U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service Western Region
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Reply to Attn. of: WFW2x2

To : FOR THE RECORD

From : Regional Flash Flood Hydrologist
Western Region

Subject: Notes on Automated Tipping Bucket System

In regard to the proposal by the Sacramento RFC pertaining to an automated tipping bucket precipitation network, the following information may be of interest:

In the Western Region, in an attempt to implement methods used by the National Weather Service to reduce the number of lives lost and property damaged by flash floods, many visitations were made to metropolitan areas. Presentations were given to local officials describing the flash flood alarm system (FFAS), watches and warnings, self-help procedures and use of educational materials. A very distinct inadequacy under many circumstances was observed. This is: What warning system can be successfully implemented under situations of a convergence of numerous tributaries with extremely short response times (less than 15 minutes)?

Under these conditions the FFAS is inadequate because: (1) Expense involved to gage each tributary, or (2) Community action generally cannot be implemented in less than 15 minutes.

Many times watches and warnings are inadequate, due to inability in defining locations and forwarding this information, to appropriate individuals, where intense rainfall may occur or is occurring. In time frames of 15 minutes, timely information is needed.

Self-help procedures rarely work properly when lag times are less than 6 hours or when flash flood events occur 2 years or more apart.

Education programs fail when events have not been observed by affected individuals.

The proposal by the Sacramento RFC has many advisable and desirable aspects. Some of these are: (1) It is a multipurpose system. [(a) Flash flood warnings can be generated. (b) It can be used in general river forecasting. (c) Radar-precipitation correlations can be made. (d) General weather forecasting is enhanced, and (e) Studies of climatology of extreme events are possible.] (2) The system is economical. (3) The system requires little maintenance. (4) The system is efficient, and (5) Many requests have been received for such a system.

From visitations to various community officials we found that in many locations, warnings of flash floods would be greatly enhanced by use of real-time automated data on depth and intensity of precipitation. The following communities are examples:

(1) Boise Front area: (a) Four small drainages with very short response times. (b) MIC would like precipitation data. (3) USGS reported that some of the highest runoff in U. S. per square mile has occurred. (c) May significantly increase warning times.

(2) Drainages north and east of Tucson, Arizona: (a) Basins with very short response times. (b) Several drainages. (c) Extremely vulnerable to flash flooding. (d) Large population of recreationists commonly use the flood plain.

(3) Wenatchee, Washington: (a) MIC requested tipping bucket system. (b) Fast response time. (c) Community disinterested in other techniques.

(4) Many small communities in central Utah: (a) Response times very fast. (b) Basins well-suited to automated tipping bucket system. (c) MIC/HIC would like real-time precipitation reports.

(5) Tonto Creek, Arizona: (a) FFAS unfeasible. (b) Watches and warnings unavailable and not precise enough. (c) Self-help not practicable. (d) MIC would like data.

(6) BLM, NPS, USFS, state recreation areas: Due to lack of communications and observers in recreation areas, the proposed system would generally be the most adequate solution to availing warnings of flash floods to visitors.

(7) In above-mentioned areas, officials were more receptive to this system than to the FFAS, or self-help procedure.

It should be noted that precipitation distribution from events causing flash flooding is extremely erratic and difficult to measure, and that on basins larger than a few square miles many gages are required to determine depth and areal coverage of precipitation. Consequently, the ideal situation lending support to the automated tipping bucket gage is a group of small basins with quick response times, where the center of mass of runoff-producing precipitation can be gaged. Large basins have been found to produce such erratic precipitation-runoff relationships that the index gage approach will not work under conditions of convectional precipitation patterns. But under requirements other than forecasting flash floods on large basins there are many valid desirable uses, as previously mentioned. In other words, the FFAS may work much better on larger basins with greater response times and with one or two main channels at least 1 hour upstream, than will an automated tipping bucket system.

cc:
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