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ENVIRONMENTAL Technical Applications Center

TECHNICAL NOTE
70-9

ETAC

THE NATIONAL AIR POLLUTION POTENTIAL FORECAST PROGRAM

A Reprint of
ESSA WBTM NMC 47 (MAY 70)

by

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U. S. Department of Commerce
Environmental Science Services Administration
Weather Bureau

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WASHINGTON, D.C., 20333

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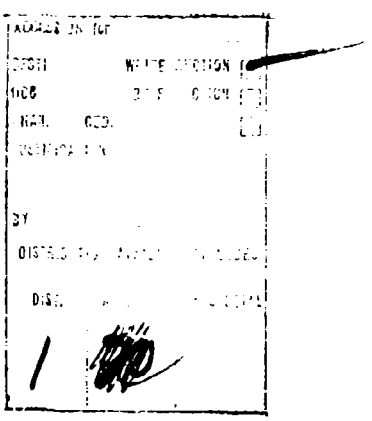
FOREWORD

AFR 161-22 "Environmental Pollution Control," 23 September 1970, makes Air Weather Service responsible to (1) develop and maintain procedures to interpret and tailor for USAF installations the available air-pollution potential (APP) forecasts of the National Meteorological Center and (2) issue forecasts and warnings as required to support Air Force global environmental-pollution-control operations. Through AFGWC, AWS is developing the capability to use the NMC forecasts in conjunction with the boundary-layer model to produce tailored APP forecasts for the USAF. In the interim, the NMC teletype air-pollution-potential bulletin (described on page 22 of this Technical Note) will be transmitted on COMET III. This Technical Note reprints WBTM NMC 47 and is provided to assist AWS detachments in the interpretation of the NMC bulletin. Further information will be provided as we learn more about the problems involved in this new area of support.

The AWS gratefully acknowledges NOAA's permission to reprint this NMC report.

Thomas D. Potter

THOMAS D. POTTER, Lt Colonel, USAF
COMMANDER



THE NATIONAL AIR POLLUTION POTENTIAL FORECAST PROGRAM

By Edward Gross

I. Introduction

The Donora, Pennsylvania, incident of October 27-31, 1948, demonstrated that lethal air pollution can occur in the United States. This disaster provoked a demand by the public that the Federal Government prevent similar hazardous events. The National Air Pollution Potential forecasting service conducted by ESSA meteorologists, with Public Health Service sponsorship, was created in response to recurrent severe episodes of high air pollution potential.

During periods of atmospheric stagnation, in which there is limited vertical or horizontal mixing, extensive control action may be required. A warning service for air pollution episodes usually is built around a series of alert levels corresponding to different degrees of severity of the problem. The first level may indicate meteorological conditions. It is within this realm of the Weather Bureau's mission that the National Air Pollution Forecast Program is dedicated. It must be emphasized that the forecasts prepared are for pollution potential and not for specific pollutant concentrations. The potential for high air pollution concentrations, given the existence of pollutant sources, is increased under specific meteorological conditions.

An experimental program to forecast air pollution potential began on a year round basis for the area east of 105°W. in August of 1960. The purpose then, as now, was to forecast meteorological conditions which are not favorable for the rapid and effective dilution of contaminants in the atmosphere, and to disseminate these forecasts to public and private interests for appropriate action. The program is supported by the National Air Pollution Control Administration.

Niemeyer (1960), Boettiger (1961), Miller and Niemeyer (1963), Korshover (1967) and others found that the meteorological conditions favorable for the accumulation of atmospheric pollutants are:

(1) A slow moving anticyclone with a small horizontal pressure gradient.

(2) Light surface winds not exceeding seven knots and winds aloft not exceeding 25 knots.

(3) Subsidence in the lower layers of the atmosphere. This phenomenon with its attendant warming and drying effect produces stabilization and the formation of inversions which limit vertical mixing.

The greatest variations of air pollution potential are those of short duration due to the systematic variation of wind and stability between night and day.

Holzworth (1962) in a climatological study of air pollution potential for the Western States also found that the quasi-stationary anti-cyclone was most conducive to poor air quality. In October 1963, the Air Pollution Potential Forecast Program was expanded to include all the contiguous United States.

Miller (1967), using statistically derived specification equations, developed an objective means to forecast mixing heights and transport winds in 12-hour increments out to 36-hours. Expanding upon Miller's work, Stackpole (1967) developed an operational numerical program to produce these forecasts on a routine daily basis. It was found that a large limitation on the usage of these objectively forecasted mixing heights is that the estimates are based on the assumption that the only significant changes in the thermal structure within the boundary layer arise from the redistribution (adiabatic) of heat input at the ground. Under synoptic scale air mass stagnation, this assumption is usually satisfied to permit the use of persistence as a forecast aid. The development of the stagnation index in 1968 and its encouraging results has led to the present state of the Air Pollution Potential Forecast Program.

Definitions

Air Pollution Potential (APP) - A measure of the inability of the atmosphere to adequately dilute and disperse pollutants emitted into it, based on values of specific meteorological parameters of the macroscale features.

Mixing Height - The height to which relatively vigorous mixing occurs (meters).

Transport Wind Speed - A measure of the average rate of the horizontal transport of air within the mixing layer (meters per second).

Ventilation - The product of the mixing height and the transport wind speed. A measure of the volume rate of horizontal transport of air within the mixing layer, per unit distance, normal to the wind (meters^2 second^{-1}).

Stagnation Area - A combination of stable stratification, weak horizontal wind speed components and little, if any, significant precipitation. It is usually associated with a warm core type anticyclone.

Stagnation Index - An objective index of meteorological parameters used in delineating areas of large scale stagnation in a numerical program.

II. Delineation of Stagnation Areas

A. To delineate salient areas of stagnation, a series of meteorological parameters independent of mixing height and the transport wind speed are indexed in a numerical program on a CDC 6600 computer. The input data are wind, temperature and stability information from the 0000Z and 1200Z RAOBS, plus the morning (near sunrise) urban low level sounding. Forecast information is based on data bilinearly interpolated from the grid points of the 0000Z run of the 6-layer Primitive Equation Model (PE). The critical values of these parameters are arbitrary, but indpendent studies indicate that during previous high air pollution potential episodes these conditions are generally observed.

B. Parameters and Critical Values for Delineating Stagnation Areas

Wind Speed - Interpolated from RAOBS and PE winds to 5000 feet above the station. Wind Speed must be less than or equal to 10 meters/second.

Temperature Change - Interpolated from the RAOBS and PE FD temperatures to 5000 feet above the station. Temperature change during the last 12 hours must be greater than or equal to -5°C.

500-mb Absolute Vorticity - Interpolated to the stations from the 0000Z PE run (baroclinic). Absolute vorticity must be less than or equal to 100×10^{-6} sec^{-1}.

500-mb Absolute Vorticity Change - Interpolated to the stations from the 0000Z PE run. Twelve-hour absolute vorticity change must be less than or equal to $+30 \times 10^{-6}$ sec^{-1}.

Precipitation or Relative Humidity - Observed precipitation during the last six hours obtained from synoptic reports at 0000Z and 1200Z must be less than or equal to .01 inch or the average relative humidity from the surface to 500 mb, interpolated to the stations from the 0000Z PE run, must be less than or equal to 80%.

Other parameters are being investigated for future inclusion in the stagnation index, they are:

1. Boundary layer (50 mb above the PE surface) wind speed and direction obtained from RAOBS and the PE 0000Z run.

2. 850-mb vertical velocity (microbars/second).

3. Lifted index (middle of the boundary layer to 500 mb) computed from RAOBS and PE 0000Z run.

4. Deformation, divergence, and vorticity fields derived from the u and v components of the boundary layer winds.

C. Output Products

Figure 1 A-E is an example of the computer printouts used to delineate the stagnation areas from yesterday afternoon until 0000Z the day after tomorrow.

Figure 2 is an objectively derived composite stagnation map, i.e, an area where stagnation is observed this morning and forecasted to continue until 0000Z the day after tomorrow. This objective output is adjusted by the air pollution specialist at NMC, using the latest prognostic and observed data available.

For definitions of numbers and symbols used in Figures 1 A-E and 2, see Appendix A.

III. Calculation of Mixing Height and Transport Wind Speeds

Once the stagnation areas have been determined, the next step is to calculate the mixing height and the transport wind speed. This is also done objectively on the CDC 6600 computer. The mixing heights and transport wind speeds are calculated for the morning and afternoon for all stations, but are only depicted on the facsimile package within areas of large-scale stagnation.

Yesterday Afternoon's Observed Mixing Height - The geometric height above the ground (meters) of the sounding adiabat intersection based on the 1200Z sounding from yesterday morning and the observed maximum temperature from the 0000Z synoptic report.

Yesterday Afternoon's Transport Wind Speed - The 0000Z observed average wind speed through yesterday afternoon's mixing layer (meters/second). The calculations include only those RAOB winds (surface winds are included) actually observed within the mixing layer. The unweighted mean of these winds form the average.

Yesterday afternoon's ventilation (product of yesterday afternoon's mixing height and the transport wind speed) should be less than or equal to 6000 meters^2/second and the wind speed must be less than or equal to 4 mps within stagnation areas.

Yesterday afternoon's mixing height, transport wind speed and ventilation are not depicted on the facsimile product, but is utilized by the NMC air pollution specialist in preparing his advisory and in the verification program.

Urban Morning Mixing Height - See Fig. 7 - The geometric height above the ground of the 1200Z sounding - adiabat intersection drawn from the surface minimum temperature observed plus 3° or 5°C depending on the station location. This 3° or 5°C is thought of as a measure of the urban heat island effect during the first two hours of so after sunrise. Three degrees are added to the minimum temperature when the RAOB or urban low level sounding site is within the confines of the urban heat island. Five degrees are added to the minimum temperature when the RAOB or urban low

level sounding is taken at a rural site. If the observed minimum temperature is missing, the 1200Z sounding temperature plus 3° or 5°C is used to calculate the mixing height.

Morning Transport Wind Speed - See Fig. 7 - The observed average wind speed through the urban morning mixing layer (mps). The calculations include only those winds, both RAOB and Surface, actually observed within the mixing layer. The unweighted mean of these winds form the average.

Criteria - The Urban Morning Mixing Height must be less than or equal to 500 meters and the transport wind speed must be less than or equal to 4 mps within stagnation areas.

Afternoon Mixing Height - See Fig. 8 - The geometric height above the ground (meters) of the sounding - adiabat intersection drawn from the Klein-Lewis maximum temperature forecast from the 1200Z barotropic run and the 1200Z sounding.

Afternoon Transport Wind Speed - See Fig. 8 - The 1200Z observed average wind speed through the afternoon mixing layer forecast (mps). The calculations include only those RAOB winds (surface winds included) actually observed within the mixing layer. The unweighted mean of these winds form the average.

Criteria - This afternoon's ventilation must be less than or equal to 6000 meters^2 sec^{-1}, and the transport wind speed must be less than or equal to 4 mps within stagnation areas.

Note: The ventilation criteria can be modified to a critical value of 8000 meters^2 sec^{-1} with wind speeds less than or equal to 4 mps within stagnation areas, if yesterday's ventilation and transport wind speed within a stagnation area were less than or equal to 6000 meters^2/second and 4 meters per second for the respective station, or after the commencement of a National Air Pollution Potential advisory.

Within delineated stagnation areas, persistence should be used as a determining factor in subjectively predicting the 24- and 36-hour mixing height and transport wind speed values. There will be some fluctuations in the mixing height, due primarily to surface heating and subsidence, but the wind speed criterion should remain generally less than 4 mps.

Figure 3 is a schematic representation of how the mixing height and transport wind speed can be calculated manually. This same method can be applied in preparing forecasts of the mixing height and the transport wind speed out to 36 hours within stagnation areas.

Figure 4 A-D is an example of the computer printouts used in determining the mixing height and transport wind speed. Figure 4D is a composite chart showing where criteria are satisfied for this morning's and this afternoon's mixing height and transport wind speed.

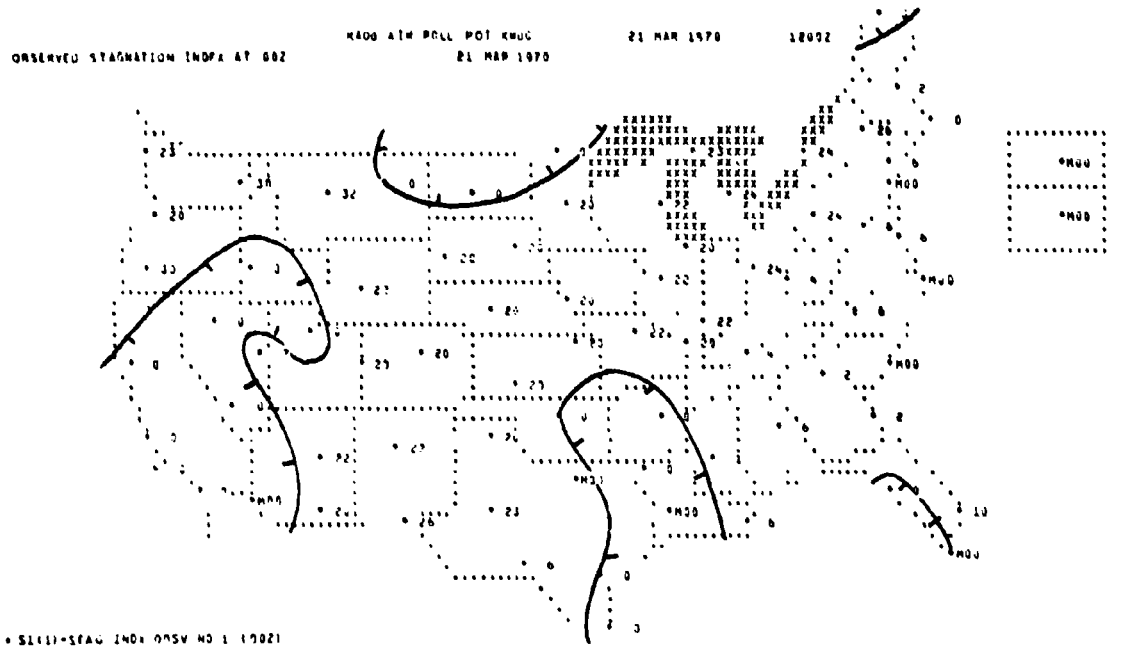


Figure 1 A

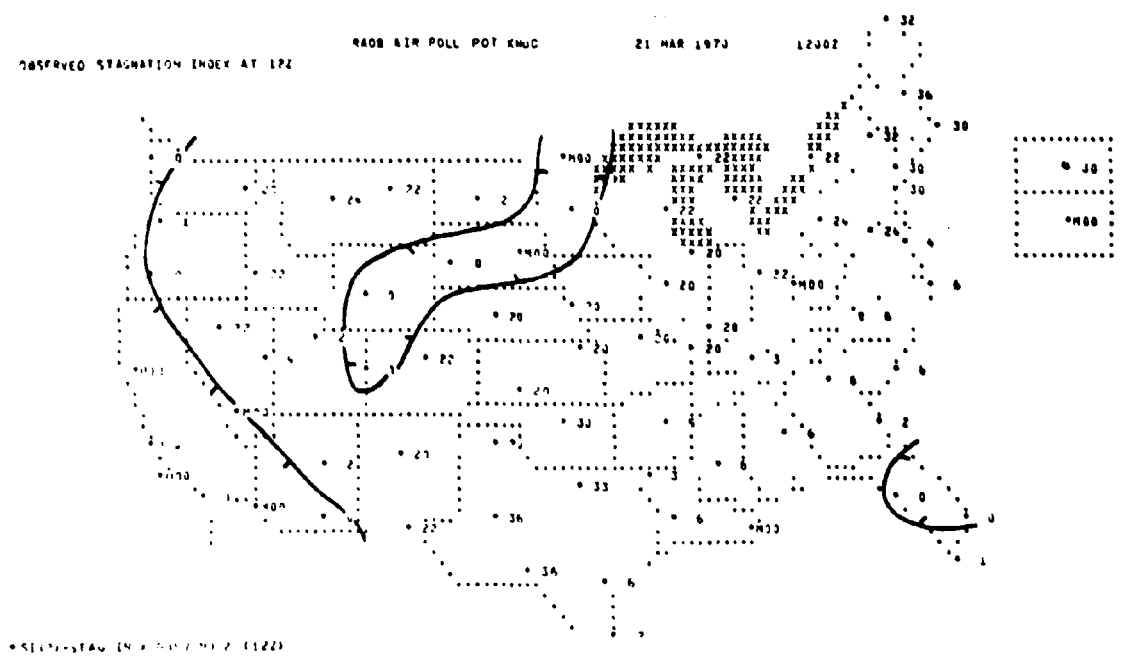


Figure 1 B

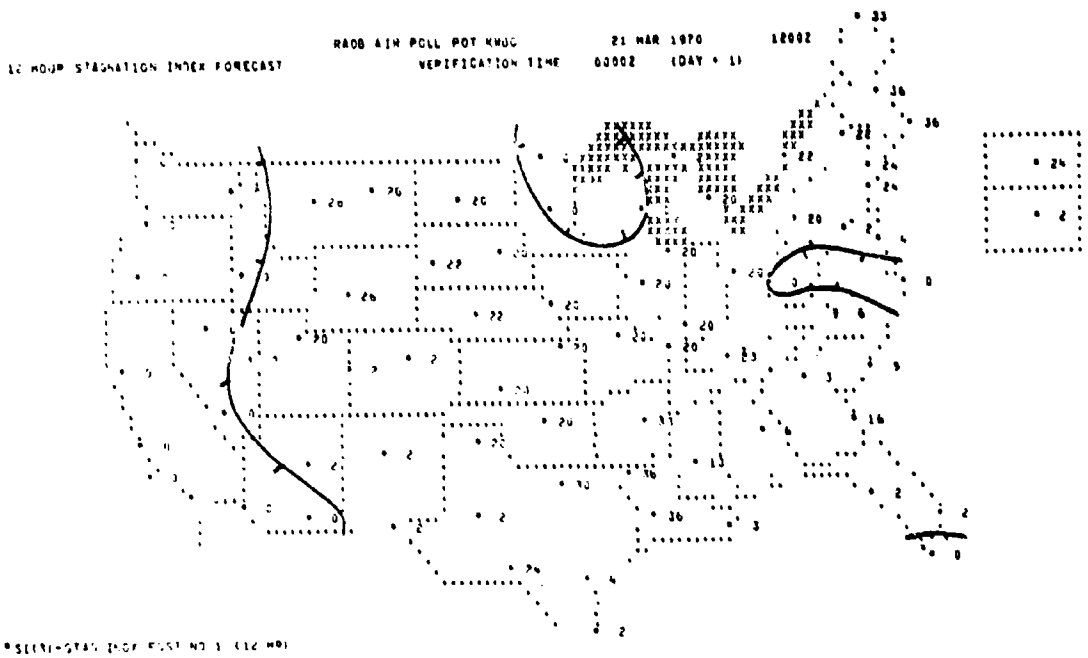


Figure 1 C

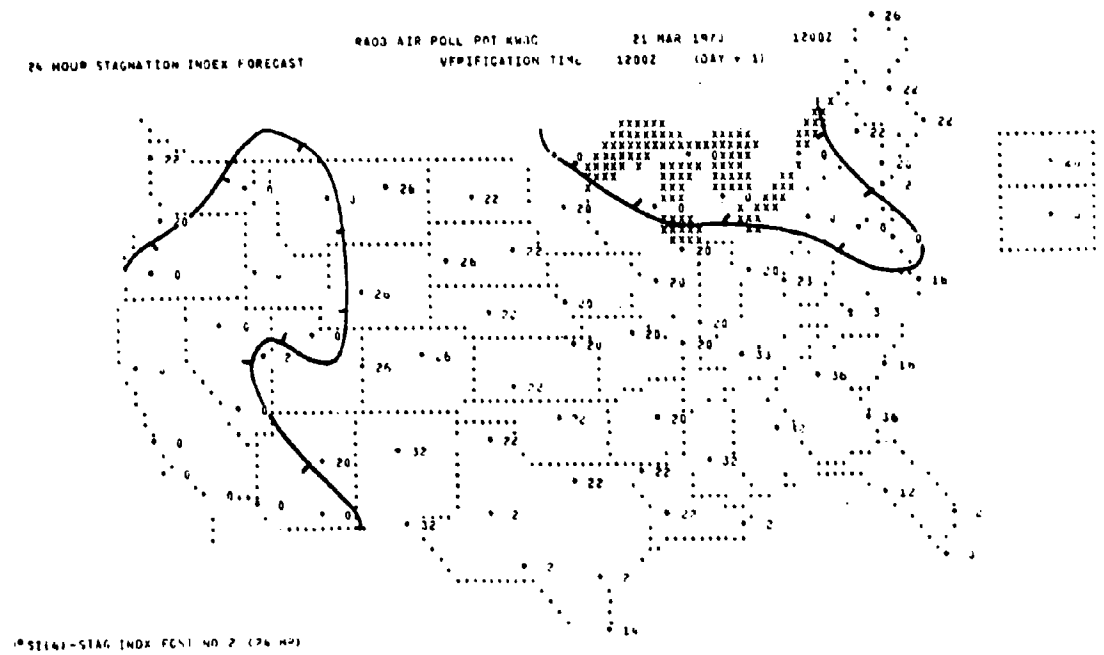


Figure 1 D

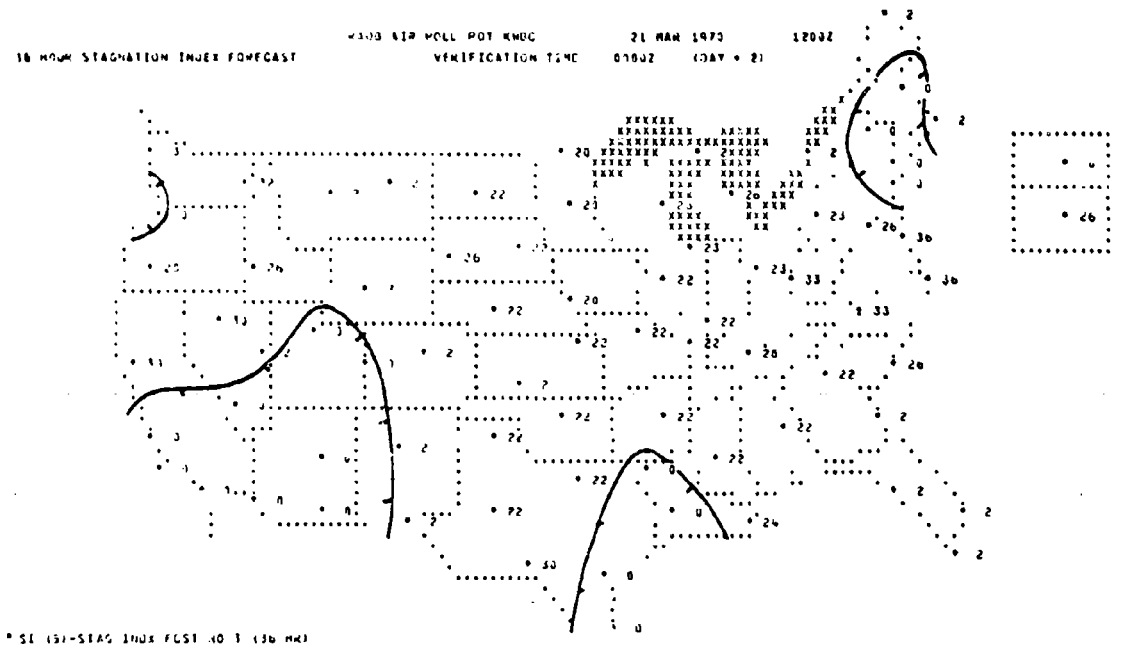


Figure 1 E

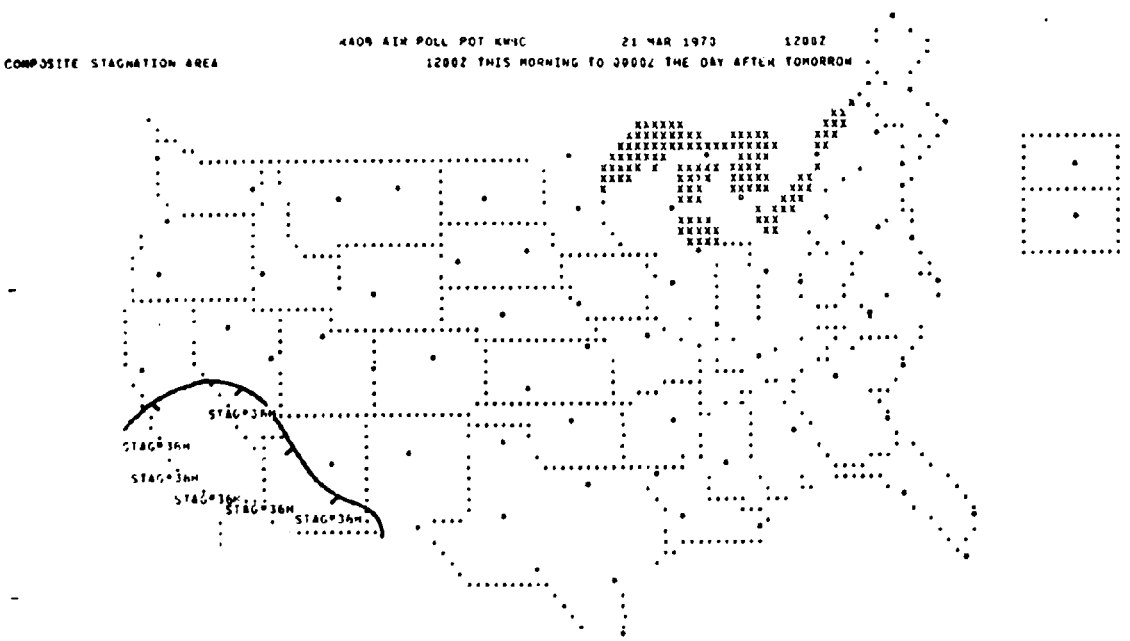


Figure 2

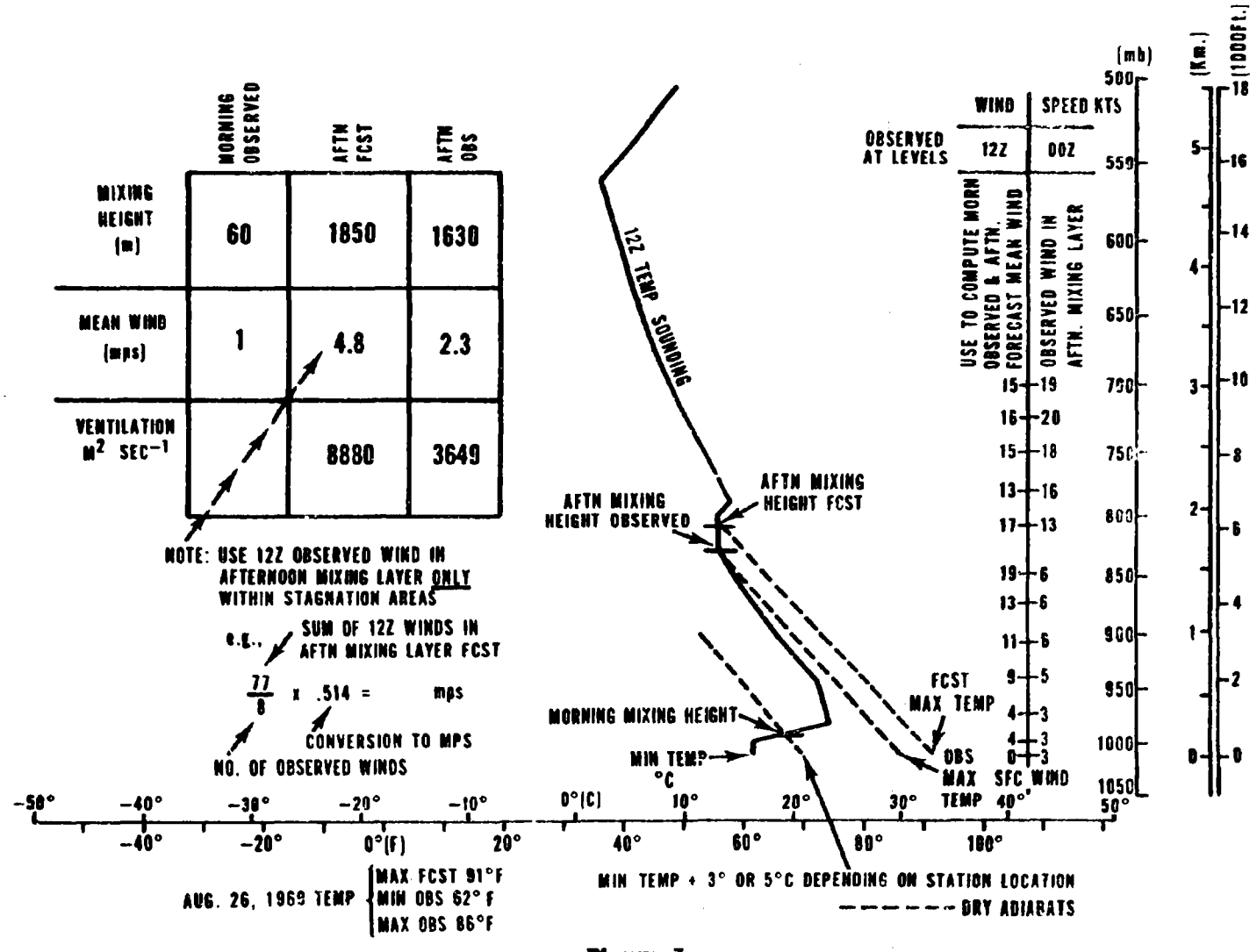

MORNING OBSERVED
AFTN FCST
AFTN OBS
MIXING HEIGHT (m)
60
1850
1630
MEAN WIND (mps)
1
4.8
2.3
VENTILATION m² SEC⁻¹
8880
3649
NOTE: USE 12Z OBSERVED WIND IN AFTERNOON MIXING LAYER ONLY WITHIN STAGNATION AREAS
e.g., SUM OF 12Z WINDS IN AFTN MIXING LAYER FCST
77/8 x .514 = mps
NO. OF OBSERVED WINDS
CONVERSION TO MPS
12Z TEMP SOUNDING
AFTN MIXING HEIGHT OBSERVED
AFTN MIXING HEIGHT FCST
MORNING MIXING HEIGHT
MIN TEMP °C
FCST MAX TEMP
OBS MAX TEMP
SFC WIND
OBSERVED AT LEVELS
WIND SPEED KTS
12Z
00Z
USE TO COMPUTE MORN OBSERVED & AFTN. FORECAST MEAN WIND
OBSERVED WIND IN AFTN. MIXING LAYER
(mb)
(Km.)
(1000Ft.)
-50° -40° -30° -20° -10° 0°(C) 10° 20° 30° 40° 50°
-40° -20° 0°(F) 20° 40° 60° 80° 100°
AUG. 26, 1969 TEMP
MAX FCST 91°F
MIN OBS 62° F
MAX OBS 86°F
MIN TEMP + 3° OR 5°C DEPENDING ON STATION LOCATION
DRY ADIABATS

Figure 3

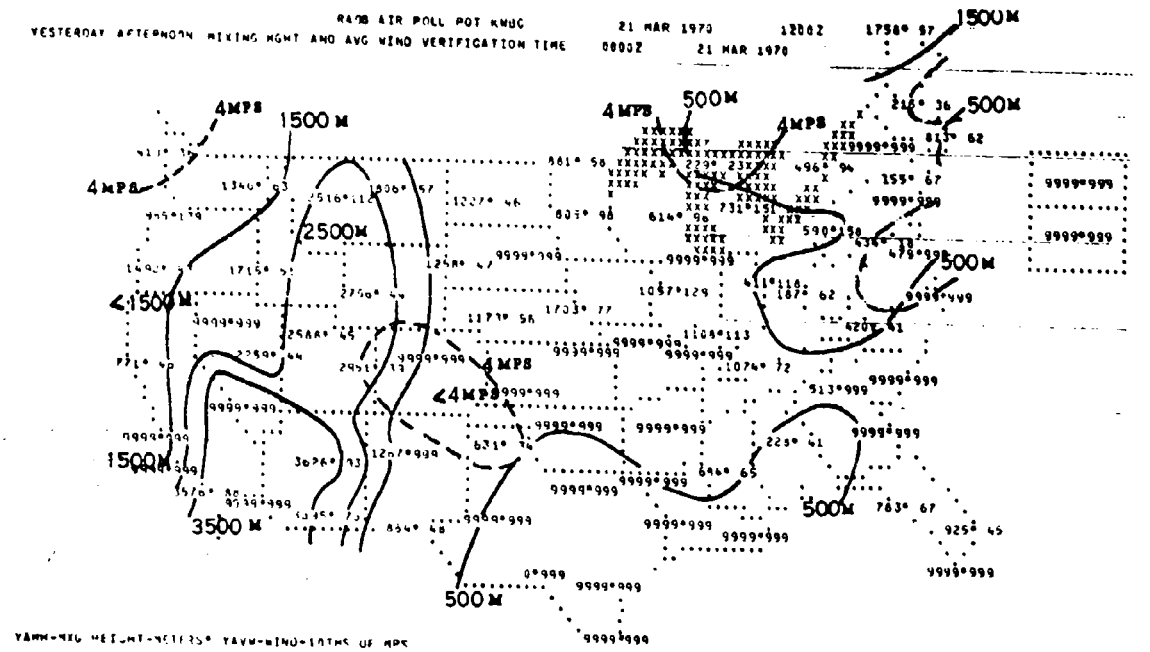


Figure 4 A

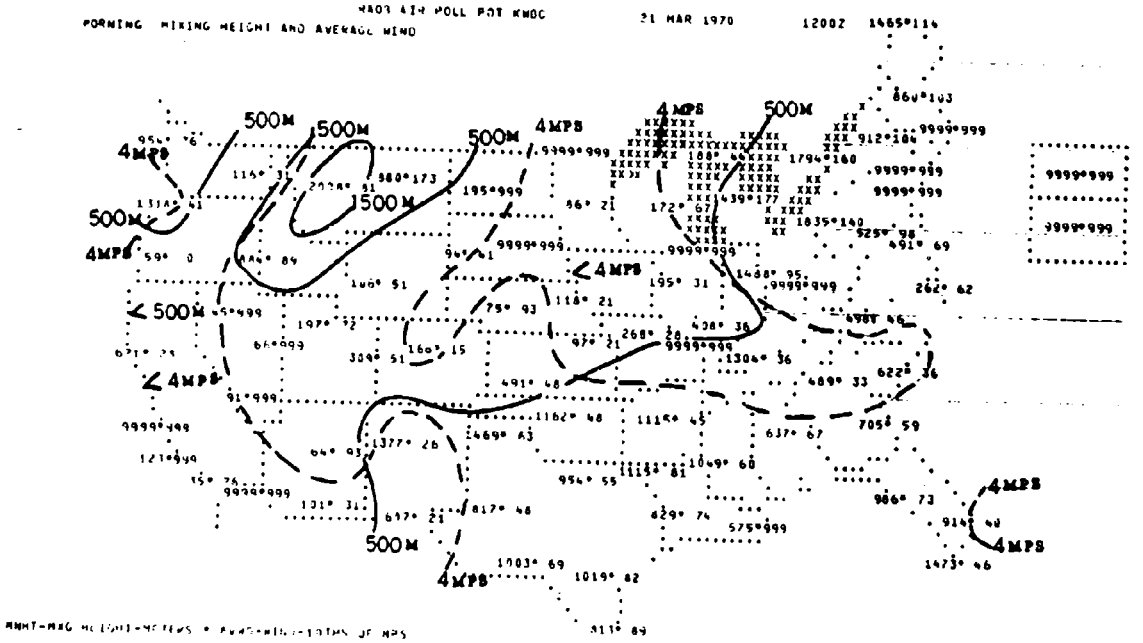


Figure 4 B

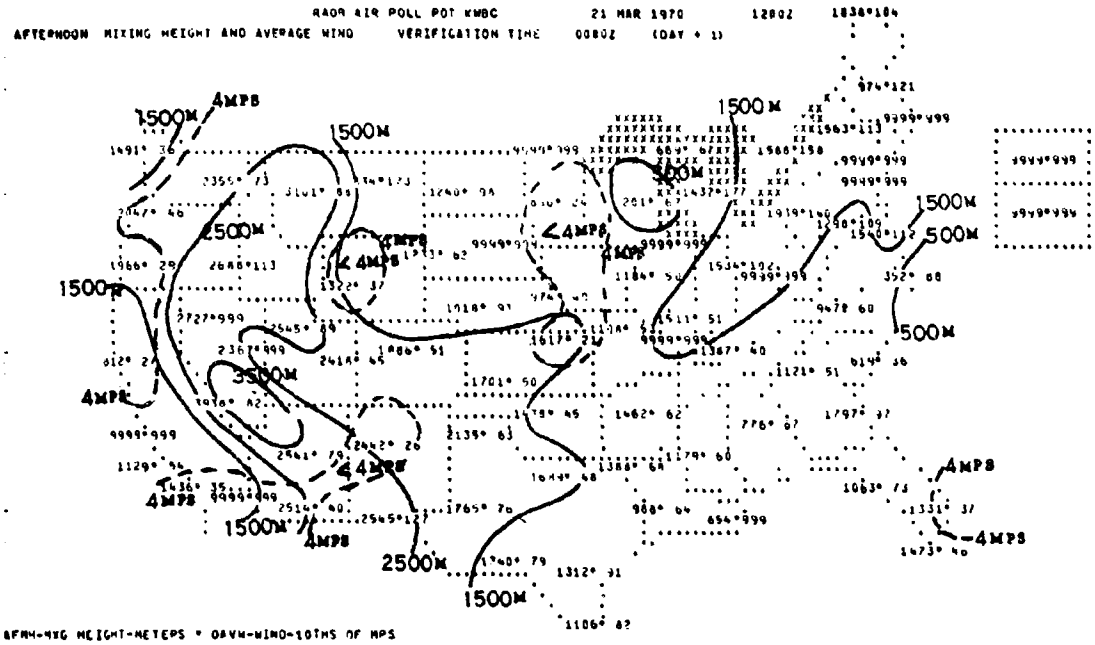


Figure 4 C

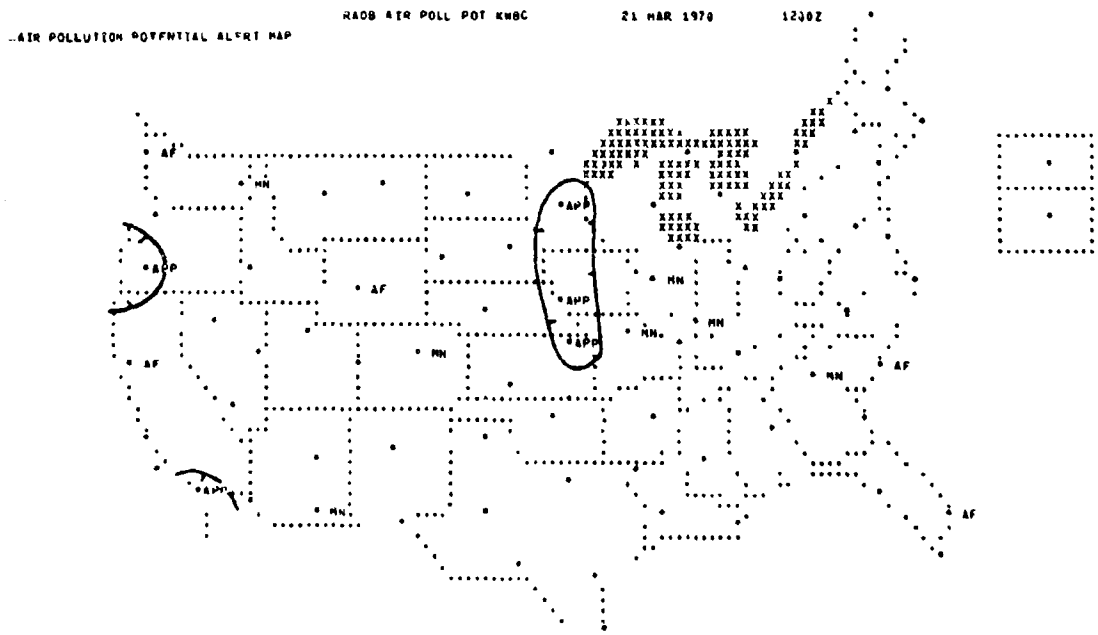


Figure 4 D

Explanation of the Symbols on Figure 4D

MN - Only the morning mixing height and transport wind speed criteria satisfied.

AF - Only the afternoon mixing height and transport wind speed criteria satisfied.

APP - Both the morning and afternoon mixing height and transport wind speed criteria satisfied.

* - Mixing height and transport wind speed data for both this morning and afternoon exceed critical values.

These data are only valid within delineated stagnation areas corresponding to the respective times for the mixing height and transport wind speed data.

IV. Criteria for the Issuance of a National Air Pollution Potential Advisory by the National Meteorological Center

A. A stagnation area must be observed this morning and be forecasted to continue for at least 36 hours. This stagnation area is delineated by satisfying all of the following criteria:

1. Wind speed 5000 feet above the station must be $\leq$ 10 mps.

2. The temperature change during the past 12 hours 5000 feet above the station must be $\geq$ -5°C. This check eliminates areas of cold air advection.

3. 500-mb absolute vorticity must be $\leq 100 \times 10^{-6}$ sec^{-1}.

4. 500-mb absolute vorticity change during the past 12 hours must be $\leq +30 \times 10^{-6}$ sec^{-1}. This check eliminates areas of positive vorticity advection.

5. Observed precipitation must be $\leq$ .01 inches or the PE relative humidity (surface to 500 mb) must be $\leq$ 80%.

B. Within stagnation areas, the mixing height, transport wind speed and the ventilation must satisfy the following criteria:

1. The morning mixing height must be $\leq$ 500 meters and the morning transport wind speed must be $\leq$ 4 meters per second.

2. The afternoon ventilation must be ≤ 6000 m^2 sec^{-1} and the afternoon transport wind speed must be $\leq$ 4 meters per second. The afternoon ventilation can be modified to a critical value of 8000 m^2 sec^{-1}

with wind speeds less or equal to 4 meters per second after the commencement of a National Air Pollution Potential advisory.

C. For an initial issuance of a national advisory, the affected area must be at least as large as a 4 degree latitude-longitude square (58,000 nautical square miles). The area criterion may be reduced when very large population centers are involved.

D. An alert area must continue for at least 36 hours from the time of the initial issuance of an advisory, i.e., an atypical case of diurnal nighttime pollution buildup and normal daytime ventilation. Once an area has been started, air pollution potential criteria may be adjusted or modified based on guidelines available to the air pollution specialist (e.g., vorticity, ventilation, windspeed).

E. After an initial issuance of an advisory, areal additions or reductions can be made without regard to the size of these reductions. For the subsequent enlargement of an affected area, the temporal criterion is reduced to 24 hours.

Figure 5 shows the number of forecasted High Air Pollution Potential days for the Western and Eastern United States. Stagnation situations in the Eastern United States concentrate in a long arc from Alabama to Eastern Pennsylvania, roughly following the Appalachian Highlands. The greatest number of episode days occur over the Western Carolina and Northern Georgia areas. In the Western United States, the greatest number of stagnation situations occur in the Great Basin region and over most of California.

Figure 6 is a map and list of stations in the contiguous United States for which Air Pollution Potential data is prepared.

V. Output of Information

A. Facsimile

The data depicted on the facsimile product will be the basis of NMC's National Air Pollution Potential Advisory and should be used as guidance by field stations for the issuance of local statements based on meteorological and air quality parameters (as per Chapter 30, Part C of the Weather Bureau Operations Manual). A Weather Bureau Handbook will be published shortly describing, in detail, the National Air Pollution Potential Program of the Weather Bureau and the National Air Pollution Control Administration.

B. The Product

A 4-panel facsimile transmitted over the Fofax circuit. The input data will be wind, temperature and stability information available from the 0000Z and 1200Z RAOBS, plus the morning (near sunrise) urban low level soundings.

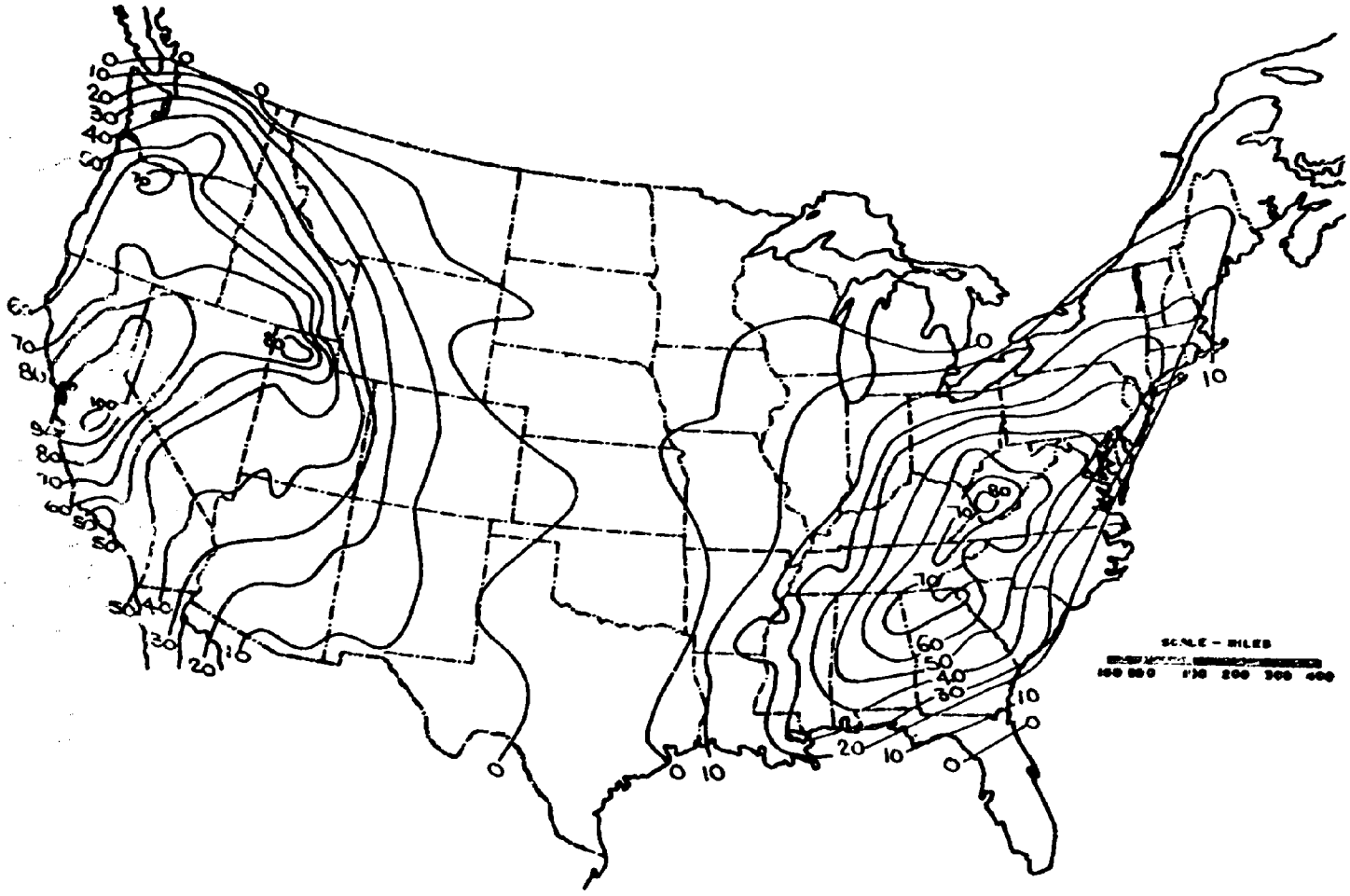
Forecast information will be based on data interpolated to stations from grid points of the 0000Z run of the 6-layer Primitive Equation Model (PE). The objective output will be adjusted by the air pollution specialist at NMC using the latest prognostic and observed data available.

The facsimile package will consist of:

1. Stagnation areas out to 36 hours in 12-hour increments from this morning's observed data.

2. A composite stagnation area for the period from 1200Z this morning through 0000Z the day after tomorrow.

3. Mixing height and transport wind speed information for this morning and this afternoon, only in the vicinity of stagnation areas.



39 Episodes West
1 October 1963 - 3 April 1970

75 Episodes East
1 August 1960 - 3 April 1970

Figure 5. Forecast High Air Pollution Potential Days

RAOB STATIONS AND *ESSA METEOROLOGICAL SUPPORT UNITS (EMSU'S)

72201	NQX	72365	ABQ	72553	OMA
72202	MIA	72376	INW	72562	LBF
72208	CHS	72385	LAS	72572	SLC
72211	TPA	72393	VBG	72576	LND
72213	AYS	72402	WAL	72583	WMC
72226	MGM	72403	IAD	72597	MFR
72235	JAN	*72405	DCA	72606	PWM
72240	LCH	*72408	PHL	72637	PNT
72248	SHV	72425	HTS	72645	GRB
72250	BRO	72429	DAY	72654	HON
72255	VCT	72433	SLO	72655	STC
72259	GSW	*72434	STL	72662	RAP
72261	DRT	72445	CBI	72681	BOI
72265	MAF	72451	DDC	72694	SLE
72270	ELP	72456	TOP	72712	CAR
72274	TUS	72469	DEN	72734	SSM
72280	YUM	72476	GJT	72747	INL
72290	SAN	72486	ELY	72764	BIS
72291	NSI	72493	OAK	72768	GGW
72304	HAT	*72503	LGA	72775	GTF
72311	AHN	72506	ACK	72785	GEG
72317	GSO	72518	ALB	72797	UIL
72327	BNA	72520	PIT	74486	JFK
72340	LIT	72528	BUF	74768	MTF
72354	TIK	72532	PIA		
72363	AMA	*72534	CHI		

Note: Stations 78526 MJSJ, San Juan, P.R., and 91165 PHNL, Lihue, Hawaii, will be added to this list.

Figure 6.

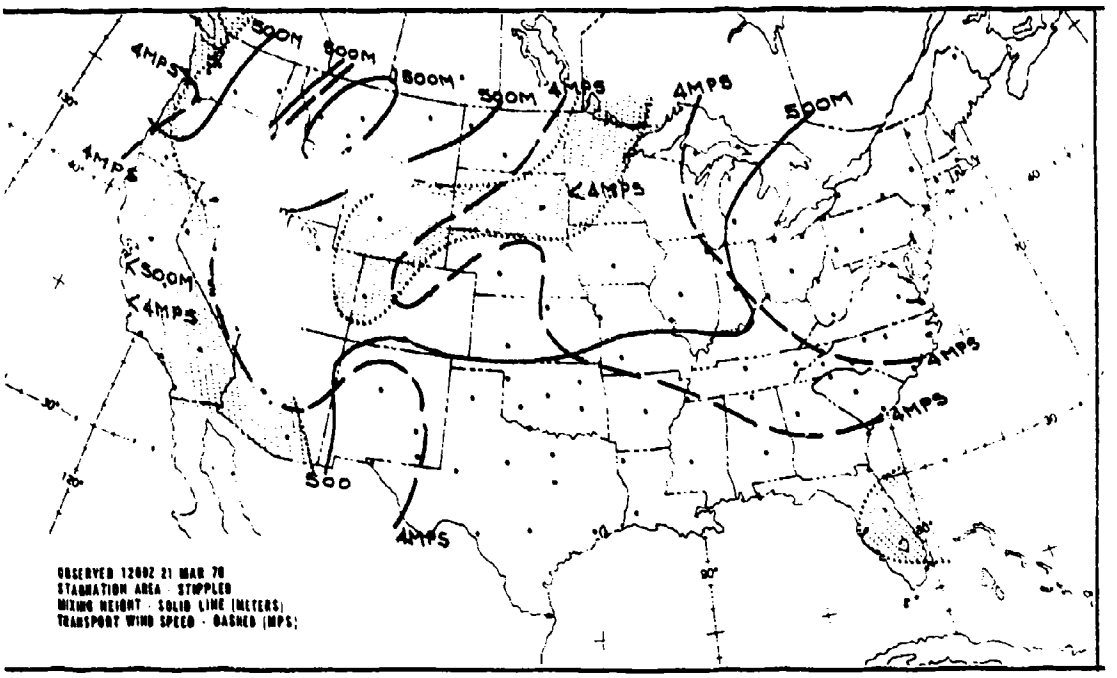


Figure 7.

Stippled Area - Stagnation Area - based on observations at 1200Z.

Solid Lines - Urban Morning Mixing Height (meters) - based on observed data for 1200Z in the vicinity of stagnation areas. Only the 500, 1500, 2500, and 3500 (meter) isopleths are depicted.

Dashed Lines - Transport Wind Speed observed in the mixing layer this morning (MPS) in the vicinity of stagnation areas. Only the 4 meter per second isotach is depicted.

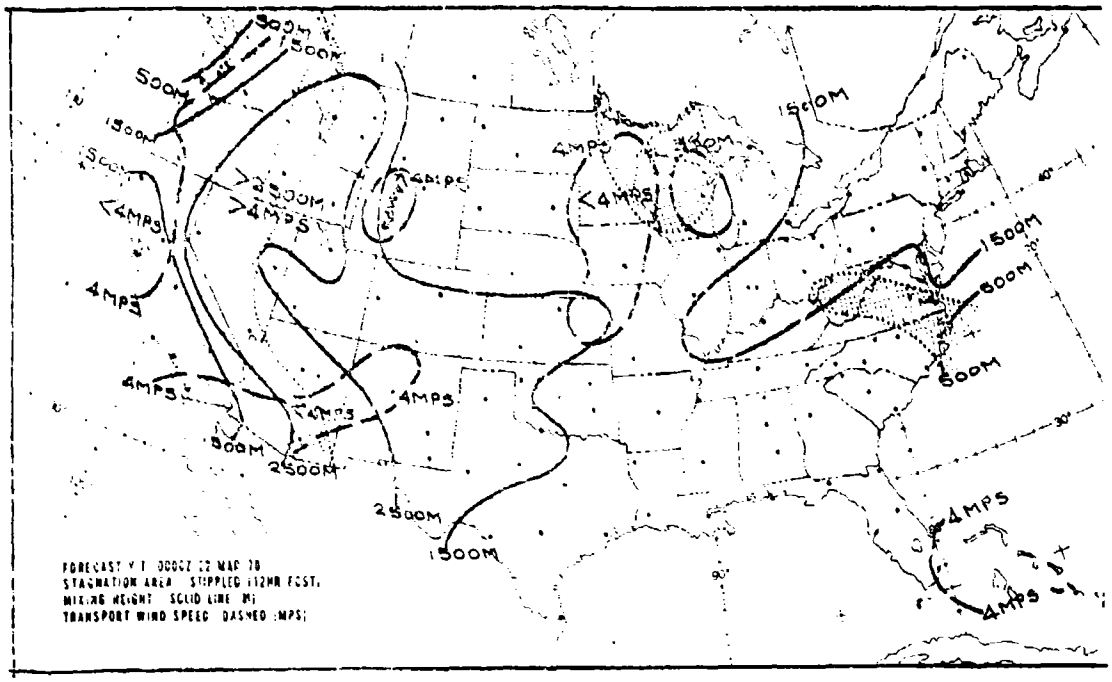


Figure 8.

Stippled Area - Stagnation Area forecast V.T. 0000Z tomorrow.

Solid Lines - Afternoon Mixing Height forecast V.T. 0000Z tomorrow (meters) in the vicinity of stagnation areas.

Dashed Lines - Transport Wind Speed in the afternoon mixing layer forecasted to verify at 0000Z tomorrow (mps) in the vicinity of stagnation areas.

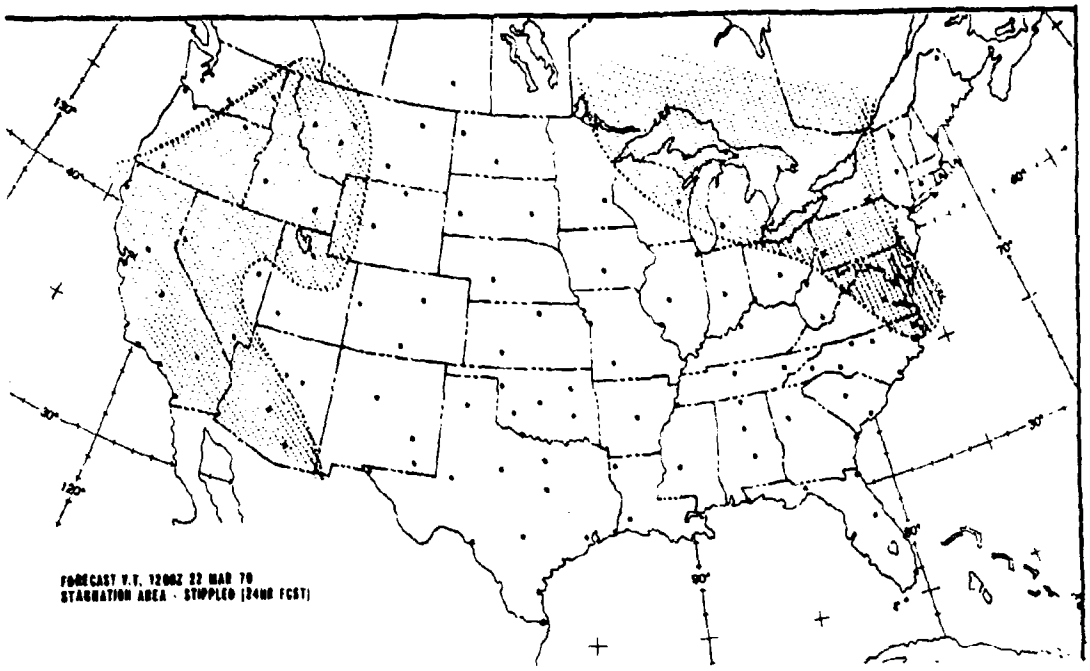


Figure 9.

Stippled Area - Stagnation Area V.T. 1200Z tomorrow morning.

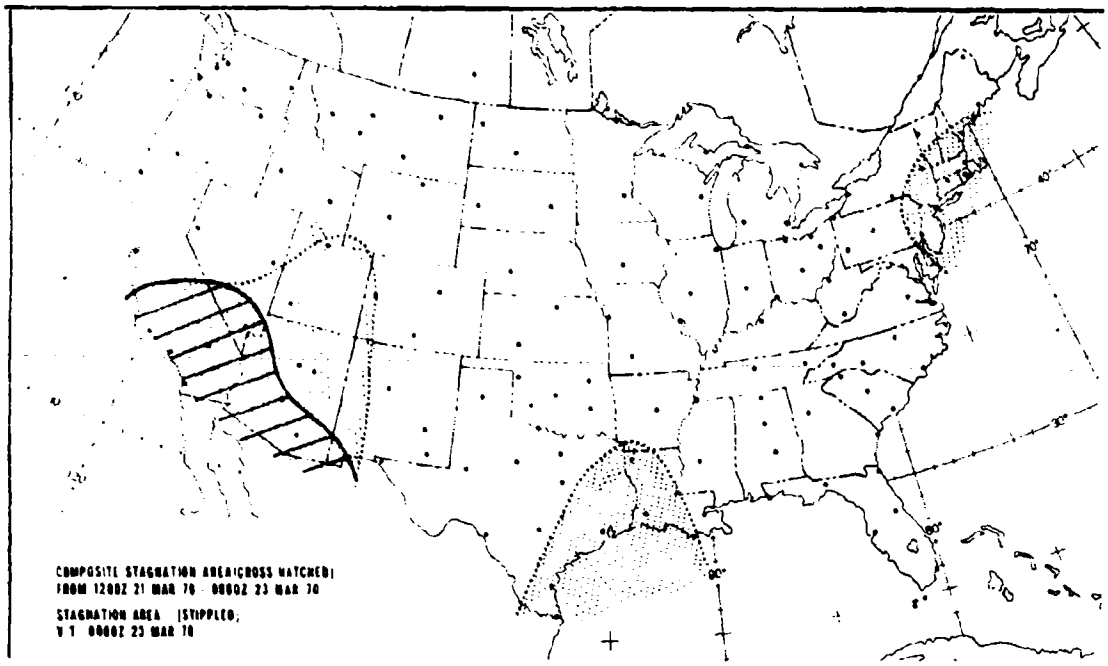


Figure 10.

Cross Hatched Area - Composite Stagnation Area - All stagnation criteria are satisfied throughout period from 1200Z this morning to 0000Z the day after tomorrow (36 hours).

Stippled Area - Stagnation Area V.T. 0000Z the day after tomorrow (36 hours).

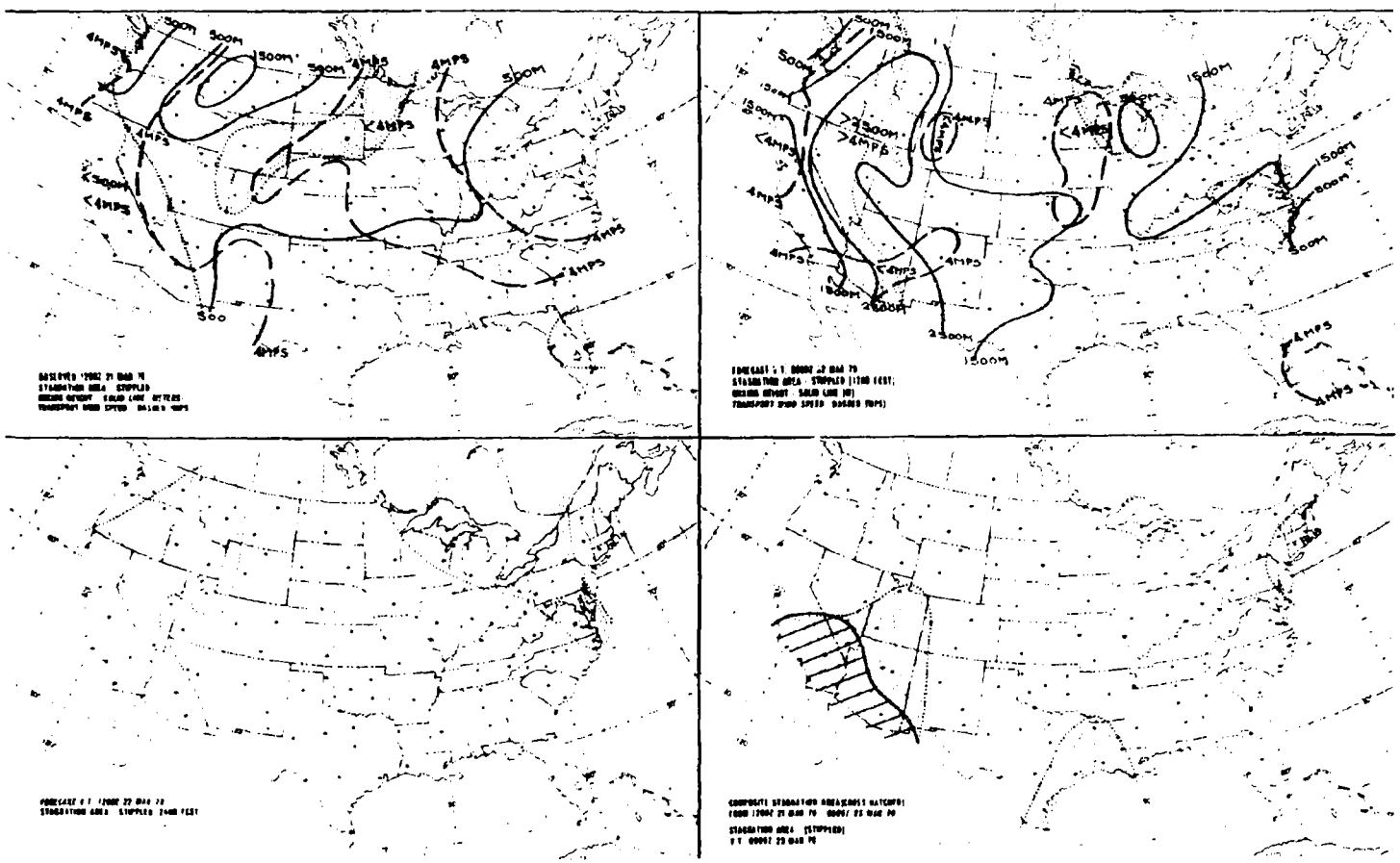


Figure 11. Sample facsimile transmission.

C. Teletypewriter Transmission Changes in FKUS, FKUS1

The NMC guidance format of the FKUS, FKUS1 transmitted on Service C is described in WBOM Chapter C-30. This format was changed as follows on March 2, 1970:

1. FKUS1, Air Pollution Potential Data.

a. The 5-digit data groups are increased to 6-digit groups.

b. The third group, "Tomorrow Afternoon" data, is deleted.

c. A group containing the observed mixing height and average wind speed for "Yesterday Afternoon" is added.

The following is the sequential arrangement and breakdown of the new code:

FKUSI KWBC XX1720
Air Pollution Potential Data

IIiii $MyMyMy\overline{W}y\overline{W}y\overline{W}y$ $MnMnMn\overline{W}n\overline{W}n\overline{W}n$ $MxMxMx\overline{W}x\overline{W}x\overline{W}x$

IIiii The block number and station number

MyMyMy The afternoon mixing height for "Yesterday Afternoon" in decameters

$\overline{W}y\overline{W}y\overline{W}y$ The average wind speed within the mixing layer for "Yesterday Afternoon" in meters per second and tenths of meters per second

MnMnMn The morning mixing height for "This Morning" in decameters

$\overline{W}n\overline{W}n\overline{W}n$ The average wind speed within the mixing layer: for "This Morning" in meters per second and tenths of meters per second.

MxMxMx The afternoon mixing height for "This Afternoon" in decameters

$\overline{W}x\overline{W}x\overline{W}x$ The average wind speed within the mixing layer: for "This Afternoon" in meters per second and tenths of meters per second.

2. FKUS Air Pollution Potential Advisory.

The abbreviated plain language narrative will be prepared and issued daily. The narrative will discuss the following:

a. The general synoptic situation as it applies to air pollution potential (APP) including possible high APP areas that do not currently meet spatial or temporal criteria for issuance of an advisory.

This portion of the narrative will concern itself with the next 24-36 hour period.

b. The highlights of the stagnation index forecast.

c. The NMC Air Pollution Potential Advisory (if any). When the data indicates that an advisory of high air pollution potential should be issued, the message delineates the affected areas. The daily message will also indicate any changes in the boundaries of the advisory areas, including termination of an episode.

D. Sample Teletypewriter Transmission Transmitted Daily at 12:20 p.m., EST, to U. S. Weather Bureau Stations via Teletype Service "C"

ZCZC
FKUS
AIR POLLUTION POTENTIAL ADVISORY
NONE TODAY. ABSENCE OF LARGE UPPER RIDGE CONTINUES TO PREVENT THE FORMATION OF MAJOR LARGE SCALE STAGNATION AREAS. A SURFACE RIDGE HOWEVER EXTENDING FROM THE PACIFIC COAST SOUTHEASTWARD TO TEXAS WILL RESULT IN LIGHT WINDS AND LOCAL STAGNATIONS FROM SOUTHERN CALIFORNIA TO WESTERN TEXAS. POOR VENTILATION WILL ESPECIALLY BE NOTICEABLE IN THE UPPER RIO GRANDE VALLEY. AN UPPER RIDGE IS AT PRESENT FORECAST TO MOVE INLAND FROM THE PACIFIC DURING SUNDAY AND MAY START TO AFFECT PORTIONS OF CALIFORNIA ON SUNDAY.

FKUSI KWBC 211720
AIR POLLUTION POTENTIAL DATA

72201	999999	147046	147046	72202	093045	091040	133037
72208	999999	062036	062036	72211	078067	099073	106073
72213	999999	070059	180097	72226	023041	064067	078067
72235	068065	105060	118060	72240	999999	083074	099064
72248	999999	112081	139068	72250	999999	081089	111082
72255	999999	102082	131091	72259	999999	095055	169048
72261	000999	100069	134079	72265	999999	082048	176076
72270	086048	061021	255127	72274	340073	010031	251040
72280	999999	999999	999999	72290	358088	003026	144035
72291	999999	012999	113054	72304	999999	026062	035088
72311	051999	049033	112051	72317	042041	050046	095060
72327	107072	130036	139040	72340	999999	112045	146062
72354	999999	116048	144045	72363	063034	147063	213063
72365	127999	138026	244026	72374	363093	006093	254079
72385	999999	009999	394082	72393	999999	999999	999999
72402	048999	049069	154112	72403	043018	052098	130109
72405	999999	999999	999999	72408	999999	999999	999999
72425	019062	999999	999999	72429	041118	149095	153102
72433	111113	041036	151051	72434	999999	999999	999999
72445	999999	027028	111053	72451	999999	049048	170050
72456	999999	010021	162021	72469	999999	017015	189051
72476	295039	031051	242045	72486	226044	007999	237999
72493	077046	062028	081028	72503	999999	999999	999999
72506	081062	999999	999999	72518	999999	091104	156113
72520	059158	184140	194140	72528	050094	179160	159158
72532	106129	020031	118050	72534	999999	999999	999999
72553	170077	012021	097040	72562	117056	007093	102093
72572	259045	020072	254089	72576	276044	011051	132037
72583	999999	004999	273999	72597	149043	006000	197029
72606	022036	086103	097121	72637	073151	144177	144177
72645	061096	017067	020067	72654	999999	999999	999999
72655	081098	009021	087024	72662	126047	009041	123062
72681	172051	088089	269113	72694	098139	132041	205046
72712	176057	146114	104104	72734	023023	019044	067067
72747	088058	999999	999999	72764	123046	020999	124098
72768	181057	088173	083173	72775	252112	201081	310088
72785	135063	012031	235073	72797	042036	095036	149036
74486	016067	999999	999999	74768	999999	058999	065999

Conclusion

Our experience has found that the forecasts of macroscale meteorological phenomena can be used to determine periods of high air pollution potential for a large portion of the United States. It is anticipated that the increase in guidance material available to the NMC air pollution specialists will be most useful in the preparation of National Air Pollution Potential advisories. The daily facsimile and teletype transmissions should increase the confidence level among WBFO forecasters and other users in the preparation of local statements of high air pollution potential. This can be especially true during those periods when temporal and/or spatial considerations prevent a National Air Pollution Potential advisory for a particular area.

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APPENDIX A

STAGNATION INDEX

If the index is:

00	All stagnation criteria are satisfied.
01	12-hour temperature change 5000 feet above the station equals or exceeds -5°C.
02	Wind speed 5000 feet above the station equals or exceeds 10 mps.
03	Observed precipitation in the past 6 hours equals or exceeds .01 inch or the PE relative humidity equals or exceeds 80%.
04	Combination of 01 plus 02.
05	Combination of 01 plus 03.
06	Combination of 02 plus 03.
07	Combination of 01 plus 02 plus 03.
10 to 17	Combinations of 12-hour vorticity change equalling or exceeding $+30 \times 10^{-6}$/second and items 01 through 07, respectively.
20 to 27	Combinations of vorticity equalling or exceeding 100×10^{-6}/second and items 01 through 07, respectively.
30 to 37	Combinations of both vorticity and vorticity change equalling or exceeding limits and items 01 through 07, respectively.
M00	All stagnation criteria satisfied, but with some data fields missing.
STAG*36	Stagnation is observed from 1200Z this morning and forecasted to continue until 0000Z the day after tomorrow.

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13. ABSTRACT

Air Pollution Potential (APP) is definable as a measure of the inability of the atmosphere to adequately dilute and disperse pollutants emitted into it based on values of specific meteorological parameters of the macroscale features. To delineate areas on the macroscale in which high APP has the greatest probability of occurring, a stagnation index has been developed independent of mixing height and transport wind speed data. The associated stagnation conditions are usually manifested by stable stratification, weak horizontal wind speed components and little, if any, significant precipitation. We describe the numerical and subjective means by which stagnation areas are delineated, mixing height and transport wind speed calculated, and how high APP conditions are transmitted to our users via facsimile and teletypewriter. The resulting program is a joint effort of the Development Division of the National Meteorological Center (NMC) and the Division of Meteorology of the National Air Pollution Control Administration (NAPCA).

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LIST OF USAF ETAC TECHNICAL NOTES

Number	Title	Date
68-1	Superseded	
68-2	Meteorological Rocket Data and Predicting the Onset of the Southwest Monsoon over India and Southeast Asia (AD-669364)	May 68
68-3	Bibliographies of Climatic References and Climatic Maps for Selected Countries (AD-672769)	Jul 68
68-4	Climatological Bibliography of the South Atlantic Ocean Area Including Certain Coastal Countries (AD-683761)	Nov 68
69-1	Selected Climatological Bibliography for Thailand (AD-685716)	Mar 69
69-2	Superseded	
69-3	An Annotated Climatological Bibliography of Romania (AD-688259)	May 69
69-4	Radar-Computed Rainfall Compared with Observations from a Dense Network of Rain Gauges (AD-688434)	Jun 69
69-5	Tractionability Study for Laotian Panhandle (AD-691006)	Jul 69
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70-3	Listing of Available Seminars (AWS Wings) (AD-702463)	Mar 70
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70-6	A Selected Annotated Bibliography of Environmental Studies of Poland (AD-709762)	Jun 70
70-7	Air Force Eastern Test Range Computer ("Printed" Rawinsonde (SKEW-T) Analysis (AWS distribution only) (AD-691228)	Jul 70
70-8	Hook Echoes on Radar (AD-711794)	Aug 70
70-9	The National Air Pollution Potential Forecast Program (AD-)	Nov 70