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PROGRAMME DEVELOPMENT REPORT

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Developing capacity for applied agricultural meteorological data collection and analysis in Eastern Africa.

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Organisation

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Final technical report on PD139
Developing capacity for applied agricultural meteorological data collection and analysis in Eastern Africa.

Roger Stern,[1] Simon Gathara[2] and Ian Dale[1]

Summary

The purpose of this project is to enhance the skills of staff at National Meteorological Services (NMSs) in Africa, so they are able to contribute, as full partners, to research and development projects that are concerned with climate variability and climate change in their country.

A series of activities was funded under PD139 to support progress towards this goal. Most were based in Kenya and were managed by staff from the Kenya meteorological Department (KMD). These activities included training courses for staff from 25 of their stations. This was so computerisation of the climatic data could be done locally, rather than being sent on paper to the headquarters.

A pilot survey was undertaken of 37 of the 600 volunteer stations that collect climatic data. This was to improve understanding of their needs and possible contributions to the national database of climatic information.

Three of the activities were in the UK and they are more concerned with the analysis, rather than the entry and management of the climatic data. These were the development of e-learning materials, the updating of a user guide for the analysis of climatic data, and the provision of a climatic component to a new electronic statistics textbook.

The conclusions are highly positive. KMD was able to use the relatively small funding to make major strides towards a decentralised system. For data entry, and basic computing skills, their results confirm that similar developments in other countries could draw on local resources, or on staff from other Met Services in the region.

The pilot e-learning materials were given to staff from 12 countries, prior to the start of PD139. This was to test their effectiveness in teaching staff the skills for analysing climatic data. Their success was due partly to the enthusiasm of the staff, but also to the ever-improving levels of computerisation and communications in the countries. The new materials developed under PD139 make us enter 2006 with great hope.

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[2] Institute for Meteorological Training and Research (IMTR), Kenya Meteorological Department.

Acronyms and Abbreviations

APSIM	Agricultural Production Systems sIMulator
CARE	CARE International (an independent humanitarian organisation)
CAST	Computer Assisted Statistics Teaching
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro de Investigación Agricola Tropical
DFID	Department for International Development
DSSAT	Decision Support System for Agrotechnology Transfer
e-SIAC	e-learning version of SIAC
FAO	Food and Agriculture Organisation
FFS	Farmers' Field Schools
HQ	HeadQuarters
ICRISAT	International Centre for Research in the Semi-Arid Tropics
IMTR	Institute for Meteorological Training and Reseach
KMD	Kenya Meteorological Department
MDGs	Millennium Development Goals
NMS	National Meteorological Service
RRSU	Regional Remote Sensing Unit (SADC)
SADC	Southern African Development Community (14 countries)
SIAC	Statistics in Applied Climatology
SSC	Statistical Services Centre (University of Reading, UK)
UKMO	The Met Office (UK)
WMO	World Meteorological Organisation

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5.	Report on 1st KMD Training Workshop for Outstation Staff (May 2005) - IMTR	Bernard Chanzu, Simon Gathara, David Muchemi
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7.	Report on 3rd KMD Training Workshop for Outstation Staff (Nov/Dec 2005) - IMTR	David Muchemi, Simon Gathara
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Resource Materials on the CD

Item	Title	Author
1.	CAST (Computer Assisted Statistics Teaching)	Doug Stirling
2.	Instat version 3.30 installation file	
3.	Link to e-SIAC 'lessons' (Flash format)	
4.	Training notes from KMD Workshops for Outstation Staff	

1. Background

Kenya Meteorological Department (KMD)

The structure of the NMS in Kenya is typical of many meteorological ('met') services in Africa. There is a large headquarters in the national capital (Nairobi), and there are 35 subsidiary stations (a mix of synoptic and agro-met stations) around the country, manned by NMS staff. These stations observe and record a range of climatic variables on an hourly, 3-hourly, or half-day schedule.

In addition there is a large network of volunteer stations, most of which record just rainfall data on a daily basis. In Kenya there used to be 2,000 such stations, but this has decreased, partly through lack of resources for support from the NMS. There are currently about 600 stations still active. They send daily rainfall data to the headquarters on a monthly basis.

Until recently the activities of the NMSs have been dominated by short-term forecasting, both for aviation and to provide the daily (and other) forecasts for the general public. A more recent activity has been the provision of a seasonal forecast. These activities have largely required skills of physics and meteorology, and have benefited from the centralised nature of most African NMSs.

Issues of climate variability and climate change require data management and statistical skills. The data collection and computerisation could benefit from some decentralisation of the activities of the NMS. Decentralisation could also benefit the analyses of these data and the dissemination of results. This is particularly for agricultural activities, but also for issues such as rainwater harvesting, and renewable energy.

Decentralisation requires that the individual met stations have computers, have reasonable communications, and that the staff in the stations have the necessary computing and statistical skills. Until recently this has not been possible.

In early 2005 the UKMO funded the provision of computers[3] for all 35 of KMD's out-stations. Project PD139 (this project) has provided resources to develop initial training courses for the staff from these stations.

Statistics in Applied Climatology (SIAC)

Once NMSs have well-managed data, SIAC provides training in the key statistical skills needed to process the climatic data. Until 2000, SIAC training consisted of a ten-week work-shop conducted by the SSC in Reading, UK. Since then, IMTR has conducted SIAC annually as a regional course. SIAC in IMTR[4] has been supported by the UK Met Office and others.

A problem with SIAC was the long period of training, which was largely necessary because of the initial lack of statistical skills of NMS participants. The long courses put a limit on the number of staff who could be trained. With decentralisation and distance-learning develop-ments, many more NMS staff and other users of climatic data would benefit from training to strengthen their data analysis skills.

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[3] These were second-hand computers supplied through ComputerAid (a UK charity). The machines were a mixture of Pentium 2 and Pentium 3 PCs, and entirely adequate for the work envisaged by KMD. ComputerAid has now opened an office in Kenya that provides support.

[4] A version of the SIAC training has also been given by AGRHYMET (Niger) for Francophone countries in 2002 and 2004, by the Algerian Met service in 2003 and 2005, and by the RRSU (Regional Remote Sensing Unit, Botswana) for SADC countries in 2003 and 2004. These courses/workshops have all also received some support from the UKMO.

In 2004 the UK Met Office (UKMO) agreed to consider funding an e-learning version of SIAC. This is intended to cover the first 4 weeks of the earlier SIAC training. It is designed to be for many staff, particularly those in out-stations. The regional training such as is given at IMTR will probably remain, as a 4-week workshop, to develop further skills. This would be for a smaller number of staff, mainly from the headquarters.

2. PD139

Table 1 is from the DFID RD2 form, and gives the outputs from the activities under PD139.

Table 1. Activities specified in PD139, July 2005

Activity	Purpose	Utility	Outputs - OVIs
1:HQ workshop[5]	Train support staff at 9 stations	Current and historical data entered locally	Training notes. Course report. Details of number of stations entering current and historical data locally
2: Provincial workshop	Train station staff from 10 stations	Current data entered locally	Training notes. Course report. Details of number of stations entering current data locally
3: Pilot survey of volunteer sites	Assess needs and resources	Improved knowledge of rainfall database	Report, including plan for future census.
4: Climate and crop models	Evaluate use of Marksim & ApSim. Develop skills of KMD staff	Support future research using these tools	Technical report of the tools. Report of practicality of NMS role in supporting activities that use these tools.
5: e-learning modules	Training materials on applications for local NMS staff	Training course for multiple groups from November 2005	Report on monitoring of initial modules. New modules on web site.

For completeness, the relevant pages of the RD2 form are given as Appendix 1.

Some other activities were linked to PD139. They are listed in Table 2 and are also reported.

[5] This is a second workshop for the staff from these stations. The first workshop was also supported by NRSP and is specified in Table 2.

Table 2. Other activities reported

Activity	Purpose	Utility	Outputs - OVIs
1. 4 participants supported for SIAC Nairobi workshop	Train application staff in utility of climatic information	Broaden SIAC to include staff from application areas	Reports from participants following workshop.
2: HQ workshop	Train support staff at 9 stations	Current data entered locally	Training notes. Course report. Details of number of stations entering current data locally
3. Instat Climatic Guide updated	Use in NMSs	Key element of training courses and applications	Updated guide in printed form and on CD.
4: CAST adapted for teaching climatic data analysis	Include with e-SIAC and other training courses	Improved teaching of difficult statistical concepts	CAST supplied on CD.
5: Moodle course management system set up in Nairobi	Manage/monitor IMTR courses including SIAC	Improved records on training courses	IMTR activities using Moodle.

In Table 2 activities 1, 2 and 3 were funded by NRSP in 2005, prior to the start of PD139. Activities 4 and 5 were added to PD139 in October 2005.

These activities are reported in Sections 3 and 4. In the final section we assess how well the Outputs in Tables 1 and 2 were achieved.

3. Activities in the UK

The under-utilisation of data is a general problem. It is not just for climatic data, nor just for data collected in Africa.

Partly through PD139, we begin 2006 with three new powerful developments, designed specifically to improve the analysis of climatic data in Africa. They are as follows:

- An e-learning approach to transferring the skills needed to process climatic data
- An electronic statistics textbook (CAST) adapted for the teaching of climatic analysis
- A new version of the Instat statistical software package, with an updated climatic guide in printed and electronic form.

In each case, as described below, the support by NRSP was complemented by support from the UKMO and from the Statistical Services Centre. The resulting combination of products enables us to start 2006 in a spirit of great optimism.

These three developments are described in turn. Overall it is for the reader to judge whether they could even serve as an example – i.e. the analysis of African climatic data could provide a model that other application groups in the region could follow.

e-SIAC

This is a facilitated, distance-learning course, comprising eight modules taken part-time over about three months. Details of the structure of the course are supplied as Appendix 2 and are also on the SSC website (http://ww.ssc.rdg.ac.uk/courses/siac).

The 8 topics in e-SIAC are as follows:

Topic 1: An introduction to SIAC and its aims; getting started with e-learning

Topic 2: Using the statistical software package Instat

Topic 3: Acquiring and preparing daily datasets for analysis

Topic 4: Producing a report or presentation

Topic 5: Thinking statistically: describing data well (descriptive statistical methods)

Topic 6: Turning data into information: tailoring products for specific applications

Topic 7: Thinking statistically: making generalizations (statistical inference & modelling)

Topic 8: Preparing a portfolio of products; working with the public

In the preparation of these on-line training materials the aim has been to produce a top-quality yet entertaining course. We have been realistic in assuming that participants in Africa have limited speed of access to online materials. But, as e-learning is taken 'at home', participants need to be involved and entertained, otherwise they may give up. This is particularly with a subject that is often dreaded, as is the case with statistics.

The UKMO funded the development of the first three topics, and a pilot run of the first three weeks was held in July 2005, for 26 staff from 14 African countries. Most (23) of the participants then attended the face-to-face SIAC workshop in Nairobi in August 2005.

Evaluations were made of these initial materials, by the participants, by a lecturer from the University of Nairobi, and by a representative of the UKMO. The essentials of the resulting report are in Appendix 3, and the full report is on the CD. The evaluation was very positive[6] in terms of the training materials[7], and the style of the course. We were relieved that all the participants were able to access the Internet and other training resources, though for some, this was only with difficulty.

The e-SIAC course runs within the Moodle course management system or 'learning environment', which was installed for our use on a computer at the University of Cape Town, South Africa. Moodle provides facilities for managing the training materials (Fig. 1) and also for monitoring the progress of the participants (Fig. 2).

A noteworthy outcome was that many of the participants carried on using the system to exchange information, after the e-SIAC course finished. Fig. 2 was captured on 3 January

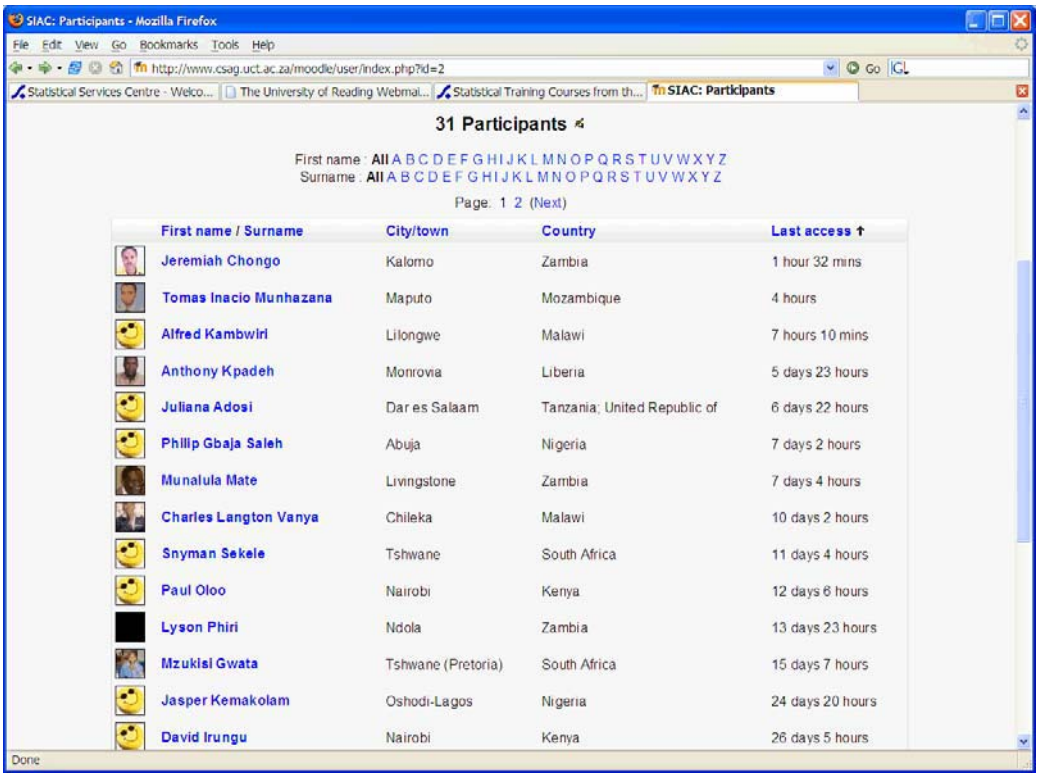
[6] The teaching materials were supplied on CD as well as being available over the web. These were appreciated, but will be made easier to access in future runs. The discussion forums were very popular, despite being novel, and will still need web access. The blended mix of e-learning and face-to-face workshops was particularly appreciated. Hence it is expected that in-country workshops might supplement the full e-SIAC, once developed.

[7] As was inevitable, the evaluations revealed many small improvements that could be made to the teaching materials. The updates have since been funded by the UKMO and will be used in the February 2006 training.

2006, and showed that many were still using the system even over the Christmas period – four months after the end of the course.

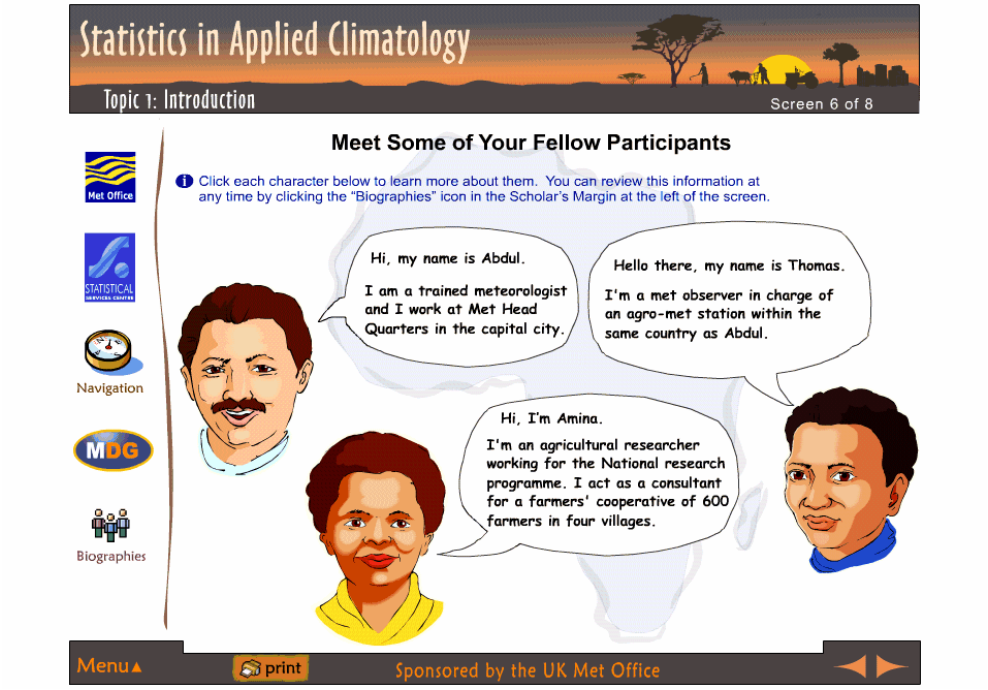
Fig. 1. Information within the Moodle learning system, once participants have logged into e-SIAC

Fig. 2. Moodle gives information on participants



Typical participants could be from the NMS headquarters, from an outstation, or they could be a user of climatic information. Fig. 3, captured from Topic 1, shows 3 typical (though fictitious) participants who discuss many of the issues, throughout the training materials.

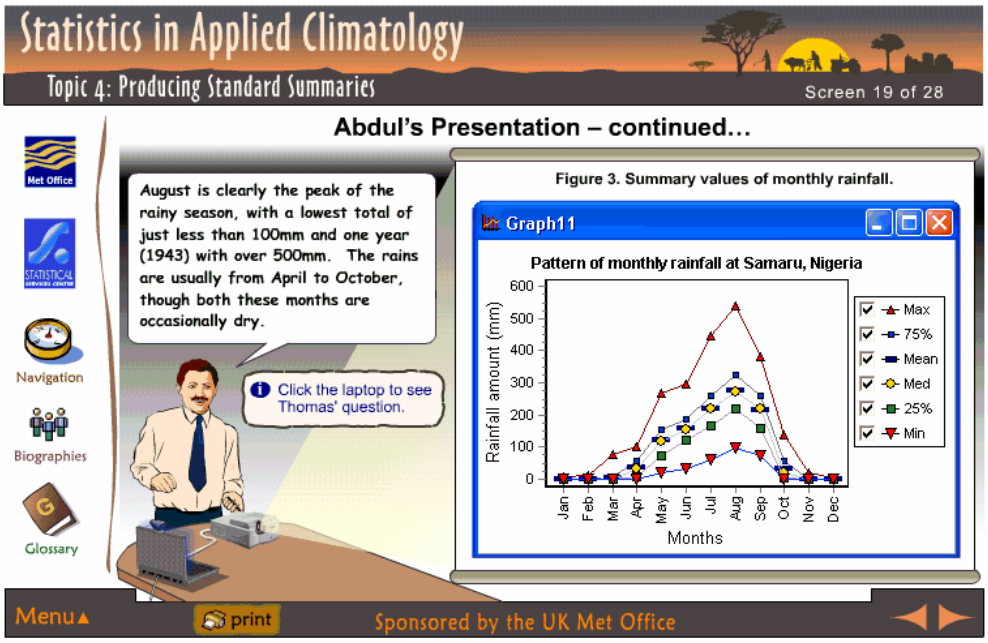
Fig. 3. Typical participants introduced in Topic 1 of e-SIAC



Funding from PD139 enabled Topics 4 and 5 to be developed.

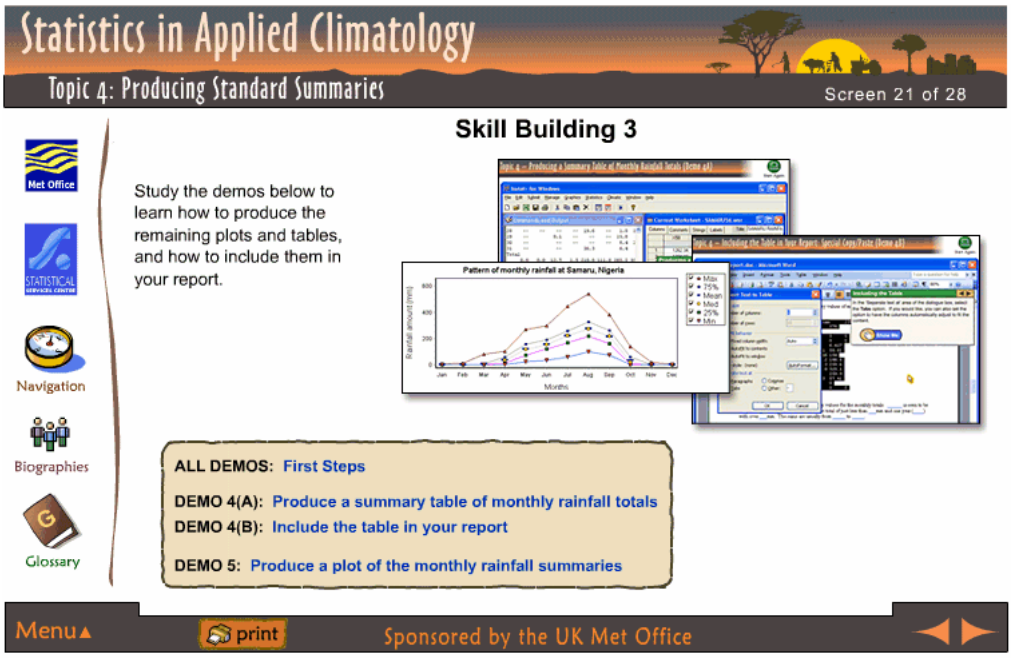
The main work in developing each Topic adapts materials from the previous face-to-face teaching. These are translated into storyboards, and then put into an html/flash format 'lesson'. Examples of the screens from the Topic 4 lesson are shown in Figs 4 and 5.

Fig. 4 One screen from Topic 4 – Producing a report or presentation. In this screen, clicking on the laptop (lower left) overlays a question from a (fictitious) participant.



Some of these screens link to practical demonstrations that simulate the tasks the participants have to do later on their own data. An example of such a screen is shown in Fig. 5.

Fig. 5. Some screens lead to simulations or demonstrations of common tasks



Other activities for the participants include quizzes and assignments. An essential component of each topic is that the participants produce some work, or a topic for discussion, that is aired on a forum.

The evaluation of the pilot, and the contribution from PD139, have resulted in the UKMO's agreement to fund the remaining Topics (6 to 8), with the work to be completed by March 2006. The second trial of the materials will start on 6 February 2006 and includes Topics 1 through 6. The UK Met Office will fund the participants. Each participant is sent a 'resource pack' for the start of the course, comprisisng:

- A Participant's Guide to e-SIAC
- The Instat Tutorial Guide
- The first 7 chapters of the Instat Climatic Guide
- A CD containing all the software, including CAST, and other training materials that are difficult to download on slow Internet lines.

A copy of the resource pack is included with this report.

The first full run of all eight topics is scheduled from 24 April 2006. The e-SIAC training is intended to be a useful course in its own right. It is also a pre-requisite for participating in the face-to-face SIAC training workshop run at IMTR, in Nairobi, from 21 August 2006.

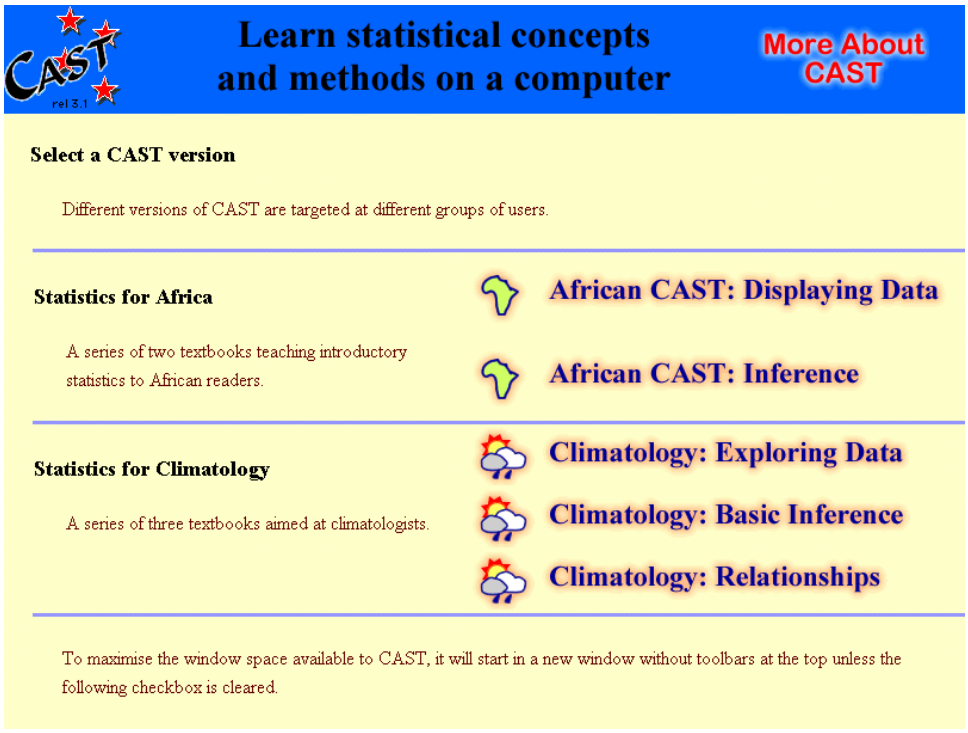
CAST – Computer Assisted Statistics Teaching

CAST is an electronic statistics textbook developed at Massey University, New Zealand, and available since 2000. A recent innovation has been the adaptation of some of the contents of

CAST to fit a new syllabus for teaching statistics to agriculture students in Africa[8]. The Rockefeller foundation has funded this development, and Massey have agreed that the CD version of the software may be distributed freely in Africa.

From this adaptation, it became clear that further changes could be made, to enable a version to be specially adapted to teaching climatic statistics in Africa. Fig. 6 shows the resulting introductory screen.

Fig. 6. Introductory screen to CAST for statistical climatology



One key feature of CAST is that the text and static figures of an ordinary book are supplemented by dynamic pictures, where the user can experiment and see the resulting changes immediately. There are over 300 of these 'Java applets' in CAST and this interaction helps enliven the teaching.

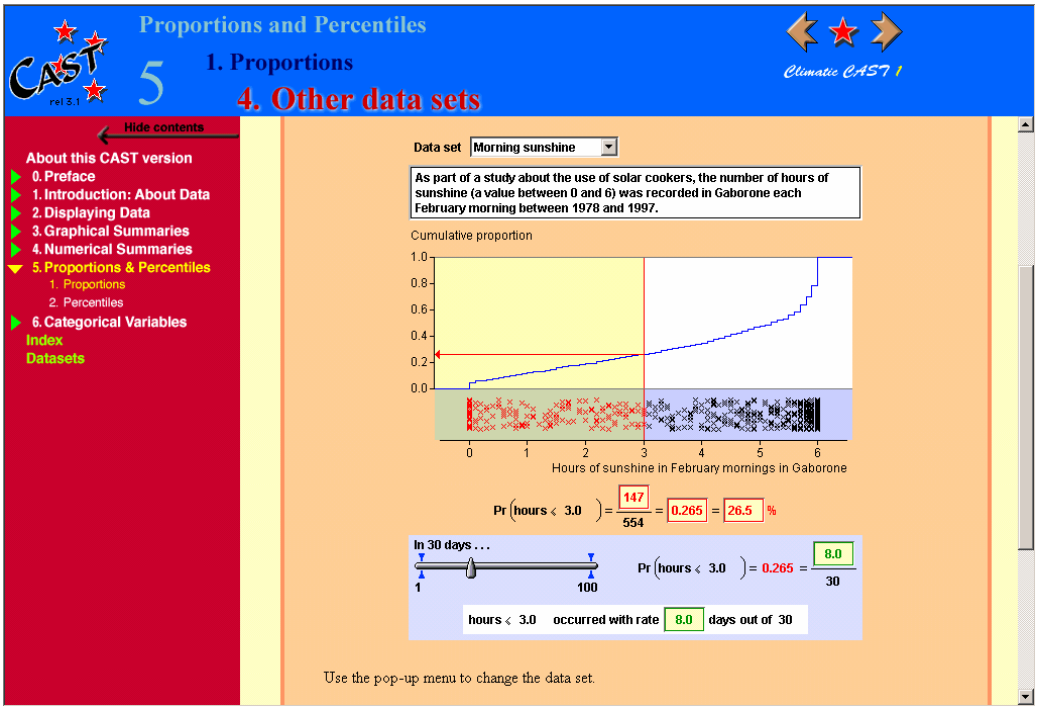
In the SIAC course in August 2005, a group of participants was given CAST and asked to evaluate its potential for teaching climatic statistics. They were very enthusiastic, provided some materials could be adapted, and datasets changed to reflect problems in Africa. Their report is in Appendix 4.

The funding from PD139 paid for three weeks of developments on the climatic version of CAST. This was used mainly to develop a new section of the book, shown in Fig. 7. (The new section uses climatic data from Botswana and Nigeria.) Prior to this there was nothing devoted to calculating risks and return periods, a topic that is key to the analysis of climatic data. It is hardly taught in a standard statistics course, and many students find it difficult. So it is an ideal topic for the sort of practice that could be encouraged within CAST. It is a key part of Topic 5 of e-SIAC.

[8] Parin Kurji, lecturer in statistics from the Crop Sciences department, University of Nairobi, has developed this new undergraduate syllabus, with some inputs from the SSC, Reading. Mrs Kurji has become a key resource person on the SIAC training in Nairobi, and has included many climatic examples in her University teaching. She was contracted by the UKMO to evaluate the new e-SIAC materials.

Fig. 7. Introductory screen from the new section

Fig. 8. Dynamic applets allow participants to experiment.
In this figure, the red line in the graph can be moved, to different hours of sunshine, and the slider can be moved to experiment with different interpretations.



A dynamic applet is shown in Fig. 8[9]. The nine new subsections (five of which appear in Fig. 7) contain 18 applets in total.

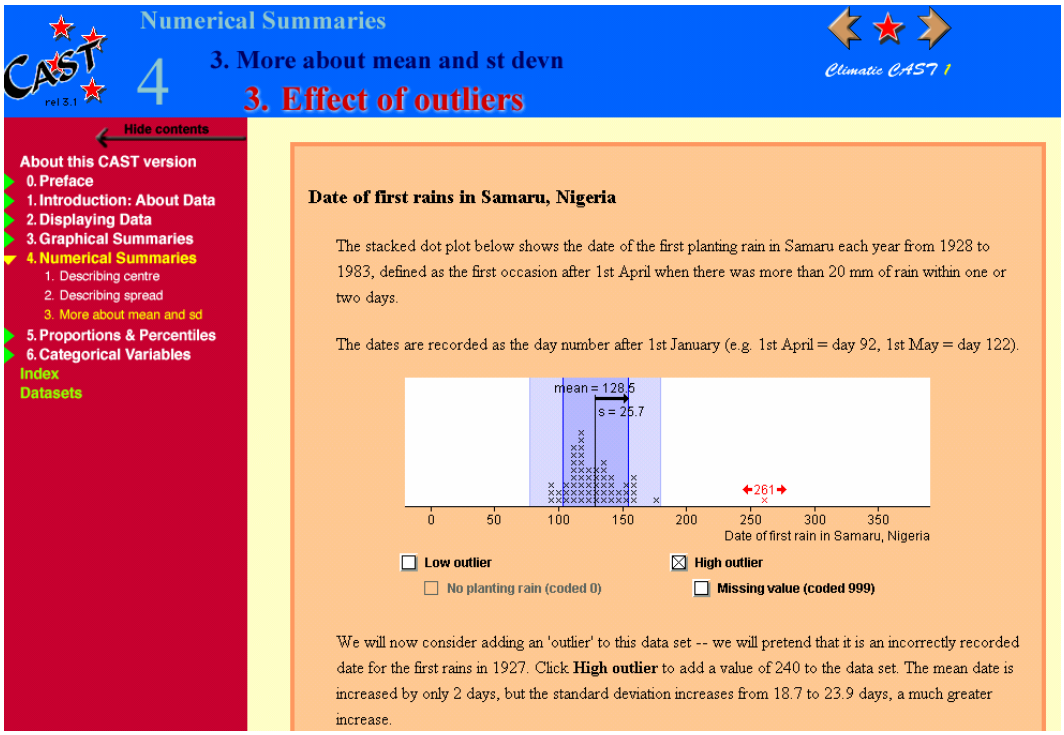
[9] It shows the cumulative graph for the number of hours of sunshine in the mornings at Gaborone, Botswana. The application is to the use of a solar cooker, which needs 3 hours sun to cook rice. The participant can switch between 5 different datasets, to show the generality of the ideas. Within a dataset the slider in the cumulative

Since the funding under PD139, the UKMO has funded the developers to continue the adaptation of CAST for climatic analyses. Their input was used to add climatic datasets throughout the 'Exploring Data' part of the book, and to develop materials that could help participants appreciate the interpretation of the variability of a dataset. The example in Fig. 9 shows the sensitivity of the mean, and particularly the standard deviation, to oddities in the data.

The current version of CAST is on the CD supplied with this report. It will be used to supplement the training materials on the e-SIAC course in Topic 5. We anticipate that this resource could be used very widely in Africa.

A preliminary version of the CAST components developed under PD139 was used – and was popular – on the statistics course given in November 2005 to undergraduate agriculture students at the University of Nairobi. This provides good evidence for the proposition made earlier that climatic examples might leap to the forefront, and become useful for applications in other areas.

Fig. 9. Further materials added to CAST from UK Met Office funding. In this applet, outliers and other oddities can be added and moved, to study their effect on the mean and standard deviation.



Instat Climatic Guide

Instat is a general statistics package, with an extra menu designed specifically to support the analysis of climatic data. It is designed to complement rather than compete with the standard commercial statistics packages. Instat is designed particularly:

- To introduce the world of statistical software to users who need more than a spreadsheet for their data analysis.
- To support the teaching of statistics.

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graph can be moved to a different point in the distribution, and the second slider at the bottom of the figure can be changed to consider alternative presentations of the result.

- To support the analysis of climatic data, see Fig 10.

It has always formed the cornerstone of the SIAC workshops and is used routinely by many NMSs in the developing world. The UKMO and the SSC recently supported the upgrade of Instat to Version 3 for Windows.

Fig 10. Climatic menu, showing 'Extremes', one of the many new features in Instat Version 3.

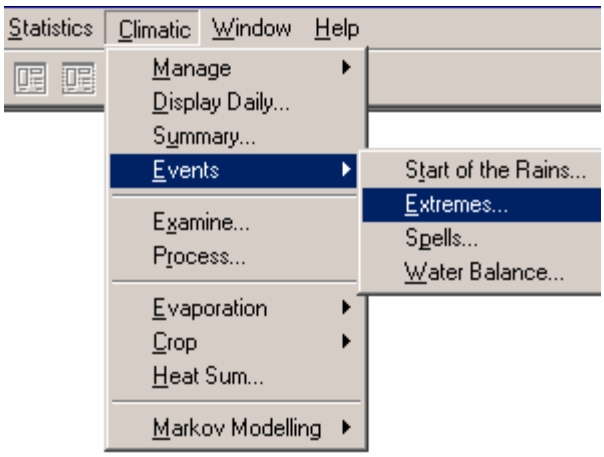


Fig. 11. The Help menu, showing the Climatic Guide is available in both pdf and help formats.

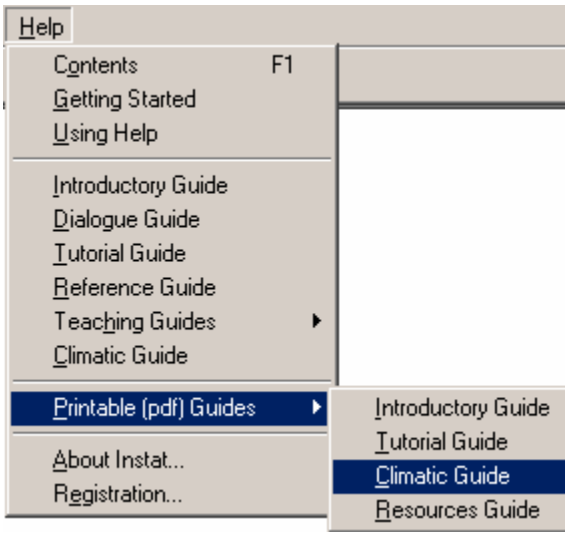
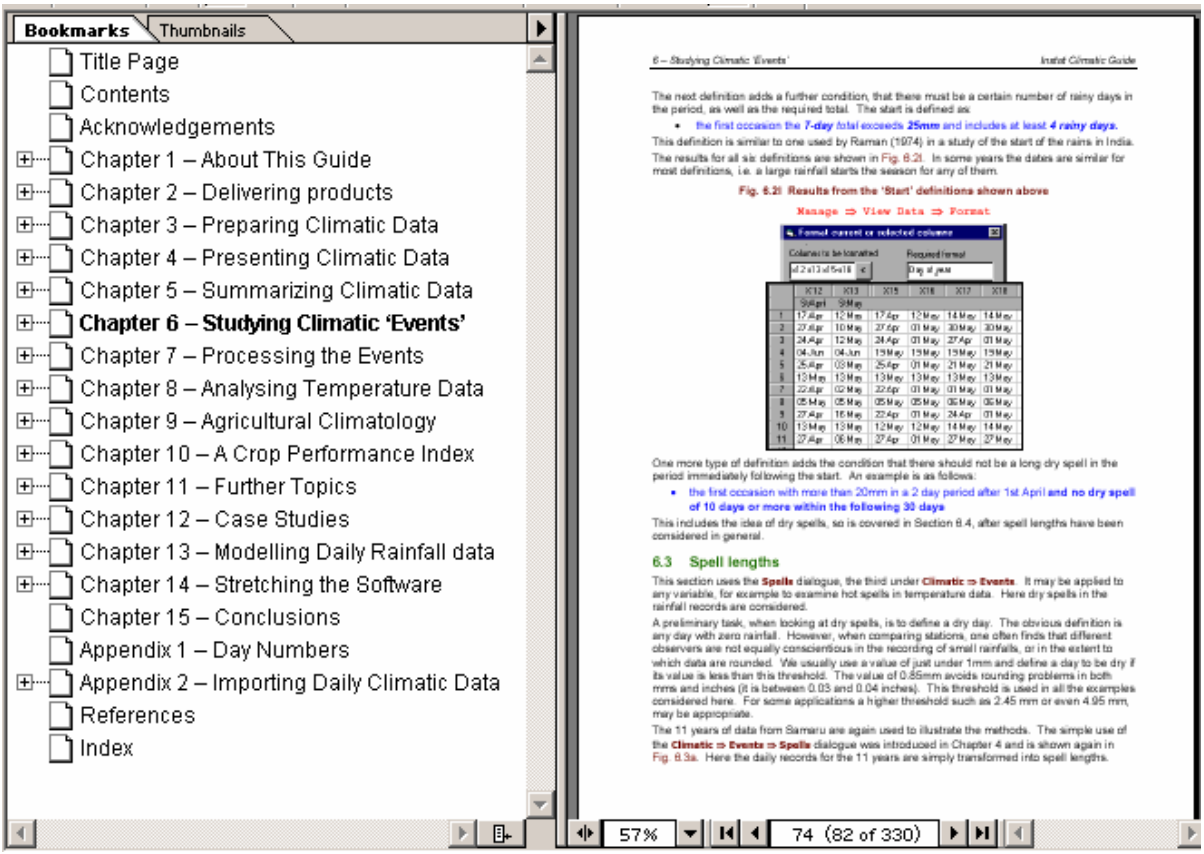


Fig. 12 Contents of the new climatic guide



One feature of Instat is the help system, which provides information as help files and also in pdf format for reading, or printing (Fig. 11). The documentation includes a 300 page climatic

guide, which had to be completely revised for the new version of Instat. This was funded by NRSP, though the final writing took far longer than had been anticipated. The contents of the new guide are shown in Fig. 12.

4. Activities in Kenya

At the start of 2005, NRSP paid for four staff to attend the four-week SIAC workshop in Nairobi in August 2005. They also contributed towards an initial training course for out-station staff. These activities are integral to PD139 and hence are also reported here.

Most of the activities under PD139, related to capacity building for KMDs outstation staff. There are typically ten staff employed per station[10], hence a total of about 350 staff. All staff have ordinary level education, plus the one year Middle Meteorological Technician Course (equivalent to WMO Class III Certificate). About one in three have received two years further training, giving them WMO Class II Certificate[11].

Initial training for outstation staff (9 stations)

In May 2005 a two-week training course was run for staff from nine of the stations, partly funded by NRSP. Part of the training was on climate data entry, using a software package called Climsoft[12]. This part of the training was very successful, in that seven of the nine stations are now entering their climatic data locally, using Climsoft, and sending their data via e-mail on diskette to the headquarters. The Climsoft software has been adapted to import these data.

The second part of the training was on simple applications using Instat, and did not work so well. The participants had started with few computing skills, and had reached saturation with the concepts needed to do the data entry and initial quality control of their data.

It was therefore decided that any future initial course, including those funded under PD139, should concentrate on the data entry and quality control. The course report is in Appendix 5.

Following this training, the UKMO is funding a small further trial at one of these stations. This is to use the mobile-phone technology to enable the station to transfer the computerised data to the HQ on a daily, or a within-day basis. If successful, it has many implications. Currently, in common with some other African countries, the data from agricultural meteorology stations is entered twice. It is entered in the HQ Ag. Met Section every ten days, to produce the bulletins through the season. The data processing section then enters it again, at the end of each month.

Attempts to integrate the two systems have been difficult, because of the pressures in the Ag. Met Section to release decadal reports as soon as possible, following the end of each dekad. The proposed new system would be of clear benefit to all parties that it should enable a harmonious advance to be made.

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[10] The airports (Kisumu, Mombasa, JKIA, Eldoret) have between 18 and 30 staff, while the purely agromet ones have 4-5 staff and the majority of others have between 7 and 9.

[11] Now referred to as Advanced Meteorological Technician.

[12] Since 1984, software called Clicom has been provided for NMSs to enter and manage their climatic data. This work has been supported by the World Meteorological Office (WMO). Climsoft is designed as a successor to Clicom. It is based on MicroSoft Access and all the programming has been undertaken by staff from NMSs in Africa, particualry from Zimbabwe, Kenya, Guinea and Botswana.

Training for staff from stations in Western Kenya

Two of the funded activities under PD139 concerned further training for staff from five stations in Western Kenya. In August and September, there were two one-week training courses for two staff from each station. One idea was to see how easily the training could be given within the region, and whether it was cost-effective. The first week was therefore based in Kisumu and was in collaboration with the University of Maseno. While it worked well, it was more expensive than bringing staff to the headquarters in Nairobi. This may not be the same in other countries, but KMD has an excellent training facility, including accommodation in 60 study bedrooms. So the second week of training was conducted in Nairobi. The second workshop also introduced the background to the pilot survey of volunteer stations. The ten students from Maseno University attended for this part. A report of the training is provided as Appendix 6.

Training for staff from other stations

In PD139 it had been planned that one training activity would be to consolidate the training for staff from the nine stations mentioned above. This would either be for further staff from those stations, or for the original staff to be trained in applications. However, this plan was changed after observing the success of the initial training. We had not expected that so many stations would be able to enter their data locally after just the one course.

Instead, KMD supplemented the funds supplied by PD139, to enable 11 staff members to come to Nairobi for training. Hence 11 of the remaining 21 stations benefited. The course was in November, slightly delayed because of the referendum in Kenya on the new constitution. A report of this training is in Appendix 7.

Overall, therefore the results on decentralisation concerning data entry have exceeded our expectations. The staff at the stations are appreciating the new challenges, and some stations have extended the work to the entry of their own historical data. A summary of the current state concerning local data entry is in Appendix 8.

A second bonus is the extent to which Climsoft, the new data management system, is holding up in Kenya[13]. It was adapted for the decentralised data entry and has clearly become a solid product, available, both in Kenya, and for other countries.

The terms of reference of PD139 stipulates that the notes for the training courses would also be made available so other countries could make use of them, should they decide to emulate the type of development. They are provided on the CD that accompanies this report.

The progress on capacity development in relation to applications has not proceeded as quickly as this, but we hope this will change in 2006. As a trial, three members of staff from these out-stations are to become participants on the next e-SIAC course, in February 2006[14]. We will evaluate their progress.

[13] Until late 2004, Climsoft development in Kenya was done by Samuel Machua, who is now on a 2-year post at the NMS in Botswana, with Commonwealth funding. In Kenya, David Muchemi has excelled, both in terms of the necessary developments to Climsoft needed for the decentralised data entry, and for his dedication in the training programme.

[14] Staff in Botswana are in a similar situation and 3 staff from their outstations are also likely to be included on the February e-SIAC. Funding is from the UKMO.

Sample survey in Western Kenya

A further activity under PD139 was a pilot survey, to learn more about the volunteer stations. This was linked with the training for the staff from the five stations round Kisumu, and 37 volunteer stations were visited.

Previously these volunteer stations were seen primarily as sources of data for the station network in Kenya. With the new role of KMD being more service orientated, it was clear, from this survey, that there is also much that KMD can provide to support the climatic activities in these stations.

The survey team included a member of staff from the nearest met station and two statistics students from Maseno University. Thus ten students were involved in the study. A report was prepared, for each of the 5 met stations, that detailed the findings at each of the 37 volunteer stations. David Muchemi (KMD), Parin Kurji (University of Nairobi) and Elly Bodo (University of Maseno) also prepared an overall report, included as Appendix 9. The individual station reports are on the CD.

Although this was only a pilot study, the findings were exciting to all concerned, as is clear from the report in Appendix 9. KMD support could be provided by the nearest KMD station, rather than always being directly from the HQ in Nairobi. Part of the difficulty of giving centralised support has been the large number of stations, and the distances from Nairobi[15].

There is clearly enormous potential to improve the application of climatic information through these volunteer stations and, at the same time, improve the network of observations. The costs would be relatively modest, compared with those involved in setting up new stations. Some organisations visited would be prepared to fund improvements themselves, because it is in their own interests.

The method of doing the survey was also very cost-effective, and the statistics students from the University of Maseno appreciated the useful work experience they were gaining.

Research activities

This activity was for HQ staff and took place in September and November 2005. It concerned the use of simulated climatic data, using software, called MarkSim, prepared by the CGIAR centre, CIAT. MarkSim provides daily climatic data for any location, that feeds into the crop simulation models, such as DSSAT and ApSim. The PD139 funds were used to obtain copies of MarkSim, DSSAT and ApSim, for KMD.

It had been expected that John Dimes, who used to work for the ApSim team, would be the main facilitator for this activity. He conducted a one-day introduction in September, which gave rise to considerable enthusiasm in the Ag. Met Section. The main activity was a one-week workshop, facilitated by Andrew Farrow from CIAT which was held at the end of November. His report is in Appendix 10.

This workshop had a clear focus in relation to the FAO 'Farmer Field Schools' in Kenya. Each school involves applications chosen by a group of villagers and facilitated by an agricultural extension officer. The activities cover a year and are sometimes extended.

[15] The Botswana Met Service has 16 outstations, each, like Kenya, with an average of about ten staff.. There are about 400 volunteer stations, each of which is attached to the nearest station, rather than the headquarters.

Climatic information does not feature, and an ICRISAT-led project[16] is investigating the potential for adding a climatic component to the activities at some of the schools.

For PD139, this activity had two separate objectives. The first was to explore the potential of MarkSim and the crop modelling software. It is clear they both have great potential.

The second was to explore the potential of KMD to be full partners in activities that involve the application of climatic data, perhaps using complex software. This was partly successful and pointed to further priorities for KMD staff.

- The KMD staff were able to supply their data in reasonable formats, though time was lost in this process. Regular practice by the staff in analysing their own data would support more efficient use of their time.
- Gaining access to the data is no problem, once KMD staff are working in partnership.
- KMD staff largely treated the workshop as an opportunity to gain skills, with the facilitator taking the role of chief instructor. They will be ready to be full partners in development projects only once they have these skills or have sufficient experience to share skills as they are gaining them.

SIAC participants in Nairobi

DFID funded four staff to take the face-to-face SIAC training at IMTR, Nairobi. The staff were as follows:

- Alfred Kambwiri, CARE Malawi
- Jeremiah Chongo, CARE Zambia
- Meleck Mwano, Sokoine University, Morogoro, Tanzania
- Munalula Mate[17], Zambia Met Service, (Southern Province), Livingstone, Zambia

They were all very dynamic participants and their presence was a success for SIAC. In each case there was a participant from the same NMS to work with the person from outside.

During the SIAC workshop the NMS staff strongly recommended that in future years, the SIAC workshop in Nairobi should have an equal split of NMS and applications staff. FAO has recently decided to include SIAC in their training schedule for participants from seven African countries, so this balance might be achieved. Reports on SIAC by some of these participants are on the CD.

Following the SIAC workshop, participants were invited to submit small proposals for follow-up activities. Only five proposals were submitted, but three out of the four participants funded by DFID were involved in their preparation. The UKMO has agreed to fund the proposal from Zambia, which is in Appendix 11. The key resource persons on this project are the three participants from SIAC, of whom two were funded by DFID.

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[16] NRSP supported an initial meeting in May 2005, to establish topics where proof-of-concept studies would be feasible. The concept is that the inclusion of climatic elements would affect the viability of different technologies. The farmer field schools was suggested as one of these topics. Being able to simulate climatic data appropriate for a village, and then use a crop simulation model could become one of the methods used.

[17] Titus Mutinda, Kenya,.was initially selected, as he was in charge of work in farmer field schools. When he was unable to attend, Mate was selected. He became known as the SIAC 'bus driver' because of his dynamism on the e-SIAC part of the course.

Moodle in IMTR

The Moodle course management system or 'learning environment' is an effective tool for managing the courses run by a training institute like IMTR. Courses can be a mix of face-to-face and e-learning, as suits the institute. IMTR was very keen to install Moodle on their local server to manage their regular courses as well as possibly to host e-SIAC and other e-learning courses in the future. Ian Dale spent a week in IMTR to support this development, providing training on Moodle and advice on implementation.

Moodle has to be installed on a web server. The visit was successful in identifying several weaknesses in the management and support of the computing network in KMD. Moodle was installed on individual computers in IMTR, but it was not feasible to run it over the current network. This will be possible when various network and software maintenance issues are addressed.[18] Staff in IMTR and KMD gained a basic knowledge of using Moodle, and some practiced installing course materials on the e-SIAC server at the University of Cape Town.

Earlier, the e-SIAC course had investigated the status of web sites for each country where staff from the NMS was a participant. It found that five of the countries did not even have an active web site. KMD does have a web site, but its fragilty is inexcusable for an NMS that hosts important regional activities. The face-to-face SIAC training is due to be run at IMTR in August 2006. However, SIAC 2006 will follow the e-SIAC and so participants will expect a much better standard of internet access than is currently available. Unless IMTR improves its network maintenance, it would be wiser to choose a different host site for the training.

5. Conclusions

Recent reports to DFID, e.g. Brew and Washington (2004)[19] stress the importance and scarcity of climatic data in Africa, but are not specific on how this can be changed. They concentrate particularly on the use of modelling to assess climate change, and the value of improving seasonal forecasts. We agree with these sentiments but claim that the mundane subjects of effective data management and simple climatic analyses are also important.

The activities supported in PD139 and by NRSP earlier, indicate how easily solid progress can now be made in these areas.

The project activities are broken into three types. This is in their own right and also to help the evaluation of these conclusions in relation to further possible projects that use climatic data in Africa.. The three areas are as follows:

- Activities related to climatic data entry and management
- Activities related to data analysis
- Activities related to research

These three areas are considered in turn. Before that, the specific outputs from PD139 and the earlier NRSP funding are listed, and compared with the intended outputs, given earlier in Tables 1 and 2.

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[18] Update (mid-January 2006): Moodle has now been installed on a web server at KMD headquarters and IMTR instructors have started to use it to manage their courses.

[19] African Climate Report: A report commissioned by the UK Government to review African climate science, policy and options for action.

Outputs

In Section 2, Tables 1 and 2 specified the activities together with the outputs and OVIs. Table 3 summarises how well the outputs were achieved.

Table 3. Meeting the outputs

Activity	Listed	Comment on activity and outputs
Participants on SIAC workshop	Table 2.1	Reports supplied as specified. Workshop very useful to participants, and they contributed well. Their proposal for follow-up activities in early 2006 is being funded. The proposal is attached.
HQ course 1	Table 2.2	Ran as planned, with report as output. Seven stations entering data locally. See CD for training notes.
HQ course 2	Table 1.1	Ran in November for staff from 11 new stations, instead of follow-up on 9 original stations.
		Course report produced. Training notes on CD.
Provincial workshop	Table 1.2	Budget and location of stations necessitated running for 2 staff from 5 stations, rather than 1 for 10 stations. Second workshop in Nairobi to simplify logistics. Report as output.
Pilot survey	Table 1.3	Ran as planned but for fewer volunteer sites (37). Individual and overall reports prepared as specified.
Climate and crop models	Table 1.4	Ran well, but later than planned (November). Practical and technical aspects combined in same report.
E-learning modules	Table 1.5	Report of initial course produced. E-learning modules on web site.
CAST materials	Table 2.4	Done as planned. New version of CAST supplied on CD.
Moodle in Nairobi	Table 2.5	Visit/training as planned; Moodle adopted by IMTR as its course management system.
Instat Climatic Guide	Table 2.3	Updated as planned. HTML version prepared for Instat help, in addition to printed and pdf versions.

The activities and reporting was ambitious for a project of such short duration. Work continued till December, and the reporting was completed only in January. The courses for staff from the outstations were sufficiently similar that it was only necessary to produce one set of training notes.

Two particular successes were the practicalities of local data entry, and the information from the pilot survey. We had not expected that transferring the entry of current data to the stations would be received so enthusiastically – and it appears to be working smoothly.

The potential of improving the system involving the volunteer stations is clearly enormous and does not necessarily require huge funds.

The introduction of Moodle into IMTR and the crop simulation exercise pinpointed areas for improvement by KMD. These were not a surprise, and it has been very useful for KMD to have these messages.

The positive report on the initial e-learning pilot was very encouraging. In particular we were pleasantly surprised by the internet access that the participants managed to achieve – though it took real determination by some.

We are optimistic that communications continue to improve in Africa. We await reactions to the new materials to be delivered in 2006, to see if they provide a real breakthrough in the teaching of basic statistics, and hence lead to improved processing of climatic data.

Data entry and management

These activities used Climsoft, which has been developed largely by staff from African met services. The software had to be adapted to a form that could be supplied to the staff at the outstations. KMD data processing staff handled all this successfully.

The visible activities were the training courses, given in Nairobi and Kisumu, to KMD staff from the outstations. KMD staff collaborated with staff from the Universities of Nairobi and Maseno to prepare and give these courses. The objectives were broader than capacity-building, and were to continue the process of decentralising some of the climatic activities of KMD, which started with the provision of computers to each station.

African NMSs (in collaboration with local Universities) now have sufficient expertise themselves[20] to undertake work in this important area. What PD139 added was a small financial injection to enable the KMD staff to conduct the in-country work in 2005. NMSs are also able to make contributions themselves[21] – this was needed to supplement the DFID funds for this training. It also provided a tight time-scale and a reporting mechanism that was useful to ensure the activities were completed as specified.

We strongly recommend that further work in Kenya and elsewhere in Africa should be driven in a similar manner.

The climate data management activities in Kenya were tightly specified by KMD staff themselves; each activity had a budget that was typically just £3000 (US$5000). One reason the activities were so well handled was the good team spirit and enthusiasm of the KMD staff. The KMD management were also very supportive, and were willing and able when necessary to supplement the PD139 funds to achieve their objectives. Having developed a 'system' for the type of activities in PD139, the NMS becomes better able to make a well-defined case for a larger budget for scaling up the work.

Budgets for proposed actions are often both large and vague. For example an 'Action Plan'[22] in 2002 gave the following budget to equip all NMSs in East and Southern Africa with a functioning database management system:

Item	Cost Estimate (US$)
Survey	50,000
Investigation for support for Data Management Centre	55,000
Implementation at NMHSs	5,000,000
Total	5,105,000

[20] There are also staff in Zimbabwe and Botswana with expertise in Climsoft. They recently installed the software and trained staff in the Pacific Islands.

[21] Funding for the computers (from ComputerAid) was from the UKMO. These computers have been a success and KMD has budgeted to buy 200 themselves in 2006.

[22] GCOS Regional Action Plan for Eastern & Southern Africa: Draft Project Proposals, prepared by a team of experts.

It is unclear that this type of injection of funds at a top level can be effective unless NMSs have started developments in a more precisely defined way, as was the case in PD139.

The time seems right for the types of developments undertaken in PD139 to be continued in Kenya and considered by other NMSs. The staff in the outstations provide a hidden resource that can support important 'bottom up' activities, while posing no threat to (indeed expanding) the existing more centralised work at the NMS headquarters.

What is suggested would not have been possible even a few years ago. The wide availability of new and second-hand computers, linked with the continuously improving communications, through the mobile phone and the Internet, is providing the new opportunities for staff in the individual stations to process their own data.

Data analysis

Merely computerising data locally would soon become dull, but adding the skills to analyse climatic data in ways that correspond to local needs is the next step. These analyses are crucial in their own right, and they also support the importance of insisting on good quality data. Unless data are analysed, the real problems are rarely identified and resolved.

While there are staff in NMSs with high level computing skills (as mentioned above), this is not paralleled by staff with similar strengths in statistical skills. In the short term, KMD has started constructive collaboration with statisticians from local Universities: this is something that could be emulated in other countries. However, applied statisticians are in short supply in Africa, and those that exist may need further training[23] to become useful in this work area.

The aim of the SIAC workshops (including e-SIAC) is to equip NMS staff and others with the skills to process their own data and produce 'tailored' products. Once NMS staff have these skills, they can to join project teams for their skills, and hence their ability to turn their data into useful information, rather than simply being asked for their data.

Reports on climate in Africa, such as Brew and Washington (2004), draw attention to the problems of accessing the (daily) climatic data. NMSs do recognise the importance of making their data available for development projects in their country. We strongly suggest that once NMS staff can genuinely join project teams, that the problems of data access will be largely in the past[24].

In PD139 the development of the training materials for e-SIAC and for CAST was largely by staff outside the region. This partly reflects the fact that developing imaginative training materials in statistics is a very hard nut to crack. We believe the training ideas in e-SIAC and in the adaptation of the CAST materials represent a real advance in two ways:

- The innovative nature of the materials should enable staff to grasp the key concepts needed to produce tailored products[25], as well as to underpin further training in statistics for more advanced applications.

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[23] As part of this collaboration, KMD funded a statistician from the University of Maseno (Elly Bodo) to take the SIAC course in 2005, and he will become a resource person in 2006.

[24] In some projects that used to require (raw) data, they will now engage the NMS staff member to produce the required products. Hence, cost recovery will be in paying for the time needed for the work, rather than for the data. The marketing of skills and services will also replace the need to concentrate on marketing data. Finally, most NMSs already supply data freely to local Universities and research institutes, and these staff can themselves become project partners.

[25] The 'tailoring' relates to an objective of SIAC that a product satisfies a users need. Thus, at least with climatic information, the NMS becomes more service (rather than product) orientated.

- The availability of e-SIAC permits the training to be offered to a much larger audience in a cost-effective manner.

These claims are to be tested in the SIAC training courses to be given from early 2006.

The development of these training materials benefited from the earlier collaboration between the statisticians from SSC and those from the Agriculture Faculty of the University of Nairobi. In the longer term it is important to foster the development of local statistical skills to parallel the computing skills that are already available.

Research

The two activities in PD139, considered under this heading are the sample survey of volunteer sites, and the work on the use of simulation and crop modelling software.

The sample survey was well handled. This was primarily by the NMS staff (both from headquarters and the relevant station) working in close collaboration with the University statisticians from Nairobi and Maseno. Statistics students from Maseno were also involved.

The collaboration was the key to the success of this activity, and all parties returned from the survey with highly positive views on the ways that connections between NMS staff and the volunteer network could be enhanced[26].

The workshop on the simulation of climatic data and the use of crop simulation models showed that the NMS staff need more capacity development before they can play a useful role in exploiting their climatic data in such complex ways. These topics are mentioned on the face-to-face SIAC, but only briefly. What is needed, perhaps more than training, is practice in their use.

It will be interesting to see whether the KMD staff are able to do further work unaided on testing the Marksim software. In the longer term it is important that NMS staff do develop the skills to be able to use their climatic data in this type of modelling software.

The future

Following the African Climate Report, mentioned at the start of the conclusions to this report, Washington *et al*. (2006)[27] are clear on the importance of the historical climatic data. They state:
"We make the case that a route to addressing the challenges of climate change in Africa rests with embracing climate variability." They continue more specifically with:
"Inter-annual climate variability, on the other hand, is rather more immediately geared to the agricultural base which forms such a vital component of Africa's economy, and is readily, and simply, served through climate information, such as rain onset dates, dry spell length during the rainy season, and other tried and tested parameters associated with seasonal totals."
These are sentiments that link directly with the purpose of PD139. The same message is echoed in the DFID publication, "Climate-Proofing Africa", that resulted largely from the African Climate Report. They say:

[26] A secondary benefit was a clarification of the role that statistics students could have if they were to work in an NMS, or in a volunteer station for the 3-month attachment that is a compulsory part of their course.

[27] "African Climate Change – Taking the shorter route", accepted for publication by the Bulleting of the American Met. Soc. 2006.

> ***Developing capacity to deal with today's climate variability is the best way to equip Africa to deal with tomorrow's climate change.***
>
> Current data on Africa's climate are inadequate. Observing systems are weak and deteriorating, and climate models are unreliable. There is a serious lack of relevant human capacity and expertise.
>
> More effective climate information is needed in order to integrate climate risk into the development process, to enable adaptation of development to climate variability and change.

This message echoes the sentiment in the earlier World Bank 2004 Report – "Look Before you Leap" which states, in the executive summary:

> Adaptation (to climate change) is likely to be more successful to the extent that it is incorporated into the sustainable development process, and recognizes that response to current climate variability and extremes is a necessary, if not sufficient, part of an effective adaptation strategy.

Such statements, taken together with the progress that can be made by an NMS, as shown in PD139, give us cause for the optimism expressed in this report. But formidable challenges remain. It is unclear that NMSs, or indeed the Regional Centres such as IMTR, recognise the full extent of the work they must do, before they can be fully involved in the poverty agenda.

There is still an insufficient sense of urgency in the NMS. For example, the computers for the KMD outstations were supplied by the UK Met Office following a well-reasoned request in 2004, and were delivered in January 2005. The agreement was that KMD would supply the UPSs to support the smooth running of the systems. They still intend to honour this commitment, but, 13 months later, it remains an intention. A reviewer of this project report stated "the weak links in actually using the decentralised system would appear to be hardware / software failure, trained personnel being absent for periods of time and motivation of staff." This raises justifiable concerns on the sustainability of the approach taken in this project. Had KMD given even more support to the outstations in 2005, including supplying two computers to each station as was originally planned, then perhaps the reviewer's concern would be less.

Similarly the report by Andrew Farrow on Marksim and ApSim in Appendix 10 is not complimentary on the state of the current database and of staff skills. The same reviewer commented that "the overall impression is one of frustrating chaos". Some work has been done by KMD, following the report, to improve the state of the data in that particular region. But the implications are worrying for the database as a whole, and have not resulted in any general activities for improvement.

There is therefore the impression that the NMS is continuing largely as before, while adding slightly to their interests in promoting climatic activities at the HQ and at outstations. A "business as usual" approach is likely to result in an NMSs continuing to be mainly a concerned spectator on the poverty agenda in the country. Urgent and decisive action by all staff at all levels – in particular at senior/middle management levels – is needed if the NMS is to qualify as a full partner in the near future. And the partnership has to be in the near future if climatic information is to be used to support the efforts of the country to meet the challenges of the MDGs, as well as further challenges of climate change in the years beyond.