EPA-R4-73-030h

July 1973

ENVIRONMENTAL MONITORING SERIES

URBAN AIR SHED PHOTOCHEMICAL SIMULATION MODEL STUDY

VOLUME III - AUTOMATION OF METEOROLOGICAL AND AIR QUALITY DATA FOR MODEL

Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

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URBAN AIR SHED PHOTOCHEMICAL SIMULATION MODEL STUDY

VOLUME III - AUTOMATION OF METEOROLOGICAL AND AIR QUALITY DATA FOR MODEL

by

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Contract No. 68-02-0339
Program Element No. 1A1009

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Prepared for

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

July 1973

This report has been reviewed by the Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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I. INTRODUCTION

In a comprehensive effort undertaken by Systems Applications, Inc. and sponsored by The Environmental Protection Agency under contract CAP 70-148, a computer-based airshed model capable of predicting concentrations of photochemically generated pollutants in an urban area was developed. This model, based essentially upon the finite difference solution of the equations of conservation of mass, requires the following data as inputs:

1. Meteorological Data
   a. Wind speeds and wind directions
   b. Mixing depths
2. Air Quality Data
   a. Initial concentrations
   b. Concentrations at boundaries (ground level)
3. Emissions Data
4. Miscellaneous Data
   a. Reaction rates
   b. Radiation intensities
   c. Concentrations aloft
   d. Others

The third and the fourth categories, in general, do not present data handling problems in the routine operation of the airshed model. For example, the emissions data are assumed to be invariant on a day-to-day basis and therefore can be considered as a "built-in" feature of the model.+ In contrast, the first two categories, which involve a vast amount of data, require manual preparation and handling of data on a daily, or case-by-case basis. The present project is intended to address the problems of preparing and handling the meteorological and air quality input data.

The manual procedures that have been used to date consist of the following steps: entering the measurements on a map, performing manual interpolation, transferring the information to coding forms, and finally punching a set of data cards. This is an extremely time-consuming task. The preparation of a map may take anywhere from 3 to 6 man-hours. In addition to the tedious procedures, the following disadvantages will unavoidably be associated with the manual preparation of the input data:

(1) Human subjectiveness
(2) Accidental errors

Based upon these arguments, an alternative approach, the automatic derivation of the meteorological and air quality input data, has been adopted.

In the next section, we present a brief review on the general subject of objective analysis of observational data and inversion heights. From among the many alternatives, the influence-factor-fit method has been chosen to automatically generate the wind field and initial concentration distribution. The results and discussion can be found in Sections III and IV, respectively.

+ With the exception that a one-hour shift is needed to account for changes between Pacific Standard Time and Pacific Daylight Time.

In Section V, the development of a computer-based method for creating maps of mixing depths is discussed. In Section VI, we describe a method capable of automatically specifying pollutant concentrations at the boundaries of the modeling region. Finally, we conclude this report by drawing general conclusions and making recommendations for future work.

II. REVIEW OF LITERATURE

The ability to obtain a complete description of the variation of a field quantity as a function of space or time or any other parameter from a finite number of observations has long been a subject of scientific inquiry. In particular, meteorologists have for years been interested in the extrapolation of measurements of temperature, pressure, humidity and wind collected at a small number of unequally-spaced monitoring stations. There have thus been a large number of publications in this area of study. We have not attempted in this section, however, to present a comprehensive review of all aspects of this subject. Rather, we discuss only those topics which are pertinent to the goal of the present project--the automatic derivation of wind fields, mixing depths, and initial and boundary conditions.

As a matter of convenience, we have divided this short review into two parts. The first part deals with the methods of interpolation in general; the second part is directed exclusively toward the determination of inversion heights.

A. OBJECTIVE ANALYSIS OF OBSERVATIONAL DATA

Many methods have been proposed in the past to interpolate data objectively. They may be grouped into the following five categories:

1. <u>Influence Factor Fit</u>

The simplest interpolation scheme that can be conceived is to weight the measurements by an influence

factor. For example, in the spatial interpolation of wind velocity, the interpolated value at location j can be written as

$$\hat{v}_j = \frac{\sum_i f_i v_i}{\sum_i f_i} \qquad (1)$$

where v_j = interpolated wind velocity at location j

v_i = observed wind velocity at location i

f_i = weighting function

Several different weighting functions have been used in the past. For instance, in analyzing the meso-scale wind pattern over the upper Snake River Plain of southeastern Idaho, Wendell (1970) has proposed

$$f_i = \frac{1}{r_i^2}$$

where r_i is the distance between location i and j. Strand (1971) and Weisburd et al. (1972) have adopted the same interpolation scheme to obtain the Lagrangian wind trajectories in Los Angeles.

On the other hand, Eschenroeder and Martinez (1971) have used

$$f_i = \frac{1}{r_i}$$

to interpolate the wind trajectories over Los Angeles.

2. Application of the Sampling Theorem

Lamb and Seinfeld (1973) have extended the classic sampling theorem (Papoulis, 1965) to the analysis of wind station data for the purpose of constructing a ground-level wind field. The pertinent form of the theorem can be stated as follows. If the wind velocities do not contain fluctuations with wave numbers greater than π/d_i, $i = 1, 2, 3$, where d_i denotes the separation between two wind monitoring stations in the i direction, then the true wind field, $u_\alpha(x,t)$, can be uniquely determined from the measured winds, $u_\alpha^m(n_1d_1, n_2d_2, n_3d_3, t)$, which is assumed to be free of experimental error,

$$u_\alpha(\underline{x},t) = \sum_{n_1}\sum_{n_2}\sum_{n_3} u_\alpha^m(n_1d_1, n_2d_2, n_3d_3, t) \prod_{i=1}^{3} \frac{\sin\left(\frac{\pi x_i}{d_i} - \pi n_i\right)}{\frac{\pi x_i}{d_i} - \pi n_i} \qquad (4)$$

In other words, only those fluctuating components of the wind having wavelengths greater than the separation of wind stations can be reconstructed exactly from measurements. For the Los Angeles area, there are about 25 wind monitoring stations covering an area of approximately 1600 square miles.

This theorem implies that the detectable wind variations are those with wavelengths greater than

$$\sqrt{\frac{1600}{25}} = 8 \text{ miles}$$

This resolution is probably sufficient for mesoscale urban airshed models.

3. Laplace's Equation Fit

A more sophisticated approach to data interpolation can be achieved via the use of the Laplace equation. The interpolated quantity $\hat{\phi}$, in this case, is generated by solving the Laplace's equation

$$\nabla^2 \hat{\phi} = 0 , \qquad (5)$$

where

$$\hat{\phi} = \phi_{observed}$$

at monitoring stations and boundary points. The advantages of this method are the following:

(1) It is more general than the first method because sinks, sources, and flow past an obstacle are all particular solutions to the Laplace's equation.

(2) The solution of Laplace's equation at any point is the arithmetic mean of its value

about a circle having that point as its center. This property assures that the interpolated values are as smooth as is possible to achieve.

(3) Objective smoothing can be accomplished by generalizing the method. For example, Anderson (1972) has used the Poisson's equation to interpolate a temperature field in his analysis of the Los Angeles mesoscale wind field. The forcing function in this approach is defined to minimize the surface curvature in the neighborhood of each data point.

4. Optimal Interpolation

Since the ultimate goal of interpolation is to obtain a "best" fit of the observational data, a straightforward approach, based purely on statistical theory, is to minimize the deviations between the interpolated value and the real value at a grid point.

Assume that observational data of a scalar quantity u are available at N locations. The best fit, $\hat{u}(\bar{x})$, can be constructed from a linear combination of the observed data, $u(\bar{x}_j)$, $j=1,2,\ldots,N$ by

$$\hat{u}(\bar{x}) = \sum_{j=1}^{N} w(\bar{x},\bar{x}_j)u(\bar{x}_j) \quad . \qquad (6)$$

The weighting functions, $w(\bar{x},\bar{x}_j)$, are determined by minimizing the mean square error,

$$\varepsilon^2 = [u(\bar{x}) - \hat{u}(x)]^2$$

The mathematical basis for this approach has been developed by Gandin in the USSR (Gandin 1965, Belousov, Gandin and Mashkovich 1971). This method has found wide use in large scale dynamic modeling in meteorology. A recent example is the application of this method by Dartt (1972) to analyze wind patterns in the tropical Pacific.

The method can be extended to include past data, as has been demonstrated by Huss (1971).

5. Data Assimilation

The four methods we discussed above have, implicitly or explicitly, assumed that the density of the measuring stations is appropriate to derive the degree of detail one desires. In other words, all necessary information to describe the variation of the interpolated quantity is contained in the observational data. This is a condition which is not met in the study of air pollution or meteorology. Its existence suggests the need for another type of analytic scheme.

This scheme involves the incorporation of some dynamical constraints into the regular statistical

treatment of the measured data. In the most sophisticated case, the use of a dynamical model is invoked. This statistical-dynamical analysis scheme, which we here call "data assimilation", has recently received considerable attention both in the studies of meteorology (Sasaki 1970, 1971) and air pollution (Wilkins 1971, 1972).

As an example, Thompson (1961) applied this scheme to analyze observational data. To minimize the intrinsic error associated with the measurements, observations made prior to the analysis time were used by extrapolating them to the present time by means of a predictive model and then blending the extrapolated results with the current observations to provide a more accurate description of the variable. Another novel application of this scheme is to "advect" accurate data from "data-rich" areas to "data-lean" areas (Richardson 1961, Smith 1962).

B. OBJECTIVE ANALYSIS OF INVERSION HEIGHTS

Approaches for estimating the height of an inversion base that have been adopted in previous studies differ from those employed in the analysis of wind fields in that the former rely primarily on modeling, whereas the latter are more commonly based on interpolation of observed data. The paucity of measurements of inversion height is the main reason for this difference. For example, in Los Angeles and St. Louis, areas having the richest data bases in the U.S., radiosonde soundings have been regularly made only twice a day and at a maximum of three locations (routine measurements

are made at only one site; during occasional special programs, observations have been made at up to three locations). It is impossible to describe the complex behavior of inversions using straightforward interpolation or extrapolation based on such meager data. The observations must be supplemented by further information regarding the behavior of the inversion layer in one form or another. Although, ideally, a dynamical model based on the Navier-Stokes equations is the most desirable one, such an approach requires an amount of numerical computation far in excess of acceptable levels.

In the following sections, we will discuss two types of approaches which have been reported in the literature. The first one enlists the use of some form of phenomenological modeling (quasi-physical models), while the second one incorporates statistical correlations based on past data (statistical models).

1. Quasi-Physical Models

a. "Eulerian" Models

This simple model is based on the assumption that, under the strong influence of overlying anticyclones, a "subsidence inversion" will persist in the lowest several thousand feet of the atmosphere. The stability of this region will be further reinforced by an intense surface-based nocturnal temperature inversion in the lowest several hundred feet of the atmosphere. During daytime hours, however, solar heating will destroy the lower part of this inversion. As illustrated in Figure 1,

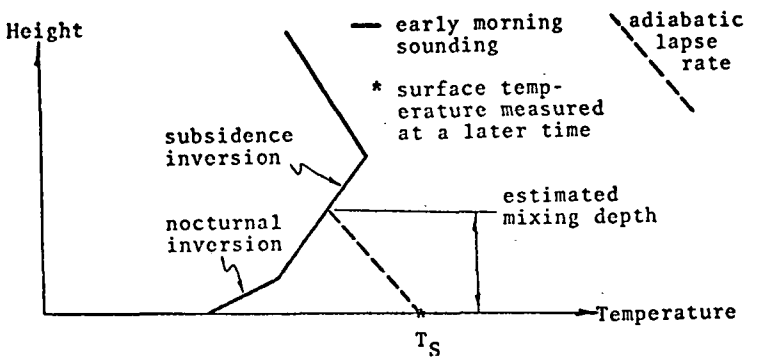


Figure 1. Sketch Illustrating an "Eulerian" Model

assuming that the layer is well-mixed up to the base of the inversion, the mixing depth at that time may be estimated from the intersection of an early morning sounding (solid line) with an adiabatic lapse profile extended from the measured surface temperature, T_S , at that time (dotted line).

First proposed by Pack and Hosler (1958), this method has been applied using data collected in the Los Angeles area and the Eastern United States. The same model was later used to forecast the maximum mixing depth in the afternoon by combining the morning sounding and the forecast maximum afternoon surface temperature (Holzworth 1964, 1967).

The deficiency of this simple model is illustrated in an interesting recent study. Wuerch (1970) has utilized data collected in St. Louis by the ESSA Weather Bureau's EMSU (Environmental Meteorological Support Unit) program to evaluate the validity of this type of model. The results of his investigation can be summarized in the following table:

	Correlation Coefficient for All Cases	Correlation Coefficient for Cases Where Average Wind Speed is Less Than 4.5 m/s
Summer 1969	0.36	0.52
Fall 1969	0.52	0.74

It is obvious from these results that, under light wind conditions, the model improves considerably. This is expected because the concept of a stationary subsidence inversion is valid only under such conditions.

b. "Lagrangian" Models

The basic idea of the "Lagrangian" model is similar to the "Eulerian" model, which we have just described. It can be best explained by the following sketch, which shows the build-up

of the adiabatic mixing layer and successive stages in the modification of the vertical temperature profile as the air moves in over the city from left to right.

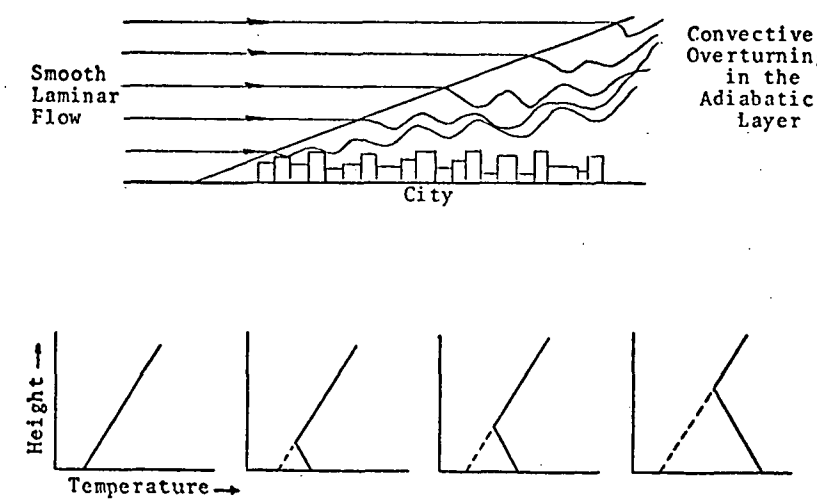


Figure 2. Sketch Illustrating a "Lagrangian" Model

We have termed this formulation a "Lagrangian" model because it is best visualized by considering a column of air having a subsidence inversion temperature profile being advected downwind. Summers (1965), based on this idea, has derived the following formula to account for the heat island effect:

$$h = \left(\frac{2HL}{\alpha \rho C_p U}\right)^{\frac{1}{2}} \quad * \quad (7)$$

where

- h mixing depth
- H heat input
- L distance from the upwind edge
- α difference between the country air lapse rate and the dry adiabatic lapse rate
- ρ air density
- C_p constant pressure specific heat
- U wind speed (assumed to be constant with height)

Leahy and Friend (1971) later used this model to estimate the mixing depths over the New York urban area. They found that correlation coefficients between observed and predicted mixing depths for the five non-summer mornings were about 0.86.

Anderson (1972), based upon essentially the same idea, has recently used the morning radiosonde soundings offshore and surface temperature measurements to estimate the mixing depths over the Los Angeles area. He reported

* Hanna (1969) has also used a similar expression to predict the strength of an urban heat island.

that predicted inversion heights compared favorably with inversion heights identified directly from temperature profiles.

c. "Hybrid" Models

As part of a study carried out by Stanford Research Institute, Johnson et al. (1971) have used both models that we have discussed above to predict the inversion behavior in the San Francisco Bay area. The maximum mixing depths in the afternoon were calculated from the maximum surface temperatures and the morning soundings (the "Eulerian" model). On the other hand, the nighttime mixing depths over the city were estimated using the "Lagrangian" model. For daylight hours other than the time of maximum temperature, the mixing depths were calculated by interpolation.

2. Statistical Models

Although it is sometimes difficult to make a clear distinction between a physical and a statistical model, we have taken the latter to be a model which is based primarily on past data or past experience.

a. Temperature Correlations

In an interesting study, Mashkova (1963) reported that, when the atmosphere is stably

stratified, the strength and the depth of a temperature inversion are strongly correlated with the daily air temperature range at the 2-meter level. For the particular settings where the data were collected, she found that

$$h = 0.25\ (T_{max} - T_{min}) \qquad (8)$$

where

- h depth of inversion layer (m)
- T_{max} maximum daily temperature (^{o}C)
- T_{min} minimum daily temperature (^{o}C)

This model would be most useful in predicting the nocturnal temperature inversion.

MacCracken et al. (1971), on the other hand, based on extensive aircraft observations made by Miller and Ahrens (1970), noted that the difference in the heights of the temperature inversions can be correlated with the difference in surface temperatures at the corresponding locales. Expressed mathematically

$$\Delta h = \alpha \Delta T \qquad (9)$$

where

- Δh inversion height difference between the two locales
- ΔT surface temperature difference between the two locales
- α constant of proportionality

This model has been used by MacCracken et al. in their multibox air pollution model for the San Francisco Bay area (1971).

In a less well known study, Olsen (1971) proposed a technique to predict the depth of the inversion layer by using a remote temperature sounding and the local minimum temperature. The following relationship

$$Z = 2[25 + 4.5\ (T_L - T_M)]^{\frac{1}{2}} - 10 \qquad (10)$$

where

- Z equivalent height above the surface in ^{o}C units on an adiabatic chart
- T_L temperature obtained by extending the sounding above the inversion down to the surface
- T_M observed minimum surface temperature

was derived from some of the aircraft soundings made during the period from Summer 1970 to March 1971 at Helena, Montana.

b. Spatial Correlations

Based on comprehensive studies made by Edinger (1959), who found that the contours of constant mixing depth in Los Angeles Basin were generally parallel to the coastline, Roth et al. (1971) devised an objective method to prepare the inversion maps for a grid model for Los Angeles. This method can be summarized as follows:

(1) Contours of constant mixing depth roughly parallel to the coastline were first drawn.

(2) The magnitudes of the mixing depths at three approximately co-linear, equally-spaced locations, LA International Airport, Commerce and El Monte, were determined from radiosonde soundings and aircraft flights and assigned to the three corresponding contours.

(3) Mixing depths at locations not on the three contours were obtained by interpolation.

(4) Temporal interpolations were made for the hours when there were no radiosonde soundings.

At present, this method appears to be fairly successful for the Los Angeles Basin. Although the operations described above were all

carried out manually, automation of most of these is obviously possible. For example, the spatial interpolation can be achieved by regression analysis.

c. Temporal Correlations

The temporal variations of mixing depths over the Los Angeles Basin were approximated by sinusoidal functions in a study made by Lamb (1971). The form of these sinusoidal functions was determined by comparison with observed data.

III. OBJECTIVE ANALYSIS OF WIND FIELD

The purpose of this section is to describe an approach we have adopted to generate hourly maps of ground-level wind speed and wind direction. These maps serve as part of the meteorological input to our urban airshed model. Techniques we reviewed in Section II.A concerning objective analysis of observational data are applicable here. Among the many alternatives, we have decided to choose the Influence Factor Fit method, a method that is based simply on field measurements and on an interpolation procedure. This selection has been made primarily because:

(1) The need for timely development of an accurate and reliable procedure.

(2) The availability of dense, sophisticated monitoring stations in the Los Angeles area.

(3) Ease of computational effort.

In Section III.A, we delineate the basic strategy and present details of the interpolation procedure. In Section III.B, we assess the applicability of the method (1) through prediction of measured wind parameters and subsequent comparison with measured values, and (2) by comparisons of the full, predicted wind field with manually prepared wind maps.

A. STRATEGIES

In interpolating the wind measurements for each grid point in our Los Angeles airshed model, we have adopted the following formula:

$$\hat{v}_j = \frac{\sum_{r_{ij} < R} r_{ij}^{-n} \bar{v}_i}{\sum_{r_{ij} < R} r_{ij}^{-n}} \tag{11}$$

where

$\hat{v}_j$ the interpolated wind vector at grid point j

$\bar{v}_i$ the measured wind vector at wind monitoring station i

r_{ij} the distance between grid point j and monitoring station i

n the distance influence factor.

The summation applies to all wind monitoring stations located within a maximum distance R from any grid point of interest. This maximum distance, as well as the distance influence factor, n , is chosen arbitrarily. The choice of these two parameters is, however, interrelated insofar as the net effect on the result of interpolation is concerned. For example, the effect of varying the distance R will diminish as the distance influence factor, n, increases.

The selection of the distance influence factor has caused some controversy among urban airshed modelers. In calculating the Lagrangian trajectories of air parcels, Weisburd et al. (1972) have elected to use $n = 2$. Eschenroeder et al. (1972), on the other hand, proposed the use of $n = 1$. He has argued that the $\frac{1}{r}$ rule may be preferable, in that it provides a closer description of planar flow since, in two-dimensional incompressible flow, velocities from singularities such as sink or

source vary as $\frac{1}{r}$. This argument is less than compelling, however, because it is difficult to imagine the wind monitoring stations physically serving as delivering or receiving points of air currents. In the present study, we have taken a more general approach by allowing the distance influence factor to vary, with the eventual determination of this factor resting upon the results of statistical analysis of the predictions. We will postpone the discussion of this topic until Section III.B.

The maximum distance, R , that a wind station measurement can be extrapolated should depend on the physical characteristics in the wind measuring procedure, as well as on the topography of the region of interest. The nature and the importance of these characteristics, however, are often difficult to determine. In the present study, the selection of the maximum distance that defines the summation signs in Equation (11) was based on the following arguments. It is desirable, on one hand, that the interpolated wind field will include, in as detailed a manner as possible, the spatial variation of the wind. This would imply that the range of influence be minimized. On the other hand, the lower limit of the range of influence is set by the density of the available wind monitoring stations. In Los Angeles, as we have stated before, a minimum distance of 8 miles is required; thus, there is, on the average, one station in an 8 x 8 mile square area. Use of a distance greater than this minimum has the advantage that the interpolated wind field will become smoother as measurements from more stations are used. In the end, of course, the final choice of the range must be based on a compromise, in effect minimizing the disadvantages of selecting too large or too small a range of influence.

For the ocean squares, as defined in Figure 3, the distance to the nearest wind measuring station is typically much larger than the eight-mile range that typifies the spacing between land-based stations. Therefore, a provision is made that, for these ocean squares, the measurements from all of the following coastal stations will be used in the calculation:

West Los Angeles
Venice
Redondo Beach
Compton
Long Beach
Anaheim
Santa Ana

The locations of these stations have been plotted in Figure 3.

The presence of the Santa Monica Mountains has created a special problem in the interpolation scheme. The sheer height of the Mountains would, at least intuitively, prohibit in many instances the direct communication of the ground-level winds between the two sides of the Mountain Range. We have, therefore, made the following arbitrary rule that squares north of the Mountains will not use measurements from wind monitoring stations located south of the Mountains, and vice versa. To insure a smooth transition, values for the squares marked x in Figure 3 are calculated using linear interpolation.

In applying Equation (11), we wish to note that it is appropriate to employ a vector interpolation; i.e., to interpolate the wind vector as a whole. By contrast, using Equation (11) in scalar form, both wind speed and wind direction can be calculated separately and then combined to yield

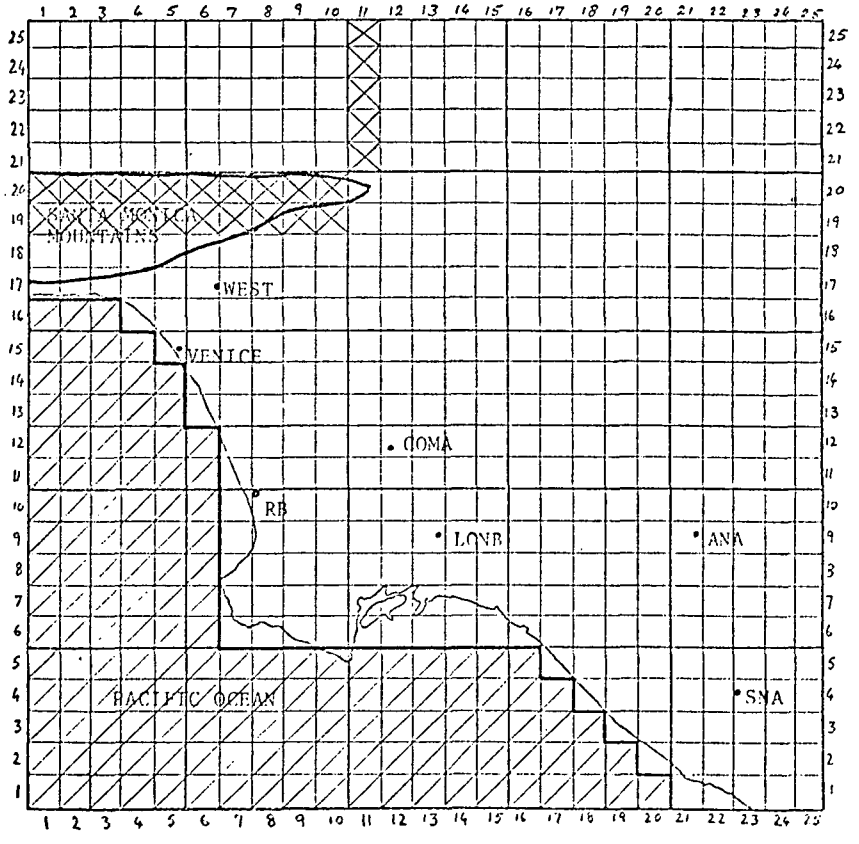


Figure 3. Map of Los Angeles for Wind Analysis

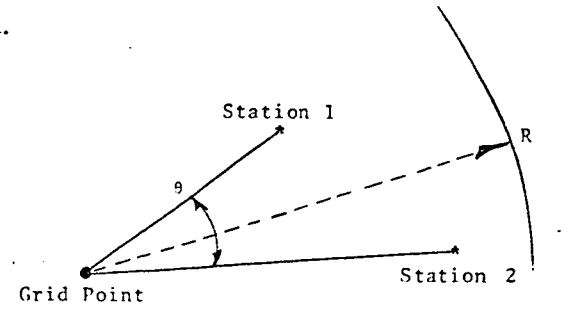
the interpolated wind vector. The results of these two approaches, as can be easily demonstrated, are not necessarily unique. The vector form is chosen in the present study for the following reasons:

(1) Vector interpolation provides a smoother wind field.

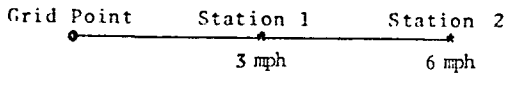
(2) Vector interpolation creates a smaller local divergence or convergence.

As a final topic of interest, we now discuss what we have called the "shadowing" effect, which has been implemented in a similar study made by Strand (1971). The problem can be posed as follows. Given that the angular separation, θ, between two monitoring stations (see Figure 4a) is small, should the measurement made at the second station, which is farther away from the point of calculation than the first, be used at all? An argument in favor of "shadowing" (i.e., excluding the farther station) is that, if the first station measurement is lower than that of the second, the interpolated value will be even higher than that of the first, as illustrated in Figure 4b, and vice versa. This appears to be contrary to what one would expect. An argument against "shadowing" is that, whether the measurement of the second station is used in the interpolation, or not, the utility of the data should not be influenced by the presence of the first station. We have implemented both versions and found that the "shadowing" will produce high-frequency fluctuations in the interpolated wind field. This is, of course, an undesirable feature. Despite the fact that we have made the transition between "shadowing" and "non-shadowing" smoother

a.



b.



Interpolation Value at the Grid Point Based on $\frac{1}{r}$ Rule

$$= \frac{\frac{1}{1} \times 3 + \frac{1}{2} \times 6}{\frac{1}{1} + \frac{1}{2}} = 4 \text{ mph}$$

Figure 4. The Effect of "Shadowing"

by applying to the "shadowed" stations an additional weighting factor:

$$f(\theta) = \begin{cases} \sin 2\theta & 0^\circ < \theta < 45^\circ \\ 1 & \text{Otherwise} \end{cases},$$

the result is still unsatisfactory. Therefore, the calculations reported hereafter are all based on the "unshadowed" version. The "shadowed" version, however, has been kept as an option in the computer program we have developed for this study.

B. DATA ANALYSIS

Los Angeles is probably one of the most instrumented areas in the world, insofar as air pollution meteorology is concerned. Surface wind speed and direction measurements are routinely made in the Basin by the Los Angeles County Air Pollution Control District (LACAPCD), the Orange County Air Pollution Control District (OCAPCD), and the National Weather Service. In addition, Scott Research Laboratories made surface wind measurements at El Monte and Commerce during the period of interest. Among these nearly three dozen wind measuring stations, only twenty-five provide continuous, hourly-averaged wind data. As such data are highly desirable, measurements made at these stations (which are listed in Table 1 with their locations in grid units relative to our airshed model) constitute the data base for the present study.

In order to assess the validity of the interpolation scheme in general, and to determine the best value for n in particular, we have carried out the following study. At the site of each wind monitoring station, we have calculated

Table 1. WIND STATIONS AND THEIR LOCATIONS

STATION NAME	X-AXIS COORDINATE	Y-AXIS COORDINATE
RESD	3.1	21.8
BURK	9.2	21.0
PASA	14.7	19.5
AZU	20.5	19.6
WEST	6.0	16.3
ELM	17.4	17.8
COMM	13.3	15.1
CAP	11.3	16.5
LONP	12.9	8.8
WHTR	17.7	12.3
LAH	19.7	12.3
ANA	20.8	8.8
POMA	25.7	17.2
SNA	23.0	3.7
RB	7.1	9.9
VEN	4.7	14.3
CPK	1.2	22.1
RVA	15.2	13.8
ENC	3.9	20.5
BKT	24.6	18.1
WNTT	22.4	14.8
LACA	12.2	22.2
COMA	11.3	11.1
MISH	5.0	24.3
KFI	18.8	10.5

the wind speed and wind direction using Equation (11), based on measurements made at nearby stations (within a radius R) but pretending that the measurement at the station in question does not exist. The calculated wind speed and wind direction is then compared with the measured wind speed and wind direction at that station. This procedure is then repeated for all hours of interest. (See APPENDIX 1). Two different statistical criteria are used for the purpose of comparison. The first one involves the use of the correlation coefficient, defined as:

$$\beta_i = \frac{\sum_{j=1}^{K}(x_{ij} - \bar{x}_i)(y_{ij} - \bar{y}_i)}{\sqrt{\sum_{j=1}^{K}(x_{ij} - \bar{x}_i)^2 \cdot \sum_{j=1}^{K}(y_{ij} - \bar{y}_i)^2}} \qquad (12)$$

where

x_{ij} the calculated wind speed or wind direction at station i and at hour j

y_{ij} the measured wind speed or wind direction at station i and at hour j

$$\bar{x}_i = \frac{1}{K}\sum_{j=1}^{K} x_{ij} \qquad (13)$$

$$\bar{y}_i = \frac{1}{K}\sum_{j=1}^{K} y_{ij} \qquad (14)$$

K the total number of hours in a validation run.

The calculation is performed for each of the 25 stations. An average correlation coefficient for all of the stations in Los Angeles Air Basin is then calculated,

$$\bar{\beta} = \frac{1}{N} \sum_{i=1}^{N} \beta_i \qquad (15)$$

where N is the total number of wind measuring stations.

Although the correlation coefficient has often been used as a test to assess the validity of a hypothesis or a procedure (for example, Wyzga (1973) has used it to evaluate an iterative technique for estimating missing air pollution measurements when the data are available at two or more sampling stations in the same vicinity), a test based on the correlation coefficient alone is rather weak, in that the calculated statistic is a measure of trend rather than of "goodness of fit" (Bulmer 1967). In a more severe test of the present interpolation scheme, we have employed the following estimate to measure the average deviation between the predicted and calculated values,

$$S_i = \left[\frac{\sum_{j=1}^{K} (x_{ij} - y_{ij})^2}{K} \right]^{1/2} \qquad (16)$$

As before, an average value for the whole air basin is computed:

$$\bar{s} = \frac{1}{N} \sum_{i=1}^{N} s_i \quad . \qquad (17)$$

Data for one of the validation days used in our earlier work, 29 September 1969, was chosen for this study. Wind measurements for the period, 5 a.m. to 4 p.m. PST, were used in the computation; the results of the calculation are shown in Tables 2 and 3.† The first entry in each of these tables is the distance influence factor utilized in the interpolation formula (Equation 11). The small differences in both the correlation coefficients and the average deviations due to changes of n are expected because differences in the distances between pairs of stations are relatively small* (The interstation distances, in grid units, are shown in Figure 5). Nevertheless, the present study

† To assess the interrelationship between station measurements, the two criteria have also been calculated for each pair of station measurements. The result are tabulated in APPENDIX 2.

* Consider the Commerce station as an example. Distances between Commerce and the closest two stations are 4.60 miles (RVA) and 4.88 miles (CAP). The ratios between the weighting factors of the two stations, for each influence factor, are then

$\frac{1}{r}$	$\frac{1}{r^2}$	$\frac{1}{r^3}$
0.945	0.894	0.844

Therefore, the change in the weighting factors is only 5% between $1/r$ and $1/r^2$, 11% between $1/r$ and $1/r^3$. Assume that the measurement of RVA differs from that of CAP by 50%, the ultimate difference in the Commerce predictions only amounts to about 2% between $1/r$ and $1/r^2$ and 5% between $1/r$ and $1/r^3$.

TABLE 2. The Correlation Coefficients

STATION \ EXPONENT	1.00 SPEED	1.00 DIRECTION	2.00 SPEED	2.00 DIRECTION	3.00 SPEED	3.00 DIRECTION
RESD	0.75	0.38	0.75	0.42	0.73	0.43
PASA	0.79	0.86	0.80	0.85	0.81	0.68
AZU	0.96	0.66	0.95	0.67	0.94	0.71
WEST	0.81	0.35	0.80	0.22	0.79	0.12
ELM	0.92	0.71	0.93	0.67	0.94	0.60
COMM	0.96	0.57	0.96	0.51	0.96	0.48
CAP	0.90	0.37	0.90	0.30	0.90	0.24
LONB	0.93	0.69	0.93	0.73	0.93	0.75
WHTR	0.85	0.70	0.86	0.91	0.86	0.76
LAH	0.89	0.16	0.89	0.20	0.89	0.23
ANA	0.81	0.00	0.84	0.04	0.86	0.05
POMA	0.96	0.74	0.92	0.75	0.91	0.75
SNA	0.73	-0.44	0.73	-0.44	0.73	-0.44
RB	0.92	0.83	0.91	0.81	0.90	0.80
VEN	0.91	0.19	0.87	0.16	0.83	0.13
CPK	0.90	-0.42	0.87	-0.37	0.87	-0.36
RVA	0.94	0.41	0.95	0.42	0.95	0.43
ENC	0.66	0.69	0.49	0.54	0.55	0.47
BKT	0.76	0.78	0.86	0.77	0.89	0.76
LACA	0.76	0.59	0.77	0.59	0.77	0.58
COMA	0.95	0.79	0.95	0.80	0.95	0.81
KFI	0.95	0.47	0.93	0.37	0.90	0.38
AVERAGE	0.864	0.452	0.857	0.451	0.857	0.425

TABLE 3. The Average Deviations

STATION \ EXPONENT	1.00 SPEED (mph)	1.00 DIRECTION (degree)	2.00 SPEED (mph)	2.00 DIRECTION (degree)	3.00 SPEED (mph)	3.00 DIRECTION (degree)
RESD	1.55	103.38	1.54	103.93	1.60	104.65
PASA	2.47	50.85	2.57	53.97	2.68	60.62
AZU	1.58	83.84	1.32	82.36	1.17	80.36
WEST	2.14	52.30	2.86	39.10	3.55	38.20
ELM	3.36	62.00	3.42	56.81	3.47	52.48
COMM	3.21	39.34	3.14	43.97	3.10	46.97
CAP	2.21	57.82	1.74	60.80	1.32	62.66
LONB	1.63	21.96	1.32	24.40	1.69	27.91
WHTR	1.62	29.73	1.52	16.44	1.53	12.91
LAH	1.20	67.60	1.09	66.19	1.16	67.00
ANA	1.93	75.37	2.12	77.31	2.41	80.59
POMA	2.52	59.84	3.27	57.65	3.54	57.16
SNA	1.85	87.62	1.85	87.62	1.85	87.62
RB	1.68	45.76	2.00	48.51	2.32	51.11
VEN	3.68	24.87	4.07	27.73	4.33	31.70
CPK	0.94	96.52	1.17	92.38	1.19	87.86
RVA	1.29	69.90	1.25	69.64	1.32	69.34
ENC	2.51	73.40	2.88	102.29	2.61	104.25
BKT	4.58	46.11	4.13	52.51	3.84	55.44
LACA	1.27	70.91	1.22	68.56	1.29	68.12
COMA	4.75	35.36	4.54	34.87	4.33	34.43
KFI	2.38	55.46	2.61	57.19	2.70	58.06
AVERAGE	2.29	59.54	2.35	60.20	2.41	60.88

	RESD	BURK	PASA	AZU	WEST	ELM	COMM	CAP	LONG	WHIT	LAM	ANA	POMA	SNA	RB	VEN	CPK	RVA	ENC	BKT	WNIT	LACA	COMA	MISH	KFI
RESD	0.0	0.2	11.8	17.5	0.2	14.8	12.2	9.8	10.3	17.4	19.1	22.0	23.1	26.9	12.6	7.7	1.9	14.5	1.5	21.8	20.5	9.1	13.5	3.1	19.3
BURK	0.2	0.0	5.7	11.4	5.7	8.8	7.2	5.0	14.7	12.4	13.6	16.8	16.9	22.1	11.3	8.1	8.1	9.4	5.3	15.7	14.6	3.2	10.1	5.3	14.2
PASA	11.8	5.7	0.0	5.8	9.3	3.2	4.6	4.5	10.9	7.8	6.8	12.3	11.2	17.8	12.2	11.3	13.7	5.7	10.8	10.0	9.0	3.7	9.1	10.5	9.9
AZU	17.5	11.4	5.8	0.0	14.9	3.6	8.5	9.7	13.2	7.8	7.3	10.6	5.7	16.1	16.5	16.7	19.5	7.9	16.6	4.4	5.2	8.7	12.5	16.2	9.3
WEST	0.2	5.7	9.3	14.9	0.0	11.5	7.4	5.3	10.2	12.4	14.3	16.6	19.7	21.2	6.3	2.4	7.5	9.5	4.7	18.7	16.5	8.6	7.4	8.1	14.1
ELM	14.8	8.8	3.2	3.6	11.5	0.0	4.9	6.2	10.1	3.5	6.0	9.6	8.3	15.2	13.0	13.6	16.6	4.0	13.8	7.2	5.8	6.8	9.1	14.0	7.4
COMM	12.2	7.2	4.6	8.5	7.4	4.9	0.0	2.4	6.3	5.2	7.0	9.8	14.0	15.4	8.1	8.6	14.0	4.3	10.8	11.7	9.1	7.2	4.5	12.4	7.2
CAP	9.8	5.0	4.5	9.7	5.3	6.2	2.4	0.0	7.9	7.7	9.4	14.6	14.4	17.3	7.8	7.0	11.5	4.7	8.4	13.4	11.2	5.8	5.4	10.0	9.6
LONG	10.3	12.7	10.9	13.2	10.2	10.1	6.3	7.9	0.0	5.9	7.6	7.9	15.3	11.3	5.9	9.9	17.7	5.3	14.8	14.9	11.2	13.4	2.8	17.6	6.1
WHIT	17.4	12.2	7.8	7.8	12.4	5.5	5.2	7.7	5.9	0.0	2.0	4.7	9.4	10.1	10.9	13.6	19.2	2.9	16.1	9.0	5.3	11.3	6.5	17.5	2.1
LAM	19.1	13.6	8.8	7.3	14.3	6.0	7.0	9.4	7.6	2.0	0.0	3.7	7.7	9.2	12.8	15.1	20.9	4.7	17.8	7.6	3.7	12.4	8.5	19.0	2.0
ANA	22.0	16.8	12.3	10.8	16.6	9.6	9.8	12.6	7.9	4.7	3.7	0.0	9.7	5.6	13.7	17.0	23.7	7.5	20.6	10.0	6.2	15.9	9.6	22.1	2.6
POMA	23.1	16.9	11.2	5.7	19.7	8.3	12.6	14.4	15.3	9.4	7.7	9.7	0.0	13.6	20.0	21.6	25.0	11.0	26.0	1.4	4.1	14.4	15.6	21.9	9.6
SNA	26.9	22.1	17.8	16.1	21.2	15.2	15.0	17.3	11.3	10.1	9.6	5.6	13.6	0.0	17.1	21.1	28.5	12.6	25.4	14.5	11.1	21.4	13.8	27.4	8.0
RB	12.6	11.3	12.2	16.5	6.5	13.0	8.1	7.8	5.9	10.9	14.8	13.7	20.0	17.1	0.0	5.0	13.6	9.0	11.1	14.3	16.1	13.3	4.4	14.6	11.7
VEN	7.7	8.1	11.3	16.7	2.4	13.2	8.6	7.0	9.9	13.2	15.1	17.0	21.6	21.1	5.0	0.0	8.5	10.5	6.3	20.3	17.7	10.9	7.3	10.0	14.6
CPK	1.9	8.1	13.7	19.5	7.5	16.8	14.0	11.5	17.7	19.2	20.9	23.7	25.0	28.3	13.6	8.5	0.0	16.4	3.1	23.7	22.4	11.0	14.9	4.6	21.1
RVA	14.5	9.4	5.7	7.9	9.5	4.6	2.3	4.7	5.5	2.9	4.7	7.5	11.0	12.8	9.0	10.5	16.3	0.0	13.1	10.3	7.3	8.9	4.7	14.6	4.9
ENC	1.5	5.3	10.8	16.6	4.7	13.8	10.8	8.4	14.8	16.1	17.8	20.6	22.0	22.4	11.1	6.3	3.1	13.1	0.0	20.8	19.4	8.5	12.0	4.0	17.9
BKT	21.8	15.7	10.0	4.4	18.7	7.2	11.7	13.4	14.9	9.0	7.6	10.0	1.4	14.3	19.3	20.7	23.7	10.7	20.8	0.0	4.0	13.1	15.0	20.6	9.6
WNIT	20.5	14.6	9.0	5.2	16.5	5.8	9.1	11.2	11.2	5.3	3.7	6.2	4.1	11.1	16.1	17.7	22.4	7.3	19.4	4.0	0.0	12.6	11.7	19.8	5.6
LACA	9.1	3.2	3.7	8.7	8.6	6.8	7.2	5.8	13.4	11.3	14.4	16.9	19.4	21.4	13.3	10.9	11.0	8.9	13.1	12.6	0.0	11.1	7.5	13.4
COMA	13.5	10.1	9.1	12.5	7.4	9.1	4.5	5.4	4.8	6.5	8.5	9.8	13.8	4.4	7.3	14.9	4.7	14.7	14.0	15.0	11.7	11.1	0.0	14.6	7.5
MISH	3.1	5.3	10.8	16.2	8.1	14.0	12.4	10.0	17.4	17.5	19.0	22.1	21.9	27.4	14.6	10.0	4.0	14.6	4.0	20.6	19.8	7.5	14.6	0.0	19.5
KFI	19.3	14.2	9.9	9.3	14.1	7.4	7.2	9.6	6.1	2.1	2.0	2.6	9.6	8.0	11.7	14.6	21.1	4.9	17.9	9.6	5.6	13.4	7.5	19.5	0.0

Figure 5. Inter-station Distances between Monitoring Stations in Grid Unit (To Obtain the Distances in Miles: Multiply the Entries by 2)

suggests that the $\frac{1}{r}$ rule may have a slight edge in the interpolation of the wind field. This speculation is based on a higher basin-wise average correlation coefficient and a lower basin-wise average deviation as n decreases.

An examination of the magnitudes of the correlation coefficients and the average deviations sheds further light on the adequacy of the present scheme. For wind speeds, a high correlation coefficient of the order of 0.8, and in particular, a low average deviation of 2 mph probably indicates that the $1/r^n$ scheme can be safely used in interpolating wind speeds. This conclusion seems plausible in view of the fact that the accuracy in the wind speed measurements is most likely on the order of ±2 mph . On the other hand, for wind directions, the low correlation coefficient calculated (~0.4), in conjunction with a high deviation (~60°), has proven to be a disappointment. These observations have been reinforced through a perusal of the individual calculations for each of the wind monitoring stations. That the wind speed correlation coefficients are high and deviations in wind speed are low has been consistent for almost every station, while the spread in the calculated correlation coefficients and average deviations for wind directions at each station is wide.

We may speculate here as to why the interpolation of wind direction is less satisfactory than the interpolation of wind speed. In our opinion, the following arguments apply:

(1) The spatial separations between the wind stations are too large for the purpose of interpolating the wind directions. In other words, the density of the present wind measuring network is not sufficient

to permit adequate description of the changes in wind direction. This is a plausible argument because the wind direction measurements are much more sensitive to the topographical settings of the monitoring stations than the wind speed measurements.

(2) The quality of the wind direction measurements is poor. This could be the result of either the poor resolution of the measuring apparatus or the inadequacy in the determination of hourly average values. This is particularly important at low wind speeds.

Close inspection of the data shows that wind directions differing by almost 180° have often been reported by two stations only a few miles apart. This fact has forced us, in the manual preparation of wind fields, to perform a somewhat subjective "smoothing" of the measured wind directions. In the same context, we feel that it may be necessary that the wind direction data should also be smoothed somewhat before interpolation is carried out. We have not, however, explored such a possibility in the present investigation. The original data, as provided by D. Bruce Turner of EPA and supplemented with raw data collected by the Orange County APCD and Scott Research Laboratories, has been used throughout this study.

Before closing, a final remark is in order. Calculations have shown that the magnitudes of the interpolated variables are relatively insensitive to moderate changes in the maximum

distance R . We have, therefore, chosen a value of 14 miles for R in the wind interpolation procedure.

C. RESULTS AND DISCUSSIONS

The interpolation scheme we have just discussed was used to calculate the wind speeds and wind directions for each grid point in the SAI airshed model. Samples of the results of these calculations are shown in Figures 6 through 11 for 7 a.m., 10 a.m., and 1 p.m. PST on 29 September 1969 respectively.

An important characteristic of these automated wind fields lies in the fact that variations in both the wind speed and the wind direction are relatively smooth. This quality insures that unduly large convergences or divergences will not be created.

Furthermore, we have compared the automated versions of the wind field with the corresponding version that was prepared manually in a previous study. The following statistical measure was used to assess the difference between the two:

$$d = \left[\frac{\sum_{m=1}^{M} (x_m - y_m)^2}{M} \right]^{\frac{1}{2}} \tag{18}$$

where

x_m the automated wind speed or wind direction at grid point m

y_m the manually prepared wind speed or wind direction at grid point m

M The total number of grid points.

WIND SPEED GRID FOR 700 HOUR 69 929

	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
25	0.8	0.8	0.8	0.9	0.9	0.9	0.7	0.6	0.8	0.7	1.2	1.6	2.0	2.0	2.0	1.1	1.0	1.0	1.0	2.0	2.0	2.0	1.6	1.8	1.9
24	0.7	0.8	0.8	0.9	0.9	0.8	0.7	0.6	0.8	0.8	1.3	1.7	2.0	1.3	1.2	1.1	1.0	1.0	0.9	0.7	1.7	1.4	1.6	1.7	1.9
23	0.7	0.7	0.9	1.0	1.0	0.8	0.7	0.6	0.7	0.9	1.2	1.6	1.6	1.2	1.1	1.1	1.0	0.9	0.9	1.2	1.2	1.6	1.8	1.7	2.0
22	0.7	0.8	1.0	1.1	1.2	0.9	0.8	0.6	0.7	0.9	1.2	1.4	1.5	1.3	1.3	1.2	1.0	0.9	1.0	1.0	1.0	1.4	1.7	1.8	2.1
21	0.8	0.9	1.1	1.5	1.5	1.0	0.8	0.7	0.7	0.8	1.0	1.2	1.3	1.4	1.4	1.3	1.2	1.0	1.0	0.9	0.8	1.0	1.7	2.2	2.4
20	0.9	0.9	1.1	1.4	1.2	0.9	0.7	0.6	0.8	0.9	1.0	1.2	1.4	1.4	1.7	1.3	1.1	1.1	1.2	0.8	1.7	0.9	1.8	2.6	2.9
19	0.9	1.0	1.0	1.2	0.9	0.7	0.6	0.6	0.8	1.0	1.1	1.2	1.2	1.4	1.5	1.3	1.1	1.4	1.2	1.0	0.8	1.0	1.8	3.0	4.0
18	1.0	1.0	1.0	1.0	0.5	0.6	0.5	0.6	0.9	1.1	1.2	1.3	1.4	1.6	1.5	1.2	1.2	2.4	1.4	1.1	1.1	1.3	2.0	2.7	3.5
17	1.0	1.0	1.0	1.0	0.6	0.9	0.9	0.8	0.9	1.1	1.2	1.6	1.5	1.8	1.6	1.4	1.2	1.2	1.2	1.1	1.1	1.3	1.6	2.3	2.4
16	1.1	1.1	1.0	1.2	0.9	0.9	0.8	0.8	1.0	1.1	1.2	1.4	1.7	2.1	1.8	1.6	1.5	1.3	1.3	1.0	1.0	1.1	1.2	1.5	2.0
15	1.1	1.1	1.1	1.0	1.1	0.8	0.9	0.9	1.1	1.2	1.4	1.5	1.8	2.0	2.0	2.0	1.7	1.4	1.3	1.0	0.8	0.9	1.0	1.1	1.3
14	1.1	1.1	1.1	1.1	1.1	0.9	1.0	1.0	1.2	1.3	1.4	1.7	1.8	1.9	2.1	2.2	1.7	1.6	1.4	0.9	0.6	0.7	0.8	0.7	1.1
13	1.1	1.1	1.1	1.2	1.2	1.3	1.0	1.2	1.3	1.4	1.9	1.9	2.0	1.7	1.9	1.8	1.8	2.7	1.7	0.7	0.4	0.7	0.6	0.7	0.9
12	1.1	1.2	1.2	1.2	1.3	1.4	1.3	1.4	1.3	1.5	1.7	2.3	2.0	1.8	1.6	1.6	1.7	1.9	1.4	0.7	0.8	0.8	0.5	0.6	0.7
11	1.2	1.2	1.2	1.3	1.4	1.6	2.1	2.1	1.5	1.5	1.8	2.1	1.9	1.8	1.6	1.7	1.7	1.5	1.1	0.9	0.7	0.5	0.6	0.6	0.2
10	1.2	1.2	1.3	1.3	1.4	1.7	2.2	2.3	1.8	1.7	1.9	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.0	0.7	0.2	0.3	0.5	0.6	0.2
9	1.2	1.2	1.3	1.3	1.4	1.6	1.7	1.9	1.8	1.7	1.7	1.9	1.9	1.9	1.6	1.6	1.3	1.2	0.9	0.6	0.4	0.2	0.4	0.6	0.2
8	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.9	1.8	1.7	1.7	1.7	1.7	1.9	1.6	1.4	1.3	1.1	0.8	0.6	0.3	0.3	0.5	0.2	0.2
7	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.8	1.8	1.7	1.7	1.7	1.7	1.5	1.5	1.4	1.1	1.0	0.9	0.8	0.5	0.5	0.2	0.3	0.3
6	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.2	1.7	1.7	1.7	1.7	1.5	0.9	1.2	1.1	0.9	0.2	0.2	0.3	0.4	0.5	0.4
5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.0	1.0	0.7	0.6	0.3	0.3	0.4	0.5	0.7	0.7	0.6
4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	0.9	0.2	0.2	0.3	0.4	0.6	0.8	0.8	0.6
3	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.3	0.3	0.4	0.6	0.7	0.7	1.0
2	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0
1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0

Figure 6. Computed Wind Speeds for 7 a.m. (29 September 1969)

WIND DIRECTION GRID FOR 700 HOUR 69 929

	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
25	309.	305.	297.	285.	267.	264.	262.	258.	238.	222.	193.	165.	157.	157.	157.	197.	182.	183.	144.	144.	135.	135.	241.	245.	248.
24	320.	316.	303.	291.	278.	266.	246.	259.	237.	198.	183.	163.	157.	177.	186.	179.	183.	185.	185.	199.	242.	232.	239.	259.	262.
23	339.	345.	306.	295.	290.	278.	272.	262.	215.	195.	181.	166.	166.	184.	197.	180.	186.	188.	186.	240.	241.	246.	268.	259.	263.
22	334.	333.	303.	295.	294.	284.	277.	266.	216.	195.	185.	175.	172.	161.	181.	186.	191.	195.	226.	233.	241.	260.	266.	260.	263.
21	316.	311.	301.	294.	294.	286.	279.	269.	217.	197.	190.	192.	185.	197.	181.	188.	200.	146.	231.	218.	202.	234.	264.	269.	267.
20	244.	241.	234.	230.	230.	224.	219.	227.	206.	198.	184.	195.	195.	189.	165.	186.	214.	228.	226.	223.	140.	225.	265.	270.	269.
19	173.	171.	168.	165.	167.	162.	160.	184.	195.	199.	214.	205.	200.	197.	185.	197.	231.	260.	241.	229.	213.	250.	269.	271.	270.
18	102.	101.	101.	100.	103.	99.	100.	142.	185.	200.	217.	223.	210.	199.	192.	203.	241.	281.	247.	228.	232.	254.	272.	273.	272.
17	102.	102.	102.	101.	102.	98.	107.	147.	168.	203.	220.	255.	203.	194.	192.	200.	216.	228.	225.	222.	231.	244.	261.	275.	275.
16	127.	126.	124.	107.	108.	104.	128.	149.	177.	187.	196.	204.	186.	174.	189.	196.	200.	199.	205.	214.	236.	243.	259.	261.	274.
15	128.	126.	124.	121.	110.	123.	139.	152.	175.	180.	184.	187.	186.	179.	191.	195.	190.	186.	178.	200.	225.	235.	255.	260.	274.
14	128.	127.	125.	123.	121.	128.	143.	153.	169.	178.	184.	179.	198.	190.	193.	190.	187.	176.	169.	180.	209.	226.	249.	238.	259.
13	129.	128.	127.	126.	125.	126.	138.	148.	166.	178.	188.	188.	186.	189.	192.	190.	180.	163.	162.	117.	181.	230.	232.	246.	254.
12	129.	129.	128.	127.	127.	126.	132.	140.	154.	178.	197.	207.	190.	180.	190.	186.	176.	169.	166.	160.	148.	154.	227.	242.	250.
11	130.	130.	129.	128.	127.	125.	121.	122.	145.	173.	194.	200.	185.	176.	179.	173.	171.	170.	179.	169.	159.	136.	137.	140.	323.
10	131.	130.	130.	129.	127.	125.	120.	120.	137.	156.	176.	174.	164.	161.	170.	171.	171.	171.	168.	163.	142.	104.	132.	139.	83.
9	132.	131.	131.	130.	129.	127.	126.	130.	139.	154.	162.	165.	153.	156.	167.	170.	173.	173.	162.	157.	23.	61.	129.	140.	92.
8	132.	132.	132.	131.	131.	130.	131.	139.	145.	152.	156.	156.	163.	162.	173.	172.	173.	160.	146.	140.	125.	126.	137.	93.	109.
7	133.	133.	133.	133.	133.	133.	134.	143.	147.	151.	154.	155.	154.	174.	169.	170.	164.	146.	145.	143.	143.	142.	112.	124.	161.
6	134.	134.	134.	134.	134.	135.	136.	138.	140.	142.	153.	154.	155.	175.	180.	183.	152.	153.	145.	117.	122.	160.	159.	159.	140.
5	135.	135.	135.	135.	135.	136.	137.	139.	140.	142.	144.	145.	145.	145.	145.	145.	146.	147.	172.	167.	163.	160.	152.	153.	148.
4	135.	135.	136.	136.	137.	137.	138.	139.	140.	142.	143.	144.	144.	145.	145.	145.	144.	96.	111.	126.	140.	149.	155.	155.	151.
3	136.	136.	136.	137.	137.	138.	138.	139.	140.	141.	142.	143.	144.	144.	144.	144.	144.	144.	121.	132.	142.	148.	152.	152.	157.
2	136.	136.	137.	137.	138.	138.	139.	140.	140.	141.	142.	143.	143.	144.	144.	144.	144.	144.	144.	157.	157.	157.	157.	157.	157.
1	137.	137.	137.	138.	138.	139.	139.	140.	140.	141.	142.	142.	143.	143.	143.	143.	144.	144.	144.	145.	157.	157.	157.	157.	157.

Figure 7. Computed Wind Directions for 7 a.m. (29 September 1969)

WIND SPEED GRID FOR 1000 HOUR 69 929

	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
25	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	1.1	1.2	1.5	1.7	1.7	1.7	1.7	1.5	0.9	0.8	0.7	1.0	1.0	1.0	1.3	1.4	1.5
24	0.1	0.1	0.1	0.3	0.4	0.6	0.7	0.7	1.2	1.0	1.4	1.8	1.8	1.6	1.5	1.0	0.9	0.8	0.7	0.4	1.2	1.0	1.2	1.6	1.7
23	0.4	0.5	0.2	0.3	0.6	0.7	0.7	0.8	0.9	1.1	1.6	2.1	2.0	1.9	1.5	1.0	0.9	0.8	0.6	0.7	0.7	1.3	1.5	1.6	1.8
22	0.3	0.3	0.3	0.5	1.0	0.9	0.8	0.8	0.9	1.1	1.8	2.5	2.3	2.3	2.0	1.9	0.9	0.7	0.8	0.5	0.7	1.1	1.4	1.7	1.9
21	0.1	0.2	0.7	1.9	1.8	1.1	0.9	0.9	0.9	1.0	1.8	2.7	2.5	2.3	1.9	1.9	1.9	1.4	0.8	0.3	0.3	0.7	1.4	1.9	2.1
20	0.9	1.0	1.2	2.0	2.1	1.6	1.5	1.8	1.9	2.0	3.1	2.9	2.7	2.4	1.8	1.8	1.9	1.6	1.4	0.4	0.8	0.5	1.5	2.1	2.5
19	1.7	1.7	1.8	2.2	2.4	2.1	2.1	2.6	2.9	2.9	3.1	3.2	3.0	2.7	2.1	2.0	2.0	1.9	1.7	1.0	0.8	1.0	1.8	2.5	3.3
18	2.5	2.5	2.4	2.4	2.8	2.6	2.7	3.5	3.8	3.9	3.8	4.0	3.7	3.3	2.6	2.4	2.1	1.9	1.8	1.7	1.3	1.6	2.0	2.4	3.0
17	2.5	2.5	2.5	2.5	2.7	2.4	2.6	3.6	3.8	4.0	4.4	5.2	4.0	3.9	3.2	2.7	2.3	2.1	2.0	1.9	1.5	1.7	2.0	2.3	2.4
16	3.3	3.2	3.1	2.6	2.8	2.8	3.1	3.7	3.9	3.9	4.1	4.2	4.4	4.9	3.7	2.9	2.6	2.3	2.1	2.0	1.8	1.8	2.0	2.1	2.2
15	3.1	3.2	3.2	3.1	2.9	3.1	3.5	3.8	4.0	4.4	4.2	4.1	4.5	4.5	3.5	3.0	2.7	2.4	2.1	2.1	1.9	1.9	2.0	2.0	2.1
14	3.3	3.3	3.2	3.2	3.1	3.3	3.7	4.0	4.2	4.4	4.6	4.2	4.1	3.8	3.2	3.0	2.8	2.5	2.2	2.3	2.0	2.0	2.0	2.0	2.4
13	3.4	3.3	3.3	3.3	3.3	3.2	3.6	4.2	4.2	4.6	5.0	5.0	4.7	3.9	3.5	3.1	2.9	2.3	2.4	2.7	2.4	2.2	2.3	2.3	2.3
12	3.4	3.4	3.4	3.4	3.4	3.4	3.7	4.1	4.5	4.8	5.7	6.8	5.1	4.3	3.6	3.3	2.8	2.5	2.3	2.1	2.2	2.1	2.2	2.3	2.3
11	3.5	3.5	3.4	3.4	3.4	3.4	3.3	3.3	4.3	4.7	5.9	6.5	5.3	4.5	4.0	3.4	3.0	2.7	2.0	2.0	2.0	2.1	2.1	2.1	2.1
10	3.5	3.5	3.5	3.5	3.5	3.4	3.2	3.2	4.3	5.2	5.5	5.6	5.5	4.9	4.1	3.6	3.2	2.8	2.1	2.1	2.0	2.0	2.1	2.1	2.1
9	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.9	4.5	5.6	6.2	5.6	5.8	5.4	4.2	3.7	3.1	2.8	2.3	2.2	2.0	2.0	2.1	2.1	2.1
8	3.6	3.6	3.6	3.6	3.6	3.6	3.7	4.6	5.1	5.6	6.1	6.4	5.4	4.9	4.4	3.6	3.2	2.5	2.5	2.4	2.0	2.1	2.1	2.2	2.2
7	3.6	3.6	3.7	3.7	3.7	3.7	3.8	5.0	5.3	5.6	6.0	6.2	6.4	6.5	4.9	4.5	3.7	2.8	2.6	2.5	2.1	2.1	2.2	2.2	2.3
6	3.7	3.7	3.7	3.7	3.8	3.8	3.9	4.0	4.1	4.3	5.9	6.1	6.2	7.7	6.2	5.0	3.2	3.0	2.7	2.2	2.2	2.3	2.4	2.5	2.5
5	3.7	3.7	3.7	3.8	3.8	3.9	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.4	4.3	4.2	3.5	3.3	2.2	2.3	2.4	2.5	2.7	2.8	2.7
4	3.7	3.7	3.8	3.8	3.8	3.9	3.9	4.0	4.1	4.2	4.2	4.3	4.3	4.3	4.2	4.1	4.0	2.4	2.4	2.4	2.5	2.7	2.9	2.9	2.7
3	3.7	3.8	3.8	3.8	3.8	3.9	3.9	4.0	4.1	4.1	4.2	4.2	4.2	4.2	4.1	4.0	3.9	3.8	2.4	2.5	2.6	2.7	2.7	2.8	3.0
2	3.8	3.8	3.9	3.8	3.9	3.9	3.9	4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.0	4.0	3.9	3.8	3.7	3.0	3.0	3.0	3.0	3.0	3.0
1	3.8	3.8	3.8	3.8	3.9	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.8	3.7	3.6	3.0	3.0	3.0	3.0	3.0

Figure 8. Computed Wind Speeds for 10 a.m. (29 September 1969)

WIND DIRECTION GRID FOR 1000 HOUR 69 929

	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
25	182.	174.	154.	147.	139.	133.	87.	80.	83.	75.	51.	27.	26.	23.	19.	34.	27.	26.	26.	303.	247.	247.	100.	98.	97.
24	299.	280.	194.	160.	141.	101.	92.	83.	83.	52.	42.	32.	31.	36.	33.	27.	26.	25.	25.	354.	58.	103.	100.	95.	94.
23	311.	308.	227.	187.	138.	107.	97.	86.	62.	51.	50.	50.	49.	52.	51.	23.	24.	24.	24.	70.	76.	97.	95.	95.	94.
22	311.	304.	199.	164.	124.	109.	100.	89.	63.	51.	52.	52.	50.	49.	46.	46.	21.	25.	57.	72.	83.	99.	96.	95.	93.
21	125.	130.	127.	118.	116.	109.	101.	91.	64.	51.	53.	55.	52.	40.	30.	33.	40.	39.	60.	78.	103.	91.	96.	93.	93.
20	103.	106.	104.	96.	95.	94.	89.	82.	67.	58.	63.	53.	49.	39.	357.	27.	43.	48.	46.	90.	245.	96.	95.	93.	92.
19	81.	83.	81.	77.	73.	79.	77.	73.	71.	64.	63.	58.	53.	45.	37.	41.	51.	60.	53.	57.	75.	79.	87.	92.	90.
18	59.	59.	58.	57.	66.	64.	65.	64.	74.	71.	73.	73.	66.	60.	46.	47.	54.	71.	55.	54.	59.	82.	85.	87.	91.
17	59.	59.	59.	59.	65.	56.	55.	72.	73.	72.	76.	84.	66.	59.	56.	57.	51.	55.	53.	56.	63.	72.	82.	85.	86.
16	84.	82.	80.	58.	64.	61.	68.	73.	71.	71.	72.	74.	63.	54.	58.	53.	56.	50.	50.	55.	66.	69.	81.	84.	84.
15	84.	82.	80.	77.	65.	73.	72.	74.	72.	78.	76.	72.	64.	57.	53.	47.	58.	49.	46.	55.	63.	66.	78.	83.	82.
14	84.	83.	81.	79.	76.	75.	73.	76.	79.	81.	81.	77.	73.	66.	51.	36.	59.	65.	52.	55.	61.	64.	76.	77.	78.
13	85.	84.	83.	81.	81.	75.	79.	82.	81.	85.	88.	89.	85.	76.	69.	65.	68.	68.	62.	49.	57.	63.	73.	75.	77.
12	86.	85.	84.	83.	82.	82.	82.	80.	86.	88.	97.	104.	94.	84.	80.	76.	73.	73.	68.	60.	57.	57.	73.	75.	76.
11	86.	86.	85.	84.	83.	80.	73.	74.	84.	89.	98.	103.	97.	91.	86.	81.	78.	78.	89.	80.	63.	74.	75.	76.	81.
10	87.	87.	86.	85.	84.	80.	70.	70.	90.	93.	56.	99.	102.	98.	92.	85.	82.	81.	81.	80.	69.	74.	76.	78.	81.
9	89.	88.	87.	86.	85.	84.	82.	85.	93.	102.	106.	99.	105.	103.	94.	88.	91.	88.	81.	79.	73.	75.	78.	80.	83.
8	89.	88.	88.	88.	87.	87.	87.	94.	98.	102.	105.	108.	105.	103.	102.	95.	92.	84.	91.	88.	78.	79.	82.	85.	86.
7	89.	89.	89.	89.	89.	89.	90.	98.	100.	103.	105.	107.	108.	112.	108.	106.	99.	94.	92.	91.	83.	84.	89.	90.	101.
6	90.	90.	90.	90.	91.	91.	92.	94.	95.	97.	104.	106.	107.	112.	112.	109.	103.	102.	94.	87.	89.	101.	103.	104.	102.
5	91.	91.	91.	91.	92.	92.	93.	94.	96.	97.	98.	100.	100.	101.	101.	100.	107.	106.	100.	101.	102.	105.	107.	108.	105.
4	91.	91.	92.	92.	92.	93.	94.	95.	96.	97.	98.	99.	99.	100.	100.	100.	100.	96.	97.	99.	102.	106.	110.	110.	107.
3	92.	92.	92.	93.	93.	94.	94.	95.	96.	97.	98.	98.	99.	99.	99.	99.	99.	99.	99.	100.	103.	105.	108.	108.	112.
2	92.	92.	93.	93.	93.	94.	95.	95.	96.	97.	97.	98.	98.	99.	99.	99.	99.	99.	99.	112.	112.	112.	112.	112.	112.
1	93.	93.	93.	93.	94.	94.	95.	95.	96.	96.	97.	97.	98.	98.	98.	99.	99.	99.	99.	100.	112.	112.	112.	112.	112.

Figure 9. Computed Wind Directions for 10 a.m. (29 September 1969)

WIND SPEED GRID FOR 1300 HOUR 69 929

	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
25	1.0	0.9	1.0	1.1	1.2	1.3	2.1	2.3	2.8	3.1	3.8	4.4	4.5	4.4	4.3	5.1	6.0	6.1	6.2	5.0	7.0	7.0	6.9	6.9	6.9
24	1.0	0.9	0.9	1.1	1.2	1.9	2.1	2.3	2.3	3.1	3.9	4.7	4.8	5.2	5.1	5.4	6.0	6.1	6.3	6.5	7.6	6.8	6.9	5.9	5.8
23	1.1	1.3	1.0	0.9	1.3	1.8	2.0	2.3	2.7	3.0	4.0	4.9	5.5	5.1	5.2	5.3	5.9	6.2	6.3	6.5	6.5	6.6	6.5	5.8	5.8
22	1.1	1.1	0.9	0.9	2.1	2.0	2.1	2.3	2.7	2.9	4.0	5.0	5.2	5.1	5.2	5.3	5.9	6.2	6.3	6.6	6.1	6.6	6.5	5.9	5.9
21	1.0	1.1	1.6	4.1	3.8	2.3	2.1	2.3	2.7	2.9	3.9	4.9	5.0	5.0	4.8	5.2	6.2	6.5	6.5	6.8	6.4	6.2	6.5	6.3	6.0
20	3.0	3.1	3.3	4.9	4.7	3.5	3.4	3.8	4.2	4.5	4.4	5.2	5.3	4.9	3.4	4.9	6.4	7.0	7.0	6.5	6.9	6.3	6.4	6.4	6.2
19	5.0	5.0	5.1	5.8	5.5	4.7	4.6	5.3	5.7	6.0	5.5	5.7	5.7	5.5	5.2	5.7	6.9	7.7	7.3	6.5	6.3	6.1	6.3	6.5	7.0
18	7.0	6.9	6.8	6.6	6.4	5.9	5.8	6.9	7.2	7.6	6.7	6.8	6.6	6.5	6.2	6.6	7.3	8.6	7.5	6.7	6.2	6.3	6.3	6.2	6.4
17	7.1	7.1	7.1	6.9	6.5	5.3	5.4	7.0	7.1	7.8	7.3	8.3	7.3	7.4	7.0	7.1	7.1	7.2	7.0	6.5	6.1	6.4	6.1	6.0	5.5
16	7.2	7.3	7.4	7.4	7.4	6.4	6.5	7.3	7.9	7.7	7.3	7.8	8.1	8.8	8.1	7.5	7.3	7.0	6.8	6.1	6.0	5.9	5.7	5.9	5.4
15	7.3	7.4	7.6	7.9	9.2	8.1	7.6	7.7	8.1	8.6	7.8	7.9	8.8	8.9	8.2	7.8	7.4	6.5	6.2	6.0	5.9	5.8	5.6	5.5	5.1
14	7.3	7.4	7.6	7.9	8.3	8.1	8.0	8.0	8.4	8.7	9.0	8.5	8.7	8.4	8.0	7.8	7.1	6.7	6.3	6.2	5.7	5.7	5.4	5.1	5.1
13	7.3	7.4	7.5	7.7	7.7	7.8	7.7	8.2	8.5	8.9	9.4	9.5	9.5	8.7	8.5	7.7	7.3	6.4	6.2	5.8	5.7	5.5	5.0	5.0	5.0
12	7.3	7.4	7.4	7.5	7.5	7.4	7.7	8.0	8.4	9.0	10.2	11.5	9.9	8.9	8.1	7.7	7.1	6.7	6.3	5.6	5.2	5.0	4.8	4.8	4.9
11	7.3	7.3	7.4	7.4	7.3	7.2	7.2	7.2	8.2	9.0	10.5	11.0	9.9	9.0	8.3	7.7	7.2	6.8	6.9	5.9	4.9	4.5	4.5	4.6	4.3
10	7.3	7.3	7.3	7.3	7.3	7.1	7.2	7.1	8.2	9.4	10.0	9.9	9.7	9.1	8.3	7.7	7.3	6.9	5.9	5.3	4.0	3.8	4.2	4.5	4.4
9	7.3	7.3	7.3	7.3	7.2	7.2	7.1	8.0	8.5	9.1	9.7	9.9	9.6	9.5	8.3	7.8	7.0	6.5	5.6	4.9	3.0	3.4	4.1	4.5	4.5
8	7.3	7.3	7.3	7.3	7.3	7.3	7.3	8.2	8.6	9.1	9.5	9.9	9.4	9.0	8.3	7.4	7.0	5.9	5.3	4.9	4.0	4.3	4.3	4.4	4.6
7	7.2	7.3	7.3	7.3	7.3	7.3	7.3	8.5	8.8	9.1	9.4	9.7	9.8	10.4	8.3	7.9	6.9	5.7	5.4	5.1	4.5	4.5	4.5	4.5	4.6
6	7.2	7.2	7.3	7.3	7.3	7.3	7.4	7.4	7.5	7.6	9.4	9.5	9.7	11.2	10.3	8.2	6.2	5.9	5.5	4.6	4.6	4.6	4.8	4.9	4.7
5	7.2	7.2	7.2	7.3	7.3	7.3	7.3	7.4	7.5	7.5	7.6	7.6	7.6	7.5	7.3	7.1	6.2	5.9	4.7	4.7	4.8	5.0	5.3	5.4	5.0
4	7.2	7.2	7.2	7.3	7.3	7.3	7.3	7.4	7.4	7.4	7.5	7.4	7.4	7.3	7.2	7.0	6.8	4.1	4.2	4.4	4.7	5.1	5.6	5.7	5.2
3	7.2	7.2	7.2	7.2	7.3	7.3	7.3	7.3	7.3	7.4	7.4	7.3	7.3	7.2	7.1	6.9	6.8	6.6	4.3	4.5	4.7	5.0	5.3	5.3	6.0
2	7.2	7.2	7.2	7.2	7.2	7.2	7.3	7.3	7.3	7.3	7.3	7.2	7.2	7.1	7.0	6.9	6.8	6.6	6.5	6.0	6.0	6.3	6.3	6.0	6.0
1	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.1	7.1	7.0	6.9	6.8	6.6	6.5	6.4	6.0	6.0	6.0	6.0	6.0

Figure 10. Computed Wind Speeds for 1 p.m. (29 September 1969)

WIND DIRECTION GRID FOR 1300 HOUR 69 929

	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
25	42.	44.	53.	45.	51.	52.	37.	34.	35.	32.	23.	15.	16.	15.	14.	28.	33.	34.	35.	35.	45.	45.	66.	69.	69.
24	25.	24.	39.	44.	56.	45.	40.	34.	33.	26.	21.	17.	17.	23.	24.	29.	33.	35.	36.	40.	36.	64.	66.	76.	78.
23	4.	356.	14.	32.	48.	54.	44.	33.	25.	22.	24.	26.	27.	32.	36.	29.	33.	35.	37.	50.	51.	62.	65.	76.	78.
22	14.	10.	26.	69.	92.	69.	49.	33.	19.	13.	25.	38.	36.	41.	44.	46.	33.	36.	45.	49.	55.	61.	65.	76.	80.
21	52.	65.	83.	107.	105.	77.	54.	35.	19.	13.	30.	46.	44.	47.	44.	46.	51.	45.	45.	48.	52.	56.	65.	71.	82.
20	55.	64.	75.	91.	91.	72.	57.	47.	40.	36.	61.	55.	55.	50.	24.	44.	51.	52.	52.	50.	46.	55.	67.	75.	86.
19	58.	63.	68.	76.	78.	68.	60.	60.	61.	59.	66.	63.	62.	58.	54.	53.	53.	51.	55.	55.	55.	53.	67.	75.	89.
18	61.	61.	61.	60.	61.	63.	64.	73.	81.	82.	75.	77.	74.	73.	62.	59.	55.	50.	55.	60.	59.	65.	69.	78.	90.
17	62.	62.	62.	61.	64.	56.	60.	76.	79.	83.	82.	84.	80.	78.	72.	71.	65.	62.	63.	66.	66.	71.	70.	75.	87.
16	73.	72.	71.	61.	64.	61.	70.	76.	80.	81.	80.	82.	83.	84.	82.	76.	73.	68.	67.	69.	69.	71.	74.	78.	82.
15	73.	72.	71.	70.	66.	70.	74.	78.	81.	84.	83.	82.	86.	86.	81.	78.	77.	71.	68.	70.	70.	71.	74.	76.	83.
14	73.	72.	71.	70.	76.	71.	75.	79.	82.	85.	85.	87.	87.	85.	80.	76.	80.	79.	73.	70.	69.	71.	73.	81.	88.
13	73.	73.	72.	71.	71.	70.	74.	80.	83.	87.	91.	94.	94.	87.	85.	83.	84.	86.	78.	59.	61.	74.	83.	85.	87.
12	74.	73.	73.	72.	72.	71.	73.	77.	83.	89.	97.	104.	97.	91.	87.	86.	85.	86.	84.	74.	74.	75.	83.	84.	86.
11	74.	74.	73.	72.	71.	69.	64.	65.	80.	88.	97.	102.	97.	92.	91.	90.	90.	92.	101.	92.	81.	78.	77.	77.	79.
10	74.	74.	74.	73.	72.	69.	62.	62.	78.	88.	94.	95.	94.	91.	92.	91.	91.	92.	92.	87.	76.	75.	76.	76.	73.
9	75.	75.	74.	74.	73.	71.	70.	73.	80.	89.	93.	92.	92.	92.	92.	91.	91.	91.	85.	82.	69.	72.	75.	76.	73.
8	75.	75.	75.	75.	74.	74.	74.	81.	85.	89.	92.	93.	92.	92.	95.	91.	91.	83.	84.	82.	76.	75.	75.	73.	73.
7	76.	76.	76.	75.	75.	76.	76.	84.	87.	89.	91.	92.	93.	101.	99.	99.	94.	84.	83.	81.	77.	76.	73.	72.	79.
6	76.	76.	76.	76.	76.	77.	78.	79.	80.	82.	91.	92.	92.	100.	102.	100.	90.	89.	82.	76.	74.	78.	76.	76.	64.
5	76.	77.	77.	77.	77.	78.	78.	79.	80.	81.	82.	83.	84.	84.	83.	83.	88.	88.	84.	82.	79.	76.	66.	66.	65.
4	77.	77.	77.	77.	78.	78.	79.	79.	80.	81.	82.	92.	83.	83.	82.	82.	81.	82.	83.	64.	64.	66.	67.	67.	66.
3	77.	77.	77.	78.	78.	78.	79.	80.	80.	81.	81.	82.	82.	82.	82.	81.	81.	80.	63.	64.	65.	65.	66.	66.	67.
2	77.	78.	78.	78.	78.	79.	79.	80.	80.	80.	81.	81.	81.	81.	81.	81.	80.	79.	79.	67.	67.	67.	67.	67.	67.
1	78.	78.	78.	78.	78.	79.	79.	79.	80.	80.	80.	81.	81.	81.	81.	80.	80.	79.	79.	78.	67.	67.	67.	67.	67.

Figure 11. Computed Wind Directions for 1 p.m. (29 September 1969)

To provide a more meaningful comparison, squares over the ocean and the San Gabriel Mountains are not included in this calculation because extrapolated values over these areas are relatively unreliable. The results are tabluated in Table 4. In surveying these results, we have concluded that, for all hours during the period of validation, the interpolated wind speed is completely satisfactory. Also, the interpolated wind direction is acceptably accurate between 11 a.m. and 4 p.m. PST. However, during the morning hours, from 5 a.m. to 10 a.m., the deviations appear to be large. This is not surprising in view of the fact that the prevailing wind speed during these hours is low.

Table 4. Average Deviation between Computed and Manually Prepared Wind

Time (PST)	Wind Speed (mph)	Wind Direction (degrees)
500	1.5	39.0
600	1.1	32.8
700	1.1	55.0
800	0.9	69.5
900	0.9	60.6
1000	0.9	47.0
1100	0.8	14.8
1200	1.1	17.3
1300	1.3	22.2
1400	1.4	18.6
1500	1.4	21.0
1600	1.3	15.6

IV. OBJECTIVE ANALYSIS OF AIR QUALITY DATA

An effort very similar to that undertaken in the automatic preparation of wind maps, as discussed in Section III, has been carried out for measured air quality data. The objective is to provide a set of automated initial concentration maps for each species of air pollutants included in our airshed model. In order to avoid repetition, we point out only the differences in the treatment of wind data and air quality data.

A. STRATEGIES

As with the wind analysis, we have adopted the Influence Factor Fit approach in analysis of the air quality. A formula, identical in form to Equation (11), is used to interpolate air quality data,

$$\hat{C}_{k_j} = \frac{\sum_{r_{ij} < R} r_{ij}^{-n} \overline{C_{k_i}}}{\sum_{r_{ij} < R} r_{ij}^{-n}} \tag{19}$$

where $\overline{C_{k_i}}$ is the measured concentration of species k at grid point i, and $\hat{C}_{k_j}$ is the corresponding interpolated value. Definitions of the rest of the parameters are the same as those defined in Equation (11). The species considered are listed below:

$$k = \begin{cases} 1 & \text{Reactive Hydrocarbons} \\ 2 & NO \\ 3 & \text{Total Oxidant} \\ 4 & NO_2 \\ 5 & CO \\ 6 & \text{Unreactive Hydrocarbons} \end{cases}$$

A notable difference between Equation (11) and Equation (19) lies in the fact that the latter is a scalar interpolation while the former involves vector interpolation, as we have discussed in Section III.

In the air quality interpolation, data from the following stations will be used to estimate concentrations for the ocean squares:

West Los Angeles
Lennox
Long Beach
Anaheim
Santa Ana

(see Figure 12.)

B. DATA ANALYSIS

During fall 1969, the period chosen for the validation of the airshed model, fifteen air-quality monitoring stations were operative in the Los Angeles area. The names and locations of these stations are listed in Table 5. Measurements made at these sites constitute the data base for the present analysis.

Among the six species of air contaminants, only total oxidant concentrations were reported by all fifteen stations listed in Table 5. NO_2 and NO (or its equivalent $NO + NO_2$) were measured at all stations except Santa Ana, and carbon monoxide at all stations except Santa Ana and La Habra. However, data required to derive concentrations of both reactive and unreactive hydrocarbons were reported only at the following

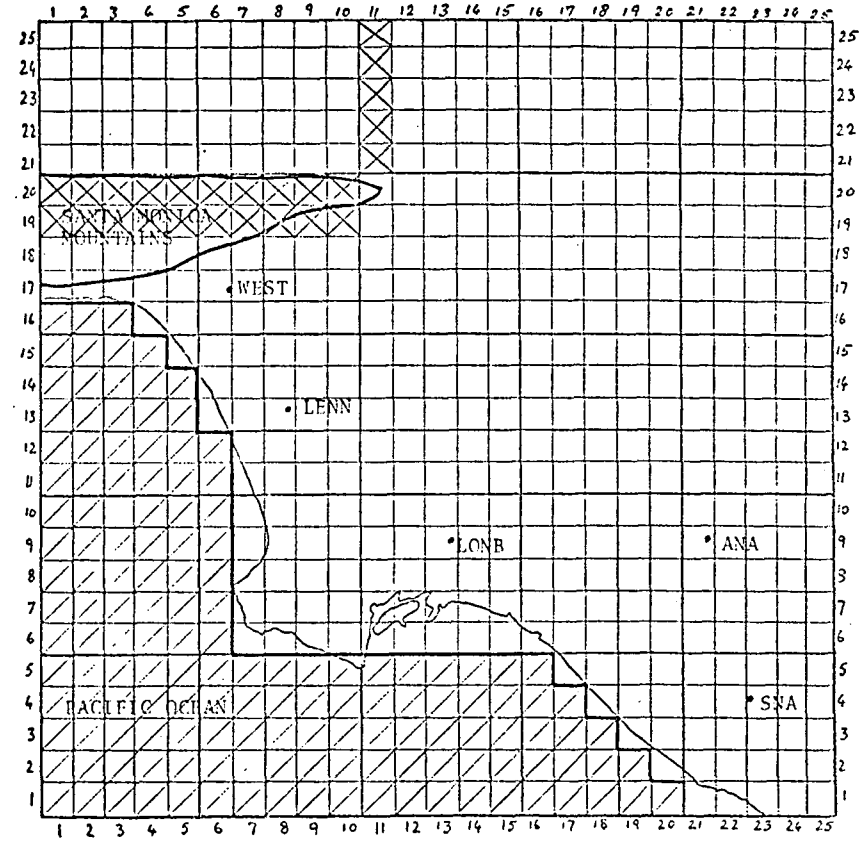


Figure 12. Map of Los Angeles for Air Quality Analysis

three stations: Downtown Los Angeles, Pasadena and Azusa. The paucity of measurements of these two species has rendered impractical the use of the maximum range of influence R, for monitoring stations. We have, therefore, relaxed the rule by allowing measurements made at all three stations to be used in the calculations for every grid point.

Table 5. Air Quality Stations and their Locations

STATION NAME	X-AXIS COORDINATE	Y-AXIS COORDINATE
RESD	3.1	21.8
BURK	9.2	21.0
PASA	14.7	19.5
AZU	20.5	19.6
WEST	6.0	16.3
LENX	7.7	12.5
ELM	17.4	17.8
COMM	13.3	15.1
CAP	11.3	16.5
LONB	12.9	8.8
WHTR	17.7	12.3
LAH	19.7	12.3
ANA	20.8	8.8
POMA	25.7	17.2
SNA	23.0	3.7

Measured air quality data has been analyzed using the same statistical techniques that were applied in the analysis of the wind data (the measured and calculated air quality data for NO, O_3, NO_2 and CO are tabulated in APPENDIX 3). The correlation coefficients and the average deviations have been calculated for every species of air pollutants except

the hydrocarbons.* This exception has been made, again, because of the lack of data. In addition, because the number of air quality stations is smaller, the maximum range of influence R has been increased in the calculation to 20 miles, as compared to 14 miles in the wind analysis. This length will be sufficient to cover all grid points in the modeling region with every monitoring station operating normally. If no station can be found within this maximum distance R because some stations failed to report data, this distance is automatically increased. The results of these statistical analyses are tabulated in Tables 6 and 7.

Although the calculated correlation coefficients are consistently high, falling within the range, 0.7 to 0.9, they differ quite markedly from each other. However, differences in the magnitude of the coefficient arising from the use of different distance influence factors are quite small. Judging from the magnitude of the calculated average deviations for each species, we may tentatively conclude that the interpolation is probably satisfactory for carbon monoxide in view of its having a background value of about 2 to 3 ppm. For the remaining three species, NO, O_3, and NO_2, the average deviations appear to be so high that the interpolations are only marginally satisfactory. It is interesting to note that these three species are the principal participants in the photochemical reactions, with a half life of the order of an hour. Therefore, the large calculated average deviations may well be a reflection of the fact that, due to the chemical transformations that are occuring, concentrations of these species must be viewed as local, rather than global, quantities. When considered in this light, straightforward interpolation techniques may not be appropriate for use.

* Again, correlation coefficients and average differences between each pair of station measurements have been computed. They are listed in APPENDIX 4.

TABLE 6. The Correlation Coefficients

STATION	EXPONENT 1.00				2.00				3.00			
	NO	O_3	NO_2	CO	NO	O_3	NO_2	CO	NO	O_3	NO_2	CO
RESD	0.85	0.84	0.57	0.84	0.87	0.83	0.59	0.85	0.89	0.83	0.60	0.86
BURK	0.90	0.89	0.96	0.86	0.89	0.88	0.96	0.84	0.88	0.88	0.97	0.83
PASA	0.75	0.96	0.10	-	0.72	0.96	0.06	-	0.69	0.97	0.03	-
AZU	0.83	0.85	0.44	0.70	0.84	0.85	0.51	0.67	0.84	0.84	0.59	0.62
WEST	0.86	0.97	0.92	0.91	0.86	0.97	0.92	0.89	0.86	0.98	0.92	0.86
LENX	0.84	0.82	0.81	0.40	0.82	0.82	0.81	0.39	0.80	0.82	0.81	0.38
ELM	-	0.97	-	0.66	-	0.97	-	0.64	-	0.97	-	0.61
COMM	0.97	0.81	0.94	0.92	0.92	0.84	0.91	0.89	0.86	0.86	0.87	0.86
CAP	0.70	0.87	0.80	0.81	0.72	0.92	0.80	0.83	0.73	0.94	0.80	0.84
LONB	0.55	0.69	0.75	0.91	0.56	0.70	0.75	0.90	0.58	0.71	0.74	0.90
WHTR	0.89	0.98	0.95	0.88	0.83	0.97	0.94	0.89	0.75	0.95	0.90	0.90
LAH	0.85	0.94	0.85	-	0.82	0.94	0.85	-	0.81	0.94	0.85	-
ANA	0.97	0.97	0.86	-	0.98	0.98	0.86	-	0.98	0.98	0.86	-
POMA	0.92	0.73	0.45	0.73	0.92	0.76	0.55	0.73	0.93	0.79	0.66	0.73
SNA	-	0.90	-	-	-	0.90	-	-	-	0.91	-	-
MEAN	0.84	0.88	0.72	0.79	0.83	0.89	0.73	0.78	0.81	0.89	0.74	0.76

TABLE 7. The Average Deviations

STATION	EXPONENT 1.00				2.00				3.00			
	NO	O_3	NO_2	CO	NO	O_3	NO_2	CO	NO	O_3	NO_2	CO
RESD	13.60	3.08	6.44	2.77	13.53	3.13	6.68	2.77	13.49	3.17	6.91	2.78
BURK	9.34	2.84	8.70	4.09	9.23	2.89	8.85	4.12	9.12	2.92	9.01	4.18
PASA	8.90	9.37	7.40	-	9.76	9.53	7.60	-	10.54	9.61	7.72	-
AZU	7.47	8.40	5.12	2.68	6.40	8.43	4.53	2.70	5.46	8.70	3.98	2.81
WEST	7.97	1.86	1.97	2.11	7.94	1.30	2.03	2.29	8.02	1.02	2.16	2.54
LENX	8.63	2.88	5.30	4.64	9.15	2.41	5.23	4.67	9.53	2.19	5.07	4.71
ELM	-	4.83	-	3.35	-	5.85	-	3.33	-	6.88	-	3.33
COMM	5.74	11.54	5.64	2.46	5.29	9.60	6.20	2.59	5.73	7.38	6.88	2.85
CAP	9.76	4.20	5.56	3.23	8.92	3.04	6.14	3.10	8.40	2.05	6.90	3.00
LONB	10.29	8.71	5.23	1.96	10.23	8.61	5.16	2.00	10.19	8.54	5.12	2.04
WHTR	8.18	4.55	11.37	2.92	8.91	3.82	12.05	2.81	9.78	3.61	12.82	2.71
LAH	6.49	5.33	6.95	-	8.27	4.19	9.50	-	9.64	4.02	11.38	-
ANA	3.31	5.91	3.26	-	2.37	4.49	3.19	-	1.89	3.41	3.21	-
POMA	4.58	6.80	4.94	2.19	3.64	6.56	4.45	2.02	2.77	6.38	4.11	1.94
SNA	-	7.78	-	-	-	7.81	-	-	-	7.83	-	-
MEAN	8.02	5.87	5.99	2.95	7.97	5.44	6.28	2.94	8.04	5.18	6.56	2.99

C. RESULTS AND DISCUSSIONS

The interpolation scheme we have discussed above has been used to calculate the initial concentrations of the six species for each grid point at 5 a.m. PST on 29 September 1969. The computed results have been compared with the manually prepared concentrations by calculating the square root of the average squared differences according to Equation (18). The results of these statistical calculations are shown in Table 8. They confirm qualitatively our previous observations that the interpolation is probably more satisfactory for inert species than for reactive ones.

The computed initial concentration maps for each of the six pollutant species are reproduced in Figures 13 through 18.

Table 8. Average Deviation between Computed and Manually Prepared Initial Conditions.

Species	Average Deviation
Reactive Hydrocarbons	0.5 ppm
NO	6.6 pphm
Total Oxidant	-- *
NO_2	2.7 pphm
CO	2.2 ppm
Unreactive Hydrocarbons	1.1 ppm

* In the SAI airshed model, the initial conditions for the oxidant are calculated from the chemical equilibrium relationship, therefore, no initial concentration map has been prepared manually.

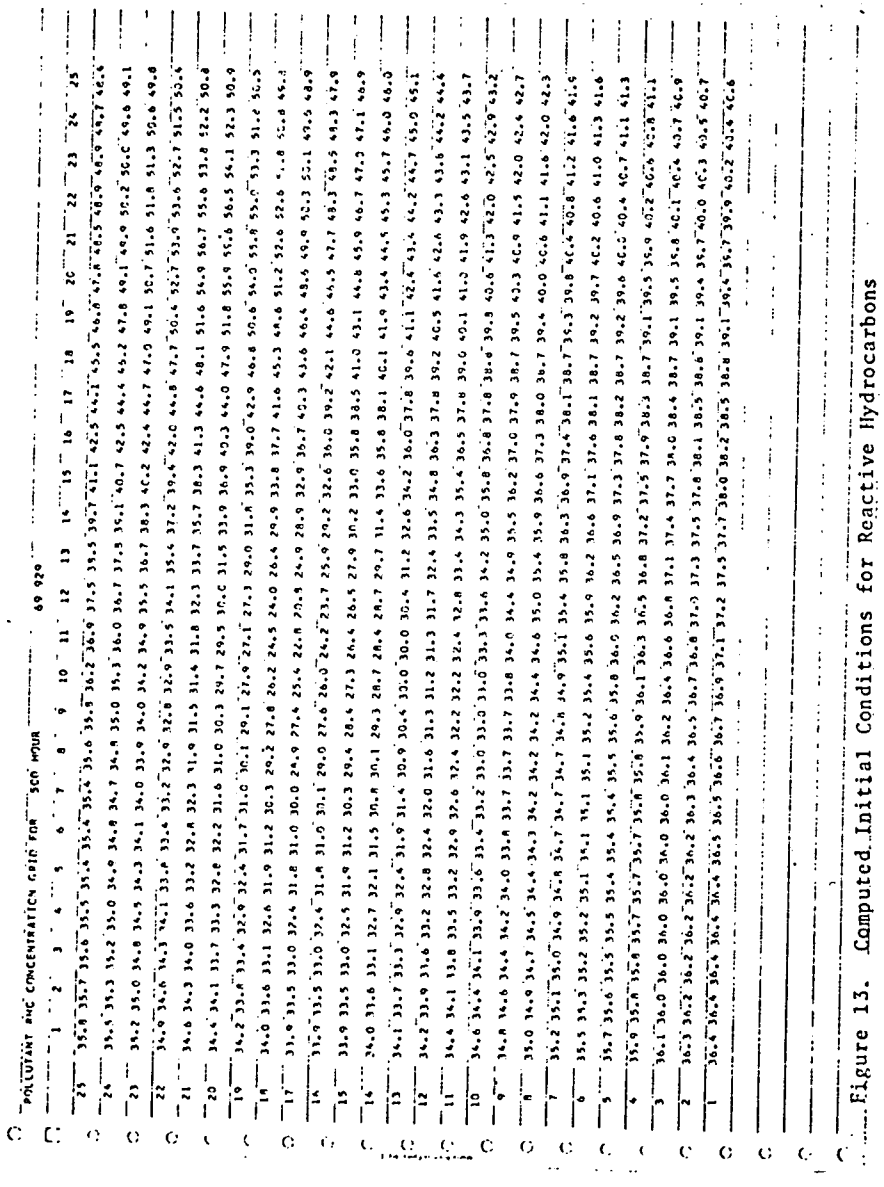


Figure 13. Computed Initial Conditions for Reactive Hydrocarbons

POLLUTANT NO CONCENTRATION GRID FOR 500 HOUR 69 929

	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
25	14.7	14.4	14.4	14.8	15.8	17.3	15.8	16.7	17.3	17.3	16.6	15.9	14.7	14.6	13.8	13.2	12.7	9.3	8.9	3.6	3.7	3.7	3.8	4.4	4.5
24	14.1	13.5	13.0	13.4	14.9	16.9	16.2	17.7	18.7	18.8	16.9	15.1	14.1	14.3	13.4	12.7	12.2	11.8	9.9	3.6	3.7	3.8	3.9	3.9	4.5
23	13.7	12.6	11.4	11.4	13.8	14.7	16.8	19.0	20.9	21.2	18.4	15.5	14.1	13.2	12.7	12.0	11.6	10.6	10.2	6.4	3.7	3.8	3.9	3.9	4.5
22	13.6	12.5	10.8	10.6	13.6	14.9	17.3	20.2	23.8	25.1	20.0	14.9	13.8	12.4	11.8	11.7	10.9	10.2	9.8	7.7	6.7	5.2	3.5	3.5	4.5
21	14.0	13.2	12.5	12.8	14.8	15.2	17.5	20.2	23.7	25.0	19.8	14.7	13.1	11.3	9.1	9.4	9.9	10.0	9.5	7.1	5.9	6.3	5.3	3.6	3.7
20	11.4	11.6	11.1	11.4	13.2	13.2	14.8	16.8	19.6	20.9	16.3	14.5	13.0	10.2	4.6	8.1	9.8	10.0	9.4	6.9	4.5	6.0	5.3	5.5	5.5
19	9.7	10.0	9.8	9.9	11.6	11.2	12.1	13.5	15.4	16.8	15.5	14.4	12.9	11.6	9.8	9.7	10.5	10.4	9.8	7.7	7.1	6.8	7.1	5.5	5.5
18	6.0	8.4	8.4	8.4	10.1	9.2	9.4	10.1	11.3	12.7	15.1	14.2	13.9	13.1	12.2	11.7	11.5	11.2	10.3	8.5	8.1	7.4	7.3	5.9	5.0
17	6.0	8.3	8.3	10.1	9.7	8.6	8.9	10.2	11.2	12.8	15.1	15.4	14.9	14.7	13.6	12.6	11.8	11.7	10.0	9.1	8.7	7.8	7.6	6.1	5.2
16	7.9	7.9	7.8	10.0	9.6	9.6	9.3	10.0	11.5	12.6	14.2	14.8	16.2	17.9	14.8	13.4	12.3	12.1	10.5	9.9	8.9	8.1	7.9	6.9	6.5
15	7.9	7.8	7.7	7.6	9.6	9.9	9.2	9.5	10.9	12.1	13.9	14.9	16.0	17.0	14.9	13.6	12.7	11.7	10.8	9.8	9.3	8.1	8.0	7.0	6.8
14	7.9	7.8	7.7	7.5	7.2	9.7	9.0	7.9	9.5	11.4	13.3	14.3	14.8	14.6	14.1	13.6	12.5	12.4	11.2	9.0	8.6	8.1	8.1	7.2	7.1
13	7.9	7.8	7.7	7.4	7.1	9.5	8.2	6.5	8.1	10.9	12.9	13.8	14.0	13.7	12.8	13.0	13.4	16.3	11.9	5.0	6.9	8.3	8.6	7.3	7.3
12	8.0	7.9	7.7	7.5	7.2	8.8	8.8	7.9	9.8	11.1	12.8	13.3	12.8	13.0	13.0	12.8	13.1	13.4	11.5	8.2	7.3	9.0	9.3	7.5	7.5
11	8.0	7.9	7.8	7.7	7.5	7.2	9.9	9.0	11.3	12.4	11.9	12.4	12.9	13.0	13.2	13.0	12.3	12.5	11.0	9.9	9.4	9.4	8.5	7.8	7.7
10	8.1	8.1	8.0	7.9	7.8	7.7	10.8	10.9	12.3	13.0	12.9	13.4	14.2	14.5	13.9	13.5	13.1	13.2	12.0	10.6	9.9	9.9	9.2	8.4	8.4
9	8.2	8.2	8.1	8.1	8.1	8.1	8.2	11.6	12.9	13.5	13.0	13.5	14.9	14.7	13.9	13.4	12.9	12.8	12.0	11.1	9.9	9.3	9.3	[illegible]	8.5
8	8.4	8.3	8.3	8.3	8.3	8.4	9.6	12.0	12.4	13.7	14.2	14.6	14.0	14.0	13.6	13.2	13.4	12.8	12.2	11.5	10.0	9.9	10.0	8.7	8.6
7	8.5	8.5	8.5	8.5	8.6	8.7	8.9	9.2	12.9	13.4	14.9	14.5	13.3	13.3	13.0	12.7	13.4	12.9	11.1	10.7	10.4	10.3	10.3	9.3	9.4
6	8.6	8.6	8.6	8.7	8.8	8.9	9.1	9.3	9.7	10.1	14.9	14.3	12.9	12.9	12.8	13.7	11.9	11.6	11.2	10.9	10.7	10.5	9.4	9.4	9.4
5	8.7	8.7	8.7	8.8	8.9	9.0	9.2	9.4	9.7	10.0	10.3	10.6	13.7	10.8	10.7	10.6	11.9	11.6	11.3	11.1	10.9	10.7	9.5	9.5	5.9
4	8.7	8.8	8.8	8.9	9.0	9.1	9.3	9.5	9.7	9.9	10.1	10.3	10.4	10.5	10.5	10.4	10.3	11.6	11.4	11.2	11.0	9.6	6.0	5.9	9.0
3	8.8	8.9	8.9	9.0	9.1	9.2	9.3	9.5	9.6	9.8	10.0	10.1	10.2	10.3	10.3	10.2	10.1	10.0	11.4	11.3	8.7	5.9	9.0	9.0	9.0
2	8.9	8.9	9.0	9.0	9.1	9.2	9.3	9.5	9.6	9.7	9.9	10.0	10.1	10.1	10.1	10.0	10.0	9.9	12.0	9.0	9.0	9.0	9.0	9.0	9.0
1	8.9	9.0	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	9.9	10.0	10.0	10.0	9.9	9.9	9.8	9.8	9.0	9.0	9.0	9.0	9.0

Figure 14. Computed Initial Conditions for Nitric Oxide

POLLUTANT OX CONCENTRATION GRID FOR 500 HOUR 69 929

	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
25	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.8	1.9	2.0	2.0	2.0	2.0	2.0	2.0
24	1.7	1.9	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.8	2.0	2.0	2.0	2.0	2.0	2.0
23	1.8	1.8	1.9	1.9	1.8	1.7	1.6	1.4	1.4	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.7	2.0	2.0	2.0	2.0	2.0	2.0
22	1.8	1.8	1.9	1.9	1.8	1.7	1.5	1.4	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.9	1.9	1.9	2.0	2.0	2.0
21	1.7	1.8	1.8	1.8	1.7	1.6	1.5	1.4	1.2	1.2	1.3	1.4	1.4	1.5	1.7	1.7	1.7	1.7	1.7	1.8	1.9	1.9	1.9	2.0	2.0
20	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.3	1.2	1.2	1.2	1.3	1.4	1.5	1.9	1.8	1.7	1.7	1.7	1.8	2.0	1.9	1.9	1.9	1.9
19	1.2	1.3	1.3	1.3	1.2	1.3	1.2	1.2	1.2	1.1	1.2	1.3	1.4	1.4	1.6	1.6	1.6	1.6	1.7	1.8	1.8	1.9	1.9	1.9	1.9
18	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.4	1.4	1.6	1.6	1.7	1.7	1.8	1.9	1.9	1.9	1.9
17	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.8	1.9	1.9
16	1.1	1.1	1.1	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.3	1.3	1.4	1.5	1.5	1.4	1.7	1.8	1.8	1.8	1.9
15	1.1	1.1	1.1	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.3	1.3	1.4	1.5	1.5	1.5	1.6	1.8	1.8	1.8	1.8
14	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.5	1.7	1.8	1.8	1.4
13	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.1	1.3	1.4	1.6	1.6	1.7	1.8	1.8
12	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.5	1.6	1.6	1.7	1.8	1.8
11	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.8	1.8
10	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.4	1.6	1.8	1.8	1.7	1.8	1.7
9	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.1	1.2	1.2	1.4	1.5	1.7	1.9	1.8	1.7	1.8	1.7
8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.8	1.7
7	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.6	1.7	1.7
6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.2	1.2	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.5	1.6	1.7	1.7	1.7
5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.7	1.7	2.0
4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.6	2.0	2.0	2.0
3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.6	2.0	2.0	2.0	2.0
2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.6	2.0	2.0	2.0	2.0	2.0
1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.4	2.0	2.0	2.0	2.0	2.0

Figure 15. Computed Initial Conditions for Oxidant

POLLUTANT N2 CONCENTRATION GRID FOR 500 HOUR 69 929

	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
25	13.6	13.5	13.5	13.6	13.7	13.8	12.7	12.7	12.7	12.5	11.4	10.2	10.5	9.9	9.8	9.7	9.8	10.8	10.9	11.1	11.3	11.5	11.6	13.3	13.4
24	13.5	13.4	13.4	13.4	13.6	13.8	12.8	12.9	12.9	12.8	11.6	10.4	10.2	9.9	9.7	9.6	9.7	9.8	11.5	11.1	11.3	11.5	11.7	11.9	13.4
23	13.4	13.4	13.2	13.2	13.5	12.8	12.9	13.1	13.4	13.3	11.9	10.5	10.0	9.5	9.4	9.4	9.5	10.3	10.5	11.2	11.4	11.6	11.8	12.0	13.4
22	13.5	13.3	13.2	13.2	13.5	12.9	13.0	13.4	13.9	14.1	12.2	10.2	9.8	9.2	9.1	9.2	9.2	9.9	10.2	10.1	10.9	11.0	11.3	11.4	13.5
21	13.5	13.4	13.4	13.4	13.6	12.8	13.0	13.3	13.9	14.1	12.0	9.9	9.4	8.8	8.4	8.6	9.4	9.8	10.2	10.4	11.3	11.2	11.2	11.5	11.8
20	11.4	11.2	11.2	11.2	11.6	11.1	11.2	11.3	11.6	11.7	9.9	9.4	9.1	9.4	7.5	8.3	9.3	9.8	10.2	10.6	11.8	11.3	11.3	11.5	11.9
19	9.6	9.0	9.0	9.1	9.6	9.3	9.3	9.3	9.2	9.2	8.7	8.6	8.5	8.2	8.1	8.5	9.3	9.7	10.1	10.3	10.7	11.1	11.2	11.7	12.3
18	7.6	6.8	6.9	7.0	7.6	7.6	7.5	7.3	6.8	6.8	7.8	7.6	7.9	8.3	8.4	8.5	9.2	9.4	10.0	10.0	10.2	10.9	11.1	11.6	12.9
17	7.6	6.8	6.9	7.5	7.6	7.7	7.7	7.1	6.9	6.8	7.0	5.5	7.8	8.5	8.6	8.6	9.1	9.3	9.2	9.7	9.9	10.6	11.0	11.5	12.7
16	7.3	7.3	7.3	7.5	7.6	7.4	7.4	7.1	7.1	6.9	7.5	7.4	8.5	9.5	8.9	8.7	9.1	9.3	9.1	9.2	9.7	10.4	10.7	11.1	12.0
15	7.2	7.2	7.3	7.3	7.5	7.2	7.1	7.0	7.1	7.0	7.7	7.9	8.7	9.3	8.9	8.7	9.0	8.9	8.9	9.0	9.1	10.1	10.4	11.1	11.5
14	7.2	7.2	7.2	7.2	7.2	7.0	7.0	7.0	7.1	7.1	7.7	7.9	8.2	8.6	8.6	8.6	8.8	8.9	8.9	8.7	8.9	9.4	10.1	10.7	11.0
13	7.2	7.2	7.2	7.2	7.1	7.0	7.0	7.0	7.1	7.1	7.7	7.7	8.0	8.3	8.1	8.2	8.6	9.4	8.9	7.8	8.6	9.2	10.2	10.4	10.7
12	7.1	7.1	7.1	7.1	7.1	7.0	6.9	6.9	7.0	7.0	7.5	7.7	7.3	7.4	7.6	8.1	8.4	9.0	8.8	8.4	8.8	9.3	9.6	10.3	10.5
11	7.1	7.1	7.1	7.0	7.0	7.0	6.8	6.9	7.0	6.9	6.8	6.9	6.8	6.9	7.2	7.6	8.2	8.4	8.8	9.1	9.3	9.4	9.5	10.2	10.4
10	7.1	7.0	7.0	7.0	6.9	6.9	6.7	6.7	6.9	6.8	6.6	6.5	5.9	6.0	6.9	7.4	7.8	8.1	8.6	9.2	9.5	9.5	9.3	10.0	10.1
9	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.6	6.9	6.7	6.5	6.4	5.3	5.6	6.7	7.3	7.7	8.4	8.6	9.0	9.5	9.5	9.4	10.0	10.1
8	7.0	7.0	7.0	6.9	6.9	6.8	6.7	6.5	6.4	6.7	6.5	6.5	6.2	6.3	6.8	7.2	8.0	8.3	8.6	8.8	8.9	8.9	8.7	10.0	10.1
7	7.0	7.0	6.9	6.9	6.9	6.8	6.7	6.1	6.6	6.4	6.8	7.0	6.9	7.0	7.3	7.6	8.0	8.2	8.2	8.4	8.6	8.6	8.5	9.2	9.2
6	7.0	7.0	6.9	6.9	6.8	6.8	6.7	6.6	6.6	6.4	6.9	7.3	7.2	7.3	7.5	7.6	7.6	7.6	9.0	8.2	8.4	8.4	9.2	9.2	9.2
5	7.0	7.0	6.9	6.9	6.8	6.8	6.7	6.7	6.6	6.5	6.5	6.4	6.4	6.5	6.6	6.8	7.6	7.8	8.0	8.1	8.2	8.3	9.2	9.2	8.9
4	7.0	6.9	6.9	6.9	6.9	6.8	6.8	6.7	6.7	6.6	6.6	6.6	6.6	6.6	6.8	6.9	7.1	7.7	7.9	8.0	8.1	9.2	8.9	8.9	10.0
3	7.0	7.0	6.9	6.9	6.9	6.8	6.8	6.8	6.7	6.7	6.7	6.7	6.7	6.8	6.8	7.0	7.1	7.2	7.6	7.9	7.5	8.8	10.0	10.0	10.0
2	7.0	7.0	6.9	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.9	7.0	7.1	7.2	7.3	7.4	10.0	10.0	10.0	10.0	10.0
1	7.0	7.0	6.9	6.9	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.9	6.9	7.0	7.0	7.1	7.2	7.3	7.4	10.0	10.0	10.0	10.0	10.0

Figure 16. Computed Initial Conditions for Nitrogen Dioxide.

POLLUTANT CO CONCENTRATION GRID FOR 500 HOUR 69 929

	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
25	10.9	10.8	10.8	10.9	11.0	11.2	11.5	11.7	11.9	12.0	10.4	8.9	9.5	9.2	9.1	9.1	9.0	11.2	11.0	9.0	8.9	8.9	8.8	8.7	8.6
24	10.4	10.7	10.4	10.7	10.9	11.2	11.5	11.8	12.1	12.2	10.6	9.1	8.9	9.2	9.1	9.0	9.0	9.0	9.8	9.1	9.0	9.0	8.9	8.7	8.6
23	10.7	10.5	10.4	10.4	10.7	11.2	11.6	12.0	12.3	12.4	10.8	9.2	8.9	8.5	9.0	9.0	9.0	8.7	8.5	9.1	9.2	9.1	8.9	8.7	8.6
22	10.7	10.5	10.3	10.2	10.7	11.2	11.7	12.1	12.6	12.7	10.8	8.9	8.8	8.4	8.2	8.6	8.6	8.5	8.6	8.3	9.0	8.9	9.0	8.7	8.5
21	10.8	10.6	10.5	10.6	10.9	11.3	11.7	12.2	12.6	12.8	10.7	8.6	9.2	7.9	8.0	8.5	8.4	8.5	8.7	8.6	9.4	9.1	8.9	8.7	8.4
20	9.0	8.7	8.6	8.7	9.0	9.3	9.6	9.9	10.2	13.3	8.4	8.0	7.8	7.6	7.7	8.3	8.3	8.4	8.7	8.8	8.8	9.2	8.7	8.3	8.0
19	7.7	6.8	6.7	6.8	7.2	7.3	7.4	7.6	7.8	7.8	7.3	7.3	7.4	7.3	7.5	7.7	8.2	8.3	8.5	8.5	8.7	9.0	8.6	8.1	7.8
18	5.4	4.8	4.8	4.8	5.3	5.3	5.3	5.3	5.4	5.4	6.4	6.3	6.7	7.2	7.4	7.6	8.0	8.1	8.3	8.1	8.2	8.6	8.4	8.0	7.6
17	5.4	4.9	4.9	5.4	5.3	5.2	5.2	5.4	5.4	5.4	5.7	4.2	6.5	7.3	7.5	7.5	7.7	8.0	7.6	7.8	7.8	8.4	8.2	7.9	7.6
16	5.7	5.7	5.6	5.4	5.4	5.4	5.4	5.5	5.6	5.5	6.2	6.2	7.2	8.0	7.6	7.5	7.7	7.8	7.4	7.5	7.6	8.2	8.1	7.8	7.7
15	5.7	5.7	5.7	5.6	5.5	5.6	5.6	5.7	5.8	5.8	6.5	6.7	7.4	7.9	7.6	7.5	7.6	7.3	7.3	7.4	7.4	8.1	8.1	7.6	7.7
14	5.8	5.7	5.7	5.7	5.7	5.7	5.8	5.8	5.9	6.0	6.6	6.8	7.1	7.4	7.4	7.4	7.1	7.1	7.2	7.3	7.3	7.9	8.0	7.8	7.8
13	5.8	5.8	5.8	5.8	5.8	5.8	5.9	6.0	6.0	6.1	6.7	6.8	7.0	7.3	6.9	7.1	7.1	7.0	7.1	7.2	7.8	7.8	8.0	7.8	7.8
12	5.8	5.8	5.8	5.8	5.9	5.9	5.9	6.0	6.1	6.1	6.7	6.8	6.5	6.6	6.6	7.0	7.1	7.1	7.1	7.2	7.7	7.8	7.8	7.8	7.8
11	5.9	5.9	5.9	5.9	5.9	5.9	6.0	6.0	6.1	6.2	6.3	6.4	6.6	6.6	6.7	6.8	7.0	7.2	7.2	7.7	7.7	7.8	7.6	7.8	7.9
10	5.9	5.9	5.9	5.9	5.9	6.0	6.0	6.0	6.2	6.3	6.4	6.5	6.7	6.8	6.8	6.7	6.7	6.8	7.4	7.4	7.4	7.4	7.0	7.0	7.0
9	5.9	5.9	5.9	6.0	6.0	6.0	6.1	6.1	6.2	6.3	6.4	6.6	6.9	6.8	6.8	6.7	6.7	7.4	7.4	7.4	7.5	7.0	7.0	7.0	7.0
8	5.9	6.0	6.0	6.0	6.0	6.0	6.1	6.1	6.2	6.3	6.4	6.7	6.7	6.8	6.7	6.7	7.4	7.4	7.4	7.5	7.0	7.0	7.0	7.0	7.0
7	6.0	6.0	6.0	6.0	6.0	6.1	6.1	6.2	7.1	7.1	7.1	7.1	7.1	7.1	7.2	7.2	7.4	7.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0
6	6.0	6.0	6.0	6.0	6.1	6.1	6.1	6.2	6.2	6.1	7.1	7.1	7.1	7.2	7.2	7.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
5	6.0	6.0	6.0	6.0	6.1	6.1	6.1	6.2	6.2	6.3	6.3	6.4	6.4	6.4	6.4	6.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
4	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.3	6.3	6.3	6.3	6.3	6.3	7.0	7.0	7.0	7.0	7.0	7.4	7.0	7.0	7.0
3	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.3	6.3	6.3	6.3	6.3	6.3	6.3	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
2	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.2	6.3	6.3	6.3	6.3	6.3	6.3	6.3	7.0	7.0	7.0	7.0	7.0	7.0	7.0
1	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.3	6.3	6.3	6.2	6.2	6.2	7.0	7.0	7.0	7.0	7.0

Figure 17. Computed Initial Conditions for Carbon Monoxide

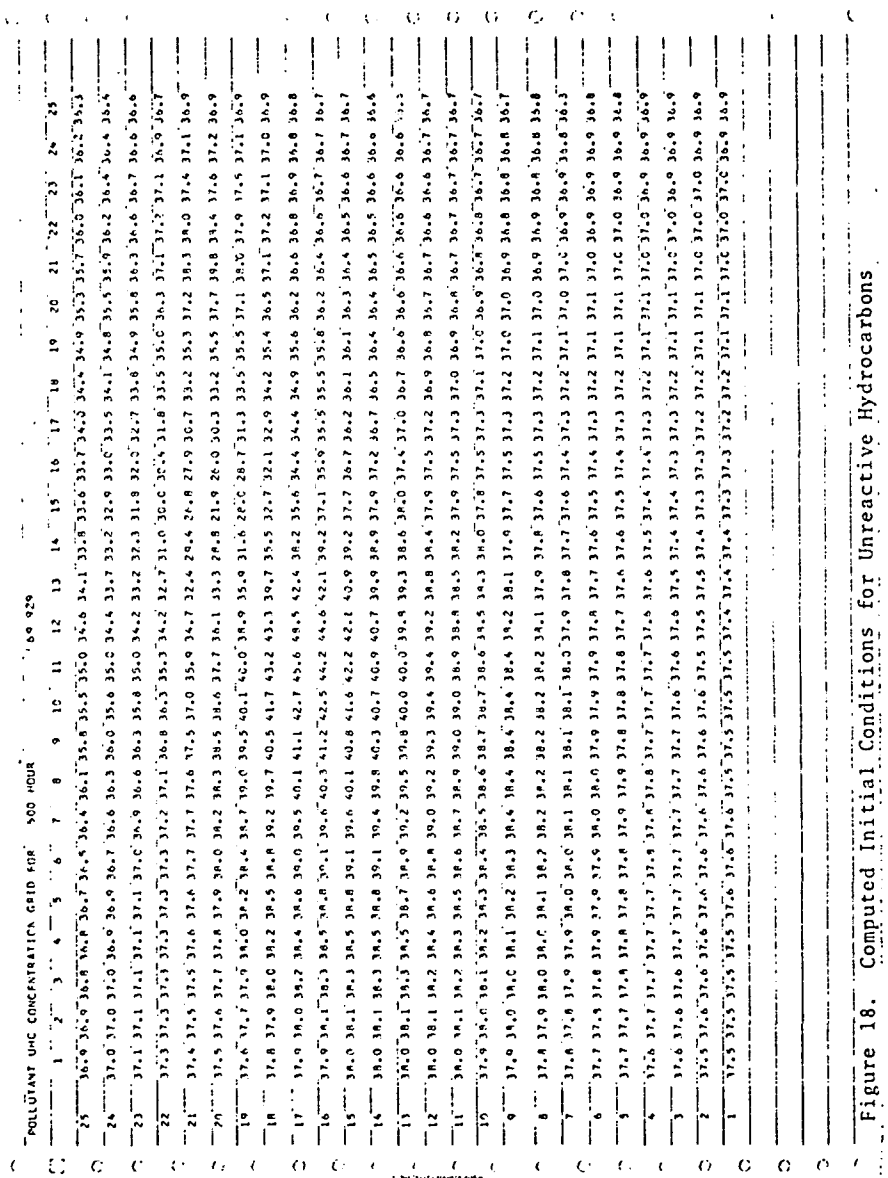


Figure 18. Computed Initial Conditions for Unreactive Hydrocarbons

V. AUTOMATIC PREPARATION OF MIXING DEPTHS

As described in Section II, an objective analysis of the inversion height (or mixing depth) can be very complicated. After much deliberation we decided that a model based on spatial correlations, as developed by Roth et al. (1971), is the preferred approach for the present project because

(1) It is relatively simple. It does not involve excessive computation; thus the burden of developing an automatic program is considerably eased. Furthermore, it does not require an extensive data base, such as the basin-wide temperature distributions, which are needed for some of the more sophisticated models we discussed in Section II.

(2) It is relatively reliable. Since the model is primarily based on measurements of the vertical profile of temperature, it should, within some degree of uncertainty, approximate reality. Therefore no extensive effort is required to validate the model.

(3) It closely resembles the model we used in the manual preparation of the mixing depths (see Roth et al. (1971)), so that comparison between the two can be made.

However, it should be noted that this approach, due to many special built-in features, is only applicable to the Los Angeles Air Basin.

In the first subsection, we describe the algorithm upon which the model is based. The results of computations based on its use are discussed in the second subsection.

A. THE ALGORITHM

Measured vertical temperature profiles, in conjunction with the guide-lines derived from numerous observations made by Edinger, which we discussed earlier in Section II B, form the strategic basis of the method we selected for the automatic preparation of mixing depth maps. This approach is feasible because, on one hand, vertical temperature measurements are available during the validation period for two to four times a day at three locations which fall on a line that is approximately perpendicular to the coastline. On the other hand, based on one of the findings of Edinger, contours of the constant inversion height over the Los Angeles basin have been found to be roughly parallel to the coastline. The procedure can be described, step by step, as follows

(1) Based on soundings made two to four times a day, temporal interpolation or extrapolation is carried out to provide estimates of average hourly mixing depths for each hour of interest at each of the three measurement sites. A simple linear interpolation or extrapolation rule is used for this purpose.

(2) The calculated hourly mixing depths are then assigned to squares lying on the corresponding contours plotted in Figure 19 as heavy dotted lines, with all grid points on the same contour having the same value of mixing depth.

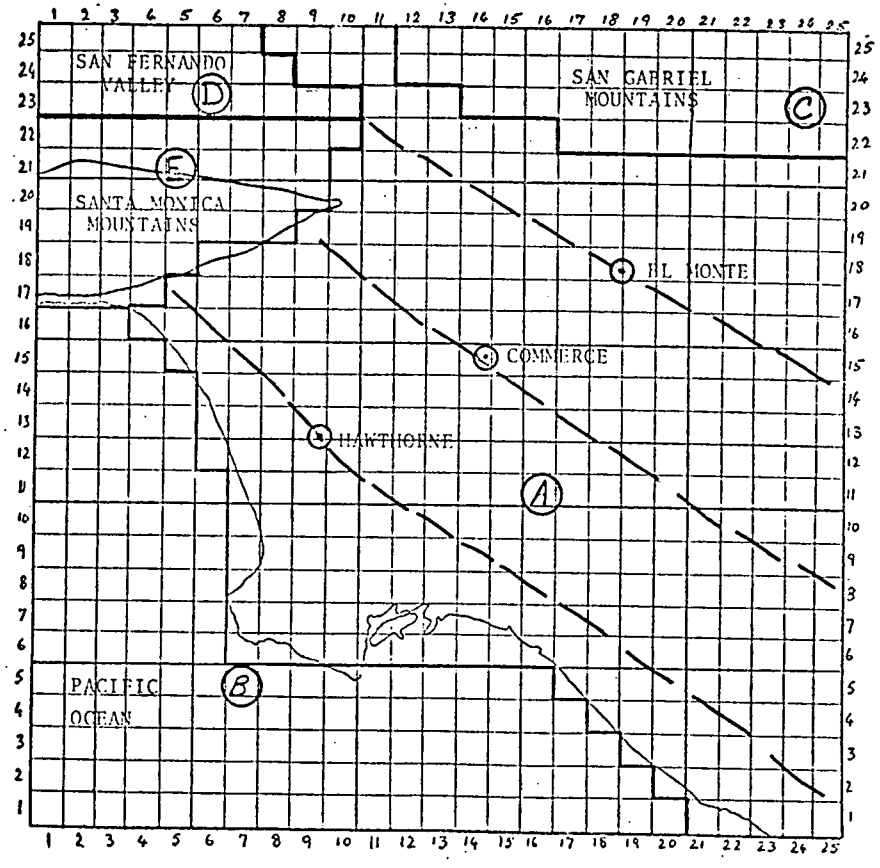


Figure 19. Map of Los Angeles for Mixing Depth Analysis

(3) For areas over the ocean (Region B in Figure 19) a constant mixing depth has been used for all grid points and for all hours. The value to be used has been determined from the morning (first) soundings made at Commerce and Hawthorne using linear interpolation,

$$Z_B = Z^o_{Hawthorne} + \frac{1}{2}(Z^o_{Hawthorne} - Z^o_{Commerce}) \quad (20)$$

where $Z^o_{Hawthorne}$=the morning sounding at Hawthorne

$Z^o_{Commerce}$=the morning sounding at Commerce

(4) For areas in the San Gabriel Mountains (Region C in Figure 19), a constant value has been used for all grid points, but this constant mixing depth may vary from hour to hour. The value used has, again, been computed through linear interpolation.

$$Z_C = Z_{El\ Monte} + \frac{3}{5}(Z_{El\ Monte} - Z_{Commerce}) \quad (21)$$

where $Z_{El\ Monte}$=hourly average mixing depths at El Monte

$Z_{Hawthorne}$=hourly average mixing depths at Hawthorne

(5) For areas in San Fernando Valley (Region D in Figure 19), mixing depths have been assumed to be the same for all grid points, and the assigned value is equal to that over El Monte at the same time.

(6) For areas in the Santa Monica Mountains (Region E in Figure 19), the mixing depths have been obtained through linear interpolations between values at Region D and Region E.

(7) For the rest of the squares in Region A of Figure 19, the mixing depths are calculated based upon known values at the nearest two contours, according to the following formula,

$$Z_A = \frac{d_1 Z_2 + d_2 Z_1}{d_1 + d_2} \quad (22)$$

where Z_1 and Z_2 are the hourly average mixing depths at the nearest two contours and d_1 and d_2 the distance from the grid point to the corresponding contours.

In addition to the above specific rules, we have imposed a minimum, as well as a maximum, for the calculated mixing depths.

$$100\ (ft) < Z < 2500\ (ft)$$

That is, whenever the calculated values fall below or above this limit, they will be replaced by the corresponding extremal values.

B. RESULTS AND DISCUSSION

Vertical temperature measurements regularly taken over the Los Angeles Basin prior to May 1971 were restricted to the radiosonde soundings made twice daily at Los Angeles International Airport at 6 a.m. and 10 a.m. PST. (Routine measurements have since been made at El Monte). During

the summer of 1969, however, the Scott Research Laboratories, as part of a comprehensive air-quality and meteorological data gathering program, made 26 aircraft flights over the Los Angeles Basin. Two flights were made on 29 September, commencing at about 7:30 a.m. and 12:00 noon PST, with a duration of about one and a half hours each. Vertical temperature profiles were among those aerometric parameters that were measured. These temperature measurements constitute the input data for the present program (Table 9, without asterisks). We have found, however, that these real measurements must be supplemented by additional estimates. This is necessary because straightforward temporal extrapolation (Step 1) on occasion produces results which appear to contradict the findings of Edinger, such as the unreasonable times at which peak heights occur and excessively large rate of change in mixing depths with time. For 29 September 1969 estimated data for the hours at 5 a.m. and 4 p.m. (based upon best judgment) were added at each of the three measurement sites (Table 9, with asterisks).

Table 9. INPUT DATA FOR INVERSION HEIGHTS

STATION	TIME	HEIGHT
HAW	500	435*
HAW	826	650
HAW	1228	700
HAW	1600	630*
COM	500	385*
COM	815	600
COM	910	850
COM	1206	1300
COM	1257	1000
COM	1600	960*
ELM	500	500*
ELM	756	500
ELM	924	825
ELM	1156	1700
ELM	1312	2800
ELM	1600	2800*

Based on the data discussed above and the strategies outlined in Section A, mixing depths have been calculated. Comparisons between the computed mixing depths and the manually prepared mixing depths have been made by evaluating the average deviations. The results are summarized in Table 10. Prior to 11 a.m., the average deviations range from 60 feet to 100 feet. This is probably acceptable considering the uncertainties of the input data. In the afternoon, during which the mixing depths were generally higher, the magnitude of the average deviations increase to about 200 feet, but in terms of percentages based on average mixing depths for the respective hour, the differences amount to about 5 to 10%. This should also be satisfactory for the present application. Samples of maps for the computed mixing depths are shown for 7 a.m., 10 a.m., and 1 p.m. PST for 29 September 1969 in Figures 20, 21 and 22 respectively.

Table 10. Average Deviation between Computed and Manually Prepared Mixing Depths

TIME, PST	AVERAGE DEVIATION, FEET
5	61.5
6	64.9
7	76.0
8	107.6
9	75.7
10	80.9
11	98.3
12	197.0
13	240.4
14	208.7
15	224.5
16	192.4

MIXING DEPTH GRID FOR 700 HOUR 69 929

	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
25	134	134	134	134	134	134	134	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24	134	134	134	134	134	134	134	134	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
23	134	134	134	134	134	134	134	134	134	134	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
22	168	168	168	166	165	163	161	159	157	160	137	106	100	100	100	100	100	100	100	100	100	100	100	100	100
21	231	202	231	199	155	191	187	193	179	217	186	156	140	106	100	100	100	100	100	100	100	100	100	100	100
20	239	237	235	230	224	217	210	204	199	212	243	209	180	151	142	106	100	100	100	100	100	100	100	100	100
19	268	271	268	260	250	241	232	224	215	326	233	262	232	203	175	148	144	106	100	100	100	100	100	100	100
18	305	306	300	297	274	425	413	395	385	366	345	315	292	253	224	197	170	144	123	106	100	100	100	100	100
17	329	360	327	309	443	447	432	417	403	389	374	350	332	302	273	244	217	191	166	141	122	107	100	100	100
16	375	375	375	402	448	470	454	439	425	410	396	381	367	353	339	291	264	237	211	186	162	138	121	107	100
15	375	375	375	375	432	483	477	461	447	432	417	403	389	375	347	337	309	282	256	230	205	191	158	136	120
14	375	375	375	375	375	465	497	479	468	454	438	425	413	396	382	369	354	324	299	273	249	224	200	177	155
13	375	375	375	375	375	473	461	490	497	475	465	446	432	418	404	390	376	345	342	316	290	265	241	218	195
12	375	375	375	375	375	375	428	468	443	496	482	467	453	439	425	411	397	383	370	355	331	306	282	258	235
11	375	375	375	375	375	375	402	432	456	478	496	445	474	459	445	431	418	404	391	377	343	346	321	297	274
10	375	375	375	375	375	375	391	413	434	455	474	450	444	465	466	452	438	424	411	398	334	371	353	336	312
9	375	375	375	375	375	375	375	391	415	436	458	464	441	464	483	472	458	445	431	418	404	351	378	366	350
8	375	375	375	375	375	375	375	375	393	413	434	444	455	487	487	437	479	465	451	438	424	411	398	385	373
7	375	375	375	375	375	375	375	386	394	404	413	414	424	433	446	467	497	477	471	457	444	431	418	405	392
6	375	375	375	375	375	375	375	375	375	375	386	393	392	365	405	417	455	488	485	477	464	450	437	424	411
5	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	415	447	473	496	483	470	457	444	431
4	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	409	440	469	494	485	476	463	450
3	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	406	435	461	485	493	482	469
2	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	404	433	455	477	498	486
1	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	401	426	449	473	490

Figure 20. Computed Mixing Depths for 7 am, 29 September 1969

MIXING DEPTH GRID FOR 1000 HOUR 69 929

	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
25	732	732	732	732	732	732	732	697	647	693	686	681	681	681	681	681	681	681	681	681	681	681	681	681	681
24	732	732	732	732	732	732	732	732	710	733	691	683	684	681	681	681	681	681	681	681	681	681	681	681	681
23	732	732	732	732	732	732	732	732	732	732	711	702	696	687	681	681	681	681	681	681	681	681	681	681	681
22	681	681	681	681	655	688	671	694	697	742	733	721	712	704	697	690	684	681	681	681	681	681	681	681	681
21	631	630	631	635	640	647	653	657	664	763	751	749	734	721	713	706	699	693	687	682	681	681	681	681	681
20	581	579	581	588	599	608	616	627	635	784	772	760	749	734	725	721	714	707	701	695	690	685	681	685	687
19	532	529	532	544	558	573	586	598	609	805	792	780	769	753	747	737	736	721	715	708	703	697	692	687	683
18	484	477	485	501	524	717	739	761	782	803	812	830	788	777	765	756	745	736	728	721	715	709	704	699	694
17	441	428	443	471	623	686	758	729	749	771	791	814	807	796	785	774	763	753	744	736	727	721	716	710	705
16	375	375	375	595	549	652	674	696	717	739	765	760	801	814	833	792	781	771	761	751	742	735	727	721	716
15	375	375	375	375	548	578	642	664	685	737	729	749	769	790	813	809	798	786	778	768	759	750	741	732	726
14	375	375	375	375	375	563	674	573	654	675	697	717	739	769	779	799	815	805	795	785	775	766	757	749	740
13	375	375	375	375	375	416	536	591	586	644	665	686	707	724	748	768	788	812	811	801	791	782	772	764	755
12	375	375	375	375	375	375	475	531	577	601	635	654	677	697	719	738	758	777	797	816	807	797	788	779	770
11	375	375	375	375	375	375	427	482	528	567	602	599	646	667	687	706	726	747	767	786	811	813	803	794	785
10	375	375	375	375	375	375	387	440	486	525	563	591	594	637	657	676	698	718	737	757	776	765	815	809	800
9	375	375	375	375	375	375	375	405	452	489	535	549	574	596	578	648	668	688	708	727	747	765	785	803	816
8	375	375	375	375	375	375	375	375	410	457	490	504	523	549	544	584	639	659	679	699	718	737	756	775	793
7	375	375	375	375	375	375	375	395	392	439	446	456	468	485	509	547	603	567	650	670	689	708	727	746	765
6	375	375	375	375	375	375	375	375	375	375	399	409	407	414	423	455	525	588	581	641	661	680	699	718	737
5	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	446	510	567	599	632	652	671	690	709
4	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	439	498	551	599	582	643	662	681
3	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	434	487	537	581	596	635	653
2	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	429	479	524	567	605	582
1	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	425	471	514	554	591

Figure 21. Computed Mixing Depths for 10 am, 29 September 1969

Figure 22. Computed Mixing Depths for 1 pm, 29 September 1969

VI. AUTOMATIC PREPARATION OF BOUNDARY CONDITIONS

The objective of the present section is to formulate a method which is capable of prescribing boundary conditions automatically. These boundary conditions, which consist of an array of 4 x 25 values of concentration per hour for each species, will be used as input to our airshed model. There are two major difficulties that must be faced in constructing an appropriate algorithm:

(1) The lack of any real measurements which can be truly described as boundary conditions. The only exception to this is the measurements made at the Pomona station, which is located at the eastern boundary of the modeling region.

(2) The inadequacy of simple extrapolation techniques for developing a predicted concentration field using measurements made by stations close to the boundary. In many cases the distance between the boundary and the nearest station is large, so that a time lag of hours may exist. The difficulty is compounded in many cases by the fact that large emissions sources may be present between the boundary and the station. An accurate determination from the station measurements of the value at the boundary would, thus, necessitate the use of a predictive model!

In the following, we will describe the details of a method which closely resembles the procedure followed in preparing the boundary conditions manually. We also present results generated using the method.

A. THE ALGORITHM

As we have noted earlier, the prescription of the boundary conditions is by no means trivial. The process is plagued on one hand by the absence of real measurements at the boundary and, on the other hand, by the need to incorporate information concerning the dynamics of the transport and dispersion of pollutants when extrapolation of interior measurements is contemplated. This algorithm has as its basis the experience we gained in preparing manually the boundary conditions for the six validation days. These difficulties notwithstanding, we have formulated an algorithm which we believe embraces the essential features of the manual procedure, yet is simple enough to be of general use.

In accordance with a qualitative criterion based on the overall meteorological or air pollution characteristics pertaining to the region, we have divided the boundary of the airshed into the following three categories as illustrated in Fig. 23.

(1) CATEGORY A

Boundaries falling into this category are generally characterized by a influx of air earlier in the morning, followed by an outward flow at a later time as the sea breeze is established over the basin. Fortunately, the boundary conditions specified during the later period of outflow are immaterial; they will not be used by the airshed model. Specification of the boundary conditions during the period of inflow can be simplified if we view the situation as the return flow of polluted air from the basin. In this case, assuming that

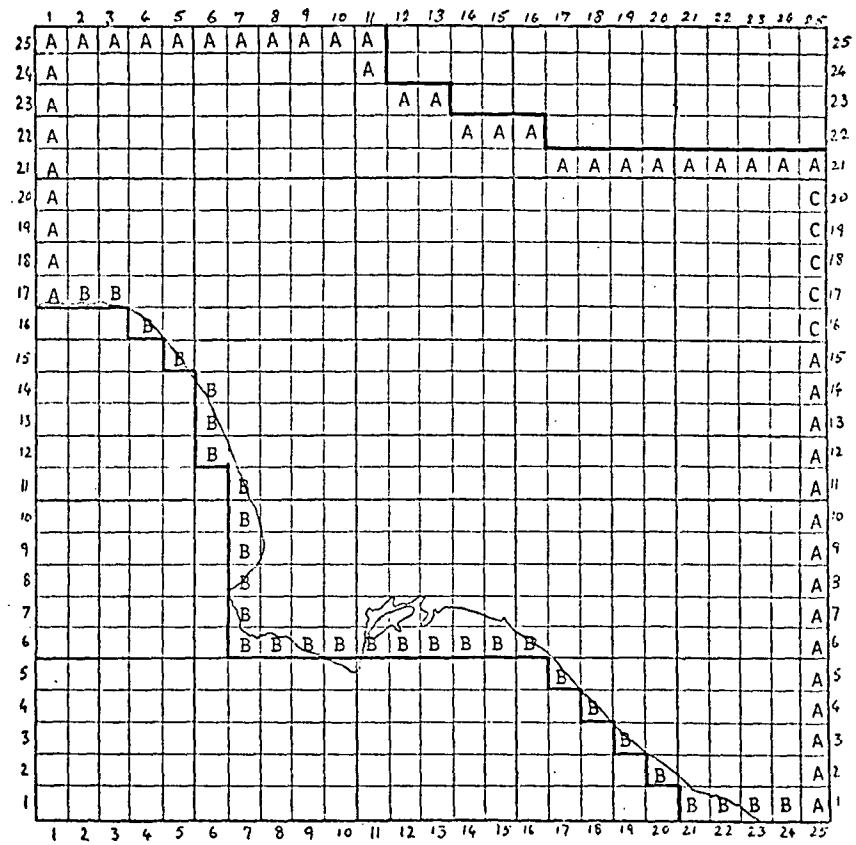


Figure 23. Map of Los Angeles for Boundary Conditions Analysis

there are no major sources beyond the boundary points, the concentrations of the influx should decay from the initial values at 5 am because of the dilution along the way. Thus we may write for boundary points of category A,

$$c_i(t) = \begin{cases} \beta_i c_{i_o} - \alpha_i (t - T_o) & T_o < t < T_B \\ c_{i_B} & T_B < t < T_E \end{cases} \qquad (23)$$

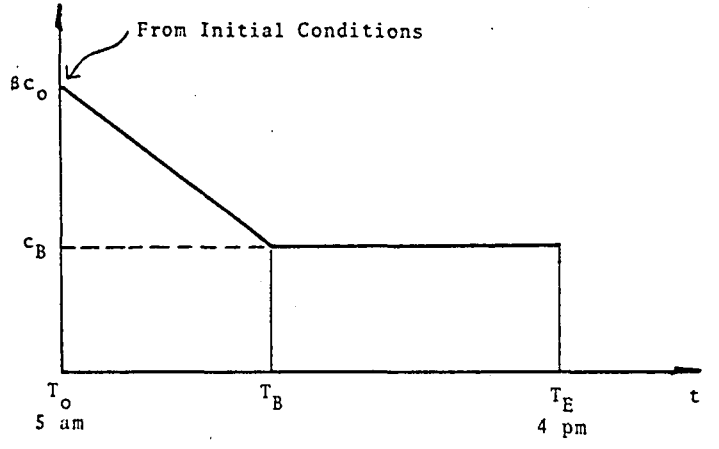
where

- c_i the pollutant concentration of species i at the boundary at time t
- c_{i_o} the initial pollutant concentration of species i at the boundary
- α_i the rate of decay for species i
- β_i the discount factor from initial concentration of species i
- c_{i_B} the background concentration of species i
- T_B the time at which the concentration of the return flow approaches background value
- T_o the starting time
- T_E the ending time

The concentration history is illustrated in Figure 24(a).

CATEGORY A

(a)



CATEGORY B

(b)

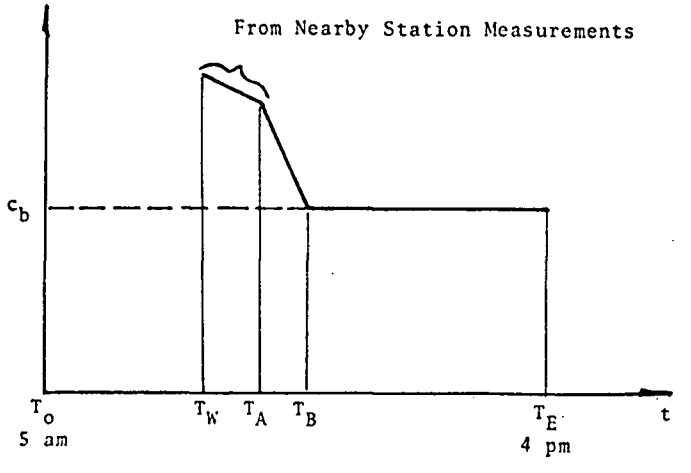


Figure 24 Concentration Histories for Boundary Conditions Preparations

(2) CATEGORY B

The boundary region falling into this category is characterized by an outflow in the morning, followed by an inflow at a later time, conditions just the opposite of those of CATEGORY A. Before the reversal of the wind, the values chosen for the boundary conditions are of no consequence. Immediately after the wind reversal, information concerning the pollutant concentrations of the return flow should be contained in the measurements made by the nearby stations. These measured data will be used with modifications to allow for 1) the lag between the time of departure of air from the vicinity of the monitoring station and the time to re-entry at the boundary, and 2) the dispersion that will have taken place over the time interval. After a period of time, one would expect that the nearby station measurements will no longer be related to the concentrations of inflow. To deal with this situation, a cut-off time has been specified, a constant decay is allowed from this onset of the cut-off until the background values are reached. To summarize,

$$c_i(t) = \begin{cases} \beta_i c_{i_s}(t - T_c) & T_W < t < T_A \\ \beta_i c_{i_s}(T_A - T_c) - \alpha_i(t - T_A) & T_A < t < T_B \\ c_{i_B} & T_B < t < T_E \end{cases} \tag{24}$$

where

c_{i_s} the measurement of species i made at a nearby station

T_c the time lag

T_W the time of wind reversal

T_A the cut-off time henceforward the station measurements will not be used

The rest of the parameters are defined as in Equation (23). A sketch of the concentration history is presented in Figure 24(b).

(3) CATEGORY C

We have classified a region of the boundary to belong to CATEGORY C if there is an air quality measuring station in the immediate vicinity of the boundary. As shown in Figure 23, only a part of the eastern boundary in the neighborhood of the Pomona station qualifies. In this region, pollutant concentrations measured at the Pomona station are used to specify boundary conditions at the point closest to the station. Between this point and the intersections of categories A and C, linear interpolation is carried out.

B. RESULTS AND DISCUSSIONS

Again, 29 September 1969 has been chosen to test the strategy we have outlined above. The same set of air quality data discussed in Section III has been used as input. The calculated boundary conditions have also been compared with those prepared manually based on the same criterion - the

square root of the average squares of the differences between the two.

The results of the comparison calculations for the critical period between 5 a.m. and 10 a.m. are listed in Table 11. Again, it can be demonstrated that the differences for carbon monoxide and unreactive hydrocarbons are sufficiently small. For nitric oxide, nitrogen dioxide and reactive hydrocarbons, the magnitudes of the differences are larger, but seem acceptable.

Samples of the computed boundary conditions at 7 am, 10 am, and 1 pm are shown in Figures 25 through 27.

Table 11. Differences Between Computed and Manually Prepared Boundary Conditions

Time (PST)	RHC (ppm)	NO (pphm)	O_x* (pphm)	NO_2 (pphm)	CO (ppm)	URHC (ppm)
5 am	0.67	3.5	-	1.8	1.1	1.2
6 am	0.68	2.7	-	1.6	1.0	1.2
7 am	0.53	2.3	-	2.1	1.3	1.2
8 am	0.58	1.6	-	2.0	1.3	1.3
9 am	0.57	2.1	-	2.4	1.3	1.3
10 am	0.63	1.0	-	2.4	0.9	0.87

* The boundary conditions for the oxidant, again, are calculated from the chemical equilibrium relationship in the SAI airshed model, therefore, no boundary condition map has been prepared manually.

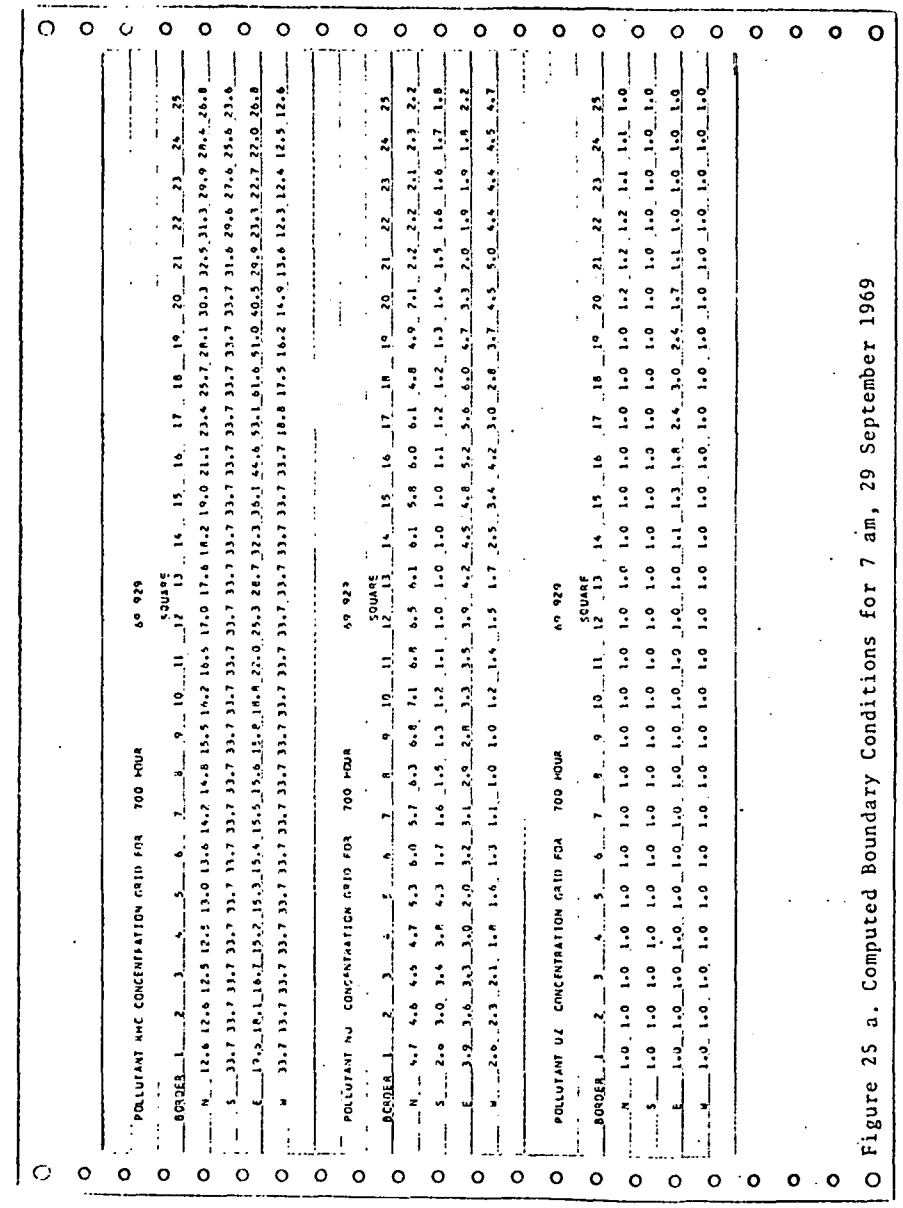


Figure 25 a. Computed Boundary Conditions for 7 am, 29 September 1969

POLLUTANT N2 CONCENTRATION GRID FOR 700 HOUR 69 929

BORDER	SQUARE 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
N	4.3	4.3	4.3	4.3	4.6	4.8	4.6	4.8	5.0	5.1	4.7	4.2	4.3	4.1	4.1	4.4	4.7	5.6	5.9	6.4	6.9	6.7	6.5	7.0	6.7
S	4.7	5.4	6.2	6.9	7.6	4.3	3.9	3.5	3.2	2.8	2.4	2.1	1.7	2.0	2.4	2.7	3.0	3.3	3.7	4.0	4.3	4.7	5.0	5.3	5.7
E	4.4	4.0	3.7	3.4	3.0	3.1	3.1	3.4	3.4	4.0	4.8	5.5	6.2	7.1	8.0	11.3	14.7	18.0	14.1	10.2	6.3	5.7	5.6	5.5	6.7
W	4.7	4.3	3.8	3.4	3.0	2.6	2.1	1.7	2.2	2.7	3.2	3.7	4.2	5.4	6.5	7.6	3.8	3.6	4.1	4.5	4.8	4.3	4.3	4.3	4.3

POLLUTANT CO CONCENTRATION GRID FOR 700 HOUR 69 929

BORDER	SQUARE 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
N	3.5	3.5	3.5	3.5	3.7	3.9	4.2	4.4	4.7	4.9	4.3	3.7	3.9	3.9	3.8	4.1	4.4	5.7	6.0	5.2	5.4	5.2	4.9	4.6	4.3
S	3.8	4.1	4.5	4.8	5.1	3.4	3.3	3.2	3.0	2.9	2.8	2.7	2.5	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9	3.0
E	3.1	2.8	2.6	2.4	2.4	2.4	2.4	2.4	2.4	2.8	3.6	4.0	4.5	5.0	5.4	6.6	7.8	9.0	7.5	6.0	4.5	3.6	3.5	3.5	4.3
W	3.8	3.6	3.5	3.3	3.1	2.9	2.7	2.6	2.7	2.9	3.1	3.2	3.4	4.0	4.5	5.1	2.7	2.5	3.1	3.5	3.8	3.4	3.4	3.4	3.5

POLLUTANT UHC CONCENTRATION GRID FOR 700 HOUR 69 929

BORDER	SQUARE 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
N	10.6	10.6	10.6	10.6	11.0	11.5	11.9	12.3	12.7	13.0	12.9	12.8	12.6	12.7	12.7	13.7	14.8	15.9	17.1	18.3	19.5	18.8	18.1	17.3	16.5
S	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	28.8	26.9	25.1	23.3	21.4
E	14.5	13.4	12.3	11.1	11.1	11.1	11.1	11.1	11.1	11.1	13.1	15.1	17.1	19.1	21.0	23.1	27.4	31.7	36.0	29.9	23.8	17.8	13.9	13.6	13.4	16.5
W	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	17.1	15.9	14.6	13.3	12.0	10.7	10.7	10.7	10.6

Figure 25 b. Computed Boundary Conditions for 7 am, 29 September 1969

POLLUTANT RHC CONCENTRATION GRID FOR 1000 HOUR 69 929

BORDER	SQUARE 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
N	2.0	2.0	2.0	2.0	2.4	2.9	3.3	3.8	4.3	4.8	5.1	5.5	5.8	6.3	6.8	8.3	10.0	11.8	13.6	15.4	17.1	15.7	14.3	12.7	11.2
S	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	27.0	25.6	24.3	22.9	21.6
E	3.7	4.9	1.1	1.0	3.3	3.3	3.3	3.3	3.4	7.0	10.8	14.7	18.8	23.0	27.4	34.2	40.9	47.7	37.1	26.6	16.1	8.3	7.4	6.5	11.2
W	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	14.3	11.8	9.4	6.9	4.4	1.9	1.9	2.0	2.0

POLLUTANT NO CONCENTRATION GRID FOR 1000 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.3	1.3	1.6	1.9	2.1	2.1	2.1	2.0	2.1	2.1	2.4	2.6	2.2	2.3	1.0	1.2	1.1	1.0	1.1	1.0
S	3.1	2.9	2.7	2.5	2.4	2.1	2.3	2.6	2.8	3.1	3.3	3.6	3.8	3.7	3.6	3.4	3.3	3.1	3.0	2.9	2.7	2.6	2.5	2.3	2.2
E	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.7	2.3	2.8	3.2	3.6	2.8	1.9	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0
W	3.1	3.2	3.3	3.4	3.5	3.4	3.7	3.8	3.5	3.1	2.8	2.4	2.1	2.2	2.3	2.4	2.3	1.9	2.2	2.1	1.6	1.0	1.0	1.0	1.0

POLLUTANT O2 CONCENTRATION GRID FOR 1000 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
S	5.4	5.1	4.7	4.4	4.0	1.6	1.5	1.4	1.3	1.1	1.0	1.0	1.0	1.6	2.5	3.3	4.1	5.0	5.8	6.6	6.6	6.6	6.5	6.5	6.5
E	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0	13.0	19.0	12.9	6.7	1.0	1.0	1.0	1.0	1.0
W	5.4	6.0	6.6	5.5	4.3	3.1	2.0	1.0	1.0	1.1	1.3	1.4	1.6	2.4	3.2	4.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Figure 26 a. Computed Boundary Conditions for 10 am, 29 September 1969

POLLUTANT N2 CONCENTRATION GRID FOR 1000 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.4	1.5	1.4	1.3	1.4	1.4	1.5	1.7	2.0	2.5	2.9	3.2	3.6	3.4	3.1	3.2	2.8
S	8.1	8.0	7.9	7.8	7.7	5.6	6.0	6.4	6.8	7.2	7.6	8.1	8.5	8.5	8.6	8.6	8.6	8.7	8.7	8.8	8.8	8.9	8.9	9.0	9.0
E	2.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	2.3	3.2	4.1	5.0	6.1	7.4	8.7	10.0	7.8	5.6	3.4	2.0	1.8	1.6	2.8
W	8.1	8.1	8.2	8.2	8.3	8.4	8.4	8.5	7.9	7.3	6.7	6.1	5.6	6.3	7.0	7.7	2.9	2.4	2.4	2.1	1.6	1.0	1.0	1.0	1.0

POLLUTANT CO CONCENTRATION GRID FOR 1000 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.3	1.4	1.3	1.2	1.3	1.3	1.4	1.6	1.9	2.6	2.9	2.6	2.9	2.6	2.3	2.1	1.8
S	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7
E	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7	2.3	2.9	3.5	4.1	4.7	5.4	6.0	6.8	3.6	2.4	1.3	1.2	1.0	1.8
W	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.2	3.0	2.8	2.1	1.7	1.8	1.6	1.3	1.0	1.0	1.0

POLLUTANT UHC CONCENTRATION GRID FOR 1000 HOUR 69 929

BORDER	SQUARE 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
N	1.7	1.7	1.7	1.7	2.0	2.4	2.8	3.1	3.5	3.8	4.0	4.1	4.2	4.4	4.5	5.4	6.3	7.3	8.3	9.3	10.3	9.5	8.6	7.7	6.9
S	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	18.0	16.8	15.5	14.3	13.1
E	6.5	3.7	1.0	1.0	2.4	2.4	2.4	2.4	2.4	4.9	7.4	9.9	12.5	15.0	17.5	20.7	23.8	27.0	21.2	15.4	9.5	5.0	4.4	3.9	6.9
W	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	13.1	10.8	8.5	6.2	3.9	1.7	1.7	1.7	1.7

Figure 26 b. Computed Boundary Conditions for 10 am, 29 September 1969

POLLUTANT RHC CONCENTRATION GRID FOR 1300 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.6	1.9	2.3	2.7	4.1	5.6	7.1	8.7	10.4	12.0	5.3	3.6	2.3	1.0
S	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9
E	9.7	4.9	1.1	1.0	3.3	3.3	3.3	3.3	3.4	7.0	10.9	14.7	18.8	23.0	27.4	24.9	22.3	19.8	15.5	11.2	6.8	1.0	2.3	1.3	6.0
W	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.5	11.9	11.9	11.9	12.8	10.0	7.2	4.3	1.4	1.0	1.0	1.0	1.0

POLLUTANT NO CONCENTRATION GRID FOR 1300 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.5	1.3	1.5	1.0	1.0	1.0	1.0	1.0	1.0
S	5.1	4.0	2.9	1.7	1.3	1.7	2.8	4.0	5.1	6.2	7.3	8.5	9.6	9.2	8.8	8.5	8.1	7.7	7.3	7.0	4.6	6.2	5.8	5.5	5.1
E	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.7	2.3	2.8	3.2	3.6	2.8	1.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
W	5.1	5.7	6.4	7.0	7.7	8.3	9.0	9.6	8.5	7.4	6.2	5.1	4.0	2.9	1.7	1.0	2.1	1.6	1.7	1.3	1.0	1.0	1.0	1.0	1.0

POLLUTANT O2 CONCENTRATION GRID FOR 1300 HOUR 69 929

BORDER	SQUARE 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
N	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
S	6.6	6.4	6.3	6.1	6.0	4.8	4.7	3.6	3.0	2.4	1.8	1.2	1.0	1.5	2.5	3.4	4.4	5.3	6.3	7.2	7.2	7.2	7.2	7.2	7.2
E	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.6	14.3	21.0	14.1	7.2	1.0	1.0	1.0	1.0	1.0
W	6.6	6.9	7.2	5.9	4.6	3.2	1.9	1.0	1.4	2.3	3.1	4.0	4.8	5.2	5.6	6.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Figure 27 a. Computed Boundary Conditions for 1 pm, 29 September 1969

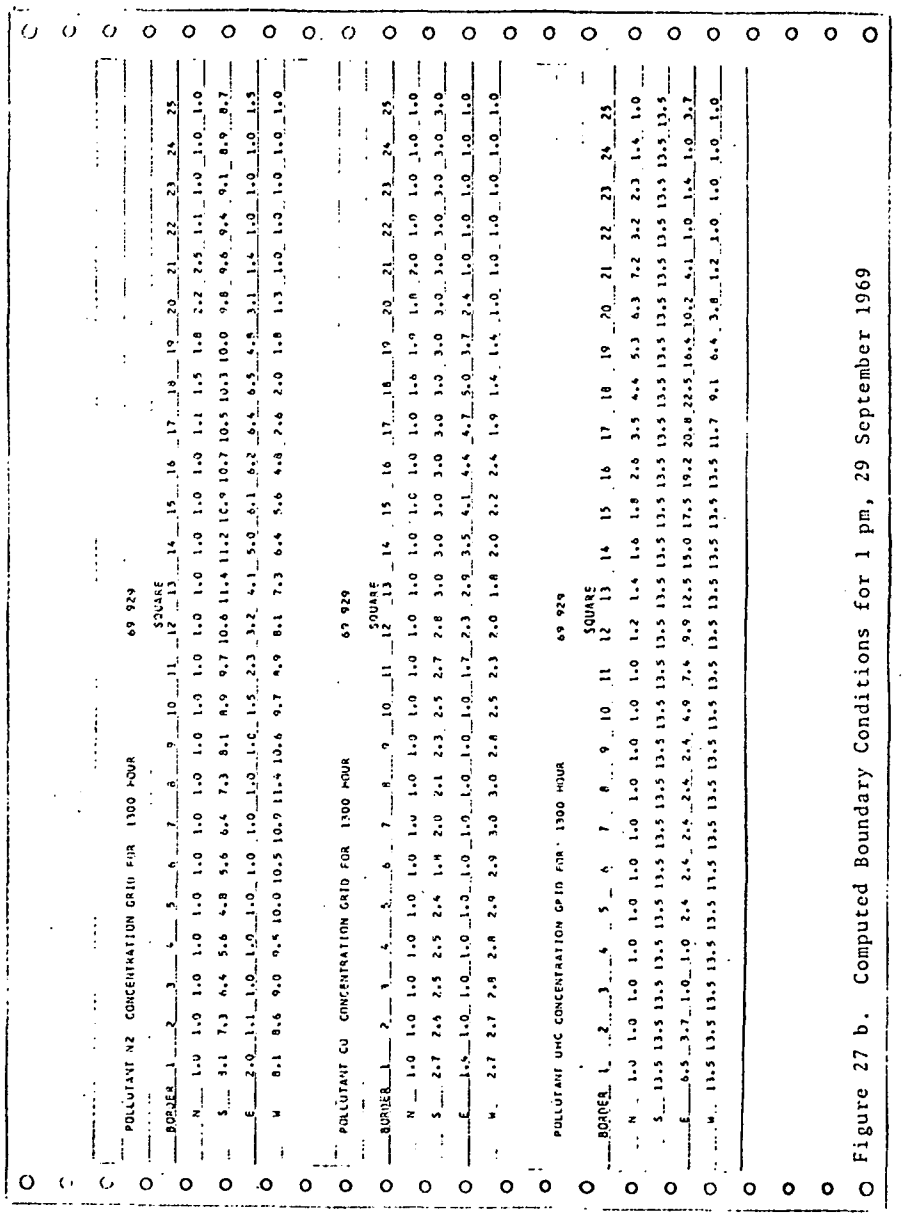


Figure 27 b. Computed Boundary Conditions for 1 pm, 29 September 1969

VII. CONCLUSIONS AND RECOMMENDATIONS

In the preceding four sections, we have discussed the development of methods for the automatic generation of the wind field, the initial conditions, the mixing depths, and the boundary conditions. As we have stated before, the methods adopted for each of these four cases are considered, in general, to be "acceptably good". By this we mean that, given the level of accuracy of the available meteorological and air quality data (which generally ranges from fair to adequate, although in some cases it is good), the predicted results compare favorably with the measured. We note, however, that critical testing of the methods must await the availability of more reliable test data, such as those to be collected during the LARPP program.

Improvements, of course, can be made through minor modifications of the basic schemes we have described in the present report. In the case of wind direction interpolation, an a priori "smoothing" of the wind direction measurements would be highly desirable, especially during the hours of the chaotic transition between the land and sea breeze. This procedure can be justified by the fact that during this period, typically characterized by low winds, uncertainties in the wind direction measurements can be quite large. With regard to air quality interpolation, the distance that measurements of a concentration of a photochemical pollutant can be extrapolated is quite limited. This implies that a larger number of monitoring stations may well be needed to yield a complete description of the distributions of photochemical species.

On the other hand, we feel that improvement in the prediction of mixing depths can be brought about only through more field measurements. This is particularly true during the afternoon hours and in the San Fernando Valley.

The automatic boundary condition program appears to be the most complicated as far as the structure of the strategy is concerned. Therefore, many modifications can conceivably be made to give a closer description of reality. We will not enumerate all the possibilities here. Instead we will only point out an apparent one that the present program is unable to cope with, the fact that nitrogen dioxide concentrations increase in the return flow during the period of late morning or early afternoon.

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APPENDIX 1. MEASURED AND CALCULATED WIND SPEEDS AND WIND DIRECTIONS

Date: September 29, 1969

Station: RESD

Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	8	10	S	SW	0.0	35.2	1.0	0.5
100	8	9	S	SSW	0.0	29.3	1.0	1.0
200	13	11	WNW	WSW	112.5	59.8	1.0	1.7
300	3	3	ENE	ENE	247.5	253.2	1.0	1.3
400	1	3	NNE	ENE	202.5	240.6	2.0	2.1
500	9	12	SSW	W	22.5	86.8	3.0	1.7
600	15	11	NNW	WSW	157.5	68.3	2.0	1.2
700	5	6	ESE	SE	292.5	306.9	1.0	0.9
800	11	7	WSW	SSE	67.5	327.0	1.0	1.0
900	8	12	S	W	0.0	93.5	1.0	1.4
1000	3	12	ENE	W	247.5	95.4	1.0	1.3
1100	9	12	SSW	W	22.5	87.9	1.0	1.4
1200	3	12	ENE	W	247.5	86.0	2.0	3.0
1300	6	12	SE	W	315.0	88.0	2.0	2.9
1400	4	13	E	WNW	270.0	113.4	2.0	4.4
1500	12	14	W	NW	90.0	127.4	7.0	4.8
1600	13	13	WNW	WNW	112.5	115.2	8.0	4.3
1700	11	13	WSW	WNW	67.5	114.0	6.0	3.2
1800	12	13	W	WNW	90.0	101.3	3.0	2.0
1900	12	12	W	W	90.0	90.0	2.0	1.7
2000	11	11	WSW	WSW	67.5	67.5	2.0	2.0
2100	15	6	NNW	SE	157.5	314.3	1.0	0.6
2200	15	5	NNW	ESE	157.5	301.3	1.0	0.6
2300	8	10	S	SW	0.0	40.1	1.0	1.1

Date: September 29, 1969
Station: PASA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	14	16	NW	N	135.0	190.3	2.0	2.5
100	15	16	NNW	N	157.5	176.1	3.0	2.2
200	16	12	N	W	180.0	86.5	2.0	1.5
300	15	13	NNW	WNW	157.5	113.1	2.0	2.6
400	14	1	NW	NNE	135.0	202.0	3.0	3.6
500	2	1	NE	NNE	225.0	201.1	2.0	1.6
600	11	13	WSW	WNW	67.5	121.3	2.0	3.1
700	15	2	NNW	NE	157.5	219.1	2.0	1.3
800	2	1	NE	NNE	225.0	211.1	1.0	0.9
900	10	14	SW	NW	45.0	137.3	1.0	0.4
1000	7	11	SSE	WSW	337.5	57.2	2.0	2.8
1100	8	10	S	SW	0.0	51.5	2.0	5.4
1200	9	10	SSW	SW	22.5	51.5	3.0	6.9
1300	8	11	S	WSW	0.0	58.9	3.0	7.1
1400	10	11	SW	WSW	45.0	60.9	4.0	7.6
1500	10	11	SW	WSW	45.0	76.7	6.0	7.2
1600	10	11	SW	WSW	45.0	66.8	3.0	6.5
1700	10	11	SW	WSW	45.0	67.5	2.0	4.7
1800	2	11	NE	WSW	225.0	56.8	1.0	3.9
1900	2	10	NE	SW	225.0	53.4	1.0	2.7
2000	16	9	N	SSW	180.0	33.7	1.0	1.8
2100	2	10	NE	SW	225.0	55.8	1.0	1.2
2200	15	13	NNW	WNW	157.5	120.9	1.0	0.5
2300	14	12	NW	W	135.0	91.7	2.0	1.0

Date: September 29, 1969
Station: AZU
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	8	15	S	NNW	0.0	163.5	1.0	2.5
100	16	2	N	NE	180.0	223.9	4.0	2.2
200	6	5	SE	ESE	315.0	296.1	2.0	1.5
300	11	10	WSW	SW	67.5	44.6	3.0	0.9
400	12	15	W	NNW	90.0	156.2	1.0	2.7
500	4	3	E	ENE	270.0	257.2	4.0	3.0
600	14	8	NW	S	135.0	349.4	4.0	2.0
700	14	4	NW	E	135.0	275.8	2.0	2.8
800	4	4	E	E	270.0	259.5	2.0	1.7
900	5	5	ESE	ESE	292.5	295.4	2.0	1.3
1000	3	12	ENE	W	247.5	79.3	1.0	2.0
1100	9	11	SSW	WSW	22.5	71.3	5.0	3.8
1200	9	11	SSW	WSW	22.5	68.0	7.0	4.9
1300	10	11	SW	WSW	45.0	63.5	7.0	5.8
1400	9	11	SSW	WSW	22.5	71.4	9.0	7.0
1500	9	12	SSW	W	22.5	87.5	10.0	8.9
1600	9	12	SSW	W	22.5	80.3	11.0	7.9
1700	9	11	SSW	WSW	22.5	70.3	9.0	5.9
1800	9	10	SSW	SW	22.5	55.0	5.0	3.5
1900	8	10	S	SW	0.0	54.0	2.0	2.2
2000	9	9	SSW	SSW	22.5	11.9	2.0	1.1
2100	9	3	SSW	ENE	22.5	254.9	1.0	0.7
2200	4	1	E	NNE	270.0	201.5	1.0	1.0
2300	2	1	NE	NNE	225.0	197.1	1.0	0.6

Date: September 29, 1969
Station: WEST
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	1	4	NNE	E	202.5	265.2	1.0	0.2
100	11	9	WSW	SSW	67.5	15.9	1.0	1.9
200	12	12	W	W	90.0	79.4	1.0	2.0
300	12	10	W	SW	90.0	43.3	1.0	1.6
400	2	2	NE	NE	225.0	226.1	3.0	5.4
500	12	11	W	WSW	90.0	73.6	1.0	4.3
600	14	11	NW	WSW	135.0	74.7	1.0	1.4
700	12	2	W	NE	90.0	223.0	1.0	0.1
800	9	10	SSW	SW	22.5	49.6	1.0	1.8
900	10	12	SW	W	45.0	87.9	1.0	3.7
1000	10	12	SW	W	45.0	80.7	2.0	2.7
1100	10	11	SW	WSW	45.0	60.5	4.0	4.3
1200	10	11	SW	WSW	45.0	74.7	5.0	6.5
1300	10	11	SW	WSW	45.0	71.2	4.0	6.0
1400	10	11	SW	WSW	45.0	75.6	3.0	6.6
1500	10	12	SW	W	45.0	80.1	4.0	7.3
1600	9	12	SSW	W	22.5	80.8	4.0	6.2
1700	9	11	SSW	WSW	22.5	63.6	2.0	4.3
1800	9	10	SSW	SW	22.5	47.6	1.0	4.0
1900	8	9	S	SSW	0.0	33.1	1.0	2.5
2000	8	8	S	S	0.0	349.8	1.0	2.6
2100	7	7	SSE	SSE	337.5	343.0	1.0	2.5
2200	1	6	NNE	SE	202.5	316.8	1.0	1.4
2300	1	8	NNE	S	202.5	358.7	1.0	1.4

Date: September 29, 1969
Station: ELM
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	1	15	NNE	NNW	202.5	165.2	5.0	1.5
100	4	15	E	NNW	270.0	161.4	4.0	2.7
200	9	13	SSW	WNW	22.5	106.0	3.0	0.8
300	12	13	W	WNW	90.0	111.6	3.0	2.0
400	16	15	N	N	130.0	190.7	5.0	1.9
500	3	15	ENE	NNW	247.5	162.5	6.0	1.1
600	13	13	WNW	WNW	112.5	110.6	4.0	2.6
700	5	15	ESE	NNW	292.5	164.4	4.0	1.9
800	2	1	NE	NNE	225.0	196.0	2.0	0.6
900	5	11	ESE	WSW	292.5	63.9	2.0	0.4
1000	12	10	W	SW	90.0	37.8	2.0	2.3
1100	10	10	SW	SW	45.0	49.1	6.0	4.3
1200	10	10	SW	SW	45.0	51.6	8.0	5.5
1300	10	11	SW	WSW	45.0	62.9	10.0	5.9
1400	10	11	SW	WSW	45.0	61.2	11.0	6.5
1500	12	11	W	WSW	90.0	59.2	12.0	6.6
1600	11	11	WSW	WSW	67.5	58.9	11.0	6.0
1700	10	11	SW	WSW	45.0	66.3	8.0	4.7
1800	9	10	SSW	SW	22.5	55.4	7.0	2.9
1900	10	9	SW	SSW	45.0	19.0	6.0	1.7
2000	10	8	SW	S	45.0	3.3	4.0	1.1
2100	10	9	SW	SSW	45.0	31.5	2.0	0.3
2200	14	1	NW	NNE	135.0	203.3	2.0	0.4
2300	11	14	WSW	NW	67.5	127.6	1.0	0.9

Date: September 29, 1969
Station: COMM
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	16	16	N	N	180.0	187.6	4.0	2.1
100	15	15	NNW	NNW	157.5	148.8	5.0	1.4
200	12	12	W	W	90.0	87.4	4.0	1.5
300	14	13	NW	WNW	135.0	108.2	4.0	2.2
400	2	1	NE	NNE	225.0	198.9	6.0	3.8
500	15	11	NNW	WSW	157.5	74.0	6.0	1.2
600	13	13	WNW	WNW	112.5	105.3	6.0	2.8
700	15	1	NNW	NNE	157.5	213.2	3.0	1.6
800	1	13	NNE	WNW	202.5	120.2	3.0	1.3
900	13	13	WNW	WNW	112.5	102.4	3.0	1.4
1000	10	11	SW	WSW	45.0	77.4	7.0	3.2
1100	11	11	WSW	WSW	67.5	71.0	8.0	4.8
1200	11	11	WSW	WSW	67.5	75.4	9.0	6.3
1300	12	12	W	W	90.0	79.0	11.0	7.5
1400	12	12	W	W	90.0	79.6	12.0	8.1
1500	12	12	W	W	90.0	85.4	12.0	8.2
1600	12	11	W	WSW	90.0	76.1	11.0	7.9
1700	12	12	W	W	90.0	84.7	9.0	5.9
1800	11	11	WSW	WSW	67.5	76.2	7.0	4.2
1900	10	10	SW	SW	45.0	53.7	5.0	3.2
2000	9	11	SSW	WSW	22.5	57.2	4.0	1.6
2100	10	10	SW	SW	45.0	51.2	2.0	1.0
2200	9	16	SSW	N	22.5	176.3	1.0	0.8
2300	11	12	WSW	W	67.5	88.0	2.0	0.8

Date: September 29, 1969
Station: CAP
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	2	16	NE	N	225.0	178.7	3.0	2.4
100	10	15	SW	NNW	45.0	165.3	4.0	2.6
200	14	12	NW	W	135.0	96.3	3.0	2.2
300	14	13	NW	WNW	135.0	111.6	4.0	2.5
400	2	1	NE	NNE	225.0	206.7	5.0	4.5
500	12	14	W	NW	90.0	144.0	5.0	1.7
600	16	12	N	W	180.0	99.0	4.0	3.5
700	4	16	E	N	270.0	182.9	2.0	1.6
800	10	16	SW	N	45.0	181.4	3.0	1.3
900	12	13	W	WNW	90.0	113.6	5.0	1.4
1000	12	10	W	SW	90.0	54.4	6.0	3.4
1100	12	11	W	WSW	90.0	57.5	8.0	4.9
1200	12	11	W	WSW	90.0	61.8	9.0	6.5
1300	12	11	W	WSW	90.0	70.9	9.0	6.6
1400	12	11	W	WSW	90.0	76.7	9.0	7.7
1500	12	12	W	W	90.0	83.5	8.0	7.7
1600	12	11	W	WSW	90.0	76.3	8.0	6.8
1700	12	12	W	W	90.0	85.2	5.0	5.2
1800	12	11	W	WSW	90.0	69.2	6.0	3.7
1900	10	10	SW	SW	45.0	55.3	4.0	2.5
2000	8	10	S	SW	0.0	45.8	3.0	1.4
2100	8	10	S	SW	0.0	55.7	2.0	0.9
2200	16	12	N	W	180.0	86.9	2.0	0.1
2300	10	13	SW	WNW	45.0	114.2	2.0	0.9

Date: September 29, 1969
Station: LONB
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	1	15	NNE	NNW	202.5	162.7	2.0	1.8
100	13	15	WNW	NNW	112.5	147.6	2.0	2.4
200	12	12	W	W	90.0	90.6	2.0	2.5
300	1	12	NNE	W	202.5	96.9	2.0	2.7
400	1	1	NNE	NNE	202.5	209.2	6.0	4.5
500	12	11	W	WSW	90.0	73.2	2.0	2.7
600	13	13	WNW	WNW	112.5	110.3	3.0	4.3
700	14	16	NW	N	135.0	182.6	2.0	2.2
800	12	14	W	NW	90.0	133.4	3.0	2.0
900	12	13	W	WNW	90.0	102.8	4.0	2.0
1000	13	12	WNW	W	112.5	82.2	7.0	4.0
1100	12	12	W	W	90.0	81.3	5.0	5.2
1200	12	12	W	W	90.0	89.4	8.0	7.0
1300	12	12	W	W	90.0	95.4	10.0	9.0
1400	12	12	W	W	90.0	98.0	10.0	9.7
1500	12	12	W	W	90.0	99.0	13.0	9.4
1600	12	12	W	W	90.0	85.1	10.0	9.4
1700	12	12	W	W	90.0	98.3	7.0	8.2
1800	12	12	W	W	90.0	88.0	3.0	6.0
1900	13	11	WNW	WSW	112.5	58.3	6.0	3.9
2000	13	11	WNW	WSW	112.5	60.2	5.0	2.5
2100	14	11	NW	WSW	135.0	70.8	2.0	1.5
2200	1	12	NNE	W	202.5	97.0	1.0	0.1
2300	15	13	NNW	WNW	157.5	106.5	1.0	0.8

Date: September 29, 1969
Station: WHTR
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	14	16	NW	N	135.0	174.6	2.0	1.9
100	13	1	WNW	NNE	112.5	193.7	2.0	1.7
200	16	11	N	WSW	180.0	59.2	1.0	1.3
300	13	13	WNW	WNW	112.5	108.8	2.0	1.4
400	12	2	W	NE	90.0	221.8	3.0	3.2
500	13	12	WNW	W	112.5	99.6	4.0	1.0
600	14	13	NW	WNW	135.0	108.8	3.0	3.2
700	15	1	NNW	NNE	157.5	199.9	4.0	0.9
800	13	15	WNW	NNW	112.5	151.3	2.0	0.8
900	8	11	S	WSW	0.0	78.3	2.0	0.5
1000	11	11	WSW	WSW	67.5	69.9	2.0	2.9
1100	11	11	WSW	WSW	67.5	74.7	5.0	4.2
1200	12	11	W	WSW	90.0	77.8	6.0	5.1
1300	12	12	W	W	90.0	80.9	6.0	7.1
1400	12	12	W	W	90.0	87.9	6.0	7.2
1500	12	12	W	W	90.0	94.1	6.0	7.6
1600	12	12	W	W	90.0	86.8	6.0	7.2
1700	12	12	W	W	90.0	89.6	4.0	6.1
1800	11	11	WSW	WSW	67.5	74.4	3.0	3.7
1900	9	10	SSW	SW	22.5	48.0	3.0	2.0
2000	8	10	S	SW	0.0	49.3	1.0	1.2
2100	12	12	W	W	90.0	101.1	1.0	0.5
2200	15	15	NNW	NNW	157.5	158.4	1.0	0.4
2300	15	13	NNW	WNW	157.5	116.5	1.0	0.7

Date: September 29, 1969
Station: LAH
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	1	15	NNE	NNW	202.5	150.2	2.0	1.9
100	4	16	E	N	270.0	173.2	2.0	1.6
200	8	12	S	W	0.0	100.2	2.0	0.6
300	9	13	SSW	WNW	22.5	118.7	1.0	1.3
400	6	1	SE	NNE	315.0	203.5	2.0	1.9
500	14	13	NW	WNW	135.0	105.7	3.0	1.3
600	12	14	W	NW	90.0	124.1	2.0	3.2
700	11	16	WSW	N	67.5	182.5	1.0	1.5
800	7	14	SSE	NW	337.5	146.0	1.0	1.0
900	7	8	SSE	S	337.5	11.1	2.0	0.6
1000	10	11	SW	WSW	45.0	62.5	3.0	2.1
1100	11	11	WSW	WSW	67.5	71.3	4.0	4.0
1200	10	12	SW	W	45.0	87.1	5.0	4.8
1300	10	12	SW	W	45.0	86.5	6.0	6.4
1400	10	12	SW	W	45.0	94.4	5.0	6.6
1500	10	13	SW	WNW	45.0	101.3	5.0	7.2
1600	11	12	WSW	W	67.5	92.5	5.0	6.5
1700	12	12	W	W	90.0	85.7	4.0	5.3
1800	11	11	WSW	WSW	67.5	65.3	2.0	3.4
1900	7	9	SSE	SSW	337.5	22.1	1.0	2.1
2000	3	8	ENE	S	247.5	11.1	1.0	1.5
2100	3	12	ENE	W	247.5	90.6	1.0	0.5
2200	15	15	NNW	NNW	157.5	148.9	1.0	0.4
2300	14	13	NW	WNW	135.0	122.3	1.0	0.7

Date: September 29, 1969
Station: ANA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	15	14	NNW	NW	157.5	139.2	1.0	1.0
100	16	2	N	NE	180.0	221.4	1.0	0.4
200	15	12	NNW	W	157.5	97.9	1.0	0.3
300	15	14	NNW	NW	157.5	138.2	1.0	1.4
400	3	3	ENE	ENE	247.5	258.7	2.0	1.3
500	15	11	NNW	WSW	157.5	78.5	2.0	1.9
600	12	14	W	NW	90.0	135.2	2.0	2.9
700	8	15	S	NNW	0.0	157.4	1.0	1.2
800	5	12	ESE	W	292.5	97.8	1.0	0.6
900	8	9	S	SSW	0.0	18.4	1.0	1.0
1000	11	12	WSW	W	67.5	83.6	2.0	2.1
1100	12	12	W	W	90.0	86.6	2.0	3.9
1200	11	12	WSW	W	67.5	93.8	2.0	4.5
1300	10	12	SW	W	45.0	86.3	2.0	6.0
1400	10	13	SW	WNW	45.0	103.5	3.0	5.7
1500	11	13	WSW	WNW	67.5	103.5	4.0	5.7
1600	12	12	W	W	90.0	98.7	3.0	5.8
1700	12	12	W	W	90.0	92.9	2.0	5.1
1800	12	12	W	W	90.0	80.3	2.0	2.9
1900	16	8	N	S	180.0	7.1	1.0	1.4
2000	12	7	W	SSE	90.0	341.0	1.0	0.8
2100	12	16	W	N	90.0	171.5	1.0	0.6
2200	12	15	W	NNW	90.0	157.2	1.0	0.7
2300	12	15	W	NNW	90.0	146.6	1.0	0.8

Date: September 29, 1969
Station: POMA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	15	12	NNW	W	157.5	85.3	3.0	2.4
100	14	2	NW	NE	135.0	216.5	2.0	3.8
200	5	4	ESE	E	292.5	273.8	2.0	4.3
300	10	6	SW	SE	45.0	325.5	2.0	3.0
400	1	12	NNE	W	202.5	90.0	2.0	2.6
500	4	5	E	ESE	270.0	300.4	2.0	2.2
600	7	5	SSE	SE	337.5	315.0	3.0	6.4
700	5	4	ESE	E	292.5	265.7	2.0	3.7
800	6	4	SE	E	315.0	270.0	2.0	2.8
900	11	4	WSW	E	67.5	272.4	2.0	3.6
1000	12	12	W	W	90.0	91.4	2.0	3.0
1100	14	12	NW	W	135.0	80.0	4.0	5.3
1200	14	11	NW	WSW	135.0	78.2	4.0	6.3
1300	13	12	WNW	W	112.5	82.4	4.0	7.5
1400	14	12	NW	W	135.0	79.2	6.0	8.9
1500	13	12	WNW	W	112.5	79.1	6.0	9.7
1600	14	11	NW	WSW	135.0	77.1	6.0	10.0
1700	13	11	WNW	WSW	112.5	76.1	4.0	7.8
1800	13	11	WNW	WSW	112.5	71.2	5.0	4.9
1900	14	11	NW	WSW	135.0	65.4	3.0	2.6
2000	1	8	NNE	S	202.5	350.3	2.0	2.0
2100	3	4	ENE	E	247.5	259.1	1.0	1.7
2200	2	4	NE	E	225.0	262.0	2.0	1.2
2300	13	3	WNW	ENE	112.5	256.5	1.0	2.2

Date: September 29, 1969
Station: SNA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	7	15	SSE	NNW	337.5	157.5	2.0	1.0
100	8	16	S	N	0.0	180.0	1.0	1.0
200	12	15	W	NNW	90.0	157.5	2.0	1.0
300	15	15	NNW	NNW	157.5	157.5	3.0	1.0
400	3	3	ENE	ENE	247.5	247.5	3.0	2.0
500	7	15	SSE	NNW	337.5	157.5	3.0	2.0
600	11	12	WSW	W	67.5	90.0	2.0	2.0
700	15	8	NNW	S	157.5	0.0	1.0	1.0
800	16	5	N	ESE	180.0	292.5	1.0	1.0
900	14	8	NW	S	135.0	0.0	2.0	1.0
1000	13	11	WNW	WSW	112.5	67.5	3.0	2.0
1100	12	12	W	W	90.0	90.0	4.0	2.0
1200	11	11	WSW	WSW	67.5	67.5	5.0	2.0
1300	11	10	WSW	SW	67.5	45.0	6.0	2.0
1400	11	10	WSW	SW	67.5	45.0	5.0	3.0
1500	11	11	WSW	WSW	67.5	67.5	5.0	4.0
1600	11	12	WSW	W	67.5	90.0	5.0	3.0
1700	11	12	WSW	W	67.5	90.0	4.0	2.0
1800	11	12	WSW	W	67.5	90.0	3.0	2.0
1900	10	16	SW	N	45.0	180.0	2.0	1.0
2000	10	12	SW	W	45.0	90.0	1.0	1.0
2100	11	12	WSW	W	67.5	90.0	2.0	1.0
2200	11	12	WSW	W	67.5	90.0	1.0	1.0
2300	10	12	SW	W	45.0	90.0	1.0	1.0

Date: September 29, 1969
Station: RB
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	10	1	SW	NNE	45.0	202.5	2.0	1.8
100	10	13	SW	WNW	45.0	103.4	2.0	1.1
200	10	13	SW	WNW	45.0	102.7	4.0	2.7
300	9	12	SSW	W	22.5	96.5	5.0	2.2
400	2	1	NE	NNE	225.0	212.4	6.0	6.1
500	10	12	SW	W	45.0	81.5	3.0	4.0
600	12	12	W	W	90.0	101.2	2.0	3.4
700	13	16	WNW	N	112.5	173.4	3.0	1.1
800	11	12	WSW	W	67.5	97.6	3.0	1.9
900	11	12	WSW	W	67.5	95.2	4.0	3.5
1000	10	13	SW	WNW	45.0	101.9	3.0	5.1
1100	9	12	SSW	W	22.5	83.0	5.0	5.4
1200	10	12	SW	W	45.0	86.8	8.0	8.1
1300	10	12	SW	W	45.0	90.2	7.0	9.2
1400	10	12	SW	W	45.0	91.2	8.0	9.5
1500	10	12	SW	W	45.0	90.3	8.0	10.4
1600	9	12	SSW	W	22.5	80.8	7.0	9.8
1700	9	12	SSW	W	22.5	92.8	5.0	7.4
1800	9	12	SSW	W	22.5	84.0	6.0	4.9
1900	9	11	SSW	WSW	22.5	77.5	5.0	3.5
2000	8	12	S	W	0.0	92.9	7.0	2.1
2100	8	11	S	WSW	0.0	68.4	6.0	0.5
2200	8	2	S	NE	0.0	221.8	5.0	1.4
2300	9	1	SSW	NNE	22.5	203.5	4.0	1.2

e: September 29, 1969
tion: VEN
oncnt Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	1	1	NNE	NNE	202.5	207.9	1.0	0.1
100	7	10	SSE	SW	337.5	46.3	2.0	1.8
200	12	11	W	WSW	90.0	69.8	2.0	1.9
300	10	10	SW	SW	45.0	54.7	4.0	1.0
400	2	2	NE	NE	225.0	227.9	8.0	3.9
500	12	11	W	WSW	90.0	63.6	7.0	2.1
600	10	13	SW	WNW	45.0	116.0	3.0	1.1
700	13	13	WNW	WNW	112.5	105.3	1.0	0.4
800	11	10	WSW	SW	67.5	36.4	2.0	1.5
900	12	12	W	W	90.0	79.2	5.0	2.4
1000	11	11	WSW	WSW	67.5	70.3	3.0	2.7
1100	10	11	SW	WSW	45.0	58.7	6.0	4.0
1200	11	11	WSW	WSW	67.5	63.6	10.0	5.6
1300	11	11	WSW	WSW	67.5	68.8	10.0	5.2
1400	11	11	WSW	WSW	67.5	68.5	11.0	4.9
1500	11	11	WSW	WSW	67.5	65.9	11.0	5.2
1600	11	10	WSW	SW	67.5	49.2	8.0	4.7
1700	10	10	SW	SW	45.0	52.6	6.0	3.0
1800	9	10	SSW	SW	22.5	52.7	7.0	2.7
1900	8	10	S	SW	0.0	36.0	4.0	2.3
2000	6	8	SE	S	315.0	10.3	5.0	2.7
2100	7	7	SSE	SSE	337.5	347.1	5.0	2.2
2200	5	6	ESE	SE	292.5	314.3	3.0	0.7
2300	5	9	ESE	SSW	292.5	29.0	2.0	1.1

Date: September 29, 1969
Station: CPK
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	14	8	NW	S	135.0	0.8	1.0	1.0
100	10	8	SW	S	45.0	5.0	1.0	0.9
200	12	11	W	WSW	90.0	71.0	1.0	1.4
300	14	3	NW	ENE	135.0	258.6	1.0	1.9
400	3	2	ENE	NE	247.5	224.2	1.0	2.2
500	11	11	WSW	WSW	67.5	61.6	2.0	1.7
600	1	13	NNE	WNW	202.5	104.9	1.0	1.6
700	9	5	SSW	ESE	22.5	295.5	1.0	1.2
800	6	9	SE	SSW	315.0	14.5	1.0	0.6
900	8	12	S	W	0.0	80.1	1.0	1.1
1000	6	14	SE	NW	315.0	144.5	1.0	0.8
1100	6	12	SE	W	315.0	84.0	1.0	1.3
1200	9	15	SSW	NNW	22.5	153.1	2.0	1.3
1300	7	12	SSE	W	337.5	95.1	2.0	1.6
1400	14	14	NW	NW	135.0	135.2	4.0	1.2
1500	15	12	NNW	W	157.5	97.7	6.0	6.5
1600	15	13	NNW	WNW	157.5	105.5	6.0	7.1
1700	15	11	NNW	WSW	157.5	75.1	4.0	5.5
1800	14	12	NW	W	135.0	90.0	2.0	3.0
1900	12	12	W	W	90.0	90.0	1.0	2.4
2000	11	11	WSW	WSW	67.5	67.5	2.0	2.4
2100	12	3	W	ENE	90.0	238.8	1.0	0.5
2200	14	3	NW	ENE	135.0	238.8	1.0	0.5
2300	12	9	W	SSW	90.0	12.4	1.0	1.4

Date: September 29, 1969
Station: RVA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	14	16	NW	N	135.0	193.2	2.0	2.5
100	16	15	N	NNW	180.0	150.4	5.0	1.5
200	9	12	SSW	W	22.5	100.8	3.0	1.8
300	10	14	SW	NW	45.0	127.6	3.0	2.5
400	1	1	NNE	NNE	202.5	205.5	5.0	3.2
500	7	14	SSE	NW	337.5	128.9	4.0	2.4
600	10	13	SW	WNW	45.0	122.9	5.0	3.8
700	1	16	NNE	N	202.5	182.6	3.0	1.5
800	15	14	NNW	NW	157.5	143.4	3.0	1.0
900	1	11	NNE	WSW	202.5	78.7	3.0	1.6
1000	8	11	S	WSW	0.0	77.4	4.0	3.8
1100	9	11	SSW	WSW	22.5	77.6	5.0	5.4
1200	10	12	SW	W	45.0	81.2	6.0	6.6
1300	11	12	WSW	W	67.5	86.0	8.0	7.9
1400	11	12	WSW	W	67.5	89.1	9.0	8.4
1500	11	12	WSW	W	67.5	93.4	7.0	9.1
1600	10	12	SW	W	45.0	88.8	7.0	8.6
1700	11	12	WSW	W	67.5	91.4	6.0	6.6
1800	10	12	SW	W	45.0	80.3	5.0	4.5
1900	9	11	SSW	WSW	22.5	58.3	4.0	3.2
2000	8	11	S	WSW	0.0	56.6	2.0	1.8
2100	9	12	SSW	W	22.5	87.0	3.0	0.9
2200	7	15	SSE	NNW	337.5	156.9	2.0	1.0
2300	9	13	SSW	WNW	22.5	114.8	2.0	1.0

Date: September 29, 1969
Station: ENC
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	9	5	SSW	ESE	22.5	296.6	2.0	0.1
100	9	8	SSW	S	22.5	6.4	2.0	0.7
200	10	12	SW	W	45.0	98.3	3.0	1.1
300	4	2	E	NE	270.0	219.9	3.0	0.2
400	3	2	ENE	NE	247.5	219.5	3.0	2.5
500	9	12	SSW	W	22.5	82.8	3.0	2.1
600	9	14	SSW	NW	22.5	133.4	3.0	1.6
700	5	6	ESE	SE	292.5	317.4	2.0	0.3
800	7	10	SSE	SW	337.5	49.6	2.0	0.5
900	13	10	WNW	SW	112.5	40.2	3.0	1.1
1000	13	8	WNW	S	112.5	349.4	3.0	0.3
1100	13	9	WNW	SSW	112.5	31.7	3.0	1.8
1200	13	10	WNW	SW	112.5	41.0	5.0	1.4
1300	13	9	WNW	SSW	112.5	15.4	7.0	2.2
1400	13	12	WNW	W	112.5	84.7	6.0	1.6
1500	13	12	WNW	W	112.5	97.2	6.0	5.3
1600	12	13	W	WNW	90.0	111.7	6.0	5.3
1700	12	11	W	WSW	90.0	78.4	5.0	3.4
1800	12	11	W	WSW	90.0	75.9	3.0	2.1
1900	12	11	W	WSW	90.0	67.8	3.0	1.1
2000	11	10	WSW	SW	67.5	42.7	3.0	1.2
2100	5	10	ESE	SW	292.5	54.0	2.0	0.3
2200	5	15	ESE	NNW	292.5	152.7	2.0	0.2
2300	9	8	SSW	S	22.5	1.0	2.0	0.5

Date: September 29, 1969
Station: BKT
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	12	15	W	NNW	90.0	154.9	3.0	2.0
100	2	15	NE	NNW	225.0	152.5	4.0	2.3
200	4	5	E	ESE	270.0	299.0	5.0	2.0
300	6	10	SE	SW	315.0	52.3	4.0	2.2
400	12	1	W	NNE	90.0	193.4	3.0	1.4
500	6	4	SE	E	315.0	270.0	2.0	2.5
600	6	8	SE	S	315.0	353.0	9.0	1.4
700	4	5	E	ESE	270.0	282.4	5.0	1.1
800	4	6	E	SE	270.0	304.4	3.0	1.9
900	4	10	E	SW	270.0	50.9	4.0	1.2
1000	12	12	W	W	90.0	94.2	4.0	1.3
1100	12	13	W	WNW	90.0	111.0	6.0	2.8
1200	12	12	W	W	90.0	101.1	7.0	2.8
1300	12	12	W	W	90.0	89.1	8.0	4.0
1400	12	13	W	WNW	90.0	106.0	10.0	4.2
1500	12	12	W	W	90.0	84.0	11.0	5.1
1600	12	12	W	W	90.0	88.9	12.0	4.9
1700	12	11	W	WSW	90.0	73.3	9.0	4.4
1800	12	12	W	W	90.0	78.9	7.0	3.2
1900	12	13	W	WNW	90.0	103.4	5.0	0.5
2000	8	3	S	ENE	0.0	249.2	2.0	0.8
2100	4	3	E	ENE	270.0	241.6	2.0	1.1
2200	4	2	E	NE	270.0	234.9	1.0	1.7
2300	4	15	E	NNW	270.0	161.8	3.0	0.8

Date: September 29, 1969
Station: LACA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CAL
0	15	16	NNW	N	157.5	190.5	2.0	2.5
100	15	14	NNW	NW	157.5	140.8	4.0	0.6
200	15	14	NNW	NW	157.5	133.2	4.0	1.2
300	15	14	NNW	NW	157.5	131.1	3.0	2.6
400	16	16	N	N	180.0	181.1	2.0	3.2
500	15	1	NNW	NNE	157.5	204.7	3.0	1.3
600	15	14	NNW	NW	157.5	124.2	2.0	2.1
700	15	3	NNW	ENE	157.5	247.8	2.0	1.2
800	4	2	E	NE	270.0	225.0	1.0	0.1
900	4	11	E	WSW	270.0	68.9	1.0	1.4
1000	10	11	SW	WSW	45.0	66.0	2.0	2.1
1100	9	11	SSW	WSW	22.5	59.9	4.0	3.9
1200	9	11	SSW	WSW	22.5	59.6	6.0	5.3
1300	9	10	SSW	SW	22.5	43.0	6.0	4.2
1400	9	11	SSW	WSW	22.5	67.9	5.0	5.6
1500	9	12	SSW	W	22.5	86.9	4.0	5.8
1600	7	12	SSE	W	337.5	85.8	2.0	4.8
1700	15	11	NNW	WSW	157.5	74.5	2.0	2.7
1800	15	11	NNW	WSW	157.5	64.0	3.0	1.9
1900	15	11	NNW	WSW	157.5	56.4	4.0	1.2
2000	15	10	NNW	SW	157.5	49.6	2.0	0.6
2100	15	10	NNW	SW	157.5	51.1	3.0	0.4
2200	15	12	NNW	W	157.5	85.5	2.0	0.7
2300	15	11	NNW	WSW	157.5	77.1	4.0	1.0

Date: September 29, 1969
Station: COMA
Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	1	16	NNE	N	202.5	175.4	3.0	1.6
100	14	14	NW	NW	135.0	126.3	3.0	2.0
200	13	11	WNW	WSW	112.5	76.7	5.0	2.2
300	13	13	WNW	WNW	112.5	101.8	5.0	1.5
400	1	1	NNE	NNE	202.5	211.1	7.0	4.8
500	11	12	WSW	W	67.5	94.2	5.0	2.1
600	13	13	WNW	WNW	112.5	108.3	7.0	2.9
700	2	15	NE	NNW	225.0	158.1	3.0	2.0
800	14	13	NW	WNW	135.0	105.7	3.0	1.9
900	13	12	WNW	W	112.5	92.9	4.0	2.6
1000	13	11	WNW	WSW	112.5	73.2	9.0	4.1
1100	13	11	WNW	WSW	112.5	65.1	9.0	5.3
1200	13	11	WNW	WSW	112.5	72.7	11.0	7.3
1300	13	12	WNW	W	112.5	81.1	14.0	8.4
1400	13	12	WNW	W	112.5	80.4	15.0	8.9
1500	13	12	WNW	W	112.5	81.5	15.0	9.2
1600	12	11	W	WSW	90.0	76.0	17.0	7.7
1700	13	11	WNW	WSW	112.5	78.6	16.0	5.7
1800	13	11	WNW	WSW	112.5	62.3	12.0	4.4
1900	12	11	W	WSW	90.0	56.9	7.0	3.7
2000	13	10	WNW	SW	112.5	34.7	7.0	2.6
2100	14	9	NW	SSW	135.0	29.6	4.0	1.9
2200	16	8	N	S	180.0	350.3	3.0	0.7
2300	16	10	N	SW	180.0	49.1	3.0	1.3

Date: September 29, 1969

Station: KFI

Exponent Used: 1.00

	Wind Direction						Wind Speed	
	(point)		(direction)		(degree)		(mph)	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	13	15	WNW	NNW	112.5	166.6	2.0	1.5
100	1	16	NNE	N	202.5	174.5	1.0	1.1
200	16	10	N	SW	180.0	43.9	1.0	0.6
300	15	12	NNW	W	157.5	94.6	2.0	0.9
400	3	1	ENE	NNE	247.5	207.6	3.0	0.9
500	10	13	SW	WNW	45.0	119.0	3.0	2.1
600	15	12	NNW	W	157.5	96.8	5.0	2.3
700	1	15	NNE	NNW	202.5	149.2	1.0	1.3
800	12	13	W	WNW	90.0	107.1	1.0	0.6
900	10	8	SW	S	45.0	1.2	1.0	1.0
1000	13	11	WNW	WSW	112.5	60.4	2.0	2.5
1100	13	11	WNW	WSW	112.5	66.4	4.0	3.8
1200	14	11	NW	WSW	135.0	68.7	6.0	4.7
1300	13	11	WNW	WSW	112.5	69.2	8.0	5.4
1400	14	11	NW	WSW	135.0	69.5	10.0	5.4
1500	14	11	NW	WSW	135.0	73.0	10.0	5.7
1600	14	11	NW	WSW	135.0	76.2	9.0	5.6
1700	13	12	WNW	W	112.5	83.3	7.0	4.3
1800	13	11	WNW	WSW	112.5	60.7	5.0	2.5
1900	12	9	W	SSW	90.0	21.3	1.0	1.4
2000	9	9	SSW	SSW	22.5	21.3	1.0	0.4
2100	15	13	NNW	WNW	157.5	115.6	1.0	0.3
2200	14	15	NW	NNW	135.0	165.8	1.0	0.4
2300	14	14	NW	NW	135.0	131.8	1.0	0.7

APPENDIX 2.

CORRELATION COEFFICIENTS BETWEEN STATION MEASUREMENTS (WIND SPEED)

	RESD	PASA	AZU	WEST	ELM	COMM	CAP	LONB	WHTR	LAH	ANA	POMA	SNA	RB	VEN	CPK	RVA	ENC	BKT	LACA	COMA	KFI
RESD	-	0.66	0.79	0.44	0.70	0.60	0.38	0.62	0.54	0.49	0.78	0.70	0.49	0.51	0.50	0.92	0.47	0.58	0.69	0.06	0.67	0.68
PASA	0.66	-	0.80	0.63	0.86	0.83	0.62	0.84	0.75	0.70	0.91	0.82	0.70	0.77	0.76	0.81	0.76	0.76	0.74	0.58	0.78	0.86
AZU	0.79	0.80	-	0.76	0.96	0.89	0.76	0.82	0.89	0.83	0.85	0.96	0.83	0.87	0.84	0.89	0.87	0.88	0.87	0.57	0.90	0.95
WEST	0.44	0.63	0.76	-	0.76	0.82	0.90	0.79	0.83	0.89	0.61	0.76	0.89	0.87	0.77	0.53	0.72	0.76	0.62	0.77	0.81	0.72
ELM	0.70	0.86	0.96	0.76	-	0.92	0.78	0.83	0.94	0.87	0.84	0.92	0.87	0.88	0.89	0.85	0.91	0.91	0.80	0.69	0.89	0.95
COMM	0.60	0.83	0.89	0.82	0.92	-	0.90	0.91	0.84	0.94	0.88	0.90	0.94	0.85	0.87	0.76	0.95	0.92	0.79	0.72	0.97	0.95
CAP	0.38	0.62	0.76	0.90	0.78	0.90	-	0.83	0.77	0.97	0.67	0.77	0.97	0.88	0.90	0.54	0.84	0.85	0.59	0.79	0.87	0.79
LONB	0.62	0.84	0.82	0.79	0.83	0.91	0.83	-	0.71	0.86	0.82	0.85	0.86	0.88	0.81	0.79	0.84	0.91	0.76	0.58	0.93	0.87
WHTR	0.54	0.75	0.89	0.83	0.94	0.84	0.77	0.71	-	0.85	0.68	0.84	0.85	0.87	0.83	0.68	0.84	0.82	0.71	0.80	0.80	0.85
LAH	0.49	0.70	0.83	0.85	0.87	0.94	0.97	0.86	0.85	-	0.73	0.80	1.00	0.88	0.92	0.63	0.89	0.93	0.65	0.82	0.91	0.86
ANA	0.78	0.91	0.85	0.61	0.84	0.88	0.67	0.82	0.68	0.73	-	0.87	0.73	0.68	0.74	0.88	0.77	0.73	0.78	0.44	0.85	0.88
POMA	0.70	0.82	0.96	0.76	0.92	0.90	0.77	0.85	0.84	0.80	0.87	-	0.80	0.86	0.79	0.86	0.89	0.83	0.91	0.54	0.92	0.95
SNA	0.49	0.70	0.83	0.89	0.87	0.94	0.97	0.86	0.85	1.00	0.73	0.80	-	0.88	0.92	0.63	0.89	0.93	0.65	0.82	0.91	0.86
RB	0.51	0.77	0.87	0.87	0.88	0.85	0.88	0.88	0.87	0.88	0.68	0.86	0.88	-	0.91	0.72	0.84	0.89	0.69	0.75	0.85	0.84
VEN	0.50	0.76	0.84	0.77	0.89	0.87	0.90	0.81	0.83	0.92	0.74	0.79	0.92	0.91	-	0.68	0.86	0.89	0.59	0.80	0.81	0.86
CPK	0.92	0.81	0.89	0.53	0.85	0.76	0.54	0.79	0.68	0.63	0.88	0.86	0.63	0.72	0.68	-	0.68	0.73	0.78	0.25	0.80	0.83
RVA	0.47	0.76	0.87	0.72	0.91	0.95	0.84	0.84	0.84	0.89	0.77	0.89	0.89	0.84	0.86	0.68	-	0.93	0.81	0.74	0.92	0.96
ENC	0.58	0.76	0.88	0.76	0.91	0.92	0.85	0.91	0.82	0.93	0.73	0.83	0.93	0.89	0.89	0.73	0.93	-	0.77	0.70	0.93	0.92
BKT	0.69	0.74	0.87	0.62	0.80	0.79	0.59	0.76	0.71	0.65	0.78	0.91	0.65	0.69	0.59	0.78	0.81	0.77	-	0.38	0.85	0.89
LACA	0.06	0.58	0.57	0.77	0.69	0.72	0.79	0.58	0.80	0.82	0.44	0.54	0.82	0.75	0.80	0.25	0.74	0.70	0.38	-	0.60	0.64
COMA	0.67	0.78	0.90	0.81	0.89	0.97	0.87	0.93	0.80	0.91	0.85	0.92	0.91	0.85	0.81	0.80	0.92	0.93	0.85	0.60	-	0.94
KFI	0.68	0.86	0.95	0.72	0.95	0.95	0.79	0.87	0.85	0.86	0.88	0.95	0.86	0.84	0.86	0.83	0.96	0.92	0.89	0.64	0.94	-

CORRELATION COEFFICIENTS BETWEEN STATION MEASUREMENTS (WIND DIRECTION)

	RESD	PASA	AZU	WEST	ELM	COMM	CAP	LONB	WHTR	LAH	ANA	POMA	SNA	RB	VEN	CPK	RVA	ENC	BKT	LACA	COMA	KFI
RESD	-	-0.29	-0.37	0.09	-0.35	-0.28	0.39	0.45	0.39	0.04	-0.11	-0.05	0.07	0.24	0.11	0.07	0.00	0.46	-0.36	-0.39	0.43	0.64
PASA	-0.29	-	0.49	0.24	0.67	0.89	0.14	0.12	0.48	0.35	0.00	0.73	0.24	0.41	0.45	-0.23	0.38	-0.09	0.71	0.69	0.18	-0.17
AZU	-0.37	0.49	-	0.17	0.77	0.52	-0.05	0.18	-0.16	-0.13	-0.23	0.30	0.24	0.38	0.40	-0.08	0.24	-0.28	0.71	0.79	0.00	-0.58
WEST	0.09	0.24	0.17	-	0.27	0.20	0.70	0.58	0.53	0.34	0.31	0.63	-0.24	0.62	0.08	-0.25	-0.09	0.04	0.63	0.26	0.17	0.27
ELM	-0.35	0.67	0.77	0.27	-	0.76	0.35	0.35	0.07	-0.09	-0.33	0.44	0.31	0.65	0.76	-0.47	0.58	0.10	0.83	0.83	0.39	-0.28
COMM	-0.28	0.89	0.52	0.20	0.76	-	0.18	0.14	0.45	-0.06	-0.39	0.76	0.24	0.55	0.46	-0.16	0.47	-0.21	0.78	0.73	0.32	-0.14
CAP	0.39	0.14	-0.05	0.70	0.35	0.18	-	0.89	0.58	0.20	-0.03	0.46	0.16	0.77	0.43	-0.37	0.32	0.62	0.39	0.13	0.74	0.70
LONB	0.45	0.12	0.18	0.58	0.35	0.14	0.89	-	0.54	0.12	-0.13	0.44	0.32	0.76	0.39	-0.13	0.26	0.54	0.35	0.18	0.76	0.64
WHTR	0.39	0.48	-0.16	0.53	0.07	0.45	0.58	0.54	-	0.29	0.05	0.80	-0.06	0.48	0.12	0.02	-0.05	0.09	0.30	-0.01	0.44	0.64
LAH	0.04	0.35	-0.13	0.34	-0.09	-0.06	0.20	0.12	0.29	-	0.82	0.18	0.05	-0.05	-0.02	-0.06	-0.03	0.33	0.05	0.04	-0.13	-0.11
ANA	-0.11	0.00	-.23	0.31	-0.33	-.39	-0.03	-0.13	0.05	0.82	-	-0.09	-0.44	-0.41	-0.22	-0.07	-0.50	0.07	-0.14	-0.30	-0.53	-0.08
POMA	-0.05	0.73	0.30	0.63	0.44	0.76	0.46	0.44	0.80	0.18	-0.09	-	0.08	0.63	0.11	-0.02	0.13	-0.22	0.75	0.49	0.32	0.24
SNA	0.07	0.24	0.24	-0.24	0.31	0.24	0.16	0.32	-0.06	0.05	-0.44	0.08	-	0.41	0.17	0.12	0.82	0.41	0.11	0.53	0.61	0.19
RB	0.24	0.41	0.38	0.62	0.65	0.55	0.77	0.76	0.48	-0.05	-0.41	0.63	0.41	-	0.48	-0.33	0.60	0.29	0.71	0.62	0.74	0.39
VEN	0.11	0.45	0.40	0.08	0.76	0.46	0.43	0.39	0.12	-0.02	-0.22	0.11	0.17	0.48	-	-0.64	0.50	0.51	0.40	0.38	0.49	-0.03
CPK	0.07	-0.23	-0.08	-0.25	-0.47	-0.16	-0.37	-0.13	0.02	-0.06	-0.07	-0.02	0.12	-0.33	-0.64	-	-0.30	-0.34	-0.33	-0.22	-0.16	-0.02
RVA	0.00	0.38	0.24	-0.09	0.58	0.47	0.32	0.26	-0.05	-0.03	-0.50	0.13	0.82	0.60	0.50	-0.30	-	0.47	0.35	0.66	0.65	0.12
ENC	0.46	-0.09	-0.28	0.04	0.10	-0.21	0.62	0.54	0.09	0.33	0.07	-0.22	0.41	0.29	0.51	-0.34	0.47	-	-0.21	-0.10	0.66	0.54
BKT	-0.36	0.71	0.71	0.63	0.83	0.78	0.39	0.35	0.30	0.05	-0.14	0.75	0.11	0.71	0.40	-0.33	0.35	-0.21	-	0.84	0.20	-0.21
LACA	-0.39	0.69	0.79	0.26	0.83	0.73	0.13	0.18	-0.01	0.04	-0.30	0.49	0.53	0.62	0.38	-0.22	0.66	-0.10	0.84	-	0.24	-0.37
COMA	0.43	0.18	0.00	0.17	0.39	0.32	0.74	0.76	0.44	-0.13	-0.53	0.32	0.61	0.74	0.49	-0.16	0.65	0.66	0.20	0.24	-	0.65
KFI	0.64	-0.17	-0.58	-0.27	-0.28	-0.14	0.70	0.64	0.64	0.11	-0.08	0.24	0.19	0.39	-0.03	-0.02	0.12	0.54	-0.21	-0.37	0.65	-

AVERAGE DIFFERENCES BETWEEN STATION MEASUREMENTS (WIND SPEED)

	RESD	PASA	AZU	WEST	ELM	COMM	CAP	LONB	WHTR	LAH	ANA	POMA	SNA	RB	VEN	CPK	RVA	ENC	BKT	LACA	COMA	KFI
RESD	0.0	1.7	3.4	2.1	4.7	5.7	4.6	4.8	2.6	2.3	1.8	1.9	2.3	3.4	4.9	1.0	3.5	2.4	4.7	2.8	7.7	3.5
PASA	1.7	0.0	3.6	1.2	4.7	5.5	4.2	4.6	2.1	1.5	0.8	1.4	1.5	2.9	4.6	1.1	3.0	1.9	4.8	1.6	7.8	3.4
AZU	3.4	3.6	0.0	3.6	1.5	2.7	2.3	2.4	2.2	2.8	4.2	2.5	2.8	1.8	2.2	3.5	1.8	2.3	2.2	3.5	4.6	1.1
WEST	2.1	1.2	3.6	0.0	4.8	5.5	3.9	4.6	2.0	1.2	1.3	1.5	1.2	2.8	4.6	1.7	3.1	1.9	4.9	1.3	7.7	3.5
ELM	4.7	4.7	1.5	4.8	0.0	1.8	2.3	2.1	3.1	3.8	5.3	3.7	3.8	2.4	1.7	4.8	2.3	3.3	2.2	4.3	3.7	1.9
COMM	5.7	5.5	2.7	5.5	1.8	0.0	2.0	1.9	3.9	4.5	6.1	4.5	4.5	3.1	2.1	5.7	2.8	4.0	2.3	5.0	2.5	2.8
CAP	4.6	4.2	2.3	3.9	2.3	2.0	0.0	2.1	2.5	3.0	4.7	3.1	3.0	1.7	1.7	4.5	1.6	2.6	2.6	3.5	4.2	2.5
LONB	4.8	4.6	2.4	4.6	2.1	1.9	2.1	0.0	3.4	3.7	5.2	3.7	3.7	2.3	2.2	4.8	2.5	3.2	2.4	4.4	3.5	2.3
WHTR	2.6	2.1	2.2	2.0	3.1	3.9	2.5	3.4	0.0	1.2	2.6	1.2	1.2	1.4	3.1	2.4	1.5	1.0	3.3	1.6	6.2	2.3
LAH	2.3	1.5	2.8	1.2	3.8	4.5	3.0	3.7	1.2	0.0	1.8	1.0	0.0	1.9	3.6	1.9	2.0	0.9	4.1	1.1	6.7	2.6
ANA	1.8	0.8	4.2	1.3	5.3	6.1	4.7	5.2	2.6	1.8	0.0	1.8	1.8	3.5	5.2	1.2	3.5	2.3	5.3	1.9	8.3	3.9
POMA	1.9	1.4	2.5	1.5	3.7	4.5	3.1	3.7	1.2	1.0	1.8	0.0	1.0	1.9	3.7	1.6	2.0	1.1	3.7	1.7	6.7	2.4
SNA	2.3	1.5	2.8	1.2	3.8	4.5	3.0	3.7	1.2	0.0	1.8	1.0	0.0	1.9	3.6	1.9	2.0	0.9	4.1	1.1	6.7	2.6
RB	3.4	2.9	1.8	2.8	2.4	3.1	1.7	2.3	1.4	1.9	3.5	1.9	1.9	0.0	2.2	3.2	1.3	1.5	2.8	2.4	5.3	1.9
VEN	4.9	4.6	2.2	4.6	1.7	2.1	1.7	2.2	3.1	3.6	5.2	3.7	3.6	2.2	0.0	4.8	2.3	3.1	3.0	4.0	4.1	2.3
CPK	1.0	1.1	3.5	1.7	4.8	5.7	4.5	4.8	2.4	1.9	1.2	1.6	1.9	3.2	4.8	0.0	3.4	2.2	4.9	2.3	7.8	3.4
RVA	3.5	3.0	1.8	3.1	2.3	2.8	1.6	2.5	1.5	2.0	3.5	2.0	2.0	1.3	2.3	3.4	0.0	1.4	2.4	2.5	5.1	1.6
ENC	2.4	1.9	2.3	1.9	3.3	4.0	2.6	3.2	1.0	0.9	2.3	1.1	0.9	1.5	3.1	2.2	1.4	0.0	3.4	1.6	6.2	2.1
BKT	4.7	4.8	2.2	4.9	2.2	2.3	2.6	2.4	3.3	4.1	5.3	3.7	4.1	2.8	3.0	4.9	2.4	3.4	0.0	4.6	3.8	2.3
LACA	2.8	1.6	3.5	1.3	4.3	5.0	3.5	4.4	1.6	1.1	1.9	1.7	1.1	2.4	4.0	2.3	2.5	1.6	4.6	0.0	7.4	3.2
COMA	7.7	7.8	4.6	7.7	3.7	2.5	4.2	3.5	6.2	6.7	8.3	6.7	6.7	5.3	4.1	7.8	5.1	6.2	3.8	7.4	0.0	4.8
KFI	3.5	3.4	1.1	3.5	1.9	2.8	2.5	2.3	2.3	2.6	3.9	2.4	2.6	1.9	2.3	3.4	1.6	2.1	2.3	3.2	4.8	0/0

AVERAGE DIFFERENCES BETWEEN STATION MEASUREMENTS (WIND DIRECTION)

	RESD	PASA	AZU	WEST	ELM	COMM	CAP	LONB	WHTR	LAH	ANA	POMA	SNA	RB	VEN	CPK	RVA	ENC	BKT	LACA	COMA	KFI
RESD	0.0	104.7	99.6	100.2	103.3	122.4	99.8	107.5	107.7	102.5	108.9	114.2	113.4	103.3	116.6	80.3	106.3	105.7	118.3	112.7	100.4	89.3
PASA	104.7	0.0	53.2	71.7	66.6	55.5	98.9	84.7	72.6	62.0	70.3	97.4	69.0	75.5	74.1	94.8	65.6	102.1	88.1	60.6	94.3	108.5
AZU	99.6	53.2	0.0	84.9	71.2	89.1	110.0	105.3	95.5	71.7	83.7	114.7	78.5	86.7	104.9	96.3	68.4	110.6	92.5	58.8	109.5	111.7
WEST	100.2	71.7	84.9	0.0	88.3	69.7	66.9	48.6	49.0	33.8	52.4	106.1	73.8	25.2	37.9	79.8	82.2	81.9	104.3	61.3	75.5	76.6
ELM	103.3	66.6	71.2	88.3	0.0	74.6	89.3	92.1	71.7	65.0	46.8	81.1	70.6	94.6	97.4	97.2	60.6	87.1	58.5	63.0	90.0	90.5
COMM	122.4	55.5	89.1	69.7	74.6	0.0	64.6	44.5	45.0	66.2	65.6	81.6	59.5	63.6	52.4	94.1	69.0	77.9	88.8	71.7	47.7	65.6
CAP	99.8	98.9	110.0	66.9	89.3	64.6	0.0	45.9	49.0	72.6	62.6	79.3	71.4	67.8	63.6	88.8	81.1	56.3	85.2	93.9	39.5	41.6
LONB	107.5	84.7	105.3	48.6	92.1	44.5	45.9	0.0	32.5	62.0	72.6	93.0	48.2	46.4	31.8	99.6	71.7	66.6	102.7	96.6	33.7	40.6
WHTR	107.7	72.6	95.5	49.0	71.7	45.0	49.0	32.5	0.0	56.6	74.6	95.5	65.0	50.3	44.5	92.8	74.9	79.5	93.0	75.7	46.8	43.1
LAH	102.5	62.0	71.7	33.8	65.0	66.2	72.6	62.0	56.6	0.0	29.0	88.6	0.0	50.3	49.9	79.0	92.1	81.1	89.3	53.6	90.5	85.7
ANA	108.9	70.3	83.7	52.4	46.8	65.6	62.6	72.6	74.6	29.0	0.0	70.0	87.6	70.0	64.0	81.6	97.9	69.3	73.8	71.2	81.6	89.1
POMA	114.2	97.4	114.7	106.1	81.1	81.6	79.3	93.0	95.5	88.6	70.0	0.0	78.5	103.5	95.2	107.9	93.9	42.1	57.0	119.4	84.7	81.1
SNA	113.4	69.0	78.5	73.8	70.6	59.5	71.4	48.2	65.0	0.0	87.6	78.5	0.0	55.9	53.2	113.6	46.4	68.7	67.8	87.6	46.8	65.6
RB	103.3	75.5	86.7	25.2	94.6	63.6	67.8	46.4	50.3	50.3	70.0	103.5	55.9	0.0	28.3	89.1	61.3	83.2	100.0	77.9	68.1	75.2
VEN	116.6	74.1	104.9	37.9	97.4	52.4	63.6	31.8	44.5	49.9	64.0	95.2	53.2	28.3	0.0	93.9	63.0	71.4	97.2	88.3	56.2	65.9
CPK	80.3	94.8	96.3	79.8	97.2	94.1	88.8	99.6	92.8	79.0	81.6	107.9	113.6	89.1	93.9	0.0	113.8	107.5	97.0	98.5	115.8	106.7
RVA	106.3	65.6	68.4	82.2	60.6	69.0	81.1	71.7	74.9	92.1	97.9	93.9	46.4	61.3	63.0	113.8	0.0	83.9	63.6	80.3	67.8	88.8
ENC	105.7	102.1	110.6	81.9	87.1	77.9	56.3	66.6	79.5	81.1	69.3	42.1	68.7	83.2	71.4	107.5	83.9	0.0	59.2	108.7	57.4	63.0
BKT	118.3	88.1	92.5	104.3	58.5	88.8	85.2	102.7	93.0	89.3	73.8	57.0	67.8	100.0	97.2	97.0	63.6	59.2	0.0	91.2	84.4	90.2
LACA	112.7	60.6	58.8	61.3	63.0	71.7	93.9	96.6	75.7	53.6	71.2	119.4	87.6	77.9	88.3	98.5	80.3	108.7	91.2	0.0	98.1	111.4
COMA	100.4	94.3	109.5	75.5	90.0	47.7	39.5	33.7	46.8	90.5	81.6	84.7	46.8	68.1	56.2	115.8	67.8	57.4	84.4	98.1	0.0	33.1
KFI	89.3	108.5	111.7	76.6	90.5	65.6	41.6	40.6	43.1	85.7	89.1	81.1	65.6	75.2	65.9	106.7	88.8	63.0	90.2	111.4	33.1	0.0

APPENDIX 3. MEASURED AND CALCULATED AIR QUALITY

Date: September 29, 1969

Station: RESD

Exponent Used: 1.00

	NO		OZ		N2		CO	
HOUR	MEAS	CALC	MEAS	CALC	MEAS	CALC	MEAS	CALC
0	12.0	10.7	2.0	1.0	17.0	8.8	15.0	5.2
100	18.0	12.4	1.0	1.0	14.0	8.7	13.0	5.2
200	19.0	11.9	1.0	1.0	12.0	8.7	9.0	5.2
300	11.0	11.7	1.0	1.4	12.0	9.0	10.0	5.6
400	9.0	14.6	0.0	0.0	11.0	9.9	9.0	7.3
500	9.0	17.9	2.0	1.0	13.0	9.7	10.0	7.6
600	8.0	21.3	4.0	1.0	12.0	9.2	12.0	10.8
700	11.0	32.9	4.0	1.6	13.0	11.7	16.0	17.4
800	7.0	33.3	9.0	3.9	21.0	20.1	11.0	17.2
900	1.0	14.8	12.0	6.5	17.0	22.8	8.0	8.5
1000	1.0	6.5	14.0	10.9	10.0	20.3	6.0	11.0
1100	1.0	3.8	10.0	12.0	4.0	15.5	4.0	7.1
1200	0.0	0.0	17.0	13.7	0.0	0.0	5.0	6.4
1300	0.0	0.0	9.0	10.8	0.0	0.0	3.0	4.9
1400	0.0	0.0	6.0	7.7	0.0	0.0	3.0	4.7
1500	1.0	1.9	7.0	4.1	2.0	8.7	5.0	4.9
1600	1.0	3.1	4.0	2.4	3.0	8.9	5.0	5.2
1700	1.0	4.5	3.0	1.4	3.0	9.7	5.0	5.0
1800	1.0	6.9	2.0	2.1	4.0	11.1	6.0	7.1
1900	2.0	14.8	1.0	1.0	6.0	11.6	7.0	9.3
2000	4.0	16.6	1.0	1.0	7.0	9.3	8.0	8.2
2100	7.0	18.0	1.0	1.0	7.0	8.2	8.0	9.0
2200	5.0	21.3	1.0	1.0	7.0	9.1	8.0	9.4
2300	8.0	25.3	1.0	1.0	7.0	9.6	11.0	10.5

Date: September 29, 1969
Station: BURK
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	19.0	8.3	1.0	1.6	13.0	9.7	9.0	6.2
100	20.0	9.6	1.0	1.4	12.0	8.6	9.0	5.5
200	21.0	8.7	1.0	1.5	12.0	7.8	10.0	4.4
300	24.0	6.8	1.0	1.7	13.0	7.7	11.0	4.6
400	27.0	8.3	0.0	0.0	14.0	7.6	12.0	6.0
500	29.0	10.3	1.0	1.4	15.0	8.1	13.0	6.4
600	31.0	14.8	1.0	1.8	15.0	7.9	15.0	10.5
700	34.0	23.9	2.0	2.2	17.0	10.3	18.0	15.6
800	27.0	20.1	4.0	5.2	25.0	16.5	17.0	13.2
900	14.0	10.5	7.0	8.9	29.0	17.1	9.0	8.6
1000	7.0	4.7	11.0	13.7	28.0	13.9	11.0	6.8
1100	3.0	3.2	14.0	16.3	19.0	9.9	10.0	5.8
1200	0.0	0.0	21.0	14.6	0.0	0.0	11.0	4.0
1300	0.0	0.0	14.0	10.1	0.0	0.0	7.0	3.2
1400	0.0	0.0	11.0	6.3	0.0	0.0	7.0	3.0
1500	1.0	2.9	5.0	5.4	11.0	5.8	5.0	4.6
1600	2.0	2.7	3.0	3.3	10.0	5.9	5.0	5.0
1700	3.0	3.5	2.0	2.1	11.0	6.2	6.0	4.4
1800	12.0	4.1	2.0	1.9	17.0	6.8	12.0	4.2
1900	27.0	7.1	1.0	1.2	19.0	7.3	16.0	4.9
2000	27.0	8.3	1.0	1.4	13.0	7.0	14.0	5.1
2100	31.0	9.0	1.0	1.2	11.0	6.8	16.0	5.4
2200	36.0	10.2	1.0	1.2	14.0	6.6	15.0	6.0
2300	36.0	13.0	1.0	1.2	15.0	7.1	14.0	8.0

Date: September 29, 1969
Station: PASA
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	11.0	8.2	3.0	1.2	15.0	8.6	0.0	0.0
100	6.0	9.9	2.0	1.3	11.0	8.8	0.0	0.0
200	3.0	9.7	2.0	1.4	9.0	8.5	0.0	0.0
300	5.0	9.5	2.0	1.5	10.0	8.1	0.0	0.0
400	3.0	12.1	0.0	0.0	6.0	9.1	0.0	0.0
500	2.0	14.7	2.0	1.2	7.0	9.4	0.0	0.0
600	9.0	19.4	2.0	1.2	9.0	9.0	0.0	0.0
700	16.0	25.4	2.0	2.1	10.0	12.3	0.0	0.0
800	2.0	20.3	9.0	3.9	9.0	19.7	0.0	0.0
900	1.0	12.6	17.0	8.0	6.0	21.9	0.0	0.0
1000	1.0	5.5	26.0	13.7	6.0	20.3	0.0	0.0
1100	1.0	3.4	41.0	17.6	12.0	13.0	0.0	0.0
1200	0.0	0.0	32.0	18.2	0.0	0.0	0.0	0.0
1300	1.0	4.8	20.0	14.6	5.0	7.8	0.0	0.0
1400	2.0	2.5	12.0	9.0	8.0	6.4	0.0	0.0
1500	1.0	3.0	9.0	6.0	6.0	7.1	0.0	0.0
1600	1.0	2.7	6.0	3.3	5.0	7.4	0.0	0.0
1700	2.0	3.3	3.0	2.0	6.0	7.1	0.0	0.0
1800	5.0	5.1	2.0	1.8	9.0	8.9	0.0	0.0
1900	11.0	10.1	2.0	1.1	13.0	9.1	0.0	0.0
2000	18.0	9.6	2.0	1.1	13.0	7.8	0.0	0.0
2100	17.0	11.6	2.0	1.0	13.0	7.1	0.0	0.0
2200	17.0	14.2	2.0	1.0	13.0	7.1	0.0	0.0
2300	18.0	15.3	2.0	1.0	11.0	8.4	0.0	0.0

Date: September 29, 1969
Station: AZU
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	O2 MEAS	O2 CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	4.0	8.2	2.0	2.2	13.0	11.8	9.0	5.7
100	5.0	7.4	2.0	1.9	15.0	10.7	10.0	5.3
200	5.0	6.7	2.0	1.9	14.0	10.3	9.0	5.3
300	5.0	7.1	2.0	1.6	13.0	9.9	9.0	5.1
400	5.0	8.2	0.0	0.0	13.0	9.2	9.0	6.4
500	4.0	9.9	2.0	1.6	12.0	9.3	10.0	6.7
600	6.0	14.8	2.0	1.6	12.0	9.6	10.0	9.4
700	4.0	19.9	3.0	2.3	13.0	13.0	10.0	13.6
800	3.0	11.5	9.0	5.0	16.0	18.4	11.0	11.0
900	1.0	8.0	16.0	10.7	11.0	18.6	10.0	9.2
1000	1.0	3.7	22.0	17.4	8.0	17.7	8.0	7.8
1100	1.0	2.4	24.0	23.2	5.0	12.8	6.0	7.0
1200	0.0	0.0	28.0	22.1	0.0	0.0	7.0	3.9
1300	0.0	0.0	38.0	16.0	0.0	0.0	9.0	3.1
1400	0.0	0.0	25.0	10.3	0.0	0.0	6.0	2.9
1500	1.0	2.5	14.0	8.0	5.0	6.7	6.0	3.5
1600	1.0	2.2	7.0	3.9	7.0	7.9	4.0	4.1
1700	1.0	2.6	2.0	3.2	7.0	7.3	5.0	3.7
1800	1.0	4.0	1.0	2.2	11.0	8.8	7.0	4.2
1900	3.0	8.4	1.0	1.8	13.0	9.1	7.0	3.9
2000	2.0	11.5	1.0	1.6	11.0	9.3	7.0	5.2
2100	3.0	14.7	1.0	1.6	11.0	9.2	8.0	7.0
2200	4.0	17.7	1.0	1.6	10.0	9.2	9.0	7.1
2300	4.0	17.1	1.0	1.6	10.0	9.6	11.0	8.1

Date: September 29, 1969
Station: WEST
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	O2 MEAS	O2 CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	6.0	10.0	1.0	1.4	7.0	10.1	4.0	7.0
100	7.0	11.3	1.0	1.4	7.0	9.0	4.0	6.1
200	4.0	11.0	1.0	1.7	7.0	8.1	3.0	5.6
300	1.0	10.1	2.0	1.7	7.0	8.0	3.0	6.0
400	5.0	11.6	0.0	0.0	9.0	8.3	6.0	6.9
500	8.0	13.5	1.0	1.3	8.0	9.3	5.0	7.9
600	15.0	18.2	1.0	1.7	8.0	9.1	9.0	12.3
700	35.0	23.7	1.0	2.4	12.0	11.2	17.0	14.9
800	38.0	17.9	3.0	5.2	21.0	17.3	17.0	12.6
900	6.0	11.8	5.0	8.3	19.0	18.6	8.0	8.6
1000	3.0	5.4	10.0	11.7	14.0	16.5	0.0	0.0
1100	0.0	0.0	12.0	13.7	0.0	0.0	5.0	6.6
1200	0.0	0.0	10.0	13.6	0.0	0.0	4.0	5.1
1300	1.0	5.4	10.0	9.5	8.0	7.2	4.0	3.8
1400	1.0	2.4	6.0	6.6	8.0	5.9	4.0	3.8
1500	2.0	2.7	4.0	5.2	8.0	6.4	4.0	5.3
1600	3.0	2.6	2.0	3.6	9.0	6.3	5.0	5.2
1700	5.0	3.2	1.0	2.4	10.0	6.7	4.0	4.9
1800	1.0	6.3	3.0	1.5	9.0	8.3	4.0	5.5
1900	5.0	10.9	1.0	1.1	9.0	8.9	4.0	7.4
2000	9.0	9.9	1.0	1.4	9.0	7.1	5.0	6.6
2100	10.0	11.1	1.0	1.1	8.0	6.8	5.0	7.4
2200	13.0	12.9	1.0	1.1	8.0	7.1	6.0	7.3
2300	21.0	14.1	1.0	1.1	7.0	8.1	8.0	8.4

Date: September 29, 1969
Station: LENX
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	O2 MEAS	O2 CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	5.0	8.3	1.0	1.3	7.0	8.0	5.0	4.2
100	3.0	9.4	2.0	1.1	6.0	7.5	3.0	4.4
200	1.0	8.5	2.0	1.1	4.0	7.5	3.0	4.1
300	1.0	7.8	3.0	1.6	3.0	7.4	3.0	4.2
400	2.0	10.5	0.0	0.0	5.0	7.5	4.0	6.2
500	3.0	15.3	1.0	1.1	7.0	7.8	6.0	6.8
600	17.0	20.3	1.0	1.1	8.0	7.8	15.0	9.9
700	20.0	29.6	2.0	1.5	10.0	10.8	9.0	16.4
800	9.0	26.6	2.0	4.0	13.0	18.5	5.0	15.7
900	6.0	13.2	3.0	6.9	10.0	22.5	5.0	10.1
1000	4.0	6.5	4.0	11.1	11.0	18.4	6.0	8.5
1100	0.0	0.0	10.0	13.2	0.0	0.0	0.0	0.0
1200	0.0	0.0	7.0	11.1	0.0	0.0	3.0	5.1
1300	0.0	0.0	8.0	8.1	0.0	0.0	3.0	4.2
1400	1.0	5.4	5.0	5.6	5.0	6.8	4.0	4.0
1500	2.0	6.2	4.0	4.0	6.0	8.4	6.0	4.7
1600	3.0	6.6	4.0	2.5	7.0	7.8	6.0	4.8
1700	3.0	7.7	4.0	1.3	8.0	7.8	5.0	4.5
1800	5.0	8.4	1.0	1.9	9.0	8.4	3.0	4.9
1900	5.0	10.1	1.0	1.3	8.0	8.2	4.0	6.1
2000	1.0	10.7	2.0	1.3	5.0	7.4	3.0	5.8
2100	1.0	12.7	1.0	1.1	5.0	7.1	4.0	6.5
2200	3.0	15.6	1.0	1.1	5.0	7.1	3.0	7.2
2300	3.0	18.2	1.0	1.1	5.0	8.0	3.0	8.3

Date: September 29, 1969
Station: COMM
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	O2 MEAS	O2 CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	11.0	7.2	0.0	0.0	7.0	8.5	7.0	4.1
100	14.0	7.6	0.0	0.0	7.0	8.2	7.0	4.0
200	14.0	7.1	0.0	0.0	8.0	7.6	7.0	3.8
300	13.0	6.8	0.0	0.0	7.0	7.2	7.0	3.8
400	21.0	7.8	0.0	0.0	10.0	7.0	10.0	5.0
500	23.0	11.5	0.0	0.0	11.0	7.6	9.0	6.3
600	26.0	17.9	0.0	0.0	10.0	7.5	12.0	10.1
700	32.0	24.1	0.0	0.0	16.0	10.1	17.0	14.6
800	22.0	18.2	0.0	0.0	26.0	16.3	15.0	12.9
900	15.0	11.6	0.0	0.0	32.0	18.9	15.0	8.2
1000	7.0	5.3	0.0	0.0	25.0	18.3	9.0	8.3
1100	6.0	3.3	9.0	20.1	14.0	14.0	6.0	6.9
1200	3.0	1.0	5.0	19.3	10.0	7.9	4.0	4.6
1300	9.0	4.0	2.0	14.5	9.0	9.0	3.0	3.9
1400	6.0	3.2	2.0	9.1	7.0	6.7	3.0	3.3
1500	9.0	3.6	0.0	0.0	7.0	7.3	4.0	4.5
1600	0.0	0.0	0.0	0.0	4.0	7.9	3.0	4.8
1700	0.0	0.0	1.0	2.3	3.0	7.8	3.0	4.4
1800	0.0	0.0	0.0	0.0	5.0	8.8	3.0	4.6
1900	0.0	0.0	0.0	0.0	4.0	9.0	3.0	5.9
2000	1.0	11.0	0.0	0.0	3.0	8.4	5.0	5.3
2100	5.0	12.6	0.0	0.0	3.0	7.9	6.0	6.0
2200	9.0	14.5	0.0	0.0	3.0	7.6	6.0	6.7
2300	8.0	16.0	0.0	0.0	0.0	0.0	7.0	8.1

Date: September 29, 1969
Station: CAP
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	5.0	9.2	1.0	1.5	5.0	9.7	1.0	6.7
100	9.0	9.8	1.0	1.4	6.0	8.8	1.0	6.5
200	10.0	9.0	1.0	1.6	6.0	8.4	1.0	6.0
300	9.0	8.5	1.0	1.8	6.0	8.0	1.0	6.2
400	10.0	11.0	0.0	0.0	5.0	8.7	2.0	7.9
500	16.0	13.4	1.0	1.3	4.0	9.6	3.0	8.4
600	16.0	19.6	1.0	1.5	2.0	9.8	7.0	11.9
700	28.0	25.0	2.0	2.0	3.0	13.3	17.0	14.9
800	36.0	16.4	5.0	4.5	11.0	20.0	18.0	12.5
900	30.0	8.0	8.0	8.5	19.0	21.4	0.0	0.0
1000	11.0	4.4	12.0	13.7	18.0	18.7	0.0	0.0
1100	5.0	3.5	5.0	18.0	10.0	14.2	6.0	6.7
1200	0.0	0.0	8.0	16.9	0.0	0.0	3.0	5.1
1300	0.0	0.0	7.0	12.3	0.0	0.0	3.0	4.0
1400	2.0	4.2	5.0	7.7	5.0	7.0	2.0	3.8
1500	3.0	4.5	3.0	6.1	6.0	7.3	6.0	4.2
1600	5.0	3.7	2.0	3.7	7.0	6.9	6.0	4.1
1700	6.0	4.3	1.0	2.2	7.0	6.7	5.0	4.1
1800	8.0	5.8	1.0	1.9	5.0	8.7	4.0	4.8
1900	11.0	9.0	1.0	1.4	4.0	9.2	7.0	5.4
2000	12.0	8.8	1.0	1.4	4.0	8.1	4.0	6.2
2100	10.0	11.5	1.0	1.2	4.0	7.6	4.0	7.1
2200	11.0	14.1	1.0	1.2	3.0	7.8	6.0	7.1
2300	15.0	14.8	1.0	1.2	5.0	8.8	9.0	8.0

Date: September 29, 1969
Station: LONB
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	3.0	7.2	1.0	1.0	6.0	7.1	2.0	4.7
100	3.0	7.9	1.0	1.3	5.0	7.4	3.0	4.2
200	2.0	7.9	1.0	1.5	5.0	6.8	2.0	4.2
300	1.0	7.1	2.0	1.7	4.0	5.7	2.0	3.9
400	1.0	9.9	0.0	0.0	2.0	7.2	3.0	5.7
500	16.0	12.4	1.0	1.2	4.0	8.3	7.0	6.4
600	27.0	20.4	1.0	1.0	6.0	7.8	9.0	11.5
700	26.0	25.2	1.0	2.0	9.0	11.7	13.0	14.1
800	18.0	14.9	1.0	3.7	17.0	19.1	11.0	12.0
900	10.0	11.0	2.0	7.2	28.0	22.0	9.0	10.4
1000	9.0	4.7	2.0	13.3	20.0	22.5	6.0	9.4
1100	8.0	3.4	6.0	20.1	22.0	14.9	6.0	6.0
1200	0.0	0.0	2.0	19.4	0.0	0.0	6.0	3.0
1300	16.0	3.8	1.0	13.5	19.0	8.2	5.0	2.4
1400	18.0	2.1	1.0	8.5	6.0	7.0	5.0	2.5
1500	21.0	3.2	1.0	6.0	13.0	6.5	5.0	4.1
1600	21.0	2.6	1.0	4.0	11.0	7.1	5.0	3.8
1700	21.0	2.9	1.0	2.8	9.0	6.8	5.0	3.4
1800	20.0	4.6	1.0	1.6	8.0	7.9	4.0	2.7
1900	4.0	6.4	2.0	1.3	5.0	7.4	4.0	4.1
2000	5.0	7.2	2.0	1.3	6.0	6.9	4.0	4.0
2100	12.0	9.8	1.0	1.0	7.0	6.2	5.0	4.8
2200	16.0	11.8	1.0	1.0	6.0	5.9	6.0	5.0
2300	15.0	12.0	1.0	1.0	6.0	6.5	5.0	6.4

Date: September 29, 1969
Station: WHTR
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	10.0	5.8	1.0	1.9	9.0	9.0	5.0	5.3
100	11.0	5.7	1.0	1.5	9.0	8.8	5.0	5.5
200	11.0	5.6	1.0	1.5	8.0	8.6	5.0	5.1
300	10.0	5.4	1.0	1.8	7.0	7.6	4.0	5.1
400	12.0	6.3	0.0	0.0	9.0	7.5	6.0	6.3
500	20.0	8.2	1.0	1.7	10.0	8.3	7.0	7.3
600	30.0	14.9	1.0	1.5	11.0	7.8	11.0	9.5
700	34.0	18.1	2.0	2.1	19.0	10.7	14.0	13.7
800	9.0	11.8	6.0	3.8	30.0	16.4	11.0	12.0
900	3.0	9.1	11.0	8.6	37.0	16.8	11.0	10.1
1000	2.0	4.4	21.0	14.5	41.0	16.0	13.0	7.1
1100	1.0	3.3	34.0	21.9	21.0	12.8	0.0	0.0
1200	0.0	0.0	30.0	23.2	0.0	0.0	2.0	4.9
1300	1.0	6.8	19.0	17.7	10.0	7.7	1.0	4.5
1400	1.0	3.8	12.0	10.6	9.0	6.5	1.0	3.8
1500	1.0	4.7	7.0	7.4	10.0	6.0	1.0	4.6
1600	2.0	4.3	4.0	4.1	12.0	6.7	1.0	4.6
1700	1.0	5.0	5.0	2.2	9.0	6.5	1.0	4.4
1800	1.0	6.4	3.0	1.5	11.0	7.9	1.0	4.6
1900	5.0	6.9	2.0	1.5	11.0	7.9	3.0	4.6
2000	13.0	8.3	1.0	1.5	13.0	7.6	4.0	5.2
2100	16.0	12.5	1.0	1.3	10.0	7.7	5.0	6.5
2200	15.0	15.9	1.0	1.4	9.0	7.5	5.0	7.1
2300	19.0	13.9	1.0	1.4	9.0	7.5	7.0	7.9

Date: September 29, 1969
Station: LAH
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	2.0	8.4	0.0	0.0	8.0	9.6	0.0	0.0
100	3.0	8.1	0.0	0.0	7.0	9.9	0.0	0.0
200	2.0	8.4	0.0	0.0	7.0	9.2	0.0	0.0
300	3.0	7.5	0.0	0.0	6.0	8.1	0.0	0.0
400	3.0	9.4	0.0	0.0	6.0	9.0	0.0	0.0
500	1.0	13.7	0.0	0.0	7.0	9.5	0.0	0.0
600	10.0	20.8	0.0	0.0	6.0	9.7	0.0	0.0
700	13.0	24.0	0.0	0.0	10.0	13.7	0.0	0.0
800	8.0	11.0	2.0	4.9	15.0	21.1	0.0	0.0
900	0.0	0.0	7.0	9.9	10.0	25.0	0.0	0.0
1000	4.0	3.3	14.0	17.1	14.0	24.6	0.0	0.0
1100	2.0	2.6	28.0	24.2	11.0	15.9	0.0	0.0
1200	1.0	1.7	35.0	22.9	5.0	11.3	0.0	0.0
1300	0.0	0.0	25.0	16.9	3.0	10.4	0.0	0.0
1400	1.0	3.3	11.0	11.9	5.0	8.1	0.0	0.0
1500	2.0	3.8	7.0	7.9	3.0	8.1	0.0	0.0
1600	2.0	3.6	4.0	4.4	5.0	9.0	0.0	0.0
1700	3.0	3.6	2.0	3.3	4.0	8.4	0.0	0.0
1800	4.0	4.8	0.0	0.0	6.0	9.9	0.0	0.0
1900	8.0	5.7	0.0	0.0	7.0	9.6	0.0	0.0
2000	10.0	9.4	0.0	0.0	7.0	9.9	0.0	0.0
2100	16.0	12.9	0.0	0.0	7.0	9.0	0.0	0.0
2200	22.0	13.9	0.0	0.0	7.0	8.5	0.0	0.0
2300	16.0	15.0	0.0	0.0	6.0	8.7	0.0	0.0

Date: September 29, 1969
Station: ANA
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	9.0	6.2	0.0	0.0	6.0	9.5	0.0	0.0
100	6.0	6.6	1.0	1.3	9.0	8.8	0.0	0.0
200	9.0	6.1	1.0	1.3	8.0	8.7	0.0	0.0
300	6.0	6.0	0.0	0.0	5.0	7.7	0.0	0.0
400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
500	9.0	11.5	2.0	1.2	10.0	8.8	0.0	0.0
600	20.0	19.2	0.0	0.0	8.0	9.1	0.0	0.0
700	21.0	22.0	0.0	0.0	9.0	14.0	0.0	0.0
800	7.0	11.1	3.0	3.2	16.0	21.4	0.0	0.0
900	4.0	6.5	7.0	8.0	20.0	23.2	0.0	0.0
1000	1.0	4.2	15.0	14.7	22.0	22.9	0.0	0.0
1100	0.0	0.0	31.0	21.2	17.0	15.6	0.0	0.0
1200	1.0	1.5	34.0	21.8	12.0	6.4	0.0	0.0
1300	1.0	7.1	22.0	15.4	10.0	8.8	0.0	0.0
1400	1.0	4.3	17.0	9.8	11.0	6.5	0.0	0.0
1500	2.0	5.4	9.0	7.1	6.0	7.5	0.0	0.0
1600	1.0	5.4	6.0	3.8	7.0	8.6	0.0	0.0
1700	2.0	5.4	3.0	3.0	10.0	7.1	0.0	0.0
1800	6.0	5.8	1.0	2.3	11.0	8.5	0.0	0.0
1900	4.0	6.3	1.0	2.0	10.0	8.0	0.0	0.0
2000	7.0	9.1	1.0	1.7	9.0	8.5	0.0	0.0
2100	12.0	14.5	1.0	1.2	8.0	8.2	0.0	0.0
2200	12.0	18.2	0.0	0.0	8.0	7.9	0.0	0.0
2300	12.0	16.5	0.0	0.0	7.0	8.0	0.0	0.0

Date: September 29, 1969
Station: POMA
Exponent Used: 1.00

HOUR	NO MEAS	NO CALC	OZ MEAS	OZ CALC	N2 MEAS	N2 CALC	CO MEAS	CO CALC
0	9.0	5.7	3.0	1.6	21.0	9.5	8.0	7.5
100	4.0	5.9	3.0	1.5	20.0	10.5	7.0	8.1
200	4.0	6.3	3.0	1.5	20.0	9.8	7.0	7.5
300	5.0	5.7	2.0	1.6	19.0	8.4	7.0	7.1
400	5.0	6.2	0.0	0.0	17.0	9.8	7.0	7.9
500	5.0	7.6	2.0	1.7	15.0	9.9	7.0	8.9
600	5.0	14.8	2.0	1.6	16.0	9.5	8.0	10.4
700	6.0	15.9	3.0	2.6	18.0	12.7	9.0	11.5
800	4.0	6.3	9.0	4.6	21.0	18.7	9.0	10.1
900	1.0	2.4	16.0	10.0	15.0	18.0	0.0	0.0
1000	1.0	2.0	19.0	17.4	10.0	19.2	6.0	8.7
1100	1.0	1.3	14.0	27.3	10.0	12.2	5.0	7.2
1200	0.0	0.0	15.0	29.8	0.0	0.0	4.0	5.1
1300	0.0	0.0	21.0	25.0	0.0	0.0	5.0	5.1
1400	1.0	1.0	21.0	15.2	5.0	8.1	6.0	3.5
1500	1.0	1.5	16.0	8.9	8.0	5.7	6.0	3.5
1600	2.0	1.5	6.0	4.8	13.0	7.5	6.0	2.9
1700	2.0	1.7	6.0	2.8	13.0	7.3	5.0	3.6
1800	3.0	2.8	3.0	1.7	14.0	9.7	6.0	4.8
1900	7.0	4.9	2.0	1.3	12.0	10.5	5.0	4.7
2000	12.0	7.3	2.0	1.0	12.0	10.0	7.0	5.9
2100	20.0	10.8	2.0	1.0	14.0	9.2	11.0	6.9
2200	27.0	12.4	2.0	1.0	15.0	8.6	10.0	7.5
2300	23.0	11.7	2.0	1.0	14.0	8.2	9.0	9.5

APPENDIX 4.

CORRELATION COEFFICIENTS BETWEEN STATION MEASUREMENTS (NO)

STATION	RESD	BURK	PASA	AZU	WEST	LENX	COMM	CAP	LONB	WHTR	LAH	ANA	POMA
RESD	-	0.95	0.75	0.89	0.73	0.72	0.95	0.54	0.61	0.92	0.69	0.87	0.99
BURK	0.95	-	0.70	0.89	0.74	0.75	0.97	0.71	0.50	0.89	0.72	0.86	0.93
PASA	0.75	0.70	-	0.68	0.64	0.92	0.78	0.37	0.68	0.89	0.87	0.91	0.75
AZU	0.89	0.89	0.68	-	0.51	0.73	0.86	0.37	0.67	0.92	0.66	0.90	0.91
WEST	0.73	0.74	0.64	0.51	-	0.74	0.79	0.79	0.42	0.63	0.82	0.67	0.73
LENX	0.72	0.75	0.92	0.73	0.74	-	0.84	0.57	0.61	0.87	0.97	0.94	0.76
COMM	0.95	0.97	0.78	0.86	0.79	0.84	-	0.70	0.67	0.93	0.81	0.92	0.95
CAP	0.54	0.71	0.37	0.37	0.79	0.57	0.70	-	0.08	0.45	0.75	0.46	0.54
LONB	0.61	0.50	0.68	0.67	0.42	0.61	0.67	0.08	-	0.69	0.59	0.68	0.65
WHTR	0.92	0.89	0.89	0.92	0.63	0.87	0.93	0.45	0.69	-	0.78	0.98	0.94
LAH	0.69	0.72	0.87	0.66	0.82	0.97	0.81	0.75	0.59	0.78	-	0.86	0.73
ANA	0.87	0.86	0.91	0.90	0.67	0.94	0.92	0.46	0.68	0.98	0.86	-	0.89
POMA	0.99	0.93	0.75	0.91	0.73	0.76	0.95	0.54	0.65	0.94	0.73	0.89	-

CORRELATION COEFFICIENTS BETWEEN STATION MEASUREMENTS (O_3)

STATION	RESD	BURK	PASA	AZU	WEST	LENX	ELM	COMM	CAP	LONB	WHTR	LAH	ANA	POMA	SNA
RESD	-	0.81	0.80	0.66	0.77	0.51	0.66	0.35	0.88	0.39	0.78	0.60	0.62	0.64	0.63
BURK	0.81	-	0.87	0.90	0.91	0.84	0.93	0.26	0.76	0.46	0.92	0.96	0.95	0.73	0.89
PASA	0.80	0.87	-	0.75	0.95	0.85	0.94	0.94	0.86	0.80	0.99	0.85	0.88	0.62	0.86
AZU	0.66	0.90	0.75	-	0.90	0.84	0.72	-0.56	0.73	0.32	0.80	0.80	0.80	0.89	0.72
WEST	0.77	0.91	0.95	0.90	-	0.88	0.93	0.76	0.88	0.64	0.96	0.88	0.89	0.77	0.91
LENX	0.51	0.84	0.85	0.84	0.88	-	0.84	0.77	0.60	0.67	0.89	0.87	0.90	0.64	0.74
ELM	0.66	0.93	0.94	0.72	0.93	0.84	-	0.78	0.65	0.66	0.98	0.97	0.97	0.37	0.94
COMM	0.35	0.26	0.94	-0.56	0.76	0.77	0.78	-	0.85	0.97	0.90	0.53	0.75	-0.92	0.74
CAP	0.88	0.76	0.86	0.73	0.88	0.60	0.65	0.85	-	0.55	0.83	0.52	0.59	0.75	0.68
LONB	0.39	0.46	0.80	0.32	0.64	0.67	0.66	0.97	0.55	-	0.75	0.51	0.59	0.21	0.54
WHTR	0.78	0.92	0.99	0.80	0.96	0.89	0.98	0.90	0.83	0.75	-	0.92	0.94	0.64	0.91
LAH	0.60	0.96	0.85	0.80	0.88	0.87	0.97	0.53	0.52	0.51	0.92	-	0.98	0.38	0.88
ANA	0.62	0.95	0.88	0.80	0.89	0.90	0.97	0.75	0.59	0.59	0.94	0.98	-	0.52	0.91
POMA	0.64	0.73	0.62	0.89	0.77	0.64	0.37	-0.92	0.75	0.21	0.64	0.38	0.52	-	0.52
SNA	0.63	0.89	0.86	0.72	0.91	0.74	0.94	0.74	0.68	0.54	0.91	0.88	0.91	0.52	-

CORRELATION COEFFICIENTS BETWEEN STATION MEASUREMENTS (NO_2)

STATION	RESD	BURK	PASA	AZU	WEST	LENX	COMM	CAP	LONB	WHTR	LAH	ANA	POMA
RESD	-	0.65	0.13	0.92	0.75	0.78	0.73	0.24	0.12	0.48	0.61	0.40	0.84
BURK	0.65	-	0.05	0.34	0.85	0.82	0.98	0.84	0.74	0.96	0.84	0.94	0.22
PASA	0.13	0.05	-	0.18	0.19	0.29	0.09	-0.30	-0.10	0.02	0.43	0.12	0.20
AZU	0.92	0.34	0.18	-	0.52	0.65	0.44	-0.12	-0.23	0.17	0.42	0.06	0.95
WEST	0.75	0.85	0.19	0.52	-	0.87	0.92	0.73	0.68	0.85	0.84	0.76	0.55
LENX	0.78	0.82	0.29	0.65	0.87	-	0.84	0.56	0.59	0.82	0.94	0.67	0.71
COMM	0.73	0.98	0.09	0.44	0.92	0.84	-	0.80	0.67	0.95	0.82	0.84	0.44
CAP	0.24	0.84	-0.30	-0.12	0.73	0.56	0.80	-	0.90	0.91	0.62	0.89	-0.03
LONB	0.12	0.74	-0.10	-0.23	0.68	0.59	0.67	0.90	-	0.72	0.43	0.74	0.03
WHTR	0.48	0.96	0.02	0.17	0.85	0.82	0.93	0.91	0.72	-	0.85	0.91	0.25
LAH	0.61	0.84	0.43	0.42	0.84	0.94	0.82	0.62	0.43	0.85	-	0.78	0.47
ANA	0.40	0.94	0.12	0.06	0.76	0.67	0.84	0.89	0.74	0.91	0.78	-	0.04
POMA	0.84	0.22	0.20	0.95	0.55	0.71	0.44	-0.03	0.03	0.25	0.47	0.04	-

CORRELATION COEFFICIENTS BETWEEN STATION MEASUREMENTS (CO)

STATION	RESD	BURK	AZU	WEST	LENX	ELM	COMM	CAP	LONB	WHTR	POMA
RESD	-	0.86	0.71	0.84	0.66	0.54	0.88	0.74	0.92	0.80	0.88
BURK	0.86	-	0.76	0.82	0.47	0.76	0.81	0.71	0.87	0.79	0.73
AZU	0.71	0.76	-	0.64	0.30	0.36	0.80	0.51	0.74	0.75	0.66
WEST	0.84	0.82	0.64	-	0.36	0.57	0.86	0.97	0.95	0.84	0.87
LENX	0.66	0.47	0.30	0.36	-	0.21	0.46	0.29	0.45	0.51	0.60
ELM	0.54	0.76	0.36	0.57	0.21	-	0.62	0.60	0.62	0.85	0.26
COMM	0.88	0.81	0.80	0.86	0.46	0.62	-	0.85	0.94	0.92	0.88
CAP	0.74	0.71	0.51	0.97	0.29	0.60	0.85	-	0.88	0.78	0.81
LONB	0.92	0.87	0.74	0.95	0.45	0.62	0.94	0.88	-	0.81	0.86
WHTR	0.80	0.79	0.73	0.84	0.51	0.85	0.92	0.78	0.81	-	0.75
POMA	0.88	0.73	0.66	0.87	0.60	0.26	0.88	0.81	0.86	0.75	-

AVERAGE DIFFERENCES BETWEEN STATION MEASUREMENTS (NO)

STATION	RESD	BURK	PASA	AZU	WEST	LENX	COMM	CAP	LONB	WHTR	LAH	ANA	POMA
RESD	0.0	15.2	3.3	3.2	14.2	5.5	13.7	15.7	13.9	11.3	3.3	5.6	2.6
BURK	15.2	0.0	16.2	18.1	10.6	13.5	4.5	9.4	11.2	7.9	16.0	12.4	17.6
PASA	3.3	16.2	0.0	4.2	13.3	4.3	13.4	15.9	14.6	10.2	2.6	4.8	3.6
AZU	3.2	18.1	4.2	0.0	17.0	7.5	16.7	17.9	15.9	14.0	4.2	8.2	0.9
WEST	14.2	10.6	13.3	17.0	0.0	11.0	9.7	9.2	13.9	11.1	13.5	10.9	15.4
LENX	5.5	13.5	4.3	7.5	11.0	0.0	10.9	13.3	12.5	8.6	3.6	2.7	6.7
COMM	13.7	4.5	13.4	16.7	9.7	10.9	0.0	8.5	6.9	7.4	12.5	9.4	15.3
CAP	15.7	9.4	15.9	17.9	9.2	13.3	8.5	0.0	13.0	13.5	12.2	13.9	16.5
LONB	13.9	11.2	14.6	15.9	13.9	12.5	6.9	13.0	0.0	12.0	14.4	12.7	15.6
WHTR	11.3	7.9	10.2	14.0	11.1	8.6	7.4	13.5	12.0	0.0	11.6	6.3	12.9
LAH	3.3	16.0	2.6	4.2	13.5	3.6	12.5	12.2	14.4	11.6	0.0	5.2	3.6
ANA	5.6	12.4	4.8	8.2	10.9	2.7	9.4	13.9	12.7	6.3	5.2	0.0	7.3
POMA	2.6	17.6	3.6	0.9	15.4	6.7	15.3	16.5	15.6	12.9	3.6	7.3	0.0

AVERAGE DIFFERENCES BETWEEN STATION MEASUREMENTS (O_3)

STATION	RESD	BURK	PASA	AZU	WEST	LENX	ELM	COMM	CAP	LONB	WHTR	LAH	ANA	POMA	SNA
RESD	0.0	3.7	11.3	11.8	3.9	5.4	5.9	7.2	3.6	7.6	8.9	10.6	10.4	6.6	4.5
BURK	3.7	0.0	10.3	10.2	3.8	5.4	3.3	11.2	4.9	8.3	7.3	7.7	7.8	6.4	2.7
PASA	11.3	10.3	0.0	8.4	12.7	14.5	9.9	23.5	13.4	17.2	3.3	7.5	6.2	10.0	10.9
AZU	11.8	10.2	8.4	0.0	13.1	14.7	11.9	25.4	13.9	17.8	7.8	8.7	7.7	7.0	11.7
WEST	3.9	3.8	12.7	13.1	0.0	2.3	5.8	5.3	1.9	4.9	9.9	11.4	11.3	8.1	4.8
LENX	5.4	5.4	14.5	14.7	2.3	0.0	7.7	3.5	3.0	3.3	11.7	13.2	13.0	9.6	6.9
ELM	5.9	3.3	9.9	11.9	5.8	7.7	0.0	12.9	7.2	10.8	6.4	6.0	6.7	8.9	3.1
COMM	7.2	11.2	23.3	25.4	5.3	3.5	12.9	0.0	3.3	2.2	20.2	21.6	22.1	14.6	10.5
CAP	3.6	4.9	13.4	13.9	1.9	3.0	7.2	3.3	0.0	4.6	10.9	12.8	12.6	8.4	5.9
LONB	7.6	8.3	17.2	17.8	4.9	3.3	10.8	2.2	4.6	0.0	14.5	16.5	16.2	12.4	10.1
WHTR	8.9	7.3	3.3	7.8	9.9	11.7	6.4	20.2	10.9	14.5	0.0	4.5	3.6	8.3	7.7
LAH	10.6	7.7	7.5	8.7	11.4	13.2	6.0	21.6	12.8	16.5	4.5	0.0	2.7	10.3	7.8
ANA	10.4	7.8	6.2	7.7	11.3	13.0	6.7	22.1	12.6	16.2	3.6	2.7	0.0	9.2	7.9
POMA	6.6	6.4	10.0	7.0	8.1	9.6	8.9	14.6	8.4	12.4	8.3	10.3	9.2	0.0	6.9
SNA	4.5	2.7	10.9	11.7	4.8	6.9	3.1	10.5	5.9	10.1	7.7	7.8	7.9	6.9	0.0

AVERAGE DIFFERENCES BETWEEN STATION MEASUREMENTS (NO_2)

STATION	RESD	BURK	PASA	AZU	WEST	LENX	COMM	CAP	LONB	WHTR	LAH	ANA	POMA
RESD	0.0	9.8	6.8	3.2	4.1	5.1	8.3	7.6	9.9	14.6	5.1	6.8	5.0
BURK	9.8	0.0	13.0	11.0	7.5	11.1	3.9	10.5	6.7	5.9	10.6	6.4	8.4
PASA	6.8	13.0	0.0	4.4	6.4	2.8	11.3	6.6	10.2	16.2	3.7	7.2	7.1
AZU	3.2	11.0	4.4	0.0	4.6	3.0	10.2	7.3	10.1	16.0	4.1	7.1	4.3
WEST	4.1	7.5	6.4	4.6	0.0	4.4	6.1	5.4	5.6	11.0	4.5	3.5	4.8
LENX	5.1	11.1	2.8	3.0	4.4	0.0	10.1	5.0	7.5	15.2	1.8	5.5	6.0
COMM	8.3	3.9	11.3	10.2	6.1	10.1	0.0	8.7	6.6	6.3	8.6	5.4	8.3
CAP	7.6	10.5	6.6	7.3	5.4	5.0	8.7	0.0	6.2	13.3	4.5	4.8	8.7
LONB	9.9	6.7	10.2	10.1	5.6	7.5	6.6	6.2	0.0	9.3	9.0	5.3	8.7
WHTR	14.6	5.9	16.2	16.0	11.0	15.2	6.3	13.3	9.3	0.0	13.7	9.6	13.1
LAH	5.1	10.6	3.7	4.1	4.5	1.8	8.6	4.5	9.0	13.7	0.0	5.5	6.3
ANA	6.8	6.4	7.2	7.1	3.5	5.5	5.4	4.8	5.3	9.6	5.5	0.0	7.0
POMA	5.0	8.4	7.1	4.3	4.8	6.0	8.3	8.7	8.7	13.1	6.3	7.0	0.0

AVERAGE DIFFERENCES BETWEEN STATION MEASUREMENTS (O_3)

STATION	RESD	BURK	AZU	WEST	LENX	ELM	COMM	CAP	LONB	WHTR	POMA
RESD	0.0	4.0	2.9	2.6	3.4	2.4	2.7	3.7	1.8	3.3	2.9
BURK	4.0	0.0	3.9	4.2	6.1	5.0	3.8	5.4	4.2	5.2	5.5
AZU	2.9	3.9	0.0	3.8	3.9	3.7	3.6	4.8	1.9	4.3	2.2
WEST	2.6	4.2	3.8	0.0	5.1	4.0	2.8	1.4	2.4	3.3	3.8
LENX	3.4	6.1	3.9	5.1	0.0	2.2	5.3	5.9	3.3	4.5	2.7
ELM	2.4	5.0	3.7	4.0	2.2	0.0	4.4	4.6	2.5	3.7	2.8
COMM	2.7	3.8	3.6	2.8	5.3	4.4	0.0	2.9	3.0	2.8	3.8
CAP	3.7	5.4	4.8	1.4	5.9	4.6	2.9	0.0	3.3	4.0	4.3
LONB	1.8	4.2	1.9	2.4	3.3	2.5	3.0	3.3	0.0	3.5	1.6
WHTR	3.3	5.2	4.3	3.3	4.5	3.7	2.8	4.0	3.5	0.0	4.3
POMA	2.9	5.5	2.2	3.8	2.7	2.8	3.8	4.3	1.6	4.3	0.0