Coastal Zone
Information
Center

Library Copy
PCD

A STUDY OF TRANSPORT INTO, WITHIN AND OUT OF COASTAL AREAS OF SOUTHERN SANTA BARBARA COUNTY AND VENTURA COUNTY

Draft Final Report

MRI 81 FR1808

TD883.5.C22S26 1981

by

Meteorology Research, Inc.

D.E. Lehrman
T.B. Smith

California Institute of Technology
Division of Chemistry and Chemical Engineering

D.D. Reible
F.H. Shair

Submitted to:

Ventura Air Pollution Control District
800 South Victoria Avenue
Ventura, California 93009

Attention: Douglas Tubbs, Director

JUNE 1981

COASTAL ZONE
INFORMATION CENTER

TD
883.5
.C22
S26
1981

ABSTRACT

An intensive field program was carried out to acquire a data base to document transport and quantify the impact of pollutants from offshore oil and gas sources in the Santa Barbara Channel to onshore receptors in southern Santa Barbara County and Ventura County. As part of that effort, Meteorology Research, Inc. (MRI) established a network of meteorology and air quality monitoring stations to supplement existing data resources for a one month period beginning in mid-September 1980. During the environmental monitoring period, the California Institute of Technology (Caltech) conducted six atmospheric tracer studies. These studies utilized sulfur hexafluoride (SF_6), released from a number of locations in the Santa Barbara Channel. The coastal and inland impacts of the tracer (and thus gaseous pollutants emitted from those locations) were determined quantitatively by measuring concentrations of SF_6 as a function of time and position. Concurrent with the tracer studies, MRI obtained intensive observations of winds aloft from several locations, and measured air quality and meteorology on a regional basis with an instrumented airplane. The data base thusly acquired will provide data to execute and verify regional air quality models.

This report consists of a test-by-test summary of the tracer results and the meteorology with emphasis on the transport winds. SF_6 was released from several locations within the Santa Barbara Channel which were selected on the basis of being known or proposed pollutant sources, and ranged from Point Conception at the west end of the channel to Point Hueneme on the east end. Generally the meteorology experienced during the study was characteristic of conditions in September and which exemplify worst case conditions. More specifically, the base of the

marine inversion was typically low over the channel during the study inhibiting vertical mixing, and strong differential heating between the channel and inland produced a well developed diurnal land-sea breeze circulation. These studies indicate that during the nighttime when offshore flows dominate along the coast and localized light flows dominate in the channel, emissions of gaseous pollutants from any of those sources within the channel can impact virtually any area within the channel. During all tests, the SF_6 was further transported onshore by afternoon sea breezes. SF_6 was not generally transported onshore west of Gaviota. However, on the one instance when Gaviota Pass and the Santa Ynez Valley were impacted, the tracer was released from the east end of the channel. Generally, tracer material would be transported by an upslope flow in the afternoon over Casitas Pass into the Ojai Valley. SF_6 in the vicinity of Ventura and Oxnard was primarily transported by a sea breeze reinforced by westerly flow in the channel inland along the Santa Clara River Basin. The inland extent of tracer transport was determined by the timing of beginning of the westerly flow in the channel and the location of the SF_6 plume offshore. The nighttime land breezes tended to transport SF_6 from inland areas back towards the coast. Thus, SF_6 was detected at coastal and inland sites for periods much longer than the release duration.

To assist in the selection of periods to be used for modeling purposes, statistical tables which summarize the gaseous pollutants (O_3, NO, NO_x, SO_2) measured by the MRI aircraft have also been included in this report.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. Introduction

During September and October of 1980, a field study was implemented jointly by Meteorology Research, Inc. (MRI) and the California Institute of Technology (Caltech) to develop a data base for use in modeling the impact of offshore drilling operations on the coastal and inland valley areas. To this end, MRI established a month-long environmental monitoring program which consisted of the following key elements:

- Measurements of winds aloft on a scheduled twice-daily basis and on a more frequent basis during tracer experiments from the Santa Ynez, Ojai, and Simi Valleys.
- Scheduled twice-daily airplane temperature soundings over the Santa Ynez, Ojai, and Simi Valleys.
- Continuous measurements of surface wind and temperature from ten locations to supplement existing data resources.
- To supplement existing air quality monitoring data, ozone was continuously monitored from two locations, carbon monoxide at one location, and at a fourth location ozone, oxides of nitrogen, carbon monoxide, and total hydrocarbons were monitored.
- Airborne measurements of air quality on a regional basis during selected periods.
- Continuous measurements of vertical mixing and atmospheric stability with an acoustic radar.

The data base thusly acquired has been submitted to the Ventura Air Pollution Control District in a Technical Report (MRI 80 DV-1793) dated 10 December 1980 and to the California Air Resources Board on magnetic tape.

Six atmospheric tracer experiments were carried out concurrently by Caltech and reported in detail to the Ventura Air Pollution Control District in a technical reported dated 15 January 1981.

This report summarizes the tracer experiments and airborne air quality sampling. In Section 2, the results of the tracer experiments are summarized and the meteorology during those periods is described on a test-by-test basis. Section 3 contains the statistics for selected parameters measured by the MRI sampling aircraft.

2. Test Summaries

2.1 Test 1 17 September 1980 - Release from Point Conception (1100 - 1600 PDT)

2.1.1 Meteorology

General

The synoptic meteorology on 17 September was characterized by a belt of high pressure at the surface which extended across California to the Great Plains (Figure 2-1a). Aloft at 500 mb (Figure 2-1b), a closed low was positioned about 600 miles off the central California coast and was moving east, continuing a trend which had been established over the past several weeks. Generally clear or scattered sky conditions existed over the channel and ceilings were unlimited.

Transport Winds

Figures 2-2 to 2-4 show surface streamline maps for the study region during and after the tracer release period. The flow in the channel at the start of the release is depicted by the surface streamlines on Figure 2-2. The flow is seen to be generally westerly throughout the channel with air diverging towards the coast east of Gaviota Pass, directed towards the Santa Ynez Valley, and over Casitas Pass into the Ojai Valley. The main streamlines continue onto the Oxnard Plain and into the interior valleys. The same basic flow pattern continued into the afternoon with one notable exception. By 1500 PDT (Figure 2-3) the flow was directed offshore at Gaviota Pass, one of the few such afternoon occurrences. Typically an eddy forms in the lee of Point Conception and an upslope flow is observed in Gaviota Pass. A strong onshore flow (5-8 m/s) continued at the east end of the channel and into the interior valleys. The 2100 PDT winds (Figure 2-4) depict the erosion of the daytime flow pattern and show the transition period between onshore and offshore flow regimes. During the transition, wind speeds are generally light (<1 m/s) along the coast and inland, and wind direction becomes variable.

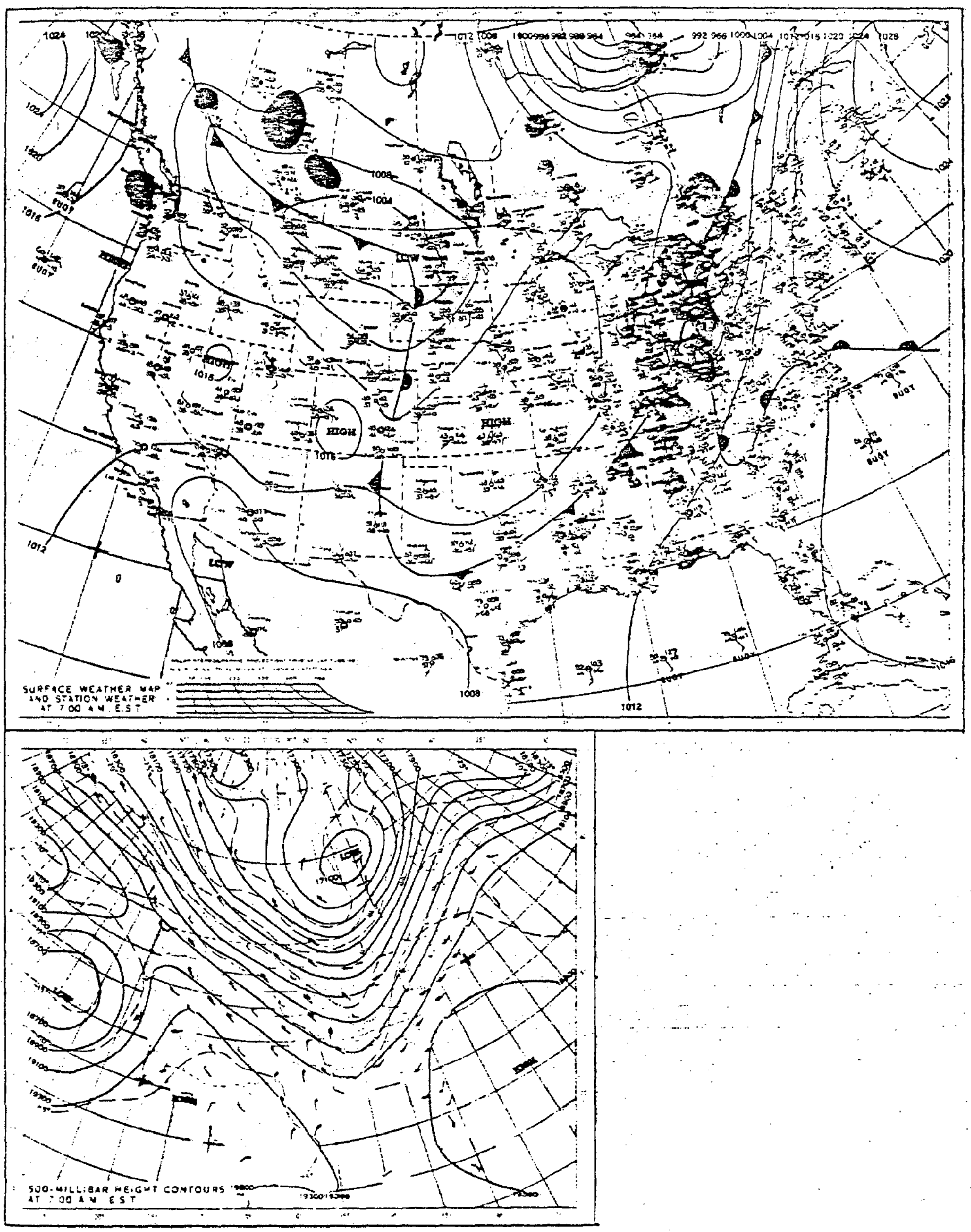


Figure 2-1. (a) Surface Weather Map (Upper Panel)
(b) 500 mb Height Contours (Lower Panel)
for 17 September 1980

Figure 2-2. Surface Streamlines
17 September 1980 1100 PDT

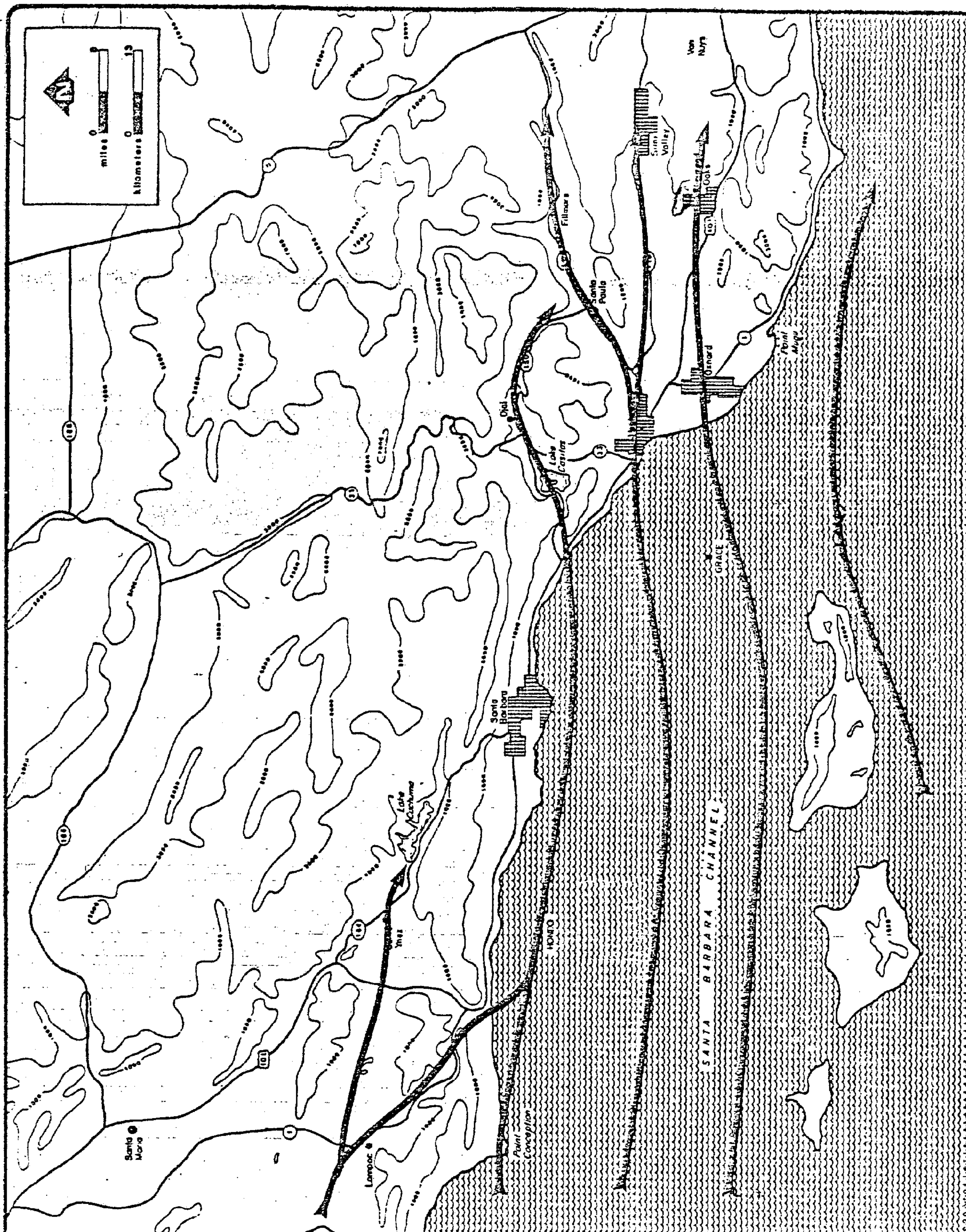


Figure 2-3. Surface Streamlines
17 September 1980 1500 PDT

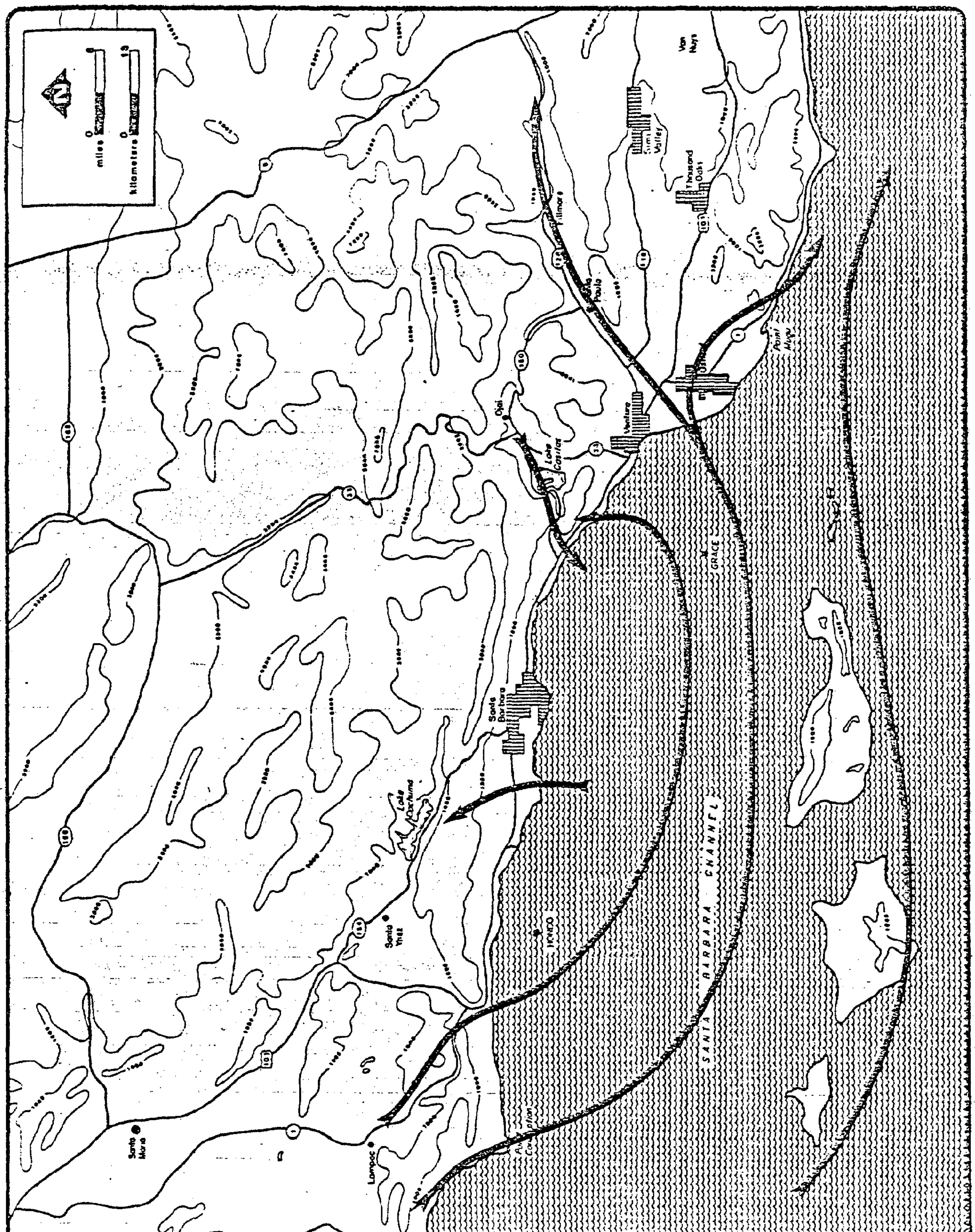


Figure 2-4. Surface Streamlines
17 September 1980 2100 PDT

The surface winds from Point Conception, tabulated in Table 2-1, show the persistence of the flow during the test. Winds in this period were from the westnorthwest and increased from 7 m/s at the start of release to a maximum of nearly 12 m/s at 1600 PDT. Wind velocities thereafter gradually decreased to 4 m/s during the night.

Table 2-1

Surface Winds at Point Conception

17 September 1980

Time (PDT)	Wind (m/s)	Time (PDT)	Wind (m/s)
1100	295/7.2	1700	280/9.0
1200	290/8.0	1800	281/7.2
1300	286/10.2	1900	296/5.1
1400	278/8.9	2000	301/5.6
1500	285/9.6	2100	302/4.3
1600	278/11.7	2200	351/4.4

Mixing Heights

Mixing heights were determined by either of two means. One method uses the soundings made by the MRI sampling aircraft by noting the top of the surface pollution layer or, if within the marine layer, the discontinuity of dewpoint. The second method is merely noting the vertical distribution of SF_6 obtained by either the Caltech or MRI sampling aircraft when within the tracer plume at a downwind distance adequate to allow sufficient mixing time.

Soundings taken by the MRI sampling aircraft just offshore of Point Conception and Santa Barbara indicate maximum vertical mixing to 500 ft.

2.1.2 Tracer Results

This test showed that pollutants from sources in the vicinity of Point Conception can be transported into the Santa Barbara Channel. Pollutants within the Santa Barbara Channel can then be transported onto shore during afternoon sea breezes. From there, pollutants can be transported further inland. For this particular test, the tracer trajectory from Point Conception was found to pass over Platform Hondo in the Santa Barbara Channel. The majority of the tracer was then transported over land in Santa Barbara County. Some material was also transported into Ventura County near Ventura and Oxnard. Some of the tracer detected along the Santa Barbara County coastline was transported into the Ojai Valley over the Casitas Pass. Reversal of the daytime wind flow patterns caused much of the SF_6 transported onshore to be returned to the coast during the night. The tracer transported across the Ventura County coastline during the day preferentially impacted the Santa Clara River Basin, including the towns of Santa Paula and Piru. Reversal of the daytime wind flow patterns also returned SF_6 towards the Ventura County coastline in much the same manner as the return flow in Santa Barbara County. The inland areas of Santa Paula and Piru showed SF_6 throughout the sample period. Thus a significant portion of the airborne pollutants crossing the coastline in mid and late afternoon required more than 24 hours to be transported out of the study area. If the pollutants from the Santa Barbara Channel arrived onshore earlier than mid afternoon, proportionately more of the pollutants would have been transported out of the study area by nightfall.

2.2 Test 2 22 September 1980 - Release from 3 Mi S of Point Conception (1100 - 1600 PDT)

2.2.1 Meteorology

General

The synoptic meteorology of 22 September was characterized by a thermal trough established at the surface over the interior of California (Figure 2-5a), a typical condition during the warmer months of the year. Aloft at 500 mb (Figure 2-5b), a weak short-wave trough moved across the state having a destabilizing effect on the atmosphere and increasing the depth of the marine layer in the study area. When conditions permitted, twice-daily aircraft temperature soundings were made by MRI over the Simi, Ojai, and Santa Ynez Valleys. The temperatures at 5000 ft (or approximately 850 mb) lowered from 22-23°C, measured during the first test, to 17-13°C in response to the trough passage. Skies remained generally overcast to broken throughout the area with ceilings in the range of 500-1500 ft. Visibilities were restricted to 4-5 miles in haze.

Transport Winds

The streamlines of Figure 2-6 depict the general flow in the early period of the tracer release. The major feature of the flow at this time is the easterly flow in the north of the channel. Thus, initially SF_6 was being transported out of the channel. On the east side of the channel, the flow was generally from the southwest and veered to the west inland. The winds remained light at the release area until after 1400 PDT. A kite, which required a 2 m/s wind velocity to operate, was employed to obtain winds above the release boat. It was not until approximately 1430 PDT that wind speeds had increased to the threshold for sustaining flight. Winds at the release site increased to 6 m/s later in the afternoon. The onboard observer first noted a shift in the wind to a westerly component at

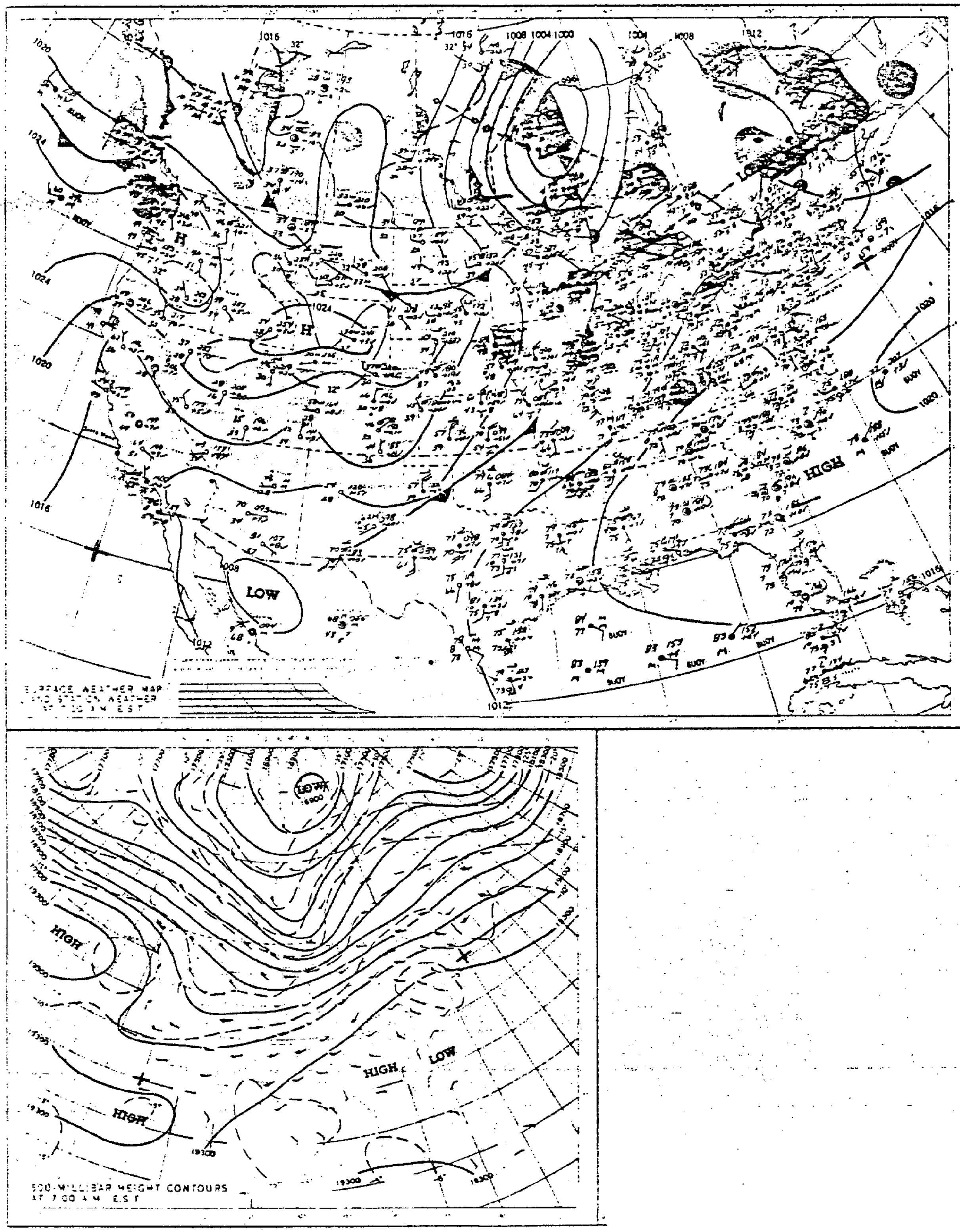


Figure 2-5. (a) Surface Weather Map (Upper Panel)
(b) 500 mb Height Contours (Lower Panel)
for 22 September 1980

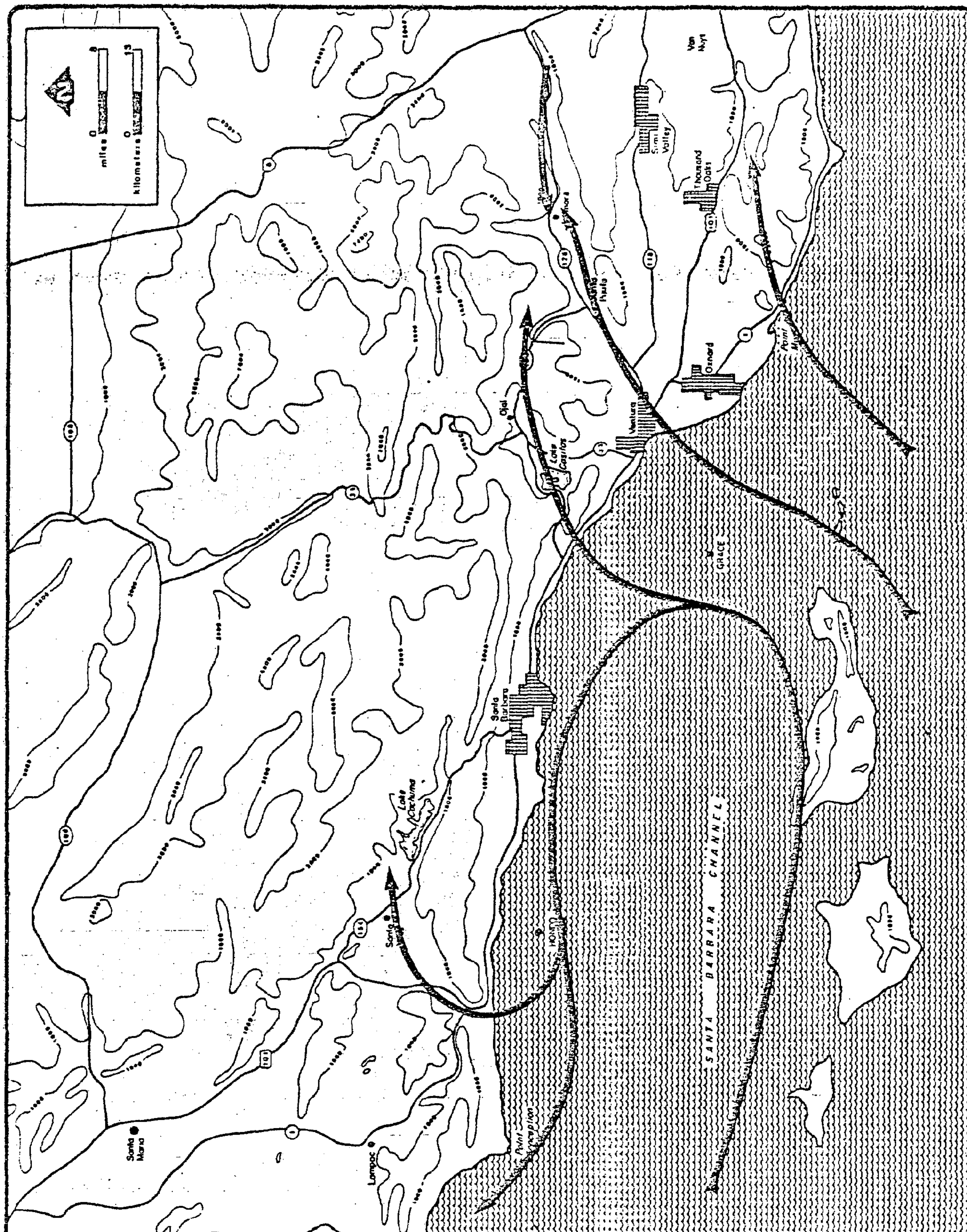


Figure 2-6. Surface Streamlines
22 September 1980 1100 PDT

1300 PDT. The 1500 PDT streamlines, shown on Figure 2-7, show that by that time a general westerly flow had developed in the channel. The major difference between the afternoon flows during this test and the previous test is the development of the eddy in the lee of Point Conception with the flow over Gaviota Pass. By 2100 PDT, the onshore flows along the coast had ceased and a pattern similar to the morning regime was developing.

Mixing Heights

MRI aircraft samplings taken near Point Conception, Gaviota State Beach, Santa Barbara, and Oxnard show vertical mixing over the channel ranged from 1500-2000 ft, the deepest measured during the field study.

2.2.2 Tracer Resulrs

Because of the wind reversal at the release site, the tracer was more dilute entering the Santa Barbara Channel than during the previous Point Conception release. While this caused the onshore SF_6 levels to be lower during this test, the path of SF_6 transport between the two tests was quite similar. The highest on-land SF_6 levels were detected west of Santa Barbara. SF_6 was also transported toward the east at the base of the coastal mountains. Also as a result of the early westerly transport at the release site, SF_6 was not transported very far into the inland valley areas and the Ventura-Oxnard Plain before the nighttime wind reversal. This led to higher nighttime concentrations along the coast than during the first test.

Figure 2-7. Surface Streamlines
22 September 1980 1500 PDT

2.3 Test 3 26 September 1980 - Release from near Platform Hondo (0200 - 0700 PDT)

2.3.1 Meteorology

General

The meteorology on the 26th was characterized at the surface by the extension of the Pacific High into central California (Figure 2-8a). The thermal trough was not well developed over the interior of California, but pressure gradients nevertheless were onshore. The pressure field aloft at 500 mb was extremely flat over the southwest United States (Figure 2-8b). There was evidence of a weak closed low aloft just south of the Mexican border, but its impact, if any, on the study area was negligible. Temperatures at 5000 ft in the study area warmed to 23°C, comparable to 17 September (Test 1). Along the channel coast, overcast to broken sky conditions were reported in the morning with ceilings ranging 200-900 ft, and visibilities lowering to less than a mile in fog. The stratus burned off by noon and skies were reported clear in the afternoon. Weather observations taken from Grace until 1100 PDT indicate fog and overcast skies also prevailed in the channel with visibilities as low as one half mile early in the release and increasing to 4 mi by late morning.

Transport Winds

Figures 2-9 to 2-11 show surface streamline maps for the Santa Barbara Channel during and after the tracer release period. The streamlines on Figure 2-9 are characteristic of the flow in the early morning while the tracer release was ongoing. The flow within the channel appears to be largely localized. The result is depicted on the figure as a cyclonically directed flow circulating the channel. The winds during the morning and afternoon at Platform Hondo, near the release location, are tabulated in Table 2-2. Winds at Hondo remained light and variable in direction until late afternoon. Beginning about 1600 PDT, the Hondo winds became westerly and increased in velocity.

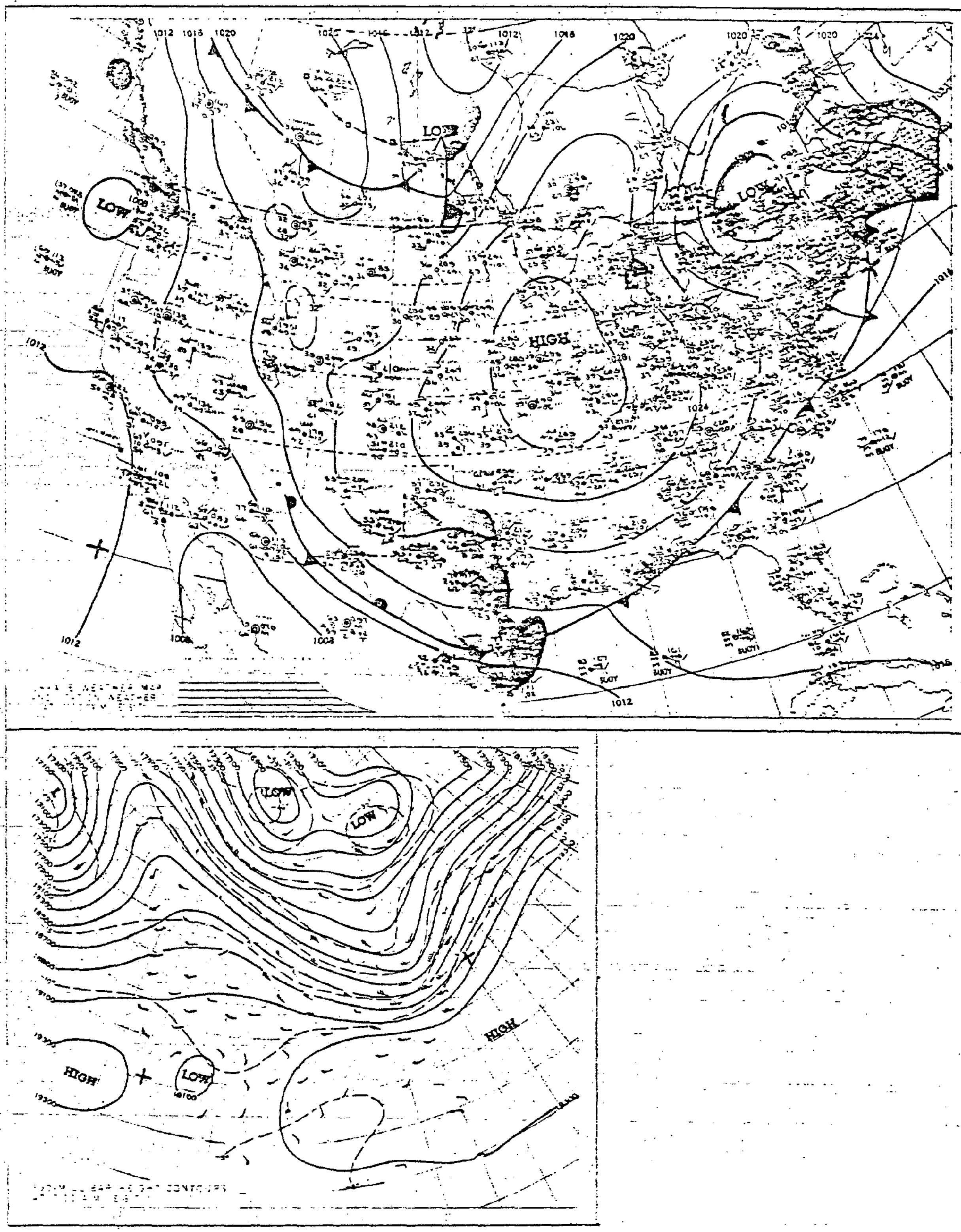


Figure 2-8. (a) Surface Weather Map (Upper Panel)
(b) 500 mb Height Contours (Lower Panel)
for 26 September 1980

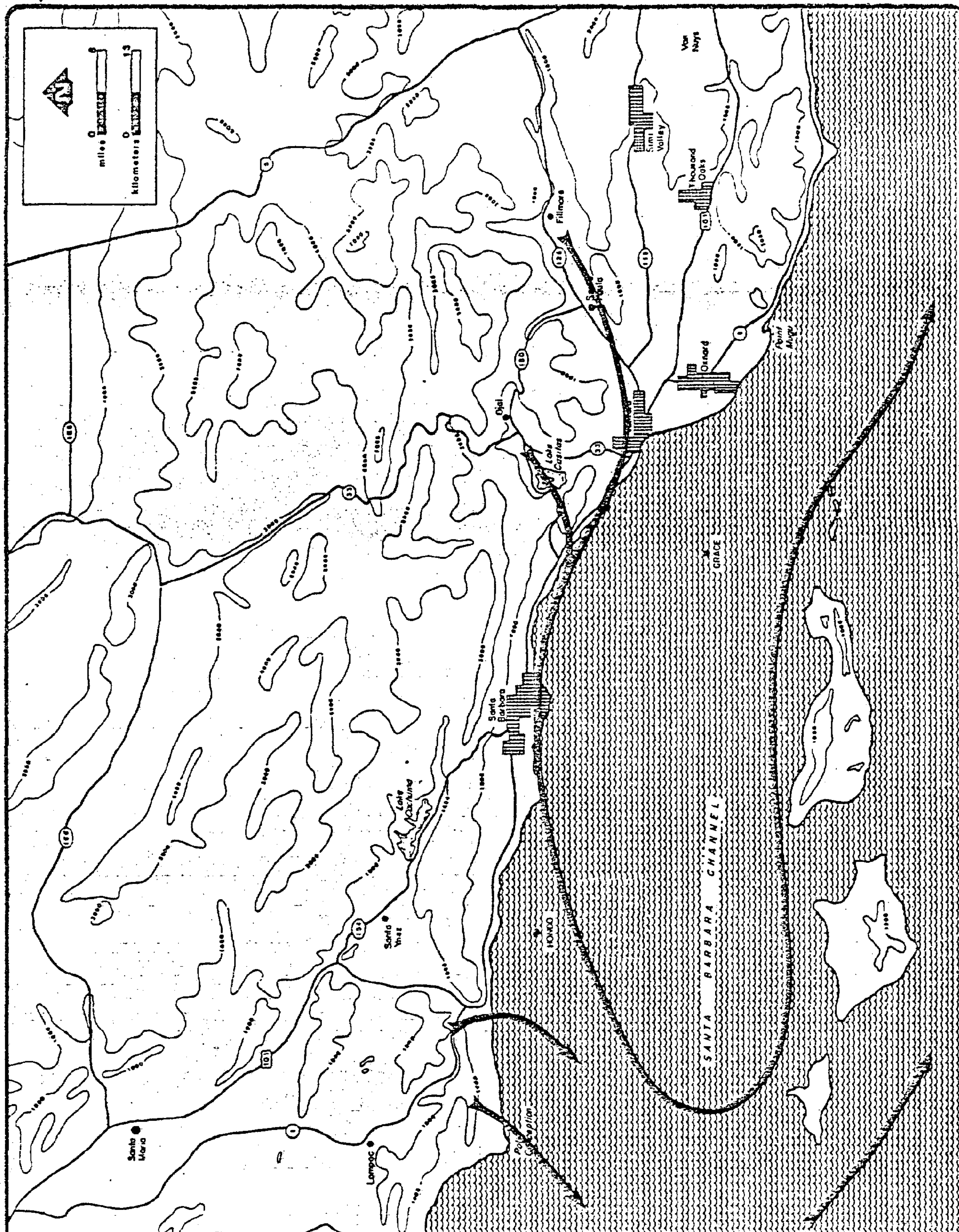


Figure 2-9. Surface Streamlines
26 September 1980 0200 PDT

Table 2-2

Surface Winds at Platform Hondo

26 September 1980

Time (PDT)	Wind (m/s)	Time (PDT)	Wind (m/s)
0200	072/2.7	1000	240/0.9
0300	072/1.8	1100	196/0.9
0400	072/0.4	1200	113/1.3
0500	080/1.8	1300	138/0.9
0600	042/1.3	1400	216/0.4
0700	020/0.4	1500	192/0.4
0800	306/0.4	1600	249/1.8
0900	270/0.9	1700	256/3.1
		1800	268/4.9

At the end of the release period, the general flow in the channel began to shift gradually into the pattern depicted by the streamlines on Figure 2-10. A generally westerly wind field had developed with an expanded eddy region in the northwest of the channel. An onshore component to the wind existed everywhere along the coast adjacent to the channel. By early afternoon a more typical wind field, more predominately westerly, had developed in the channel (Figure 2-11). Afternoon wind speeds ranged from less than 1 m/s at Hondo to greater than 15 m/s at Anacapa and Point Conception. By 2200 PDT an offshore wind had developed along the coast and drainage flows were established in the passes.

Mixing Heights

The Caltech sampling aircraft spiraled within the tracer plume at several locations during the afternoon. Table 2-3 gives the mixing heights at those locations as determined from the SF_6 data.

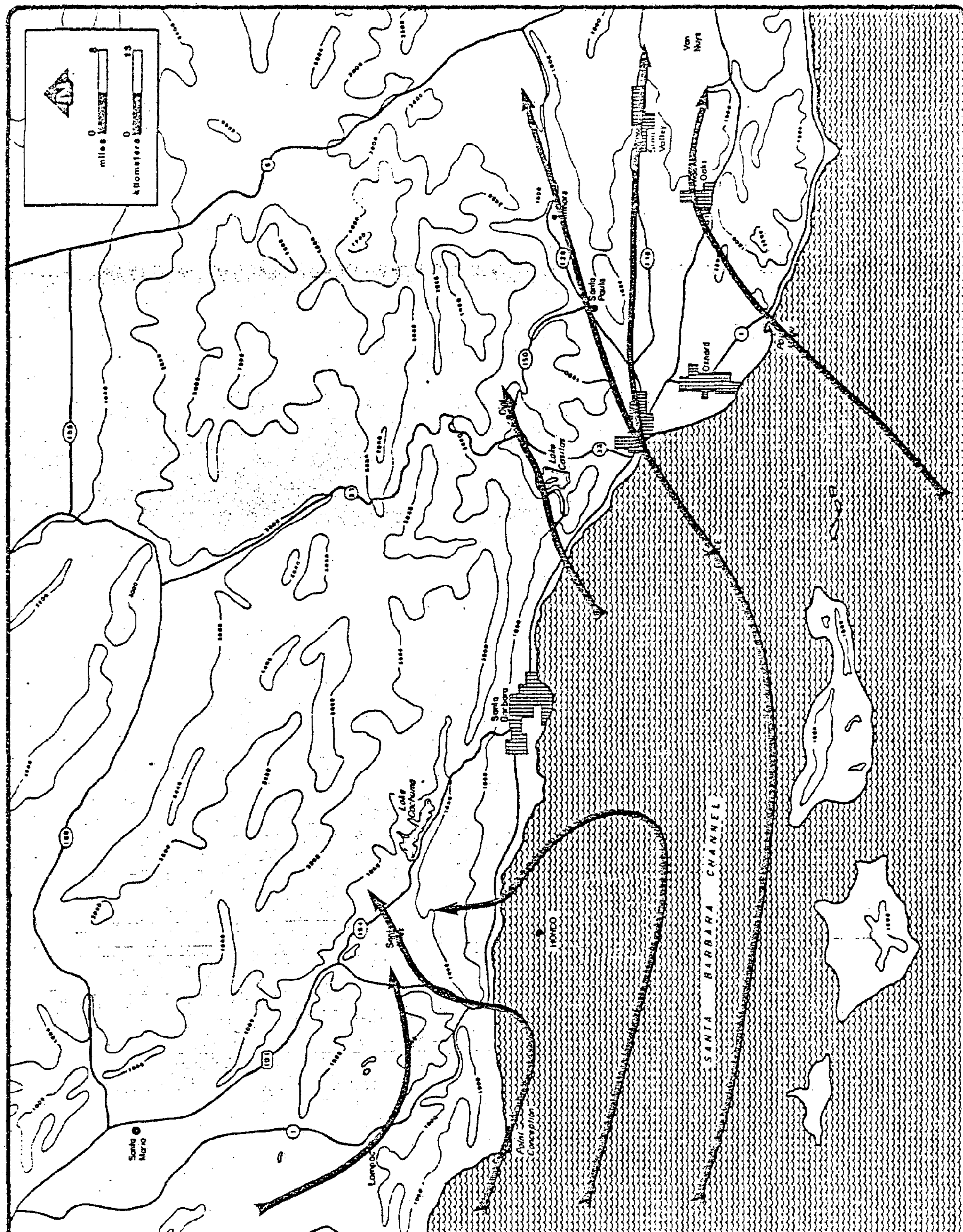


Figure 2-10. Surface Streamlines
26 September 1980 1200 PDT

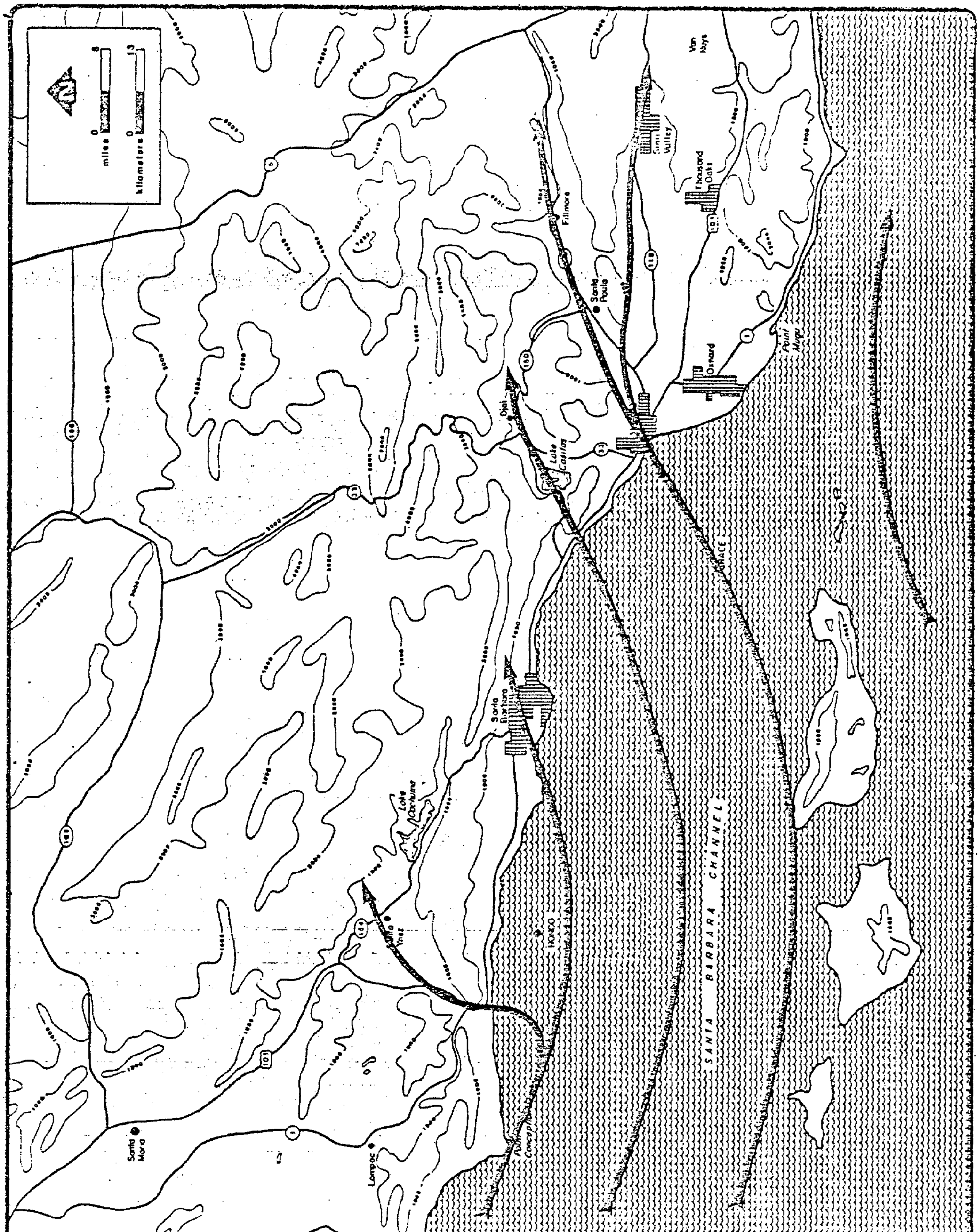


Figure 2-11. Surface Streamlines
26 September 1980 1600 PDT

Table 2-3

Mixing Heights - 26 September 1980

Time (PDT)	Location	Mixing Height (ft-msl)
1355	Santa Barbara Airport	500
1505	Camarillo	1000
1525	Santa Paula	2000
1550	Santa Susana Airport	1500
1605	Santa Paula	2000
1626	Santa Barbara	1000
1739	Piru	2000
1301	Ventura	1000

2.3.2 Tracer Results

This test differed from the first two tests in that the SF_6 was released early in the morning rather than in the late morning and early afternoon. This caused the SF_6 to be transported by the nighttime land breezes and spread over a wide area before the onset of the daytime sea breezes. This led to the tracer being spread rather uniformly over the coastline during the afternoon. By mid afternoon, SF_6 levels along the entire Santa Barbara Channel coastline from Gaviota Pass to Oxnard were essentially constant at about 20-40 PPT (48-96 PPT/lb-mole released/hr). Considering the initial westerly transport, the winds at the release site (Table 2-2) do not support the observed timing of tracer movement to the Oxnard-Ventura coast. As in previous tests, the SF_6 was transported inland during the afternoon into the Ojai Valley, the Santa Clara River Basin and the Ventura-Oxnard Plain. Also as in previous tests, nighttime land breezes caused transport back towards the coastline. Due to the initial dispersion of the tracer, all SF_6 concentrations detected during this test were lower than during previous tests.

2.4 Test 4 28 September 1980 - Release from the Acania, 4 Mi W Ventura Marina (1240 - 1900 PDT)

2.4.1 Meteorology

General

The major synoptic meteorological feature during the test was the occurrence of a dissipating weather front which at 0500 in the morning was located east of Los Angeles (Figure 2-12a). Ridging at the surface followed the passage of this weak weather system. As a consequence, the thermal trough, typically established over the interior of California, was less pronounced. Support aloft is reflected on the 500 mb chart (Figure 2-12b). by the short wave trough, which, at the map time, was located coincident with the surface system. Generally clear or scattered sky conditions and unlimited ceilings existed over the study area during the test. Skies partially obscured (> 1/10) were reported between 0700 and 1700 PDT at Point Mugu and between 1300 and 1400 PDT at Oxnard. Visibilities ranged between 7-10 mi during the test.

Transport Winds

Streamlines depicting the flow during the release are shown on Figure 2-13. The winds in the channel remained remarkably consistent during the afternoon. This consistency was reflected in the winds at Surfers Point on the coast downwind of the release. After 1200 PDT the winds were from the southwest and ranged from 2-3 m/s. These are shown in Table 2-4. A 2 m/s wind component up Gaviota and Casitas Passes persisted throughout the afternoon until early evening. By 2100 PDT, a land breeze regime was again developing (Figure 2-14). Noteworthy features of the streamfield during the developing period is the flow convergence between Platform Grace and the coast and a weak eddy offshore from Gaviota Pass in the vicinity of Platform Hondo. The latter feature continued throughout the night.

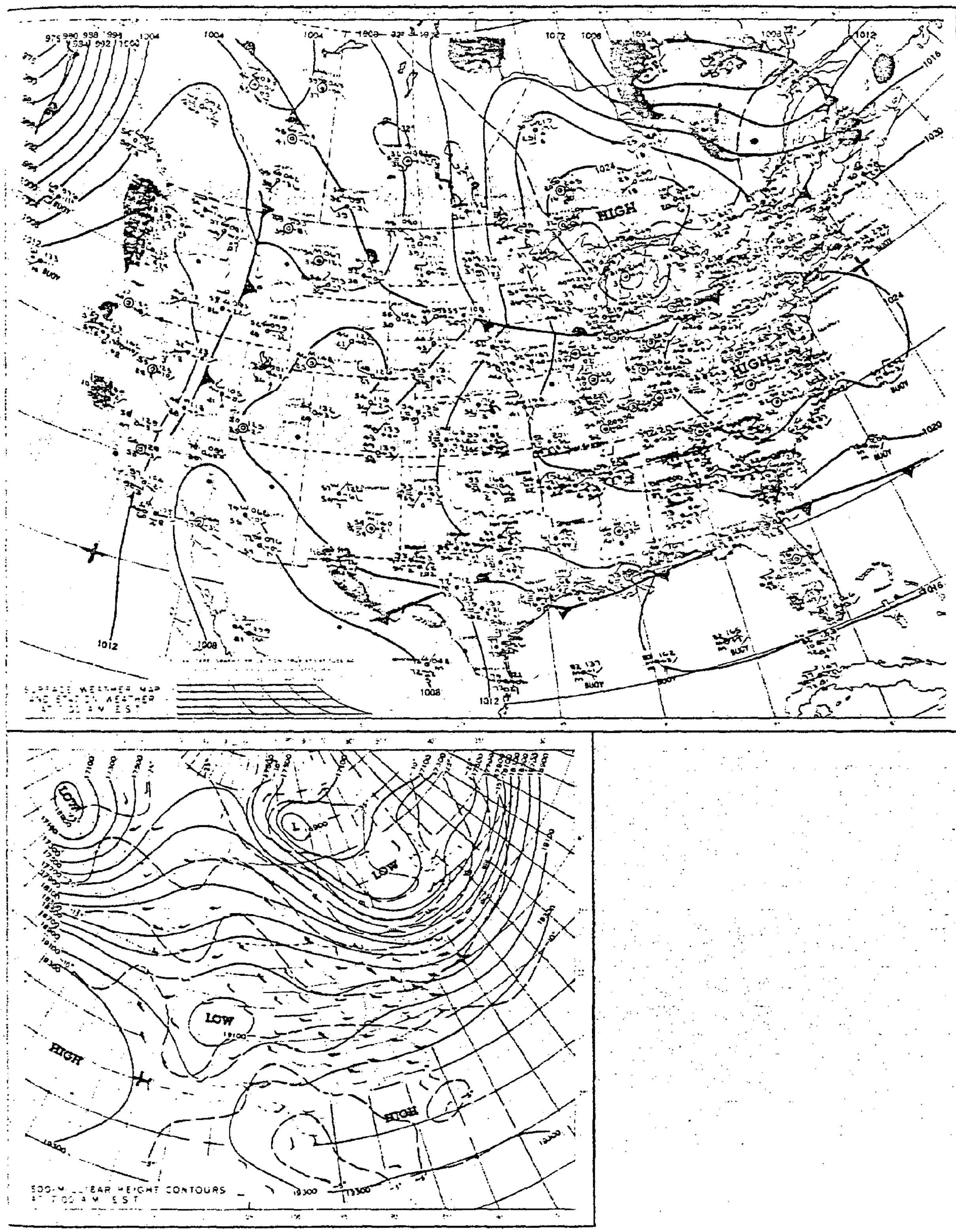


Figure 2-12. (a) Surface Weather Map (Upper Panel)
(b) 500 mb Height Contours (Lower Panel)
for 28 September 1980

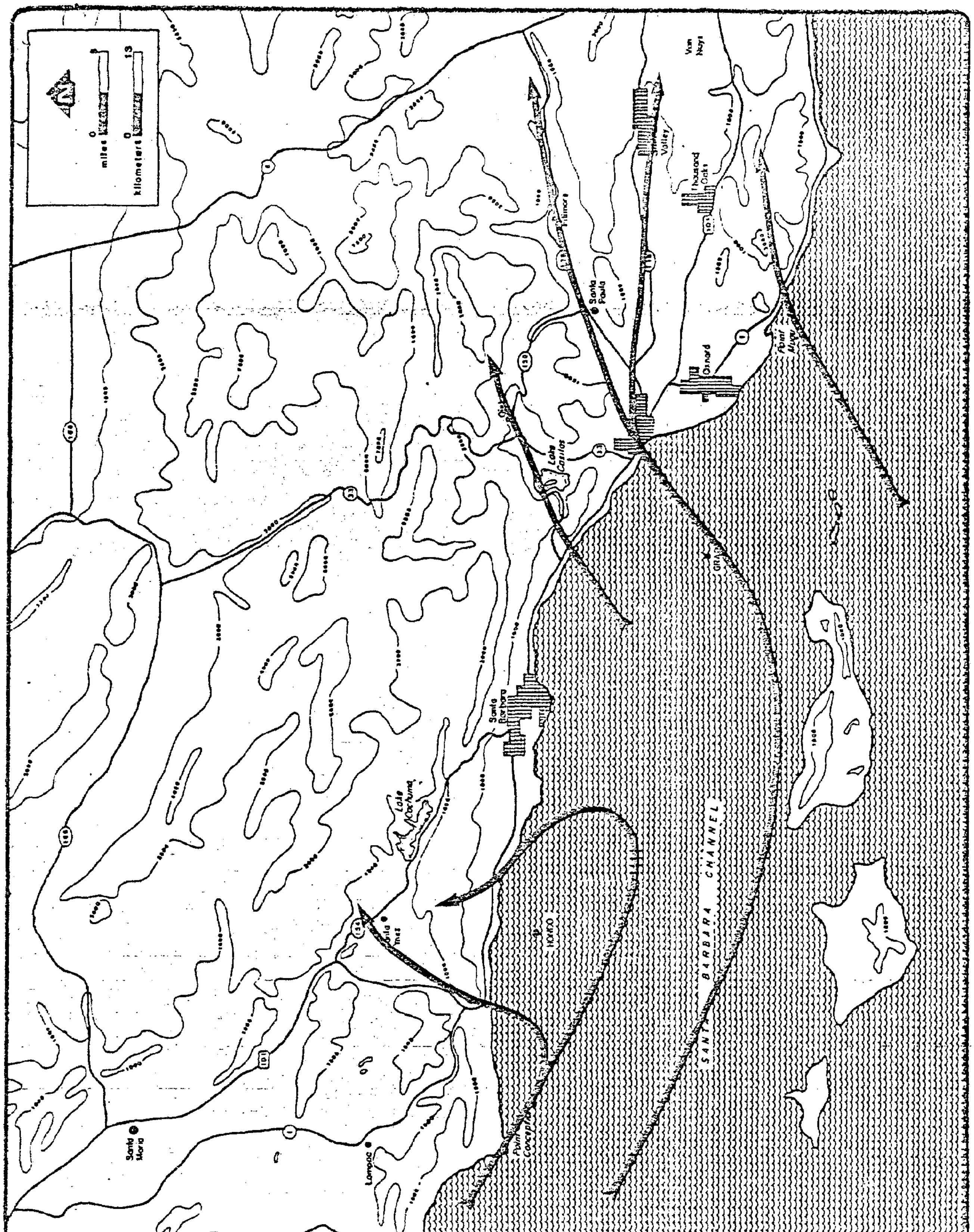


Figure 2-13. Surface Streamlines
28 September 1980 1500 PDT

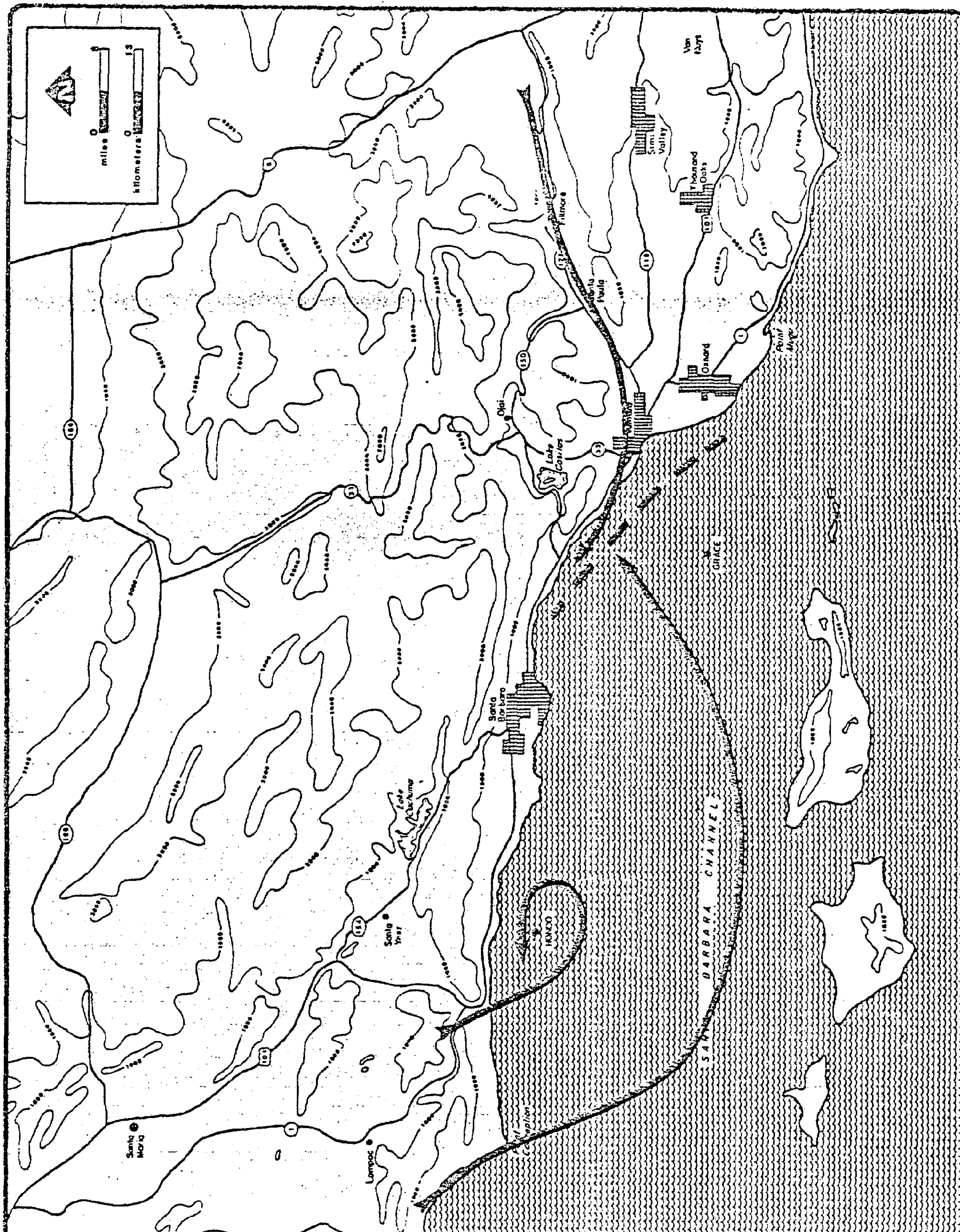


Figure 2-14. Surface Streamlines
28 September 1980 2100 PDT

Table 2-4

Surface Winds from Surfers Point (Ventura)

28 September 1980

Time (PDT)	Wind (m/s)	Time (PDT)	Wind (m/s)
1200	210/2.4	1700	235/3.3
1300	220/2.9	1800	210/1.7
1400	225/3.3	1900	210/0.7
1500	225/3.3	2000	320/0.8
1600	235/3.2	2100	110/0.6

Mixing Heights

Afternoon mixing heights over the channel were determined by the MRI sampling aircraft to be between 200-300 ft. Inland in the Santa Clara River Valley, mixing as determined by SF_6 vertical distributions extended to approximately 2000 ft.

2.4.2 Tracer Results

This test was conducted under the simplest daytime coastal meteorological regime. The release was not begun until after the onset of the afternoon sea breeze. Thus the SF_6 sampling during the release was measuring the direct downwind impact of a Santa Barbara Channel pollutant source during the typically strong and uniform afternoon flow. The complexities of flow reversal did not become important until after the end of the release.

Automobile traverses along the coast first detected the plume on shore in Venture between 1400-1500 PDT. Continuing traverses across the plume measured peak SF_6 concentrations of about 10000 PPT (29800 PPT/lb.-mole). The plume characteristic thusly acquired could be accurately modeled assuming a Pasquil-Giffard stability class E or F.

After crossing the coastline near the Ventura Marina, the bulk of the SF_6 plume was transported eastward along the Sante Clara River Valley. Low but detectable levels of SF_6 were measured in the late afternoon and early evening inland on the Ventura-Oxnard plain and east as far as Thousand Oaks and Santa Susana. The characteristics of the sea-land breeze wind reversal during this test was similar to the previous tests. Most of the tracer appeared to have a residence time within the study area in excess of one day. The nighttime wind reversal caused SF_6 to be transported back towards the coastline and beyond. Even though the release was made into a westerly wind from near Ventura, the nighttime land breeze transported pollutants as far west as Santa Barbara, about 30 miles west of the release point.

2.5 Test 5 1 October 1980 - Release from near Platform Grace (0600 - 1100 PDT)

2.5.1 Meteorology

General

The synoptic meteorology during the test was characterized by a thermal trough established at the surface over the interior of California and by high pressure or ridging aloft along the west coast (Figures 2-15a and 2-15b). Temperatures at 5000 ft over Simi and Santa Ynez Valleys were 28°C or among the highest measured during the study. Sky conditions were varied within the study area during the test. Point Mugu reported fog throughout most of the day with visibilities ranging from 0 to 5 mi. Oxnard reported visibilities as low as 1/10 mi in fog during the morning, but clear skies after 0900 PDT. At Platform Grace, fog was likewise present until 0900 PDT. Santa Barbara reported clear skies with no restrictions to visibility until late in the evening (0000 PDT on the 2nd).

Transport Winds

As shown by the streamlines on Figure 2-16, the test began under a well developed offshore flow regime. In the channel, out of the land breeze, the flow was directed northwest and west roughly paralleling the coastline. Thus, tracer released from Grace would be transported west in the channel. By 1000 PDT (Figure 2-17), the winds along the coast had shifted to onshore. The flow in the middle of the channel remained east to west, but at reduced velocities (1 m/s as opposed to 3-6 m/s earlier). In the afternoon, a westerly flow gradually developed. Figure 2-18 shows the streamlines for 1600 PDT with both the westerly flow in the channel and onshore flow along the coast well established. Additional details on the surface wind flow in the channel near Platform Grace are shown in Table 2-5. The easterly to southeasterly flow persisted

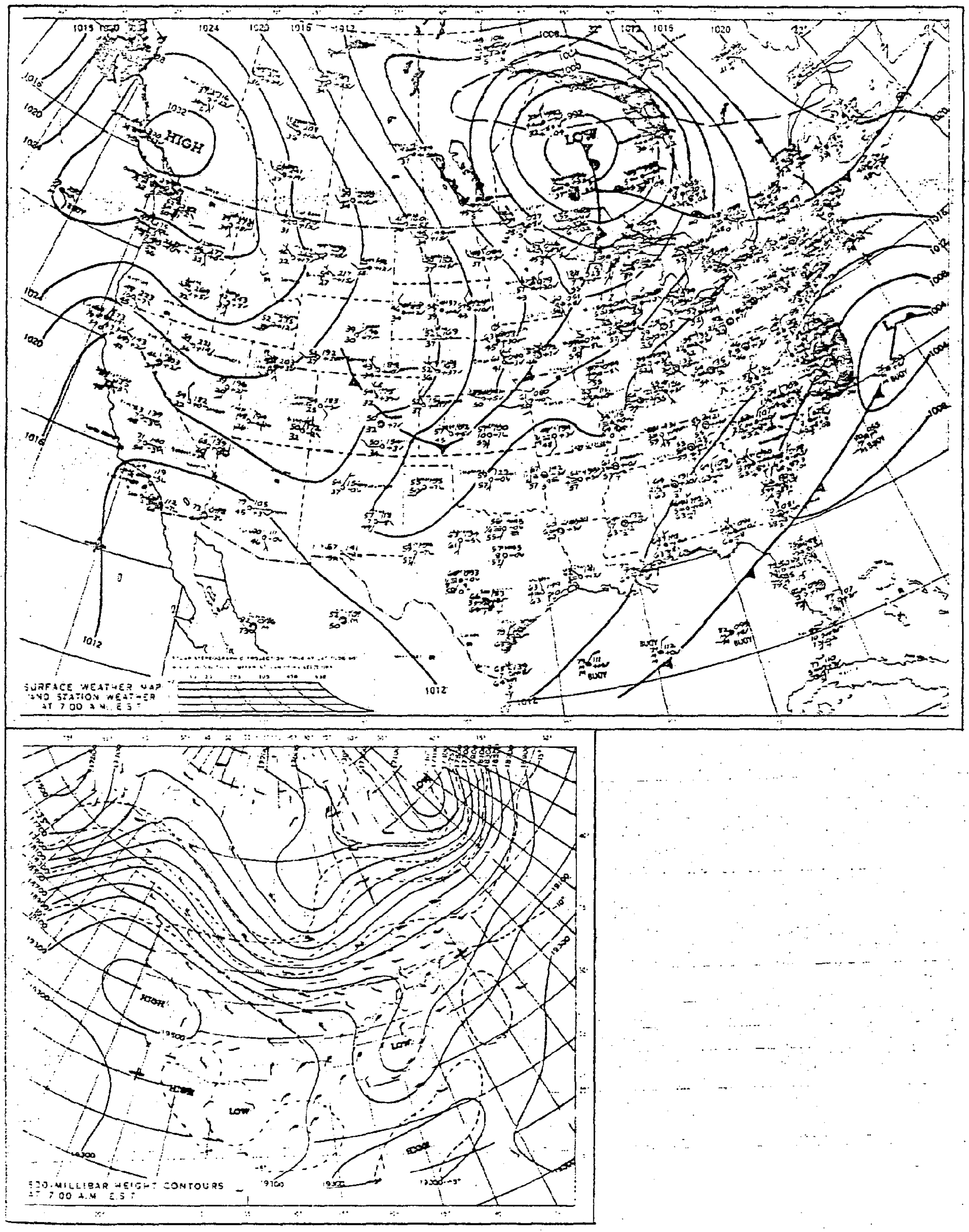


Figure 2-15. (a) Surface Weather Map (Upper Panel)
(b) 500 mb Height Contours (Lower Panel)
for 1 October 1980

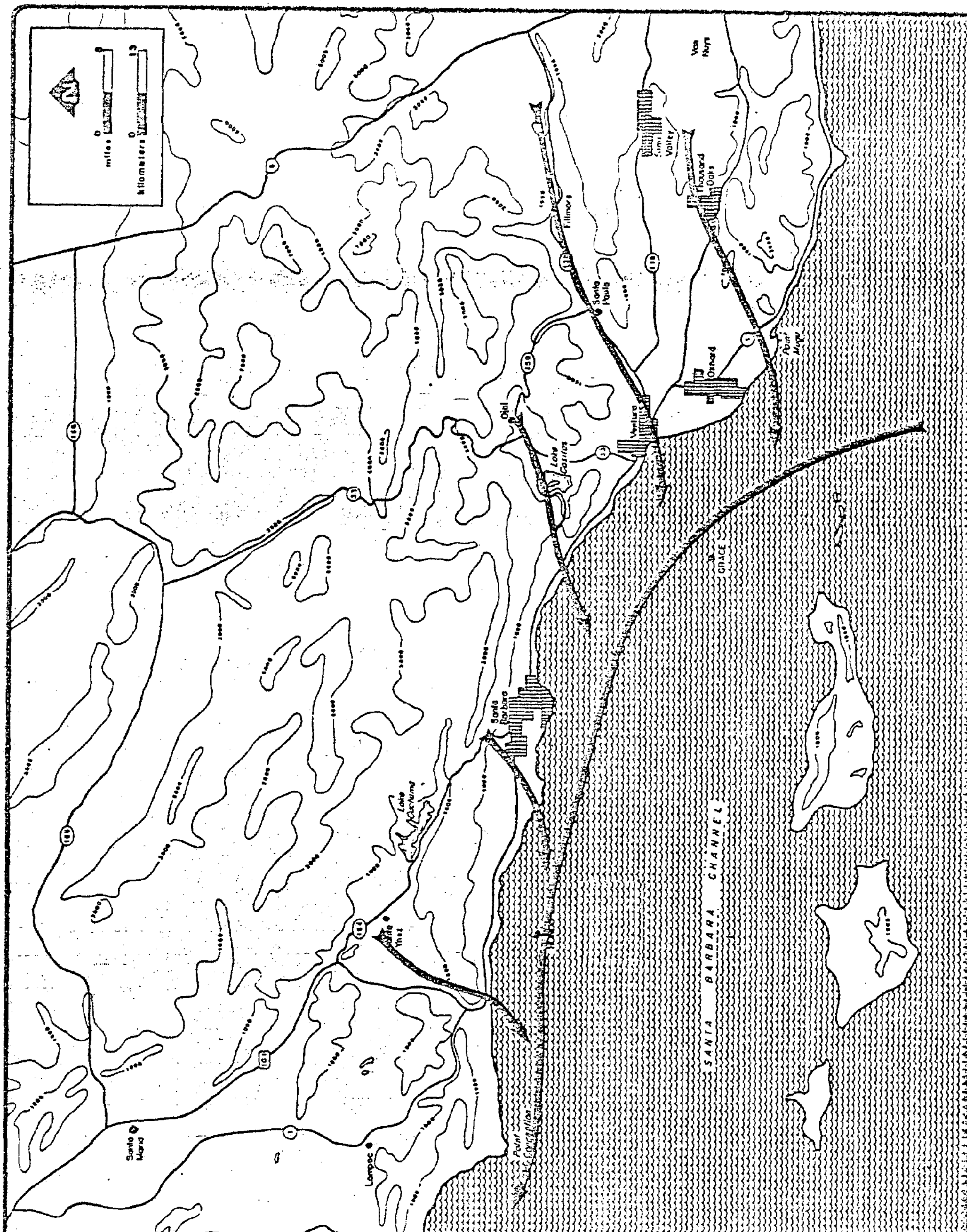


Figure 2-16. Surface Streamlines
1 October 1980 0600 PDT

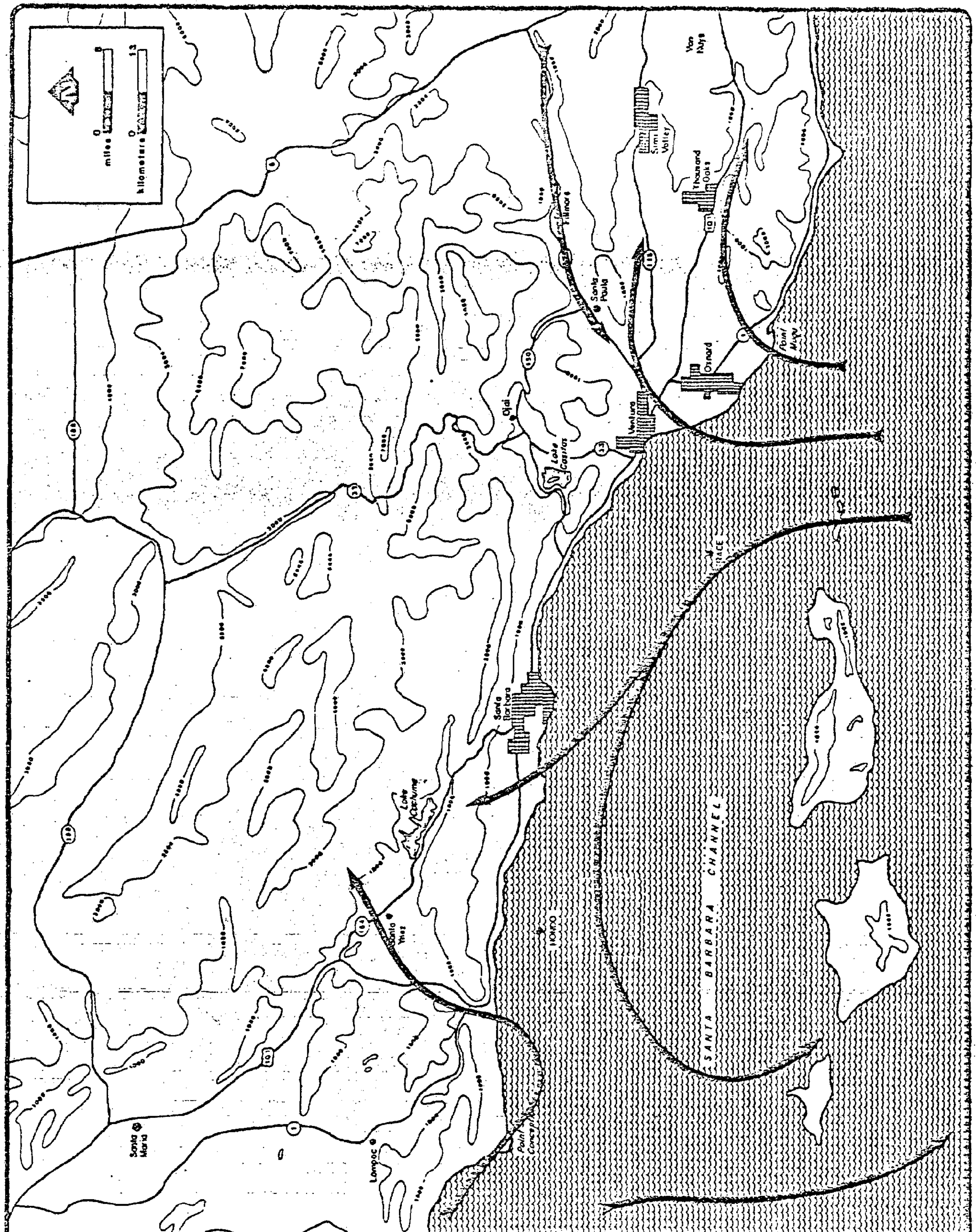


Figure 2-17. Surface Streamlines
1 October 1980 1000 PDT

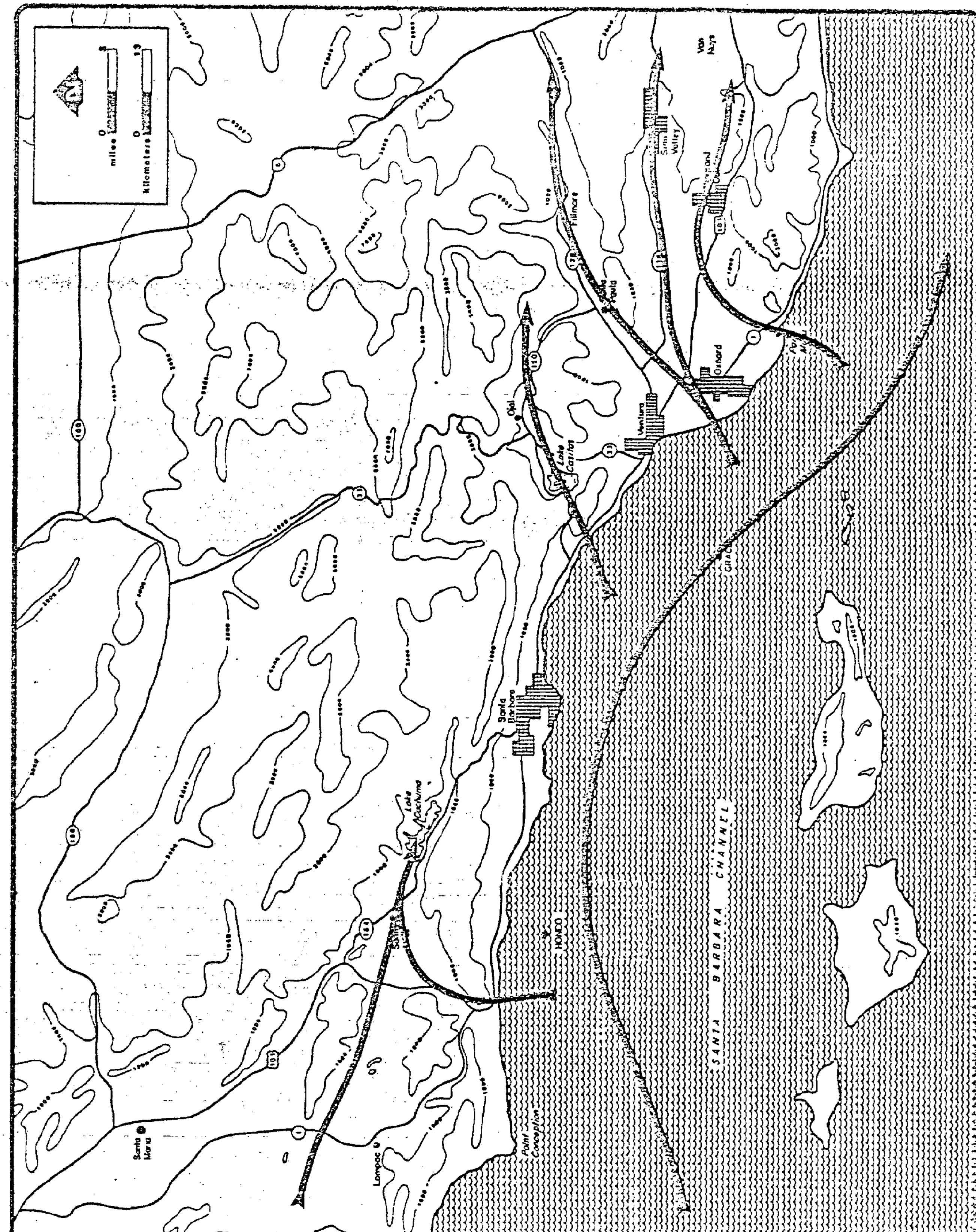


Figure 2-13. Surface Streamlines
1 October 1980 1600 PDT

at Grace until after 1400 PDT. An important feature to be noted from the table is that, with the exception of 1500 PDT, the winds in the east channel did not exhibit a component towards the Oxnard-Ventura coastline, which during the previous tests had reinforced the sea breeze. Over an approximate two hour period, the flow shifted from southeasterly to northwesterly, or, in either case, parallel to the coastline. These flows were reflected in the streamlines on Figures 2-16 to 2-18.

Table 2-5

Surface Winds at Platform Grace

1 October 1980

Time (PDT)	Wind (m/s)	Time (PDT)	Wind (m/s)
0600	115/2.8	1200	170/1.9
0700	120/2.7	1300	140/3.9
0800	140/2.1	1400	150/3.6
0900	105/0.9	1500	215/3.1
1000	110/0.6	1600	310/3.1
1100	150/0.6	1700	350/2.7

Mixing Heights

As might be expected from the substantial warming at 5000 ft, the atmosphere was extremely stable during the test, especially in the lower 2500 ft. From the MRI sampling aircraft data, vertical mixing over the channel near Ventura and at Grace appeared to be confined to below 300 ft. The Caltech sampling aircraft data shows mixing to 500 ft in the channel near Santa Barbara and through a 1000 ft layer in the Ojai Valley.

2.5.2 Tracer Results

The SF_6 release for this test was completed just before the onset of the afternoon sea breeze. Thus part of the SF_6 plume was widely dispersed before being transported towards shore and part of the SF_6 plume was transported almost directly onshore. Two distinct plumes were detected by automobile traverses along 101 near Santa Barbara. In one, the peak SF_6 concentration detected was about 13000 PPT (41000 PPT/lb-mole released/hr). In the other plume, which was spread over a larger area and present for a longer period of time, the maximum SF_6 concentration detected was about 3000-4000 PPT (9500-12700 PPT/lb-mole released/hr). As in previous tests, the SF_6 was detected further and further east along the coastline as the afternoon progressed. SF_6 was transported into the Ojai Valley over the Casitas Pass and into the Ventura-Oxnard Plain via the Ventura coastline. During the night, the reverse land breeze transported SF_6 back towards the coastline. This effect was most noticeable at Santa Barbara and Carpinteria.

2.6 Test 6 3 October 1980 - Release from 4 Mi SW Point Hueneme (0045 - 0545 PDT)

2.6.1 Meteorology

General

During this test, the west coast of California was located in a col region at the surface with high pressure centered in the eastern Pacific and Idaho and low pressure areas centered in the northern Gulf of California and off the coast of Washington (Figure 2-19a). Aloft at 500 mb (Figure 2-19b), a high pressure cellwas centered over Nevada and intense ridging was present from the western United States well into the Northwest Territory of Canada. The warming trend aloft noted during the previous test continued and temperatures at 5000 ft increased to 34°C over Santa Ynez Valley and 33°C over Simi Valley. Low ceilings and visibilities restricted to less than 1 mi in fog were the rule in the channel and along the adjacent coast. Low stratus and fog also shrouded the Oxnard Plain throughout the test.

Transport Winds

Figures 2-20 to 2-22 show several surface streamline maps which depict the flows during this test. The general flow during the release period is shown by the 0600 PDT streamlines on Figure 2-20. Similar to the previous test (1 October), the test began under a well developed offshore flow regime. In the channel, away from the land breeze influence, the flow was directed northwest and west roughly paralleling the coastline. The streamlines for 1200 PDT (Figure 2-21) show the wind field after the winds along the coast had shifted to onshore. Transport in the channel was generally to the northwest during the early afternoon. By 1600 PDT, the flow in the channel had shifted to the southwest (Figure 2-22) and gradually developed into a pattern similar to the afternoon of the previous test (Figure 2-18) with streamlines in the channel paralleling the coast and transport to the east.

FRIDAY, OCTOBER 3, 1980

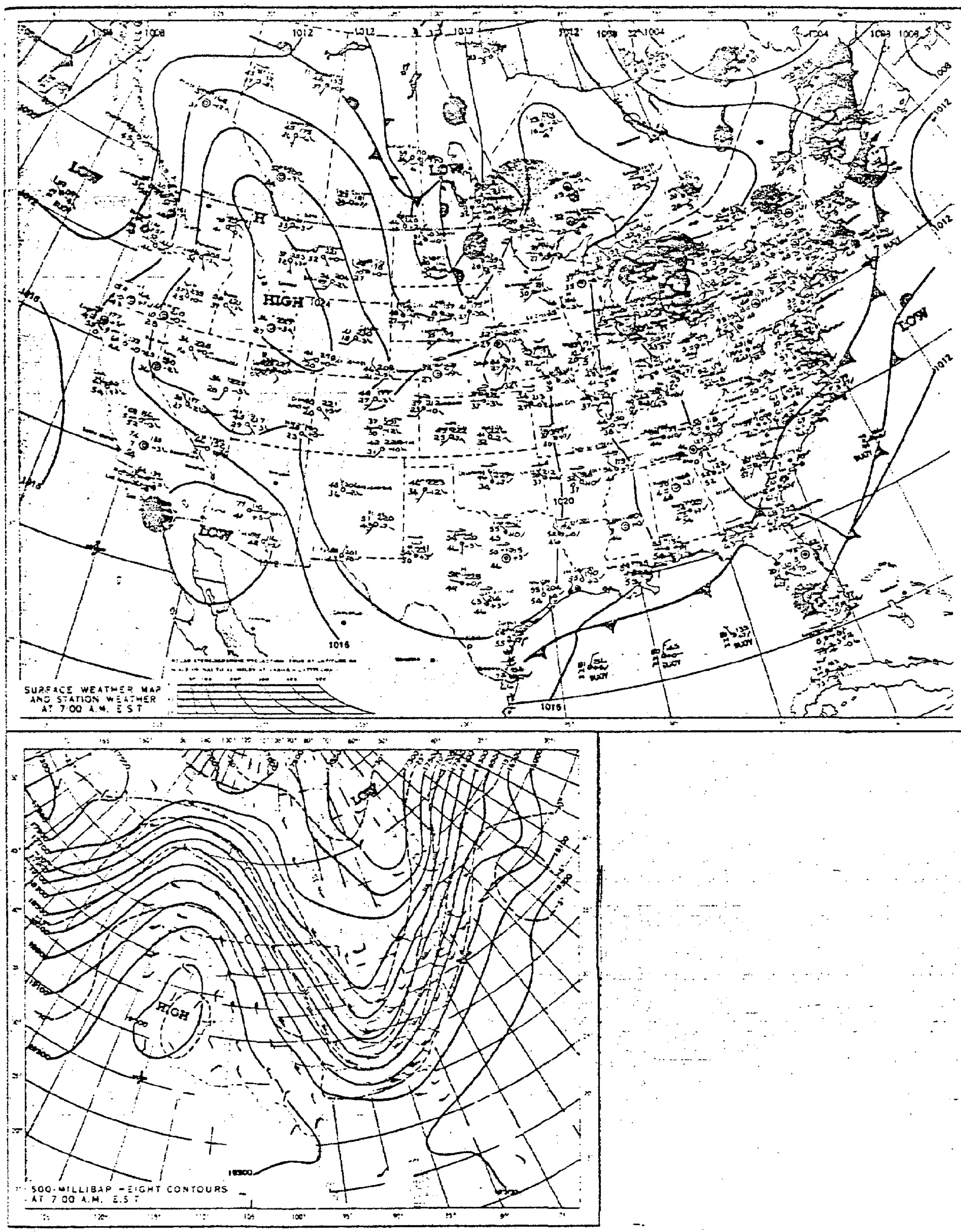


Figure 2-19. (a) Surface Weather Map (Upper Panel)
(b) 500 mb Height Contours (Lower Panel)
for 3 October 1980

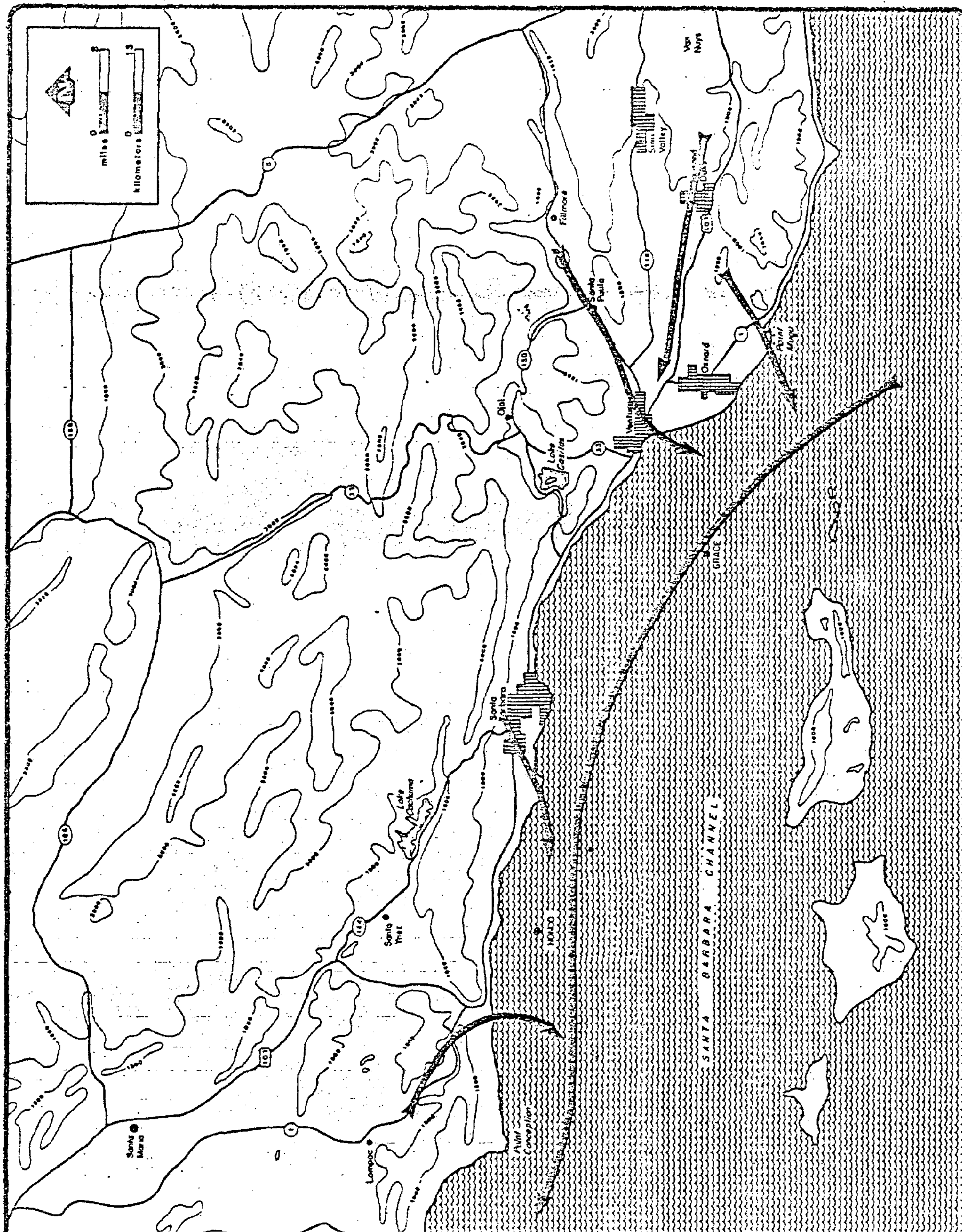


Figure 2-20. Surface Streamlines
3 October 1980 0600 PDT

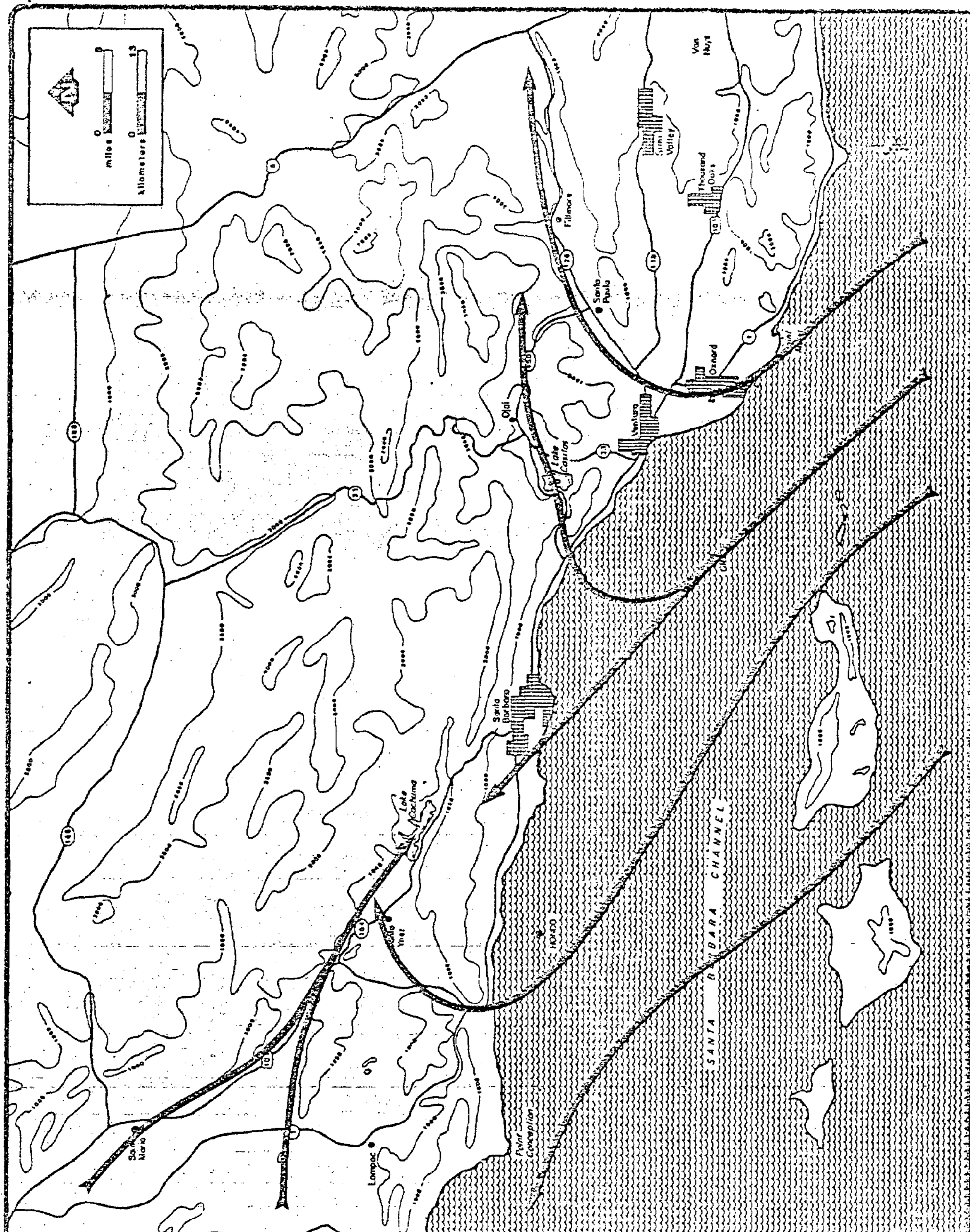


Figure 2-21. Surface Streamlines
3 October 1980 1200 PDT

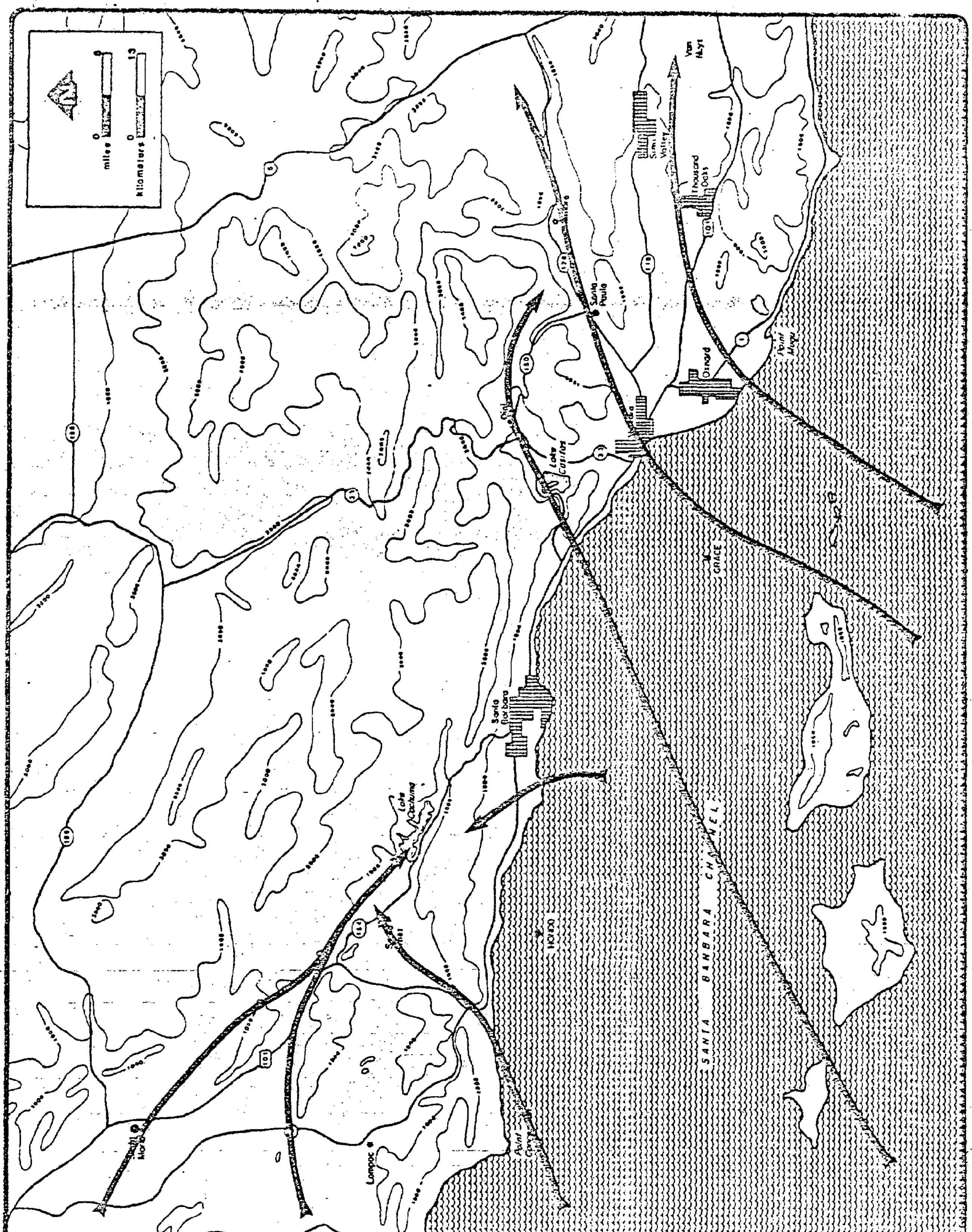


Figure 2-22. Surface Streamlines
3 October 1980 1600 PDT

Mixing Heights

Due to the low ceilings throughout the channel and on the Oxnard Plain, airplane vertical sampling was not possible during the test. Mixing was, however, observed to 1000 ft above the ground in the Santa Ynez Valley where flying conditions allowed for sampling.

2.6.2 Tracer Results

This test was designed to investigate the possibility of transport from the eastern end of the Santa Barbara Channel towards its western end. This test took advantage of the typical easterly winds at night in the Santa Barbara Channel for this purpose. Due to a combination of the early release time and the late development of a westerly flow in the channel, the SF_6 was transported further west than on any of the prior tests. The bulk of tracer material was detected near Gaviota Pass and in the Santa Ynez Valley. Unlike the previous tests in which releases were made under nighttime flow regimes, the SF_6 was not returned to the east channel coast. No significant concentrations of tracer material were detected east of Santa Barbara during the test. In addition, only during this test was SF_6 transported through Gaviota Pass. This test combined with the others provided evidence that SF_6 could be transported from almost any point within the Santa Barbara Channel to any other point within the channel depending upon the timing of the release and the particular wind conditions established at that time.

2.7 Conclusions and Recommendations

The principal conclusion which can be drawn from these studies is that under the various flow regimes encountered during the study, a parcel of air along with its associated pollution burden can be transported from virtually any location within the channel to any other location in the channel. In spite of the complexities of the flows experienced, some generalizations can be made:

- Diurnal land/sea breeze conditions dominate the flow along the channel coastline.
- At some time during the afternoon, generally westerly winds developed in the channel.
- The afternoon westerly winds reinforce the sea breeze along the east channel coast and thus the timing of their development determines the extent of transport inland.

A simple Gaussion model can be used to describe diffusion from an off-shore source while under the influence of a sea breeze, which typically approximates a simple steady state flow, so long as experimentally determined dispersion coefficients are used. The modeler is confronted with a considerably more difficult task to describe the dynamic and changing nature of the flows encountered in the channel at night and in the morning, and the flow eddy structure which develops offshore. However under conditions which produce low inversions over the channel and most likely represent worst case pollution potential from local sources, these flows result in efficient lateral mixing in the channel suggesting that simple box models may amply describe the dispersion characteristics of aged pollutants.

Clearly a detailed understanding of the channel flows was seriously limited by a lack of wind data in the channel itself. Much of our knowledge gleaned from this study was inferred from the tracer experiments.

When operative, three wind sites were available in the channel which simply was not adequate. It is therefore recommended that any further study place a high priority on obtaining additional winds, expecially in the west channel where the least data is available. It is further recommended that, since possible sites are few and the existing sites even fewer, backup instruments be provided to minimize data losses.

3. Aircraft Air Quality Sampling Summary

The MRI Cessna 206 airplane was utilized in the field study to sample the air quality and provide meteorological data on a regional basis. A summary of the sampling missions is given in Table 3-1. The objective of the airborne sampling was to provide a data base for use in regional modeling studies. Special attention was given to documenting the areal distribution of ozone. This section offers users of the aircraft data base statistical tables which summarize the gaseous pollutants (O_3, NO, NO_x, SO_2) measured during the study. The tables are intended to assist in the selection of periods to be used for modeling purposes.

3.1 Sampling Methodology

The sample routes included some assumed major transport source receptor pathways such as the Gaviota and Casitas Passes, the Santa Clara River Valley, and the Oxnard Plain to the San Fernando Valley. Spirals were flown both along the coast and in the interior valleys. Emphasis was placed equally on sampling in the northern and southern regions of the study area during the first three flights, but shifted to the southern portion during the later sampling as the tracer release locations moved south.

The specific flight plan for any given sampling mission depended upon the particular goals of that test, but nevertheless consisted of a combination of spiral ascents (or descents) which map the atmosphere above a location as a function of altitude and of horizontal traverses. The traverse altitudes were selected by the observer in the airplane after review of the spiral normally flown at or near the traverse start point. The altitude selection would be based on the depth of the surface mixing layer or the occurrence of regions of high ozone concentrations aloft. Sampling was thusly designed to define the horizontal variability within the mixing layer or to define the extent of elevated pollutants.

TABLE 3-1

MRI 206 Aircraft Flight Summary

Date	Time (PDT)	Purpose of Flight
9/17/80	1300-1859	Regional sampling from Pt. Conception to Simi Valley during maximum ozone period.
9/22/80	1249-1817	Regional sampling from Pt. Conception to Simi Valley during maximum ozone period.
9/26/80	0630-0953	Regional sampling from Simi Valley to Santa Ynez Valley during initial stable conditions.
9/28/80	1255-1700	Regional sampling concentrating in southern region of study area during maximum ozone period.
10/01/80	1255-1930	Regional sampling concentrating in southern region of study area during maximum ozone period.
10/03/80	1320-2145	Regional sampling from the Santa Ynez Valley south to the Oxnard Plain and Van Nuys during maximum ozone period.

3.2 Explanation of Tables

In Tables 3-2 to 3-5 which follow, average and maximum concentrations of ozone (O_3), oxides of nitrogen (NO, NO_x), and sulfur dioxide (SO_2) measured during the aircraft sampling are listed. The data in the tables are identified by date and observational units referred to as "passes", which are either a traverse or a spiral. In this manner, each traverse or spiral can be uniquely identified by a date and pass number. Maps showing the sampling locations and tables giving the particulars (altitude, end points, etc.) of each pass are included in the appendix of this report. More specific information of traverse,end point, and spiral locations can be found in the Santa Barbara Channel Oxidant Study Data Volume dated 16 December 1980. It should be noted that each flight includes one or two "zero" spirals which are used to define the instrument zero-altitude relationships, a relationship used during data processing. Since during those types of passes the gas sampling monitors are in zero mode, the data have not been included in the following tables.

3.2 Explanation of Tables

In Tables 3-2 to 3-5 which follow, average and maximum concentrations of ozone (O_3), oxides of nitrogen (NO, NO_x), and sulfur dioxide (SO_2) measured during the aircraft sampling are listed. The data in the tables are identified by date and observational units referred to as "passes", which are either a traverse or a spiral. In this manner, each traverse or spiral can be uniquely identified by a date and pass number. Maps showing the sampling locations and tables giving the particulars (altitude, end points, etc.) of each pass are included in the appendix of this report. More specific information of traverse,end point, and spiral locations can be found in the Santa Barbara Channel Oxidant Study Data Volume dated 16 December 1980. It should be noted that each flight includes one or two "zero" spirals which are used to define the instrument zero-altitude relationships, a relationship used during data processing. Since during those types of passes the gas sampling monitors are in zero mode, the data have not been included in the following tables.

Table 3-2

Santa Barbara Channel Oxidant Study

MRI Sampling Aircraft Data Summary

Ozone (pphm)

Date		Pass Number																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
9/18/80	Mean	7	3	4	9	6	7	5	*	7	7	3	3	4	4	6	8	5	*				
	Max.	10	7	7	11	8	7	7	*	15	8	6	7	9	5	8	10	9	*				
9/22/80	Mean	8	8	8	8	8	8	*	11	10	11	10	11	11	11	9	9	*					
	Max.	9	10	10	8	8	9	*	13	13	14	13	20	20	14	10	11	*					
9/26/80	Mean	*	M	10	8	6	6	9	6	7	8	8											
	Max.	*	M	11	9	9	9	10	8	8	8	9											
9/28/80	Mean	*	7	10	8	7	*	13	11	8	13	13	13	15	11	9							
	Max.	*	12	12	12	18	*	17	17	15	17	18	24	23	21	12							
10/1/80	Mean	*	8	11	8	8	14	8	*	13	14	10	10	11	9	15	12	9	10	8	12	7	*
	Max.	*	18	16	9	9	15	15	*	17	22	14	14	15	19	18	18	14	13	12	17	14	*
10/3/80	Mean	*	7	11	9	12	8	13	21	9	13	23	26	17	10	*							
	Max.	*	12	12	11	21	17	22	26	22	25	37	33	22	20	*							

M Missing data

* Instrument zeroing pass

Table 3-3

Santa Barbara Channel Oxidant Study

MRI Sampling Aircraft Data Summary

NO_x (pphm)

Date		Pass Number																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
9/18/80	Mean	1	0	0	1	1	1	1	*	1	1	0	1	1	1	1	1	1	*				
	Max.	2	1	1	1	1	1	2	*	2	2	1	3	13	3	3	5	3	*				
9/22/80	Mean	1	1	1	1	1	1	*	2	1	1	2	1	2	2	1	1	*					
	Max.	2	1	1	2	1	1	*	2	2	2	3	2	3	3	2	2	*					
9/26/80	Mean	*	M	M	M	M	M	M	M	M	M	M											
	Max.	*	M	M	M	M	M	M	M	M	M	M											
9/28/80	Mean	*	1	1	1	1	*	2	2	1	2	3	2	3	1	1							
	Max.	*	4	3	2	3	*	5	5	3	2	4	4	6	4	3							
10/1/80	Mean	*	1	2	1	1	1	1	0	1	3	1	1	2	1	2	2	1	1	1	3	1	*
	Max.	*	2	4	2	1	2	2	2	3	5	3	6	3	3	4	2	4	3	2	8	7	*
10/3/80	Mean	*	1	1	1	2	1	2	3	2	2	3	4	3	2	*							
	Max.	*	2	2	2	4	4	3	5	5	5	6	6	7	7	*							

M Missing data

* Instrument zeroing pass

Table 3-4

Santa Barbara Channel Oxidant Study

MRI Sampling Aircraft Data Summary

NO (pphm)

Date		Pass Number																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
9/18/80	Mean	0	0	0	0	0	0	0	*	0	0	0	M	0	0	0	0	0	*				
	Max.	1	1	1	1	1	1	1	*	1	1	1	M	6	1	1	1	1	*				
9/22/80	Mean	0	0	0	0	0	0	0	*	0	0	0	0	0	0	0	0	*					
	Max.	1	1	1	1	1	1	1	*	1	1	1	1	1	1	1	1	*					
9/26/80	Mean	M	M	M	M	M	M	M	M	M	M	M											
	Max.	M	M	M	M	M	M	M	M	M	M	M											
9/28/80	Mean	*	0	0	0	0	*	0	0	0	0	0	0	0	0	0							
	Max.	*	1	1	1	1	*	1	1	1	1	1	1	1	1	1							
10/1/80	Mean	*	0	0	0	0	M	0	0	M	0	0	0	0	0	0	0	0	M	0	M	0	*
	Max.	*	1	1	1	1	M	1	1	M	1	1	1	1	1	1	1	1	M	1	M	1	*
10/3/80	Mean	*	0	0	0	0	0	0	0	M	0	M	M	M	M	*							
	Max.	*	1	1	1	1	1	1	1	M	1	M	M	M	M	*							

M Missing data

* Instrument zeroing pass

Table 3-5

Santa Barbara Channel Oxidant Study

MRI Sampling Aircraft Data Summary

SO_2 (pphm)

Date		Pass Number																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
9/18/80	Mean	0	0	0	0	1	1	0	*	0	0	0	0	1	1	1	1	1	*				
	Max.	1	1	1	1	1	1	1	*	1	1	1	1	4	1	2	1	2	*				
9/22/80	Mean	1	0	0	1	1	0	*	1	1	1	1	1	0	1	1	0	*					
	Max.	1	1	1	1	1	1	*	1	1	2	3	2	1	2	1	1	*					
9/26/80	Mean	*	0	0	0	0	0	1	1	1	1	1											
	Max.	*	1	1	1	1	1	1	1	1	1	2											
9/28/80	Mean	*	0	0	1	0	*	1	1	1	1	2	1	1	1	1							
	Max.	*	1	1	1	1	*	2	2	2	2	2	2	2	2	2							
10/1/80	Mean	*	0	1	0	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	0	*
	Max.	*	2	3	1	1	2	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	*
10/3/80	Mean	*	0	1	0	1	1	1	2	0	1	2	2	1	0	*							
	Max.	*	1	1	1	2	2	2	4	2	2	4	3	2	2	*							

M Missing data

* Instrument zeroing pass

ACKNOWLEDGEMENTS

A cooperative effort such as this study requires the cooperation and assistance of many more persons than can be cited herein practically. Notwichstanding, the suthors wich to publicly thank Douglas Tubbs of the Ventura Air Pollution Control District, and John English and Donald Jones of the Santa Barbara Air Pollution Control District for their support and cooperation throughout the study. We also appreciate the support and recommendations given to us by Jack Suder and Charles Bennett of the California Air Resources Board. Data were made available to this program by Valerie Brown of Chevron, and Mike Aston and William Richter of Exxon. We further wish to thank Jeaniene Wright of the Bixby Ranch Company, Brad Lundberg and Andy Mills of the Cojo Ranch, and the personnel of the U.S. Coast Guard at Channel Islands who made it possible to monitor at Point Conception. We gratefully acknowledge the cooperation of the personnel from the Bureau of Land Management, Aerovironment, ERCO and ER&T for their cooperation in the field effort.

Finally, we would like to acknowledge Kevin Clover and William Beale, the pilots for the sampling aircraft, and Greg Rose, Shelia Kallison, Charles Warren and the Science Class at Thatcher School and the personnel at the North American Weather Consultants for their excellent pibal observations on such a grueling schedule.

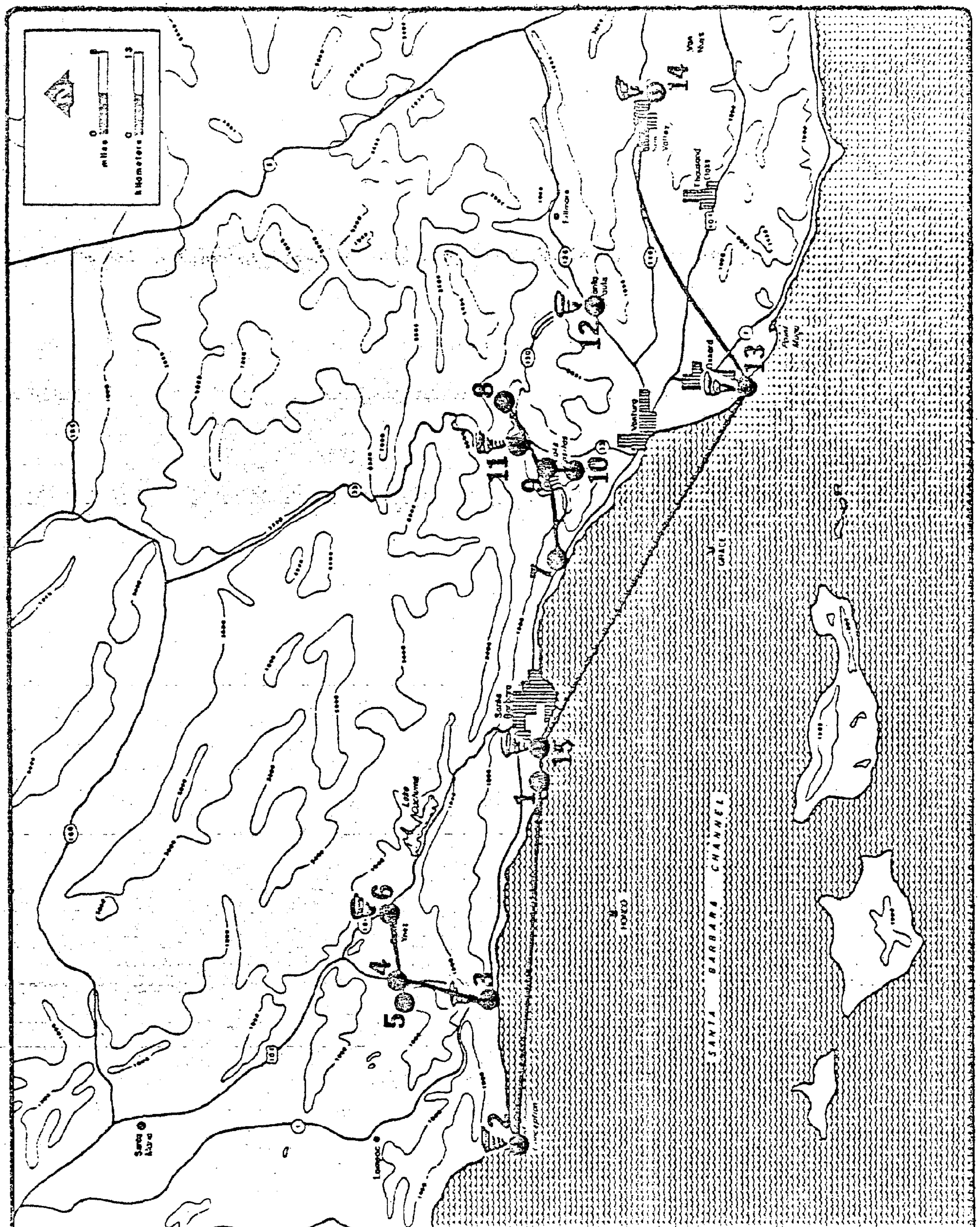
APPENDIX

Date: 9-17-80 General Comments: Test 1.

Flight Objective: Regional Sampling from Pt. Conception to Simi Valley During Maximum Oxidant Period

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
181/ 1	1333	1352	152	152	T	1- 2	50	A1-A20	
2	1353	1409	5	1524	S	2	-	B1-B11	
3	1416	1424	1524	46	S	3	-	C1-C11	
4	1425	1426	61	30	T	~3	4	D1-D 6	At entrance to Gaviota Pass
5	1430	1435	305	305	T	3- 4	20		
6	1437	1440	229	229	T	5- 6	13	E1-E 4	
7	1442	1458	183	1829	S	6	-	F1-F12	
8	1503	1517	1829	15	S	6- 7	-		Instrument Zeroing
9	1523	1532	305	457	T	7- 8	31	G1-G11	
10	1537	1539	305	198	T	9-10	4		
11	1543	1554	198	1524	S	11	-	H1-H10	
12	1601	1610	1524	91	S	12	-	J1-J 10	
13	1715	1732	152	1524	S	13	-	K1-K11	
14	1745	1753	1524	290	S	14	-	M1-M9	
15	1756	1812	549	396	T	14-13	50	N1-N18	
16	1815	1834	152	152	T	13-15	56	P1-P19	
17	1834	1849	15	1524	S	15	-	Q1-Q11	
18	1849	1900	1524	3	S	~15	-		Instrument Zeroing

*T - traverse, S- spiral



MRI 206 Sampling Flight
Santa Barbara Channel Oxidant Study

Tape 181 17 September 1980

Santa Barbara Channel Oxidant Study

Tape 181

17 September 1980

TRAVERSE END POINT AND SPIRAL LOCATIONS

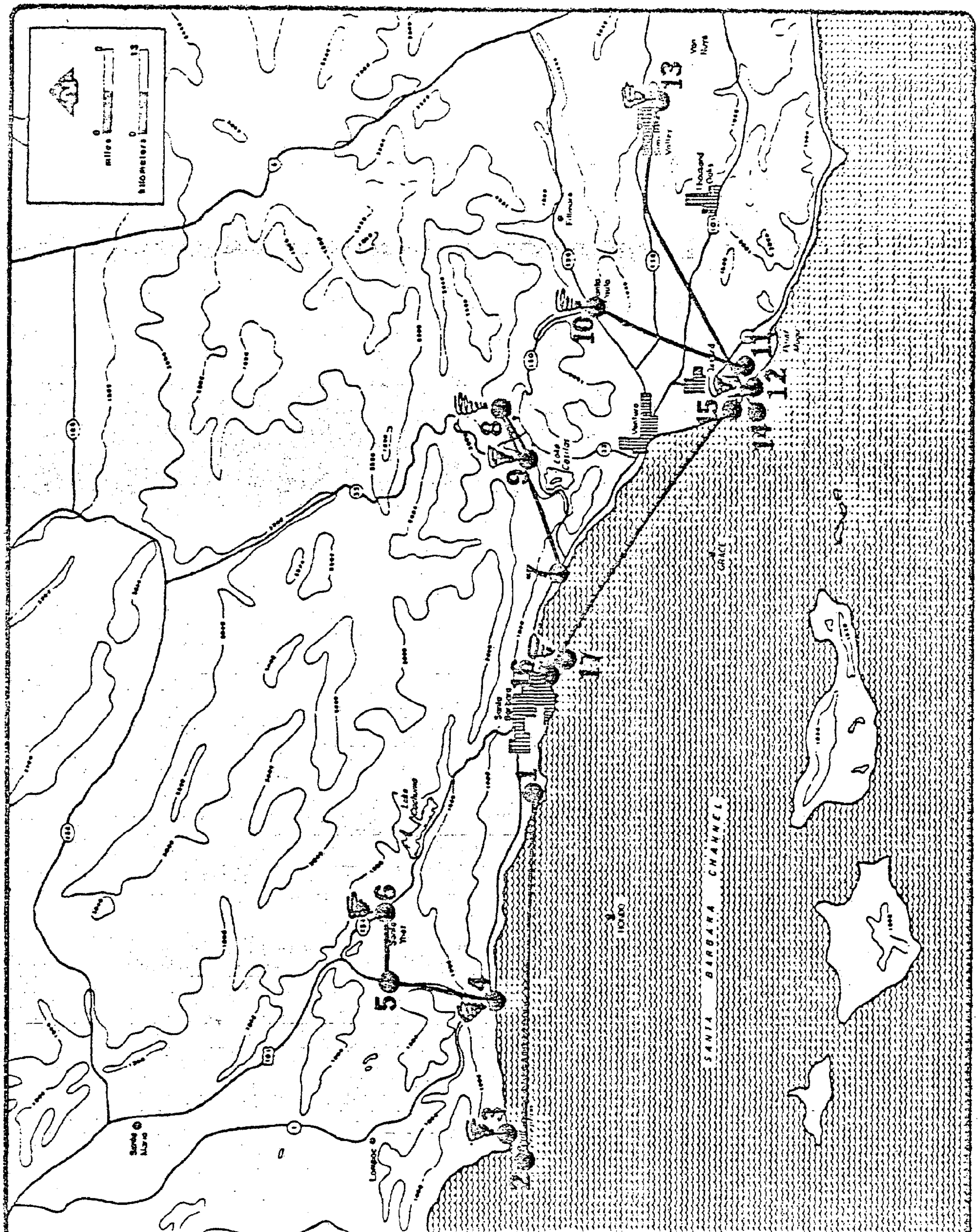
POINT	LATITUDE	LONGITUDE	DESCRIPTION
1	34° 25.7'	119° 50.2'	Santa Barbara Airport
2	34° 26.7'	120° 27.3'	Off Pt. Conception
3	34° 29.0'	120° 13.4'	West End of Gaviota Pass
4	34° 37.3'	120° 11.8'	Buellton
5	34° 37.0'	120° 13.0'	Wash, SW of Buellton
6	34° 36.5'	120° 04.6'	Santa Ynez Airport
7	34° 24.1'	119° 31.4'	West Side of Carpinteria
8	34° 27.6'	119° 14.0'	NE of Ojai
9	34° 25.1'	119° 20.2'	NE of Lake Casitas
10	34° 22.5'	119° 19.7'	Casitas Lake Dam
11	34° 27.0'	119° 16.5'	NW of Ojai
12	34° 20.8'	119° 03.9'	Santa Paula Airport
13	34° 10.4'	119° 12.4'	Oxnard Airport
14	34° 16.3'	118° 42.3'	Santa Susana Airport
15	34° 25.1'	119° 44.8'	Offshore Santa Barbara

Date: 9-22-80 General Comments; Test 2. Stratus and Low Clouds Over Coastal Sections.

Flight Objective: Regional Sampling from Pt. Conception to Simi Valley During Maximum Oxidant Period.

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
182/ 1	1256	1314	122	122	T	1- 2	50	B301-B320	
2	1318	1338	6	2439	S	3	-	B321-B337	
3	1344	1359	2439	3	S	4	-	B338-B355	
4	1401	1406	213	305	T	4- 5	20	B356-B361	
5	1407	1410	213	213	T	5- 6	13	B362-B366	
6	1411	1423	207	1829	S	6	-	B367-B378	
7	1427	1438	1829	3	S	6- 7	-		Instrument Zeroing
8	1442	1451	305	457	T	7- 8	31	B379-B388	
9	1455	1503	207	1524	S	9	-	B389-B398	
10	1512	1522	1524	76	S	10	-	B399-B408	
11	1525	1531	381	381	T	10-11	19	B409-B415	
12	1620	1636	3	2134	S	12	-	B416-B430	
13	1652	1703	2134	305	S	13	-	B431-B443	
14	1705	1722	518	518	T	13-14	53	B444-B461	
15	1724	1739	122	122	T	15-16	29	B462-B476	
16	1741	1755	3	2134	S	17	-	B477-B491	
17	1756	1816	2134	3	S	~17	-		Instrument Zeroing

*T - traverse, S- spiral



MRI 206 SAMPLING FLIGHT

Santa Barbara Channel Oxidant Study

Tape #182 22 September 1980

Santa Barbara Channel Oxidant Study
Tape 182

22 September 1980

TRAVERSE END POINT AND SPIRAL LOCATIONS

POINT	LATITUDE	LONGITUDE	DESCRIPTION
1	34° 24.7'	119° 50.8'	University of California Santa Barbara
2	34° 26.0'	120° 27.5'	Four miles SE of Pt. Conception
3	34° 26.7'	120° 27.3'	Off Pt. Conception
4	34° 29.0'	120° 13.4'	Near End of Gaviota Pass
5	34° 37.3'	120° 11.8'	Buellton
6	34° 36.5'	120° 04.6'	Santa Ynez Airport
7	34° 24.1'	119° 31.4'	West End of Carpinteria
8	34° 27.6'	119° 14.0'	NE of Ojai
9	34° 25.1'	119° 20.2'	NE of Lake Casitas
10	34° 20.8'	119° 63.9'	Santa Paula Airport
11	34° 17.4'	119° 07.0'	East of Oxnard Airport
12	34° 10.4'	119° 12.4'	Oxnard Airport
13	34° 16.3'	118° 42.3'	Santa Susana Airport
14	34° 14.0'	119° 15.4'	South of Oxnard Marina
15	34° 15.4'	119° 15.0'	Oxnard Marina
16	34° 24.5'	119° 41.2'	Santa Barbara Marina
17	34° 24.0'	119° 41.0'	South of Santa Barbara Marina

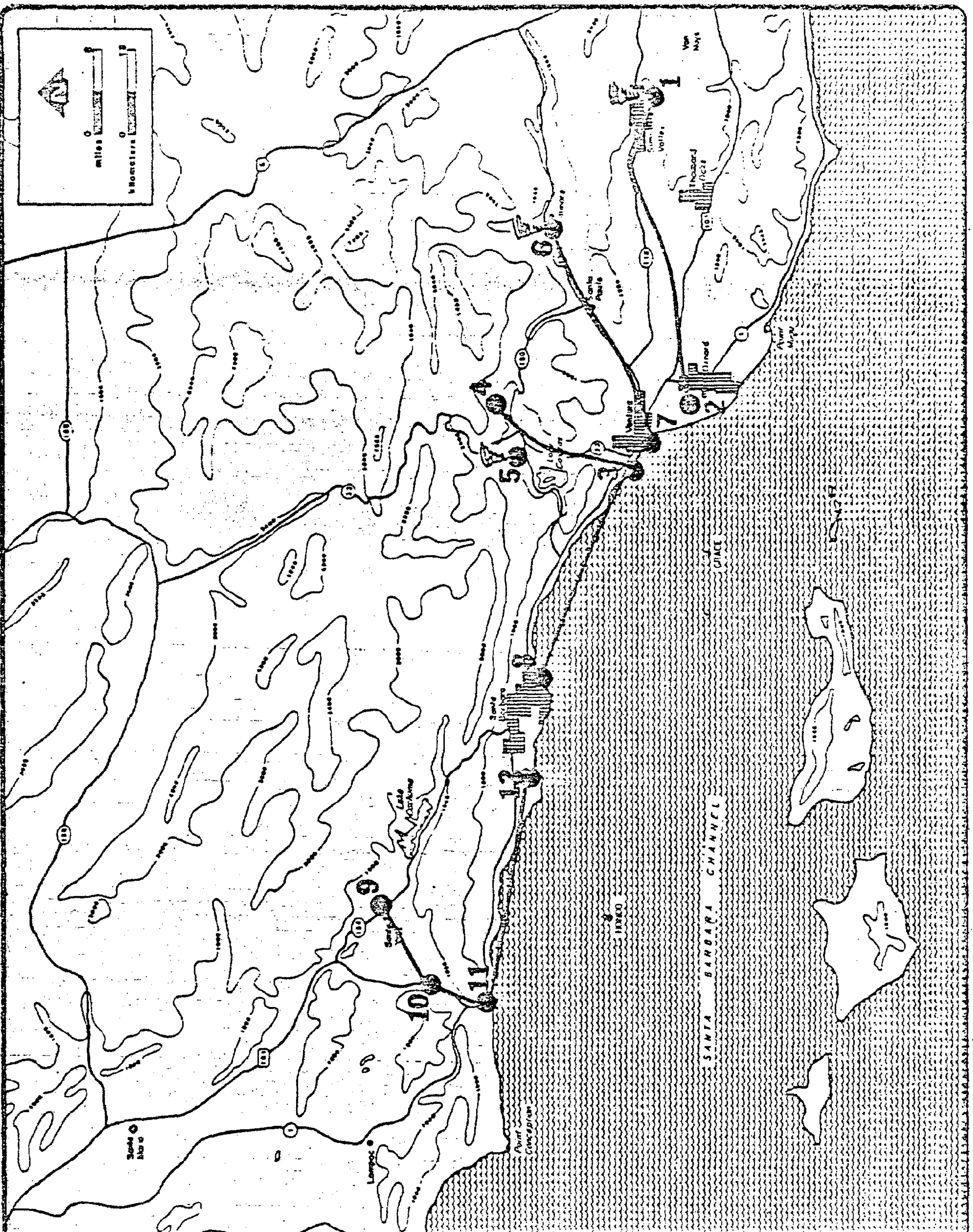
Date: 9-26-80

General Comments: Test 3. NO/NO_x Instrument Inoperative Stratus and Low Clouds Over Coastal Sections

Flight Objective: Regional Sampling from Santa Ynez Valley to Simi Valley During Initial Stable Conditions

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
183/ 1	651	709	3	1829	S		-	C 1-C 11	Instrument Zeroing
2	727	738	1829	305	S	1	-	C12-C 21	O_3 Inoperative
3	744	759	609	609	T	1- 2	35	C22-C 36	
4	802	811	609	609	T	3- 4	56	C37-C 45	
5	812	822	280	1524	S	5	-	C46-C 54	
6	830	838	1524	213	S	6	-	C55-C 64	
7	843	852	701	701	T	6- 7	29	C65-C 74	
8	855	909	701	701	T	7- 8	45	C75-C 89	
9	921	925	640	640	T	9-10	14	C90-C 96	
10	927	930	640	640	T	10-11	10	C97-C100	
11	932	938	609	609	T	11-12	29	C101-C106	

*T - traverse, S- spiral



MRI 206 SAMPLING FLIGHT

Santa Barbara Channel Oxidant Study

Tape #183 26 September 1980

Santa Barbara Channel Oxidant Study
Tape 183

26 September 1980

TRAVERSE END POINT AND SPIRAL LOCATIONS

POINTS	LATITUDE	LONGITUDE	DESCRIPTION
1	34°16.3'	118°42.3'	Santa Susana Airport
2	34°15.0'	119°17.0'	32.5 nm 107° Radial SBA VOR
3	34°17.5'	119°22.2'	27.0 nm 107° Radial SBA VOR
4	34°27.6'	119°14.0'	NE of Ojai
5	34°25.1'	119°20.2'	NE of Lake Casitas
6	34°24.5'	118°55.0'	West of Fillmore
7	34°16.9'	119°18.7'	30.4 nm 105° Radial SBA VOR
8	34°22.3'	119°44.9'	1.5 nm Offshore Santa Barbara
9	34°36.5'	120°04.6'	Santa Ynez Airport
10	34°32.6'	120°12.0'	
11	34°29.0'	120°13.4'	West End of Gaviota Pass
12	34°25.7'	119°50.7'	Santa Barbara Airport

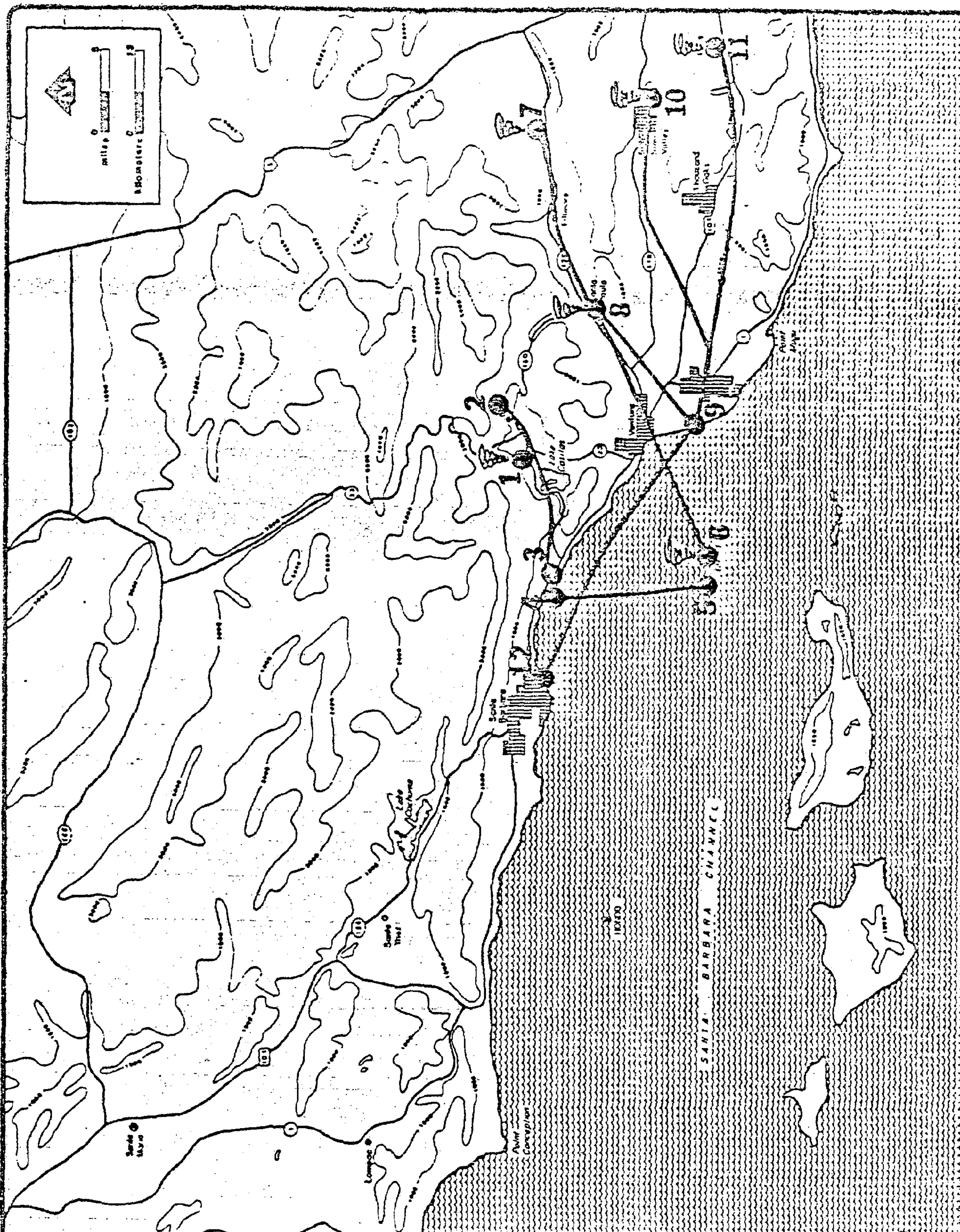
Date: 9-28-80

General Comments: Test 4. No Obstructions to Visibility

Flight Objective: Regional Sampling During Maximum Oxidant Period with Emphasis in Southern Region of Study Area.

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
184/ 1	1318	1335	3	1829	S		-		Instrument Zeroing
2	1336	1346	1829	210	S	1	-		
3	1350	1358	457	457	T	2- 3	31		
4	1401	1408	122	122	T	4- 5	24		
5	1410	1422	15	1524	S	6	-		
6	1423	1432	1524	61	S	6	-		Instrument Zeroing
7	1436	1456	457	457	T	6- 7	68		
8	1458	1510	207	1829	S	7	-		
9	1517	1527	1829	79	S	8	-		
10	1530	1537	305	305	T	8- 9	23		
11	1541	1555	396	396	T	9-10	53		
12	1556	1605	305	1524	S	10	-		
13	1610	1617	1524	503	S	11	-		
14	1620	1636	762	457	T	11- 9	56		
15	1638	1654	122	122	T	9-12	42		

*T - traverse, S- spiral



MRI 206 SAMPLING FLIGHT

Santa Barbara Channel Oxidant Study

Tape #184 28 September 1980

Santa Barbara Channel Oxidant Study
Tape 184

28 September 1980

TRAVERSE END POINT AND SPIRAL LOCATIONS

POINT	LATITUDE	LATITUDE	DESCRIPTION
1	34° 25.1'	119° 20.2'	NE of Lake Casitas
2	34° 27.6'	119° 14.0'	NE of Ojai
3	34° 24.0'	119° 30.4'	Carpinteria and US 101
4	34° 24.1'	119° 31.4'	West Side of Carpinteria
5	34° 11.1'	119° 31.2'	Two miles west of Grace
6	34° 11.1'	119° 28.0'	Platform Grace
7	34° 25.0'	118° 47.4'	Near Piru
8	34° 20.8'	119° 03.9'	Santa Paula Airport
9	34° 15.0'	119° 15.5'	Oxnard Coast
10	34° 16.3'	118° 42.3'	Santa Susana Airport
11	34° 08.8'	118° 40.2'	West Edge of Santa Fernando Valley
12	34° 24.5'	119° 41.2'	Santa Barbara Marina

FLIGHT SU. /\ARY TABLE

Date: 10-1-80

General Comments: Test 5. Dew Point Inoperative Stratus and Low Cloud over Coastal Sections.

Flight Objective: Regional Sampling During Maximum Oxidant Period with Emphasis in Southern Region of Study Area.

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
185/ 1	1318	1339	3	2134	S	-	-		Instrument Zeroing
2	1341	1355	2134	37	S	1	-	F 1-F 15	
3	1357	1402	213	213	T	2- 3	19	F 16-F 21	
4	1403	1422	213	2439	S	3	-	F 22-F 36	
5	1428	1436	457	457	T	3- 4	26	F 37-F 45	
6	1440	1448	183	183	T	4- 5	25	F 46-F 52	
7	1449	1505	30	2134	S	5	-	F 53-F 66	
8	1505	1516	2134	37	S	5	-		Instrument Zeroing
9	1519	1524	213	213	T	5- 1	21	F 67-F 72	
10	1525	1539	61	305	T	1- 6	48	F 73-F 86	
11	1539	1553	229	2134	S	6	-	F 87-F 96	
12	1560	1612	2134	91	S	7	-	F 97-F103	
13	1615	1622	366	366	T	7- 8	22	F109-F116	
14	1707	1723	3	2134	S	1	-	F117-F128	
15	1729	1738	305	305	T	1- 9	36	F129-F139	
16	1739	1744	305	549	T	9-10	16	F140-F145	
17	1746	1801	274	2134	S	10	-	F146-F155	
18	1805	1816	2134	457	S	11	-	F156-F161	
19	1818	1838	610	610	T	11- 1	56	F162-F172	

*T - traverse, S- spiral

FLIGHT SUMMARY TABLE

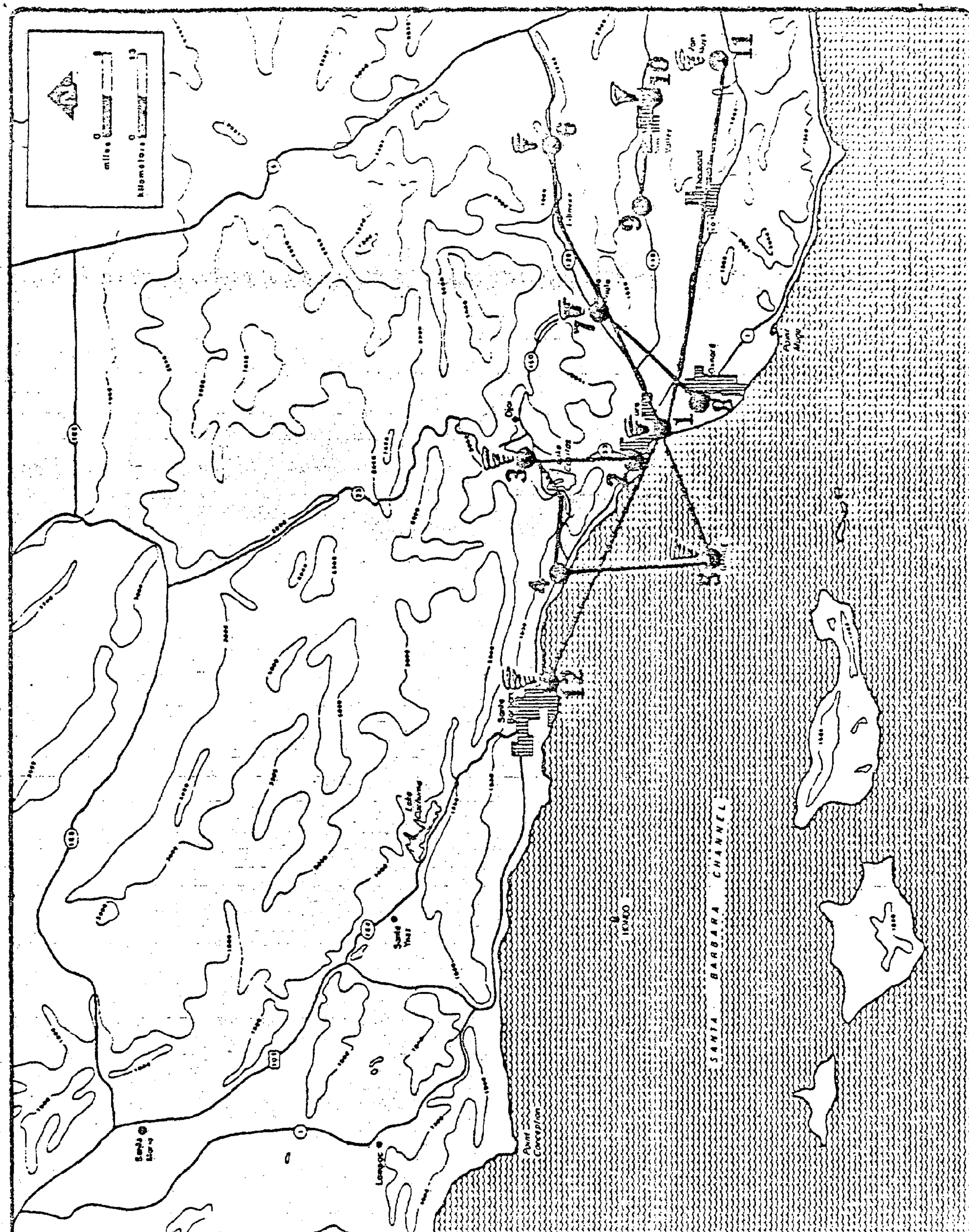
Date: 10-1-80 Continued

General Comments: Test 5, Continued

Flight Objective:

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
185/20	1842	1856	122	122	T	1-12	42	F173-F187	
21	1857	1911	3	1829	S	12	-	-	
22	1912	1922	1829	3	S		-	-	Instrument Zeroing

*T - traverse, S- spiral



MRI 206 SAMPLING FLIGHT

Santa Barbara Channel Oxidant Study

Tape #185 1 October 1980

Santa Barbara Channel Oxidant Study
Tape 185

1 October 1980

TRAVERSE END POINT AND SPIRAL LOCATIONS

POINT	LATITUDE	LONGITUDE	DESCRIPTION
1	34° 25.6'	119° 15.9'	Ventura Marina
2	34° 27.2'	119° 18.0'	Ventura and SR33
3	34° 27.6'	119° 14.0'	Ojai Valley
4	34° 24.1'	119° 31.4'	West End of Carpinteria
5	34° 11.1'	119° 31.2'	Platform Grace
6	34° 25.0'	118° 47.4'	Near Piru
7	34° 20.8'	119° 03.9'	Santa Paula Airport
8	34° 20.4'	119° 12.4'	Oxnard Airport
9	34° 17.1'	118° 52.3'	Moorpark
10	34° 16.3'	118° 42.3'	Santa Susana Airport
11	34° 08.8'	118° 40.2'	West End of San Fernando Valley
12	34° 24.5'	119° 41.2'	Santa Barbara Marina

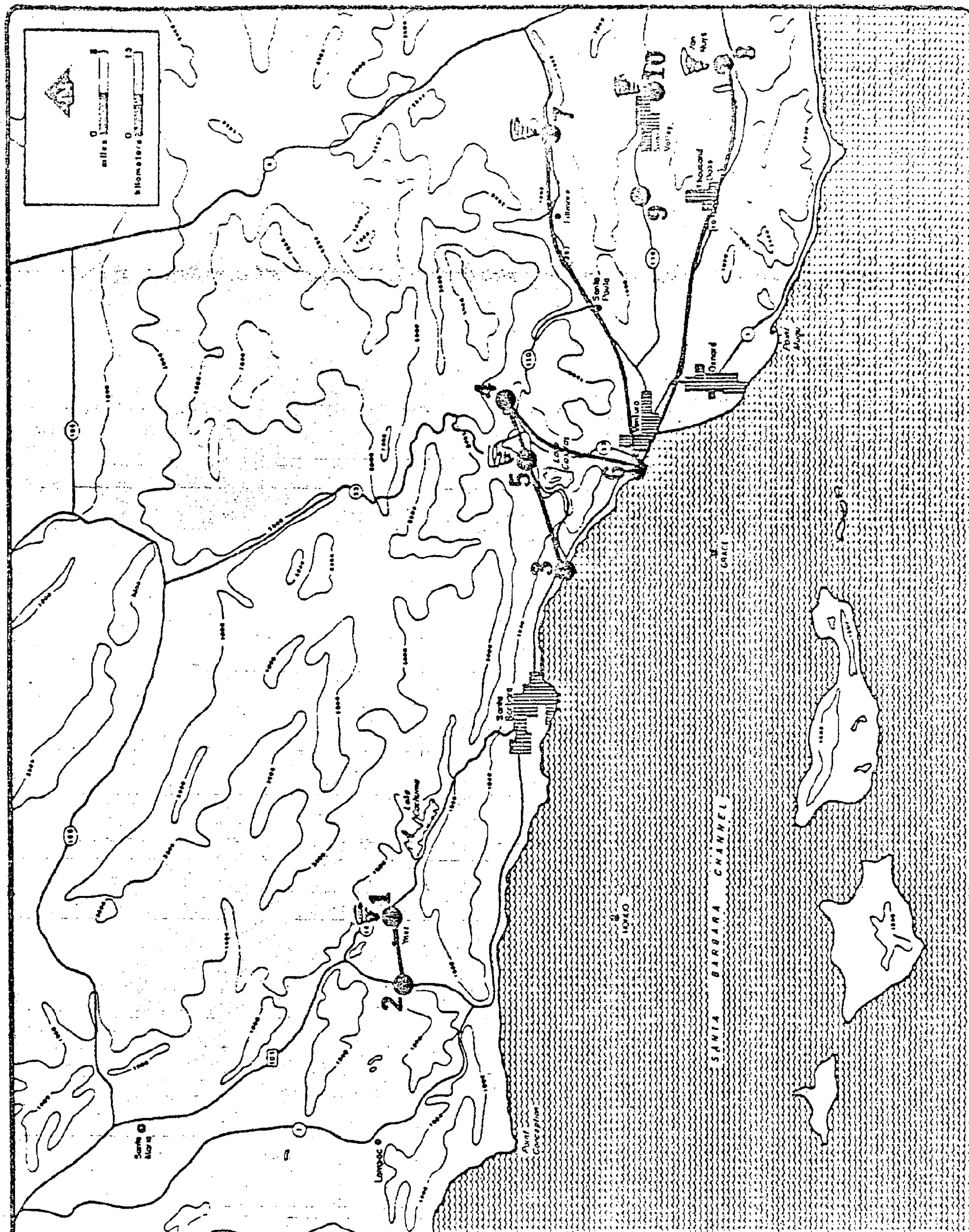
Date: 10-3-80

General Comments: Test 6. Dew Point Inoperative Stratus and Low Clouds Over Coastal Sections.

Flight Objective: Regional Sampling from the Santa Ynez Valley South to Oxnard Plain and San Fernando Valley During Maximum Oxidant Period

Tape/Pass	Time(PDT)		Altitude (m-msl)		Type*	Location	Traverse Length(km)	Tracer Samples	Comments
	Start	Stop	Start	Stop					
186/ 1	1323	1341	3	1824	S		-	-	Instrument Zeroing
2	1349	1358	1824	207	S	1	-	T1-T9	
3	1401	1404	305	305	T	1- 2	13	T10-T12	
4	1409	1412	610	610	T	2- 1	13	-	
5	1431	1440	457	457	T	3- 4	31	T13-T22	
6	1444	1455	207	1829	S	5	-	T23-T33	
7	1458	1506	427	427	T	4- 6	23	T34-T42	
8	1508	1522	427	427	T	6- 7	45	T43-T57	
9	1523	1531	244	1524	S	7	-	T58-T67	
10	1542	1549	1829	427	S	8	-	T68-T75	
11	1551	1609	701	427	T	8- 6	62	T76-T94	
12	1611	1620	427	427	T	6- 9	44	T95-T104	
13	1621	1626	427	549	T	9-10	16	T105-T110	
14	1628	1638	305	1829	S	10	-	T111-T120	
15	1648	1720	1829	3	S	SB A/P	-	T121-T126	Instrument Zeroing

*T - traverse, S- spiral



MRI 206 SAMPLING FLIGHT

Santa Barbara Channel Oxidant Study

Tape #186 3 October 1980

Santa Barbara Channel Oxidant Study
Tape 186

3 October 1980

TRAVERSE END POINT AND SPIRAL LOCATIONS

POINT	LATITUDE	LONGITUDE	DESCRIPTION
1	34° 36.5'	120° 04.6'	Santa Ynez Airport
2	34° 37.3'	120° 11.8'	Buellton
3	34° 24.1'	119° 31.4'	West Side of Carpinteria
4	34° 27.6'	119° 14.0'	NE of Ojai
5	34° 25.1'	119° 20.2'	NE Lake Casitas
6	34° 27.2'	119° 18.0'	Ventura Coast
7	34° 25.0'	118° 47.4'	Piru
8	34° 08.8'	118° 40.2'	West End of San Fernando Valley
9	34° 17.1'	118° 52.2'	Moorpark
10	34° 16.3'	118° 42.3'	Santa Susana Airport

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 14104 6831