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16. ABSTRACT
In cooperation with the California Air Resources Board and the Fresno Air Pollution Control District, regional modeling was performed simulating two high ozone days in the Fresno, California area. Gathering of the meteorologic and aerometric data was done in the summer of 1976. An air pollution emissions inventory was taken for the study area. The SMOG photochemical model was used in the computer simulations. The modeling results and the problems encountered are discussed. The SMOG model results depended significantly more on initial conditions than on emission levels.

The scope of all aspects of the research project is reviewed, and implementation of the research findings is discussed.

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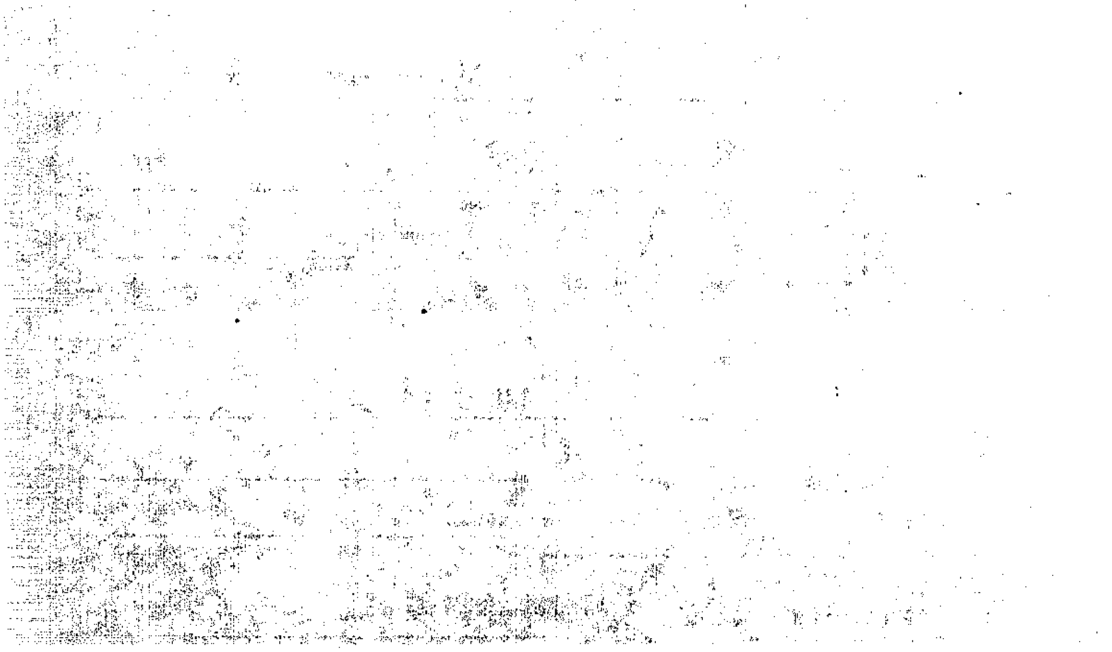

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
OFFICE OF TRANSPORTATION LABORATORY

June 1980

FHWA No. A-8-27
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TRANSPORTATION SYSTEMS AND REGIONAL AIR QUALITY
FINAL REPORT
PHOTOCHEMICAL MODELING OF FRESNO, CALIFORNIA REGION

Study Made by .... Enviro-Chemical Branch

Under the Supervision of .... Earl C. Shirley, P.E.

Principal Investigator .... Roy W. Bushey, P.E.

Co-Investigator .... Bennett T. Squires, P.E.

Report Prepared by .... Bennett T. Squires, P.E.

APPROVED BY

Neal Andersen

NEAL ANDERSEN
Chief, Office of Transportation Laboratory

CONVERSION FACTORS

English to Metric System (SI) of Measurement

Quanity	English unit	Multiply by	To get metric equivalent
Length	inches (in)or(")	25.40	millimetres (mm)
		.02540	metres (m)
	feet (ft)or(')	.3048	metres (m)
	miles (mi)	1.609	kilometres (km)
Area	square inches (in^2)	6.432×10^{-4}	square metres (m^2)
	square feet (ft^2)	.09290	square metres (m^2)
	acres	.4047	hectares (ha)
Volume	gallons (gal)	3.785	litres (l)
	cubic feet (ft^3)	.02832	cubic metres (m^3)
	cubic yards (yd^3)	.7646	cubic metres (m^3)
Volume/Time (Flow)	cubic feet per second (ft^3/s)	28.317	litres per second (l/s)
	gallons per minute (gal/min)	.06309	litres per second (l/s)
Mass	pounds (lb)	.4536	kilograms (kg)
Velocity	miles per hour(mph)	.4470	metres per second (m/s)
	feet per second(fps)	.3048	metres per second (m/s)
Acceleration	feet per second squared (ft/s^2)	.3048	metres per second squared (m/s^2)
	acceleration due to force of gravity(G)	9.807	metres per second squared (m/s^2)
Weight Density	pounds per cubic (lb/ft^3)	16.02	kilograms per cubic metre (kg/m^3)
Force	pounds (lbs)	4.448	newtons(N)
	kips (1000 lbs)	4448	newtons (N)
Thermal Energy	British thermal unit (BTU)	1055	joules (J)
Mechanical Energy	foot-pounds(ft-lb)	1.356	joules (J)
	foot-kips (ft-k)	1356	joules (J)
Bending Moment or Torque	inch-pounds(ft-lbs)	.1130	newton-metres (Nm)
	foot-pounds(ft-lbs)	1.356	newton-metres (Nm)
Pressure	pounds per square inch (psi)	6895	pascals (Pa)
	pounds per square foot (psf)	47.88	pascals (Pa)
Stress Intensity	kips per square inch square root inch ($ksi \sqrt{in}$)	1.0988	mega pascals $\sqrt{metre}$ ($MPa \sqrt{m}$)
	pounds per square inch square root inch ($psi \sqrt{in}$)	1.0988	kilo pascals $\sqrt{metre}$ ($KPa \sqrt{m}$)
Plane Angle	degrees (°)	0.0175	radians (rad)
Temperature	degrees fahrenheit (F)	$\frac{tF - 32}{1.8} = tC$	degrees celsius (°C)

ACKNOWLEDGEMENTS

The success of this project is due to the cooperation of personnel from many agencies.

At the Transportation Laboratory, Messrs. R. Duncan, D. Wood, G. Vidwan, and Miss M. Johnson are acknowledged for editing and organizing various data.

At the Caltrans District 06 Office in Fresno, thanks are extended to Mr. F. Waterhouse for general supervision and Messrs. J. Bardakjian, J. Exum, T. Nagata, and R. Cramer for establishing and operating the meteorologic monitoring devices and the Caltrans air quality van. Mr. R. Nakagawa gathered the traffic related emissions data.

Mr. G. Turl of the Fresno Air Pollution Control District (APCD) and Mr. M. Redemer, formerly of the APCD, presently with the California Air Resources Board (CARB), are extended thanks for accumulating the stationary emissions inventory.

At the Caltrans Division of Transportation Planning, the help of Mr. R. Salmon and Mr. L. Seitz in the effort to accumulate mobile emissions data is acknowledged.

The patient help of Mr. R. Baishiki of the Caltrans Office of Computer Systems was invaluable.

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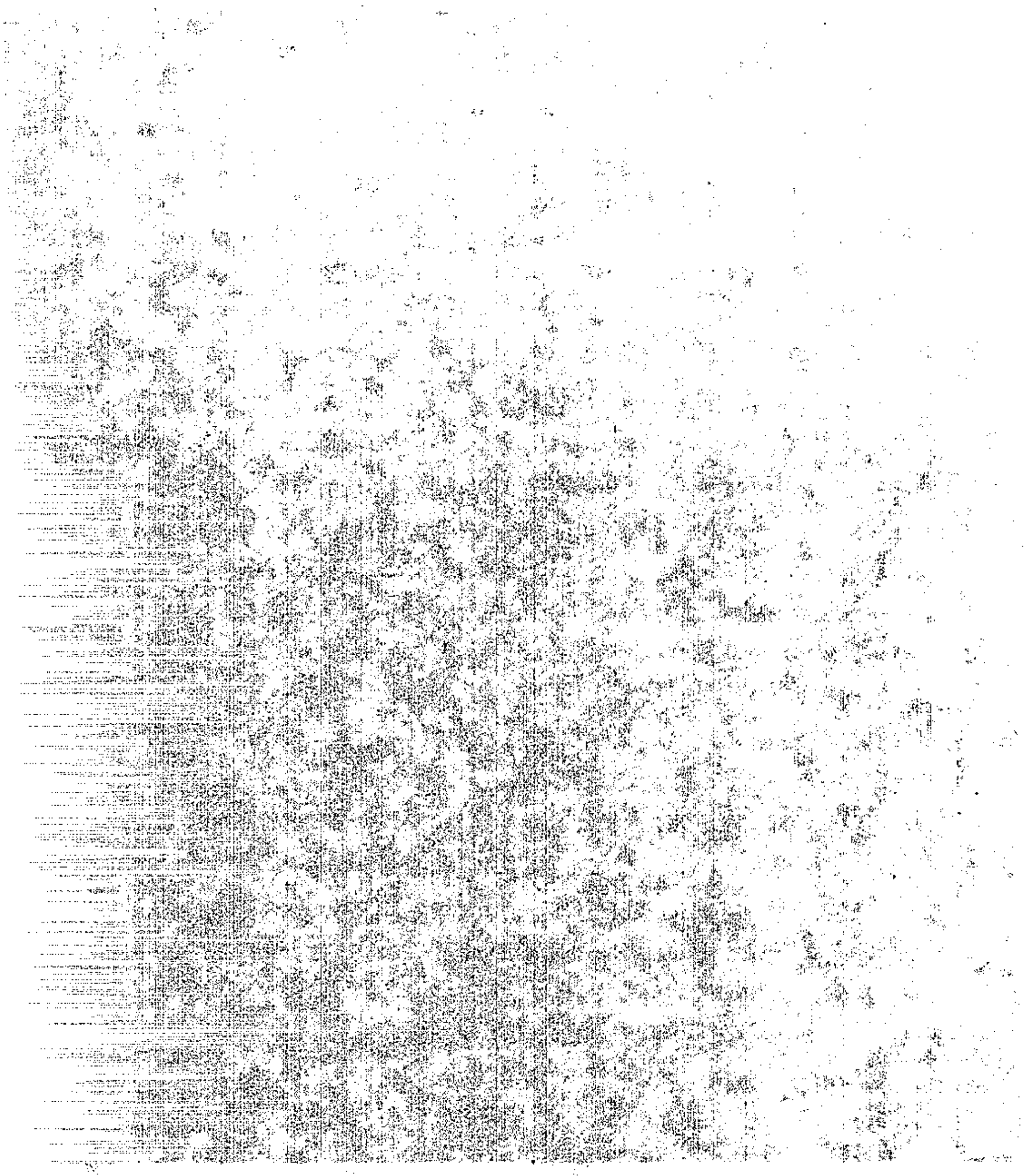

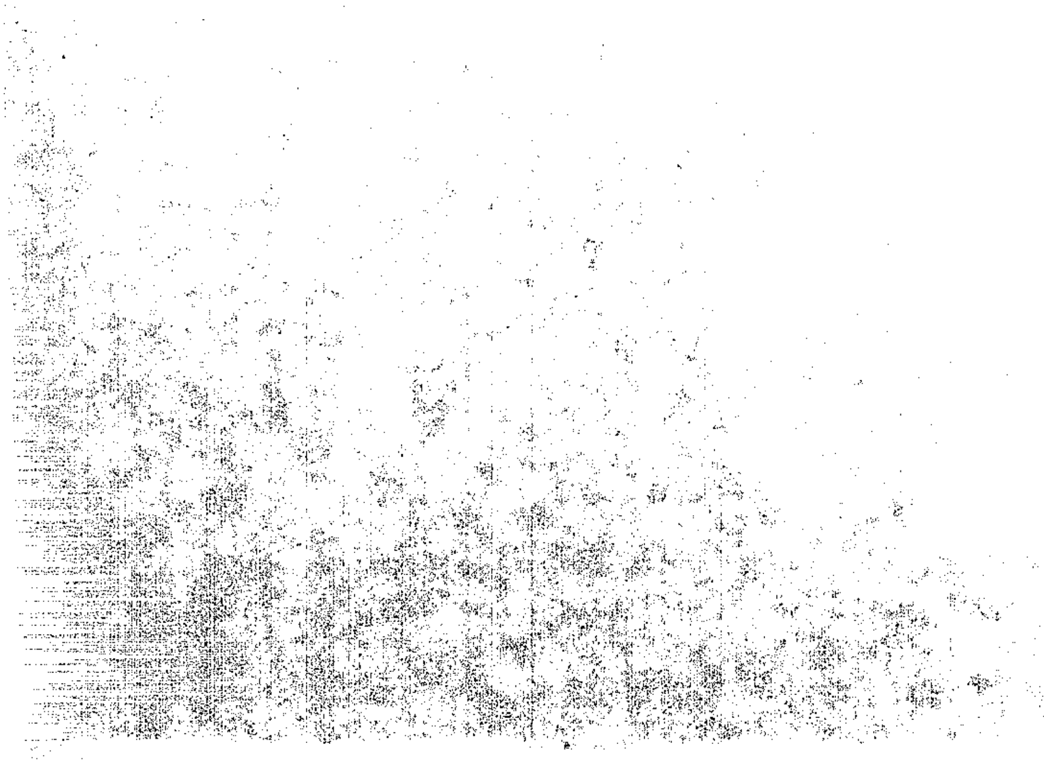

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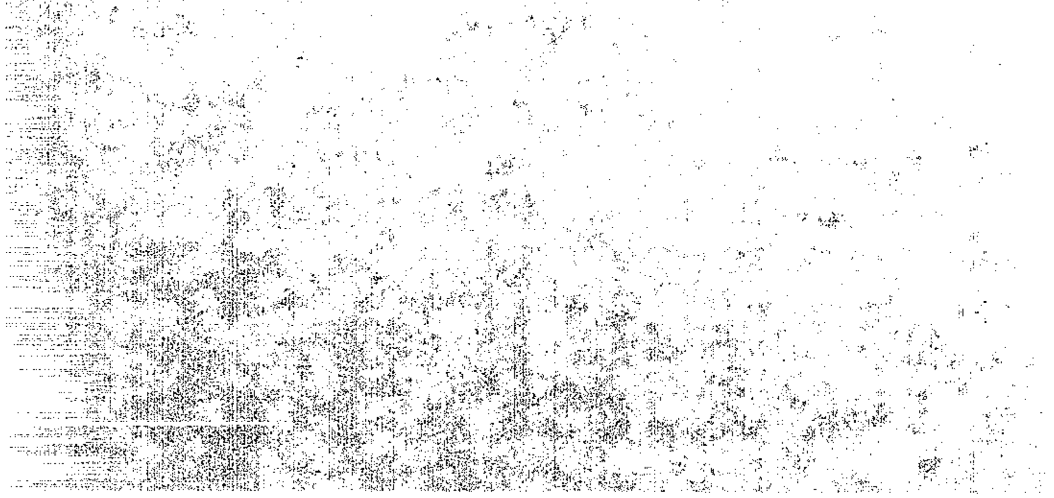

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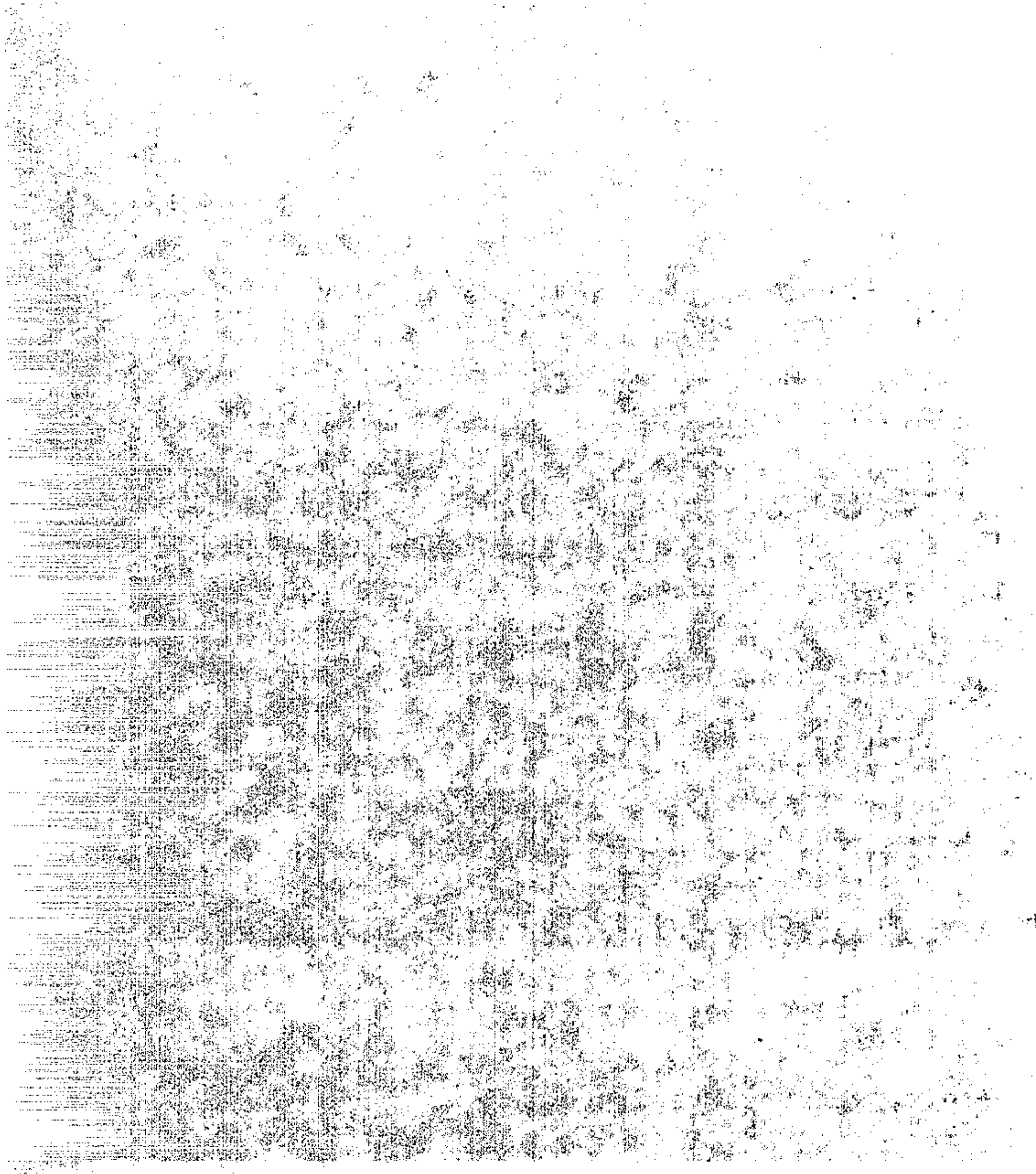

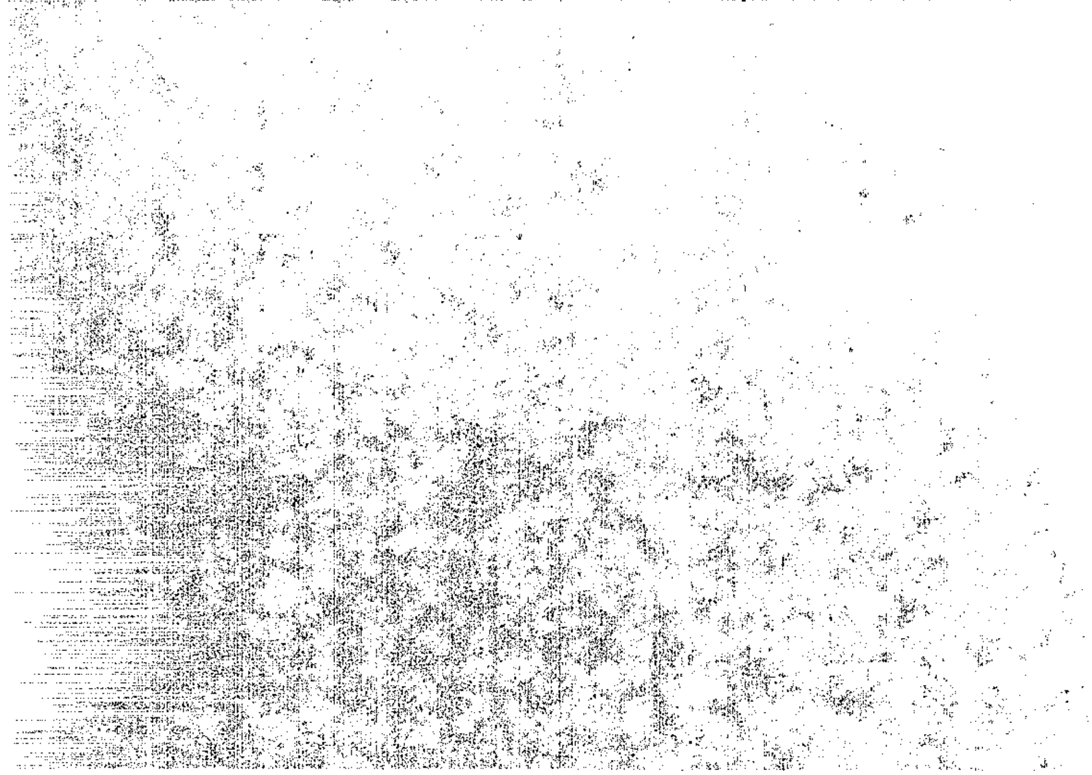

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INTRODUCTION

The research project entitled "Transportation Planning and Regional Air Quality" was initiated in 1974. Objectives of this most recent research are to generate verified regional air quality computer models for the Sacramento and Fresno areas of California. This is the final report which describes the modeling activities in the Fresno area.

Regional air quality models are being developed to aid officials in environmental planning. Those planners and engineers charged with administration of clean air laws submit proposed transportation plans, zoning restrictions and energy saving ideas for evaluation by the verified models. The models are expected to be able to evaluate the effect of these planning suggestions on local air quality.

Federal law mandates an Air Quality Maintenance Plan (AQMP) under which local jurisdictions must travel the road toward attainment of the National Ambient Air Quality Standards (NAAQS). The plan necessarily involves control of fixed source and mobile source pollutant emissions.

Although one can imagine a wide variety of air pollutant emission control strategies, the vast majority of those considered to be significantly effective threaten to disrupt established work or pleasure habits of the American middle class and are thus politically and/or economically unacceptable. One role of the regional air quality model, then, is to provide the planner with a tool for testing the air quality improvement effectiveness of the relatively few strategies that might be successfully implemented.

The computer modeling output is also useful for influencing the planners in their decisions concerning recommended strategies, and in providing backup evidence when the proposed strategies are standing for approval. It is anticipated that among the decisions to be influenced by this work will be: 1) consideration of the environmental effects of transportation systems, 2) locating optimum sites for those systems found to be environmentally acceptable, 3) impact of land use and population growth on air quality, and 4) optimally locating major industrial pollution sources found to be necessary and/or acceptable.

This report is the seventh and last in the series published under this research project. The preceding six interim reports are enumerated below along with a synopsis of their content.

1. "Transportation Systems and Regional Air Quality - An Approach and Computer Program for Wind Flow Field Analysis"(1),

Regional air quality studies and photochemical simulation models require the description of wind flow patterns for specific hours of various meteorological regimes. This report presents an approach for conducting a wind flow field analysis. Included are user instructions, input forms, and a computer program.

The research results can be implemented for design of a network of wind monitoring stations given relatively sparse initial data or for analysis of region wide wind flow fields from the plots yielded by the computer program.

2. "Transportation Systems and Regional Air Quality - A DIFKIN Sensitivity Analysis"(2),

DIFKIN is a trajectory type photochemical air quality simulation model. This report concerns an analysis of the DIFKIN photochemical model characteristics and sensitivities to various input parameters using air quality data measured on September 29, 1969, a day that the oxidant concentrations were in excess of 0.35 ppm in the South Coast Air Basin (Los Angeles area), California.

The most sensitive input parameters to ozone production are RHC/NO_x ratios, initial concentrations, reaction rate constants, and inversion base height, while the model is significantly less sensitive to emissions.

3. "Transportation Systems and Regional Air Quality - Evaluation of a Modified APRAC-1A Carbon Monoxide Diffusion Model for the Sacramento Region"(3),

A validation study and sensitivity analysis of the APRAC-1A model for predicting concentrations of carbon monoxide were performed. Samples of carbon monoxide were collected at nine locations in urban Sacramento during the winter of 1974 and model predictions were compared to the field measurements. The model underpredicted field values by an average of 170%. After the APRAC-1A work was completed, the EPA published information which indicated that carbon monoxide emission rates were underestimated for this investigation. If a correction for this were applied, the average predictions from APRAC-1A might be very close to the measurements.

4. "A Consistent Scheme for Estimating Diffusivities to be Used in Air Quality Models"(4).

A vertical diffusivity model consistent with the latest developments in the theory of the atmospheric boundary layer was developed. It considers the Pasquill stability classes, micrometeorology, and land use. The model constitutes a "cookbook" procedure for estimating vertical diffusivity from available meteorology and land use information. A method of interfacing the diffusivity model with grid and trajectory models was discussed. The combination of these models allows transportation planners and engineers to evaluate the interrelationships of land use, transportation and air quality planning.

Land use significantly affects the vertical diffusivity profile by as much as a factor of ten when considering urban areas vs rural areas.

5. "Design of an Air Quality Monitoring Trailer for Regional Air Quality Assessment"(5),

Field data on ambient air pollution levels are required to assess transportation systems impact on the regional air quality. A description of the design and development of an air monitoring trailer for measuring ambient levels of air pollution was presented. The pollutant analyzers used, their operation and calibration procedures are discussed. The trailer units are equipped with carbon monoxide, oxides of nitrogen, ozone, and hydrocarbon analyzers. Data loggers are used to facilitate reduction of air pollutant data.

These trailers have been used to obtain extensive air quality data bases in the San Diego, Sacramento, and Bakersfield regions.

6. "Transportation Systems and Regional Air Quality - Photochemical Modeling of Sacramento, California Region"(6),

In cooperation with the California Air Resources Board (CARB) and the Sacramento Regional Area Planning Commission, regional modeling was performed simulating a high ozone day in Sacramento, California. The study area was selected to include populated sections of Sacramento. An air pollution emission inventory was taken for the study area. Field gathering of meteorologic and aerometric data was done in the summer of 1976. Verification of two models, the SAI 15-step chemistry and the SMOG models was attempted. A verification was not effected with the SAI model, but the SMOG model seemed to verify. Problems involved with the use of each model are discussed in the report as are the unique properties of the models. The SMOG model results depended significantly more on initial conditions than on emission levels.

Following a review of the treatment of the overall project objectives, this report considers, in approximate chronological order, the steps necessary in preparing data for the modeling work. This work typically starts with "field work" which is largely gathering air quality and meteorological data followed by processing of these data into acceptable form for the modeling programs. Methodology for accumulating pollutant emission inventories, both mobile and stationary, is the subject of a section, as is the selection of candidate days for modeling. The verification process is described and potential use of the model's output is discussed.

Finally, the Fresno modeling project is discussed and recommendations are made for future work with the model.

CONCLUSIONS

1) Regional oxidant modeling is too complex to be performed routinely by transportation planners or engineers. Specialized modelers who are familiar with the models' theory and computer procedures must supervise the work or be available for consultation on a regular basis.

2) The regional ozone model originally proposed for the Fresno area, the SAI 25x25 Airshed model with 15-step chemistry, could not be verified for the Sacramento region. Therefore, no attempt was made to verify it with Fresno data.

3) The SMOG model gave mixed results in reproducing the measured ozone concentrations for the August 24 and August 31, 1976 candidate days. A verification was achieved for August 31 but not for August 24.

4) The SMOG model tends to predict highest ozone concentrations downwind of the maximum precursor emissions of NO_x and hydrocarbons.

5) The SMOG model tends to predict the temporal and spatial patterns of ozone, NO_2 and NO consistent with measurements.

6) Based on dawn to dusk simulation runs, the SMOG model appears to be sensitive to the specification of initial concentrations and boundary conditions for hydrocarbons and NO_x and insensitive to large changes in emission rates.

This leads to the conclusion that simpler ozone modeling techniques such as the Empirical Kinetic Modeling Approach (EKMA) may be preferable for consideration of transportation system air quality effects. EKMA yields ozone concentrations similar to those produced by the SMOG model.

7) Emission controls on a mesoscale or microscale basis would have little effect on reducing ozone levels on the first day of their implementation. For this reason, emergency controls in episodic situations would be ineffective initially.

RECOMMENDATIONS FOR ADDITIONAL SMOG MODEL WORK

1) Evaluate the SMOG model for multi-day simulations which will allow a more realistic evaluation of emissions control

initial concentrations become. If the multi-day simulations show sensitivity to emissions, future control strategies for transportation related emissions in the Fresno area can be evaluated for ozone impact using the SMOG model.

2) Perform an analysis to establish the relative sensitivity of the model to various initial and boundary conditions for NO_x and hydrocarbons. These are the pollutants that transportation related sources contribute toward ozone generation, and such an analysis would be most useful in choosing future control strategies.

3) Evaluate the model for different types of meteorological conditions.

4) Support the continued development and evaluation of new photochemical models. As an example, the California Institute of Technology has a regional ozone model in an advanced state of development. Development of such new models is most rational when it is based on user evaluation of deficiencies in existing models. An effort should be made to simplify the job control language and data requirements in order that, eventually, project level personnel will be able to perform routine modeling operations.

PROJECT RESEARCH OBJECTIVES

The original project proposal (May 1974) outlined the following research objectives. Each item is followed by a discussion.

1) "Analyze existing regional air quality models and select two or three which are most applicable to the analysis of the environmental effects of alternative transportation system configurations."

Four regional ozone models plus the APRAC-1A carbon monoxide model have been used and/or materially evaluated under the project.

The APRAC-1A findings were reported in April 1976(3). Ozone models called DIFKIN, MADCAP, SAI Regional Airshed and SMOG (formerly called IMPACT) have been used. DIFKIN was tried on the Los Angeles Basin with limited success as reported in April 1976(2). The SAI Regional Airshed model was tried on the Los Angeles Basin with little success and considerable expenditure of time and funds. The same model was tried unsuccessfully on the Sacramento region(6). Successful runs using MADCAP on the San Diego area were reported(7,8), and SMOG was successfully verified for the Sacramento region(6). SMOG was also used on the Fresno regional study.

Previous regional air quality modeling under the auspices of Caltrans has included work in Los Angeles using the SAI model. Subsequent to the Fresno work, a Bakersfield ozone study was made using SMOG as the regional model.

Emission inputs to SMOG, MADCAP and the SAI Regional Airshed models are rationally representative of the effects of alternative transportation system configurations; that is to say that functions in each of these models are capable of being changed to reflect a myriad of possible transportation planning schemes. A few examples include relocation of transportation corridors, changes in volume and speed of vehicles, changes in emission rates, temporal variations of any physical or chemical inputs, and creation of zoning that moves stationary sources into a designated area. More work, however, must be done to make the models sensitive to the changes in emissions that these relocations cause.

2) "Analyze existing line source models capable of treating complex terrain and meteorology and select two or three which show promise."

Since the transportation corridor is a line source, this is a particularly important aspect of transportation related pollution modeling. This was realized early in the research, and microscale line source modeling was separated from the subject research project. This dichotomy remains today, and line source modeling remains the most important research subject that the Transportation Laboratory's air quality unit pursues. The CALINE2 line source model(9) and the newly developed CALINE3 line source model(10) are the results of the latter research. Due to prohibitive cost and lack of ideal siting, it was felt that collecting data bases for validating a line source model in complex terrain either under this research project or the CALINE3 research project was not feasible. Stanford Research International (SRI), however, has been active in researching line source pollution in complex terrain.

3) "Perform a sensitivity analysis of the selected air quality model(s) to determine the most important input parameters and the accuracy with which they should be monitored."

Sensitivity analysis can generally be defined as the fractional variation in output (predicted concentration) as a function of fractional changes in the model input parameters. The sensitivity analysis serves as a means for examining the responses of a model by varying the input parameters within a range of physical reality or uncertainty. The purpose is to assess the influence of each parameter insofar as predicted air quality is concerned. A model can be classified as sensitive to a given input variable if the predicted concentration changes at a rate equal to or greater than the change in the input variable.

Extensive sensitivity analysis was performed on the DIFKIN trajectory model. The DIFKIN sensitivity analysis concluded that the model is most sensitive to photochemical activity, especially solar intensity and chemical reaction rates.

The wind flow field analysis report(1) indicated that the program is sensitive to data from faulty wind speed and direction devices. The data from these poor devices can be readily recognized by inspection of computer printouts.

Some sensitivity analysis on the SMOG program has been done, although extensive analysis using presently available research funds is not economically feasible. The sensitivity of SMOG to 30 percent reduction in hydrocarbons, 30 percent reduction in oxides of nitrogen, and to reductions in emissions to as great a degree as 100 percent were discussed in a CARB report on Sacramento area modeling(11), and in the Transportation Laboratory's report on the Sacramento modeling(6).

4) "Design an adequate regional or line source air monitoring program, with proper exposure, to acquire CO, HC, NO_x, O_3, wind speed, wind direction and vertical temperature structure data to determine the temporal and spatial distribution of pollutants for validation of the air quality models; and

5) "Validate existing air quality model(s) based on seasonal variations of pollutant concentrations for a variety of isolated cities in California considering meteorology, topography and sources of pollutants."

Caltrans monitoring programs, funded by this research, developed data bases for the Fresno, Sacramento and San Diego regions. The SMOG, SAI Regional Airshed, and MADCAP models have had verifications accomplished or attempted at one or more of the above locations. As previously mentioned, the SAI and DIFKIN models were also used without great success in the Los Angeles region.

All three data bases include pollutant data from three or more monitoring sites for use in verifying a regional ozone model. Pollutants measured include ozone, hydrocarbons, oxides of nitrogen and carbon monoxide. Additionally, each data base contains the necessary meteorological information for developing wind flow fields and stability classes. Solar intensity and emission inventories are other aspects of the data bases.

Temporally, the San Diego data base extends from June 1975 to October 1975, the Sacramento data base from February 1975 to February 1977, and the Fresno data base from May 1976 to October 1976.

Caltrans is also the custodian of air quality data bases for the Los Angeles and Bakersfield areas, althouah those data bases were not accumulated under the subject project.

6) "Using statistical regression techniques, identify important dispersion parameters and develop a statistical model if applicable."

Statistics are widely used in microscale air quality studies which are short of data, time and/or funds. For example APRAC-1A and Larsen's model have been used for statistical estimates of carbon monoxide concentrations. It has also been found convenient to use statistics to estimate concentrations and meteorology between adjacent monitoring stations.

One method of using statistics to lower costs with a simplified program involves the use of "repro-modeling"(12). In this technique, a complex air quality model may be verified for a typical transportation engineering system on a one-time maximum-effort basis. With this model information, and statistical regression analysis, the air quality effects of many other more specific projects could be estimated using the results from the complex model. Thus, detail and some accuracy on the individual projects will be sacrificed for an inexpensive but rational air quality analysis.

7) "Recommend to transportation planners and engineers a ready-to-use package of the air quality model(s) and techniques most applicable for assessment of the impact of transportation systems on the air environment."

Microscale models can be packaged with relatively simple input instructions for use by planners and engineers with little training in air quality fundamentals. Several are available. However, regional models are quite complex and the work of air quality engineers is usually limited to data preparation and analysis. Our findings are that modeling specialists such as CARB Modeling Air Quality Unit (MAQU) are necessary to run the models.

The Environment Protection Agency requires a sophisticated photochemical model be used in the Los Angeles Basin. All other nonattainment areas can use simpler models. It is true that oxidant models are too complex to be performed routinely, and there is doubt that direct application of regional photochemical models is economical when evaluating various transportation control alternatives.

Regional models have been verified and information from the San Diego, Fresno and Sacramento modeling has the potential for implementation in assessing the impact of transportation related contributors to air pollution. The MADCAP model is available for simulations in the San Diego region. MADCAP (Model of Advection, Diffusion and Chemistry of Air Pollution) is a product of an office of Science Applications, Inc., based in La Jolla, California. It is a three-dimensional regional air quality model which is designed to determine ozone levels. Input similar to that used for SMOG is required. MADCAP is based on a horizontal Lagrangian and vertical Eulerian grid solution of the atmospheric diffusion equation. The San Diego Air Pollution Control District (APCD) is the custodian of MADCAP.

The LIRAQ model(13), developed by the Lawrence Livermore Laboratory is being used for air quality simulations in the San Francisco Bay area under the auspices of the Bay Area Air Quality Management District.

The trend has been toward the development of models uniquely created for a single area. The SMOG model's versatility enables it to be used, with the assistance of modeling specialists, by local agencies which lack models prepared specifically for their regions.

IMPLEMENTATION

The air quality monitoring trailers represent the most frequently implemented development of the research program entitled "Transportation Systems and Regional Air Quality". The equipment in the trailers can be used for ambient air quality measurements in conjunction with microscale or regional study activities. The monitoring capability includes measurements of carbon monoxide, oxides of nitrogen, ozone and hydrocarbons. Caltrans has designed three such trailers, and the findings of the research were disseminated in the report entitled "Design of an Air Quality Monitoring Trailer for Regional Air Quality Assessment"(5).

In conjunction with monitoring by the trailers, implementation of the research was achieved through the development of the Air Quality Data Handling System (AQDHS) file for the California Department of Transportation. This file is currently used by the Transportation Laboratory in Sacramento and air quality personnel of the Caltrans Districts throughout the state.

Several regional models were evaluated using these research funds and a better understanding of the use of regional modeling for evaluation of transportation systems has been achieved.

Explicit algorithms for the description of diffusivities for air quality modeling were developed under this research. These algorithms are state of the art and are currently used in those air quality models, both mesoscale and microscale, with which Caltrans and the CARB are involved. This diffusivity method is described in the report entitled "A Consistent Scheme for Estimating Diffusivities to be Used in Air Quality Models"(4).

The wind flow field program has been implemented. This program provides the air quality engineer with a method to take wind speed and direction data from the AQDHS file and have wind flow fields plotted to map scale entirely by automated methods.

Available models developed wholly or in part under this research project include SMOG, SAI, and MADCAP.

AGENCY RESPONSIBILITY

The air quality regional modeling of the Fresno area was a joint effort of several agencies. These agencies are MAQU, the CARB's Technical Services and Planning Division, the California Transportation Laboratory, the California Department of Transportation Planning, Department of Transportation District 06 in Fresno, the Fresno APCD and the Fresno Council of Governments.

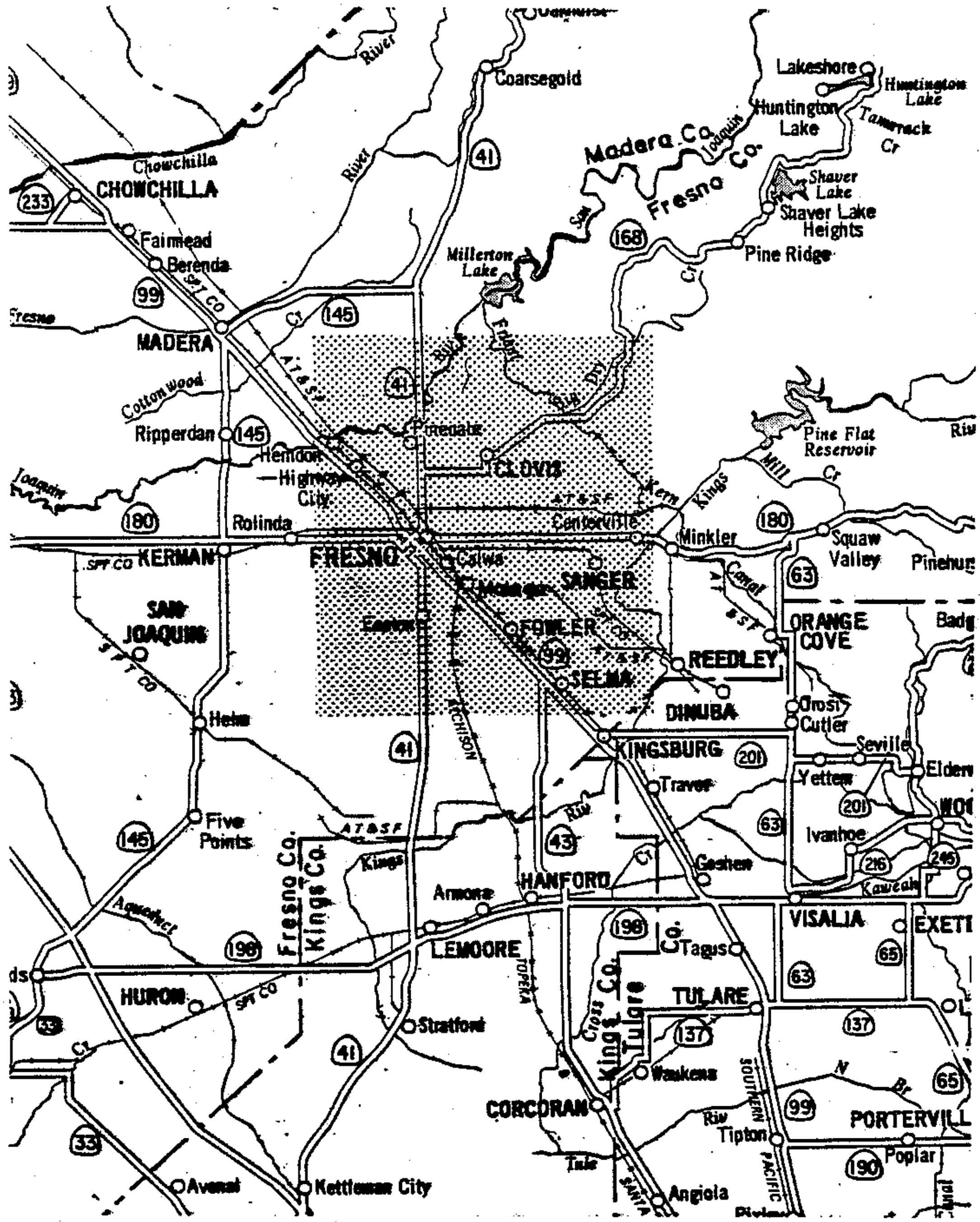
There follows a summary of each agency's duties. Overall direction was provided by Caltrans District 06 and the Caltrans Laboratory. The air quality and meteorologic data base for model verification was gathered by the CARB's Technical Services Division and Caltrans District 06. Personnel of the State Department of Health calibrated the monitoring instruments. Data reduction was provided by personnel of the CARB Technical Services Division and the California Transportation Laboratory. The stationary emissions inventory was made by personnel of the Fresno APCD. Raw data for the mobile emissions inventory was provided by Caltrans District 06 and the Caltrans Department of Transportation Planning, and the CARB Planning Division provided computer programming for automation of the mobile emissions data. Data input and execution of the SMOG model were performed by personnel of MAQU and the California Transportation Laboratory.

REGIONAL STUDY AREA

To accommodate the SMOG regional oxidant model, which is an Eulerian type grid model, the Fresno area was divided into 625 squares, 25 squares per side. The size of each grid square is 1 mile by 1 mile and the point of cartesian origin, that is, the southwest corner of grid square (1,1) is set at the intersection of Springfield Road and Chateau Fresno Road. The grid square numbering increases toward the east and toward the north, thus the location of any feature within the grid can be represented by the coordinates of the grid square in which it resides. The limits of the grid were chosen to include the metropolitan Fresno area and the communities of Sanger, Fowler and Parlier. The location of the Fresno gridded area is shown in Figures 1 and 2.

The concept of a regional grid is especially versatile. There are 625 distinct areas in which emissions can be totaled and used by the computer program, and there are the same 625 distinct areas in which to compute pollutant concentrations. The 100 grid squares that border the area are ordinarily used to assign concentrations to air being advected into the area. Any control strategy chosen by planners to alleviate air quality problems can be assigned to a grid square, and the computer model will attempt to evaluate the signficance of the strategy in that particular location. Throughout this report, air quality information concerning all locations will be referred to by their grid square.

FRESNO MODELING STUDY AREA

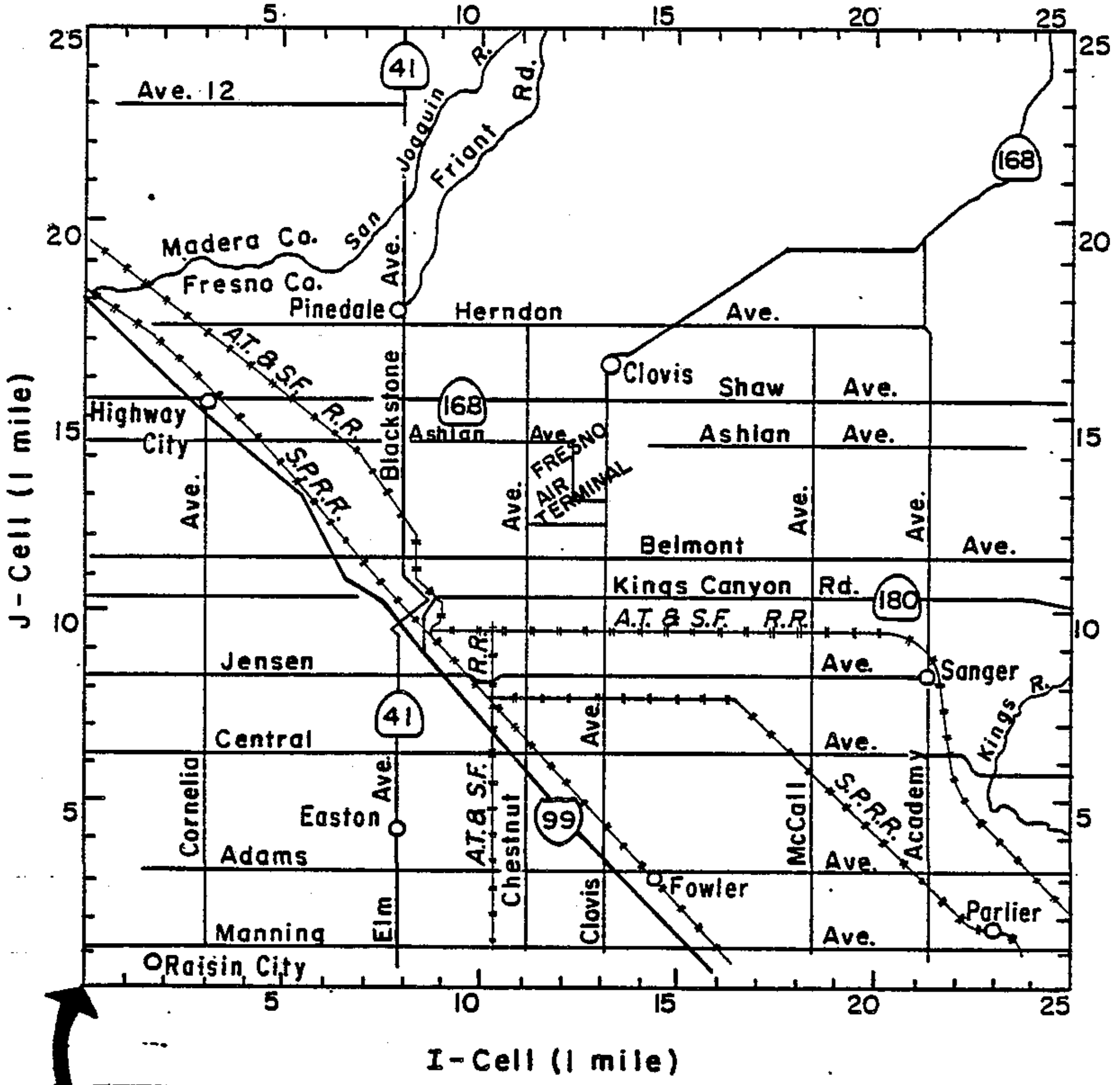


AIR QUALITY MAINTENANCE PLAN AREA

FIGURE 1

FIGURE 2

FRESNO MODELING REGION



Intersection of
extensions of Springfield
Road and Chateau Fresno
Road
UTM 237, 530E; 4,054,000 N

PHOTOCHEMICAL MODEL DESCRIPTION

The Integrated Model for Plumes and Atmospherics in Complex Terrain (IMPACT) is a grid model(14,15). This means that conditions within a specified area in the study region (the so called grid square) are the basic consideration of the modeling process. IMPACT solves the conservation of mass equation with a detailed representation of wind and diffusion, especially in the vertical dimension, and uses a 39-step chemistry.

IMPACT is a product of an office of Science Applications, Inc., based in La Jolla, California. IMPACT was developed by Dr. Ralph Sklarew in Westlake Village, California. Dr. Sklarew now has his own firm (Form and Substance, Inc.) in Westlake Village. IMPACT has been revised, and is now in the custody of MAQU. IMPACT began as a point source model and has been expanded by Dr. Sklarew and MAQU personnel into a model with regional capabilities. MAQU has renamed it "Simulation Model for Ozone Generation" (SMOG). The SMOG model was developed in 1976-78. The SMOG model was used with success on the Fresno project.

GEOGRAPHY

Fresno is located on the east side of the San Joaquin Valley approximately midway between Stockton and Bakersfield at an elevation near 300 feet above sea level. The valley is bounded by topographic barriers on three sides. They are the Coast Range on the west, the Tehachapi Mountains on the south and the Sierra Nevada Mountains on the east. The northern end of the valley is not well defined, but is usually understood to be north of Stockton near the Mokelumne River.

The valley is oriented northwest-southeast and is some 300 miles in length by 50 miles in width. The shape of the valley and the surrounding mountains establish the prevalent wind directions.

During the summertime ozone season, the Pacific high pressure cell and the basin-like topography combine to cause high temperatures, mostly cloudless skies and a typical subsidence inversion. Nocturnally, a shallow surface inversion results from surface cooling. This surface inversion is usually strongest in the early morning and confines pollutants near the ground until intense midday solar radiation promotes mixing to the height of the subsidence inversion. The most frequent summertime wind direction is northwest.

The Fresno study region has a flat topography. The populated sections are surrounded by agricultural land with the exception of the northeast corner of the region where foothills of the Sierra Nevada range are found. The Fresno area's relative topographic simplicity makes it desirable for air quality computer modeling.

STATIONARY EMISSIONS INVENTORY

Integrated point and area source stationary emissions were determined for each grid cell in the Freso modeling area. Personnel of the Fresno APCD assigned appropriate pollutant emissions to each of the grid cells. Pollutants inventoried included carbon monoxide (CO), oxides of nitrogen (NOX), total hydrocarbons (THC), oxides of sulfur (SOX), and total suspended particulates (TSP).

The inventory data are based on the year 1976. Two days in that year, August 24 and August 31, were selected for computer modeling. Analysis of the field data indicated that these dates out of those in which pollutant monitoring was done during the summer of 1976, were most meteorologically conducive to the formation of ozone in excess of the NAAQS.

The air polluting gasses that are typically emitted in urban, industrial or agricultural areas (the "area" sources) during each business day in the summer season were totaled for a typical Fresno area day in 1976. To this amount were added emissions peculiar to the individual study days. An example of an exceptional emission source is agricultural waste burning. Emissions from area sources, such as vegetation, not involving activities of man were not included in the emissions inventory.

Major point source emissions were taken from permits on file with the APCD while minor point sources and area source emissions were estimated by APCD personnel.

A file of the stationary emissions was placed on magnetic tape to be accessed for the SMOG model.

MOBILE EMISSIONS INVENTORY

For the purposes of this study, mobile emissions were taken to include only highway vehicles. Emissions from aircraft and rail sources were included by grid square among the stationary emissions.

Emissions from highway vehicle sources were estimated using the Direct Travel Impact Model (DTIM). The model assigns highway vehicle pollution sources to each of the 625 grid squares and generates the resultant pollutant emissions. The base year used was 1976, and the models were programmed to generate emissions for any year through 1995.

The input to DTIM is a summary of traffic counts along segments of roadway (links) in order to generate estimates of vehicle miles traveled (VMT) along each segment. Other inputs to the model include the nature of each trip; for example, going to work, going shopping, etc. The model considers whether the automobile is in a cold travel mode or a hot travel mode, and is also able to estimate the variations in fuel usage due to socio-economic factors for different neighborhoods in the metropolitan area under consideration.

DTIM takes, for each grid square, the VMT generated from the input and calculates the amount of air pollution emitted from the aggregate of motor vehicles. DTIM bases its figures on emission factors used by the CARB and Caltrans. It writes a report on the quantity of air pollutants being emitted in a geographical area, and it also writes, on magnetic tape, a file of mobile source emissions which can be used directly by the SMOG photochemical model.

TABLE 1

Emissions Summary for August 1976
Fresno Study Area
(kilograms/day)

Emission Category MSDS No.	Description	CO	NO_x	THC
2	Motor vehicle	288458.3	21272.04	32710.30
4	Railroad	52.8	152.00	43.20
10	Petroleum marketing	0	0	1632.30
15	Chemical industry	0	0	168.80
16	Commercial air dried surface coatings	0	0	1170.59
19	Aircraft piston exhaust	0	0	7.00
20	Jet exhaust	348.4	169.20	126.60
24	Pesticides	0	0	96.30
25	Wood processing	0	32.80	112.00
27	Waste burning and wildfires	283.2	0	79.20
31	Mineral industry	33.6	1000.80	0
32	Food processing	0	1228.80	0
35	Metallurgical industry	0	1.60	11.20
40	Petroleum storage at gas stations	0	0	152.00
41	Industrial air dried surface coatings	0	0	2311.15
42	Halogenated degreasing	0	0	248.00
43	Synthetic dry cleaning	0	0	447.80
46	Perchloroethylene dry cleaning	0	0	995.70
48	Heat treated surface coating	0	0	406.60
62	Domestic fuel combustion	86.8	542.77	36.26
66	Wine processing	0	0	9753.50
71	Industrial external combustion boilers-natural gas	78.9	1149.23	13.84
78	Petroleum production external combustion boiler	0	0	2.40
127	Commercial natural gas-external combustion boilers	35.2	212.50	14.56
	Totals	289377.2	25761.74	50539.21

AUGUST 1976

FRESNO THC EMISSIONS

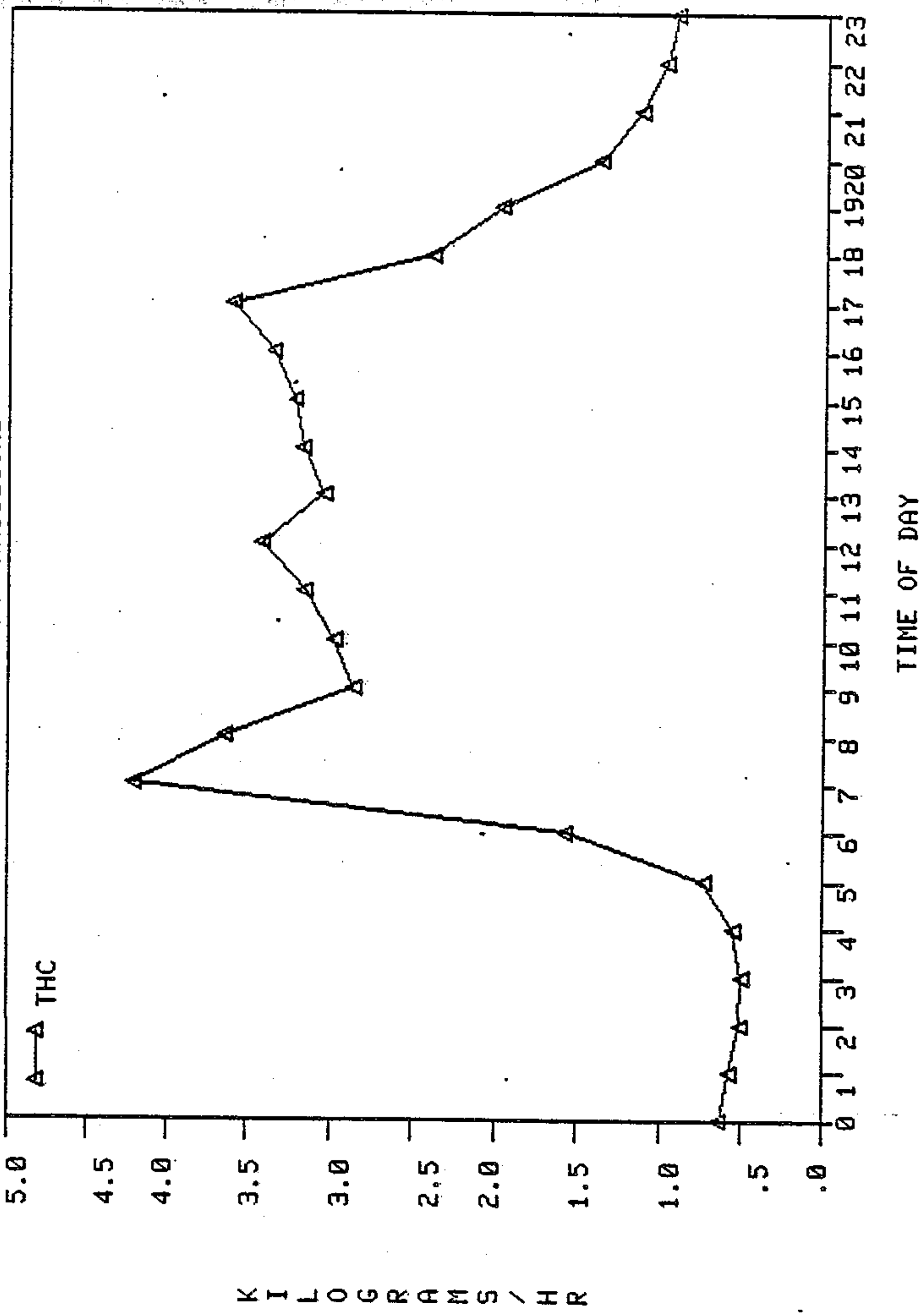


FIGURE 3

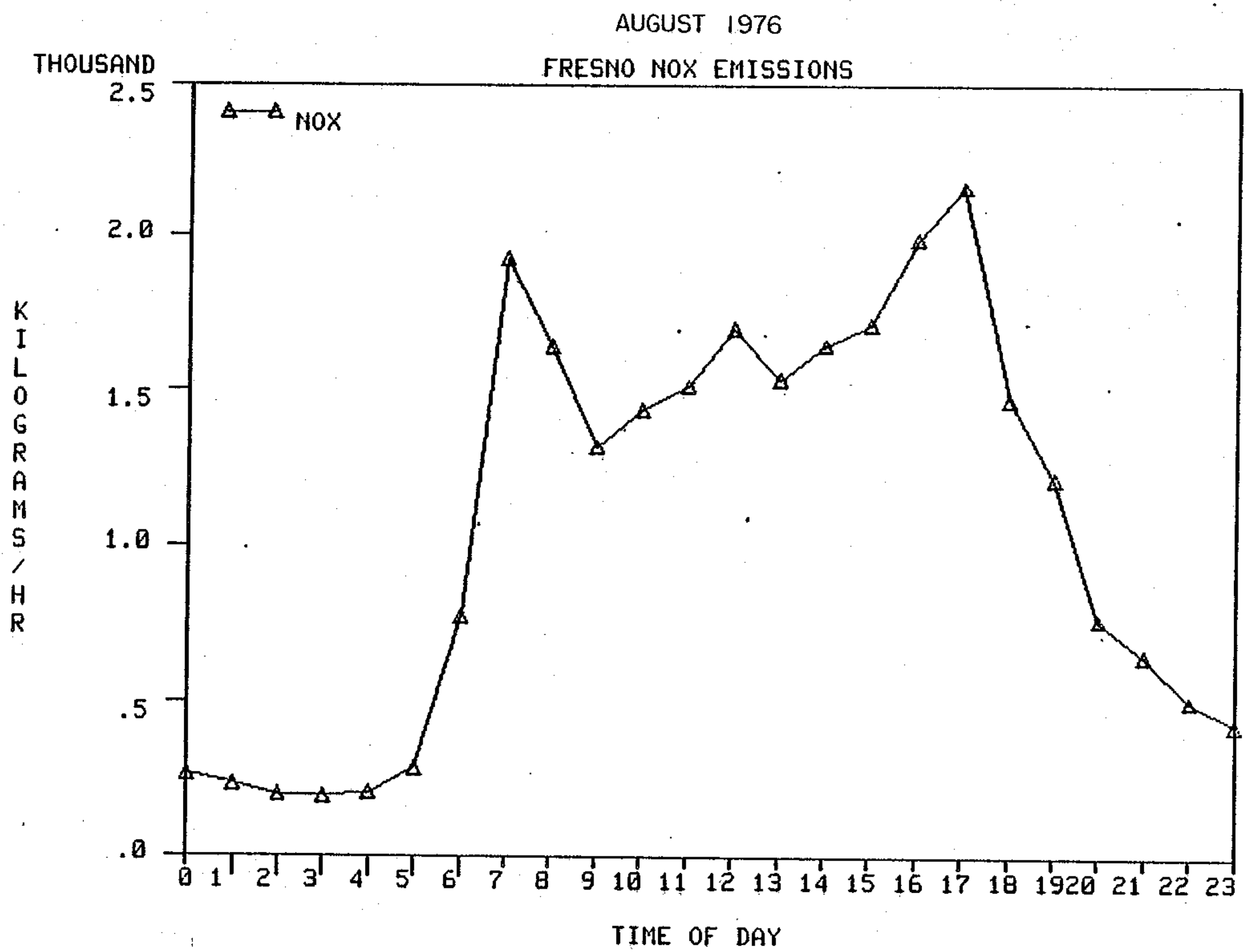
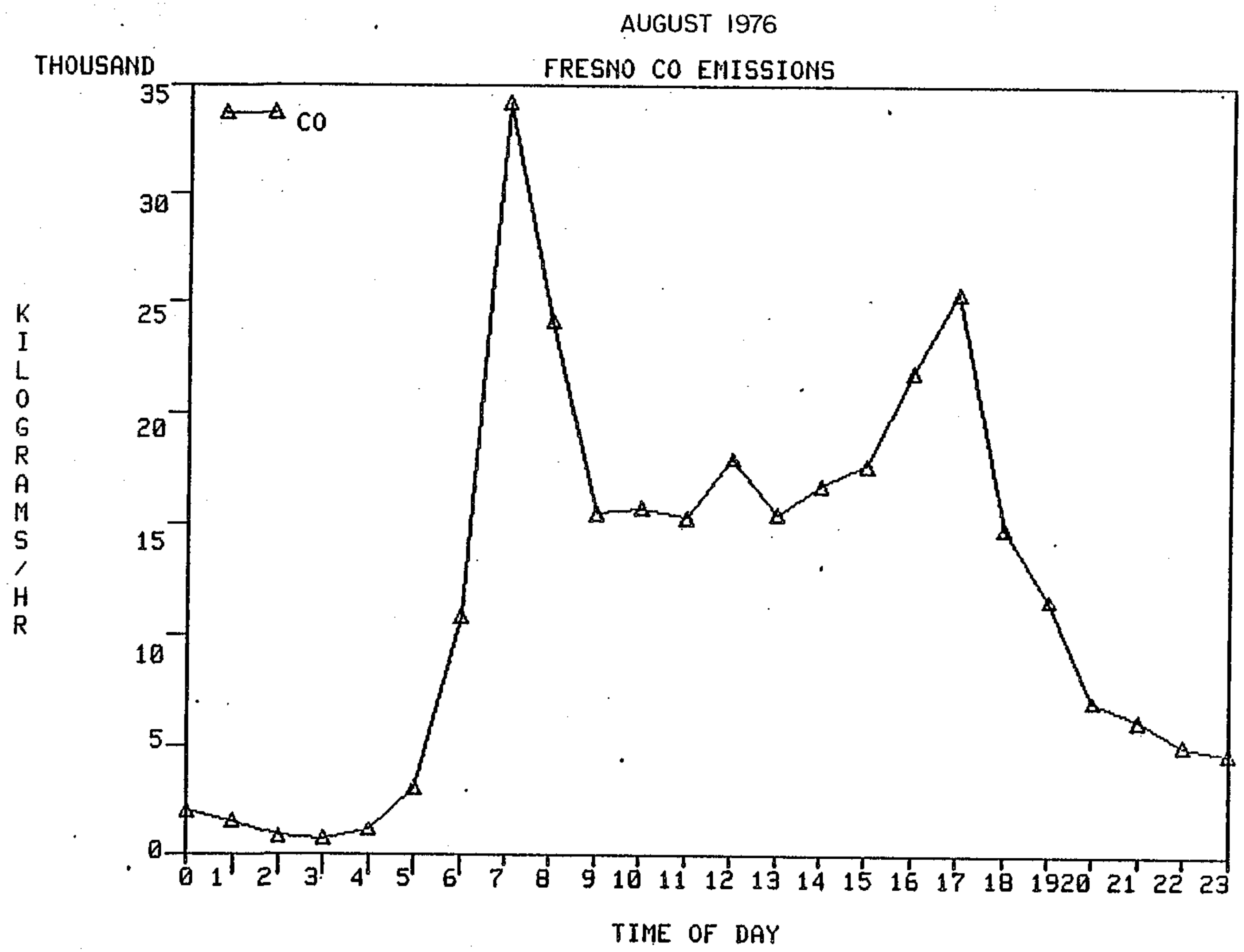

AUGUST 1976
FRESNO NOX EMISSIONS
THOUSAND
2.5
2.0
1.5
1.0
.5
.0
KILOGRAMS/HR
NOX
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 1920 21 22 23
TIME OF DAY

FIGURE 4



AUGUST 1976
FRESNO CO EMISSIONS
THOUSAND
KILOGRAMS/HR
CO
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 1920 21 22 23
TIME OF DAY

FIGURE 5

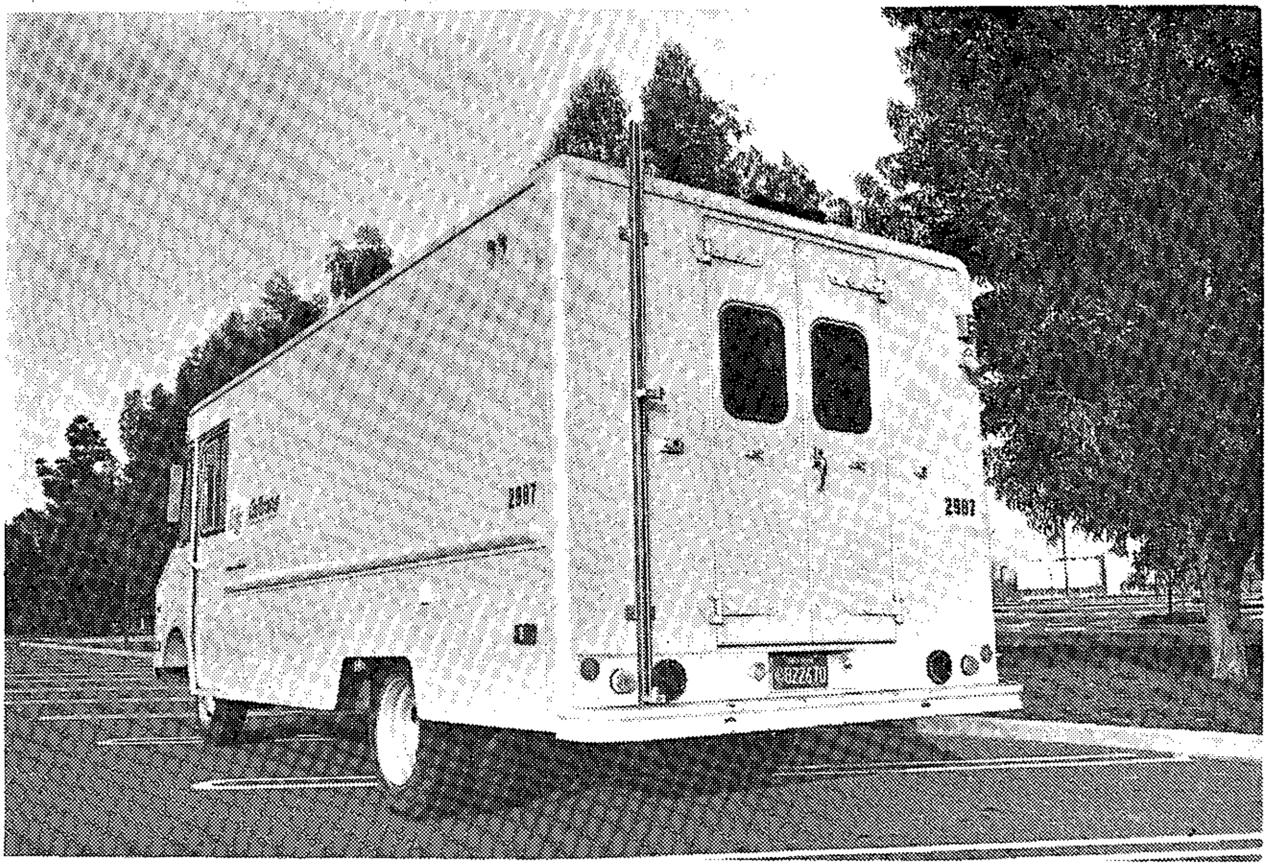
Table 1 and Figures 3 through 5 show data on emissions from sources in the Fresno region.

AEROMETRIC DATA BASE

In order to verify a regional air quality model, it is necessary to rationally determine the ambient air quality concentrations throughout the study area. This process is referred to as development of a data base. Then when the predictions from the air quality simulation program are computed, the predicted concentrations can be compared with the known concentrations and the ability of the simulation model to effectively estimate pollutant concentrations can be judged. In order to establish such a data base for the Fresno study, several locations were monitored during the summer of 1976. The monitoring was a joint effort of the CARB Technical Services Division and Caltrans District 06. Other air quality data were received from the CARB downtown stations and the Parlier monitoring station of the Fresno APCD.

Air Quality Monitoring

The CARB Technical Services Division stationed three vans containing pollutant monitoring equipment in the Fresno study region. They were stationed in the western, eastern and northern areas of the metropolitan Fresno area; on Neilsen Avenue near Marks Avenue in the west, on Simpson Avenue near Chestnut Avenue in the east and on the campus of Fresno State University in the north. The pollutant monitoring van operated by Caltrans District 06, shown in Figure 6, divided its time between several locations. It was moved during the morning of each working day.



MOBILE AIR MONITORING VAN

FIGURE 6

Each of these four monitoring units had the capability of monitoring ozone, oxides of nitrogen, hydrocarbons and carbon monoxide. Information on sampling devices is given in Table 2. The CARB's permanent downtown Fresno station, located near the intersection of First and Olive Streets, monitored ozone, oxides of nitrogen and carbon monoxide. The monitoring stations of the Fresno APCD at the Fresno County Court House and in the Parlier area both measured ozone and carbon monoxide.

For analysis of midday peak ozone periods, the vans placed in the north and west sections of the study region can be viewed as representing the upwind or background concentrations. The readings from the Parlier APCD station can be viewed as representative of the downwind ozone concentrations showing the effect of pollutant emission contributions from metropolitan Fresno.

The Caltrans data were placed on magnetic tape as they were measured while the other information was delivered as written monthly reports.

Meteorologic Data

Six stations, generally concentrated in the central urban area, were established to gather wind speed, wind direction and temperature data. They were mechanical weather stations (MWS) produced by Meteorology Research, Inc. (MRI). These are self-contained battery-driven units which record wind speed, wind direction and temperature data on paper tape. Solar radiation was measured using a detector on the roof of the Caltrans District 06 materials laboratory building.

TABLE 2

Type of Instrumentation Used in Air Quality Data Collection

		ARB	APCD	CALTRANS
Ozone				
	Instrument	Dasibi	Dasibi 1003AH	Dasibi 1003AH
	Technique	UV absorption	UV absorption	UV absorption
	Calibration	Once every 6 mos. (daily check)	Once every 6 mos.	Checked every day. Calibrated by AIHL every 3 mos.
NO_x				
	Instrument	TECO	Not measured	Monitor Labs 8440
	Technique	Chemiluminescent		Chemiluminescent
	Calibration	Once every 6 mos. (daily check)		Weekly
THC				
	Instrument	Beckman 6800	Not measured	Bendix 8201
	Technique	Gas Chromatograph		Flame Ionization
	Calibration	Daily		Zeroed and spanned on a daily basis.
CO				
	Instrument	Beckman 6800	Beckman 315	Beckman 315
	Technique	Gas Chromatograph	NDIR	NDIR
	Calibration	Daily	Once every 6 mos.	Daily

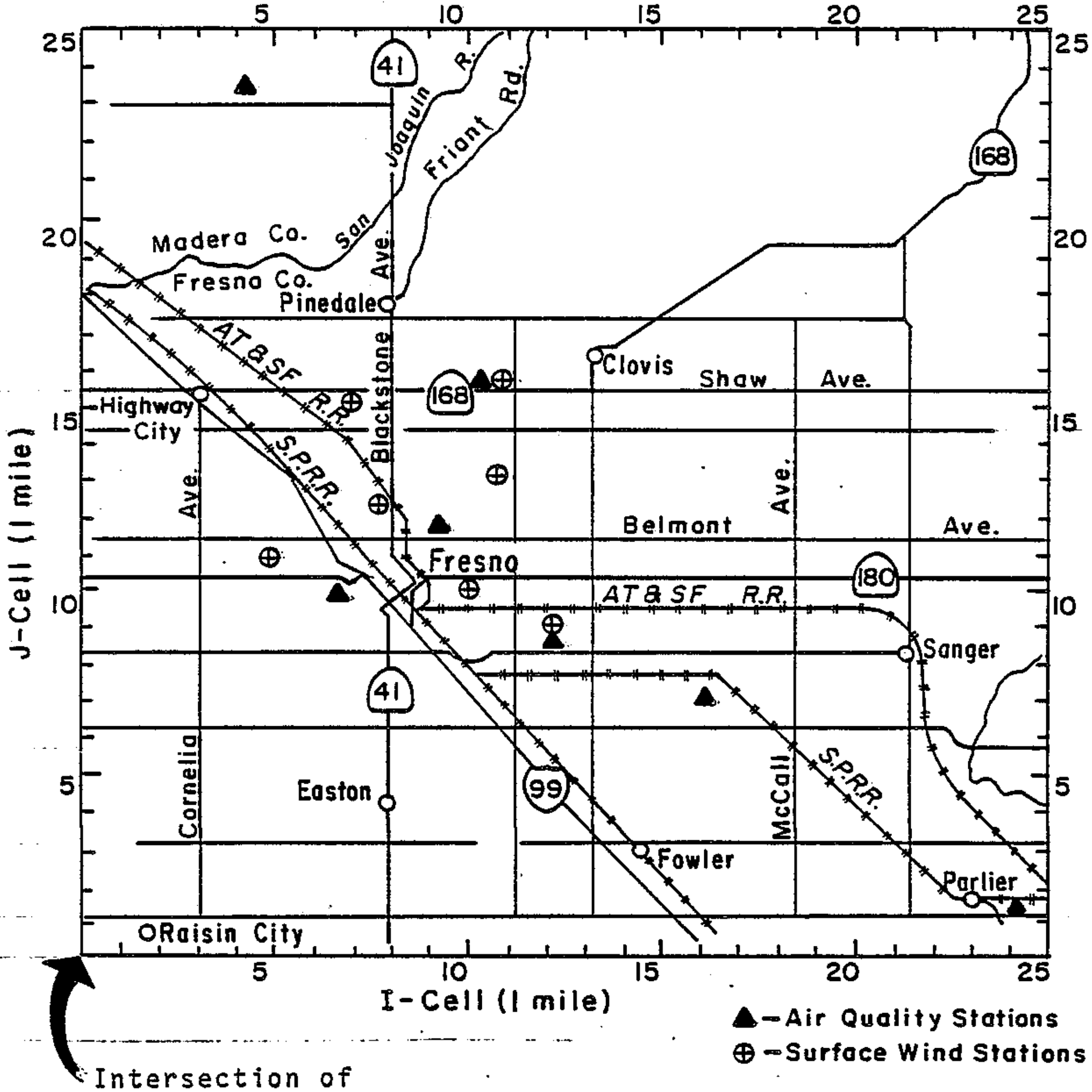
TABLE 3

Monitoring Stations

Area-Site	Station Name	U.S.G.S.Quad	I UTM(east)	I Grid Unit	J UTM(north)	J Grid Unit
2800-032	Chandler Field	Fresno South	248,020	6.50	4,068,700	9.15
2820-033	3145 S. DeWolf Ave.	Malaga	263,550	16.15	4,063,650	6.00
2800-034	USDA-Peach Ave.	Malaga	257,400	12.35	4,067,400	8.35
2800-035	1st and Olive	Fresno North	252,700	9.45	4,071,400	10.80
2800-036	Fresno State Univ. (Caltrans)	Clovis	255,050	10.90	4,077,850	14.80
2820-037	Raisin City	Raisin	240,000	1.55	4,054,200	0.10
4320-038	Rd 35,1/4 Mi S of Ave.14	Gregg	242,400	3.05	4,091,200	23.10
2800-039	Fresno City College(ARB)	Fresno North	250,800	8.25	4,072,600	11.55
2800-040	Arthur & Santa Ana(ARB)	Fresno North	249,000	7.15	4,076,700	14.10
2800-041	USDA-Peach Ave.(ARB)	Malaga	257,350	12.30	4,067,500	8.40
2800-042	NCFD-Neilson & Marks(ARB)	Fresno South	246,000	5.25	4,069,800	9.80
2800-043	Near Fresno Air Terminal (ARB)	Clovis	255,750	11.30	4,073,650	12.20
2800-044	Fresno State Univ.(ARB)	Clovis	255,900	11.40	4,077,850	14.80
2800-045	Fresno District Fair	Malaga	254,450	10.50	4,068,800	9.20
2800-046	County Courthouse(ARB)	Fresno South	251,000	8.35	4,069,050	9.35
2800-047	1st and Olive(ARB)	Fresno North	252,700	9.45	4,071,350	10.85
2800-048	County Health Dept.(ARB)	Fresno South	254,350	10.45	4,069,100	9.40
2820-049	Parlier(APCD)	Selma	275,850	23.80	4,054,150	0.10
2800-050	Caltrans District Office	Fresno North	247,650	6.30	4,071,650	10.95
2800-301	Fresno MFCD, Shaw Ave.	Fresno North	246,600	5.65	4,077,250	14.45
2800-302	Caltrans Maint. Station	Fresno North	247,500	6.20	4,071,800	11.05
2800-303	Rte 41/99 Interchange	Fresno South	251,300	8.55	4,067,100	8.15
2800-304	Rte 180 at Phillips	Malaga	259,250	13.50	4,068,800	9.20
2800-305	Fresno Irrigation Dist.	Fresno North	253,500	9.95	4,072,100	11.25
2800-306	Fresno State Univ.	Clovis	255,200	11.00	4,077,950	14.90
2820-308	E. Herndon Road	Round Mtn.	267,900	18.90	4,079,650	15.95
4320-309	Rd 35,1/4 Mi S of Ave.14	Gregg	242,350	3.00	4,091,200	23.10
2820-310	Parlier Met Station	Selma	275,750	23.75	4,054,150	0.10
2820-311	Raisin City Met.	Raisin	240,100	1.60	4,054,200	0.10

FIGURE 7

AIR QUALITY AND SURFACE WIND STATIONS



Intersection of
extensions of Springfield
Road and Chateau Fresno
Road
UTM 237, 530E; 4,054,000 N

Table 3 lists the stations that were used to gather data for the study and Figure 7 shows the locations of the stations by type.

FIELD DATA PROCESSING(16)

Data Logger

The data logger used on the Caltrans van was the Datel Model LPS-16 as modified by the California Transportation Laboratory. The data logger is an electrically powered tape recording device that can interface with a monitoring system. The output from ambient pollutant level analyzers or meteorologic equipment is placed on magnetic tape, and the tape is reduced by the use of a minicomputer. The minicomputer, using BASIC computer language, prints out the readings in report form by type of pollutant or weather feature. These readings are then visually inspected for completeness and accuracy, and faulty data are removed. The edited data are then automatically placed into our AQDHS computer file, through the use of another computer program.

Digitizer

Wind and temperature data taken by the MWS devices, were reduced using a Graf-pen sonic digitizer. The digitizer is a device for determining X-Y coordinates in digital form from entries on a graphic record. The coordinates are then entered automatically into a data processing mini-computer. The digitized coordinates in the mini-computer are reduced to recognizable formats of wind speed, wind direction, and temperature. The data are then recorded on a 7-track magnetic tape and placed into the AQDHS computer file.

Data Handling Files

Two important air quality data files were used in the modeling portion of this research project.

AQDHS was developed by the Environmental Protection Agency (EPA) at Research Triangle Park, North Carolina(17). It has provisions for handling and storing every type of air pollution-related data of general interest. AQDHS is considered a central file for all air quality data taken by Caltrans in the State of California. The Caltrans AQDHS file(18) is managed and maintained by the Transportation Laboratory, and most Caltrans District environmental sections store data in this file.

Caltrans air quality data taken in the field or received from other data gathering agencies is reduced to AQDHS format and put into the AQDHS computer file. AQDHS is programmed for adding, deleting, or changing data in the file. From this computer file, programs are available to print out written reports for distribution to interested agencies or individuals and computer programs exist to access the file for use in various aspects of modeling work.

Modeling Study Data Staging (MSDS)(19) is a file developed by MAQU to store the information needed by a particular model for particular candidate modeling days. Rapid data access from MSDS to air quality models of any scale is designed into the MSDS system.

A computer program was developed for this research project which automatically converts the AQDHS file format to MSDS format. The MSDS file is also compatible with the Emission Inventory System (EIS) point source accounting effort(20). It is expected that point and area source data to be used in a computer modeling effort would be formatted directly for the MSDS file.

To aid the researcher/analyst in determining the meteorology of a region to be modeled, a computer program(1) was developed to select all the AQDHS meteorology data for a candidate day and print the magnitude and direction of the measured winds. After the wind data are taken from the AQDHS file, they are processed by the computer program, and vectors representing the wind speed and direction are plotted using a Calcomp plotter.

The output from this plot program enables the air quality engineer to see the directions of the wind for each of the hours to be modeled. It also can serve to show the analyst that certain wind stations were perhaps not operating correctly, enabling him to have the faulty data removed from the modeling data base.

CANDIDATE DAYS AND THE MODELING PROCESS

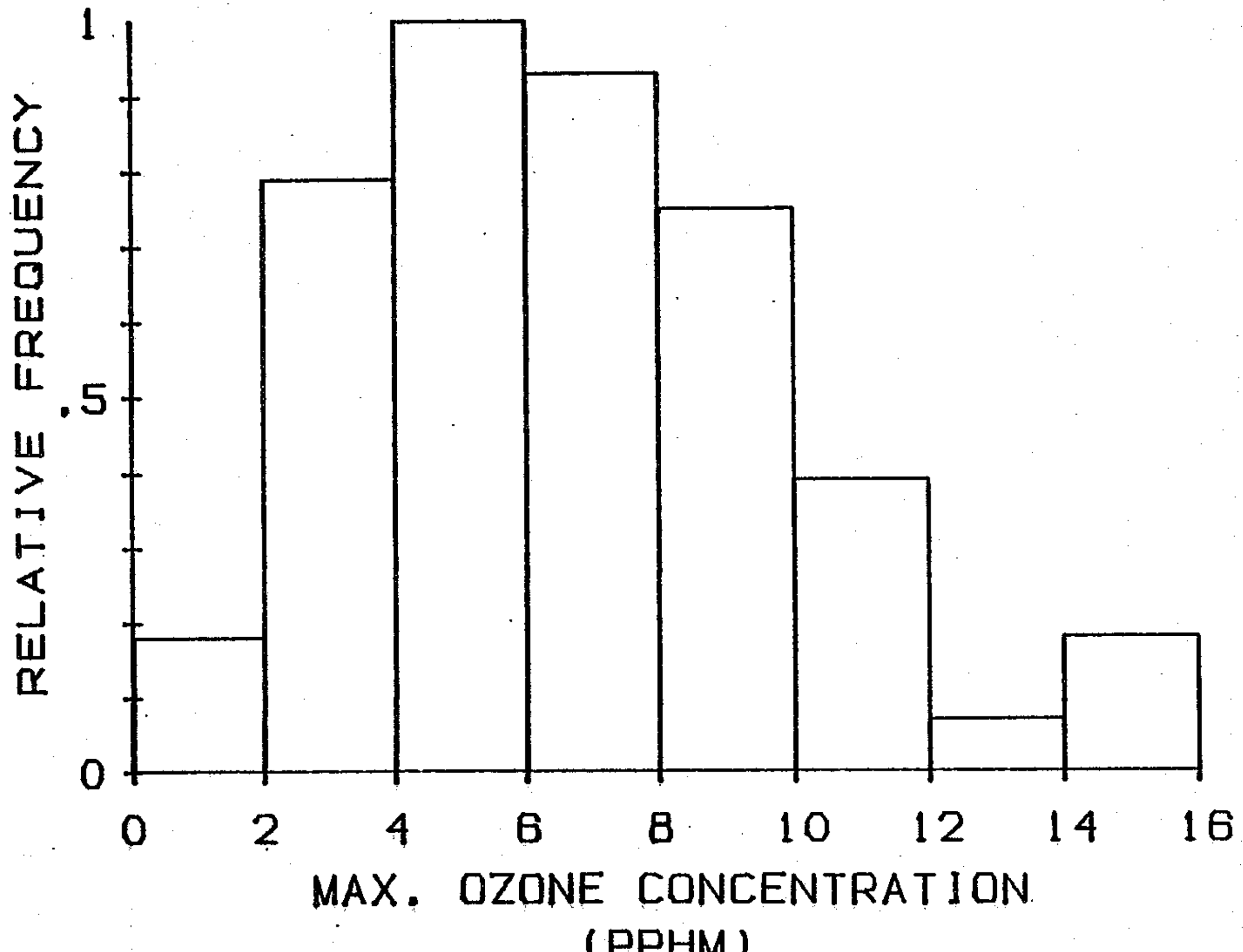
The selection of days for ozone modeling is determined from several considerations. Since the desired end result of air pollution simulation modeling for ozone is a verified model which can simulate the various control strategies available to alleviate high ozone levels, the verification must be done for a day where ambient ozone measurements were unusually high.

Therefore, the first chore in selecting a candidate day is to review all days for which air pollution concentrations have been monitored with an eye toward selection of ozone episode days. Figures 8, 9, and 10 show the relative frequency of maximum ozone concentrations during July, August, September and October 1976 at the County Health Department, CARB Olive and Parlier monitoring sites. In these figures, the relative frequency of 1.0 was assigned to the most frequent maximum ozone concentration range in the Fresno region for the months studied. Thus, a relative frequency of 0.5 indicates that this range of ozone concentrations occurred one-half as often as did the most frequent range.

After the initial review designates the days of high ambient ozone concentrations, the second step is to check the day of the week on which the high ozone concentrations were measured. In this step, the days where the data base will surely be incomplete (Saturdays and Sundays, for example) can be eliminated. Weekends do not qualify since employees assigned to gather data are not working those days, and pilot balloons will not have been released, nor will temperature and pollutant monitoring aircraft have been flown on those days. Furthermore, the automated monitoring instrumentation will not have received its daily checkout.

On any day it is possible that one or more monitoring locations were not in service; and since fiscal constraints usually limit the data gathering effort to that amount minimally sufficient, the completeness of the prospective data must be considered when judging the qualifications of a candidate day. This will reduce the candidate days to those weekdays where high ozone occurred, and the data gathering effort seems adequate.

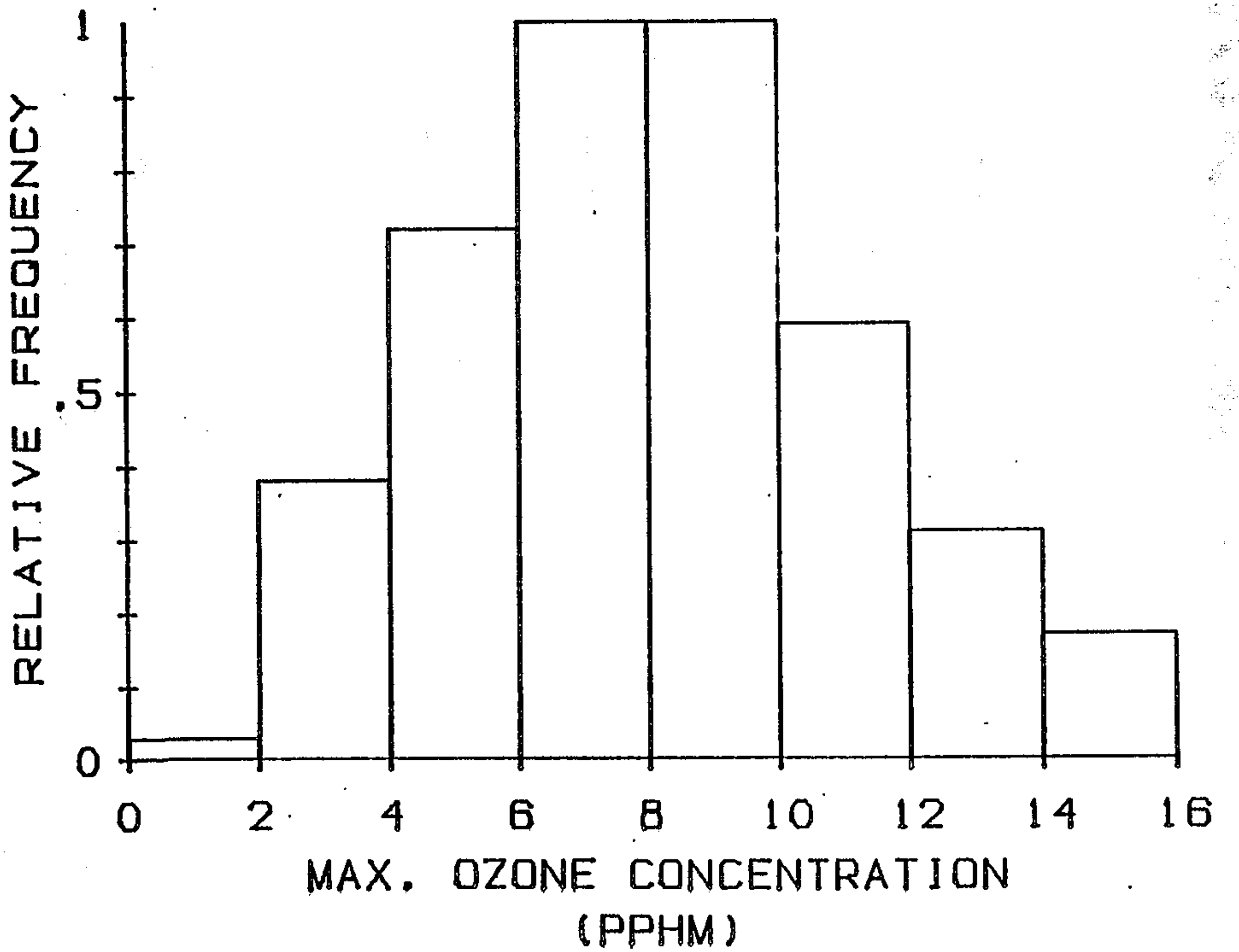
FREQUENCY OF OCCURRENCE OF MAXIMUM OZONE CONCENTRATIONS, JULY THROUGH OCTOBER, 1976



CARB OLIVE

FIGURE 8

FREQUENCY OF OCCURRENCE OF MAXIMUM OZONE CONCENTRATIONS, JULY THROUGH OCTOBER, 1976



COUNTY HEALTH DEPT.

FREQUENCY OF OCCURRENCE OF MAXIMUM OZONE CONCENTRATIONS, JULY THROUGH OCTOBER, 1976

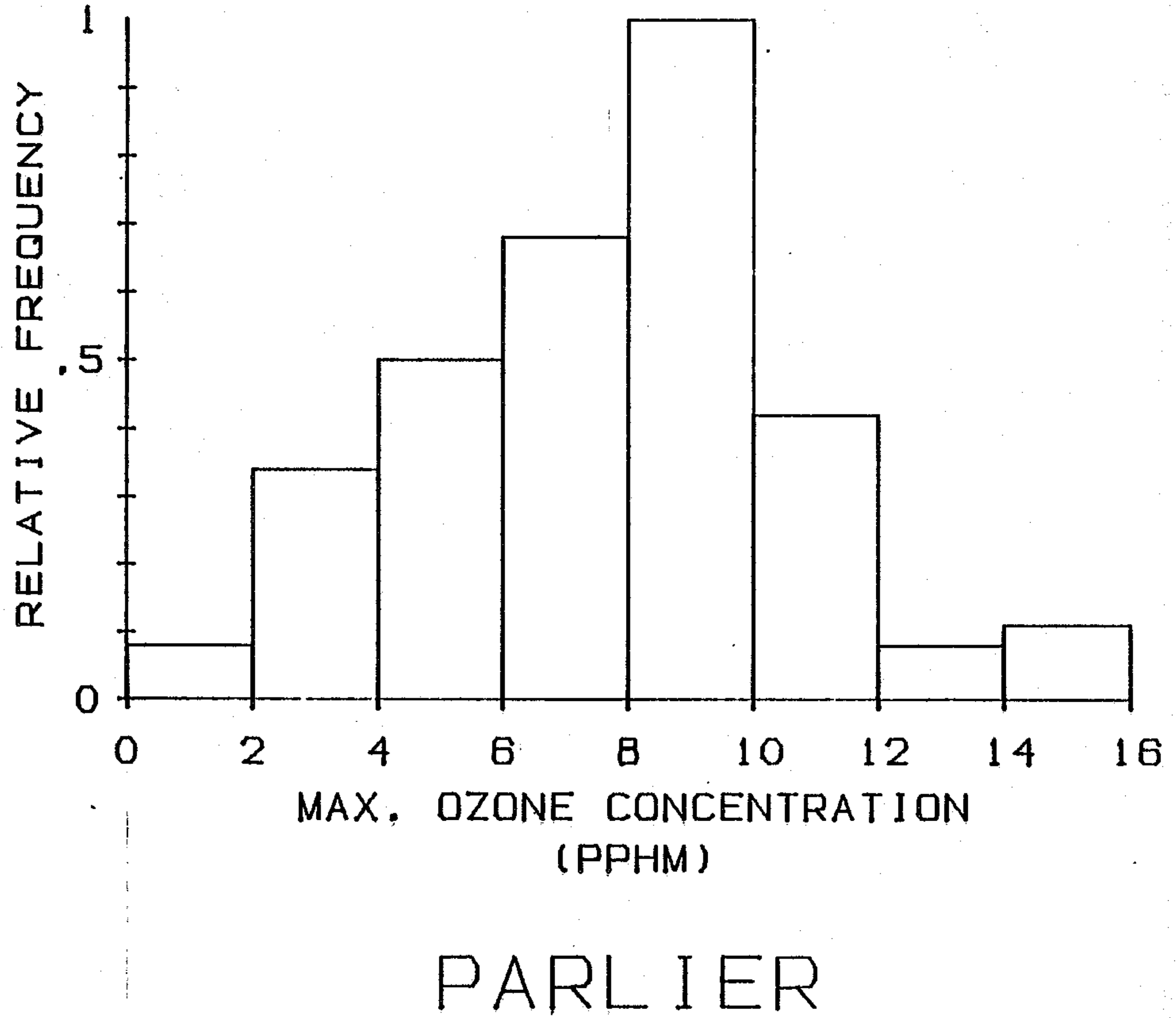


FIGURE 10

The next step is to review other agencies as possible sources of data that can be used in the modeling effort. Examples are APCDs for wind and meteorologic data, the ARB and APCD monitoring stations for ozone, carbon monoxide and other pollutants, and segments of private industry which often monitor ambient air quality for a number of public or private reasons.

Next to be considered is the quality of all the gathered data, their completeness, and their compatibility with the objectives of a regional ozone air pollution simulation program. It should now be possible to reduce the data collected during a two to three month monitoring period to those four to eight candidate days most appropriate for verifying an ozone model, and to tentatively rank them in order of desirability.

All available data for the candidate days are then entered into the AQDHS and MSDS computer files. These data include solar insolation, temperature, wind speed and direction at ground level and aloft, and all monitored ambient air pollutant observations.

For the Fresno project, wind data from as many as nine stations were put into the aforementioned computer program which plots wind flow fields. A second computer program associated with the SAI Airshed model used an "r^{-2}" distribution to determine wind speeds and directions statistically in order to find an estimate of speed and direction for each of the 625 grid cells in the Fresno study region. Similar statistical methods from the SAI model were used to distribute the measured ambient air pollutant levels throughout the 625 grid cells. These data provided an estimate for pollutant concentrations between monitoring stations, and they also provided estimated pollutant levels in those boundary areas of the modeling area in which no pollution monitoring devices existed.

The wind flow field plots and the statistically distributed pollutant concentrations were then inspected for compatibility with computer requirements. An example of an important requirement for computer modeling is the lack of any steep gradients. For example, between adjacent grid cells, changes like an order of magnitude are not allowable, and indeed gradients that simply double across cell boundaries are not desirable.

After examining the data for completeness and viewing the computer generated distribution of air pollution and meteorologic data throughout the study area, the final step in the process of selecting candidate days is to inspect the emissions data to determine if any unedited anomalous sources that might upset the verification of an ozone model were inventoried for any of the days.

SMOG MODEL VERIFICATION

The SMOG model (Simulation Model for Ozone Generation) was developed from the IMPACT model by MAQU and Form and Substance, Inc. of Westlake Village, California. The SMOG model is maintained for public usage by the CARB. MAQU used the SMOG model for a Sacramento ozone simulation using the data of June 28, 1976(11) and were successful in achieving a model verification. The Air Quality Unit of the Caltrans Laboratory also verified the same model for ozone in Sacramento using the data base for August 24, 1976.

Model Input Requirements

Unlike models which use preparation programs, grid cell distribution of wind data, air quality data, diffusivity data, and upper cell concentrations are included in the SMOG model's single simulation run.

Inputs must include initial concentrations of ozone, nitrogen dioxide (NO_2), nitric oxide (NO), and hydrocarbons. An important set of air quality inputs is that of the boundary conditions. This information is necessary to enable the computer to quantify the pollutant concentrations in air advected into the gridded study area. Wind information must be submitted for each hour of simulation time.

The SMOG model user may choose the number of layers to be modeled in the vertical direction. Each may have independent and changing pollutant concentrations. The user must input background (starting) concentrations for each of the layers. The number of vertical layers is generally determined by assessing the funding available for computation time (more cells mean higher costs), the user's knowledge of aloft pollutant levels, and the height of the mixing level.

Development of the Input Values

As the modeler gains experience, he finds that he is able to assign relatively correct pollutant concentrations to various locations in the ground surface layer, and in the elevated layers even in the absence of direct measurements. Certain phenomena help the modeler. In the case of ozone, direct ground interception and NO emissions from motor vehicles tend to scavenge the ozone at night along the surface of the earth. On the central valley floor in urban areas, this ozone depression is perhaps 80-100 percent complete. Analysis of the data taken during our airplane flights in the southern San Joaquin Valley with an ozone monitoring device on board enabled our personnel to estimate the ozone profile in Fresno up to the maximum vertical cell elevation of 600 or 800 meters. This was done largely by examining the Fresno ground concentrations over a two-day period and determining night and morning surface and aloft concentrations measured in the Bakersfield region under similar conditions. Specifically, for the August 24 candidate day, the ground level ozone initial conditions were fixed at 0.01 ppm and ozone concentrations for the second vertical layer were fixed at 0.05 ppm. For the August 31 candidate day, on which higher ozone concentrations were encountered, the assigned initial conditions were 0.01 ppm for the surface layer and 0.07 ppm for the second layer.

Other inputs which require judgment are the correct ambient concentrations of reactive hydrocarbons. It is generally agreed that measurement of ambient reactive hydrocarbons is the weakest link in the state of the air pollution monitoring science, and the measurements made in the Fresno region would tend to support this idea. The reactive hydrocarbon readings taken in the Fresno region on the candidate days vary from zero to 0.9 ppm with zero being by far the most predominant reading. For example, during the critical 6:00 a.m. to 9:00 a.m. period on August 31, the reactive hydrocarbon concentrations observed were zero, 0.2 ppm, and 0.9 ppm. These readings vary too greatly to arrive at a sensible average.

As an alternative to using the directly monitored reactive hydrocarbon readings, it was decided to use an equation developed by the CARB for relating total hydrocarbon (THC) and reactive hydrocarbon (RHC) concentrations in the Los Angeles Basin. The equation is

$$THC = 1.55\ RHC + 1.35 \qquad \text{(Eq. 1)}$$

The monitored total hydrocarbon readings are recognized to be reasonably accurate since they are more easily distinguished than reactive hydrocarbons in a sample of air.

After determining the estimated reactive hydrocarbon concentration from Equation 1, a set of hydrocarbon splits developed by the CARB was used to break down the reactive hydrocarbons developed from the equation into the lumped species to be used by the SMOG model.*

In the absence of any measurements of concentrations of total or reactive hydrocarbons for the upper vertical cells, concentration assignments were based on the amount of pollutant that atmospheric chemists on the CARB staff said were necessary to produce ozone concentrations determined to be correct for that altitude.

*Hydrocarbon Splits

1. Olefins 13% with 2.9 average carbon atoms/molecule
2. Aromatics 26% with 7.0 average carbon atoms/molecule
3. Paraffins 60% with 3.75 average carbon atoms/molecule
4. Aldehydes 1% with 1.73 average carbon atoms/molecule

There is another way to view the situation, one which would have resulted in a lower hydrocarbon assignment for the upper level cells. In this alternate scenario, the modelers could have assumed that the upper level ozone was advected from nearer the surface and was simply residing there without accompanying significant concentrations of hydrocarbons and NO_x.

In the case of oxides of nitrogen, the observed surface concentrations from our field monitoring were used. NO concentrations close to zero were taken when high concentrations of ozone were present. Concentrations of NO_x aloft were based on the steady state equilibrium equation $O_3 = \frac{K_1}{K_3} \frac{NO_2}{NO}$ where K_1 is a function of the solar insolation, and K_3 = 20.8 (a constant).

Attached as Appendix A to this report are the SMOG input data for the runs of August 24 and August 31, 1976. The SMOG model user's manual prepared for the CARB is available through that agency(15).

Other necessary inputs were taken from various sources. The elevation of the terrain was taken from U.S. Geologic Survey quad sheets; the surface roughness was estimated by air quality engineers of Caltrans; the solar intensity was measured on the Caltrans District 06 property, and these data were checked for reasonableness by output from computer programs that can develop the solar intensity for any latitude in the northern hemisphere for a given month and day; the air pressure and the concentration of water vapor were taken from U.S. Weather Bureau records and the hourly temperatures were averaged from various Caltrans meteorologic station data.

Initial conditions are presented for the first simulation hour (in these cases 0600-0700). The boundary concentrations are basically similar to initial concentrations, however, boundary concentrations are necessary for each hour of ozone simulation. There is a set (four or six vertical layers thick) of boundary concentrations for each of the four sides of the gridded square plus a set of concentrations for the lid of the simulation box. Caltrans air quality engineers used four vertical layers of 200 meter thickness, MAQU used six vertical layers of 100 meter thickness.

The stability profiles for each hour were largely developed using known surface wind speeds. This procedure was made necessary by the small numbers of pilot balloon readings on candidate days. The vertical temperature profiles were based on data from aircraft temperature flights.

Surface wind and initial concentration inputs to the SMOG model for the candidate days are shown in Tables 4 through 7.

SMOG SIMULATION PROGRAM OUTPUT

The program yields windflow fields for each hour of simulation. Vectors are developed for each vertical cell. Diffusivities are calculated for each vertical cell; and the atmospheric chemistry program, of course, creates the average ozone, NO_x, and hydrocarbon concentration for each grid cell. This information is output in two ways; one is an instantaneous concentration on the hour, and the second is the average

TABLE 4

Surface Wind Data
August 24, 1976

Time (PST)	Shaw Ave @ Santa Fe Cell (6,15)		Caltrans(Olive Street) Cell (7,12)		Rte 41/99 Interchange Cell (9,9)	
	Wind Speed (m/sec)	Direction (Az)	Wind Speed (m/sec)	Direction (Az)	Wind Speed (m/sec)	Direction (Az)
06-07	1.8	0	1.3	330	1.3	330
07-08	1.3	0	1.3	330	1.3	30
08-09	0.9	120	0.9	30	1.3	60
09-10	0.9	330	1.3	105	0.9	210
10-11	1.8	285	1.8	263	1.8	285
11-12	2.2	285	2.7	263	2.7	315
12-13	2.7	285	2.7	263	2.7	308
13-14	3.6	330	2.7	240	3.1	285
14-15	2.7	308	2.7	240	2.7	285
15-16	3.1	285	2.7	263	3.6	285
16-17	3.6	285	3.6	263	3.6	285
17-18	4.0	285	3.6	285	4.0	285
18-19	3.1	285	2.7	285	3.6	285

TABLE 4 (Continued)

Surface Wind Data
August 24, 1976

Time (PST)	Route 180 @ Phillips Cell (14,10)		Fresno Irrigation District Cell (10,12)	
	Wind Speed (m/sec)	Direction (Az)	Wind Speed (m/sec)	Direction (Az)
06-07	0.5	0	0.9	330
07-08	0.5	50	0.9	45
08-09	1.3	135	1.3	135
09-10	1.8	210	1.3	135
10-11	1.3	263	1.8	218
11-12	1.8	285	2.2	285
12-13	2.2	308	1.8	308
13-14	1.8	308	2.2	285
14-15	2.7	285	2.7	285
15-16	3.1	285	2.7	285
16-17	3.6	285	3.1	263
17-18	3.1	285	3.1	263
18-19	2.7	285	2.7	285

TABLE 4 (Continued)

Surface Wind Data
August 24, 1976

Time (PST)	Fresno State Univ. Cell (11,15) Wind Speed (m/sec)	Direction (Az)	Neilson Ave @ Marks Cell (6,10) Wind Speed (m/sec)	Direction (Az)
06-07	0.9	345	1.3	353
07-08	0.5	345	1.8	23
08-09	0.9	120	0.9	353
09-10	2.2	150	1.8	308
10-11	1.8	195	3.1	308
11-12	1.8	240	3.1	308
12-13	2.2	240	2.7	308
13-14	2.7	240	3.1	330
14-15	3.6	263	3.6	308
15-16	3.6	240	3.6	308
16-17	3.6	240	4.5	308
17-18	4.0	263	4.5	308
18-19	3.6	263	3.6	308

TABLE 5

Surface Wind Data
August 31, 1976

Time (PST)	Shaw Ave @ Santa Fe Cell (6,15) Wind Speed (m/sec)	Shaw Ave @ Santa Fe Cell (6,15) Direction (Az)	Caltrans(Olive Street) Cell (7,12) Wind Speed (m/sec)	Caltrans(Olive Street) Cell (7,12) Direction (Az)	Rte 41/99 Interchange Cell (9,9) Wind Speed (m/sec)	Rte 41/99 Interchange Cell (9,9) Direction (Az)
06-07	0.9	105	0.4	270	0.9	75
07-08	0.9	75	0.9	30	1.3	105
08-09	1.3	150	0.9	135	1.8	135
09-10	2.2	165	1.3	150	1.8	165
10-11	1.8	180	1.3	180	1.3	180
11-12	1.8	270	1.3	240	1.8	225
12-13	2.2	300	2.2	270	2.2	240
13-14	2.7	300	2.7	270	2.7	255
14-15	4.0	300	4.0	285	3.6	300
15-16	4.5	300	4.5	285	4.9	300
16-17	4.9	300	4.5	285	4.5	300
17-18	4.0	300	4.0	285	4.5	300
18-19	2.7	285	2.7	270	3.1	285

TABLE 5 (Continued)

Surface Wind Data
August 31, 1976

	Route 180 @ Phillips Cell (14,10)		Fresno Irrigation District Cell (10,12)		Fresno State Univ. Cell (11,15)	
Time (PST)	Wind Speed (m/sec)	Direction (Az)	Wind Speed (m/sec)	Direction (Az)	Wind Speed (m/sec)	Direction (Az)
06-07	0.1	60	0.9	60	0.9	45
07-08	0.4	75	0.9	90	0.9	60
08-09	1.3	150	1.8	135	1.3	135
09-10	1.8	150	2.2	150	2.2	150
10-11	2.2	150	2.2	150	2.7	135
11-12	1.3	195	1.3	225	1.8	210
12-13	1.3	225	1.8	300	1.3	240
13-14	1.8	315	2.2	270	2.2	270
14-15	2.7	300	3.1	300	3.1	270
15-16	3.6	285	3.6	300	4.0	270
16-17	4.0	285	4.0	285	5.8	270
17-18	3.6	285	3.1	285	4.5	270
18-19	2.2	270	2.2	270	4.0	270

TABLE 6

Fresno - August 24, 1979

Initial Concentrations (PPM)

Area From Central Fresno to Parlier

	NO_2	NO	O_3	Olefins	Aromatics	Paraffins	Aldehydes
Surface - 200m	.04	.04	.01	.019	.016	.067	.002
200m - 400m	.04	.001	.05	.013	.011	.044	.002
400m - 600m	.04	.001	.05	.013	.011	.044	.002
600m - 800m	.02	.001	.03	.006	.005	.020	.001

Northern and Southwest Areas

	NO_2	NO	O_3	Olefins	Aromatics	Paraffins	Aldehydes
Surface - 200m	.04	.01	.01	.008	.007	.031	.001
200m - 400m	.02	.001	.05	.005	.004	.020	.001
400m - 600m	.02	.001	.05	.005	.004	.020	.001
600m - 800m	.01	.001	.03	.002	.002	.008	.001

TABLE 7

Fresno - August 31, 1976

Initial Concentrations (PPM) For All Grid Cells

	NO_2	NO	O_3	Olefins	Aromatics	Paraffins	Aldehydes
Surface - 100m	.060	.060	.01	.015	.009	.033	.006
100m - 200m	.001	.001	.07	.010	.006	.022	.004
200m - 300m	.010	.010	.01	.010	.006	.022	.004
300m - 400m	.010	.001	.01	.010	.006	.022	.004
400m - 500m	.010	.001	.01	.010	.006	.022	.004
500m - 600m	.010	.001	.01	.010	.006	.022	.004

concentration for each of these pollutants throughout the hour. At the user's option, this information can be computed and printed out for other selected periods of time, for example every three hours, every six hours, etc. The Fresno study was output on a one hour basis.

The amount of computer expense is largely based on the size and complexity of the modeling volume. For the Fresno SMOG simulation, four vertical cells of 200 meters height (August 24) and six vertical cells of 100 meters height (August 31) were used. These vertical dimensions, along with the 25 north-south cell columns and the 25 east-west cell rows resulted in a central processing unit (CPU) time of approximately 1-1/2 hours. So the Fresno SMOG model required 7 to 8 minutes of CPU time per hour of simulation time or a cost of approximately $50 per hour of simulation time.

SMOG MODEL SIMULATION RUNS

The surface ozone and oxides of nitrogen levels for the runs that simulated candidate day conditions were input directly from data taken by the monitoring equipment. As stated previously, however, development of the reactive hydrocarbon input was not so simple.

Two candidate days, August 24 and August 31, 1976, were the subjects of ozone simulation by the SMOG model in the Fresno region. The August 24 candidate day was modeled by personnel of the Caltrans Laboratory air quality section and the August 31 candidate day was modeled by MAQU personnel. The higher ozone concentrations were observed on the August 31 candidate day.

Two simulation runs were made using the August 24 candidate day conditions, the first with an emission data base showing zero emissions and another with full emissions as determined by the stationary and mobile emissions data inventory. These simulation results were generally favorable, however, the observed ozone pollutant levels were closely approximated in only two downtown stations and not closely approximated in Parlier in particular. Parlier is known to be a high ozone site downwind from the Fresno metropolitan area, and for the August 24 simulations, the ozone levels generated by the computer were low. Figures 11 through 29 show relationships for measured vs model-predicted air pollutant values at the monitoring stations for the August 24 candidate day.

As was the case in the Sacramento regional computer runs, little difference was detected between the zero emissions run and the full emissions run. It is believed this is due to the SMOG model's being more sensitive to the input of initial and boundary conditions than it is to emissions data when the model simulation is done on an intra-day basis.

In other sensitivity trials, Ranzieri, Allen, and Tilden(11) found that a decrease in hydrocarbon emissions of 30% or a decrease in NO_x emissions of 30% resulted in no change on the average in SMOG model generated ozone concentrations from intra-day simulations.

The computer simulations showed that "waves" of high ozone oriented north to south drifted across the study area during

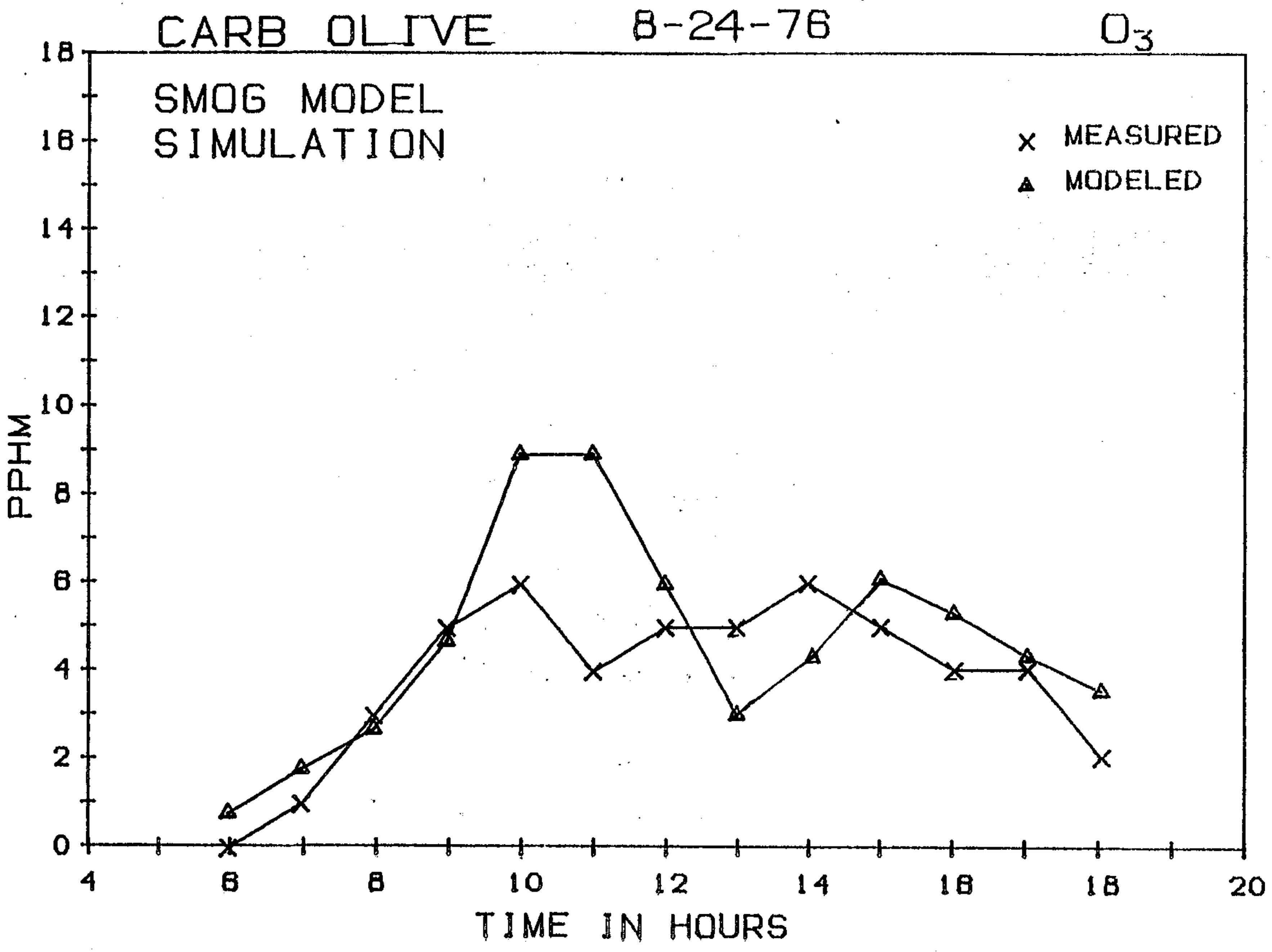
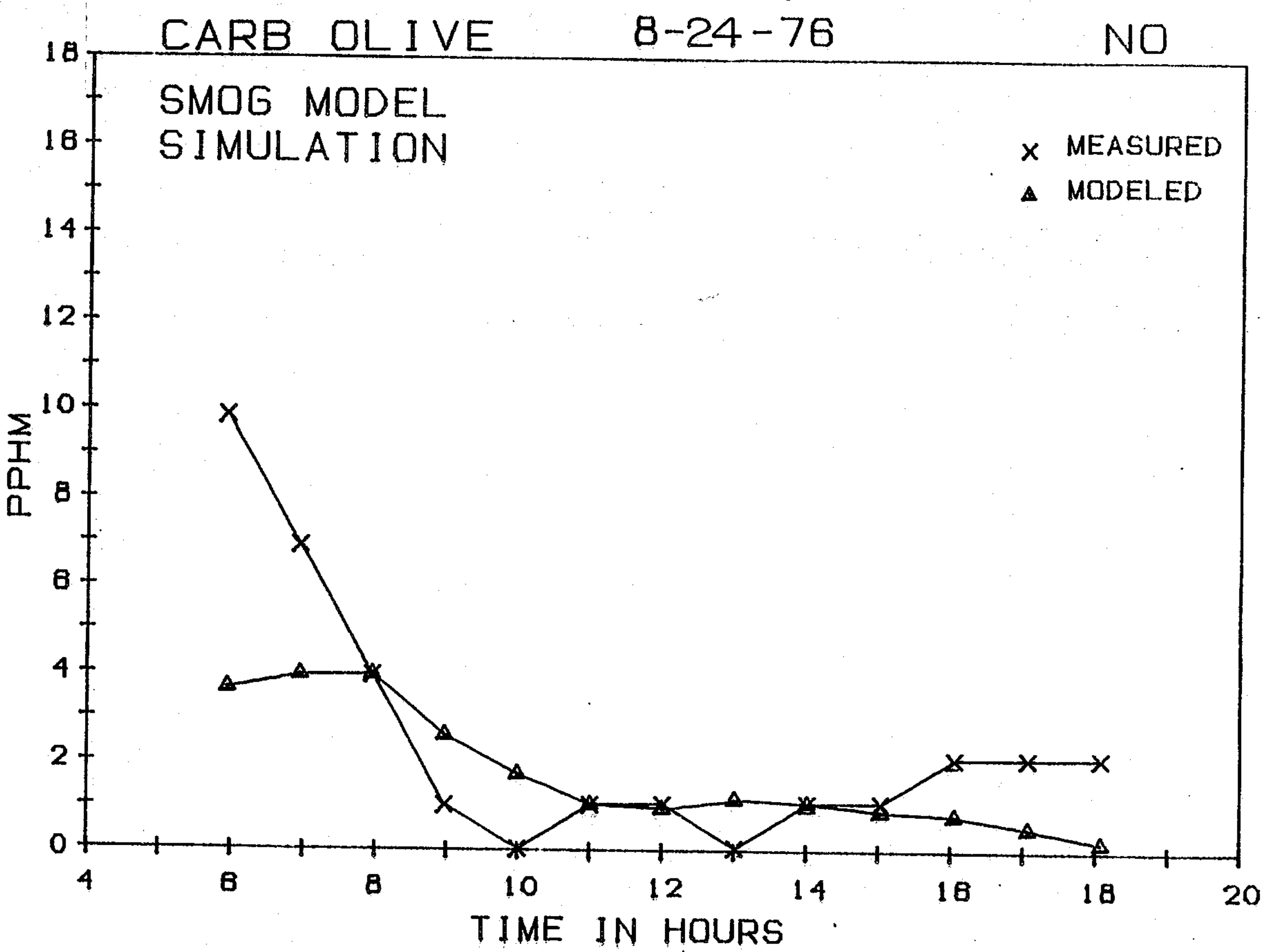

CARB OLIVE
8-24-76
O3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
TIME IN HOURS

FIGURE 11


CARB OLIVE
8-24-76
NO
SMOG MODEL
SIMULATION
X MEASURED
▲ MODELED
PPHM
18
16
14
12
10
8
6
4
2
0
4
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8
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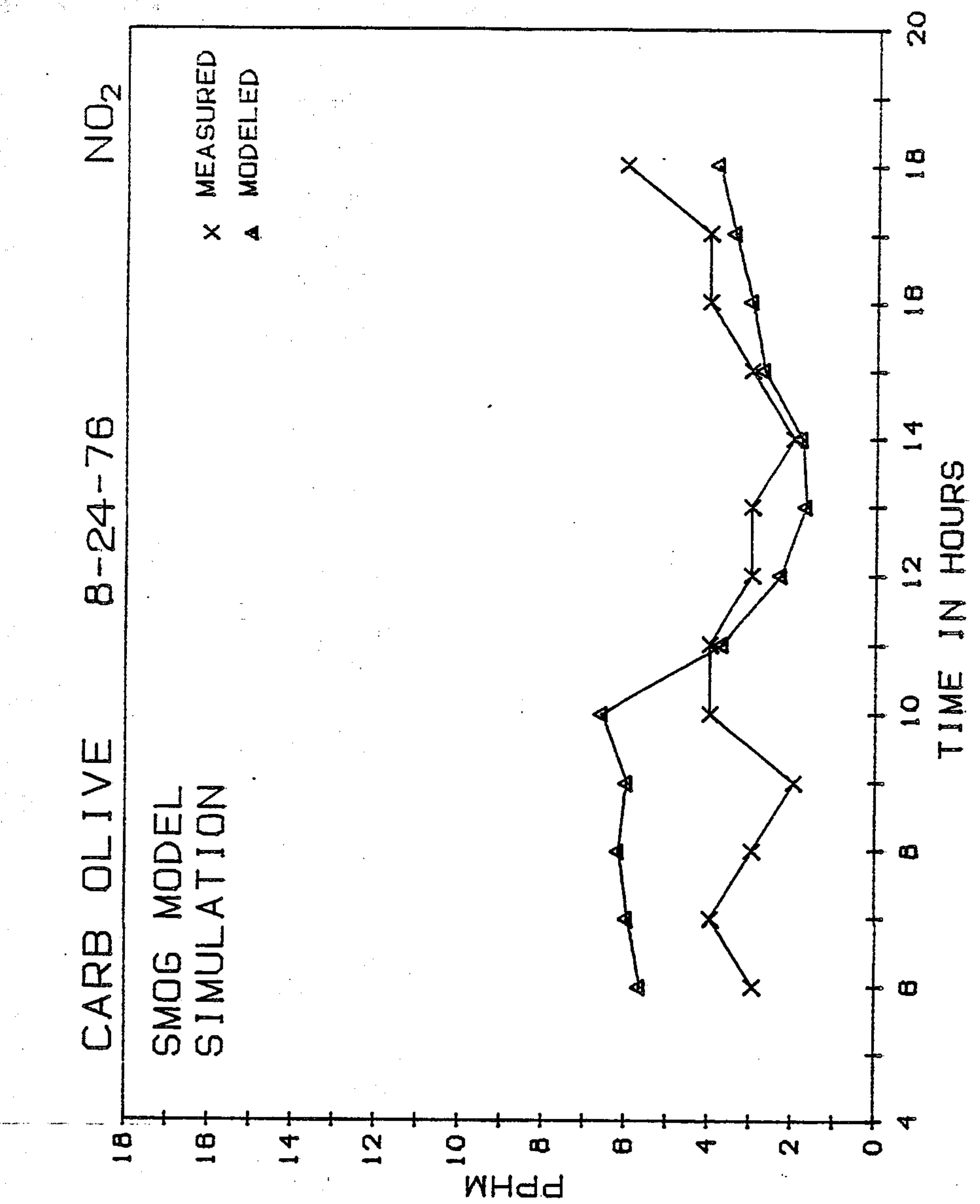
12
14
16
18
20
TIME IN HOURS

FIGURE 12


CARB OLIVE
8-24-76
NO_2
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
TIME IN HOURS

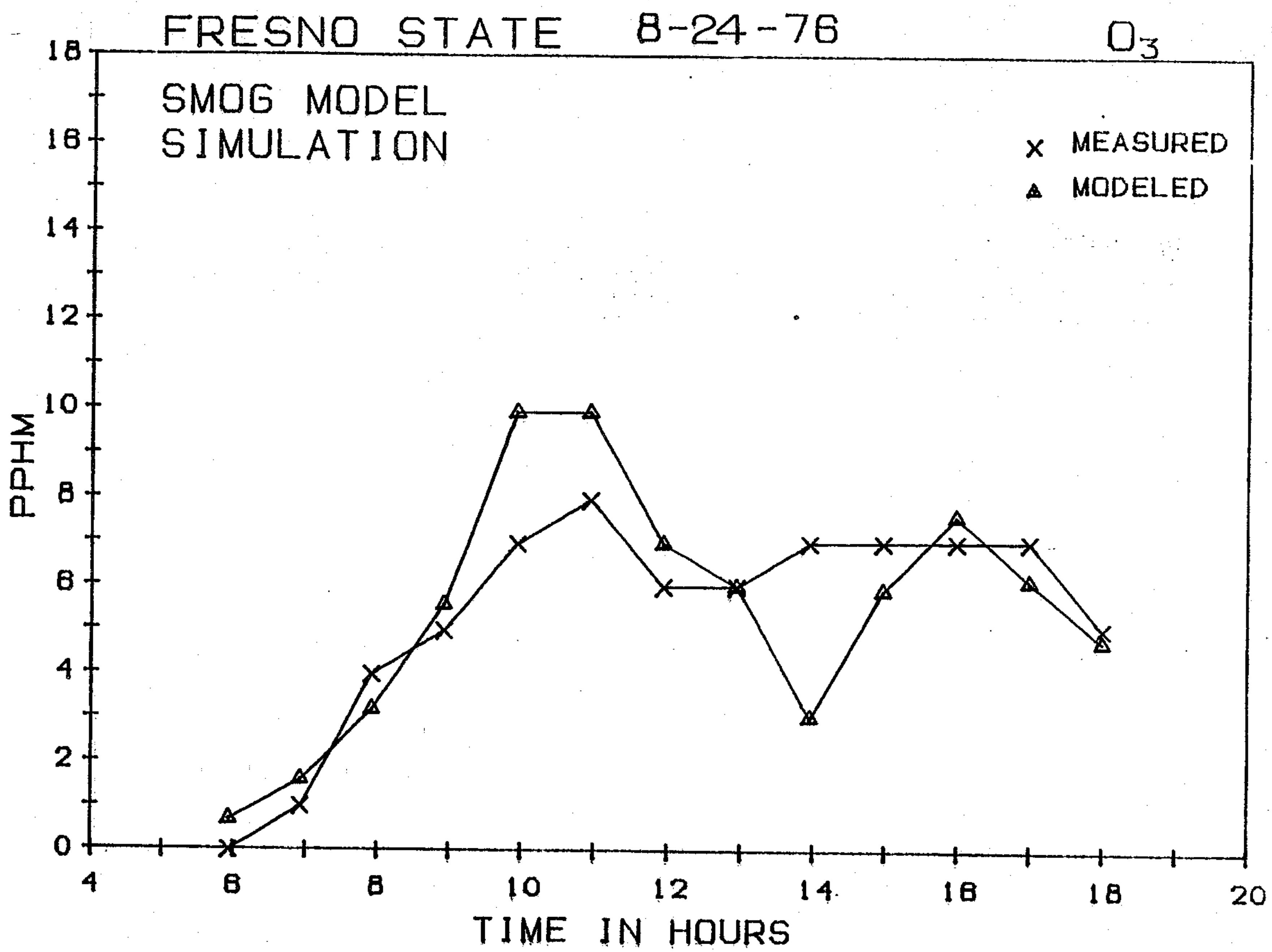
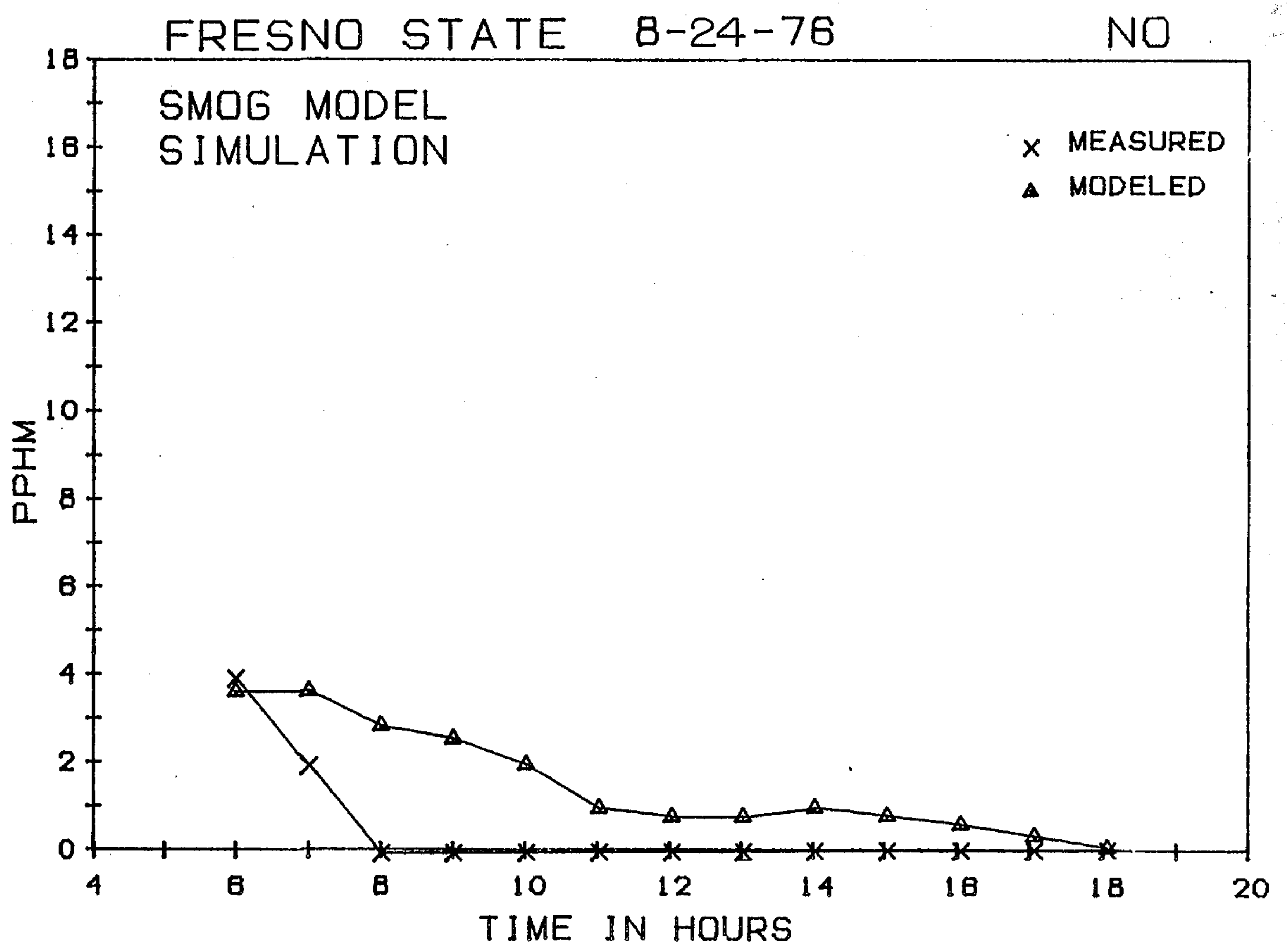

FRESNO STATE 8-24-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
TIME IN HOURS
0 2 4 6 8 10 12 14 16 18
4 6 8 10 12 14 16 18 20

FIGURE 14


FRESNO STATE 8-24-76
NO
SMOG MODEL
SIMULATION
X MEASURED
▲ MODELED
PPHM
0
2
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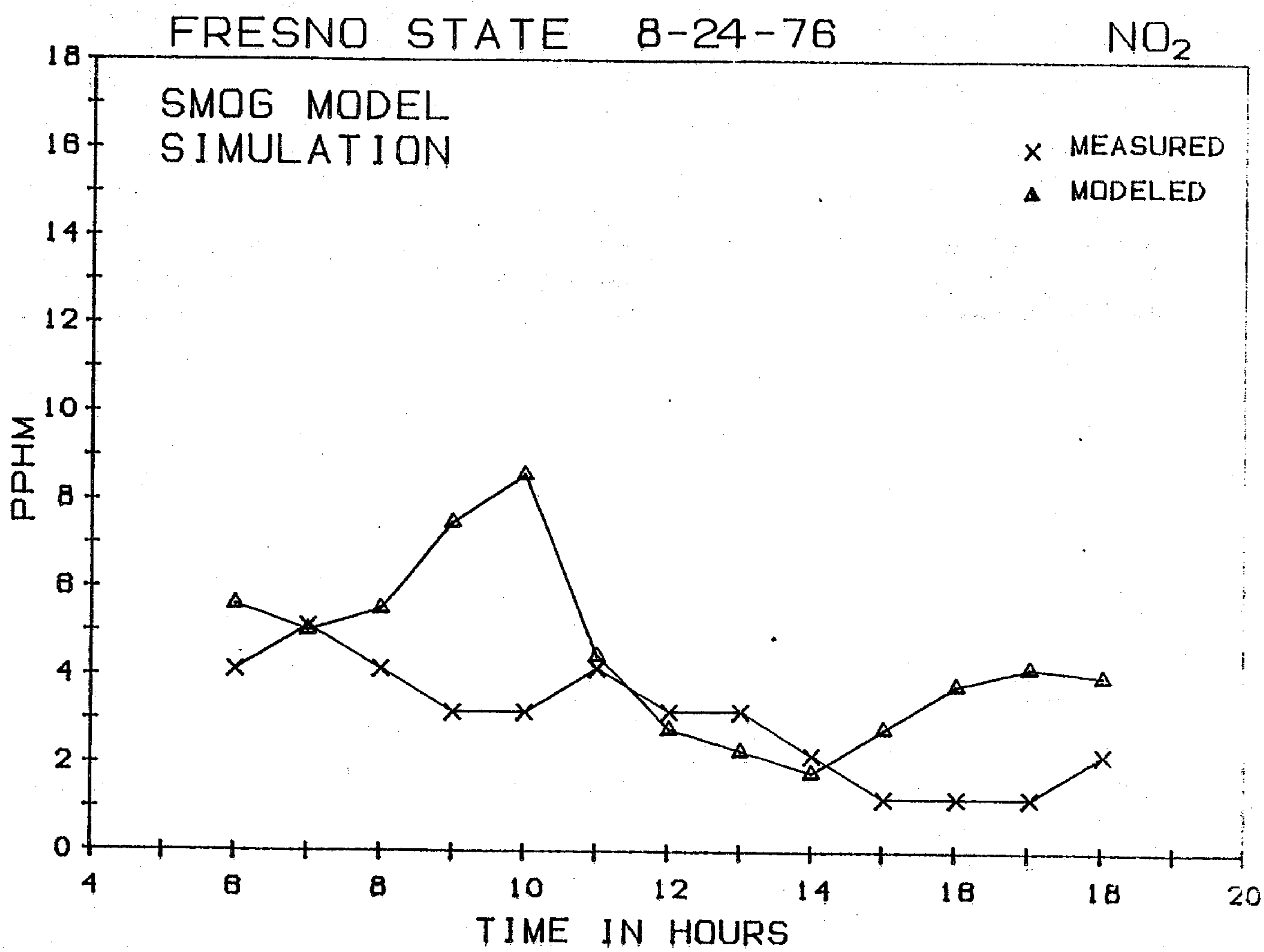
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 15



FRESNO STATE 8-24-76
NO2
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
18
16
14
12
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6
4
2
0
4
6
8
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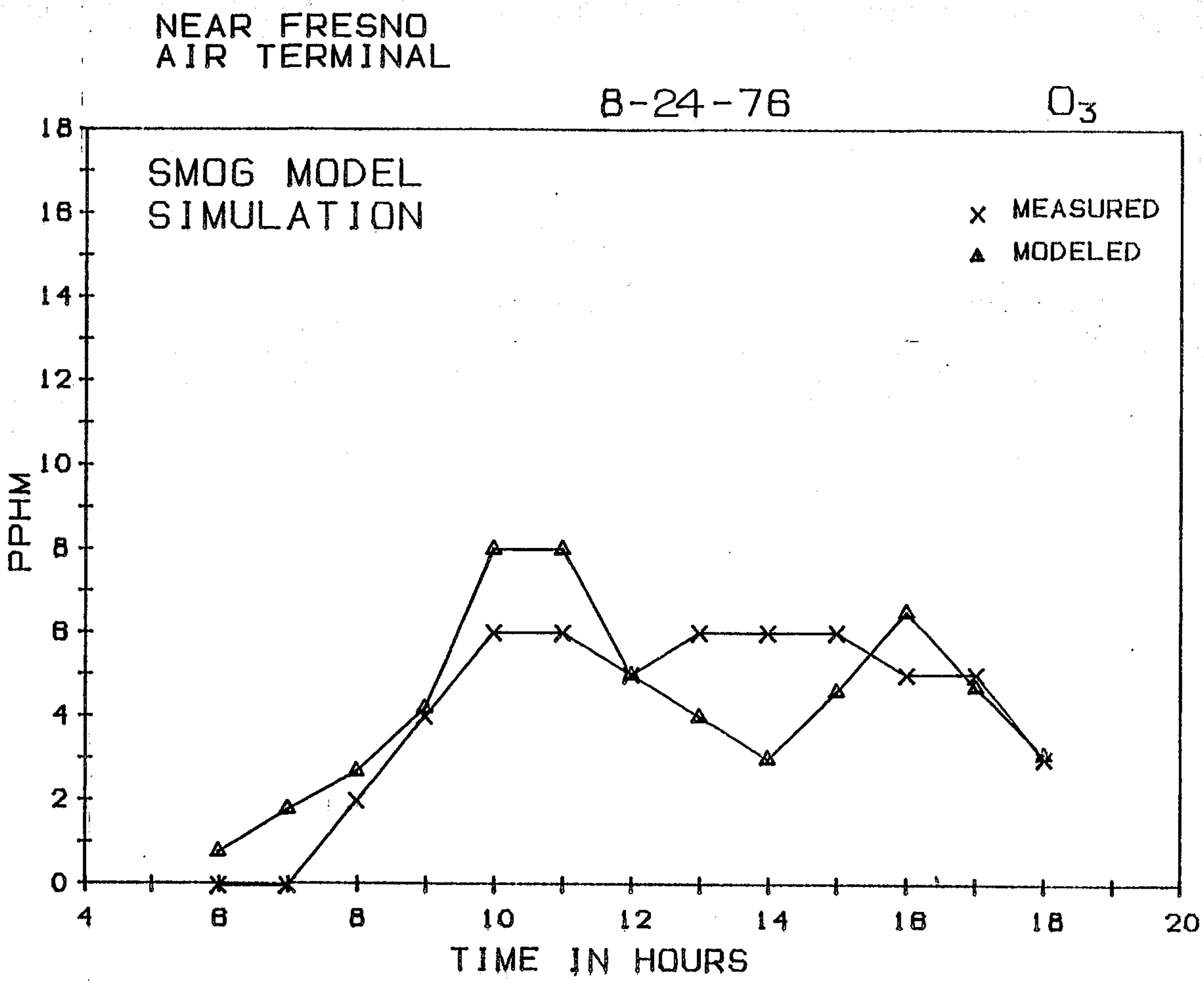
12
14
16
18
20
TIME IN HOURS

FIGURE 16


NEAR FRESNO
AIR TERMINAL
8-24-76
O3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
4
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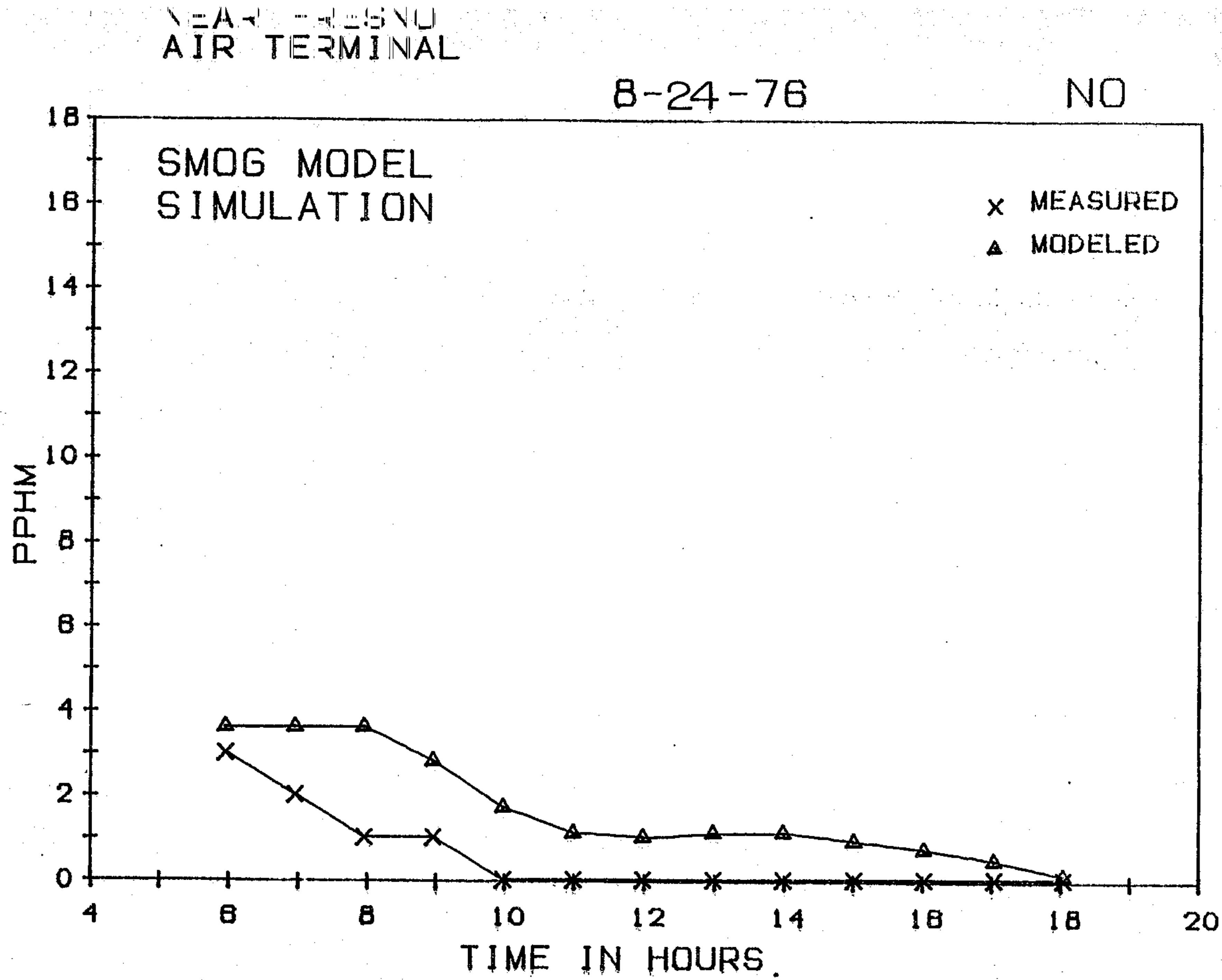
16
18
20
TIME IN HOURS



AIR TERMINAL
8-24-76
NO
SMOG MODEL
SIMULATION
× MEASURED
△ MODELED
PPHM
18
16
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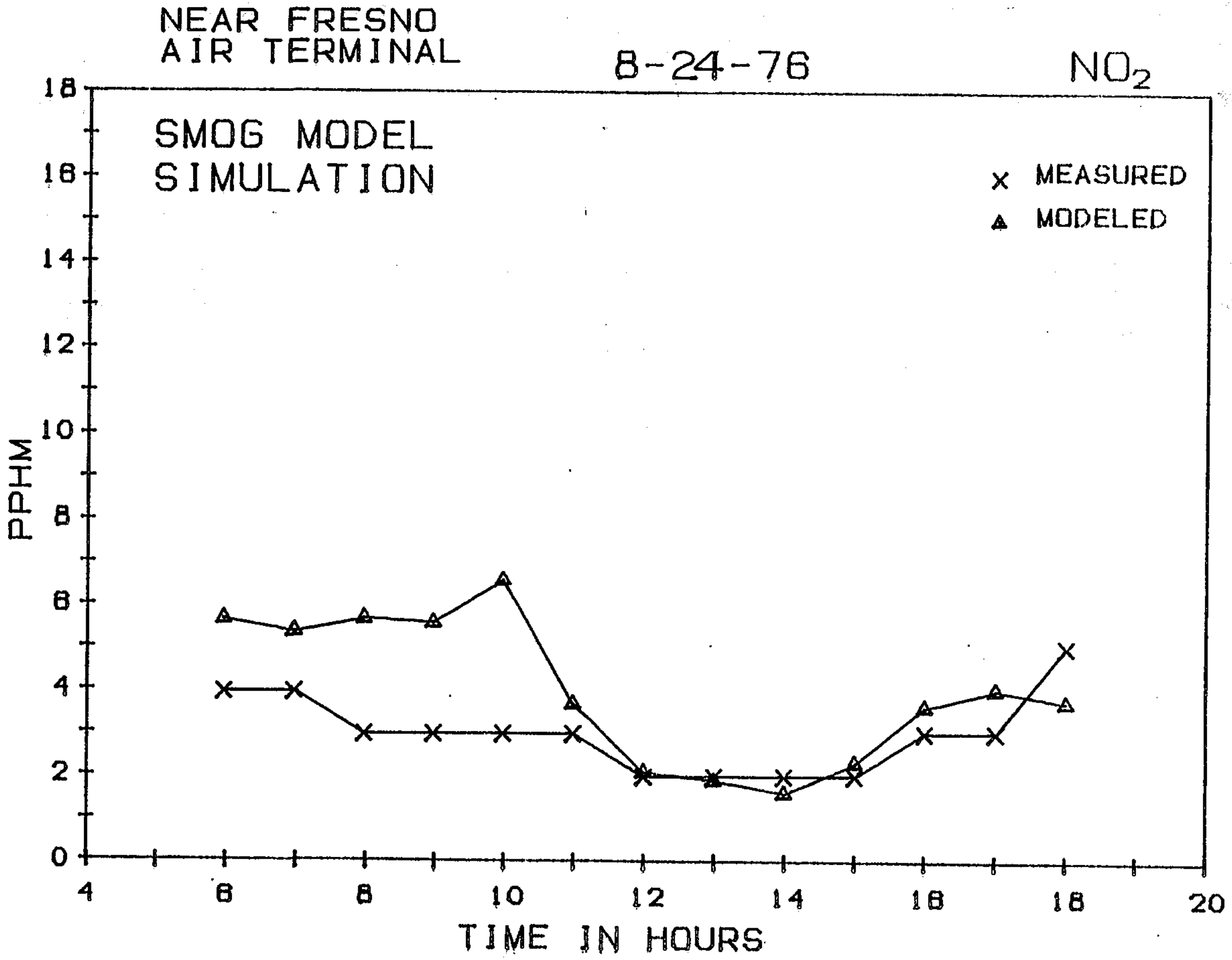
16
18
20
TIME IN HOURS

FIGURE 18



NEAR FRESNO
AIR TERMINAL
8-24-76
NO2
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
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18
TIME IN HOURS
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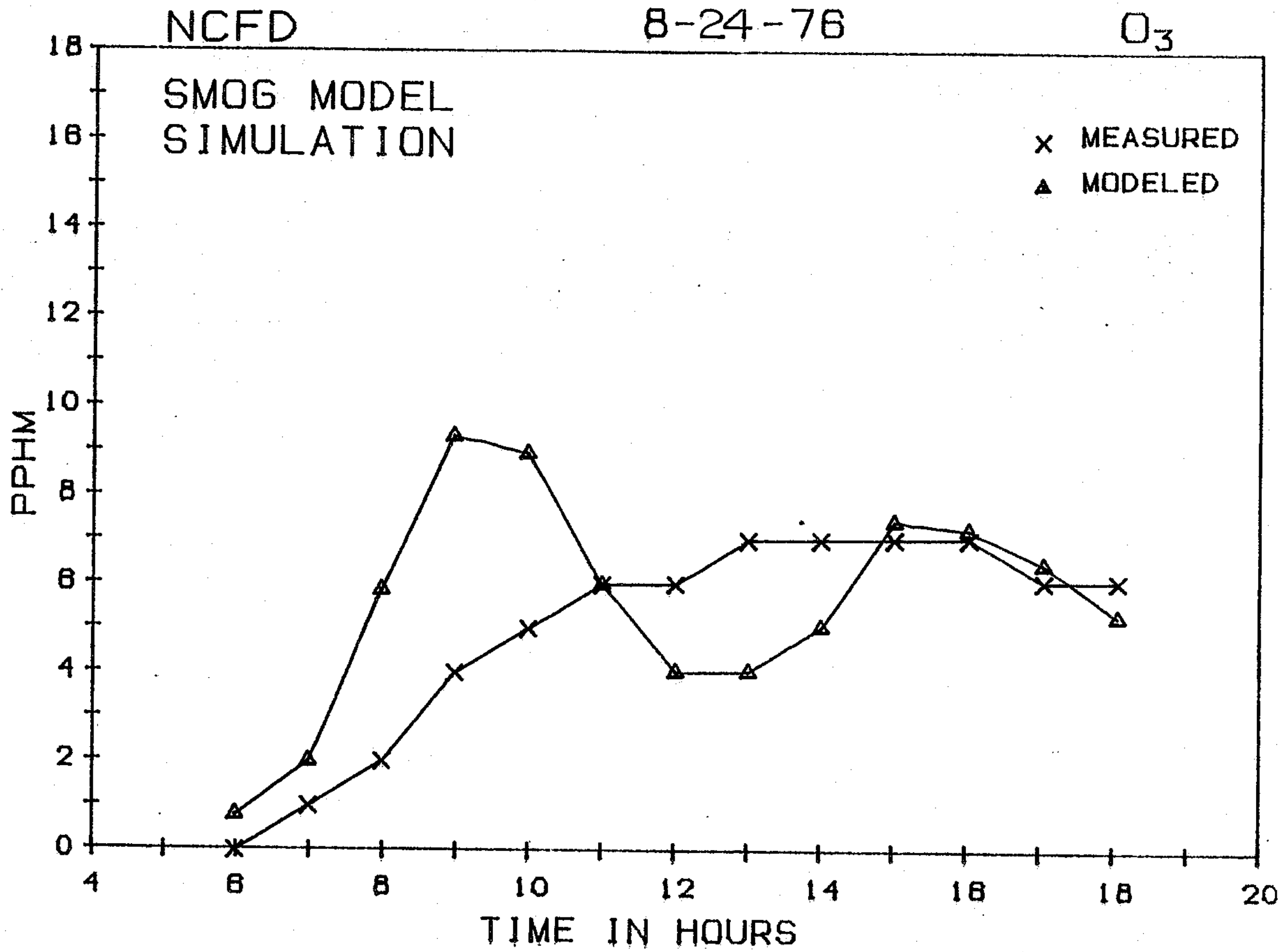
18
20


NCFD
8-24-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
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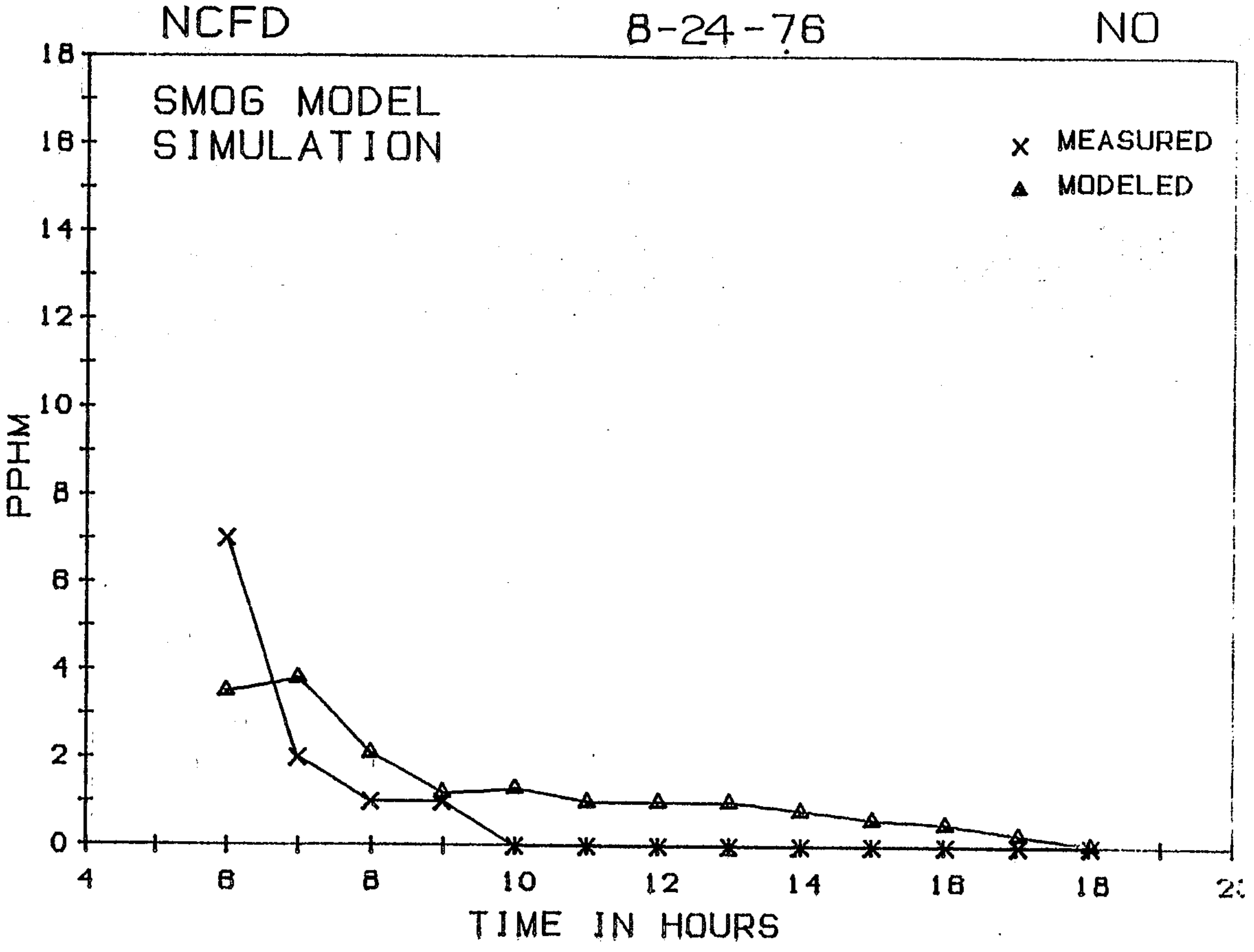
20
TIME IN HOURS

FIGURE 20


NCFD
8-24-76
NO
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
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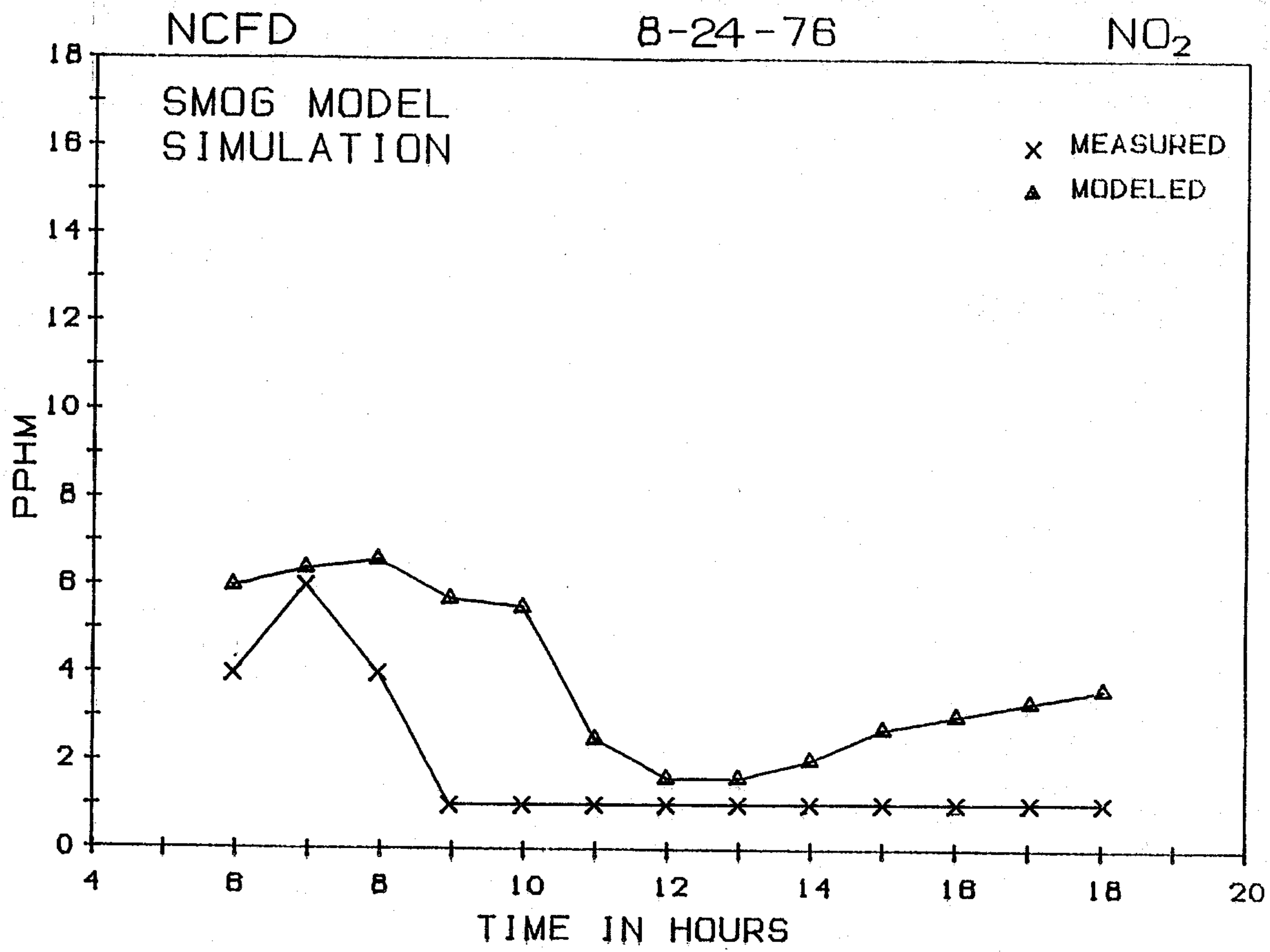
16
18
TIME IN HOURS


NCFD
8-24-76
NO_2
SMOG MODEL SIMULATION
× MEASURED
△ MODELED
PPHM
0
2
4
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16
18
TIME IN HOURS
4
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8
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16
18
20

FIGURE 22

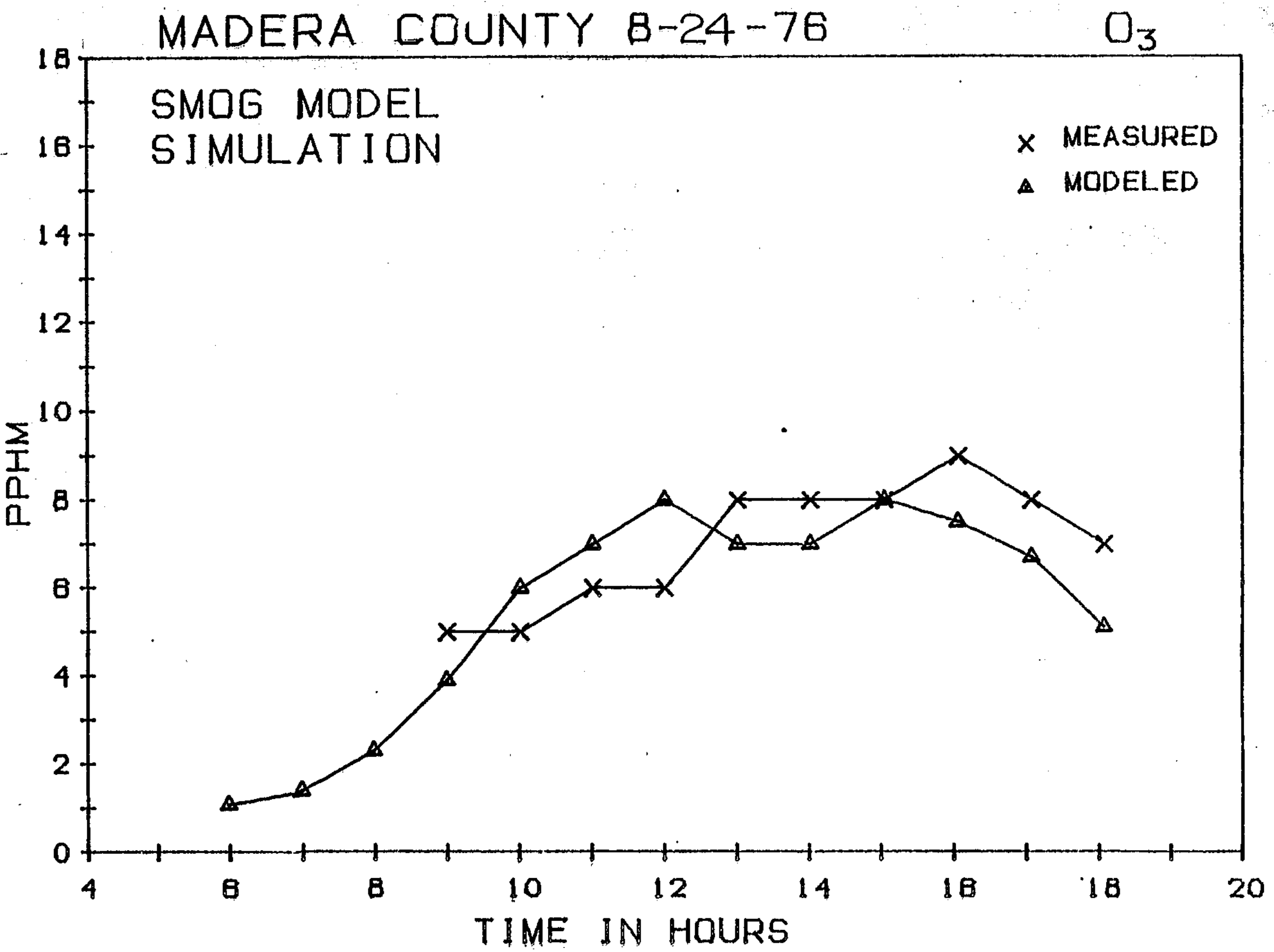
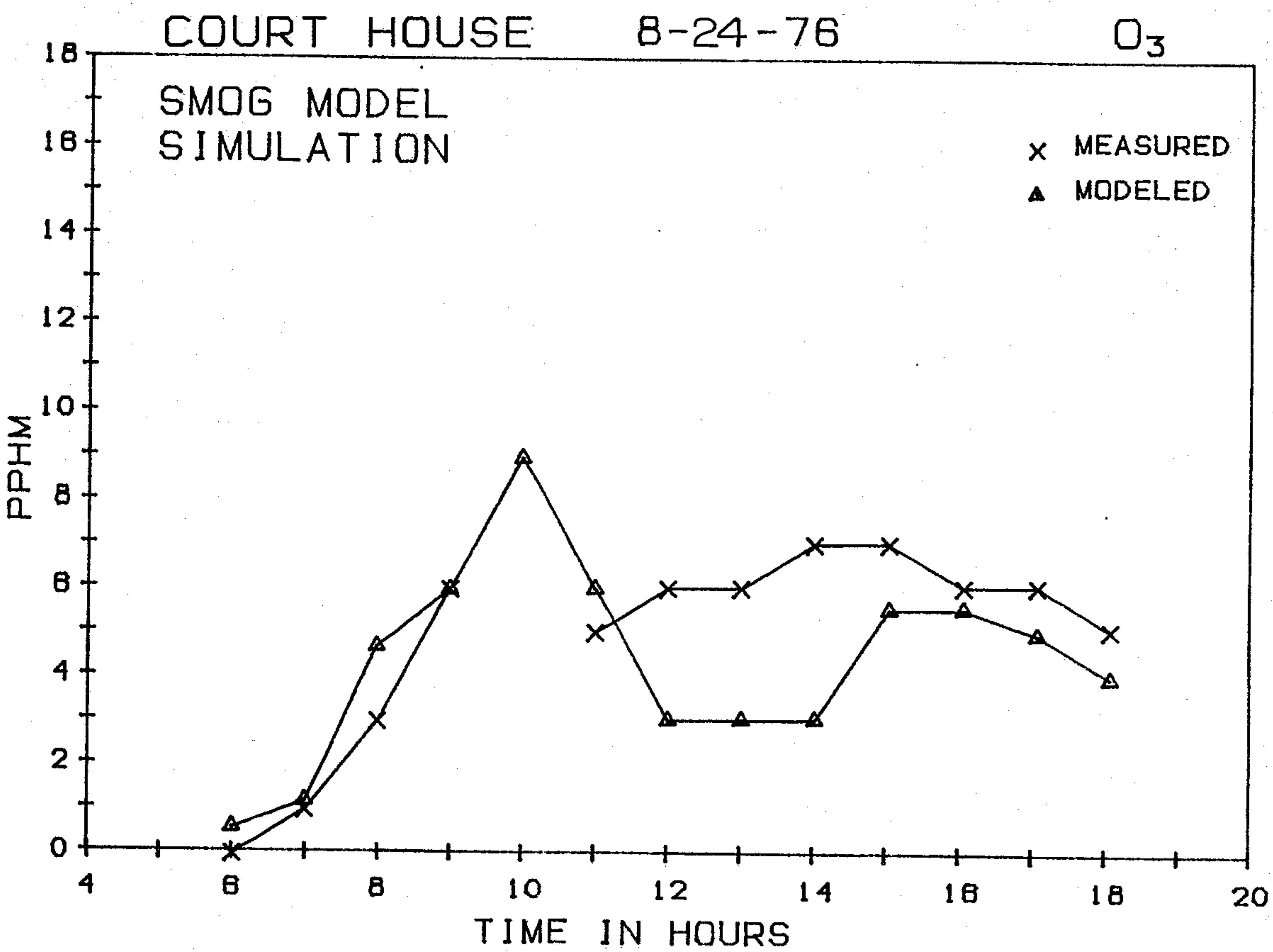

MADERA COUNTY 8-24-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
TIME IN HOURS

FIGURE 23


COURT HOUSE 8-24-76 O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
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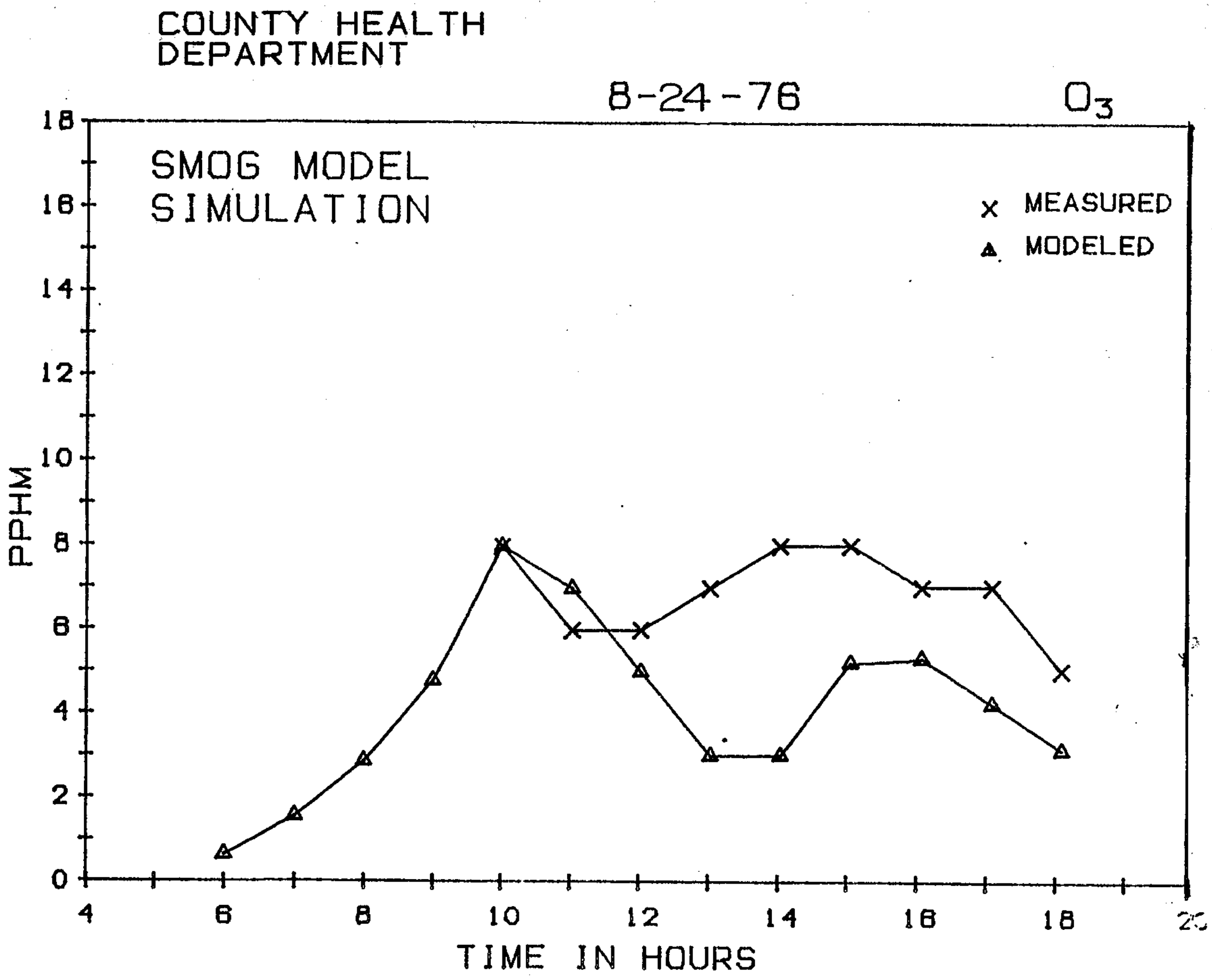
18
20
TIME IN HOURS

FIGURE 24


COUNTY HEALTH DEPARTMENT
8-24-76
O_3
SMOG MODEL SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
4
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8
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8
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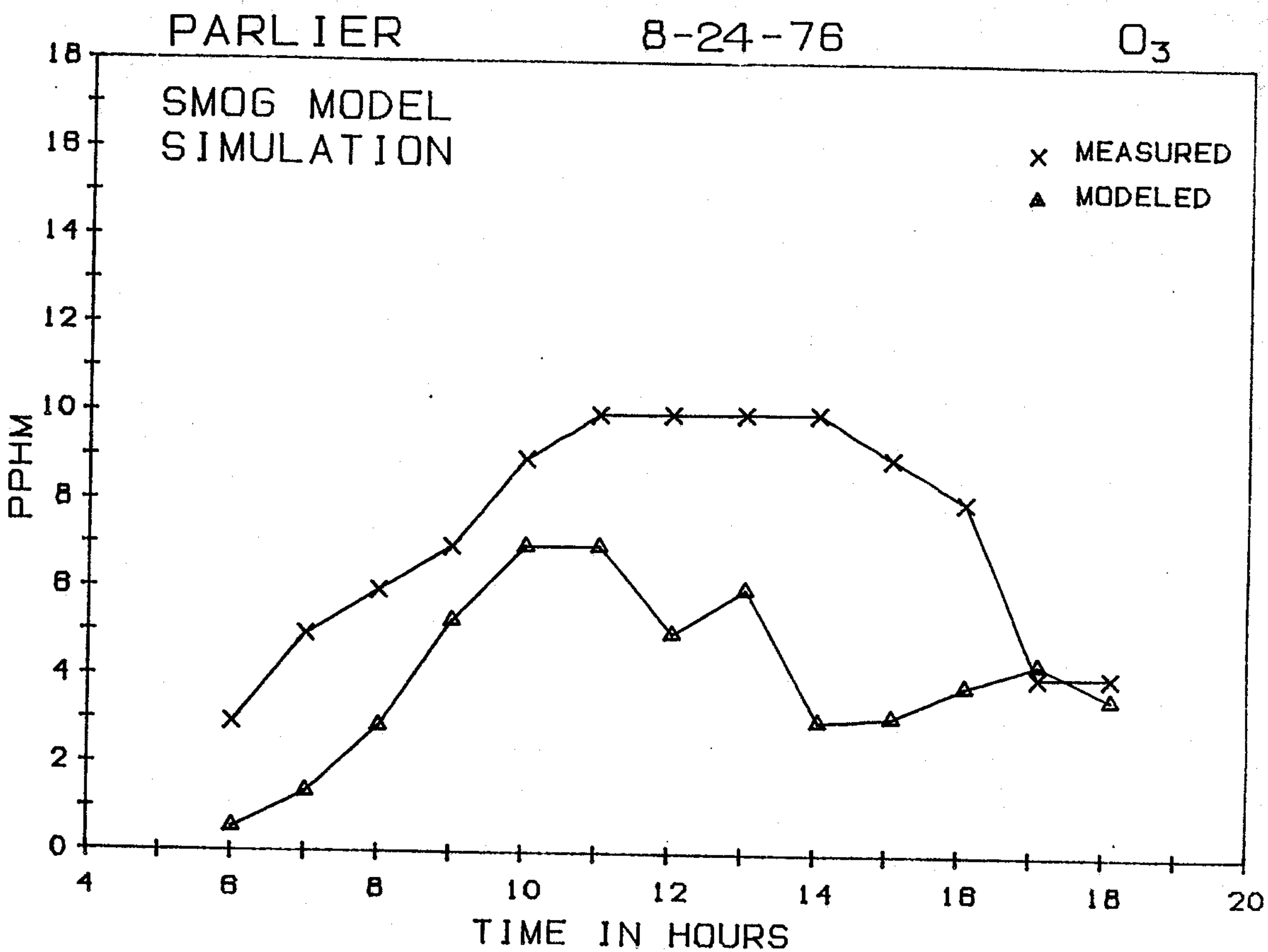
12
14
16
18
20
TIME IN HOURS

FIGURE 25


PARLIER
8-24-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
4
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8
10
12
14
16
18
4
6
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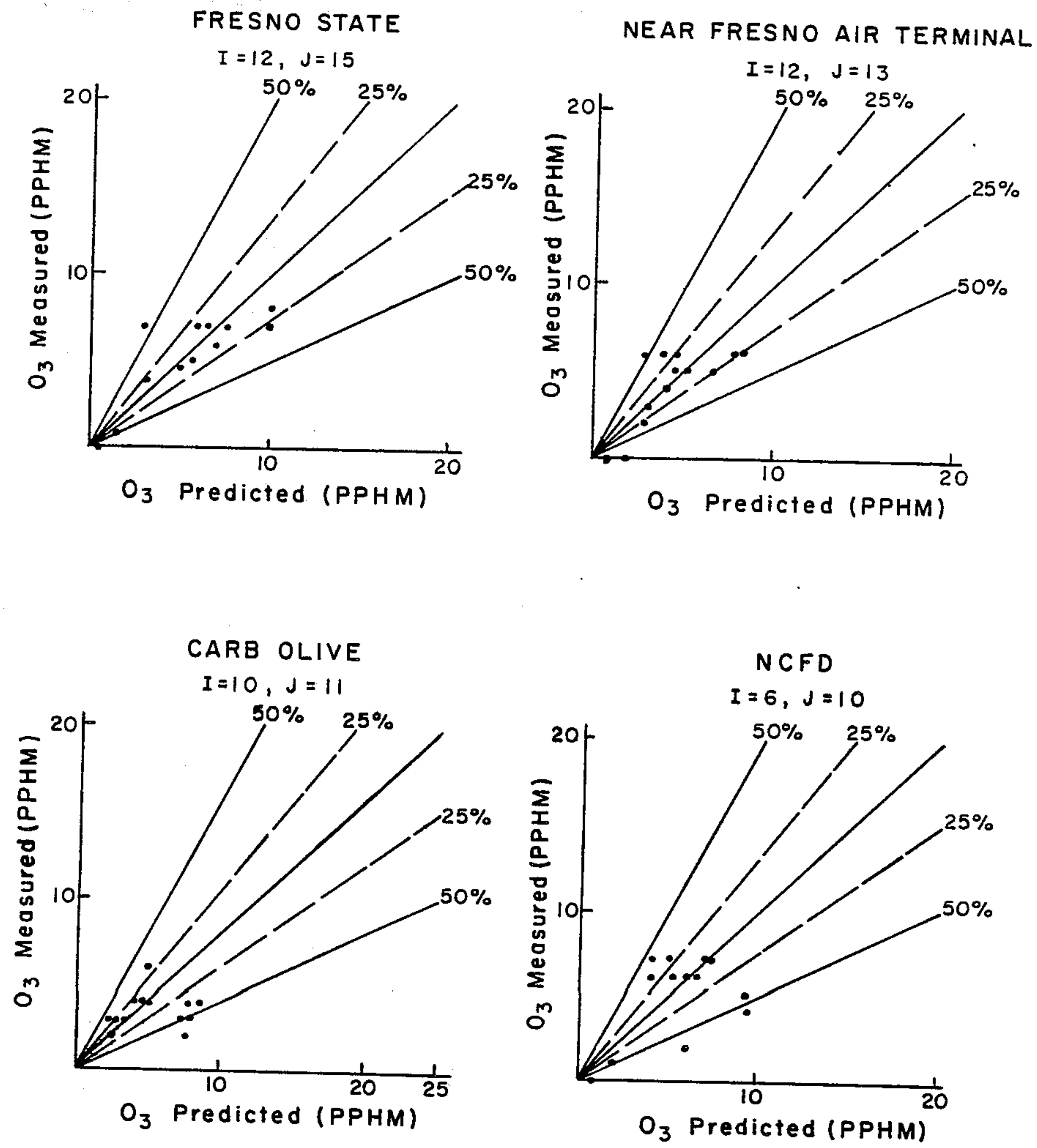
12
14
16
18
20
TIME IN HOURS

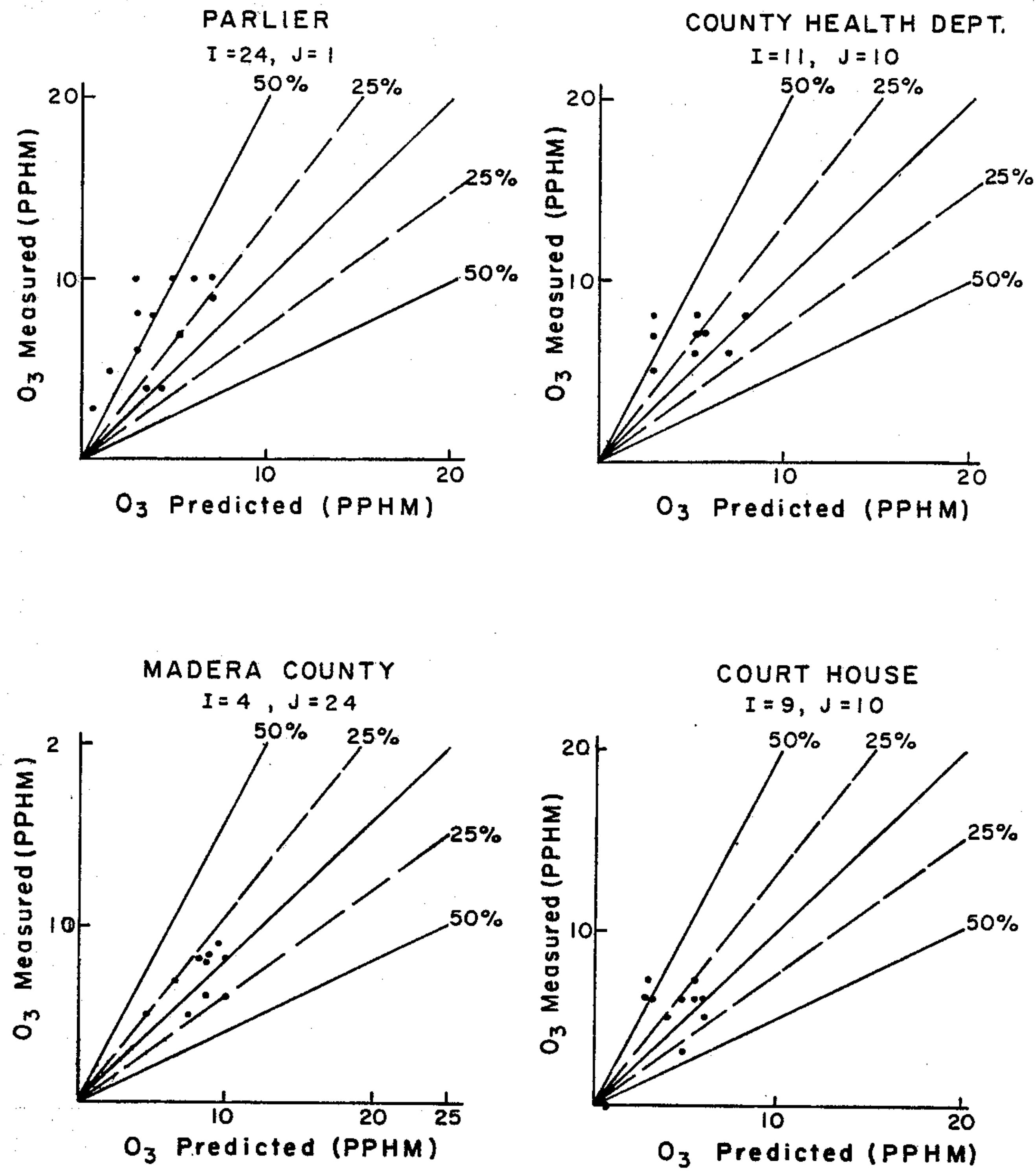
FIGURE 26



SCATTER PLOTS – MEASURED VS PREDICTED OZONE

Fresno Area, August 24, 1976

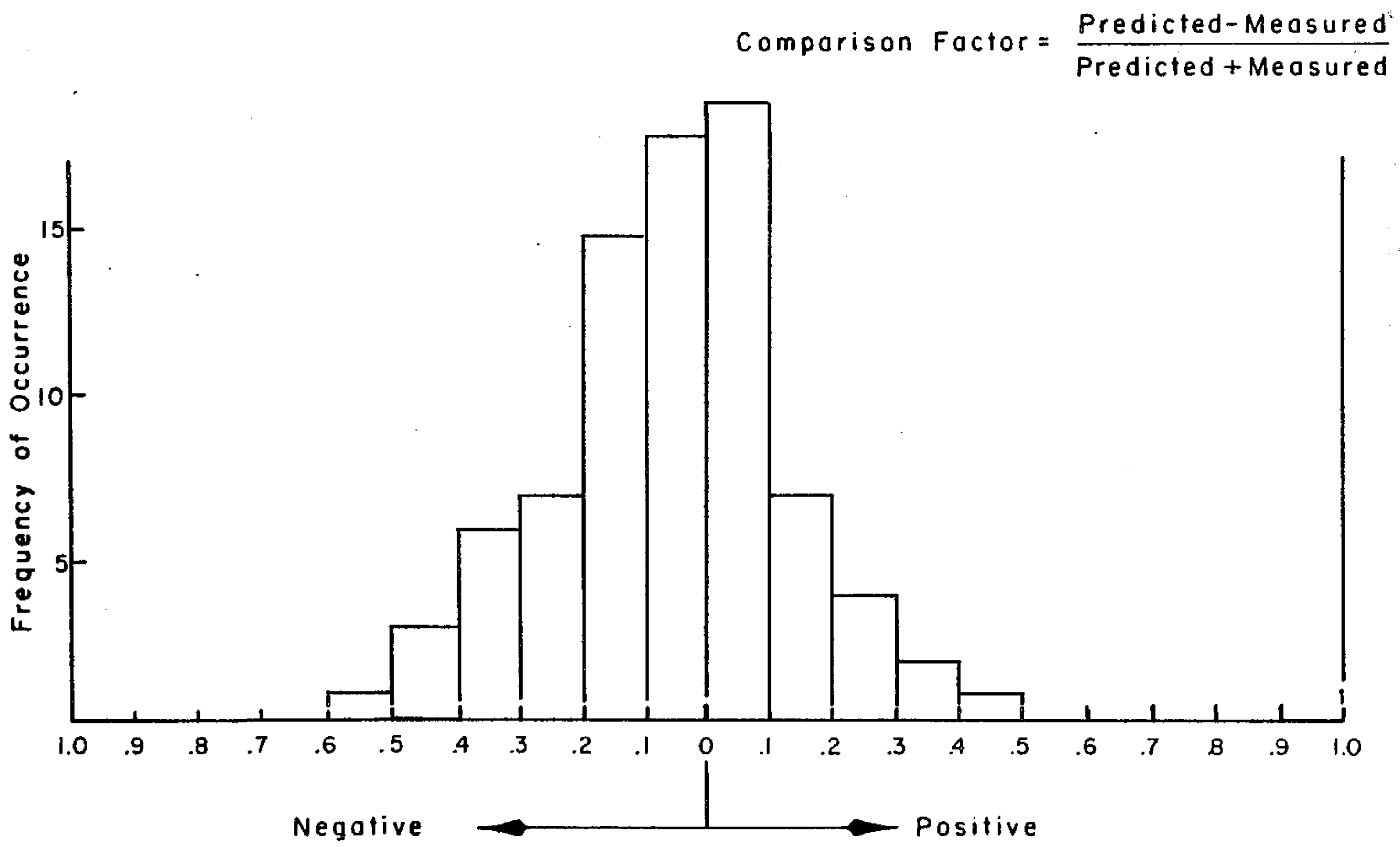
FIGURE 27



SCATTER PLOTS – MEASURED VS PREDICTED OZONE

Fresno Area, August 24, 1976

FIGURE 28



COMPARISON FACTOR – MEASURED AND MODELED OZONE CONCENTRATIONS

Fresno Area, August 24, 1976

Figure 29

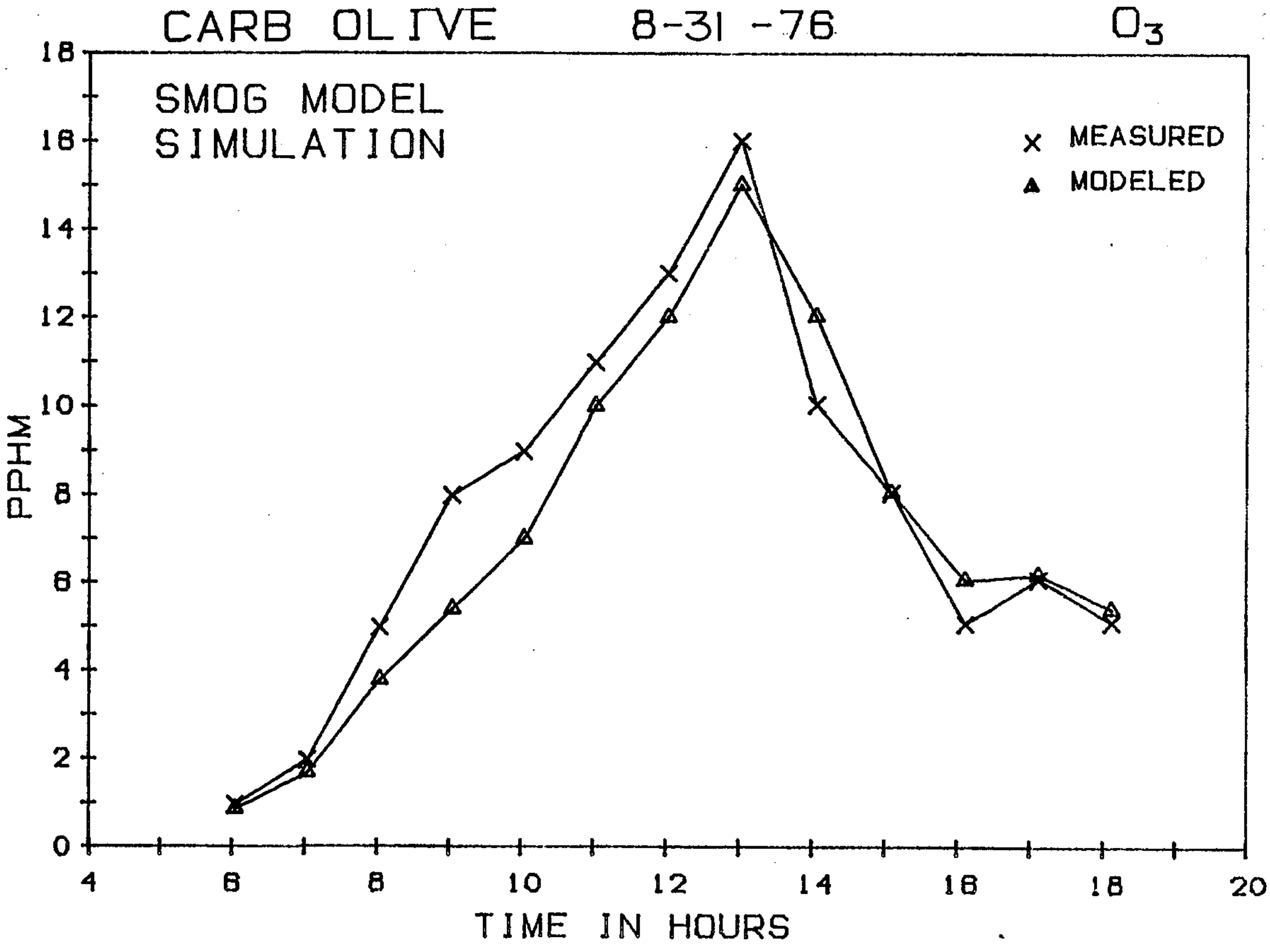
the simulation period. These waves are apparent in the computer printouts, Figures 48 and 49. Since our ozone monitoring stations were grouped in the metropolitan area, there were not sufficient data available to determine if these ozone patterns actually exist in the "real world".

The results of the August 24 simulations also indicate that a double peak can be anticipated in ozone concentrations in the Fresno area. The initial peak occurred around 10:00 in the morning and the second peak appeared around 4:00 p.m.

There is only a hint of the double peak in the observed readings. This also might be due to the fact that the monitoring stations were concentrated in the downtown Fresno area instead of uniformly distributed through the study region.

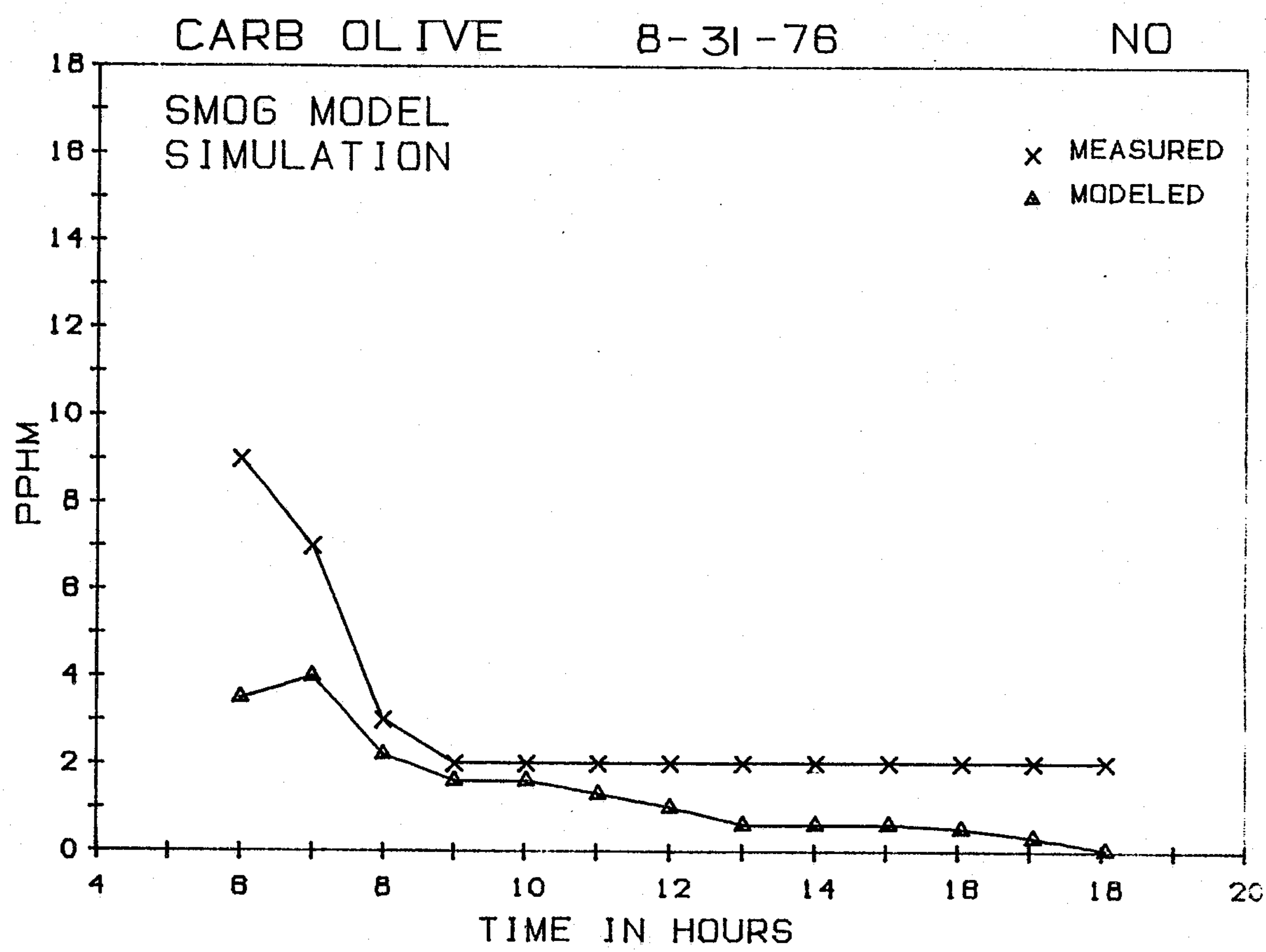
The observed readings on August 24 are generally lower than the simulated ozone concentrations by an average of 40 percent. Using this as a basis, it cannot be stated that the August 24 runs resulted in a verification.

A successful run is one in which the predicted ozone values agree, within a reasonable range, with the measured ozone values. In examining the Figures which show the relationships between the measured and modeled ozone values, it is obvious that the modeling has not approximated the observed for August 24, compared to August 31. The Figures for August 31 show the measured and modeled plots consistently following each other. The Figures for August 24 show that the modeled ozone concentrations does not correspond well with the measured ozone values.



CARB OLIVE 8-31 -76 O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
TIME IN HOURS

FIGURE 30


CARB OLIVE
8-31-76
NO
SMOG MODEL
SIMULATION
MEASURED
MODELED
PPHM
0
2
4
6
8
10
12
14
16
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4
6
8
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12
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16
18
20
TIME IN HOURS

FIGURE 31

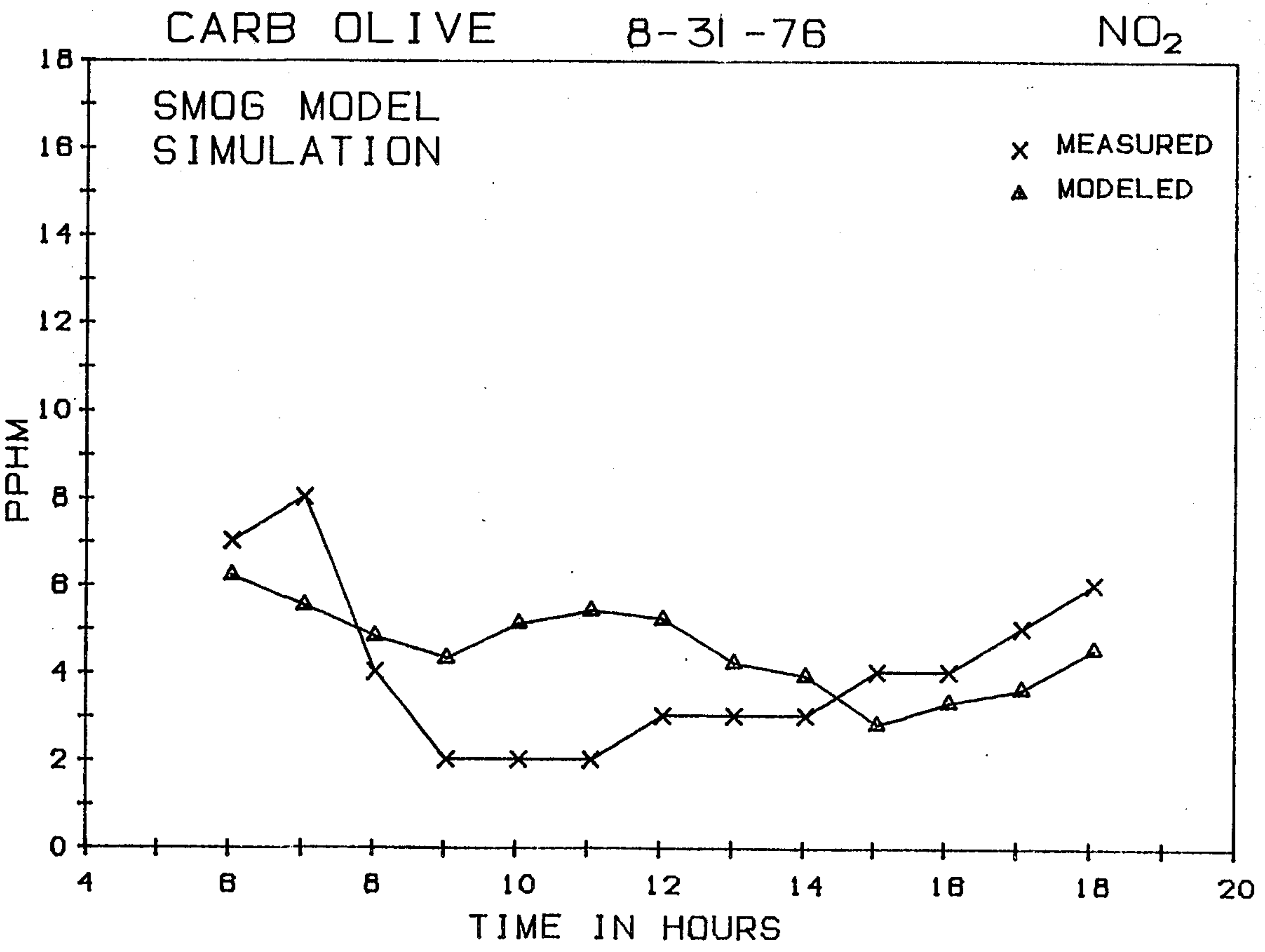

CARB OLIVE
8-31-76
NO2
SMOG MODEL
SIMULATION
MEASURED
MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 32

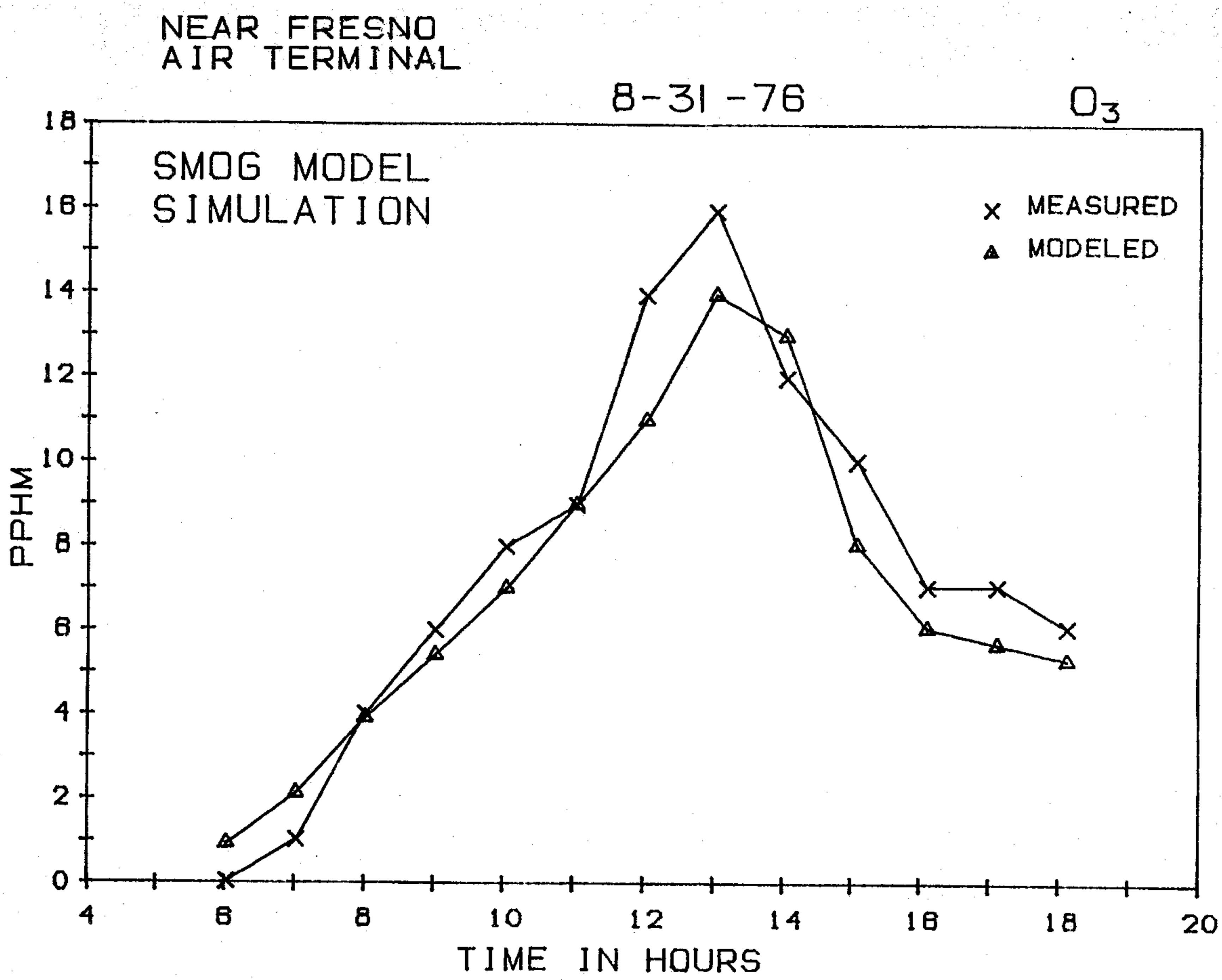

NEAR FRESNO
AIR TERMINAL
8-31-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 33

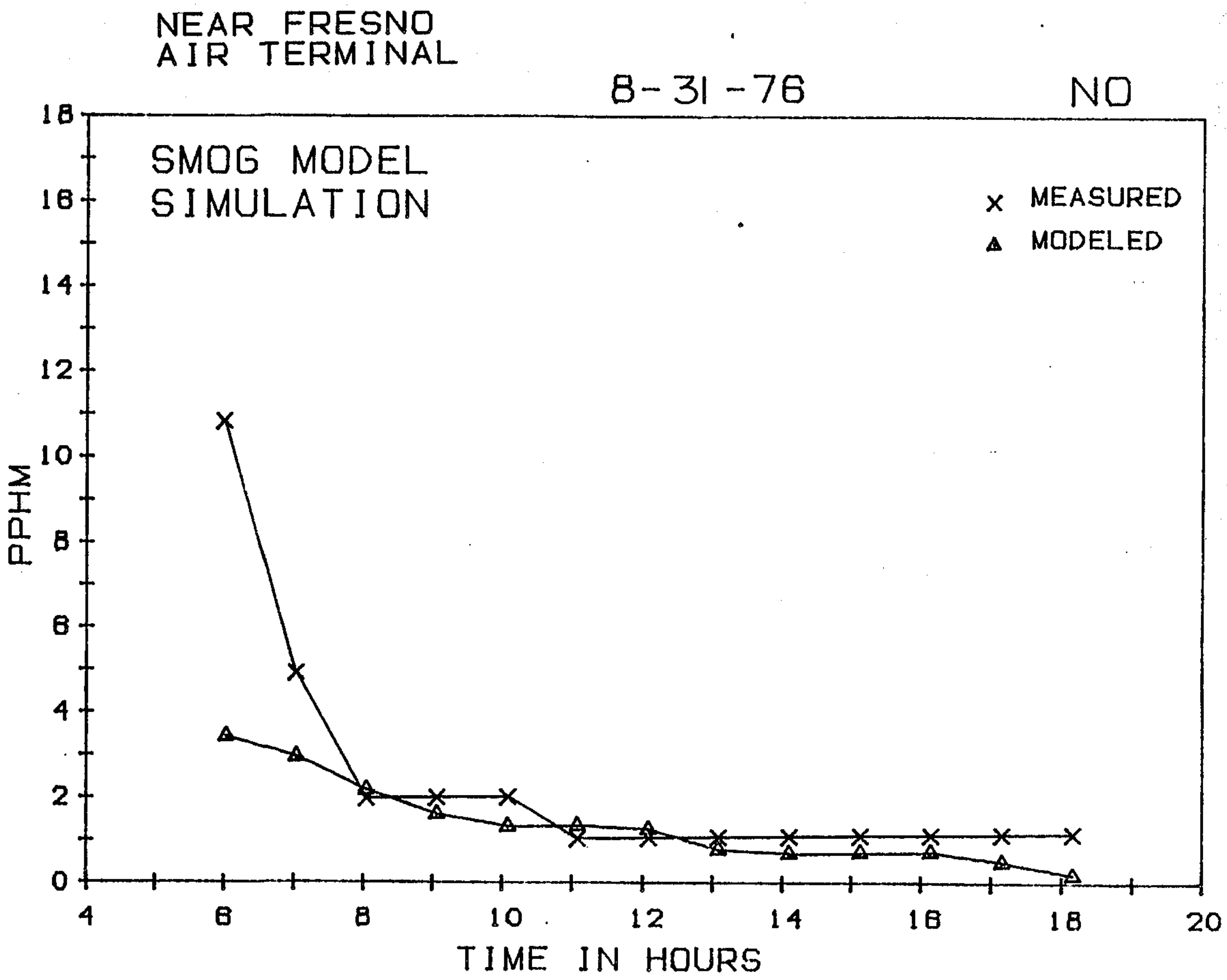
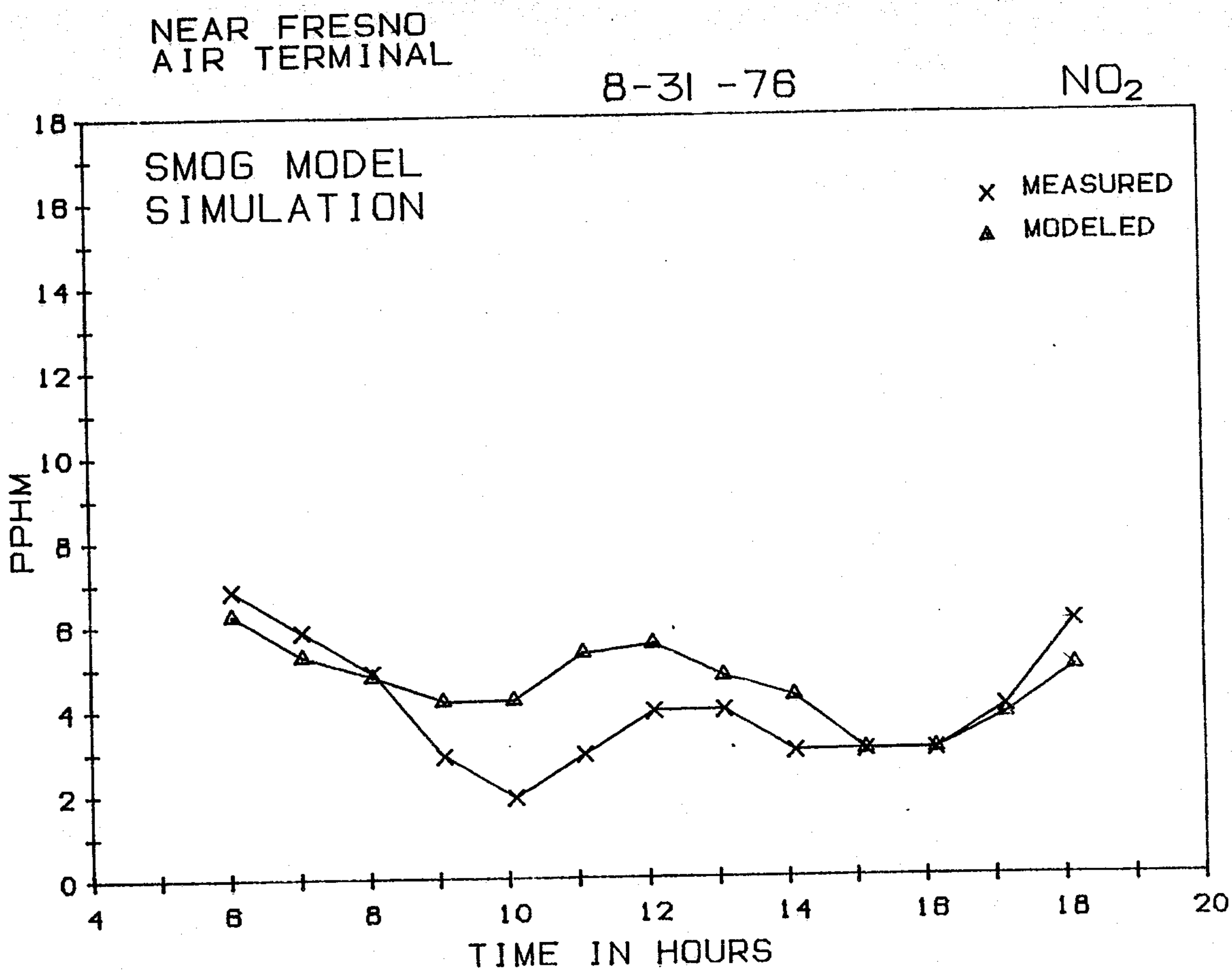

NEAR FRESNO
AIR TERMINAL
8-31-76
NO
SMOG MODEL
SIMULATION
× MEASURED
▵ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 34



NEAR FRESNO
AIR TERMINAL
8-31 -76
NO2
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
TIME IN HOURS

FIGURE 35

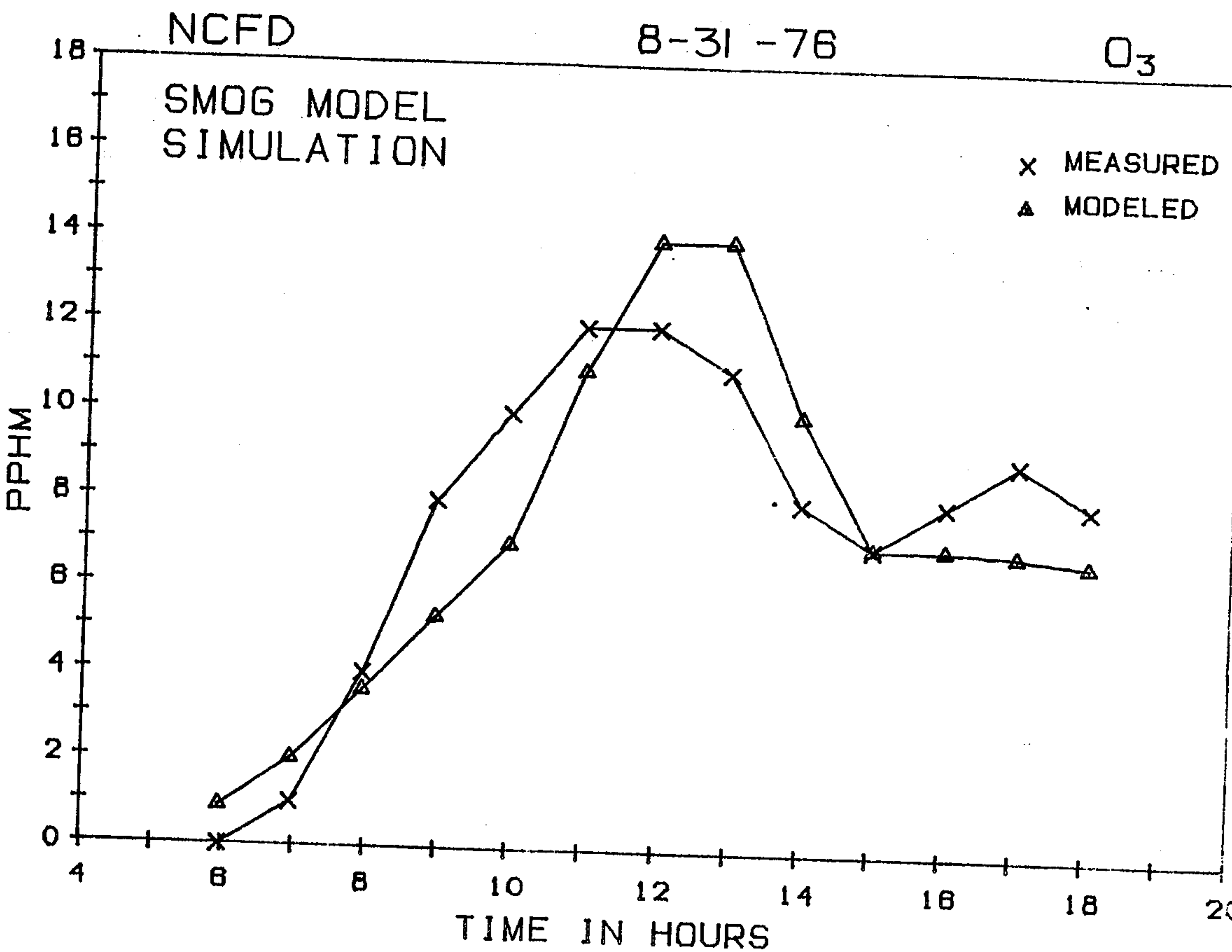

NCFD
8-31-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
△ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 36

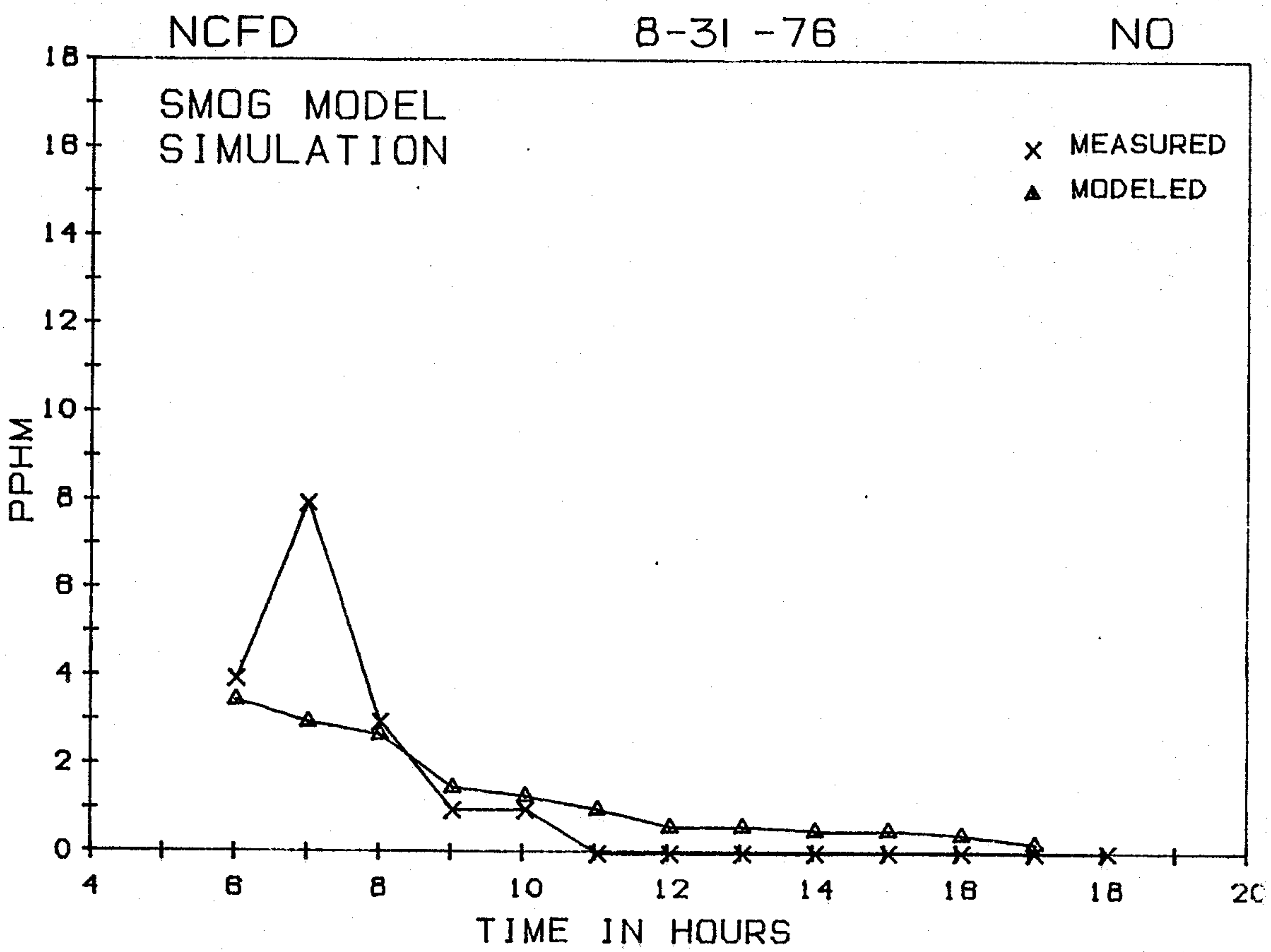

NCFD
8-31-76
NO
SMOG MODEL
SIMULATION
MEASURED
MODELED
PPHM
18
16
14
12
10
8
6
4
2
0
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 37

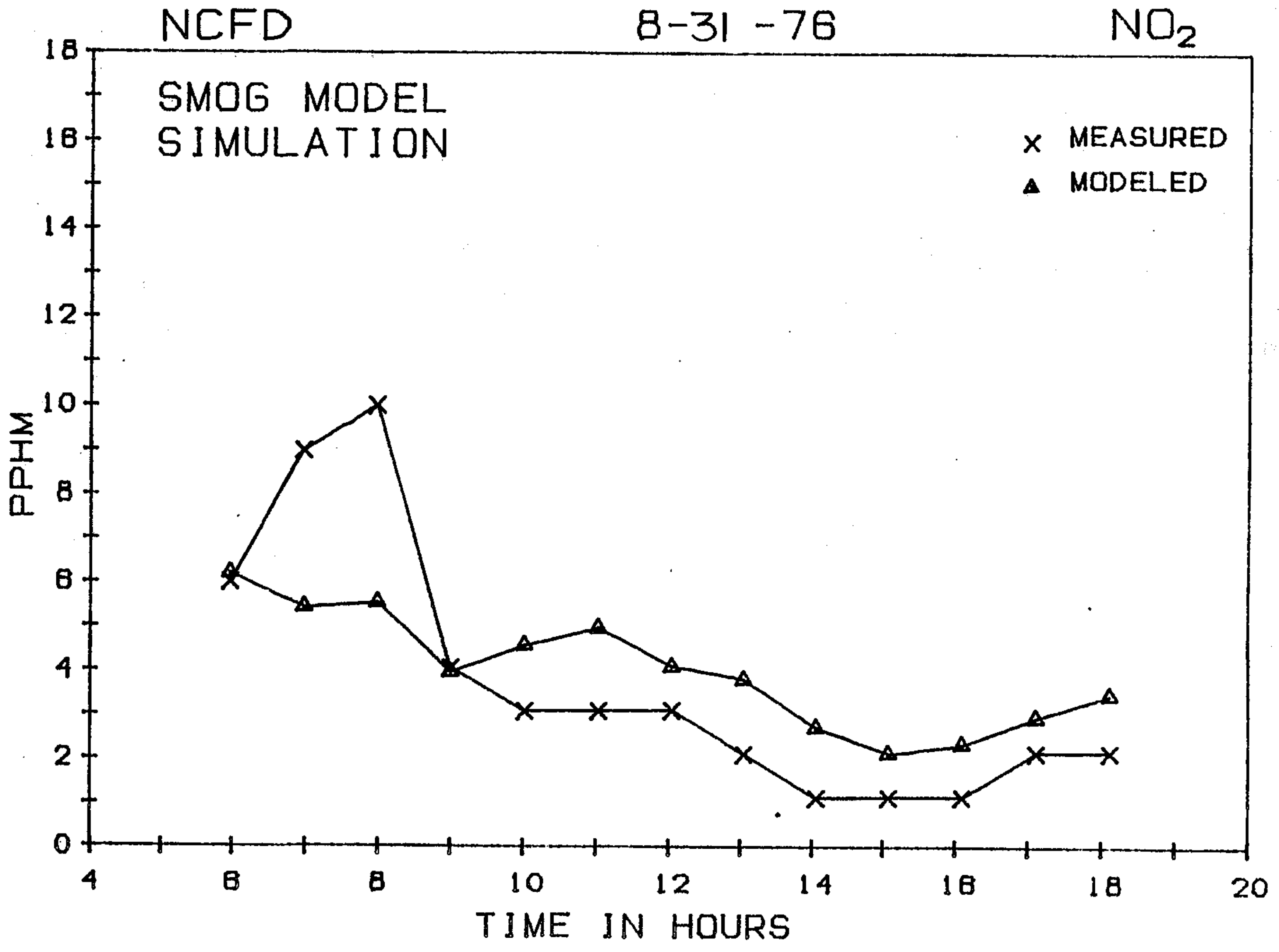
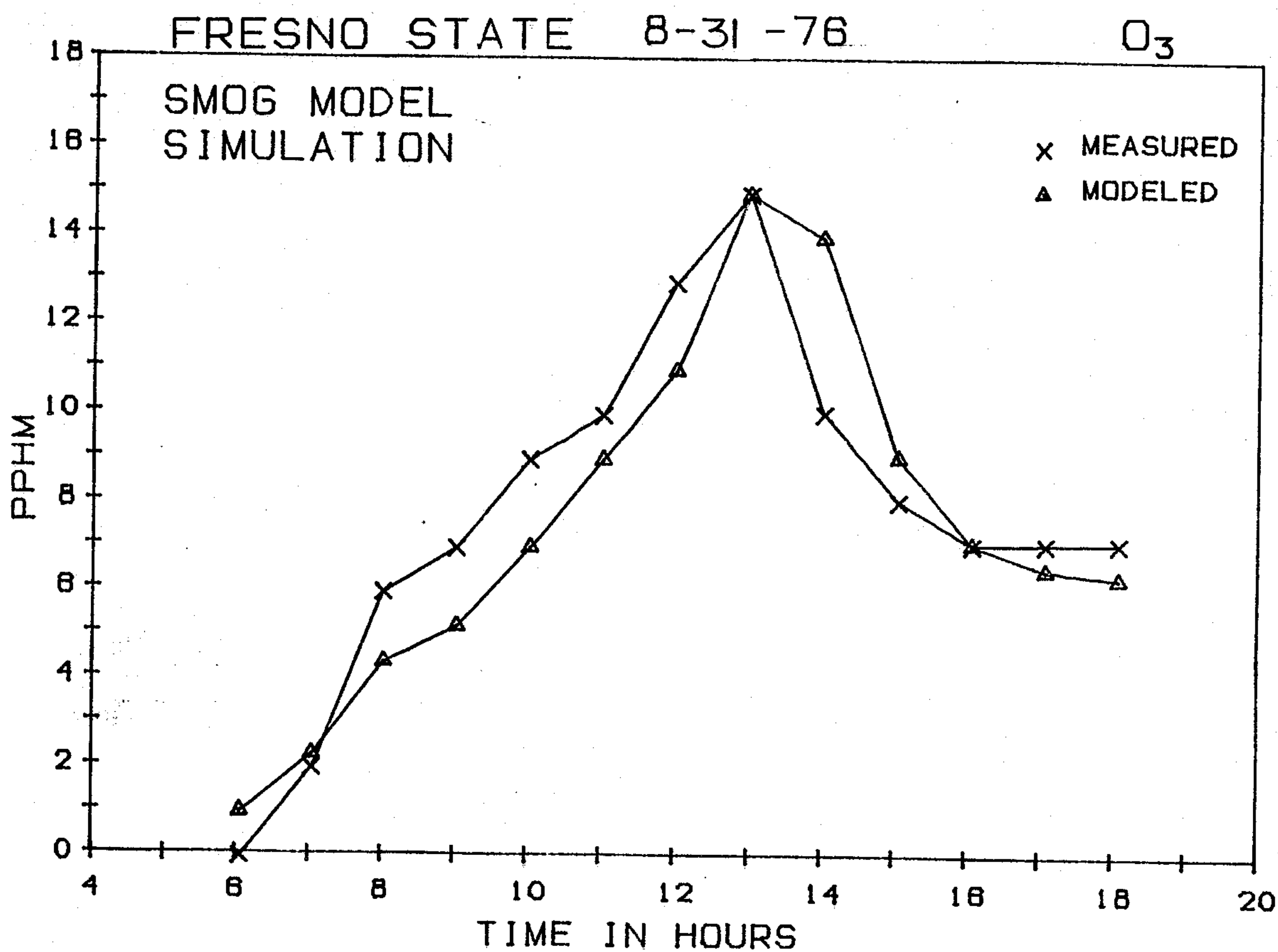

NCFD
8-31-76
NO_2
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 38



FRESNO STATE 8-31-76
O3
SMOG MODEL
SIMULATION
× MEASURED
△ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 39

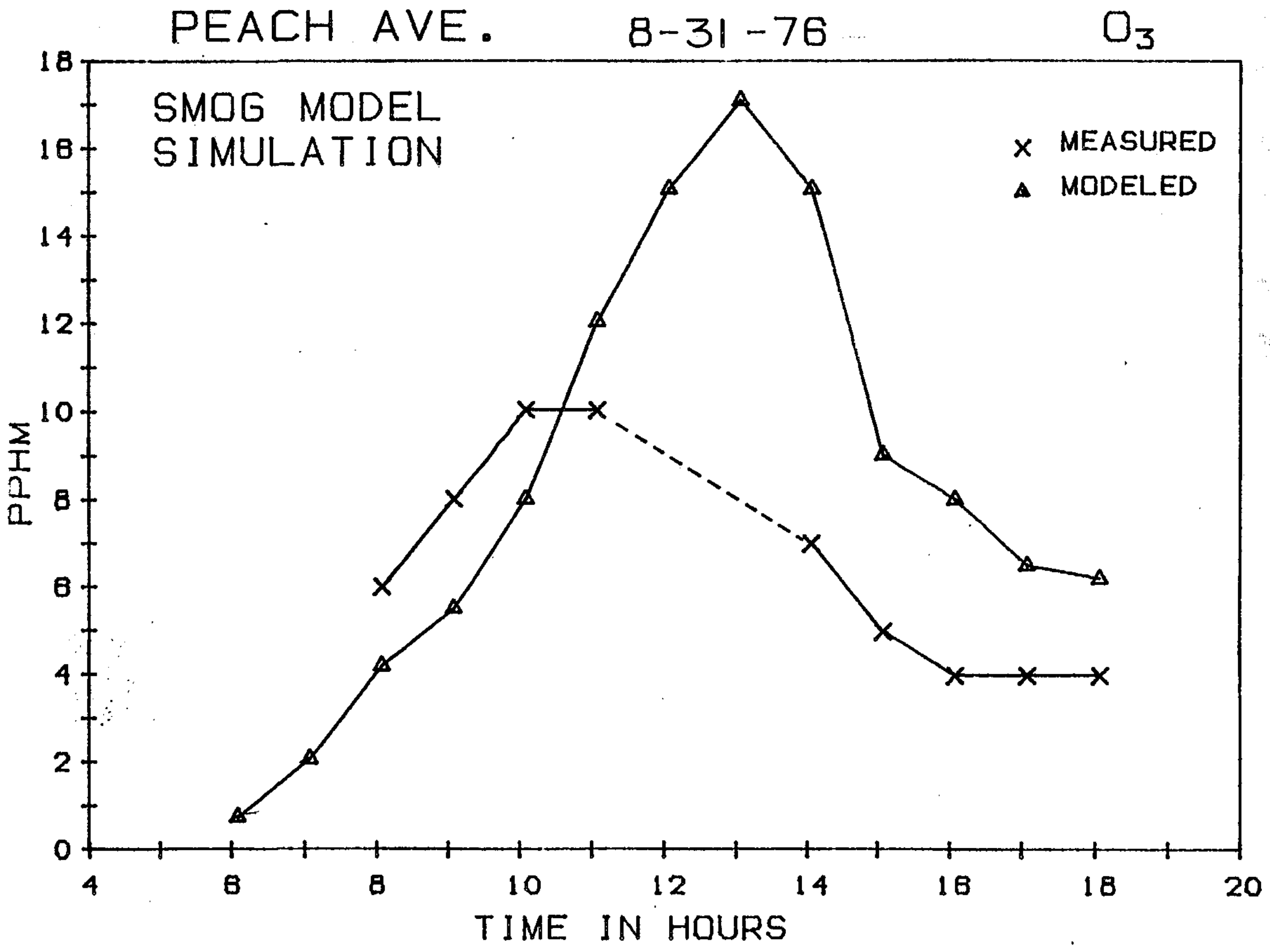

PEACH AVE.
8-31-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
▲ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 40

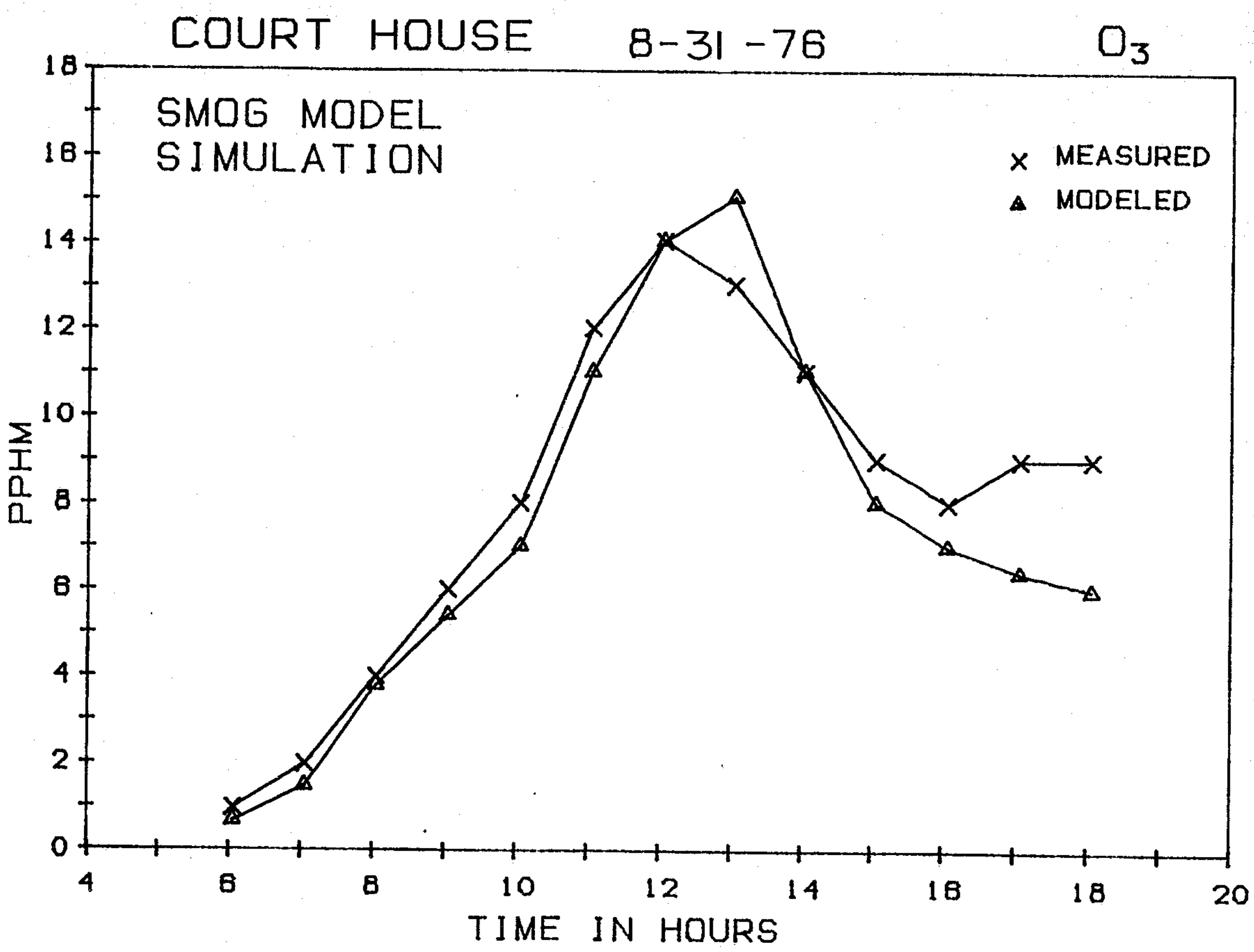

COURT HOUSE 8-31-76 O3
SMOG MODEL
SIMULATION
MEASURED
MODELED
PPHM
TIME IN HOURS
0
2
4
6
8
10
12
14
16
18
20

FIGURE 41

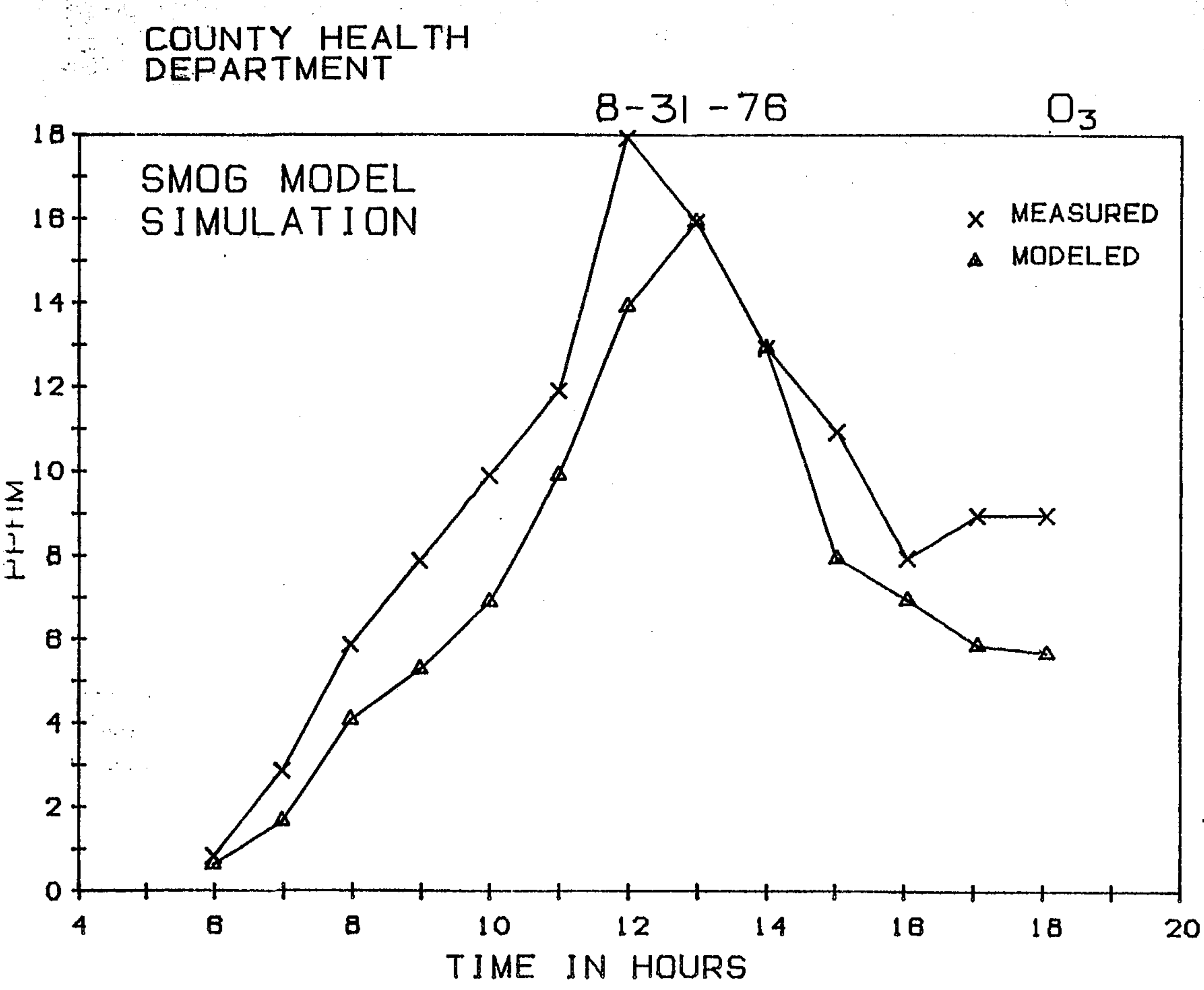

COUNTY HEALTH
DEPARTMENT
8-31-76
O_3
SMOG MODEL
SIMULATION
× MEASURED
△ MODELED
PPHM
0
2
4
6
8
10
12
14
16
18
4
6
8
10
12
14
16
18
20
TIME IN HOURS

FIGURE 42

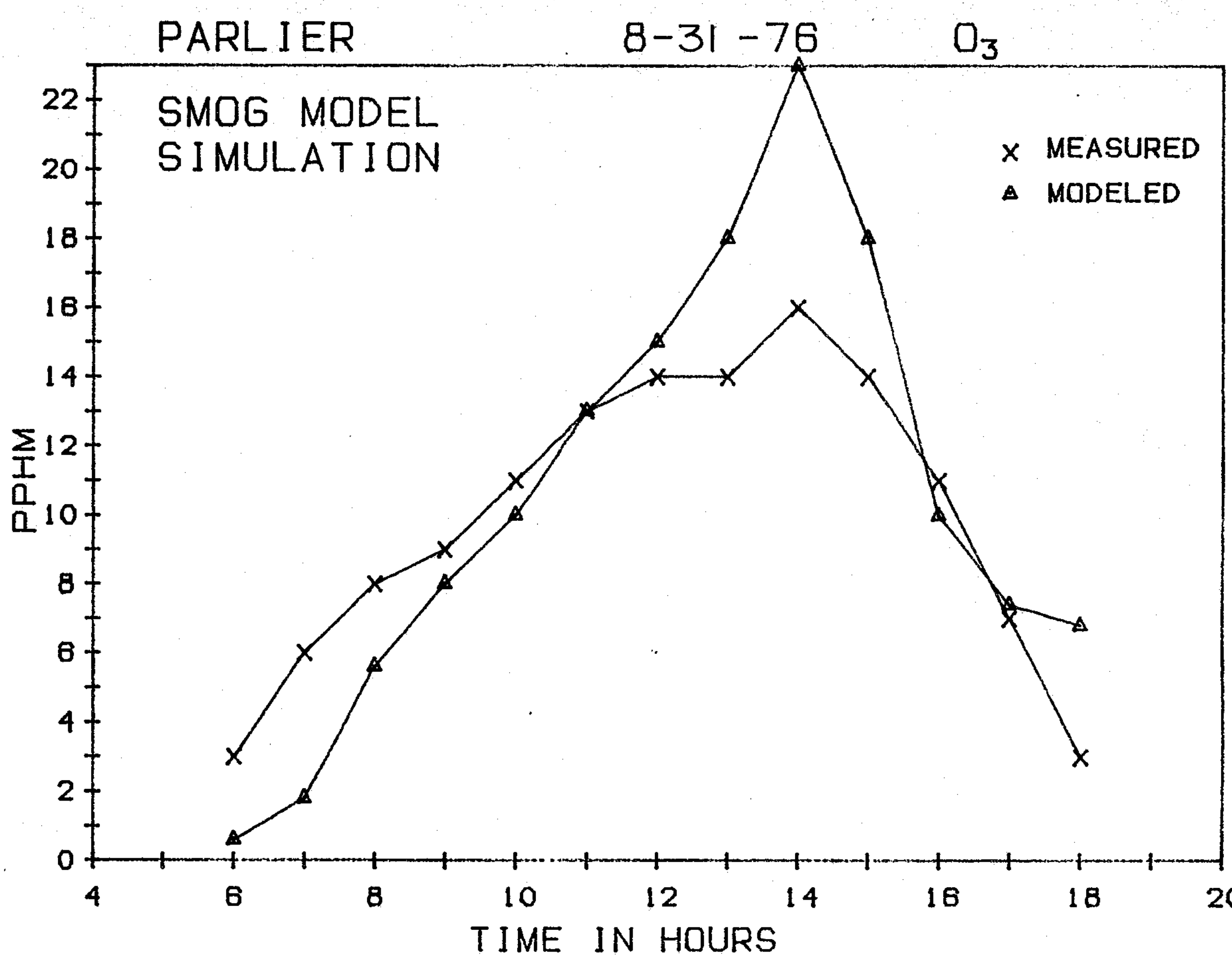
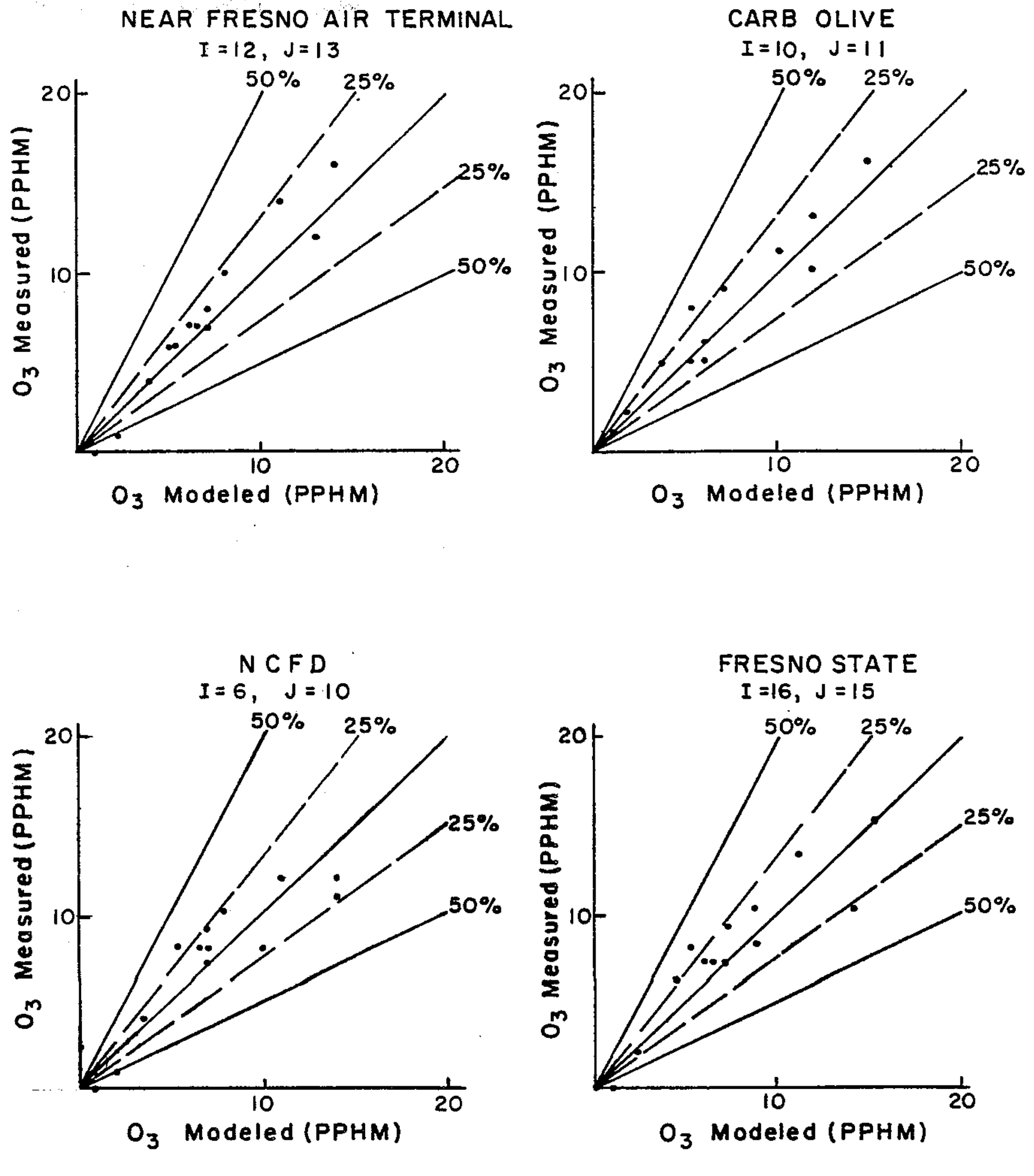
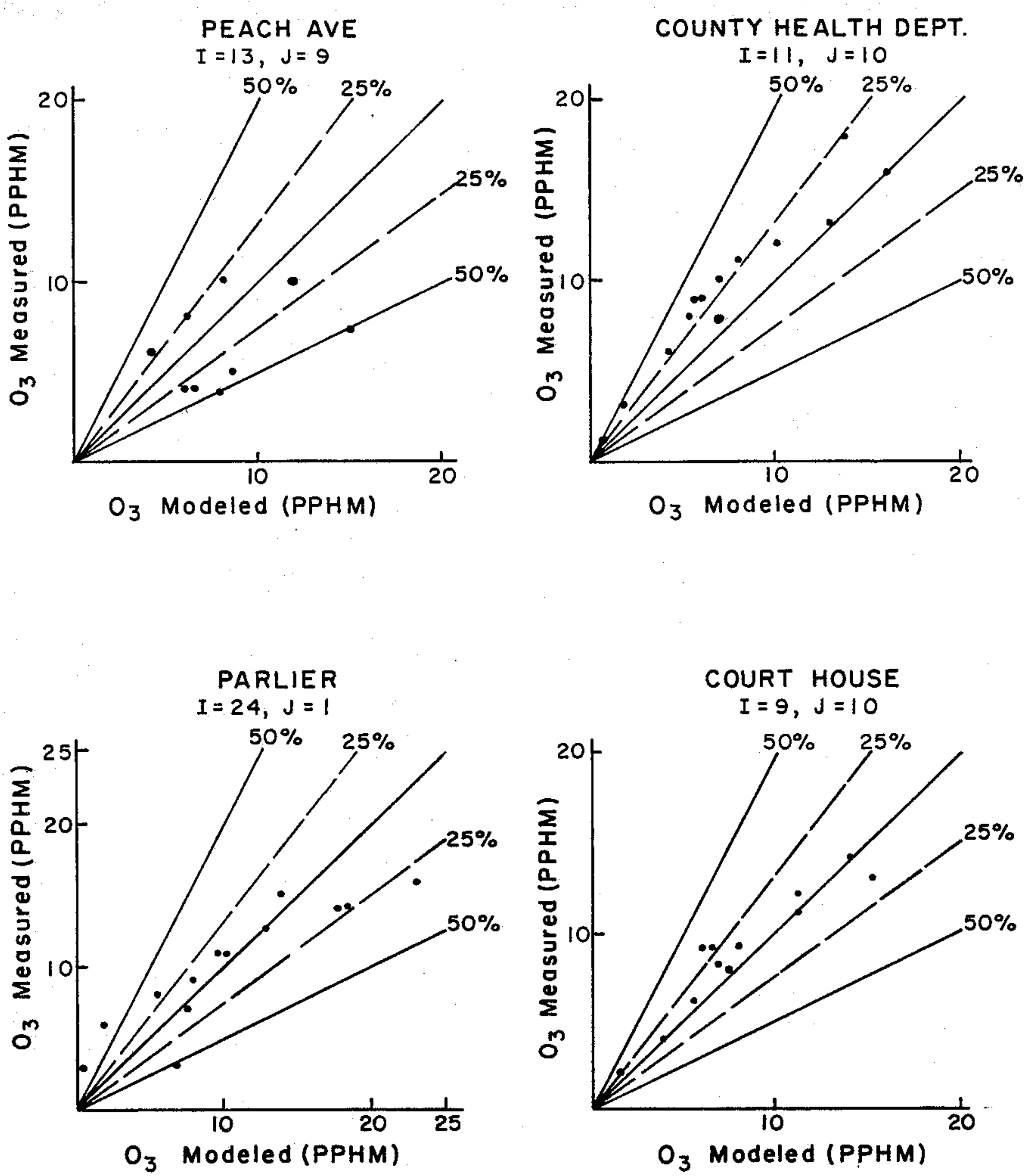

PARLIER
8-31-76
O_3
SMOG MODEL
SIMULATION
MEASURED
MODELED
PPHM
TIME IN HOURS
0
2
4
6
8
10
12
14
16
18
20
22
4
6
8
10
12
14
16
18
20

FIGURE 43



SCATTER PLOTS – MEASURED VS PREDICTED OZONE
Fresno Area, August 31, 1976

FIGURE 44

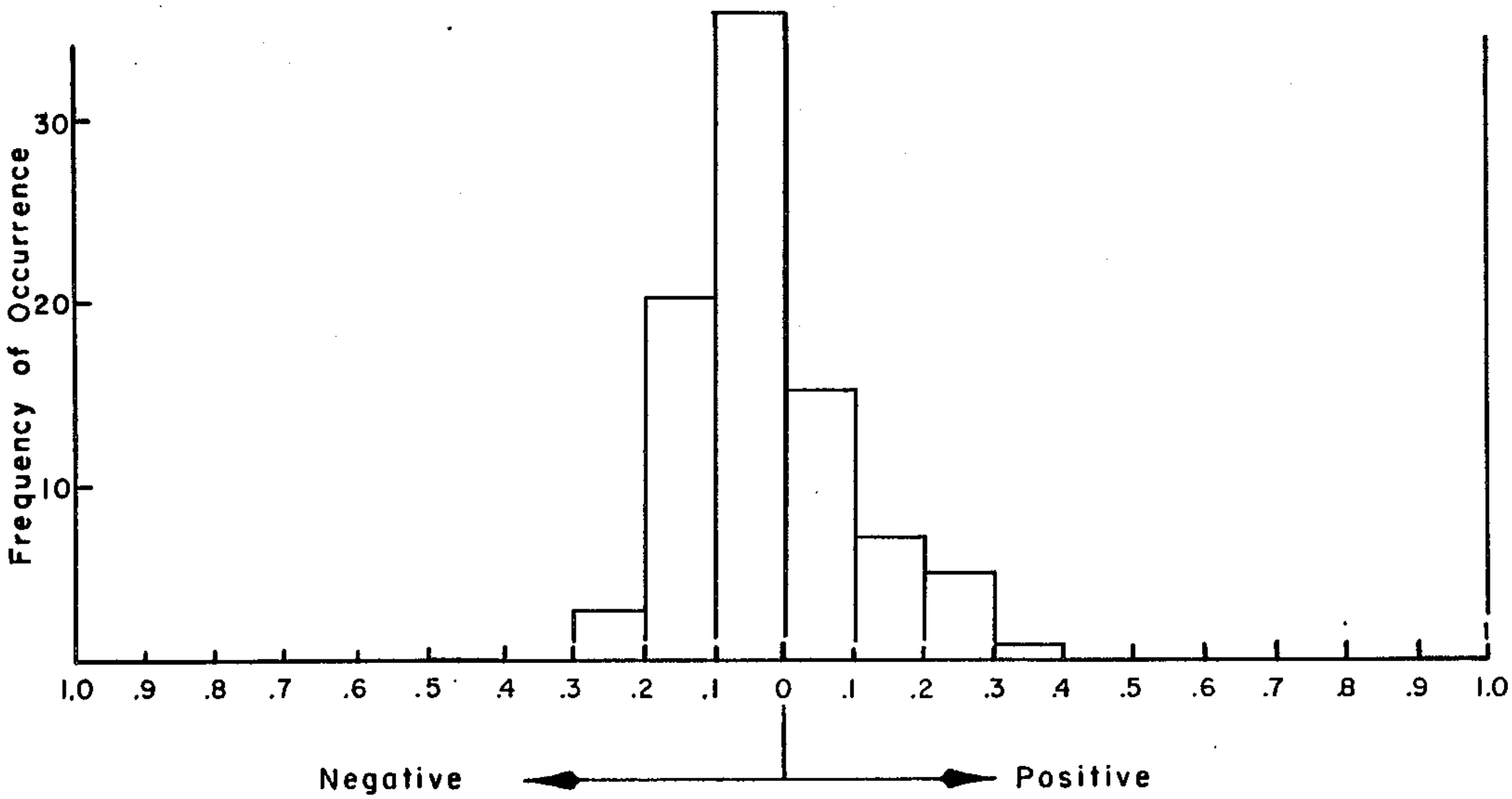


SCATTER PLOTS – MEASURED VS PREDICTED OZONE

Fresno Area, August 31, 1976

FIGURE 45

Comparison Factor = $\frac{\text{Predicted} - \text{Measured}}{\text{Predicted} + \text{Measured}}$



COMPARISON FACTOR – MEASURED AND MODELED OZONE CONCENTRATIONS

Fresno Area, August 31, 1976

Figure 46

The verification is further illustrated by the "Scatter Plots-Measured vs. Predicted Ozone." For the August 24 plots, the points are often outside of the 50% range, whereas for the August 31 plots, the points are almost always inside of the 50% range. The comparison factor Figures also show clearly that, in the case of August 24, the comparison factor deviates much more from the perfect value of zero, compared to deviation for August 31, where there appears to be more of a grouping effect around zero.

As shown in Figures 30 through 46, the MAQU modeling of the August 31 candidate day did result in a verification. The MAQU work also included a zero emissions run and a full emissions run. The peak ozone occurred around 1:00 p.m. and the double peak simulation which developed for the August 24 day did not occur in their August 31st simulations, but the north-south waves of high ozone did appear. It was the feeling of the MAQU air pollution engineers and atmospheric chemists that the north-south oriented waves of high ozone were the result of the emissions inventory. This theory is supported by the fact that the ozone simulations in the Sacramento regional modeling were relatively uniform in comparison with those in Fresno and the geography of the two areas is so similar.

It is believed that the success of the MAQU work is due to the higher ozone concentration on August 31 and to their perseverance in trying simulations with various initial hydrocarbon concentrations.

Figures 29 and 46 show the frequency of occurrence of various values of a statistical "comparison factor". As the SMOG model's predictions approach agreement with the measured ozone concentrations, the comparison factor approaches zero. This graph also reveals the tendency for the model to underpredict or overpredict the measured concentrations. The negative comparison factors indicate underprediction while the positive indicate overprediction.

Figures 47 through 52 are reproductions of the actual computer output from the SMOG model. The grid squares are designated by the "I" and "J" values, and the grid cell concentrations are averaged over the indicated hour. Figures 53 through 78 are wind speed and direction plots, computer generated for the candidate days, and are reproduced output from the windflow field analysis program(1).

SMOG MODEL OZONE PREDICTIONS

8-24-76, FRESNO REGION

SURFACE PRINT OF U3 PPM 0900-1000 HOURS

MULTIPLIER= 1.00000E-02

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
J= 25	6	6	6	6	6	6	6	6	6	6	6	6	6	7	8	8	7	7	7	7	8	8	8	8	8
J= 24	6	6	6	6	6	6	6	6	6	6	6	6	6	5	7	8	7	7	7	7	8	7	8	8	8
J= 23	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	8	7	7	6	7	8	7	8	8	8
J= 22	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	6	7	7	5	6	8	6	8	3	7
J= 21	6	6	6	6	6	7	7	7	7	7	7	7	7	6	7	5	5	5	4	7	6	5	8	8	7
J= 20	7	6	6	7	7	8	8	8	8	7	7	7	7	6	6	6	7	6	6	5	7	6	8	8	7
J= 19	7	7	7	7	6	8	9	9	9	8	8	6	7	6	6	6	6	6	6	5	5	6	7	8	7
J= 18	7	7	7	8	8	9	9	9	9	8	8	8	7	7	6	6	6	6	6	6	6	6	7	3	7
J= 17	7	7	7	8	8	9	9	9	9	8	8	8	7	7	6	5	6	6	6	6	6	6	5	6	7
J= 16	7	7	7	8	8	8	9	9	9	8	7	8	7	7	7	7	6	6	6	6	6	6	6	8	8
J= 15	7	7	8	8	9	9	8	9	9	7	8	10	8	8	7	6	6	6	6	6	6	6	6	5	4
J= 14	7	7	7	8	9	7	9	10	10	9	7	7	7	7	7	7	6	6	6	6	6	7	7	6	6
J= 13	7	7	7	6	8	9	9	9	9	8	8	8	8	7	7	7	7	6	6	6	6	6	6	7	7
J= 12	7	7	7	8	8	9	9	8	9	9	8	8	7	8	7	7	7	7	7	7	7	7	7	7	7
J= 11	7	7	7	7	8	8	8	8	9	9	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7
J= 10	6	6	6	7	8	9	7	7	9	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7
J= 9	6	6	6	6	8	4	7	10	10	7	7	8	8	6	6	7	7	7	7	7	7	7	7	7	7
J= 8	6	6	6	6	7	7	7	8	6	7	7	7	7	8	7	7	7	7	7	8	7	7	7	8	8
J= 7	6	6	6	6	6	6	7	7	6	8	7	7	7	7	7	7	7	7	8	8	8	7	7	8	8
J= 6	6	6	6	6	7	7	7	7	7	7	8	7	7	7	7	7	7	8	8	8	7	7	8	8	8
J= 5	7	6	6	6	6	7	7	7	7	7	7	7	7	7	7	8	8	8	6	8	7	8	8	8	8
J= 4	7	7	7	7	7	7	7	7	7	7	7	8	7	7	8	8	8	7	7	7	7	8	8	8	8
J= 3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8
J= 2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
J= 1	7	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

FIGURE 47

SMOG MODEL OZONE PREDICTIONS
8-24-76, FRESNO REGION
1200-1300 HOURS

SURFACE PRINT OF O3 PPM

MULTIPLIER= 1.00000E-02

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
J= 25	7	7	7	7	7	7	7	8	8	8	8	9	7	8	9	8	9	9	8	7	7	7	6	7	6
J= 24	7	7	7	7	7	7	7	8	8	8	8	8	9	8	9	9	8	8	7	6	6	5	5	5	5
J= 23	8	7	7	6	7	6	6	7	8	8	8	8	9	7	7	9	8	7	6	5	5	4	4	4	4
J= 22	7	7	7	7	7	7	6	6	7	8	9	8	8	8	7	8	7	6	5	5	4	4	4	4	4
J= 21	7	6	6	6	6	6	6	6	7	8	9	9	8	8	7	6	6	5	4	4	4	3	4	4	4
J= 20	7	6	5	5	5	6	6	6	7	8	8	9	9	8	7	6	5	5	4	4	4	3	3	3	4
J= 19	7	6	5	5	5	5	6	6	7	8	8	9	9	9	8	6	5	4	4	4	4	3	4	4	4
J= 18	7	6	5	5	4	4	5	6	7	8	8	9	9	9	9	7	5	4	4	3	3	3	4	4	4
J= 17	7	6	5	5	4	4	4	4	6	6	8	9	9	10	9	8	7	5	4	4	4	4	4	4	4
J= 16	7	6	5	4	4	3	3	4	3	8	6	8	9	10	10	9	8	6	4	3	3	4	4	4	4
J= 15	7	7	5	5	4	3	3	4	3	7	5	6	7	10	11	12	13	12	9	7	5	5	4	4	4
J= 14	8	7	6	5	4	3	3	4	3	5	3	4	5	6	8	9	10	10	10	9	7	6	5	5	5
J= 13	7	7	7	6	5	4	3	3	3	4	4	4	4	4	5	6	7	7	7	8	8	7	6	5	5
J= 12	8	8	6	5	5	4	3	3	3	4	4	4	4	4	4	5	5	5	5	6	6	7	6	5	4
J= 11	8	7	6	5	4	4	3	3	3	3	4	4	4	4	4	4	4	4	5	5	6	6	6	5	4
J= 10	8	7	6	5	4	4	3	3	3	3	3	4	4	4	4	4	4	4	5	5	6	7	6	5	4
J= 9	8	7	6	5	5	4	4	3	3	3	3	4	4	4	4	3	4	4	5	6	7	7	7	6	4
J= 8	8	7	7	6	5	4	4	3	3	3	3	3	4	5	4	4	4	4	5	6	7	8	7	6	5
J= 7	8	7	7	6	5	5	4	4	4	3	3	3	4	5	5	4	4	4	5	6	7	8	8	7	5
J= 6	6	7	7	6	5	5	4	4	4	4	4	3	4	5	5	5	4	4	5	6	7	8	8	7	5
J= 5	8	7	7	6	5	5	4	4	4	4	4	4	4	5	6	5	5	4	5	6	6	8	8	8	6
J= 4	8	7	6	6	5	5	4	4	4	4	4	5	5	6	7	7	6	5	5	6	6	8	9	8	6
J= 3	8	6	7	6	5	5	4	4	4	4	5	5	6	7	9	8	7	6	5	6	5	7	8	8	6
J= 2	6	6	3	7	6	5	4	4	4	4	5	5	7	8	9	11	9	7	6	5	5	6	7	6	6
J= 1	8	8	8	8	7	6	6	5	5	5	6	7	8	9	10	12	12	10	8	6	5	5	6	6	6

FIGURE 48

SMOG MODEL OZONE PREDICTIONS

8-24-76, FRESNO REGION

1500-1600 HOURS

SURFACE PRINT OF O3 . PPM

MULTIPLIER= 1.00000E-03

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
J= 25	71	72	74	75	76	77	78	79	78	81	76	88	60	76	77	78	78	79	79	80	80	80	80	81	81
J= 24	71	72	74	75	76	78	79	80	81	80	84	78	90	66	82	81	81	81	81	81	81	81	81	81	80
J= 23	71	73	74	76	77	78	79	80	81	83	84	78	92	63	82	82	83	82	82	81	80	79	78	78	75
J= 22	72	73	74	75	77	78	79	80	81	83	82	86	80	92	69	86	86	85	85	84	83	83	82	81	77
J= 21	71	72	74	75	77	78	79	81	82	83	84	84	85	84	85	87	81	88	68	79	68	52	64	65	64
J= 20	72	73	75	76	77	78	79	81	82	83	84	85	86	85	86	84	86	81	87	76	93	63	72	70	66
J= 19	72	73	75	76	77	78	79	81	82	83	84	85	85	85	65	84	84	81	64	75	89	58	72	71	66
J= 18	72	73	74	75	76	78	79	81	82	83	64	85	65	85	85	83	81	78	81	73	87	56	73	73	69
J= 17	72	72	72	74	75	77	79	79	80	80	80	84	83	90	80	64	63	64	63	65	64	67	65	65	61
J= 16	72	73	72	73	73	80	79	81	80	82	82	78	78	76	80	75	76	75	72	70	66	67	64	66	65
J= 15	72	73	73	72	71	73	71	73	72	71	75	76	76	77	78	80	79	77	72	71	62	73	45	55	49
J= 14	72	72	74	73	72	68	65	72	64	83	61	58	59	62	63	67	69	70	68	66	65	62	63	62	59
J= 13	72	72	73	73	72	70	69	68	63	67	68	65	65	63	62	62	64	64	65	64	62	60	60	61	62
J= 12	71	72	73	73	73	71	66	64	61	63	66	67	65	64	62	61	60	59	59	60	58	58	57	58	59
J= 11	71	73	73	73	74	66	56	55	51	55,	56	59	61	64	61	59	57	55	54	54	53	52	53	53	56
J= 10	71	73	73	73	73	72	69	64	55	52	53	55	58	59	58	57	55	53	51	51	49	48	48	47	51
J= 9	71	72	74	72	76	63	65	65	58	55	55	54	57	53	54	53	52	50	49	48	46	45	44	43	46
J= 8	71	73	73	74	73	73	72	71	63	58	54	51	51	51	51	50	50	48	46	45	44	42	43	39	41
J= 7	71	73	74	74	74	74	73	72	66	68	54	49	48	47	47	46	46	45	44	43	42	40	40	38	38
J= 6	72	73	74	74	75	74	72	71	69	66	61	56	52	49	47	46	45	44	42	41	40	38	38	36	36
J= 5	72	73	74	74	75	75	74	72	69	65	62	56	52	48	46	44	43	42	41	40	39	37	37	35	34
J= 4	72	73	74	74	75	75	74	73	69	66	61	58	52	48	45	43	42	40	39	38	37	36	35	34	33
J= 3	72	73	74	74	75	75	74	73	70	66	61	57	53	49	45	43	41	40	38	37	36	35	34	34	33
J= 2	72	73	74	75	75	75	74	72	69	65	61	57	52	49	46	43	41	40	38	37	36	35	34	33	32
J= 1	72	73	74	75	75	74	73	72	69	66	62	58	54	51	48	46	45	43	42	41	40	39	38	38	37

FIGURE 49

SMOG MODEL OZONE PREDICTIONS
8-31-76, FRESNO REGION
0900-1000 HOURS

SURFACE PRINT OF O3 PPM

MULTIPLIER= 1.00000E-02

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
J= 25	9	9	9	10	9	9	9	8	8	8	7	7	7	7	7	7	6	6	7	7	8	9	9	10	10
J= 24	9	10	10	11	10	10	9	9	8	8	7	7	7	7	7	7	6	6	7	7	8	9	9	10	10
J= 23	9	10	10	11	11	10	9	9	8	8	7	7	7	7	7	7	6	6	7	7	8	9	9	10	10
J= 22	9	10	11	11	11	10	9	8	8	8	8	7	7	7	7	7	6	6	7	7	8	9	9	10	10
J= 21	9	10	10	11	10	10	9	8	8	8	8	7	7	6	7	7	6	6	7	7	8	9	9	10	10
J= 20	8	10	10	10	10	10	9	8	8	8	7	7	7	6	6	7	6	6	7	7	8	9	9	10	10
J= 19	8	9	10	10	10	9	9	8	7	7	7	7	7	6	6	7	7	6	7	7	8	9	9	10	10
J= 18	8	9	9	9	9	9	9	8	7	7	7	7	7	6	6	6	7	6	7	7	8	9	9	10	10
J= 17	8	8	8	9	8	8	9	8	7	7	7	7	7	7	5	5	7	6	7	7	8	9	9	10	10
J= 16	7	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7	6	7	7	7	8	9	9	10	10
J= 15	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	7	7	8	9	9	10	10
J= 14	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	9	9	10	10
J= 13	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	9	9	10	10
J= 12	7	7	7	7	7	7	7	6	6	7	7	7	7	7	8	7	7	7	7	7	8	9	9	10	10
J= 11	7	7	7	7	7	7	7	7	6	7	7	7	7	7	8	8	7	7	7	7	8	9	9	10	10
J= 10	8	8	8	8	8	7	7	7	7	7	7	8	7	8	8	8	8	8	8	8	8	9	9	10	10
J= 9	8	8	8	8	8	8	8	8	7	7	7	8	8	8	8	8	8	8	8	8	8	9	9	10	10
J= 8	8	8	8	8	8	8	8	8	8	7	7	8	8	8	8	9	9	9	9	9	9	9	9	10	10
J= 7	9	9	9	9	9	9	9	9	9	9	7	9	9	9	9	9	9	9	9	9	9	9	9	10	10
J= 6	10	10	9	9	9	9	9	9	9	9	10	9	9	10	10	10	10	10	10	10	10	10	9	10	10
J= 5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
J= 4	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
J= 3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	11	10	10	10	10	10	10
J= 2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	11	10	10	10	10	10
J= 1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

FIGURE 50

SMOG MODEL OZONE PREDICTIONS

8-31-76, FRESNO REGION

1200-1300 HOURS

SURFACE PRINT OF O3 PPM

MULTIPLIER= 1.00000E-02

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
J= 25	11	12	13	13	14	14	14	14	15	15	15	16	16	16	15	15	15	14	14	13	13	13	13	12	13
J= 24	11	11	12	13	14	14	15	16	16	17	17	17	18	17	17	16	16	15	14	14	13	13	13	12	12
J= 23	11	11	12	13	14	14	15	16	16	17	17	17	17	17	17	17	16	15	15	14	13	13	13	12	12
J= 22	11	11	12	13	14	14	15	16	17	17	17	17	17	17	17	17	16	15	15	14	13	13	13	12	12
J= 21	11	11	12	13	14	14	15	16	16	17	17	17	17	17	16	16	16	15	15	14	13	13	13	12	12
J= 20	11	11	12	13	14	14	15	16	16	17	16	16	16	16	16	16	15	15	15	14	14	13	13	12	12
J= 19	11	11	12	13	14	14	15	16	16	16	16	15	15	15	15	15	15	15	14	14	14	13	13	13	12
J= 18	11	11	12	13	14	15	15	16	16	16	16	15	14	14	14	15	15	15	15	14	14	14	14	13	13
J= 17	11	11	12	13	13	14	15	16	16	16	15	14	13	14	12	10	12	12	13	13	14	14	14	14	13
J= 16	11	11	12	12	13	14	15	16	16	16	15	14	13	13	13	12	13	13	14	14	14	14	15	14	14
J= 15	11	11	12	12	13	14	15	16	16	16	15	15	14	13	13	13	14	14	14	14	15	15	15	15	15
J= 14	11	11	12	13	13	14	15	15	16	16	16	15	14	14	13	14	14	14	14	15	15	15	15	15	15
J= 13	11	11	12	13	13	14	15	15	15	15	15	14	14	14	14	14	14	15	15	15	15	15	16	16	16
J= 12	11	11	12	13	13	14	15	15	16	16	16	15	14	14	14	15	15	16	16	16	16	16	16	16	17
J= 11	11	11	12	12	13	14	14	15	15	15	15	15	14	14	15	15	16	16	17	17	17	17	17	17	18
J= 10	11	11	12	12	13	14	15	15	15	16	16	16	15	15	15	16	17	17	18	18	19	19	19	19	19
J= 9	11	11	12	12	13	14	15	15	16	17	17	18	17	17	17	18	18	19	19	19	19	20	20	20	20
J= 8	11	11	12	13	13	14	15	16	16	17	17	18	18	18	18	18	19	19	19	20	20	20	21	21	21
J= 7	11	11	12	13	13	14	15	16	16	18	16	17	18	19	19	19	20	20	20	21	21	21	21	21	21
J= 6	11	11	12	13	13	14	15	16	17	18	18	19	20	20	20	21	21	21	21	22	22	22	22	22	22
J= 5	11	11	12	13	13	14	15	16	17	18	19	20	21	21	21	22	22	22	22	22	22	22	22	22	22
J= 4	11	11	12	13	13	14	15	16	17	18	19	21	21	21	22	22	22	22	22	22	22	22	22	22	22
J= 3	11	11	12	13	13	14	15	16	17	18	19	20	21	21	21	21	21	21	21	21	21	21	21	21	21
J= 2	11	11	12	13	13	14	15	16	17	18	19	19	20	20	20	20	20	20	20	20	20	19	19	19	19
J= 1	11	11	12	13	14	14	15	16	17	17	18	18	18	19	19	18	18	18	18	18	18	18	18	18	18

FIGURE 51

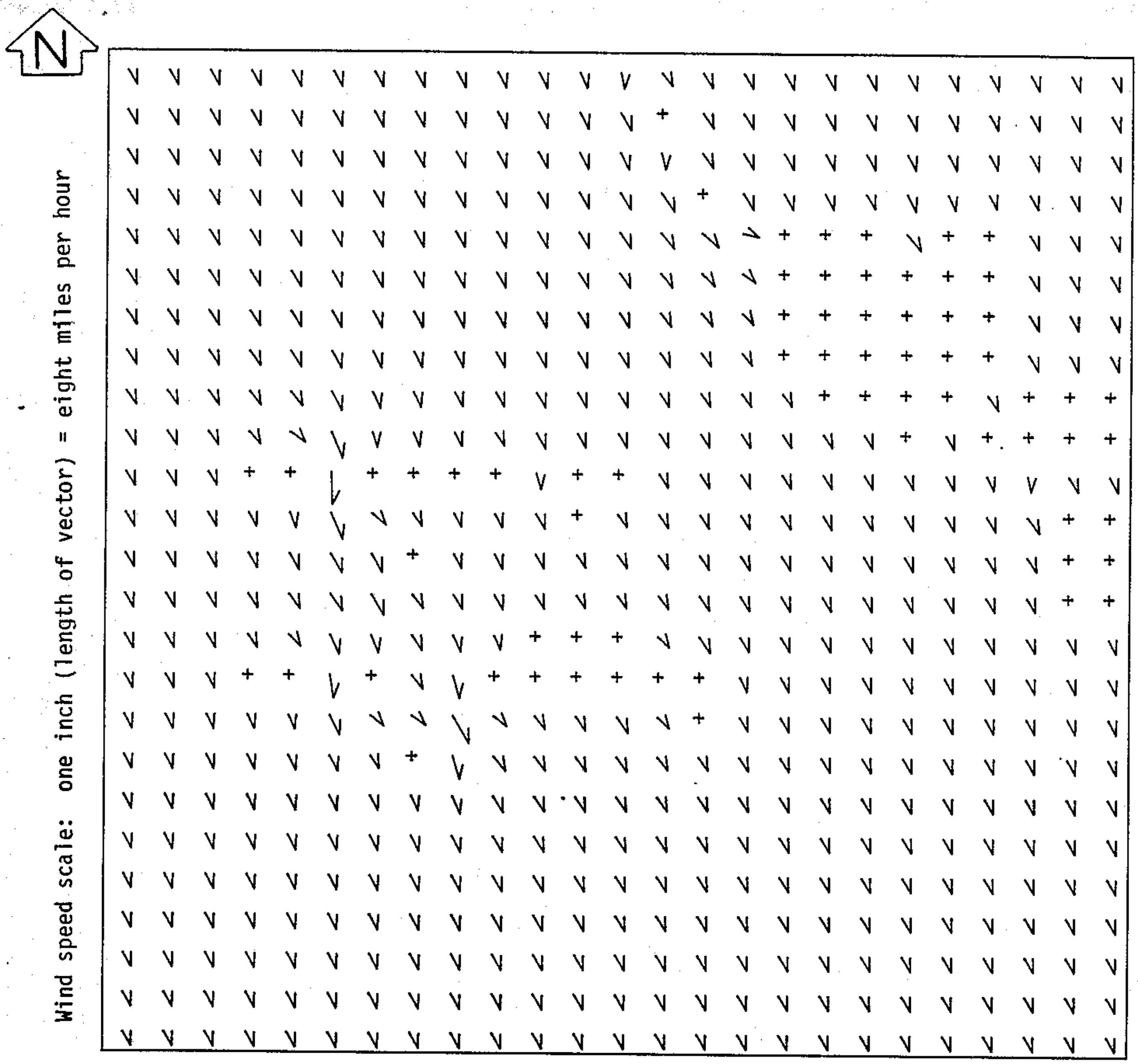
SMOG MODEL OZONE PREDICTIONS
8-31-76, FRESNO REGION
1500–1600 HOURS

SURFACE PRINT OF O3 PPM

MULTIPLIER= 1.00000E-02

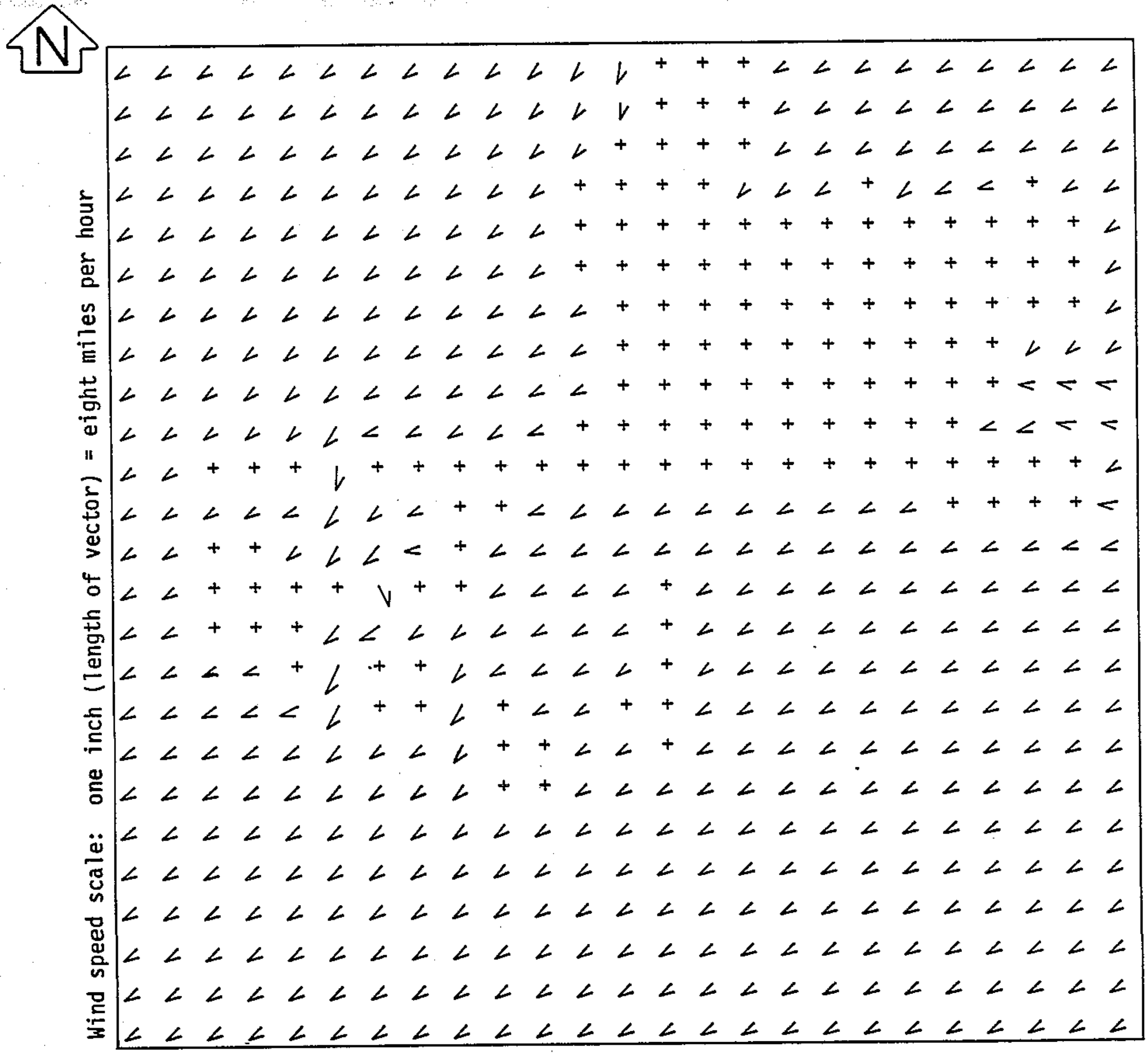
I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
J= 25	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
J= 24	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
J= 23	7	7	7	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	9	9	8	8	8	8	8
J= 22	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9
J= 21	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9
J= 20	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	10
J= 19	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	9	9	10	10	10
J= 18	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	9	9	10	10	10	10	11	11
J= 17	7	7	7	7	7	7	7	7	7	7	7	7	7	8	7	5	6	6	7	8	9	9	10	11	11
J= 16	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	9	9	10	11
J= 15	7	7	7	7	7	7	7	7	7	6	7	7	7	7	7	7	7	8	8	8	8	9	9	9	10
J= 14	7	7	7	7	7	7	7	7	7	6	6	7	7	7	7	7	8	8	8	8	9	9	9	9	10
J= 13	7	7	7	7	7	7	7	7	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10
J= 12	7	7	7	7	7	7	7	7	6	6	6	6	6	6	7	7	8	8	8	9	9	9	10	10	10
J= 11	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	7	7	8	8	8	9	9	10	10	10
J= 10	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	9	9	10	10	11
J= 9	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	9	9	10	10
J= 8	7	7	7	7	7	7	7	7	7	6	7	7	8	8	8	8	8	8	8	8	9	9	9	9	10
J= 7	7	7	7	7	7	7	7	7	7	7	6	6	7	7	8	8	9	9	9	9	9	9	9	10	10
J= 6	7	7	7	7	7	7	7	7	7	7	7	6	7	7	7	8	8	9	9	9	9	10	10	10	11
J= 5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	9	9	9	10	10	10	11
J= 4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	10	10	11
J= 3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	9	9	9	10	10	11
J= 2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	9	9	9	10	11
J= 1	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	9	9	9	10	10

FIGURE 52



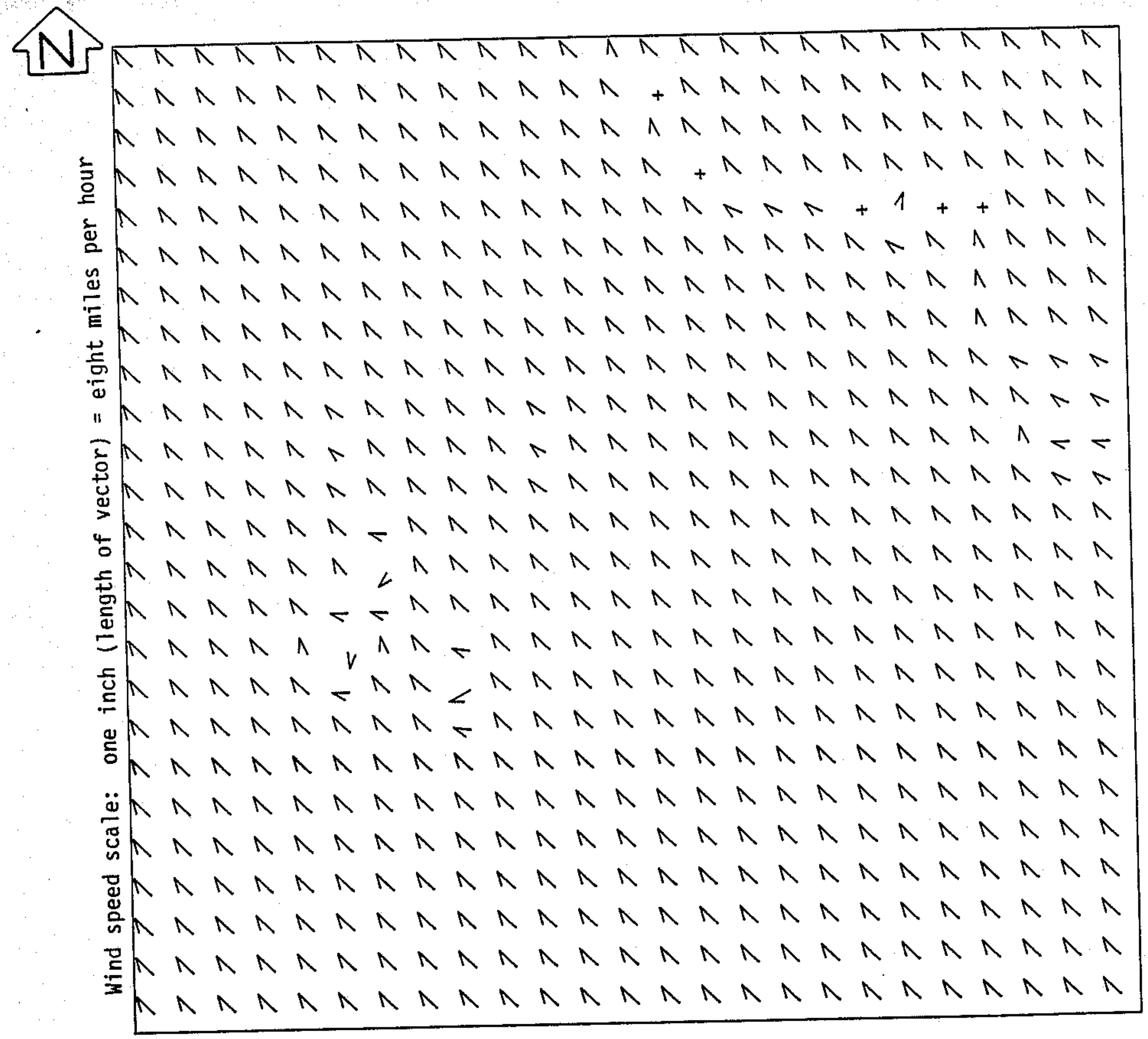
WIND FLOW FIELD — FRESNO
0600 HOURS AUGUST 24, 1976

FIGURE 53



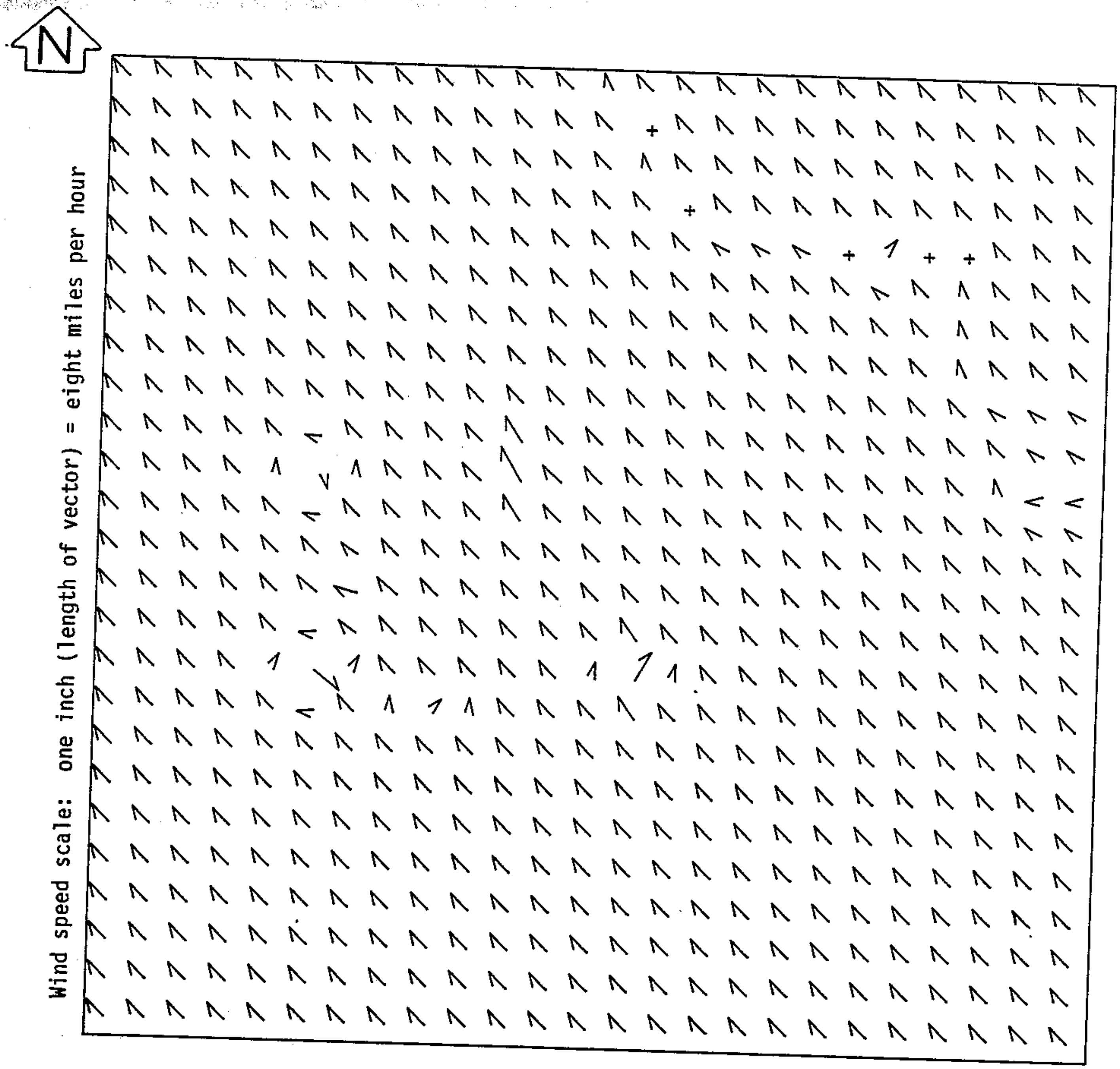
WIND FLOW FIELD — FRESNO
0700 HOURS AUGUST 24, 1976

FIGURE 54



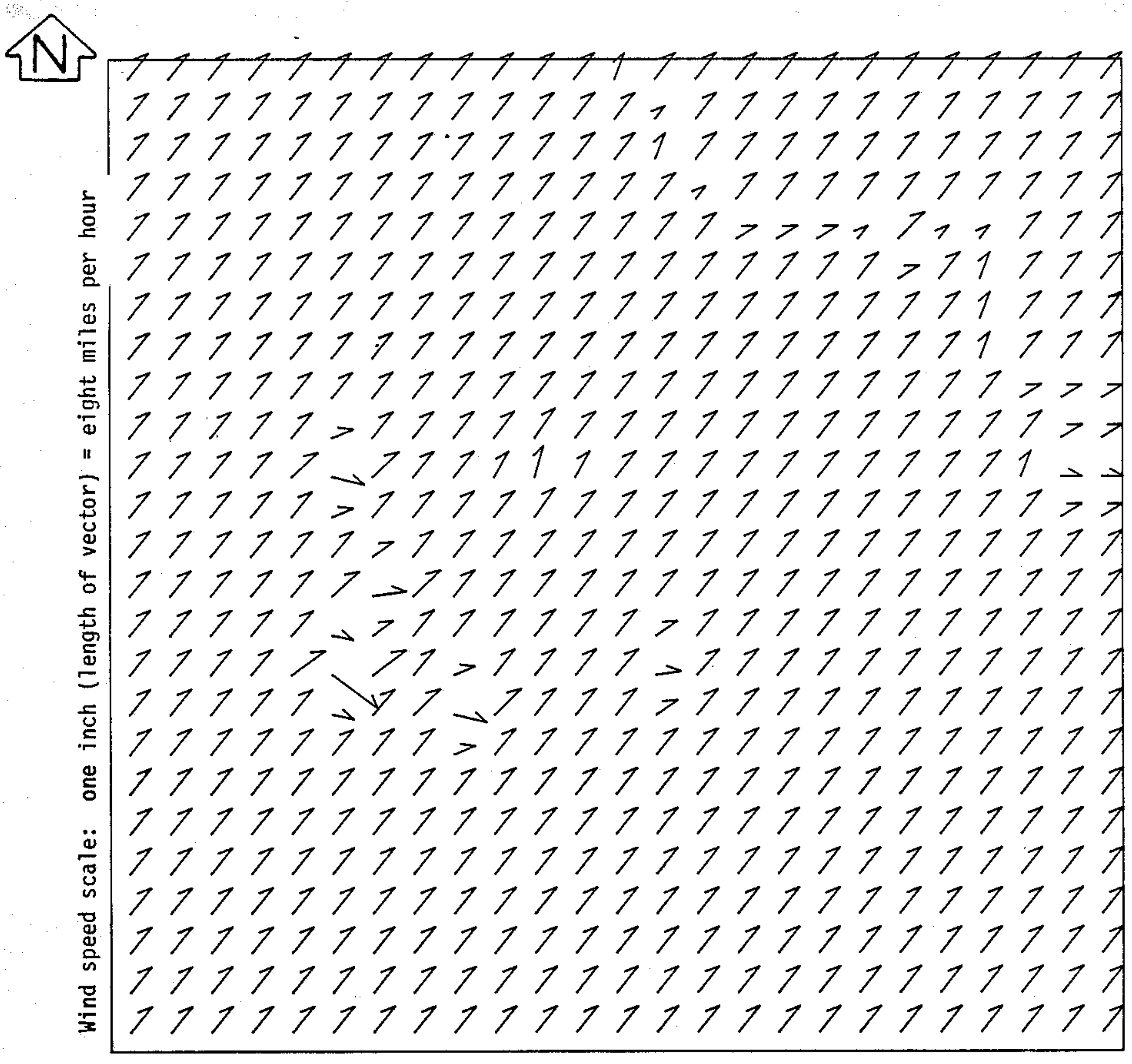
WIND FLOW FIELD— FRESNO
0800 HOURS AUGUST 24, 1976

FIGURE 55



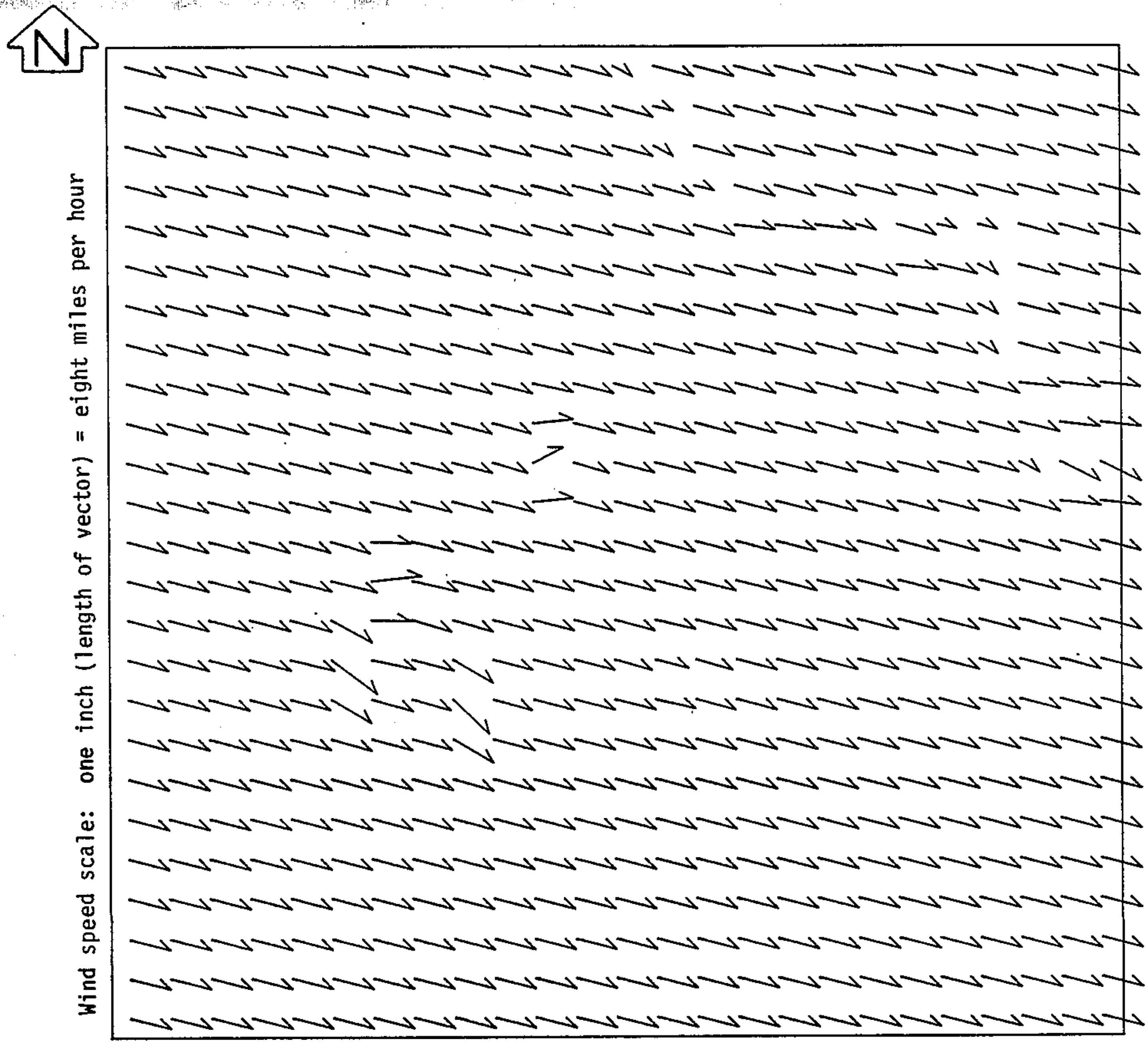
WIND FLOW FIELD — FRESNO
0900 HOURS AUGUST 24, 1976

FIGURE 56



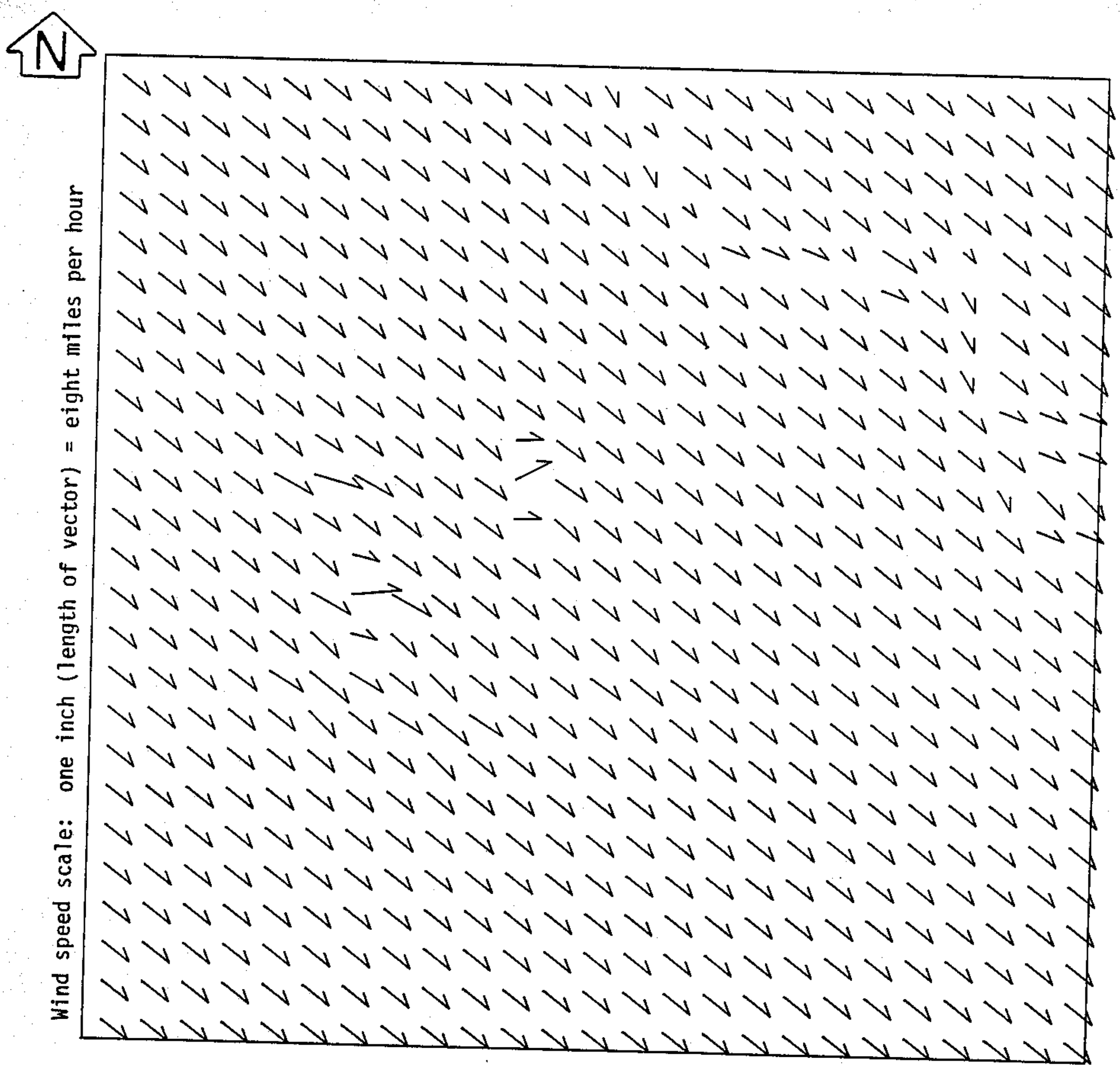
WIND FLOW FIELD — FRESNO
1000 HOURS AUGUST 24, 1976

FIGURE 57



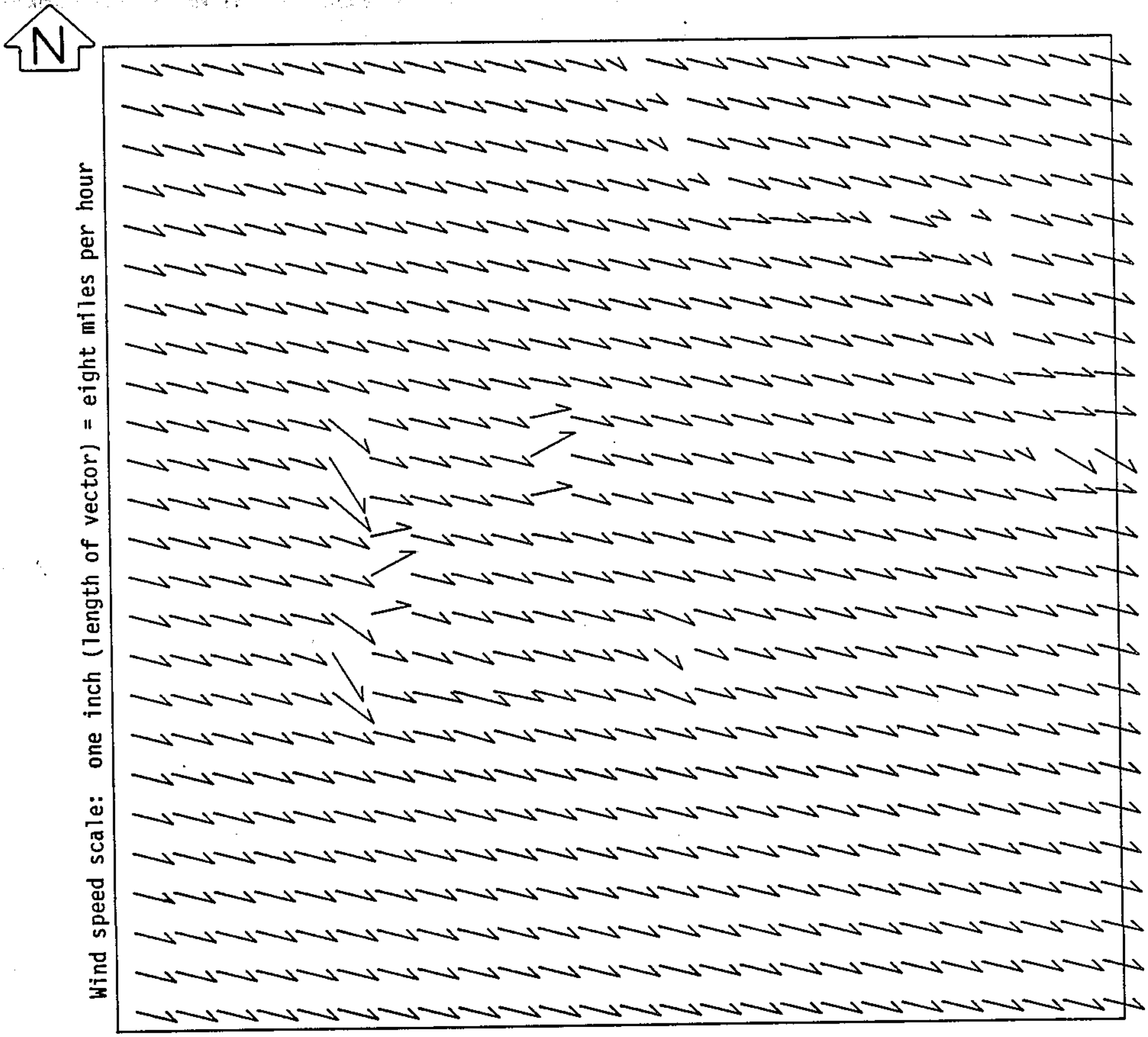
WIND FLOW FIELD — FRESNO
1100 HOURS   AUGUST 24, 1976

FIGURE 58



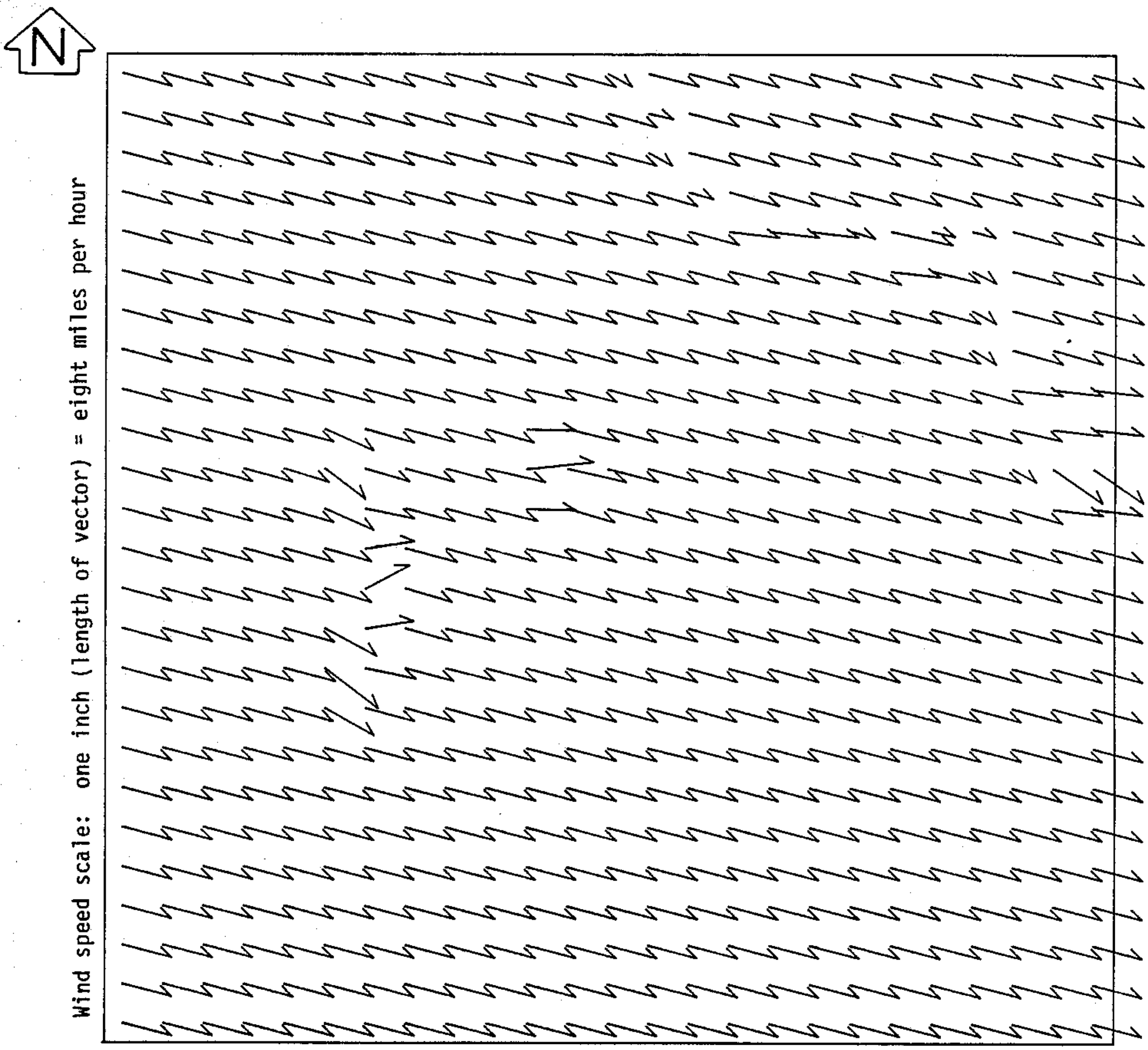
WIND FLOW FIELD — FRESNO
1200 HOURS AUGUST 24, 1976

FIGURE 59



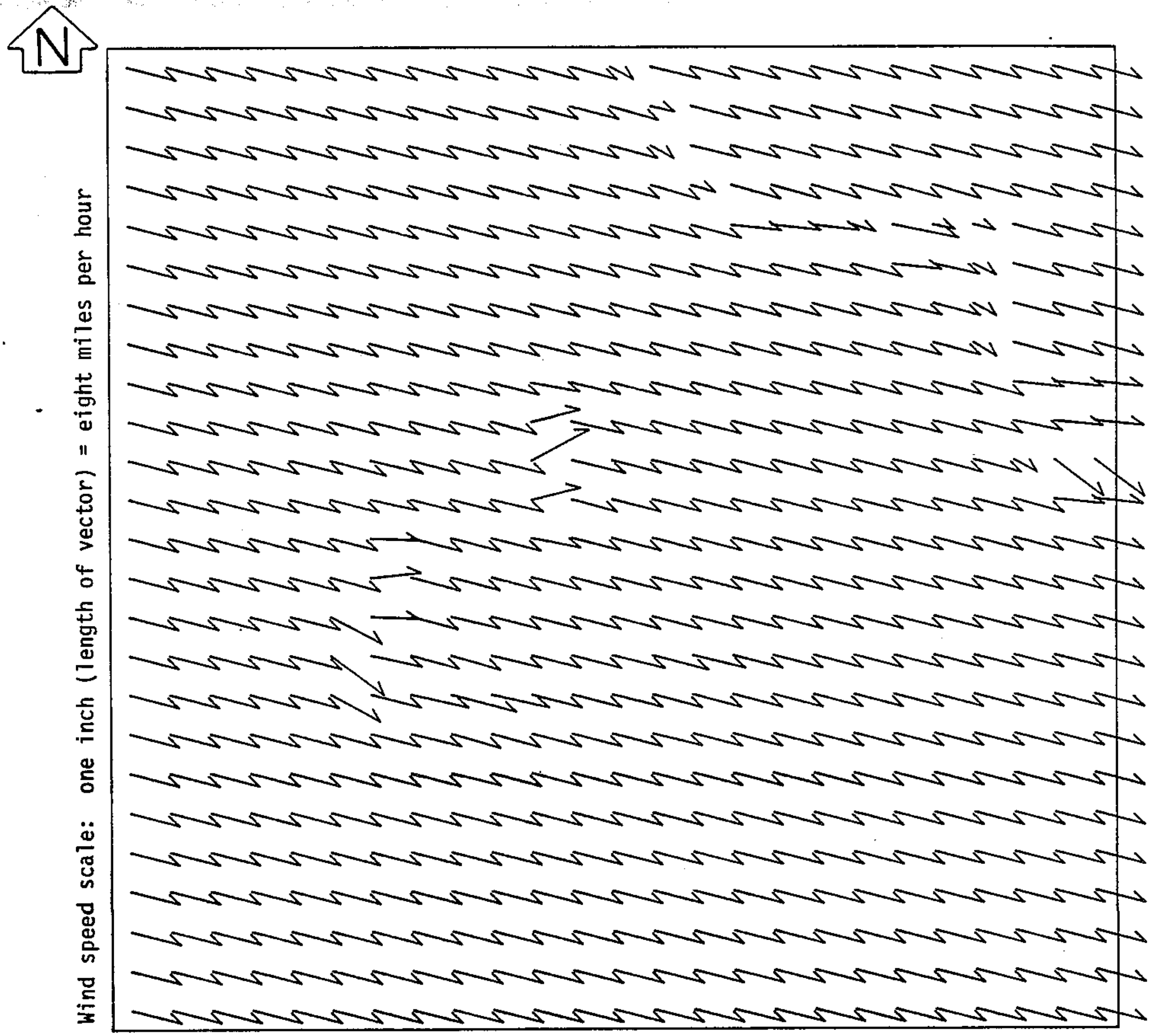
WIND FLOW FIELD — FRESNO
1300 HOURS AUGUST 24, 1976

FIGURE 60



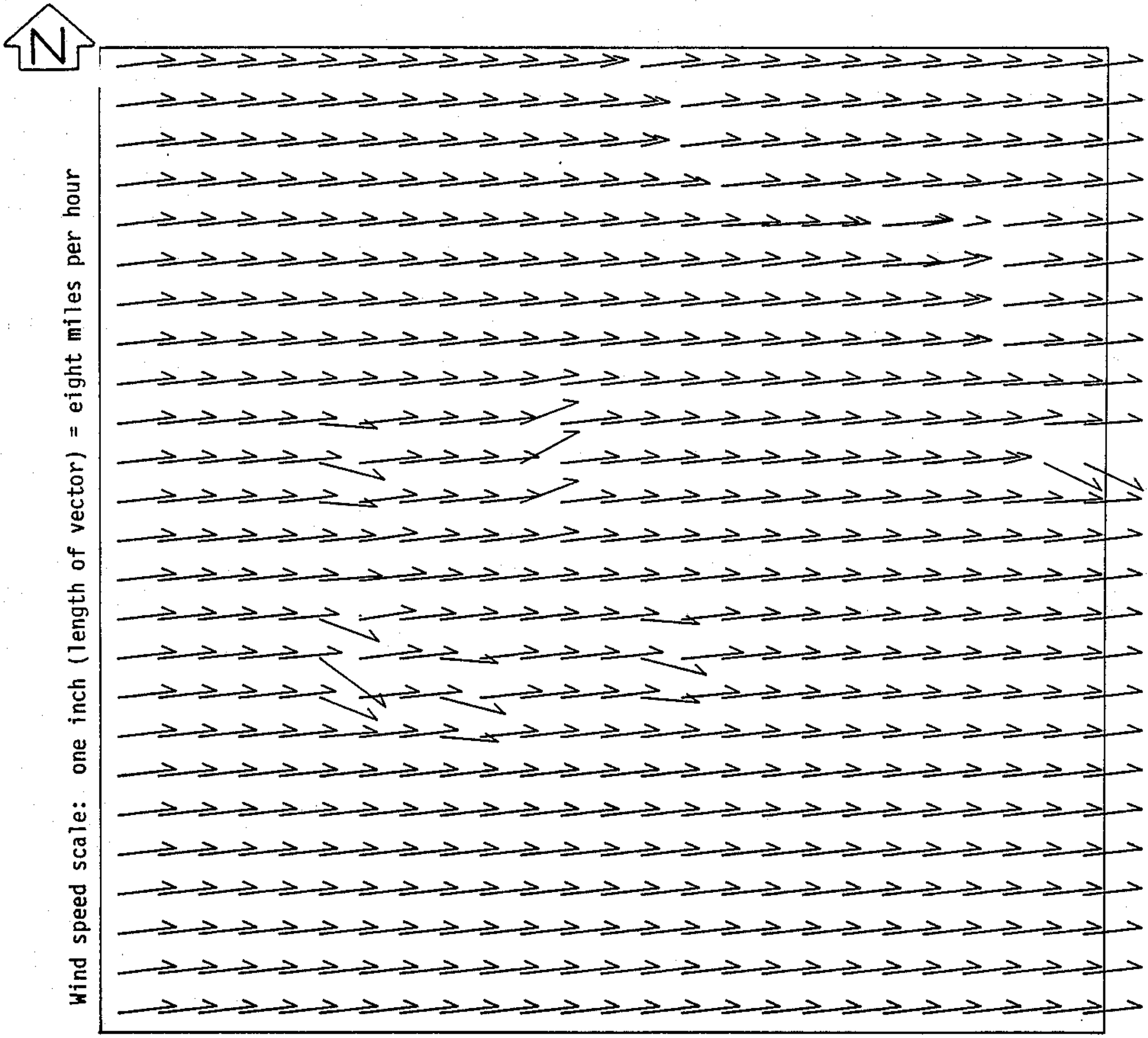
WIND FLOW FIELD — FRESNO
1400 HOURS AUGUST 24, 1976

FIGURE 61



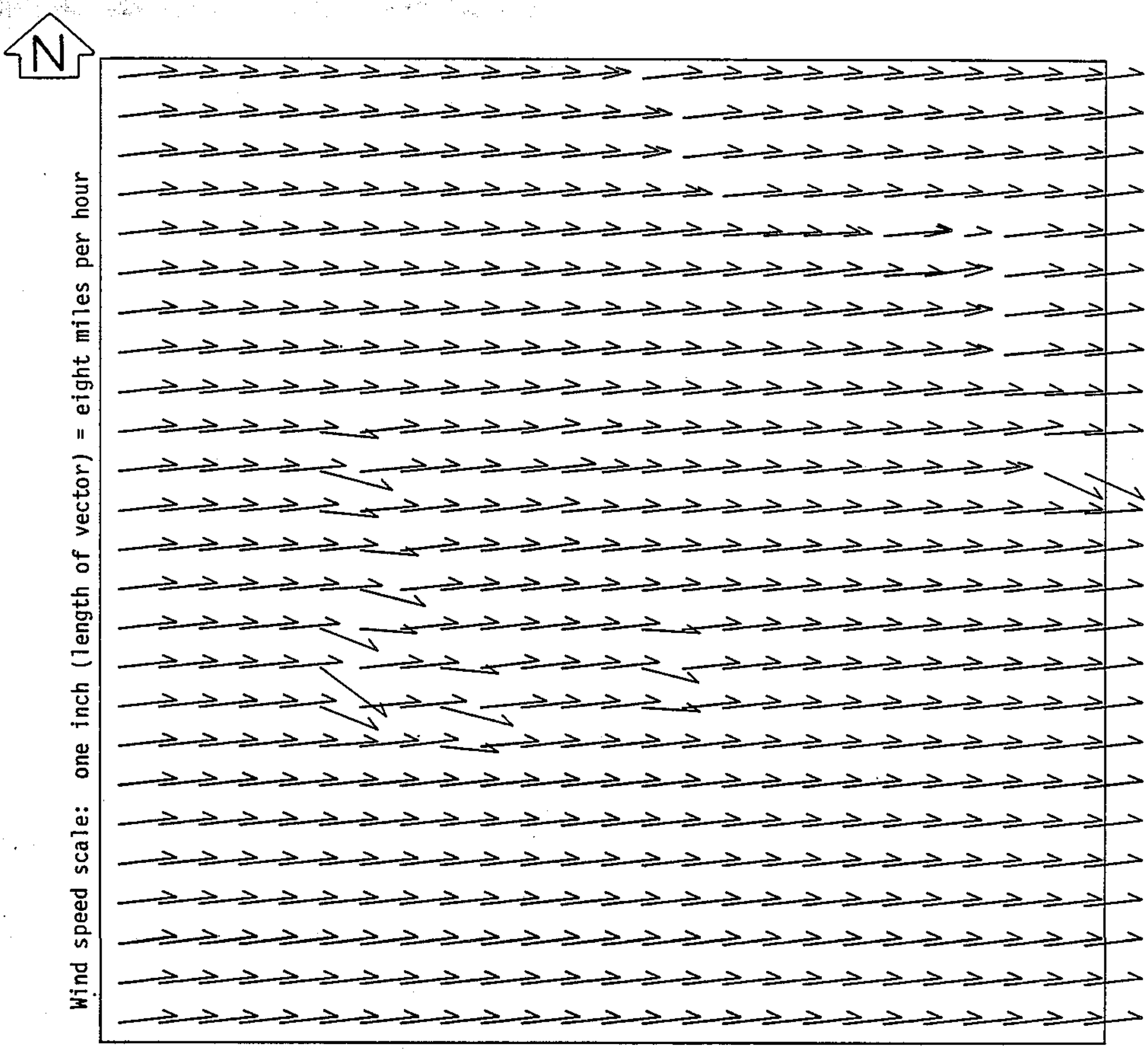
WIND FLOW FIELD — FRESNO
1500 HOURS AUGUST 24, 1976

FIGURE 62



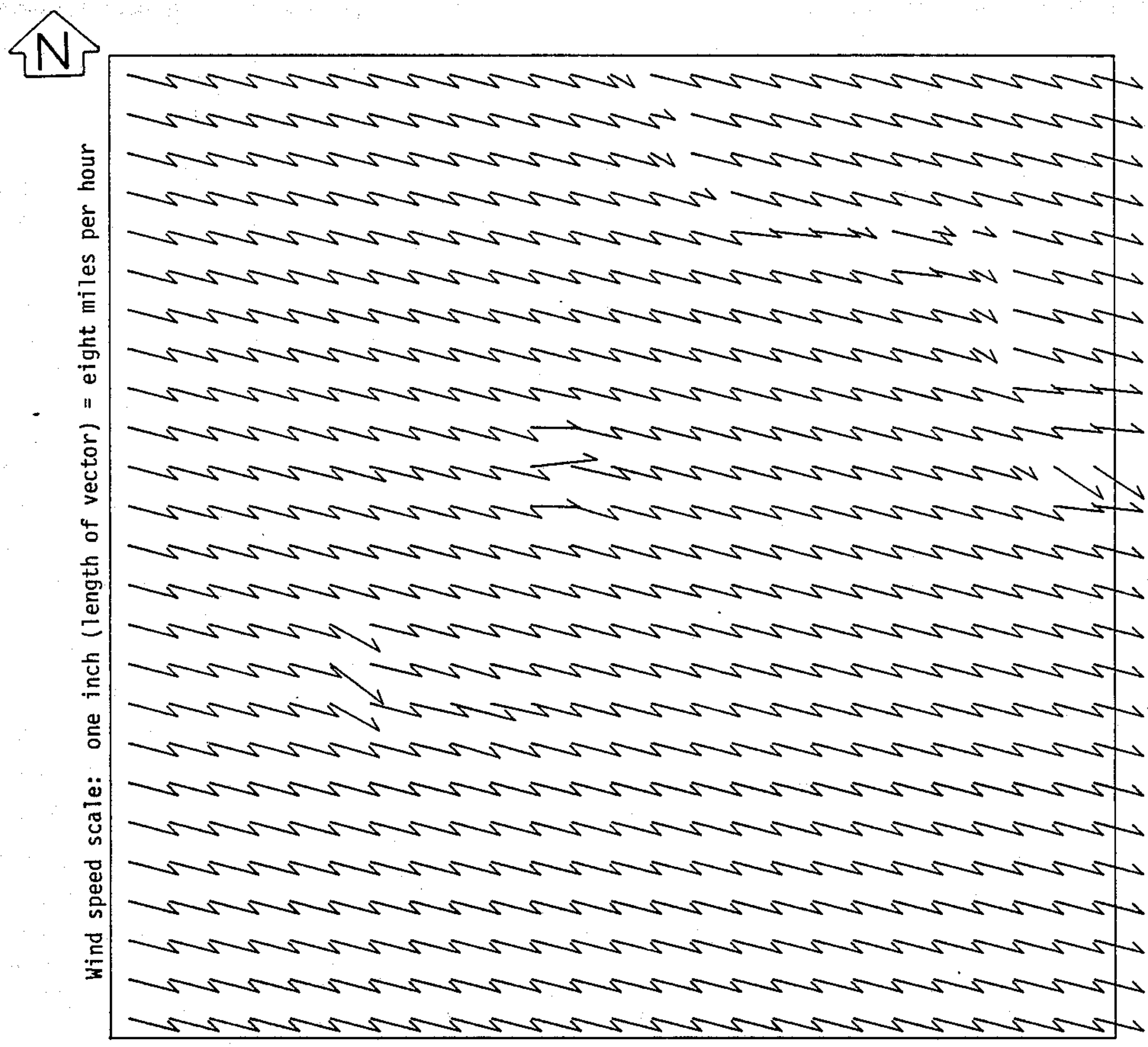
WIND FLOW FIELD — FRESNO
1600 HOURS AUGUST 24, 1976

FIGURE 63



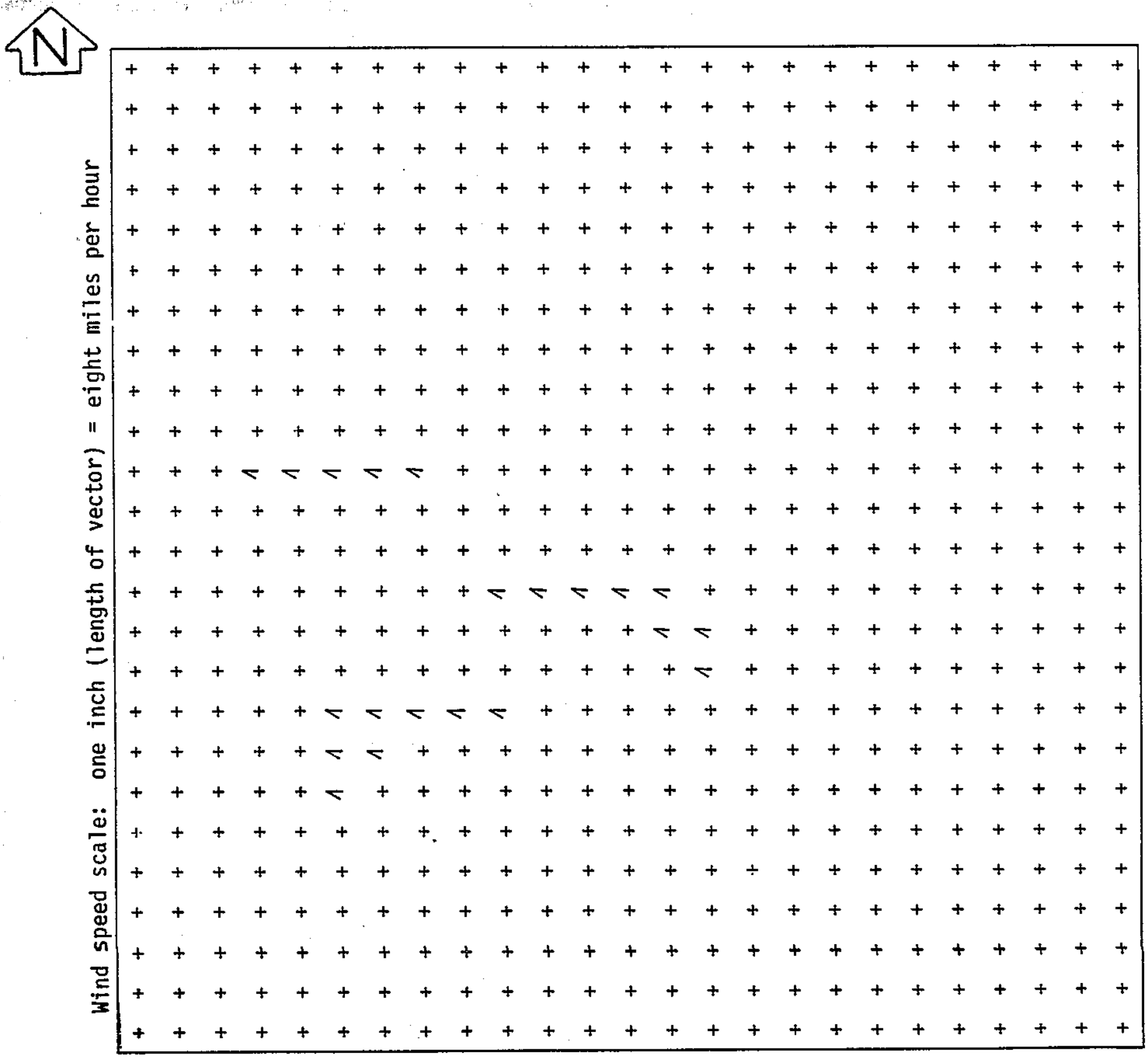
WIND FLOW FIELD — FRESNO
1700 HOURS AUGUST 24, 1976

FIGURE 64



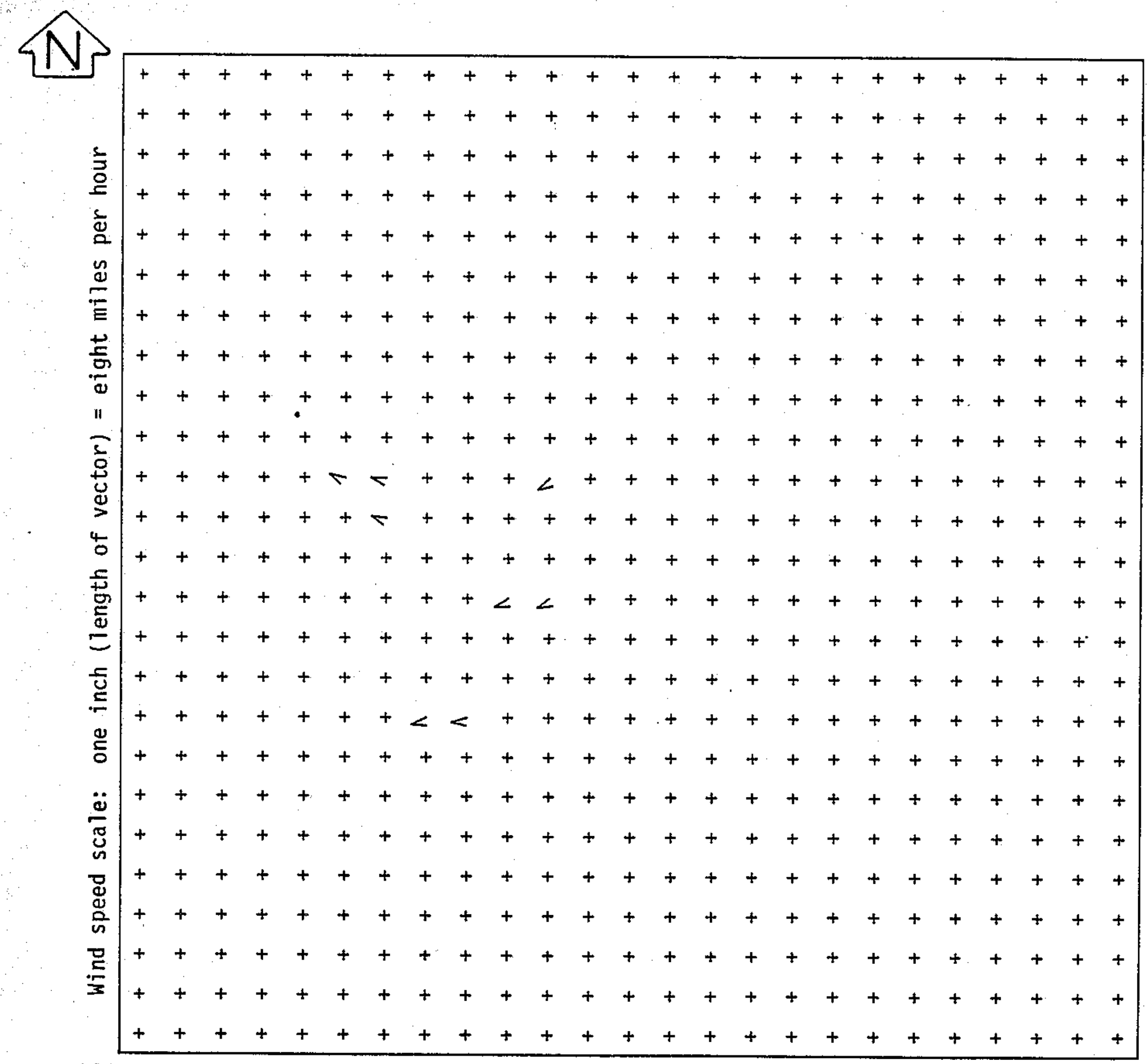
WIND FLOW FIELD — FRESNO
1800 HOURS AUGUST 24, 1976

FIGURE 65



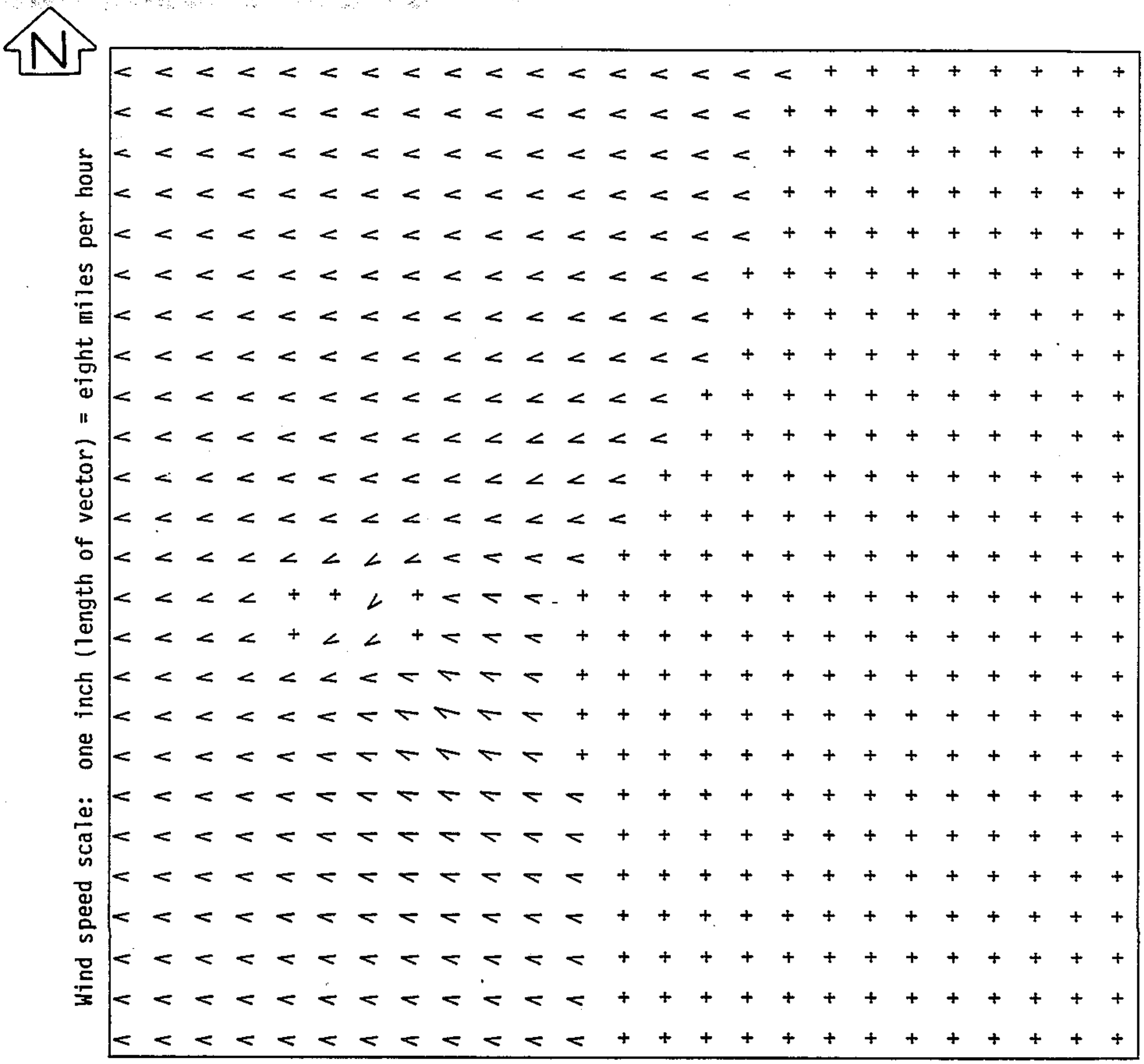
WIND FLOW FIELD — FRESNO
0600 HOURS AUGUST 31, 1976

FIGURE 66



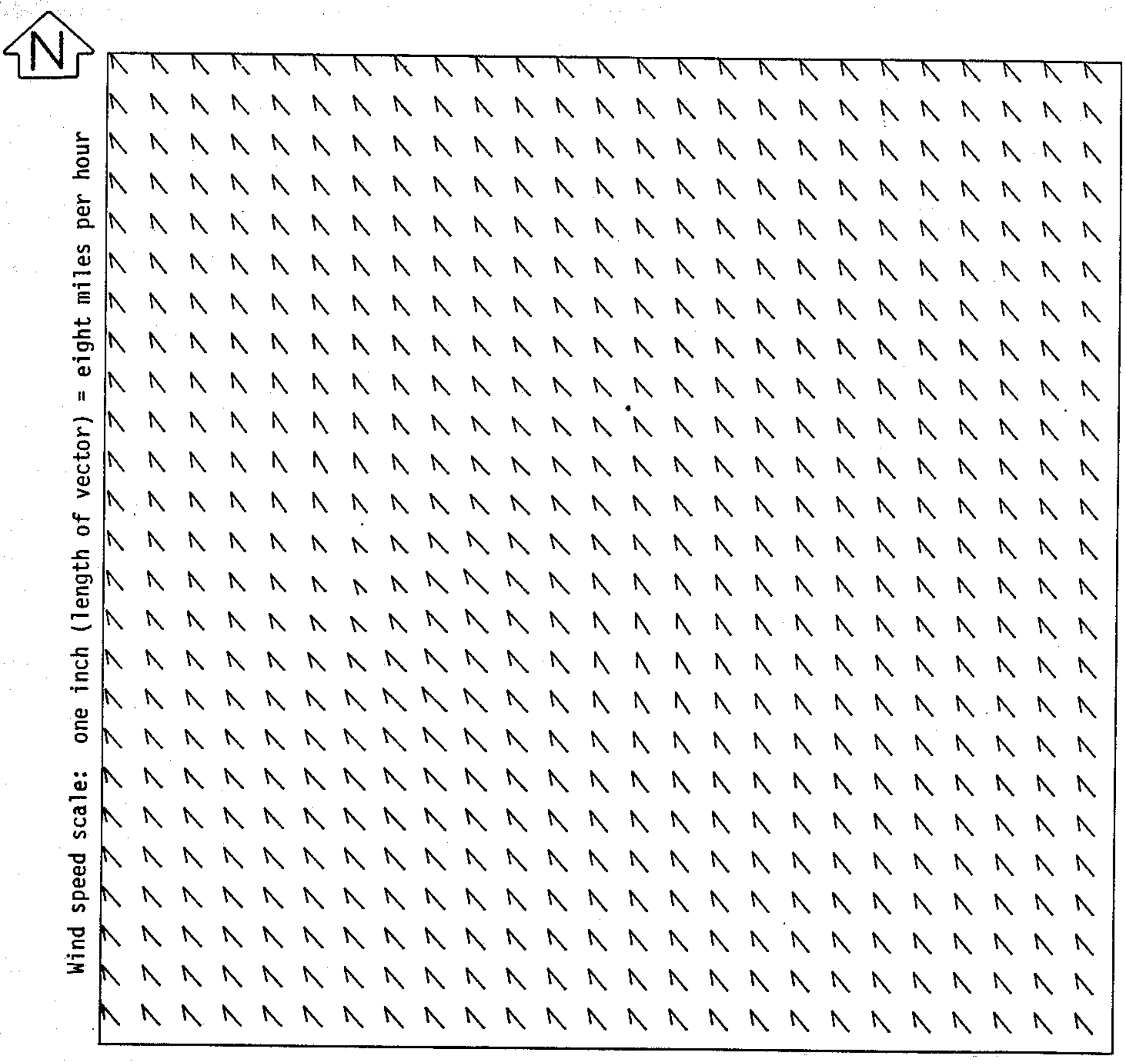
WIND FLOW FIELD — FRESNO
0700 HOURS AUGUST 31, 1976

FIGURE 67



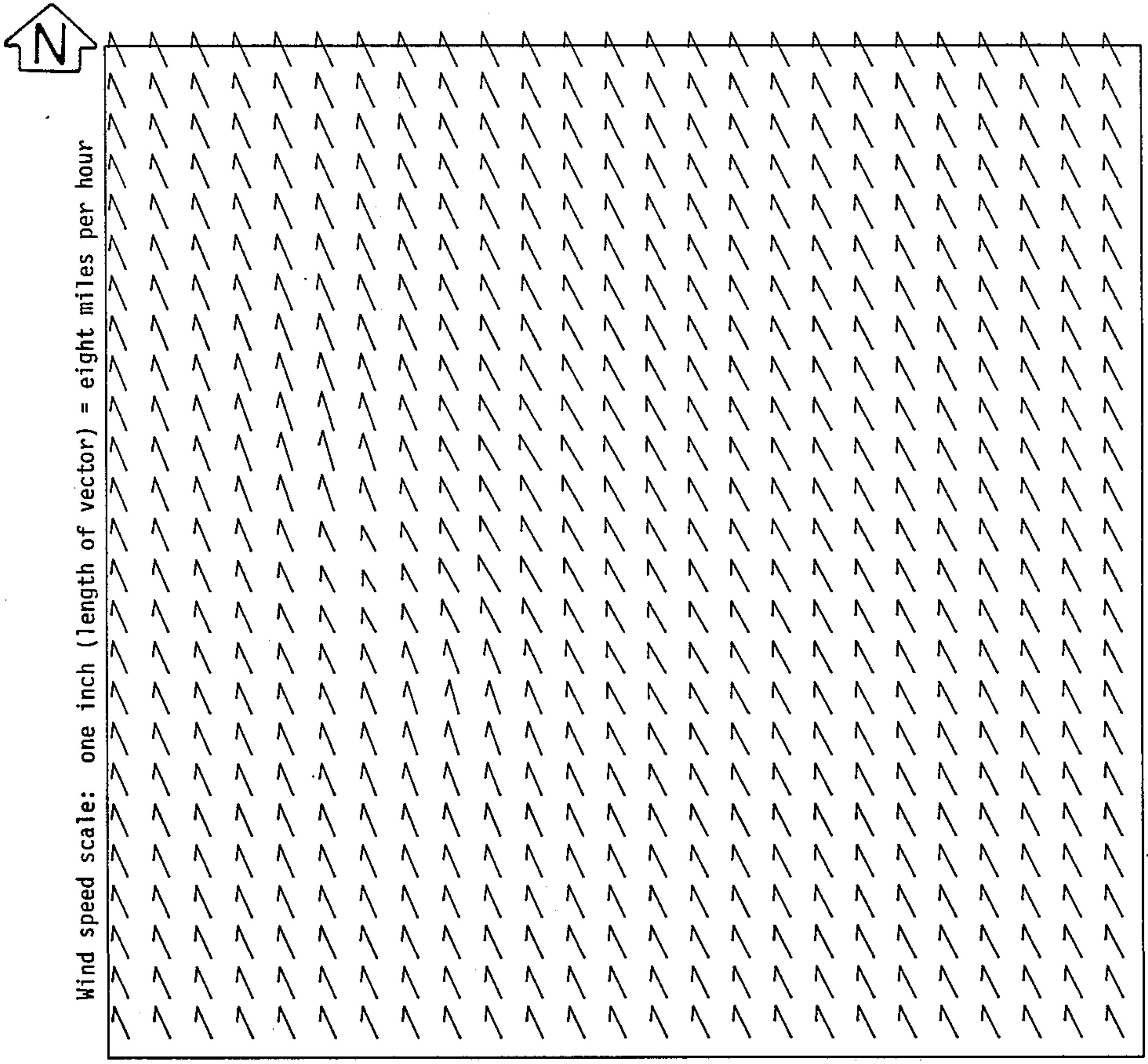
WIND FLOW FIELD — FRESNO
0800 HOURS AUGUST 31, 1976

FIGURE 68



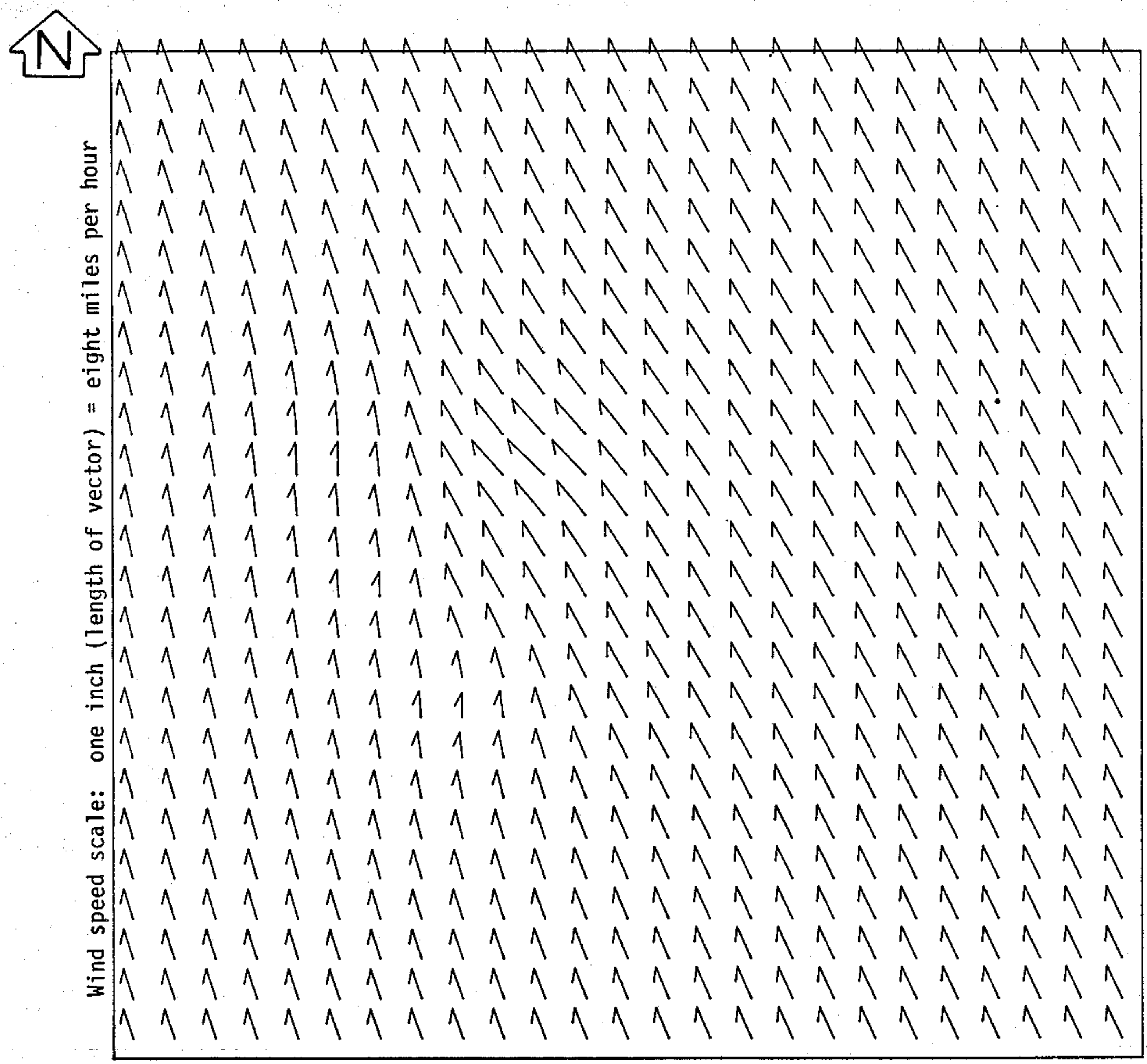
WIND FLOW FIELD — FRESNO
0900 HOURS AUGUST 31, 1976

FIGURE 69



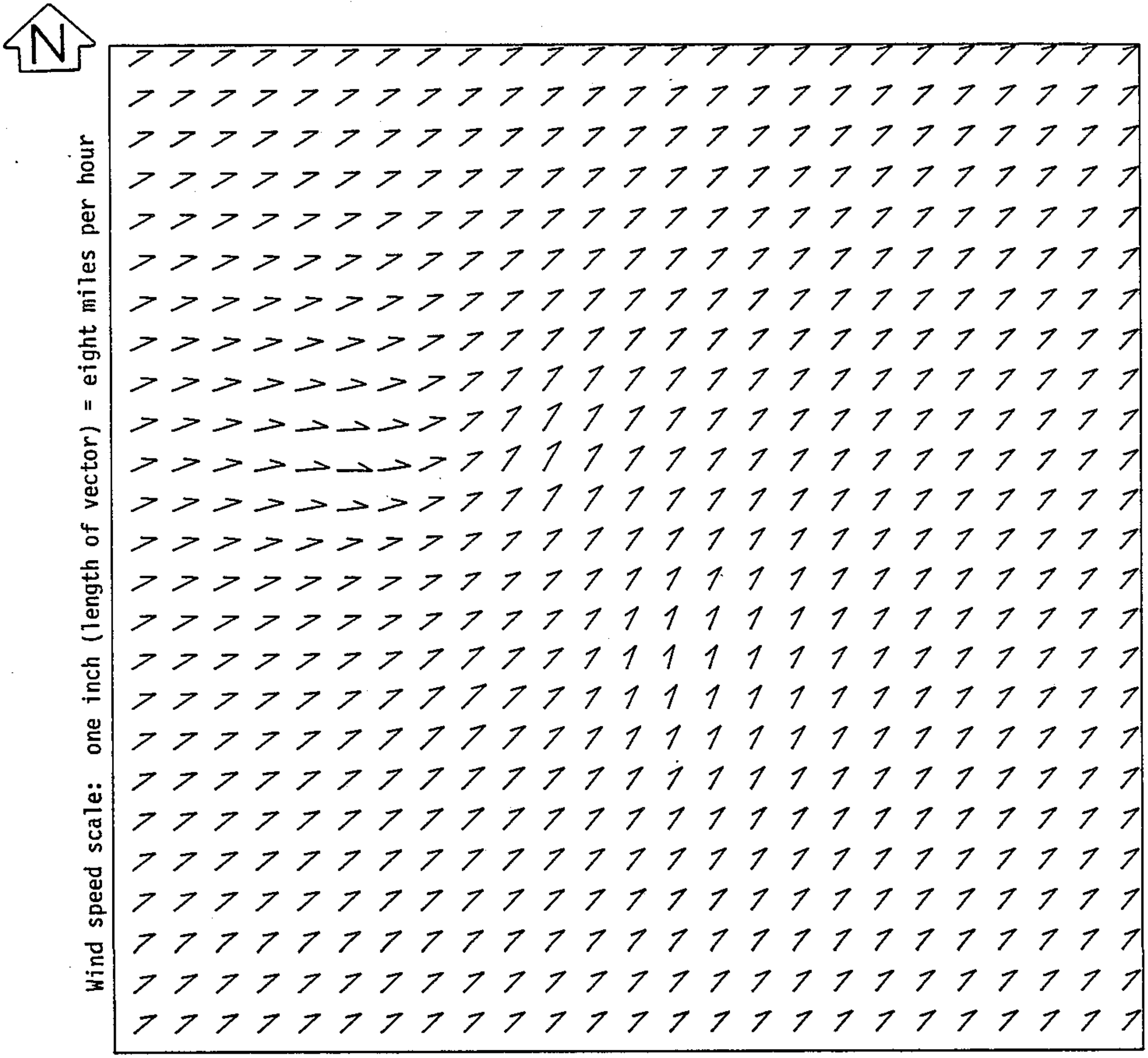
WIND FLOW FIELD— FRESNO
1000 HOURS AUGUST 31, 1976

FIGURE 70



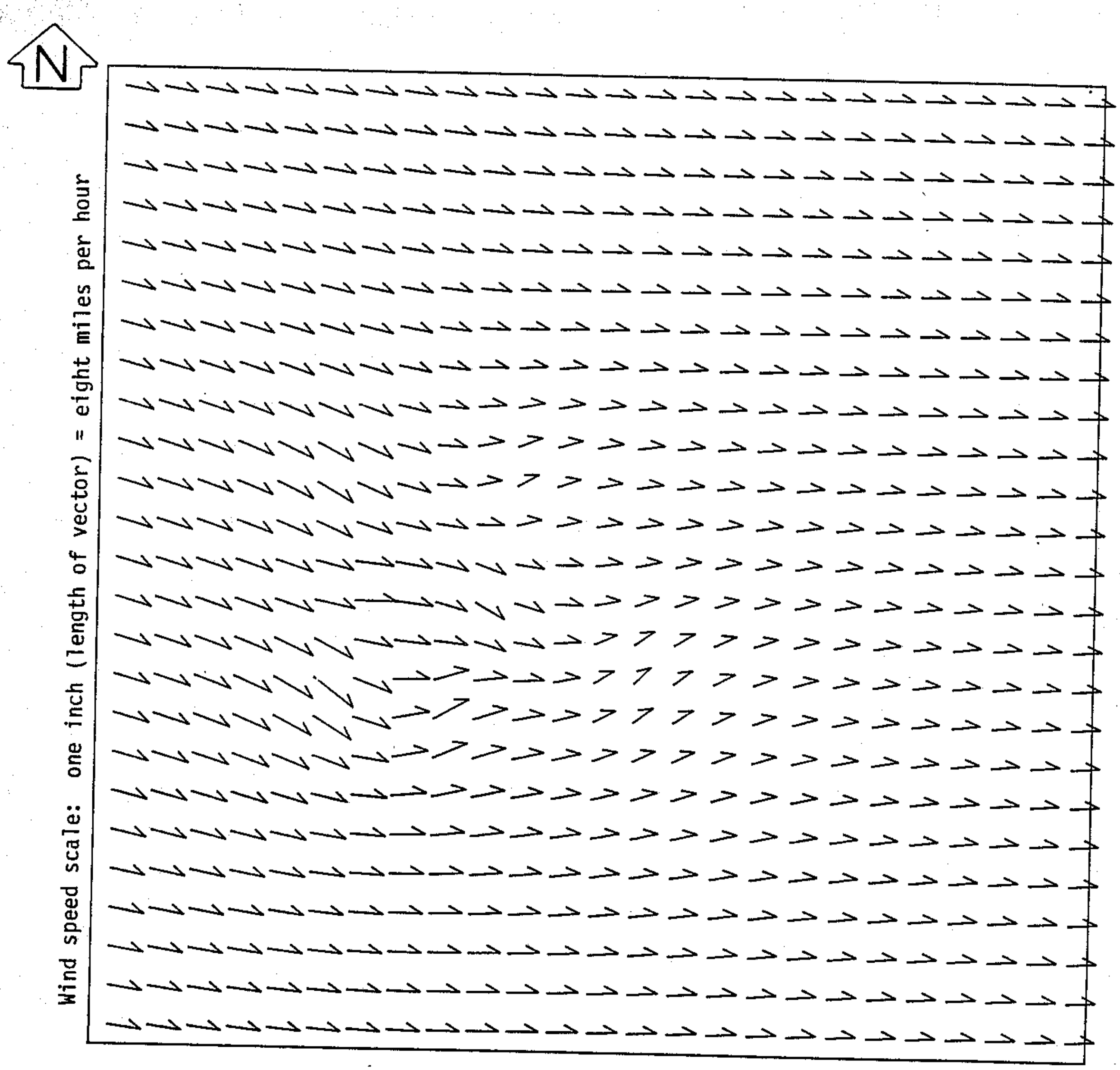
WIND FLOW FIELD — FRESNO
1100 HOURS AUGUST 31, 1976

FIGURE 71



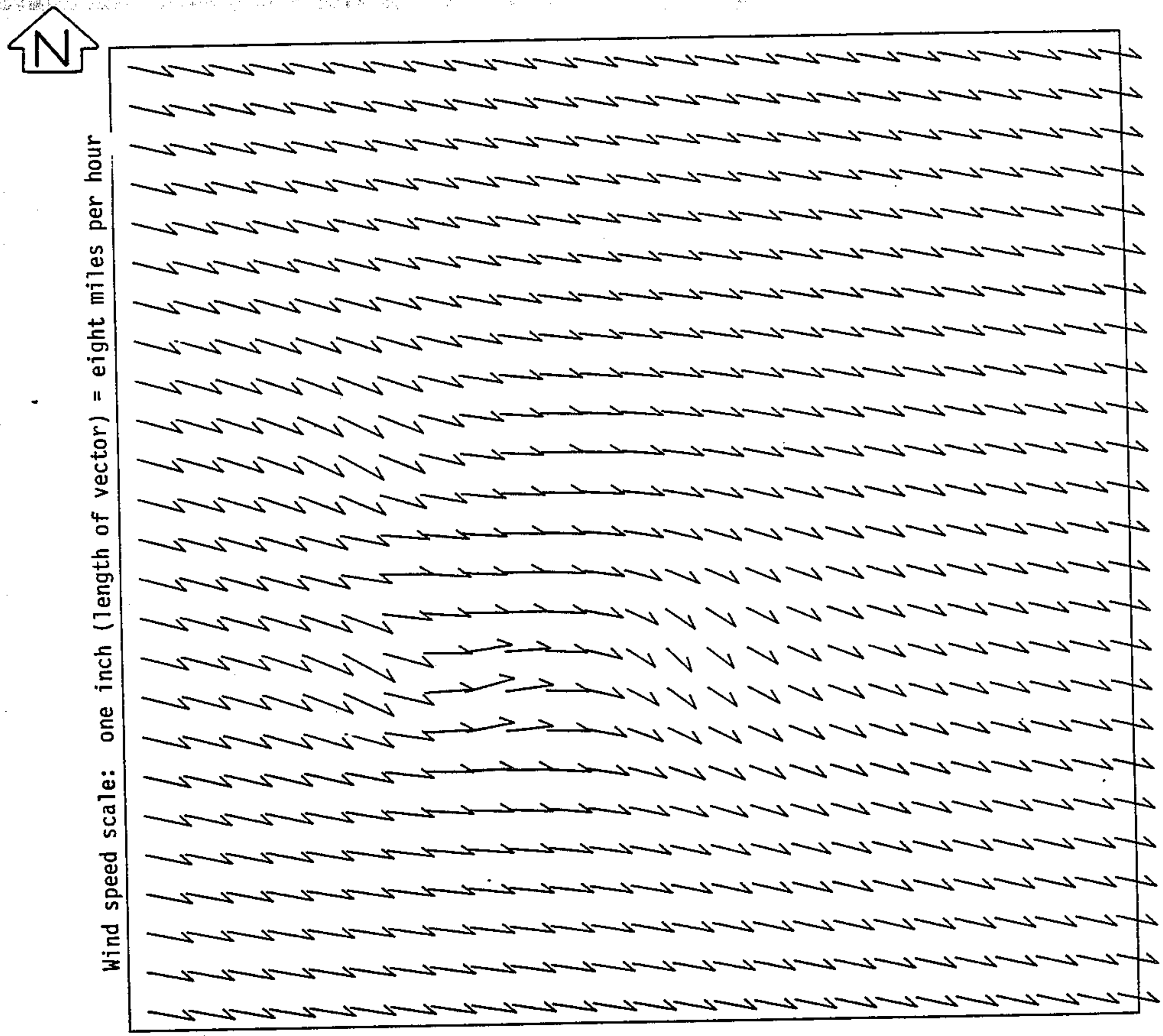
WIND FLOW FIELD — FRESNO
1200 HOURS AUGUST 31, 1976

FIGURE 72



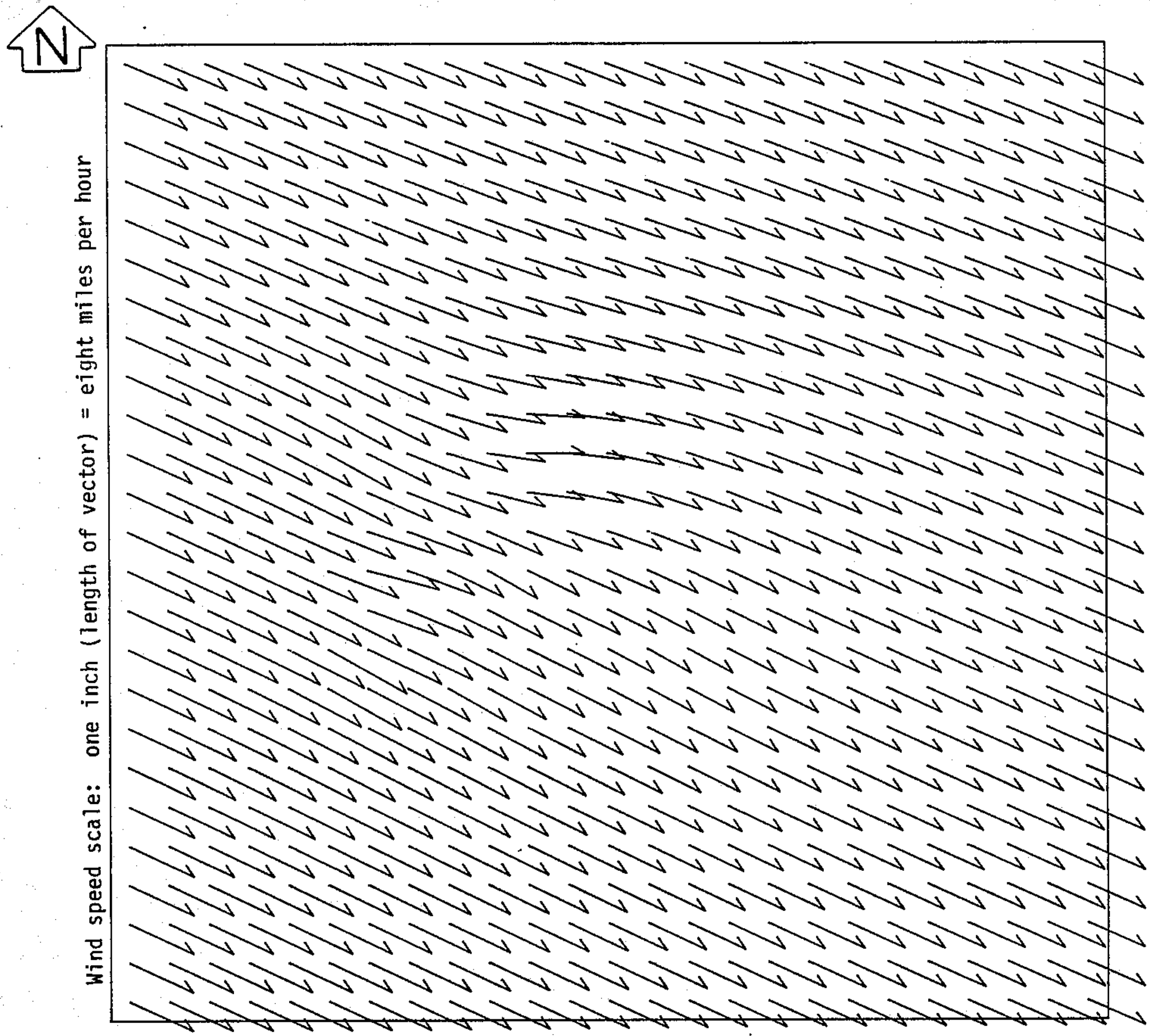
WIND FLOW FIELD — FRESNO
1300 HOURS AUGUST 31, 1976

FIGURE 73



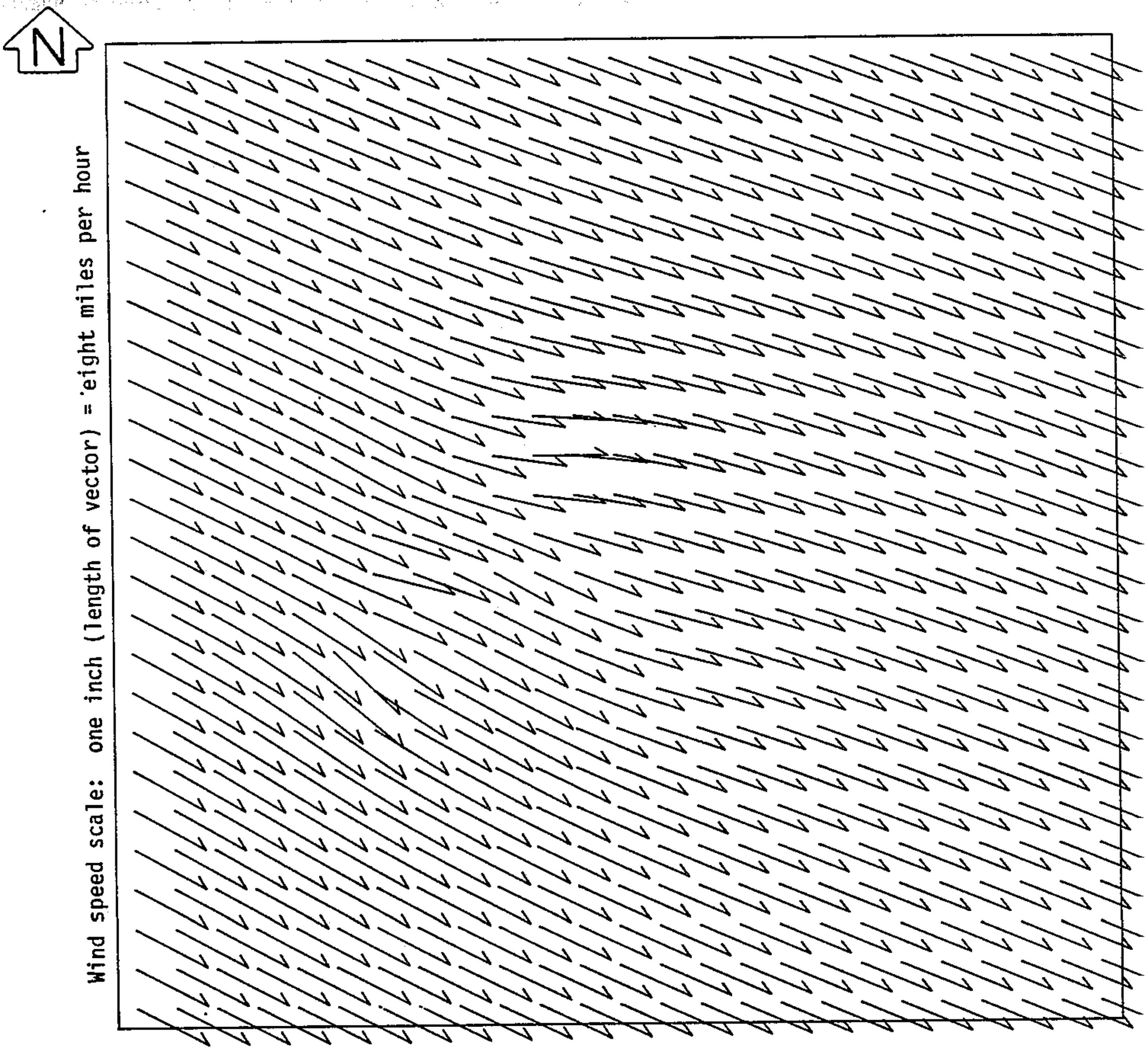
WIND FLOW FIELD — FRESNO
1400 HOURS AUGUST 31, 1976

FIGURE 74



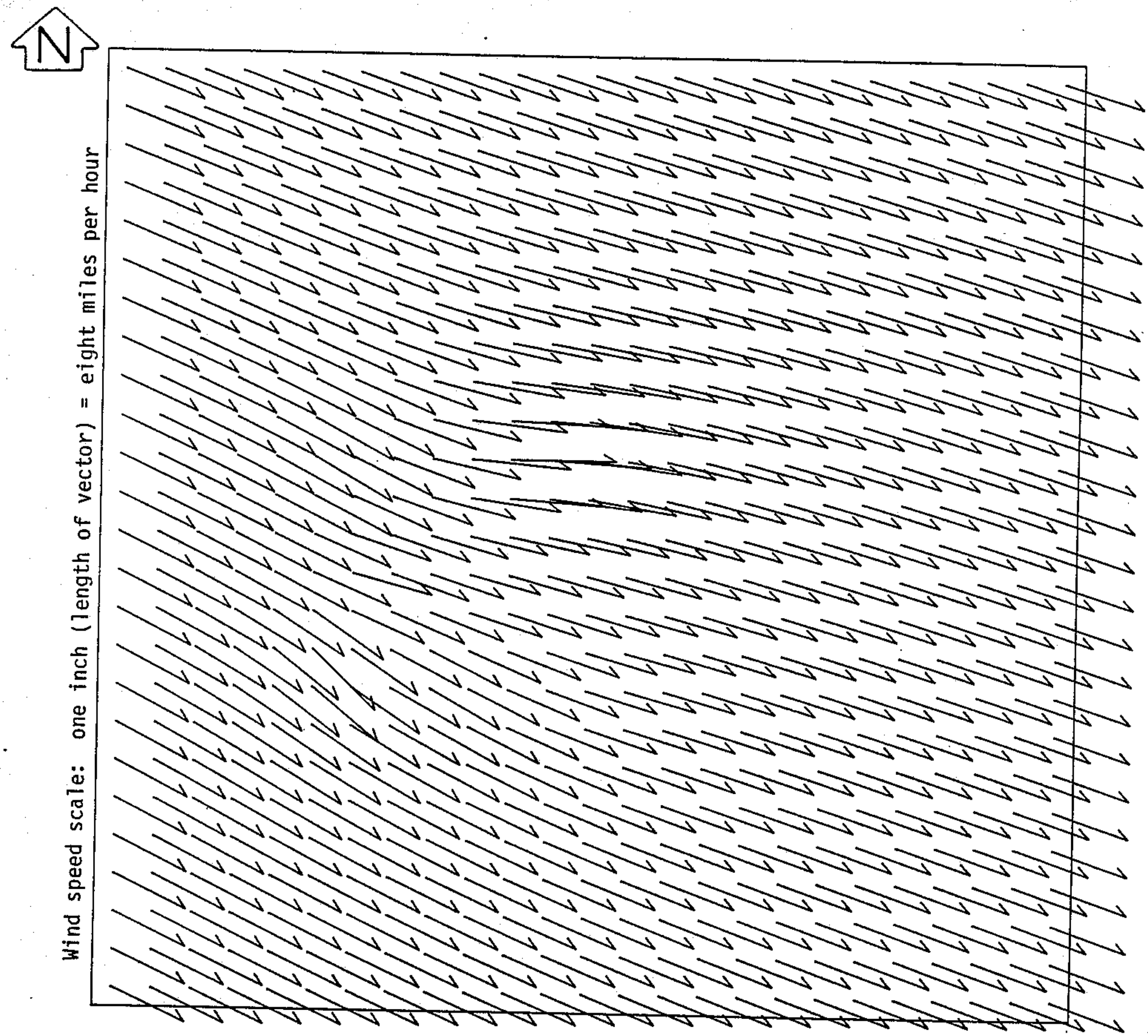
WIND FLOW FIELD — FRESNO
1500 HOURS AUGUST 31 , 1976

FIGURE 75



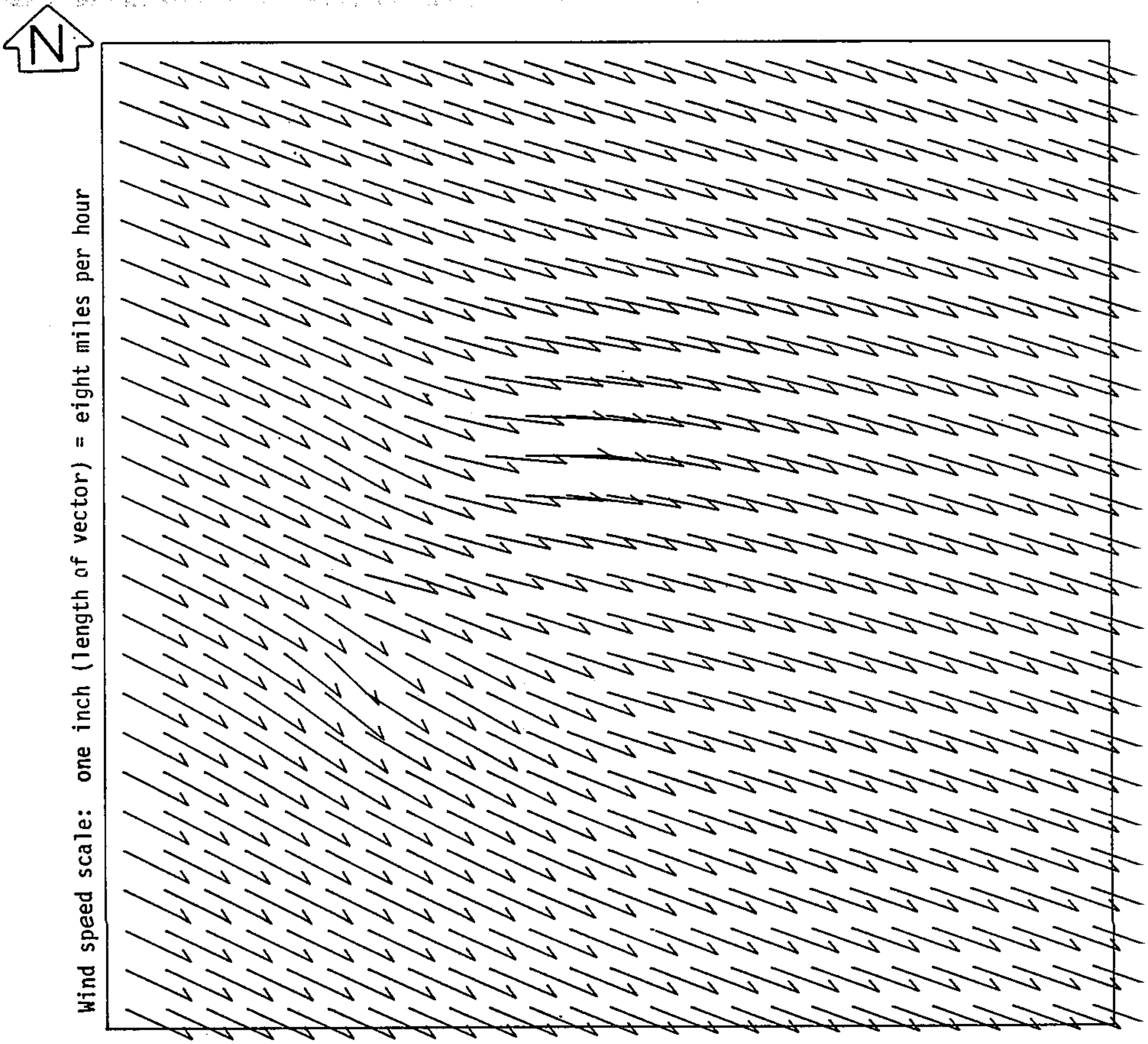
WIND FLOW FIELD — FRESNO
1600 HOURS AUGUST 31, 1976

FIGURE 76



WIND FLOW FIELD — FRESNO
1700 HOURS AUGUST 31, 1976

FIGURE 77



WIND FLOW FIELD — FRESNO
1800 HOURS AUGUST 31, 1976

FIGURE 78

FAVORABLE AND UNFAVORABLE ASPECTS OF THE SMOG MODEL

Favorable

1. The model has an up-to-date chemistry. A verification was achieved using input data for the Sacramento region. MAQU was able to verify the model for the August 31 candidate day using Fresno data.

2. The inputs have options with regard to the types of plume rise and diffusivity algorithms to be used. Many temporal output options are available.

3. The hydrocarbons are input by species.

4. The thickness and size of vertical cells are variable. Thus a rational vertical concentration and wind profile can be readily established.

5. There is no limit on the lengths of the sides of the study area (within economic feasibility).

6. Ancillary programs such as a plot of wind flow fields are easily prepared and accessed.

Unfavorable

1. A rectangular study area is required. Thus computer time is often expended to study areas of noninterest.

2. The SMOG model is not sensitive to emissions in a 13-hour or less simulation.

APPLICATION OF THE SMOG MODEL'S FINDINGS AND POTENTIAL USES

The results of this study seem to indicate that the SMOG model can predict the ozone concentration in the Fresno region over a short period of time. The model therefore should be applied to a situation where an agency wants to estimate the maximum ozone level that can be anticipated in the afternoon of a specified day, given the wind regime and the initial concentrations for early in the morning of that day.

There are indications that the model can generate accurate episodic ozone concentrations from so-called "clean air" using the meteorology regime and the emissions data base from a region. In a 13-hour simulation on Sacramento data, air with an ozone concentration of .01 ppm was taken to the .05 ppm level given a meteorologic regime conducive to the propagation of ozone. However, to reach episodic levels, the ozone generation must be over at least one night and perhaps more than one night. Since the computer cost for one hour of simulation time is more than $50, the costs of overnight work will be high. Along with the problem of obtaining funding for such simulations, the question of the atmospheric chemistry being valid through a nighttime period is also unresolved.

PROBLEMS AND UNCERTAINTIES IN MONITORING AND MODELING

1) State of the Science (Art)

The fact that the science of regional ozone modeling is in a state of flux is perhaps the most important problem. As an example, when this research project was initially proposed in 1973, the SAI 15-step 25x25 regional airshed model was designated as a model to be tested. When the modeling actually began in 1979, MAQU recommended the SMOG model. During the period of time from 1973 until the present, SAI improved their regional ozone model several times.

Currently, the state of the art in ozone modeling refers to the sophistication of the algorithms that represent atmospheric chemistry. Rapid improvements in this area have occurred in the period 1975-1980. Computer representations of air pollution chemistry during nighttime is an important aspect of computer ozone modeling now being developed.

Basic research into the improvement of regional photochemical ozone models continues at a rapid pace. At times it appears that the models develop without the proper level of user input and that model sophistication is seen as an end in itself. The work performed on this project would indicate that some of this improvement effort should go toward user-orienting the models. This refers not only to establishing rapport between the model's potential users and developers in order that solutions to the user's needs can be provided, but also concerns such things as data intensity vs accuracy of output and ability of the user to provide the specific data required. Further model development should be based on user feedback.

It was a major decision on the part of the investigators to abandon the SAI 15-step chemistry model and go to the SMOG model. At the present time, SAI's latest model with the 38-step carbon-bond-mechanism is claimed by SAI to be the state of the art; the SMOG model has proven to modelers of the CARB and Caltrans that it is capable of predicting ozone to the point of achieving a verification in a region; the LIRAQ model(13) for the San Francisco Bay Area and the MADCAP model(7) in the San Diego area are in current use; and a new model with advanced chemistry is in the final stages of development at the California Institute of Technology.

2) Emissions

An emissions inventory is at best a guess. Just as the census takers can never be sure that they have counted everybody, the assembling of an emissions inventory is an estimate. Intuitively it can be concluded that the emissions tally is probably short. The mobile emissions estimate is likely more accurate than the stationary emissions estimate because the traffic counts are made with reasonable accuracy, while the consumption of products releasing hydrocarbons in domestic and business life is much more difficult to quantify. Examples of important sources that can be included in the latter category are emissions due to household use of aromatics, agricultural burning and backyard bar-b-cue cooking. Other potential sources when discussing emissions are those from vegetation, particularly conifers(21). Although the EPA minimizes the importance of reactive hydrocarbons emanating from vegetation, considerable evidence exists that the thicker vegetative covers which grow in periods of heavy rainfall emit substantial amounts of terpenes. These hydrocarbons, if actually present, would result in higher generation of ozone after wet winters than one might observe in years with lighter vegetative cover.

Any discussion of pollutant emission uncertainties should include the fact that automobile emission technology is changing rapidly. Auto emissions are scheduled to decrease through the next decade, but there is a chance that they may increase if public demand for more fuel economy becomes more important than the demand for clean air.

3) Incomplete Data Base

It is important that the modeler have confidence in his air quality data base; and, with limited funding, it is quite likely that the modeler will not have all the air quality monitoring facilities that he might wish. In the case of the Fresno study, a region of 625 square miles was represented by fewer than 10 air quality monitoring stations, and the windflow regime was developed on the basis of a similar number of meteorological sensing devices.

In rural areas the importance of intensive air quality monitoring is not so great as in the urban areas. In the urban areas where major emission sources exist, large gradients in air quality concentrations can occur within one grid square;

indeed within a few city blocks. Developing the air quality concentrations in an urban area is very complex; and there, perhaps, is an instance where fewer monitoring stations are preferable to many. The reason for this might be that many monitoring stations would provide such variations in concentrations due to proximity to major sources that it would be difficult to arrive at a satisfactory estimate. Furthermore, even when gradients within grid squares are recognized in the urban areas, the model provides no means with which to enter these microscale gradients. They must be averaged within the minimum size area considered by the model which is the single grid square.

Another area where necessary estimating results in a confidence problem is in the height of temperature inversion or the mixing depth level. Usually the temperature inversion height is determined by airplane temperature flights or the use of an acoustic sounder. The typical project budget allows one acoustic sounder for the entire region, and the airplane flights are so costly that only one or two parts of the region can be measured three times per day. This results in the necessity of estimating the inversion height for much of the areal and temporal extent of the ozone modeling.

4) Vertical Resolution

In the Fresno area the air quality above the ground surface was monitored on only one day, so all concentrations of air quality for the vertical cells had to be made by estimations based on information from literature and from our experience in air quality sampling aloft in the Bakersfield area. Similarly, the surface wind regime is well delineated, but the wind regime in the upper level cells is partly an estimate since the use of pilot balloons to determine upper level winds was seldom more frequent than once per day. The stability classes aloft were estimated by engineers, but "power law" calculations built into the SMOG model were used to estimate the speed of the upper level winds.

5) Computer Expenses

The 1979 computer cost (based on lowest "weekend" Teale Data Center rates) for executing the SMOG model is about $50 per simulation hour. A thirteen hour simulation has run $600 to $800. The budget allotment for computer time was too little to allow much flexibility in developing a pattern of computer runs for verification. Results of certain runs suggested that additional simulations should be performed to enlarge upon knowledge gained during these runs. Although it is hoped that this project can be continued in the future, lack of funding prevented immediate follow up on the information.

6) Determination of Pollutant Transport

Reaching conclusions on the role of transport of air pollutants into the Fresno study region was not feasible due to lack of upper air pollutant concentration data. An apparent key factor in estimating the transport of pollutants into a region is being able to use aircraft to measure the pollutants carried by prevailing winds. This was not done, so the project ended with the impression that transport into the Fresno region is possibly a significant air quality problem and requires additional evaluation.

A comprehensive study of pollutant transport in the San Joaquin Valley is scheduled to be completed in 1981. The California Air Resources Board is the project originator and their contractors include Meteorology Research, Inc., Environmental Research and Technology, California Institute of Technology, and Rockwell International Corporation.

Frequency distribution. A display of the percentage frequency of occurrence of each potential value for a particular variable.

Gas chromatography. A method of analyzing the components of a mixture of gases based on the difference in adsorption of different gases on specially selected filter materials.

Gaussian model. A mathematical simulation of dispersion in which pollutant concentrations are assumed to have a statistically normal distribution in the crosswind and vertical directions.

Grid model. An air quality model in which all relevant equations are solved at a number of discrete points that represent points on a grid covering the region of interest.

Initial conditions. The values of a variable at each point of a region at a specified starting time that are necessary to determine a solution at subsequent times.

Insolation. Incoming solar radiation.

Inversion. A condition in the atmosphere where temperature increases with altitude. An inversion suppresses turbulent mixing and thus limits the upward dispersion of polluted air.

Inversion base. The lowest altitude of the thermal gradient that forms an inversion.

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GLOSSARY

This glossary has been assembled from several sources. Almost all came from one of the following three U.S. Department of Transportation sponsored publications:

1. Pollack, R. I., et al, "Highway Air Quality Impact Appraisals, Volume I - Introduction to Air Quality Analysis," Systems Applications, Inc., San Rafael, California, June 1978.

2. "Fundamentals of Air Quality," Greiner Engineering Sciences, Inc., Baltimore, Maryland, 1976.

3. Noll, K. E. and Miller, T., "Highway Air Quality, Volume 1 - Design of Air Monitoring Surveys," University of Tennessee, Knoxville, Tennessee, March 1975.

Adiabatic lapse rate. The rate at which a small volume of air will cool as it rises in the atmosphere, assuming there is no exchange of heat between the environment and the volume of air. The normal adiabatic lapse rate is -1.0°C/100m.

Advection. Transport of material (e.g., pollutants) by the wind.

Aerometric. Pertaining to the science of measuring properties of the air.

Air parcel. Any air mass that is assumed to retain its identity; i.e., to be relatively free of mass interchanges with its surroundings.

Air pollution. The presence, in the ambient atmosphere, of substances put there by the activities of man in concentrations sufficient to interfere directly or indirectly with his health, safety, or comfort, or with the full use and enjoyment of his property.

Air pollution meteorology. The study of atmospheric phenomena that influence or are influenced by air pollutants.

Air quality data base. A collection of information about ambient pollutant concentrations that existed within an area during a particular time period.

Air quality model. A relationship between pollutant emissions and pollutant concentrations.

Air quality monitor. A device for measuring pollutant concentrations.

Air quality standard. A legal requirement on air quality, usually expressed in terms of a maximum allowable pollutant concentration averaged over a specified interval.

Airshed. A geographical region in which the air flow patterns are such that emissions sources within the region affect primarily the receptors within the region, and these receptors are affected primarily by those sources.

Aldehyde. A partially oxidized hydrocarbon with the structure $R-\overset{O}{\overset{\|}{C}}-H$ where R is a hydrogen atom or organic group.

Algorithm. A calculation procedure used to solve a problem.

Aloft. At a height (variably defined) above the surface.

Ambient air quality. The existing state of the atmospheric pollution in an outdoor area.

Ambient concentration. The concentration of a substance at some point as it would be without any local sources or sinks of that substance.

Ambient monitoring. Systematic measurements of the characteristics (e.g., pollutant concentration and wind velocity) of the air at a fixed location.

Anomalous concentration. A concentration that is much higher or much lower, relative to the usual variations, than the concentration a short distance or a short time away.

Area source. A source of pollutant emissions composed of many small points spread over a large region.

Aromatic. A hydrocarbon containing a benzene ring.

Atmospheric stability. The resistance to or enhancement of vertical air movement caused by the vertical temperature profile. See inversion.

Averaging time. A period of time over which measurements of air quality parameters are taken and averaged.

Background concentration. Pollutant concentration in the absence of effects from local anthropogenic emissions.

Base year. The year associated with data used as a common reference point for comparison with data collected in other years.

Boundary conditions. The values of a variable at each point along the boundaries of a region being analyzed. Such values are necessary to determine the solution within the region.

Box model. A mathematical model that assumes that all emissions and reactions take place in a single well-mixed air parcel in which all conditions are homogeneous.

Chemiluminescent. Of or relating to a chemical reaction producing light, e.g., the reaction of ethylene with ozone.

Chemiluminescent method. The method of measuring ozone by measuring the light emitted from the reaction between ozone and ethylene. The intensity of the light is proportional to the ozone concentration.

Clean Air Act. A series of Congressional acts with amendments in 1967, 1970 and 1977 which promoted improvements in air quality.

Control strategy. Actions planned or taken to reduce the concentration of pollutants in the air.

Correlation coefficient. A measure of the extent to which two variables or two sets of data are related linearly.

Diffusion. The gradual mixing of the molecules of two or more substances as a result of random thermal motion.

Dispersion. The process by which atmospheric pollutants are disseminated due to wind and vertical stability.

Diurnal. Related to a 24-hour period; e.g., diurnal variations in oxidant concentration.

Emissions factor. The rate of pollutant emissions under specified conditions.

Emissions inventory. A complete list of sources and rates of pollutant emissions within a specified area and time interval.

Empirical. Determined from or based on observation rather than physical law.

Entrainment. The drawing of material into an air mass as a consequence of the movement of that air mass.

Environmental Impact Statement. A document in which the impacts of any significant projects are evaluated prior to construction; required by the National Environmental Policy Act of 1969.

Environmental lapse rate. The actual vertical distribution of temperature, which seldom approximates the adiabatic lapse rate in the lowest 100 meters over any extended time period.

EPA. U.S. Environmental Protection Agency.

Episode. A period of time when low wind speeds combine with limited mixing depths to create conditions favorable for high pollutant concentrations.

Eulerian. Having a coordinate system fixed with respect to the earth's surface. Compare Lagrangian.

Exceedance (oxidant). An observed occurrence of oxidant concentration higher than the specified maximum one-hour average. An exceedance of the oxidant NAAQS more than once per year is a violation.

Flux. The rate per unit area at which material or energy moves. Often it is measured relative to the mean motion.

Frequency analysis. A study of the frequency of occurrence of various levels of a given variable in a data set.

Frequency distribution. A display of the percentage frequency of occurrence of each potential value for a particular variable.

Gas chromatography. A method of analyzing the components of a mixture of gases based on the difference in adsorption of different gases on specially selected filter materials.

Gaussian model. A mathematical simulation of dispersion in which pollutant concentrations are assumed to have a statistically normal distribution in the crosswind and vertical directions.

Grid model. An air quality model in which all relevant equations are solved at a number of discrete points that represent points on a grid covering the region of interest.

Initial conditions. The values of a variable at each point of a region at a specified starting time that are necessary to determine a solution at subsequent times.

Insolation. Incoming solar radiation.

Inversion. A condition in the atmosphere where temperature increases with altitude. An inversion suppresses turbulent mixing and thus limits the upward dispersion of polluted air.

Inversion base. The lowest altitude of the thermal gradient that forms an inversion.

Kinetic mechanism. A set of chemical reactions and rate constants intended to represent some chemical process. Because of incomplete knowledge, kinetic mechanisms contain uncertainties regarding the values of rate constants and the products of particular reactions.

Lagrangian. Having a coordinate system that moves with respect to the earth's surface. Compare Eulerian.

Layer aloft. A layer of air that can be differentiated from the air above and below it, as by an inversion.

Line source. A source in which pollutants are emitted in a narrow corridor, such as a highway.

Link. A portion of a road in a highway network.

Mesoscale. Medium size scale; for pollutant source modeling, analyses within an area 0.30 to ca 100 km.

Meteorological variables. Wind speed and direction, mixing depth, temperature, pressure, degree of turbulence, sunlight intensity, humidity, and precipitation; also, the variation of these parameters.

Methane. The simplest hydrocarbon (CH_4); the major component of natural gas.

Microscale. Smallest scale; for pollutant source analysis localized around a project site within 0.30 km.

Mixed layer. Layer of air near the ground where turbulent mixing of pollutants occurs. It is limited by an inversion base, if one is present.

Mixing depth. The depth of the mixed layer.

Mobile source. A moving vehicle that emits pollutants.

Monitoring network. An array of measurement devices designed to characterize regional air quality and, often, meteorology.

Monitoring site. The location of a measurement device in a monitoring network.

NAAQS. National Ambient Air Quality Standards; established by the EPA to protect human health (primary standards) and to protect property and aesthetics (secondary standards).

Nocturnal inversion. A surface-based temperature inversion formed at night by radiational cooling of the earth's surface and, as a result, the air near the surface.

Nocturnal jet. A high-velocity wind observed to occur at night within inversion layers. A frequent phenomenon in California's San Joaquin Valley.

Olefin. A hydrocarbon containing one or more carbon-carbon double bonds. An alkene.

Oxidation. Partial or complete loss of an electron from an atom in a chemical reaction.

Ozone (O_3). A strong photochemical oxidant whose molecules consist of three bound oxygen atoms, 0-0-0.

PAN. Peroxyacyl nitrates, oxidants normally found in photochemical smog and believed to cause eye irritation.

Paraffin. A hydrocarbon among those classified as alkanes. They contain only hydrogen and carbon and have no double or triple bonds.

Pasquill stability class. A method of classifying hourly surface conditions based on insolation stability and wind speed.

Photochemical reactions. Chemical transformation whose character, rates, or both are affected by the presence and intensity of light.

Photochemical smog. The atmospheric condition that results when hydrocarbons and nitrogen oxides emitted into the atmosphere react in the presence of sunlight to form other pollutants, such as oxidants, PAN, and aerosols.

Pilot balloon. A colored balloon which is released and optically tracked to determine winds (Pibal).

Point source. A single origin of emissions located at a fixed point.

pphm. Parts per hundred million (10^8) by volume.

ppm. Parts per million (10^6) by volume.

ppmC. Parts per million carbon; ratio of the volume of hydrocarbons to 1 million parts of air that would result if all carbon atoms were in the form of methane.

Precursor. A chemical compound that leads to the formation of a pollutant, e.g., hydrocarbons and nitrogen oxides are precursors of photochemical oxidant.

Prevailing wind. The wind direction most frequently observed during a given period.

Primary pollutant. Chemical contaminants which are released directly to the atmosphere by a source.

Rate constant. A constant of proportionality that relates the rate at which the concentration of a species changes with time to the concentration of the reactant species at any particular time.

Reactive hydrocarbon (RHC). A hydrocarbon that readily combines with radicals and thereby contributes to the production of ozone.

Regression analysis. The construction of a relationship between a set of predictor variables and a predicted variable. The procedure, which involves the use of past measurements, is based on minimization of the sum of the squared errors in prediction.

Reliability. The extent to which a model, experiment, or test will yield the correct results for a variety of trials.

Scavenging. Removal of a pollutant from the atmosphere, particularly by precipitation or chemical reaction.

Secondary pollutant. Atmospheric contaminants formed in the atmosphere as a result of chemical reactions, such as hydrolysis, oxidation, and photochemistry.

Sensitivity analysis. A test of a model using different input and parameters to discover what effects changes in their values have on model predictions.

Simulation model. A mathematical description of real physical and/or chemical process. The responses of the model to input variations are analogous to those of the real processes.

Sink. A process that removes pollutants from the atmosphere.

Smog chamber. An experimental apparatus used to study the chemical reactions that take place in a polluted atmosphere. Such a chamber may have controllable inlets for introducing pollutants and outlets for removing samples. It can also be artificially illuminated to simulate sunlight.

Solar radiation. Energy emitted by the sun that reaches the earth as ultraviolet, visible, and infrared light.

Sounding. Measurement of meteorological properties, such as temperature or wind velocity, during a vertical transit of the atmosphere.

Spatial resolution. A measure of the precision with which two points separated in space are distinguished from one another. In air pollution models, it is the characteristic distance over which major dependent variables, such as wind and emissions, are averaged.

Stability. A property of the atmosphere which determines the amount of vertical mixing.

Stable layer aloft. A layer of air at least 100 feet thick, located 500 to 5000 feet above the ground, in which little or no mixing takes place.

State Implementation Plan (SIP). A document specifying measures to be used in achieving and maintaining compliance with the 1970 Clean Air Act.

Stationary source. A source of pollutants that is immobile. Such sources include industrial complexes, power plants, and individual heating units.

Statistical model. A statistical relationship between a set of predictor variables and a predicted variable.

Subsidence inversion. A type of temperature inversion associated with high-pressure systems in which a thermal gradient is established by the heating due to compression of an air parcel as it descends.

Surface layer. The layer of air near the ground, generally 1 to 100 meters deep, where surface features (e.g., trees, buildings) affect atmospheric turbulence and diffusion.

Surface roughness. The characteristic height of obstructions in the path of the wind near the surface, such as the heights of trees and buildings.

Temperature gradient. Change of the ambient temperature as a function of distance (either vertical or horizontal).

Temporal resolution. A measure of the precision with which two points separated in time are distinguished from one another. In air pollution models, it is the characteristic time over which major dependent variables, such as winds and emissions, are averaged.

Trajectory model. A mathematical model designed to follow a single parcel of air along a trajectory determined by the wind (Lagrangian).

Transport. Movement of pollutants or other material in the atmosphere from one location to another.

Transportation Control Plan. A document specifying measures to regulate the emission of pollutants from mobile sources.

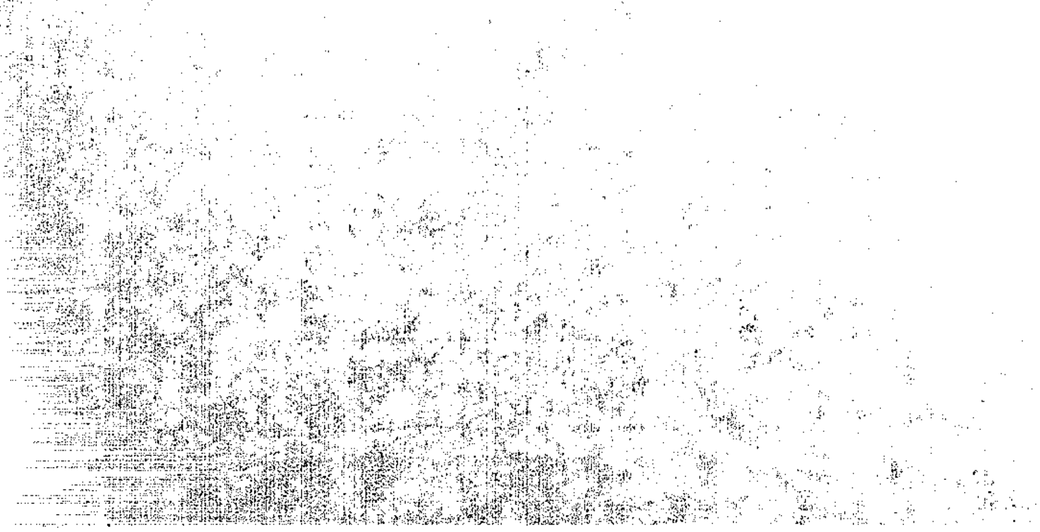
Turbulence. Unsteady and irregular motions of air in the atmosphere.

Ultraviolet light (UV). Light of a wavelength in the range of 40 to 4000 Angstroms (10^{-10} meters). These wavelengths are shorter (corresponding to higher frequencies) than those of visible light.

Verification study. An experiment designed to provide data that can be used to verify the predictions or computations of a mathematical or graphical model.

Windflow field. The distribution of wind velocities and directions over some area or within a volume.

Wind shear. The spatial variation of wind velocity. It is frequently used to mean the variation of wind velocity with height above the ground.



APPENDIX A

Computer printouts, accompanying this report to the Federal Highway Administration research office, as Appendix A, are a complete record of the aerometric data base gathered during the Fresno portion of this research project. The printouts are in Air Quality Data Handling System format. See References Nos. 17 and 18.

A magnetic tape record of the data base has been forwarded with this report to the Federal Highway Administration research office in Washington, D.C.

Completing Appendix A are the input data for the SMOG model for the candidate days August 24 and August 31, 1976. Preceding the reproduction of the data file is a narrative to orient the reader to the data fields.

INPUT FILE DESCRIPTION (See Reference #15)

Title

The title record consists of up to 80 characters in a 20A4 format that identify the particular run.

& GRIDIT

This namelist record describes the size and resolution of the study area.

DX: DY: DZ:	specifies the cell size in meters (east-west, north-south, and vertical)
NX: NY: NZ:	specifies the number of grid cells in the x, y, z-directions

& OPTION

This namelist record describes the options requested for wind field, chemistry, computer use, plume rise, etc.

IDOWND:	selects wind field model
IDOCEM:	selects the chemistry model
IDOPLM:	selects the plume rise option
IDODIF:	selects the diffusivity model option
IDOBAK:	indicates the type of background concentration input submitted
ITEST:	indicates if this run is a test.
ISTART:	option for "restart" or "write restart"
IWINDS:	option to write a wind flow field file
ICONC:	option to create a pollutant concentration file
IAREA:	option to grid large area source(s) into individual grid cells
ISTAB:	option for stability class to be input by grid cell or statistically distributed from each known location.

& OUTPUT

This namelist record describes the total number of hours to be simulated and the output options desired.

NUMHRS:	the number of hours to be simulated by SMOG
IDOPLT:	the frequency in integer hours for printer contour output
IDOPRN:	the frequency in integer hours for printer edit output
IDOCAL:	option for CALCOMP plots of wind field vectors and pollutant concentration contours
HRSAVG:	the integer number of hours desired for calculating the average surface concentration
IDOSUR:	option to print all vertical levels of the field arrays or merely the values at the surface
NOWTIM:	indicates the desired starting time of the computer simulation.

Terrain Deck

Each card in the terrain deck holds consecutive x terrain heights (in feet) and is self-identified by having x and y cell location values. A record with a value of I = -1 is required to terminate the terrain deck.

Each terrain record holds up to 10 distinct elevations. The terrain record format is diagrammed below:

I2, I2, 10 F5.0

I-coordinate locator — J-coordinate locator — 10 terrain heights (feet)

The I coordinate locator value is the I-coordinate of the 1st terrain value on the record and can have only the following values: 1, 11, 21, 31, The values on the card thus correspond to locations at (I, J), (I+1, J), ... (I+9, J). The J-coordinate locator has the values 1, 2, 3.....NY.

Surface Roughness Deck

The surface roughness deck contains two types of records. The first record, read as an I5 format, describes the number of surface roughness data records to follow. The next records contain data on the location and value of surface roughness. The format is as follows:

I5, I5, 10F5.0

I-coordinate — J-coordinate — Surface roughness (meters)

The following data decks are required each hour except as noted.

Wind Data Deck

The first record of the wind data deck describes the number of wind data sites and the hour at which the next wind data deck is to be read.

I5 I5

number of wind data locations — hour at which next wind data deck is to be read.

For each wind data site, at least two records are required. The first record specifies the location of the wind data site and the confidence value (from 0.0-1.0) that the user places in the data. Valid, reliable hourly averaged wind data is usually weighted as 1.0, while instantaneous pibal data is usually weighted as 0.1.

The format for this record is as follows:

I2,	I2,	F5.0
I location	J location	confidence value (0.0 to 1.0)

The other record(s) required for a given wind data site contains the wind speed and direction for each level above the local ground height.

F5.0	F5.0
wind speed	wind direction

Stability Data Deck

The first record of the stability data deck, like the first record of the wind data deck, describes the number of stability data sites and the hour at which the next set of stability data is to be read. The format is the same as for the wind data record:

I5,	I5
number of stability data locations,	hour at which the next stability data are to be read.

For each stability data location, at least two records are required. The first record contains the location of the stability data:

I5,	I5
I-location	J-location

The next record contains up to 16 values of atmospheric stability. The data are entered in the format 16F5.0.

Point Source Deck

Special point sources may be input. Fresno's were in the emissions inventory.

Area Source Deck

Special area sources may be input. Fresno's were in the emissions inventory.

Background Deck

The first record of the background concentration deck describes the number of background sites and the hour at which the next background concentration deck is to be read. The format is:

I5, I5

number of sites → hour.

The next records describe the background concentrations for each of the five (NZ) vertical levels. The format is 14F5.0. The fourteen fields are in order: NO_2, NO, O_3, olefins, aromatics, paraffins, aldehydes, N_2O_5, HNO_3, HNO_2, HO_2, H_2O_2, and radicals ROO and RCOO.

There are three stacks of background data. The number chart below the background data is a map of the 625 grid cells. The cells showing "1" indicates the top background information was used for that cell. "2" indicates the cells using the middle data, and "3" indicates those using the bottom data.

Boundary Concentrations

The format for the boundary concentration data is the same as that for the background concentrations. There are 21 lines of input per simulation hour. The four stacks of five lines each are the left, right, bottom, and top boundaries of the modeling region. The 21st line assigns concentrations above the top vertical layer.

Global Parameters

The five fields for the global parameters are formatted 5F5.0. The parameters in order, are 1) surface temperature in degrees centigrade, 2) insolation in watts/m^2, 3) atmospheric pressure in atmospheres, 4) ambient CO concentration in ppm, and 5) water vapor concentration in ppm.

```
++WRITE PRINT,TMENVFSN24
*          DATA SET TMENVFSN24 AT LEVEL 029 AS OF 10/26/79
 SMOG PROGRAM TEST FOR  FRESNO  STUDY AUG. 24 1976 FULL DATA
 &GRIDIT DX=1609,DY=1609,DZ=200,NX=25,NY=25,NZ=4 &END
 &OPTION IDOWND=1,IDOCEM=15,IDOPLM=0,IDODIF=1,IDOBAK=-5 &END
 &OPT ITEST=0,ISTART=0,IWINDS=1,ICONC=1,IAREA=1,ISTAB=1 &END
 &OUTPUT NUMHRS=13,IDOPLT=0,IDOPRN=1,IDOCAL=0,HRSAVG=1,IDOSUR=1,
         NOWTIM=6 &END                FRESNO    TERRAIN
   01    01    0.    2.    3.    3.    6.    8.    9.    9.   12.   14.
   11    01   14.   17.   18.   21.   21.   24.   26.   29.   27.   34.
   21    01   34.   34.   34.   35.   34.
   01    02    0.    2.    3.    5.    6.   11.    9.   12.   12.   12.
   11    02   15.   17.   18.   21.   21.   23.   26.   26.   27.   29.
   21    02   35.   35.   37.   37.   37.
   01    03    0.    2.    3.    5.    6.    6.    9.   11.   12.   15.
   11    03   17.   18.   17.   21.   24.   26.   27.   27.   29.   31.
   21    03   35.   37.   37.   38.   37.
   01    04    0.    2.    3.    5.    6.    6.    9.   11.   12.   15.
   11    04   17.   18.   20.   23.   24.   26.   26.   27.   29.   31.
   21    04   35.   37.   27.   29.   31.
   01    05    0.    2.    3.    6.    6.    8.    9.   11.   14.   15.
   11    05   17.   18.   21.   23.   24.   26.   27.   27.   31.   32.
   21    05   37.   37.   31.   32.   32.
   01    06    0.    2.    5.    6.    8.    9.   11.   12.   14.   15.
   11    06   17.   18.   20.   21.   23.   24.   26.   31.   32.   34.
   21    06   40.   32.   34.   32.   34.
   01    07    3.    3.    6.    8.   11.   11.   12.   12.   12.   17.
   11    07   17.   18.   20.   23.   27.   29.   31.   32.   34.   34.
   21    07   38.   41.   34.   34.   35.
   01    08    5.    6.    6.    8.   11.   11.   14.   15.   15.   17.
   11    08   18.   20.   21.   24.   26.   27.   29.   31.   34.   35.
   21    08   40.   43.   34.   35.   35.
   01    09    5.    8.    9.   11.   12.   14.   14.   15.   18.   20.
   11    09   21.   21.   24.   26.   27.   29.   31.   32.   34.   35.
   21    09   41.   44.   40.   37.   38.
   01    10    6.    8.    9.   12.   15.   15.   18.   17.   18.   21.
   11    10   21.   24.   26.   27.   29.   32.   34.   37.   34.   37.
   21    10   44.   44.   46.   47.   40.
   01    11    9.    9.   12.   14.   17.   17.   18.   21.   21.   21.
   11    11   24.   24.   27.   31.   31.   34.   37.   40.   43.   44.
   21    11   46.   49.   50.   55.   55.
   01    12   11.   12.   14.   15.   15.   18.   21.   20.   21.   23.
   11    12   24.   31.   29.   32.   32.   37.   38.   41.   41.   44.
   21    12   49.   49.   53.   52.   58.
   01    13   12.   12.   14.   18.   20.   20.   21.   23.   24.   26.
   11    13   27.   31.   32.   34.   37.   37.   38.   41.   44.   46.
   21    13   52.   52.   52.   55.   58.
   01    14   15.   17.   18.   20.   20.   21.   24.   26.   26.   27.
   11    14   29.   34.   34.   37.   40.   37.   41.   43.   46.   52.
   21    14   55.   58.   61.   64.   67.
   01    15   15.   18.   20.   20.   21.   24.   26.   27.   27.   31.
   11    15   32.   34.   37.   40.   43.   46.   49.   49.   52.   52.
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21	15	52.	61.	67.	119.	113.					
01	16	21.	23.	21.	24.	24.	24.	26.	27.	31.	32.
11	16	34.	37.	40.	40.	43.	46.	49.	55.	58.	61.
21	16	61.	64.	67.	75.	82.					
01	17	20.	21.	23.	24.	27.	29.	31.	32.	34.	37.
11	17	37.	40.	43.	46.	49.	52.	55.	61.	61.	64.
21	17	64.	67.	82.	98.	98.					
01	18	18.	21.	6.	6.	29.	23.	24.	9.	37.	37.
11	18	40.	40.	43.	46.	49.	52.	58.	58.	64.	67.
21	18	72.	76.	106.	112.	112.					
01	19	20.	21.	27.	29.	32.	29.	37.	37.	9.	37.
11	19	43.	46.	46.	49.	52.	55.	59.	64.	67.	76.
21	19	76.	82.	124.	192.	197.					
01	20	21.	21.	27.	31.	34.	37.	37.	40.	14.	37.
11	20	46.	47.	45.	49.	52.	58.	49.	88.	93.	82.
21	20	82.	93.	174.	206.	206.					
01	21	21.	24.	29.	32.	34.	40.	38.	41.	43.	17.
11	21	21.	43.	46.	52.	76.	82.	82.	82.	90.	109.
21	21	90.	90.	123.	140.	144.					
01	22	21.	26.	31.	34.	34.	37.	40.	43.	43.	21.
11	22	21.	52.	52.	61.	90.	150.	210.	155.	107.	132.
21	22	120.	113.	113.	216.	216.					
01	23	24.	27.	34.	37.	37.	37.	41.	43.	44.	46.
11	23	15.	29.	67.	79.	158.	188.	213.	268.	240.	171.
21	23	168.	171.	168.	165.	168.					
01	24	26.	31.	34.	40.	40.	40.	43.	43.	44.	46.
11	24	21.	37.	73.	98.	270.	220.	152.	170.	215.	241.
21	24	207.	199.	235.	223.	233.					
01	25	27.	34.	35.	41.	43.	43.	43.	43.	44.	44.
11	25	46.	52.	52.	128.	108.	109.	128.	127.	192.	268.
21	25	207.	265.	234.	210.	210.					
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1		SURFACE ROUGHNESS									
01	01	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
11	01	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	01	.25	.25	.25	.25	.25					
01	02	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
11	02	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	02	.25	.25	.25	.25	.25					
01	03	.25	.25	.25	.25	.25	.10	.10	.10	.25	.25
11	03	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	03	.25	.25	.25	.74	.74					
01	04	.25	.25	.25	.10	.10	.10	.25	.10	.25	.25
11	04	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	04	.25	.25	.25	.74	.74					
01	05	.25	.10	.10	.10	.10	.10	.10	.25	.25	.25
11	05	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	05	.25	.25	.74	.74	.74					
01	06	.10	.10	.10	.25	.10	.74	.10	.10	.10	.25
11	06	.10	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	06	.25	.25	.25	.25	.74					
01	07	.10	.10	.10	.25	.10	.10	.10	1.00	1.00	.10
11	07	1.00	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	07	1.00	1.00	.25	.25	.25					
01	08	.10	.10	.10	.25	.25	.10	1.00	1.00	1.00	1.00
11	08	1.00	.25	.74	.25	.25	.25	.25	.25	.25	.25
21	08	1.00	1.00	1.00	.01	.25					

01	09	.10	.10	.25	.25	.25	1.00	1.00	1.00	1.00	1.00
11	09	1.00	1.00	1.00	1.00	1.00	.25	.25	.25	.74	.74
21	09	.25	.25	.25	.74	.25					
01	10	.25	.25	.25	.25	.10	1.00	1.00	1.00	2.00	1.00
11	10	1.00	1.00	1.00	1.00	.25	.25	.25	.25	.74	.74
21	10	.25	.25	.74	.74	.74					
01	11	.10	.74	.10	.25	1.00	1.00	1.00	1.00	1.00	1.00
11	11	1.00	1.00	1.00	.74	.74	.25	.25	.25	.74	.74
21	11	.74	.74	.74	.74	.74					
01	12	.10	.25	.25	.10	.10	1.00	1.00	1.00	1.00	1.00
11	12	1.00	1.00	1.00	.25	.25	.10	.25	.25	.74	.74
21	12	.25	.74	.74	.74	.74					
01	13	.74	.10	.25	.25	1.00	1.00	1.00	1.00	1.00	1.00
11	13	1.00	1.00	1.00	1.00	.10	.74	.74	.10	.74	.25
21	13	.10	.10	.74	.74	.74					
01	14	.74	.25	.10	.74	1.00	1.00	1.00	1.00	1.00	1.00
11	14	1.00	1.00	1.00	1.00	.10	.74	.10	.10	.01	.10
21	14	.10	.10	.10	.01	.01					
01	15	.74	.74	.74	.74	1.00	1.00	1.00	1.00	1.00	1.00
11	15	1.00	1.00	1.00	1.00	1.00	.74	.01	.01	.01	.01
21	15	.01	.01	.01	.01	.01					
01	16	.74	.74	.74	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	16	1.00	1.00	1.00	1.00	1.00	.10	.74	.01	.01	.01
21	16	.01	.01	.01	.01	.01					
01	17	.74	.74	.74	.01	1.00	1.00	.74	1.00	1.00	1.00
11	17	1.00	.74	1.00	.74	.74	.01	.01	.01	.01	.01
21	17	.01	.01	.01	.01	.01					
01	18	.74	.74	.01	.01	.01	.01	.01	.01	.01	.74
11	18	.74	.74	.74	.74	.74	.74	.74	.01	.01	.01
21	18	.01	.01	.01	.01	.01					
01	19	.25	.25	.25	.01	.01	.01	.01	.01	.01	.01
11	19	.10	.74	.74	.01	.01	.01	.01	.01	.01	.01
21	19	.01	.01	.01	.01	.01					
01	20	.25	.25	.25	.01	.74	.01	.74	.01	.01	.01
11	20	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	20	.01	.01	.01	.01	.01					
01	21	.01	.10	.01	.01	.74	.74	.74	.01	.01	.01
11	21	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	21	.01	.01	.01	.01	.01					
01	22	.74	.01	.01	.01	.74	.74	.74	.74	.01	.01
11	22	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	22	.01	.01	.01	.01	.01					
01	23	.01	.25	.25	1.00	.01	.74	.74	.74	.74	.01
11	23	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	23	.01	.01	.01	.01	.01					
01	24	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
11	24	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	24	.01	.01	.01	.01	.01					
01	25	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
11	25	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	25	.01	.01	.01	.01	.01					

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  07    07            WIND DATA 0600-0700
  06    15 1.0    301   SHAW AVE.
 1.8     0
  07    12 1.0    302   CALTRANS MAINTENANCE YARD
 1.3   330
  09    09 1.0    303   41/99 INTERCHANGE
 1.8   330
  14    10 1.0    304   ROUTE 180 MR1                          HOUR 0600-0700
  .5     0
  10    12 1.0    305   FRESNO IRRIGATION
  .9   330  1.2  310   .5  322   .9   38
  11    15 1.0    306   FRESNO STATE
  .9   345
  06    10 1.0    042   ARB   N C F D
 1.3   353
   1    07            STABILITY DATA
  12    13            AIRCRAFT TEMPERATURE SOUNDINGS
   6     5     5    4
   0    24            POINT SOURCE DATA
  01    07            AREA  SOURCE DATA
   2    24            BACKGROUND   DATA
.040   .04  .01 .019 .016 .067 .002    0    0  .02    0    0    0    0
 .04 .001   .05 .013 .011 .044 .002    0    0  .02    0    0    0    0
 .04 .001   .05 .013 .011 .044 .002    0    0  .02    0    0    0    0
 .02 .001   .03 .006 .005 .020 .001    0    0  .02    0    0    0    0
.040   .01  .01 .008 .007 .031 .001    0    0  .02    0    0    0    0
 .02 .001   .05 .005 .004 .020 .001    0    0  .02    0    0    0    0
 .02 .001   .05 .005 .004 .020 .001    0    0  .02    0    0    0    0
 .01 .001   .03 .002 .002 .008 .001    0    0  .02    0    0    0    0
2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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       07           BOUNDARY CONCENTRATIONS
 .040  .04  .01 .019 .016 .067 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .02 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
 .040  .04  .01 .019 .016 .067 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .02 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
 .040  .04  .01 .019 .016 .067 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .02 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
 .040  .04  .01 .019 .016 .067 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .05 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
  .04 .001  .02 .013 .011 .044 .002  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .02 .006 .005 .020 .001  .00  .00  .02  .00  .00  .00  .00
   16   39    1  1.018000     GLOBALS FOR HOUR  0600/0700  GO   HERE
   07   08          WIND DATA  ***************   HOUR 0700-0800
   06   15 1.0      301    SHAW AVE.
  1.3    0
   07   12 1.0      302    CALTRANS MAINTENANCE YARD
  1.3  330
   09   09 1.0      303    41/99 INTERCHANGE
  1.3   30
   14   10 1.0      304    ROUTE 180 MRI
   .5   60
   10   12 1.0      305    FRESNO IRRIGATION
   .9   45   .8   310   .3  322   .6    38
   11   15 1.0      306    FRESNO STATE
   .5  345
   06   10 1.0      042    ARB N C F D
  1.8   23
    1   08              STABILITY DATA
   12   13              AIRCRAFT TEMPERATURE SOUNDINGS
    6    5    5     4
   01   08              AREA SOURCE DATA
        08              BOUNDARY CONCENTRATIONS
 .040  .04  .01 .019 .016 .067 .002  .00  .00  .02  .00  .00  .00  .00
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 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.040  .04  .01 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.040  .04  .01 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.040  .04  .01 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.010 .001  .02 .006 .005 .020 .001  .00   .00   .02   .00   .00   .00   .00
  21   95    1  1.018000    GLOBALS FOR HOUR  0700/0800  GO   HERE
  07   09           WIND DATA  ***************   HOUR 0800-0900
  06   15 1.0   301   SHAW AVE.
  .9  120
  07   12 1.0   302   CALTRANS MAINTENANCE YARD
  .9   30
  09   09 1.0   303   41/99 INTERCHANGE
 1.3   60
  14   10 1.0   304   ROUTE 180 MR1
 1.3  135
  10   12 1.0   305   FRESNO IRRIGATION
 1.3  135  1.4  310   .6  322  1.1   38
  11   15 1.0   306   FRESNO STATE
  .9  120
  06   10 1.0   042   ARB   N C F D
  .9  353
  01   09           STABILITY DATA
  12   13           AIRCRAFT TEMPERATURE SOUNDINGS
   2    6    5    4
  01   09           AREA SOURCE DATA
       09           BOUNDARY CONCENTRATIONS
.040  .02  .03 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.040  .02  .03 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.040  .02  .03 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .01 .001  .02 .006 .005  .02 .001  .00   .00   .02   .00   .00   .00   .00
.040  .02  .03 .019 .016 .067 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .05 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
 .04 .001  .02 .013 .011 .044 .002  .00   .00   .02   .00   .00   .00   .00
.010 .001  .02 .006 .005  .02 .001  .00   .00   .02   .00   .00   .00   .00
  26  135    1  1.018000    GLOBALS FOR HOUR  0800/0900  GO   HERE
  07   10           WIND DATA  ***************   HOUR 0900-1000
  06   15 1.0   301   SHAW AVE.
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   .9  330
   07   12 1.0    302   CALTRANS MAINTENANCE YARD
  1.3  105
   09   09 1.0    303   41/99 INTERCHANGE
   .9  210
   14   10 1.0    304   ROUTE 180 MR1
  1.8  210
   10   12 1.0    305   FRESNO IRRIGATION
  1.3  135  2.3  310   .9  322  1.7   38
   11   15 1.0    306   FRESNO STATE
  2.2  150
   06   10 1.0    042   ARB   N C F D
  1.8  308
   01   10        STABILITY DATA
   12   13        AIRCRAFT TEMPERATURE SOUNDINGS
    2    6    5    4
   01   10        AREA SOURCE DATA
        10        BOUNDARY CONCENTRATIONS
 .020 .005  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .02 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .020 .005  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .02 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .020 .005  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .02 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .020 .005  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .02 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .01 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
   29  160    1  1.018000    GLOBALS FOR HOUR  0900/1000  GO   HERE
   07   11        WIND DATA  ***************   HOUR 1000-1100
   06   15 1.0    301   SHAW AVE.
  1.8  285
   07   12 1.0    302   CALTRANS MAINTENANCE YARD
  1.8  263
   09   09 1.0    303   41/99 INTERCHANGE
  1.8  285
   14   10 1.0    304   ROUTE 180 MR1
  1.3  263
   10   12 1.0    305   FRESNO IRRIGATION
  1.6  218  2.2  310   .9  322  1.7   38
   11   15 1.0    306   FRESNO STATE
  1.8  195
   06   10 1.0    042   ARB   N C F D
  3.1  308
   01   11        STABILITY DATA
   12   13        AIRCRAFT TEMPERATURE SOUNDINGS
    2    6    5    4
   01   11        AREA SOURCE DATA
        11        BOUNDARY CONCENTRATIONS
 .020 .005  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
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 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .005  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .005  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .005  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  30  174    1  1.018000    GLOBALS FOR HOUR  1000/1100  GO   HERE
  07   12          WIND DATA  ***************   HOUR 1100-1200
  06   15 1.0      301   SHAW AVE.
 2.2  285
  07   12 1.0      302   CALTRANS MAINTENANCE YARD
 2.7  263
  09   09 1.0      303   41/99 INTERCHANGE
 2.7  315
  14   10 1.0      304   ROUTE 180 MRI
 1.8  285
  10   12 1.0      305   FRESNO IRRIGATION
 2.2  285  2.5   309  1.3  315  2.2    1
  11   15 1.0      306   FRESNO STATE
 1.8  240
  06   10 1.0      042   ARB  N F C D
 3.1  308
  01   12          STABILITY DATA
  12   13          AIRCRAFT TEMPERTAURE SOUNDINGS
   2    2    4      4
  01   12          AREA SOURCE DATA
       12          BOUNDARY CONCENTRATIONS
.020 .002  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .002  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .002  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .002  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .05 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  31  180    1  1.018000    GLOBALS FOR HOUR  1100/1200  GO   HERE
  07   13          WIND DATA  ***************   HOUR 1200/1300
  06   15 1.0      301   SHAW AVE.
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  2.7   285
   07    12 1.0     302    CALTRANS MAINTENANCE YARD
  2.7   263
   09    09 1.0     303    41/99 INTERCHANGE
  2.7   308
   14    10 1.0     304    ROUTE 180 MR1
  2.2   308
   10    12 1.0     305    FRESNO IRRIGATION
  1.8   308  2.7  308  1.6  306  2.4  305
   11    15 1.0     306    FRESNO STATE
  2.2   240
   06    10 1.0     042    ARB    N C F D
  2.7   308
   01    13             STABILITY DATA
   12    13             AIRCRAFT TEMPERATURE SOUNDINGS
    2     2      4       4
   01    13             AREA SOURCE DATA
         13             BOUNDARY CONCENTRATIONS
 .020 .001  .06 .007 .006 .025 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
 .020 .001  .06 .007 .006 .025 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
 .020 .001  .06 .007 .006 .025 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
 .020 .001  .06 .007 .006 .025 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .02 .001  .08 .005 .004 .016 .001   .00   .00   .02   .00   .00   .00   .00
  .01 .001  .02 .002 .002 .008 .001   .00   .00   .02   .00   .00   .00   .00
   32   180      1  1.018000    GLOBALS FOR HOUR   1200/1300  GO   HERE
   07    14             WIND DATA  ***************   HOUR 1300-1400
   06    15 1.0     301    SHAW AVE.
  3.6   330
   07    12 1.0     302    CALTRANS MAINTENANCE YARD
  2.7   240
   09    09 1.0     303    41/99 INTERCHANGE
  3.1   285
   14    10 1.0     304    ROUTE 180 MR1
  1.8   308
   10    12 1.0     305    FRESNO IRRIGATION
  2.2   285  3.3  308  2.6  308  3.4  305
   11    15 1.0     306    FRESNO STATE
  2.7   240
   06    10 1.0     042    ARB    N C F D
  3.1   330
   01    14             STABILITY DATA
   12    13             AIRCRAFT TEMPERATURE SOUNDINGS
    2     2      4       4
   01    14             AREA SOURCE DATA
         14             BOUNDARY CONCENTRATIONS
 .020 .001  .07 .007 .006 .025 .001   .00   .00   .02   .00   .00   .00   .00
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 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010  .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  34   174    1  1.018000    GLOBALS FOR HOUR  1300/1400  GO   HERE
  07    15        WIND DATA  ***************   HOUR 1400-1500
  06    15 1.0    301    SHAW AVE.
 2.7   308
  07    12 1.0    302    CALTRANS MAINTENANCE YARD
 2.7   240
  09    09 1.0    303    41/99 INTERCHANGE
 2.7   285
  14    10 1.0    304    ROUTE 180 MR1
 2.7   285
  10    12 1.0    305    FRESNO IRRIGATION
 2.7   285  4.7   308  4.2  308  4.6  305
  11    15 1.0    306    FRESNO STATE
 3.6   263
  06    10 1.0    042    ARB   N C F D
 3.6   308
  01    15            STABILITY DATA
  12    13            AIRCRAFT TEMPERATURE SOUNDINGS
   2     2    4        4
  01    15            AREA SOURCE DATA
        15            BOUNDARY CONCENTRATIONS
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020  .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02  .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010  .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  34   160    1  1.018000    GLOBALS FOR HOUR  1400/1500  GO   HERE
  07    16        WIND DATA  ***************   HOUR 1500-1600
  06    15 1.0    301    SHAW AVE.
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 3.1  285
  07   12 1.0    302   CALTRANS MAINTENANCE YARD
 2.7  263
  09   09 1.0    303   41/99 INTERCHANGE
 3.6  285
  14   10 1.0    304   ROUTE 180 MRI
 3.1  285
  10   12 1.0    305   FRESNO IRRIGATION
 2.7  285  5.4  308  5.4  308  4.6  305
  11   15 1.0    306   FRESNO STATE
 3.6  240
  06   10 1.0    042   ARB   N C F D
 3.6  308
  01   16              STABILITY DATA
  12   13              AIRCRAFT TEMPERATURE SOUNDINGS
   4    4    4    4
  01   16              AREA SOURCE DATA
       16              BOUNDARY CONCENTRATIONS
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  34  136    1  1.018000    GLOBALS FOR HOUR  1500/1600  GO   HERE
  07   17              WIND DATA ****************   HOUR 1600-1700
  06   15 1.0    301   SHAW AVE.
 3.6  285
  07   12 1.0    302   CALTRANS MAINTENANCE YARD
 3.6  263
  09   09 1.0    303   41/99 INTERCHANGE
 3.6  285
  14   10 1.0    304   ROUTE 180 MRI
 3.6  285
  10   12 1.0    305   FRESNO IRRIGATION
 3.1  263  5.3  308  5.3  308  4.5  305
  11   15 1.0    306   FRESNO STATE
 3.6  240
  06   10 1.0    042   ARB   N C F D
 4.5  308
  01   17              STABILITY DATA
  12   13              AIRCRAFT TEMPERATURE SOUNDINGS
   4    4    4    4
  01   17              AREA SOURCE DATA
       17              BOUNDARY CONCENTRATIONS
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
```

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 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .07 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  34   96    1  1.018000    GLOBALS FOR HOUR   1600/1700  GO   HERE
  07   18        WIND DATA  ***************    HOUR 1700-1800
  06   15 1.0    301   SHAW AVE.
 4.0  285
  07   12 1.0    302   CALTRANS MAINTENANCE YARD
 3.6  285   .
  09   09 1.0    303   41/99 INTERCHANGE
 4.0  285
  14   10 1.0    304   ROUTE 180 MR1
 3.1  285
  10   12 1.0    305   FRESNO IRRIGATION
 3.1  263   5.0  308  5.0  308  4.3  305
  11   15 1.0    306   FRESNO STATE
 4.0  263
  06   10 1.0    042   ARB   N C F D
 4.5  308
  01   18        STABILITY DATA
  12   13        AIRCRAFT TEMPERATURE SOUNDINGS
   4    4    4    4
  01   18        AREA SOURCE DATA
       18        BOUNDARY CONCENTRATIONS
.020 .001  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.020 .001  .06 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
.010 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
  33   41    1  1.018000    GLOBALS FOR HOUR   1700/1800  GO   HERE
  07   24        WIND DATA  ***************    HOUR 1800-1900
  06   15 1.0    301   SHAW AVE.
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  3.1   285
   07    12 1.0     302    CALTRANS MAINTENANCE YARD
  2.7   285
   09    09 1.0     303    41/99 INTERCHANGE
  3.6   285
   14    10 1.0     304    ROUTE 190 MRI
  2.7   285
   10    12 1.0     305    FRESNO IRRIGATION
  2.7   285   4.5   308   4.5   303   3.8   305
   11    15 1.0     306    FRESNO STATE
  3.6   263
   06    10 1.0     042    ARB    N C F D
  3.6   308
   01    24             STABILITY DATA
   12    13             AIRCRAFT TEMPERATURE SOUNDINGS
    4     4     4     4
   01    24             AREA SOURCE DATA
         24             BOUNDARY CONCENTRATIONS
 .020 .001  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .020 .001  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .020 .001  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .020 .001  .05 .007 .006 .025 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
  .02 .001  .08 .005 .004 .016 .001  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .02 .002 .002 .008 .001  .00  .00  .02  .00  .00  .00  .00
   31     5     1  1.018000    GLOBALS FOR HOUR  1800/1900  GOES HERE
***** ABOVE ACTION SATISFACTORILY COMPLETED *****
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++WRITE PRINT,TMENVFSN31
*          DATA SET TMENVFSN31 AT LEVEL 043 AS OF 05/09/80
 SMOG PROGRAM OF ARB'S.    FRESNO     STUDY AUG. 31 1976 FULL DATA
 &GRIDIT DX=1609,DY=1609,DZ=100,NX=25,NY=25,NZ=6 &END
 &OPTION IDOWND=1,IDOCEM=15,IDOPLM=0,IDODIF=1,IDOBAK=-3 &END
 &OPT ITEST=0,ISTART=0,IWINDS=1,ICONC=1,IAREA=1,ISTAB=1 &END
 &OUTPUT NUMHRS=13,IDOPLT=0,IDOPRN=1,IDOCAL=0,HRSAVG=1,IDOSUR=1,
        NOWTIM=6 &END          FRESNO   TERRAIN
   01    01    0.    2.    3.    3.    6.    8.    9.    9.   12.   14.
   11    01   14.   17.   18.   21.   21.   24.   26.   29.   27.   34.
   21    01   34.   34.   34.   35.   34.
   01    02    0.    2.    3.    5.    6.   11.    9.   12.   12.   12.
   11    02   15.   17.   18.   21.   21.   23.   26.   26.   27.   29.
   21    02   35.   35.   37.   37.   37.
   01    03    0.    2.    3.    5.    6.    6.    9.   11.   12.   15.
   11    03   17.   18.   17.   21.   24.   26.   27.   27.   29.   31.
   21    03   35.   37.   37.   38.   37.
   01    04    0.    2.    3.    5.    6.    6.    9.   11.   12.   15.
   11    04   17.   18.   20.   23.   24.   26.   26.   27.   29.   31.
   21    04   35.   37.   27.   29.   31.
   01    05    0.    2.    3.    6.    6.    8.    9.   11.   14.   15.
   11    05   17.   18.   21.   23.   24.   26.   27.   27.   31.   32.
   21    05   37.   37.   31.   32.   32.
   01    06    0.    2.    5.    6.    8.    9.   11.   12.   14.   15.
   11    06   17.   18.   20.   21.   23.   24.   26.   31.   32.   34.
   21    06   40.   32.   34.   32.   34.
   01    07    3.    3.    6.    8.   11.   11.   12.   12.   12.   17.
   11    07   17.   18.   20.   23.   27.   29.   31.   32.   34.   34.
   21    07   38.   41.   34.   34.   35.
   01    08    5.    6.    6.    8.   11.   11.   14.   15.   15.   17.
   11    08   18.   20.   21.   24.   26.   27.   29.   31.   34.   35.
   21    08   40.   43.   34.   35.   35.
   01    09    5.    8.    9.   11.   12.   14.   14.   15.   18.   20.
   11    09   21.   21.   24.   26.   27.   29.   31.   32.   34.   35.
   21    09   41.   44.   40.   37.   38.
   01    10    6.    8.    9.   12.   15.   15.   18.   17.   18.   21.
   11    10   21.   24.   26.   27.   29.   32.   34.   37.   34.   37.
   21    10   44.   44.   46.   47.   40.
   01    11    9.    9.   12.   14.   17.   17.   18.   21.   21.   21.
   11    11   24.   24.   27.   31.   31.   34.   37.   40.   43.   44.
   21    11   46.   49.   50.   55.   55.
   01    12   11.   12.   14.   15.   15.   18.   21.   20.   21.   23.
   11    12   24.   31.   29.   32.   32.   37.   38.   41.   41.   44.
   21    12   49.   49.   53.   52.   58.
   01    13   12.   12.   14.   18.   20.   20.   21.   23.   24.   26.
   11    13   27.   31.   32.   34.   37.   37.   38.   41.   44.   46.
   21    13   52.   52.   52.   55.   58.
   01    14   15.   17.   18.   20.   20.   21.   24.   26.   26.   27.
   11    14   29.   34.   34.   37.   40.   37.   41.   43.   46.   52.
   21    14   55.   58.   61.   64.   67.
   01    15   15.   18.   20.   20.   21.   24.   26.   27.   27.   31.
   11    15   32.   34.   37.   40.   43.   46.   49.   49.   52.   52.
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21	15	52.	61.	67.	119.	113.					
01	16	21.	23.	21.	24.	24.	24.	26.	27.	31.	32.
11	16	34.	37.	40.	40.	43.	46.	49.	55.	56.	61.
21	16	61.	64.	67.	75.	82.					
01	17	20.	21.	23.	24.	27.	29.	31.	32.	34.	37.
11	17	37.	40.	43.	46.	49.	52.	55.	61.	61.	64.
21	17	64.	67.	82.	98.	98.					
01	18	18.	21.	6.	6.	29.	23.	24.	9.	37.	37.
11	18	40.	40.	43.	46.	49.	52.	58.	58.	64.	67.
21	18	72.	76.	106.	112.	112.					
01	19	20.	21.	27.	29.	32.	29.	37.	37.	9.	37.
11	19	43.	46.	46.	49.	52.	55.	59.	64.	67.	76.
21	19	76.	82.	124.	192.	197.					
01	20	21.	21.	27.	31.	34.	37.	37.	40.	14.	37.
11	20	46.	47.	45.	49.	52.	58.	49.	88.	93.	82.
21	20	82.	93.	174.	206.	206.					
01	21	21.	24.	29.	32.	34.	40.	38.	41.	43.	17.
11	21	21.	43.	46.	52.	76.	82.	82.	82.	90.	109.
21	21	90.	90.	123.	140.	144.					
01	22	21.	26.	31.	34.	34.	37.	40.	43.	43.	21.
11	22	21.	52.	52.	61.	90.	150.	210.	155.	107.	132.
21	22	120.	113.	113.	216.	216.					
01	23	24.	27.	34.	37.	37.	37.	41.	43.	44.	46.
11	23	15.	29.	67.	79.	158.	188.	213.	268.	240.	171.
21	23	168.	171.	168.	168.	168.					
01	24	26.	31.	34.	40.	40.	40.	43.	43.	44.	46.
11	24	21.	37.	73.	98.	270.	220.	152.	170.	215.	241.
21	24	207.	199.	235.	223.	233.					
01	25	27.	34.	35.	41.	43.	43.	43.	43.	44.	44.
11	25	46.	52.	52.	128.	108.	109.	128.	127.	192.	268.
21	25	207.	265.	234.	210.	210.					
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1 SURFACE ROUGHNESS

01	01	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
11	01	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	01	.25	.25	.25	.25	.25					
01	02	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
11	02	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	02	.25	.25	.25	.25	.25					
01	03	.25	.25	.25	.25	.25	.10	.10	.10	.25	.25
11	03	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	03	.25	.25	.25	.74	.74					
01	04	.25	.25	.25	.10	.10	.10	.25	.10	.25	.25
11	04	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	04	.25	.25	.25	.74	.74					
01	05	.25	.10	.10	.10	.10	.10	.10	.25	.25	.25
11	05	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	05	.25	.25	.74	.74	.74					
01	06	.10	.10	.10	.25	.10	.74	.10	.10	.10	.25
11	06	.10	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	06	.25	.25	.25	.25	.74					
01	07	.10	.10	.10	.25	.10	.10	.10	1.00	1.00	.10
11	07	1.00	.25	.25	.25	.25	.25	.25	.25	.25	.25
21	07	1.00	1.00	.25	.25	.25					
01	08	.10	.10	.10	.25	.25	.10	1.00	1.00	1.00	1.00
11	08	1.00	.25	.74	.25	.25	.25	.25	.25	.25	.25
21	08	1.00	1.00	1.00	.01	.25					

II

01	09	.10	.10	.25	.25	.25	1.00	1.00	1.00	1.00	1.00
11	09	1.00	1.00	1.00	1.00	1.00	.25	.25	.25	.74	.74
21	09	.25	.25	.25	.74	.25					
01	10	.25	.25	.25	.25	.10	1.00	1.00	1.00	2.00	1.00
11	10	1.00	1.00	1.00	1.00	.25	.25	.25	.25	.74	.74
21	10	.25	.25	.74	.74	.74					
01	11	.10	.74	.10	.25	1.00	1.00	1.00	1.00	1.00	1.00
11	11	1.00	1.00	1.00	.74	.74	.25	.25	.25	.74	.74
21	11	.74	.74	.74	.74	.74					
01	12	.10	.25	.25	.10	.10	1.00	1.00	1.00	1.00	1.00
11	12	1.00	1.00	1.00	.25	.25	.10	.25	.25	.74	.74
21	12	.25	.74	.74	.74	.74					
01	13	.74	.10	.25	.25	1.00	1.00	1.00	1.00	1.00	1.00
11	13	1.00	1.00	1.00	1.00	.10	.74	.74	.10	.74	.25
21	13	.10	.10	.74	.74	.74					
01	14	.74	.25	.10	.74	1.00	1.00	1.00	1.00	1.00	1.00
11	14	1.00	1.00	1.00	1.00	.10	.74	.10	.10	.01	.10
21	14	.10	.10	.10	.01	.01					
01	15	.74	.74	.74	.74	1.00	1.00	1.00	1.00	1.00	1.00
11	15	1.00	1.00	1.00	1.00	1.00	.74	.01	.01	.01	.01
21	15	.01	.01	.01	.01	.01					
01	16	.74	.74	.74	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	16	1.00	1.00	1.00	1.00	1.00	.10	.74	.01	.01	.01
21	16	.01	.01	.01	.01	.01					
01	17	.74	.74	.74	.01	1.00	1.00	.74	1.00	1.00	1.00
11	17	1.00	.74	1.00	.74	.74	.01	.01	.01	.01	.01
21	17	.01	.01	.01	.01	.01					
01	18	.74	.74	.01	.01	.01	.01	.01	.01	.01	.74
11	18	.74	.74	.74	.74	.74	.74	.74	.01	.01	.01
21	18	.01	.01	.01	.01	.01					
01	19	.25	.25	.25	.01	.01	.01	.01	.01	.01	.01
11	19	.10	.74	.74	.01	.01	.01	.01	.01	.01	.01
21	19	.01	.01	.01	.01	.01					
01	20	.25	.25	.25	.01	.74	.01	.74	.01	.01	.01
11	20	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	20	.01	.01	.01	.01	.01					
01	21	.01	.10	.01	.01	.74	.74	.74	.01	.01	.01
11	21	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	21	.01	.01	.01	.01	.01					
01	22	.74	.01	.01	.01	.74	.74	.74	.74	.01	.01
11	22	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	22	.01	.01	.01	.01	.01					
01	23	.01	.25	.25	1.00	.01	.74	.74	.74	.74	.01
11	23	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	23	.01	.01	.01	.01	.01					
01	24	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
11	24	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	24	.01	.01	.01	.01	.01					
01	25	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
11	25	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
21	25	.01	.01	.01	.01	.01					

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   06    07
   06    15 1.0     301    SHAW AVE.                ******AUGUST 31,1976****
  0.9   105
   07    12 1.0     302    CALTRANS MAINTENANCE YARD
  0.4   270
   09    09 1.0     303    41/99 INTERCHANGE
  0.9   075
   14    10 1.0     304    ROUTE 180 MRI                  HOUR 0600-0700
   .1   060
   10    12 1.0     305    FRESNO IRRIGATION
   .9   060
   11    15 1.0     306    FRESNO STATE
   .9   045
    1    07                STABILITY DATA
   12    13                AIRCRAFT TEMPERATURE SOUNDINGS
    6     6     6     6     6     6
    0    24                POINT SOURCE DATA
   01    07                AREA  SOURCE DATA
    2    24               INITIAL CONCENTRATIONS @ 0600
 .060   .06  .01 .015 .009 .033 .006    0    0  .02    0    0    0    0
 .001  .001  .07 .010 .006 .022 .004    0    0  .02    0    0    0    0
 .010  .010  .01 .010 .006 .022 .004    0    0  .02    0    0    0    0
 .010  .001  .01 .010 .006 .022 .004    0    0  .02    0    0    0    0
 .010  .001  .01 .010 .006 .022 .004    0    0  .02    0    0    0    0
 .010  .001  .01 .010 .006 .022 .004    0    0  .02    0    0    0    0
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        07     BOUNDARY CONCENTRATIONS (LEFT,RIGHT,TOP,BOTTOM,LID)
 .060   .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001  .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060   .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001  .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060   .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001  .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060   .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001  .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010  .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
   21    39     1   3.018000     GLOBALS FOR HOUR  0600/0700  GO   HERE
   06    08          WIND DATA  ***************   HOUR 0700-0800
   06    15 1.0      301    SHAW AVE.
  0.9   075
   07    12 1.0      302    CALTRANS MAINTENANCE YARD
  0.9   030
   09    09 1.0      303    41/99 INTERCHANGE
  1.3   105
   14    10 1.0      304    ROUTE 180 MRI
   .4   075
   10    12 1.0      305    FRESNO IRRIGATION
   .9    90
   11    15 1.0      306    FRESNO STATE
   .9   060
    1    08              STABILITY DATA
   12    13              AIRCRAFT TEMPERATURE SOUNDINGS
    4     6     6     6     6     6
   01    08              AREA SOURCE DATA
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        08          BOUNDARY CONCENTRATIONS
 .060  .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001 .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060  .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001 .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060  .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001 .001   .07 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060  .06   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001 .001   .07 .010 .006 .033 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .010   .01 .015 .006 .033 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .015 .006 .033 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .015 .006 .033 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .015 .006 .033 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
   26   95     1  3.018000     GLOBALS FOR HOUR  0700/0800  GO   HERE
   06   09          WIND DATA  ****************   HOUR 0800-0900
   06   15 1.0      301    SHAW AVE.
  1.3  150
   07   12 1.0      302    CALTRANS MAINTENANCE YARD
   .9  135
   09   09 1.0      303    41/99 INTERCHANGE
  1.8  135
   14   10 1.0      304    ROUTE 180 MRI
  1.3  150
   10   12 1.0      305    FRESNO IRRIGATION
  1.8  135
   11   15 1.0      306    FRESNO STATE
  1.3  135
   01   09              STABILITY DATA
   12   13              AIRCRAFT TEMPERATURE SOUNDINGS
    2    6     6    6    6    6
   01   09              AREA SOURCE DATA
        09              BOUNDARY CONCENTRATIONS
 .060  .03   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001 .001   .05 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .060  .03   .01 .015 .009 .033 .006   .00   .00   .02   .00   .00   .00   .00
 .001 .001   .05 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .010   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
 .010 .001   .01 .010 .006 .022 .004   .00   .00   .02   .00   .00   .00   .00
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 .060  .03   .01 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .001 .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .010   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .060  .03   .01 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .001 .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .010   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
   30  135     1  2.018000    GLOBALS FOR HOUR  0800/0900  GO   HERE
   06   10          WIND DATA  ****************  HOUR 0900-1000
   06   15 1.0      301    SHAW AVE.
  2.2  165
   07   12 1.0      302    CALTRANS MAINTENANCE YARD
  1.3  150
   09   09 1.0      303    41/99 INTERCHANGE
  1.8  165
   14   10 1.0      304    ROUTE 180 MRI
  1.8  150
   10   12 1.0      305    FRESNO IRRIGATION
  2.2  150
   11   15 1.0      306    FRESNO STATE
  2.2  150
   01   10          STABILITY DATA
   12   13          AIRCRAFT TEMPERATURE SOUNDINGS
    2    2    6     6    6    6
   01   10          AREA SOURCE DATA
        10          BOUNDARY CONCENTRATIONS
 .060 .030   .01 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .001 .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .010   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .060 .030   .01 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .001 .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .010   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .060 .030   .01 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .001 .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .010   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .060 .030   .01 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .001 .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .010   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001   .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
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  33   160     1  1.518000    GLOBALS FOR HOUR  0900/1000  GO   HERE
  06    11          WIND DATA  ***************   HOUR 1000-1100
  06    15 1.0      301   SHAW AVE.
 1.8   180
  07    12 1.0      302   CALTRANS MAINTENANCE YARD
 1.3   180
  09    09 1.0      303   41/99 INTERCHANGE
 1.3   180
  14    10 1.0      304   ROUTE 180 MRI
 2.2   150
  10    12 1.0      305   FRESNO IRRIGATION
 2.2   150
  11    15 1.0      306   FRESNO STATE
 2.7   135
  01    11              STABILITY DATA
  12    13              AIRCRAFT TEMPERATURE SOUNDINGS
   2     2     2     6     6     6
  01    11              AREA SOURCE DATA
        11              BOUNDARY CONCENTRATIONS
.020 .005  .04 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
.001 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .010  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.020 .005  .04 .015 .006 .033 .006  .00  .00  .02  .00  .00  .00  .00
.001 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .010  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.020 .005  .04 .015 .006 .033 .006  .00  .00  .02  .00  .00  .00  .00
.001 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .010  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.020 .005  .04 .015 .006 .033 .006  .00  .00  .02  .00  .00  .00  .00
.001 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .010  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
.010 .001  .01 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
  36   174     1  1.518000    GLOBALS FOR HOUR  1000/1100  GO   HERE
  06    12          WIND DATA  ***************   HOUR 1100-1200
  06    15 1.0      301   SHAW AVE.
 1.8   270
  07    12 1.0      302   CALTRANS MAINTENANCE YARD
 1.3   240
  09    09 1.0      303   41/99 INTERCHANGE
 1.8   225
  14    10 1.0      304   ROUTE 180 MRI
 1.3   195
  10    12 1.0      305   FRESNO IRRIGATION
 1.3   225
  11    15 1.0      306   FRESNO STATE
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  1.8   210
   01    12            STABILITY DATA
   12    13            AIRCRAFT TEMPERTAURE SOUNDINGS
    2     2     2       6     6     6
   01    12            AREA SOURCE DATA
         12            BOUNDARY CONCENTRATIONS
 .010  .001   .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
   38   180     1  1.518000    GLOBALS FOR HOUR  1100/1200   GO   HERE
   07    13            WIND DATA  ***************   HOUR 1200-1300
   06    15 1.0        301    SHAW AVE.
  2.2   300
   07    12 1.0        302    CALTRANS MAINTENANCE YARD
  2.2   270
   09    09 1.0        303    41/99 INTERCHANGE
  2.2   240
   14    10 1.0        304    ROUTE 180 MRI
  1.3   225
   10    12 1.0        305    FRESNO IRRIGATION
  1.8   300
   11    15 1.0        306    FRESNO STATE
  1.3   240
   06    10 1.0        042    ARB   N C F D
  2.7   308
   01    13            STABILITY DATA
   12    13            AIRCRAFT TEMPERATURE SOUNDINGS
    2     2     2       2     6     6
   01    13            AREA SOURCE DATA
         13            BOUNDARY CONCENTRATIONS
 .010  .001   .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010  .001   .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
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 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
   38  180    1   1.518000    GLOBALS FOR HOUR  1200/1300  GO   HERE
   07   14         WIND DATA  ***************    HOUR 1300-1400
   06   15 1.0     301    SHAW AVE.
  2.7  300
   07   12 1.0     302    CALTRANS MAINTENANCE YARD
  2.7  270
   09   09 1.0     303    41/99 INTERCHANGE
  2.7  255
   14   10 1.0     304    ROUTE 180 MRI
  1.8  315
   10   12 1.0     305    FRESNO IRRIGATION
  2.2  270
   11   15 1.0     306    FRESNO STATE
  2.2  270
   06   10 1.0     042    ARB   N C F D
  3.1  300
   01   14             STABILITY DATA
   12   13             AIRCRAFT TEMPERATURE SOUNDINGS
    2    2    2    2    5    5
   01   14             AREA SOURCE DATA
        14             BOUNDARY CONCENTRATIONS
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
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 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .015 .009 .033 .006  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
   39  174    1  2.518000    GLOBALS FOR HOUR  1300/1400  GO   HERE
   07   15         WIND DATA  ****************   HOUR 1400-1500
   06   15 1.0     301    SHAW AVE.
  4.0  300
   07   12 1.0     302    CALTRANS MAINTENANCE YARD
  4.0  285
   09   09 1.0     303    41/99 INTERCHANGE
  3.6  300
   14   10 1.0     304    ROUTE 180 MRI
  2.7  300
   10   12 1.0     305    FRESNO IRRIGATION
  3.1  300
   11   15 1.0     306    FRESNO STATE
  3.1  270
   06   10 1.0     042    ARB   N C F D
  4.9  300
   01   15             STABILITY DATA
   12   13             AIRCRAFT TEMPERATURE SOUNDINGS
    4    4     4    4    5    5
   01   15             AREA SOURCE DATA
        15             BOUNDARY CONCENTRATIONS
 .010 .001  .07 .015 .009 .033 .006  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .015 .009 .033 .006  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .015 .009 .033 .006  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .015 .009 .033 .006  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .07 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .05 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
 .010 .001  .04 .010 .006 .022 .004  .00   .00   .02   .00   .00   .00   .00
   39  160    1  1.518000    GLOBALS FOR HOUR  1400/1500  GO   HERE
   07   16         WIND DATA  ****************   HOUR 1500-1600
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   06    15 1.0     301    SHAW AVE.
  4.5   300
   07    12 1.0     302    CALTRANS MAINTENANCE YARD
  4.5   285
   09    09 1.0     303    41/99 INTERCHANGE
  4.9   300
   14    10 1.0     304    ROUTE 180 MRI
  3.6   285
   10    12 1.0     305    FRESNO IRRIGATION
  3.6   300
   11    15 1.0     306    FRESNO STATE
  4.0   270
   06    10 1.0     042    ARB    N C F D
  4.9   315
   01    16             STABILITY DATA
   12    13             AIRCRAFT TEMPERATURE SOUNDINGS
    4     4     4     4     4     5
   01    16             AREA SOURCE DATA
         16             BOUNDARY CONCENTRATIONS
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
   41   136     1  1.518000     GLOBALS FOR HOUR  1500/1600  GO  HERE
   07    17             WIND DATA   ****************   HOUR 1600-1700
   06    15 1.0     301    SHAW AVE.
  4.9   300
   07    12 1.0     302    CALTRANS MAINTENANCE YARD
  4.5   285
   09    09 1.0     303    41/99 INTERCHANGE
  4.5   300
   14    10 1.0     304    ROUTE 180 MRI
  4.0   285
   10    12 1.0     305    FRESNO IRRIGATION
  4.0   285
   11    15 1.0     306    FRESNO STATE
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  5.8  270
   06   10 1.0    042   ARB   N C F D
  4.9  315
   01   17        STABILITY DATA
   12   13        AIRCRAFT TEMPERATURE SOUNDINGS
    4    4    4    4    5    5
   01   17        AREA SOURCE DATA
        17        BOUNDARY CONCENTRATIONS
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
   40   96    1  2.018000    GLOBALS FOR HOUR  1600/1700  GO   HERE
   07   18        WIND DATA  ****************   HOUR 1700-1800
   06   15 1.0    301   SHAW AVE.
  4.0  300
   07   12 1.0    302   CALTRANS MAINTENANCE YARD
  4.0  285
   09   09 1.0    303   41/99 INTERCHANGE
  4.5  300
   14   10 1.0    304   ROUTE 180 MRI
  3.6  285
   10   12 1.0    305   FRESNO IRRIGATION
  3.1  285
   11   15 1.0    306   FRESNO STATE
  4.5  270
   06   10 1.0    042   ARB   N C F D
  4.0  315
   01   18        STABILITY DATA
   12   13        AIRCRAFT TEMPERATURE SOUNDINGS
    4    4    4    4    5    5
   01   18        AREA SOURCE DATA
        18        BOUNDARY CONCENTRATIONS
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
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 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
   39   41    1  1.518000    GLOBALS FOR HOUR 1700/1800  GO   HERE
   07   24         WIND DATA  ****************   HOUR 1800-1900
   06   15 1.0     301   SHAW AVE.
  2.7  285
   07   12 1.0     302   CALTRANS MAINTENANCE YARD
  2.7  270
   09   09 1.0     303   41/99 INTERCHANGE
  3.1  285
   14   10 1.0     304   ROUTE 180 MRI
  2.2  270
   10   12 1.0     305   FRESNO IRRIGATION
  2.2  270
   11   15 1.0     306   FRESNO STATE
  4.0  270
   06   10 1.0     042   ARB   N C F D
  3.6  315
   01   24         STABILITY DATA
   12   13         AIRCRAFT TEMPERATURE SOUNDINGS
    4    4    4    4    5    5
   01   24         AREA SOURCE DATA
        24         BOUNDARY CONCENTRATIONS
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .05 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .04 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .015 .009 .033 .006  .00  .00  .02  .00  .00  .00  .00
 .010 .001  .07 .010 .006 .022 .004  .00  .00  .02  .00  .00  .00  .00
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.010	.001	.05	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.05	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.04	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.04	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.07	.015	.009	.033	.006	.00	.00	.02	.00	.00	.00	.00
.010	.001	.07	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.05	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.05	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.04	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.04	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00
.010	.001	.04	.010	.006	.022	.004	.00	.00	.02	.00	.00	.00	.00

36 1 1 1.518000 GLOBALS FOR HOUR 1800/1900 GO HERE

***** ABOVE ACTION SATISFACTORILY COMPLETED *****