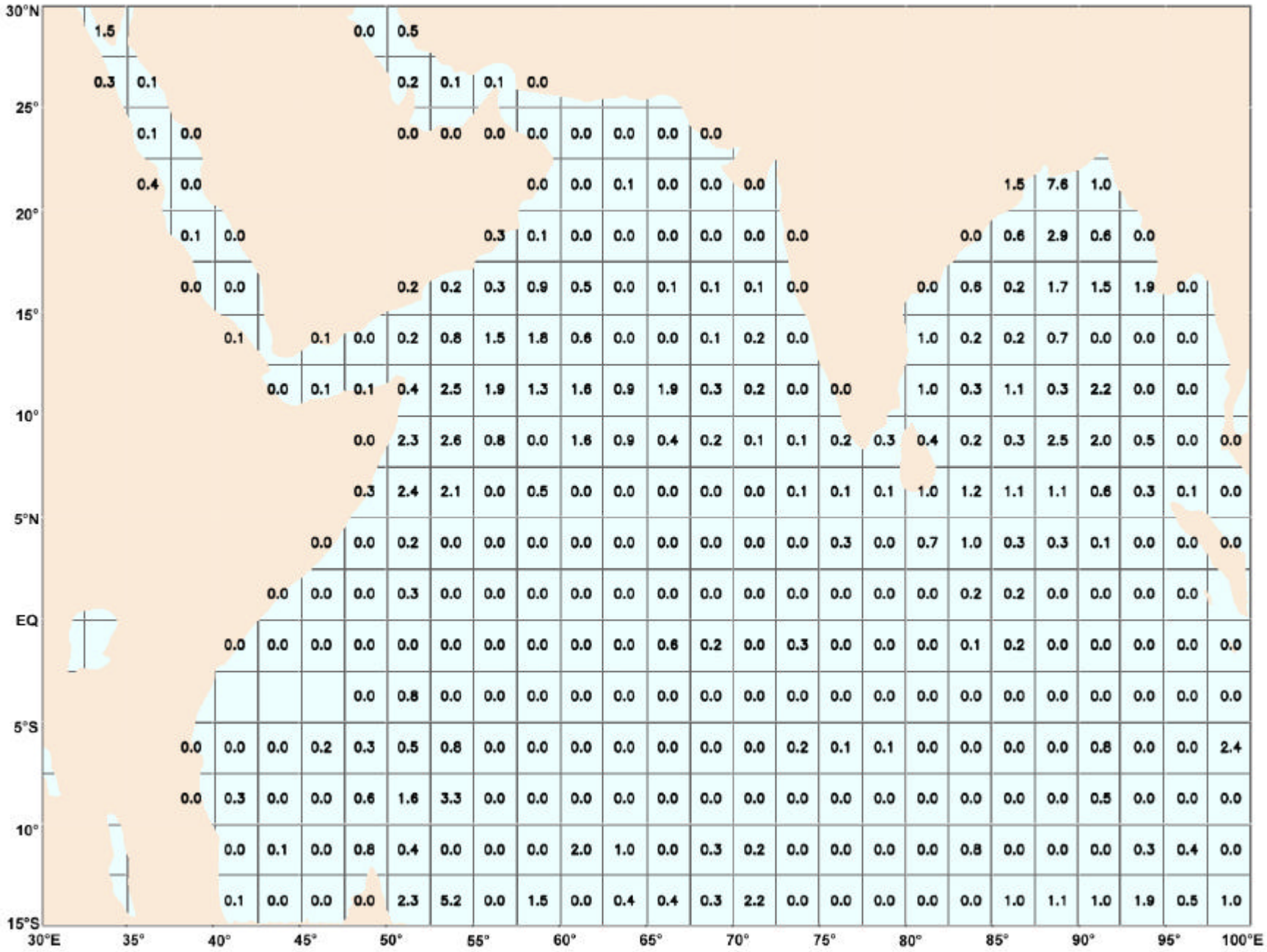
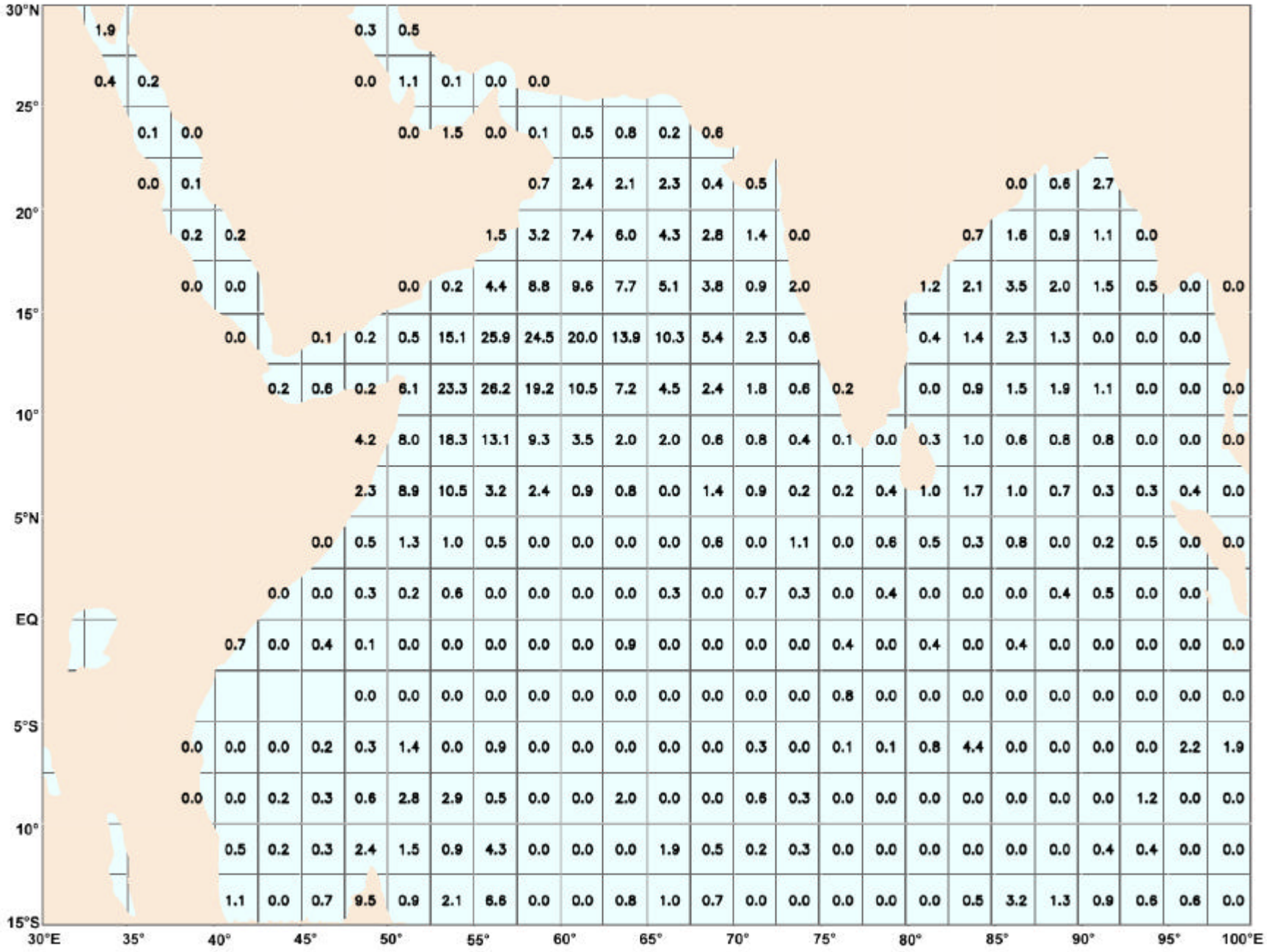
100°E

CHART NO.8.5 GALE WIND (%) MAY

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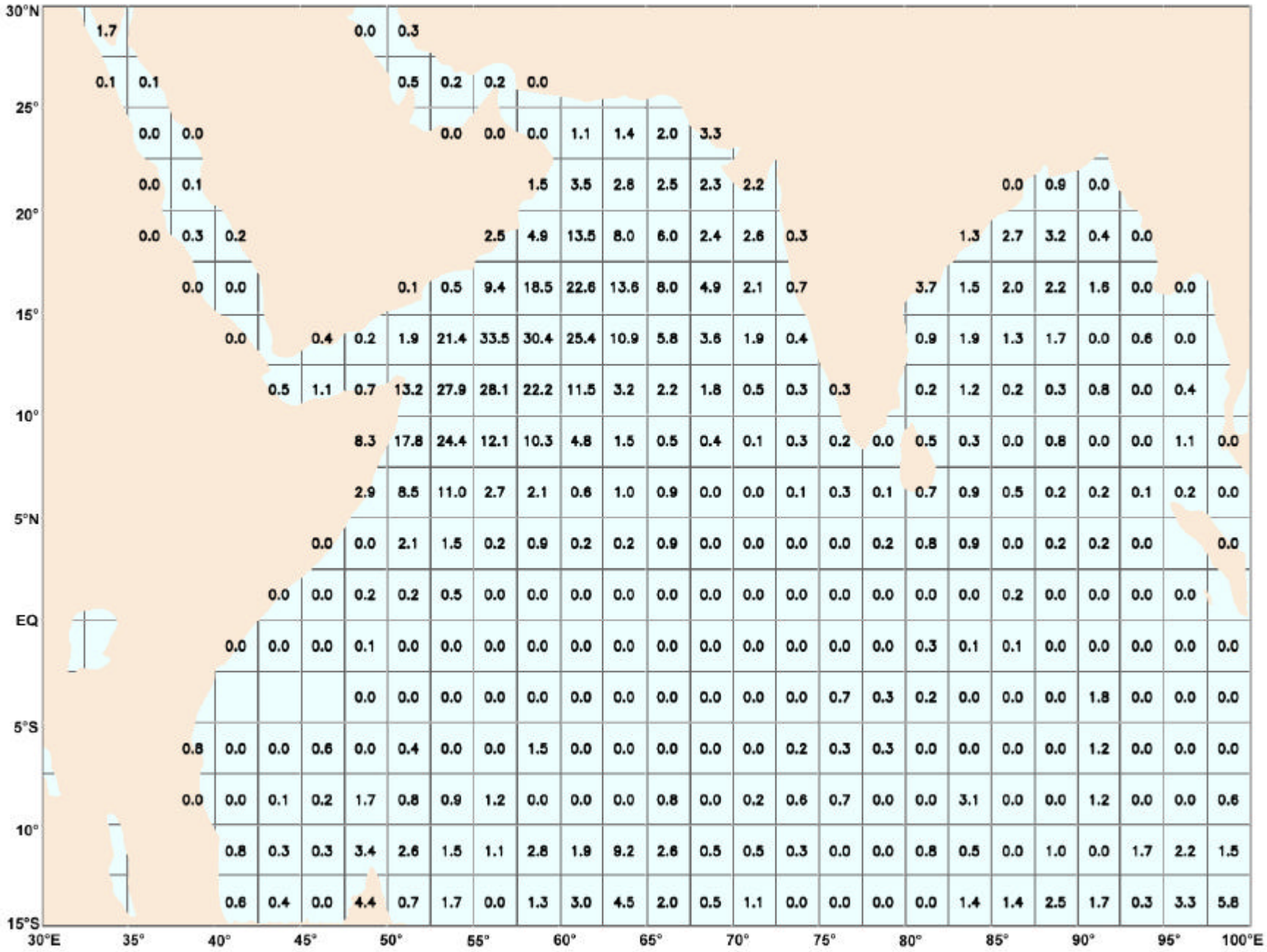
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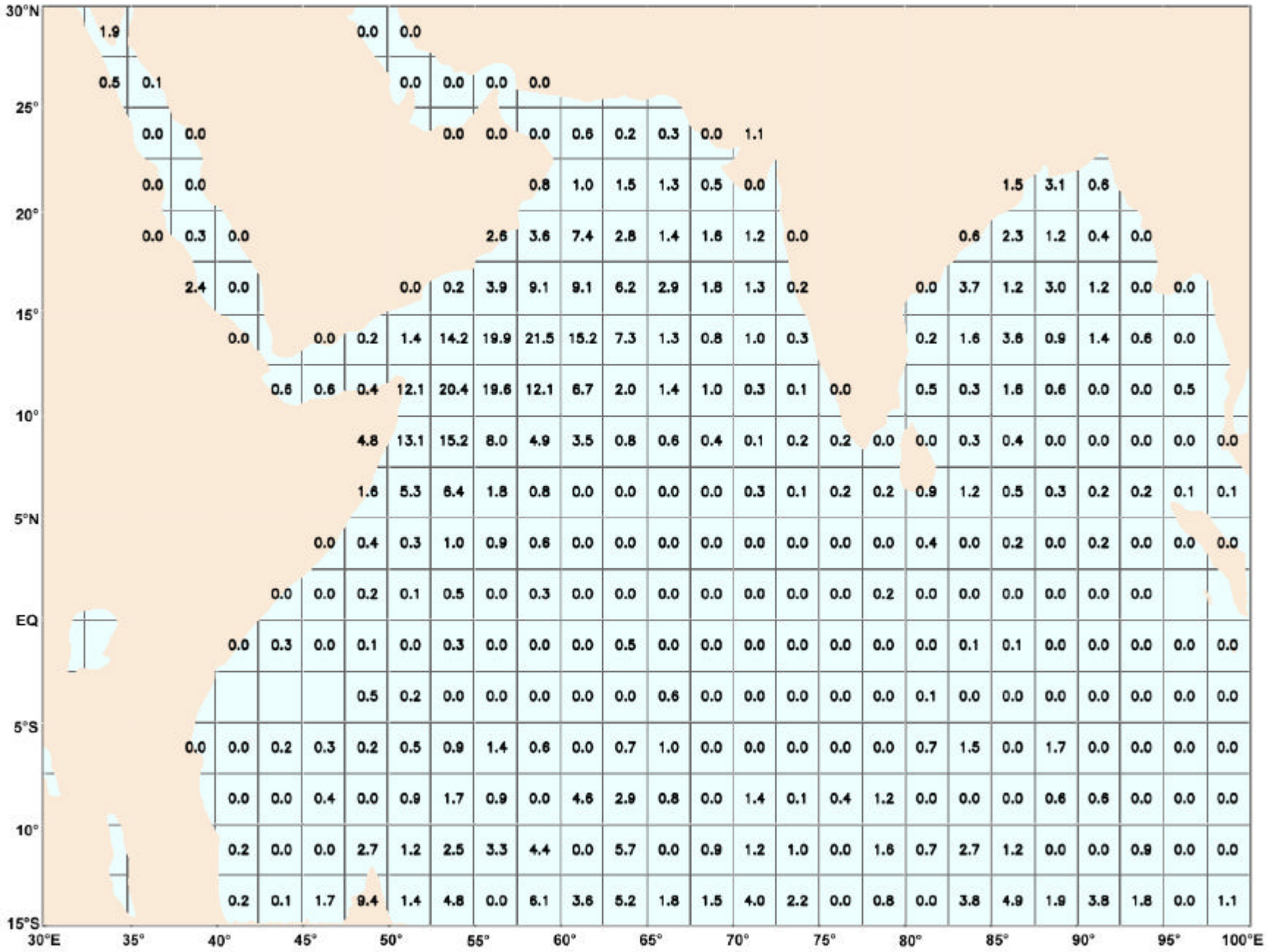
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CHART NO.8.9 GALE WIND (%) SEPTEMBER

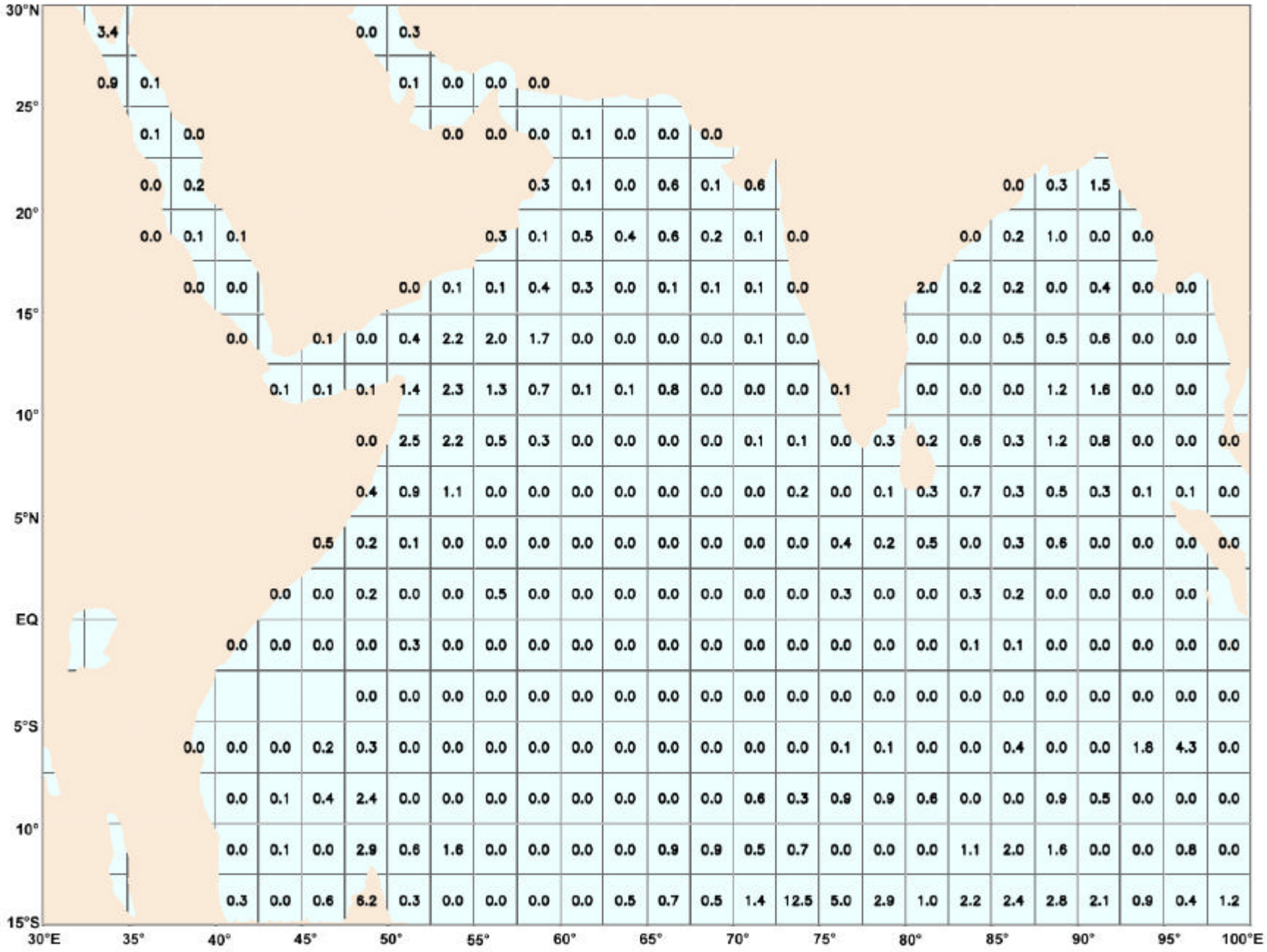
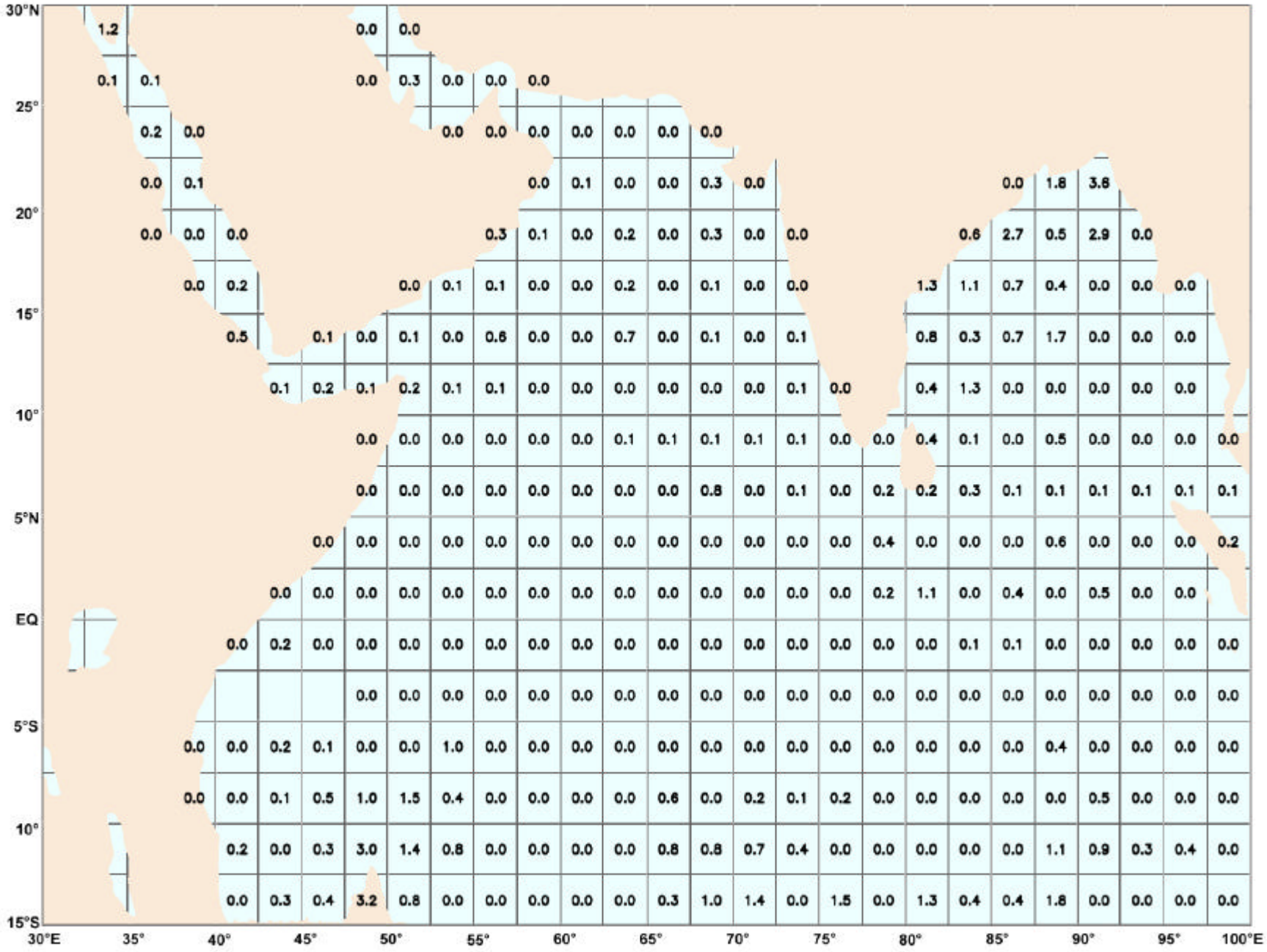
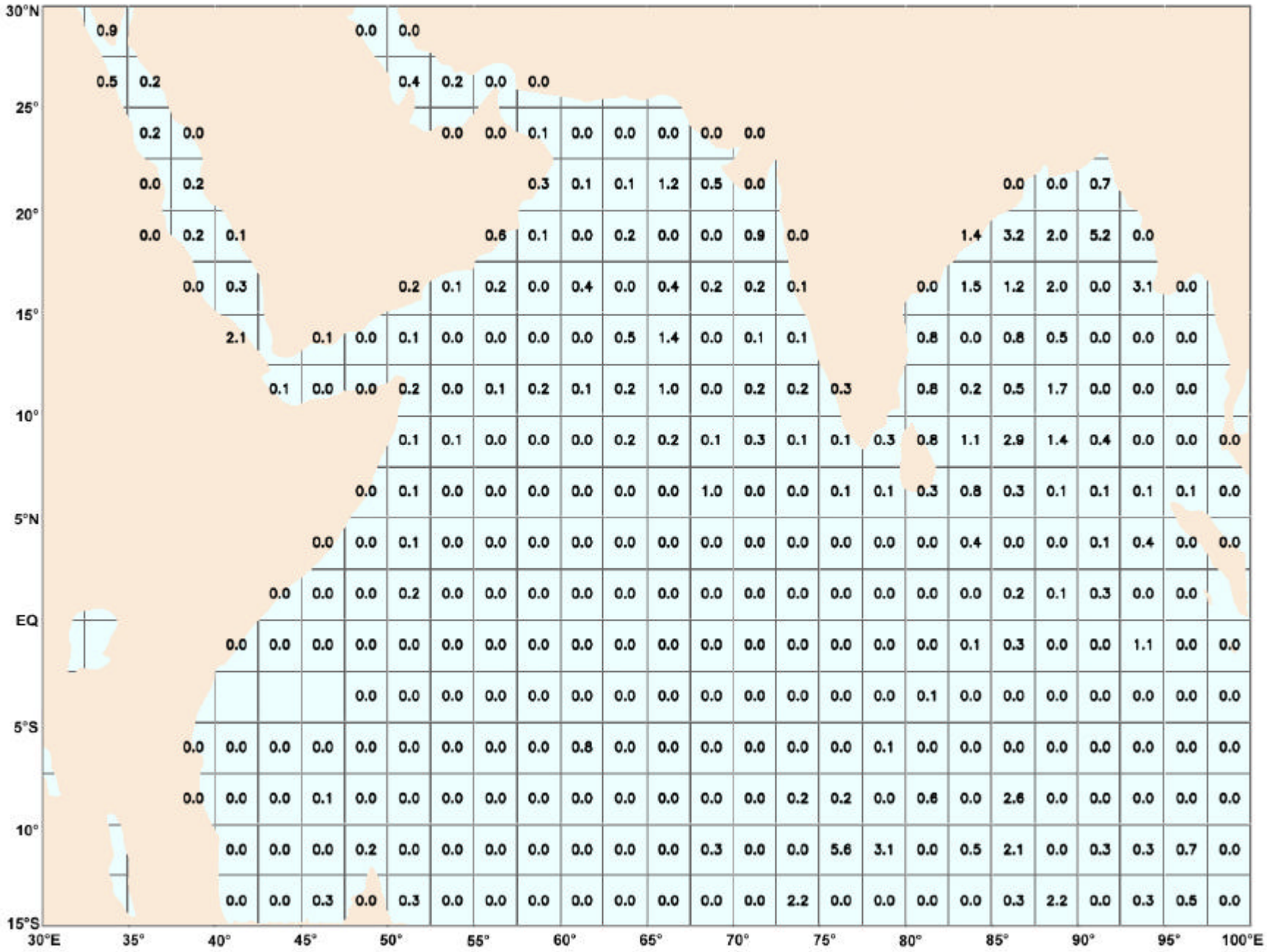


CHART NO.8.10 GALE WIND (%) OCTOBER

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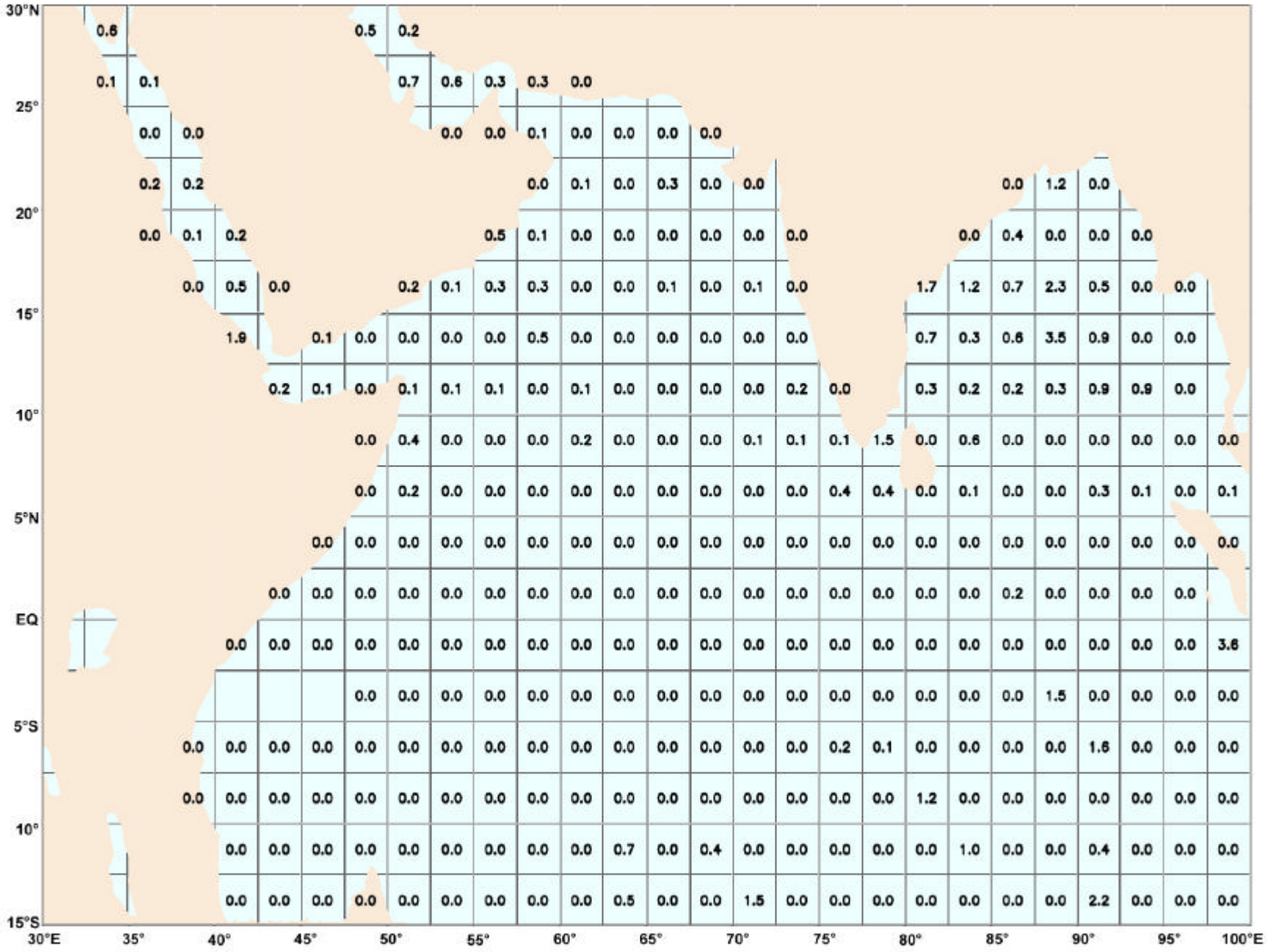
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CHART NO.9.1 TOTAL CLOUD AMOUNT (%) JANUARY

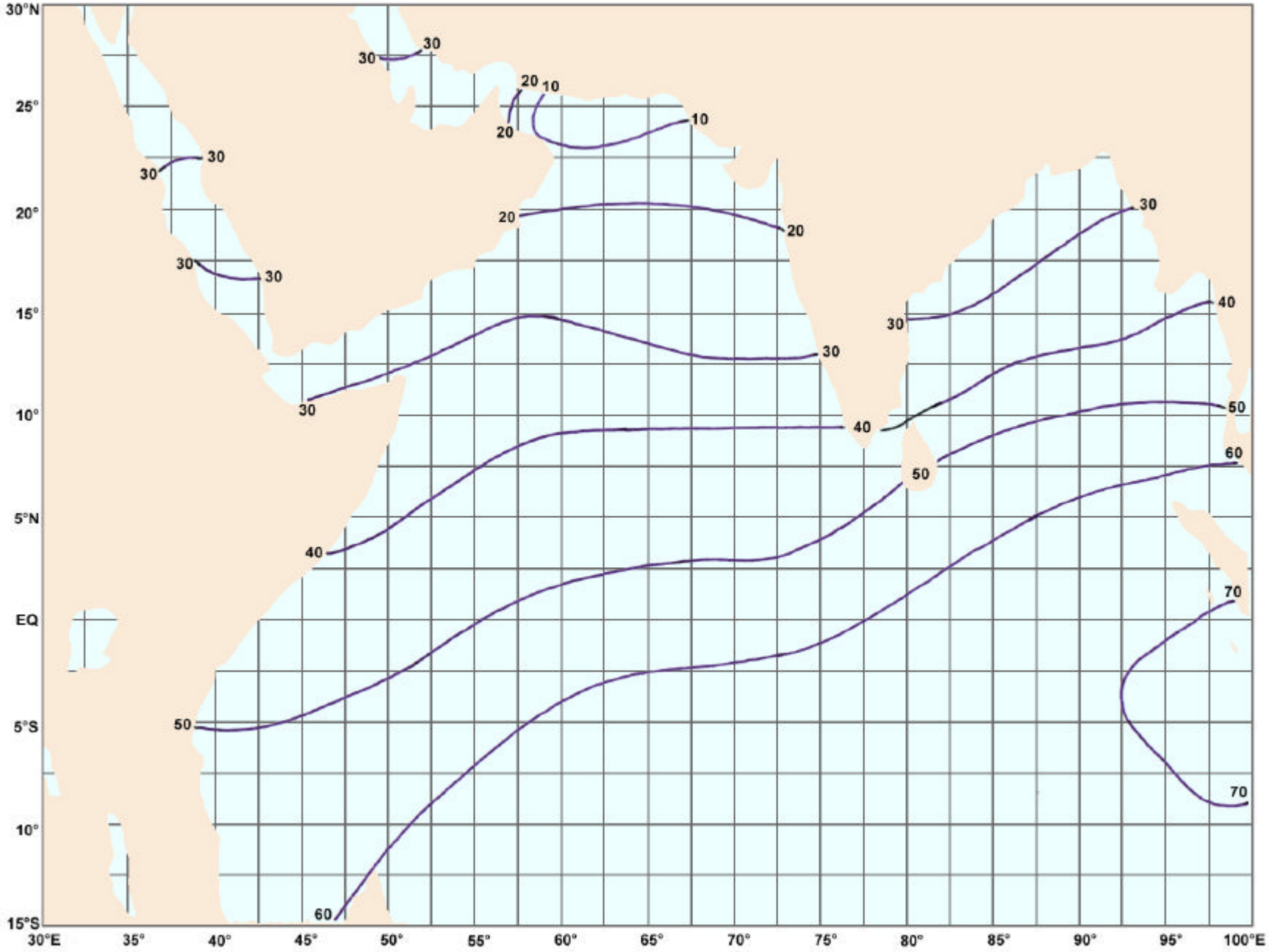


CHART NO.9.2 TOTAL CLOUD AMOUNT (%) FEBRUARY

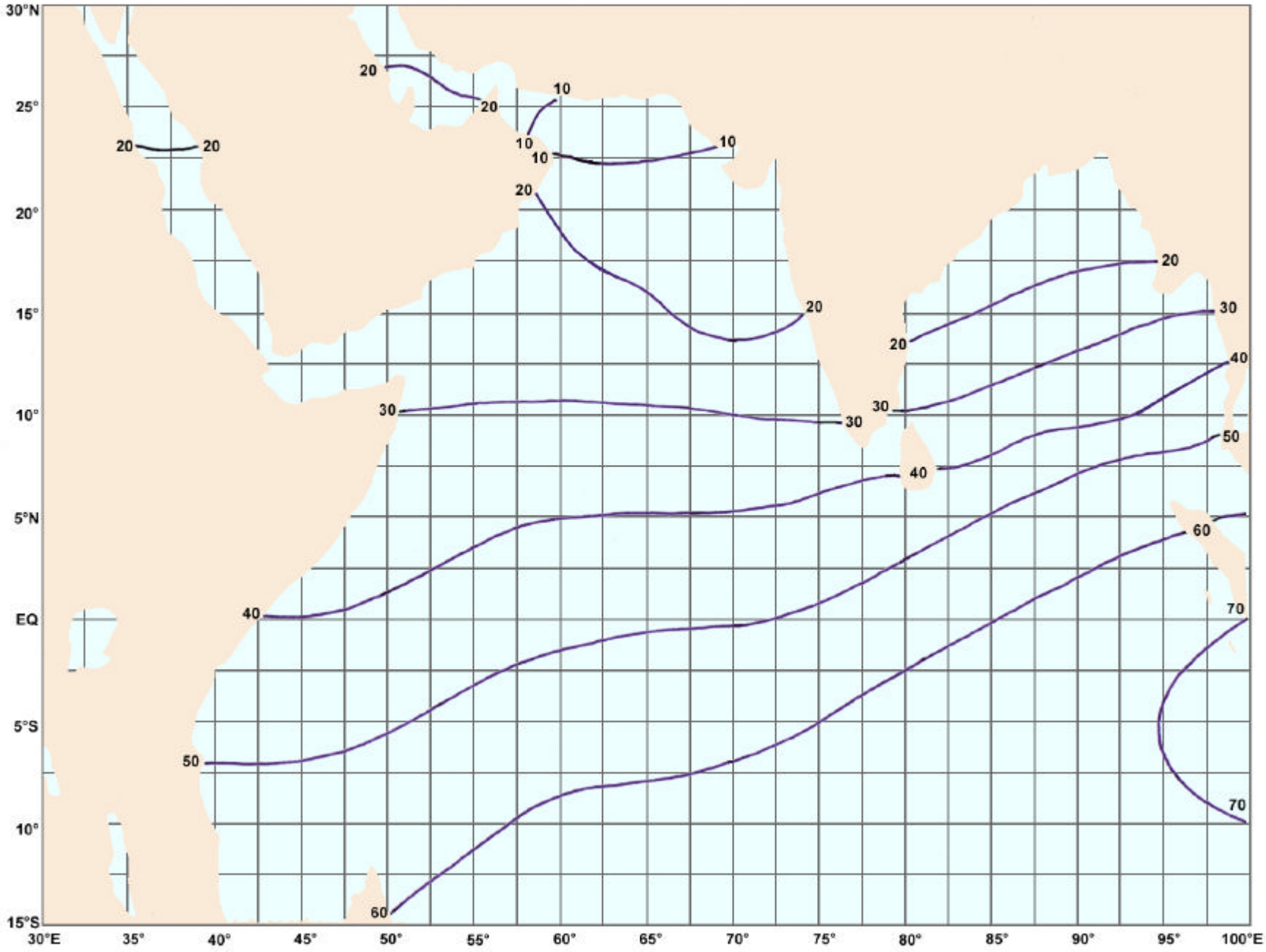


CHART NO.9.3 TOTAL CLOUD AMOUNT(%) MARCH

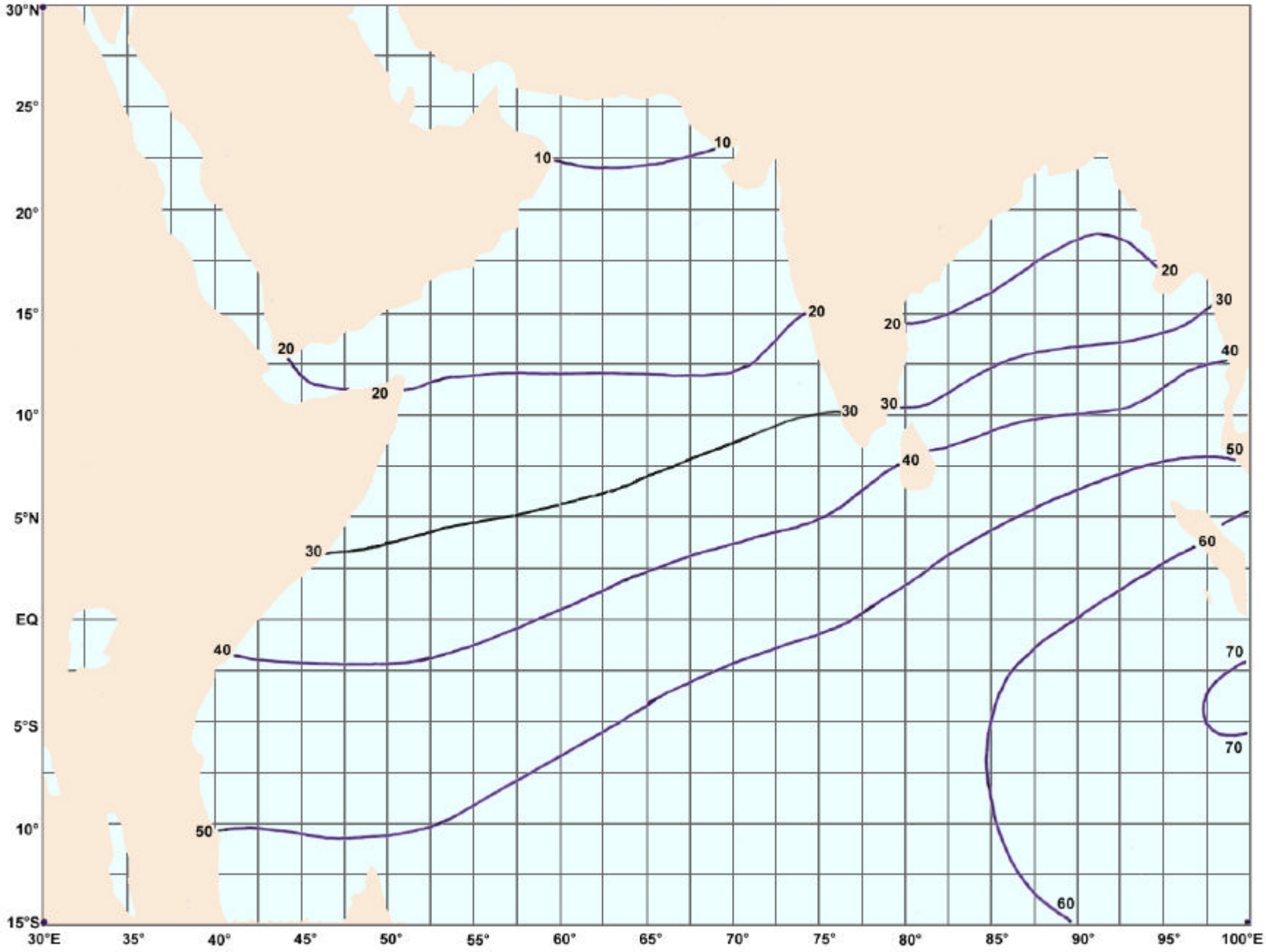


CHART NO.9.4 TOTAL CLOUD AMOUNT(%) APRIL

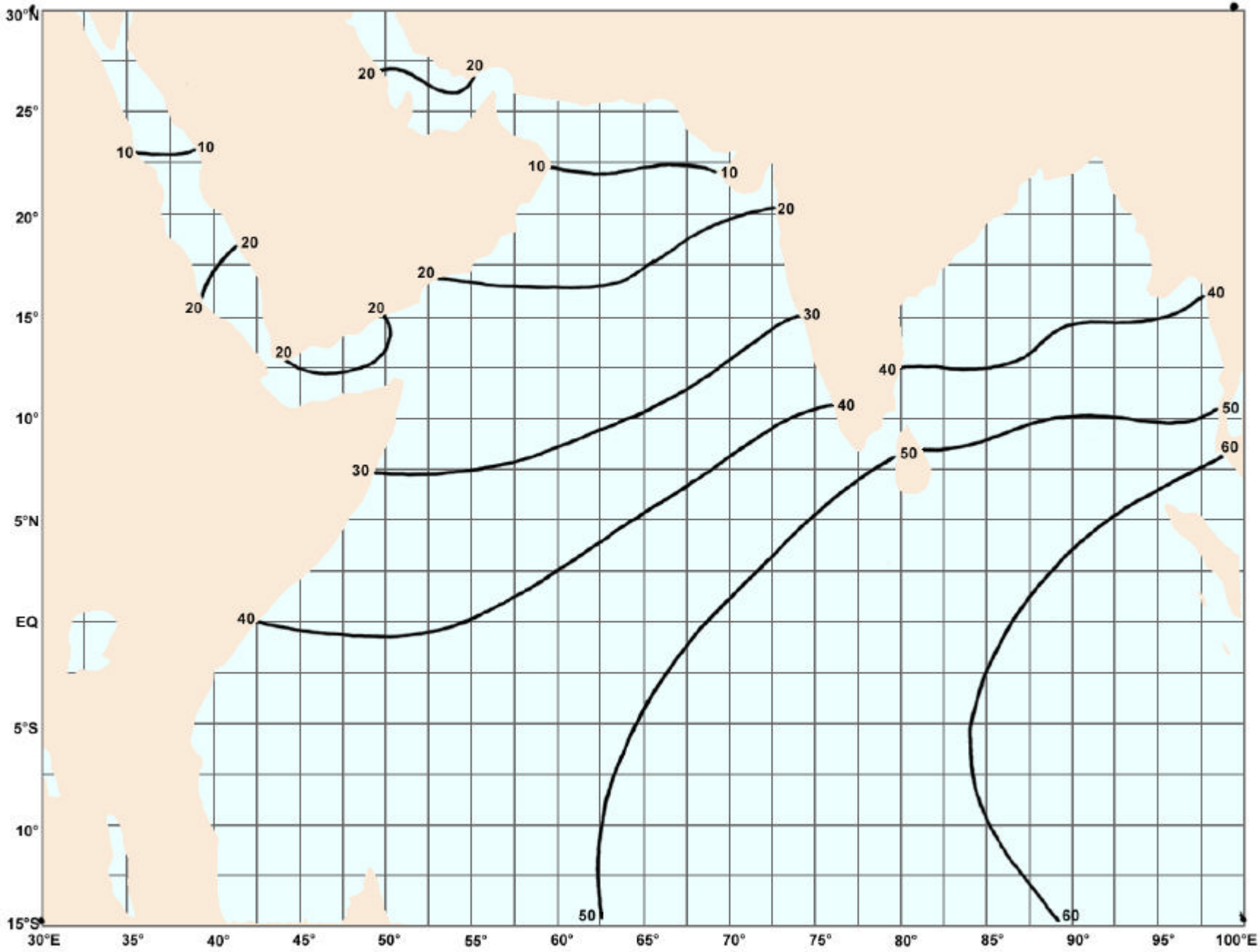


CHART NO.9.5 TOTAL CLOUD AMOUNT(%) MAY

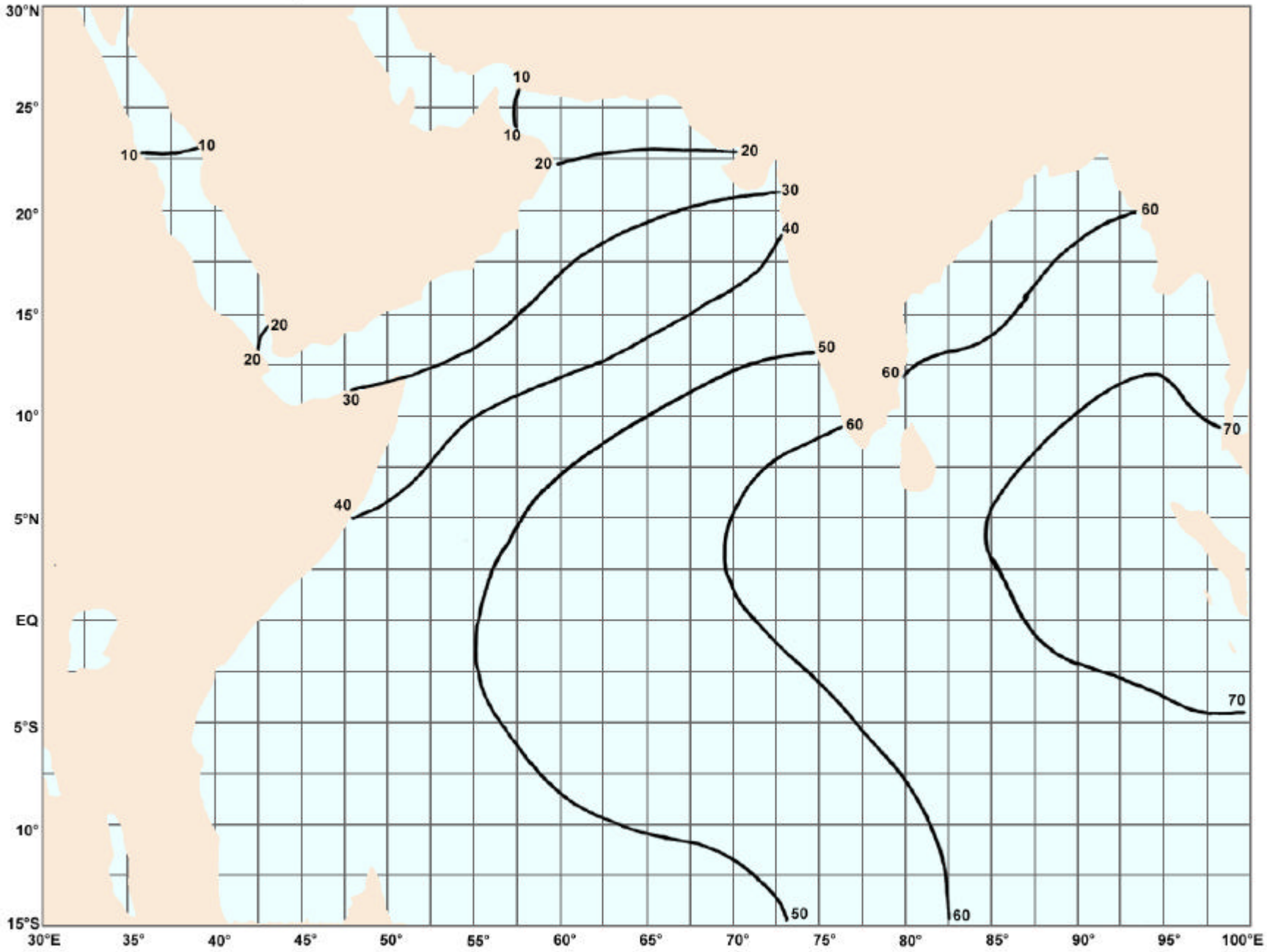


CHART NO.9.6

TOTAL CLOUD AMOUNT (%)

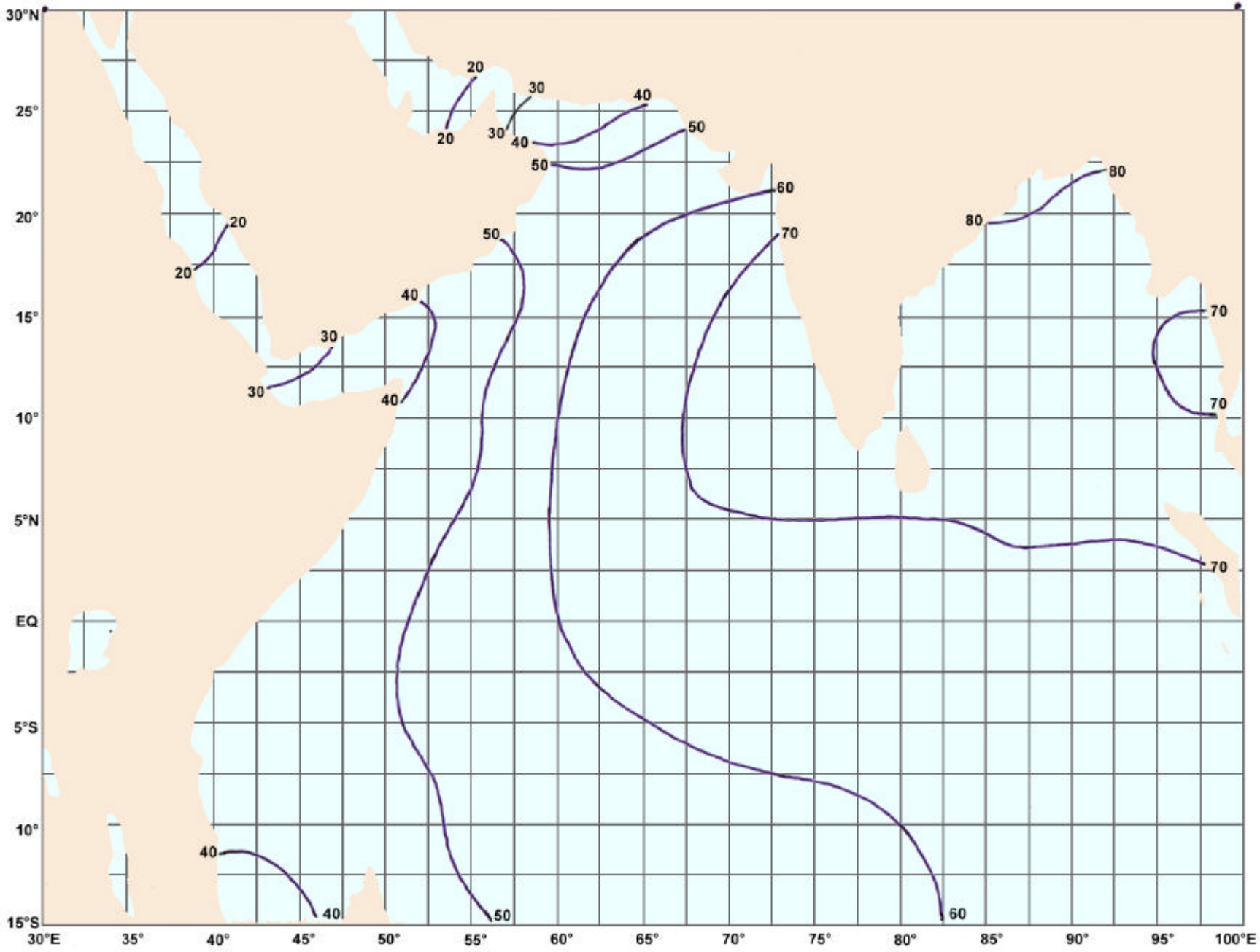


CHART NO.9.7 TOTAL CLOUD AMOUNT (%) JULY

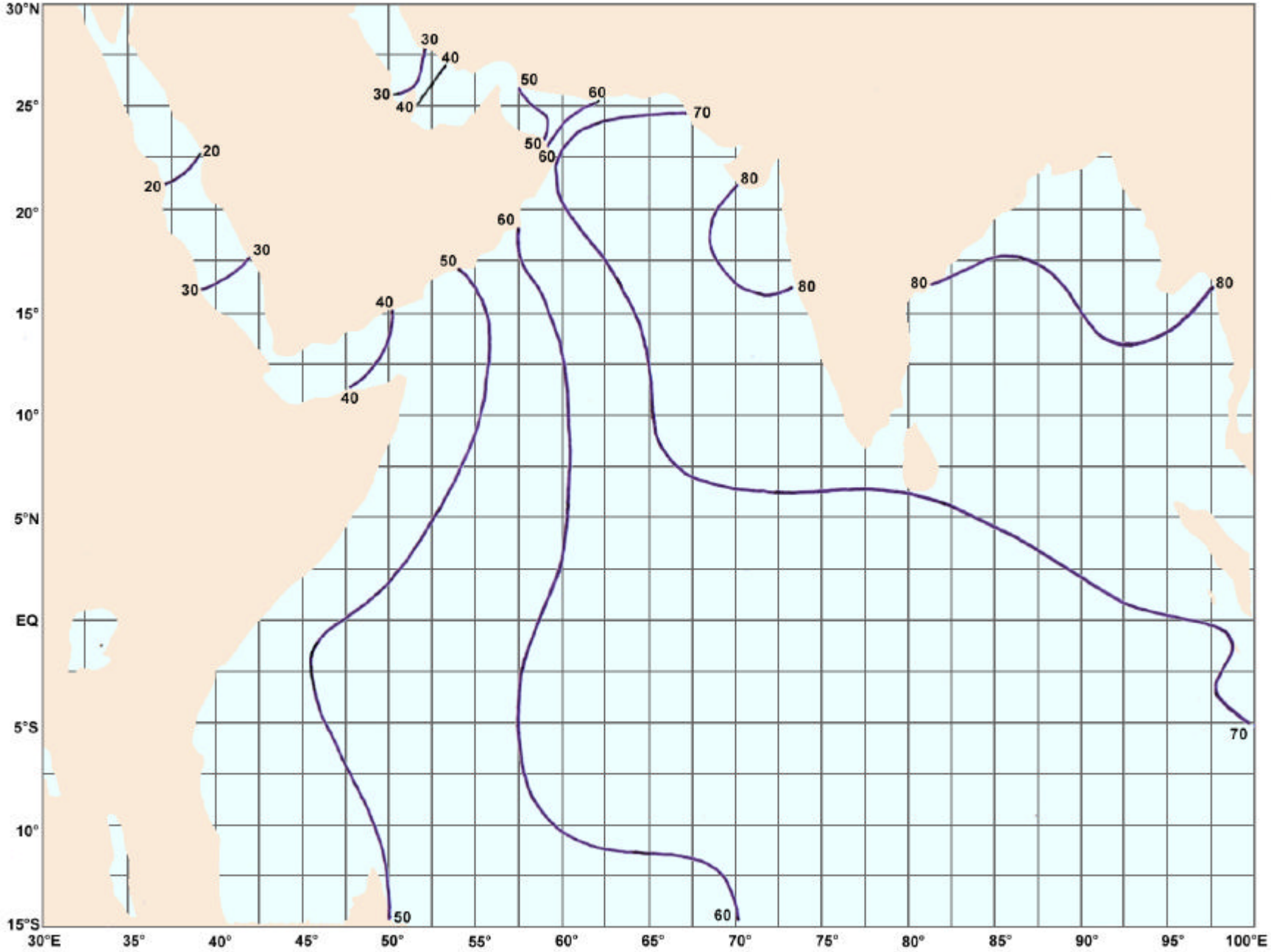


CHART NO.9.8 TOTAL CLOUD AMOUNT (%) AUGUST

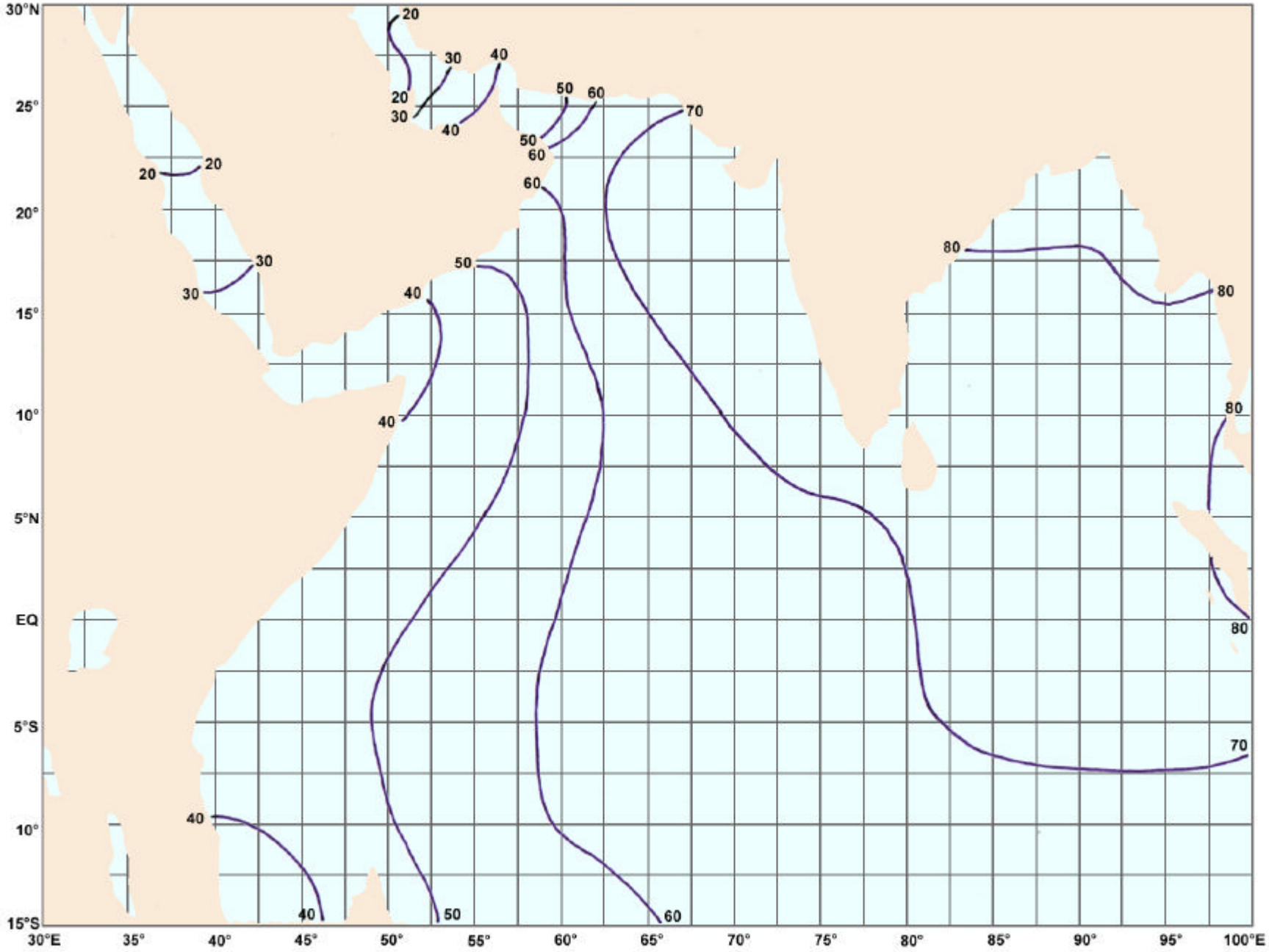


CHART NO.9.9 TOTAL CLOUD AMOUNT(%) SEPTEMBER

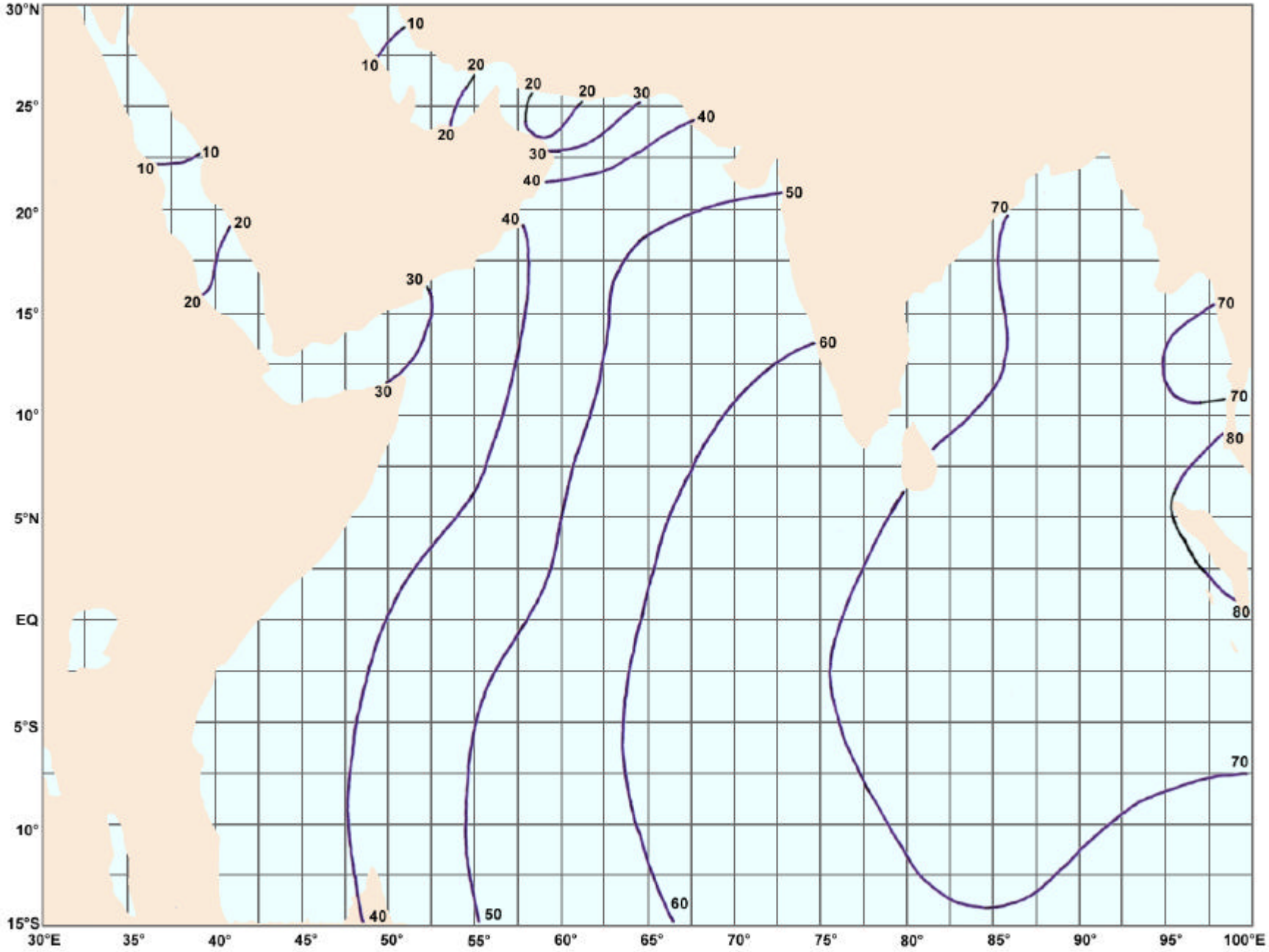


CHART NO.9.10 TOTAL CLOUD AMOUNT (%) OCTOBER

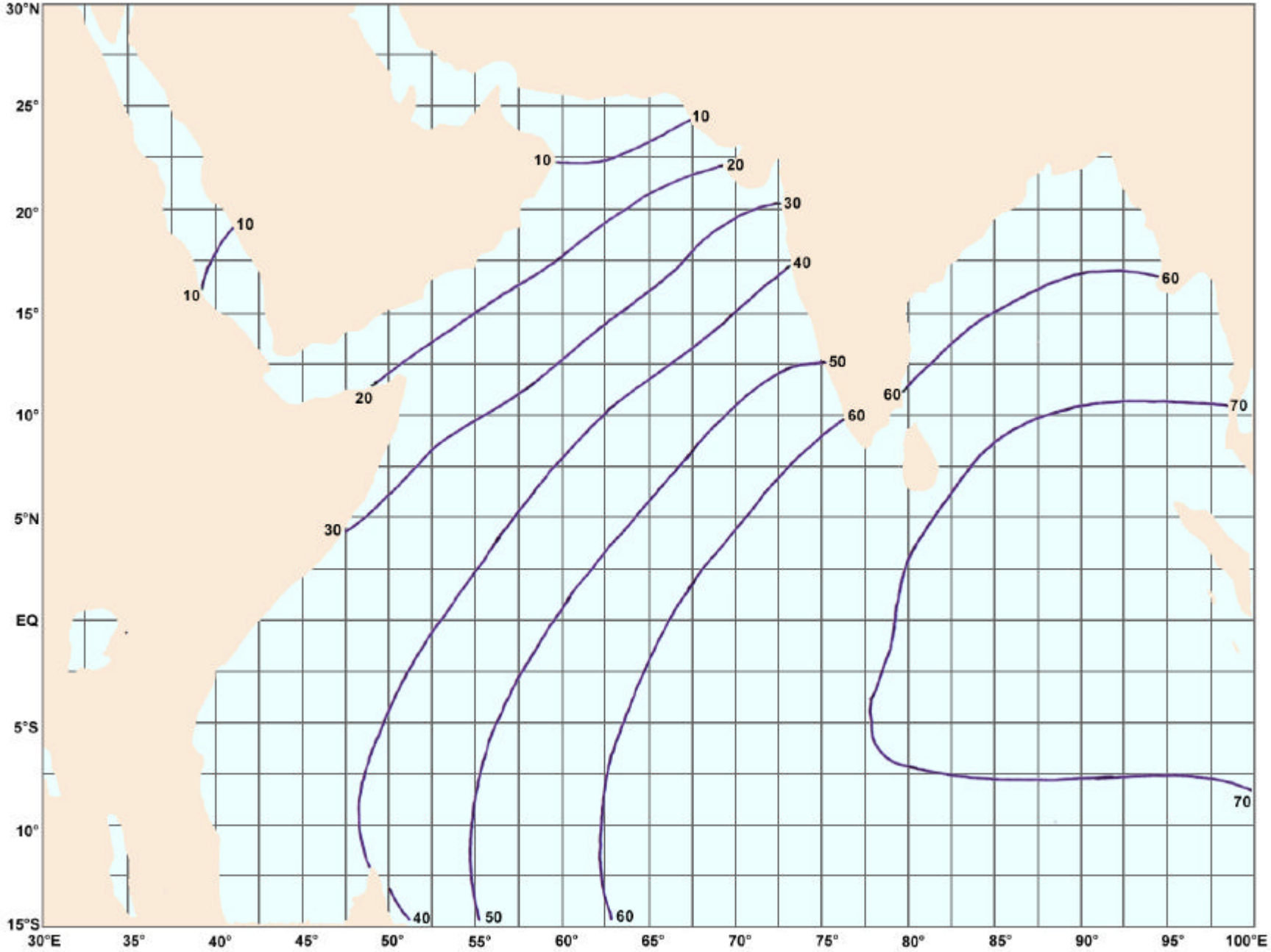


CHART NO.9.11 TOTAL CLOUD AMOUNT (%) NOVEMBER

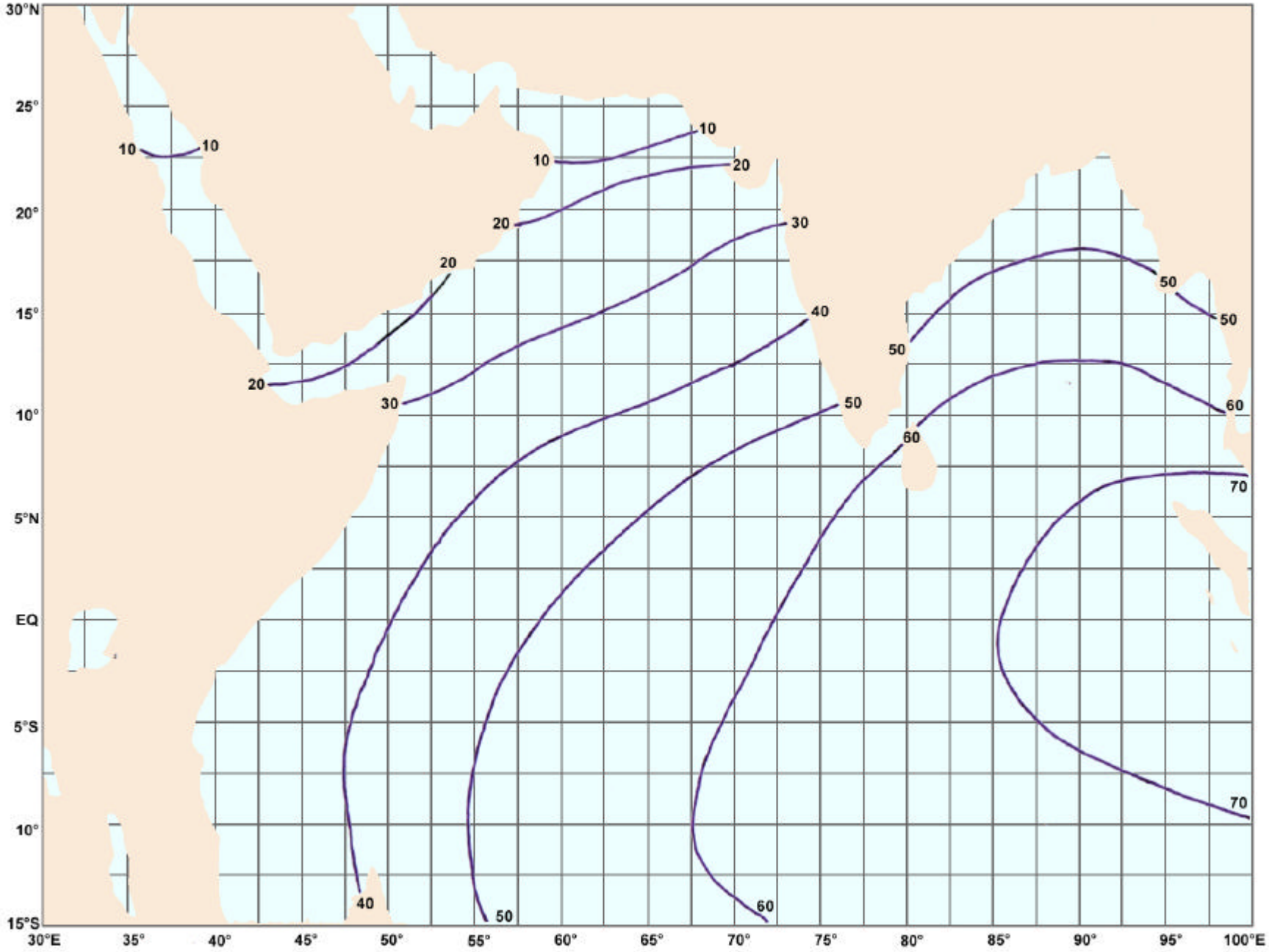


CHART NO.9.12 TOTAL CLOUD AMOUNT (%) DECEMBER

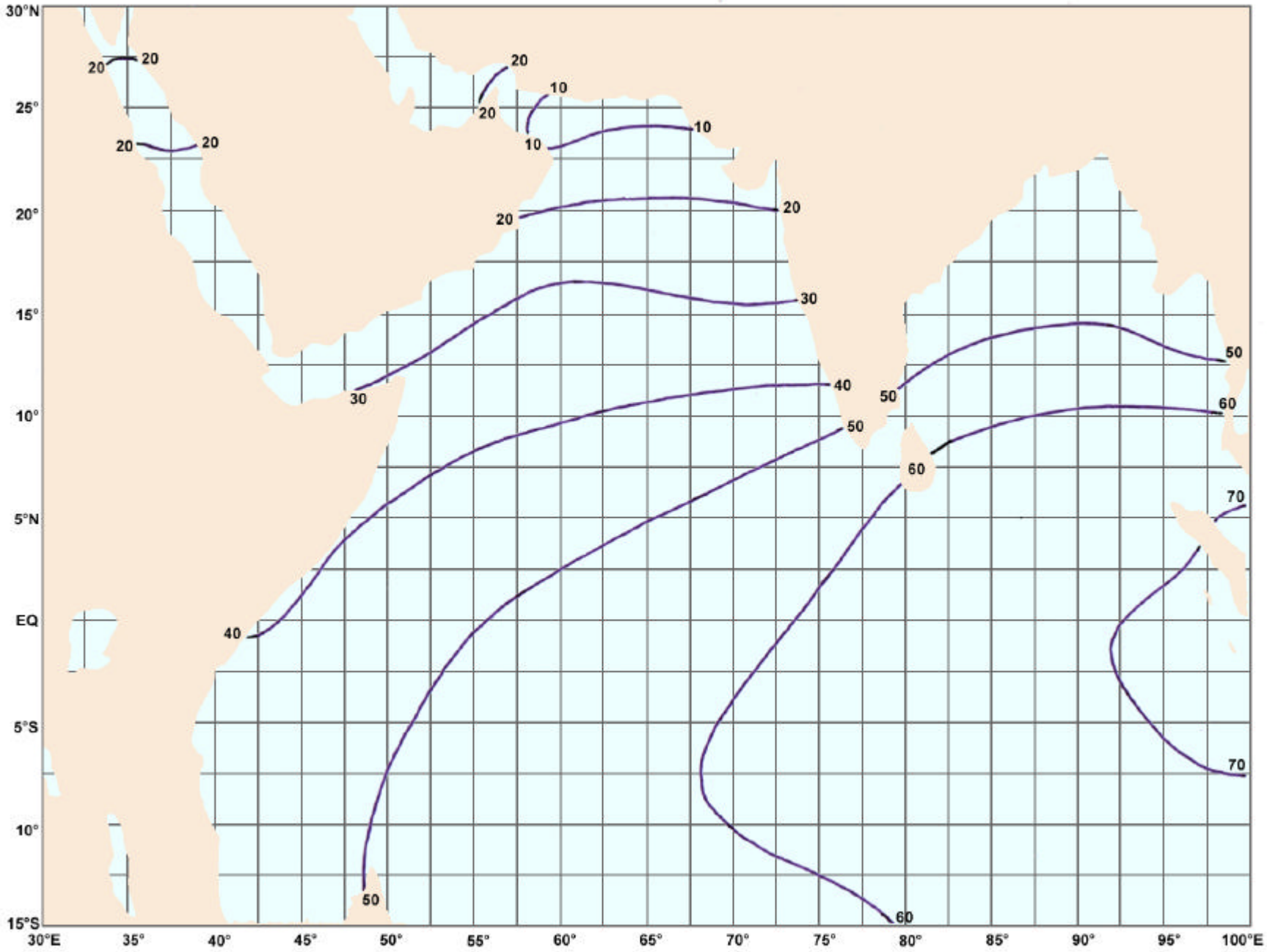


CHART NO.10.1 LOW CLOUD AMOUNT (%) JANUARY

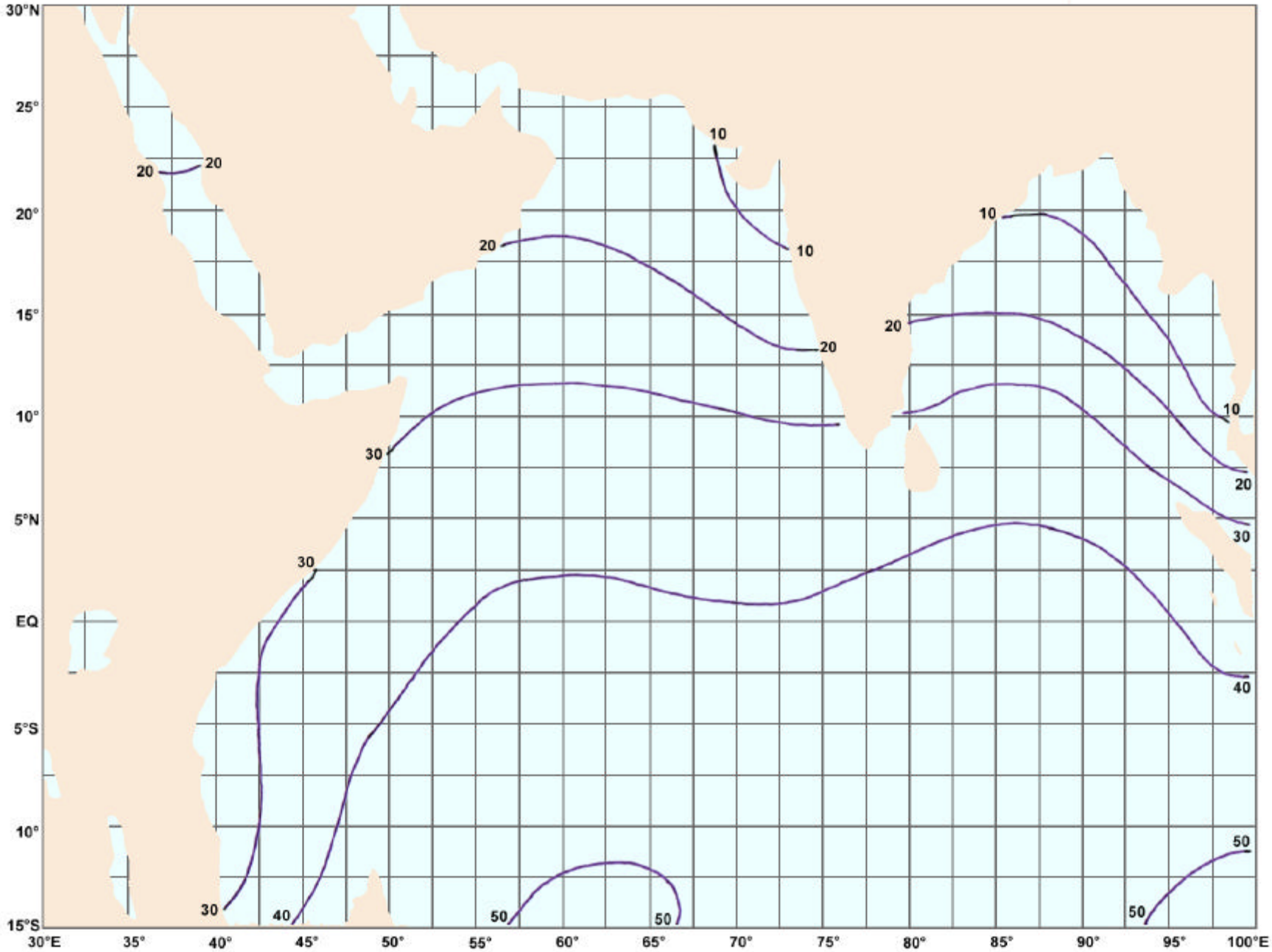


CHART NO.10.2 LOW CLOUD AMOUNT (%) FEBRUARY

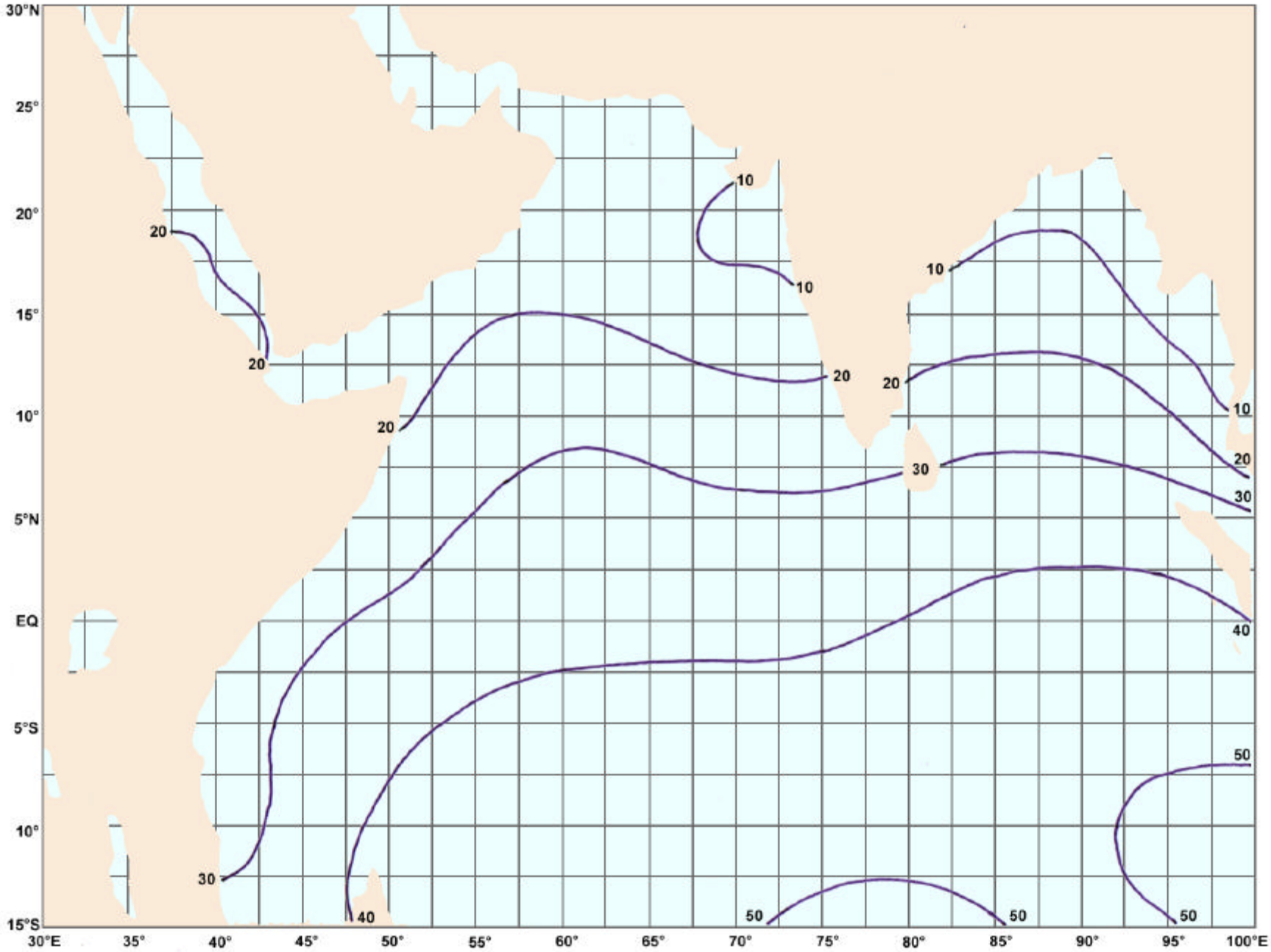


CHART NO.10.3 LOW CLOUD AMOUNT (%) MARCH

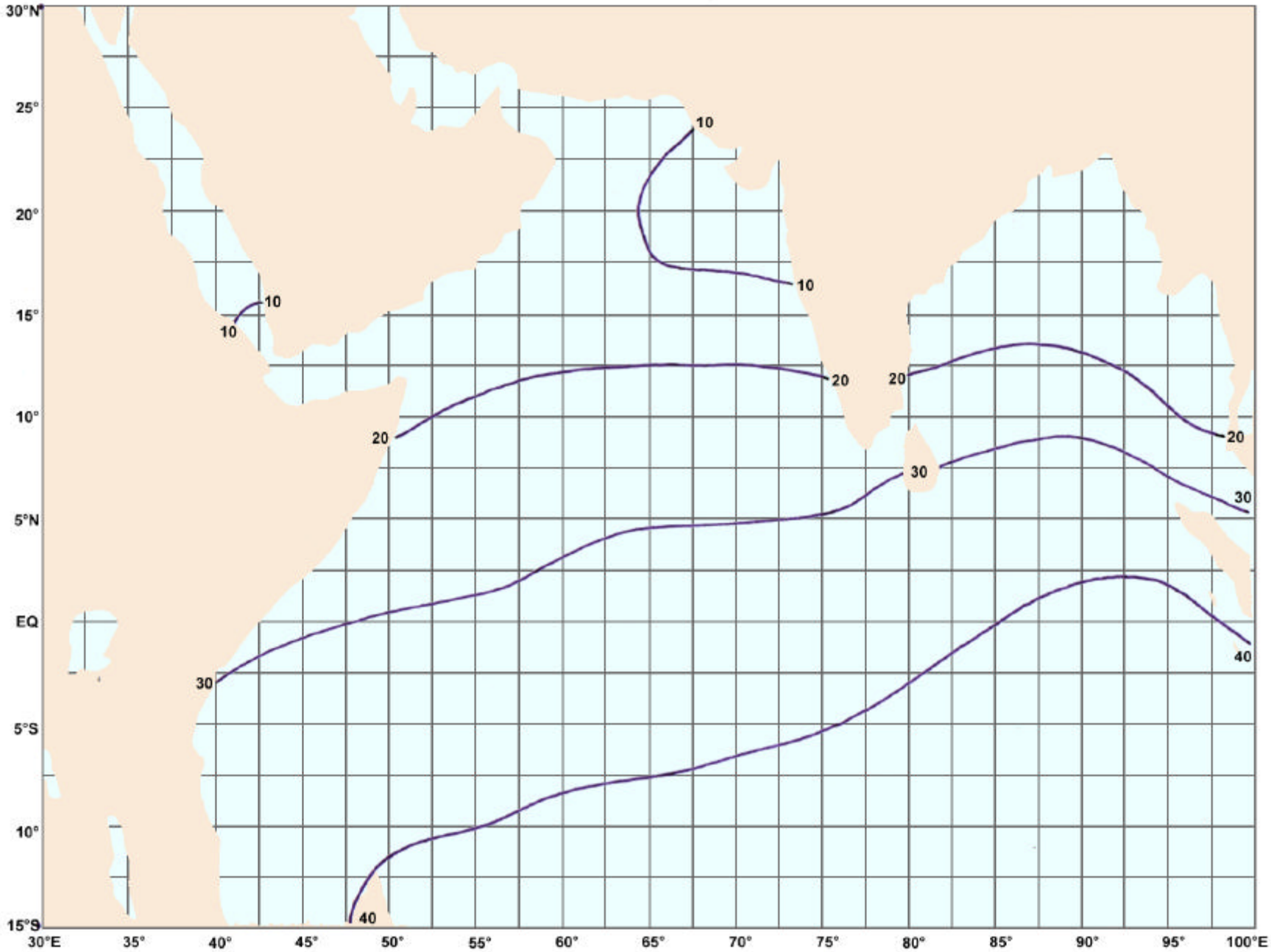


CHART NO.10.4 LOW CLOUD AMOUNT (%) APRIL

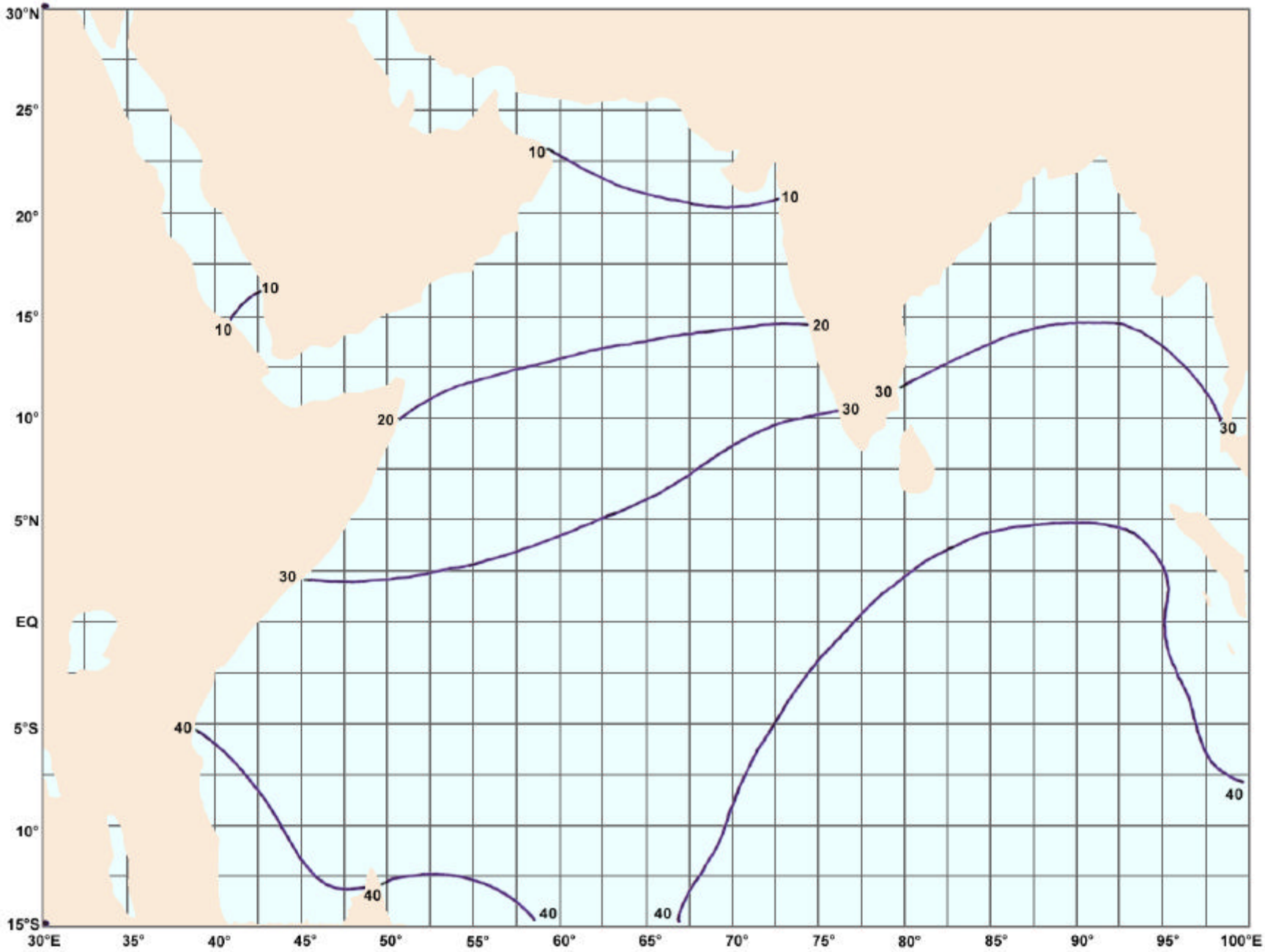


CHART NO.10.5 LOW CLOUD AMOUNT (%) MAY

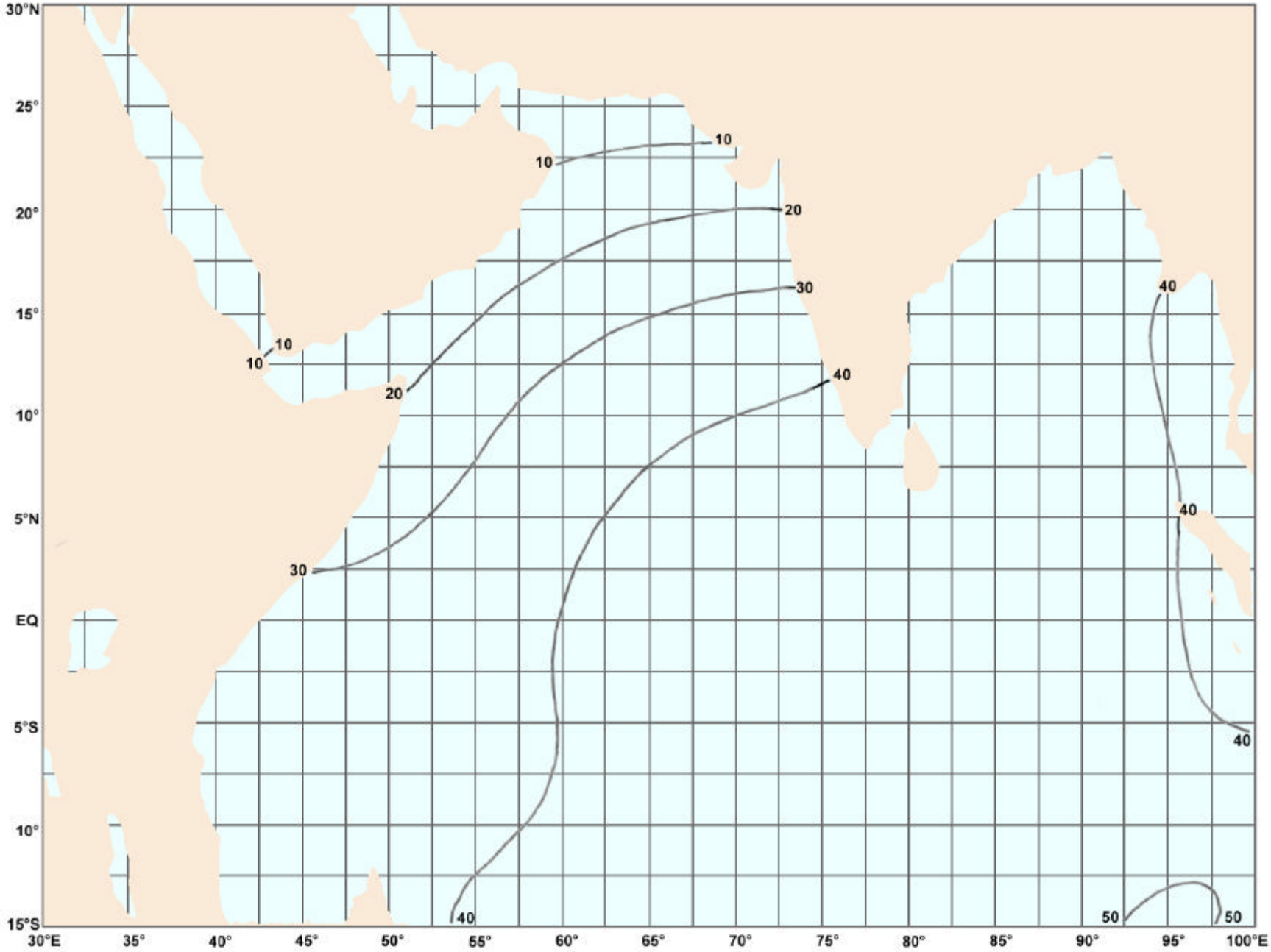


CHART NO.10.6 LOW CLOUD AMOUNT (%) JUNE

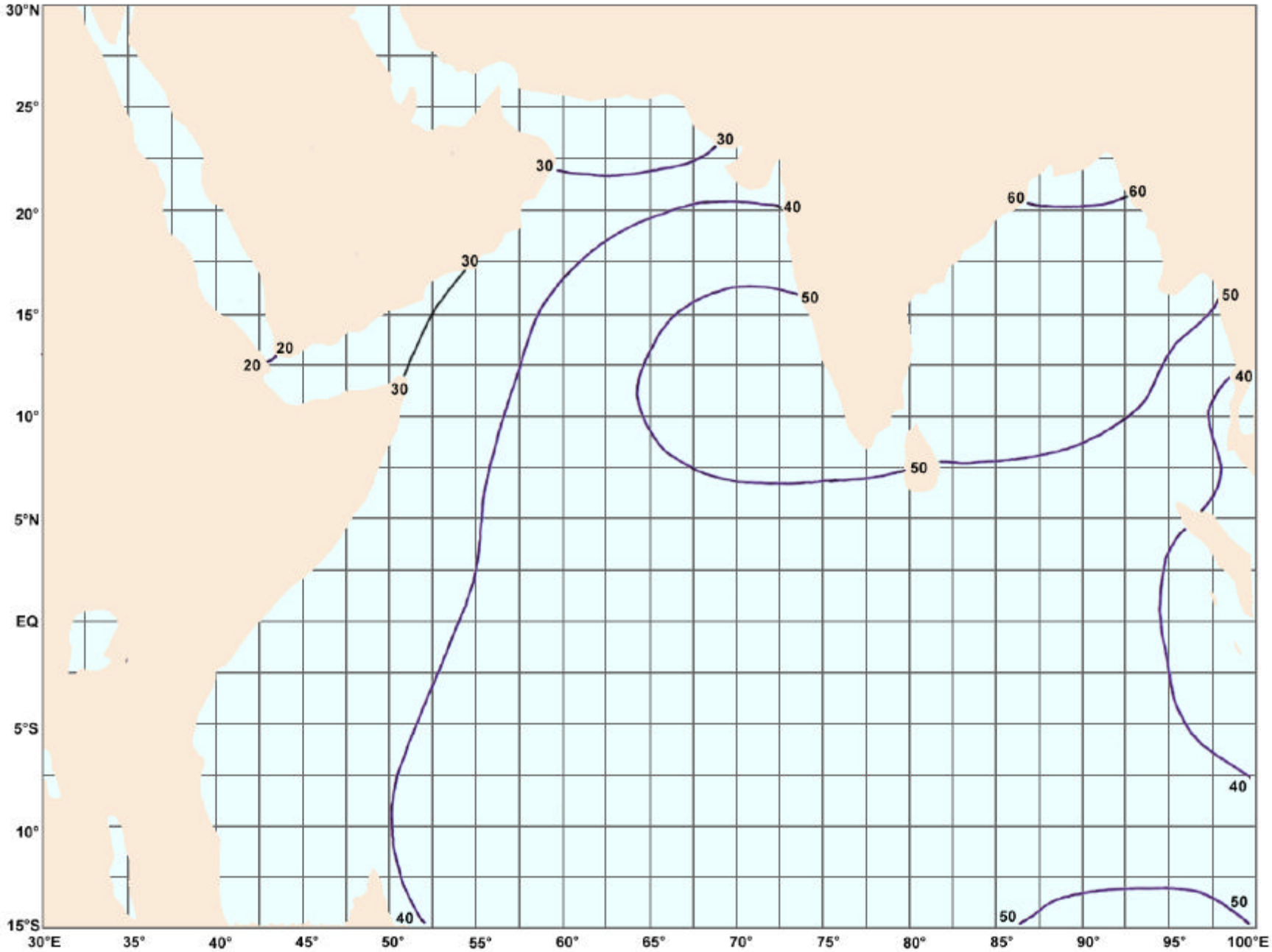


CHART NO.10.7 LOW CLOUD AMOUNT(%) JULY

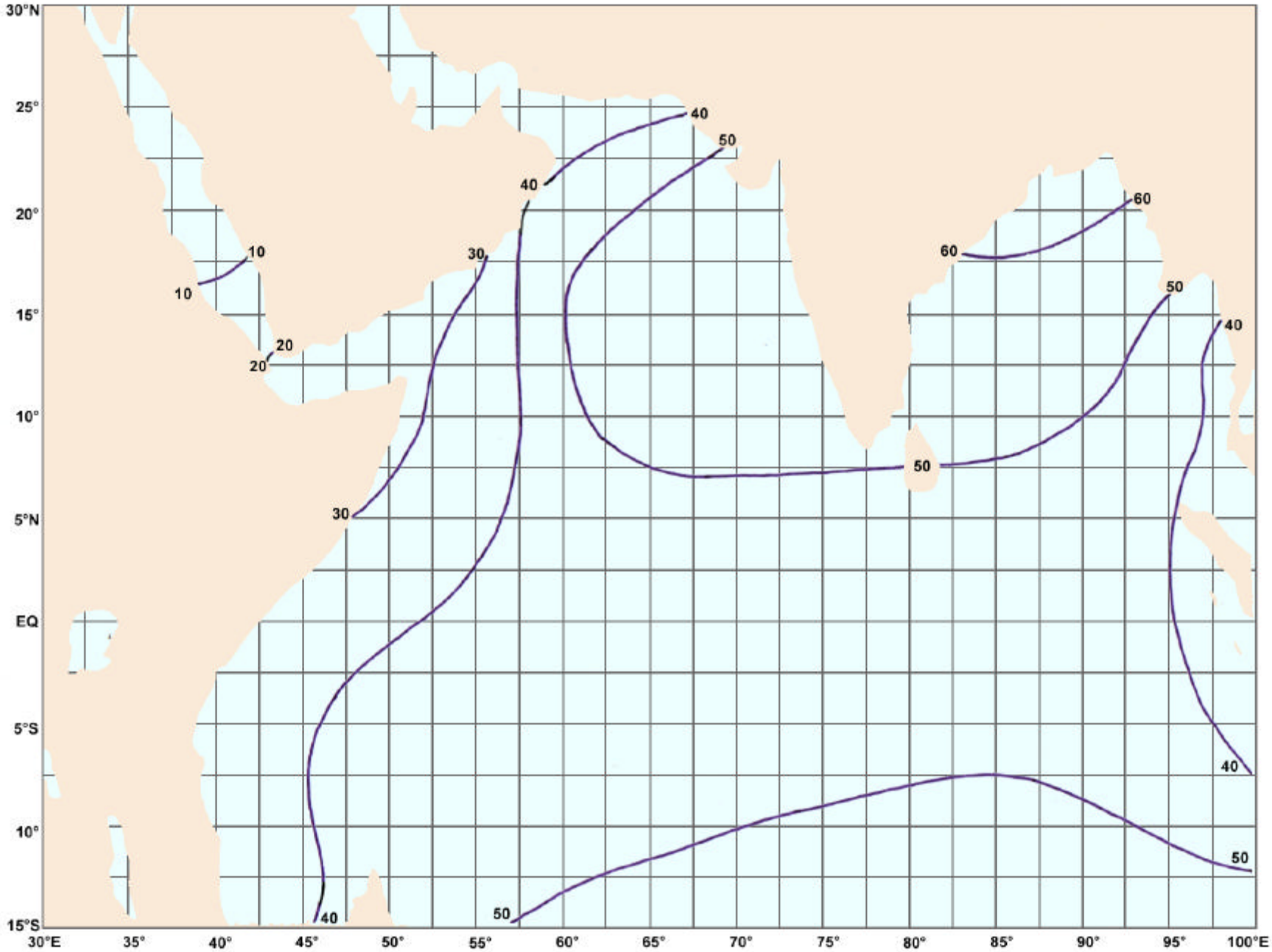


CHART NO.10.8 LOW CLOUD AMOUNT (%) AUGUST

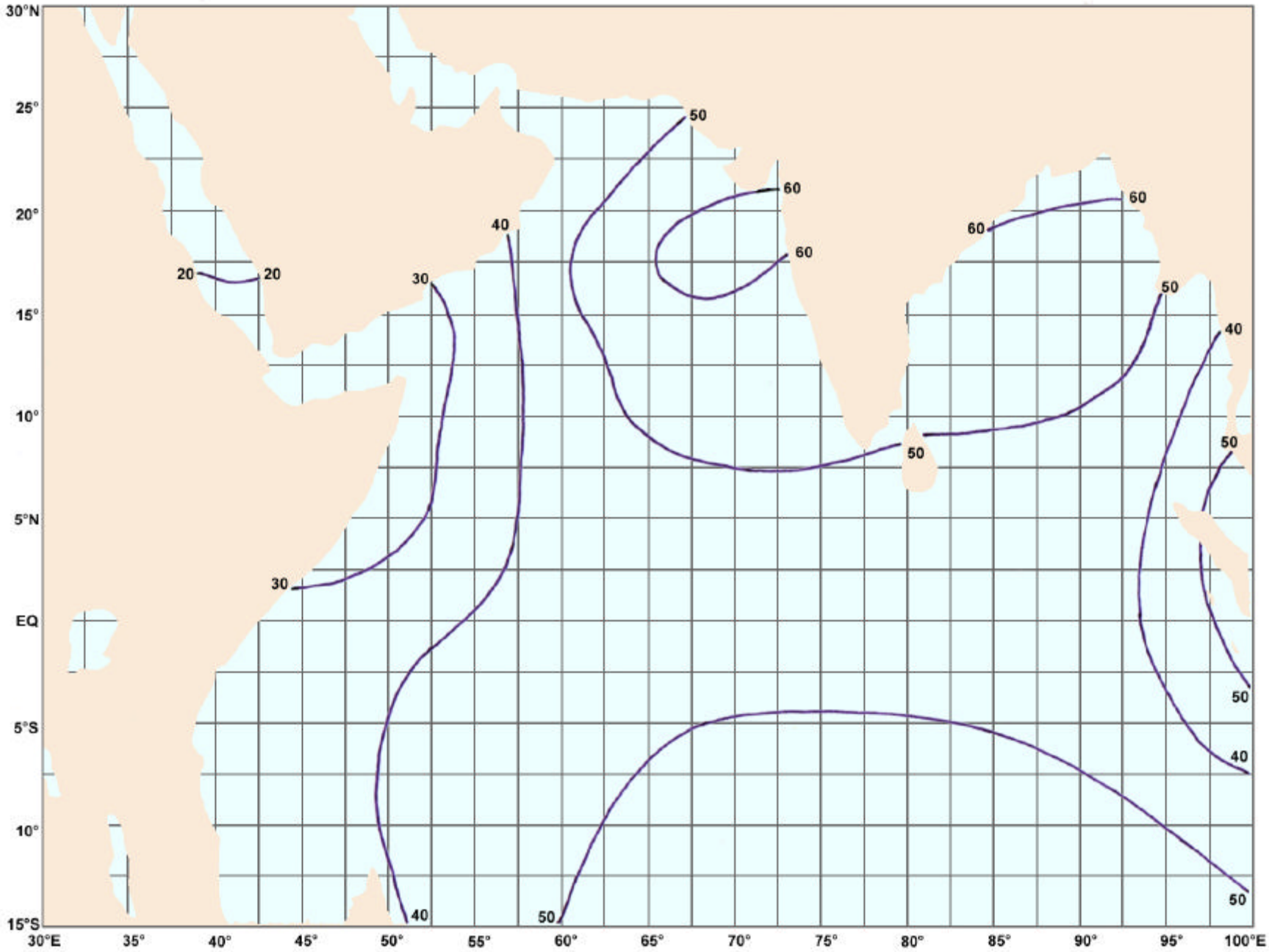


CHART NO.10.9 LOW CLOUD AMOUNT (%) SEPTEMBER

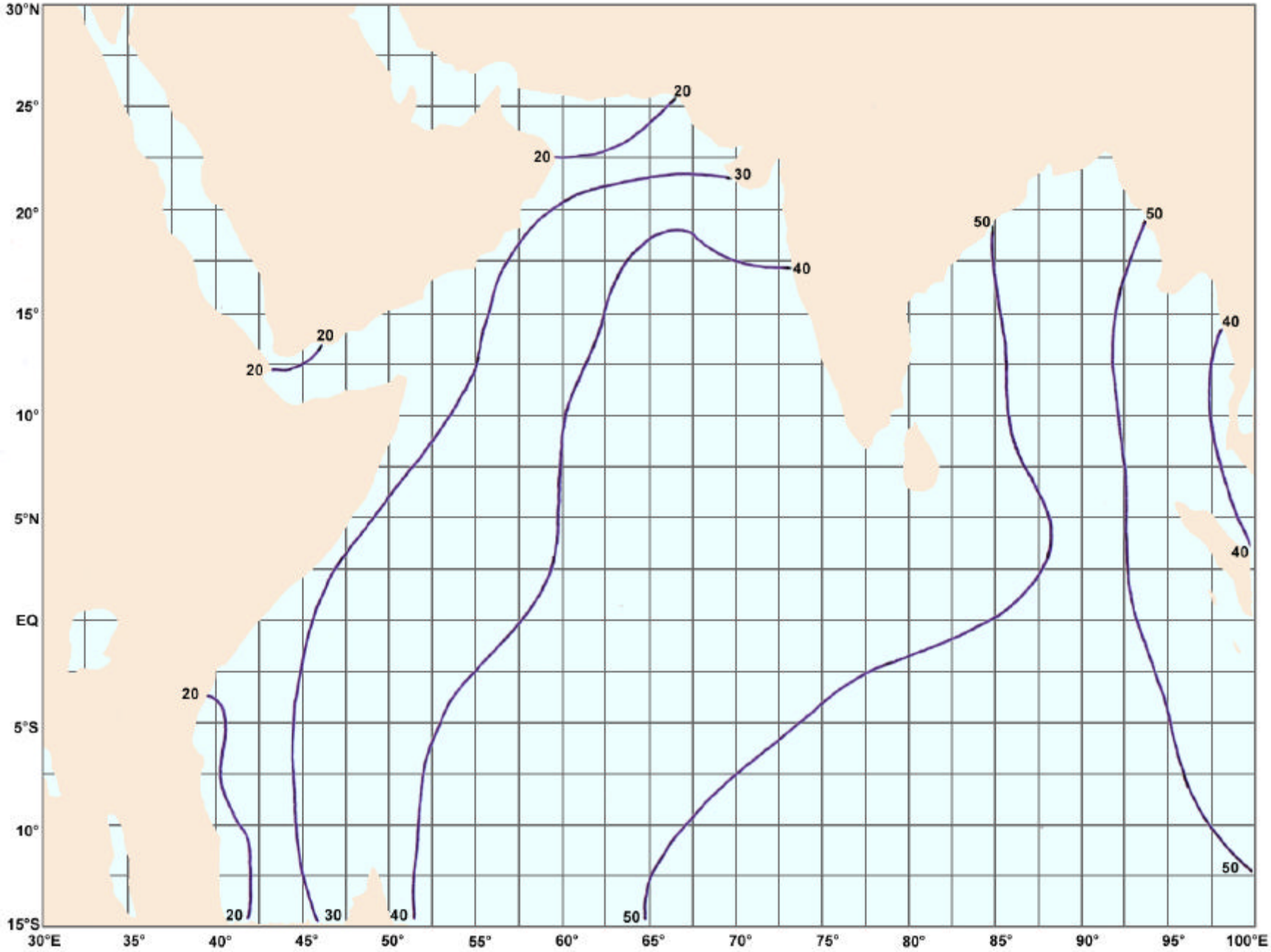


CHART NO.10.10 LOW CLOUD AMOUNT (%) OCTOBER

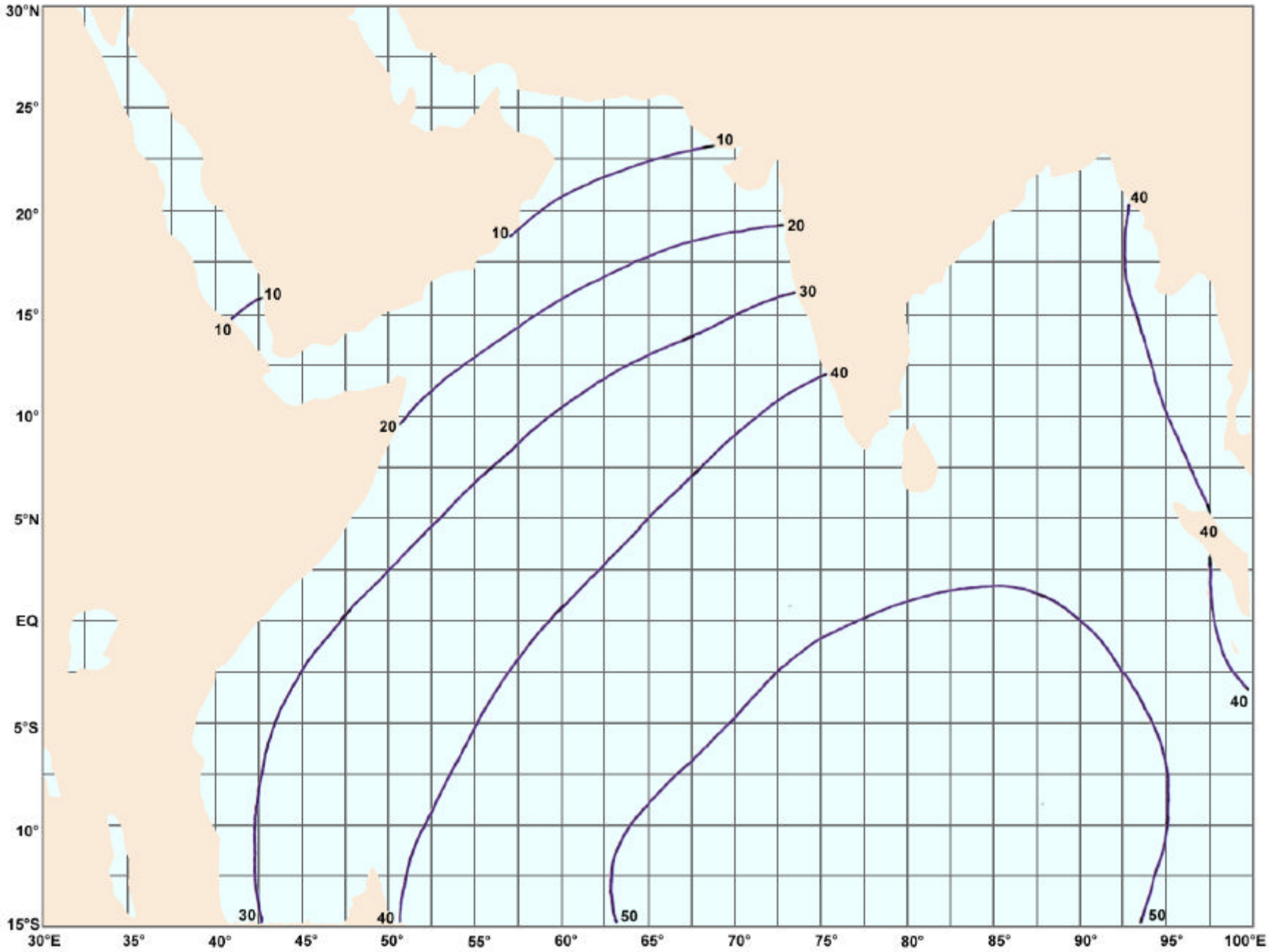


CHART NO.10.11 LOW CLOUD AMOUNT (%) NOVEMBER

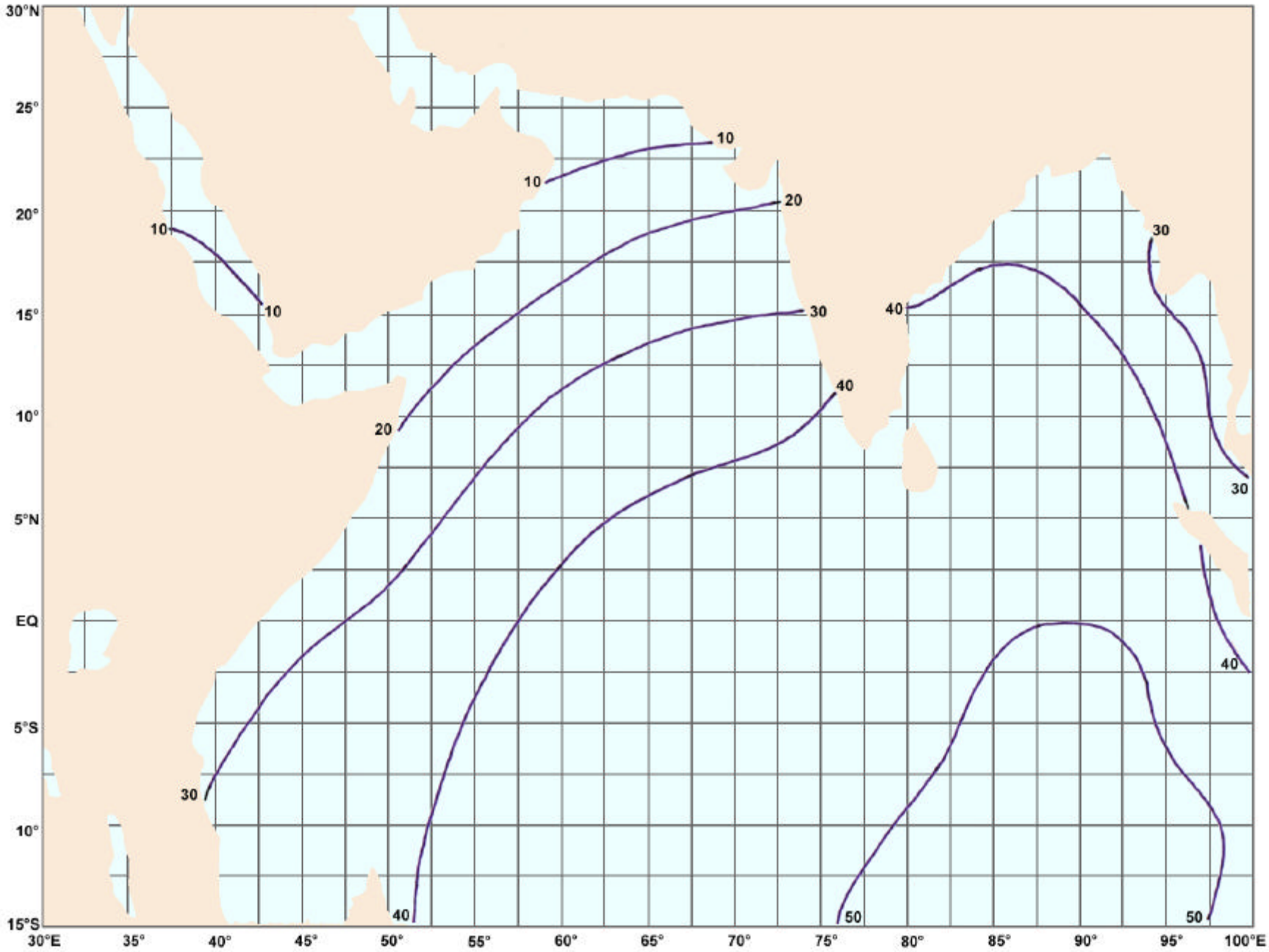


CHART NO.10.12 LOW CLOUD AMOUNT (%) DECEMBER

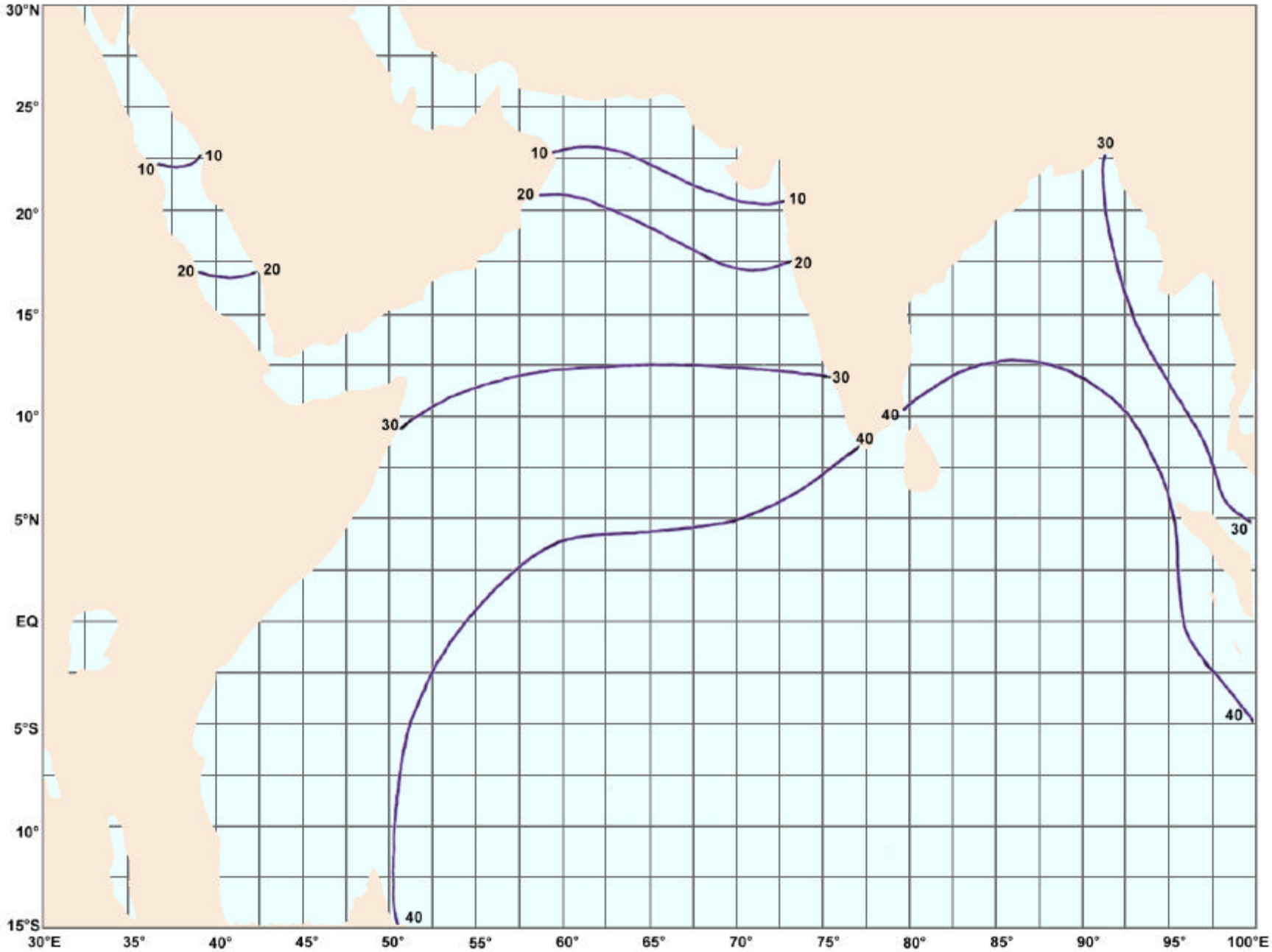


CHART NO.11.1 MEAN WAVE HEIGHT (m) JANUARY

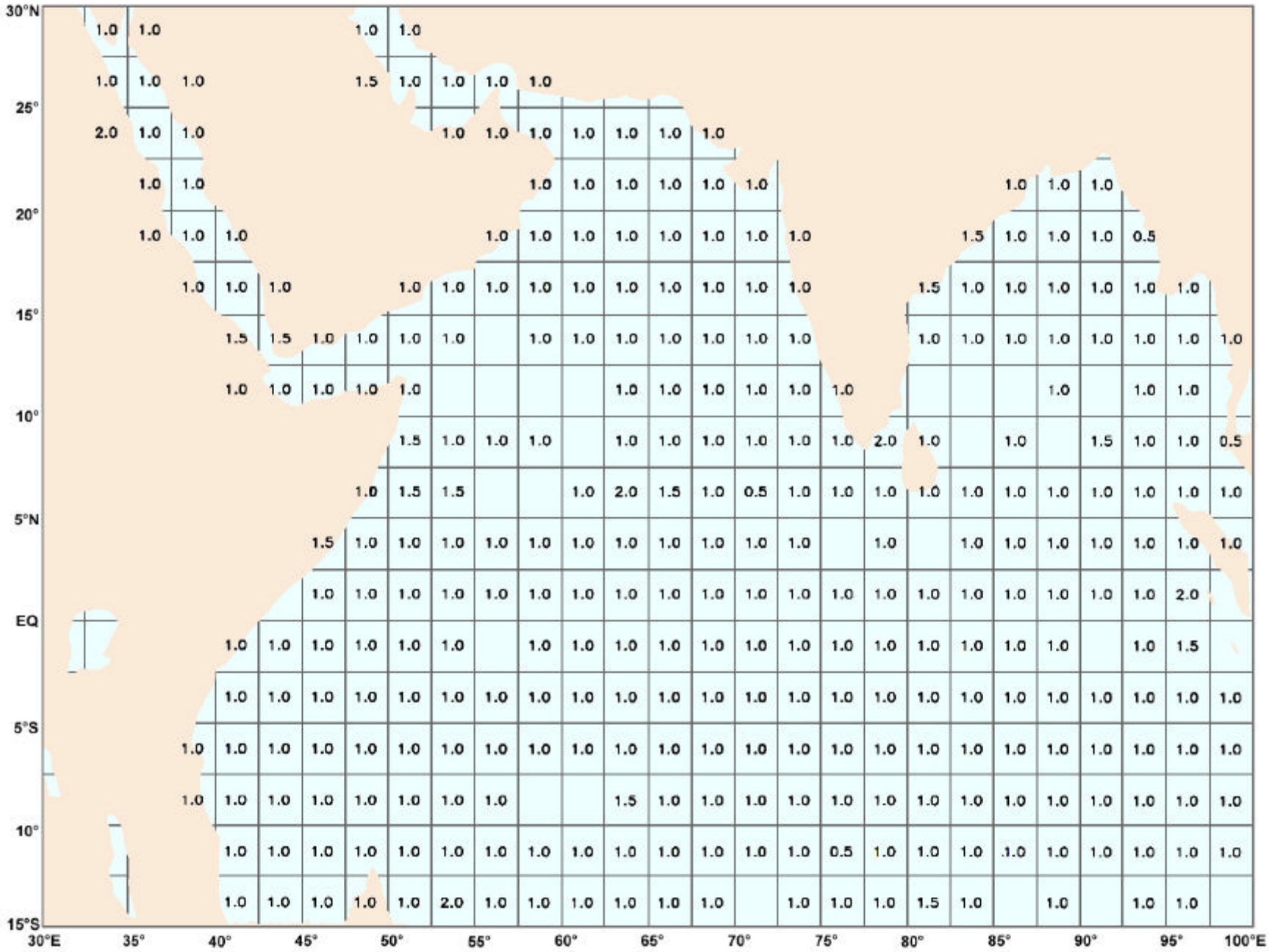


CHART NO.11.2 MEAN WAVE HEIGHT (m) FEBRUARY

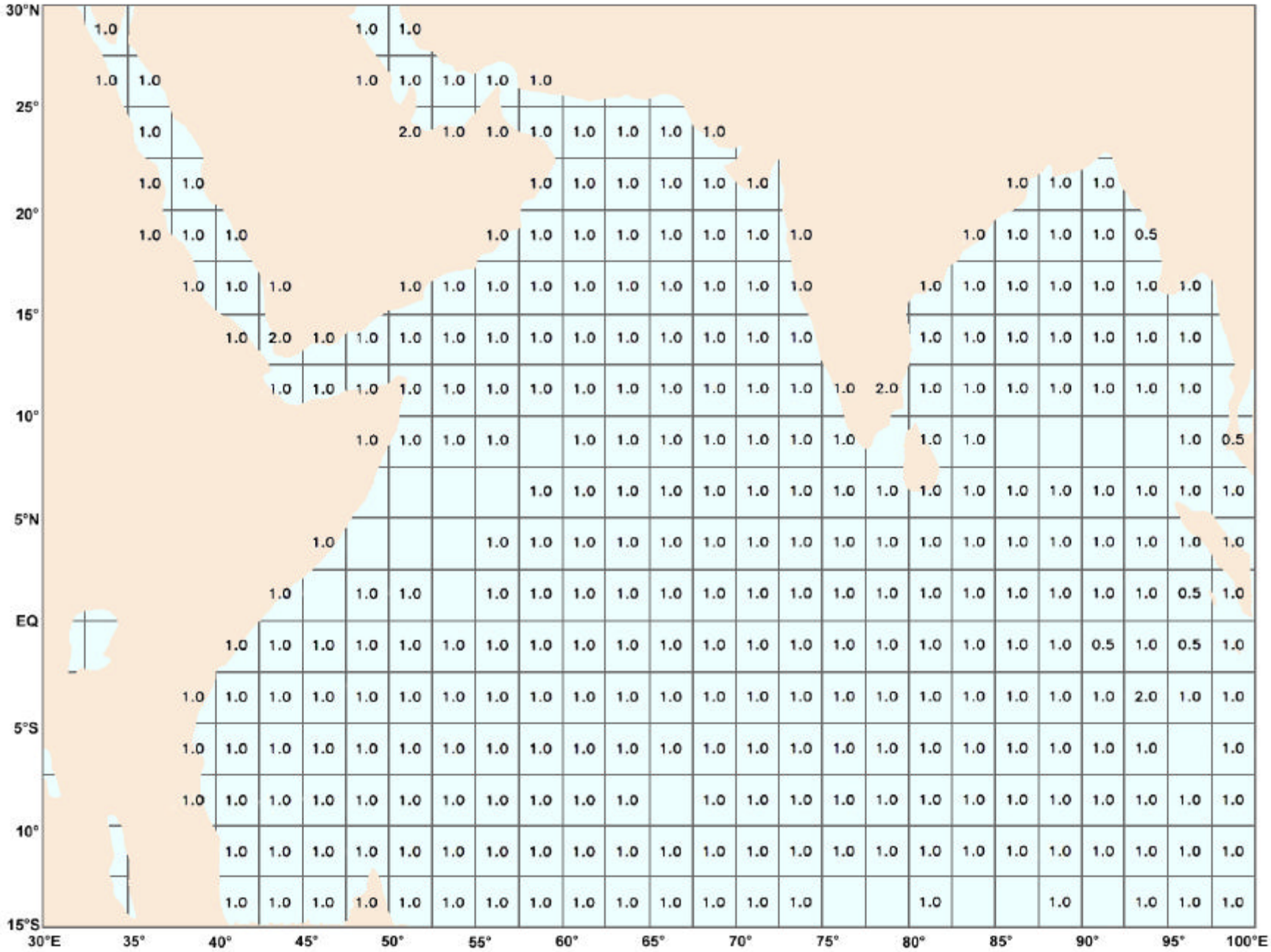


CHART NO.11.3 MEAN WAVE HEIGHT (m) MARCH

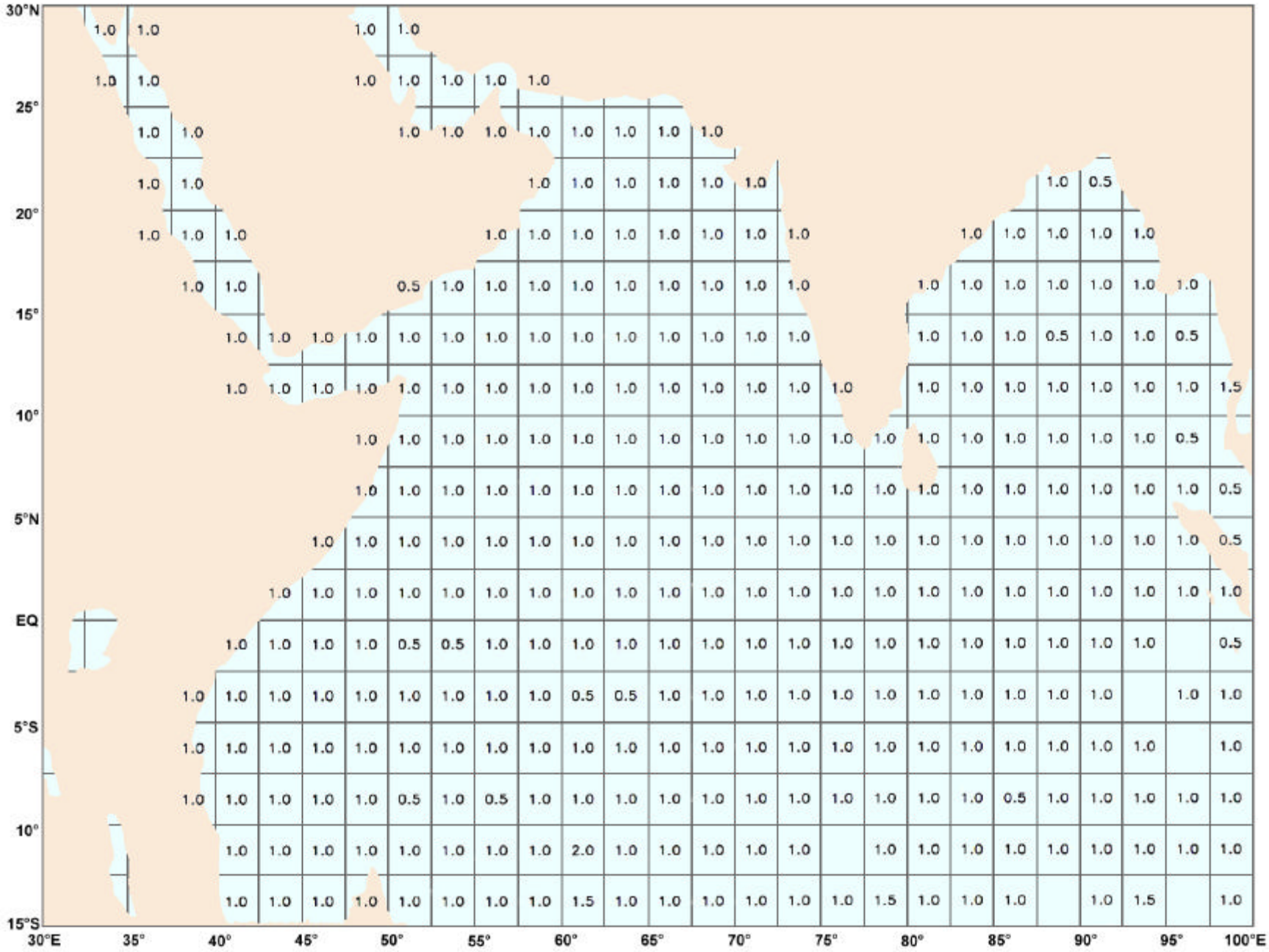


CHART NO.11.4 MEAN WAVE HEIGHT (m) APRIL

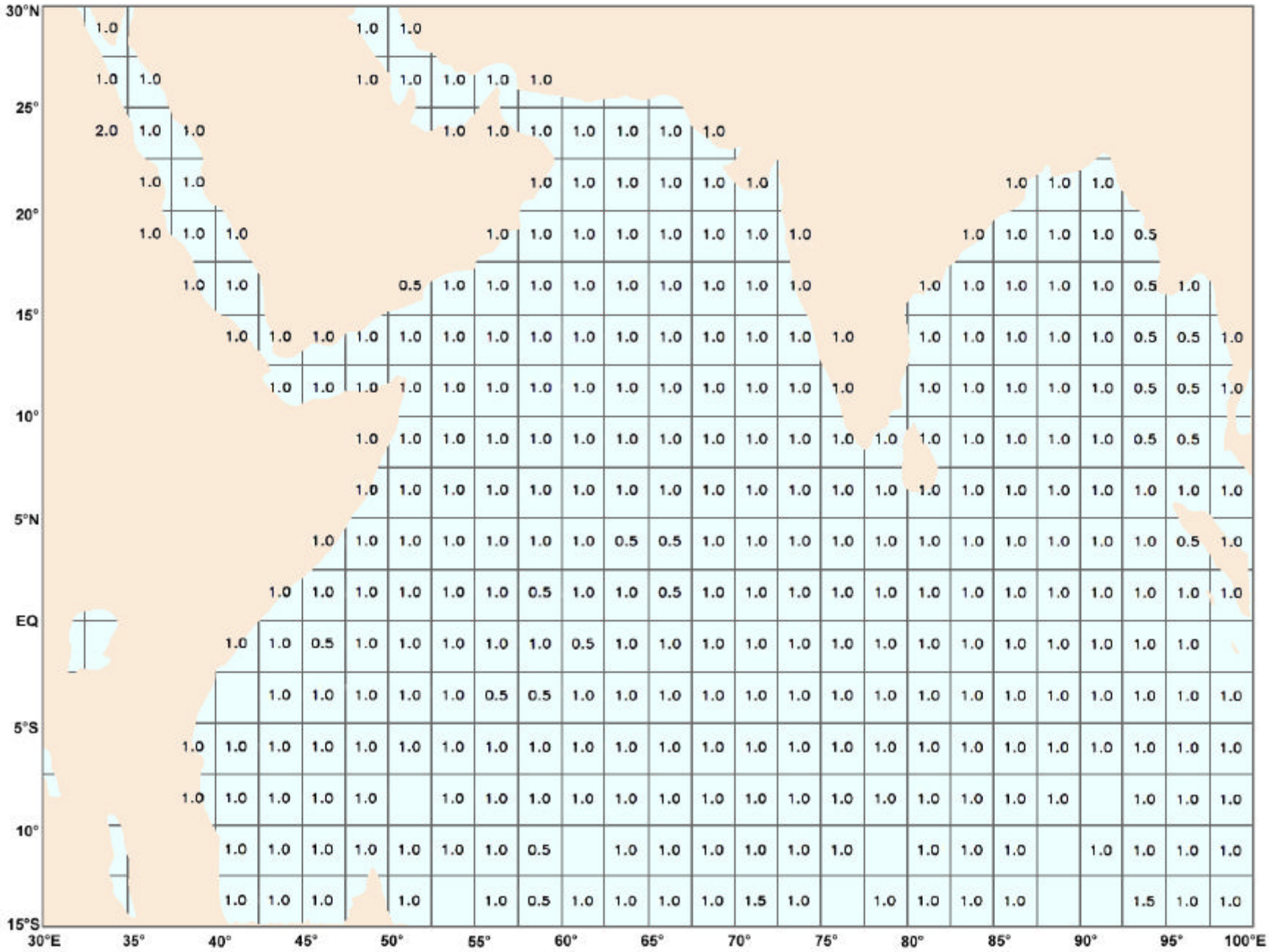


CHART NO.11.5 MEAN WAVE HEIGHT (m) MAY

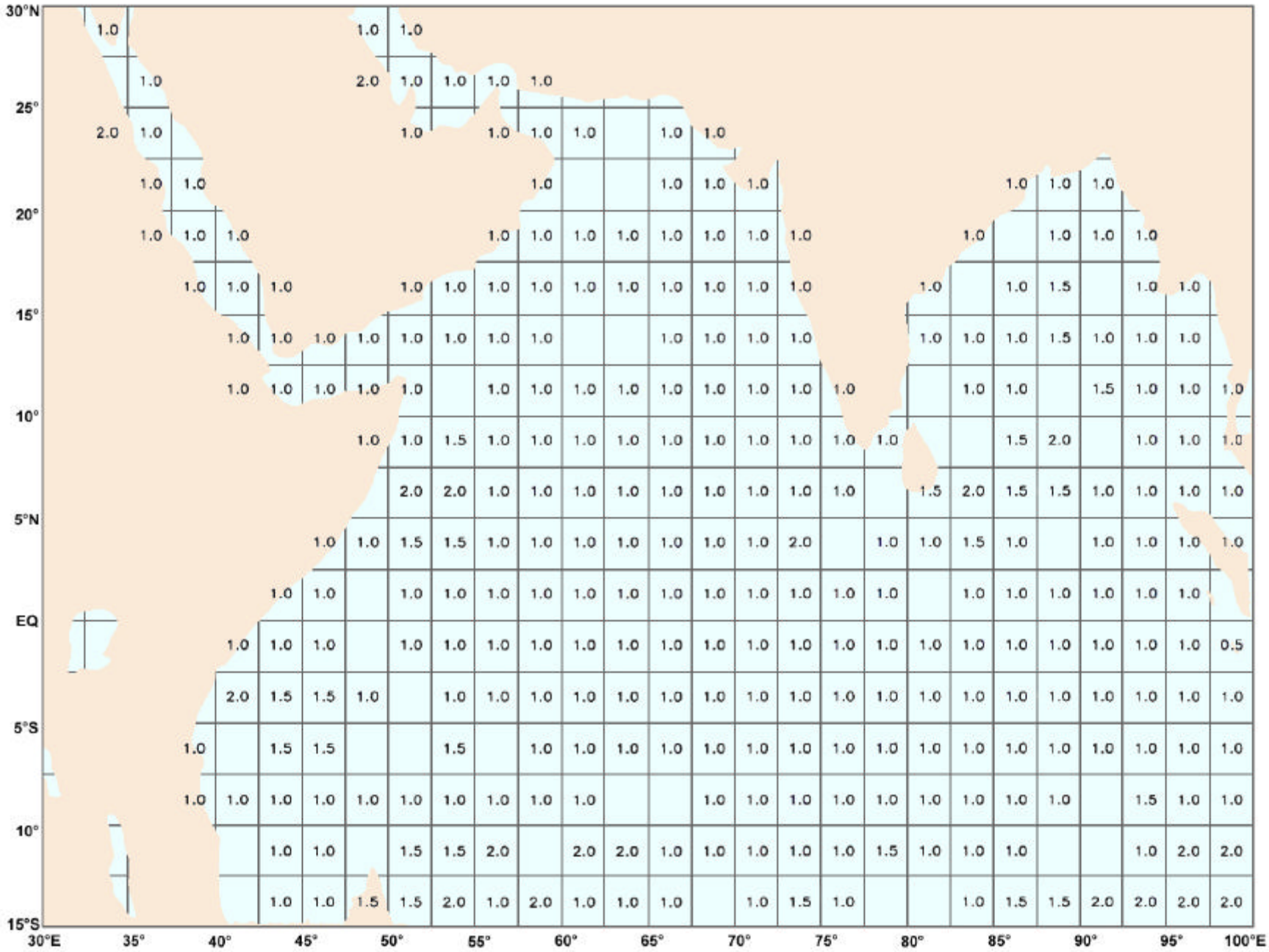


CHART NO.11.6 MEAN WAVE HEIGHT (m) JUNE

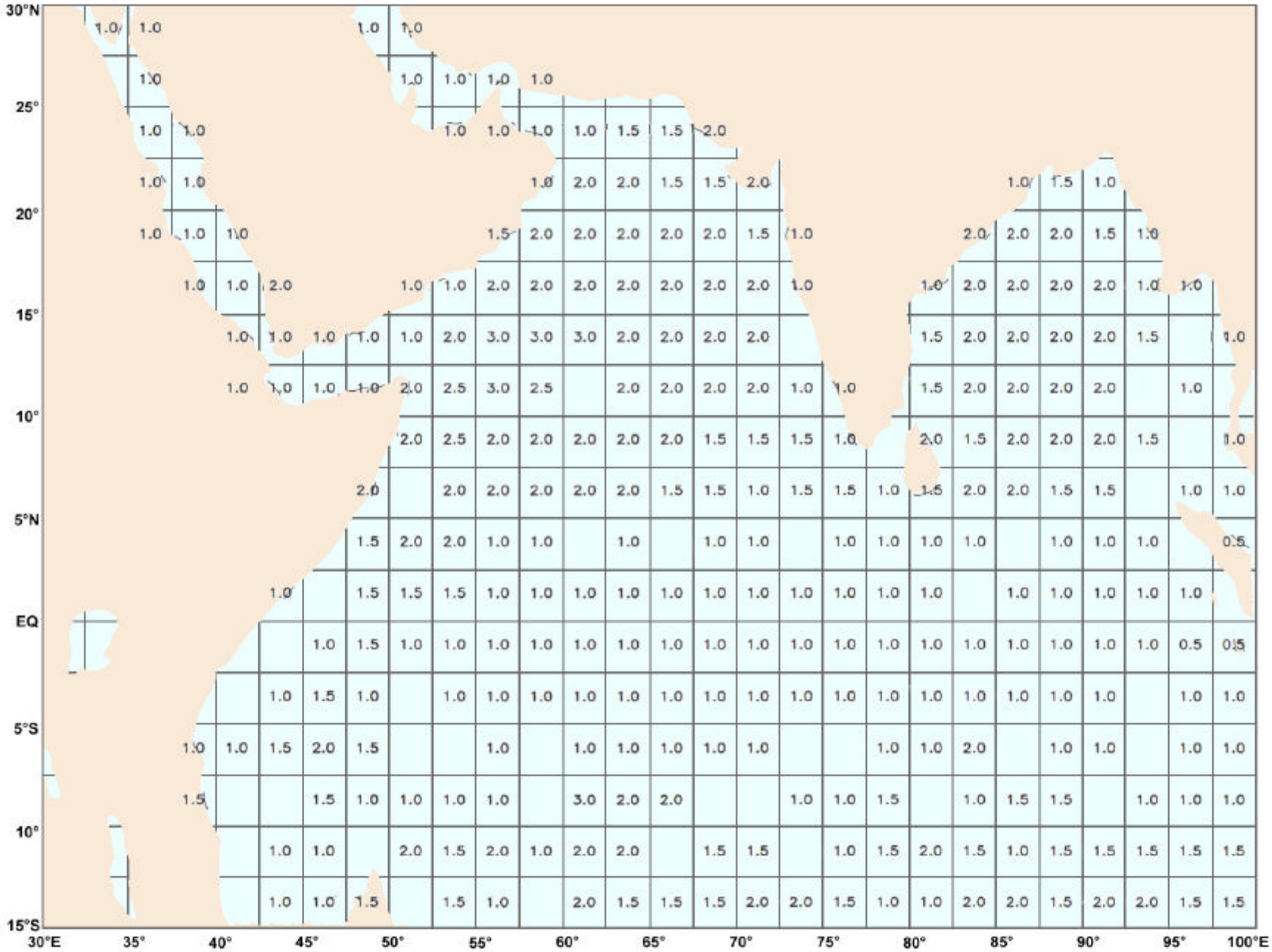


CHART NO.11.7 MEAN WAVE HEIGHT (m) JULY

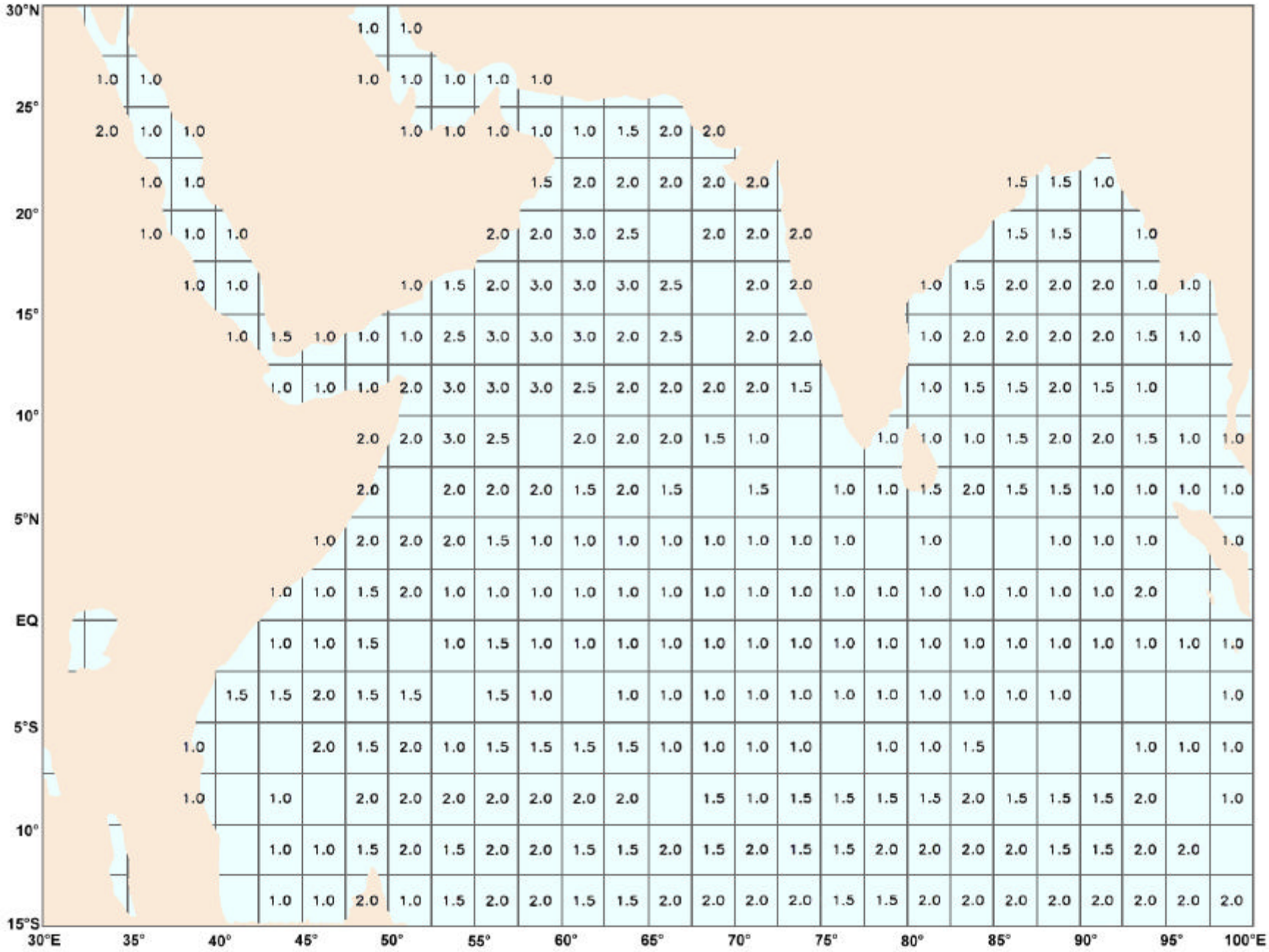


CHART NO.11.8 MEAN WAVE HEIGHT (m) AUGUST

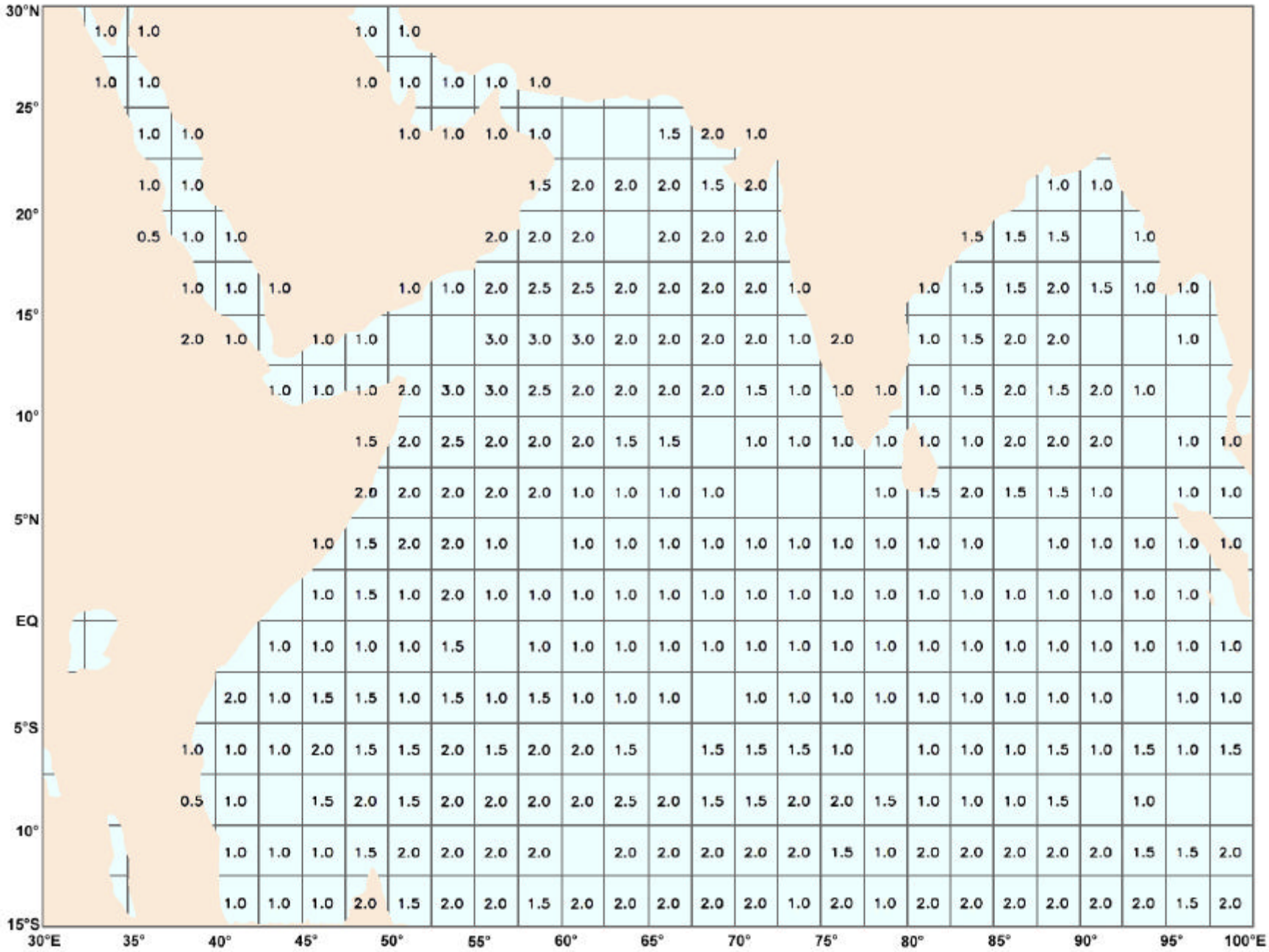
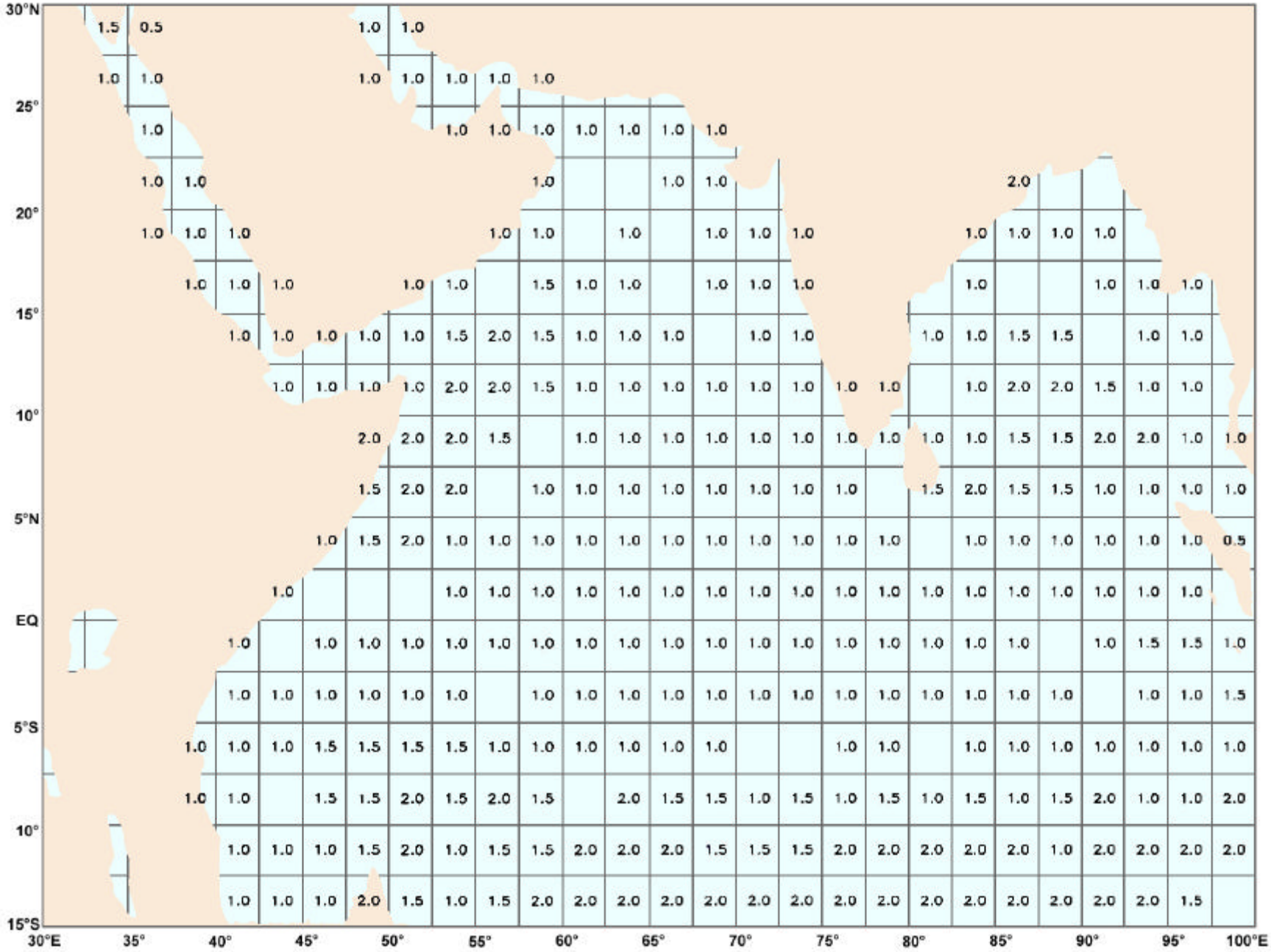
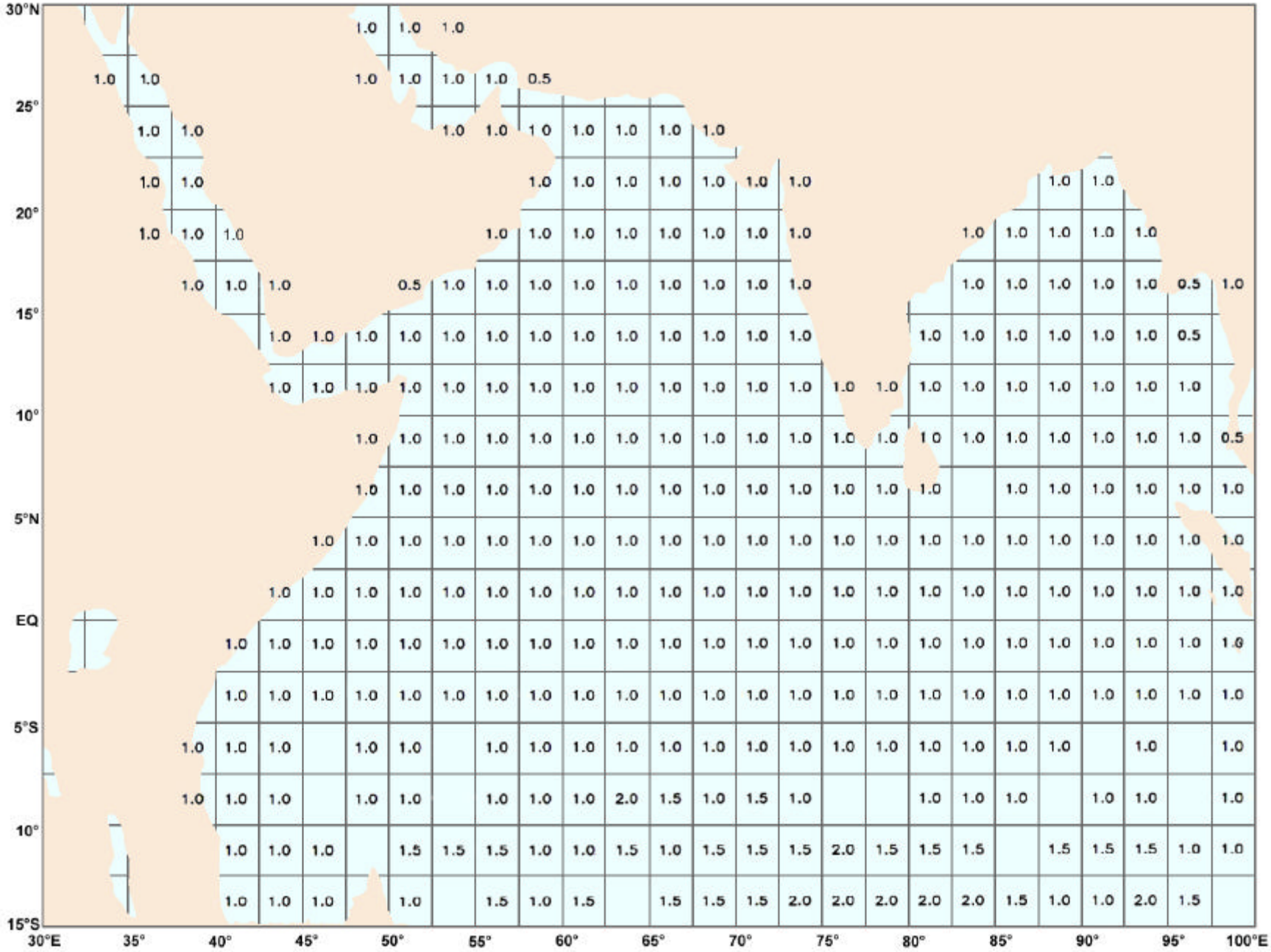


CHART NO.11.9 MEAN WAVE HEIGHT (m) SEPTEMBER

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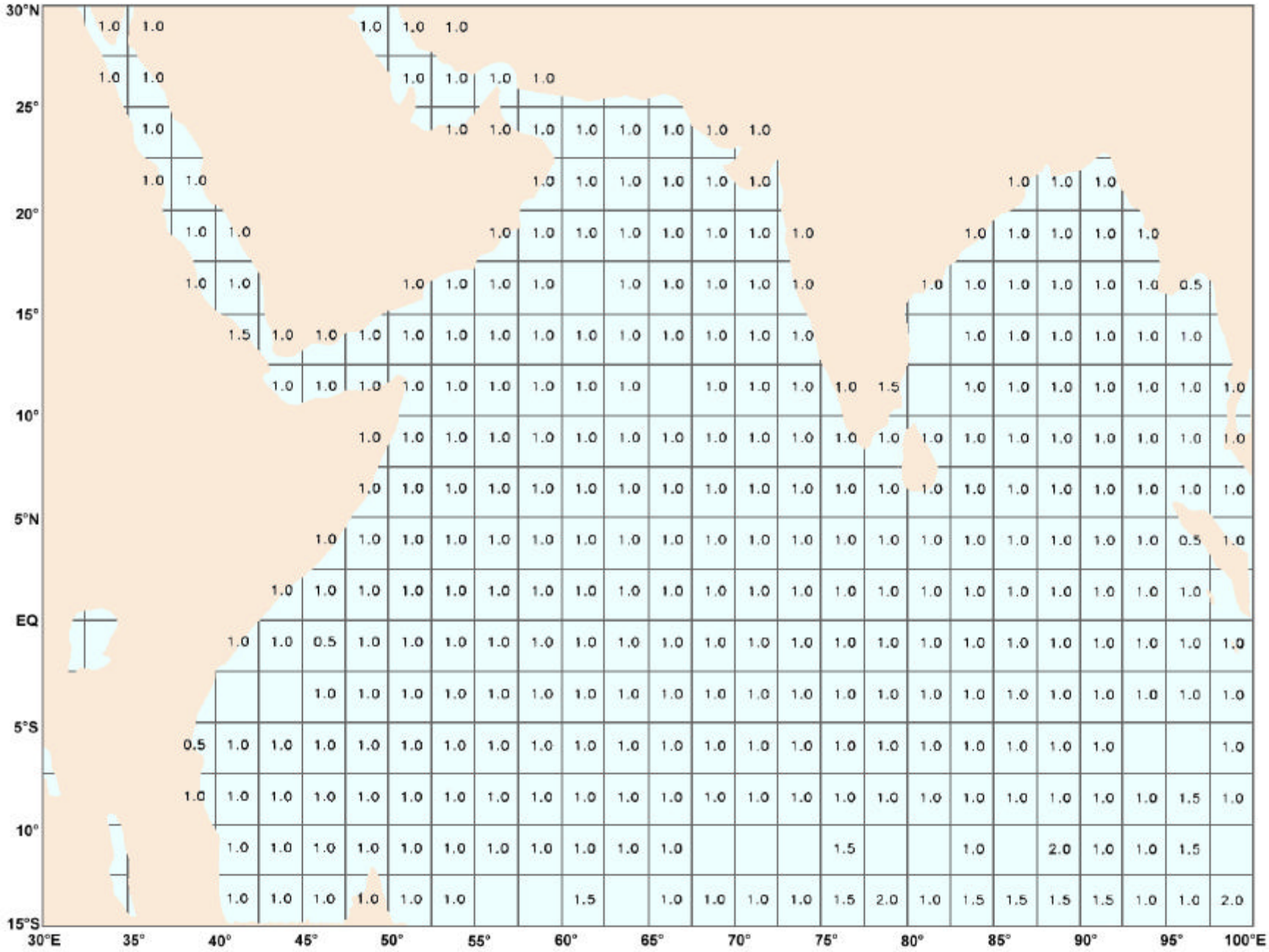
100°E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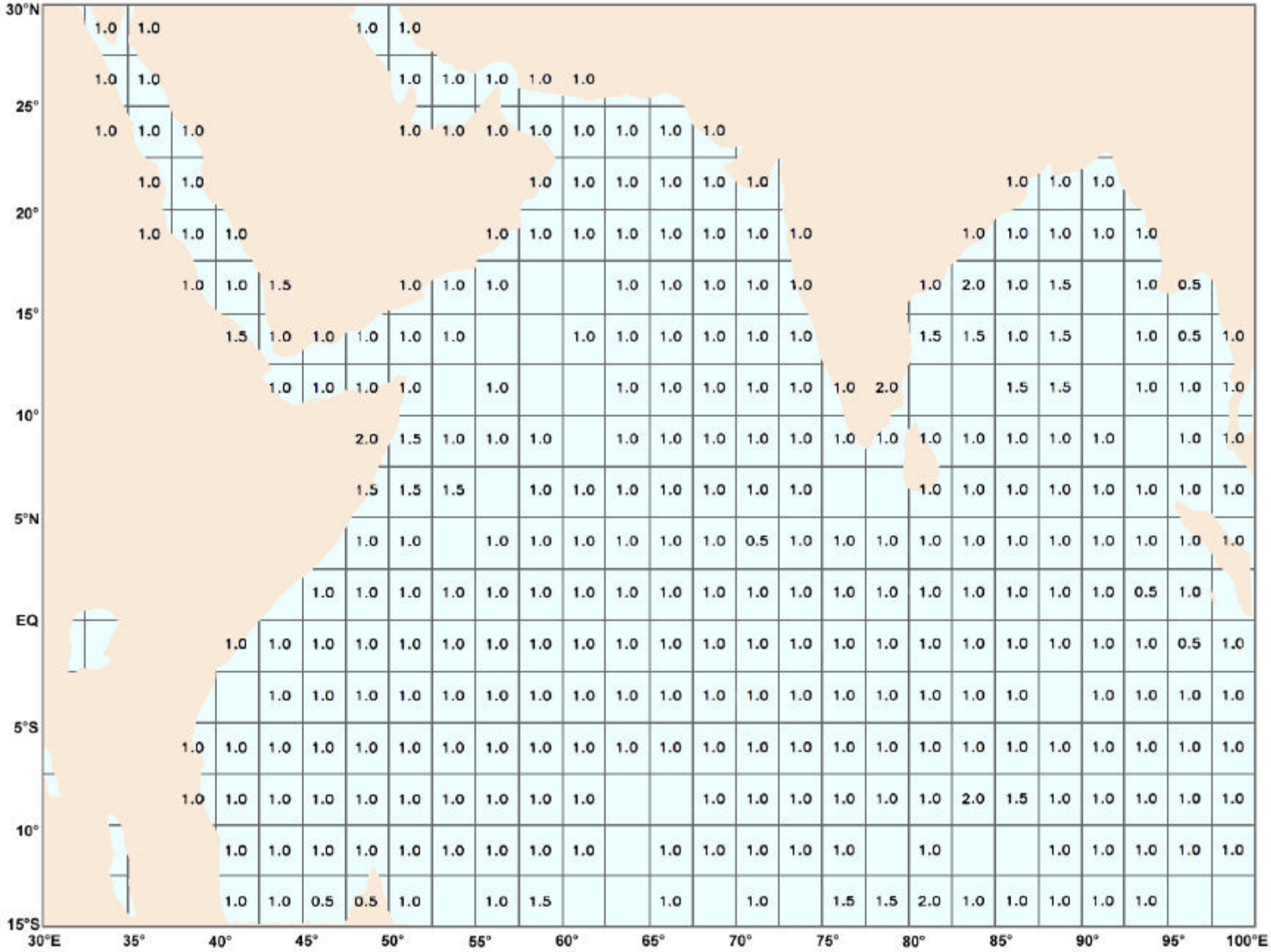
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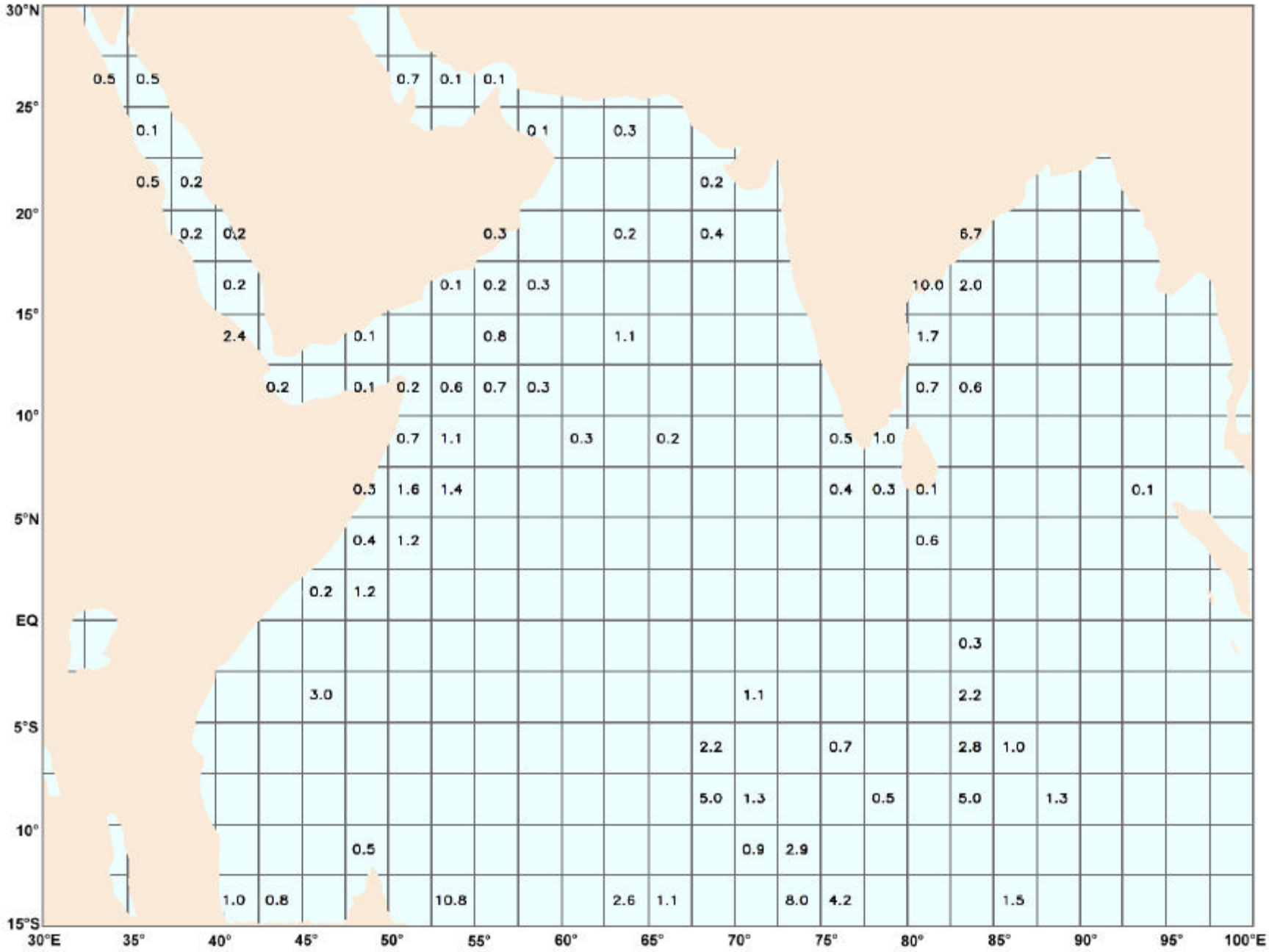
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100°E
0.5 0.5
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0.5 0.2
0.2 0.2
0.2
2.4
0.2
0.7 0.1 0.1
0 1
0.3
0.2
0.3
0.2
0.4
0.1 0.2 0.3
0.8
1.1
0.1 0.2 0.6 0.7 0.3
0.7 1.1
0.3
0.2
0.3 1.6 1.4
0.4 1.2
0.2 1.2
3.0
1.0 0.8
0.5
10.8
2.6 1.1
0.9 2.9
8.0 4.2
2.2
5.0 1.3
1.1
0.7
0.5
6.7
10.0 2.0
1.7
0.7 0.6
0.5 1.0
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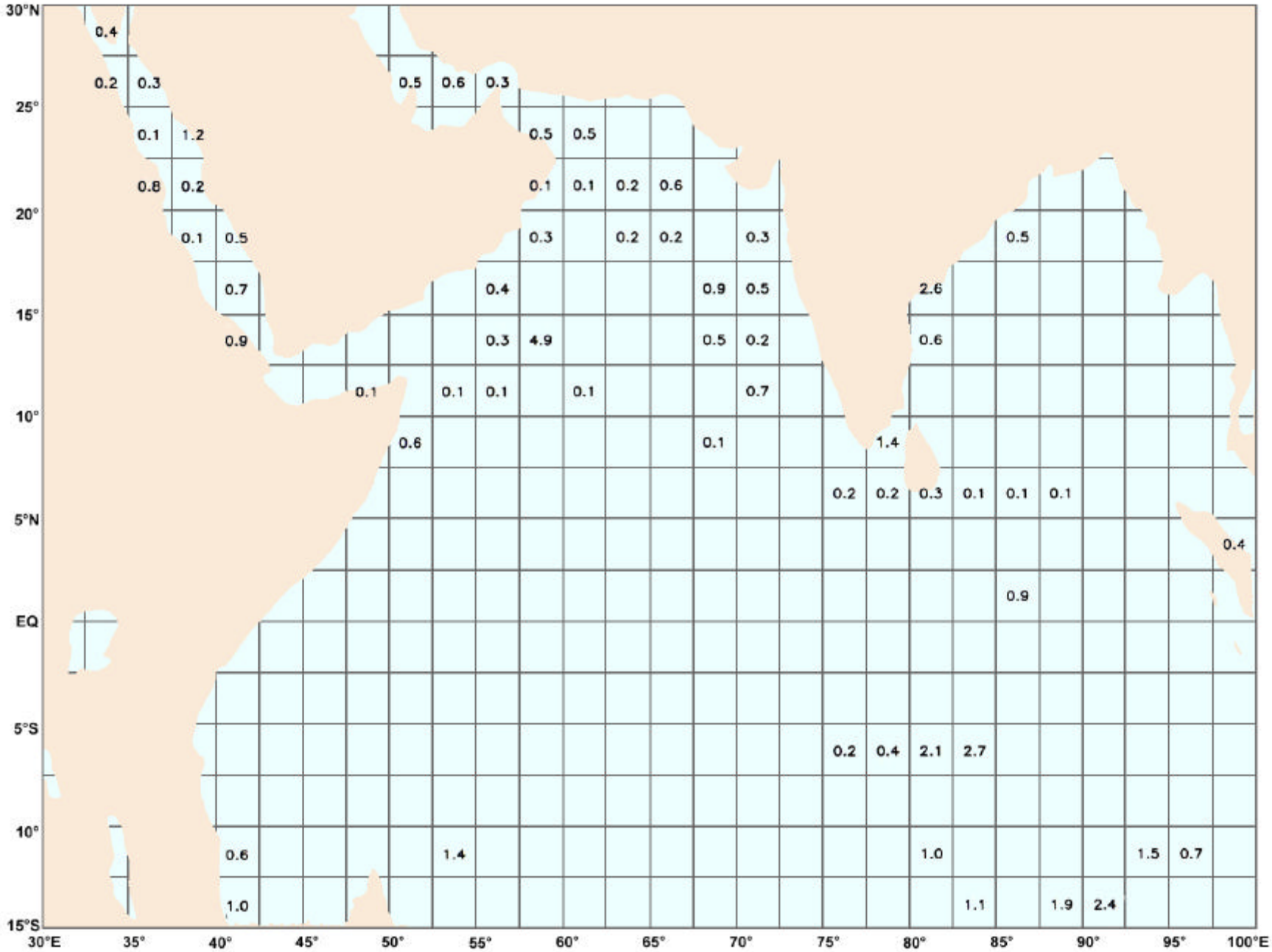
0.6
0.3
2.2
2.8 1.0
5.0
1.5
1.3
0.1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95°
100°E
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0.1 1.2
0.8 0.2
0.1 0.5
0.7
0.9
0.1
0.6
0.5 0.6 0.3
0.5 0.5
0.1 0.1 0.2 0.6
0.3 0.2 0.2 0.3
0.4
0.3 4.9
0.1 0.1 0.1 0.1 0.7
0.9 0.5
0.5 0.2
0.1
2.6
0.6
1.4
0.2 0.2 0.3 0.1 0.1 0.1
0.2 0.4 2.1 2.7
1.0
1.1
0.5
0.4
0.9
1.5 0.7
1.9 2.4
0.6
1.4
1.0

CHART NO.12.3 WAVE HEIGHT >4.0m (%) MARCH

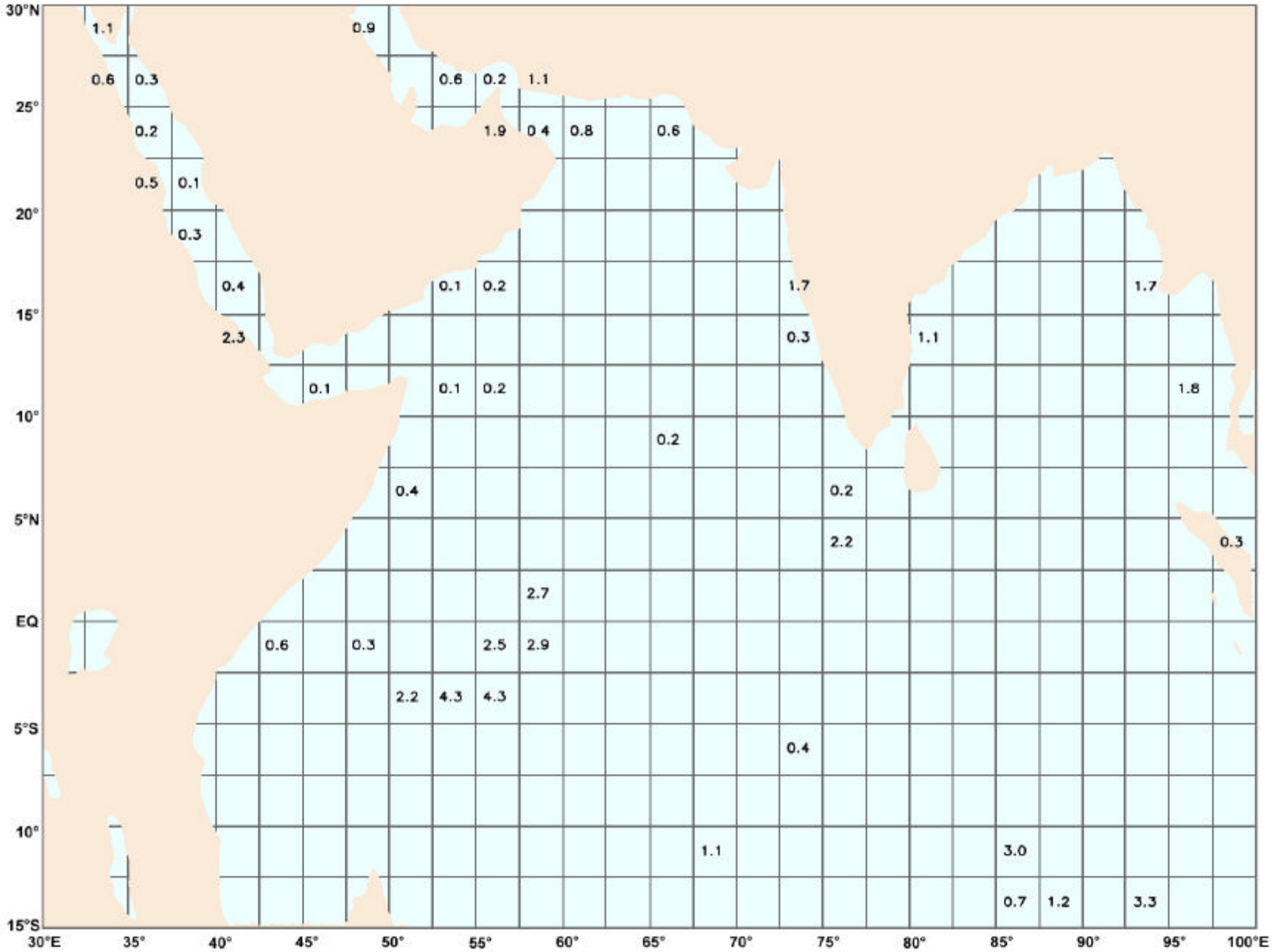
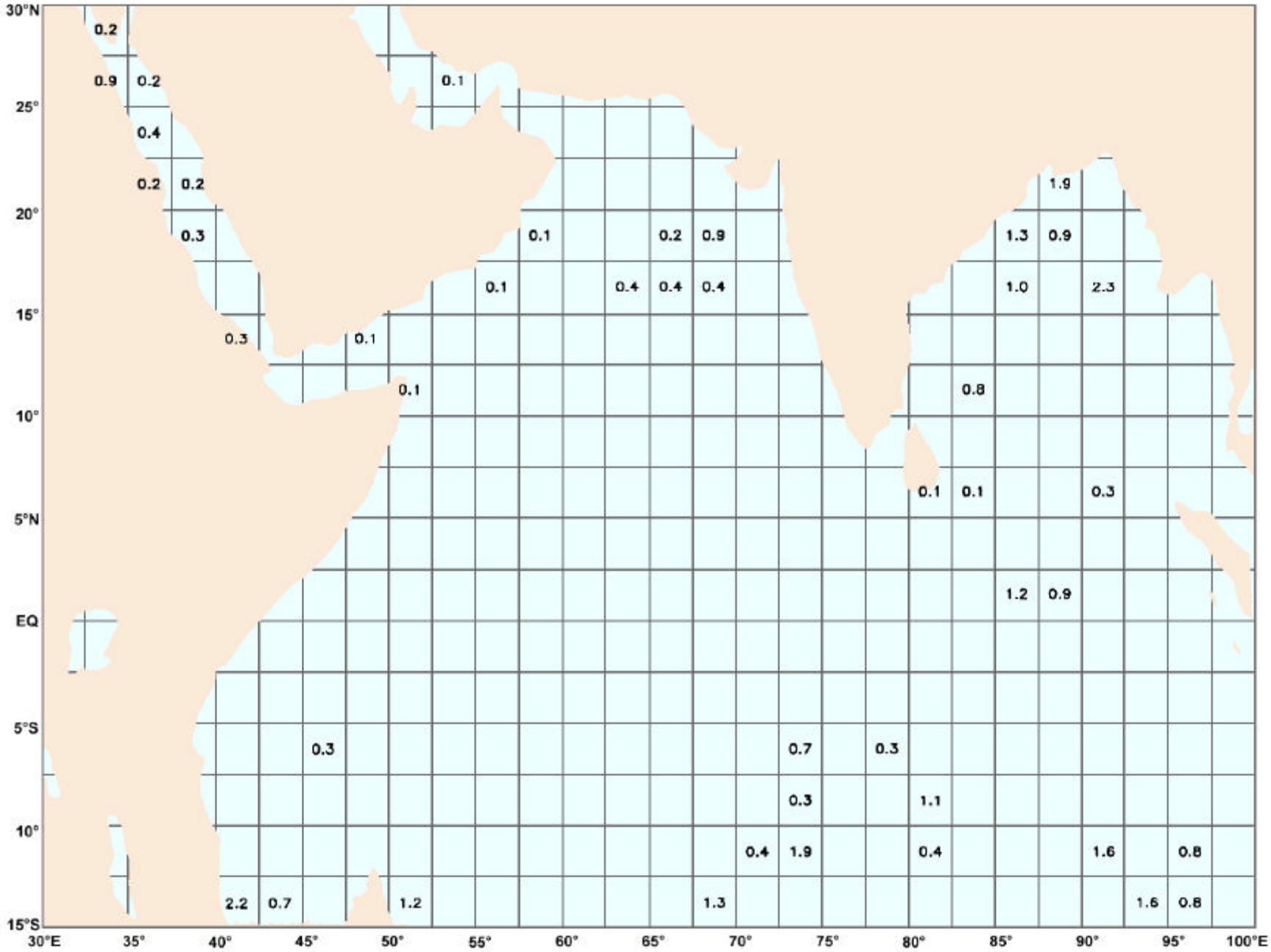
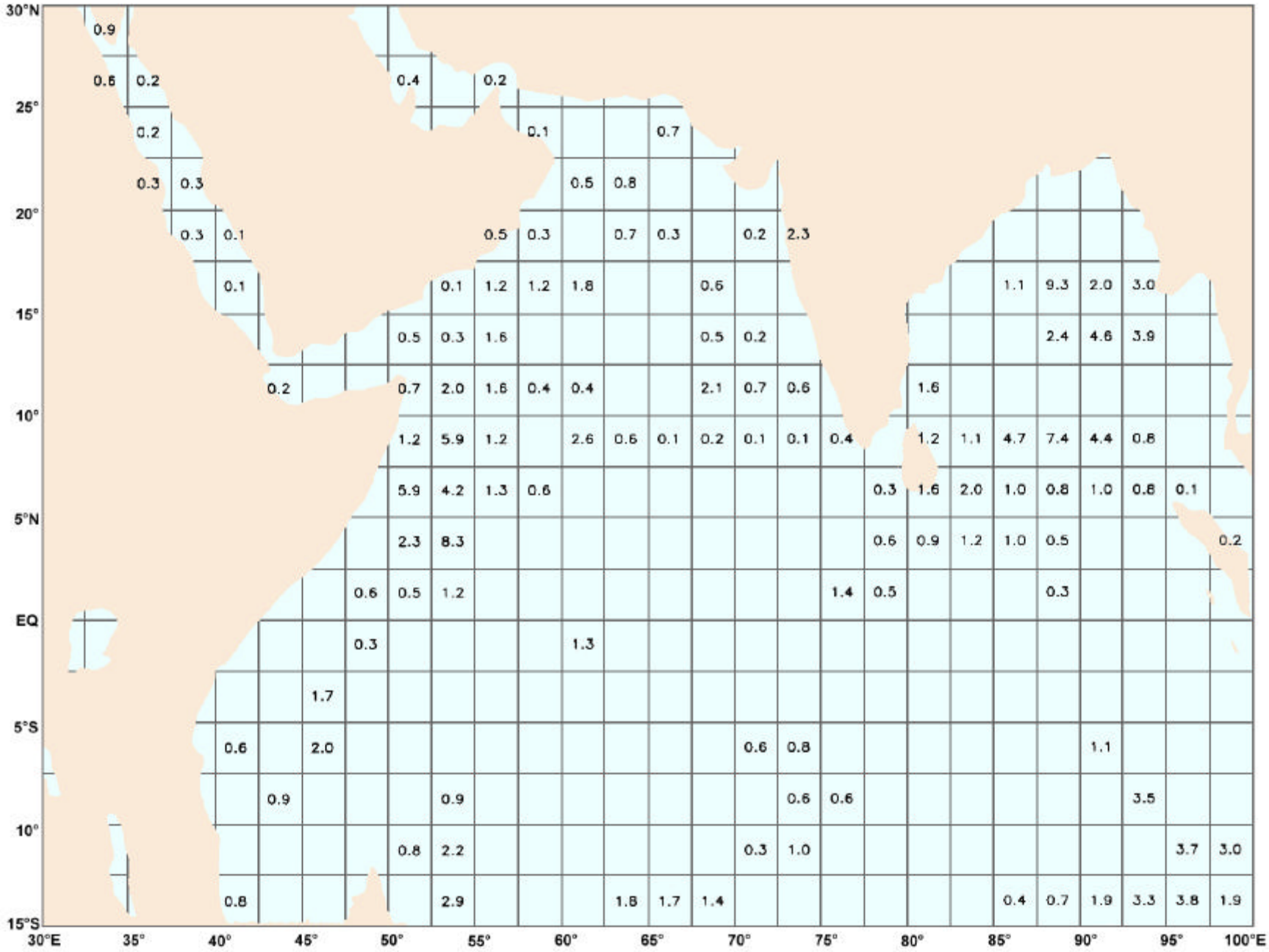


CHART NO.12.4 WAVE HEIGHT >4.0m (%) APRIL

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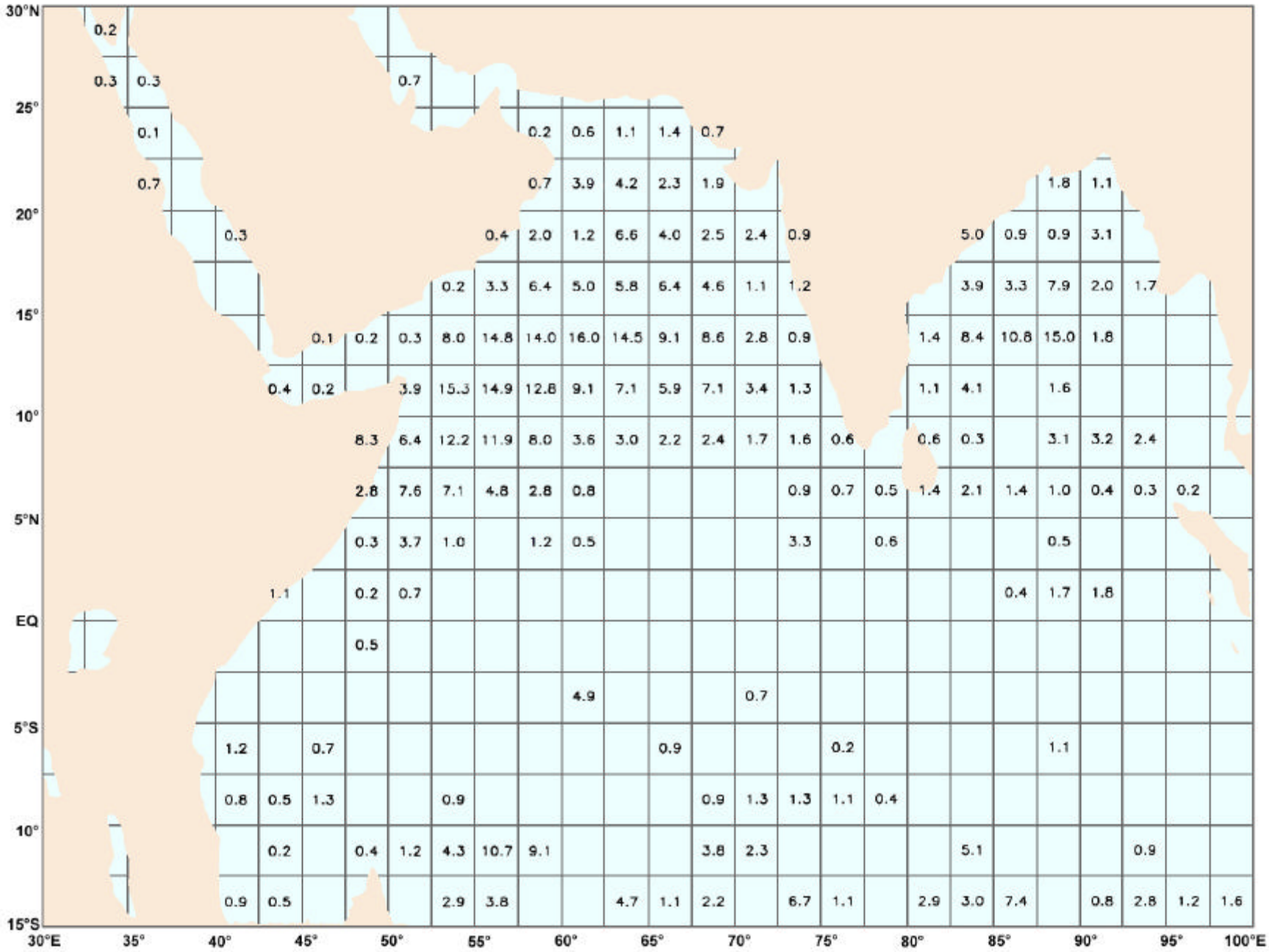
90°
95°
100°E
0.9
0.6 0.2
0.2
0.3 0.3
0.3 0.1
0.1
0.2
0.4 0.2
0.1 0.7
0.5 0.8
0.5 0.3 0.7 0.3 0.2 2.3
0.1 1.2 1.2 1.8 0.6
0.5 0.3 1.6 0.5 0.2
0.7 2.0 1.6 0.4 0.4 2.1 0.7 0.6
1.2 5.9 1.2 2.6 0.6 0.1 0.2 0.1 0.1 0.4
5.9 4.2 1.3 0.6 0.3 1.6 2.0 1.0 0.8 1.0 0.8 0.1
2.3 8.3 0.6 0.9 1.2 1.0 0.5 0.2
0.6 0.5 1.2 1.4 0.5 0.3
0.3 1.3
1.7
0.6 2.0 0.6 0.8 1.1
0.9 0.9 0.6 0.6 3.5
0.8 2.2 0.3 1.0 3.7 3.0
0.8 2.9 1.8 1.7 1.4 0.4 0.7 1.9 3.3 3.8 1.9
1.1 9.3 2.0 3.0
2.4 4.6 3.9
1.6
1.2 1.1 4.7 7.4 4.4 0.8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85°
90°
95°
100°E

CHART NO.12.7 WAVE HEIGHT >4.0 (%) JULY

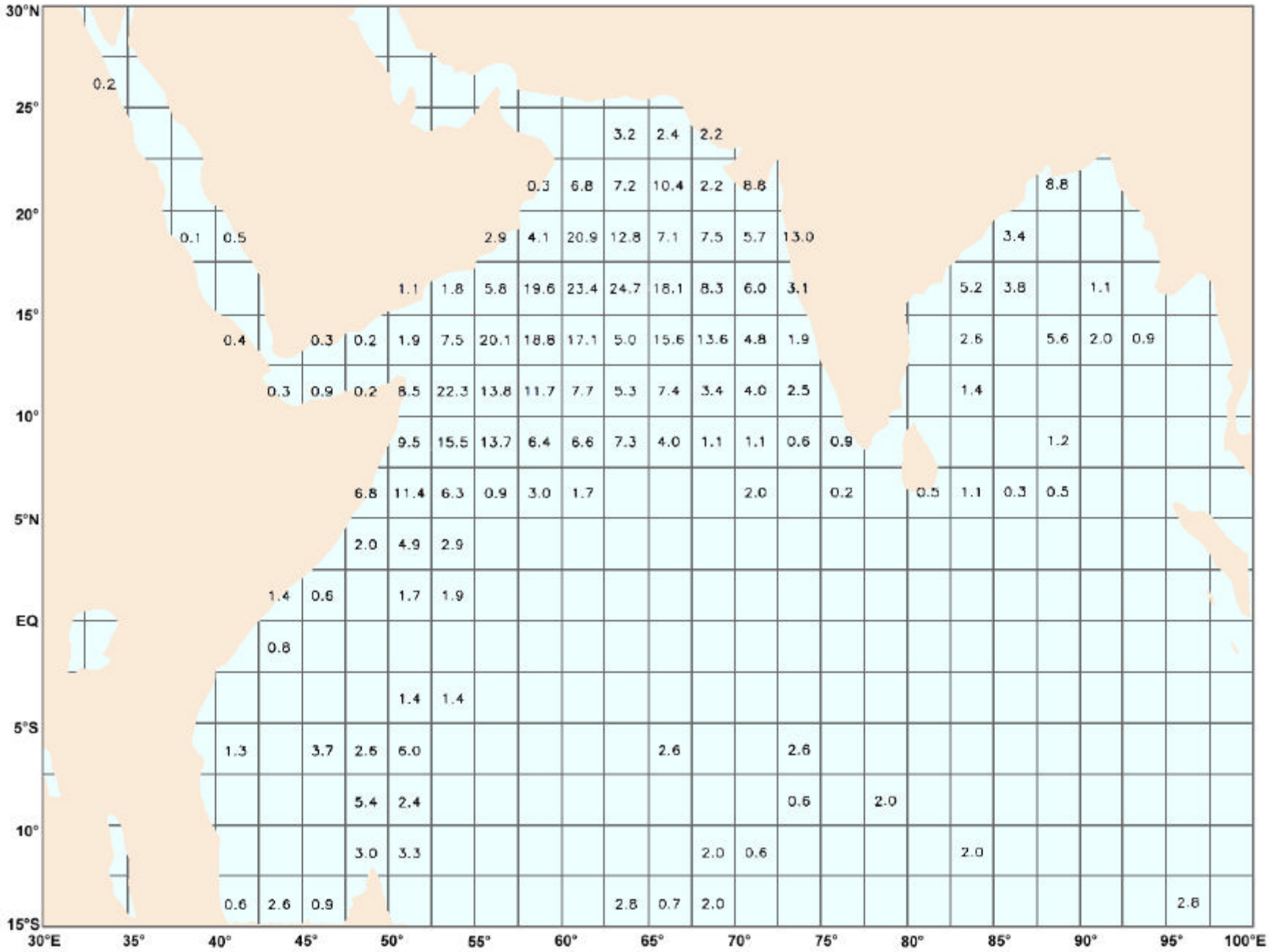
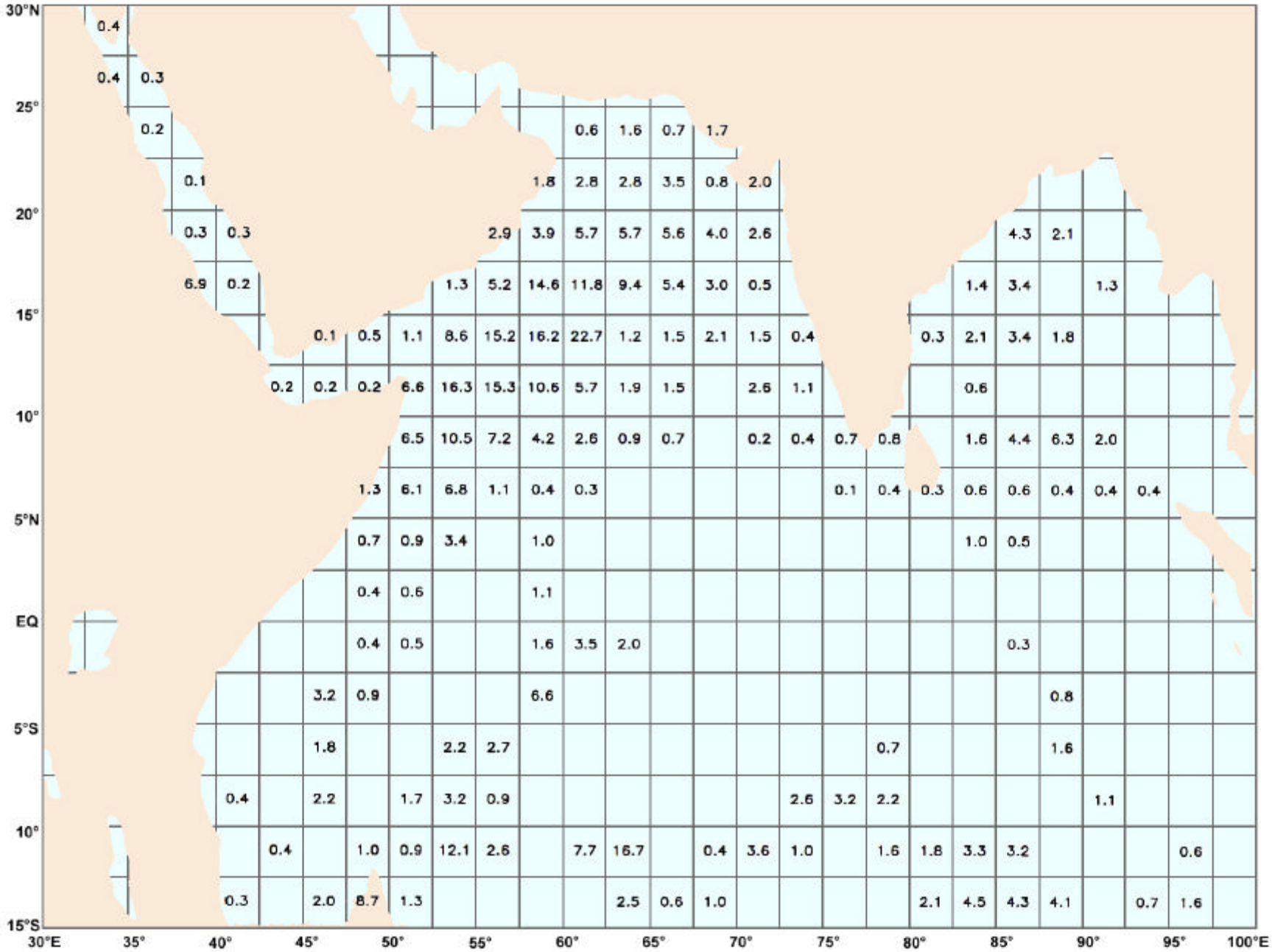
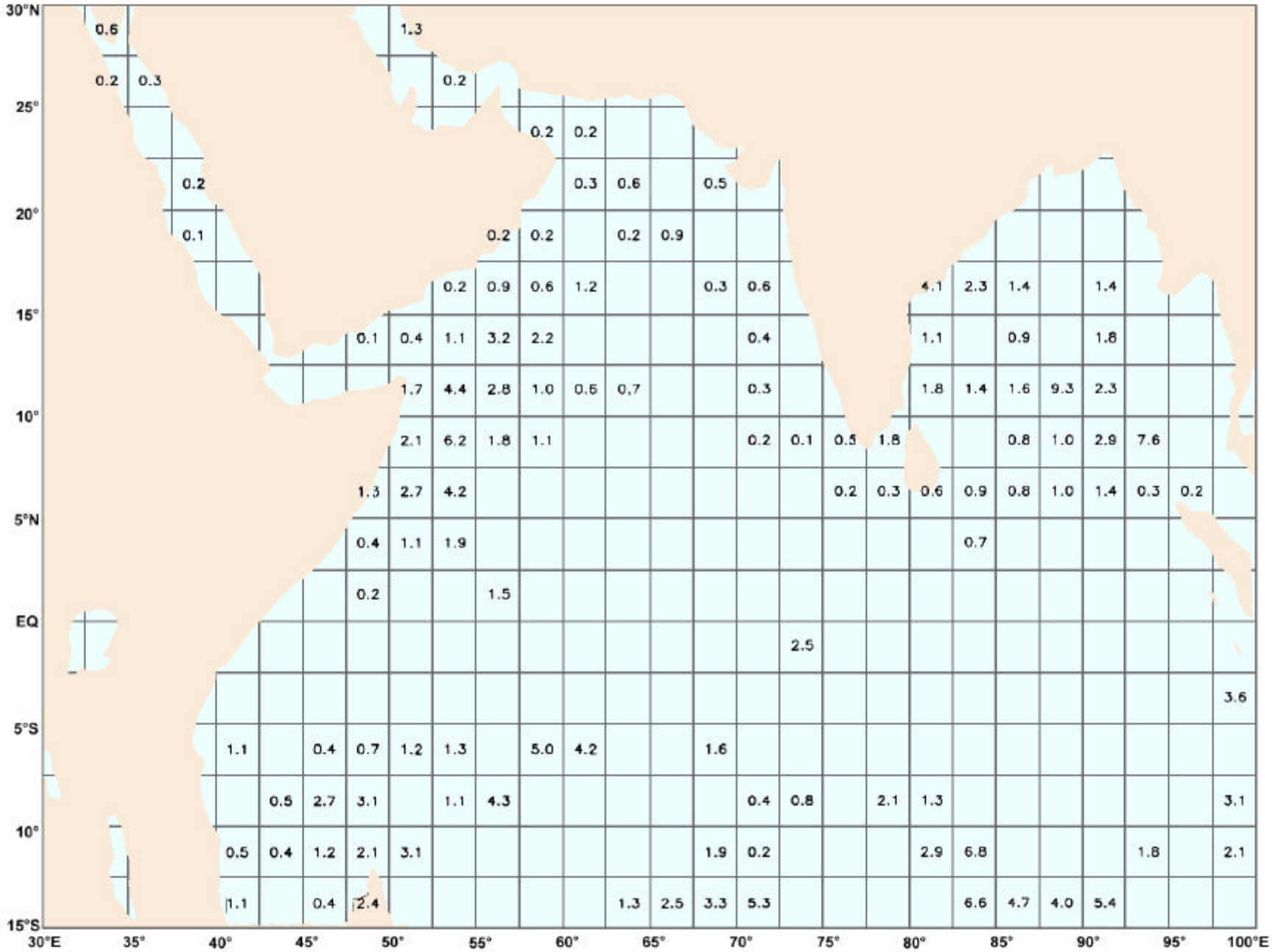


CHART NO.12.8 WAVE HEIGHT >4.0 m (%) AUGUST

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100°E
0.6 1.3
0.2 0.3 0.2
0.2 0.2
0.2 0.3 0.6 0.5
0.1 0.2 0.2 0.2 0.9
0.2 0.9 0.6 1.2 0.3 0.6 4.1 2.3 1.4 1.4
0.1 0.4 1.1 3.2 2.2 0.4 1.1 0.9 1.8
1.7 4.4 2.8 1.0 0.6 0.7 0.3 1.8 1.4 1.6 9.3 2.3
2.1 6.2 1.8 1.1 0.2 0.1 0.5 1.8 0.8 1.0 2.9 7.6
1.3 2.7 4.2 0.2 0.3 0.6 0.9 0.8 1.0 1.4 0.3 0.2
0.4 1.1 1.9 0.7
0.2 1.5
2.5
3.6
1.1 0.4 0.7 1.2 1.3 5.0 4.2 1.6
0.5 2.7 3.1 1.1 4.3 0.4 0.8 2.1 1.3 3.1
0.5 0.4 1.2 2.1 3.1 1.9 0.2 2.9 6.8 1.8 2.1
1.1 0.4 2.4 1.3 2.5 3.3 5.3 6.6 4.7 4.0 5.4

CHART NO.12.10 WAVE HEIGHT > 4.0m (%) OCTOBER

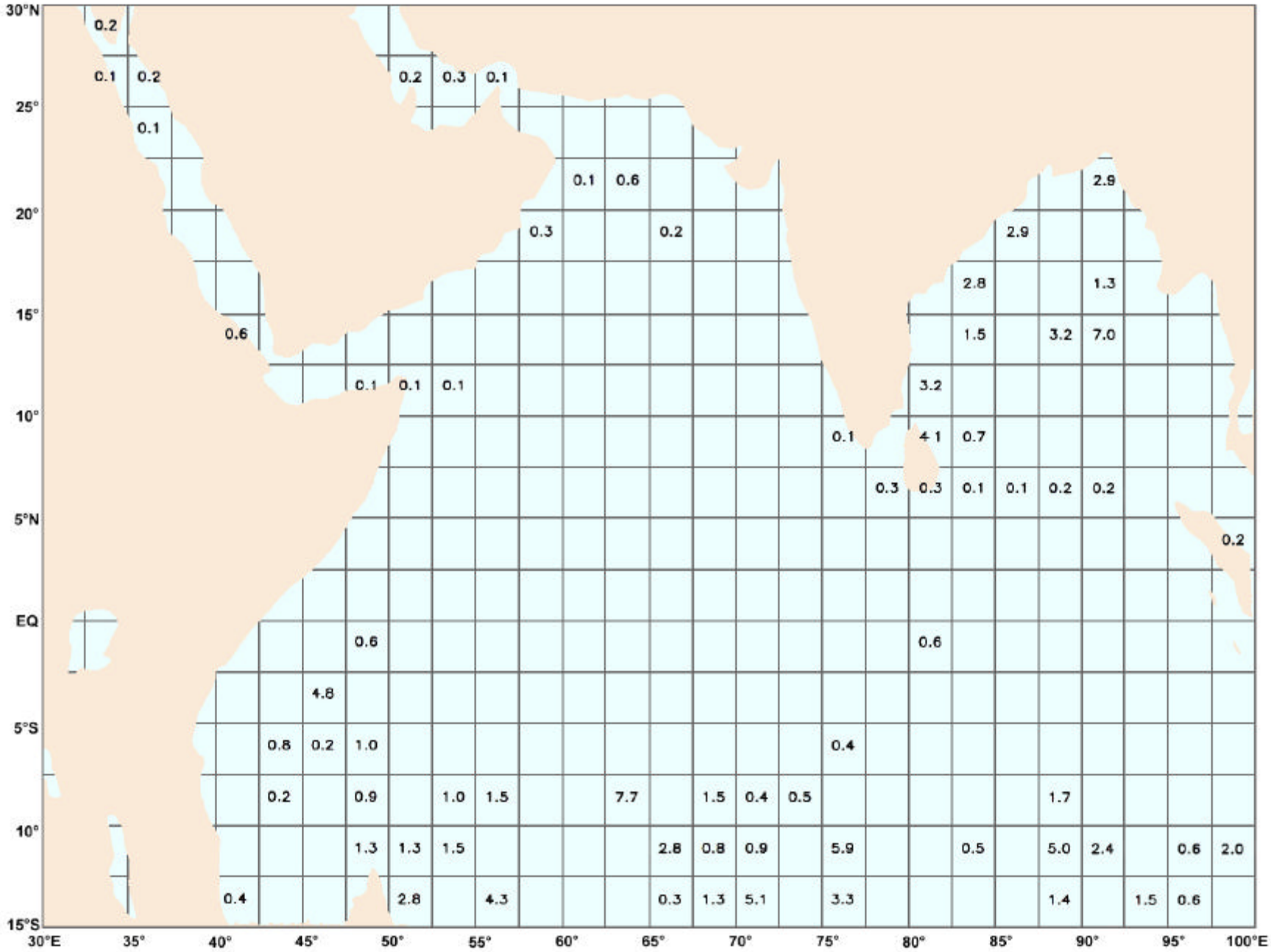


CHART NO.12.11 WAVE HEIGHT > 4.0m (%) NOVEMBER

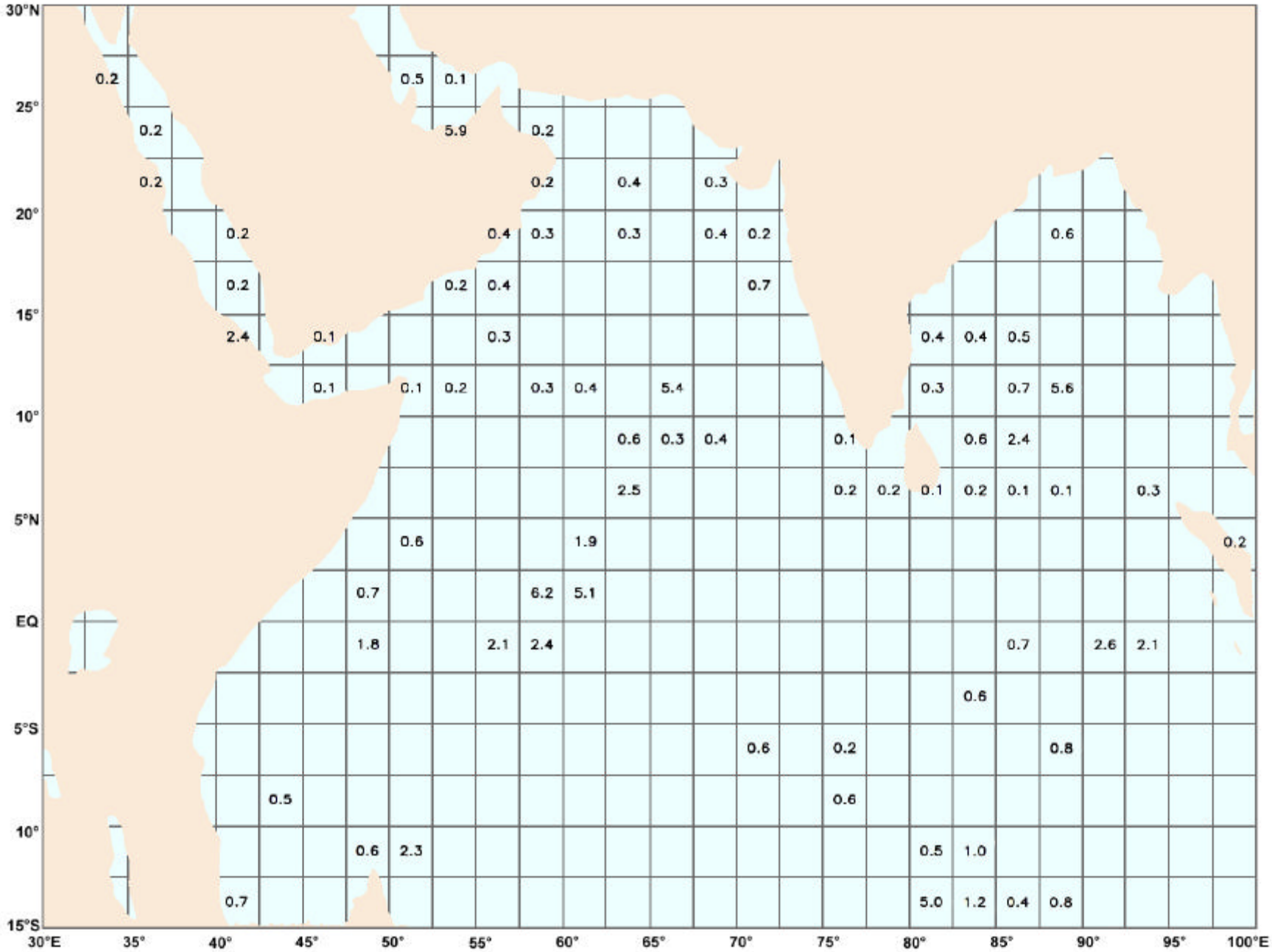


CHART NO.12.12 WAVE HEIGHT > 4.0m (%) DECEMBER

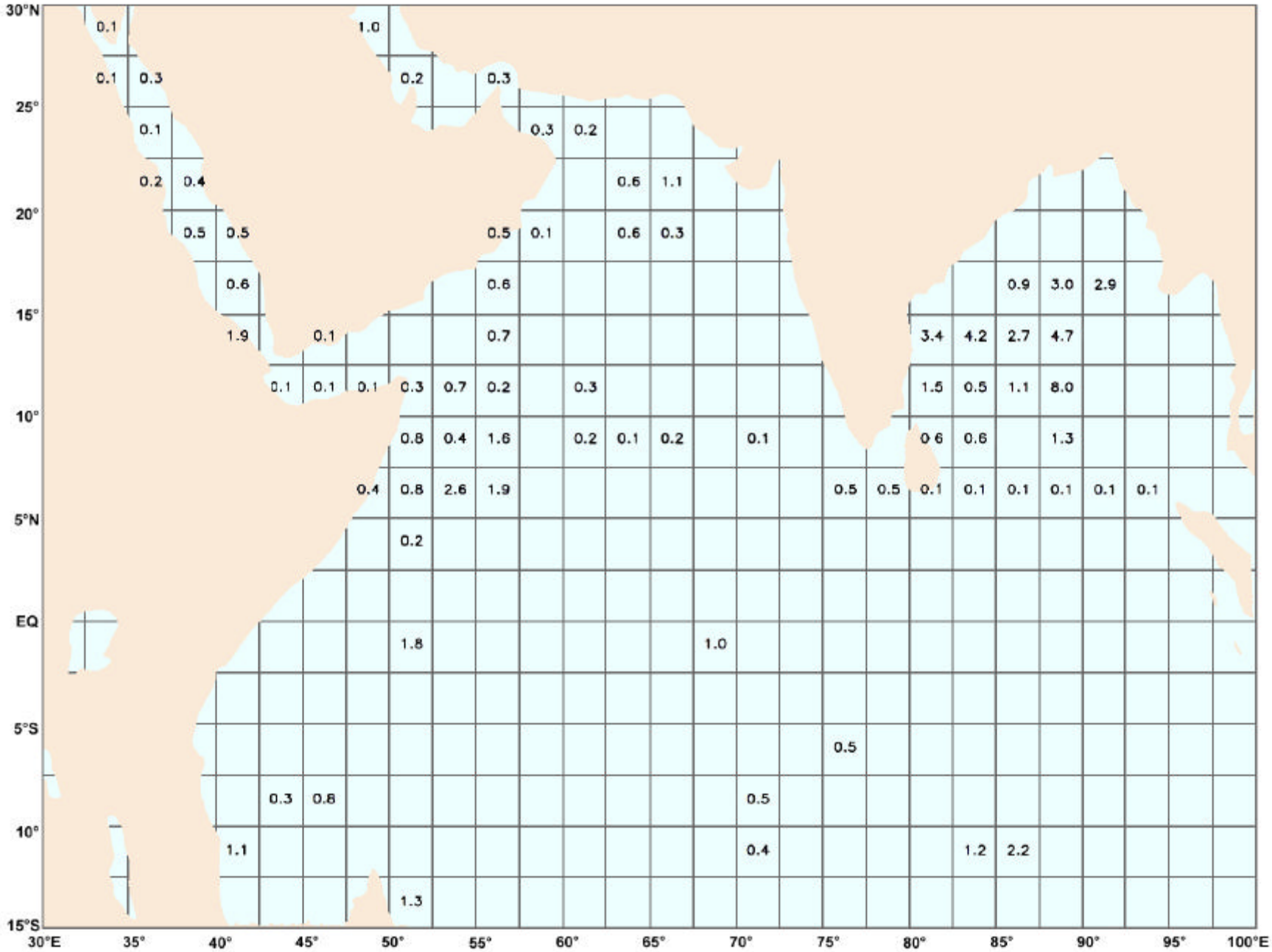


CHART NO.13.1 MAXIMUM WAVE HEIGHT (m) JANUARY

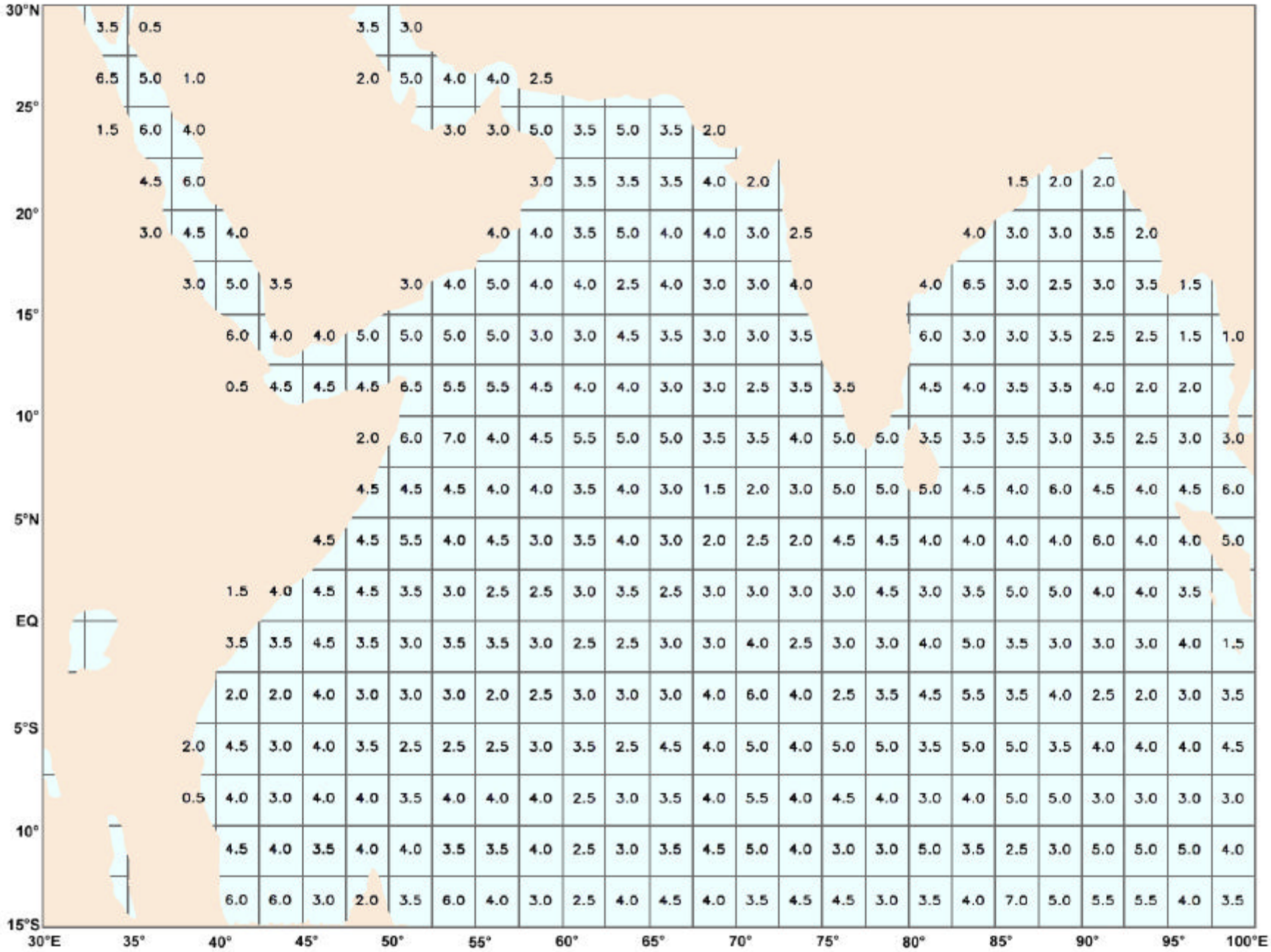


CHART NO.13.2 MAXIMUM WAVE HEIGHT (m) FEBRUARY

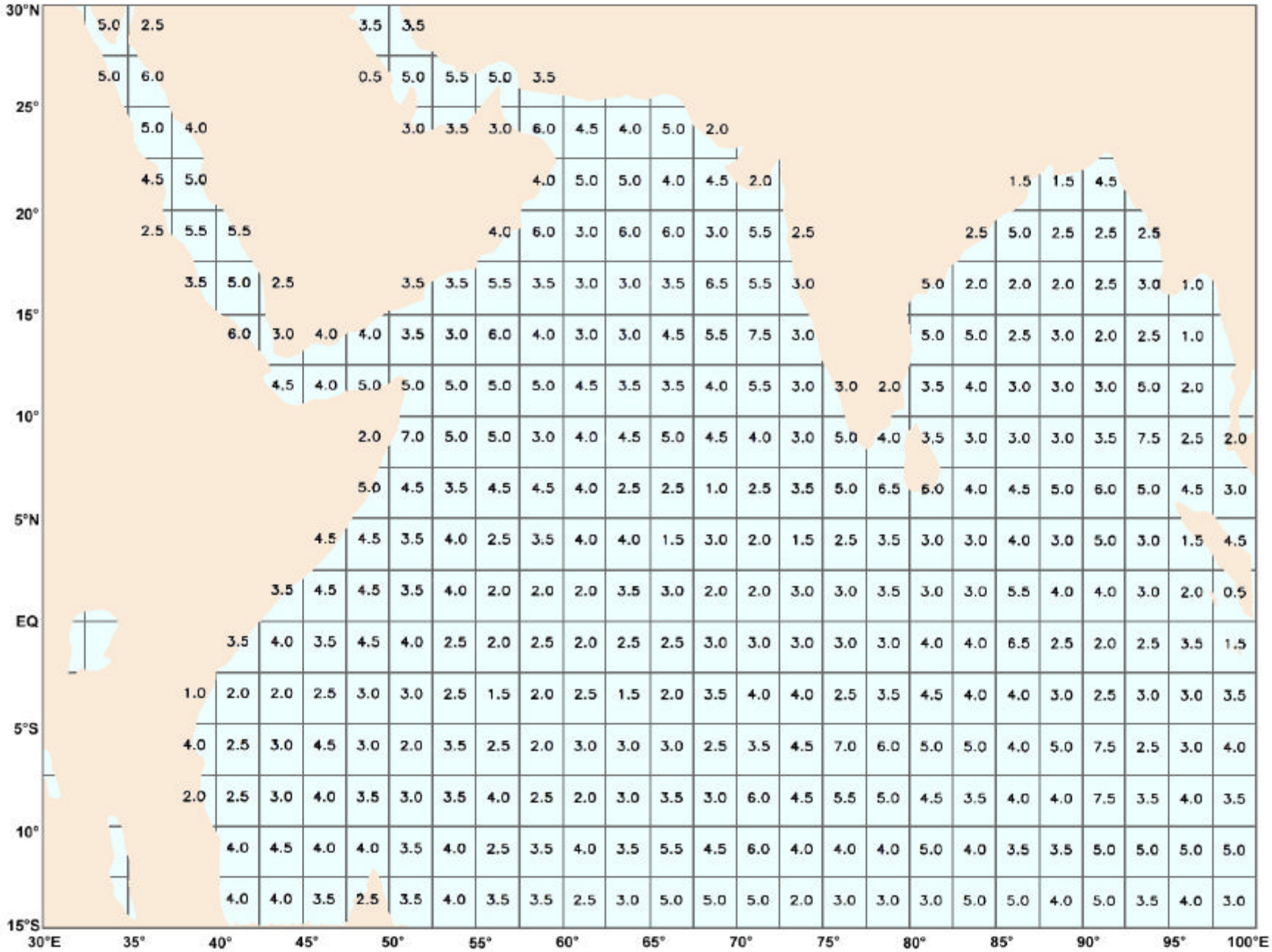


CHART NO.13.3 MAXIMUM WAVE HEIGHT (m) MARCH

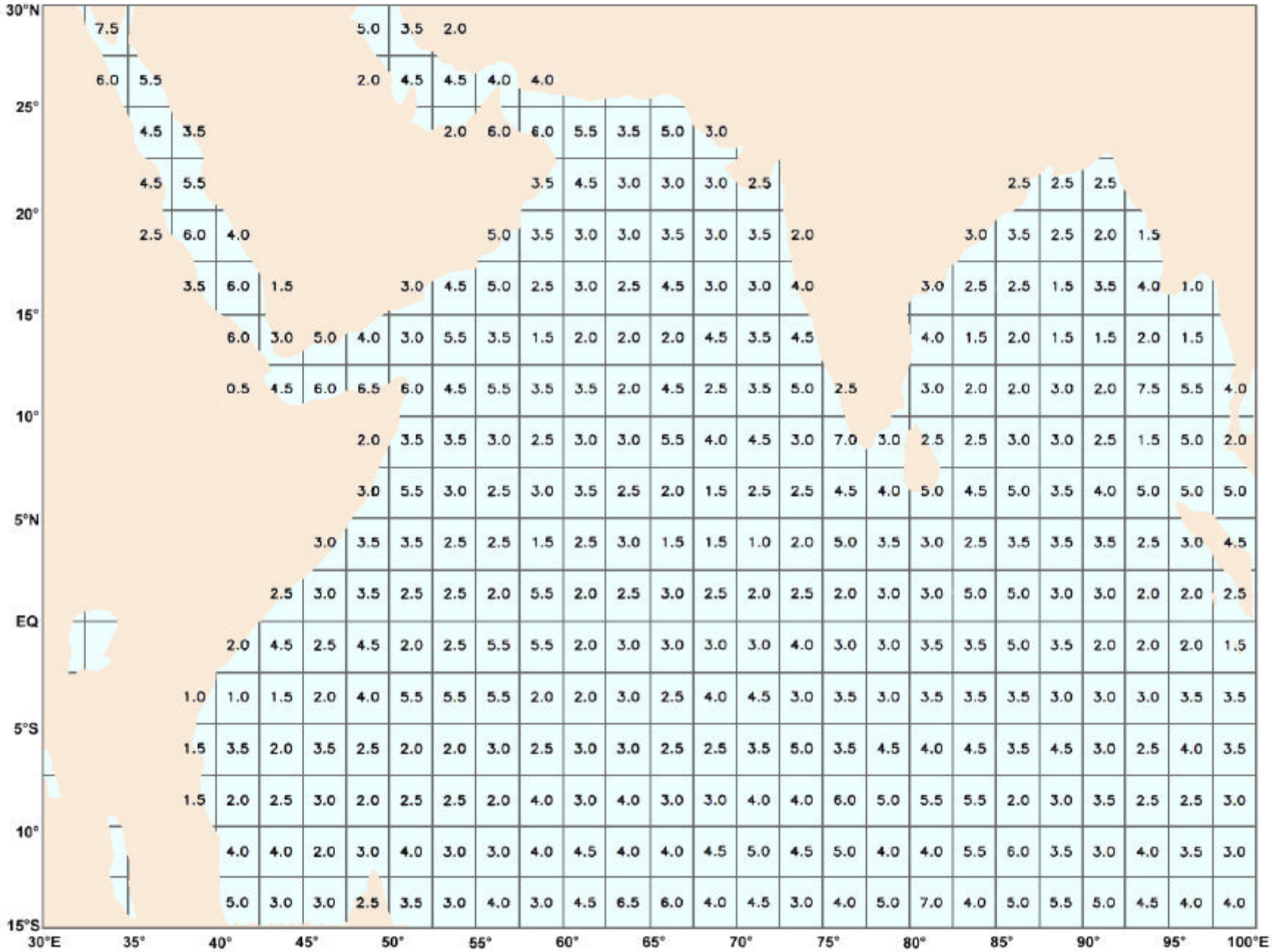
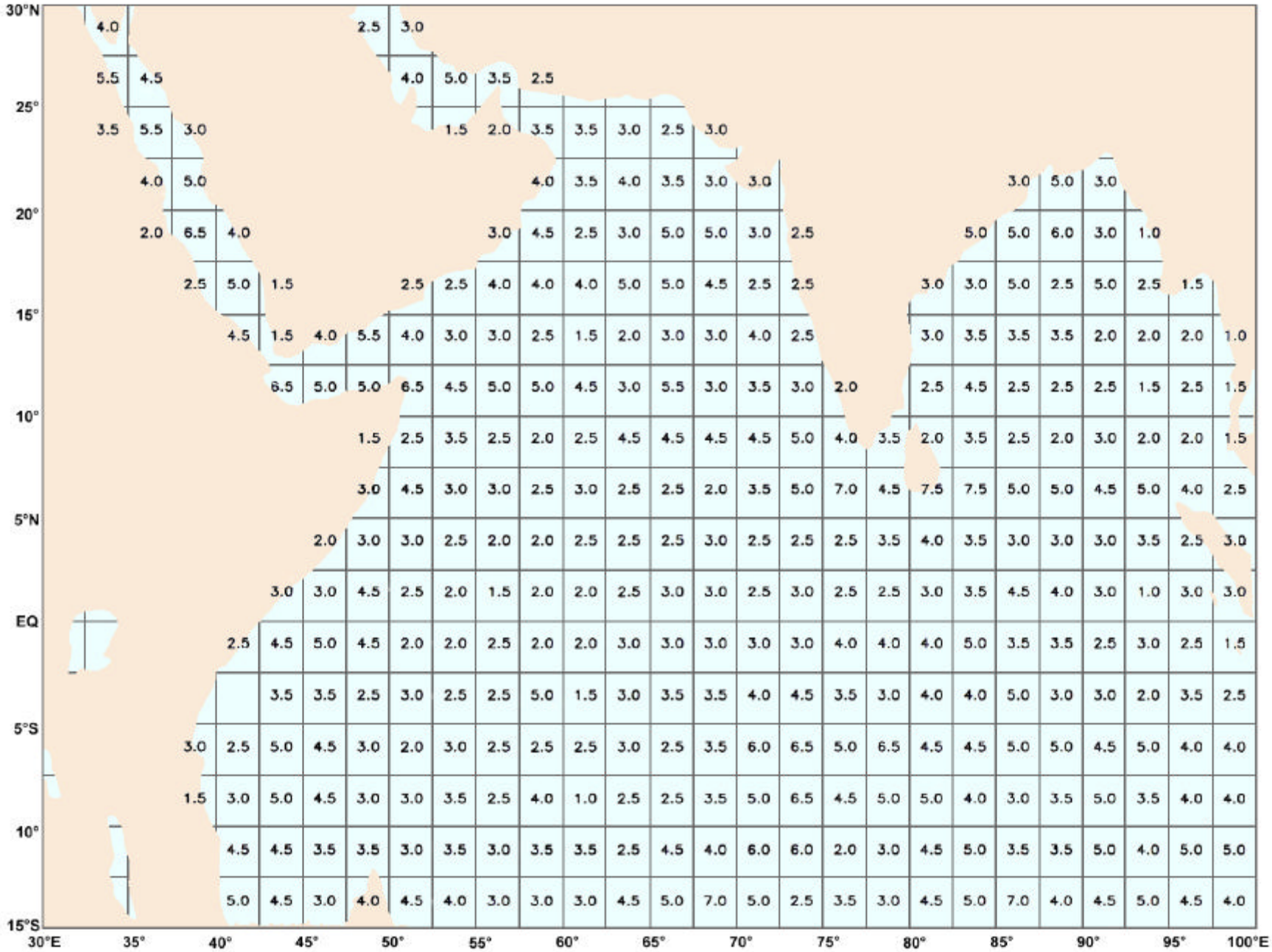


CHART NO.13.4 MAXIMUM WAVE HEIGHT (m) APRIL



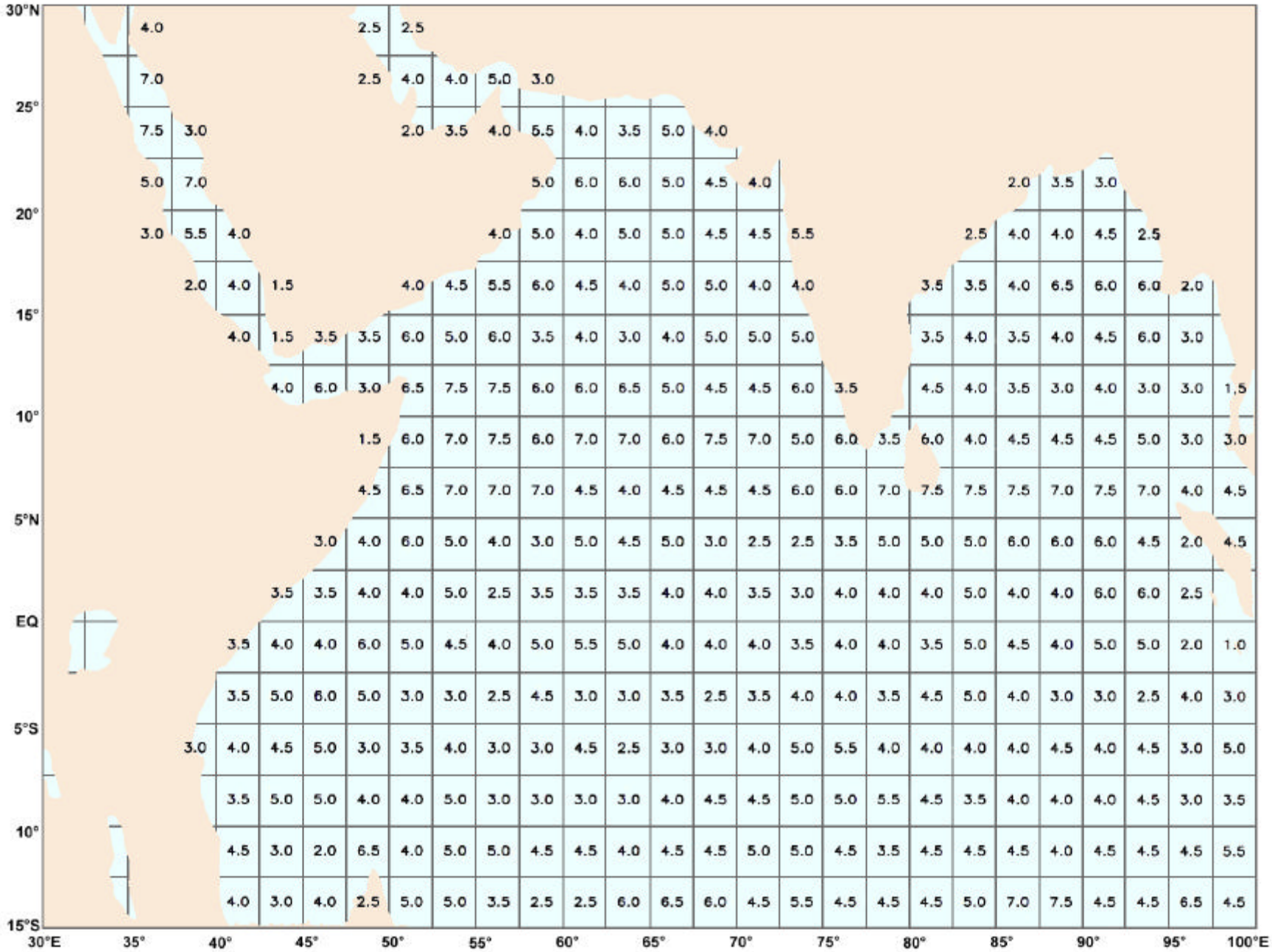

30°N
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CHART NO.13.6 MAXIMUM WAVE HEIGHT (m) JUNE

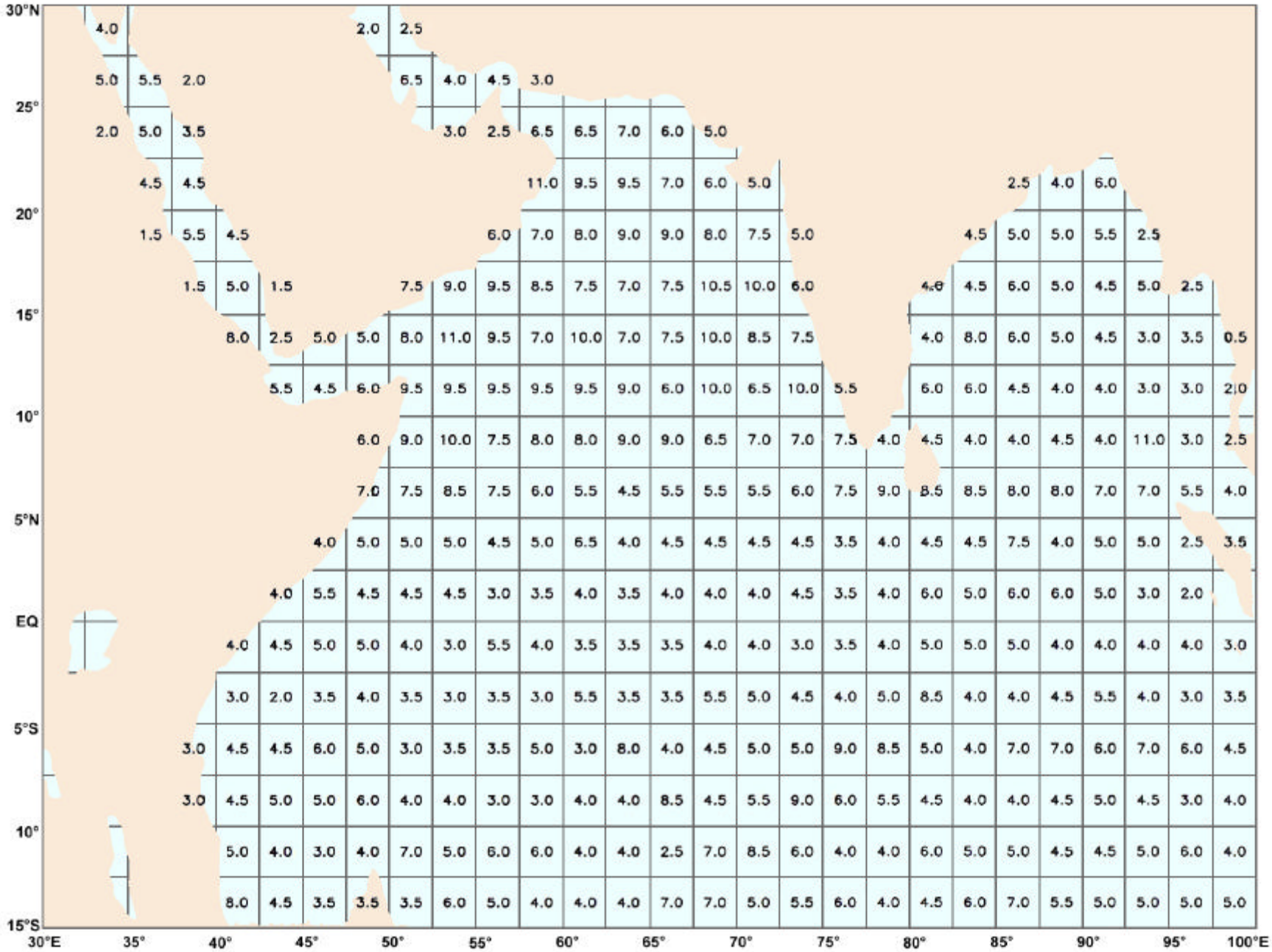
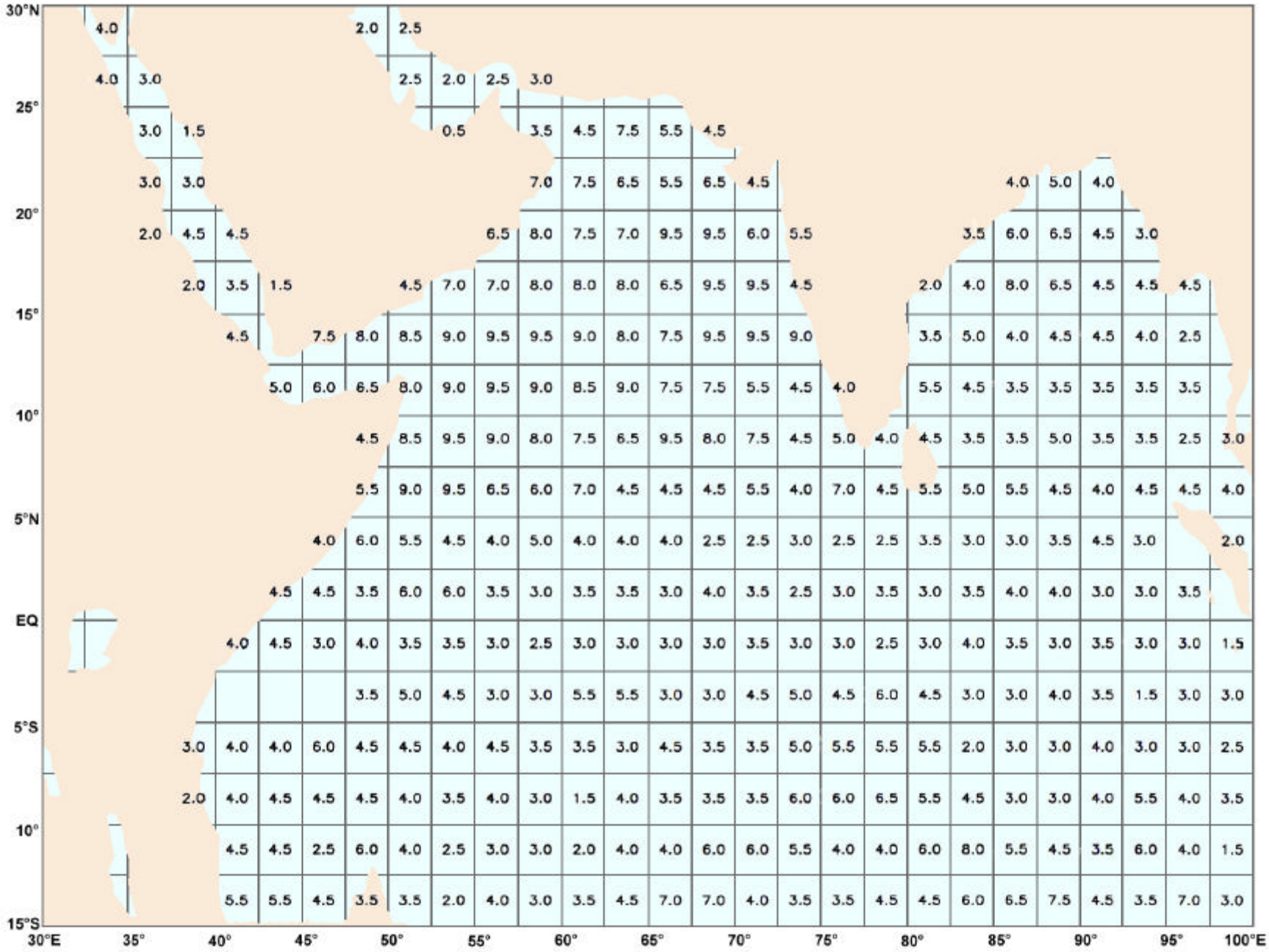
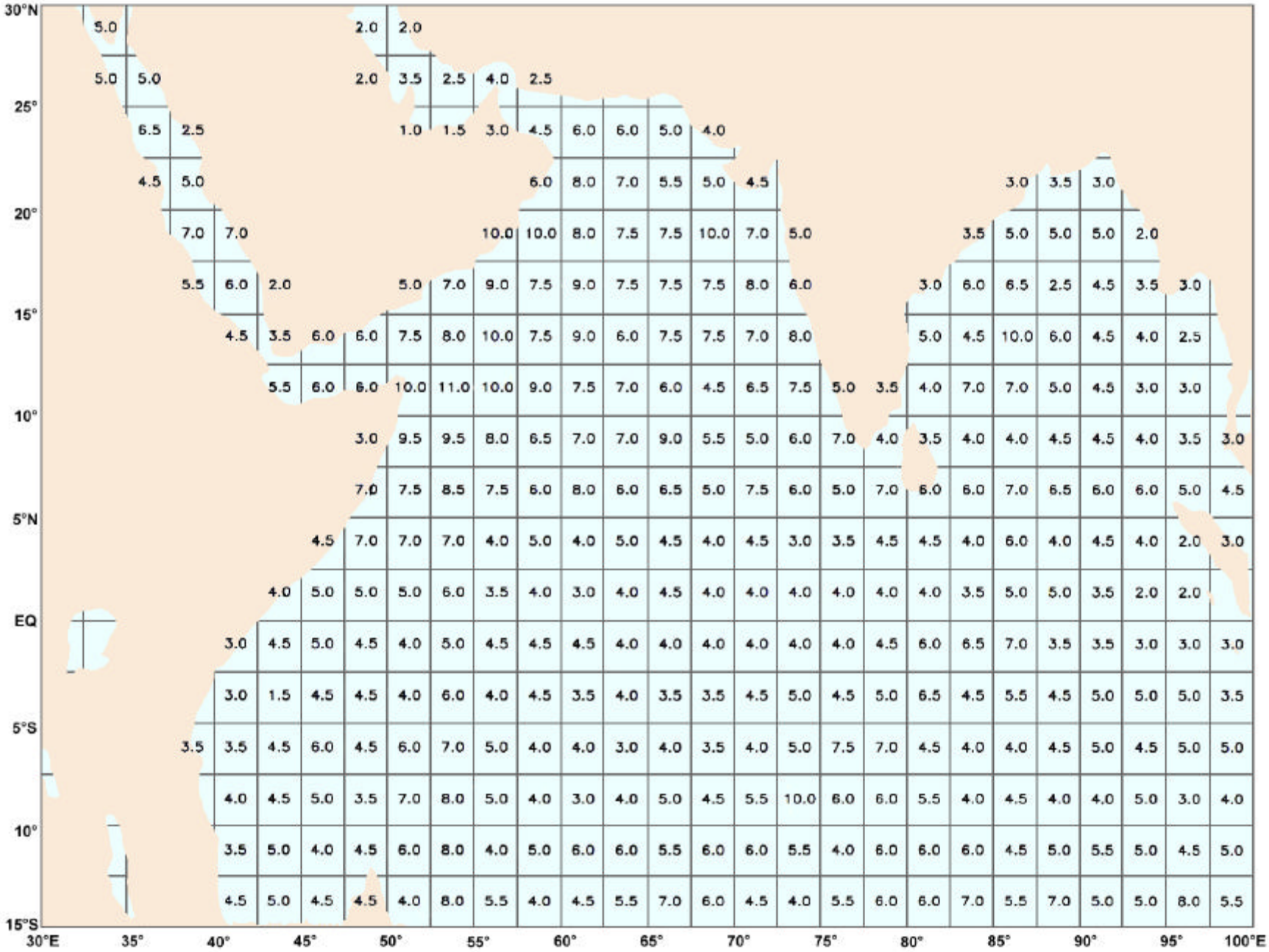


CHART NO.13.7 MAXIMUM WAVE HEIGHT (m) JULY

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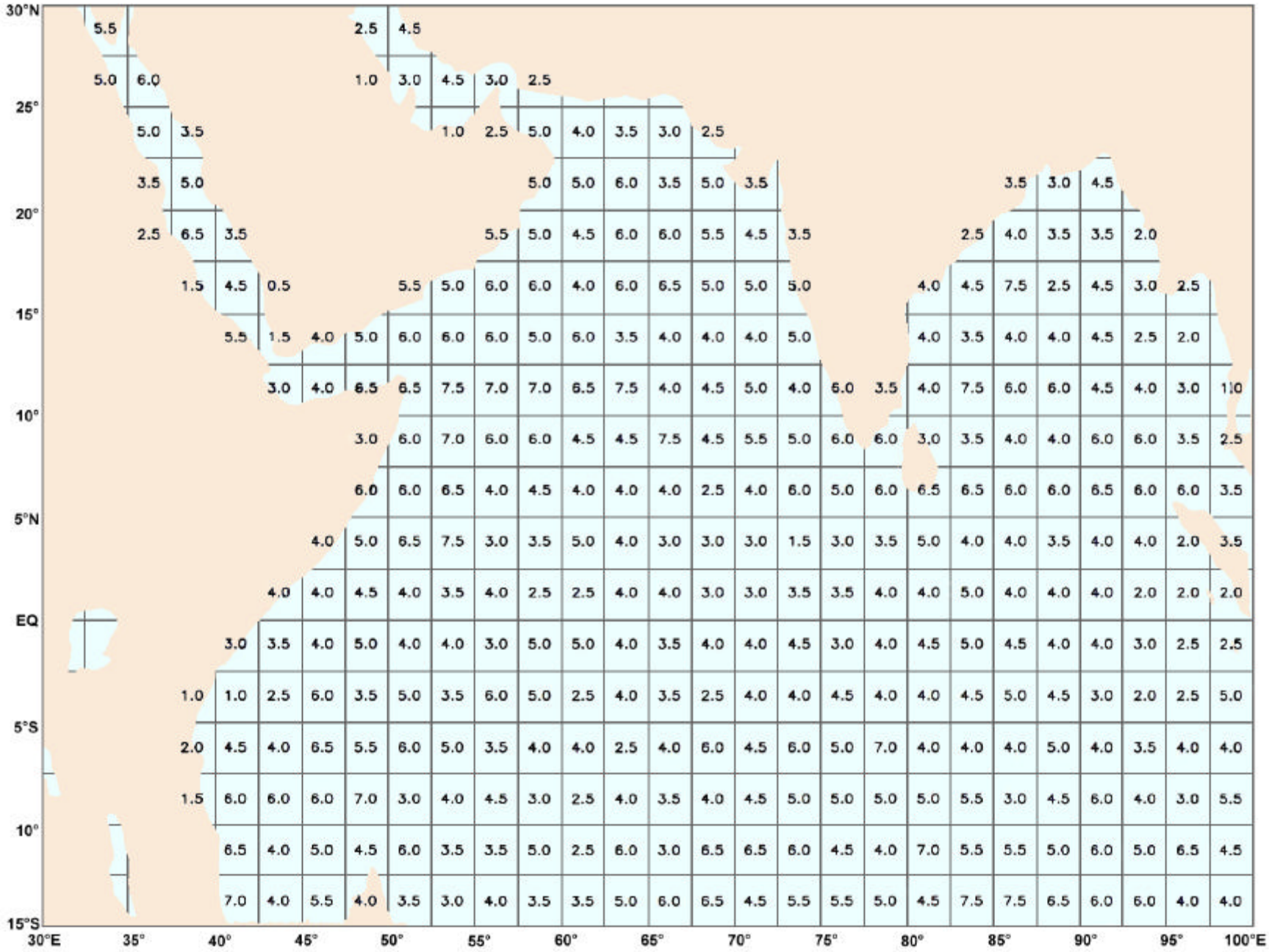
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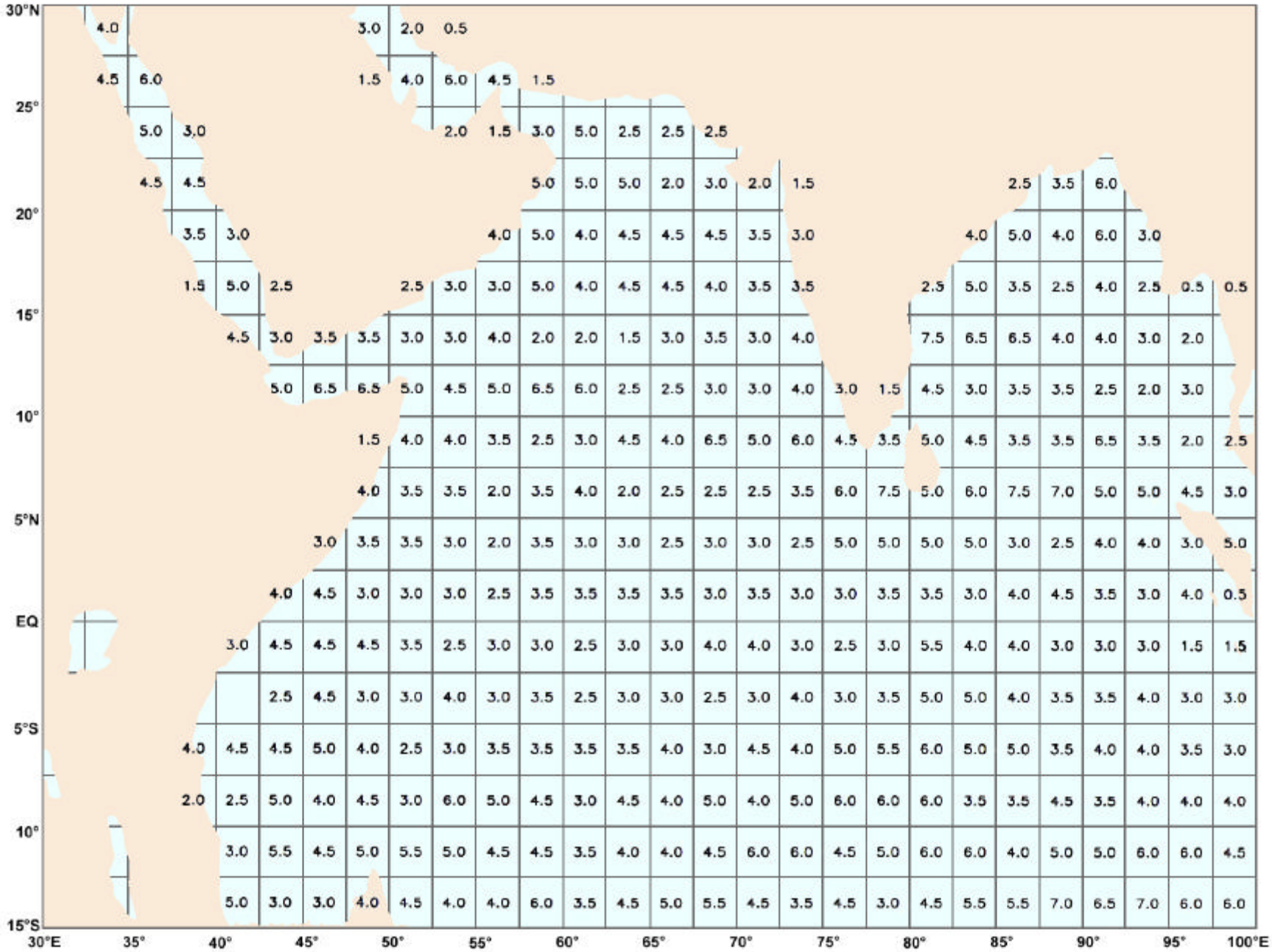
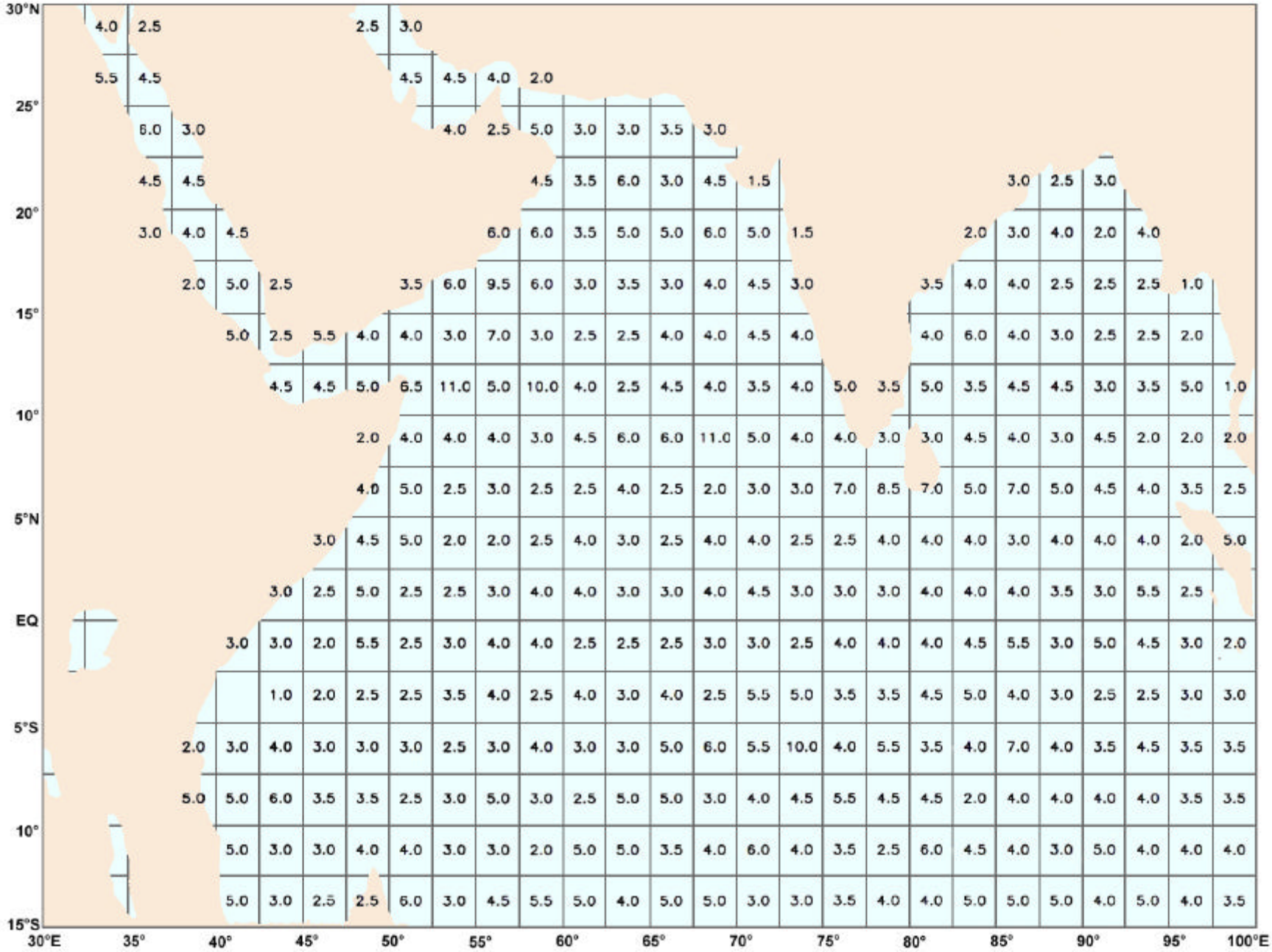
CHART NO.13.10 MAXIMUM WAVE HEIGHT (m) OCTOBER

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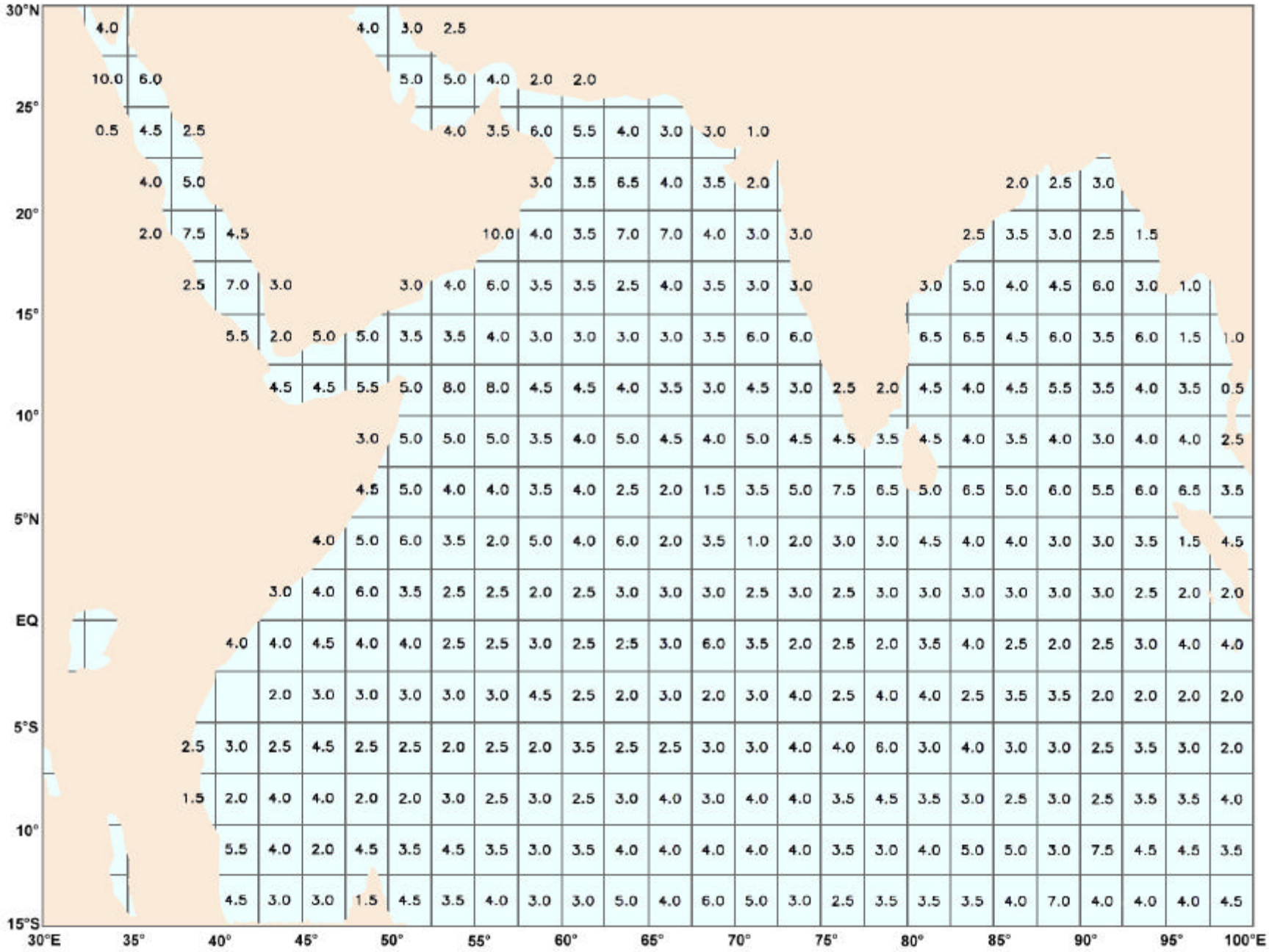
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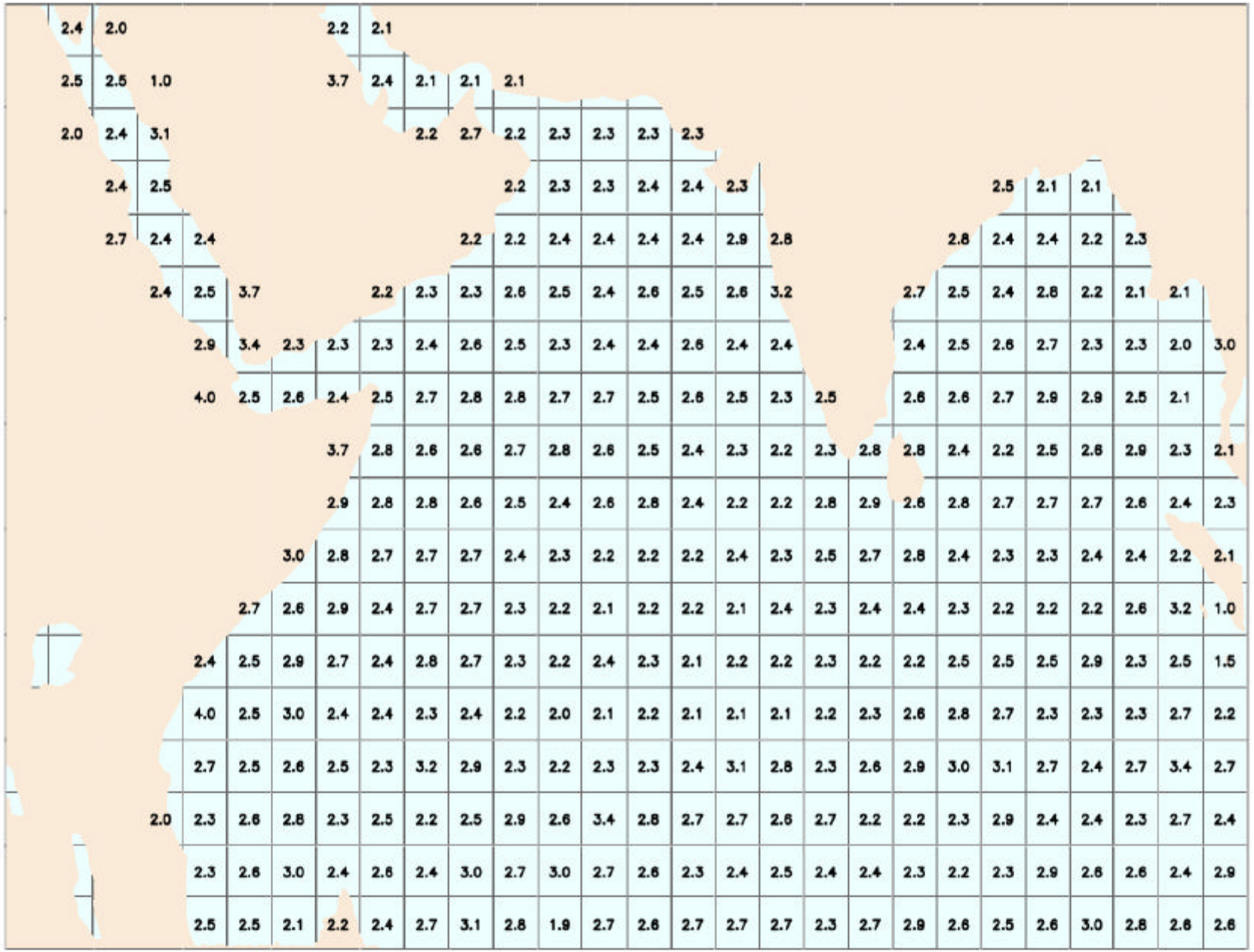
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2.7 2.6 2.9 2.4 2.7 2.7 2.3 2.2 2.1 2.2 2.2 2.1 2.4 2.3 2.4 2.4 2.3 2.2 2.2 2.2 2.6 3.2 1.0
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2.3 2.6 3.0 2.4 2.6 2.4 3.0 2.7 3.0 2.7 2.6 2.3 2.4 2.5 2.4 2.4 2.3 2.2 2.3 2.9 2.6 2.6 2.4 2.9
2.5 2.5 2.1 2.2 2.4 2.7 3.1 2.8 1.9 2.7 2.6 2.7 2.7 2.7 2.3 2.7 2.9 2.6 2.5 2.6 3.0 2.8 2.6 2.6

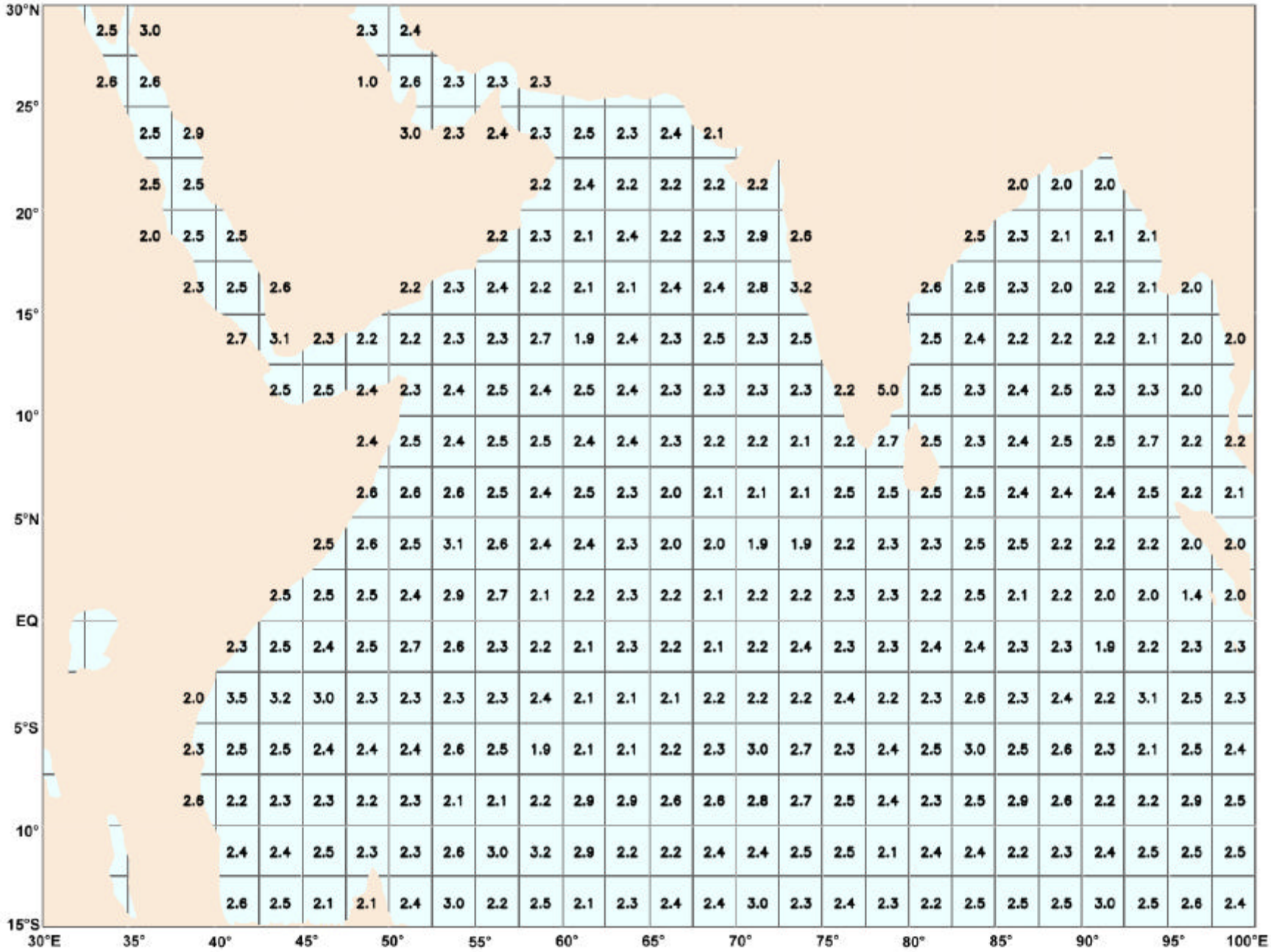
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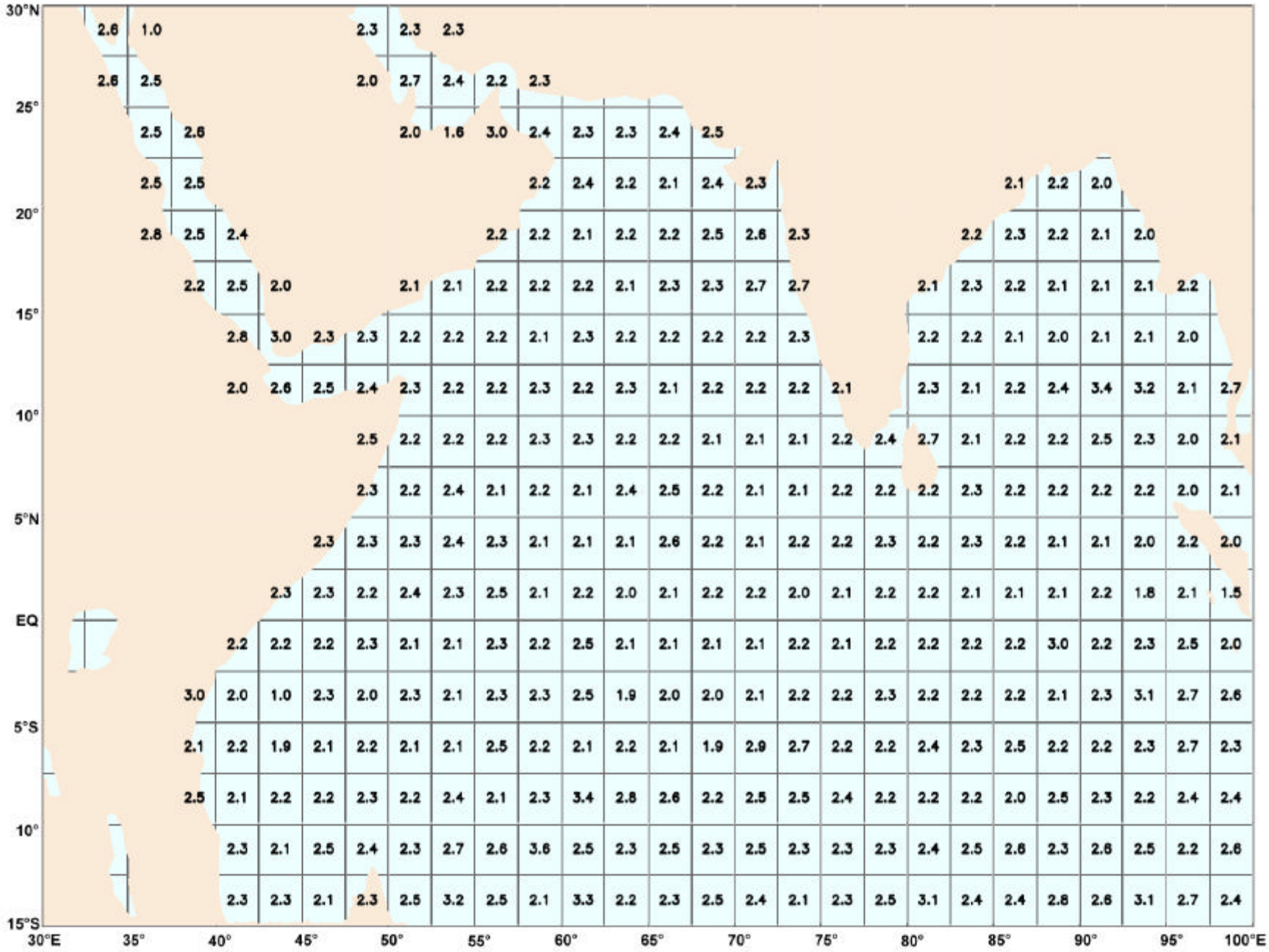
CHART NO. 14.3 MEAN WAVE PERIOD (sec) MARCH



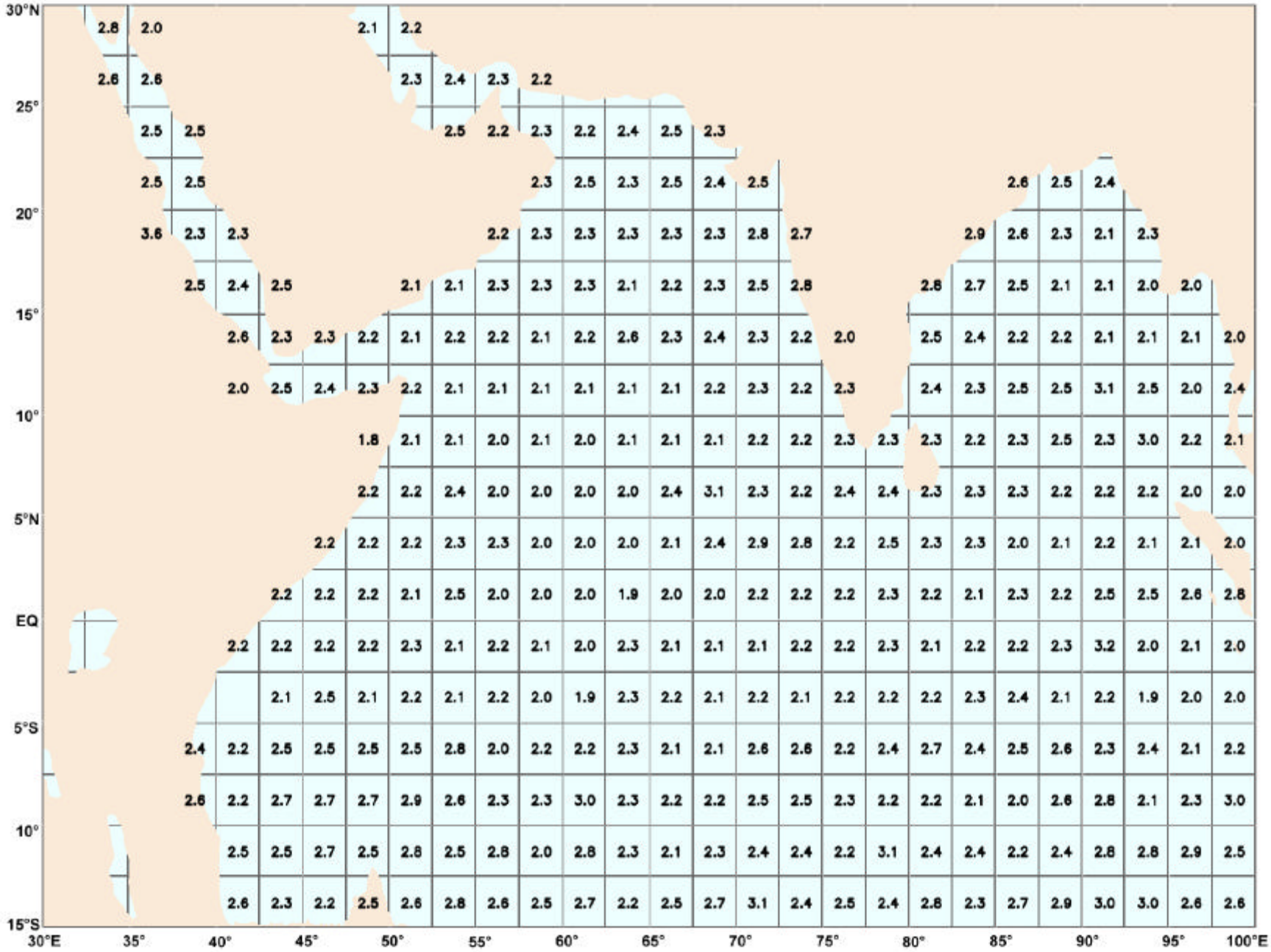

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CHART NO. 14.5 MEAN WAVE PERIOD (sec) MAY

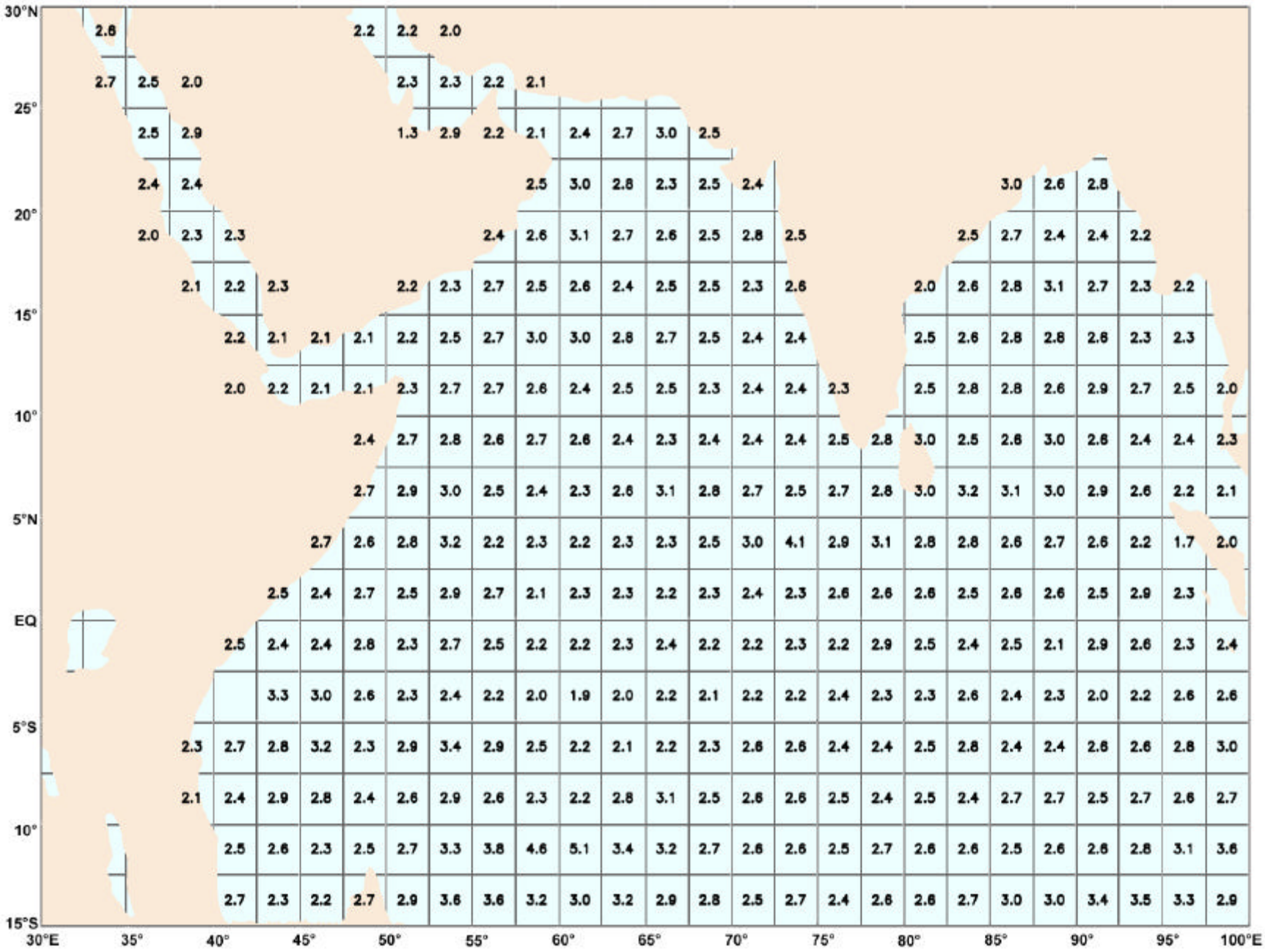
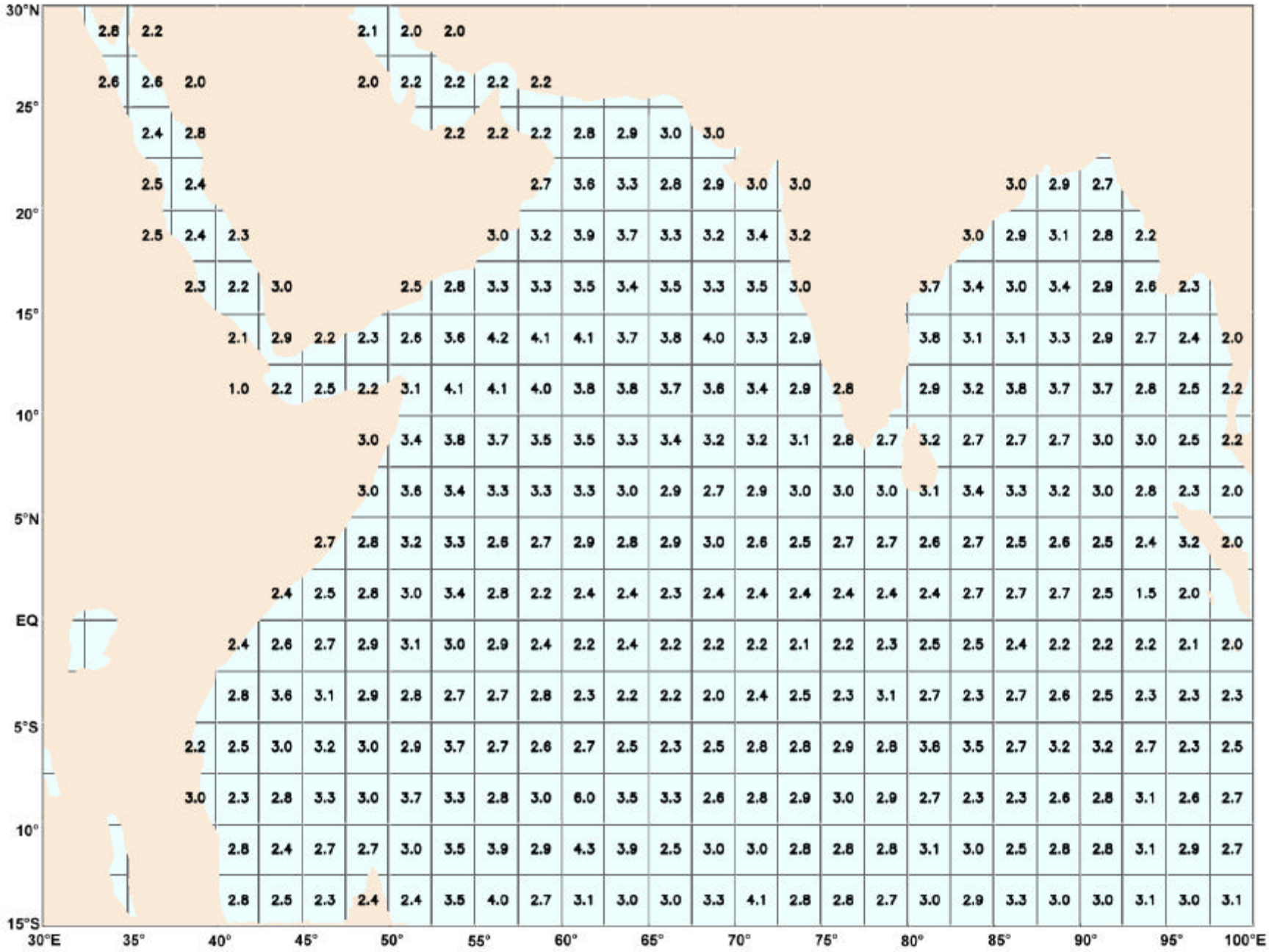
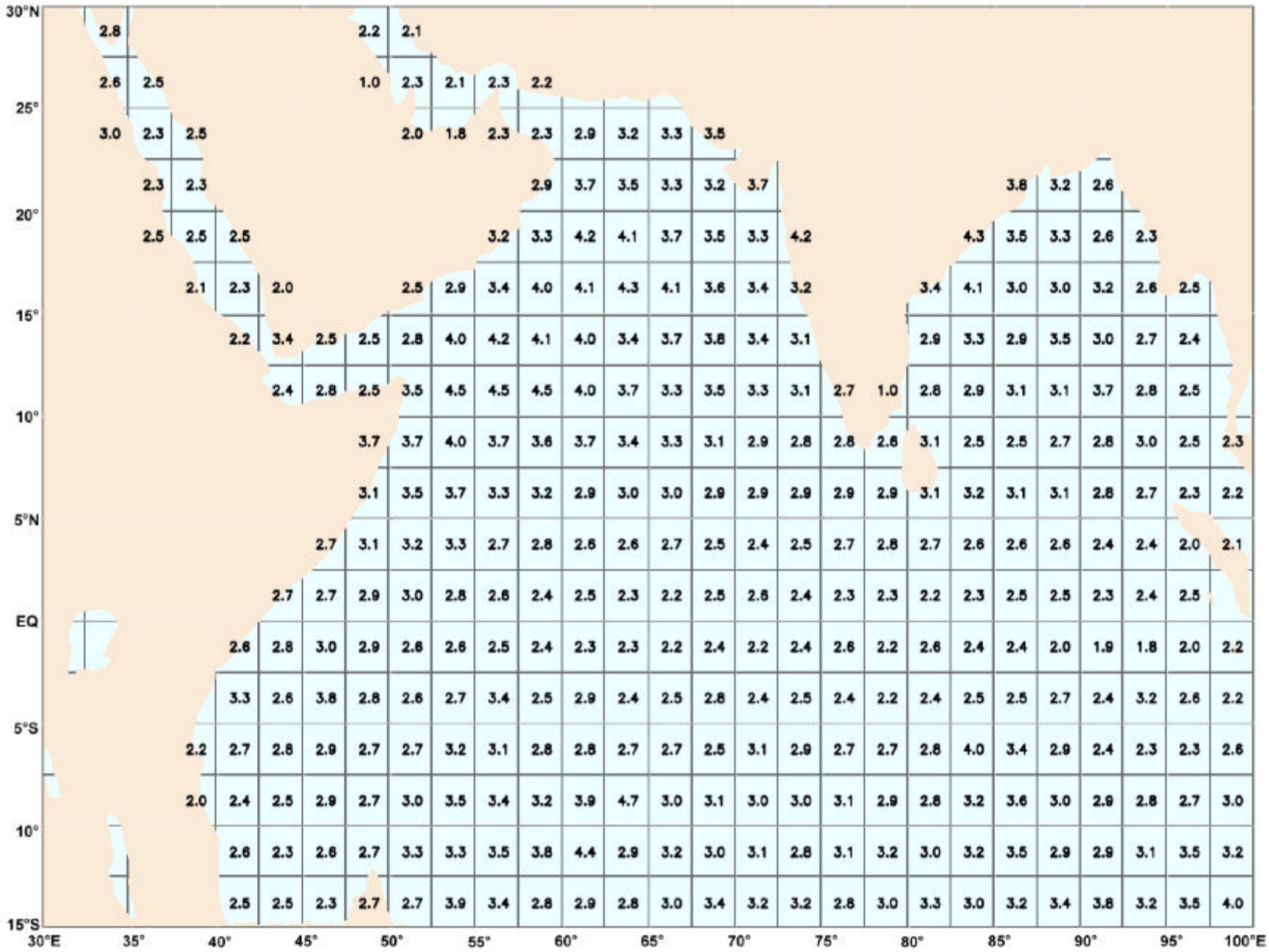


CHART NO. 14.6 MEAN WAVE PERIOD (sec) JUNE

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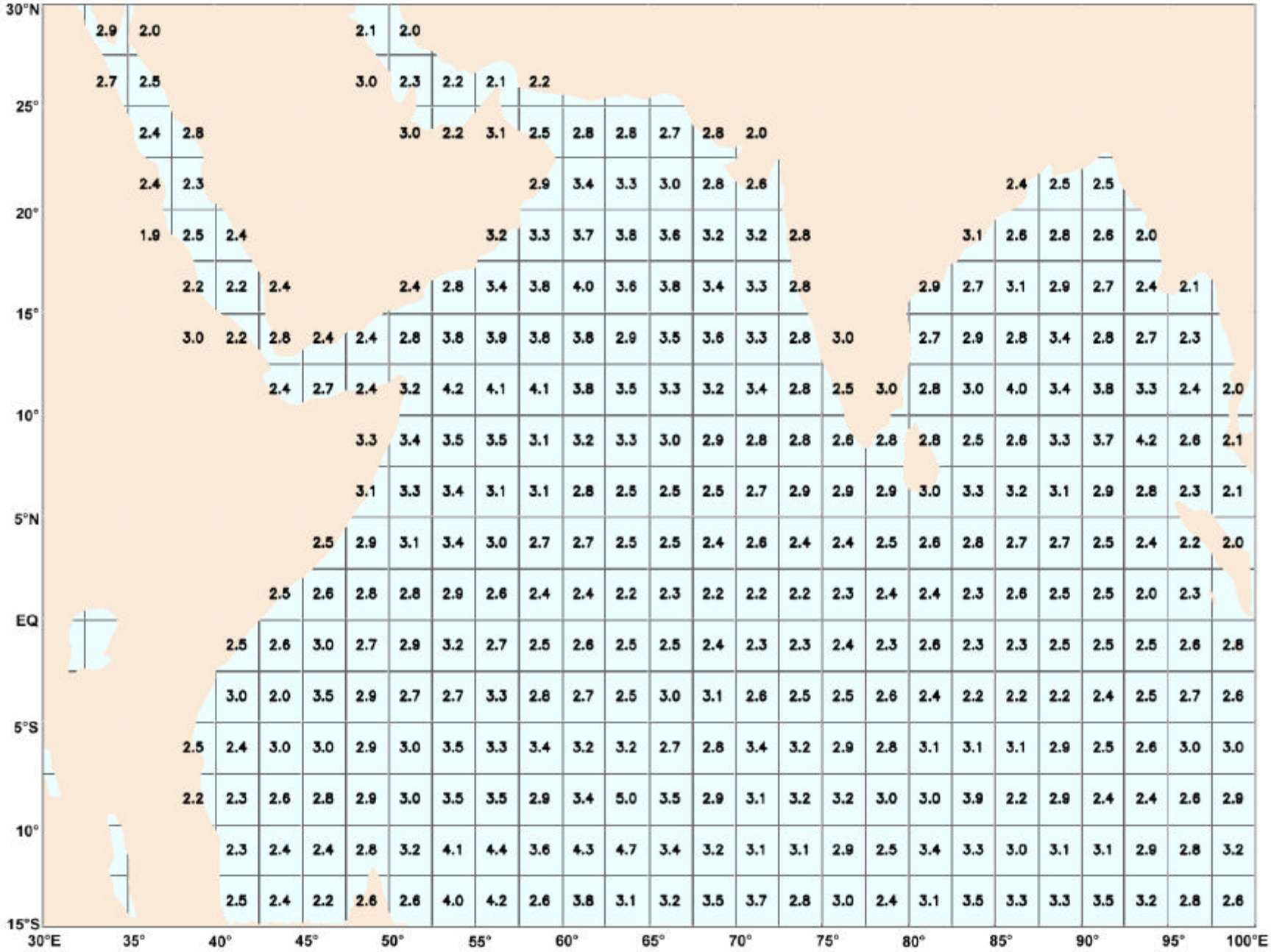
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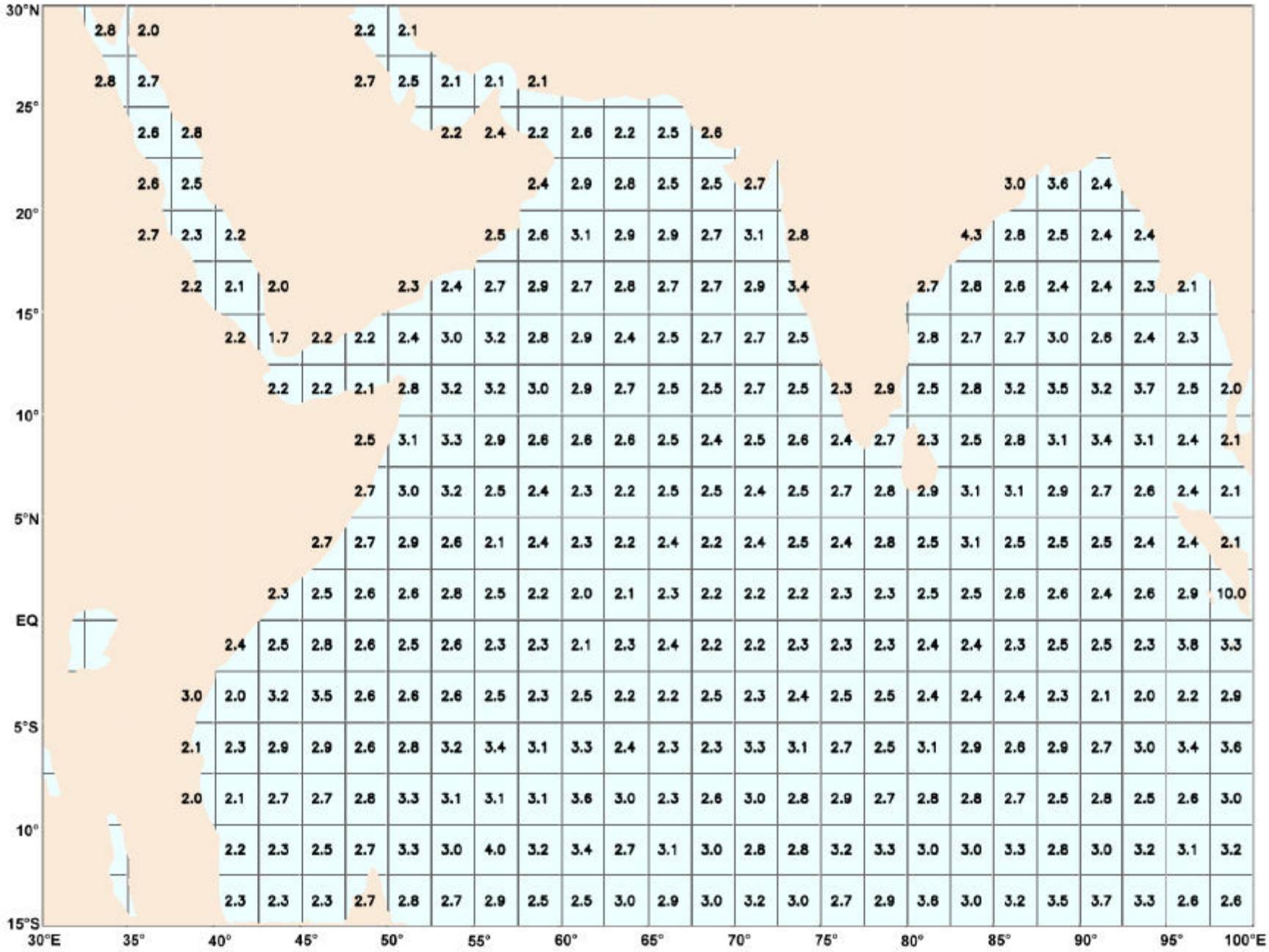
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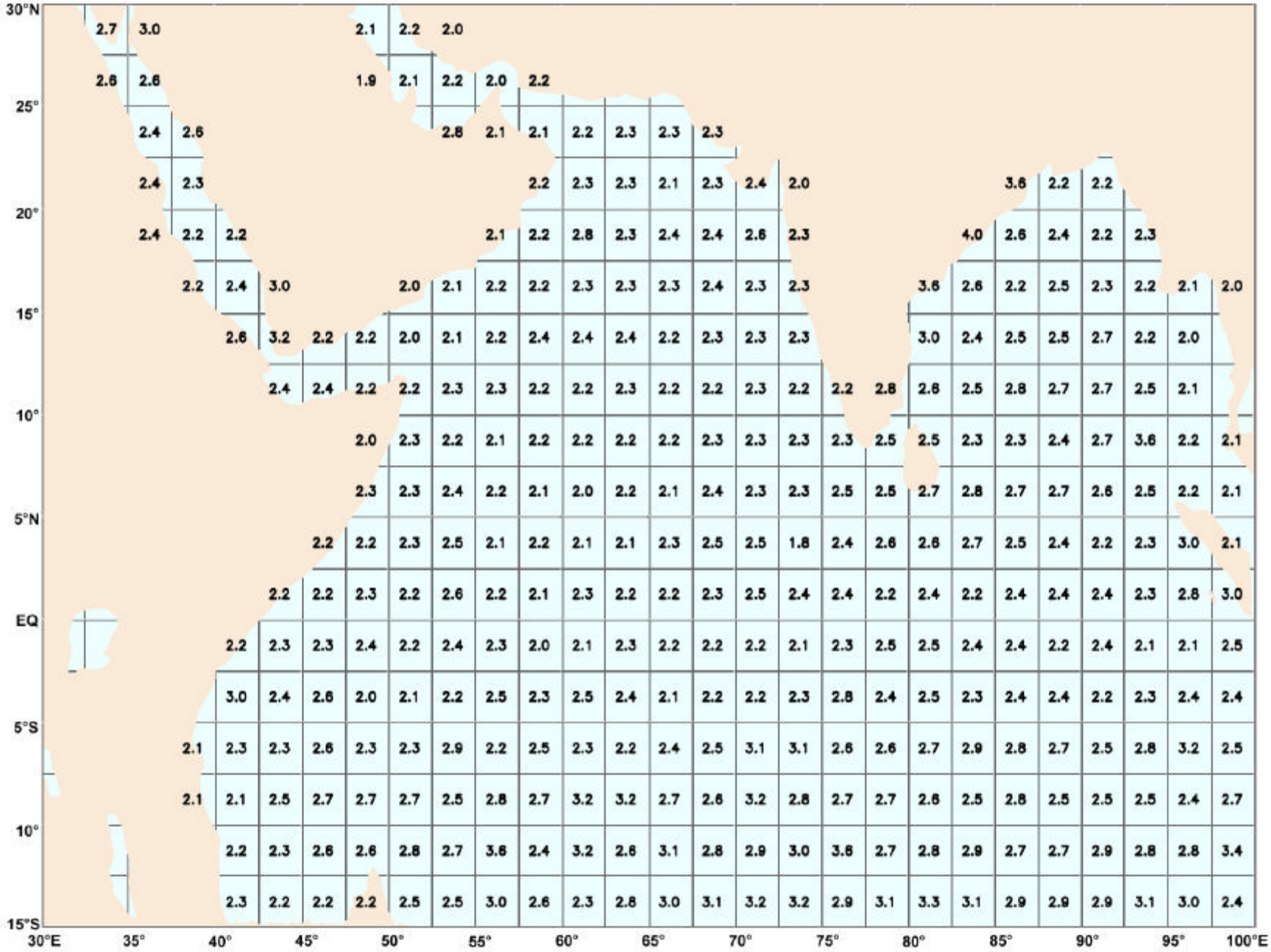
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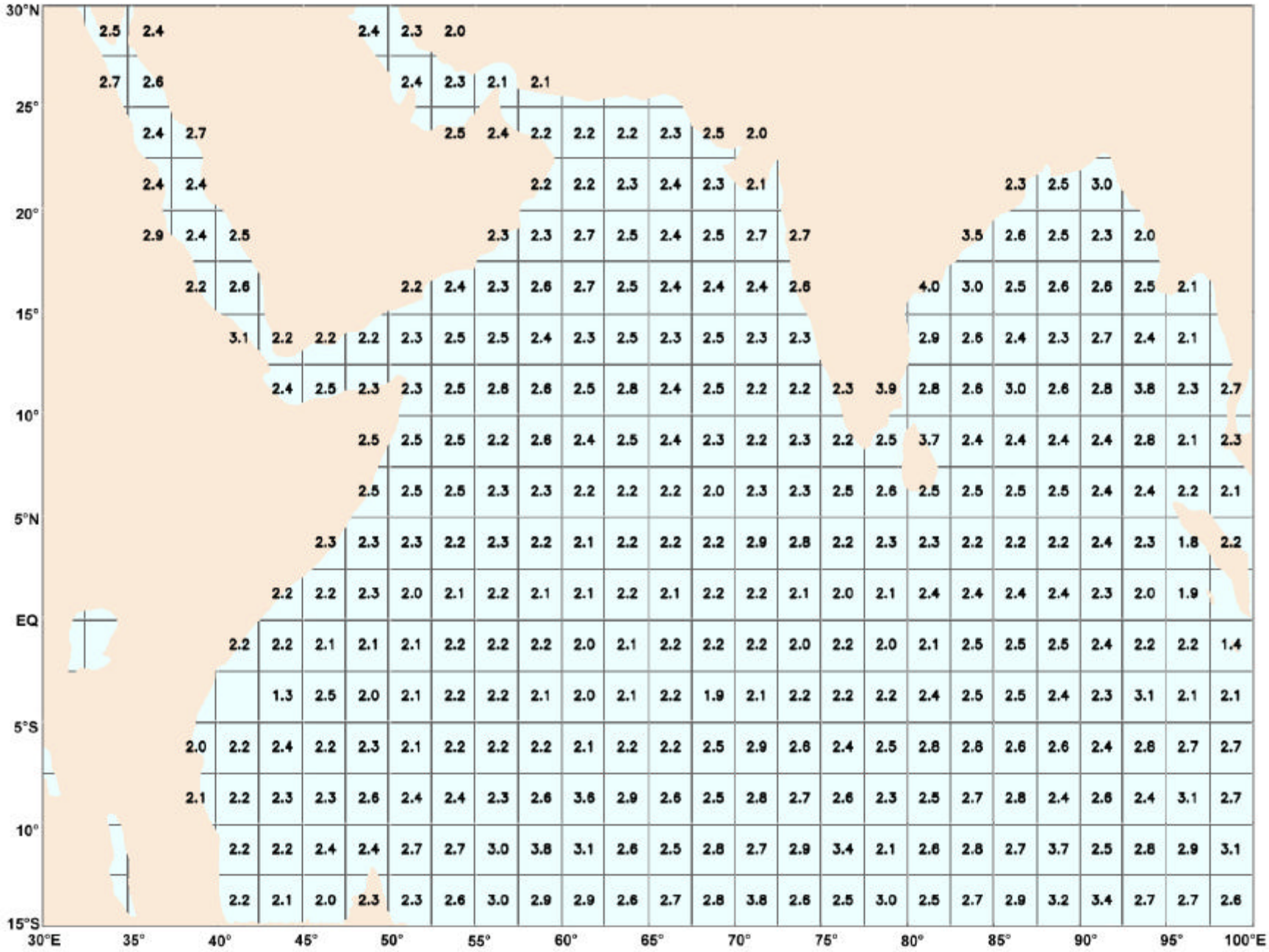
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CHART NO. 14.12 MEAN WAVE PERIOD (sec) DECEMBER

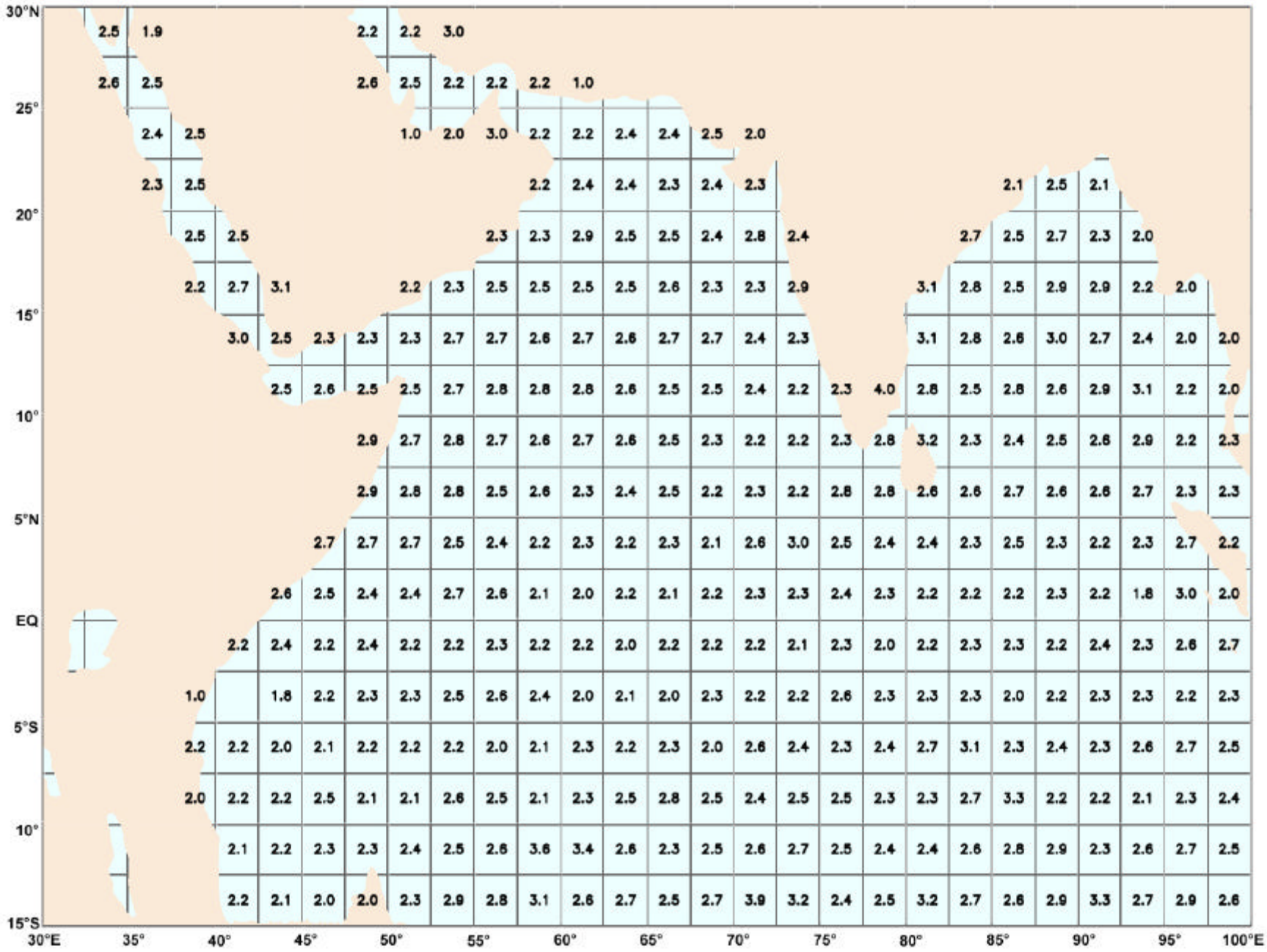

CHART NO.15.1 VISIBILITY (>10 Km)(%) JANUARY

CHART NO.15.2 VISIBILITY (>10 Km)(%) FEBRUARY

CHART NO.15.3 VISIBILITY (>10 Km)(%) MARCH

CHART NO.15.4 VISIBILITY (>10 Km)(%) APRIL

CHART NO.15.5 VISIBILITY (>10 Km)(%) MAY

CHART NO.15.6 VISIBILITY (>10 Km)(%) JUNE

CHART NO.15.7 VISIBILITY (>10 Km)(%) JULY


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CHART NO.15.9 VISIBILITY (>10 Km)(%) SEPTEMBER

CHART NO.15.10 VISIBILITY (>10 Km)(%) OCTOBER

CHART NO.15.11 VISIBILITY (>10 Km)(%) NOVEMBER


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