The National Weather Service Rainfall Data Collection Network in Indiana

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The primary mission of the National Weather Service is to provide severe weather warnings and flood warnings to the public. To accomplish the flood warning part of this mission, staff members at the Indianapolis weather office collect daily reports of precipitation measurements taken across Indiana by the official hydrologic network. These reports represent a large part of the official National Weather Service cooperative network in Indiana.

There are nearly 180 official National Weather Service cooperative stations in the state. But because of monetary constraints, only about 10 percent of these observers are asked to report on a daily basis. However, when rainfall amounts exceed one half inch, then nearly 60 percent of the network observers report. In the Central Region, of which Indiana is a part, it is estimated that the present average network efficiency is only 30 to 50 percent.

Various sources in the climatological literature suggest that one observing site for every 50 square miles is necessary to accurately describe the spatial variation of rainfall. This is especially important where convective precipitation contributes one third or more of the annual precipitation total. It should be obvious that with an average of one official observer in each 205 square miles, the reporting network in Indiana falls far short of this goal. Around 750 stations would be needed just in our state to approximate the one observation per fifty square miles criteria.

One example of how the lack of reporting observers in the official network has sometimes failed the public to some degree occurred in June of 1980. On this occasion, data collected from the official network was sufficient to accurately forecast some flooding along the White River in Central Indiana. The network reports also enabled Weather Service forecasters to issue flood statements for tributaries and small streams in Kokomo and some other areas of Central Indiana. However, when television coverage of the resulting flood in Kokomo was reviewed, it became obvious that the predictions for small stream flooding were too low because of grossly inadequate rainfall data.

There are always ongoing plans and goals within the Weather Service to upgrade the present hydrologic networks. Unfortunately, this sort of change seems to take many years and millions of dollars and these funds are rarely available. So, to try to prevent a repeat of the Kokomo flood situation, the hydrologic unit staff at the Indianapolis Weather Office appealed to the Indiana Amateur Radio Operators who have always been a public spirited group. They responded in the way that the nation has come to expect and went to work to solve the problem.

In October 1980, a small group of 40 Amateur Radio Operators organized by Mr. Herb Clark, began collecting rainfall reports on a daily basis; forwarding them to the Indianapolis Weather Office. Mr. Ray Fullman of Brownsburg became the local relay for these reports. The individual check-ins were then compiled by Mr. Fullman and called into the Indianapolis Weather Office by telephone. Under Mr. Clark's and Mr. Fullman's guidance and determination, the Indiana "WETNET", as the network is now called, quickly grew to 60 daily reports, then to 100 reports, and finally to the current number of about 150. The Indianapolis Amateur Radio Network is now approximately the same size as the official Weather Service Hydrologic Network.

Results of the Amateur Radio Rainfall Reporting Program have met or exceeded

all expectations. Since the Network's inception, the addition of this data has helped the isohyetal analyses of every major rainfall or snowfall that has occurred in Indiana. For example, in 1981, forecast of flooding along the Tippecanoe River was possible only because of Amateur Radio Reports. Many times, excessive rainfall from isolated thunderstorms has been verified only through these reports. However, our goal of at least one Amateur Radio rainfall report per Indiana county has yet to be realized.

The project has not been without difficulties. Because of the time involved in the collection and processing of so many reports by hand, the Amateur Radio operators seemed to reach their limit with 150 daily reports. While this number has effectively doubled the precipitation network that existed in the June 1980 flood event, it still leaves the state far short of that optimum spacing of one observation in each fifty square miles. Large gaps remain in the network. Some counties are still without an observer that reports on a daily basis. Many more reports are needed but the collection and relay of these numbers of reports has created a bottleneck.

Fortunately, the home computer has appeared in the "shack" of many Amateur Radio operators during the past several years and this will apparently provide an answer to the data collection problem. Mr. Tom Bowen, Amateur Radio Operator and manager of the Indiana "WETNET" has written several programs for the Commodore 64 computer to monitor and reformat the reports into a message that can be used by National Weather Service computers. Test transmissions have proven successful and further refinements are planned in the last two months of 1984. As we go "on line" with the data transfer computer to computer, an almost unlimited number of reports may be processed and the existing bottleneck eliminated.

The Amateur Radio Precipitation Network is far from the precise official network that has been established and is maintained by the National Weather Service. Very few private citizens can afford a standard rain gage that cost over $100 or a recording rain gage that can cost in excess of $3500. Although Weather Service personnel instruct the Amateur Radio operators in the proper exposure requirements for rain gages, no staff member is able to visit and inspect all the sites. Many of the observers use the inexpensive 6 inch Tru Check Wedge Plastic Gage that is available in many hardware stores. A few have the more expensive 11 inch plastic gage that has been certified by the National Weather Service for use. Still, these reports are quite legitimate when closely compared with those of the official network.

Another difficulty is turnover of participants in the Net. When an observer quits for any reason, there is no guarantee that a replacement will be found at or near the previous location. During the past year, the rate of observer turnover has been nearly 15 percent.

In spite of these and some other disadvantages, the usefulness of the data received makes the network worthwhile to maintain. Not only does the National Weather Service use the information on a real time basis, but the Agricultural Center at Purdue University as well as State and other Federal Agencies use the data for maintaining climatology records, for research, and water level maintenance to name a few examples.

Local electronic archiving of the rainfall data has not been possible to date. Machine manipulation of the data also cannot be done at the Weather Service Forecast Office level as yet. However, we feel that this information could be of significant value in mesoscale analysis for research and other purposes if placed in the right hands. The National Weather Service will certainly cooperate with any such requests.

The future holds promise for an increasingly efficient and acceptable hydrologic network. As expertise grows in the use of satellite imagery to estimate rainfall amounts and correlation of both, Doppler and conventional radar observations to rainfall is better understood, these networks may become redundant. Full automation of data

collection and processing is certainly in the future, but until this becomes a reality, we will continue to rely on the Amateur Radio Network and other hydrologic networks to aid in warning the public of excessive rainfall events and any resulting floods.