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Atlas of Cloud-Free Line-of-Sight Probabilities Part 4: Europe

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13 November 1978

METEOROLOGY DIVISION PROJECT 6670
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AIR FORCE SYSTEMS COMMAND, USAF

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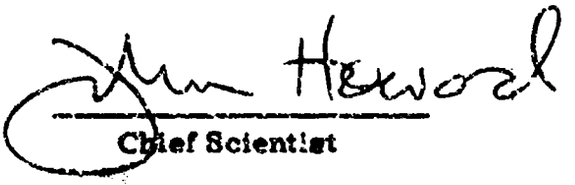

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This is the fourth part of a planned Northern Hemisphere atlas of probabilities of cloud-free lines-of-sight between the earth and space. The probabilities are for the mid-season months: January, April, July, and October; four times of day: 0000-0200 LST, 0600-0800 LST, 1200-1400 LST, and 1800-2000 LST; and three elevation angles: 10°, 30°, and 90°. Parts 1, 2, and 3 depicted cloud-free line-of-sight probabilities for Germany, the USSR, and the USA, respectively.

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Atlas of Cloud-Free Line-of-Sight Probabilities
Part 4: Europe

1. INTRODUCTION

The increased use of optical, infrared, and microwave observing and transmitting devices has resulted in a greater demand for information on humidity, haze, clouds, and precipitation. The Air Force Geophysics Laboratory (AFGL)* Climatology and Dynamics Branch (LYD), Hanscom AFB, MA 01731, and the USAF Environmental Technical Applications Center (ETAC)*, Scott AFB, IL 62225, have responsed to this demand by collecting special observations, developing models for estimating the desired information in the absence of direct observations, and processing vast quantities of data.

One of the items frequently requested is information on the probability of a cloud-free line-of-sight (CFLOS) between a specific point on the surface of the earth and an aircraft or an object in space. In response to these requests AFGL and ETAC are endeavoring to prepare a Northern Hemisphere atlas of CFLOS probabilities. Because this is a very time-consuming effort, we have decided to prepare the atlas in parts as data become available. The first, second, and third

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*Department of Defense organizations and contractors are encouraged to contact AFGL or ETAC for additional information on line-of-sight probabilities. Persistence, recurrence, joint probabilities, and probabilities as a function of altitude are available.

parts depicting CFLOS probabilities over Germany,[1] the USSR[2], and the USA[3] have been published.

2. THE MODEL

Lund and Shanklin[4] developed models for estimating probabilities of CFLOS through the atmosphere at any desired elevation angle and geographical location. The models require a knowledge of sky-cover climatology for the locations.

The model used to estimate CFLOS probabilities through the entire atmosphere can be expressed as follows:

$$ {}_{\alpha}\hat{P}_1 = {}_{\alpha}C_s K_1 \qquad (1) $$

where ${}_{\alpha}\hat{P}_1$ is a column vector of α rows, one row for each angle considered; ${}_{\alpha}C_s$ is a matrix of α rows and s columns, one column for each sky cover category; and ${}_{s}K_1$ is a column vector of s rows. The $\hat{P}$ values are estimates of CFLOS probabilities, the C values are CFLOS probabilities at angle α given k tenths of cloudiness, and the K values are probabilities of each k tenths of cloudiness.

The ${}_{\alpha}C_s$ matrix used for this paper is given in Table 1.

Table 1. Probabilities of Cloud-Free Lines-of-Sight as a Function of Elevation Angle and Observed Total Sky Cover in Tenths. This is the ${}_{\alpha}C_s$ Matrix

Elevation Angle (degrees)	Sky Cover (tenths)										
	0	1	2	3	4	5	6	7	8	9	10
90	1.00	0.97	0.92	0.87	0.81	0.77	0.70	0.62	0.48	0.31	0.08
30	0.98	0.93	0.86	0.80	0.73	0.66	0.57	0.50	0.38	0.24	0.06
10	0.97	0.86	0.76	0.65	0.55	0.47	0.39	0.32	0.24	0.16	0.03

1. Lund, I. A., Grantham, D. D., and Elam, C. B., Jr. (1975) Atlas of Cloud-Free Line-of-Sight Probabilities, Part 1: Germany, AF Surveys in Geophysics No. 309, AFCRL-TR-75-0261, 77 pp.

2. Lund, I. A., Grantham, D. D., and Elam, C. B., Jr. (1976) Atlas of Cloud-Free Line-of-Sight Probabilities, Part 2: Union of Soviet Socialist Republics, AF Surveys in Geophysics No. 358, AFGL-TR-77-0005, 63 pp.

3. Lund, I. A., Grantham, D. D., and Elam, C. B., Jr. (1977) Atlas of Cloud-Free Line-of-Sight Probabilities, Part 3: United States of America, AF Surveys in Geophysics No. 374, AFGL-TR-77-0188, 73 pp.

4. Lund, I. A., and Shanklin, M. D. (1973) Universal methods for estimating probabilities of cloud-free lines-of-sight through the atmosphere, J. Appl. Meteorol. 12(No. 1):28-35.

3. AN EXAMPLE

The climatic record of sky cover at Tempelhof AB, Berlin, Germany, shows that 0/10, 1/10, ..., 9/10, and 10/10 sky cover was reported 8.9, 3.0, 0.8, 2.7, 2.7, 2.7, 4.2, 2.1, 6.3, 14.0, and 52.8 percent of the time, respectively, between 1200-1400 LST during January 1947 through 1963. Performing the matrix multiplication, we obtain:

$$\alpha \hat{P}_1 = \begin{bmatrix} 1.00 & 0.97 & ..... & 0.31 & 0.08 \\ 0.98 & 0.93 & ..... & 0.24 & 0.06 \\ 0.97 & 0.86 & ..... & 0.16 & 0.03 \end{bmatrix} \begin{bmatrix} 0.089 \\ 0.030 \\ . \\ . \\ 0.140 \\ 0.528 \end{bmatrix} = \begin{bmatrix} 0.350 \\ 0.304 \\ 0.240 \end{bmatrix} \quad (2)$$

The computations show that there is a 35.0 percent probability of a CFLOS at Tempelhof AB looking toward the zenith (90°), and a 30.4 percent and 24.0 percent probability of a CFLOS at 30° and 10° elevation angles, respectively.

4. THE STATIONS

Table 2 lists stations from which long records of hourly sky cover observations are available. CFLOS probabilities were computed for these stations, which are shown in Figure 1.

5. THE ANALYSIS

A total of 51 maps are included in this report: one station locator map, Figure 1; one map for each of the four mid-season months (January, April, July, October) covering four 3-hr periods (0000-0200 LST, 0600-0800 LST, 1200-1400 LST, 1800-2000 LST), and three elevation angles (10°, 30°, 90°), Figures 2 through 49; and two maps depicting the extreme conditions (that is, the highest and the lowest probability for any of the above months and periods), Figures 50 and 51. In order to conserve space, the extreme condition is shown for the 30° elevation angle only.

Eq. (1) was used to compute CFLOS probability values. The ${}_sK_1$ column vector was changed with every station, month, or 3-hr time period. For more than ninety percent of the European stations, the probabilities were based on more than 300 sky-cover observations, that is, about a 10-yr period-of-record. The probability values were plotted on maps and analyzed as shown in Figures 2 through 51.

Because the isolines were drawn strictly to the data, the analysis seldom departs more than 2 or 3 percent from the computed probabilities.

The analysis is based solely on probabilities at the locations shown by dots on the maps. Probabilities were not computed and station location dots are not shown for hours and months when less than 50 observations were available for determining the CFLOS probabilities. Terrain features were not specifically considered in the analysis. However, their effects are evident by the irregular patterns and many closed isolines of probability shown on the maps.

The data coverage over some coastal and mountain areas, all large bodies of water, most islands, and north Africa, was too sparse for accurate, detailed analysis; therefore, only the probability values are plotted on the maps at these locations. If the location of interest is not close to a station used in the analysis, the user of this atlas may wish to consult other data sources for additional cloud cover data and compute cloud-free line-of-sight probabilities using Eq. (1).

The CFLOS atlas for Germany, Part 1 of this series, included probabilities for the 50° elevation angle. They are not included in this report because more than 97 percent of the time they range from 1 to 2.5 percent less than corresponding probabilities for the 90° elevation angle. The 50° elevation angle probabilities were always at least 1 percent less than the 90° probabilities but never more than 3.5 percent less. Probabilities for the 50° elevation angle should be estimated by subtracting 2 percent from the 90° probabilities.

Table 2. Station Locator

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	Greenland (Denmark)					
04390		1	Prince Christian	60-02 N	43-07 W	75
04175		2	Ice cap Site-2/Dye-3	65-11 N	43-50 W	2438
04360		3	Angmagssalik	65-36 N	37-38 W	34
04165		4	Ice cap Site-1/Dye-2	66-29 N	46-17 W	2134
	Iceland					
04018		5	Keflavik	63-59 N	22-36 W	52
04048		6	Vestmannaeyjar	63-25 N	20-17 W	122
04072		7	Fagurholsmyri	63-53 N	16-39 W	40
04063		8	Akureyri	65-39 N	18-04 W	2
	Norway					
01001		9	Jan Mayen	70-56 N	08-40 W	9
01005		10	Isfjord Radio	78-04 N	13-38 E	5
01028		11	Bjornoya	74-29 N	19-03 E	16
01098		12	Vardo	70-22 N	31-06 E	13
01023		13	Bardufoss	69-03 N	18-32 E	79
01152		14	Bodo	67-16 N	14-22 E	13
01271		15	Vaernes	63-28 N	10-56 E	17
01384		16	Oslo/Gardermoen	60-12 N	11-05 E	204
01415		17	Stavanger/Sola	58-53 N	05-38 E	9
	Sweden					
02051		18	Karesuando	68-27 N	22-30 E	327
02056		19	Stensele	65-04 N	17-10 E	327
02062		20	Ostersund/Froson	63-12 N	14-30 E	376
02066		21	Sundsvall/Harnosand	62-32 N	17-27 E	4
02067		22	Sarna	61-41 N	13-08 E	441
02077		23	Stockholm/Bromma	59-21 N	17-57 E	15
02073		24	Karlstad	59-22 N	13-28 E	46
02084		25	Goteburg/Torslanda	57-42 N	11-47 E	6

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	Sweden (Cont)					
02097		26	Malmo/Bulltofta	55-36 N	13-04 E	6
02094		27	Utklippan	56-02 N	15-48 E	5
02090		28	Visby	57-40 N	18-21 E	51
	Finland					
02836		29	Sodankyla	67-22 N	26-39 E	176
02864		30	Kemi	65-47 N	24-35 E	18
02897		31	Kajaani	64-17 N	27-41 E	143
02911		32	Vaasa	63-03 N	21-46 E	4
02935		33	Jyvaskyla	62-24 N	25-41 E	140
02972		34	Turku	60-31 N	22-16 E	49
02974		35	Helsinki/Seutula	60-19 N	24-58 E	51
	Faroe Is. (Denmark)					
06011		36	Thorshavn	62-01 N	06-46 W	24
	Scotland (U.K.)					
03005		37	Lerwick - Shetland Island	60-08 N	01-11 W	87
03026		38	Stornoway - Hebrides Island	58-13 N	06-20 W	9
03091		39	Aberdeen/Dyce	57-12 N	02-12 W	72
03100		40	Tiree - Hebrides Island	56-30 N	06-52 W	12
03135		41	Prestwick	55-30 N	04-35 W	20
	England (U.K.)					
03262		42	Tynemouth	55-01 N	01-25 W	29
03334		43	Manchester	53-21 N	02-17 W	78
03814		44	Lizard	49-57 N	05-12 W	73
03370		45	Hemswell	53-24 N	00-34 W	63
03470		46	Holbeach Gunnery Range	52-53 N	00-11 E	12
03655		47	Oxford/Upper Heyford RAF Station	51-56 N	01-15 W	133
03669		48	Bovingdon	51-43 N	00-32 W	157

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	England (U.K.) (Cont)					
03562		49	Alconbury RAF Station	52-22 N	00-13 W	49
03583		50	Lakenheath RAF Station/Brandon	52-24 N	00-34 E	10
03688		51	Wethersfield RAF Station	51-58 N	00-30 E	101
03596		52	Woodridge/Bentwaters RAF Station	52-08 N	01-26 E	26
	Wales (U.K.)					
03601		53	Pembroke	51-42 N	04-57 W	14
	Northern Ireland (U.K.)					
03917		54	Belfast	54-39 N	05-13 W	81
	Ireland					
03980		55	Malin Head	55-22 N	07-20 W	20
03973		56	Blacksod Point	54-06 N	10-04 W	5
03965		57	Birr	53-05 N	07-53 W	70
03953		58	Valentia	51-56 N	10-15 W	9
03952		59	Roche's Point	51-48 N	08-15 W	40
	Denmark					
06021		60	Hanstholm	57-07 N	08-36 E	45
06110		61	Skrydstrup	55-13 N	09-16 E	42
06180		62	Kobenhavn	55-37 N	12-39 E	5
	East Germany					
10170		63	Warnemunde	54-11 N	12-05 E	4
10279		64	Neusterlitz	53-21 N	13-05 E	64
10384		65	Berlin/Templehof AB	52-28 N	13-24 E	50
10361		66	Magdeburg	52-06 N	11-34 E	79
10470		67	Leipzig/Mockau	51-24 N	12-25 E	131
10499		68	Gorlitz	51-10 N	14-57 E	237

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	East Germany (Cont)					
10488		69	Dresden	51-08 N	13-46 E	230
10567		70	Gera/Leumnitz	50-53 N	12-08 E	300
10546		71	Kaltennordheim	50-38 N	10-09 E	487
	West Germany					
10035		72	Schleswig	54-32 N	09-33 E	44
10147		73	Hamburg/Fuhlsbuttel	53-38 N	10-00 E	16
10202		74	Emden/Wolthusen	53-22 N	07-13 E	0
10338		75	Hannover	52-28 N	09-42 E	56
10313		76	Munster	51-58 N	07-36 E	64
10453		77	Brocken	51-48 N	10-37 E	1142
10438		78	Kassel	51-19 N	09-29 E	158
10513		79	Koln/Bonn	50-52 N	07-09 E	91
EDEX		80	Fulda AAF	50-33 N	09-39 E	305
10610		81	Bitburg AB	49-57 N	06-34 E	374
10607		82	Spangdahlem AB	49-59 N	06-42 E	365
10616		83	Hahn AB/Hunsruck	49-57 N	07-16 E	502
EDEH		84	Bad Kreuznach AAF	49-51 N	07-53 E	105
EDOT		85	Finthen AAF	49-58 N	08-09 E	231
10633		86	Wiesbaden AB	50-03 N	08-20 E	140
10636		87	Rhein-Main Apt./Frankfurt	50-02 N	08-34 E	112
10642		88	Hanau AAF	50-10 N	08-58 E	112
10657		89	Wertheim AAF	49-45 N	09-30 E	339
10655		90	Wurzburg	49-48 N	09-58 E	259
10659		91	Kitzingen AAF	49-45 N	10-12 E	213
10519		92	Baumholder AAF	49-39 N	07-18 E	426
10712		93	Sembach AB	49-30 N	07-52 E	321
10614		94	Ramstein AB	49-26 N	07-36 E	238
EDOR		95	Sandhofen/Coleman AAF	49-34 N	08-28 E	108
10708		96	Saarbrucken/Ensheim	49-13 N	07-07 E	322
10714		97	Zweibrucken RCAF Station	49-13 N	07-24 E	343
10734		98	Heidelberg AAF	49-24 N	08-39 E	110

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	West Germany (Cont)					
10752		99	Illesheim AAF	49-28 N	10-23 E	325
EDEW		100	Nurnberg/Fuerth AAF	49-30 N	10-57 E	302
10687		101	Grafenwohr AAF	49-42 N	11-56 E	414
10755		102	Katterbach/Ansbach AAF	49-18 N	10-35 E	413
10745		103	Schwaebisch Hall AAF	49-07 N	09-47 E	398
EDIH		104	Hohenfels AAF	49-13 N	11-50 E	442
10776		105	Regensburg/Oberhub	49-01 N	12-04 E	376
10738		106	Stuttgart/Echterdingen Apt.	48-41 N	09-13 E	396
10803		107	Freiburg	48-01 N	07-50 E	239
		108	Gablingen AAF	48-27 N	10-52 E	502
10869		109	Erding Air Station	48-19 N	11-57 E	460
10866		110	Munchen	48-08 N	11-42 E	528
10971		111	Bad Tolz AAF	47-46 N	11-36 E	716
	Netherlands					
06270		112	Leeuwarden	53-14 N	05-46 E	1
06200		113	Ypenburg	52-03 N	04-22 E	-2
06380		114	Zuid-Umburg	50-55 N	05-46 E	114
	Luxembourg					
06590		115	Luxembourg	49-38 N	06-12 E	378
	France					
07089		116	Chambley AB	49-02 N	05-53 E	265
07149		117	Paris/Orly Fld.	48-44 N	02-21 E	89
07354		118	Chateaurous/Deols Air Station	46-52 N	01-44 E	161
07510		119	Bordeaux/Merignac	44-50 N	00-43 W	49
	Spain					
08001		120	La Coruna	43-18 N	08-23 W	97
08160		121	Zaragoza AB	41-40 N	01-02 W	263

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	Spain (Cont)					
08180		122	Barcelona	41-24 N	02-09 E	93
08314		123	Mahon Baleric Is.	39-52 N	04-13 E	91
08285		124	Valencia	39-29 N	00-23 W	13
08280		125	Albacete/Los Llanos	38-57 N	01-52 W	702
08227		126	Madrid/Torrejon AB	40-29 N	03-27 W	607
08330		127	Badajoz	38-54 N	06-49 W	185
08391		128	Sevilla	37-25 N	05-54 W	34
08397		129	Moron AB	37-10 N	05-37 W	87
08449		130	Rota/Fleweacen	36-39 N	06-21 W	26
08420		131	Granada/Armilla	37-08 N	03-37 W	684
08495	(England)	132	North Front Gibraltar	36-09 N	05-21 W	5
	Poland					
12105		133	Koszalin	54-12 N	16-09 E	33
12150		134	Gdansk-Wrzeszcz	54-23 N	18-28 E	138
12195		135	Suwalki	54-08 N	22-57 E	183
12250		136	Torun	53-03 N	18-35 E	69
12400		137	Zielonia Gora	51-56 N	15-30 E	180
12435		138	Kalisz	51-44 N	18-05 E	140
12375		139	Warsaw/Okecie	52-10 N	20-58 E	110
12495		140	Lublin	51-14 N	22-34 E	171
12580		141	Rzeszow-Jasionka	50-06 N	22-03 E	200
12560		142	Katowice	50-14 N	19-02 E	284
	Czechoslovakia					
11518		143	Praha	50-06 N	14-16 E	380
11541		144	Ceske Budejovice	48-57 N	14-27 E	432
11723		145	Brno	49-09 N	16-42 E	238
11903		146	Sliac	48-38 N	19-09 E	316
11968		147	Kosice	48-42 N	21-16 E	230

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	Switzerland					
06670		148	Zurich	47-28 N	08-33 E	431
06610		149	Payerne	46-49 N	06-57 E	489
06720		150	Sion	46-13 N	07-20 E	483
06750		151	Gutsch	46-39 N	08-37 E	2287
	Austria					
11120		152	Innsbruck	47-16 N	11-21 E	581
11146		153	Sonnblock	47-03 N	12-57 E	3106
11240		154	Graz	47-00 N	15-26 E	340
11010		155	Linz/Horsching	48-14 N	14-12 E	297
11035		156	Wien/Hohe Warte	48-15 N	16-22 E	203
	Hungary					
12812		157	Szombathey	47-16 N	16-38 E	224
12920		158	Keszthely	46-45 N	17-15 E	117
12860		159	Szolnok	47-10 N	20-14 E	86
12982		160	Szeged	46-15 N	20-06 E	83
12882		161	Debrecen	47-29 N	21-38 E	111
	Italy					
16520		162	Alghero Sardinia	40-38 N	08-17 E	23
16560		163	Calgliari Sardinia	39-15 N	09-04 E	4
16080		164	Milano/Linate	45-27 N	09-17 E	107
16090		165	Verona	45-24 N	10-53 E	73
16036		166	Aviano AB	46-02 N	12-36 E	128
16158		167	Pisa/Guisto	43-41 N	10-24 E	2
16190		168	Ancona	43-37 N	13-31 E	103
16242		169	Roma/Fiumichino	41-48 N	12-14 E	2
16230		170	Pescara	42-26 N	14-11 E	12
16300		171	Potenza	40-38 N	15-48 E	823
16320		172	Brindisi	40-39 N	17-57 E	15

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	Italy (Cont)					
16337		173	Bonifati	39-35 N	15-53 E	484
16405		174	Palermo Sicily	38-11 N	13-06 E	17
16453		175	Gela Sicily	37-05 N	14-13 E	11
16459		176	Sigonella Sicily NWSED	37-24 N	14-55 E	22
16420		177	Messina Sicily	38-12 N	15-33 E	59
	Yugoslavia					
13128		178	Sljeme	45-54 N	15-58 E	988
13150		179	Slavonski Brod	45-10 N	18-00 E	88
13274		180	Beograd	44-48 N	20-28 E	132
13334		181	Split/Marjan	43-31 N	16-26 E	122
13353		182	Sarajevol/Butmir	43-49 N	18-20 E	519
13377		183	Kraljevo	43-44 N	20-41 E	219
13462		184	Titograd	42-22 N	19-15 E	33
13483		185	Skopje - Petrovac	41-58 N	21-38 E	238
	Romania					
15247		186	Timisoara	45-46 N	21-15 E	90
15120		187	Cluj	46-47 N	23-34 E	410
15090		188	Iasi	47-10 N	27-36 E	102
15260		189	Sibiu	45-48 N	24-09 E	445
15420		190	Bucuresti/Banesa	44-30 N	26-06 E	91
15360		191	Sulina	45-09 N	29-40 E	3
15480		192	Constanta/Mihail	44-21 N	28-29 E	101
	Bulgaria					
15501		193	Novoseio	44-09 N	22-47 E	38
15526		194	Pleven	43-25 N	24-36 E	71
15552		195	Varna	43-12 N	27-55 E	41
15613		196	Chernivrah	42-34 N	23-17 E	2295
15712		197	Sandanski	41-34 N	23-17 E	191

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	Greece					
16641		198	Kerkyra	39-36 N	19-55 E	2
16622		199	Thessaloniki	40-31 N	22-58 E	8
16651		200	Limnos Town	39-55 N	25-15 E	12
16704		201	Chios	38-22 N	26-09 E	60
16662		202	Skopelos	39-07 N	23-44 E	11
16682		203	Andravidha	37-55 N	21-18 E	15
16724		204	Kalamata Town	37-06 N	21-59 E	11
16732		205	Naxos	37-06 N	25-23 E	9
16754		206	Iraklion	35-20 N	25-10 E	37
	Malta					
16597		207	Luqua	35-52 N	14-29 E	91
	U.S.S.R. (Europe)					
22113		208	Murmansk	68-58 N	33-03 E	46
22165		209	Kanin Nos	68-39 N	43-18 E	
22550		210	Arhangel'sk	64-35 N	40-30 E	13
22602		211	Reboly	63-49 N	30-49 E	181
22837		212	Vytegra	61-01 N	36-27 E	59
26063		213	Leningrad	59-58 N	30-18 E	4
26038		214	Tallin	59-25 N	24-48 E	44
26477		215	Velikiye Luki	56-23 N	30-36 E	98
26629		216	Kuanas	54-53 N	23-53 E	75
26850		217	Minsk/Loshitsa	53-52 N	27-32 E	234
33393		218	Lvov	49-49 N	23-57 E	325
33345		219	Kiev/Julyany	50-24 N	30-27 E	179
33837		220	Odessa	46-29 N	30-38 E	64

Table 2. Station Locator (Cont)

WMO Number	Country	Map Number	Station Name	Lat.	Long.	Altitude (m)
	North African Stations					
	Morocco					
60155		221	Casablanca	33-34 N	07-40 W	61
60150		222	Meknes	33-52 N	05-31 W	576
	Tunisia					
60715		223	Tunis	36-51 N	10-14 E	6
60745		224	Gafsa	34-25 N	08-49 E	315
	Ocean Stations					
00001		A	Vessel A	62 N	33 W	
00009		I	Vessel I	59 N	19 W	
00013		M	Vessel M	66 N	2 E	

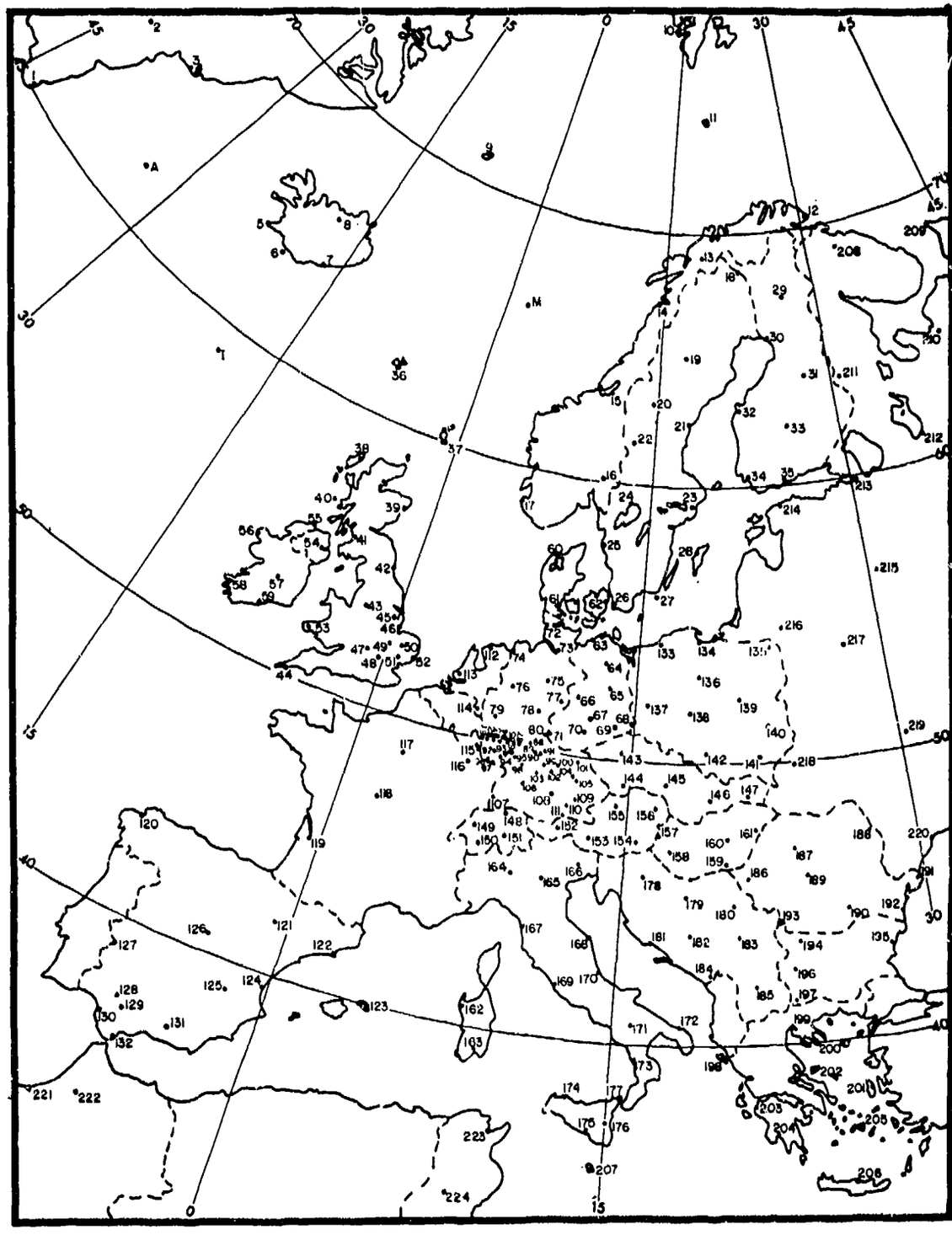

Figure 1. Station Locator Map

Figure 2. CFLOS Probabilities for Jan, 0000–0200 LST, 90° Elevation

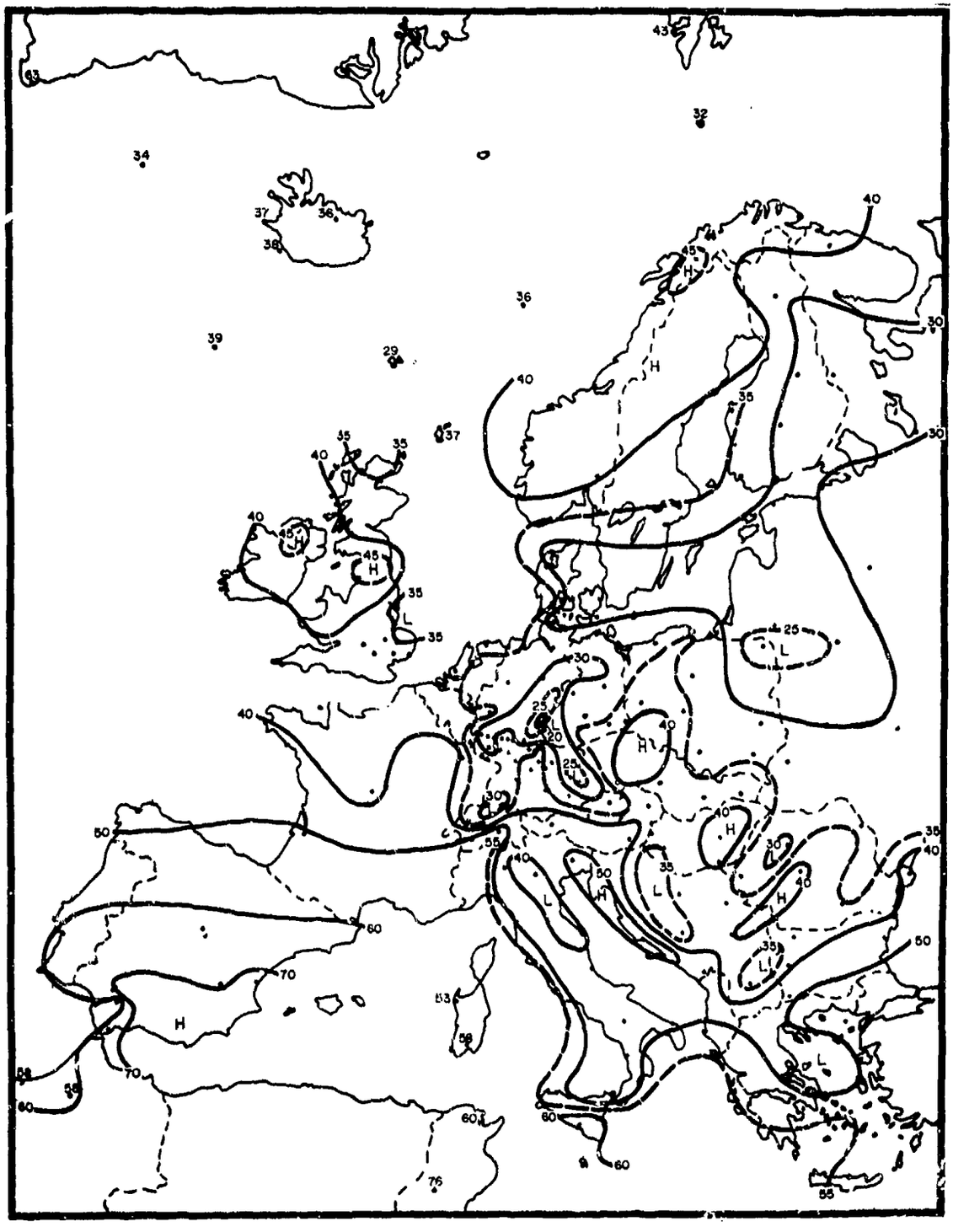

Figure 3. CFLOS Probabilities for Jan, 0000–0200 LST, 30° Elevation

Figure 4. CFLOS Probabilities for Jan, 0000–0200 LST, 10° Elevation

Figure 5. CFLOS Probabilities for Jan, 0600–0800 LST, 90° Elevation

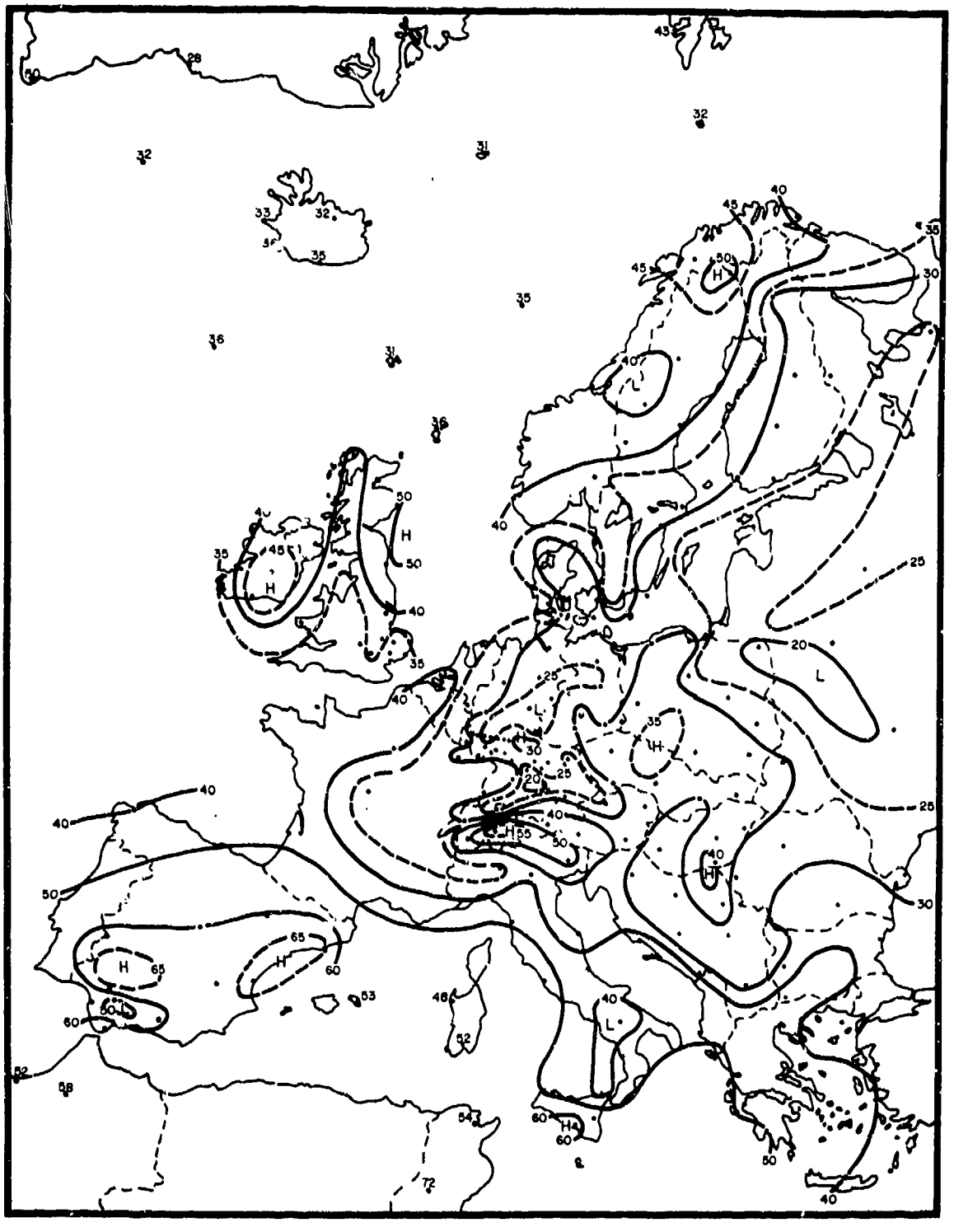

Figure 6. CFLOS Probabilities for Jan, 0600–0800 LST, 30° Elevation

Figure 7. CFLOS Probabilities for Jan, 0600–0800 LST, 10° Elevation

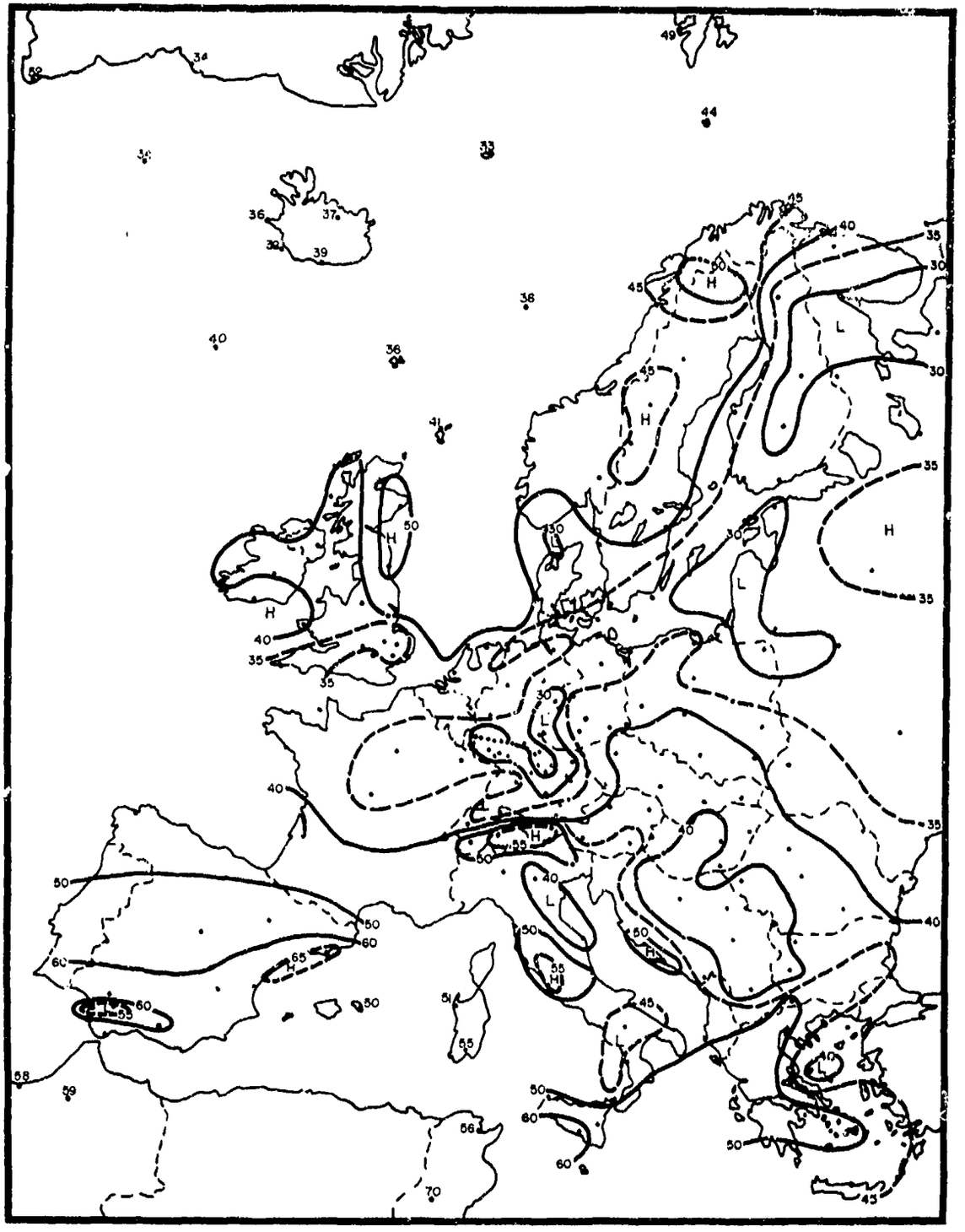

Figure 8. CFLOS Probabilities for Jan, 1200–1400 LST, 90° Elevation

Figure 9. CFLOS Probabilities for Jan, 1200–1400 LST, 30° Elevation

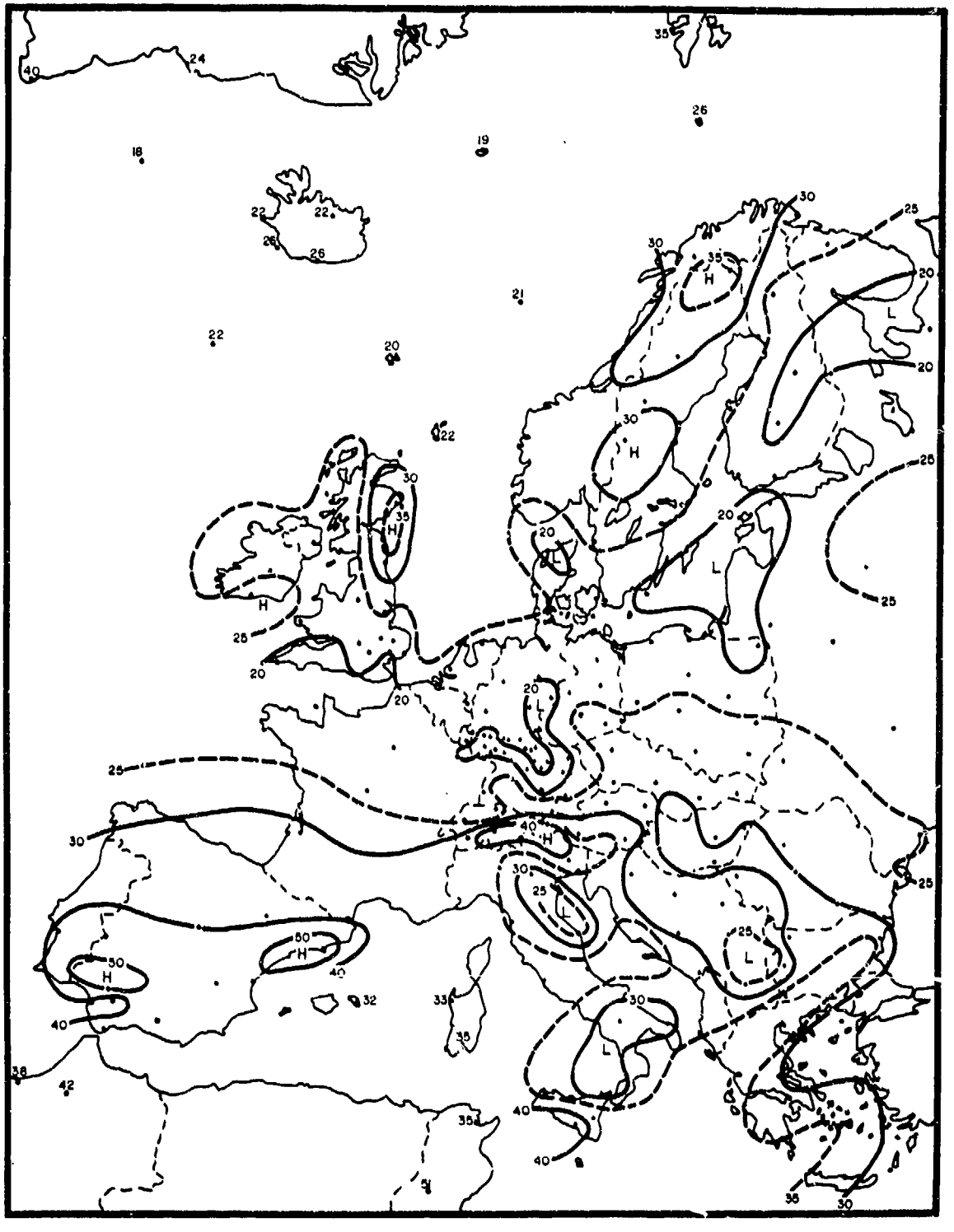

Figure 10. CFLOS Probabilities for Jan, 1200–1400 LST, 10° Elevation

Figure 11. CFLOS Probabilities for Jan, 1800–2000 LST, 90° Elevation

Figure 12. CFLOS Probabilities for Jan, 1800–2000 LST, 30° Elevation

Figure 13. CFLOS Probabilities for Jan, 1800–2000 LST, 10° Elevation

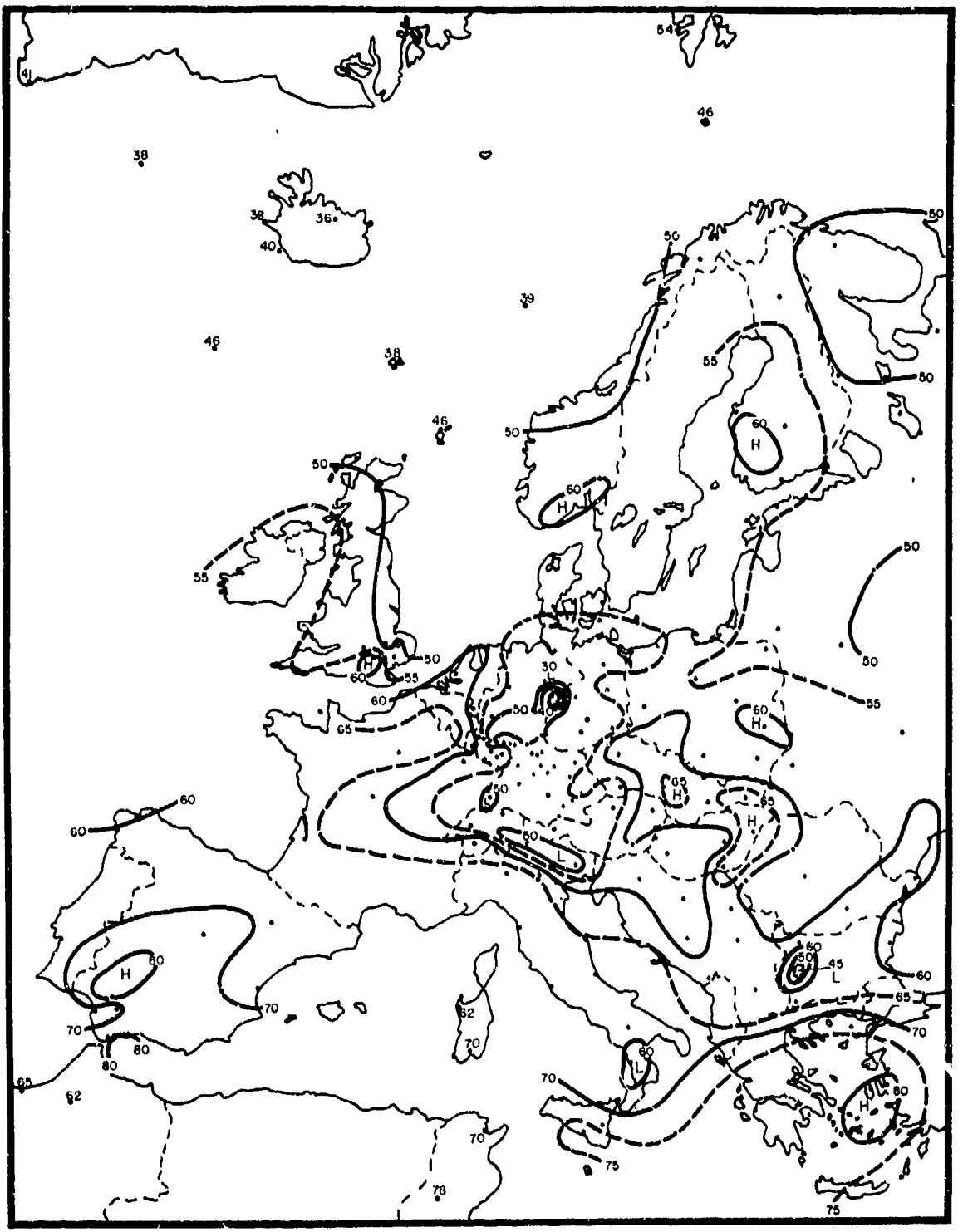

Figure 14. CFLOS Probabilities for Apr, 0000–0200 LST, 90° Elevation

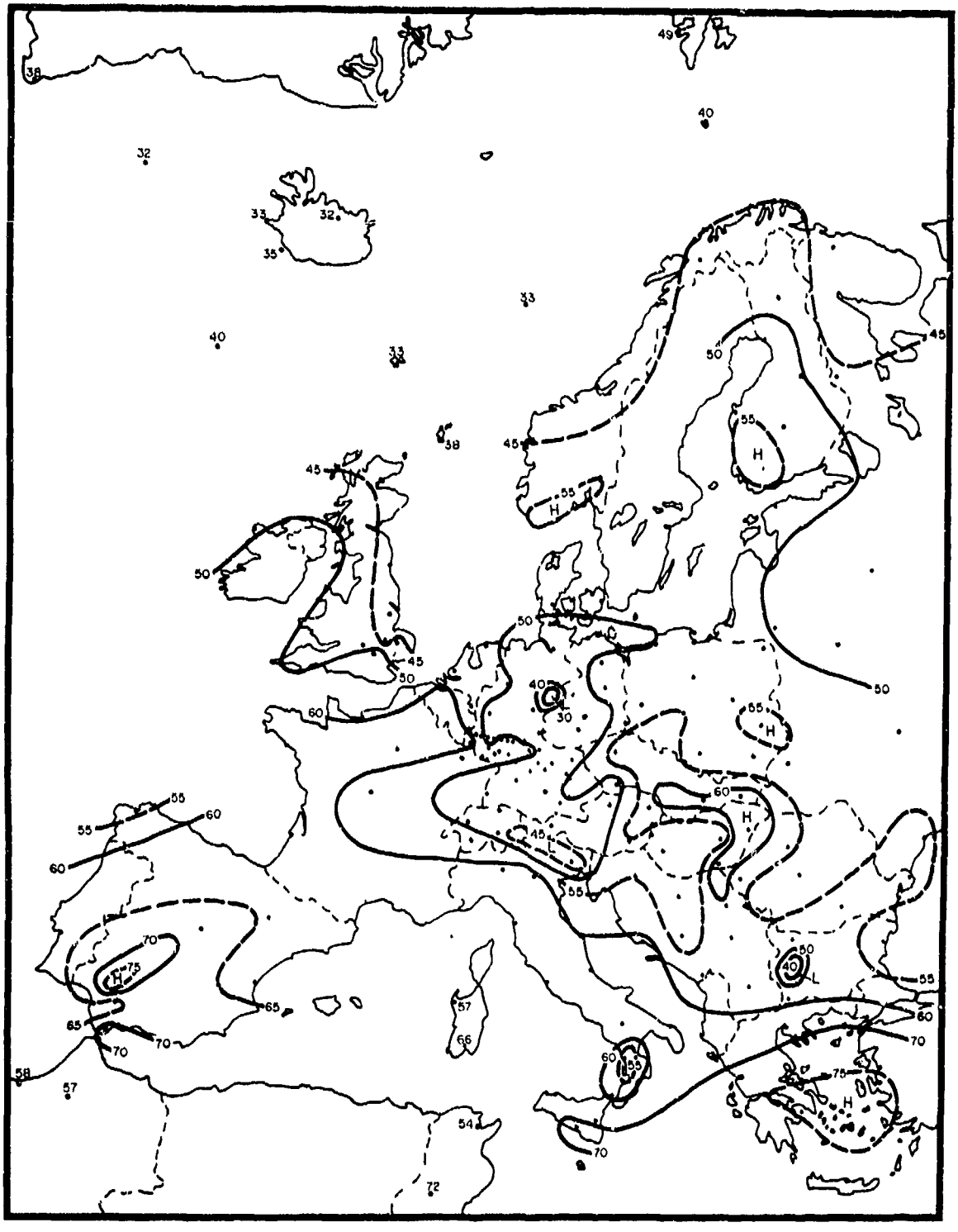

Figure 15. CFLOS Probabilities for Apr, 0000–0200 LST, 30° Elevation

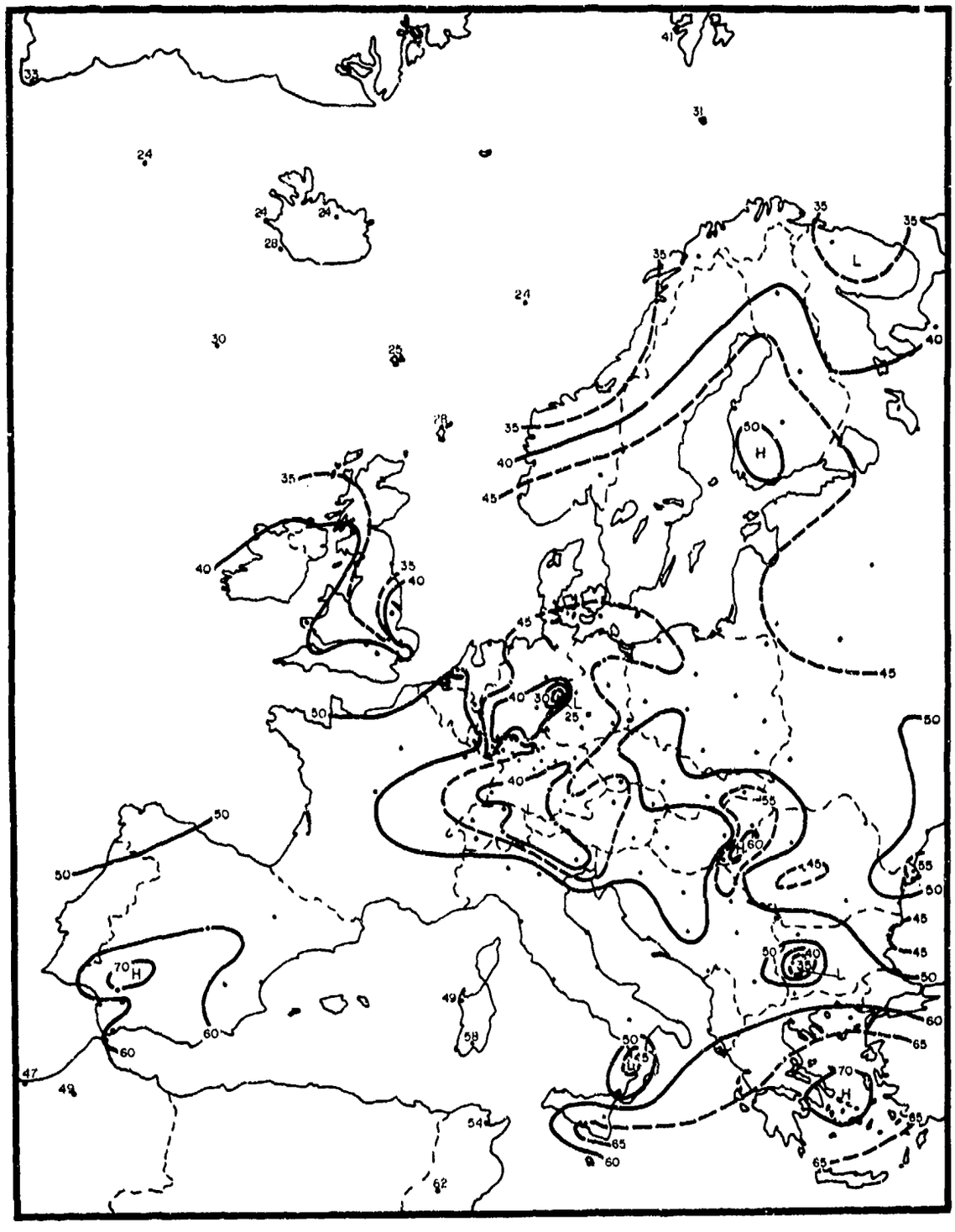

Figure 16. CFLOS Probabilities for Apr, 0000–0200 LST, 10° Elevation

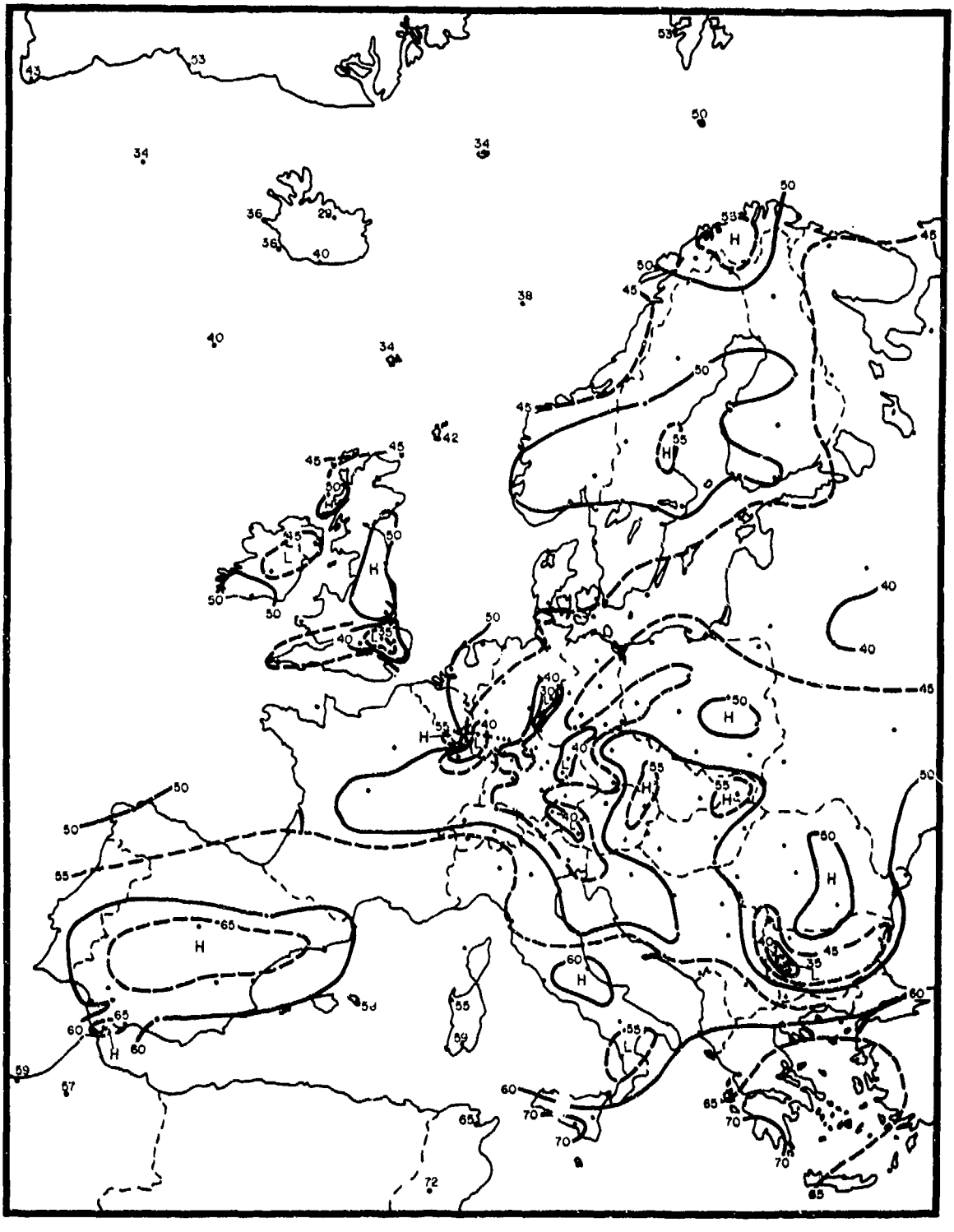

Figure 17. CFLOS Probabilities for Apr, 0600–0800 LST, 90° Elevation

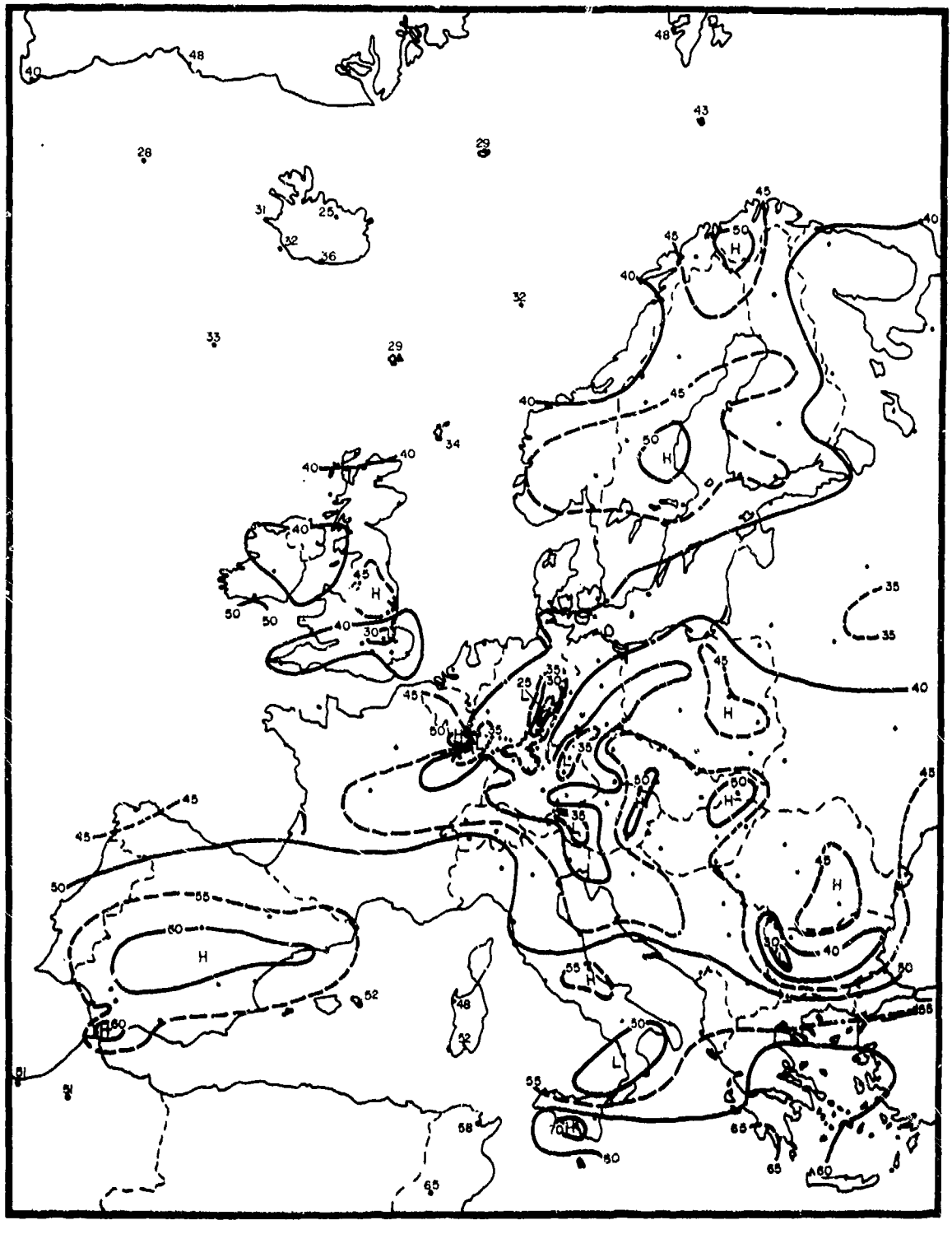

Figure 18. CFLOS Probabilities for Apr, 0600–0800 LST, 30° Elevation

Figure 19. CFLOS Probabilities for Apr, 0600–0800 LST, 10° Elevation

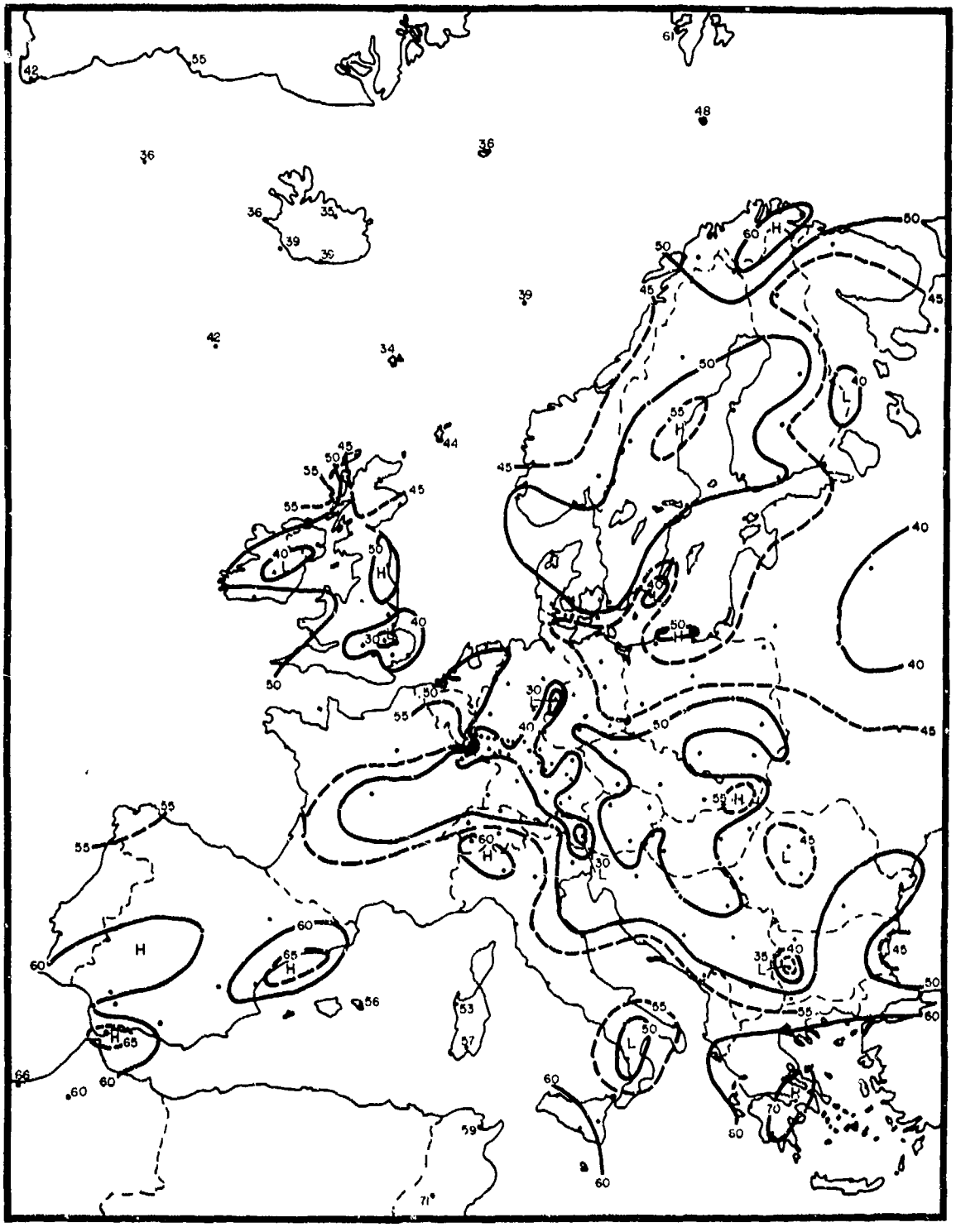

Figure 20 CFLOS Probabilities for Apr, 1200–1400 LST, 90° Elevation

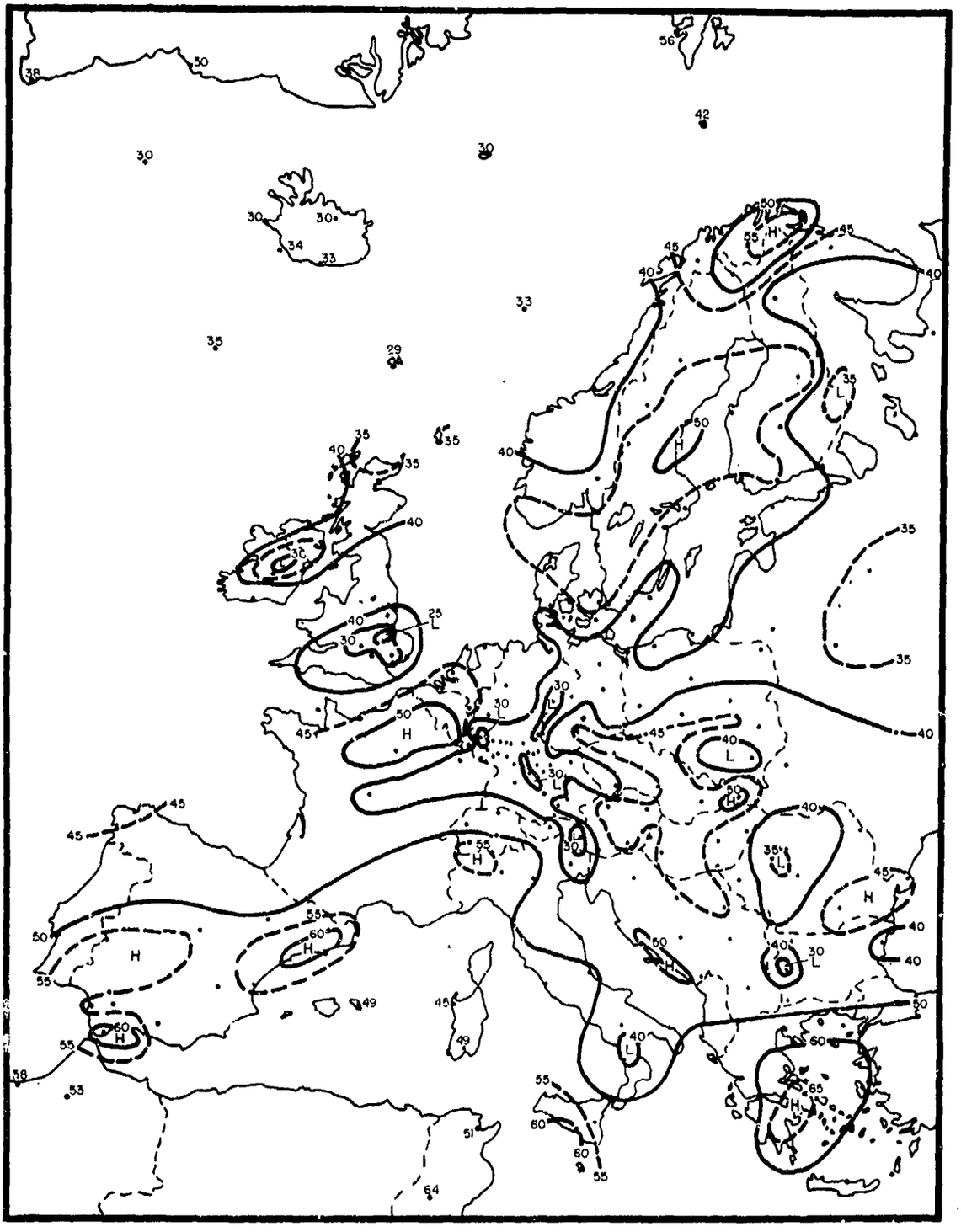

Figure 21. CFLOS Probabilities for Apr, 1200—1400 LST, 30° Elevation

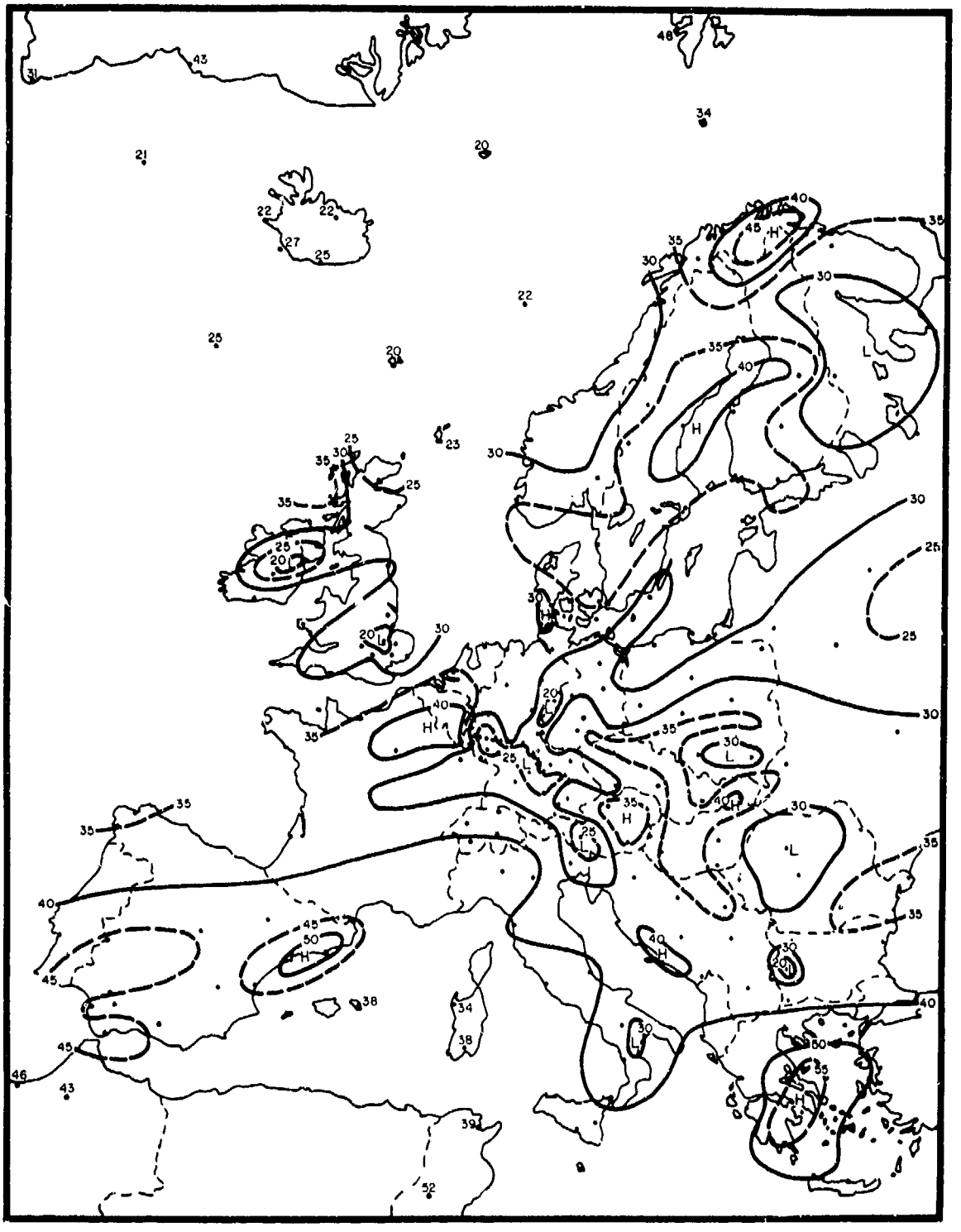

Figure 22. CFLOS Probabilities for Apr, 1200–1400 LST, 10° Elevation

Figure 23. CFLOS Probabilities for Apr, 1800–2000 LST, 90° Elevation

Figure 24. CFLOS Probabilities for Apr, 1800—2000 LST, 30° Elevation

Figure 25. CFLOS Probabilities for Apr, 1800–2000 LST, 10° Elevation

Figure 26. CFLOS Probabilities for July, 0000–0200 LST, 90° Elevation

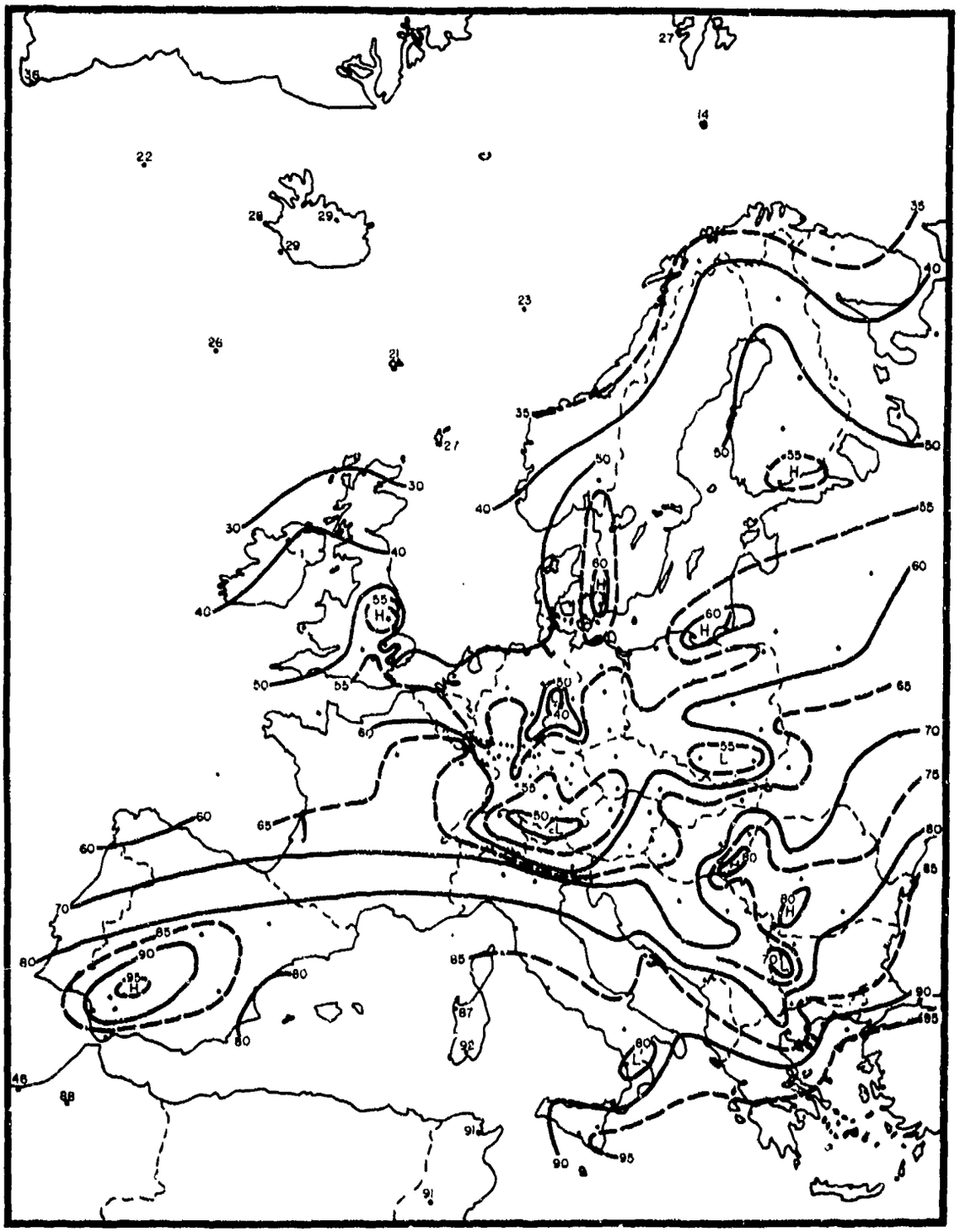

Figure 27. CFLOS Probabilities for July, 0000–0200 LST, 30° Elevation

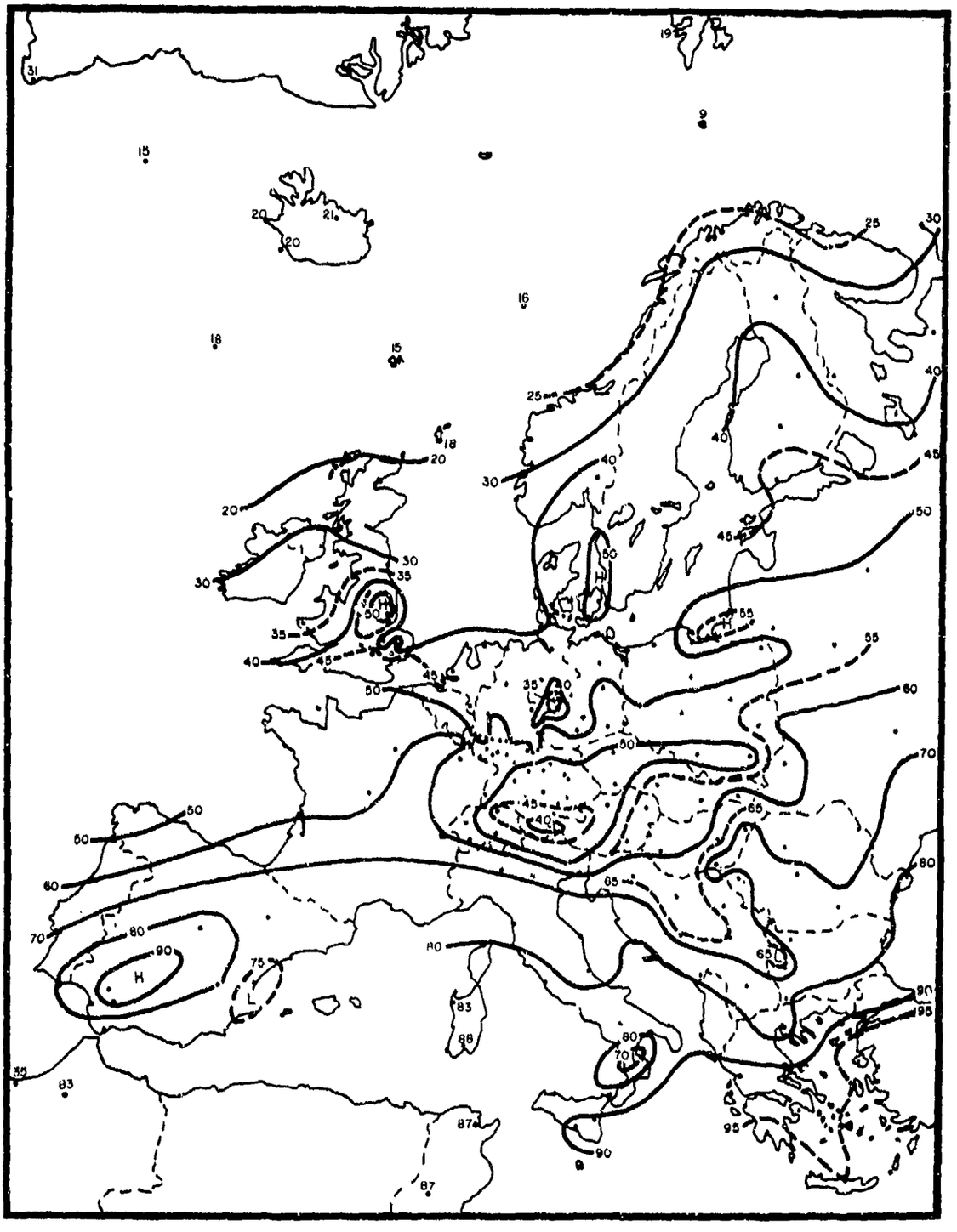

Figure 28. CFLOS Probabilities for July, 0000–0200 LST, 10° Elevation

Figure 29. CFLOS Probabilities for July, 0600—0800 LST, 90° Elevation

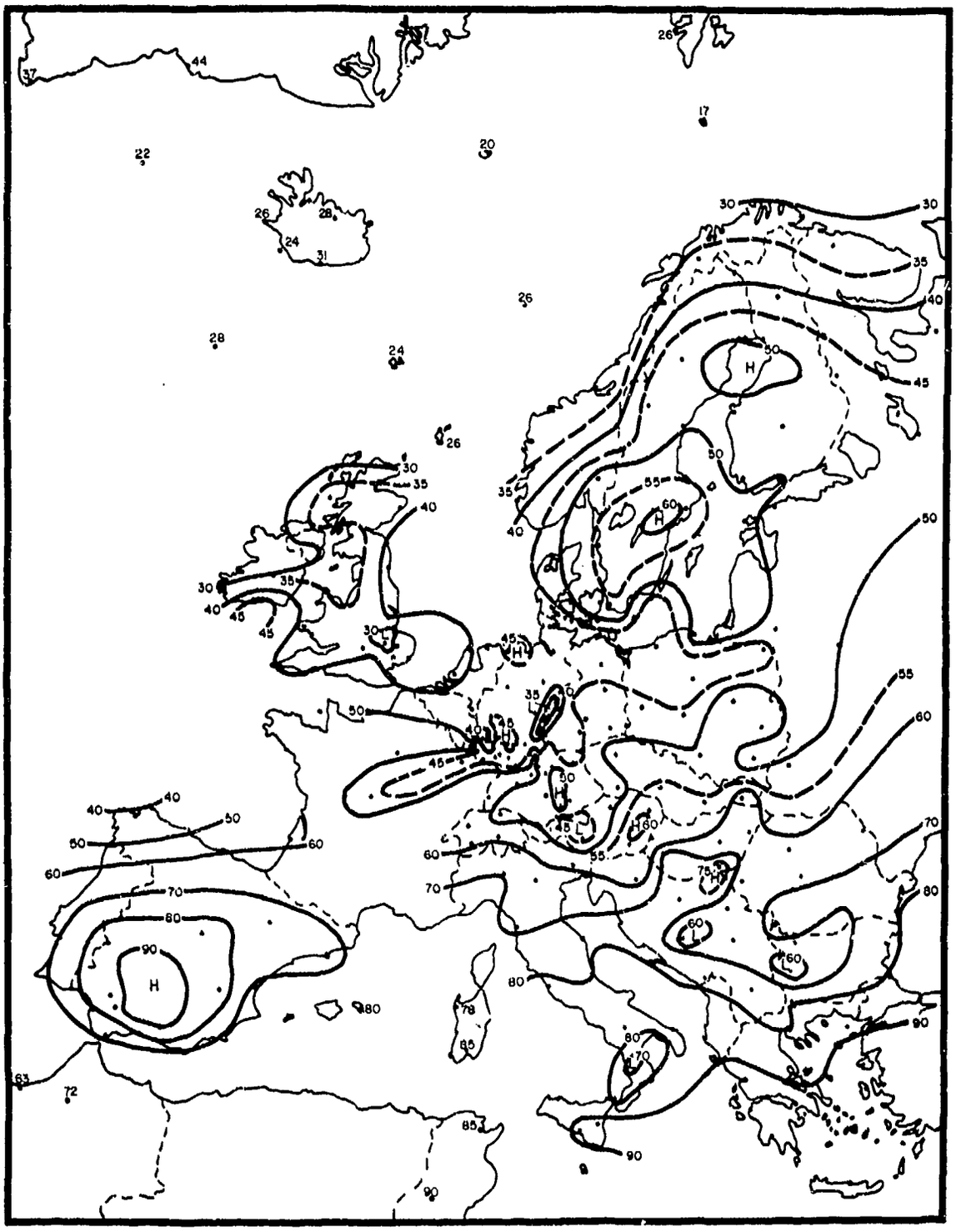

Figure 30. CFLOS Probabilities for July, 0600–0800 LST, 30° Elevation

Figure 31. CFLOS Probabilities for July, 0600–0800 LST, 10° Elevation

Figure 32. CFLOS Probabilities for July, 1200–1400 LST, 90° Elevation

Figure 33. CFLOS Probabilities for July, 1200—1400 LST, 30° Elevation

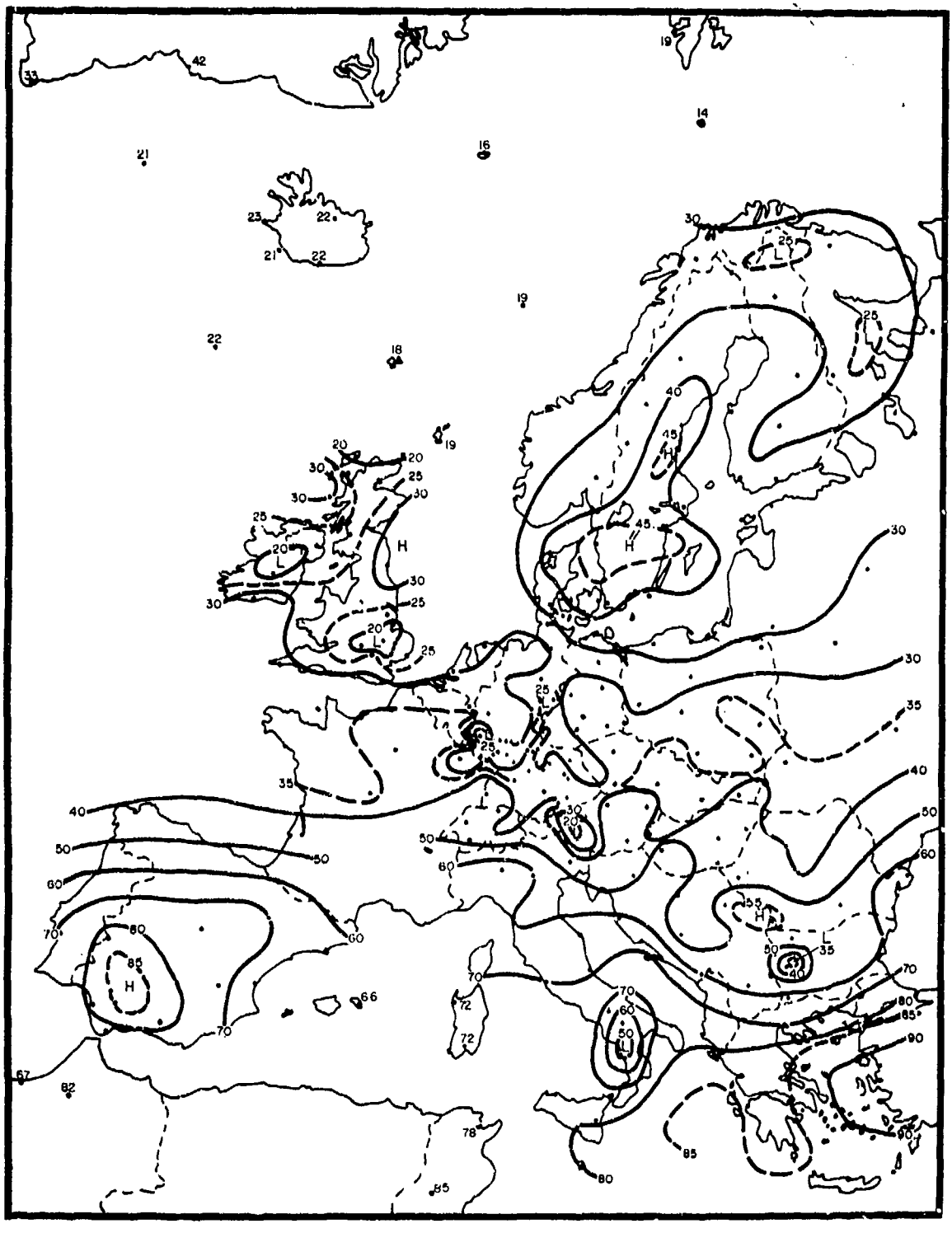

Figure 34. CFLOS Probabilities for July, 1200–1400 LST, 10° Elevation

Figure 35. CFLOS Probabilities for July, 1800–2000 LST, 90° Elevation

Figure 36. CFLOS Probabilities for July, 1800—2000 LST, 30° Elevation

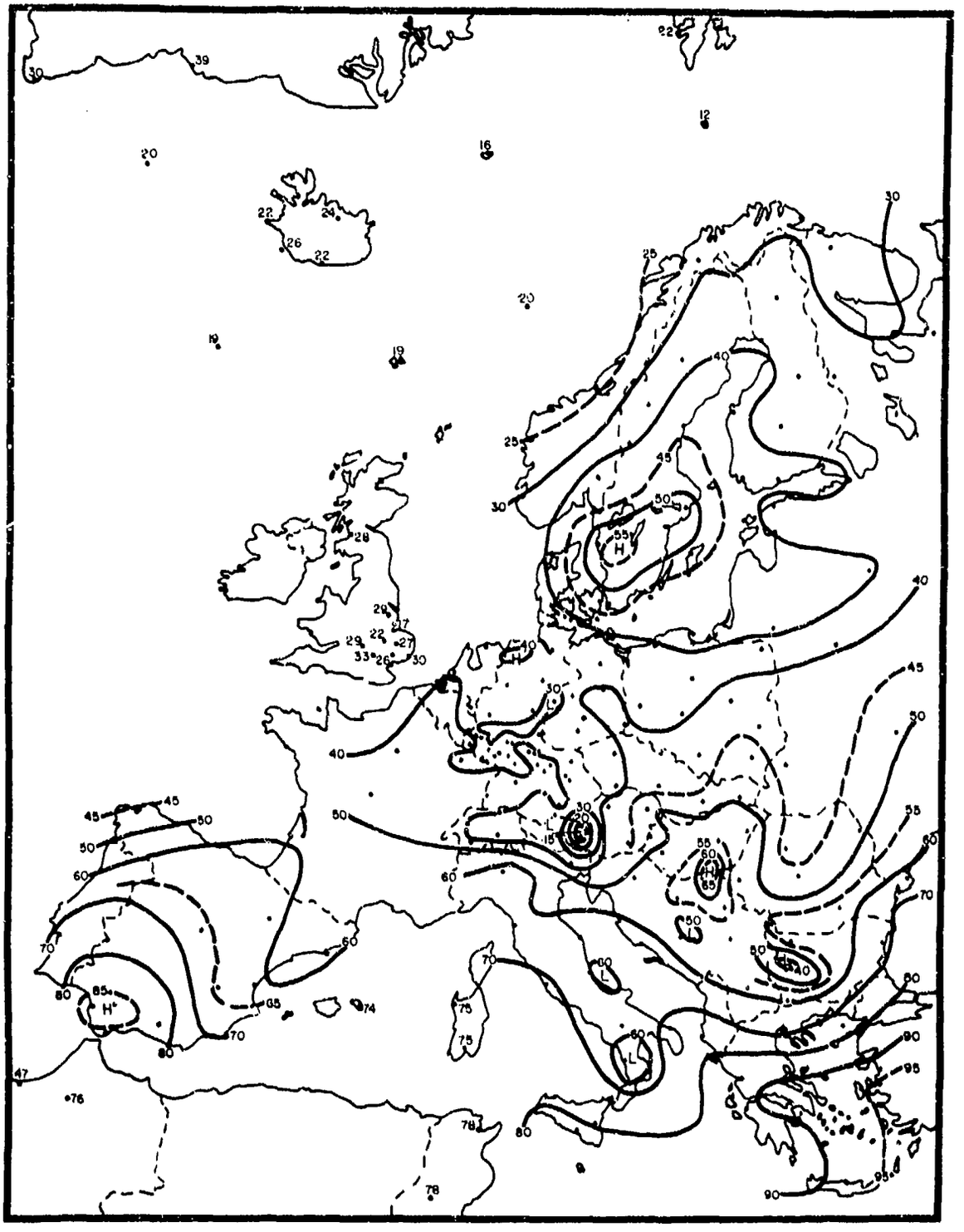

Figure 37. CFLOS Probabilities for July, 1800–2000 LST, 10° Elevation

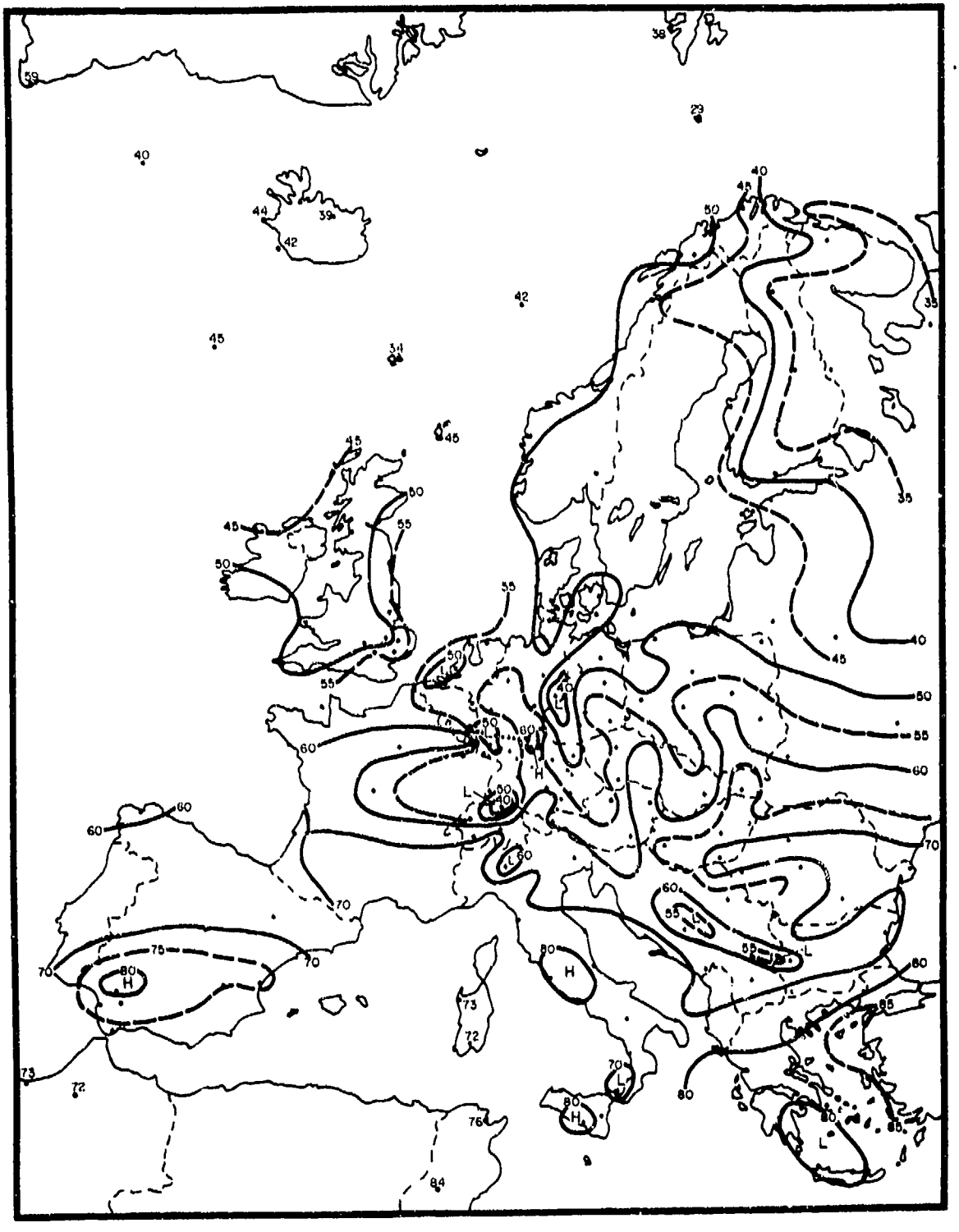

Figure 38. CFLOS Probabilities for Oct, 0000–0200 LST, 90° Elevation

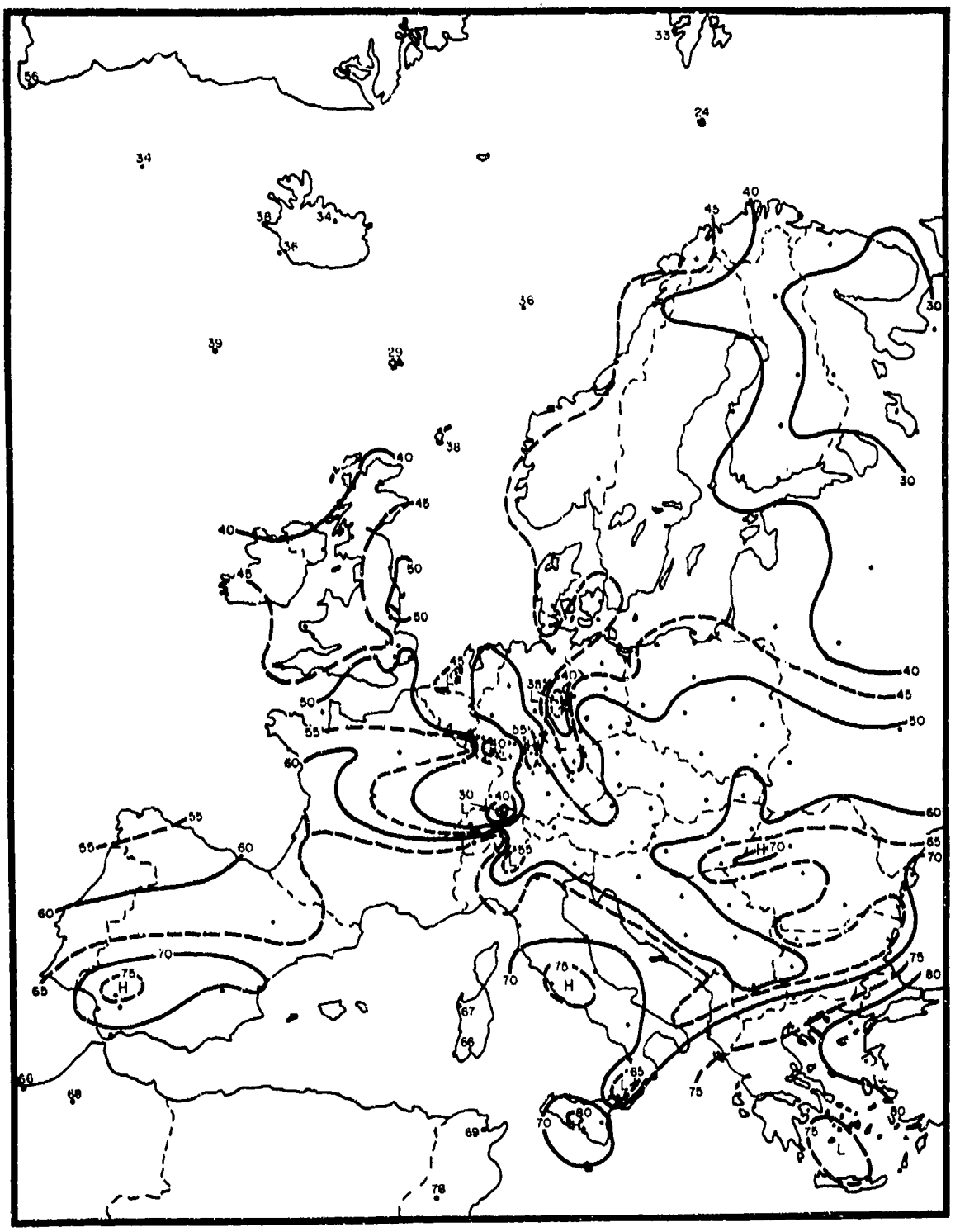

Figure 39. CFLOS Probabilities for Oct, 0000–0200 LST, 30° Elevation

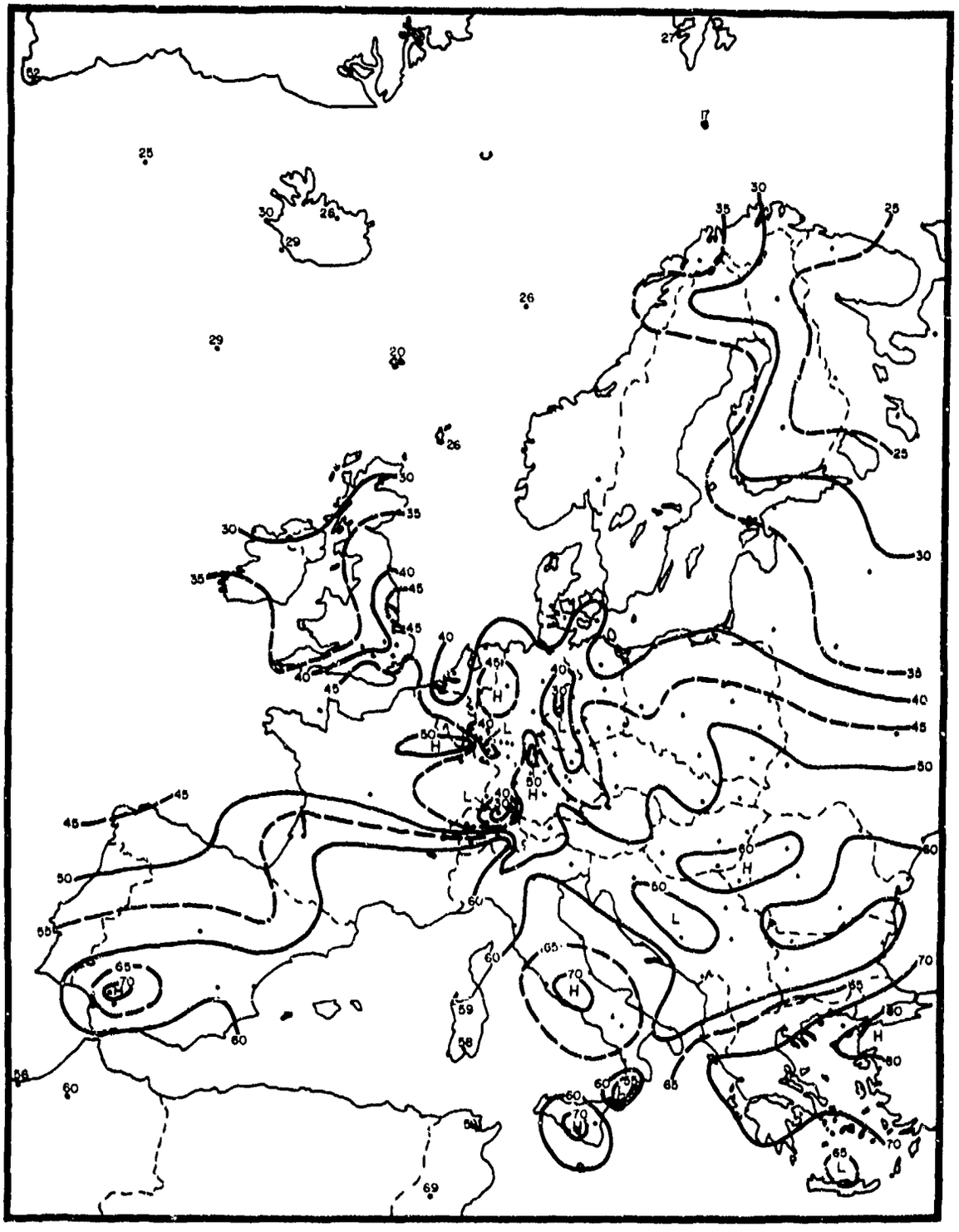

Figure 40. CFLOS Probabilities for Oct, 0000–0200 LST, 10° Elevation

Figure 41. CFLOS Probabilities for Oct, 0600–0800 LST, 90° Elevation

Figure 42. CFLOS Probabilities for Oct, 0600–0800 LST, 30° Elevation

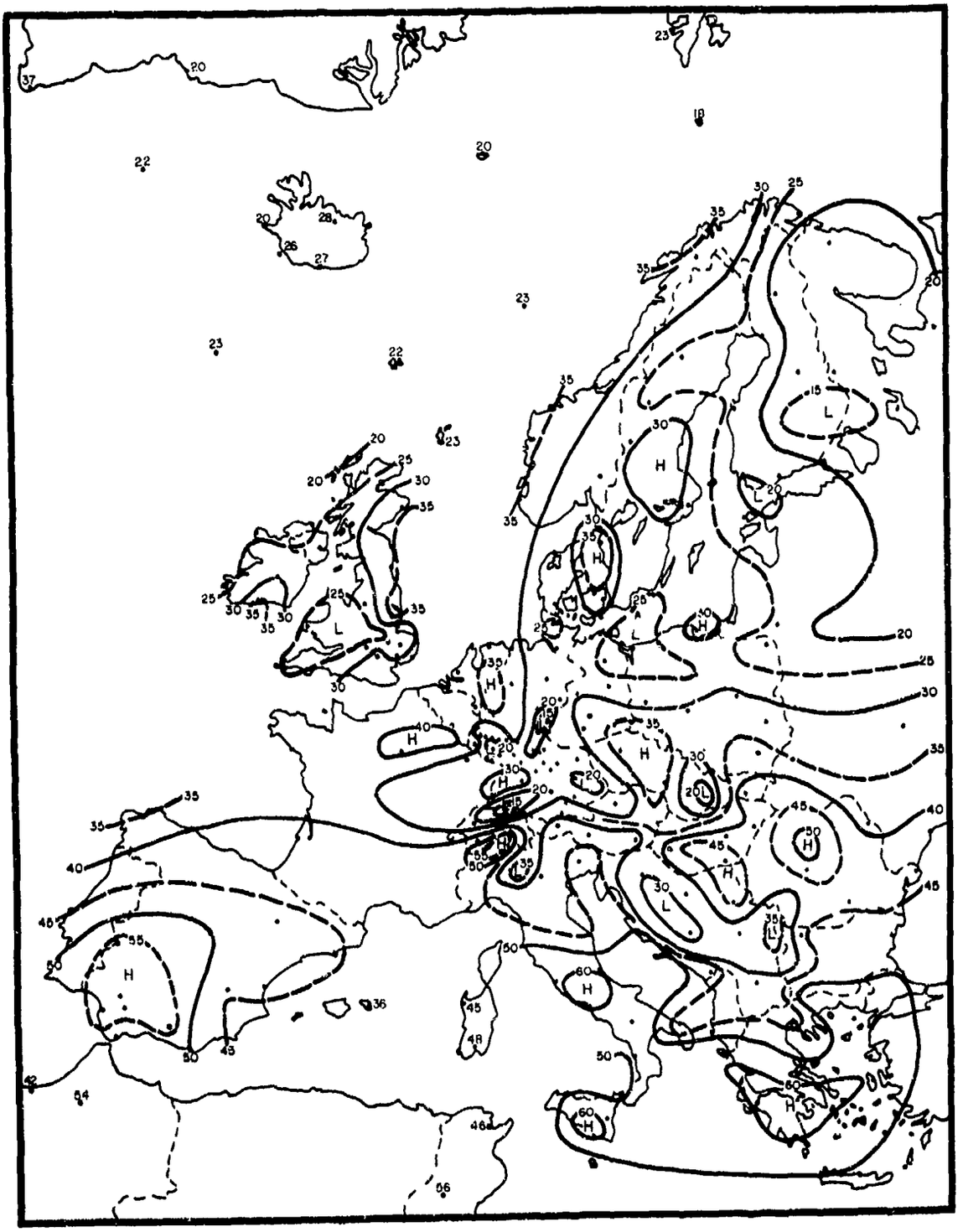

Figure 43. CFLOS Probabilities for Oct, 0600–0800 LST, 10° Elevation

Figure 44. CFLOS Probabilities for Oct, 1200–1400 LST, 90° Elevation

Figure 45. CFLOS Probabilities for Oct, 1200–1400 LST, 30° Elevation

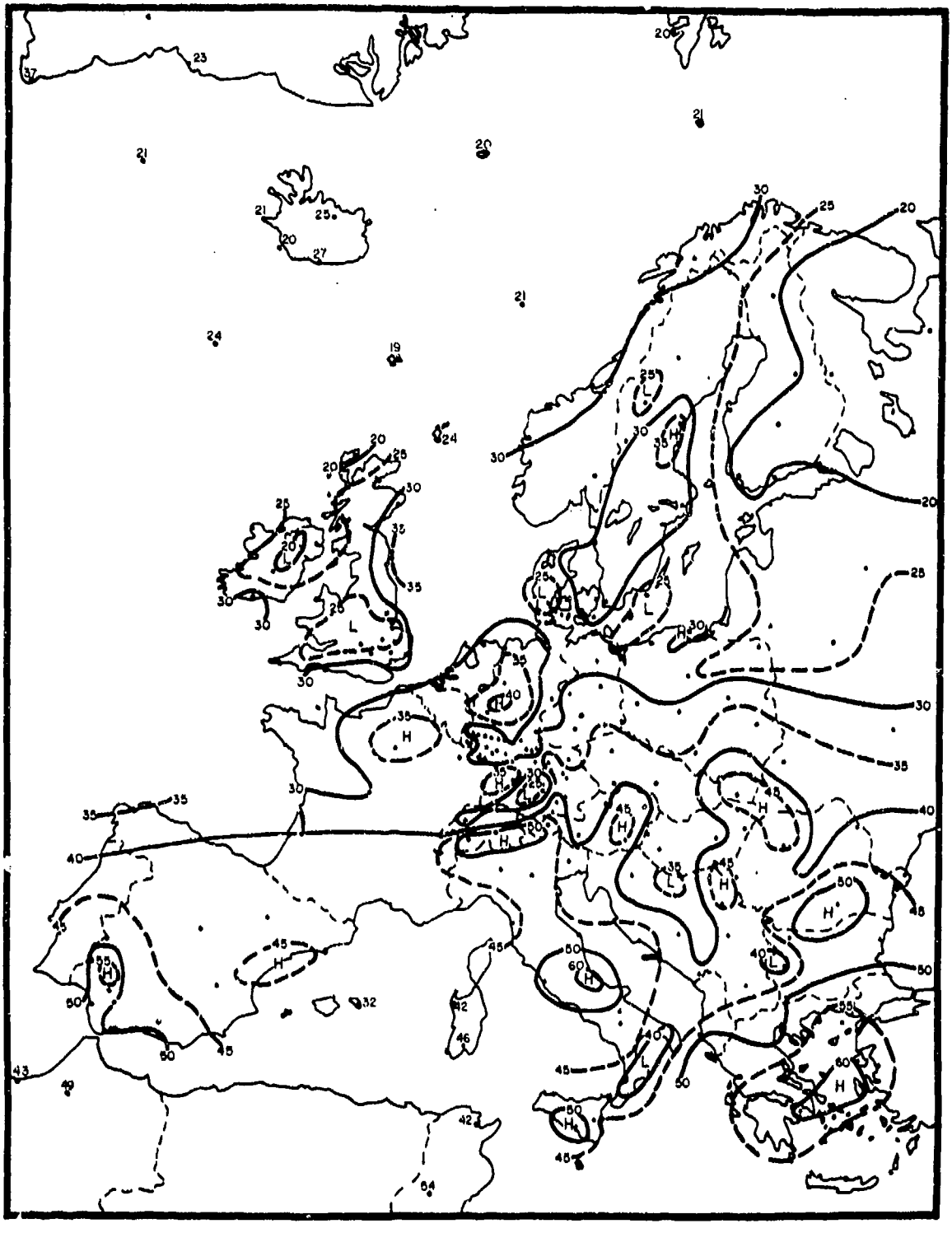

Figure 46. CFLOS Probabilities for Oct, 1200–1400 LST, 10° Elevation

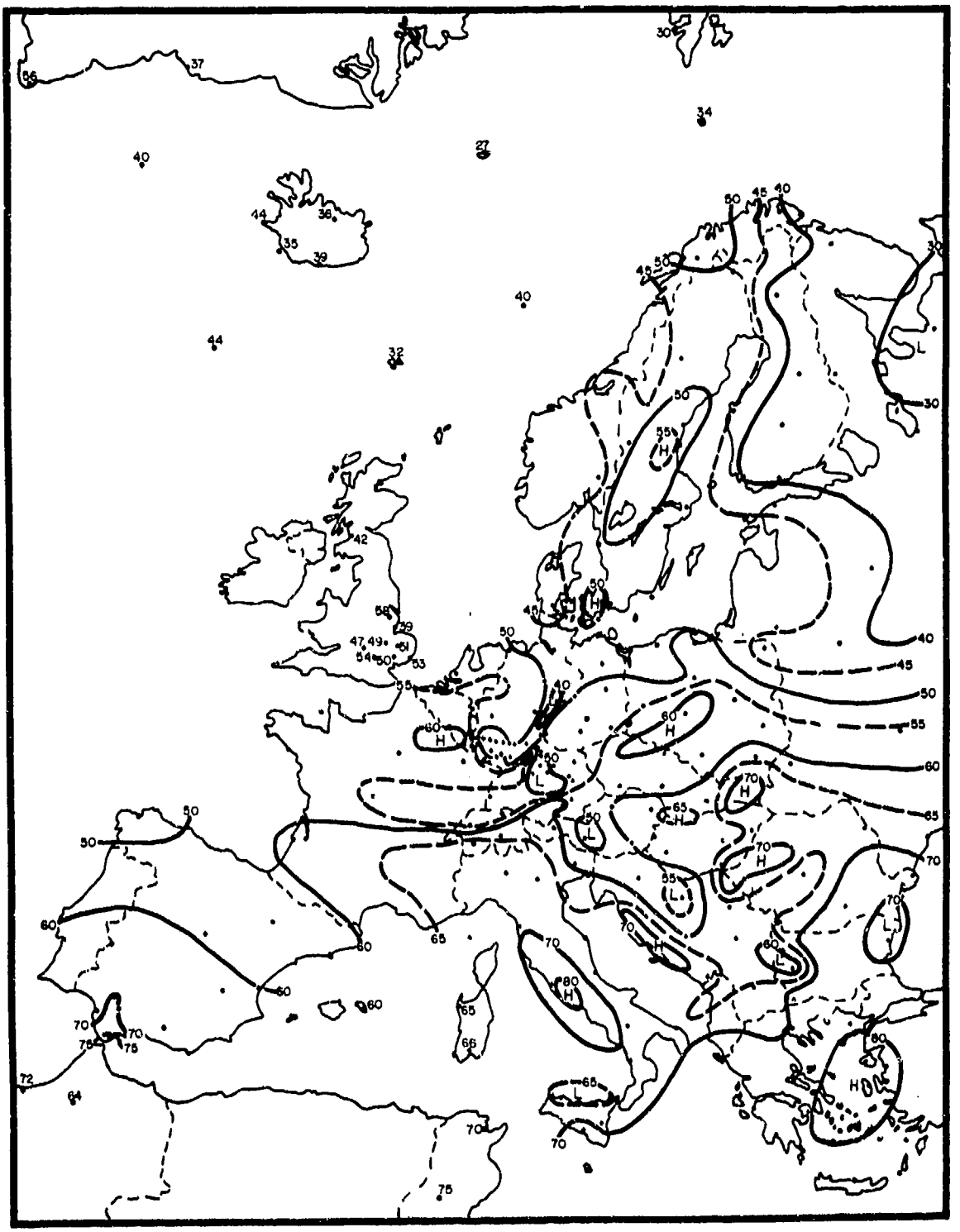

Figure 47. CFLOS Probabilities for Oct, 1800–2000 LST, 90° Elevation

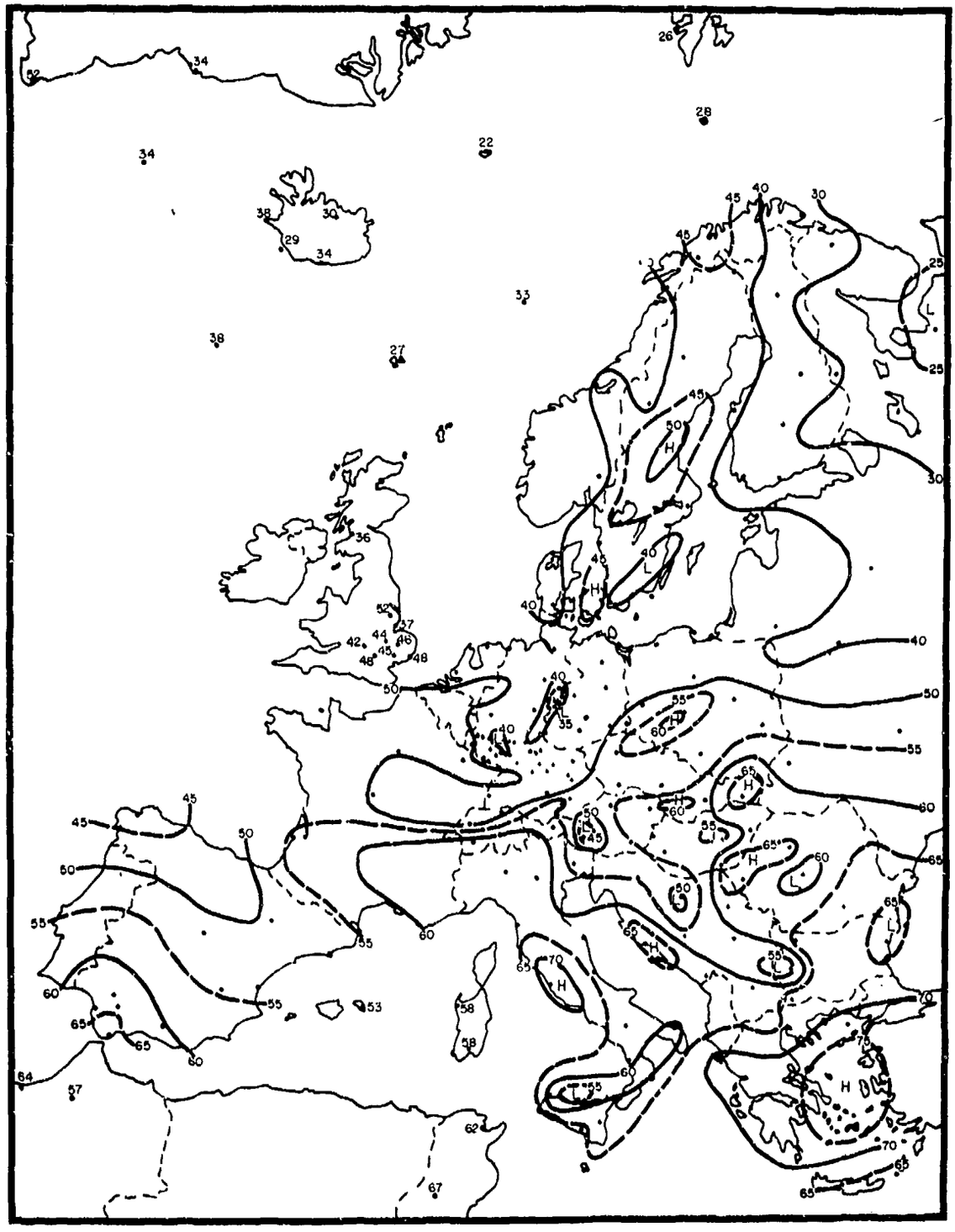

Figure 48. CFLOS Probabilities for Oct, 1800–2000 LST, 30° Elevation

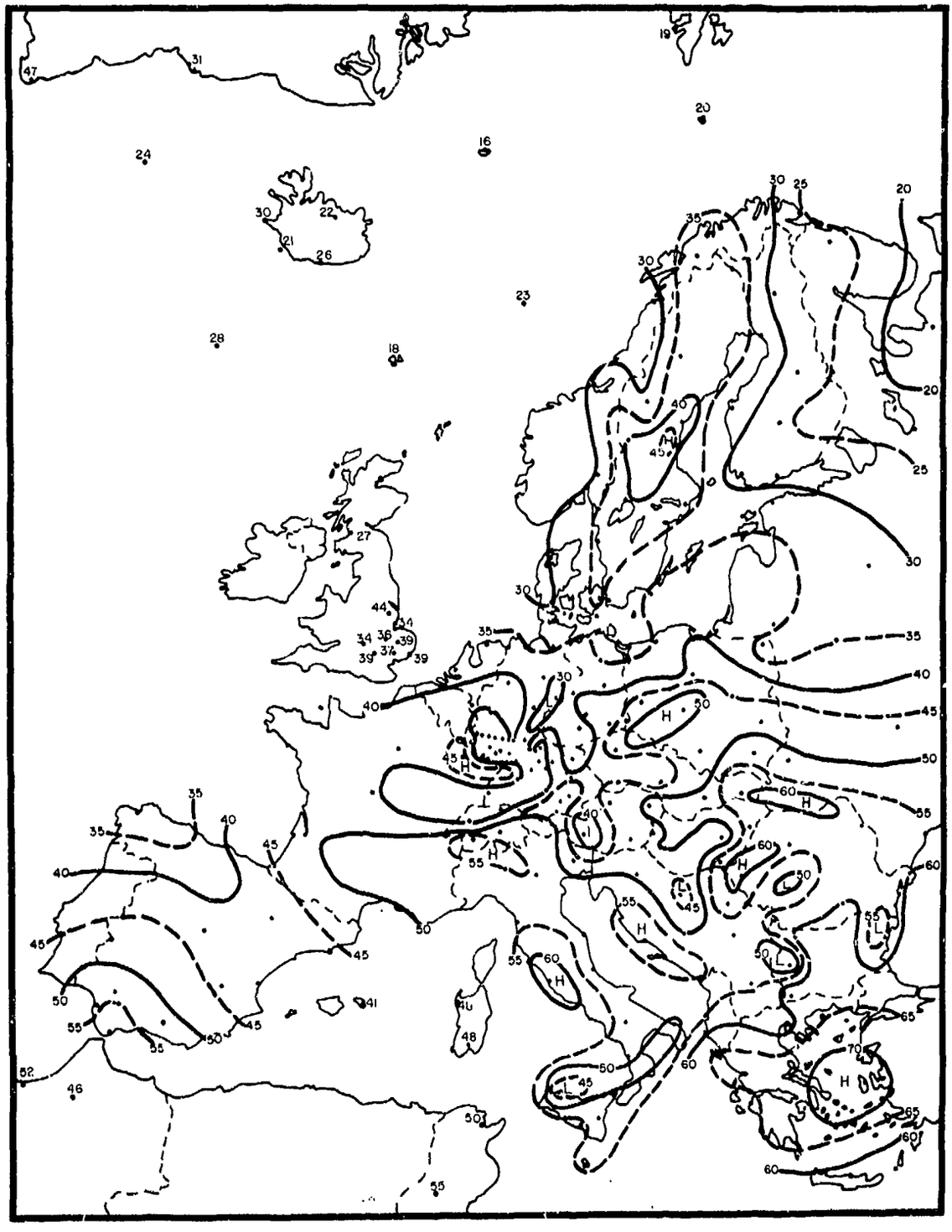

Figure 49. CFLOS Probabilities for Oct, 1800–2000 LST, 10° Elevation

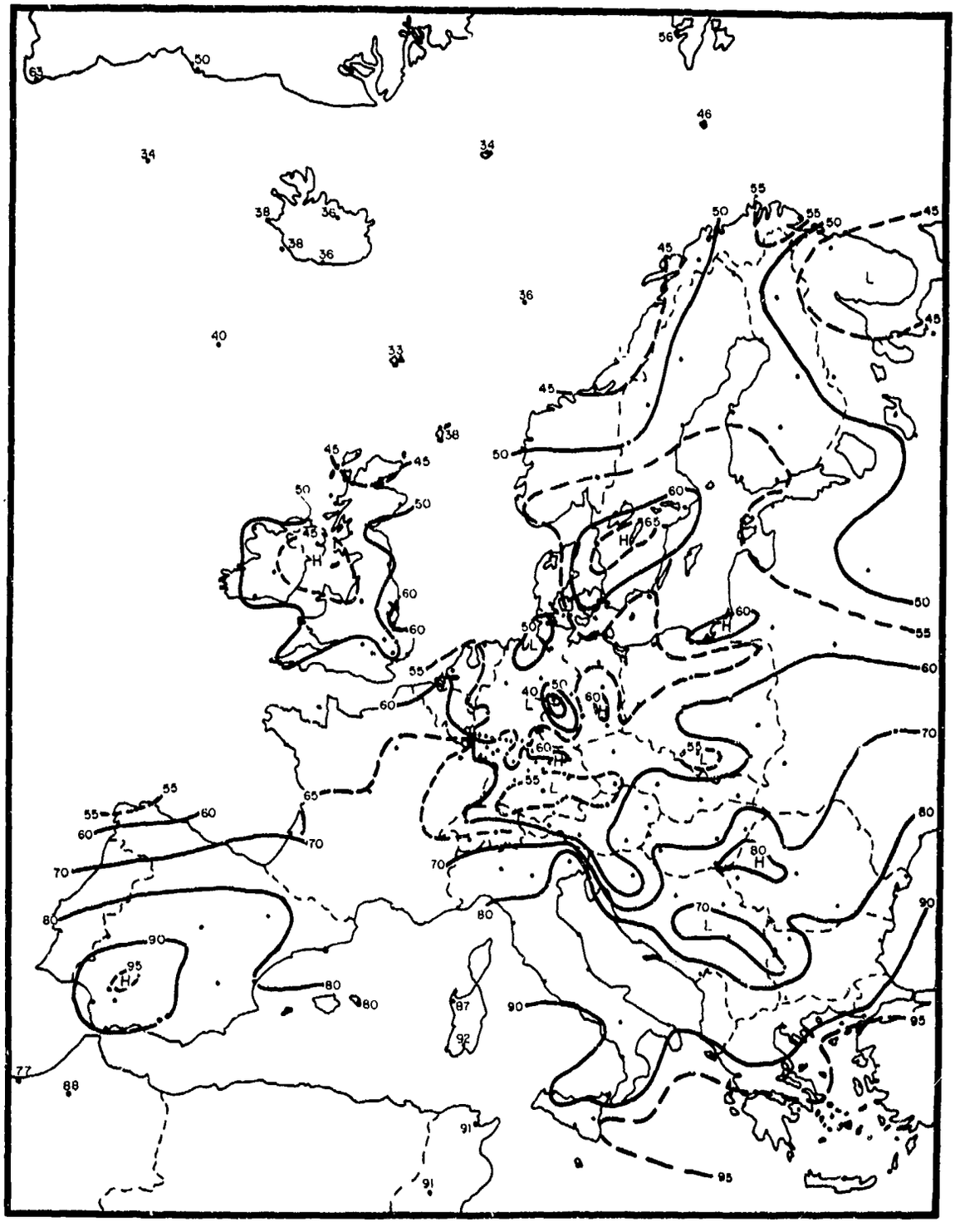

Figure 50. Highest CFLOS Probability, 30° Elevation

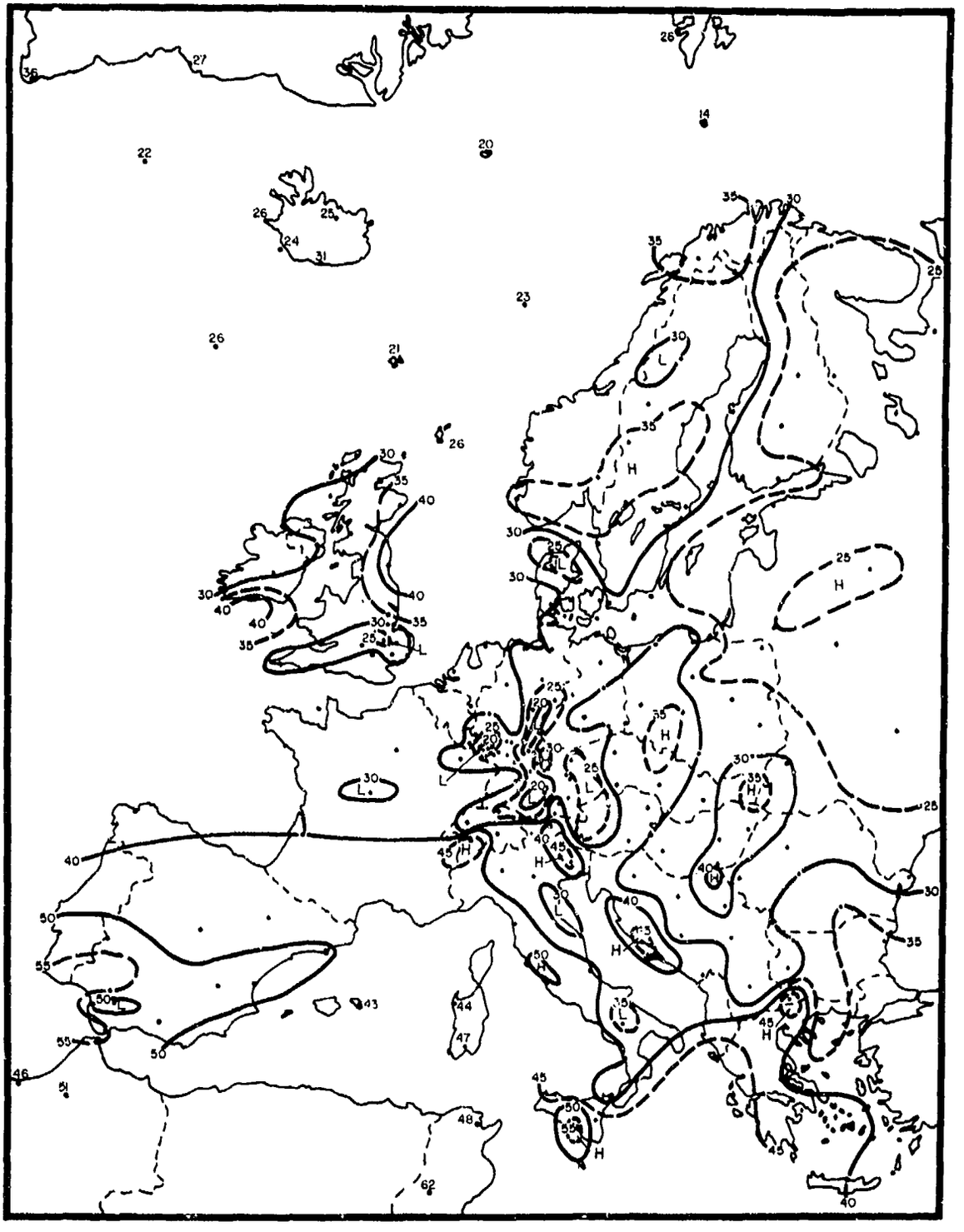

Figure 51. Lowest CFLOS Probability, 30° Elevation