SPATIAL ANALYSIS OF STORMS USING WEATHER RADAR

DR. I.D. CLUCKIE and MR. G.W. SHEPHERD

Department of Civil Engineering
University of Birmingham

Resources Recovery Board
States of Jersey

The construction, calibration and use of a digital simulation model for the purpose of the design and evaluation of drainage systems is a very expensive exercise. A typical flow survey may cost in excess of £25,000 and the extraction of pipe data and the construction of the data set may take several man-years if the system is old and site records are somewhat sketchy. Having created the model it is often the case that event data, as opposed to design data, is created from indifferent readings from one or two raingauges.

The latest development of WASSP-SIM has allowed the application of up to nine distributed storm events to a model thereby enabling a more realistic rainfall profile to be applied to the different catchments making up the simulation. The provision of ideally sited raingauges on each of these catchments is generally an impossibility and some form of estimation must be used to establish storm shapes for use with the simulation. Several statistical and graphical interpolation methods are available for this purpose.

The quality of the results obtained from the simulation are only as good as the inputs used in the construction of the primary data set. This requires the rainfall hyetographs as well as the estimated hydraulic data.

An alternative method of rainfall intensity estimation that is currently being researched is to use one of the available Weather Radar products, the five minute, two kilometer resolution data. This product produces an averaged value of the rainfall intensity for each of the 2 kilometer elements at five minute intervals, and considerable parallel research has been and is continuing to be carried out into the reliable calibration and use of this data. The requirements of WASSP-SIM for the observed rainfall are that the data is presented in units of mm/hr at intervals that are dependent upon the catchment size. This interval should be one minute for catchments of less than 100 hectares, two minutes for catchments of between 100 and 1000 hectares and may be five minutes for catchments that are in excess of 1000 hectares. The simulation of a large city, may contain several large catchments which are in excess of 1000 hectares and the five minute data may be applied directly to these areas without modification. For smaller catchments however some interpolution may be necessary and the effect of the inherent smoothing effect of this is being evaluated. The basic principle of single point gauging may prove to be erroneous since an examination of the movement of storm cells over an urban area often shows small, well defined areas of relatively high intensity rainfall occupying only a few of the 2 kilometer elements. If the rainfall intensity information were derived from conventional raingauges it is not inconcievable that either the gauge would register the peak intensity of the storm or that it could completely under estimate the impact of the storm. In either case the hyetograph produced would not represent the averaged rainfall input to the catchment.

The attraction of data acquired using Weather Radar is obvious

P.T.O.

since it has an inherent spatial distribution that could only be matched by a large number of raingauges. The definition of catchment boundries is no more difficult than for the more conventional areal estimation methods and the numeric construction of suitable hyetographs forms the basis of the current research activities in this area.

A study is being carried out of the Greater Manchester area for which a network of raingauges were installed by the WRC. There were 20 raingauges in total, including permanent installations and data from these gauges are being used in conjunction with data obtained from the Hameldon Hill Weather Radar station to evaluate the pros and cons of radar as a primary data source.

There are of course problems. The radar data has associated interference, known as clutter, which masks portions of the area covered by the radar. These are identified during the calibration procedure for the radar site and their effect minimised. Another problem termed 'Bright Band' is associated with snow melting as it falls. The reflection from this discontinuity causes loss of accuracy and reduced reliability. Research is being carried out to identify and make corrections for this error.

There exists various possibility for the use of radar derived rainfall data in the future. These are not neccessarily confined to use in a 'design' situation. In addtion, access to such information in real time may allow the introduction of some element of active sewer control on systems constructed in our largest urban areas. It is envisaged that this present work will be completed during 1987, though results of interest will be disemminated as they arise.