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Sea Surface Temperature Distributions Obtained Off San Diego, California, Using an Airborne Infrared Radiometer

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ABSTRACT

Sea surface temperature surveys were conducted weekly off San Diego, Calif., using an airborne infrared radiometer during the months of April through October 1972-74. A total of 90 surveys were made over the 320-mile flight track. The analog chart record of temperature was keyed to a "ground truth" temperature measurement and read to determine 1 min average temperatures which were plotted on the flight track and 1°F (0.56°C) isotherms were contoured from the data. The trend of sea surface temperatures during the 3-yr period showed warmer temperatures in 1972, which was an "El Niño" year, cooler in 1973, warmer than 1973 in 1974, but not as warm as 1972. In early July 1974, an anomalous warming period occurred and highest average temperatures of 73°F (22.7°C) were recorded in 19 July 1974. Lowest average temperature of 54°F (12.2°C) was recorded on 2 April 1973.

The 1972-74 survey temperatures taken over the "ground truth" calibration site were compared with a time series of temperature observations taken during the same months from 1963 to 1968. The average temperature during 1963-68 was 63.4°F (17.4°C) and for 1972-74, 64.1°F (17.8°C), a difference of less than 1°F (0.56°C). Average monthly temperature differences, 1963-68 compared with 1972-74, shows April the same, warmer 2°F (1.12°C) for May, 3°F (1.68°C) for June, 1°F (0.56°C) for July, same for August, 1°F (0.56°C) less for September, and 2°F (1.12°C) less for October.

INTRODUCTION

Synoptic sea surface temperature surveys with an airborne infrared radiometer were first conducted off the Pacific coast in August 1963 over the coastal waters of Washington, Oregon, and California by the National Marine Fisheries Service's (NMFS) Tiburon Fisheries Laboratory at Tiburon, Calif. Surveys over three areas were conducted in cooperation with the U.S. Coast Guard, and these surveys are being continued as part of the U.S. Coast Guard oceanographic program. The first 5 yr of surveys (1963-68) were reviewed by the author (Squire 1971). The objective of the coastal program was to increase the general knowledge about the nearshore temperature structure, to define areas of nearshore upwelling, and to develop temperature data that may be useful in relating the distribution and relative abundance of major coastal species of fishes to sea surface temperature and its changes.

The initial surveys, conducted monthly, were broad in geographical scope and in time. The data have been useful in computing average catch temperatures for salmon off central California, and for a number of pelagic species common to southern California waters (Squire unpubl. manuscr.). However, this broad-based survey did not cover some of the more important coastal fishing areas in sufficient detail and at short enough time intervals to permit the determination of the relation of changes in catch composition and catch rates to short-term temperature fluctuations.

To determine short-term temperature effects, an area having a heavy amount of fishing effort and catch was selected for detailed study. This area covered the southern California coastal waters from near Del Mar, Calif., to south of the United States-Mexico border, and to about 22.3 km (12 n.mi.) offshore. The area, known by the project name of "San Diego Test Area" encompasses the major sportfishing grounds off La Jolla, Point Loma, and about the Coronado Islands off Mexico.

The airborne temperature surveys used a "ladder-type" search pattern, modified to accommodate navigational aids. These surveys were flown once each week, 1 April through 31 October during 1972 to 1974. A total of 90 surveys was made, each requiring about 2 h to complete.

OPERATIONAL PROCEDURES

The airborne sea surface temperature sensing unit used in the study was a Barnes research radiometer (PRT-5) modified with a special lens filter system to restrict the viewing range in the infrared spectrum to 10.5 to 12.5 nm. This spectral range approximates the infrared range that is used in the ITOS (NOAA, National *Environmental Satellite Service*) series weather satellite.

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The PRT-5 was piloted by the author in a NMFS twin-engine aircraft over the survey flight track (Fig. 1) at elevations between 152 and 304 m (500 and 1,000 ft). Low stratus bases at 243 and 304 m (800 to 1,000 ft) common to the coastal areas were encountered on most flights during the 3-yr period. On numerous occasions, flights were rescheduled due to very low stratus or fog conditions. Only on rare occasions was there an absence of haze or low stratus, middle and high clouds, the type of conditions that would allow direct comparison of satellite data with the low altitude temperature surveys.

Calibration measurements, or "ground truth," were obtained from surface sources for each flight either from observations taken at the end of the Scripps Institution of Oceanography pier, La Jolla, Calif., or from the U.S. Naval Undersea Center's (NUC) oceanographic tower located approximately 2.8 km (1½ n.mi.) off Mission Beach, San Diego, Calif. Most comparative observations were taken over the oceanographic tower as it is located offshore, and the temperature of surrounding surface waters are relatively stable when compared with those near the outer surf zone at Scripps pier. Simultaneous sea surface temperature observations were made with either a surface bucket thermometer off Scripps pier, or a surface thermistor temperature reading from the NUC oceanographic tower. To obtain a comparative reading, the aircraft was flown over the pier or tower at an elevation of about 45.7 m (150 ft). At the moment the aircraft passed over the pier or tower, the radiative surface of the structures, being much warmer than the sea surface, would produce a response from the infrared detector to make a synchronous mark on the temperature analog recorder chart. The analog recorder chart was driven at a speed of 2.54 cm (1 in) per minute.

The temperature analog chart was keyed to the "ground truth" temperature measurement, and the chart was read to determine a 1-min average temperature, with a slide rule averaging readout device developed by the author (Squire 1971). The 1-min temperature averages were plotted on the flight track, and 1°F (0.56°C) isotherms were contoured from the data. The weekly isotherm charts were given limited distribution to a list of interested fishing and scientific organizations and their personnel.

Isotherm charts are shown in the Appendix for all surveys in 1972, 1973, and 1974 (1972, Figs. 1-28; 1973, Figs. 29-61; 1974, Figs. 62-90). For conversion of °F to °C see comparative temperature data on each figure.

RESULTS

Isotherm charts were developed for each of the 90 survey flights. Distribution of survey flight effort by month for the 3-yr period is as follows:

Month	*Flights*
April	12
May	13
June	10
July	15
August	14
September	12
October	14

June has the least number (10) of flights during the survey period, reflecting the problems of conducting aerial surveys during a period when persistent low stratus is most present over the coastal waters off San Diego.

The general trend of sea surface temperature during the 3-yr period showed that 1973 was cooler than 1972, which was an "El Niño" year with above-normal warming along the west coast of North and South America (Miller and Laurs 1975). Temperatures in 1974 were warmer than those observed in 1973, but not as warm as those experienced in 1972. However, in 1974, an anomalous warming period occurred in early July off southern California, and the highest temperatures were recorded at that time. Examples of isotherm patterns observed during surveys having the lowest average temperature (2 April 1973) and the highest average temperature (19 July 1974) are shown in the Appendix, Figures 31 and 76.

Semimonthly isotherm charts of the northeastern Pacific, developed from ship data, are issued by the NMFS Southwest Fisheries Center. To develop data for comparative purposes, weekly temperatures were then averaged by semimonthly periods for each month, 1 through 15 days and 16 through 30/31 days, for the 3 yr of data from temperatures observed at locations along the survey flight track, as shown in Figure 1. Isotherm charts in 1°F with °C equivalents drawn to these semimonthly data are presented in Figures 2 to 15.

The only time series of infrared sea surface temperature data available for comparison with the 1972 to 1974 data off San Diego is the 1963-68 data resulting from the cooperative program with the U.S. Coast Guard. During these surveys, ground truth calibration checks were also made over the NUC oceanographic tower. Comparing 1963-68 monthly average temperatures (to the nearest whole °F) for the area off Mission Beach (NUC tower area) with those observed in the same location during the 1972-74 surveys, we note an average difference of less than 1°F (0.56°C). The average temperature for 1963-68 was 63.4°F (17.4°C) and for 1972-74 was 64.1°F (17.8°C). Average monthly temperatures rounded to the nearest °F for the 3-yr period were observed (Table 1) to be the same for April, warmer 2°F (1.12°C) for May, 3°F (1.68°C) for June, 1°F (0.56°C) for July, the same for August, 1°F (0.56°C) less for September, and 2°F (1.12°C) less for October.

A general description of sea surface temperature patterns that would be typical of those usually observed off San Diego during the weekly surveys is as follows: Temperatures that are greater than any other locations in the survey area are usually found north offshore and to the northwest of La Jolla. From off La Jolla Point to Pacific Beach and continuing southwest and offshore to the southwest is an area of upwelling with generally lower temperatures than those to the north. Evidences of this

Table 1.—Comparative temperatures—U.S. Naval Undersea Oceanographic Tower for airborne infrared sea surface temperature surveys, 1963-68/1972-74.

Month	1972-74 monthly mean temperature °C	1972-74 monthly mean temperature °F	1963-68 monthly mean temperature °C	1963-68 monthly mean temperature °F
April	14.6	58.2	14.4	58.0
May	16.8	62.3	15.6	60.0
June	18.4	65.3	16.7	62.0
July	19.7	67.4	18.9	66.0
August	20.0	68.0	20.0	68.0
September	17.3	63.3	18.3	65.0
October	17.3	63.3	18.3	65.0

upwelling area was also observed when a temperature decline, sometimes sharp, was frequently present west of Mission Beach and the NUC tower when proceeding toward the coast. The kelp bed area west of Point Loma appears to be slightly warmer than the area to the north off Mission Beach. Near the area south of Point Loma and about the San Diego harbor entrance channel, a significant drop in temperature is usually observed, this resulting from upwelling near the south end of the Point. Temperatures tend to remain lower than those found west of the Point Loma peninsula and they remain lower to the southeast of Point Loma, off the Coronado Strand, and increase slightly off Imperial Beach. Immediately south of the International Border of Mexico is frequently found the northern edge of an extensive coastal upwelling zone. The effects of this upwelling increase to the south and extend further offshore. Warmer temperatures than those found near the coast of Mexico are encountered offshore about the Coronado Islands, and temperatures in this area are more typical of those found offshore in the northern portion of the survey area.

ACKNOWLEDGMENTS

The interest and cooperation of E. C. LeFond, Dale Good, Paul Hansen, and the staff associated with the NUC oceanographic tower in making sea surface calibration observations is appreciated. To a number of personnel from the Southwest Fisheries Center, NMFS, NOAA, and to Clyde Melendy of the National Weather Service, NOAA, who took time from their activities to assist in the airborne surveys, I express my appreciation.

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1971. Measurements of sea surface temperature on the eastern Pacific continental shelf using airborne infrared radiometry, August 1963-July 1968. U.S. Coast Guard Oceanogr. Rep. 47 (CG373-47), 229 p.

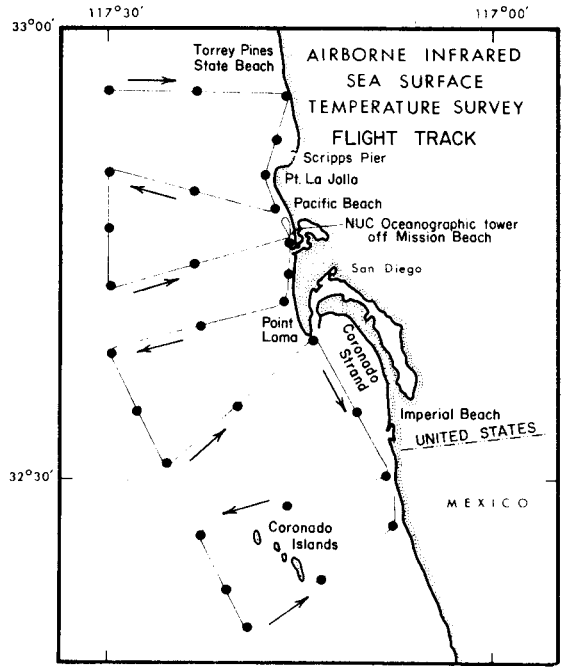


Figure 1.—Survey flight track pattern flown during the 3-yr study. Dots indicate points where temperatures were taken for the development of biweekly average isotherm charts.

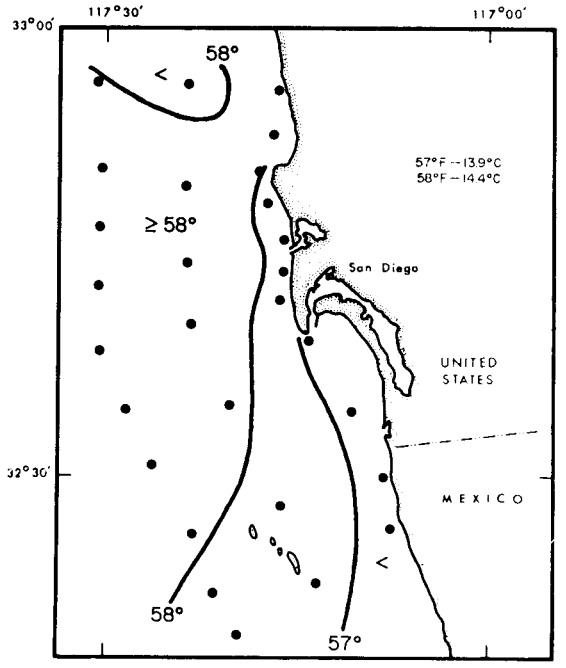


Figure 2.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 April 1972-74.

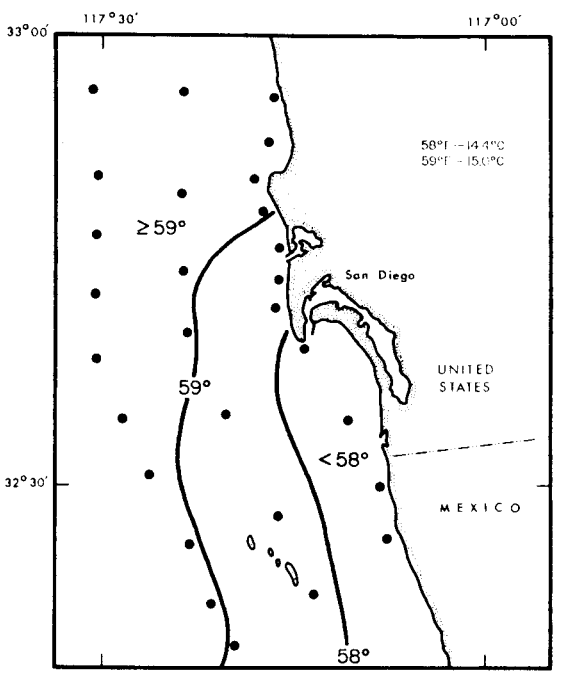


Figure 3.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 30 April 1972-74.

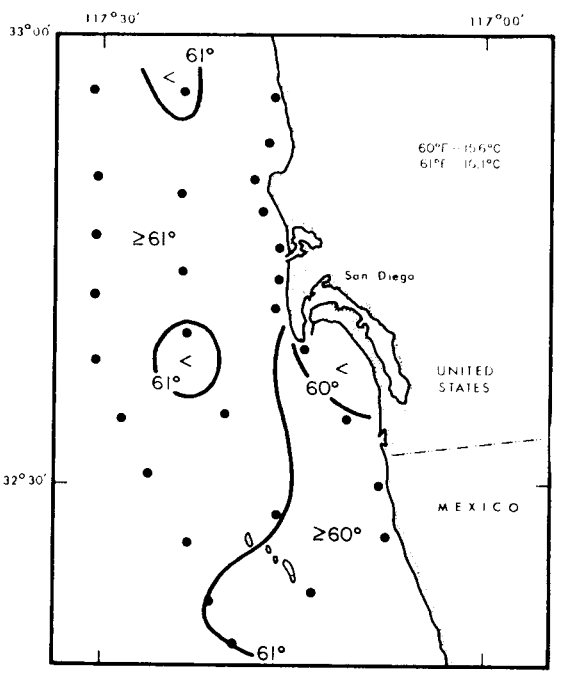


Figure 4.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 May 1972-74.

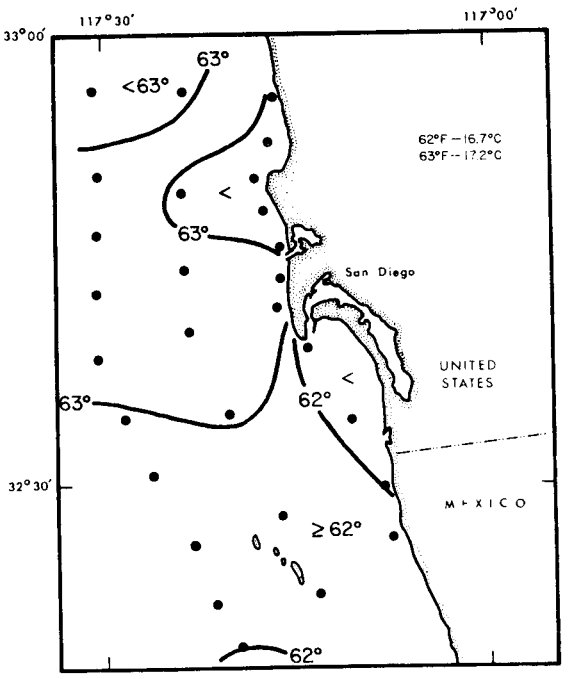


Figure 5.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 31 May 1972-74.

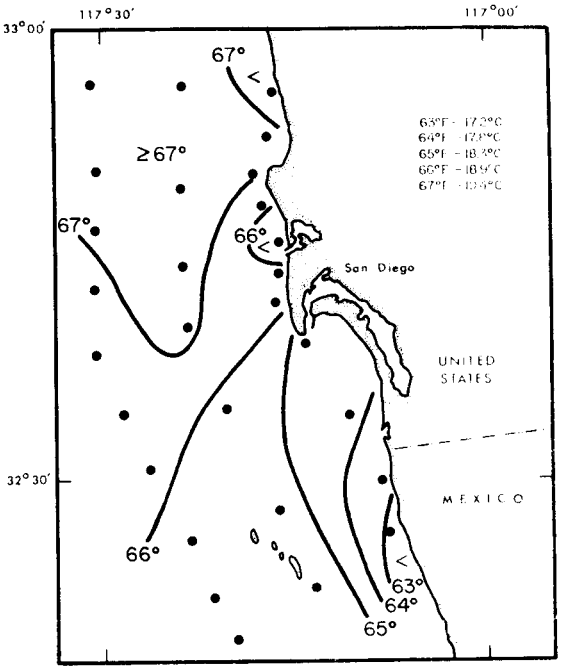


Figure 7.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 30 June 1972-74.

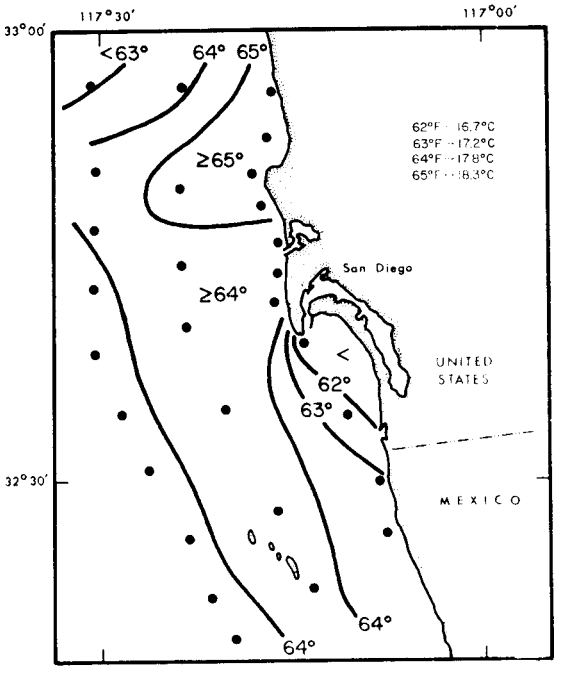


Figure 6.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 June 1972-74.

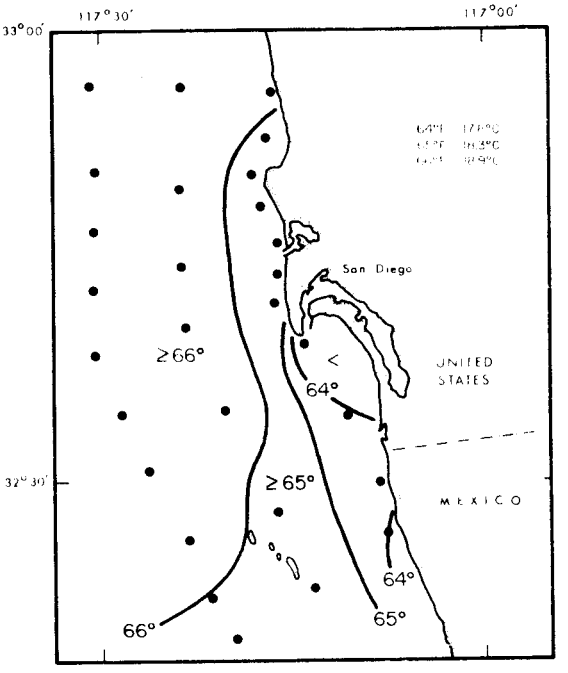


Figure 8.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 July 1972-74.

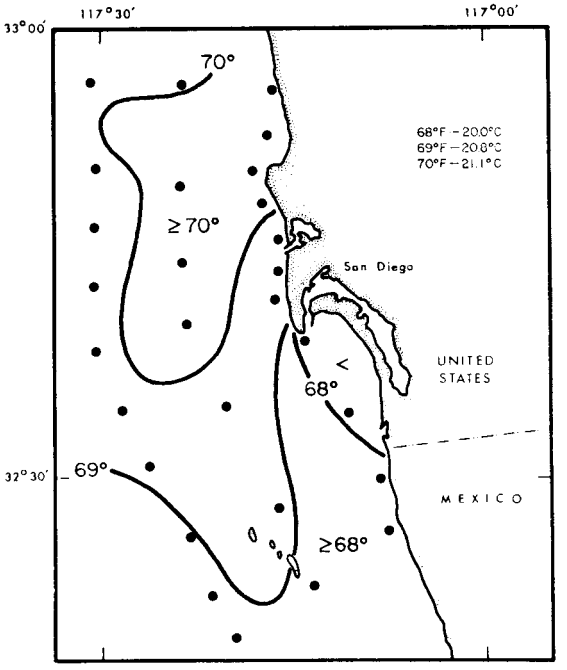


Figure 9.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 31 July 1972-74.

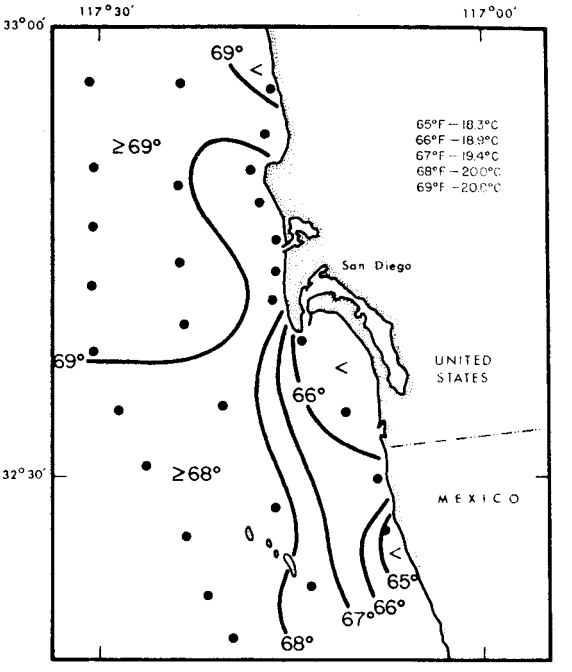


Figure 11.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 31 August 1972-74.

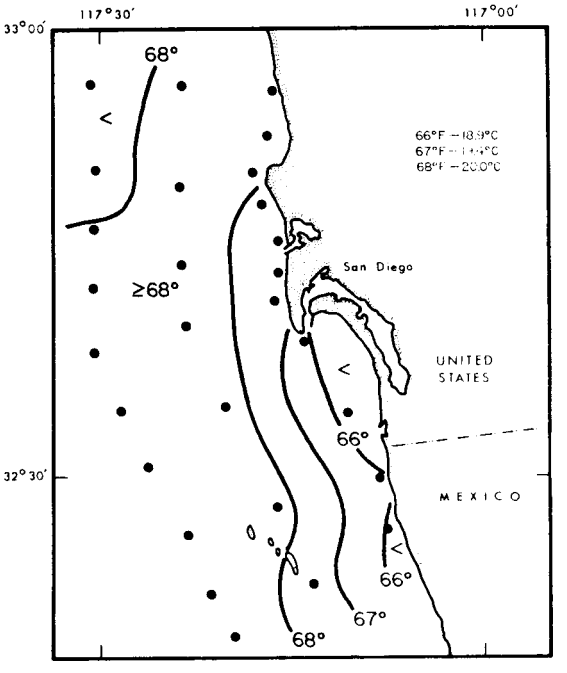


Figure 10.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 August 1972-74.

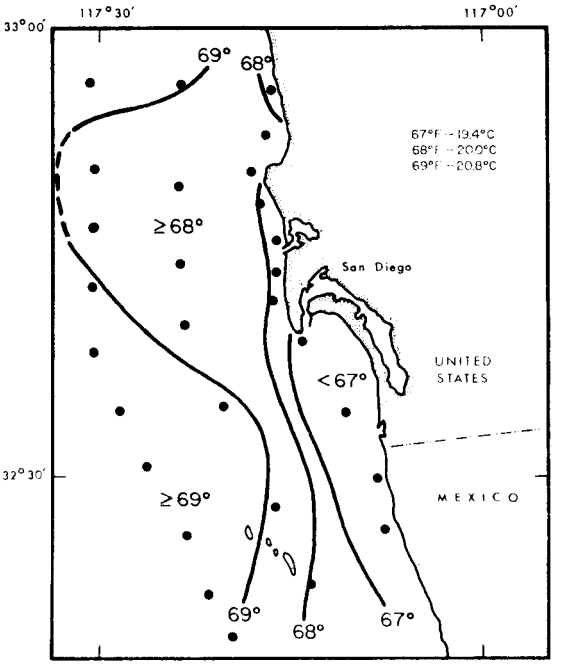


Figure 12.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 September 1972-74.

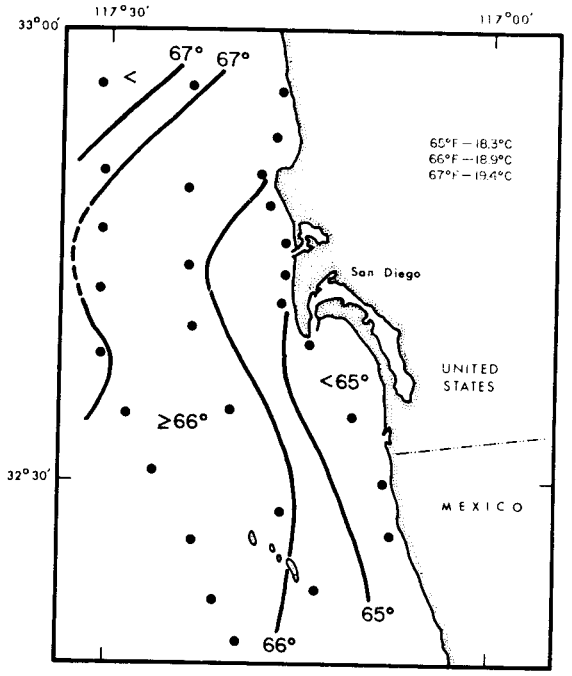


Figure 13.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 30 Septembver 1972-74.

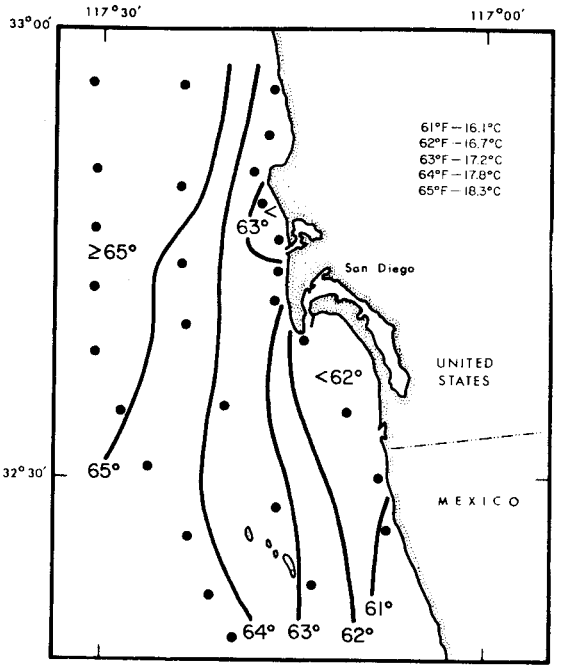


Figure 15.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 16 to 31 October 1972-74.

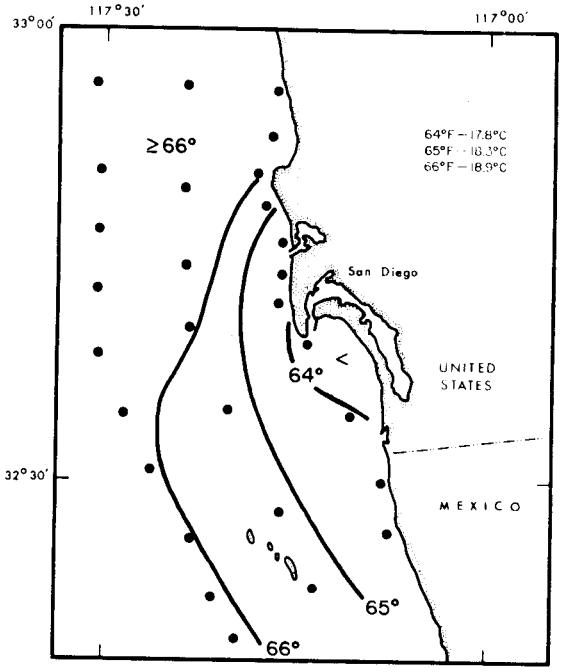
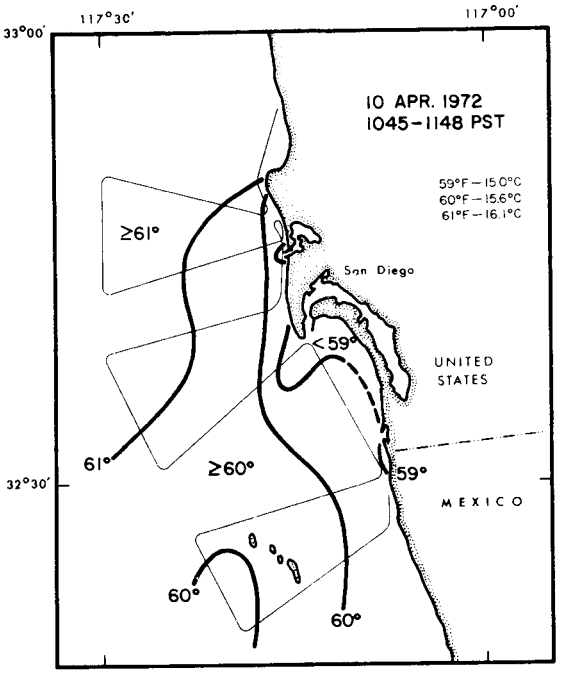
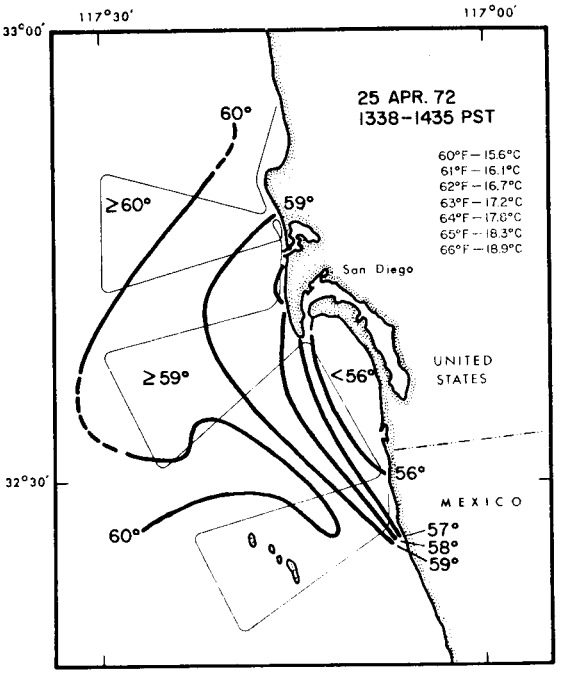


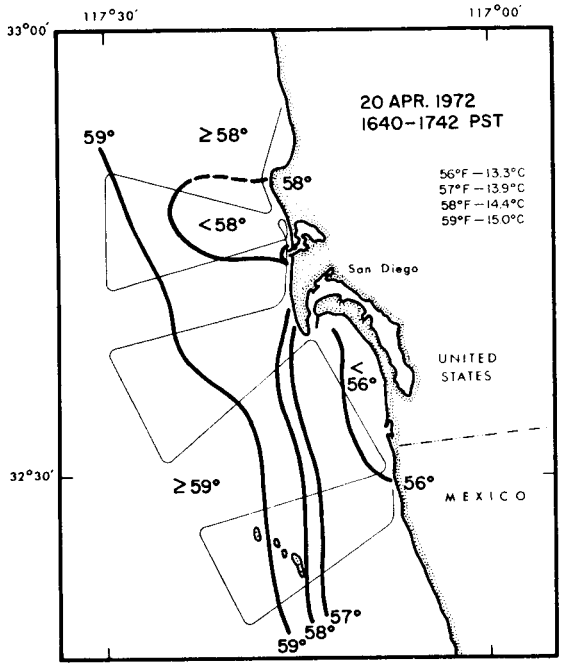
Figure 14.—Average isotherm patterns observed off San Diego in °F with °C equivalents for the 3-yr period, 1 to 15 October 1972-74.

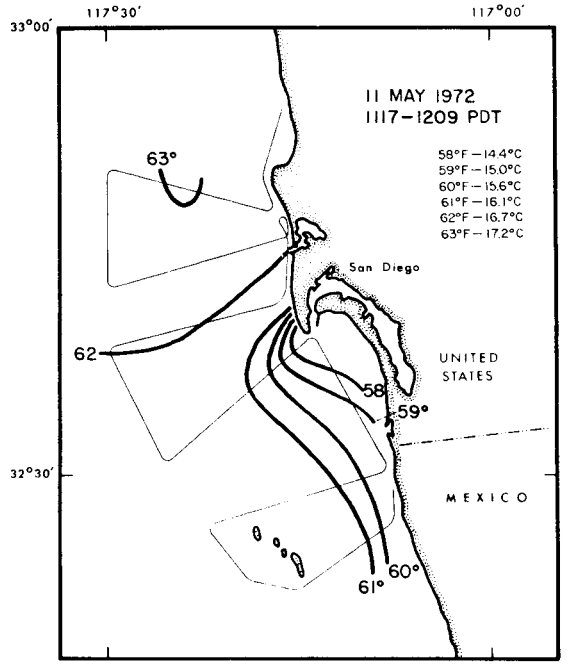
APPENDIX

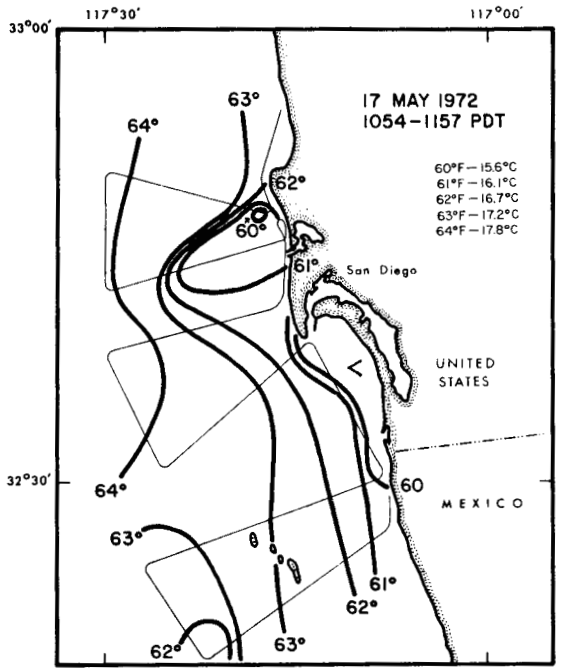
Sea surface temperature isotherms observed during survey flights off San Diego. Figure 1 to 90.







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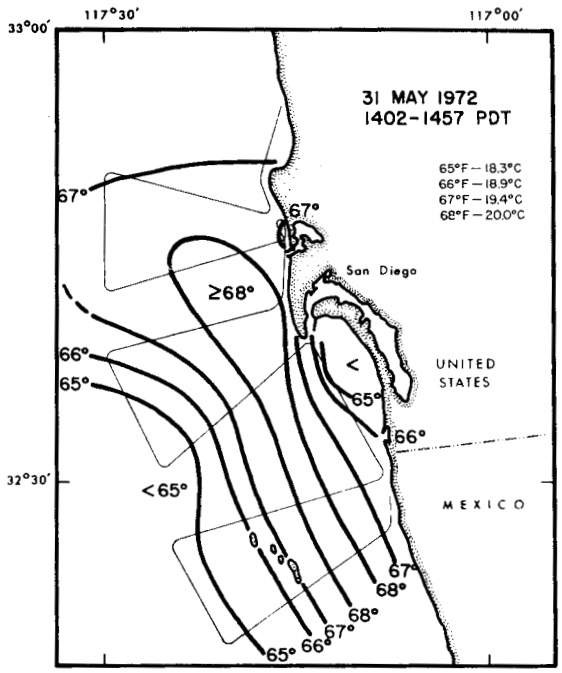
117°30'
117°00'
17 MAY 1972
1054–1157 PDT
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
San Diego
UNITED STATES
MEXICO
32°30'
64°
63°
62°
60°
61°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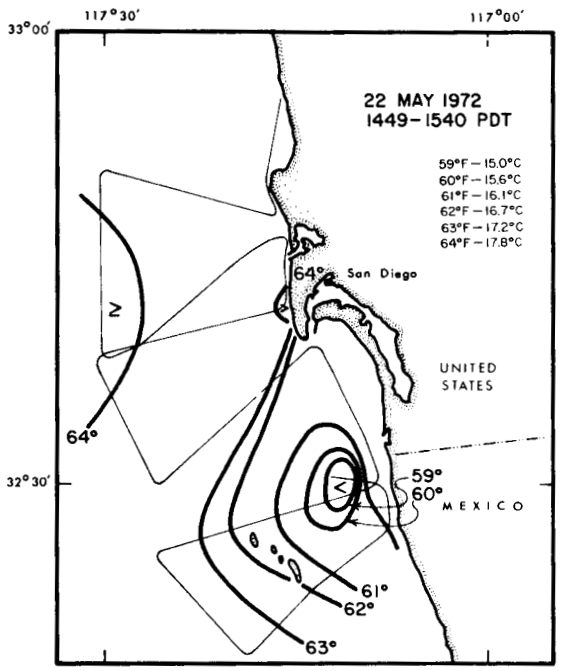
117°30'
117°00'
31 MAY 1972
1402–1457 PDT
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
32°30'
≥68°
<65°
67°
66°
65°
68°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62°F – 16.7°C
63°F – 17.2°C
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62°
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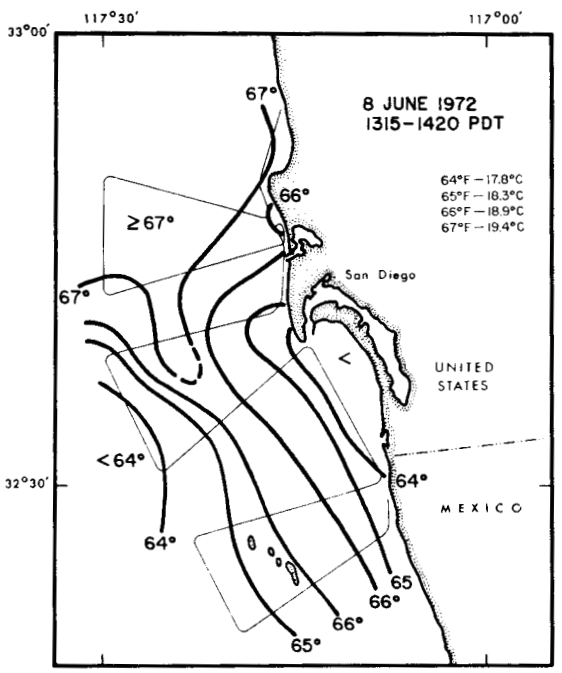
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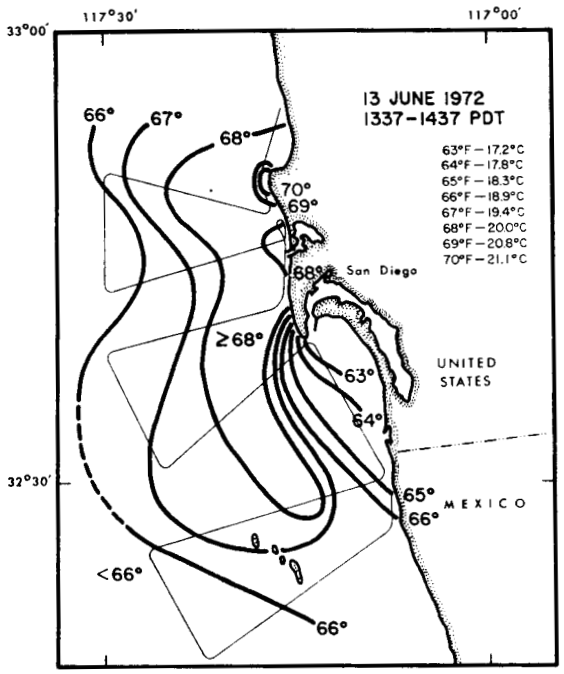
67°
66°
64°
65°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66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
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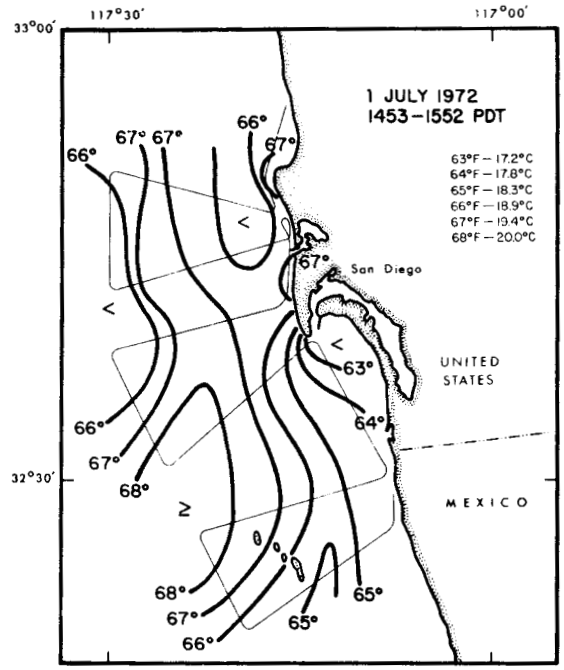
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66°F – 18.9°C
67°F – 19.4°C
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67°
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San Diego
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64°
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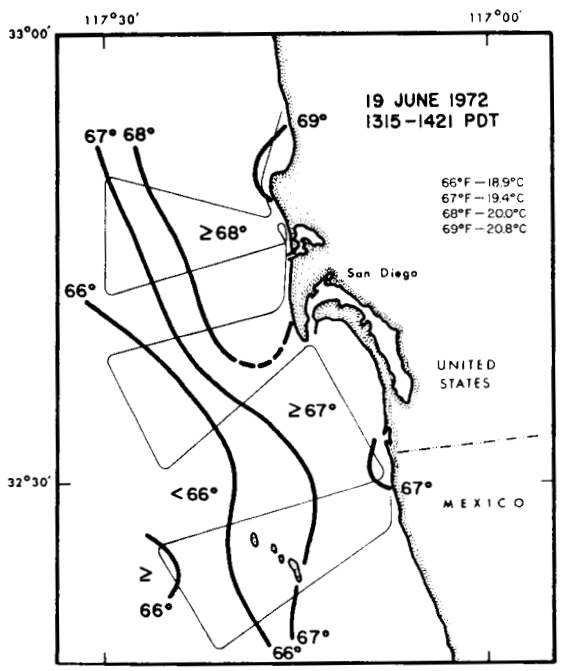
≥
68°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117°00'
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32°30'
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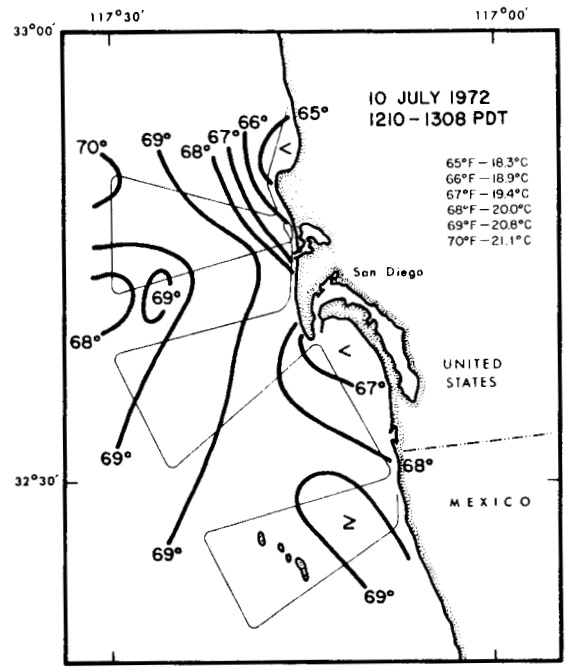
MEXICO
≥
66°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70°
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68°
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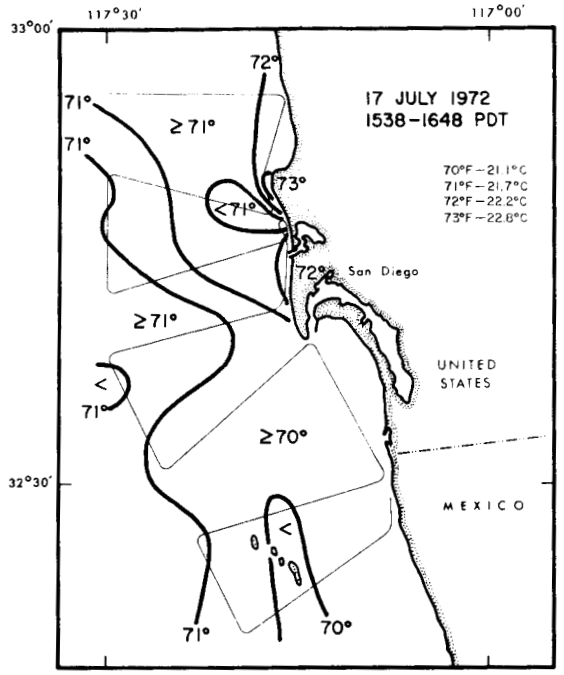
San Diego
UNITED STATES
MEXICO
≥


33°00'
117°30'
117°00'
32°30'
17 JULY 1972
1538-1648 PDT
70°F-21.1°C
71°F-21.7°C
72°F-22.2°C
73°F-22.8°C
72°
71°
≥71°
71°
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72°
San Diego
≥71°
UNITED
STATES
<
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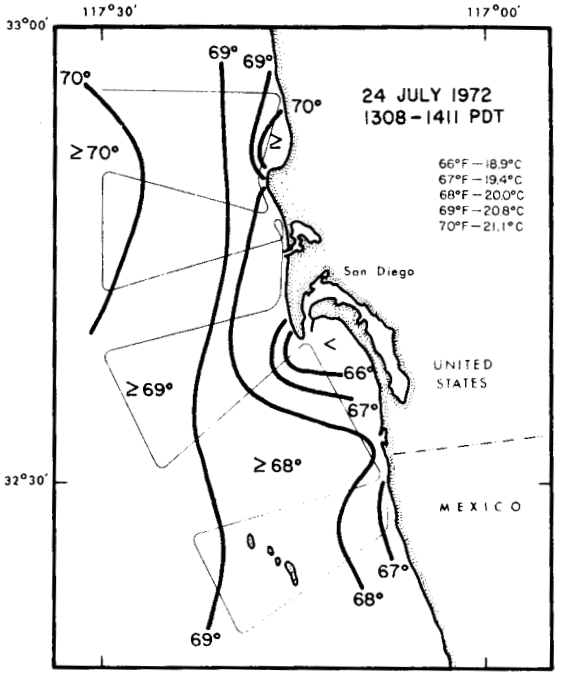
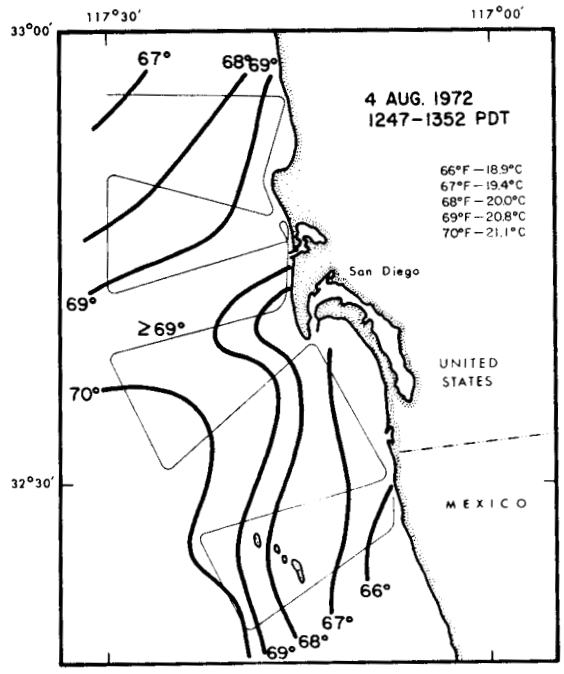
≥70°
MEXICO
71°
70°


33°00'
117°30'
117°00'
32°30'
24 JULY 1972
1308-1411 PDT
66°F-18.9°C
67°F-19.4°C
68°F-20.0°C
69°F-20.8°C
70°F-21.1°C
69°
69°
70°
70°
≥
≥70°
San Diego
<
66°
UNITED
STATES
≥69°
67°
≥68°
MEXICO
67°
68°
69°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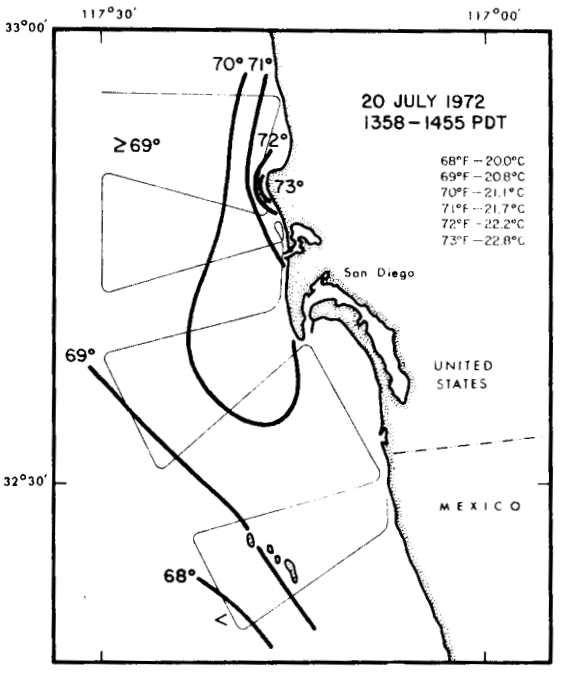
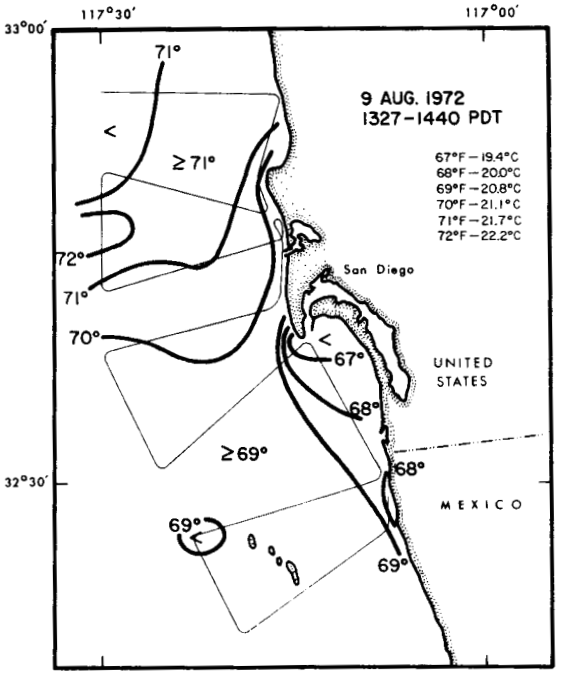
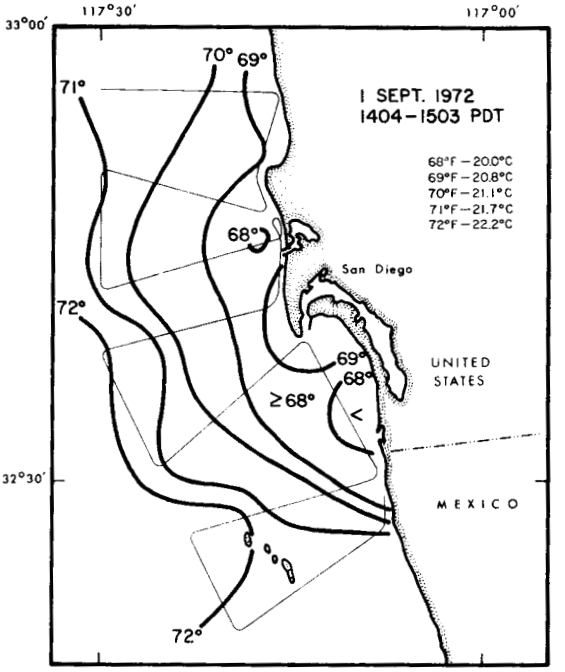
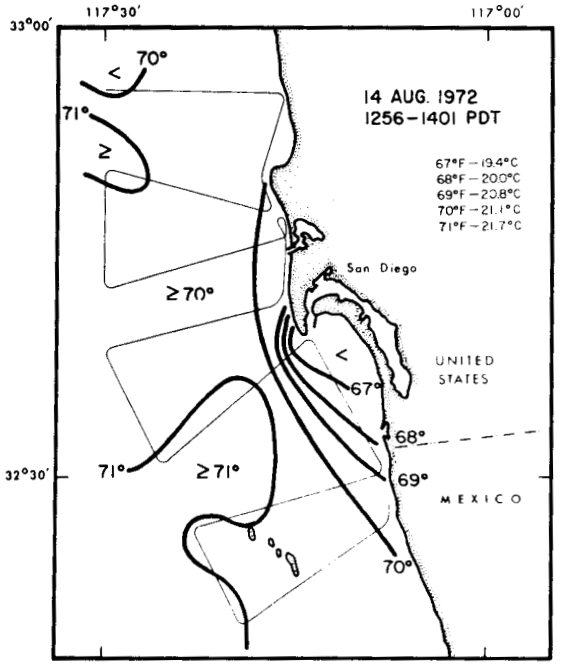
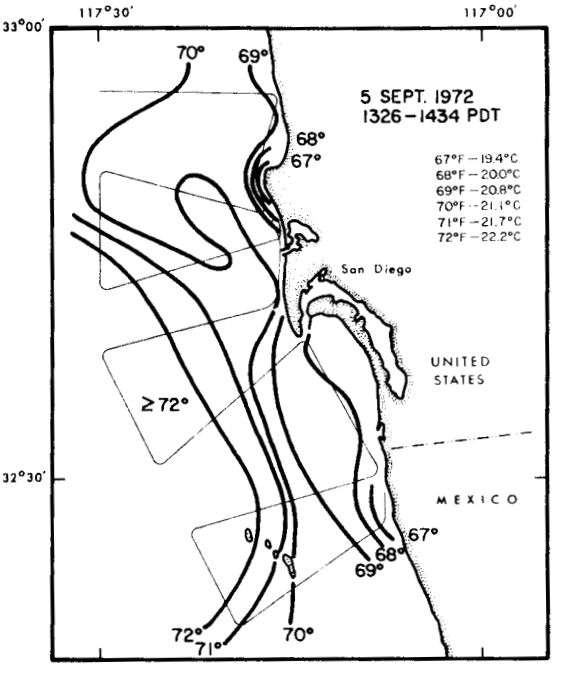
117°30'
117°00'
32°30'
4 AUG. 1972
1247-1352 PDT
66°F-18.9°C
67°F-19.4°C
68°F-20.0°C
69°F-20.8°C
70°F-21.1°C
67°
68°
69°
San Diego
69°
≥69°
UNITED
STATES
70°
MEXICO
66°
67°
68°
69°

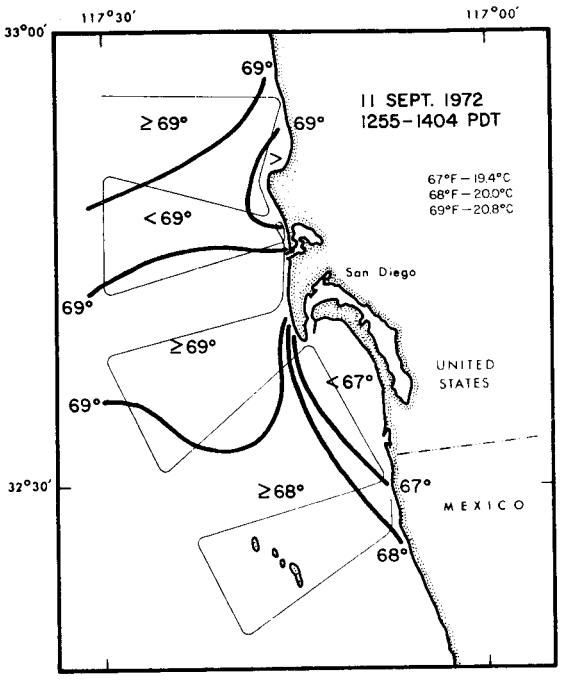

33°00'
117°30'
117°00'
32°30'
20 JULY 1972
1358-1455 PDT
68°F-20.0°C
69°F-20.8°C
70°F-21.1°C
71°F-21.7°C
72°F-22.2°C
73°F-22.8°C
70°
71°
≥69°
72°
73°
San Diego
69°
UNITED
STATES
MEXICO
68°
<

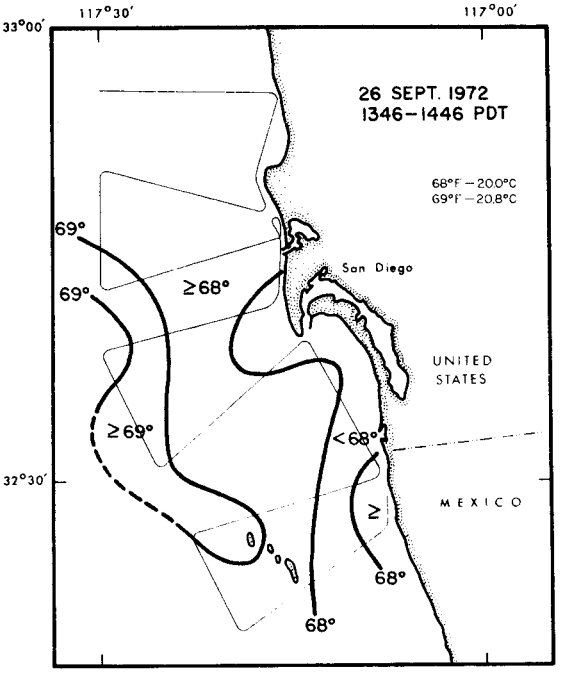

9 AUG. 1972
1327–1440 PDT
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

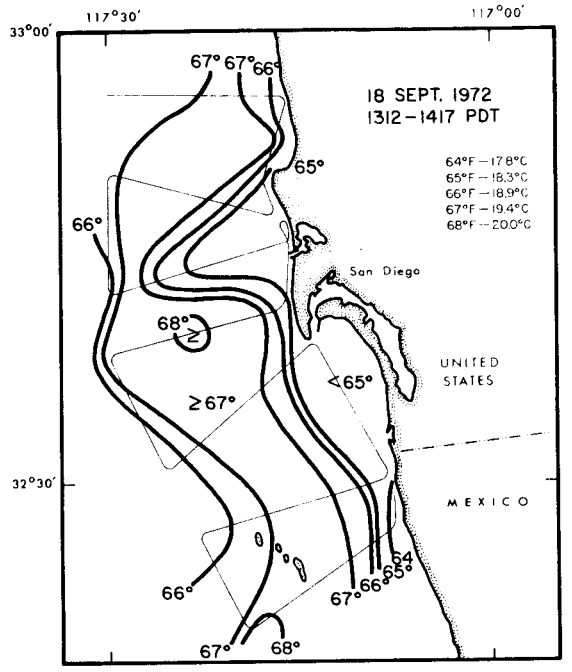

1 SEPT. 1972
1404–1503 PDT
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

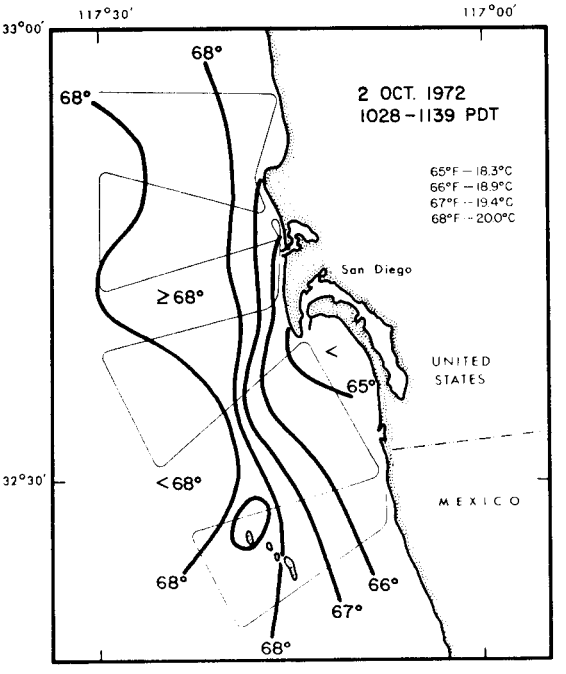

14 AUG. 1972
1256–1401 PDT
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

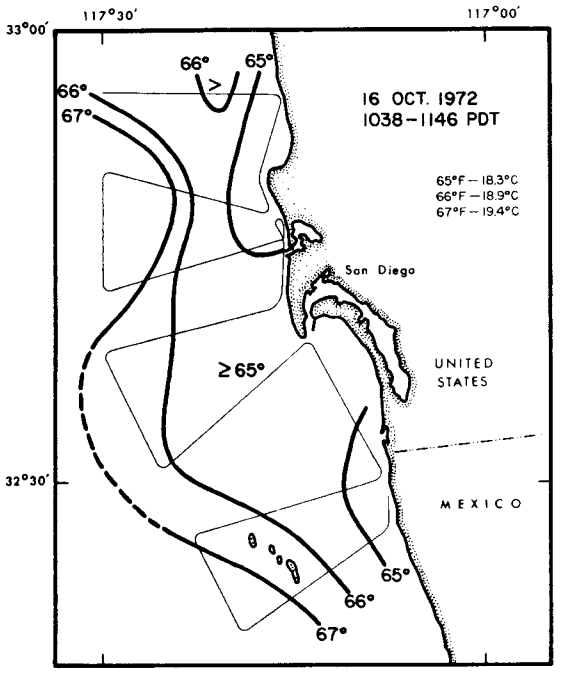

5 SEPT. 1972
1326–1434 PDT
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

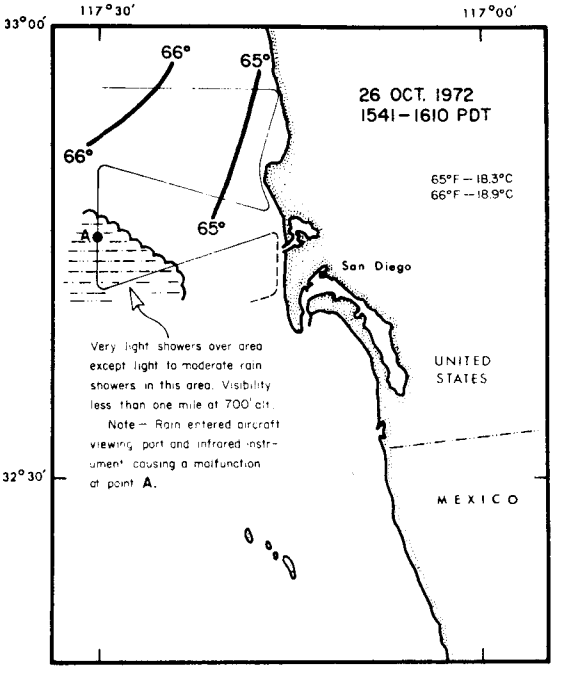

11 SEPT. 1972
1255–1404 PDT
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
33°00′
117°30′
117°00′
32°30′
69°
≥ 69°
< 69°
≥ 68°
< 67°
67°
68°

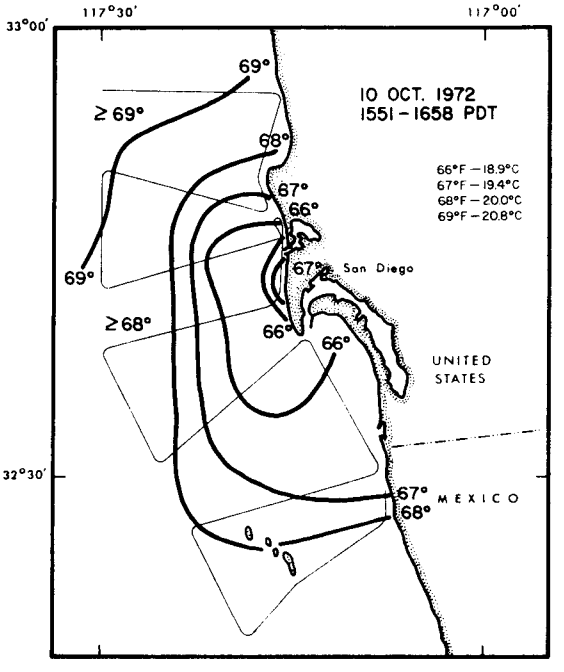

26 SEPT. 1972
1346–1446 PDT
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
33°00′
117°30′
117°00′
32°30′
69°
≥ 68°
≥ 69°
< 68°
68°

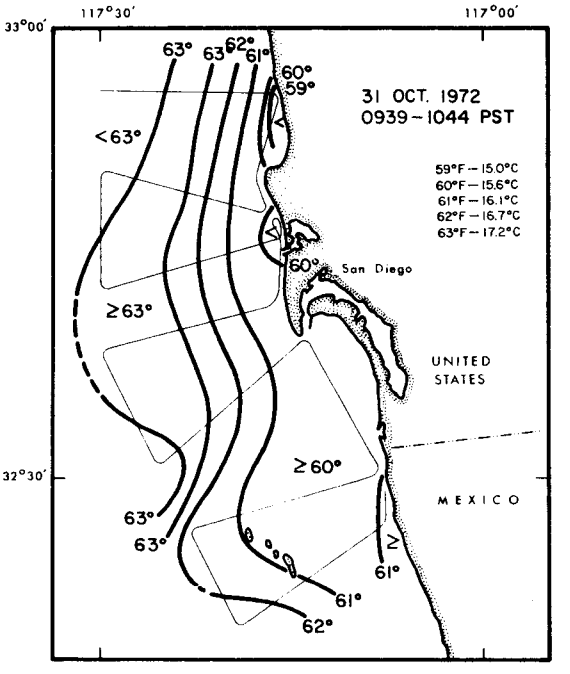

18 SEPT. 1972
1312–1417 PDT
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
33°00′
117°30′
117°00′
32°30′
67°
66°
65°
≥ 68°
≥ 67°
< 65°
64°
68°

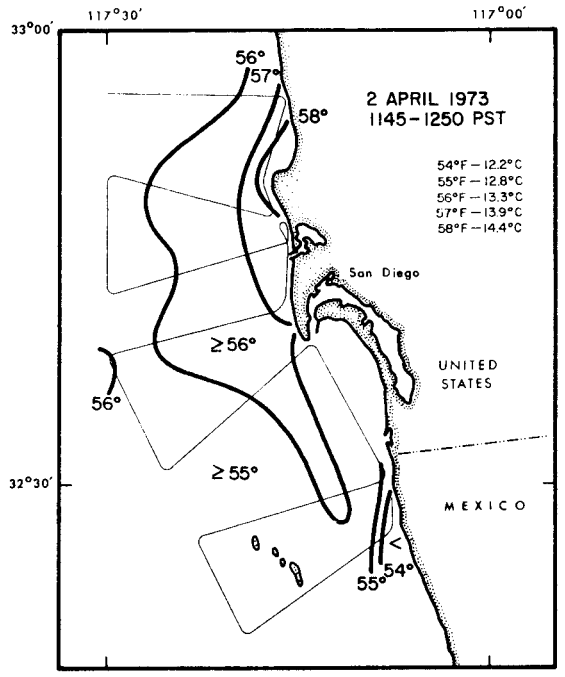

2 OCT. 1972
1028–1139 PDT
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
33°00′
117°30′
117°00′
32°30′
68°
≥ 68°
< 68°
65°
66°
67°

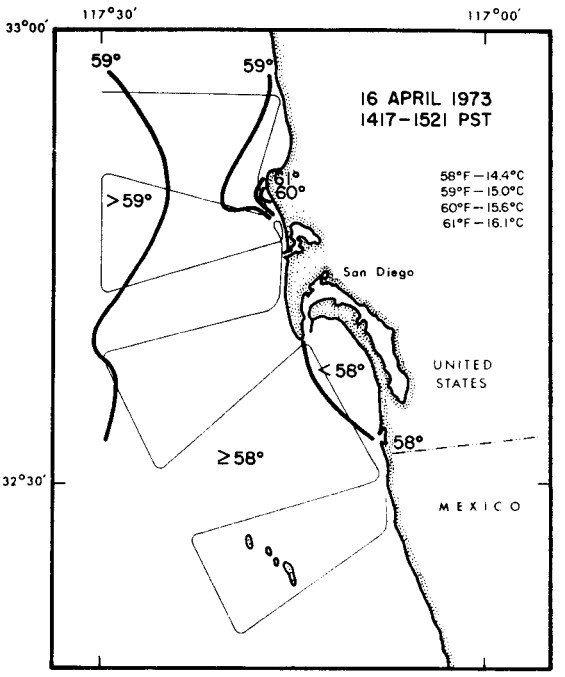

117°30'
117°00'
33°00'
32°30'
16 OCT. 1972
1038–1146 PDT
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
66°
65°
67°
≥65°
San Diego
UNITED STATES
MEXICO

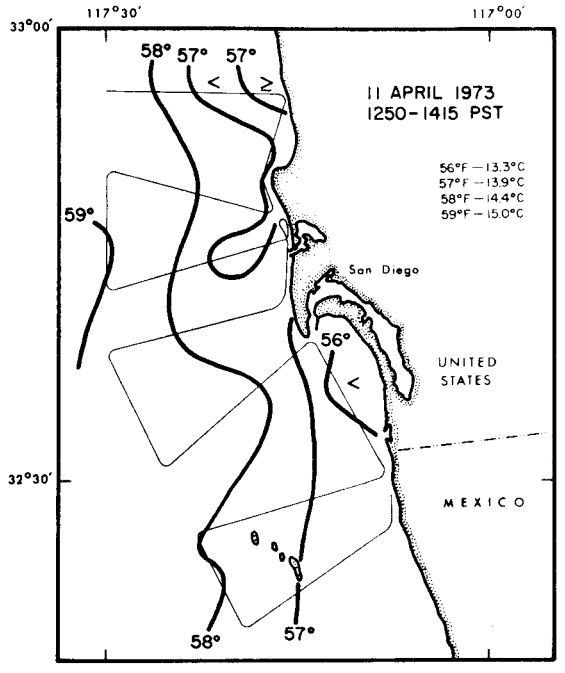

117°30'
117°00'
33°00'
32°30'
26 OCT. 1972
1541–1610 PDT
65°F – 18.3°C
66°F – 18.9°C
66°
65°
A
San Diego
Very light showers over area except light to moderate rain showers in this area. Visibility less than one mile at 700' alt.
Note – Rain entered aircraft viewing port and infrared instrument causing a malfunction at point A.
UNITED STATES
MEXICO

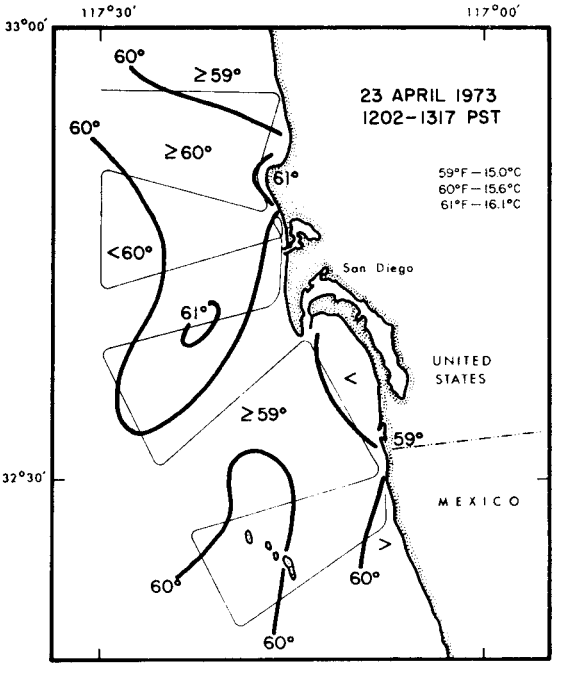

117°30'
117°00'
33°00'
32°30'
10 OCT. 1972
1551–1658 PDT
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
69°
≥69°
68°
67°
66°
≥68°
San Diego
UNITED STATES
MEXICO

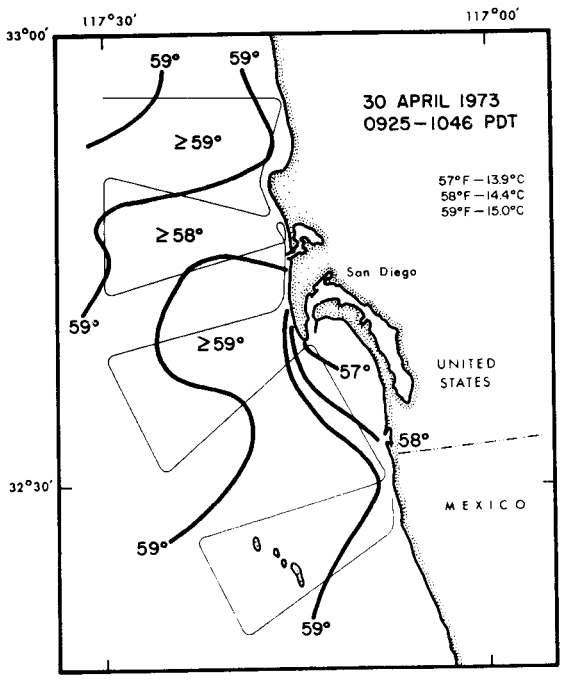

117°30'
117°00'
33°00'
32°30'
31 OCT. 1972
0939–1044 PST
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
63°
62°
61°
60°
59°
<63°
≥63°
≥60°
San Diego
UNITED STATES
MEXICO

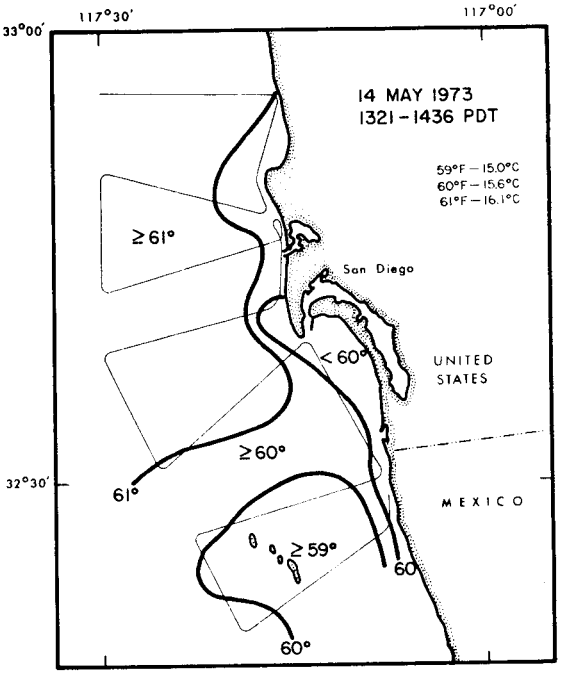

33°00'
117°30'
117°00'
32°30'
2 APRIL 1973
1145-1250 PST
54°F - 12.2°C
55°F - 12.8°C
56°F - 13.3°C
57°F - 13.9°C
58°F - 14.4°C
56°
57°
58°
≥56°
56°
≥55°
<
55°
54°
San Diego
UNITED STATES
MEXICO

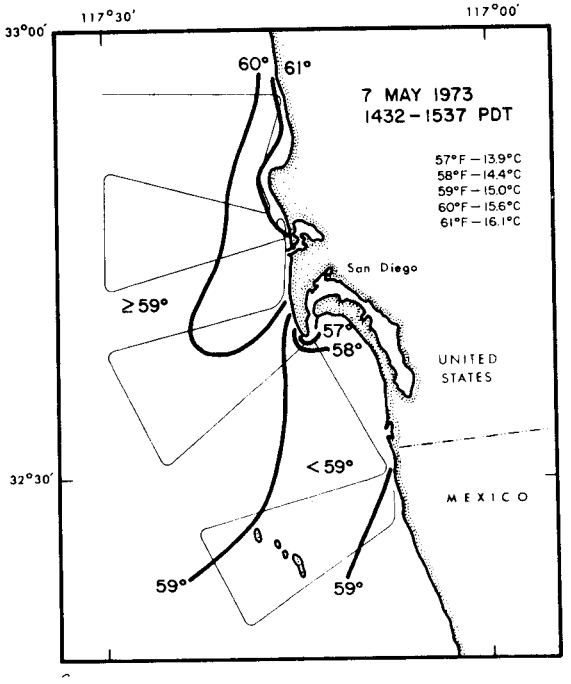

33°00'
117°30'
117°00'
32°30'
16 APRIL 1973
1417-1521 PST
58°F - 14.4°C
59°F - 15.0°C
60°F - 15.6°C
61°F - 16.1°C
59°
59°
>59°
61°
60°
<58°
58°
≥58°
San Diego
UNITED STATES
MEXICO

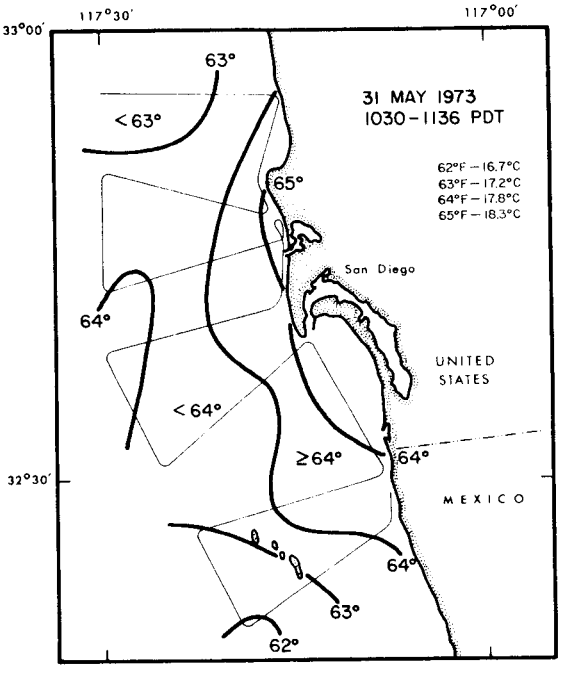

33°00'
117°30'
117°00'
32°30'
11 APRIL 1973
1250-1415 PST
56°F - 13.3°C
57°F - 13.9°C
58°F - 14.4°C
59°F - 15.0°C
58°
57°
57°
<
≥
59°
56°
<
58°
57°
San Diego
UNITED STATES
MEXICO

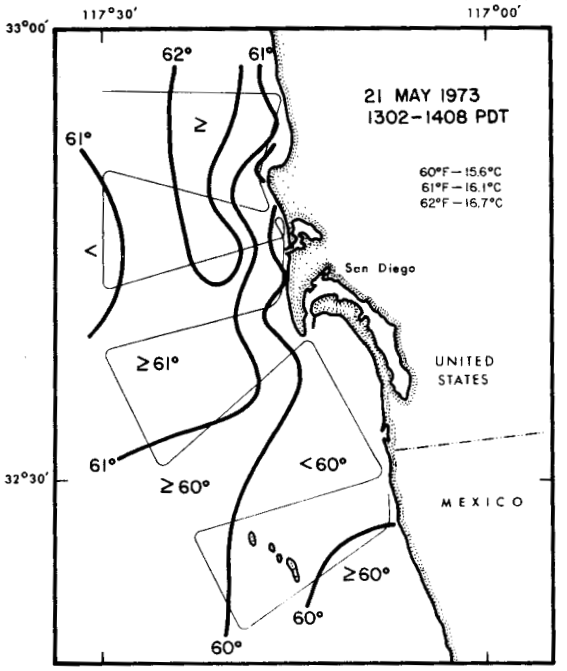

33°00'
117°30'
117°00'
32°30'
23 APRIL 1973
1202-1317 PST
59°F - 15.0°C
60°F - 15.6°C
61°F - 16.1°C
60°
≥59°
60°
≥60°
61°
<60°
61°
<
≥59°
59°
>
60°
60°
60°
San Diego
UNITED STATES
MEXICO

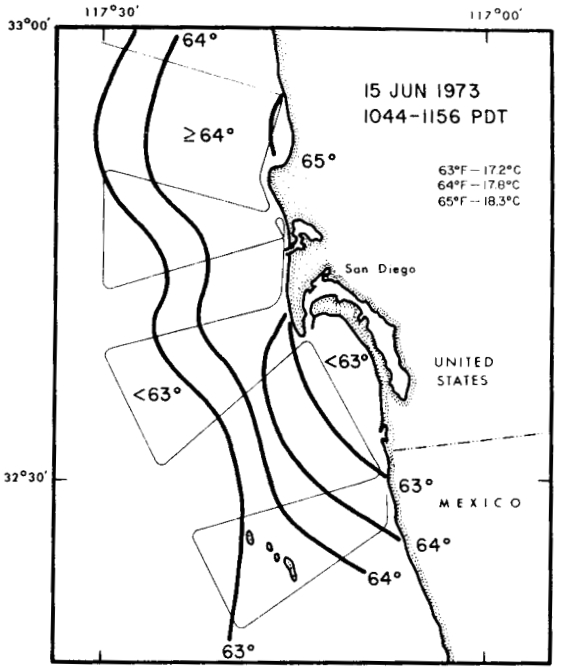

33°00'
117°30'
117°00'
32°30'
30 APRIL 1973
0925–1046 PDT
57°F – 13.9°C
58°F – 14.4°C
59°F – 15.0°C
59°
59°
≥59°
≥58°
59°
≥59°
57°
58°
59°
59°
San Diego
UNITED
STATES
MEXICO


33°00'
117°30'
117°00'
32°30'
14 MAY 1973
1321–1436 PDT
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
≥61°
< 60°
≥60°
61°
≥59°
60
60°
San Diego
UNITED
STATES
MEXICO


33°00'
117°30'
117°00'
32°30'
7 MAY 1973
1432–1537 PDT
57°F – 13.9°C
58°F – 14.4°C
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
60°
61°
≥59°
57°
58°
< 59°
59°
59°
San Diego
UNITED
STATES
MEXICO


33°00'
117°30'
117°00'
32°30'
31 MAY 1973
1030–1136 PDT
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
63°
< 63°
65°
64°
< 64°
≥64°
64°
64°
63°
62°
San Diego
UNITED
STATES
MEXICO


117°30'
117°00'
33°00'
32°30'
21 MAY 1973
1302-1408 PDT
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
62°
61°
≥
61°
≥61°
61°
≥60°
<60°
≥60°
60°
60°
San Diego
UNITED
STATES
MEXICO


117°30'
117°00'
33°00'
32°30'
15 JUN 1973
1044-1156 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
64°
≥64°
65°
<63°
<63°
63°
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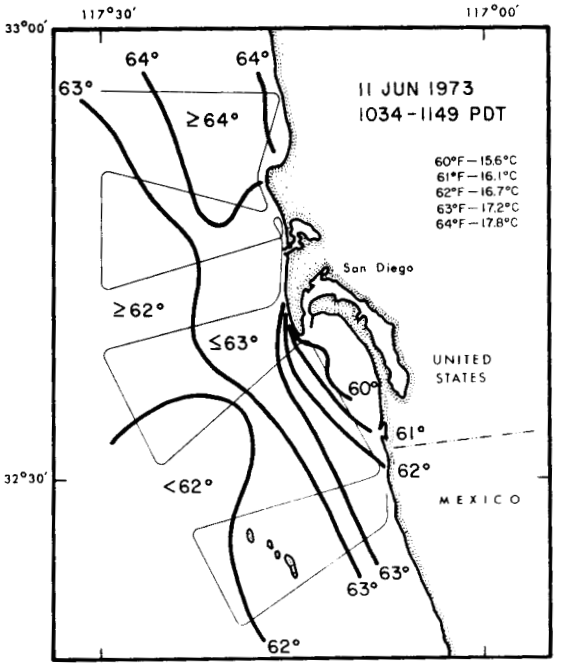
64°
63°
San Diego
UNITED
STATES
MEXICO


117°30'
117°00'
33°00'
32°30'
11 JUN 1973
1034-1149 PDT
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
64°
64°
63°
≥64°
≥62°
≤63°
<62°
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61°
62°
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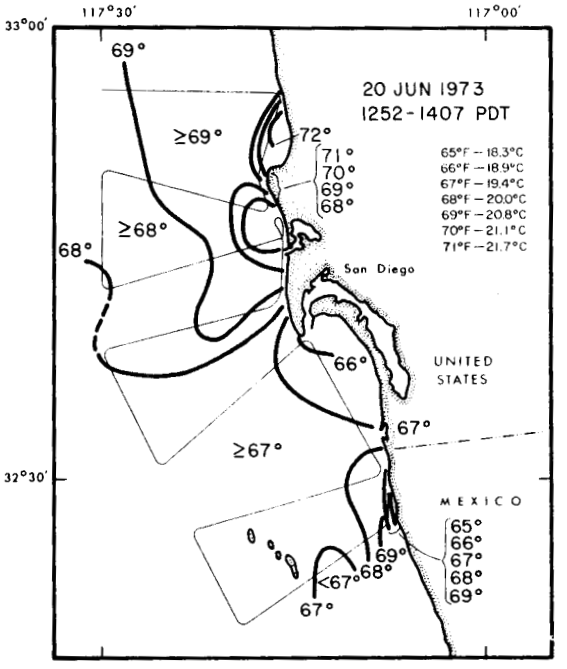
63°
62°
San Diego
UNITED
STATES
MEXICO


117°30'
117°00'
33°00'
32°30'
20 JUN 1973
1252-1407 PDT
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
69°
≥69°
72°
71°
70°
69°
68°
≥68°
68°
66°
67°
≥67°
<67°
68°
69°
67°
65°
66°
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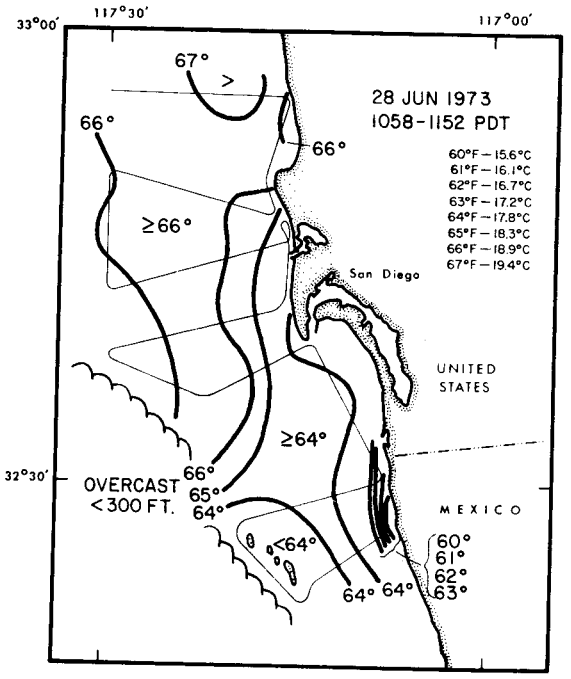
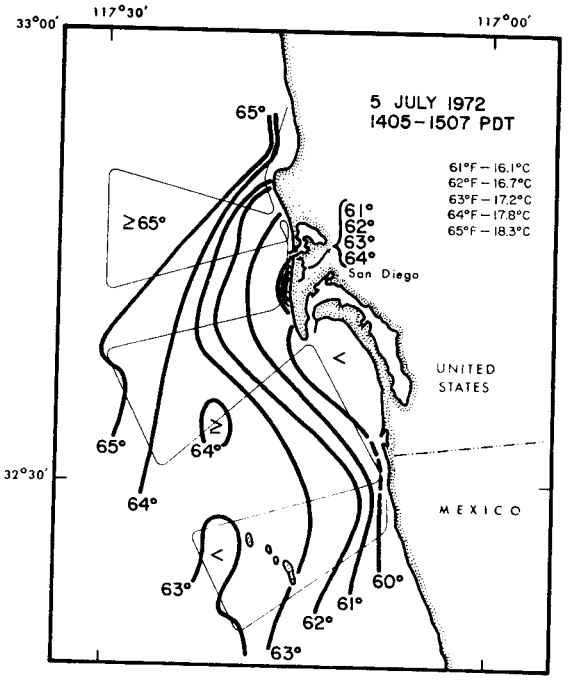
68°
69°
San Diego
UNITED
STATES
MEXICO


33°00'
117°30'
117°00'
28 JUN 1973
1058-1152 PDT
60°F-15.6°C
61°F-16.1°C
62°F-16.7°C
63°F-17.2°C
64°F-17.8°C
65°F-18.3°C
66°F-18.9°C
67°F-19.4°C
67°
66°
66°
≥66°
San Diego
UNITED STATES
≥64°
32°30'
OVERCAST
<300 FT.
66°
65°
64°
MEXICO
<64°
64°
64°
60°
61°
62°
63°


33°00'
117°30'
117°00'
5 JULY 1972
1405-1507 PDT
61°F-16.1°C
62°F-16.7°C
63°F-17.2°C
64°F-17.8°C
65°F-18.3°C
65°
≥65°
61°
62°
63°
64°
San Diego
UNITED STATES
32°30'
65°
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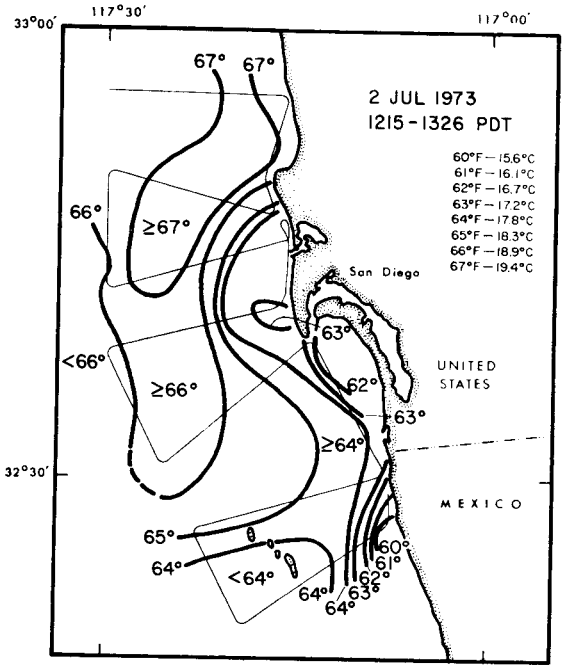
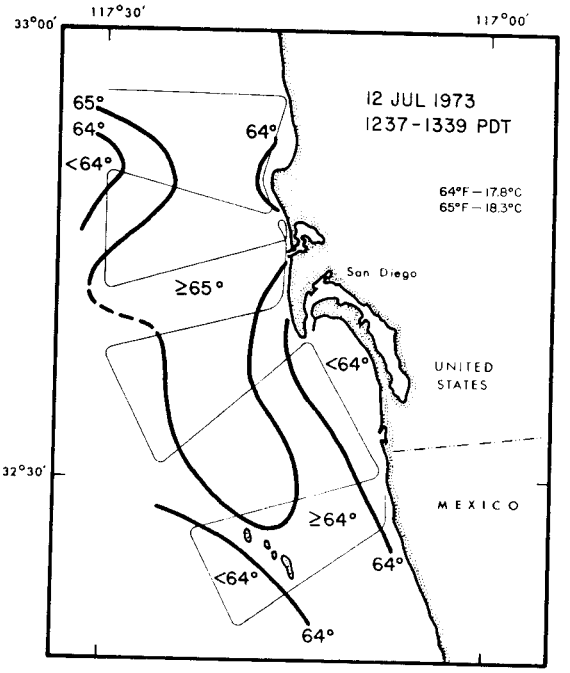
MEXICO
63°
60°
61°
62°
63°


33°00'
117°30'
117°00'
2 JUL 1973
1215-1326 PDT
60°F-15.6°C
61°F-16.1°C
62°F-16.7°C
63°F-17.2°C
64°F-17.8°C
65°F-18.3°C
66°F-18.9°C
67°F-19.4°C
67°
67°
66°
≥67°
San Diego
63°
<66°
≥66°
UNITED STATES
62°
63°
≥64°
32°30'
MEXICO
65°
64°
<64°
64°
63°
64°
60°
61°
62°


33°00'
117°30'
117°00'
12 JUL 1973
1237-1339 PDT
64°F-17.8°C
65°F-18.3°C
65°
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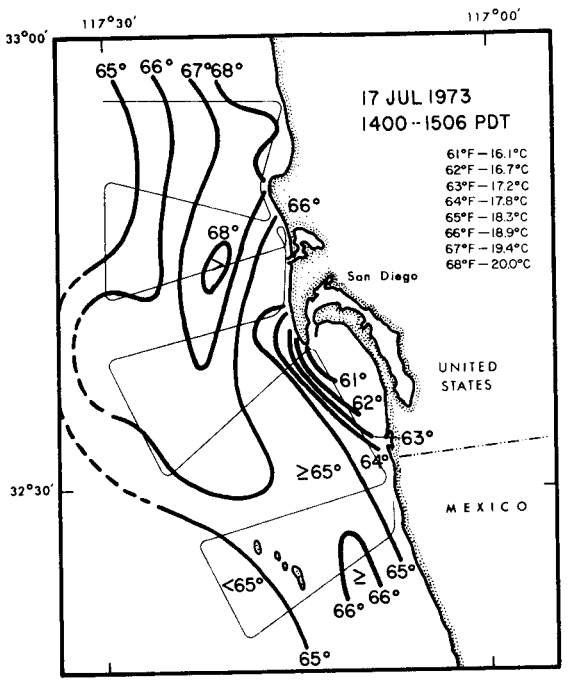
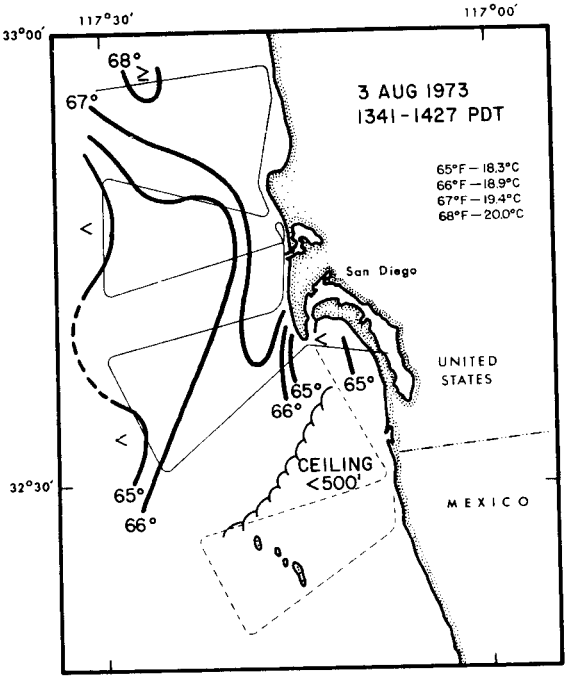
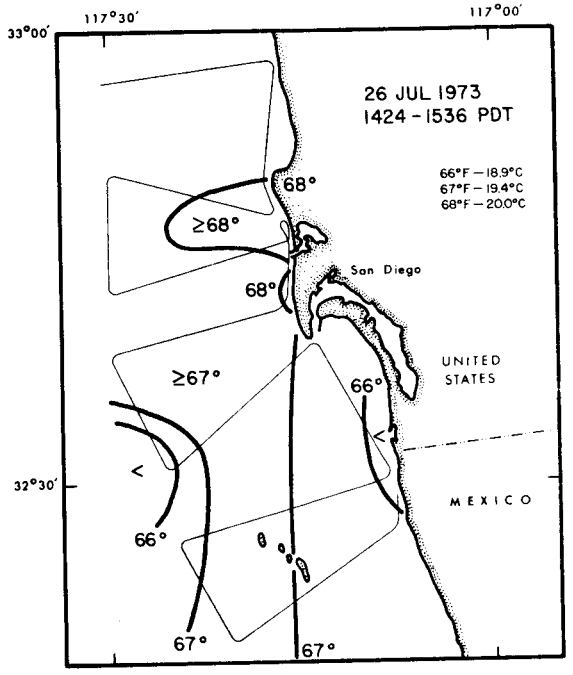
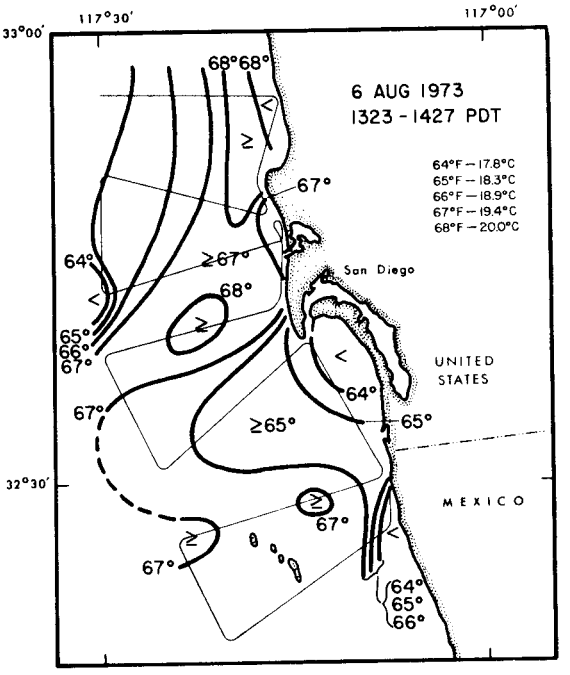
≥65°
San Diego
<64°
UNITED STATES
32°30'
≥64°
MEXICO
<64°
64°
64°


117°30'
117°00'
33°00'
32°30'
17 JUL 1973
1400 - 1506 PDT
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO


117°30'
117°00'
33°00'
32°30'
3 AUG 1973
1341 - 1427 PDT
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
CEILING
<500'


117°30'
117°00'
33°00'
32°30'
26 JUL 1973
1424 - 1536 PDT
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO


117°30'
117°00'
33°00'
32°30'
6 AUG 1973
1323 - 1427 PDT
64°F – 17.8°C
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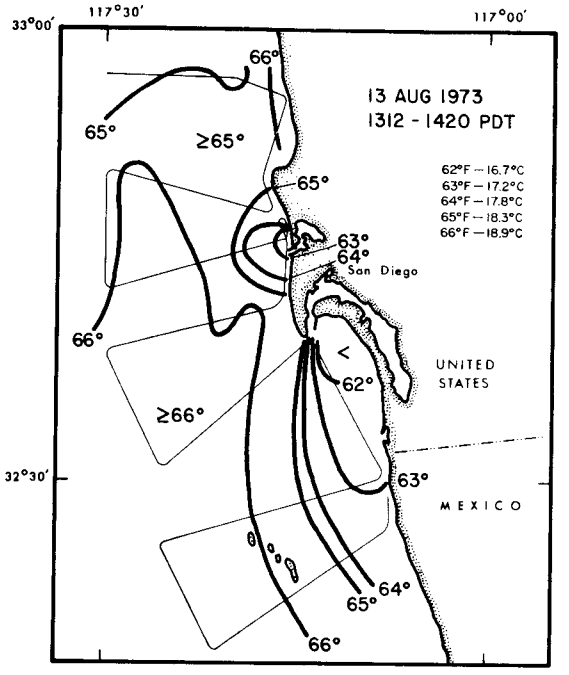
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO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117°00'
32°30'
13 AUG 1973
1312 - 1420 PDT
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
66°
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≥65°
65°
63°
64°
66°
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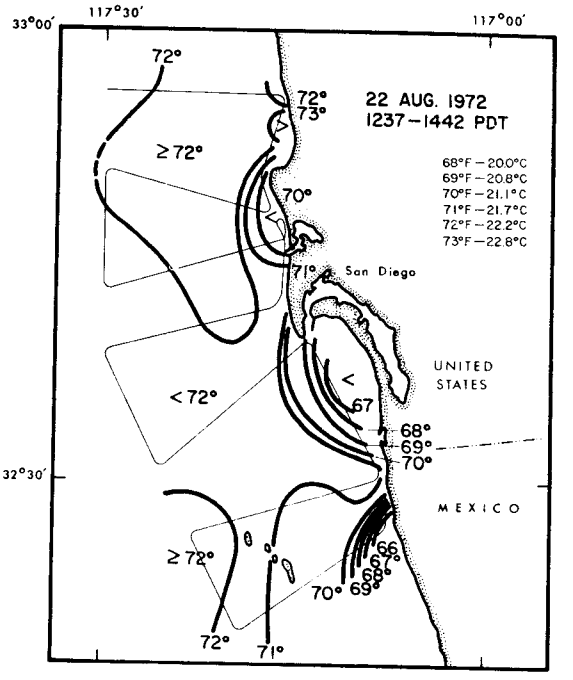
62°
≥66°
63°
65°
64°
66°


33°00'
117°30'
117°00'
32°30'
22 AUG. 1972
1237–1442 PDT
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
73°F – 22.8°C
San Diego
UNITED STATES
MEXICO
72°
72°
73°
≥72°
70°
<
71°
<
67
<72°
68°
69°
70°
≥72°
66
67°
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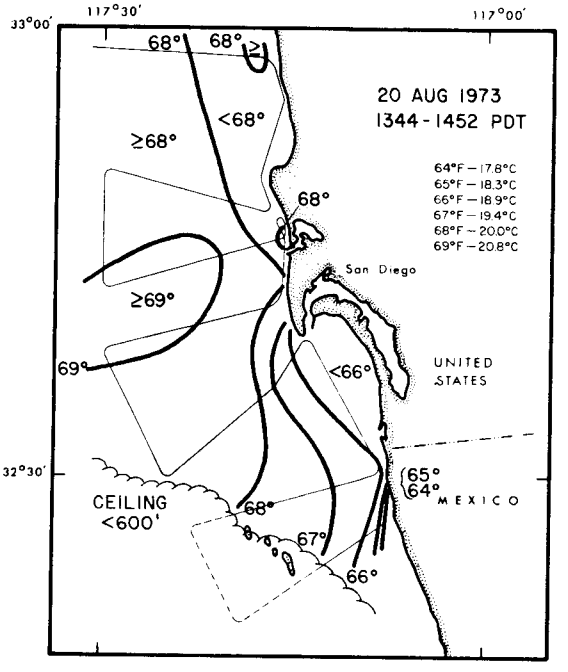
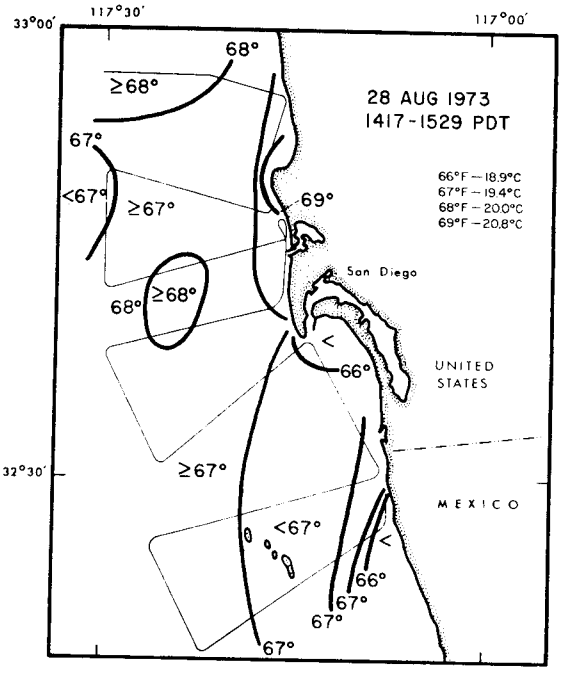
69°
70°
72°
71°


33°00'
117°30'
117°00'
32°30'
20 AUG 1973
1344 - 1452 PDT
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
CEILING
<600'
68°
68°
≥
<68°
≥68°
68°
≥69°
69°
<66°
65°
64°
68°
67°
66°


33°00'
117°30'
117°00'
32°30'
28 AUG 1973
1417 - 1529 PDT
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
68°
≥68°
67°
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68°
≥68°
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66°
≥67°
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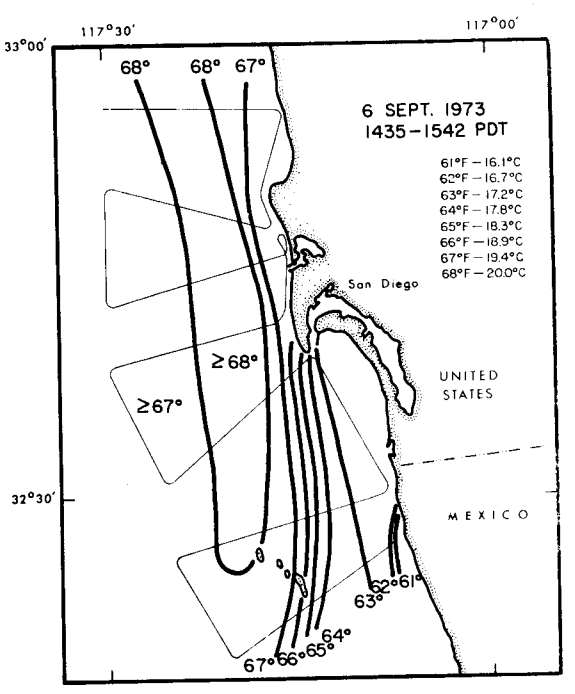
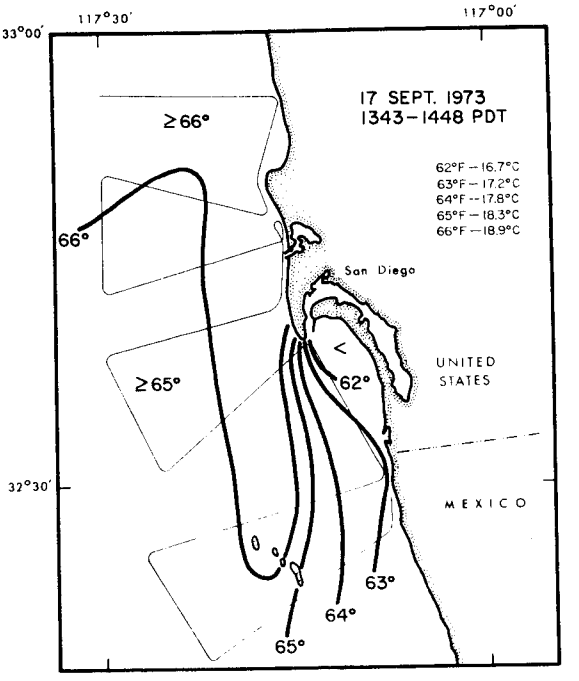
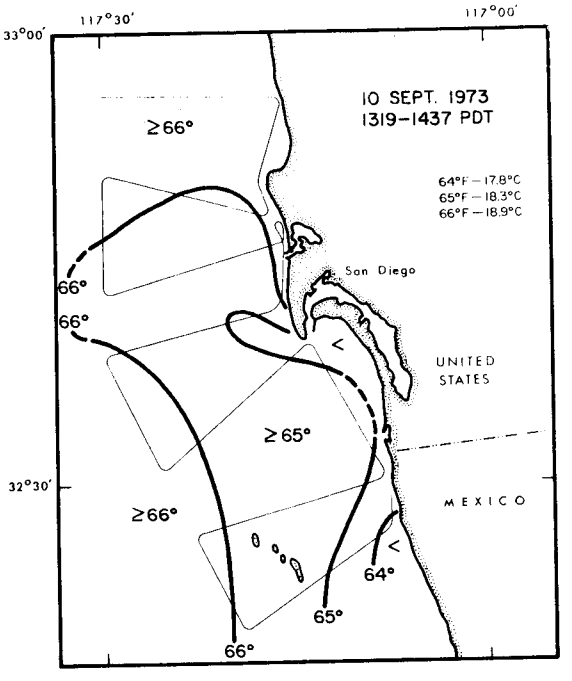
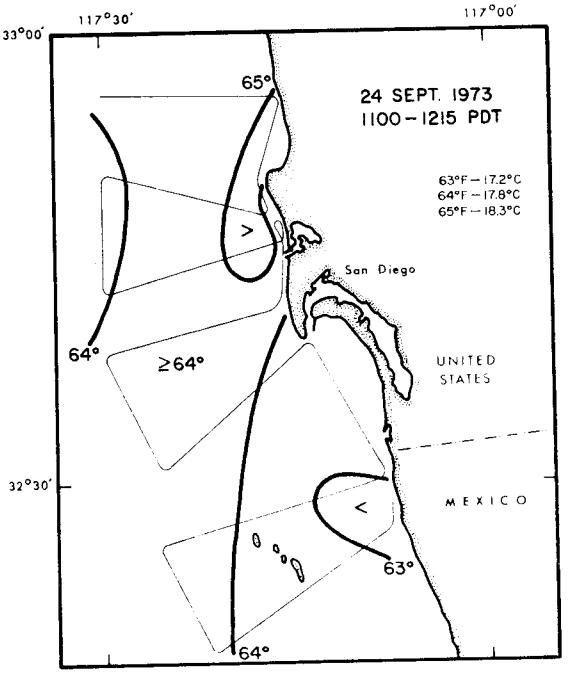
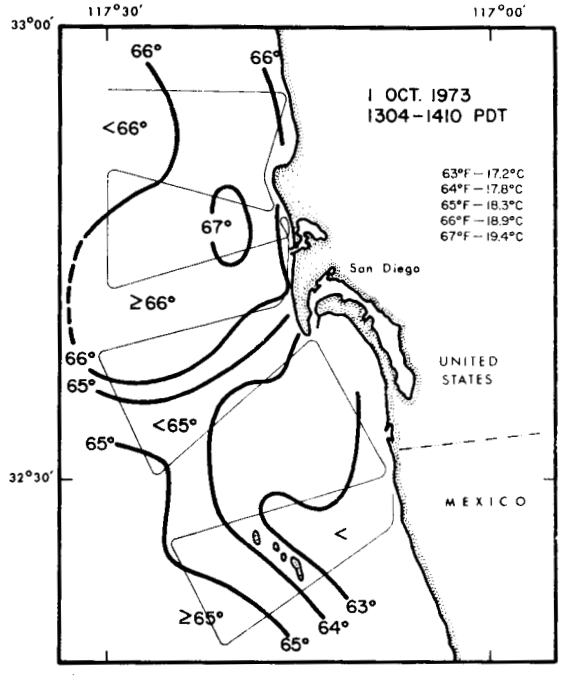
66°
67°
67°
67°

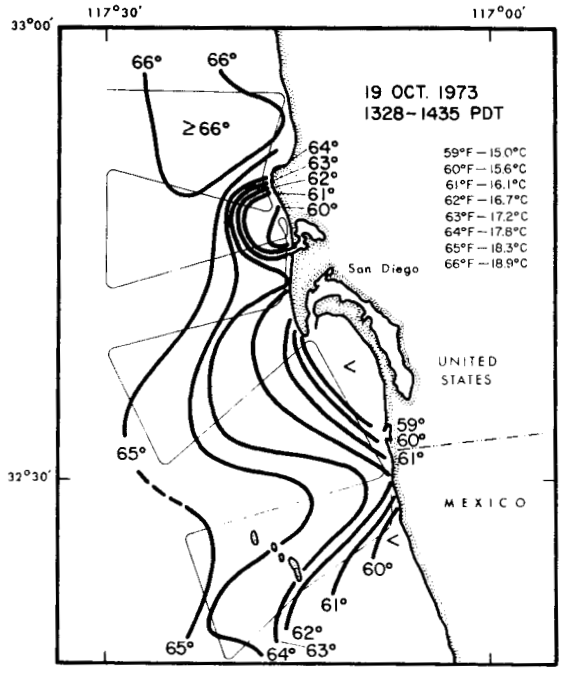

6 SEPT. 1973
1435–1542 PDT
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
≥68°
≥67°
68°
68°
67°
63°
62°
61°
64°
67°
66°
65°
117°30'
117°00'
33°00'
32°30'

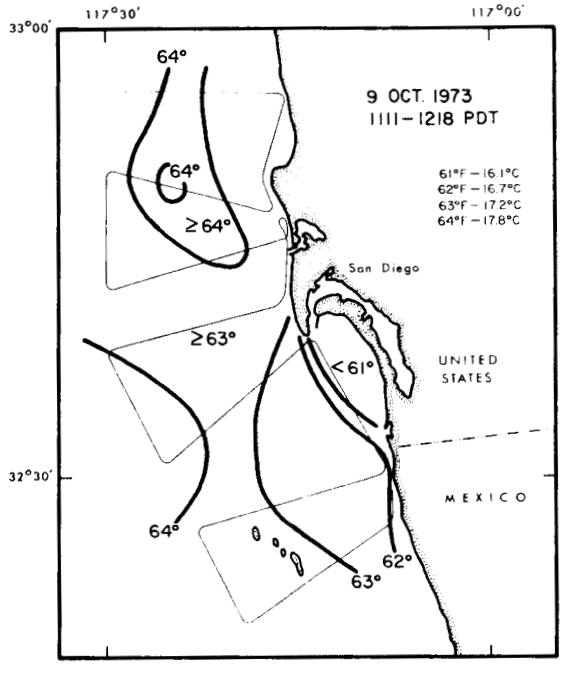

17 SEPT. 1973
1343–1448 PDT
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
≥66°
≥65°
66°
62°
63°
64°
65°
117°30'
117°00'
33°00'
32°30'

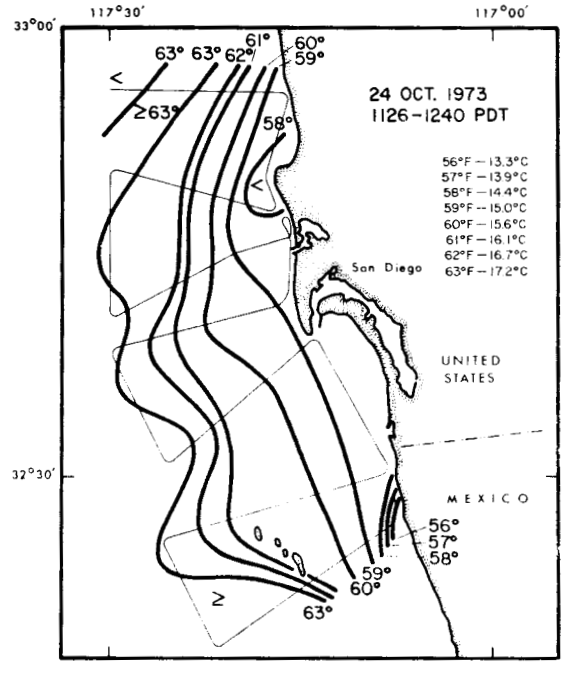

10 SEPT. 1973
1319–1437 PDT
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
≥66°
≥65°
≥66°
66°
66°
64°
65°
66°
117°30'
117°00'
33°00'
32°30'

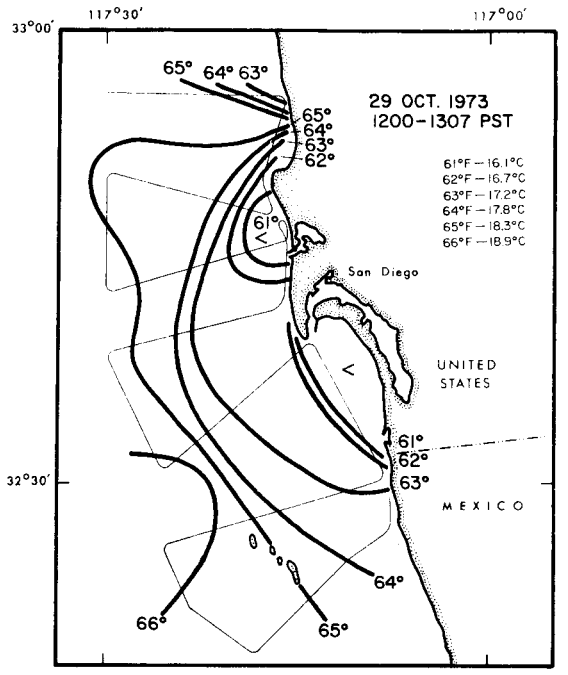

24 SEPT. 1973
1100–1215 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
San Diego
UNITED STATES
MEXICO
≥64°
65°
64°
63°
64°
117°30'
117°00'
33°00'
32°30'

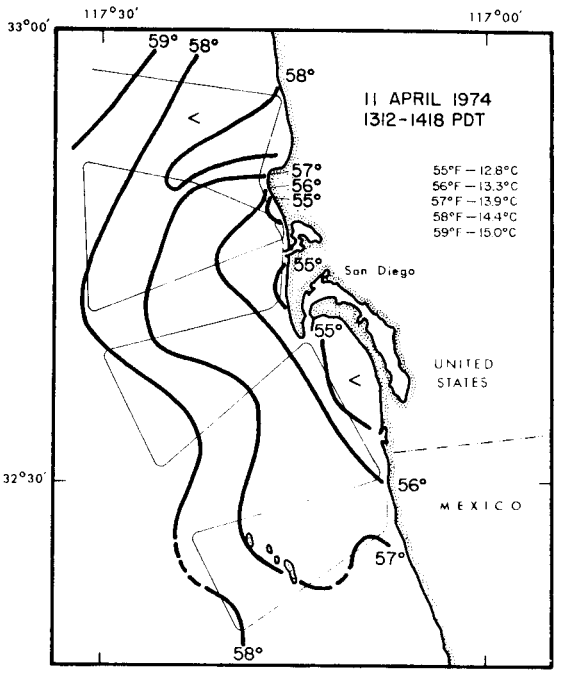

1 OCT. 1973
1304–1410 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

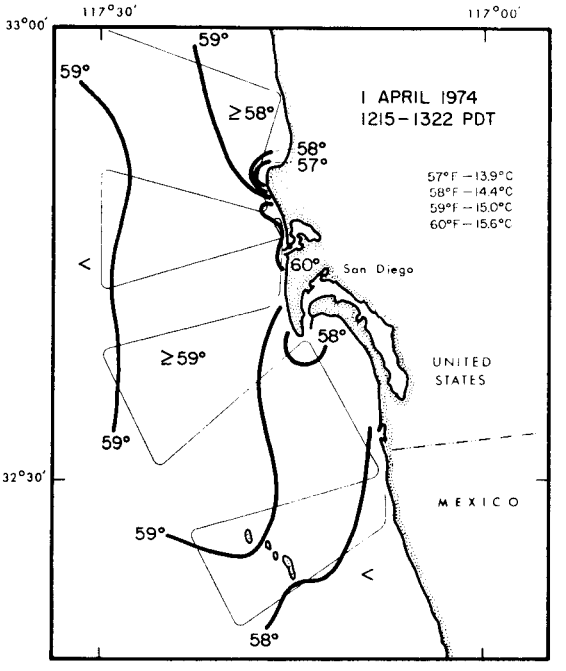

19 OCT. 1973
1328–1435 PDT
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

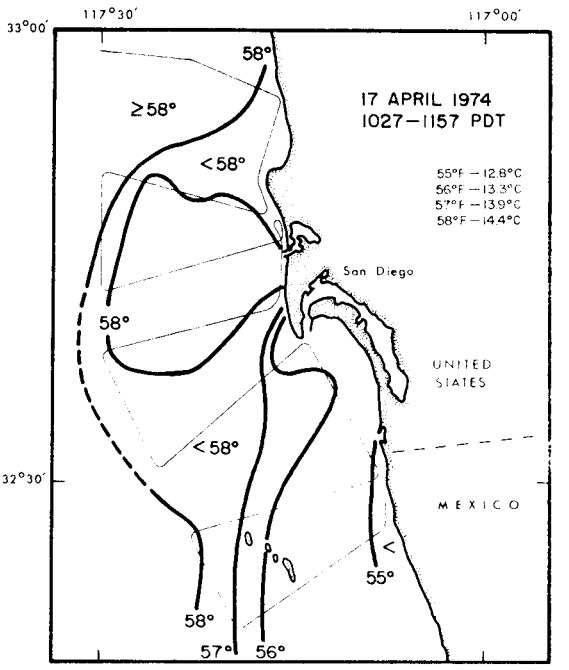

9 OCT. 1973
1111–1218 PDT
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

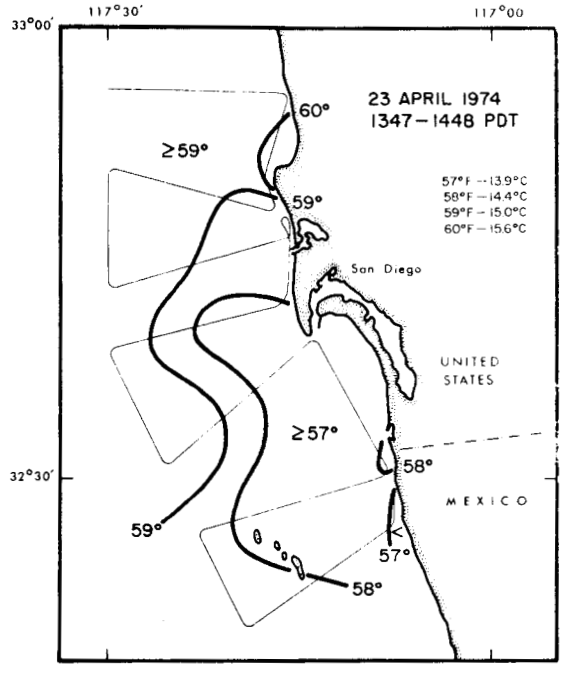

24 OCT. 1973
1126–1240 PDT
56°F – 13.3°C
57°F – 13.9°C
58°F – 14.4°C
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
San Diego
UNITED STATES
MEXICO
33°00′
32°30′
117°30′
117°00′

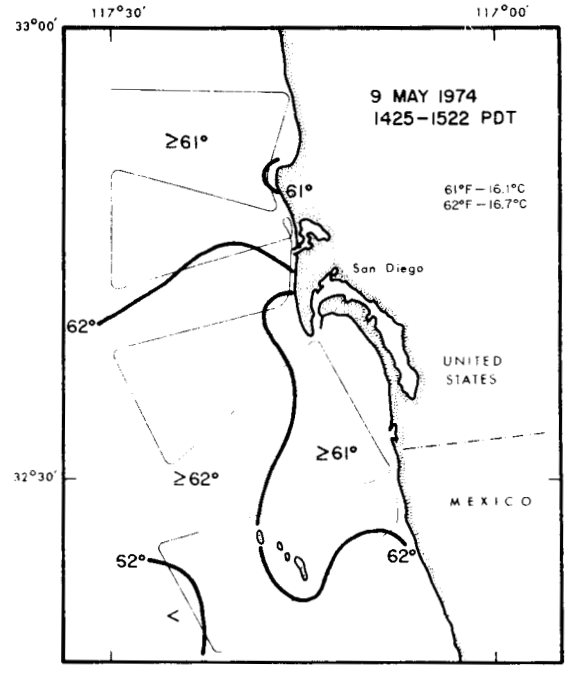

33°00'
117°30'
117°00'
32°30'
29 OCT. 1973
1200-1307 PST
61°F — 16.1°C
62°F — 16.7°C
63°F — 17.2°C
64°F — 17.8°C
65°F — 18.3°C
66°F — 18.9°C
San Diego
UNITED STATES
MEXICO
65°
64°
63°
62°
61°
66°

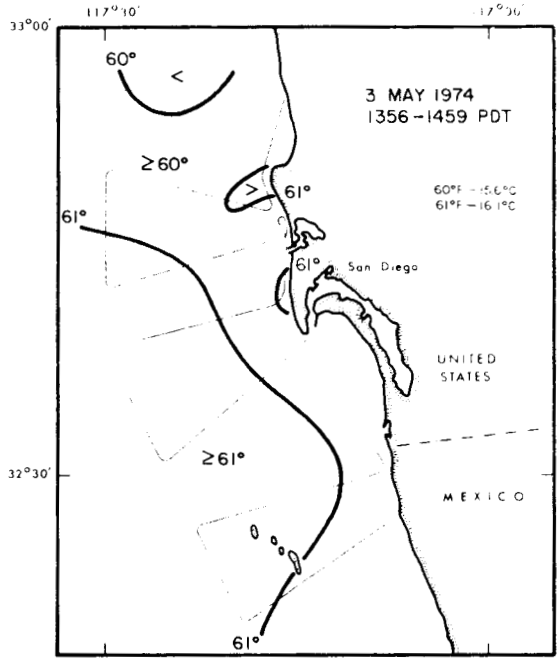

33°00'
117°30'
117°00'
32°30'
11 APRIL 1974
1312-1418 PDT
55°F — 12.8°C
56°F — 13.3°C
57°F — 13.9°C
58°F — 14.4°C
59°F — 15.0°C
San Diego
UNITED STATES
MEXICO
59°
58°
57°
56°
55°

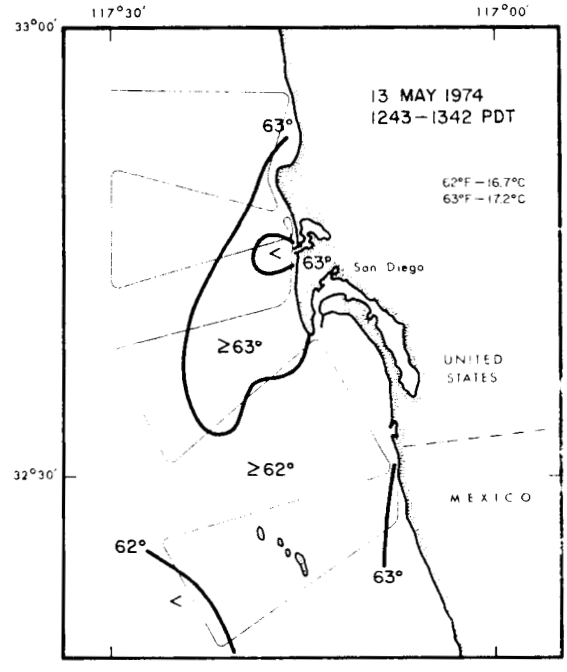

33°00'
117°30'
117°00'
32°30'
1 APRIL 1974
1215-1322 PDT
57°F — 13.9°C
58°F — 14.4°C
59°F — 15.0°C
60°F — 15.6°C
San Diego
UNITED STATES
MEXICO
≥58°
≥59°
60°
59°
58°
57°

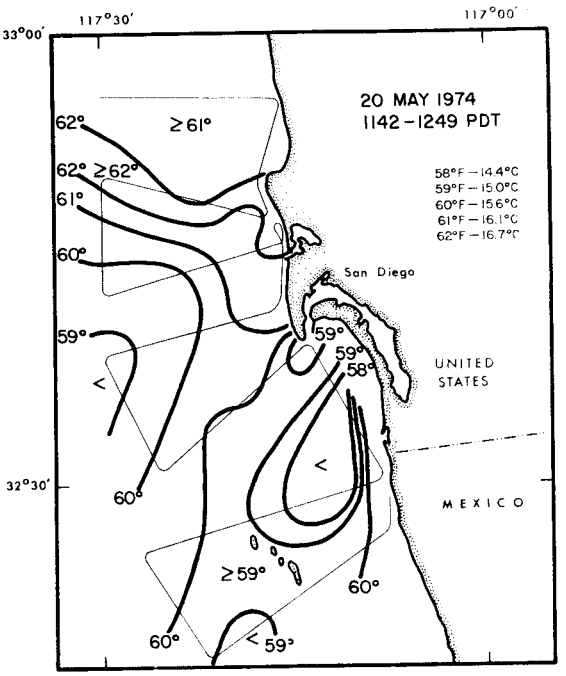

33°00'
117°30'
117°00'
32°30'
17 APRIL 1974
1027—1157 PDT
55°F — 12.8°C
56°F — 13.3°C
57°F — 13.9°C
58°F — 14.4°C
San Diego
UNITED STATES
MEXICO
≥58°
<58°
58°
57°
56°
55°

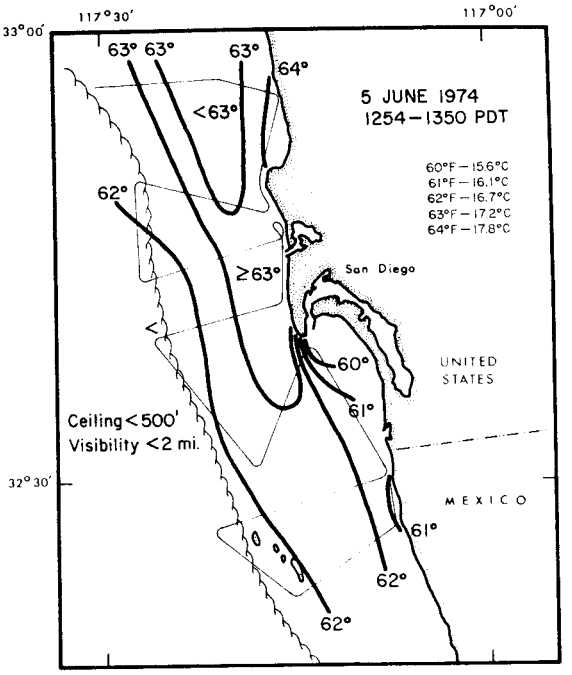

33°00'
117°30'
117°00'
23 APRIL 1974
1347–1448 PDT
57°F – 13.9°C
58°F – 14.4°C
59°F – 15.0°C
60°F – 15.6°C
≥59°
60°
59°
San Diego
UNITED STATES
≥57°
58°
MEXICO
32°30'
59°
57°
58°

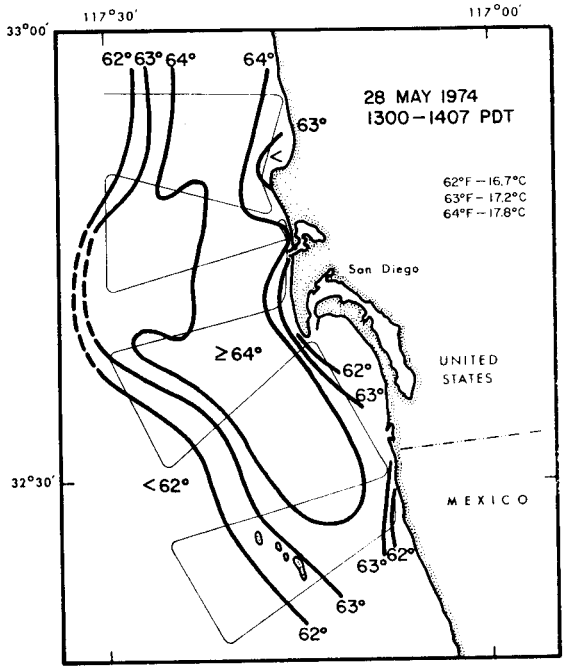

33°00'
117°30'
117°00'
9 MAY 1974
1425–1522 PDT
61°F – 16.1°C
62°F – 16.7°C
≥61°
61°
San Diego
62°
UNITED STATES
≥61°
≥62°
MEXICO
32°30'
52°
62°

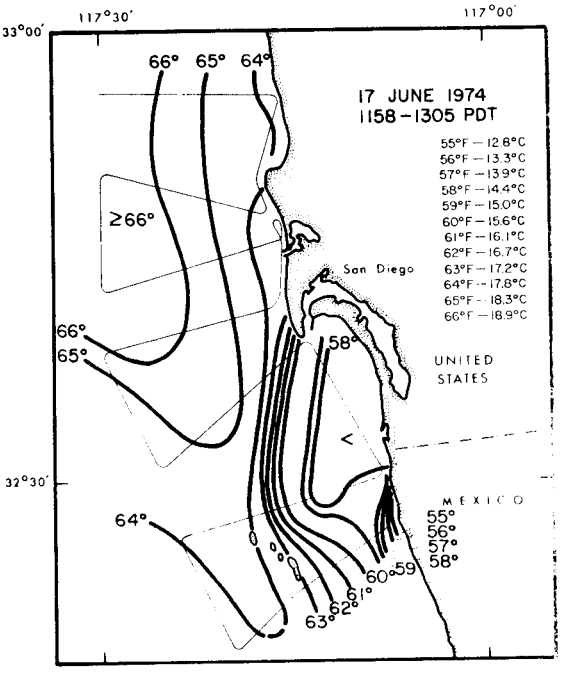

33°00'
117°30'
3 MAY 1974
1356–1459 PDT
60°F – 15.6°C
61°F – 16.1°C
60°
≥60°
61°
61°
San Diego
UNITED STATES
≥61°
MEXICO
32°30'
61°

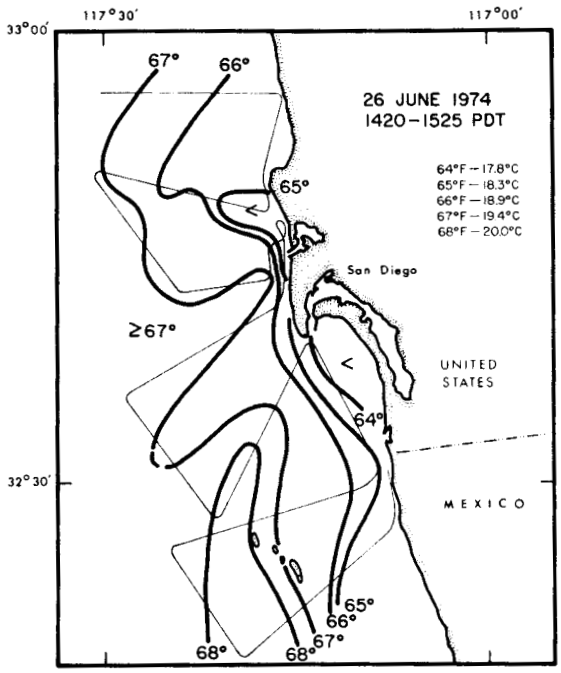

33°00'
117°30'
117°00'
13 MAY 1974
1243–1342 PDT
62°F – 16.7°C
63°F – 17.2°C
63°
63°
San Diego
≥63°
UNITED STATES
≥62°
MEXICO
32°30'
62°
63°

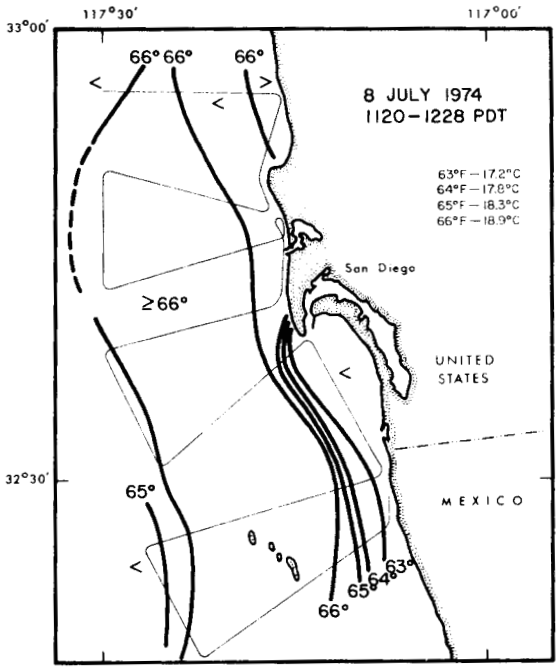

20 MAY 1974
1142–1249 PDT
58°F – 14.4°C
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
San Diego
UNITED STATES
MEXICO
117°30'
117°00'
33°00'
32°30'

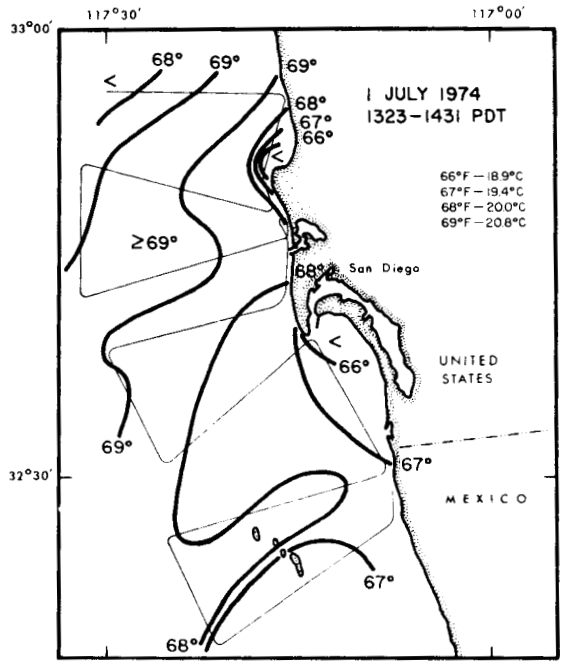

5 JUNE 1974
1254–1350 PDT
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
Ceiling < 500'
Visibility < 2 mi.
San Diego
UNITED STATES
MEXICO
117°30'
117°00'
33°00'
32°30'

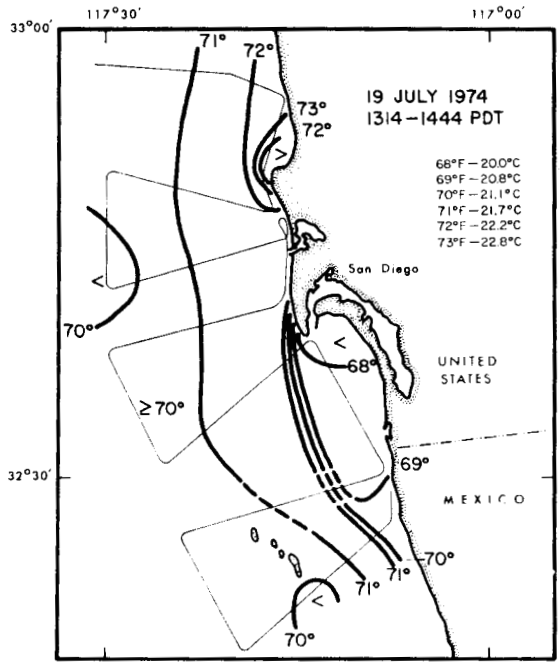

28 MAY 1974
1300–1407 PDT
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
San Diego
UNITED STATES
MEXICO
117°30'
117°00'
33°00'
32°30'

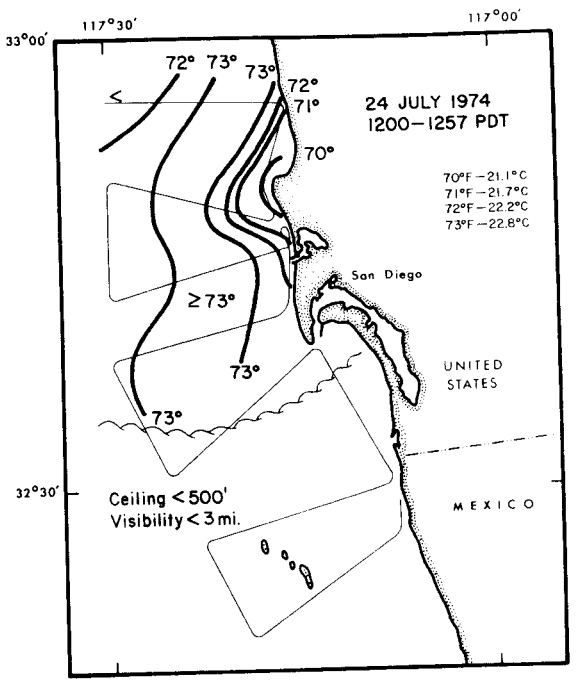

17 JUNE 1974
1158–1305 PDT
55°F – 12.8°C
56°F – 13.3°C
57°F – 13.9°C
58°F – 14.4°C
59°F – 15.0°C
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
117°30'
117°00'
33°00'
32°30'

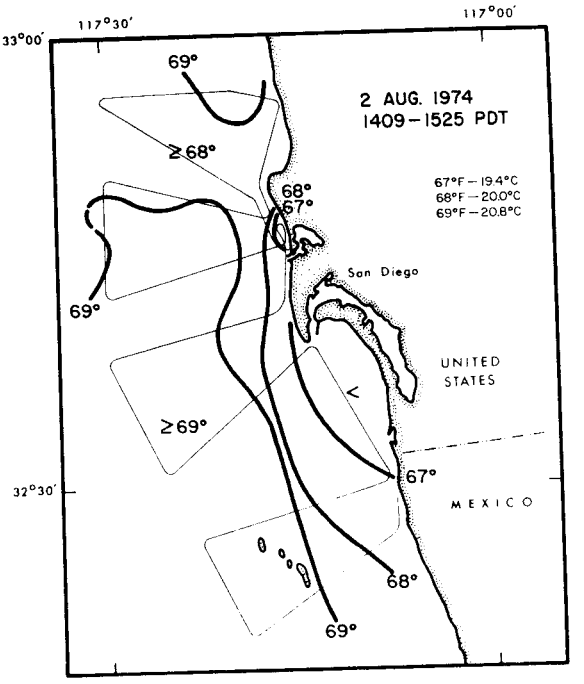

117°30'
117°00'
33°00'
32°30'
26 JUNE 1974
1420–1525 PDT
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
67°
66°
65°
≥67°
64°
65°
66°
67°
68°
68°

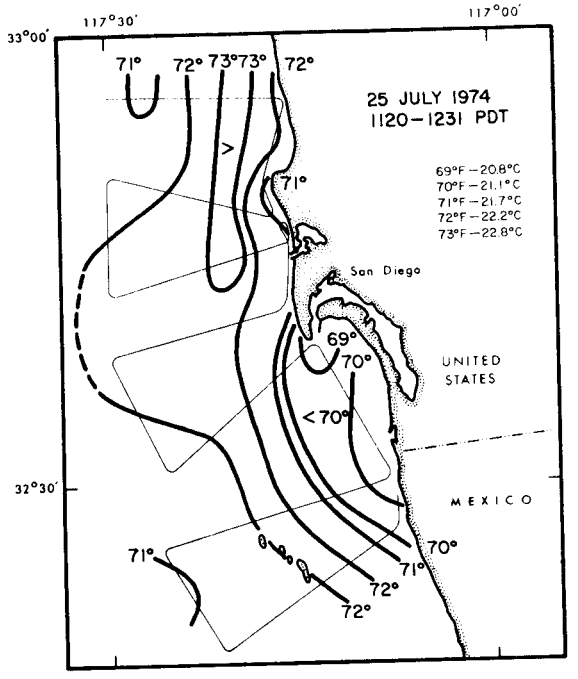

117°30'
117°00'
33°00'
32°30'
8 JULY 1974
1120–1228 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
66°
66°
66°
≥66°
65°
63°
64°
65°
66°

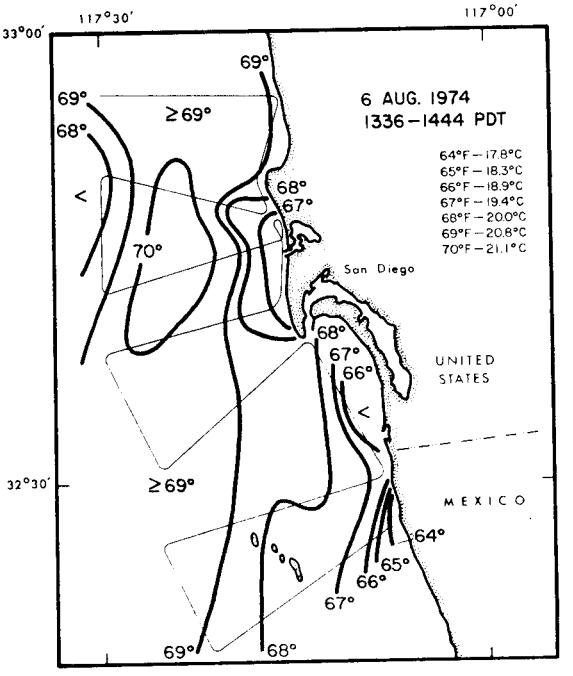

117°30'
117°00'
33°00'
32°30'
1 JULY 1974
1323–1431 PDT
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
68°
69°
69°
68°
67°
66°
≥69°
68°
66°
69°
67°
67°
68°

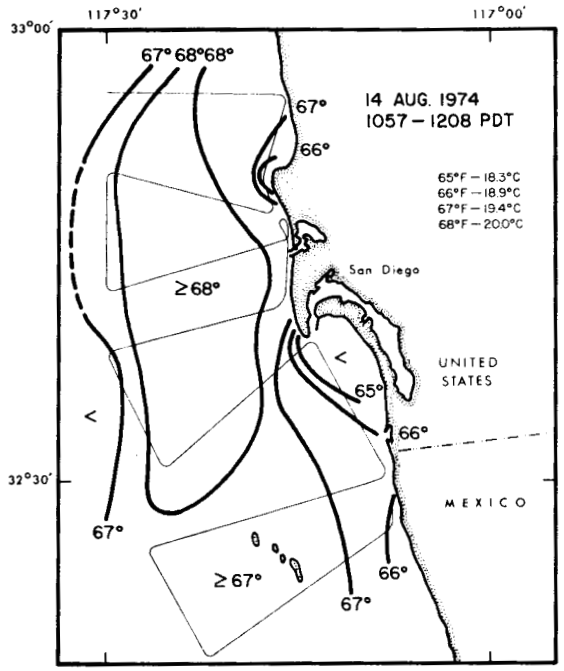

117°30'
117°00'
33°00'
32°30'
19 JULY 1974
1314–1444 PDT
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
73°F – 22.8°C
San Diego
UNITED STATES
MEXICO
71°
72°
73°
72°
70°
≥70°
68°
69°
70°
71°
71°
70°

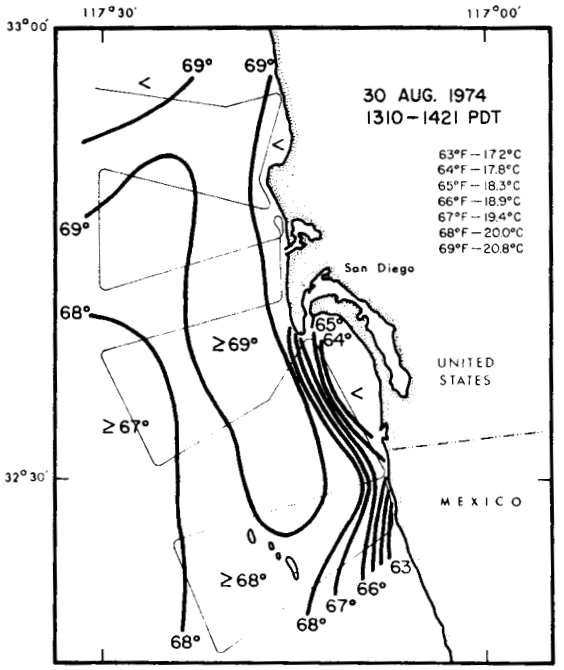

117°30'
117°00'
33°00'
32°30'
24 JULY 1974
1200–1257 PDT
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
73°F – 22.8°C
San Diego
UNITED STATES
MEXICO
Ceiling < 500'
Visibility < 3 mi.

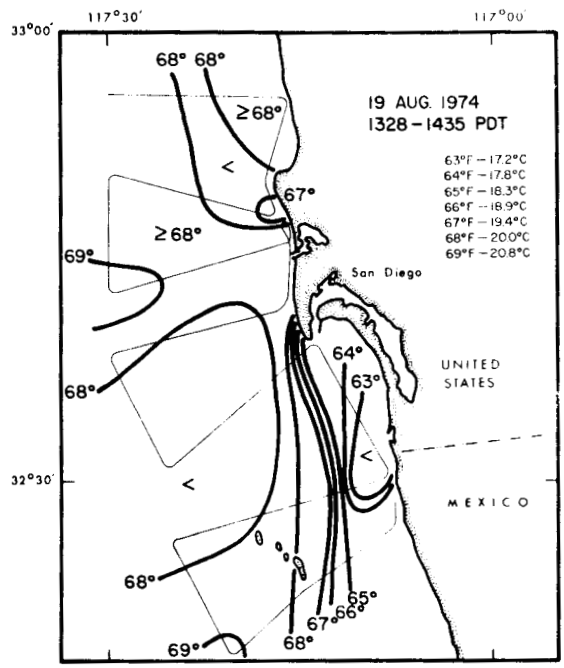

117°30'
117°00'
33°00'
32°30'
2 AUG. 1974
1409–1525 PDT
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO

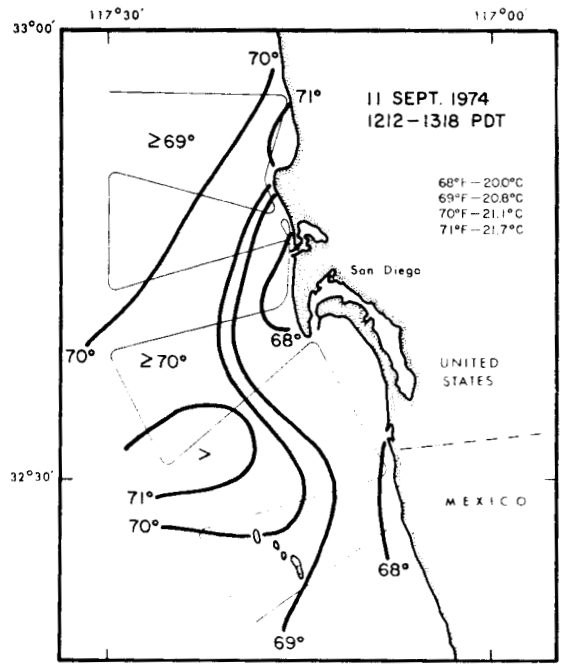

117°30'
117°00'
33°00'
32°30'
25 JULY 1974
1120–1231 PDT
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
72°F – 22.2°C
73°F – 22.8°C
San Diego
UNITED STATES
MEXICO

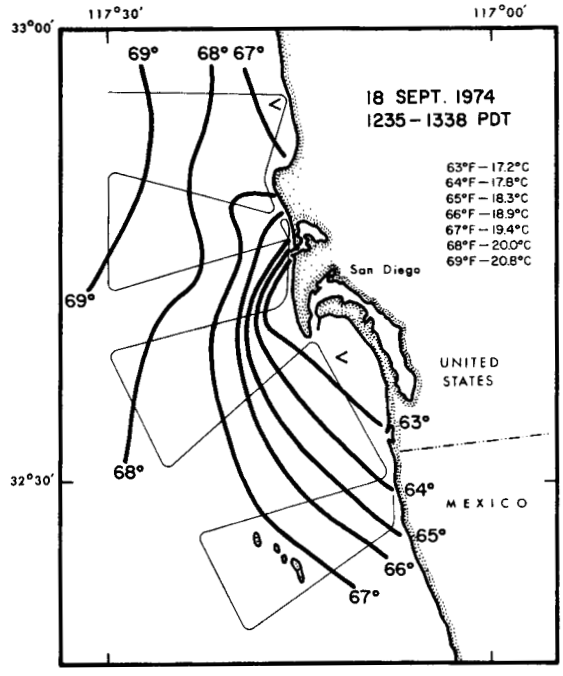

117°30'
117°00'
33°00'
32°30'
6 AUG. 1974
1336–1444 PDT
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
San Diego
UNITED STATES
MEXICO

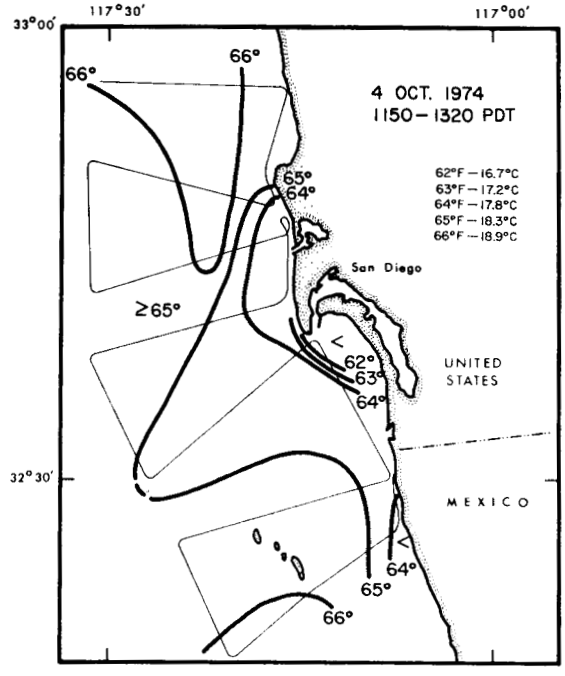

117°30'
117°00'
33°00'
32°30'
14 AUG. 1974
1057 – 1208 PDT
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
San Diego
UNITED STATES
MEXICO
67° 68° 68°
67°
66°
≥68°
<
65°
66°
67°
≥67°
66°
67°

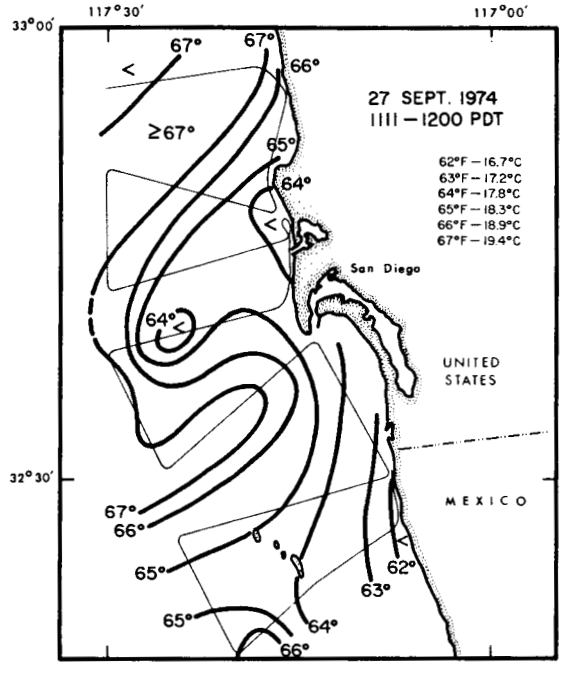

117°30'
117°00'
33°00'
32°30'
30 AUG. 1974
1310 – 1421 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
69°
69°
<
<
69°
68°
≥69°
65°
64°
<
≥67°
≥68°
63
66°
67°
68°
68°

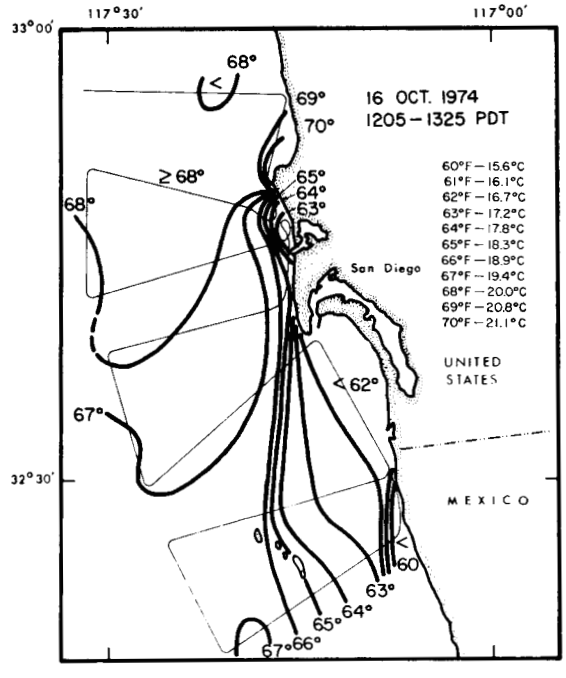

117°30'
117°00'
33°00'
32°30'
19 AUG. 1974
1328 – 1435 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
68° 68°
≥68°
<
67°
≥68°
69°
64°
63°
68°
<
<
68°
65°
67°
66°
68°
69°

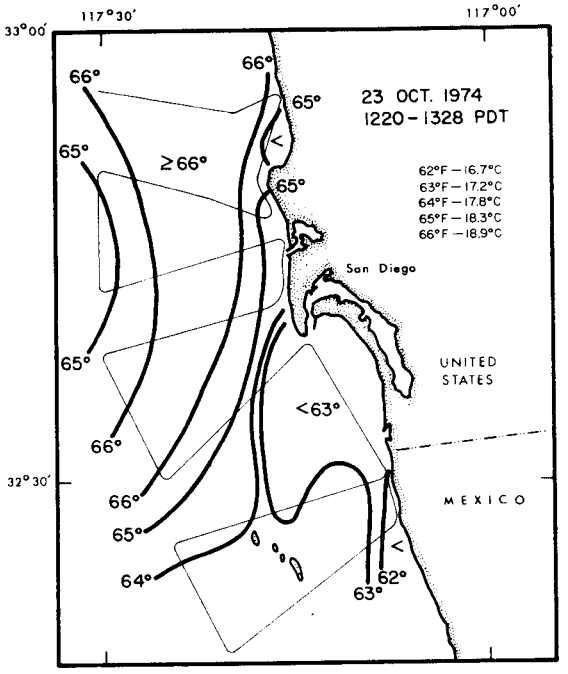

117°30'
117°00'
33°00'
32°30'
11 SEPT. 1974
1212 – 1318 PDT
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
71°F – 21.7°C
San Diego
UNITED STATES
MEXICO
70°
71°
≥69°
70°
68°
≥70°
>
71°
70°
68°
69°

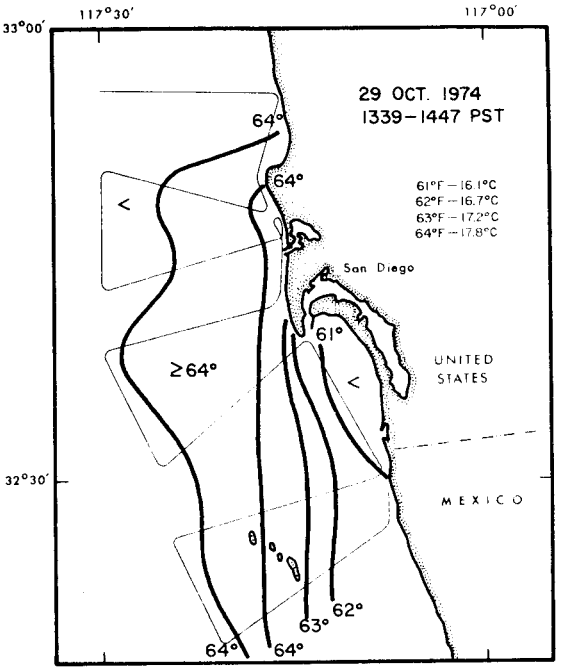

33°00'
117°30'
117°00'
32°30'
18 SEPT. 1974
1235 – 1338 PDT
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
San Diego
UNITED STATES
MEXICO
69°
68°
67°
63°
64°
65°
66°


33°00'
117°30'
117°00'
32°30'
4 OCT. 1974
1150 – 1320 PDT
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
San Diego
UNITED STATES
MEXICO
66°
≥65°
65°
64°
62°
63°


33°00'
117°30'
117°00'
32°30'
27 SEPT. 1974
1111 – 1200 PDT
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
San Diego
UNITED STATES
MEXICO
67°
≥67°
66°
65°
64°
63°
62°


33°00'
117°30'
117°00'
32°30'
16 OCT. 1974
1205 – 1325 PDT
60°F – 15.6°C
61°F – 16.1°C
62°F – 16.7°C
63°F – 17.2°C
64°F – 17.8°C
65°F – 18.3°C
66°F – 18.9°C
67°F – 19.4°C
68°F – 20.0°C
69°F – 20.8°C
70°F – 21.1°C
San Diego
UNITED STATES
MEXICO
68°
69°
70°
≥68°
65°
64°
63°
62°
67°
60





☆ GPO: 1978—799-830/10-10