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Ocean Climate Data for User Community in West and Central Africa: Needs, Opportunities and Challenges

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Introduction

The urgent need to improve data delivery systems needed by scientists studying ocean role in climate and climate characteristics has been manifested in recent years because of the unprecedented climatic events experienced in many parts of the world. Indeed, there has been a striking and growing realization by governments and the general public indicating that national economies and human welfare depend on climate and its variability. In West and Central Africa, for instance (Fig. 1) climatic events, which have resulted in floods and droughts, have caused a lot of concern to both governments and people of the region. In particular, the droughts have been so widespread that greater awareness and concern have become generated for the need to find solutions to the problems created by the consequences of the climatic events. Particularly in the southern border regions of the Sahara Desert as well as in the Sahel region, the drought episodes considerably reduced food production and led to series of socioeconomic problems, not only in the areas affected by the droughts, but also in the other parts of West Africa. The various climatic variabilities which have caused the climatic events are no doubt related to the ocean- atmosphere interactions. Unfortunately, not much has been done on the understanding of these interactions, particularly as they affect developing countries. Indeed, not much has been done to develop programmes which will reflect the general concerns and needs for researching into the ocean-atmosphere systems and their implications on man-environmental systems in many developing countries. This is for example, true of West and Central Africa, where compared with the middle latitude countries, much less is known about the characteristics of the ocean- atmosphere systems and their significance on man- environmental systems of the area.

One of the major reasons for the apparent lack of interest for researching into the ocean-atmosphere systems and their implications on man-environmental systems in many countries are concerned with the non availability of data. Thus, to enable researchers to develop greater interests, there is urgent need to improve the data delivery systems needed by scientists studying the ocean's role in climate and climate change; and their implications on man-environmental systems. In the present paper, the need for, the opportunities available, and the challenges for the future of ocean climate data with particular reference to West and Central Africa, are discussed. The paper in particular reviews and critically examined the status of the available data, for example, the length of the data series, the quality and their accessibility to researchers in the region. Other issues discussed include the network and spatial/temporal coverage of the data, the storage and protection of

the data, monitoring and archival and the data management and the user services. The paper also discusses the urgent need to improve ocean climate data management in support of ocean climate research and emphasizes the need for improved local technology, transfer of technology, adaptation of technology transferred, education and training, provision of adequate funding and mobilizing sufficient resources to improve data and cooperation and coordination of efforts at national, regional and international levels.

Data Needs

In general, ocean climate data and information are required for research, application and impact studies. In particular, they are required for describing, understanding and predicting the behaviour and other aspects of ocean-climate systems including man's impacts on climate and the relationship of climate to various aspects of the environmental systems. For example, ocean climate data and information are significant for planning a variety of operational activities, especially the very sensitive ones including those dealing with food production, water resources, energy and human settlements and health. Socioeconomic activities in these sectors have no doubt evolved over a long period of time, and have reflected adaptation to the regional and local climates. Whereas in many developed countries, a reasonably adequate data storage and archival of ocean climate data are characteristic, in West and Central Africa in particular, and may developing countries in general, data storage and archiving are yet to be established.

Different types of ocean-climate data and data bases are required to fulfill the objectives of data monitoring and data collection. In particular, global, regional, national and local data bases are required for application of climate data and information in human activities as well as for the study of the impacts of climatic variability and changes on human activities. Global and regional data are also needed for assessment of global and regional climate conditions, and for scientific research on climate change, climate variability and climate change prediction. The representativeness and the resolution of data are also determined by the natural variability of the parameters being observed and by procedures for averaging the data, which should no doubt meet the requirements for the development and testing of models for ocean-climate services, and needs for various applications.

Among the ocean-climate data needed to respond to the demands of the user community, increase their awareness for the uses of ocean-climate data and information, and improve their capability to employ this information are surface data from synoptic climatological and specialized stations such as radiation station, upper air data and oceanographic data including sea surface temperatures, sub-surface temperatures and sea surface/subsurface salinity. Unfortunately, West and Central Africa has a lot of problems associated with data acquisition and availability, data archiving and the management of data. Thus, the region is faced with the problems of providing adequate services for the user community and assisting the community in using the services. In the following section, some of these problems are discussed.

Problems of Data

Among the basic problems facing data delivery systems in West and Central Africa are those related to the network and coverage of the data. In all the West and Central Africa countries located along the coast, the length of the data series, the quality of the data, the storage, accessibility and protection of the data are significant problems. For example, until very recently, oceanographic data observations were very irregularly made mainly along the coast between southern Mauritania, across the Gulf of Guinea to northern Angola, and westward to approximately 20°W. Similarly, network stations over the coastal land surface are very inadequate and the coverage of available data cannot meet the target densities set out by WMO for meaningful research, climate application and impact programmes. Also significant is the fact that data in many stations are collected to meet specific research requirements or projects. Data series vary in length of coverage with individual stations in the region. It is in very few stations that data are available for more than fifty years, while in most of the coverage, data are available for less than twenty years. Moreover, most of the data cover only rainfall and sometimes temperature in many locations. Where data have been available for more than twenty years, there have been possibly changes in the station locations and changes in the instruments and exposure, thus creating the problem of comparative analysis of data between the different time periods. Significant problems are also related to data quality, sometimes because of mechanical and human problems. For example, there have been stories of meteorological assistants who merely crook figures in their offices or rooms without actually going into the field to read from the instruments.

Another major problem is concerned with data archiving. In this regards, coordination and collaboration in the different countries or institutions connected with ocean-atmosphere study programmes cannot be overemphasized. Unfortunately, in West and Central Africa, data collection and archiving are not necessarily based on scientific goals and very little research is carried out on ocean climate data. This considerably limits the availability of such data to the user community. Other significant problems which concern data acquisition, archiving and availability are related to the fact that currently most of the available data are found in a variety of sources not always known to the user community. Part of the data are, for example, scattered in libraries, record offices and other places and in most cases, they are usually incomplete, hopelessly inaccurate and of no use for any meaningful research, application or impact studies. Moreover, there is always the possibility of administrative bureaucracy which has for long been recognized, but for which no solution has been found. In many places, quite a significant amount of data is still in raw form, even though these data could be applied to several problems, if they were available in usable format.

Equally important is the fact that most of the available data are located outside West and Central Africa, in countries where a lot of activities related to ocean-atmosphere interface of West and Central Africa are carried out. Examples of these countries are France, Germany and the U.S.A. In France, for instance,

such activities are carried out under the auspices of scientific institutions such as CNRS, CNEXO, and ORSTOM. Unfortunately, none of these institutions which are engaged in promoting research interest in ocean-atmosphere systems in West and Central Africa are strongly based in the region. This makes it difficult to have the research results to become available to scientists and other members of the user community in West and Central Africa, interested in utilizing the results for studies on ocean- atmosphere systems.

Data Management and the User Community Services

A main purpose of the World Climate Data and Monitoring Programme (WCDMP) is to ensure the availability of data which are accessible, exchangeable and acceptable in usable form and time. But, as already emphasized above, most of the data available in West and Central Africa are far from satisfying the qualities of accessibility, exchangeability and acceptability in form and time. Thus, data and information are not readily available to the user community who could need the data for most effective research, application and impact studies and for example, operations and activities related to or influenced by ocean-atmosphere processes. Even if the basic data are conveniently available, they still need to be transformed into derived products specialized to the needs of the users, as is being done in most advanced countries. Thus, unfortunately, the users' needs are far from being met in West and Central Africa.

A lot of these problems are related to data management which are far from ideal and far from meeting the needs of the user community. Data management strategies or techniques are no doubt significant for improved data delivery systems that are needed by scientists studying the ocean role in climate change. Apart from the fact that most available data are found in sources other than meteorological and oceanographic institutions, there is a lack of coordinated efforts for improved data availability, data management and access to data. Indeed, there are a lot of jurisdictional problems which are associated with the collection and synthesizing of the data in order to have them readily available to meet the needs and demands of the user community. It is no doubt urgently necessary to improve data management in the region and organize a timely and direct flow of data and information for easy accessibility. With better management, it would be easier to pinpoint where there are data gaps and augment the data systems. It would also be easier to achieve the much needed expansion of networks, improvement in data collection, data quality control, processing and storage, if necessary, with international assistance and support from developed countries.

Other Problems

Three other categories of problems may be noted. First, there are problems related to technology and technology transfer. Secondly, there are problems

related to education and training, and, thirdly, there are problems related to funding programmes related to data acquisition, archiving and analysis to make them readily available to the user community. No doubt, it seems a fairly evident proposition that the solution of most data problems depend to a large extent on the application of science and technology. In this regards, a lot of cooperation is needed to ensure the transfer of the correct and adequate technology and, where necessary, modifications to these technologies are made within the context of traditional technologies. Over the past few decades, there have been considerable advances in science and technology, and in techniques using satellite data and computer sciences, and a number of ocean-atmospheric modelling techniques have been developed using these technologies. Unfortunately, these advances, which facilitate the provision of ocean climate data and information, and make the application and impact methodologies faster and easier have not been widely applied in West and Central Africa. To scientists from developed countries these technologies are easy and relatively cheap to own. But, to users from the developing countries in general, and West and Central Africa in particular, they are very expensive and are completely not affordable, except through assistance and financial support. There are, no doubt, considerable problems getting the hardware and software to the right place, and for improved data delivery systems, there is need for improved dialogue between developing and developed countries. There is also need for support from developed countries in order to meet the users' needs in the application of technology.

Education and training are also necessary for providing necessary personnel for data delivery systems. No doubt, trained and motivated people are needed to translate available compilation, consolidation and data analysis. They are also required for archiving of data, rescue operations, and for collaborating with users in applying data for solving problems and for impact studies. Special needs for trained personnel in ocean climate data can be perceived for such activities as data processing, computer techniques and onshore and offshore operations related to the users' activities. A basic problem which militates against education and training, as well as other problems relating to ocean climate data, is concerned with mobilizing sufficient resources to meet the financial investment needed to solve the problems. Currently, inadequate funding is characteristic of research activities in West and Central Africa. Of course, it is true that the economies of many of the countries in the region are poor. However, the situation is worsened by the fact that most national governments place very little priorities on programmes of research which would not yield immediate economic and commercial benefits. The situation is so bad that in the universities and some of the research institutions, there are usually no funds available for research of typing or duplicating research papers. In many of the countries, the social status of education and research has been relegated to the background and has become one of the least reckoned with.

Education also involves promotion of awareness of the user community, as regards the availability of the data needed. It also involved interacting with them on the need to make use of the available data in the research activities. It is also

necessary to educate the public on the need to improve data delivery systems, and for the user community to participate in addressing ocean climate issues and develop appropriate responses using the available data required particular in areas which require the provision of courses and skills in the short and medium term, while in the long term international assistance and support should aim at building education and training institutions located in these countries.

Conclusions

The growing recognition of the important role played by ocean climate data in planning national socioeconomic development in West and Central Africa calls for effective action in facing the challenges and opportunities connected with the users' needs for, and services related to ocean climate data. Such data are, no doubt, needed for research into understanding the behaviour of the ocean-atmosphere system and for understanding the processes which determine the climate and climatic variations in the region. In particular, such data are needed for understanding the characteristics of the ocean and the atmosphere as a time dependent system and the extent to which the system is predictable on varying time scales for the purpose of understanding the mechanisms and the processes underlying their predictability.

No doubt, the situation in West and Central Africa illustrate the general problems faced by developing countries in data availability, storage, archiving and retrieval for the users' community. Other problems are related to transfer of technologies, adaptation of technologies transferred, development of local technologies, education and training and problems related to adequate funding. West and Central Africa, in particular, and developing countries in general, also require a lot of cooperation and support at national, regional and international levels to find solutions to these problems. For example, at the national level, the need for governments' support in funding and giving adequate support for promoting efforts at improving the status of data acquisition and availability for the user community cannot be overemphasized. It is also important that there should be collaboration between national governments and international institutions in their efforts to promote data acquisition. There may also be need for assistance in such areas as technical cooperation programmes, for example, in terms of computer and hardware and data processing technology and through the use of satellites and the provision of remotely sensed data and information that can be related to conventional historical measurements taken from the platforms of the sea or land. It may also be remarked that coordination in the establishment of both national and sub-regional ocean climate data banks will considerably enhance the success of efforts towards improvement of data delivery systems in West and Central Africa. Other areas of action include the stimulation of data utilization and promotion of awareness on the availability of data in usable formats, the improvement of data exchange to serve the various needs and the promotion of quality control of the data.

For considerations of improved data delivery systems, the developing countries are currently in a unique and different position compared with the developed countries, and the situation must be so treated, examined and discussed. The present gross inadequacy in the ocean climate data acquisition and availability, data storage and archival, and data management call for concern. Also important is the fact that the few data available are fast deteriorating and need to be rescued, for example, by using some of the available advances in technology (e.g., micro-filming). There is also the urgent need to improve and enlarge the networks of ocean climate data stations, computerize climate data management systems, upgrade the national, regional and the international data management and exchange procedures, and provide opportunities for the provision and international exchange of high quality long term data for climate related studies. It is also important that data should be made available at costs affordable to the users community in West and Central Africa in particular, and the developing countries in general.

Access to data and data products are no doubt prerequisites to improved ocean climate data delivery systems, and to achieve this, improved cooperation and collaboration between developing and developed countries is essential, particularly in the fields of technical assistance and the application of modern tools and techniques for acquiring and storing data. Such technical assistance should include education and training programmes, improved public awareness for the need to improve data delivery systems, assistance in the adaptation of technology transfer, and/or development of affordable low cost, but effective, data acquisition and management strategies which would take maximum advantage of technological advances, and enable the user community in many developing countries to improve their capabilities to use ocean climate data and obtain maximum social and economic benefits under the different environmental sustainability. Thus, with such assistance, it would be possible to obtain ocean climate data needed for the most effective operations of climate sensitive activities, reduce the vulnerability of these activities to climatic hazards and respond positively to the demands of the user community.

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Effect of Change in the Ocean and on the Life Cycle

Convener - Hugh Ducklow

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Effect of Change in the Ocean and on the Life Cycle

In order to have a more complete discussion of the chemical and biological data management needs in relation to the oceans and climate change this session directed its attention on the Joint Global Ocean Flux Study (JGOFS) and particularly on the 1989 North Atlantic Bloom Experiment (NABE). The talk given by Evans added a more general discussion of data management for satellite derived parameters. Similarly the paper presented by Gamble added a more general discussion on the availability and use of time series biological data. Both of the papers on data management (Flierl & Lowry) resulted in a number of questions and comments both during this session and in formulating recommendations and issues for future discussion. It was noted by many that schemes such as the JGOFS/BOFS Topical Centres in the United Kingdom (and others in WOCE & TOGA) were the best way to ensure rapid delivery and high quality data to project scientists and eventually to the World Data Center system. Although each project has its own variations, each has the characteristic of bringing scientists and data managers together as a team rather than as separate entities.

Introduction of the JGOFS program enabled the participants to focus on a truly multi-disciplinary project. Not only is the program multi-disciplinary, but most of the presentations were on what happened (or is happening) when plans are put into practice. Thus Workshop attendees were able to make recommendations that directly meet the objectives of the Workshop and may also serve as a guideline to other global change research in the future.

