Sea surface temperatures in the northwestern Atlantic in 1979

(Figures 36-50; Table 3)

Sea surface temperature (SST) data, principally collected from cooling water intakes of merchant ships, are reported in radio weather messages and log books transmitted to the U.S. Fleet Numerical Oceanography Center (FNOC) and the National Climatic Center for processing and archiving. The "real-time" reports of the data base provided by the radio messages are analyzed by FNOC and the Pacific Environmental Group of the National Marine Fisheries Service, which is co-located with FNOC. An elementary step in the analysis is the computation of average monthly temperatures and anomalies (from 1948–1967 means) for each 1° × 1° square for which at least 2 observations have been reported each month. The average SSTs, anomalies, and number of observations are then printed in the 1° × 1° squares they characterize to produce a map such as the one shown in Figure 36. To facilitate interpretation of the data, anomalies greater than +1°C or less than −1°C are shaded.

Monthly maps of this sort for the northwestern Atlantic for 1979 (Figs. 36-47) reveal that an area of colder-than-average water developed throughout the western section from Cape Hatteras to Nova Scotia in February, weakened slightly in March, and disintegrated in April. The weather changes which produced this sequence are clearly shown in meteorological data collected at coastal weather stations. For example, data from the Boston, Massachusetts, station showed that below-normal air temperatures occurred in February (4·1°C colder than normal) and were accompanied by vigorous westerly winds (average speed 8·1 m/sec). This combination of factors caused a strong flow of cold, dry air over coastal waters and caused rapid cooling of the surface water. In March more moderate weather conditions prevailed, particularly during the last 10 days of the month. The

Table 3. Anomalies of monthly mean sea surface temperature (°C) from the long-term mean (1948–1967) for 1979 in the northwestern Atlantic Ocean (35°–46°N 60°–76°W)

Month	Number of 1°-squares	Area mean anomaly	Standard deviation of area mean anom. 1948-1967
Jan	117	−0·18	1·26
Feb	109	−0·80	1·23
Mar	121	−0·35	1·49
Apr	126	+0·20	1·51
May	133	+0·60	1·22
Jun	130	+0·65	0·91
Jul	127	−0·39	0·89
Aug	126	0·00	0·85
Sep	128	+0·29	0·89
Oct	126	−0·02	0·95
Nov	121	+0·42	0·90
Dec	105	+0·28	0·91

Figures 36-47. Average sea surface temperature anomalies (°C). Also shown in each one-degree square are average sea surface temperatures (upper number) and the number of observations (lower number).

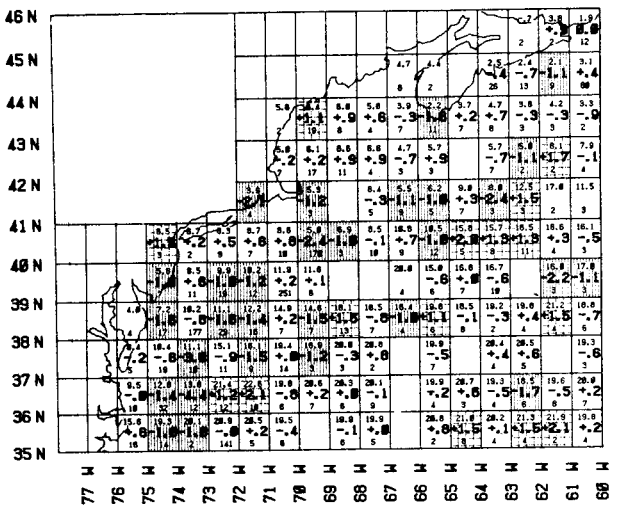

Figure 36. January 1979.

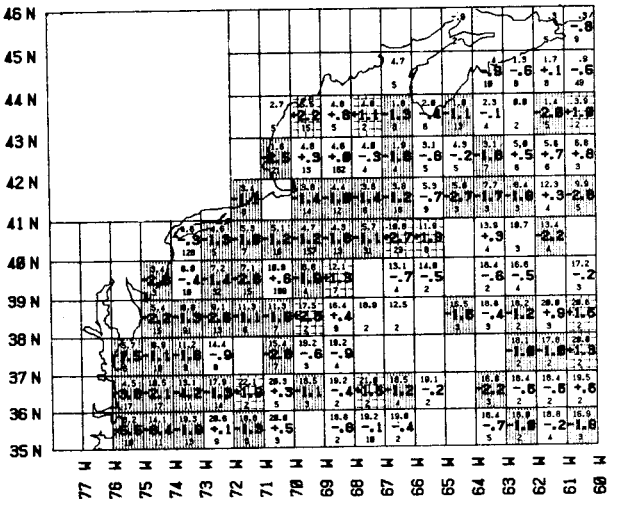

Figure 37. February 1979.

average air temperature in March was 2·4°C above normal with weaker westerly winds (average speed 6·6 m/sec). The moderation in weather continued in April, with nearly average air temperatures and less vigorous winds, which became southerly during the last third of the month.

The most unusual occurrence in the surface layer temperature field in 1979, however, was the development of a band of warm temperature anomalies between 38° and 40°N in the western section in May (Fig. 40). One month later, in June, this band appears to have shifted northward and broadened to occupy the area between 41° and 46°N. By July the area of positive anomalies disintegrated except for a small region southwest of Nova Scotia. The link between this anomaly and coastal meteorological conditions was not as apparent as was the case in winter.

In order to characterize the SST of the entire area

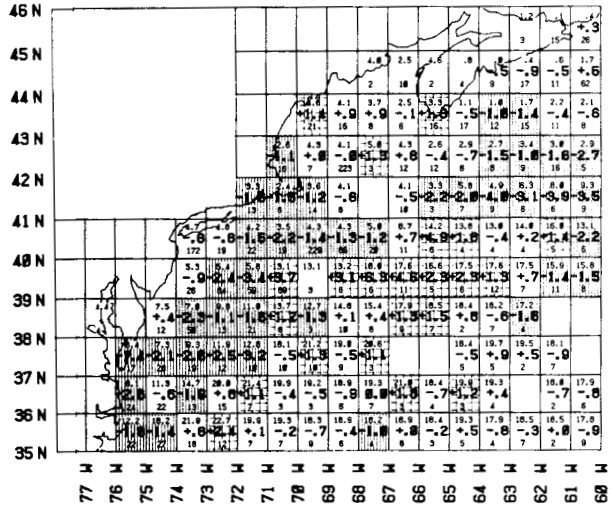

Figure 38. March 1979.

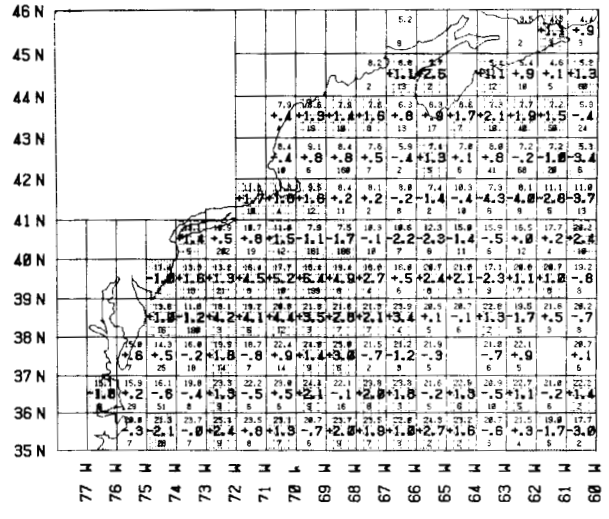

Figure 40. May 1979.

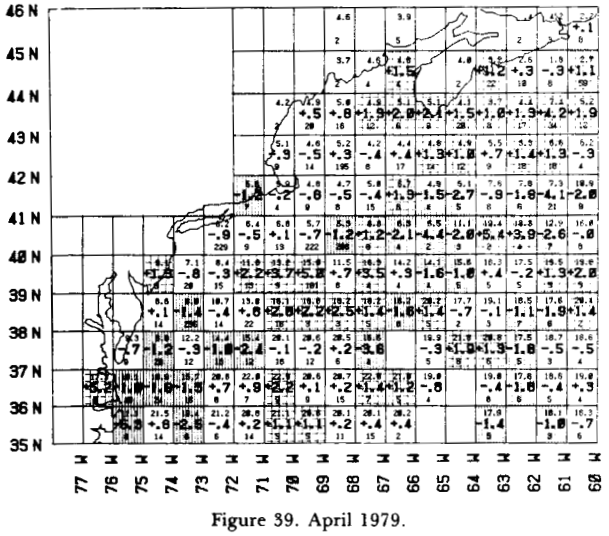

Figure 39. April 1979.

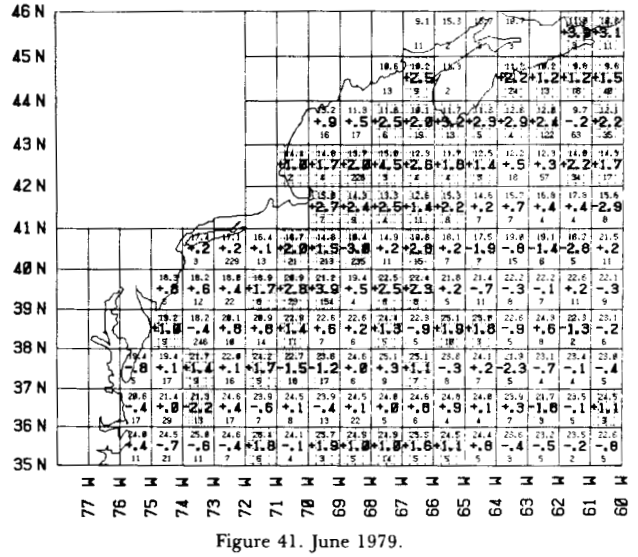

Figure 41. June 1979.

(35°-46°N 60°-76°W) with a single number, the mean of all the mapped anomalies was computed for each month. The resulting monthly area means (Table 3) show a strongly negative value only in February and strongly positive ones in May and June.

Spatial and temporal gradients of SST in the near-shore shelf waters can be portrayed by plotting the monthly anomalies from selected coastal one-degree squares on a space-time grid. Figure 48 is a plot such as this for 15 one-degree squares between Cape Hatteras and Nova Scotia for 1979 (Fig. 49). The plot clearly shows the widespread effect of the cooling which took place in late January and February; all 15 squares showed negative anomalies in February. The anomalously cold water appears to have persisted longer in the southern squares (13-15) than in the others. The development of warmer-than-usual water in April-July occurred in the northern squares only.

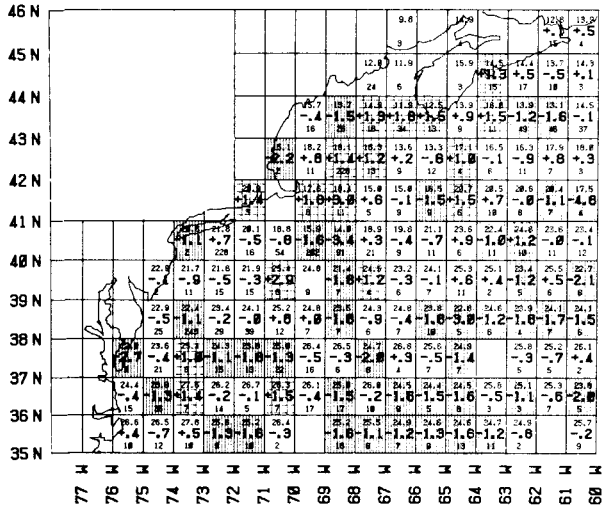

Figure 42. July 1979.

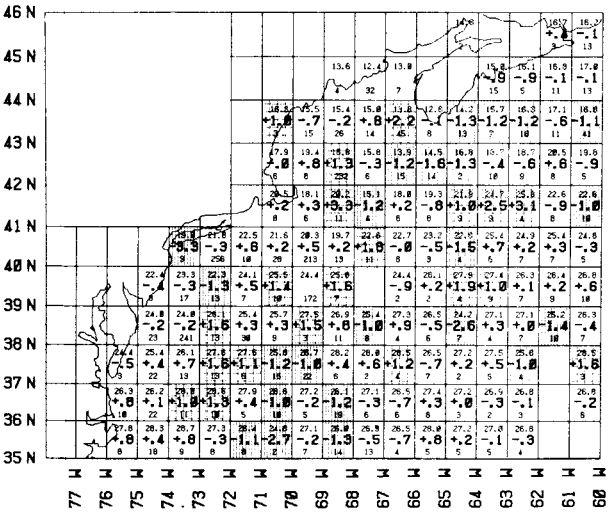

Figure 43. August 1979.

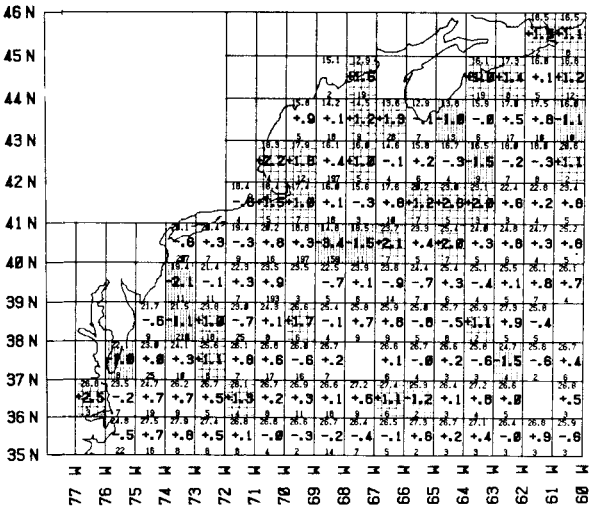

Figure 44. September 1979.

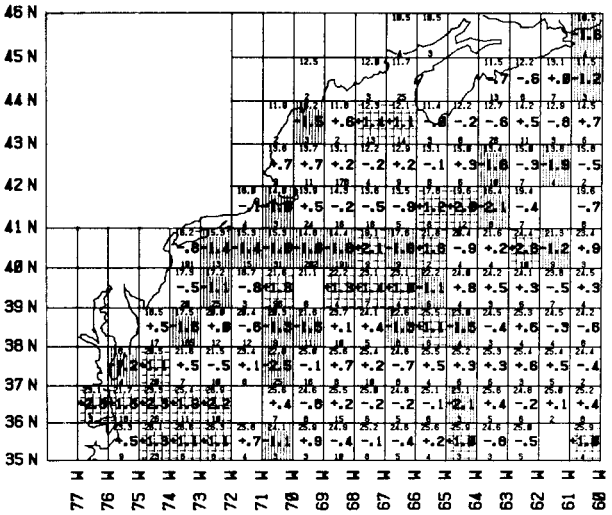

Figure 45. October 1979.

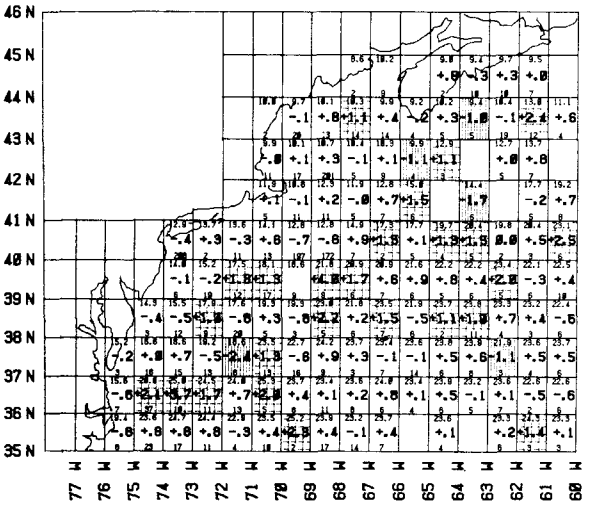

Figure 46. November 1979.

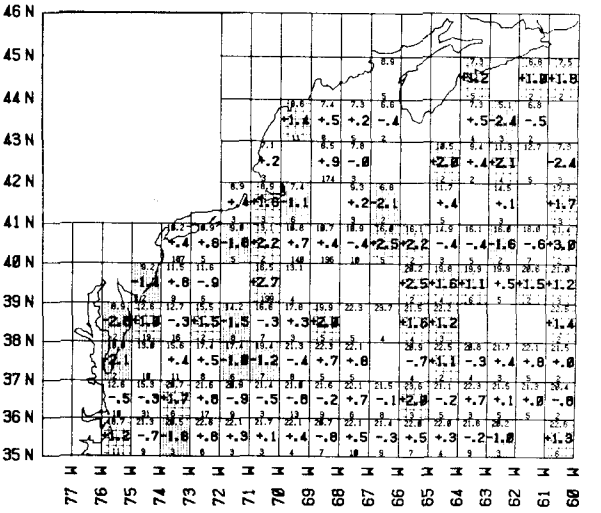

Figure 47. December 1979.

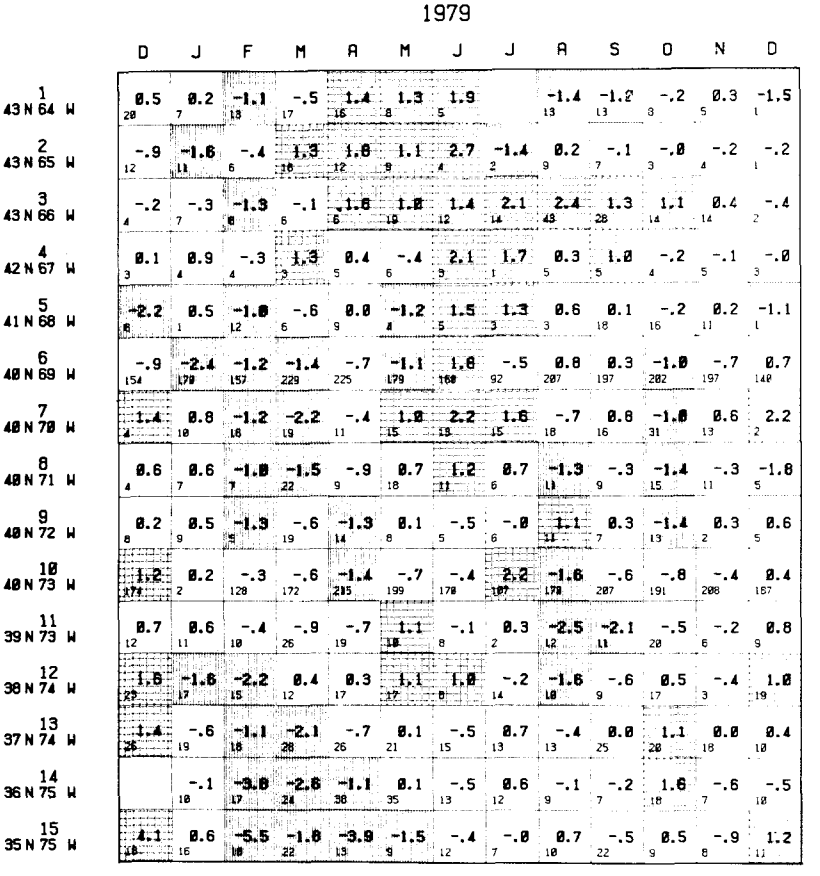

Figure 48. Space-time plot of sea surface temperature anomalies (°C) for 1979. Also shown are the numbers of observations utilized (lower left corner of squares). Location of one-degree squares (1-15) shown in Figure 49.

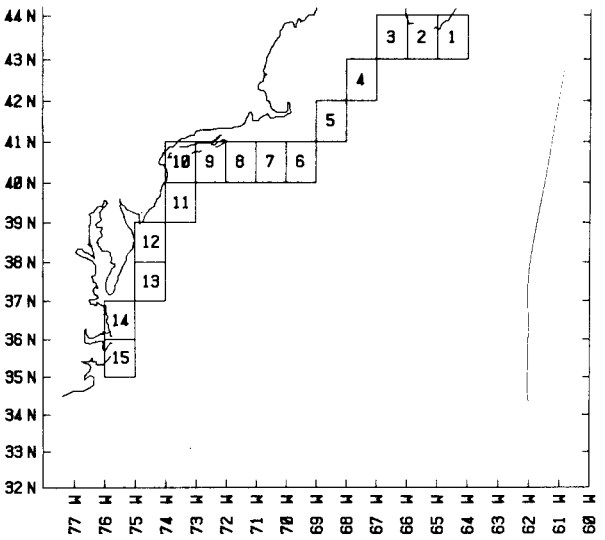

Figure 49. Location of one-degree squares of interest utilized in Figures 48 and 50 (Nova Scotia-Cape Hatteras).

In contrast with the 1979 conditions, those in 1978 (Fig. 50) led to the development of a long-lasting (February-July) band of negative anomalies in the southern half of the area (squares 6-15), but only weak positive anomalies appeared in the July-November period.

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1978

	D	J	F	M	A	M	J	J	A	S	O	N	D
1 43 N 64 W		-.5 (7)	-.5 (9)	-.2 (15)	1.1 (17)	-.7 (16)	0.5 (4)	1.0 (1)	1.6 (12)	1.7 (12)	1.0 (8)	1.2 (5)	0.5 (20)
2 43 N 65 W		-.5 (5)	-1.0 (13)	0.7 (20)	1.2 (16)	0.3 (7)	0.1 (8)	-.7 (2)	-.8 (17)	1.0 (2)	1.6 (6)	1.1 (9)	-.9 (12)
3 43 N 66 W		0.2 (2)	-2.0 (14)	0.6 (12)	0.6 (17)	0.2 (10)	-.6 (7)	1.0 (15)	1.1 (5)	-.7 (2)	0.3 (7)	0.8 (9)	-.2 (4)
4 42 N 67 W		-1.0 (2)	1.0 (2)	-.6 (13)	-1.4 (2)	0.6 (17)	0.6 (15)	0.1 (6)	-.7 (10)	-.2 (14)	1.1 (35)	0.5 (12)	0.1 (3)
5 41 N 68 W		-.2 (2)	-1.7 (1)	-1.3 (31)	-.5 (4)	-.6 (13)	2.4 (3)	-1.0 (5)	-1.7 (6)	1.1 (4)	-1.0 (20)	0.5 (20)	-2.2 (6)
6 40 N 69 W		-1.1 (125)	-.7 (142)	-.7 (171)	-.7 (189)	-1.3 (221)	-2.3 (185)	-.6 (171)	1.2 (151)	-2.1 (131)	-1.0 (155)	-.5 (144)	-.9 (154)
7 40 N 70 W		-.2 (20)	-1.4 (21)	-1.4 (34)	-2.3 (15)	-1.6 (17)	-.5 (7)	-.8 (17)	1.0 (10)	-1.6 (10)	-1.1 (22)	0.9 (9)	1.4 (4)
8 40 N 71 W		-.8 (8)	-.6 (15)	-1.0 (22)	-2.3 (25)	-2.0 (28)	-.7 (7)	-4.0 (10)	0.7 (21)	0.1 (15)	-1.7 (17)	-.2 (6)	0.6 (4)
9 40 N 72 W		0.0 (1)	-.4 (3)	-2.7 (10)	-1.4 (15)	-1.9 (16)	-.2 (8)	-.7 (9)	1.2 (4)	1.6 (8)	-.8 (12)	0.7 (7)	0.2 (8)
10 40 N 73 W		0.7 (134)	1.2 (28)	-.8 (16)	-1.0 (148)	-3.0 (154)	-1.0 (150)	-1.5 (154)	1.5 (131)	1.0 (42)	0.1 (13)	0.1 (49)	1.2 (174)
11 39 N 73 W		-.4 (18)	-1.7 (9)	-1.1 (14)	-1.9 (11)	-1.1 (15)	-.7 (19)	-1.4 (20)	1.2 (14)	1.3 (14)	-.5 (11)	0.7 (12)	0.7 (12)
12 38 N 74 W		-5.1 (8)	-2.6 (18)	-1.0 (29)	-2.0 (22)	-.6 (14)	-2.0 (25)	-.4 (26)	0.0 (7)	-1.3 (7)	0.2 (11)	-.4 (9)	1.6 (25)
13 37 N 74 W		-.5 (11)	-2.7 (23)	0.8 (44)	-1.7 (27)	-2.3 (15)	-1.4 (26)	0.3 (23)	0.9 (13)	2.3 (29)	-.3 (21)	-.4 (19)	1.4 (26)
14 36 N 75 W		-4.2 (18)	-4.0 (31)	-2.0 (38)	0.3 (38)	-2.0 (34)	-2.4 (29)	-.9 (14)	-.7 (2)	1.0 (11)	-.6 (16)	-.1 (14)	
15 35 N 75 W		1.0 (19)	-7.7 (19)	-5.7 (18)	-4.5 (24)	0.7 (10)	0.0 (6)	1.7 (14)	1.0 (13)	1.0 (15)	-.9 (16)	-2.0 (18)	4.1 (18)

Figure 50. Space-time plot of sea surface temperature anomalies (°C) for 1978. Also shown are the numbers of observations utilized (lower left corner of squares). Location of one-degree squares (1-15) shown in Figure 49.