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Hydrometeorology in Australia

by A. F. Rainbird

Mr. Rainbird, of the Bureau of Meteorology, opened his talk with the observation that the scope of Hydrometeorology was not easily defined. Strictly the subject covered all aspects of Meteorology which affect or influence the hydrologic cycle. Precipitation and evaporation are two major factors in this cycle and there are few aspects of Meteorology which do not impinge to some degree on these two elements. The present talk would be confined to a description of work carried out by the Bureau's Hydrometeorological Section since its formation in 1958.

Data of adequate quality and quantity are a pre-requisite to hydrometeorological studies, so an interest has been taken in the present rainfall observing networks in Australia. A large expansion of the Australian pluviograph network is planned, and rain gauges of larger capacity are to be installed in strategic heavy rainfall areas where 24 hour rainfall totals may exceed the capacity of the existing standard 8 inch gauges.

Estimates have been made of extreme rainfall depths likely to occur over specific catchment areas in a given period (24 hr, 48 hr, etc). For the design of hydraulic structures, such as large dams, estimates are required of the extreme stream discharge which may occur at the point on a stream where construction is planned. Estimates of extreme stream discharge are frequently derived by statistical analysis of long period streamflow records when these are available. In Australia, however, it is frequently necessary to make the estimates direct from estimates of extreme catchment rainfall depths, as long period streamflow records are available for relatively few stations.

Generally a synoptic rather than statistical approach to this estimation of extreme rainfall has been favoured. For each catchment under study, the surrounding zone considered to be meteorologically homogeneous with the catchment has been delineated. All large historical rain storms over the catchment and surrounding zone are studied and estimates are made of the rainfall depths which these storms might have produced had the moisture charge of the atmosphere at the time been at its maximum. Rainfall patterns within the homogeneous zone are transposed to the study catchment, with adjustment for differences in latitude and topography, whenever this transposition appears reasonable on meteorological grounds.

A major interest of the Section has been the development of a flood forecasting system for the lower Macleay Valley of N.S.W. This was a joint project between the meteorologists and engineers (hydrologists) within the Section, and their work was closely integrated in the development and operation stages of the forecasting system.

Rainfall over the catchment is estimated from observations at eight key reporting stations; the portion of this rainfall held within the catchment by interception, infiltration etc. is estimated, and the time distribution at the catchment outlet (flood hydrograph) of the remaining rainfall which enters the streams is estimated by hydrological techniques.

The Macleay River rises very rapidly after heavy rainfall, so catchment rainfall depths for the following 6 to 9 hours are forecast to obtain earlier warnings of flood heights than could be obtained from observed rainfall alone.

The flood forecasting system was tested during a flood in April 1962 and worked satisfactorily, the peak river height being forecast within a few inches approximately 33 hours before it occurred. The forecasts of expected rainfall amounts proved to be very useful and gained an additional 6 hours warning in daylight at an important stage of development of the flood.