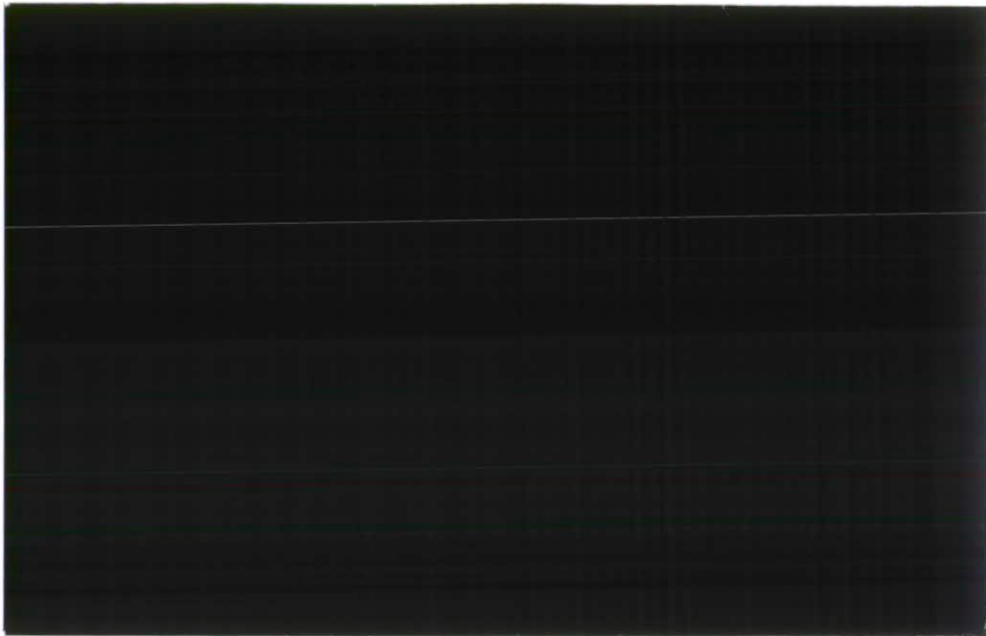




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SADC-HYCOS

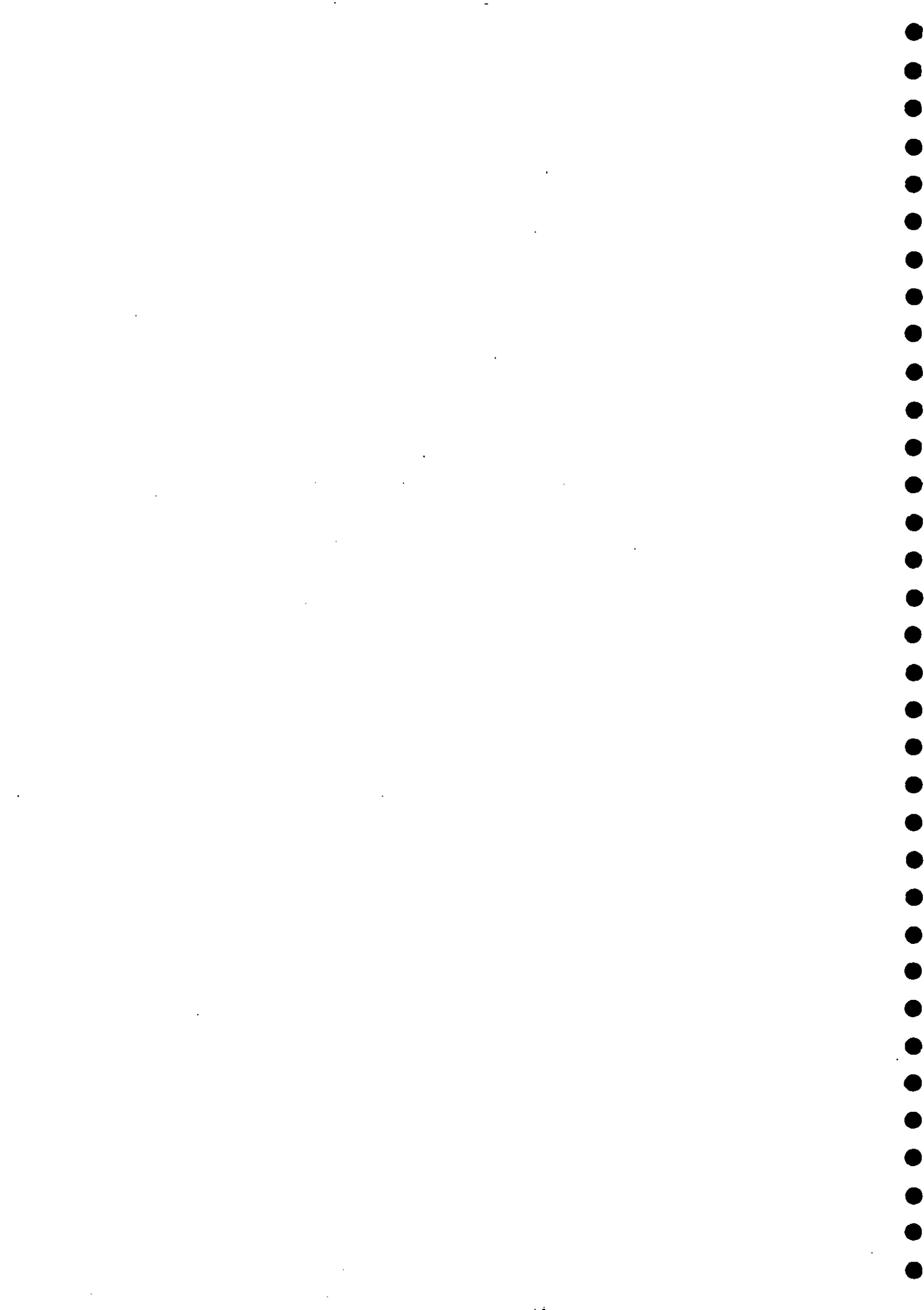
HYDATA v4.0 training course

**PRC Pretoria, South Africa
28 July - 6 August 1998**

Institute of Hydrology
Maclean Building
Crowmarsh Gifford
Wallingford
Oxon
OX10 8BB

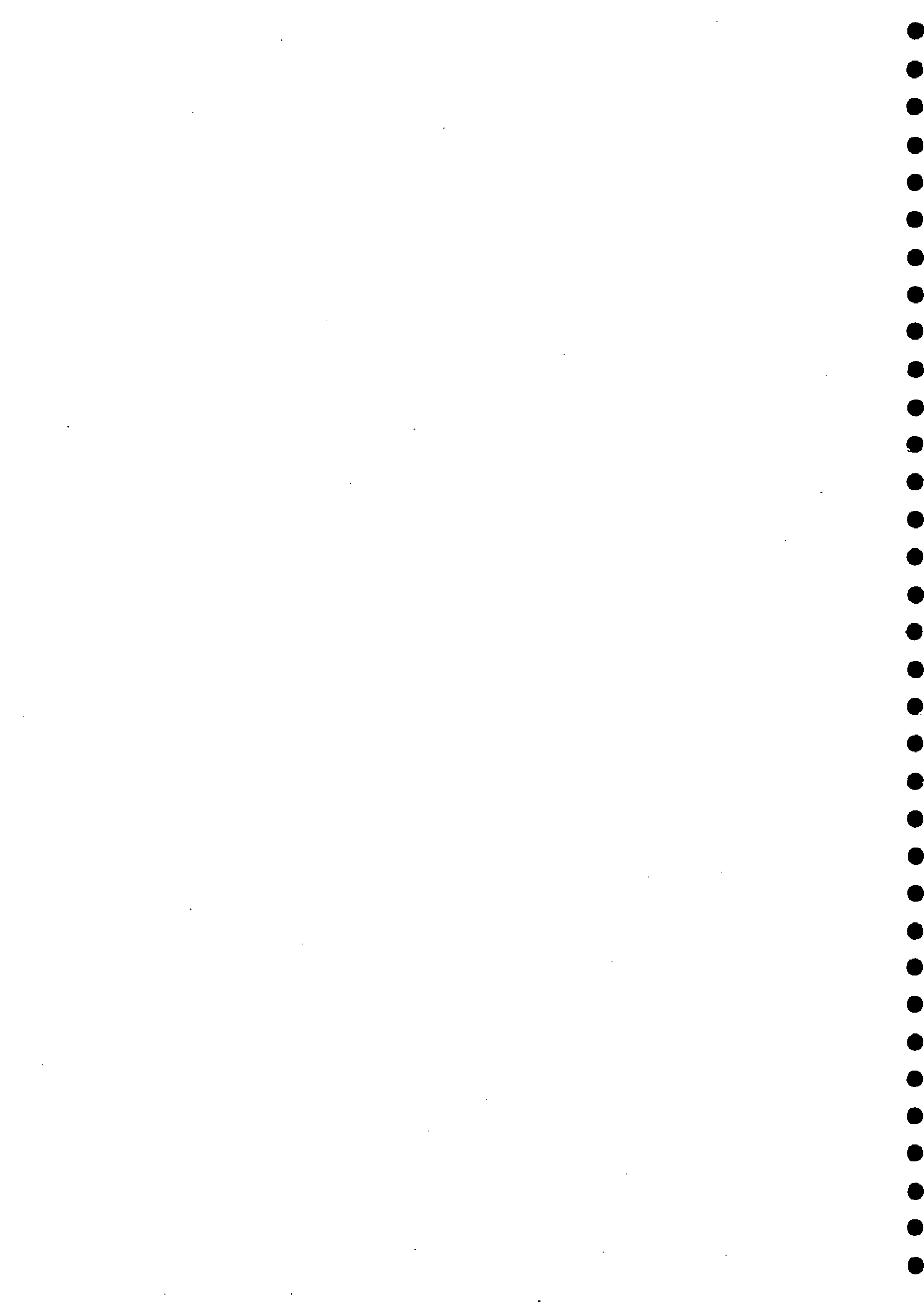
Tel: 01491 838800
Fax: 01491 692424
Telex: 849365 HYDROL G

September 1998



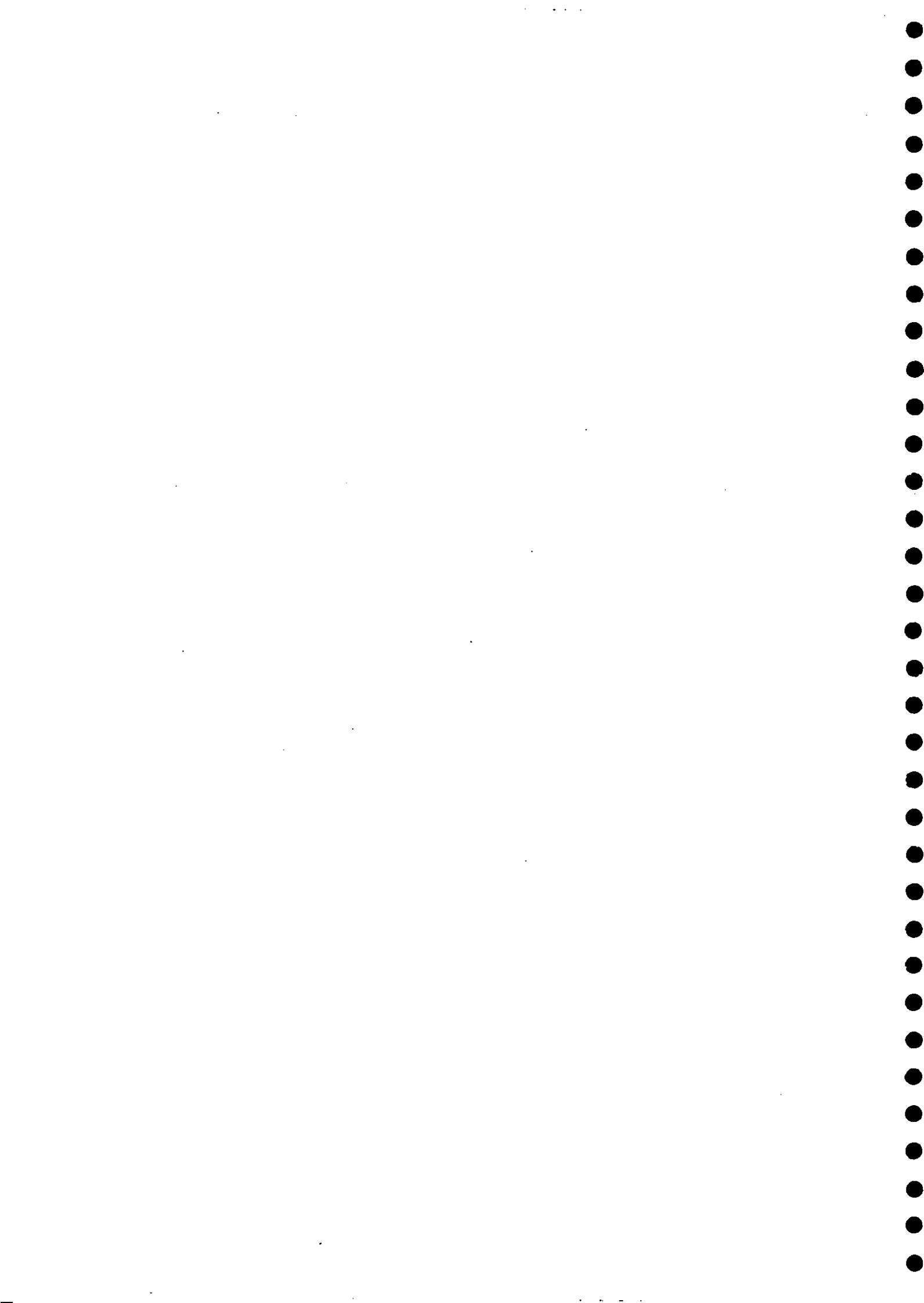
Summary

A key stage in the implementation of the SADC-HYCOS project involves establishing a regional database system. The database selected was the Institute of Hydrology's HYDATA system. HYDATA is used in more than 50 countries worldwide, and is the national database system for surface water data in more than 20 countries, including many of the SADC countries. A new Windows version of HYDATA (v4.0) is near release (scheduled January 1999), and provides several improvements over the original DOS-based system. It was agreed that HYDATA v4.0 would be provided to each National Hydrological Agency for the SADC-HYCOS project, and that a 2-week training course would be held in Pretoria, South Africa. The first HYDATA v4.0 training course was held at the DWAF training centre in Pretoria between 28 July and 6 August 1998. The course was attended by 16 delegates from 11 different countries. This report provides a record of the course and the software and training provided.



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1. Introduction

1.1 BACKGROUND TO SADC-HYCOS

SADC-HYCOS (Southern African Development Community Hydrological Cycle Observation System) is a 2-year project, funded by the European Union, which started in April 1998. The project is coordinated by staff of SADC, the National Hydrological Agencies in each of the participating SADC countries, and the Pilot Regional Centre (PRC) at the Department of Water and Agriculture (DWA) in Pretoria, with a supervisory role by WMO. Technical assistance is provided by the Institute of Hydrology in the UK and ORSTOM in France.

SADC-HYCOS is one regional component of the HYCOS network presently being initiated worldwide (WHYCOS). The WHYCOS project has several principal objectives. Firstly, it aims to strengthen the technical and institutional capacities of hydrological services to capture and process hydrological data, and meet the needs of their end users for information on the status and trend of water resources. Secondly, it aims to establish a global network of national hydrological observatories which provide information of a consistent quality, transmitted in real-time to national and regional databases, via the Global Telecommunications System of WMO. Thirdly, it aims to promote and facilitate the dissemination of water-related information, using modern technology such as the World Wide Web and CD-ROMs.

A key stage in implementation is the upgrading of national data processing and archiving systems and the establishment of a regional database. The Institute of Hydrology's HYDATA database system is already widely used in southern Africa, for both national databases and specific projects and, it was agreed that it should be used for the SADC-HYCOS database.

1.2 BACKGROUND TO HYDATA

HYDATA is a hydrological database system for personal computers which was developed by the Institute of Hydrology. The first version of HYDATA was produced in the mid-1980s and was based on the mainframe database system in use at the time for the UK national surface water archive. HYDATA has since been used in more than 50 countries worldwide, and is the national database system for surface water data in more than 20 countries. Current users in Africa include several countries in West Africa, and most of the IGAD and SADC countries of Eastern and Southern Africa (Figure 1).

The impetus to use HYDATA in Africa has come from several sources. During the mid-to late 1980s, several countries independently started to use the system either as the national database, or in support of hydropower, water supply and other projects. Since 1990, with support from WMO and DFID (UK Department for International Development, formerly Overseas Development Administration), more than 100 African hydrologists and hydrometeorologists have received training in HYDATA and hydrological database techniques at a series of courses held annually at the Institute for Meteorological Training and Research (IMTR) in Nairobi, Kenya. Since 1992, again with DFID support, HYDATA has been adopted as the common database system for the southern African FRIEND project. FRIEND (Flow REGimes from International Experimental and Network Data) is a contribution to the fourth International Hydrological Programme of UNESCO, whose central theme is hydrology and water resources for sustainable development in a changing environment.

The HYDATA database system meets the need for a modern computer-based data archiving and retrieval system which can be used by staff with little experience of computers, and yet is powerful enough to use for archiving national records and for advanced hydrological analysis work. A new Windows version of HYDATA (v4.0) is near release (scheduled January 1999), and provides several improvements over the original DOS-based system (versions up to v3.21), as well as offering a multi-user, network version. For example, a flexible time series data structure solves the problems of storing non-regular time intervals of water level data or the zero levels which can occur through much of year in tropical countries. It was agreed that HYDATA v4.0 would be provided to each National Hydrological Agency for the SADC-HYCOS project, and that a 2-week training course would be held in Pretoria.

1.3 BACKGROUND TO COURSE

The SADC-HYCOS HYDATA v4.0 training course was held at the DWAF training centre in Pretoria, South Africa between 28 July and 6 August 1998 (Appendix B). Each country was invited to nominate one delegate to attend the course, and was encouraged to find additional funds to send a second delegate. Several countries were enthusiastic about sending two delegates, but only Mozambique, Namibia and South Africa eventually took up the offer. The course was attended by 16 delegates from 11 different countries (Appendix C). The delegates from those countries which use HYDATA v3.21 for the national database were already familiar with the HYDATA concept, though few of them had been on formal training courses. However, some of the delegates from those countries where HYDATA v3.21 has only been used on specific projects, or on a regional basis, had no experience of the software.

HYDATA users in Africa

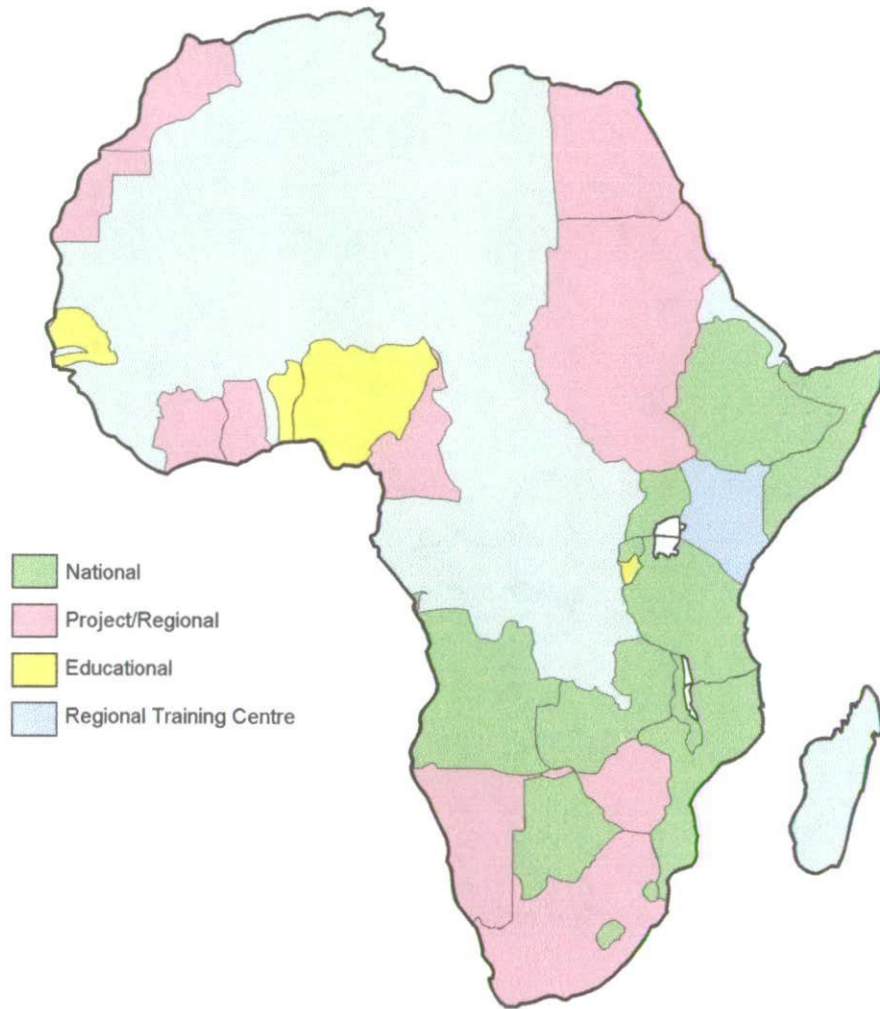


Figure 1

2. The HYDATA training course

2.1 THE HYDATA V4.0 TRAINING COURSE

The main aim of the training course was to give participants as much practical experience as possible in using HYDATA v4.0. A detailed programme was prepared (Appendix B), which concentrated on the more routine aspects of operation in the first week, and more advanced topics in the second week. The course was based round a set of 18 prepared exercises covering all aspects of the software, and a 4-part project simulating a crisis in a hydrological department and enabling delegates to put the skills they had acquired to practical use. Some delegates had brought data sets from their country, and they had an opportunity to discuss data formats and transfer to HYDATA v4.0, and to use their data for some of the exercises. The course programme was followed fairly closely, and all the participants were able to attempt all of the exercises and all parts of the project.

In the first week, morning and afternoon sessions typically comprised a short lecture on the day's topic followed by practical exercises on the computers, during which delegates were able to ask supplementary questions. In the second week, the mornings tended to follow the same pattern, but the afternoons were devoted to work on the project. During the course, delegates were also instructed on the software installation procedure, and given the opportunity to install HYDATA v4.0 on a designated computer; this was done for delegates from two countries a day, over a five day period. During the course, each country was provided with one set of HYDATA v4.0 installation disks (Appendix A) and one draft HYDATA v4.0 operation manual. In addition, each delegate was provided with a set of paper copies of the overhead transparencies, as well as copies of the course exercises and project notes.

The training room was equipped with 11 Pentium computers of varying ages and specifications; 10 for the delegates to use during the practical sessions, either working alone or sharing between two, and one designated for training in the installation procedure. There were problems installing HYDATA v4.0 on three of the computers; these three machines were all brand-new IBM PCs. In each case, the copy protection token failed to transfer properly and was lost. A temporary solution to the problem was provided through loading unprotected versions of the software on to the three computers for the duration of the course. There were three HP deskjet printers, each shared between three or four computers using T-switches.

There were several power cuts of varying durations during the training course, including four in a single morning. These were sometimes genuine power cuts, and otherwise caused by the training room trip switch cutting out when a particular wall socket was touched. Though very inconvenient, the power cuts enabled the robustness of the HYDATA v4.0 database, compared to the HYDATA v3.21 database, to be demonstrated. The topics of system management, computer viruses and the importance of regular data back-ups were also discussed, and delegates were made aware of the HYDATA data disaster recovery service offered by the Institute of Hydrology.

Although a considerable amount of time has been spent testing HYDATA v4.0, the software has not been thoroughly tested in real-life situations, and it was anticipated that the delegates on the training course would identify additional problems not revealed by standard testing. Around 60 software bugs, of varying degrees of seriousness, were identified during the training course, and are summarised in Appendix D.

The majority of the bugs were caused by one of three reasons:

- The original development tools (SQLBase and SQLWindows) have been extremely problematic, and there has been great difficulty in obtaining fixes for problems. To overcome this, the database has been switched to ODBC and Microsoft Access, and the code has been rewritten in C++; this has been done for all modules except the gauging and ratings editor which is, therefore, still slightly unstable. Running the gaugings and ratings editor within the HYDATA main window has also caused some problems.
- Problems also exist with the third-party tools for graphs and spreadsheets. Indeed, the method of producing graphs was changed shortly before the course, in order to solve problems with the position of the axis on the graph and the redrawing of the screen. This was quite a major change and caused a number of knock-on effects which, because there was insufficient time to thoroughly retest the software, only materialised during the course.
- The testing process has identified new requirements as well as highlighting existing problems. Implementing the new requirements has added problems to parts of the software which previously worked, and has rendered previous testing invalid so that the process must be restarted.

It was possible to provide a fix for some of these bugs during the training course, and each country was given an additional disk to add to their HYDATA v4.0 installation disks. The delegates were also given a fault report form to complete should they identify any further bugs, and telephone and fax numbers, and email addresses, for the Software Development Section at the Institute of Hydrology. Each country will receive another set of installation disks when HYDATA v4.0 is officially released in January 1999.

2.2 VISIT TO DWAF OFFICES

On 7 August, the day after the training course finished, a half-day visit was made to the DWAF offices in Pretoria to install HYDATA v4.0 on two of their computers, one machine storing the raw data, and another the processed data. There were problems installing HYDATA v4.0 on one of the designated computers, as the partitioned hard disk had insufficient room for the temporary file created by the installation program. However, this problem was quickly solved by creating a new temporary file space. The opportunity was also taken to see a demonstration of DWAF's flood monitoring system. The visit concluded with a review of the training course with DWAF staff.

3. Conclusions and future plans

A controlled release version of HYDATA v4.0 has been provided to each National Hydrological Agency for the SADC-HYCOS project, and at least one delegate from each country has attended a 2-week training course in Pretoria. Provision of the software at this stage will give the participating countries time to train staff on the database system before the data collection phase of the project commences. Several of the delegates who were familiar with the DOS-version of HYDATA gave favourable comments about the user-friendliness and ease-of-use of the Windows version.

Each country will receive a release version of HYDATA v4.0 by January 1999, and subsequent upgrades when these become available. The software maintenance agreement also provides for telephone, fax and email support on technical problems relating to successful operation of the system and, should the need arise, advice on reinstating the system following computer failures or virus problems.

Several delegates expressed concern that their computing facilities were inadequate for running HYDATA v4.0, or that they would have problems justifying the need for a powerful machine to their managers. To try and assist the delegates, a official letter specifying the minimum specification for running HYDATA v4.0 was passed to each country.

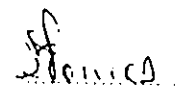
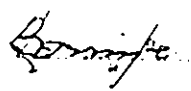
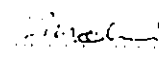
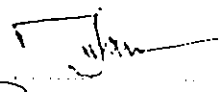


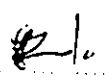
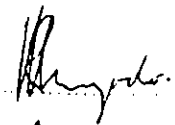



Experience with other HYDATA users in Africa has shown that many countries experience similar problems when starting to use the system. The main difficulty is usually in devising methods for transferring existing data from older, sometimes obsolete databases. It is hoped that the more flexible import facilities within HYDATA v4.0 will overcome some of these problems. Other issues commonly raised include difficulties with developing multi-part rating curves, and protecting the database from hardware failures, power cuts and computer viruses. These matters are generally best addressed by providing follow-up visits to each country to provide additional training, and to solve any operational problems which have arisen. Several delegates also expressed an interest in upgrading their national database system when HYDATA v4.0 was officially released and, therefore, lodged requests for additional copies of HYDATA v4.0 in the future.

To help address some of these matters, the Institute of Hydrology is approaching WMO and DFID for resources to provide further copies of HYDATA v4.0 and additional training to interested countries, and to upgrade the disk-based self-help training course and the course material for the annual IMTR training courses in Nairobi. If the Institute is successful, questionnaires will be sent to each country asking what assistance they require, in terms of software, training and other issues.

Appendix A Receipts for HYDATA v4.0 software

SADC-HYCOS
 RECEIPT OF HYDATA v 4.0
 (Controlled Release Version)

6 HYDATA v 4.0 Installation disks
 3 ODBC Installation disks

COUNTRY	SERIAL NO.	NAME	SIGNATURE	DATE
Angola	4003	Mr. Mario Joao Mota Lemos		31/07/98
Botswana	4005	Mr. Baemedi Letsholathebe		30/7/98
Lesotho	4000	Ms. Jeminah Makolia Mohasisa		5/8/98
Malawi	4007	Mr. Tumbikani Mwasinga		19
Mozambique	4002	Mr. Bob van Kappel		31/07/98
Namibia	4000	Ms. Sylvia Andreas		08/08/98
Swaziland	4001	Mr. Patrick Zondo		05/08/98
Tanzania	4004	Mr. R. Mngodo		30 July 98
Zambia	4009	Mr. Alex Lusaka		4/8/98
Zimbabwe	4008	Mr. R. Chikwanha		6/4/8/98
South Africa (2 copies)	999	Mr. Johan Wentzel		7/8/98

Appendix B Programme of visit

Monday 27 July

Arrive in Pretoria

Set-up training room at DWAF training centre

Install HYDATA v4.0 software on course PCs

Tuesday 28 July

Welcome and background to SADC-HYCOS project (Stefan van Biljon, DWAF)

Introduction to HYDATA v4.0 training course

Introductory exercise

General principles of operation of HYDATA v4.0

Exercise 1: General principles of operation

Exercise 2: Examining the contents of a database

Exercise 3: Setting-up a new database, new stations and new time series

Wednesday 29 July

Time series editor

Exercise 4: Introduction to the time series editor

Exercise 5: Editing data, printing and plotting data

Data conversion

Exercise 6: Converting daily data to monthly data

Thursday 30 July

Gaugings and ratings

Exercise 7: Introduction to gaugings and ratings

Exercise 8: Introduction to fitting ratings

Exercise 9: Fitting ratings

Installation session for Botswana and Tanzania

Friday 31 July

Gaugings and ratings (continued)

Data conversion (continued)

Exercise 10: Converting stage data to discharge data

Installation session for Angola and Mozambique

Course project part I

Monday 3 August

Data transfer into and out of HYDATA v4.0

Exercise 11: Importing and exporting data

Installation session for Malawi and Namibia

Course project part II

Tuesday 4 August

Reporting options in HYDATA v4.0

Data analysis

Exercise 12: Time series comparison plots

Exercise 13: Double mass plots

Exercise 14: Flow duration curves

Installation session for Zambia and Zimbabwe
Course project part III

Wednesday 5 August

Data analysis (continued)

Exercise 15: Low flow analysis

Exercise 16: Validation plot editor

Exercise 17: Revision exercise

Installation session for Lesotho and Swaziland
Course project part IV

Thursday 6 August

Completion of course project

System management and data security

Review of SADC-HYCOS project and HYDATA v4.0 training course

Presentation of certificates and course closure

Friday 7 August

Visit DWAF offices in Pretoria

Install HYDATA v4.0 software on DWAF PCs

Demonstration of DWAF flood monitoring system

Review of HYDATA v4.0 training course (with Stefan van Biljon and Felix Wulff, DWAF)

Appendix C List of course participants

Angola	Mario João Mota Lemos	National Directorate of Water
Botswana	Bamedi Letsholathebe	Department of Water Affairs
Lesotho	Jemimah Makolia Mohasisa	Department of Water Affairs
Malawi	Tumbikani Mwasinga	Ministry of Water Development
Mozambique	Luisa do Ceu Ricardo da Conceicao Bob van Kappel Paulino Mamuel Maluvane	National Directorate of Water National Directorate of Water National Directorate of Water (ARA Sul)
Namibia	Sylvia Andreas Antje Eggers	Department of Water Affairs Department of Water Affairs
South Africa	Isabel van As Johan Wentzel Gerhard Booysen	DWAF DWAF Beryllium Software Solutions (Consultant to DWAF)
Swaziland	Patrick S Zondo	Water Resources Department
Tanzania	Raymond J Mngodo	Department of Water Resources (MAJI, Ubungo)
Zambia	Alex Lusaka	Department of Water Affairs
Zimbabwe	Remigio Chikwanha	Department of Water Development (Hydro Branch)

Appendix D List of software bugs

Analysis	<p>Analysis routines may crash when using time series with missing data and start and end gaps</p> <p>Time series plot: Various scale problems on primary and secondary y-axes, on both linear/logarithmic scales, for both standard/inverted axes</p> <p>Time series plot: Primary and secondary y-axes labels confused</p> <p>Time series plot: Missing language string error message for y-axis label</p> <p>Time series plot: Time series properties apply to only primary axis</p> <p>Time series plot: Lagged histograms may not plot correctly</p> <p>Time series plot: Time series selection dialog may not show time series for a station unless the station is reselected</p> <p>Flow frequency: values are plotted incorrectly</p> <p>Validation plot: Plot may initially fail to open on a time series</p> <p>Validation plot: Unable to select data for last year of time series</p> <p>Validation plot: Zero values are excluded from log plot</p>
Convert	<p>No data error message when converting a single year of a long daily rainfall time series to monthly totals</p> <p>Highest stage value may not be correctly converted to discharge</p> <p>Selection dialog may fail to pick up appropriate time series for converted data</p>
Copy protection	<p>Copy protection worked on only 7 out of 10 course PCs</p> <p>Copy protection message is not clear and does not fit in dialog box</p>
Definitions	<p>Time series type: Relative humidity has measurement type 6</p> <p>Time series interval: For add new interval. 'Fixed irregular' should be 'Specific times' and 'Seconds between readings' should be 'Number of seconds since midnight'</p>
Dialogs	<p>Some dialogs cannot handle leading spaces or trailing characters</p>
Export	<p>Export message says 'Import Complete'</p>
Gaugings & ratings	<p>Having Gaugings and ratings open at the same time as TS editor may cause registry conflict and crash</p> <p>Can open G&R editor on top of G&R report; graph properties still valid but refers to hidden graph</p> <p>Gaugings and ratings may crash when changing windows</p> <p>Gaugings: Numbers greater than 999 are displayed with commas (e.g. 1,300.25); import of such data as CSV file does not work correctly</p> <p>Gaugings: Highest stage value not always compared in comparison column</p> <p>Gaugings: Tendency to keep adding new gaugings</p> <p>Gaugings: Latest gauging may not always be displayed properly</p> <p>Fit Rating: Default start and end dates should be start and end dates of gaugings</p> <p>Fit Rating: Right clicking on point may cause program to hang</p> <p>Fit Rating: Graph may go blank</p> <p>Ratings: Tendency to keep adding parts to new ratings</p>

	Ratings: Ratings may not always be saved Ratings: Print previewing rating equations may cause program to hang
Graphics	Cannot paste WMF graphs into MS Office 97 (paste as picture and resize)
HYDATA	Debug mode compilation causes intermittent debug/assertion errors
Import	DOS database import sets station x,y coordinates to zero rather than null 'Success' message appears minimised Import (text file, cut & paste) to preexisting time series may result in 2 readings per day/month for daily/monthly data or invalid dates Cancel button in import DXF data does not work Attempt to open a text file when disk removed from drive A prematurely produces unexpected results (e.g. MS Access login dialog)
Installation	HYDATA DLL files are installed into Windows system directory rather than HYDATA4 directory
Map	Map preferences edit dialog may not fit large numbers (e.g. 123432e234) Map may cause crash when setting-up map extents and closing map down
Reports	Selection dialogs may not update list of available stations Station summary: printing landscape on HP deskjet 690C loses RH edge Station summary: Year 09 written as 9 and all data shifted left Time series annual: allow a binding edge Time series summary: show years as well as months G&R plot: Rating may be plotted as symbols rather than line G&R plot: missing language string error message G&R plot: intermittent floating point error causes crash
Station set-up	Cannot change existing rainfall time series to flow (rainfall being default) Cannot create mean monthly evaporation time series
TS editor	Editor does not prompt to save on close all windows Intermittent 'Date out of range for time series' error message on close editor Resizing may make spread control bars appear in incorrect place Data: Loading 1900-2049 4 readings per day empty time series into editor causes crash Data: Selection may inverse colours Data: Move data may lose some data Data: Removing missing flag sets value to 0.00 and colours it red even though it is not out of range Data: 'Value not in range for time series' error message prevents changing flag from missing Data: Cannot set end gap flag on missing value Data: Printing values may cause general protection error on printer driver Graph: Graph may go off screen, disappear except for dates and produce incorrect graph properties when no data in time series Graph: Histogram has strange triangles for long time series