

NEWS

WATER RESOURCES MAP

A map of New Zealand water resources has recently been prepared by Mr C. Toebes of the Water and Soil Division, Ministry of Works. It was compiled as part of a Ministry of Works programme of water resources studies, and will eventually be published to a scale of 1:1 000 000, together with details of the data used. A simplified version, having 6 divisions of average annual specific discharge instead of the 12 divisions in the original version, has also been prepared and is included with this issue of the Journal.

To interpret this map correctly, it should be noted that the 'isohyd' lines do not correspond to the potential isohyds used by F. Scarf in his paper in this issue. Rather than joining points of equal potential specific discharge, they enclose areas where the actual specific discharges (of rivers with catchments of 50 km² or more) lie within the limits shown in the key. Thus, at any point on a river, the range of the average annual discharge (in l/s) may be calculated by multiplying the value for specific discharge found from the map by the catchment area (in km²) above that point. (To convert to m³/s, divide by 1000.) The average annual discharge is defined as the average of the mean annual discharges for the years of record – mean annual discharge for any year being obtained in turn from the mean daily discharges.

An interesting pattern can be seen on this map, where rivers originating in high-rainfall areas cross much drier areas on their way to the coast. This is particularly noticeable on the east coast of the South Island.

SYMPOSIUM ON UNCERTAINTIES IN HYDROLOGICAL AND WATER RESOURCES SYSTEMS

The above symposium, held at the Hilton Inn, Tucson, Arizona, during 11–14 December 1972, was attended by Dr R. P. Ibbitt as the official representative of the New Zealand Hydrological Society. Finance for attendance was provided by the National Science Foundation of America, the New Zealand Hydrological Society and the Ministry of Works. At the invitation of the Organizing Committee he also acted as a general reporter for one of the technical sessions. His report to the Hydrological Society follows:

At the start of the symposium blizzards and ice storms swept south over much of the central and eastern parts of the United States, and this affected the number of delegates attending the first two days. In spite of the inclement weather the symposium was attended by over 180 delegates representing 17 countries.

The symposium lasted for four days and on each day there were two full sessions. The sessions can be loosely grouped under the following topics.

1. *Hydrological Models*

The first three sessions (model choice and validation; stochastic and statistical models; and uncertainties in deterministic models) dealt with a wide range of material. The subjects discussed varied from how to choose the right model for the right purpose, to how to allow for the inevitable uncertainties arising from the choice of any model.

2. *Data Network Design*

One of the largest forms of uncertainty arising from the use of any model occurs because of uncertainty in the input quantities to the model. This uncertainty arises because the input, e.g. precipitation, is widely distributed in space. To sample at all points in space is economically impossible and even if it were not, the consequence of collecting all the input to measure it would reduce the input to the prototype system to zero. The outcome of these restrictions is that data on spatially distributed quantities can only be measured by sampling at a few locations. This session discussed how networks should be designed to give the best return for the purposes for which the networks are established.

3. *Management Consequences of Uncertainties in Hydrological and Water Resource Systems*

The papers in the last four sessions were dominated by management scientists and economists and were primarily concerned with the operating policies of water undertakings. The work presented showed that increasing use is being made of decision theory and Bayesian statistics. Decision theory is gaining acceptance for helping to determine operating policies because it diverges from the idea of implementing a new policy only if there is a statistically significant improvement over existing policies. Instead, decision theory leads to the adoption of a new policy if its acceptance results in a better-than-even chance of an improvement. The scope of decision theory is being increased by using Bayesian statistics to allow intuitive or subjective impressions to be introduced into problems.

The start of the technical sessions was preceded by an opening address from Dr J. Rodier, President of the International Association of Hydrological Sciences, and an invited lecture by Drs J. Neyman and E. Scott.

In his speech, Dr Rodier said that he considered that too many hydrologists were getting involved in highly mathematical work and were losing sight of the inherent uncertainty in both their data and their assumptions. It was for this reason that the IAHS had considered the time was ripe for a reappraisal of current attitudes and that the IAHS was consequently glad to be able to sponsor the symposium.

Dr Rodier was followed by an invited lecture from Drs Newman and Scott on some of the current problems associated with cloud seeding, a technique that is being increasingly used to try to improve the rainfall in arid areas.

The intensity of the first day's timetable coupled with delays caused by microphone problems made the day an extremely long one and necessitated the severe curtailment of the discussion sessions. This was unfortunate, for the general reporters were unable to present their reports properly. Both reports for the second session, along with that by L. Duckstein and C. Kisiel for the first session, were penetrating reviews of the work done in their respective fields and are recommended reading to anyone interested in particular papers in the first two sessions.

The second day kept closer to the timetable, but even so the discussion sessions had to be closed before everyone had had their say. This at least showed that the symposium was a success from the point of view of exchanging ideas and comments.

The third day commenced with an invited lecture by Professor C. A. Cornell on "First-order analysis of model and parameter uncertainty". The technique described represents a simplified way to analyse stochastic models. The lecture was primarily concerned with how the techniques of first-order analysis could be applied to hydrological problems, and many examples were given. The techniques described have not been tested on hydrological problems, and whether they will be successful remains to be found out.

In the second half of the symposium the number of papers per session was on average less than for the first half, and this left more time for discussion. Much of the discussion concerned why the management policies which result from use of techniques such as decision theory were not as successful as had been hoped. Two explanations were advanced. One delegate challenged the validity of making judgements based on single-valued cost functions and

maintained that satisfactory policies would not be obtained until vector cost functions were used. This idea received considerable support, and some of the papers had endeavoured to use this approach.

A less theoretical explanation that received wide support from those active in implementing new policies was that although the operators of a policy thought they were acting in accordance with that policy to maximize long-term benefits, they were subconsciously operating a less optimal policy that maximized short-term benefits. This was occurring because the operators were being affected by the immediate consequences of their environment. For example, reservoir operators often live within the area affected by floods attributable to high reservoir levels. Consequently they tend to operate the reservoir level at lower levels than those needed to satisfy water demand during a period of drought. Recognition of this problem is expected to lead to better use of water resources through the implementation of more explicit and objective control regulations.

The discussions in the second half of the symposium were just as forthright as those in the first half. At times the general reporters were far more outspoken than their reviews suggest. The impression left by the reviewers was that it was unfortunate that some valuable and original work had to be interspersed with many mediocre papers of an unoriginal character. The dictum "publish or perish" is very strong in certain countries, and it led one general reporter to propose the setting up of an organization for the non-proliferation of scientific literature.

Outside the conference room there were some very useful discussions which have given the writer some new ideas. It is in this way that the individual can gain so much from attendance at such symposia.

Besides hearing about new techniques and ideas I was also able to contribute a general report on six of the papers in the third session as well as present, along with D. E. Jamieson and C. Wilkinson, a joint paper on the use of a stochastic model to improve the forecasts of a deterministic model.

INTERNATIONAL HYDROLOGICAL PROGRAMME

A step towards the continuation of organized international effort in hydrology as a follow-up to the International Hydrological Decade (IHD) programme was taken by the Seventeenth General Assembly of UNESCO in November 1972 when it approved the

International Hydrological Programme (IHP). This programme was developed under the guidance of the Co-ordinating Council for the IHD at the instigation of the Mid-Decade Conference in 1969.

The objective of the IHP is the more efficient utilization of water, nationally and internationally, through the enhancement of national capabilities in science and education related to water resources and water quality. More specifically, the programme seeks to create, directly or indirectly, a system of selected observing and monitoring stations that can provide information on hydrological elements and their variation in time around the world.

The programme includes interest in three major areas: (1) investigations of large-scale processes of moisture transfer; (2) quantitative and qualitative assessments of the effects of man's activities on the water cycle; and (3) the dissemination of information on new methods for measuring, computing, and forecasting water balance elements. Finally, the programme lays great stress on the education and training of people in hydrology and the field of water resources.

Implementation of the IHP will be through an Intergovernmental Council very much like the Co-ordinating Council for the IHD. However, the Intergovernmental Council will have a dual role in relation to the intergovernmental agencies, such as the World Meteorological Organization (WMO), the Food and Agriculture Organization (FAO), the World Health Organization (WHO), and the United Nations Organization (UNO). While it will provide a forum for discussion of all work going on in the field of hydrology around the globe, it will be able to provide direct guidance and supervision only to that part of the IHP that lies within UNESCO's competence in educational and scientific activities.

Activities within those parts of the programme that lie outside UNESCO's competence, but within the competence of other intergovernmental agencies, will be controlled strictly by those agencies. (For example, WMO has an interest in operational hydrology, FAO is interested in hydrology as a vital factor in the production of food. UNO is concerned with hydrology in economic development, and WHO considers water to be closely related to matters of sanitation.) At most, the Intergovernmental Council might suggest that these agencies consider undertaking certain activities as beneficial to the advancement of hydrology and of water resources projects within the IHP.

Co-operation between the UNESCO activities under the IHP and those of the other intergovernmental agencies undoubtedly will occur, just as there is now a large measure of co-operation between

UNESCO and WMO in those areas where their interests in water and water resources development either coincide or abut each other.

The details of the IHP and its final determination will be worked out at the End-of-Decade Conference, which is now planned for September 1974 in Paris. At that time, in addition to reviewing the accomplishments of the Decade, the Conference will consider post-Decade needs and is to lay out a programme of activities for UNESCO for the next five or six years.

The New Zealand delegation to the Seventeenth General Assembly, which included Dr K. F. O'Connor as spokesman on natural sciences, emphasized the need for correlation of IHP with the current programme on Man and the Biosphere (MAB).

HYDROLOGICAL SOCIETY ANNUAL SYMPOSIUM

The 1973 Annual Symposium of the N.Z. Hydrological Society will be held on 27-29 November at Lincoln College, Canterbury. Papers are invited in the fields of soil moisture, models, water resources - instruments and measurement, management of surface and groundwater resources, and water quality. For further details contact:

The Symposium Secretary,
J. A. Hayward,
P.O. Box 56,
Lincoln College.
