World Meteorological Organization

SADC-HYCOS – Project N°. 7.RPR.600
Monitoring and Supervision Contract

FINAL REPORT ON THE IMPLEMENTATION OF THE SADC-HYCOS PROJECT

Prepared by the Secretariat of WMO

Geneva, 23 September 2004

Table of contents

FINAL REPORT ON THE IMPLEMENTATION OF THE SADC-HYCOS PROJECT

1. PREAMBLE

The World Hydrological Cycle Observing System (WHYCOS) has been developed by WMO in response to the recommendations of Agenda 21, Chapter 18. This programme was launched in 1993 with financial support from the World Bank, the EC and other donor agencies. It has been implemented through sub-regional components (projects) aiming at fostering the development of hydrological activities in the countries, in particular supporting the basic knowledge on the distribution and availability of water resources, mainly by means of improving their data collecting and managing capacity. Furthermore WHYCOS is also promoting a regional approach to the management of water resources, of particular importance when countries are confronted with internationally shared basin. The main objective is to improve co-operation at the river basin level, as well as at regional and global levels, and to contribute to the establishment of consistent and reliable water data information systems.

SADC-HYCOS has been the second HYCOS component to be implemented in the framework of WMO WHYCOS Programme. Eleven continental countries of the Southern African Development Community participated in the project (Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia, Zimbabwe and South Africa). In 1997 the European Commission approved the funding of this project with US$ 2.40 million over 2 years. WMO was the supervising agency for the project. The Directorate of Hydrology, Department of Water Affairs and Forestry (DWAF) in Pretoria, South Africa hosted the Pilot Regional Centre. Concerning the Technical Assistance (TA) component, a contract was awarded to the Institute of Hydrology (Wallingford U.K.) in co-operation with ORSTOM (France).

This final report on the implementation of the Southern Africa Development Community Hydrological Cycle Observing System (SADC-HYCOS) is in partial fulfillment of the Monitoring and Supervision Contract SADC-HYCOS-Project No. 7. RPR 600 between WMO and the European Union. This report has been prepared by the Secretariat of WMO, with inputs from both the Pilot Regional Centre (PRC) and the Technical Assistance to the project (TA).

This report is based on:

- The review of technical and activity reports prepared by Pilot Regional Centre (PRC) and by Technical Assistance;
- The findings of the evaluation missions conducted by the Secretariat of WMO to the PRC and to some countries in the SADC sub-region during the project implementation;
- The findings of the independent evaluation mission carried out by two consultants (Messrs D. Rutashobya and J. Wellens-Mensah in May 2002);
- The presentation by the PRC coordinator to the 6th WHYCOS International Advisory Committee (WIAG) and the ensuing discussions and recommendations.

2. OBJECTIVES OF THE SADC-HYCOS PROJECT

The general objective of the project, as endorsed by the SADC summit in 1994, is to contribute to regional socio-economic development through the provision of management tools necessary for sustainable and cost effective water resources development and management and for environmental protection.

The expected results for what was designed as a two-year project are:

i. The installation of a real time hydrological data collection network using the METEOSAT data transmission system. Fifty Data Collection Platforms (DCPs) were planned to be installed on water bodies of regional interest in the SADC sub-region.

ii. The improvement and/or development of data exchange and dissemination systems at national and regional levels.

iii. The development and implementation of a Regional Data Base (RDB) and improvement and/or development of the National Data Bases (NDBs).

iv. The preparation of hydrometeorological products of national and regional interest.

v. The implementation of the required training activities.

vi. The creation of a Regional HYCOS Centre.

The project actually started in June 1998, with the signature by SADC, EU and TA of the Technical Assistance Contract. Its original duration of 24 months (until June 2000) has been successively extended until 31 August 2001 upon a common request of WMO, the PRC and SADC-Water Sector Coordination Unit. This extension was requested mainly for accommodating some delays in the implementation of the DCPs network caused by the late delivery of the DCPs that forced their installation to be postponed until after the end of the rain season 1998-99.

3. WMO TASKS IN THE CONTRACT – RESPONSIBILITIES AND ACTIVITIES

WMO under the contract 7 ACP RPR 600.1 with the European commission was entrusted the task of providing technical and scientific supervision to the project implementation.

WMO's main tasks were:

- Task A. Evaluation of tenders
- Task B. Liaison with/visits to EUMETSAT and Contractors
- Task C. Project Monitoring
  - Sub-task 1: review of technical and activity reports
  - Sub-task 2: implementation progress appraisal missions
  - Sub-task 3: preparation of six-monthly reports
  - Sub-task 4: scientific and technical support to PRC

3.1 Task A – Evaluation of Tenders

Under this task WMO was expected to review the bids for services (technical assistance) and supply of equipment, prepare the relevant evaluation reports and participate in the evaluation committee meetings.

Two tenders were floated in the framework of the SADC-HYCOS project:

- Supply of 50 DCPs and spare parts
- Technical Assistance to the Pilot Regional Centre

Earlier, WMO had prepared the tender documents, including Terms of Reference for the Technical Assistance and Technical Specifications for the DCPs and spare parts, in the framework of consultancy contract 95/203 with the European Commission, for the preparation of the SADC-HYCOS project document. In doing so the experience earned by WMO in the implementation of other WHYCOS projects, and in the installation of DCP networks in Africa in the framework of other projects, was largely taken into account. Draft of these documents was sent to the European Commission on 31 July 1996 (our Ref. 19.783/H/SADC-HYCOS).

The tenders were launched in early 1997. WMO had prepared an in depth evaluation report of the offers received which was used during the first evaluation committee meeting was held in Pretoria (South Africa) from 3 to 4 April 1997 under the Chairmanship of Mr Makhoalibe, SADC Water Sector Coordination Unit.

The Committee had to award the following two contracts:

3.1.1 Supply of 50 DCPs

In response to the invitation tender No 4139 six companies provided offers:

- CEIS TM (France)
- OTT Gmbh (Germany)
- SAINCO (Spain)
- SEBA Hydrometrie (Germany)
- SERPE_IESM (France)
- Space Technology Services - STS (United Kingdom)

The offer by OTT was discarded due to incompliance with article XV under special Conditions of the invitation to tenders. The remaining five were ranked according to their total cost as follows:

	STS	SERPE-IESM	CEIS-TM	SEBA	SAINCO
Maloti	4,787,186.61	4,942,921,.00	5,206,523.87	6,429,900.18	6,549,864.82
ECUs	818,608.91	845,239.49	890,315.58	1,098,828.93	1,127,721.88

The committee decided to focus the review only on the three least expensive offers: STS, SERPE-IESM and CEIS-TM.

The STS offer was found not compliant because it offered only one memory card per DCP, while two were requested; and too limited number of spare part was proposed, that was the main reason for offering the least expensive tender.

CEIS offered earthing for lightning protection only as an optional extra (584.72 Maloti each), while same feature was included in the price of SERPE-IESM, together with 10 hydrological towers, not proposed by other bidders.

Comparing the offers by equaling the amount of spares lead to the following ranking:

	STS	SERPE-IESM	CEIS-TM
Maloti	4,787,186.61	4,611,652.75	5,080611.37

The meeting considered that the offer by SERPE-IESM was the least expensive for the provision of the equipment complying with the technical specification of the invitation, with adequate supply of spare parts and extra features not included in the other offers. Therefore on the basis of the recommendation of the Committee SADC-WSCU as Contracting Authority awarded the contract to SERPE-IESM in July 1997.

3.1.2 Technical Assistance to the Pilot Regional Centre

Three companies responded to the invitation to provide bids for the Technical Assistance:

- Bundesanstalt für Gewasserkunde (BfG) (Germany)
- Aquater (Italy)
- Institute of Hydrology (IH) (United Kingdom)

BfG proposed to work with RODECO, a German sub-contractor, and IH proposed to work with the ORSTOM (France).

The offer by BfG was considered insufficiently formulated, as the work programme was lacking any detail, subdivision of tasks among the main contractor and the subcontractor was not specified, an indication of the task attributed to the various experts proposed was not available. It was therefore discarded from any further consideration.

The offer by Aquater was fully compliant with the tender specifications, however it appeared that the company and the majority of its personnel had very little experience and expertise in operational hydrology to provide the necessary technical support to the project.

The offer by IH was presenting for each task a detailed action plan, including analysis of potential problems and identification of solutions, a description of the hydrological products and a timetable accounting for the constraints generated by the rain season to the field activities. However their financial proposal of ECU 802,650 exceeded the ceiling of ECU 741,000 stated in the invitation letter. As it was felt that

Aquater was not in a position to provide the required technical assistance, the committee decided to suspend the evaluation and seek the advice of the Commission.

The EC delegation in Lesotho on 13 May 1997 (ref. D(97)144) advised that, a re-evaluation might have to be made. The evaluation committee met the second time on 25 July 1997. After reexamination Aquater proposal was discarded because of considerable lack of experience of the staff in installation of field equipment, development and maintenance of hydrological databases, creation of hydrological products and their dissemination through Internet.

SADC-WSCU, Contracting Authority, therefore recommended the annulment of the tender and entering into direct negotiations with the IH (letter of 7 August 1997, ref. NR/SADC-WS/3.2). A further independent review carried out by the Danish Hydrological Institute in January 1998 confirmed the results of the second evaluation committee meeting. The EC (ref. D898)0188 of 19 February 1998) endorsed these conclusions. In March 1998 an agreement was reached between SADC-WSCU and IH for a Technical Assistance contract with a budget reduced within the ceiling of ECU 741,000. The Final Project Report and Recommendation for SADC-HYCOS prepared by TA consultants (CHE and IRD) is attached to this report.

While the process for the selection of the equipment supplier was relatively straightforward, the process of selection of the Technical Assistance took almost one year, partly affecting the start up of the project, as TA was required to support the installation of the DCPs in the countries. The experience pointed out that in assessing the quality and adequacy of an offer for expert services it is of paramount importance not only evaluating the formal compliance with the invitation for tenders, but also evaluating in a very strict and critical way, based on all the available information, the real capacity of the tender to perform the expected tasks.

3.2 Task B Liaison with / visits to EUMETSAT and Contractors

Under this task WMO was to facilitate free access to METEOSAT Data Collection System of the DCPs purchased for the project, supervise and accept the factories for the DCPs and coordinate with PRC and contractors the implementation of the SADC-HYCOS network of DCPs.

3.2.1 Access to METEOSAT DCS

In order to ensure that DCP-generated messages are transmitted via the METEOSAT satellite and through the EUMETSAT Data Collection System, for each DCP a EUMETSAT Admission Form has to be filled in, detailing location, type, purpose and requested transmission slots, plus the contact detail of the responsible institution. Each station shall also be attributed a unique WMO station number.

The list of DCPs sites was adopted by the Initial Technical Meeting, held in Pretoria (South Africa) 20 to 23 April 1998 and endorsed by the SADC Water Resources Technical Committee in May 1998. WMO prepared a list of proposed WMO station numbers and requested the Permanent Representatives of the countries (usually the directors of the Meteorological Service) to endorse the proposal. WMO also had extensive contacts with all the participating countries in order to help them in filling the admission form and submitting them to EUMETSAT. The procedure of DCPs acceptance in EUMETSAT DCS was successfully completed and the PRC and TA began DCPs installation in the fourth quarter of 1998.

3.2.2 Factory acceptance

In this regard WMO carried out, from 18 to 26 May 1998, a mission to Guidel (France) where the SERPE-IESM factory is located. During the factory acceptance test (in the presence of representatives of the PRC and of the TA) four randomly chosen DCPs were connected to the full array of sensors and powered up. The messages emitted by the DCP were verified using the EUMETSAT Data Receiving Station (DRS) of SERPE-IESM. A power-down was simulated to check the capacity of the DCPs top restart and reinitiating correctly. Finally the DCPs were operated continuously for 72 hrs. Battery consumption was also monitored over the whole testing period. All the tests proved the compliance of the equipment with the technical specification and the terms of the contract.

3.2.3 Coordinate the implementation of the SADC-HYCOS network of DCPs

This activity spanned over all the implementation period of the project. A mission was carried out on 4-5 September 1997 to SERPE-IESM premises. An agreement was reached on the details of goods and services to be provided by SERPE-IESM to the SADC-WSCU. It was also agreed that further order for additional water level sensors could be placed within six months from the signature of the contracts. It was also decided to amend the delivery schedule originally adopted and instruct SERPE-IESM not to ship the equipment to the countries until they had completed the acceptance procedure of their DCPs with EUMETSAT. It was also found more effective and time saving to deliver the material directly to the recipient country and not, as planned to the PRC. SERPE-IESM also accepted to extend the training to two weeks.

The installation of the DCPs was undertaken by the PRC and TA experts. Prior to the actual installation WMO, PRC and TA felt appropriate to carry out preliminary visits to the installation sites, although this activity was not explicitly foreseen in the activity plan. As many DCPs were to be installed in very remote areas, where even the basic construction material (sand, concrete, bolts, etc.) is not readily available, those visits were necessary to ensure that all the needed material for the site preparation and civil works were available at the moment of the DCP installation. The extra expenditures generated by these visits were compensated by more time-efficient and cost-effective missions required for the installation of the equipment.

The installation of the DCPs war carried out successfully in almost all the countries. Ten stations were commissioned in 1998, 18 in 1999, 7 in 2000 and 8 in 2001. The delays in the implementation of the DCPs installation were mainly due to the delayed start of the project and because the rainy season (starting in October) prevented most of the planned installations in 1998. Specific problems were encountered in Mozambique and in Angola. In Mozambique it took one full year to clear the DCPs through the customs due to a disagreement on the payment of custom duties. The major floods that affected the country in February 2000 further exacerbated the delays. In Angola the large areas of insecurity due to the long-running civil war prevented any travel to most of the selected sites. By the end of the project in Mozambique only three stations were installed, and two in Angola.

3.3 Task C – Project Monitoring

Under this task four main activities had to be carried out:

3.3.1 Review of technical and activity reports

The Technical Assistance, jointly with the Pilot Regional Centre, prepared six intermediate reports and a final report Submitted in July 2003. Other reports were prepared following the Initial Technical Meeting (Pretoria, 20-23 April 1998), the Factory Acceptance Test (May 1998). They were all reviewed by WMO, or jointly prepared with other project partners.

3.3.2 Implementation progress appraisal missions

In the framework of this task WMO officers carried out, according to the project plans, evaluation missions as follows:

Dates	WMO Officer
July 1997	S. Pieyns
March 1998	J.L. Bassier
April 1998	S. Pieyns
May 1999	S. Pieyns
March 2000	J.M. Fritsch
September 2000	J.M. Fritsch

Furthermore in the context of other missions carried out in the region for other institutional purposes, WMO officers had frequent consultations with PRC staff in order to ensure a close and continuous follow-up to the project.

3.3.3 Preparation of six-monthly reports

WMO also submitted to the EU delegation and Water Sector Coordination Unit (WSCU) in Lesotho the following progress reports:

1st Report	November 1997	Including evaluation of tenders for the supply of equipment and services
2nd Report	January 1999	The project was officially launched during the Initial Technical Meeting in April 1998 but activities could start only after signature of the agreement between SADC, TA and EU in June 1998
3rd Report	May 1999	The report was submitted at the first SADC-HYCOS Steering Committee Meeting in May 1999 in Luanda, Angola
4th Report	May 2000	The report was submitted during an informal technical meeting at PRC in April 2000

3.3.4 Scientific and technical support to PRC

SADC-HYCOS has been the second regional component implemented in the framework of the WHYCOS programme. Many lessons that WMO had learnt in the implementation of the preceding MED-HYCOS project and other cooperation projects were applied to this project.

Together with the experience and expertise of the local partners this helped in ensuring overall smooth implementation in spite of a limited number of problems encountered. In view of the global scope of the WHYCOS programme, WMO in particular attempted to ensure that the project is coordinated with the other HYCOS regional components

4. PROJECT PERFORMANCE AND LESSONS LEARNED

The following are summary of the main achievements of, and difficulties encountered during the project implementation, as well as the lessons learnt

4.1 Installation and operation of a regional DCPs observing network

Not all the stations planned in the project could be installed. As already mentioned the major problems were experienced in Angola (security reasons in some of the selected sites) and in Mozambique (delay in custom clearance) that resulted in the delayed or missed installation of several stations. In all the other countries the installation of the stations was implemented without major problems. Some delays were experienced due to the onset of the rain season (November – June), which prevents field activities in remote areas and, with high water level in rivers, the installation of the water level pressure probes below the lowest water level was very difficult.

Although the problems connected with the rain season were taken into account in the work-plan proposed by the Technical Assistance, some delays in the delivery of the equipment disrupted the plans in few cases.

Lessons learned

In order to avoid in future problems like those encountered in Angola and Mozambique, it will be necessary that a) all the project actors, and in particular the local partner and the executing agency liaise timely and closely with national custom authorities to optimize shipment and custom clearance of the equipment; and b) in selecting the station location, while giving priority to regional hydrological criteria, nevertheless also the logistic and security issues shall be taken into account, particularly in areas of civil unrest.

Carrying out preliminary field visits (although not originally planned) proved to be extremely effective and cost efficient, saving time when the actual installation of the stations was undertaken. In future projects, such visits should be carried out in the earliest stages of the project, in order to provide technical inputs for the preparation of the equipment technical specification, in particular for better adapting the equipment to the specific setting of each station (particularly for locating it in a flood safe area and therefore providing for adequate length of the cables connecting the station with submerged sensors). As a consequence of the imperfect fitting of the standard equipment (particularly the cable length) to the condition of selected site, a minor number of stations had to be installed in not optimal sites.

Technically the equipment installed proved to be robust, reliable and suitable to the environmental conditions of the region. Nevertheless a number of malfunctioning was experienced which in several cases interrupted the regular transmission of the observational data. Only in two cases the transmission failure were caused by poor installation of the equipment (antenna shadowed by tree branches). In all the other cases the failures were due to:

- Antenna moved by animals or people
- Cable damaged by animals
- Vandalism

The cases of vandalism account for the majority of the transmission problems. In particular solar panels and batteries have been frequently object of theft. The limited amount of funds available in the NHSs' budget for field operation, as well as the limited number of spares, have often prevented a timely repair of the faulty stations. The lack of staff properly trained, in spite of the several training courses organized by the project (see after for details), has also contributed to the difficulties in restoring the functionality of the faulty stations. In a number of cases, when only the transmission device was affected, the data observed were stored in the stations' memory and could be recovered during field visits. PRC made available its experience in providing solution to limit the vandalism acts: sealing the solar panel in the roof of the station shelters, or changing type of power supply (batteries, electrical land lines)

The proper functioning of the network of observing station is among the basic element for the successful implementation of any HYCOS project. The undeniable advantages of automatic stations, such continuous functioning, possibility of local storage of observed data (one year of observation) allowing less frequent visits, or operation in remote and inhabited areas, should be weighted against the weakness described above. A more flexible choice of technical solution (particularly in terms of power supply) and a stronger involvement of local communities, in order to create a feeling of ownership towards the station, shall be considered in future as ways for minimizing the above mentioned malfunctioning.

4.2 Data exchange and dissemination

WMO, as in all WHYCOS project, has also promoted the implementation of the principles depicted in the Resolutions 40 (Cg-XII) and 25 (Cg-XIII) promoting the free and unrestricted circulation respectively of meteorological and hydrological data and products. In the framework of the project this principle has been implemented in particular by allowing access to the content of the RDB through Internet. Free access was allowed for consulting the raw data of the last month of all the stations installed by the project as well as relevant metadata.

Lessons learned

Although it is responsibility of the NHSs originating the data to perform validation and quality control, this exercise has not yet been completely successful, partly because of the difficulties encountered by the NHSs in accessing and downloading their national data from the RDB via internet (problem solved by implementing a more robust and user friendly web site) and partly because of the institutional problems of the NHSs themselves, that are often understaffed for performing the validation and quality control process. Furthermore the difficulties experienced in the initial phases in accessing the RDB did not contribute to build an ownership feeling in the NHSs and this in part can explain the lack of validated data.

4.3 Data Transmission and Regional Data Base

Data from the DCP are transmitted every 3 hours from the DCPs through the METEOSAT satellite to the EUMETSAT ground receiving facilities and hence retransmitted to the central Data Receiving Station (DRS) located in the PRC

headquarters in Pretoria. Data are received in CREX format (WMO standard format) and converted into a more readable format and loaded in the project database.

The received data are loaded into the SADC-HYCOS regional data bank. The data bank has been explicitly developed for the project and designed in such a way to allow easy access to data via Internet. In the implementation of the data bank the developers have made use of some of the features previously developed under another WMO-lead project, notably MED-HYCOS. WMO as supervising agency has also provided continuous guidance to the developers of the website. In particular the technical limitation to Internet access in the region (limited bandwidth, old browser software) had to be taken into account in designing and implementing the site by avoiding any unnecessary use of non-basic web features. NHSs in participating countries have been equipped with more performing e-mail system, and this positively impacted on project communication, e.g. in solving problems related to RDB access

The RDB stores the data as received from the DCPs and represents the main source of data for the project activities oriented to the production of user-oriented information. The raw data shall be subsequently validated by the originating NHSs to correct and eliminate errors. Validation process takes normally few months and hence for the main operational purposes the raw data can be used. Each NHSs has been provided with CEH's HYDATA software for storage and management of their data sets, and, when required, with up-to-date PCs in order to allow them to operate this software and others. Having provided all but one country with the same data management system (Namibia uses HYDSYS) has not only improved their data management capabilities but also enhanced the potential for international data exchange.

The data were stored in the Regional Data Bank in raw format, as they had been collected by the DCPs. The country originating the data is also responsible for carrying out a quality control over their data in order to eliminate invalid data caused by whatever problem might occur in the collection and transmission chain (sensor malfunctioning, message corruption, etc). Such data validation has not been carried out and this can diminish partly the value and usefulness of the Data Bank itself.

Lessons learned

Unfortunately it appeared that a certain amount of data received by PRC contained a variety of missing and corrupted characters. Although some of the corrupted messages can be generated during the retransmission from EUMETSAT to the PRC, it appears that the majority of them is generated during the transmission from the DCP to EUMATSAT satellite. The most likely cause, are other DCPs with faulty clocks operated in the same region by other agencies. Each DCP is assigned a unique "time slot" for transmitting to the satellite. SADC-HYCOS DCPs are equipped with GPS antennas that uses GPS satellite constellation to reset the DCP internal clock after each transmission. However many old DCPs are equipped with quartz clocks that may suffer, over time, of drifting causing the shifting of the transmission over the next "time slot" and consequent corruption of both messages. This has been for long a major fault in EUMETSAT DCS, affecting not only SADC-HYCOS DCPs, as EUMETSAT has not means of remotely deactivate the faulty station or resetting the clock.

4.4 Preparation of hydrometeorological products

The purpose of this task was to design a range of tools and information product, suitable to the needs of the NHSs in the region, to enable them better discharging their duties and provide to other user useful and timely information.

The NHSs have been provided with HYDATA software which enables them to perform data management and validation and produce basic information products such as double mass curve plots, gap filling for interpolating missing stage or flow data, computation of baseflow index and comparison of plots.

NHSs were also equipped with ARIDA software. This software package provides a rapid assessment capability to estimate the state of current drought episodes in comparison to historical events. ARIDA can be easily linked with SADC-HYCOS data bank in each country, benefiting from the availability of real time data in order to provide timely drought outlooks. It also allows producing regular bulletins and accompanying statistics placing the present flow status in the context of the relevant historical series.

In Malawi a test installation has been run of a software-based methodology providing support in assessing, planning and managing water resources based on a similar package developed by CEH for use by the UK Environmental Authority. This system was developed as a prototype to be subsequently extended to all the other countries. It is based on a hydrological model capable of estimating low flows also at ungauged sites, and of accounting for artificial influences on the flow regime. To improve the reliability of the forecasts (often influenced by the scarcity and low accuracy of data), it is possible to plot the observed flow against the previously estimated one.

The systems proved to be efficient in the more humid part of the region and further improvement can be expected through increased knowledge of the inter-monthly variability of flow regimes in the region.

Lessons learned

In spite of the above-mentioned achievements, however, the implementation of this project component cannot be considered fully satisfactory. The reasons to which this partial failure can be ascribed are mainly two. On one hand a preliminary assessment of the information needs of the participating countries and a detailed definition of the information products better responding to their needs could not be carried out in depth during the formulation phase of the project document, and on the other hand the funds allocated in the project budget to this activity appeared to be insufficient (ECU 64,000, i.e. only 3.2% of the total budget) to undertake this assessment during the project implementation.

WMO is fully aware that the simple existence of a hydrological network is not a goal per se, as the cost for purchasing, installing, operating and maintaining the equipment can only be justified if the data produced can be operationally used in support of the socio-economic development of the country, protection from natural disasters, environmental conservation, water resources management and research. On the other side no development is possible without a sound and reliable basis of field data. In view of the poor status of the observing network in the region it was decided to give priority to the reinforcement of the collection of baseline data, while the production of hydrological information products is given a more prominent role in the second phase of SADC-HYCOS, whose implementation is expected to start soon.

4.5 Training

Training component is one of the most important elements in any development project particularly in a project like HYCOS, aiming at introducing new, technologies for water resources monitoring and water related data management. Ensuring the

durability and sustainability over time of the project achievements depends, among other factors, also on the technical capacity of the services involved and their staff to operate, maintain and when required repair the equipment installed in the framework of the project, operate and troubleshot data management and other software, interpret and make use of the data collected and information produced. To ensure that these capacities were made available to the participating countries a comprehensive training plan had been planned and implemented in the framework of the project.

Four training events have been carried out, namely:

- 28 June – 10 July 1998: Workshop on installation and maintenance of DCPs (organized by SERPE-IESM – DCP suppliers – with support from PRC and the Technical Assistance);
- 28 July – 6 August 1998: Workshop on HYDATA database software (organized by the Technical Assistance);
- 22 February – 3 March 2000: Workshop on Regional database and Electronic Networks (organized by the Technical Assistance);
- 2 – 13 July 2001: Final workshop on Regional Data Bank, HYDATA, Electronic Networks and website (organized by the PRC with support from the Technical Assistance).

Other training events originally planned were not held for different reasons. The training on WMO Global Telecommunication System (GTS) was cancelled as during the project implementation it had been agreed that other system should be used for data transmission, notably e-mail and Internet. The planned training at PRC for seconded staff from the NHSs has been replaced by training visits carried out by experts of the PRC to the various participating countries in mid 2001. These visits allowed several staff to be trained in each country, rather than having only one seconded staff to the PRC as originally planned in the project document. These training visits allowed also discussing with NHSs specific problems and, when possible, to solve them, such as in the case of specific data transfer related problems.

Although the training programme implemented in the framework of the project has no doubt helped the participating countries in increasing their expertise and capacity in dealing with data collection and management and in the production of hydrological information. Participating countries expected more extensive training programme, particularly concerning installation, operation and maintenance of DCPs.

The training visits allowed to overcoming partly these problems, as in each of the training events several NHSs personnel were involved (total 61 trainees in all the participating countries), including those directly involved in the subject of the training.

Lessons learned

The implementation of the training programme was not perfectly coordinated with other project activities. In particular the time elapsed between the training on DCP maintenance and installation and the actual delivery of the equipment to the countries (also caused by custom delays) was important and therefore some re-training happened to be necessary.

Another problem encountered in the implementation of the training problem is related to the qualification of the trainees, as often their qualification and expertise was not the best responding to the requirement and scope of the training offered, and to the lack of staff continuity, as some trained staff was subsequently assigned to other tasks

for which the training received was less relevant. Selection of trainees and their subsequent assignments were exclusive responsibility of the National Hydrological Services, and the project had no say in these decisions.

4.6 Creation of Regional HYCOS center

The work of the Pilot Regional Centre has been greatly appreciated by the participating countries, which have recognized its professionalism and its availability to promptly supply assistance and advice in the various technical and scientific areas touched by the project, and in particular the installation, commissioning and maintenance of the DCPs.

The PRC has also ensured a continuous monitoring of the performances of the DCP network, alerting when necessary the responsible NHSs to take the necessary action. PRC also established and managed the Regional Data Bank and the project Web site. It was always ready to introduce the necessary modification in their structure and appearance in order to improve their use by the project partner. In particular it carried out a major redesign of the Web site, in order to overcome problem of excessive slowness and difficult access to country data.

Lessons learned

The role of Project Regional Center (PRC) was crucial for the success of SADC-HYCOS. Besides creating and maintaining the spirit of co-operation among the participating countries the PRC also played a vital role in the implementation of the project. Its role covered a varying range of the project activities.

It can have the prime responsibility with a proposed Project Management Unite the day-to-day project implementation or may be limited to co-ordination of the project and some specific issues, such as the management and update of regional database and the operation of the Internet server of the project**.** The life duration of the PRC is a decision of the countries, which might decide to transform it into a permanent structure for supporting integrated water resources management, especially at the river basin scale.

5. CONCLUSION

In general all countries participated actively in the project and made available staff and other facilities required for the project implementation. Staff attended training events both in country and abroad, support was provided to the PRC and technical assistance when they were carrying out country visits.

Some delays were experienced in carrying out the civil works required prior to the installation of DCPs, due to problems in securing and allocating the required funds. The same financial problems affected the field visits for station inspection and maintenance, which had been carried out regularly only in few countries. The main weakness in the country input to the project activities has been the lack of data validation.

With respect to the objectives set at the beginning of the project, the project results can be summarized as follows:

- A network of real time hydrological data collecting stations has been installed and commissioned.

- The data exchange facilities among the countries have been improved.

- A Regional Data Bank has been created, and made accessible through Internet however the date therein contained has not been validated.

- Through the training on data management software the countries have acquired the part of the skills necessary to improve their own national data banks.

- Several training events have been carried out, and it is recognized that the training needs of the NHSs in the participating countries could not be completely satisfied.

- A Regional centre has been established and the participating countries have largely recognized its usefulness.

- The only expected result that not satisfactorily achieved is the preparation of hydrometeorological information products. As already explained in view of the poor status of the observing network in the region it was decided to give priority and to devote more financial resources to the reinforcement of the collection of baseline data, while the production of hydrological information products is given a more prominent role in the second phase of SADC-HYCOS.

WORLD METEOROLOGICAL ORGANISATION

Monitoring and Supervision contract
Project 7 ACP RPR 600/1 SADC-HYCOS

Final financial statement in ECU

A. Fixed Unit Price in ECU

1. WMO experts and staff cost (including salary, social cost and WMO support cost)

7 months x 12,100 =	€ 84,700

2. Average local allowance for hotel and subsistence in:

SADC sub-region	75 days x 105 =	€ 8,925
Europe	15 days x 105 =	€ 1,575

3. Lump sum allowance for other mission costs (local transport, telecommunications, etc) € 2,000

TOTAL A (fixed unit prices) € 97,200

B. Reimbursable Costs (supporting document)

Airfares - Return trip Europe and flights in the SADC sub-region	€ 17,242.67
Travel in Europe	€ 440.72
TOTAL B (reimbursable costs)[1]	**€ 17,683.39**
NET (A+B)	**€ 114,883.39**

C. Contingencies (airfare increase and possible extra services to be expressly authorized beforehand by the Commission)

€ **0.0**

TOTAL DUE TO WMO € 114,883.39

[1] Our letter 11.213-02/H/SADC-HYCOS dated 13 February 2002 and subsequent exchange of e-mails between Mr P. De Rouck (EC) and J. M. Fritsch (WMO)

WORLD METEOROLOGICAL ORGANISATION

Monitoring and Supervision contract
Project 7 ACP RPR 600/1 SADC-HYCOS
Final financial statement in ECU

Detail of the payments received from the European Commission to WMO

Installment	Contractual requirement	Amount paid on	Amount Received
30% of A) + B)	60 days after signature of the Agreement	2.05.97	€ 35,760.00
30% of A) + B)	After approval of the first 6-month report	26.6.98	€ 35,760.00
30% of A) + B)	After approval of the third 6-month report	23.04.02	€ 33,643.39
10% of A) + B) and contingencies	After approval of the fourth 6-month report	€ 0.0	€ 0.0
	Total received until 1 September 2004		**€ 105,163.39**

Total amount claimable by WMO	**€ 114,883.39**
Total amount received	**€ 105,163.39**
Amount due for payment	**€ 9720.00**