Institute of Hydrology

1990/020

Overseas Development Report

Natural Environment Research Council

The Hydata Workshop

INSTITUTE FOR METEOROLOGICAL TRAINING AND RESEARCH, NAIROBI, KENYA

19-23 November 1990

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INTRODUCTION

1.1 The Workshop

This report describes the HYDATA workshop held at the Institute for Meteorological Training and Research (IMTR) in Nairobi, Kenya, from 19th to 23rd Novemrer 1990.

The administration of the workshop, the venue, equipment and accommodtion for participants was ably organised by the IMTR. The technical content of the workshop was presented by staff from the Institute of Hydrology, UK. The aim of the workshop was to demonstrate an operational hydrological database, this being the first step in developing a homogeneous hydrological database throughout the SADCC and IGADD countries.

The workshop was jointly funded by O.D.A. (through IH) and WMO through their project RAF/88/044 "Drought Monitoring for Eastern and Southern Africa".

1.2 The Software

HYDATA is a microcomputer based hydrological database and analysis system; produced by the Institute of Hydrology, and already in use in many countries of the world. In its most basic form it allows storage of raw hydrological data, conversion of water levels, through ratings to flows etc., and report quality summary printing of the stored information. There is the option of purchasing additional software from a range of analysis programs including flow duration and low flow analyses.

HYDATA has been used in many countries in Africa during work carried out by the Institute of Hydrology. It has already been purchased and is in use in Somalia, the Ivory Coast, Morocco, Kenya, Lesotho, Botswana and Egypt.

Additional components of the system are: HYTRAN designed to automatically transfer time series data from external sources to HYDATA, and HYCOM to interface between HYDATA and CLICOM (a climate and meteorological package produced by WMO).

2. ORGANISATION OF THE WORKSHOP

The workshop consisted of formal introductions and demonstration sessions in a lecture room, followed by practical seminar sessions held in the data processing laboratory at the IMTR. Thirteen computers were made available by the IMTR, namely:

1. IBM XT
2. IBM XT
3. IBM-PS2 Series 60
4. OLIVETTI M280
5. OLIVETTI M240
6. BULL MICRAL 45
7. BULL MICRAL 45
8. BULL MICRAL 45
9. BULL MICRAL 45
10. BULL MICRAL 45
11. DIGITAL VAXMATE
12. DIGITAL VAXMATE
13. DIGITAL DEC STATION

The provision of these machines meant each participant had access to a personal computer which considerably facilitated the speed of learning.

Additionally two portable PCs were brought from the Institute of Hydrology, namely:

1. TOSHIBA 5100
2. COMPAQ II

plus a SHARP projection panel Model QA-50 designed to display computer screens on an overhead projector to assist with the lectures.

Educational copies of HYDATA were supplied to the participants and were installed on all machines.

A total of two printers were available for producing hard copies of printed output, and a Laserjet II was used for graphical output.

3. COURSE MATERIAL

The course was attended by 12 hydrologists and meteorologists from Anglophone African countries (Appendix I).

The main aim of the course was to give participants a thorough working knowledge of HYDATA through practical experience.

The workshop also provided an introduction to working with personal computers, and a background hydrological introduction as part of the analyses sections.

A detailed program was prepared based on the expected interests and abilities of the participants. It was decided to concentrate primarily on processing of surface water data using HYDATA including the operations of entering and editing data, and of developing rating curves. The course was based around a set of 15 prepared exercises. In the latter part of the course, the peripheral support packages to HYDATA were demonstrated and the students given the opportunity to try them. Typically, morning and afternoon sessions were *started with a short talk on the topics to be covered and participants were* then allowed to attempt the exercises. Some of the more complicated exercises were demonstrated beforehand.

Most of the participants had experience of hydrological measurements and data processing, but some had little or no computer experience. All showed great enthusiasm for the software, particularly where it related to their day to day work, such as storing stage data and producing rating curves. The course program was followed fairly closely, and the participants were able to attempt and, in most cases, complete, all of the exercises.

Part of the last day of the course was given over to revision of the exercises and to demonstrations of other hydrological software packages. Participants who had brought data from their own countries were encouraged to try entering it onto HYDATA. The following software was demonstrated:

HDBINS - The HYDATA installation program;
FORTRAN Subroutine Library "HYLIB";
GETOFF - an external program for accessing HYDATA information;
HYTEL - to interrogate telemetry equipment;
HYLOG - to download logger cachettes;
HYTRAN - for transfer of data into HYDATA;
HYRROM - the IH lumped catchment, rainfall runoff model;
HYCOM - the link between HYDATA and CLICOM; and
HYDATA 3.1. - the new version of HYDATA soon to be released.

Together these components provide a complete system for data capture, basic analysis and storage of hydrological information.

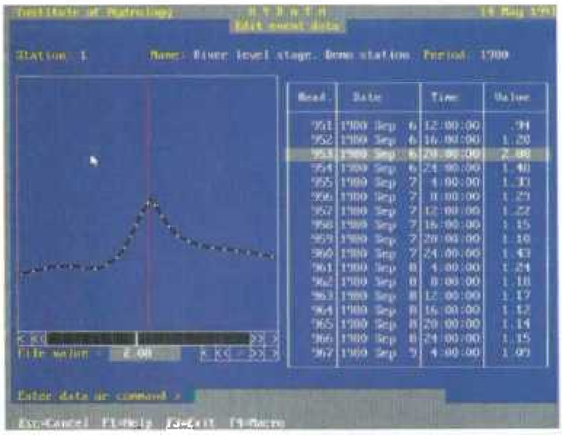
Hydrological Database System
Software from the Institute of Hydrology

HYDATA is a hydrological data processing and analysis system developed for use on IBM and IBM-compatible personal computers. The software has been developed by hydrologists and draws on the extensive experience of the Institute of Hydrology in hydrological and water resources studies both in the United Kingdom and throughout the world. HYDATA is a well-tested and robust system that has to date been used in more than 20 countries.

HYDATA has been designed for ease of use with no requirement for users to understand the structure of data files, the computer operating system or the running of individual programs. The software is menu-driven and users are aided by information and error messages.

HYDATA is sold as a stand-alone data processing and storage system, with the option of purchasing additional software from a rapidly expanding range of analysis programs.

Some of the HYDATA applications worldwide



Editing water level data.

HYDATA in use.

Data Types
HYDATA has been designed to handle the types of data most often encountered in hydrological studies, and is used by a growing number of consultants, water authorities and government organisations.

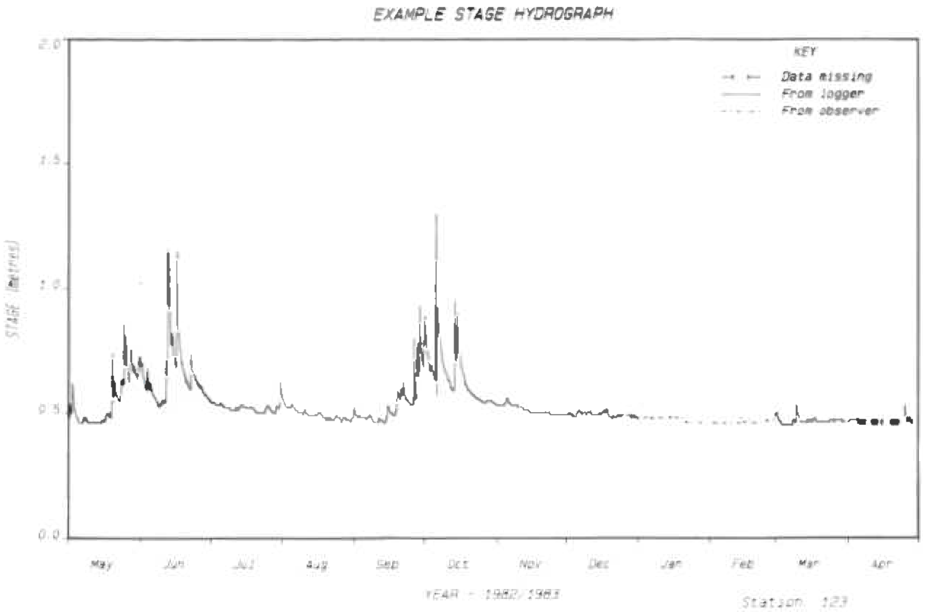
Both daily and monthly data can be stored. Daily flow and storage data may be calculated automatically using stored rating equations. Monthly data may be derived from daily data.

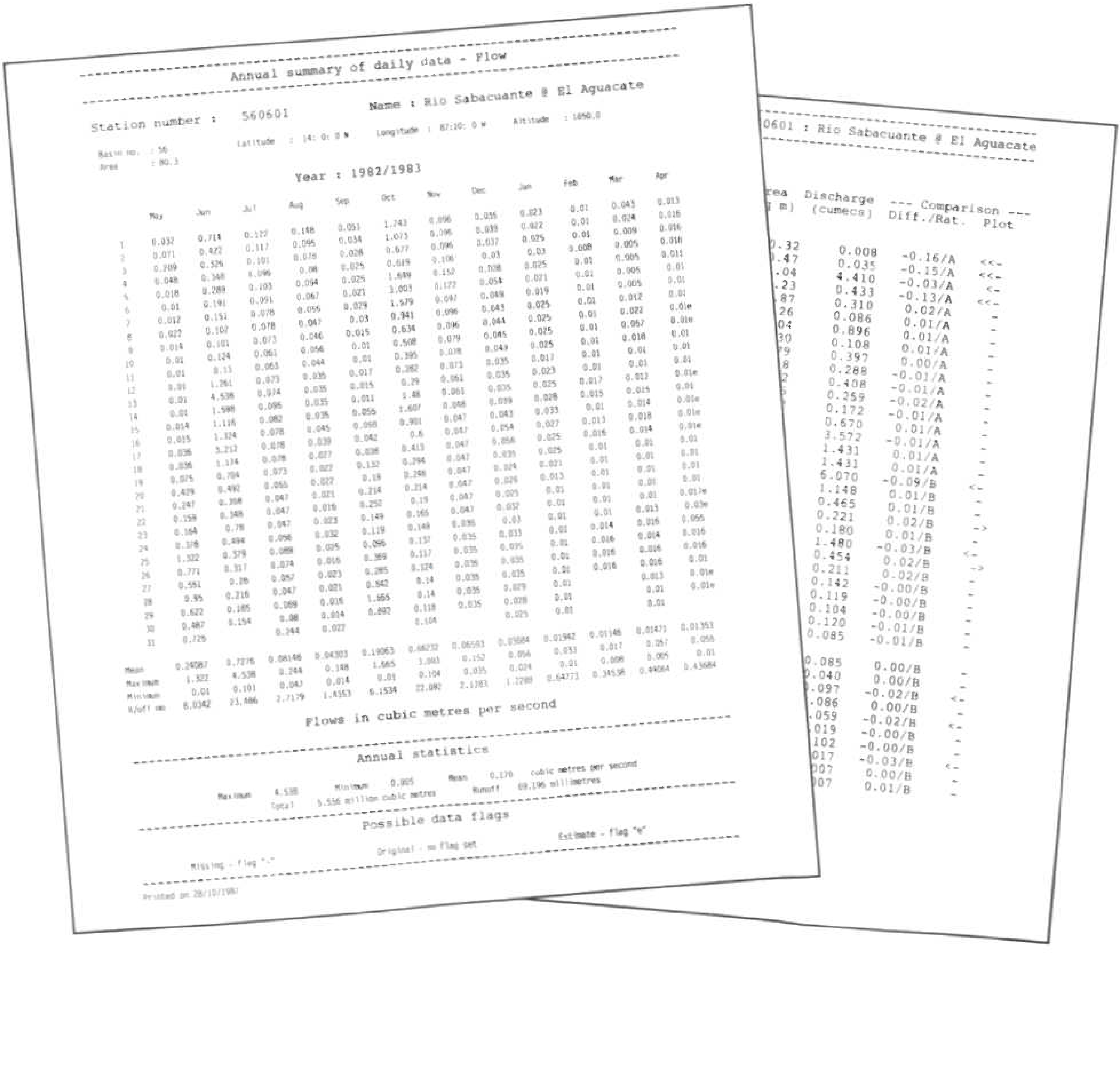
- Station location
  Latitude/Easting
  Longitude/Northing
  Altitude
- Station details
  Name and number
  River basin area and number
- Event data
  River level
  Rainfall
  Lockage
  Lake/reservoir level
  Up to 100 readings per day
- River gauging data
  Date
  Stage
  Velocity
  Area
  Discharge
- Rating equations
  Stage/discharge or level/storage
  3 parameter logarithmic
  Up to 3 parts, 20 ratings/station
  Up to 6 parts, 11 ratings/station
- Discharge
- Rainfall
- Lake or reservoir storage
- General time series data
  Any user-defined daily data or monthly data (e.g. Evaporation, Temperature, Electrical conductivity)

Database Operations

Data may be entered and edited from the keyboard, using HYDATA's screen editing facilities, or can be read directly from computer data files. By selecting file input, data can be transferred from external sources, such as loggers, digitisers and mainframes. HYTRAN provides a flexible transfer for many data formats. Quality checks are made on all data types during entry.

Stored data can be displayed using HYDATA's graphics and printing facilities. Graphs can be viewed on the screen or produced on paper, and can be customised for inclusion in reports. The tabulated data are suitable for use in hydrological yearbooks. Data can also be output directly to computer files for use with other software packages, such as spreadsheets, word processors or a user's own programs.



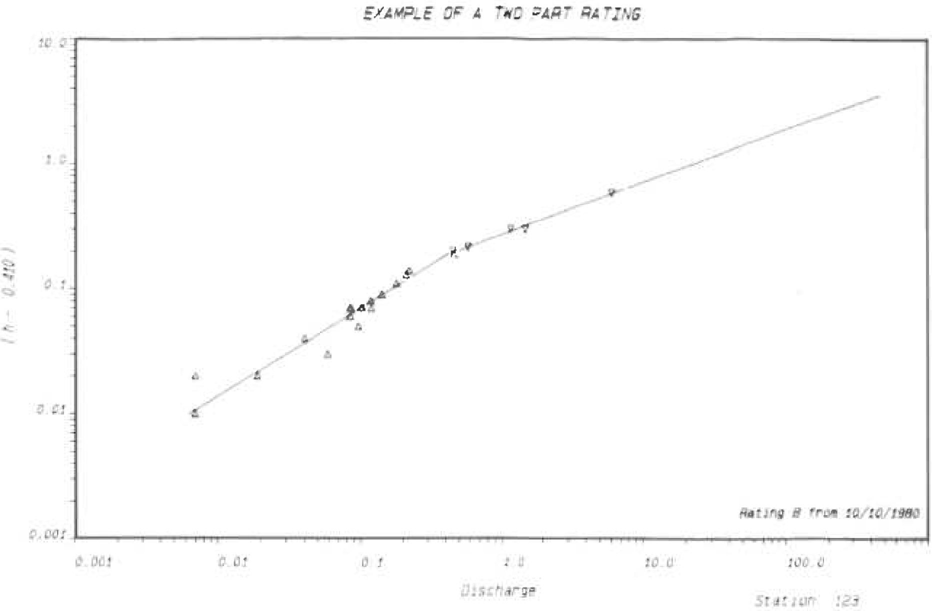


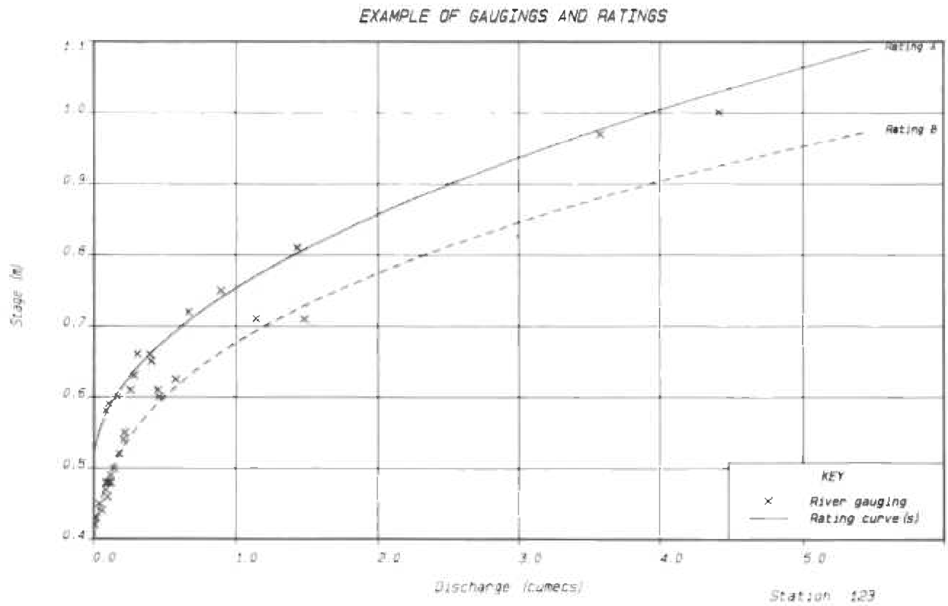
Rating Equations

In hydrological studies, it is often necessary to develop rating equations giving the relationship between river level and discharge, or between the water level of a lake (or reservoir) and its storage. HYDATA allows rating equations to be derived quickly and accurately from measured data.

The rating equations used by HYDATA are logarithmic in form and can have up to 3 segments, each station having up to 20 rating equations, or 6 segments, each station having up to 11 rating equations. The gauging data required to develop a rating are entered using HYDATA's gauging editor.

Rating equations can be entered directly, if available, or can be derived using the interactive graphics facility provided. A 'best fit' rating equation can





be calculated if required. Printouts may be obtained of any of the rating equations or gaugings, and rating tables can be produced. Hard copies may be obtained of all the graphs used in developing a rating.

Analysis Programs

Several analysis programs are available as optional extras to the basic HYDATA system. The programs are accessed directly from the HYDATA menus, and share all of HYDATA's plotting and printout facilities.

Comparison plots

The comparison plot program allows time series data for two different stations to be plotted on the same graph. Options are available to lag or invert one curve with respect to the other. Double mass plots can also be produced.

Flow Duration Curves

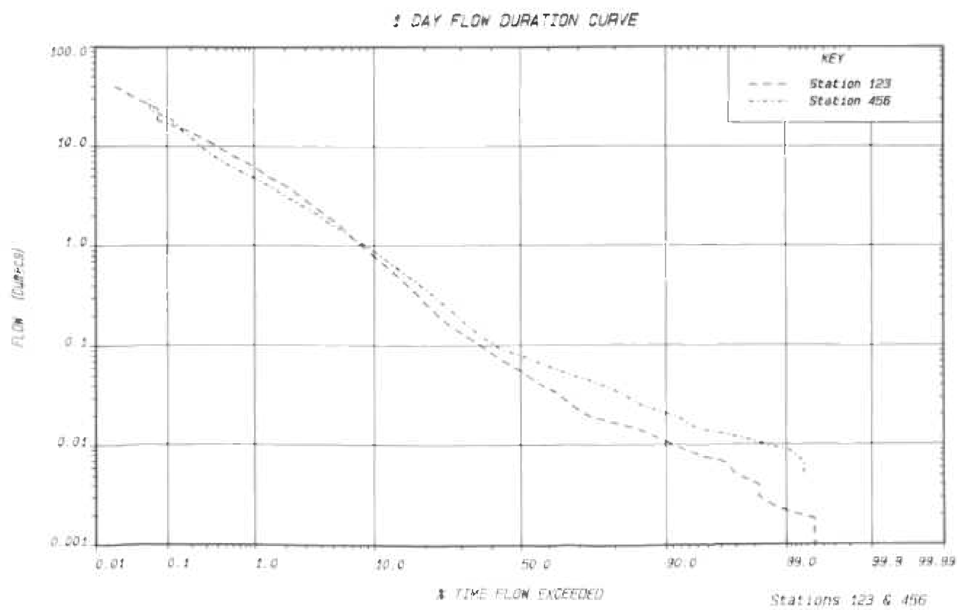
Flow duration curves can be produced for up to five stations simultaneously, on linear or logarithmic coordinates. The 5, 10, 25, 50, 75, 90 and 95 percentile flows are computed automatically.

Low flow analysis

The low flow analysis programs are designed to assist in computing parameters which describe the low flow behaviour of a catchment, such as baseflow index and recession constants. The analysis techniques are based on the recommendations in the Low Flow Studies Report (NERC 1980). The main features of the programs are the options to produce low flow frequency curves, and to calculate low flow return periods.

FORTRAN subroutines library

A library of FORTRAN subroutines is available which allows selected data to be read from the database for analysis by the user's own software.

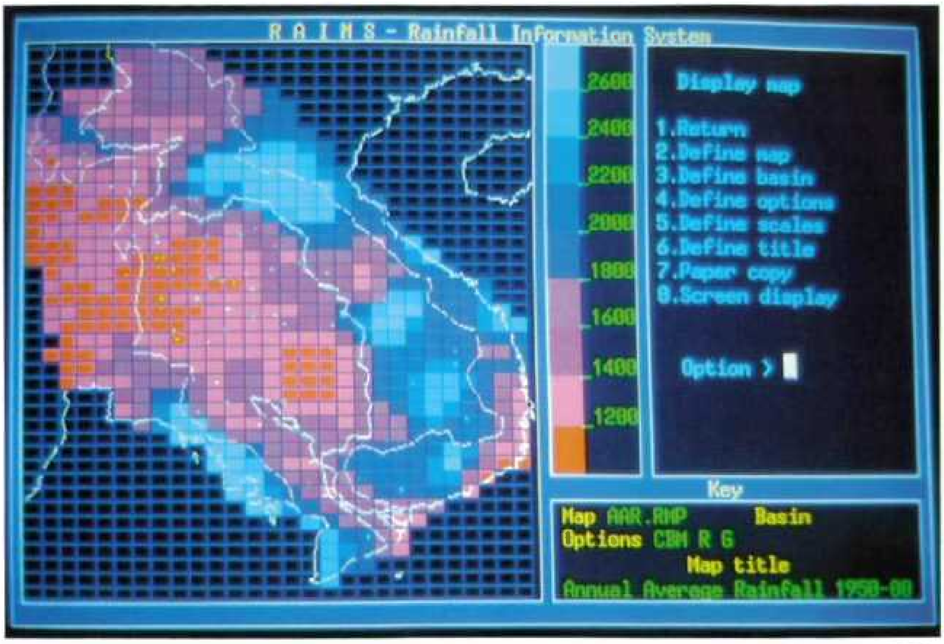


* FFAP is now called HYFAP

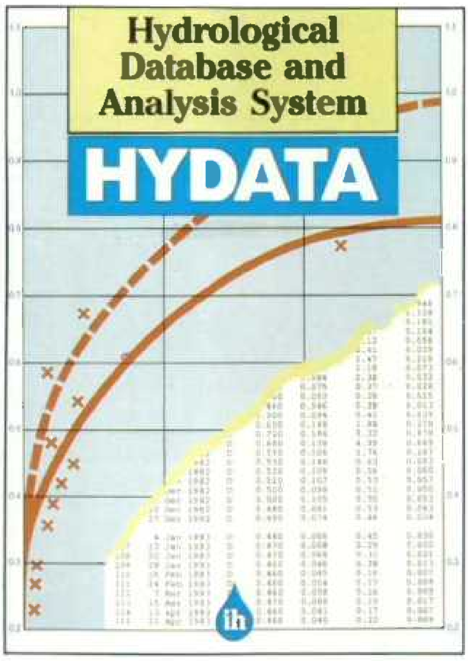
Future Developments
Several improvements to the HYDATA system are currently under development. All new software will be fully compatible with the existing HYDATA system. Users will be able to take advantage of these developments as they become available.

Additional components already available are HYLOG, HYTEL, HYTRAN, HYSTAT and links to other packages such as HYRROM and FFAP.*

In the longer term, a rainfall information system, combined with a geographic information system (GIS), is under development. The rainfall information system uses monthly and annual rainfall data stored on HYDATA to provide estimates of basin-wide monthly and annual rainfall for any region or tributary. The GIS component will plot the location of stations on HYDATA on a UTM base map and will handle gridded information such as percentage forest cover.



Rainfall Information System and GIS



Full details in this brochure, available on request

The HYDATA package
HYDATA is designed to run on the IBM range of personal computers operating under PC or MS DOS. The requirements are:

- **Memory**
Minimum 640K.

- **Disk Space**
Minimum 10Mb hard disk and one floppy disk drive (5.25 or 3.5 inch). Programs occupy 6Mb. Data storage is dependent on application but 2 to 10Mb is typical.

- **Screen graphics**
Hercules, IBM, EGA and VGA and most other types.

- **Printer**
IBM/Epson 80 column graphics printer, or similar, HP Laser Jet, or many others.

- **Plotter**
Hewlett Packard 7475A recommended. Graphics printers can be used.

Compatibility
HYDATA is guaranteed to run on an IBM PS/2 (model 50 minimum) with 640K memory, 20Mb hard disk, VGA Colour Graphics, IBM Pro-Printer and a Hewlett Packard 7475A pen plotter. HYDATA is also known to work on other types of IBM personal computer, including the AT and on many other compatible machines.

HYDATA is supplied on 5.25 or 3.5 inch floppy disks. The package includes a comprehensive user manual and a demonstration data set for tutorial purposes. Advice on installation is provided free of charge. Training courses can be arranged at the Institute of Hydrology or at the place of use. Assistance with specific HYDATA applications can be provided on a consultancy basis.

If you require further information on HYDATA please contact:

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Natural Environment Research Council

SUMMARY PROGRAMME

UNDP/WMO PROJECT

Hydrological Data Processing

WORKSHOP ON THE OPERATION OF HYDATA

(HYDATA: Hydrological Database and Analysis Systems)

Programme of the Workshop (IMTR)
Nairobi, November 19-23 1990

Monday 19th:	Welcoming address by the Principal Mr S.J.M. Njoroge
	Opening of the Workshop by the Director of the Institute of Meteorological Training and Research Mr Evans A. Mukolwe
	Outline of the work in the week ahead
	Introduction to HYDATA and General Principles of Operation
	Evening reception provided by IMTR
Tuesday 20th:	Revision of editing data
	Gaugings and ratings
	Conversion to daily data (flow etc.)
	Other types of data, namely rainfall, storage, general
Wednesday 21st: -	Analysis programmes
	Data input (from keyboard & importing)
	Introduction to linking to spreadsheets (using Lotus 123)
Thursday 22nd:	System management
	FORTRAN Subroutine Library plus GETOFF
	Other related programmes

Friday 23rd:	Associated programs
	Installation of HYDATA
	Review of individual needs and problems

DETAILED PROGRAMME

Monday 19th November

Introduction to Workshop

Background, Aims of project

Introduction to HYDATA

Types of data, Main uses of HYDATA, Analysis routines, Hardware and storage requirements, Brief introduction to personal computers, Brief introduction to personal computers, Brief introduction to the Demonstration data, Future developments of HYDATA.

General principles of operation

Special keys, Selecting options, Key disc, Printer and plotter output, Error and information messages.

Exercise 1 - Plot max and min temperatures for Wallingford. Experiment with appearance of plot.

Exercise 2 - Obtain a printed Data Summary for the Demonstration dataset. Experiment with the summary options.

Stage data - Editing and output

No.readings/day, Flags, Editor options and commands, Saving data.

Exercise 3 - Plot one year of stage data. Identify and correct an obvious error. Replot the data and obtain a hard copy.

Tuesday 20th November

Gaugings and ratings

Brief review of theory, Gauging data editor, Fitting a rating, Multiple part ratings, Saving ratings.

Exercise 4 - Examine gaugings and ratings for a station.

Exercise 5 - Develop a rating for a station.

Conversion to flow/storage

Relevant stage editor commands.

Exercise 6 - Use a rating to generate a year of discharge data.

Monthly data

Exercise 7 - Plot a year of rainfall data on a daily and monthly basis.

Other data types

Exercise 8 Examine some of the other types of data stored by HYDATA.

Wednesday 21st November

Analysis programs

Comparison plots, Double mass plots, Flow duration analysis, Low flow analysis, Demonstration of RAINS.

Exercise 9 Produce a time series comparison plot

Exercise 10 - Produce double mass plots for rainfall stations.

Exercise 11 - Produce a flow duration plot.

Exercise 12 - Calculate a base flow index.

Data input and system management

Subroutine library, Writing a file from data to Datain.dat. Data input.

Exercise 13 - Set up a new station for some location in your country. Allocate space for data.

Exercise 14 - Enter data for station from keyboard and input data file.

Thursday 22nd November

Data input and system management (continued)

Exercise 15 - Backup the demonstration data.

Further demonstrations

Data into and out of system in relation to outside spreadsheet (Lotus 123)

Fortran Subroutine Library and Getoff

HDBINS

HYTEL, HYLOG, HYTRAN

Friday 23rd November

HYRROM

Demonstration of new version of HYDATA 3.1

HYCOM

Installation of HYDATA.

Distribution of HYDATA software to participants.

APPENDIX I BACKGROUND INFORMATION

INFORMATION ON THE WORKSHOP ON THE OPERATION OF HYDATA AND ASSOCIATED SOFTWARE

organised by the Kenyan Institute of Meteorological Training and Research and the World Meteorological Organisation (WMO)

19-23 November 1990

Background

This is an international training course on Hydrological Data Processing, organised within the framework of the project ODA/WMO.

Date and Place

The workshop is scheduled to be held from 19 to 23 November 1990 at the Kenyan Institute of Meteorological Training and Research, I.M.T.R., Nairobi.

Programme of the Workshop

The formal part of the workshop will consist of lectures and computer exercises on the subjects indicated in the Annex.

Training Staff

Lectures will be conducted by Yvonne Parks, a staff member of the Institute of Hydrology, Wallingford (UK), and Dr C. Green, consultant, and assisted in the computer practices by Valerie Bronsdon, also a staff member of the Institute of Hydrology.

Participants

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