IHD BULLETIN

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The International Hydrological Decade Bulletin is an official publication of the New Zealand National Committee for the International Hydrological Decade and presents, twice annually, a survey of programmes, activities and findings of hydrology in New Zealand, carried out under the auspices of the IHD; and also a summary of international activities.

IHD RESEARCH PROJECTS

The Co-ordinating Council for the International Hydrological Decade has selected, by means of a number of resolutions, subjects of international interest on which more research is desirable. In some cases working committees have been set up to produce consolidated reports on information supplied from research projects. Other working groups, such as that on representative and experimental basins on which New Zealand has a member, have the task of compiling handbooks for the guidance of nations undertaking particular activities.

A considerable amount of hydrological research is in progress in New Zealand at the present time. Possibly the most active in this field is the Water and Soil Division of the Ministry of Works. Details of this research are known to the National Committee for the IHD, and suitable projects are being reported to Paris. There may, however, be other research carried out by other government departments, by universities or by other bodies which might also be reported to Paris and about which the National Committee knows nothing.

The following list sets out the Co-ordinating Council's resolutions. It will be noted that a number of the resolutions have been superseded as the decade progressed (in the table, roman numerals indicate the year — I to IV — in which the resolution was adopted, and arabic numerals the number of the resolution). These are the subjects on which there is international interest in research. Any person or organization carrying out research in a field covered by a resolution is invited to submit details to the Chairman, National Committee, IHD, Box 12–041, Wellington North, for consideration as an IHD research project. Research must be reported in the prescribed manner, first by an initial statement of what is proposed, followed by annual progress reports. One of these is given here as

an example. Measurements, etc., must be in metric units. On completion of the project a report must be prepared stating what has been done, what results have been achieved and what conclusions have been drawn.

It must be distinctly understood that the National Committee is unable to grant any financial assistance towards any research accepted as an IHD project. The work would, however, receive wider notice than if reported only in New Zealand. The fact that it has been accepted as an IHD research project will in no way prejudice the right of individuals or agencies to publish the results of the research in any way they choose.

If more specific information is required it can be supplied on request.

INTERNATIONAL HYDROLOGICAL DECADE
PROGRESS REPORT ON NATIONAL IHD ACTIVITIES

COUNTRY: New Zealand YEAR: 1969

Title of project or activity	The measurement of transpiration.
Resolution of 1st session or 2nd session of the Co-ordinating Council	I–37
Name of organization carrying out the project	Hydrological Survey, National Water and Soil Conservation Organization, Ministry of Works, Box 12–041, Wellington.
Work carried out during period under review	Quantitative techniques have been developed, in the United States, which measure the vertical sapflow in a plant stem. This is considered indicative of transpiration.
Publications during period under review	No publications yet.
Research to be undertaken in 1969	It is proposed to: (1) test the method on New Zealand grass and tree species; (2) relate the sapflow results to characteristics at the crown and root environments.
Foreign services or organizations with whom the above-mentioned organizations are collaborating or wish to collaborate closely	Soil and Moisture Programme, Water Resources Division, U.S. Geological Survey, Denver, Colorado, U.S.A.

RESOLUTIONS OF FIRST SESSION, WITH SUBSEQUENT AMENDMENTS

I–1 **Basic data projects** Establishment of a basic network of hydrological stations.

I–2 **Decade stations** Superseded by III–1, which includes II–6 (publication of data).

III–1 **Decade stations** From the basic network a number of representative stations to be chosen for inclusion in IHD publications; these would also supply the data needed for world water balance. IHD Co-ordinating Council commends data being supplied but urges that more attention be given to such matters as water quality, sediment transport, ground water, soil moisture.

I–3 **Benchmark basins and stations** Establishment of permanent benchmark stations to provide simple measurement of time trends unaffected by man.

I–4 **Vigil basins** Superseded by II–3, III–3 and IV–4.

II–3 **Representative and experimental basins** Set up a working committee to prepare a guidance manual (N.Z. included).

III–3 **Representative and experimental basins** Establishment of stations to observe the effects of changing land use.

IV–4 **Representative and experimental basins** Working group has prepared *Guide to Research on Representative and Experimental Basins*. National committees invited to publish processed data.

I–5 **Network planning, design and establishment** (Quebec working group).

IV–1 **Network planning and design** Panel to continue activities and prepare a report. Member states that already have networks of significant extent for collection of data on water quality, sediment transport, ground water and soil moisture to analyse procedures and problems and make suggestions to panel.

I–6 **Projects on inventories and water balance** Studies to be developed for establishing water balances.

I–7 **Global water balance** Superseded by II–2 (working group), III–2 and IV–3.

IV–3 **World water balance** Working group to develop methodology for world balance computations, and national committees urged to strengthen efforts to improve methods of water balance computations.

I–8 **Hydrological maps** Superseded by IV–2.

IV–2 **Hydrological maps** National committees to provide national map inventories and state requirements for hydrological maps. Note: cyclostyled *International Legend for Hydrological Maps* published.

I–9 **Hydrogeological map of the arid zones**

I–10 **Hydrogeological map of Europe**

I–11 **Representative and experimental basins** Superseded by IV–4 (see I–4).

I–12 **World inventory of perennial and annual ice and snow masses** Data on permanent snow, glaciers, ice caps, shelf ice, etc., to be assembled for publication.

I–13 **Measurements of glacier variations on a world basis** Glaciers may be the most sensitive climatic indicators in nature, and member states are asked to summarize and evaluate past measurements of glacier variations and to formulate a detailed national programme including benchmark stations.

I–14 **Combined water, ice and heat balance measurements at selected representative glaciers** North-south and east-west chains of stations to be established, plus less detailed observations elsewhere. New Zealand specially mentioned with regard to latter.

I–15 **Gross sediment transport to oceans** Stations to be established to measure solid transports at mouths of great rivers.

I–16 **Discharge of tritium to the oceans by major rivers** Major rivers to be sampled on a scheduled basis and tritium content determined.

I–17 **Hydrology of fractured limestones of Mediterranean** Superseded by II–4 and III–4 (directions to a working group studying carbonate rock of the European region).

I–18 **Hydrological data for design of water resources projects** Superseded by III–5.

III–5 **Design of water resources projects with inadequate data** Small group of experts to consider devising procedures to alleviate scarcity of data. Member states asked to provide available data.

I–19 **Research projects** (Now inoperative, absorbed into more specific resolutions). The following groups of hydrological problems have primary significance:

(1) Hydrological cycle and world water balance.
(2) Principles that control regimes of superficial and underground waters.

(3) Problems of floods and evaluation of flood characteristics.
(4) Stream channel morphology and evolution, erosion and sediment transport.
(5) Influence of human activity on hydrological regimes.
(6) Topical research on specific aspects of hydrology.

I–20 **Water balance of the earth and its variations in time** Delineation of zones of synchronous and asynchronous fluctuations in annual run-off; countries in a position to participate to notify the Secretariat.

I–21 **Chronological hydrology** Superseded by II–5.

II–5 **Nuclear techniques in the unsaturated and saturated zones** Working group set up to co-ordinate application of nuclear techniques, to promote improvement of nuclear and isotope techniques and to prepare technical and educational documents on the subject. Member states to include in annual IHD report information suitable for evaluation by group.

I–22 **Incidence and spread of continental drought** Extensive information on drought incidence required to help establish instrumentation for study of future droughts. Study of physics of atmospheric transport of undissipated radiant energy.

I–23 **Hydrology of deltaic and coastal areas, estuaries and coastal waters** To establish relations between salinity conditions in coastal areas and quality, quantity and timing of outflow of freshwater.

I–24 **Relations between soil moisture and run-off** Objective is to establish rainfall/run-off relations so that run-off data could be computed for similar basins where only rainfall data are available.

I–25 **Relations between excess soil moisture, drainage and behaviour of plant species** Data required on the scientific basis of soil drainage, drainage methods and their efficiency.

I–26 **Genesis and physical chemistry of natural waters** Data required on stability relations of minerals in aqueous solutions, on kinetics of reaction of minerals and waters and on physical chemistry of natural solutions.

I–27 **Effect of land use on water quality: forested, agricultural and urban basins** Water quality to be determined in natural mountain forested basins. Effect of later changes in land use to be evaluated — road construction, logging, recreation developments, etc.

I–28 **Effects of physiographic features on precipitation** Past studies have been on a local basis. Further study is required to develop procedures for systematic evaluation by climatic provinces with ultimate object of application to regions for which rainfall data are inadequate.

I–29 **Depth-duration-frequency relations of precipitation in various geographical regions** Collection and analysis of annual series of daily maximum rainfall as well as rainfall of shorter duration. Preparation of generalized relations of depth, duration, and frequency. National meteorological organization to publish 24-hour precipitation recordings and where possible recordings for less than 24 hours. Maps of rainfall intensity, duration, area, and frequency data to be prepared where practicable.

I–30 **The study of water balance in connection with evaluation of water-regulating and water-conserving role of forests** Water balance elements on open and forested catchments, water balance of different types of forest and different stands, and investigations of water balance on catchments on which forestry reclamative measures are carried out.

I–31 **Relations between sediment transport, stream flow and channel morphology** An international programme of measurements at frequent intervals in selected reaches of selected rivers should establish relations between cohesive soil properties, flow regimes and vegetation.

I–32 **Prediction of sediment distribution in reservoirs** Available information and procedures are unsatisfactory, new methods should be devised or old ones improved.

I–33 **Dispersion of moving ground water** Studies would include physical and chemical dispersion and diffusion, sorption and other geochemical processes, biological factors and others necessary to trace and explain the permeation of nuclides.

I–34 **Investigations on artificial recharge of ground water** Investigations on artificial recharge. General experience on recharge and storing of ground water.

I–35 **Effects of variations of piezometric head on land subsidence** Studies of effects of extraction of ground water on on land surface levels.

I–36 **Hydrology and hydrodynamics of the zone of vadose water** Steps to organize knowledge and devise quantitative techniques for computing vadose moisture at given times and places for broad areas.

I–37 **Evapotranspiration processes** Research into the theoretical and practical aspects of evaporation phenomena.

I–38 **Maximum run-off from rainfall and snow melt** Superseded by IV–6.

IV–6 **Floods and their computation** Leningrad symposium and report of working group. National committees to supply information for compilation of a catalogue of floods.

I–39 **Hydrological consequences of irrigation and drainage projects** Superseded by II–8, III–6.

II–8 **Influence of man on the hydrological cycle** (Working group).

III–6 **Influence of man on the hydrological cycle** Working group to continue, national committees to supply information.

I–40 **Hydrology of forest, grasslands and arable land** Superseded. See I–39.

I–41 **Ecology of water-loving vegetation** Superseded by III–11.

III–11 **Ecology of water-loving vegetation** A group of hydrologists and plant physiologists is studying the effect of vegetation on water quality and water loss, also the nuisance effect in waterways.

I–42 **Methods for geophysical exploration of ground water** Application of geophysical methods for ground water exploration, including surface, underground and air methods. Application of computer techniques.

I–43 **Evaporation reduction from open surfaces** Study of monomolecular films to reduce evaporation, possible damage to water quality or biota, effect of reservoir shape and location, local microclimates.

I–44 **Dynamics of lakes and reservoirs** Thermodynamic regimes of lakes and reservoirs, wind-driven circulations, movement and deposit of sediments, time-dependant changes through sedimentary, biological and chemical processes.

I–45 **Applications of stable isotopes to hydrology** Superseded by II–5.

II–5 **Nuclear techniques in the saturated and unsaturated zones** See I–21.

I–46 **Water-soil relations and the degree of aridity** Study of the soil and subsoil moisture content in arid zones.

I–47 **Vapour-flux evaluation of the hydrological budget** Investigations of the potentialities of vapour-flux computations in evaluating the hydrological cycle, particularly in areas of sparse surface networks.

I–48 **Application of mathematical models for run-off prediction in various climatic and physiographic regimes** Proposals for research.

I–49 **Automatic processing of hydrological data** Mechanization of the processing of data for publication in hydrological yearbooks.

I–50 **Mathematical analysis of stream-flow and precipitation sequences** The gap between theories of probability, stochastic processes and mathematical statistics and their application to hydrological processes is about 25 years. This gap needs to be closed.

I–51 **Methods of calculation and forecasting the regime of subterranean waters with the aid of statistics and computing devices** Superseded by III–7, IV–5.

III–7 **Hydrological forecasting** Working group to review current knowledge of predicting run-off, river flow and lake levels.

IV–5 **Hydrological forecasting** Panel of experts has published a preliminary report on predicting river flows and lake levels. Activities to extend to forecasting aspects of soil moisture, sedimentation, and water quality, but to concentrate on guidance material for forecasting ground water.

I–52 **Measurements of snowfall and snow pack** Superseded by IV–8.

IV–8 **Measurements of precipitation including snow and snow pack** WMO has pointed out the deficiency of measurement of precipitation in the IHD programme. This has been added to the original resolution, and WMO has been asked to act as the technical secretariat. There is a need for more accurate areal measurement of snowfall and water equivalent.

I–53 **Improvements of existing methods for discharge measurements** Research on accuracy of measurements under different conditions of chemical stability in large and small rivers; improvement of methods under ice cover, in flood plains, and at mouths of large rivers; improvement of current meters, etc.; design of instruments based on new physical principles, and elaboration of methods using aircraft.

I–54 **Nuclear techniques to determine water content in the unsaturated zones** Superseded by II–5.

II–5 **Nuclear techniques in the unsaturated and saturated zones** See I–21.

I–55 **Direction and velocity measurements in ground water by radionuclide techniques** Superseded by IV–9.

IV–9 **Nuclear techniques in hydrology** IAEA working group has prepared a draft of the *Guidebook on Nuclear Techniques in Hydrology*. Activities to continue on the widened scope.

I–56 **Application of isotopic techniques to glaciology and snow hydrology** Superseded by IV–9.

I–57 **Radar measurement of rainfall** Accelerate current research into the amount of hydrological information that can routinely be obtained by radar.

I–58 **Methods for hydrological forecasting** Superseded by III–7 and IV–5.

III–7 **Hydrological forecasting**

IV–5 **Hydrological forecasting** See I–51.

I–59 **Consideration of other co-operative projects proposed by member states** Not in force.

I–60 **Dissemination and availability of results and data** Superseded by II–6, III–12, IV–10.

II–6 **Exchange of information**

III–12 **Exchange of information, symposia and publications**

IV–10 **Exchange of information, symposia and publications** Member states to publish data from Decade networks for international exchange. Secretariat to publish *Yearbook of Main Rivers of the World* (about 1,000 rivers). Panel experts preparing *Guide to Hydrogeological Practices*.

I–61 **Improvement, comparison and standardization of instruments and techniques** Working group to standardize instruments, techniques, units of measurement and terminology so that data from all areas will be comparable.

I–62 **Education and training of hydrologists** Superseded by II–7, III–14 and IV–12.

II–7 **Education and training**

III–14 **Education and training** Working group reported on postgraduate training, training of technicians and observers, need for hydrologists, summer schools for hydrology teachers, textbooks and manuals, scholarships, teaching aids and co-ordination with other bodies. Group to continue.

IV–12 **Education and training** Working group to continue.

I–63 **Symposia** Superseded by IV–11.

IV–11 **Symposia** International symposia to be announced at least 18 months in advance, authors to be given at least six months notice of deadline for papers.

I–64 **Publications** Superseded by IV–10.

I–65 **International glossary of hydrology** Draft glossary prepared.

I–66 **Regional co-operation** Superseded by II–15 and III–15.

II–15 **Regional co-operation**

III–15 **Regional co-operation** Co-operation between countries sharing common basins or situated in regions with similar hydrological conditions.

FURTHER RESOLUTIONS OF SUBSEQUENT SESSIONS

II–9 **Assistance to developing countries by United Nations agencies** Superseded by III–16, IV–13.

III–16 **Technical assistance to developing countries** Member nations invited to assign specialists to backward countries and bear all costs.

IV–13 **Technical assistance** Extended to all countries, exchange of university staff, joint research, etc.

II–10 **Handbook of hydrological activities under IHD programme** Superseded by IV–10.

II–11 **Water information systems** Superseded by III–8 and IV–7.

III–8 **Systems for acquisition, transmission and processing of hydrological data**

IV–7 **Systems for acquisition, transmission and processing of hydrological data** Panel to prepare a technical paper on SAPHYDATA. Modern systems for evaluation of regional, continental and world water balance, including remote sensing, satellites and telecommunications.

II–12 **Manual on representative and experimental basins** Superseded by III–3.

III–3 **Representative and experimental basins** See I–4.

II–13 **Snowline observations** Seasonal observations of snowline. Not in force.

II–14 **Hydrological aspects of the world weather watch** Referred to WMO in relation to global water balance; matters for particular consideration: water-vapour transport, precipitation, evaporation.

III–9 **Hydrological problems related to artificial and natural changes in quality of water** Group of experts to investigate. To be confined to hydrological aspects only.

III–10 **Hydrological problems affecting the use of saline waters** Working group to study.

III–13 **Tercentenary of scientific hydrology** To be celebrated by a symposium in Paris in 1974 paying particular homage to Pierre Perault and Edmé Mariotte whose work on the Paris basin set hydrology on the path of true science late in the seventeenth century.

III–17 **Mid-decade intergovernmental meeting** Superseded by IV–14. UNESCO recommended to convene an intergovernmental meeting in late 1969 or early 1970 to evaluate progress.

IV–14 **Mid-decade conference on international co-operation in hydrology** UNESCO recommended to convene an international conference in the second half of 1969 on the practical and scientific results of IHD.

THE MID-DECADE REPORT

When asking member states for a mid-decade report the IHD Bureau stipulated that it should cover the achievements during the first half of the decade, make an appraisal of the principal gaps in current knowledge, and state the objectives for the remaining half of the decade — particularly identifying those problems requiring international co-operation. Below is a brief summary of New Zealand's Mid-Decade Report.

Achievements

Out of a proposed 90 representative basins, 46 are in operation and 19 more in various stages of investigation and instrumentation. Nine out of a proposed 18 experimental basins have been established. In them, soil-water-plant relationships are being studied to provide data for land-use hydrology. Water-balance studies are included on both representative and experimental basins and on some of the Rotorua lakes. Studies are in progress on the prediction of sediment distribution in Lake Roxburgh. A programme of snow observations has been initiated. A very comprehensive network of climatological, rainfall, and evaporation stations is operated by the Meteorological Service and is being continually extended. Several hydrological maps have been published, including one showing hydrological regions which will facilitate water-resources planning. Both the Ministry of Works and the Meteorological Service have issued publications of hydrological interest. In preparing material for these, and in analysing data generally, extensive use has been made of electronic computers.

National agencies and universities not only make direct contribution of data and research to the IHD programme but also co-operate in assessing purely national needs for data and research. This co-operation is being strengthened by technical subcommittees which have been set up by the National Committee for the IHD to deal with specific fields of interest, viz. experimental basins, snow and ice, education, ground water, water quality, hydrometeorology, and hydrological mapping.

Gaps in Current Knowledge

The failure to achieve sound predictions using mathematical models is associated with the present lack of knowledge of hydrological processes and the inability to express the environment in quantitative terms. This is a world-wide deficiency and does not apply only to New Zealand.

Future Objectives

New Zealand's response to the Bureau's invitation to identify specific hydrological problems that call for research effort at the international level has been made with due regard to the stated

broad objective of the IHD: "The programme will focus on science but give strong attention to utilitarian factors." Three key tasks have been stated:

Developing mathematical models and standardizing hydrological parameters, the parameters to be in the form most suitable for use in models and for fostering, with other disciplines, research related to hydrology.

Developing simple codes of practice (semi-empirical methods), the codes to use parameters that can be given numerical values on present knowledge. These would all be subject to testing and modification as data and research accumulates on representative and experimental basins.

Expressing hydrological parameters in terms of the soil catena. Expression in these terms is essential for presenting knowledge of the likely variation of hydrological processes according to position on a slope. Such knowledge is the key to designing land-use practices efficiently for hilly country.

In 1970 New Zealand will hold two major conferences of great significance to IHD work, one dealing with results of research on representative and experimental basins and the other dealing comprehensively with the development and management of water resources.

Following a meeting of the National Committee for the IHD, the future objectives listed in New Zealand's Mid-Decade Report (see page 46 of this issue) have been amended to:

- Clarification of the organization of work amongst international bodies.
- More specific definition of the terms of reference of working groups and panels of experts.
- More intensive investigation of fundamental hydrological processes.
- Urgent development of mathematical models and other methods generally useful for prediction.

Investigations will be made into the possibility of continuance of international hydrological activities on a basis similar to that which now obtains under the IHD.