MICROSCALE METEOROLOGY IN METROPOLITAN REGIONS

Washington's "Free" 300-Station Microscale Weather Network

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ABSTRACT.—This article is intended to encourage those planning to conduct meso- or microscale weather studies to supplement their sophisticated observing techniques and equipment with low-cost observations taken by volunteers. Such observations can often show high benefits per unit costs in expanding the geographical area of study, increasing the density of observations, or in verifying the validity of urban study findings. Techniques used in recruiting and sustaining the 300-station volunteer Washington, D.C., Network are described.

DATA FROM APPROXIMATELY 320 precipitation - observing sites within a 25-mile radius of downtown Washington, D.C., are recorded after each occurrence, under the sponsorship of the Washington National Weather Service Forecast Office (WSFO). About 150 of these sites record maximum and minimum temperatures once daily, and many report additional meteorological events of interest, such as high winds, hail, thunderstorms, ice storms, and floods. Observers mail in their reports at the end of each month, and a few report real-time weather events to the WSFO via recording telephone.

COSTS OF OPERATING WASHINGTON NETWORK

All observers supply their data to the Washington Network without pay, and the majority of them purchase and pay for their own equipment. The rest are participants in separate networks sponsored by the federal and county governments.

Bookkeeping, tabulation of the reports, and preparation of a monthly weather summary are done in off-duty time, largely by Stephen Flood and the author. Flood also puts in a limited amount of time during slack periods in his NWS work schedule. Many of the observers have also contributed their time generously.

There are two NWS cost items to the Washington Network. One is the printing of the Metropolitan Network Monthly Reports (fig. 1) costing less than 5¢ each. The reverse side of this form contains the mailing address. Mailing is free, using government franking privileges. The second cost item is the printing of the monthly weather summary, which averaged $43 per 8-page issue in 1974. Franking privileges are used to mail this free to volunteer observers and a few others.

Figure 1.—Metropolitan Network monthly report card, used by volunteer observers to record and mail observations.

WS FORM F-54
(9-72)

U.S. DEPARTMENT OF COMMERCE
NATION A' OCEANIC AND ATMOSPHERIC ADMIN
NATIONAL WEATHER SERVICE

METROPOLITAN NETWORK MONTHLY REPORT

Please mail by fifth day of month

STATION NUMBER	MONTH	YEAR
NAME		

TIME OF OBSERVATION

TEMPERATURE	PRECIPITATION	OR	☐ AFTER PRECIP ENDS

DAY	TEMPERATURE PAST 24 HR. MAX.	MIN.	OBS	PCPN HNDTHS	SNOW TENTHS	REMARKS
1						
2						
3						
4						
5						
27						
28						
29						
30						
31						
TOTAL						

☐ *Check if more cards are needed*

'S FORM F-54 (9-72)

NETWORK INSTRUMENTATION AND DATA EXCHANGE WITH OTHER NETWORKS

Of the 320 rain-gage sites, 40 are recording and 20 are NWS standard 8-inch. Of the 40 recording gages, 34 are operated by county governments comparing rainfall vs. runoff and flooding relationships between urbanized areas and the outer suburbs where urbanization is planned. Most of the other recording gages are located at NWS and military weather stations at airports. The 8-inch gages are operated mostly by stations in the NWS climatological network. The network has an additional 20 or so clear plastic cylindrical rain-snow gages having an 11-inch capacity, and 240 wedge-type plastic gages with a 6-inch capacity. These are purchased by observers both for participation in the Washington Network and for their own use; they cost about $10 and $2.50, respectively, in 1975. These are significantly below retail, thanks to bulk purchases.

Maximum-minimum thermometers are of the U-shaped type, except for about 30 at NWS and military weather stations and in the NWS climatological network. The U-shaped thermometers were bulk-purchased for about $9 in 1974.

Temperature and rainfall data from climatological, county, and federal government stations are freely shared with the Washington Network; and summarized data from the Washington Network are shared with those operating the government networks.

POTENTIAL OF UNPAID VOLUNTEERS IN SUPPLEMENTING MICROSCALE STUDIES

The main purpose of describing the Washington Network is to suggest usage of the same type of data to augment other types of meso- or microscale studies. Suggestions for the establishment and maintenance of such networks are offered later.

It would be difficult to justify establishing much of a volunteer network to supplement short-period studies, such as 2 or 3 nights of temperature traverses, due to the time and effort required to establish it. However, the value of volunteer networks increases as the length of the period of the microscale study increases. Some suggested microscale studies using volunteer observers are discussed below.

Studies of the Influence of Urbanization or Terrain on Precipitation Patterns

Application of the low-cost Washington Network concept is most obvious as a supplement to urban precipitation studies. The appeal of volunteer observations lies in the use of a mix of simple and complex observing systems. For example, instead of setting up a network of recording rain gages about 2 miles apart, every other station in this 2-mile grid could consist of a simple rain gage operated by a volunteer. Use of the low-cost gages at about half of the planned observing sites would cut field instrumentation costs significantly. It is doubtful that estimations of rainfall rates and measurements of storm totals would suffer unduly from this substitution, even in the case of stationary thunderstorms with intense isohyetal gradients, especially if digital radar data were available for the study area to assist with analyses.

A correlary use of volunteer observers would be to intersperse these between recording gages installed at the preplanned locations, as a means of increasing data density and hence, analysis accuracy. This type of use is particularly apropos for studying rainfall-runoff relationships (and for improving real-time flash-flood warning capabilities) over small drainage basins, or over somewhat larger basins lacking digital radar within a reasonable distance.

Urban-Heat-Island Studies

One of the main goals of urban temperature studies is to establish relationships between temperature and nonmeteorological factors such as terrain, degree of urbanization, and vegetation (TUV). Empirical relationships established between these in one metropolitan area are most beneficial if they are exportable to other areas.

The establishment of reliable TUV relationships to temperature over any sizable area can be quite difficult using temperature traverses alone, due to short-period temperature changes or the number of simultaneous traverses needed. There are two means by which volunteer observers may contribute. First, they can be informed in advance of the times of planned temperature traverses, in order to coordinate their readings. However, many traverses are conducted during inconvenient hours (at night). This problem is partly overcome by the second method, which uses volunteers having maximum-minimum thermometers. Readings by the volunteers need not be made at specific times if the traverses are made at or near times of maximum or minimum temperature.

An additional advantage of volunteers is their capability of taking readings over extended periods of time — a procedure that is usually impractical for temperature traverses. Extended records are beneficial not only for obtaining long-term averages, but also for getting several sets of samplings under different combinations of wind speed, cloud, and snow cover.

Pollution-Sampling Networks

Volunteer pollution observers judiciously scattered over a city could provide a low-cost yet valuable supplement to more sophisticated pollutant-measuring networks. Volunteer observers could either retain samples of their rainfall for certain types of air (or water) pollutant analysis, or expose other types of pollution collectors to the air.

Recruiting procedures depend on the type of sampling employed. Small, light samples could possibly be mailed after exposure, while the larger ones should be taken to a common collection point. For the latter, recruiting might be concentrated within a given office building, where volunteers could drop samples off at work.

Selection of pollution observers from pre-existing temperature or rainfall networks offers about the best chance of obtaining people of proven reliability, likely to be interested in participating, and capable of following instructions. Random recruiting can often result in volunteers lacking these qualities.

Relationship of Urban Temperature Patterns to Vegetation and Length of Growing Season

Costly temperature-measuring devices need not be relied on entirely to determine the effect of vegetation on urban temperature patterns and vice versa. Much can be learned by comparing maximum and minimum temperatures taken by volunteers in builtup vs. forested areas. These same observers could also report the impact of weather and urbanization on plant life, such as flower-blooming dates and frost, fungus, and pest damage.

Washington's annual Cherry Blossom Parade would usually have to take place 3 weeks later if it were held in the northern part of the suburbs, yet still inside the Beltway. Volunteer observations have shown the growing season to be 3½ months longer in the warmest part of the heat island than in the outer suburb valleys 25 miles away in two of the past 4 years, despite variations in elevation of only 500 feet.

The increased evaporation rate in the heat island is probably the main reason the downtown Arlington Army-Navy Country Club requires more watering than the rural golf courses.

POTENTIAL SOURCES OF FREE OBSERVATIONS

There are two basic sources of free observations. One consists of existing observing sites and the other of potential new observers. Either source may be surprisingly easy to tap, and may provide more data than seem necessary in some areas. The acceptance of some redundancy can help compensate both for what might be less accurate observations and (in the case of extended-period studies) for dropouts and temporary observer absences during summer vacations.

Pre-Existing Observations

The following list includes potential sources of pre-existing observations. The number at the end of each source indicates the number of that type of observation in the Washington Network.

1. Airports (military or civilian) handling scheduled traffic. These take observations hourly. There are seven of these in the Washington Network,

each of which submits monthly summaries.
2. NWS climatological stations, or USDA experiment stations etc. recording maximum and minimum temperatures and daily precipitation (about 15).
3. Networks of recording rain gages operated by county governments or the U.S. Geological Survey (about 34).
4. Golf courses (5), farmers (15), utilities — electric and natural gas (5), who have an economic stake in weather.
5. Employees of the NWS, Geological Survey, or any other federal or local agency having an interest in weather (about 80).
6. Those having weather as a hobby, or interested in temperature and/or rainfall for lawn or garden growth and watering needs, or school earth-science departments and college meteorology or geography departments (about 50).

More than 200 of Washington's 320 observations were obtained from the above pre-existing sources. They provide the advantages of more weather knowledge and a lower turnover than in newly recruited observers, whose enthusiasm is more likely to wane soon.

New Observations

Sources of new observers would include those in (d) through (f) above who are not yet participating, the general public, perhaps 4-H or Future Farmers of America (if suburban data are needed), and retired people, who often are looking for a meaningful hobby useful to others.

Recruiting Suggestions

Several methods of finding existing observers and recruiting new ones have successfully been employed in Washington, and should be applicable elsewhere. Some are listed below.

1. Contact airports and NWS climatological stations. These must generally be contacted individually and supplied with envelopes in which to mail their reports. Names and addresses of climatological stations may be obtained from NWS substation network specialists, generally located at NWS forecast offices.
2. Put notices in local weekly or monthly news bulletins distributed to an organization's or business establishment's employees. One such notice put in a National Bureau of Standards weekly bulletin resulted in 30 new Washington Network observers.
3. Set up model weather-observing stations at science fairs, county fairs, or state fairs. One of the most successful recruiting efforts was at an NWS open house held outdoors and visited by many Washington-area school classes.
4. Contact weekly or daily newspapers likely to be interested in your project. Try to assure that the article prominently emphasizes your desire to recruit observers — a fact often buried toward the end of articles carried in Washington papers.
5. Have a television station prepare a short filmstrip describing your project, and have it shown along with the regular TV weather forecast. Many amateur meteorologists are avid watchers of the TV weather programs.
6. Ask scientifically oriented organizations to permit you to request volunteers via their monthly meeting announcements. An announcement in the local American Meteorological Society monthly bulletin drew several volunteers. Notices in local publications of the American Association of Retired People (AARP) should prove fruitful, at least for warm-season observers.
7. Make house-to-house or farm-to-farm visits. Though this method may seem difficult, these visits let you know exactly where in your network each

new station is located, its proximity to vegetation, valleys, and pollution or heat sources, and each station's instrument exposure.

A stock of weather equipment should be maintained for mailing or personal delivery to observers who do not have their own. Rain gages and maximum-minimum thermometers are purchased in bulk at reduced prices for distribution in the Washington area. The 11-inch capacity gages are purchased in lots of six for about $10 each, postage paid, from the Lake Region Rehab. Ind., Inc., P.O. Box 404, Fergus Falls, Minn. 56537, telephone 218-736-5668. The 6-inch capacity wedge gage comes from the Tru-Chek Rain Gage Div., Edwards Mfg. Co., Albert Lea, Minn. 56007, telephone 507-373-8206. These may be purchased for about $2.40 each plus shipping, in lots of 20. Maximum-minimum thermometers are purchased at a discount through one of our golf-course superintendent volunteers.

MAINTAINING THE INTEREST AND COOPERATION OF VOLUNTEERS

The retention of unpaid volunteers in extended period studies is highly dependent on frequent feedback showing the fruits of observers' efforts. This is achieved in two ways in the Washington Network. First, a letter of thanks is sent out annually with each new supply of weather-reporting forms; and second, observers receive copies of the monthly Metropolitan Climatological Summary (MCS). The summary contains: (1) analyzed maps of individual storms, on which each observer's rainfall amounts are plotted; (2) maps on which average and extreme maximum and minimum temperatures are plotted for each station; (3) a table listing each observer's name, station number, and monthly (and sometimes maximum 24-hour) precipitation; and (4) observer's comments and descriptions of the month's weather events both in the descriptions of individual storms and a summary of the highlights of the month's weather events.

The success of the Washington Network in retaining the cooperation of its volunteers may be attested to by the fact that there has been no recruiting since 1972, during which time the Network has suffered a net loss of active volunteers of only about 50 (from about 370 to 320). Another 75 or so dropouts have been matched by word-of-mouth volunteers.

Figure 2 shows a sample MCS storm analysis. Note the use of observers' comments.

QUALITY CONTROL

Quality control covers both instrument accuracy and instrument exposure.

Instrument Accuracy

Rain-gage accuracy should be satisfactory if gages are of equal or better quality to those described above. Even the simple farm gages having no magnification are useful in the absence of other readings, provided precise rainfall amounts are not required. The U-shaped type of maximum-minimum thermometers should not be used unless it is possible to adjust upward or downward the maximum and minimum temperature scales independently of each other as may be needed to eliminate errors. This requirement excludes thermometers with scales printed on the frame. If money is of secondary importance, separate maximum-and-minimum thermometers meeting NWS specifications are preferred.

Washington Network thermometers are mostly of the U-shaped type with independently adjustable scales. Calibration is accomplished by placing all thermometers on a table in a room having no heat and cold sources and by circulating the air rapidly by a fan. Five separate sets of calibrations are run against a precision thermometer marked to the nearest 0.2°.

Figure 2.—Analysis of Washington area rainfall 25-26 June 1975. Solid lines are isohyetals of equal rainfall amounts, drawn at 1/2-inch intervals. Shaded areas received more than 2.50 inches of rain. Note use made of observers' comments in text at top.

RAINS OF JUNE 25-26

SYNOPTIC SITUATION AND EFFECTS

A weak "back door" cold front (a front coming in from the NE instead of NW) drifted southward through the DC area on the afternoon of the 25th, setting off heavy thunderstorms and localized violent winds and some hail, all to the northern Va. and western Montgomery County areas of the NCA (National Capital Area). Then, after midnight, the heaviest rains of the year struck the Beltsville and northern Gaithersburg (Washington Grove) areas, setting off heavy flash flooding. Fortunately, these came at a time of day when little inconvenience resulted.

EVENING STORMS - HAIL AND WIND

Storms first formed about 4:30 p.m. in western Montgomery Co. and adjacent areas of northern Loudoun County. Goldstein (121) reported .24" rain by 5pm (and another .44" mostly between 6 and 7 pm). Seebode (318) heard thunder from this storm before a new storm formed overhead, bringing him up to 1/2" hail for 20 minutes and 1.44" of rain between 5:16 and 6:38 p.m. Swindler (321) also reported hail, as well as 45 mph winds.

Soon after this, new storms developed suddenly over Dulles Airport (403) eastward to the Vienna-Fairfax City areas, dumping over 2" of rain on both locales. High winds (from the storm's downdrafts) swept through a small area of western Fairfax City, where Adams (618A) reported strong gusty north winds, a corn crop flattened, extensive tree damage throughout the Cobbdale area, and heavy flooding, with 2.22" rain from 6:40 to 8 p.m. Weber (618) noted gigantic oak trees downed along route 123 and Hunter Mill Rd., and Atkiss (in Cobbdale) lost several trees and suspected tornadic activity. Mersereau (619) was soused with 2.25" of rain in an hour. MacNulty (927) observed the next big storm getting underway over and south of him around 8 p.m.

STORM CELL MOVEMENT

While the active thunderstorm cells were developing (not moving) southward through Fairfax Co., the upper layers of the stormclouds moved eastward, sprinkling much of the rest of the NCA with gentle rains. A multitude of observers commented on the long periods of the evening during which they heard distant and eventually overhead rolls of thunder, but experienced only light rains-after 1-2 hours of thunder.

POST-MIDNIGHT STORMS

To most of us it appeared that the thunderstorm activity had ended for the night, as thunder diminished by late evening. Not so. Shortly after midnight very localized but drenching storms struck Beltsville, Layhill and Gaithersburg, with an abundant electrical display. Oliver (268) reported nearly continuous lightning and rain beginning 10 p.m., and ending by 5 a.m., with 3.45" rain. Nealis (267) reported "severe electrical storms from midnight to 2:30 a.m., streets flooded," and 5.88" of rain. Fisher (269) was also near the center of the "violent thunderstorm after midnight." In all, four stations received over 5" of water in the Beltsville area, while Whitcombe (35) recorded 5.60" in Washington Grove.

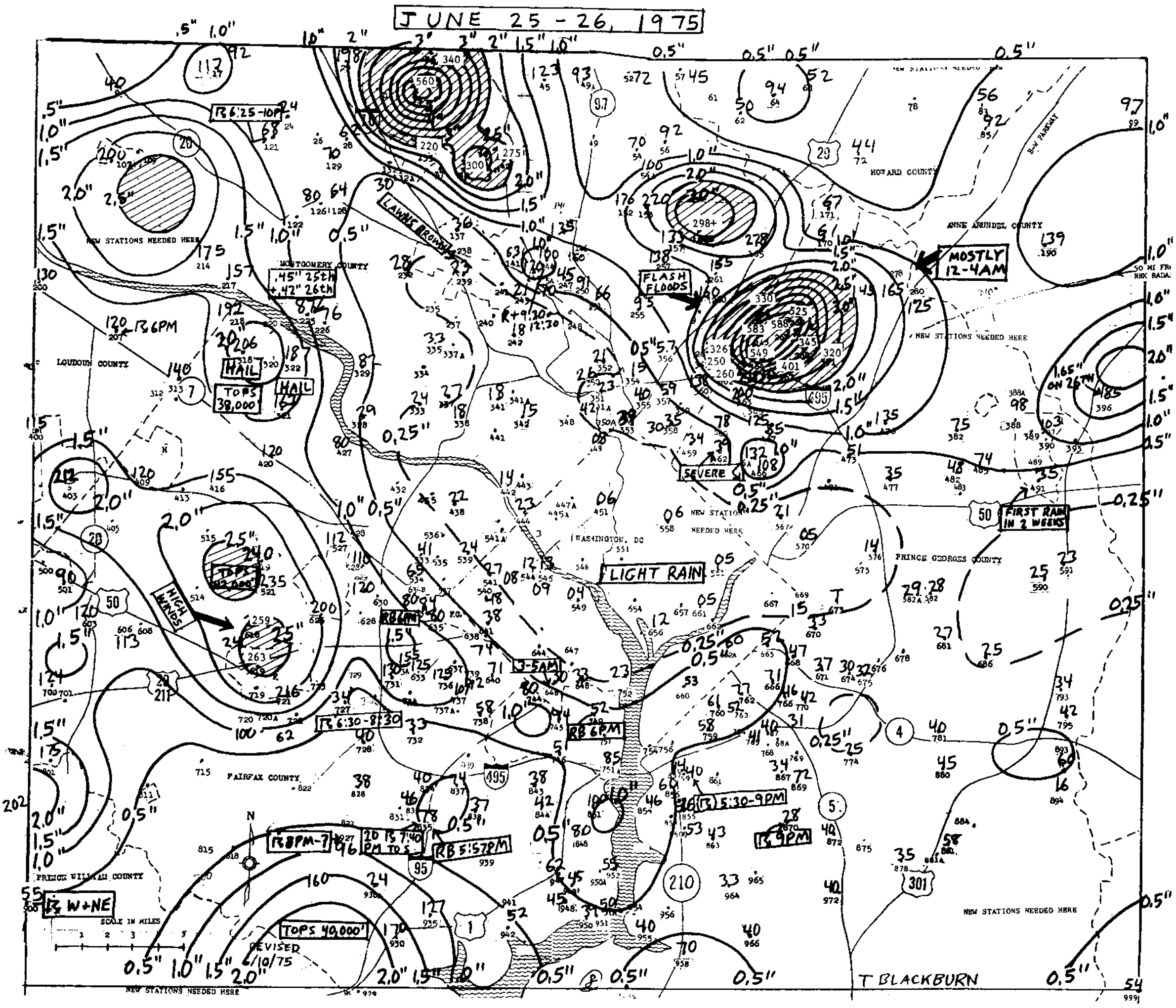
MIDNIGHT STORMS MORE LOCALLIZED AND PERSISTENT

While the evening storms in Va. moved around somewhat, thereby spreading out the area over which rains fell, the Beltsville storms had a net of zero motion, dumping all their rains in essentially the same spot. The cause of the change was apparently an increase in the low level easterly wind, that seemed to neutralize almost exactly the westerly winds at higher levels. Rainfall isohyetals were thus much more tightly packed than during the previous evening. The Beltsville storm was amazingly persistent, resulting in the following hourly amounts at Beltsville Plant Industry Station #7 (367):

12-1 a.m.	0.98"	2-3 a.m.	1.60"
1-2 a.m.	1.47"	3-3:40a.m.	1.27"

Note that the rate of fall per hour at 367 was less than in the Virginia storms, but the deluge persisted much longer.

Continued (see July 11-13 storm for conclusion of text)



Instrument Exposure

Instrument exposure can be checked at the time the instrument is installed, if done in person. Most new Washington Network instruments have been mailed out, and have had no such inspection. To compensate for this, detailed site-selection instructions are sent, together with occasional reminders in the MCS.

Inadequate rain-gage exposure may show up in readings inconsistent with adjacent data for rains having negligible isohyetal gradients. Such consistency checks, however, are only the poor man's substitute for on-site inspection.

Only about a fourth of the thermometers are located in official NWS "Cotton Region Shelters." The rest are usually mounted on the shady side of a structure, some with a small white shield installed on one side as protection from morning or evening sunshine.

Direct exposure to sunshine can usually be detected by plotting and comparing maximum temperatures on a clear windless day. Similar plots on uniform temperature cloudy days will often show up stations whose temperatures do not appear to fit the expected isohyetal pattern.

PROCESSING VOLUNTEER WEATHER OBSERVATIONS

The most obvious problem with the acquisition of a large volume of data regards how it is to be processed. Several day's work have been accomplished in an afternoon by assembling several of the volunteer observers to plot the past month's Washington Network rainfall amounts. One person reads the daily amounts from each monthly report, while each of the other participants plots the amount for his assigned rainfall date on a blank base map. Maximum and minimum temperature plots can be handled by the same type of group effort.

Initial analyses of the plotted data can be entered by the participant on a transparent overlay. The smoothed final product requires some training, however.

Observers have been very cooperative in totalling their own temperature and rainfall data.

REPORTING WEATHER AS IT OCCURS

Observers in the Washington Network have three options for telephoning weather data to the NWS Forecast Office as it occurs.

1. *Live Conversations.* The observer calls the forecaster, who takes the message live. This is used for urgent (severe weather) messages.
2. *Recorded Messages.* Significant, but not severe weather is recorded on a Code-a-Phone and played back by the forecaster once per hour, or more frequently during bad weather.
3. *Touch Tone.* Observers having touch-tone telephones send messages directly to a computer, which converts the tone signals first to a printout of the numbers sent (optional), and second into a formatted, printed plain-language message. This method can eliminate answering the telephone and manual computer input. However, it is not for the low-budget study, as a program must be written to decode the tones; a computer terminal is needed to display the observations; etc.

POSSIBLE USES FOR URBAN STUDY RESULTS AND OBSERVATIONS

There are a few uses of urban studies and observations that could be applied to improve the accuracy of daily forecasts, either by the NWS, or by private meteorologists, the latter being the more likely users in the immediate future. The NWS, however, has increased its interest in making detailed short-period forecasts to the point where the telephoned observations received are now used to issue hourly Washington metropolitan-area weather summaries and forecasts. Also, a special Summer 1975 project used data from volunteer observers on boats and at marinas to prepare similar detailed forecasts and warnings for Chesapeake Bay boaters. The latter observations are sent by touch-tone telephone.

Four possible uses of urban studies or observations are listed below.

Urban-Heat-Island Studies

Studies of urban temperature patterns could be used, for example, to show expected temperature *deviations* in different parts of the city from the official minimum temperature forecast. The change in the daily deviation would depend on factors such as wind, cloud, and snow cover. A sample procedure for doing this is shown below.

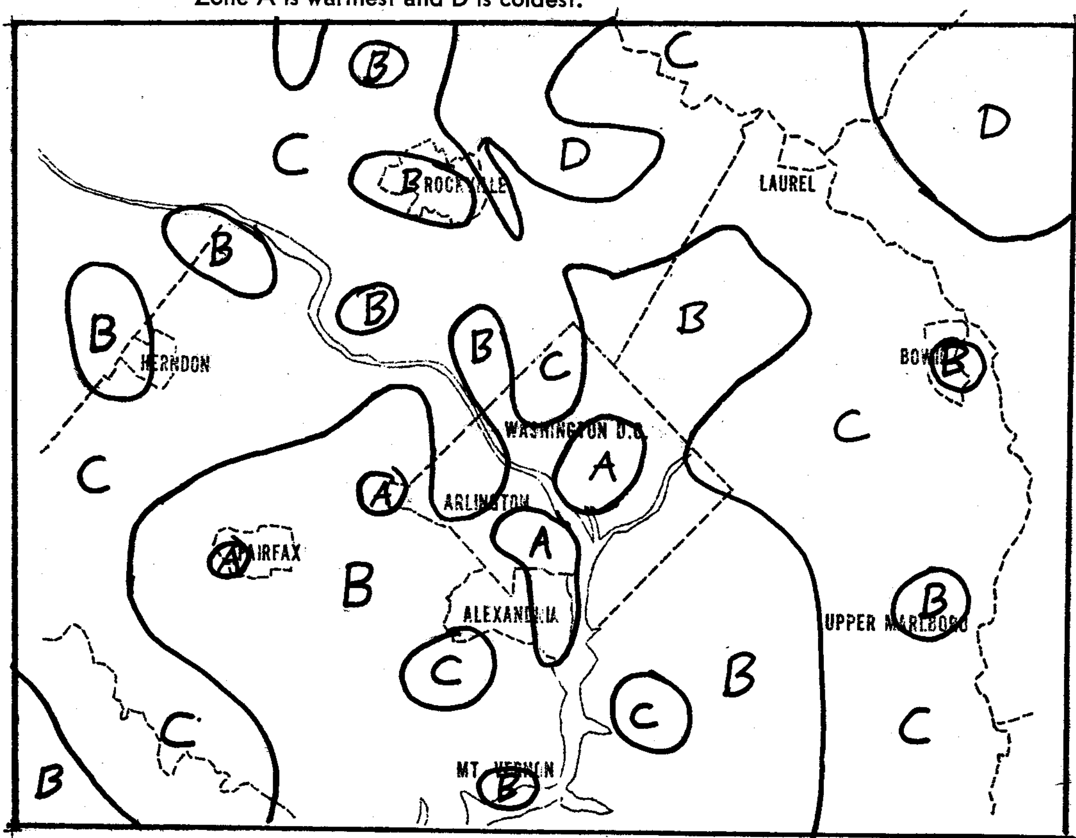
1. Take a metropolitan area for which isotherm patterns (at times of minimum temperatures) have ben determined, and divide it into about four temperature zones. Label the warmest and coldest zones Zones A and D, respectively, with Zones B and C having values between A and D.
2. Determine weather conditions associated with both the greatest and least geographical urban temperature variations, and about two other stages between these extremes. Call these conditions 1 through 4, condition 1 being weather associated with the least variation.
3. For this simplified example, assume that zones A and D will encompass the warmest and coldest areas, respectively, in each of conditions 1 through 4 and regardless of wind direction or any other variable.
4. Assign average temperature *departures* from the central heat island temperature for zones A through D for each of conditions 1 through 4. Zone A would be assigned a departure of 0°. Temperature *ranges* could be used instead of averages for each zone, in which case zone D might have a range from −14° to −18° instead of an average of −16° under condition 4.
5. Assume the official minimum temperature forecast for the city to be the minimum expected in the heat island. For example, a forecast of "low tonight 45° in the city of 30° in the colder suburbs" might mean minima of 45° in zone A and 30° in zone D, and average departures would be 0° and −15°, respectively.
6. Find a television weathercaster willing to read the official forecast, modified by the zone B, C, and D temperature adjustments. This assumes he or she is willing to forecast which of conditions 1 through 4 will apply.

Figure 3 shows a rough approximation (and gross simplification) of zones A through D for the Washington metropolitan area. The area shown is 45 miles wide — probably much larger than is needed, and the data base consists entirely of volunteer observers. Under conditions 1 and 4 the temperature differential between Washington's *adjacent* zones are about 1° and 5° F, respectively, although with snow cover, no wind and clear skies (which seldom occurs more than once per year), temperatures have varied by 26°.

Air-Pollution Distribution Forecasts

Should it be determined useful to predict which parts of a metropolitan area will suffer the severest pollution in the next day or so, studies of the relationship of low-level winds and other factors to pollution distribution could be used to make such predictions. The forecast procedure would be somewhat like that for temperature distribution, except that emphasis would be on the distribution and concentration of pollutants over the metropolitan area under different wind and lapse-rate directions.

Figure 3.—Smoothed temperature zones for Washington area. Zone A is warmest and D is coldest.



Improvement of Short-Period Metropolitan Area Forecasts and Warnings

While volunteer observations have been used extensively in tornado spotter networks, their use in daily forecasts and warnings has been rather limited.

Real-time urban network observations can be a tremendous aid in the detection and hence the issuance of short-period hail, heavy rain, flash-flood, local fog, snow, and wind warnings and forecasts. Reports can also assist in the issuance of detailed hourly synopses and forecasts of metropolitan weather conditions. Knowledge of which sections of a city will receive rain during the next hour or two can be very useful to people engaged in activities such as boating and construction.

Real-time [illegible]erature reports received on days with precipitation accompanied by temperatures near freezing can be useful in the optimum deployment of snow-removal crews from above-freezing to below-freezing areas of a city. In the case of freezing rain, travelers advisories can be limited to below-freezing areas. Volunteer observations can also assist in monitoring the movement of the rain-snow line.

Improving Summertime Probability of Precipitation (POP) Forecasts

POP forecasts for metropolitan areas verify at a single observing point. Thus, if measurable rain fell at the verification point, a POP of 80 percent would have verified with only a 20 percent error (a 100 percent POP would have had no error) even if three-fourths of the rest of the metro area remained dry.

During seasons when rains tend to be spotty, I would like to see the POP verified against 5 or 10 evenly spaced observing sites, which could be operated by volunteers at essentially no cost. If 6 of the 10 stations reported precipitation, the best POP would have been 60 percent.

Verification procedures would have to be redefined to indicate the percentages of the metropolitan area expected to have measurable precipitation, rather than the POP at any given spot. Hopefully, this redefinition would increase the credibility as well as accuracy of summer forecasts. For example, while the radio listener now scorns a 30 percent POP forecast if he's in a downpour, he's more likely to believe it if it's defined to mean only 30 percent of the *area* will have rain.

An alternative to the rain-gage network would be radar determination of rainfall coverage. This is quite promising. The only problem noted in the Washington area is that the radar precipitation area often appears to extend 2 to 3 miles beyond the actual rain area. This problem should not be unsolvable.

Let's Make Quantitative Precipitation Forecast (QPF) Verification More Realistic

QPF's are verified for accuracy at a given point (the official metro area observing site). Though this method may be satisfactory for prolonged nonconvective rains, it can be gravely misleading during thunderstorm situations.

Rainfall amounts from the same 5 to 10 sites proposed for POP verification could be averaged to obtain a value more representative of the metropolitan area than single-station verification.

A second QPF verification scheme would use rainfall depths determined by radar. However, the accuracy of radar-determined convective rainfall amounts is such that rain-gage readings are needed to calibrate the radar. Nevertheless, radar-determined amounts alone should be preferable to single-station QPF verification.

Until the QPF verification method is changed, it will be difficult to evaluate QPF accuracy, as is needed before significant additional forecast improvement is possible.

Injury and Damage Claims

Lawyers and insurance companies are frequently in need of more localized meteorological data than that available from the official observing site. They are quick to question a wind- or hail-damage claim if the official site had none. A lawsuit resulting from a fall on a snow-covered sidewalk may be justified, but will be difficult to support if the official station reported only rain and above-freezing temperatures, and no other data are available. Lawyers and insurance adjusters frequently request data for a particular suburb of Washington, D.C.
