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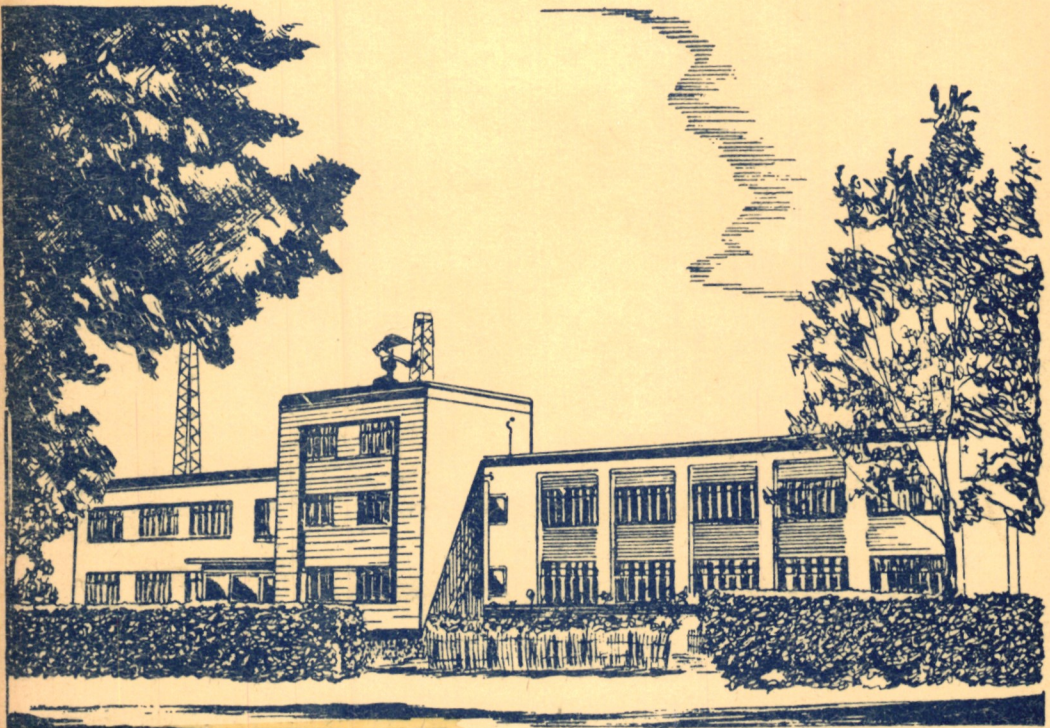


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**KENYA**

**METEOROLOGICAL DEPARTMENT**

**ANNUAL REPORT 1977 / 1978**



Meteorological Headquarters

060

KMB

ANNUAL REPORT  
ON  
THE METEOROLOGICAL DEPARTMENT  
FOR THE PERIOD  
1ST JULY 1977 TO 30TH JUNE 1978

Presented by the Director  
to the  
Minister for Power and Communications

KENYA NATIONAL ASSEMBLY  
Accession: 10012928  
Call No: 060 KMD



Kenya Meteorological Department  
Nairobi, June, 1979



CORRIGENDA SLIP

**KENYA**  
**METEOROLOGICAL DEPARTMENT**  
**ANNUAL REPORT 1977/1978**

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- p. (v) line 4: Amend "Ballon" to read "Balloon"
- p. 6 para 7, line 5 Amend "international" to read "International"
- p. 8 para 3, line 1: Amend "imager" to read "imagery"
- p. 9 para 4, line 4: Amend "activities" to read "activities"
- p. 11 para 1, line 4: Amend "manipulator" to read "Manipulator"
- p. 14 para 7, line 2: Amend "include" to read "included"
- p. 20 para 4, line 3: Amend "Hotel" to read "Hostel"
- p. 25 para 3, line 5: Amend "affectively" to read "effectively"

## 1.1 Foreward by The Director:

The most significant event during the period of the report was the break-up of the East African Community which was running a joint Meteorological service for Kenya, Uganda and Tanzania. At this stage it is appropriate to review the historical development of the Meteorological Department in Kenya.

The Meteorological Department was established in Kenya in 1929 under the Ministry of Agriculture in the Government of the day. The Department continued as a Government Department until 1948 when it was transferred to the East African High Commission to be administered on an East African basis on behalf of the Governments concerned. In 1961 the functions and the responsibilities of the East African High Commission, including the administration of the Meteorological Department, were transferred to the East African Common Services Organization and in 1967 those of the East African Common Services Organization were transferred to the East African Community. The latter body was administering the Meteorological Department on behalf of the Governments concerned until it broke up on 1st July 1977. Consequent upon the break-up of the East African Community on 1st July 1977 the Meteorological Department was transferred back to the Kenya Government Civil Service where it belongs.

Although we now have a Meteorological Department for Kenya only, the demand for Meteorological Services continues at the same level as that existing prior to 1st July 1977. The major reason for this is that Nairobi is a Regional Meteorological Centre in the World Weather Watch system of the World Meteorological Organization and an Area Forecast Centre in the Area Forecast System of the International Civil Aviation Organization with the responsibility of making weather forecasts for all purposes, particularly the air transport industry, within Africa. It is also a Regional Telecommunications Hub with responsibility of receiving and disseminating meteorological data within Africa and also a Regional Training Centre with responsibility for the training of Meteorological Personnel in Africa.

The accuracy of weather forecasts largely depends on adequate supply of observational data. In order for the Meteorological Department to make accurate weather forecasts in Kenya it is absolutely necessary to obtain data from the neighbouring countries and the Western Indian Ocean. It has therefore been found necessary to maintain the Meteorological Telecommunications Network in East Africa and to improve it.

The extensions to the Departmental Headquarters building was completed during the period at a cost of two million shillings. This provided the



Department with sufficient weather analysis area, ample weather forecasting conference room, a large telecommunications centre and a new teleprinter workshop. Some additional office space was also provided but was utilized by the Kenya Region Units which moved to Headquarters in July 1977. The Hostel for the East African Institute for Meteorological Training and Research was also completed during the period at a cost of nine million shillings. The hostel was opened in September 1977 by the Minister for Power and Communications, Hon. Omolo Okeru, M.P.

The Meteorological Department hosted the Seventh Session of the World Meteorological Organization Regional Association for Africa meeting in Nairobi in February 1978. The meeting was opened by the Vice-President and Minister for Home Affairs, His Excellency Daniel T. Arap Moi, M.P. This was the first occasion since 1965 that a meeting of the WMO Regional Association was held on African soil. The Director of the Department Mr. J.K. Murithi was elected to the Executive Committee of World Meteorological Organization and attended the 30th Session of the Executive Committee in Geneva in June 1978.

Following the break-up of the East African Community, one hundred and fifty non-Kenyan junior staff left for their home countries. In an effort to fill the gap created by the departure of the non-Kenyans the Department recruited sixty Meteorological Assistants, five Assistant Teleprinter Mechanics, three Shorthand Typists, one Cateress, three cooks and seven subordinate staff. However, due to lack of qualified staff, forty non-Kenyan scientific and technical staff were retained in the department on three years contracts. Arrangements were made during the year to recruit Kenyan graduates for training with a view to replacing the non-Kenyan staff at the end of their contracts.

Some difficulties were however encountered in personnel management. Those staff who had been promoted by the defunct East African Community just before the break-up of the Organization had their promotions rescinded by the Directorate of Personnel Management. Other staff who were given higher responsibilities as a result of the departure of senior staff from Tanzania and Uganda did not receive the promotions they deserved. Many others were converted to lower Job Groups in the Kenya Civil Service Salary Scales than those they were enjoying in the East African Community. This adversely affected the staff morale.

Difficulties were also experienced in procuring stores and repairing vehicles through the Ministry of Works.

J.K. Murithi  
DIRECTOR

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### **1.3 Functions of The Meteorological Department:**

The Meteorological Department is the State Meteorological Service. It forms part of the Ministry of Power and Communications. The Director is responsible to the Minister for Power and Communications through the Permanent Secretary, Ministry of Power and Communications.

The general functions of the Meteorological Department are:

- (i) The provision of meteorological and climatological service to agriculture, plantation farming, forestry development and for the better exploitation and utilization of natural resources for national development.
- (ii) The provision of meteorological and climatological service to water resources development and other government departments, public corporations, local authorities, the mass media and the general public.
- (iii) The provision of meteorological service to civil aviation for the safety and economy of civil aircraft operations.
- (iv) The provision of meteorological service to shipping in the western Indian Ocean including the issue of cyclone warning for the safety of merchant and other ships in the western Indian Ocean.
- (v) The provision of meteorological service to military aviation for the safety of Kenya Air Force aircraft for national defense.
- (vi) The provision of meteorological and climatological advice to the private sector including industry, commerce and public utilities.
- (vii) The provision of meteorological and climatological advice for the improvement and preservation of national environment for a better human life.
- (viii) The organization and administration of surface and upper air meteorological observations within its area of responsibility and the publication of climatological data.
- (ix) The maintenance of an efficient telecommunication system for rapid collection and dissemination of meteorological information required for national and international use in accordance with World Meteorological Organization and ICAO procedures.
- (x) Research in meteorology and climatology including co-operation with other authorities in all aspects of applied meteorological research.



- (xi) The maintenance of the National Meteorological Library.
- (xii) International co-operation in the field of meteorology on behalf of Government.
- (xiii) Evolving suitable training programmes in all fields of meteorology relevant to national development.

The Meteorological Department also takes a leading part in International co-operation in meteorology. The Director is the Permanent Representative of Kenya to the World Meteorological Organization and acts in concert with the other Directors of the Meteorological Services in the general development of meteorology in Africa.

#### 1.4 Principal Officers of The Meteorological Department:

##### *DIRECTOR*

**J.K. Murithi B.Sc. (London) Dip. Met. (Nairobi)**

##### *DEPUTY DIRECTOR*

**A.L. Alusa B.Sc. (Oregon State) M.Sc. (Sunya)**

#### **Operational Services Division:**

Assistant Director (Acting) – P.C. Okot B.Sc. (London) Dip. Met. (Nairobi)

#### **Regional Meteorological Centre:**

Principal Meteorologist (Acting) – E.A.A. Mukolwe B.Sc. Dip. Met. (Nairobi)

#### **Aeronautical Section:**

Principal Meteorological Officer – E.G. Njoroge

Principal Meteorological Officer (Coast) – L.K. Kariungi

#### **Senior Meteorological Officers (In charge of Forecast Offices)**

- Jomo Kenyatta International Airport – A.C. Warratho
- Mombasa International Airport – S. Magalasia (Acting)
- KAF Eastleigh Airport – L.K. Njoroge
- KAF Nanyuki Airport – S. Wanderi (Acting)
- Port Meteorological Office, Kilindini – S. Ochieng (Acting)

#### **Engineering Section:**

Principal Engineering Technician (Acting) – P.S. Mwasi

#### **Communications Section:**

Senior Communications Officer: – J.M. Oluoch

**General Services Division :**

Assistant Director (Acting) – E. Nyoni B.Sc. Dip. Met. (Nairobi)

Climatological Section

Principal Meteorologist (Acting) – S.J.M. Njoroge B.Sc. Dip. Met. (Nairobi)

Observatories Section

Principal Meteorologist (Acting) – J.H. Kinuthia B.Sc. (Nairobi)

Agrometeorology Section

Senior Meteorologist – G.W. Mugenyi B.Sc. (Makerere)

Instruments Section

Senior Instruments Officer – G.M. Muchemi

**Institute for Training and Research Division :**

Assistant Director (Acting) – J.K. Njihia B.Sc. Dip. Met. (Nairobi)

Training Section

Principal Meteorologist (Acting) – G.W. Mwebesa (Mrs) B.Sc. (Nairobi)

Research Section

Principal Meteorologist (Acting) – P. Mwingira B.Sc. Dip. Met. (Nairobi)

**Administrative, Finance and Supply Division :**

Administrative Section

Senior Executive Officer – Vacant

Accounts Section

Senior Accountant – J.E. Kamau

Supplies Section

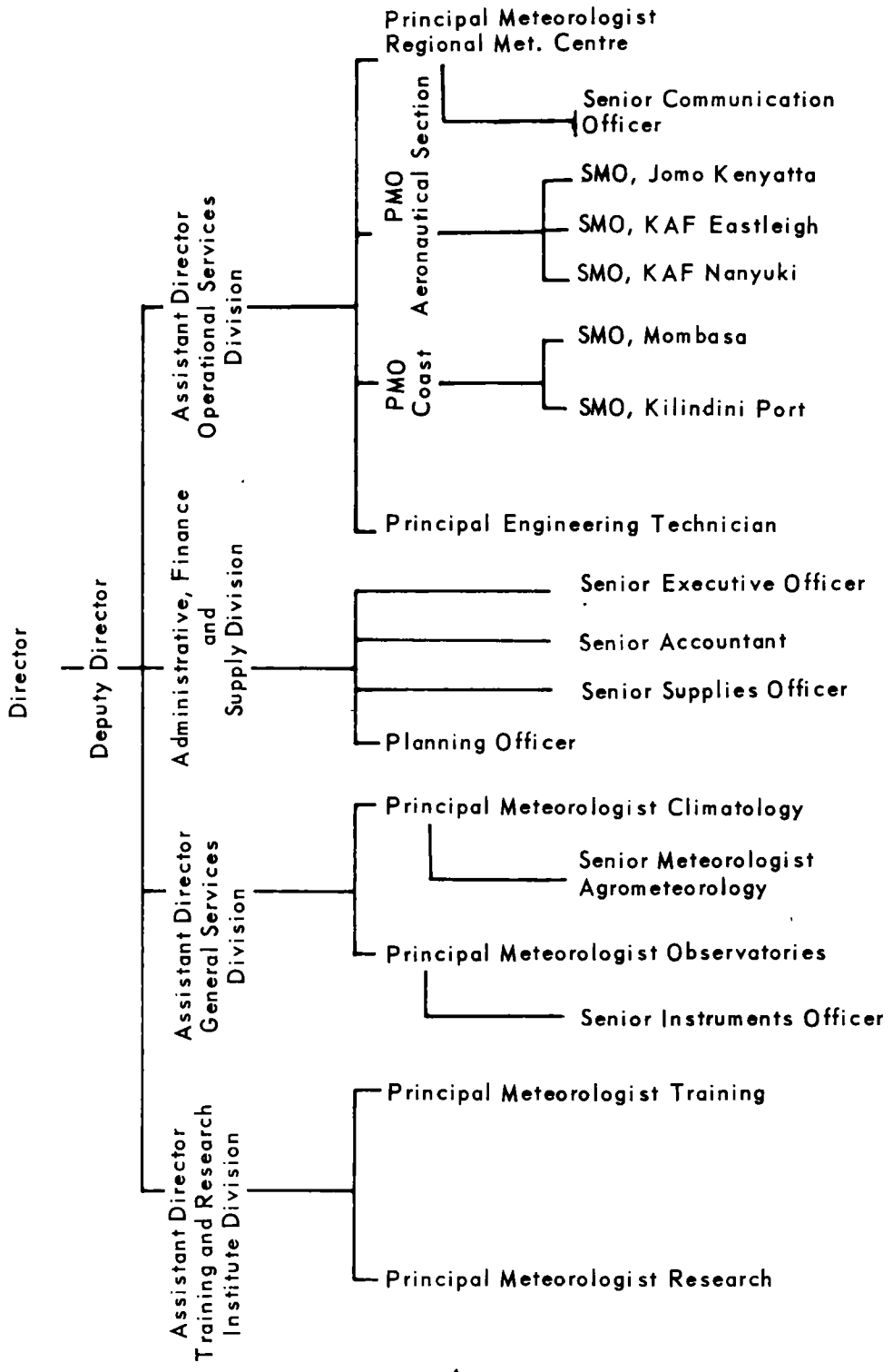
Senior Supplies Officer (Acting) – R.N. Wanyama

Planning Section

Planning Officer – J. Agin



1.5 ORGANIZATION OF THE METEOROLOGICAL DEPARTMENT



## **2. TECHNICAL CO-OPERATION AND GENERAL INTERNATIONAL MATTERS**

Consequent upon the demise of the East African Community, the international responsibilities shared by the three partner States in connection with the Regional Telecommunications Hub, Regional Meteorological Centre, Area Forecast Centre and the East African Institute for Meteorological Training and Research, were assumed by the Government of Kenya. With these responsibilities being shouldered by Kenya Meteorological Department, it became necessary to seek aid through bilateral arrangements, from World Meteorological Organization (both regular budget and Voluntary Assistance), United Nations Development Programme and other agencies. What follows is a summary of the international affairs in which the Department was involved.

### **2.1 Institute for Meteorological Training and Research – United Nations Development Programme Special Fund Project:**

The funding of the Institute through a U.N.D.P. Special Fund Project, ended when Mr. C. Reyes left at the expiry of his contract. However, because of shortage of qualified staff for the post of Professor at the University of Nairobi, the World Meteorological Organization has continued to fund this post out of its regular budget. Dr. Todorov, who was a WMO expert under U.N.D.P. Special Fund Project also left during the period under review.

During the same period, Mr. J. Findlater, who was seconded to the Department by the British Government also left the Institute at the end of his contract.

Every attempt was made towards getting additional funds and personnel for the Institute under the auspices of U.N.D.P. but problems associated with the collapse of the East African Community made it difficult to get assistance from U.N.D.P.'s Regional Fund. Notwithstanding personnel problems, the Institute continued to accept students from all over Africa and beyond and continued to enjoy international respect. A co-operative research effort between scientists from National Centre for Atmospheric Research and our scientists was made towards the study of the Low Level Jet discovered here in East Africa.

### **2.2 Training – Voluntary Aid Programme (VAP) and other Bilateral Support**

Because of the need to become self reliant consequent upon the demise of the East African Community, a concerted effort was made towards seeking training through World Meteorological Organization's Voluntary Aid

Programme. Emphasis was placed on the training of technicians on specific equipment such as radars, transmitters and receivers. Although these applications were filed during the period under review, the fellowships did not come through until afterwards.

Additional requests were made for VAP support for the training of a Hydrometeorologist in the United Kingdom. The Indian Government through the Special commonwealth Assistance Programme offered a scholarship to one of our meteorologists to study Seismology in India. However the course was postponed until the next year.

### **2.3 International Conferences:**

The major highlight during the period under review was the historic hosting of the Regional Association I (Africa) by Kenya in Nairobi, in February 1978. The two week conference which brought together meteorologists from all over Africa was opened by the Vice-President of Kenya, His Excellency Mr. Daniel Arap Moi, M.P. and addressed by the Secretary General of World Meteorological Organization (WMO) Dr. D.A. Davies.

During the same month, Mr. Alusa represented the Department at a meeting of the Commission for Atmospheric Science (CAS) held in Manila, Philippines. Mr. S.J.M. Njoroge and Mrs. G. Mwebesa represented the Department at a meeting by the Commission for Special Applications of Meteorology and Climatology (CoSAMC).

Mr. Murithi, the Director was elected a member of the Executive Committee in place of Mr. Padya of Mauritius.

In general, international agencies, and friendly countries were prepared to assist the Kenya Meteorological Department as much as possible. During this period, negotiations for possible funding of the modernization of the Department's telecommunication system through a French Government loan were initiated.

## **3. OPERATIONAL SERVICES DIVISION**

### **3.1 Collection of Weather Reports and Dissemination Forecasts to International Airports:**

The Division conducts the real-time functions of the Kenya Meteorological Service. Such functions include the maintenance and operation of both national and international meteorological telecommunication circuits for the data collection and dissemination; data processing and forecasting services to the public, national and international Civil Aviation and shipping

concerns.

The Regional Meteorological Centre, Area Forecast Centre and Regional Telecommunications Hub are co-located at the Department Headquarters while the National Meteorological Centre and Aerodrome Meteorological Office are located at Jomo Kenyatta Airport. A port Meteorological Office and Aerodrome Meteorological Office are located at Mombasa.

The centre at Headquarters serves as the main collecting centre for meteorological observational data from outstations throughout Kenya and disseminates processed information to other stations as required. Observational data in the form of surface and Upper air reports of weather reports relating to the state of the sea (Western Indian Ocean area) are collected and analysed on a routine basis. The processed information is then issued in the form of public forecast to radio and the press or in some other suitable forms to the Airports for air navigation and to the ports for shipping interests. In this connection the centre is linked to the outstations by means of telephone, radio-telephones, radioteletypes and facsimile broadcasts as appropriate. In addition the Centre serves as one of the Regional Centres within the African Region for data collection and dissemination within and without its zone of responsibility in the context of the World Meteorological Organization Weather Watch Plan and the International Civil Aviation Plan. To achieve this the Centre maintains point-to-point meteorological telecommunications circuits and international facsimile broadcasts with selected outside centres, for example Offenbach, Kano, Cairo, Re-Union, etc.

### 3.1.1 Regional Meteorological Centre (RMC):

#### 3.1.1.1 Data Processing

On the real-time data processing and forecasting service, the Division operated the Regional Meteorological Centre (RMC) whose analysis and forecast products cover most of the African Continent and Western Indian Ocean. In this connection the Division maintained a facsimile broadcast for analysed forecast products for various levels in the atmosphere in accordance with agreed World Meteorological Organization procedures and requirements of members of the Organization.

National collection of surface observations was satisfactory while the National Upper Air data was deficient. Only Nairobi radiosonde station remained operational during the period while Garissa radiosonde station remained closed due to faulty equipments and lack of consumables. Pilot balloon observations from synoptic stations were scarce due to theodolite unserviceability and lack of adequate consumables. International collection



of data from associated National Meteorological Centres (NMCs) and Regional Telecommunications Hub (RTH) was just satisfactory. High degree of efficiency was achieved from Offenbach and Pretoria (in case of RTH) and also from the National Meteorological Centres of the partner States (of the former East African Community). Poor data collection was experienced from other National Centres.

The reporting period covered the first year immediately after the break-up of the East African Community. Some staff shortage was thus experienced in the early stages. However, during the second half more meteorologists who had just graduated were posted to the Regional Meteorological Centre.

### *3.1.1.2 Satellite Picture Unit*

The satellite imager ground receiving unit, Automatic Picture Transmission (APT) was operational for part of the period. With the launching of the new series of satellites in orbit (for example METEOSAT and TIROS-N), modification of the old receiving unit became essential and plans are underway to acquire the requisite accessories.

Cloud pictures from satellites have continued to provide useful additional information to the operational weather forecaster. Active weather areas are indicated by the amount and sometimes types of cloud coverage (for example formations and locations of tropical storms in the Western Indian Ocean are usually well indicated). In absence of an operational APT, temporary arrangements has been made to receive some such pictures from outside through the Global Telecommunication System (GTS).

### *3.2.1 Meteorological Service to Civil Aviation*

Jomo Kenyatta Airport Meteorological Office operated as the National Meteorological Centre (NMC) and Airport Forecast Office. Services to International and general Civil Aviation were provided by Regional Meteorological Centre for the East African Flight Information Region through the Area Control Centre in Nairobi and also by the NMC and Mombasa Airport to Aircrafts operating through those Airports by means of flight documentations and trend type forecasts. The Airport centres also collected post-flight reports from various aircrafts operating through their respective centres.

The following is the summary of the weather forecasts and report returns:

Forecast Folders Ex-Embakasi	—	12,383
Forecast Folders Ex-Wilson	—	3,555
Route Forecasts	—	1,589
TREND type landing forecasts	—	18,311

Aerodrome forecasts Embakasi	—	4,066
Aerodrome forecasts Mombasa	—	1,460
Aerodrome forecasts Malindi	—	730
Aerodrome forecasts Kisumu	—	730
Miscellaneous forecasts/Enquiries (Aviation)	—	78

### 3.2.2 *Meteorological Service to Military Aviation*

The Department provided full meteorological services for military aviation in the two Airforce Bases, Eastleigh and Nanyuki. After the collapse of the East African Community it was agreed that apart from the staff the Department should also meet the cost of the new equipment in our offices at the Airforce Military bases and also meet the maintenance and repair charges. Charges for the teleprinter circuits would also be met by the Department.

### 3.2.3 *Meteorological Service to Shipping in Western Indian Ocean*

The Regional Meteorological Centre kept close constant watch on the weather in the Western Indian Ocean area of responsibility. Routine shipping broadcasts and special broadcasts of Tropical storms and near Gale or Gale force winds were issued through the coastal radio station, (Mombasa) especially for shipping interests in the Western Indian Ocean.

A Port Meteorological Office was maintained at Mombasa whose activities related to liaison with ships' captains and checking meteorological equipments on board the ships and advice on ships weather observations and the collection. Plans are underway for the office to increase its activities in the interpretation to ships, the shipping broadcasts and introducing ships' routine forecast service.

### 3.2.4 *Meteorological Service to the General Public:*

The Jomo Kenyatta Airport Meteorological Office which operated as the National Meteorological Centre (NMC) provided services to the general public by way of public forecasts through the local press, radio, television and Automobile Association.

Press Forecasts	—	724
Forecasts for Automobile Association	—	362
Forecasts for Radio and Television	—	1,577
Sigments	—	NIL

Special Weather Forecasts were also made for the ASK Nairobi International Show and the 1978 Safari Rally.

### 3.3 Regional Telecommunications Hub (RTH):

International circuits linked to RTH Nairobi operated well apart from Kano – Nairobi circuit which was faulty and could not be repaired due to lack of spare parts.

New circuits OPNET drop off were established in Nanyuki bringing the number of local circuits from RTH, Nairobi, to sixteen.

RTH, Nairobi participated in the following WMO exercises:

- (a) Non-real time monitoring the operations of Global Observing System and Global Telecommunications system in the month of June and December 1978.
- (b) Special observing period of First Garp Global Experiment (FGGE) which started in December 1978.

During the period the following surface and Upper Air bulletins were received and transmitted out from the Regional Telecommunications Hub, Nairobi.

Synop	74,784
Temp	13,680
Pilot	25,932
Ship	2,628

### 3.4 Engineering:

The Engineering Section experienced an acute shortage of trained personnel throughout the period under review. This was due to the fact that all non-Kenyan personnel left the services immediately after the break-up of the East African Community. During this period the section lost thirty eight Officers. Seven technicians were trained in United Kingdom and Canada. Only two teleprinter mechanics were recruited during this period.

#### 3.4.1 Equipment

In all engineering sub-sections the maintenance work was hampered by none availability of spare parts. The section carried out installations of equipment in the new extended office in the main building. The semi-automatic switching equipment functioned satisfactorily. The transmitter for Kano circuit remained unserviceable due to lack of spares.

The Siemens Transmitter for Addis-Ababa circuit was installed and commissioned. The RF Communication transmitter for Pretoria was installed. Transmit Aerial for Pretoria was installed and commissioned, Transmit Aerial for Addis-Ababa was installed but feeder was short and an extra one was ordered. All transmitting Aerials were serviced by contractors.

Routine maintenance of machines were carried out but a number of teleprinter machines had to remain unserviceable due to lack of spares. New teleprinters were installed at Jomo Kenyatta Airport, Nanyuki, Mombasa Airport and Eastleigh. Scanning Radiometer Digital manipulator (SRDM) on loan was added into Automatic Picture Transmission (APT) ground equipment.

A new Vaisala Radio theodolite Recording Receiver was installed for use when the WF3 Radar is unserviceable. A new automatic Radiosonde Receiver AR16, Ground check chamber GC20 and assessor system KP11 were installed. The Vaisala Company introduced water activated Batteries which replaced the acid activated batteries to be used as electrolytes to the Vaisala Radiosondes.

#### **4. GENERAL SERVICES DIVISION**

##### **4.1 General Services Co-ordinative Activities:**

This Division is responsible for natural resources activities of the Department which include Climatology, Data Processing, Agrometeorology and Hydrometeorology. In addition Observatories, Instruments and Printing fall under this Division.

##### **4.1.1 Weather in Kenya During the Year:**

###### **Western and Nyanza Province**

The area received average to above average rainfall except during September, April and June. June temperatures were below normal in the whole area whereas Western had below normal temperatures during February, March and April as well. The sunshine hours were around normal except during July, February and March. Air moisture was about average during the year.

###### **Rift Valley Province**

This Province received varied rainfall from place to place. August, September and May were dry months whereas during January and February, Central Rift Valley Province stations reported twice the normal rainfall for the area. Temperatures and sunshine were about normal except during November and May when they were much below normal. During November, Lodwar recorded an average of 2°C. below normal.

###### **Central and Nairobi Area**

September and May received below normal rainfall whereas during March some stations in the area reported 400% of their average rainfall. The other



months received above normal rainfall. As a result temperature and sunshine were mainly normal to below normal. The air was mainly humid and during May, Nairobi Wilson Airport reported 24% relative humidity above that month's normal.

#### Eastern Province

August, September and October received less than normal rainfall but February and March were wet months with some stations reporting nine times their average rainfall. May and June were also dry months in most of the area and afternoon relative humidities were below normal.

#### North Eastern Province

The area received normal rainfall most of the time except during September, December, January and June when the area was dry. The temperatures were mainly normal to below normal except during July, September, and June. Air moisture was generally about normal except during July, May and June when the afternoon relative humidity figures showed a deficit.

#### Coast Province

There was generally good rainfall in the area except during July when most stations got about a half of their long term averages and February when rainfall was variable over the area. Temperatures were normal to above normal except during October, November and December when they were slightly below normal. The air was mainly moist except during August and May as indicated by afternoon relative humidity figures. Attached is the map of rainfall distribution during the year.

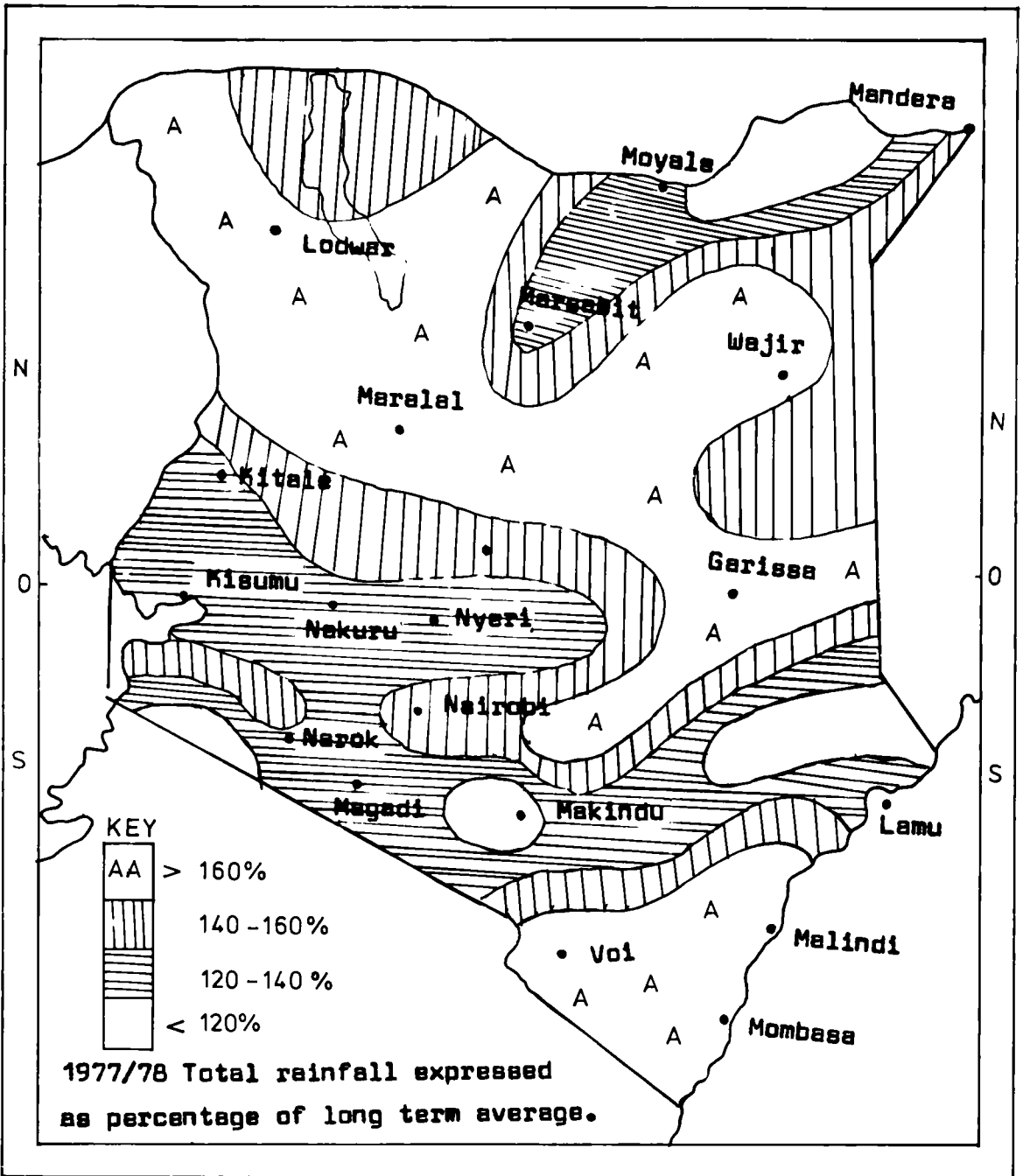
#### **4.1.2 Agrometeorology and Agromet Observations:**

The former Kenya Region Agromet. Section was amalgamated with the main Agromet. Section in the Headquarters after the collapse of the East African Community. This section was understaffed following the resignation of meteorological assistants who were serving in outstations. During this period no new stations were opened and no grade-B stations were upgraded (a grade-B station is one in which synoptic and phenological observations are taken). The Department stopped the allowances of the personnel recruited to work in grade-B stations.

The following is the list of Agrometeorological stations in Kenya:

Kabete, Katumani, Kitale, Nyeri, Embu, Meru, Nyahururu, Kakamega, and Njoro.

In these stations the following observations are carried out:



- (a) Synoptic observations at 0600 and 1200 GMT.
- (b) Phenological observations, i.e. development and state of crop carried out three times a week (Monday, Wednesday and Friday).
- (c) Soil moisture observations, i.e. percentage of soil moisture content carried out three times a month (7th, 17th and 27th) from surface to 200 cm depth.

#### **4.1.3. Hydrometeorology:**

The section has been working closely with the Water Department and the Hydromet Survey Project of Lake Victoria. So far, there is no qualified hydrometeorologist in this section but plans are underway to train a hydrometeorologist to head this section. The Director of Meteorology, Kenya, was co-opted as a non-voting member of the Technical Committee of the Hydromet Survey Project.

During this period the Department gave the following services to the Hydromet Survey Project:

##### **Data Processing**

Extraction of 1975/76 Climat Data

Extraction of 1975/76 Rainfall Data

Form 603 for Lake Victoria Rainfall stations containing daily rainfall figures were forwarded to Hydromet Project – Entebbe monthly.

Hourly rainfall and wind data were extracted for a number of stations for a specific period.

Participated in the formation of a mathematical model.

A total of about twenty thousand forms of various types were printed on request for the project by the Printing Section of the Department.

##### **Hydrometeorological Observations**

The following hydrometeorological network was maintained and was being improved to serve better the Hydromet Project.

Climatological stations at Eldoret, Kitale, Kericho, Kisii and Kisumu.

About five hundred rainfall stations in the Kenyan part of the project area were maintained.

In order that this network could run efficiently the Department stationed a meteorological superintendent at Kisumu to supervise the project work.

## Seismology

There were no seismology activities though Inter-Ministerial consultations were on hand on who was best suited to handle this field for the Government. However, the Department was called upon to comment on the Earthquake that shook Nairobi, Thika, Embu, Meru, Nanyuki, Makindu and Kilimanjaro on the night of 5th April, 1978.

### **4.1.4 Climatology and Data Processing:**

#### Climatology

During the year 1977/78, the work of Climatological Section went on well Meteorological records were collected from about one thousand five hundred rainfall stations, fifty five Agromet. stations, forty two temperature stations and twenty four synoptic stations. The records were kept on forms, computer tapes, and non-statistical records like weather charts which were kept permanently on microfilms but the original charts were kept in store for some time where they can be obtained for quick research and investigations. Towards the end of the year there was a shortage of microfilms which delayed the work in the section.

Climatological information was given to users in written form, publications, computer tapes and by telephone.

#### Data Processing

The routine processing of data for Kenya, Tanzania and Uganda continued despite the break-up of the Community and by the end of the period under review, all data upto December 1976 was processed. Also completed was a special project whereby another two hundred and twenty stations were added to the "Back Punched" rainfall file. We also prepared data for the Mount Kenya Baseline Project.

Having recognized that Kenya rainfall data was in great demand, a set of tapes containing only Kenya data was prepared. This set consisting of about six tapes proved a tremendous computer time saver.

Necessitated by change of equipment, new procedures for the preparation of Climatological summaries had to be formulated. Programme coding to handle the rainfall publications was started.

During the period numerous requests were handled. Some of them requiring extensive computer work. These include rainfall requests for the Tana River Development Authority, Kenya Water Master Plan, Hydromet Entebbe, Tanzania Water Master Plan, Tanzania Paper Factory at Njambe and East

African Forestry Research Organization (EAFRO) at Muguga. As the number of Post-Graduate students in the Department of Meteorology at the University increases, so does the demand for research data. During the period under review many requests were received from University. Some of them requiring rather complicated computer programming as in the case of calculation of rainfall pentads in Kenya.

We also had some overseas visitors who visited the Data Processing Section and collected data. In some cases it was necessary for the section to do extensive computer work for some of the visitors as in the case of Mr. Beresford from the United Kingdom.

#### **4.2 Training Activities:**

The following local and overseas training including seminars were attended during the year:

- (a) Six engineers were trained in Britain under Kenya Government Scholarships. This was on a crash programme to enable the nationals to man the equipment previously being looked after by the non-nationals.
- (b) Two officers were trained under the Voluntary Assistance Programme (VAP) fellowships in Cairo in the field of Telecommunications. One meteorologist was offered an Organization of African Unity (OAU) fellowship to study computer Science at the Postgraduate level in Lagos.
- (c) Six trainees were recruited and given an initial training on welding by the East African Oxygen Ltd. During their on-the-job training in the workshops they assisted in making over 2000 WF 3 radar reflectors.
- (d) Five instrument Assistants attended a Diploma course in Kenya Polytechnic. Fifteen Communication Assistants attended a twelve months Telecommunications Basic training at the School of Aviation. Seven technicians were trained in the United Kingdom and Canada.
- (e) The Librarian attended a course on Design and Administration of Information Systems at the Management Institute, Arusha, Tanzania. Two Library Assistants attended a six month library course leading to certificate in library science at the "Hamarskjold Memorial Library" in Kitwe, Zambia.
- (f) Sixty seven trainees attended a World Meteorological Organization (WMO) Class IV Course at the East African Institute for



Meteorological Training and Research in Nairobi. Fifteen University graduates attended an Operational Training Course (OTC) at the East African Institute for Meteorological Training and Research (EAIMTR) in Nairobi.

- (g) Fifteen trainees attended a World Meteorological Organization Class II course at the East African Institute for Meteorological Training Research.
- (b) One meteorologist attended a course on computer application for Hydromet Personnel.
- (i) Fifteen officers attended a Regional Seminar on Background Air Pollution Monitoring.
- (j) Seven officers attended UNESCO/NORAD third Region Training course for Hydrology Technicians.
- (k) Twelve Assistant Meteorological Officers were posted for three months on-the-job training and radar training in Jomo Kenyatta Airport.
- (l) Twelve Radiosonde staff attended a four week course on radiosonde operator at the Meteorological Institute.

Some members of the staff attended a symposium on "Role of Water Resources in Development" held at the University of Nairobi under the joint auspices of the East African Academy and United Nations Educational, Scientific, and Cultural Organization (UNESCO).

### 4.3 Observatories:

#### 4.3.1 *Synoptic Observations*

During this period the observatories were not physically inspected. As a result several instruments were **unserviceable**. The outstations also ran out of the consumables. This was mainly because after the change-over from the East African Community to Kenya Government the supply was exhausted before the arrival of the ordered supply. It was also difficult to transport the available consumables to outstations due to lack of vehicles.

No new synoptic stations were opened and no station was upgraded. The surface synoptic network comprises of the stations operating on a 24-hour, 21-hour, 18-hour and 15-hour basis depending on the category. The Department also operates one part time station.

The following is a full list of the national network. Some of these stations operate as both Agrometeorological stations and Synoptic stations.

(see 4.1.2)

24-Hr. Stations	21-Hr. Stations	18-Hr. Stations	12-Hr. Stations
Embakasi	Meru	Voi	Nyeri
Observatory	Nakuru	Makindu	Moyale
Mombasa		Narok	Thika
Observatory		Lodwar	Machakos
Malindi		Mandera	Kisii
Kisumu		Marsabit	Nyahururu
Kitale		Embu	Kabete
		Lamu	
		Wajir	
		Eldoret	
		Wilson	
		Garissa	

Part Time Station: Magadi

#### 4.3.2 Upper Air Observations including Pilot Balloon Ascents

There are three Upper Air stations, namely Dagoretti, Garissa and Kericho. Dagoretti and Garissa do two ascents daily at 0000 and 1200 GMT. Kericho does only one ascent at 0600 GMT. During this period Garissa Upper Air Unit was not operational due to major equipment breakdown. There were only a limited number of Pilot Balloon Ascents done due to lack of consumables.

There are thirteen Pilot Balloon stations in Kenya. These are:

Wajir, Mandera, Meru, Embu, Makindu, Voi, Mombasa, Malindi, Nakuru, Kitale, Lodwar, Kisumu and Narok.

These stations do two Pilot Balloon ascents daily.

#### Dagoretti Upper Air Unit

This section participated in two sets of intensive observations for the feasibility studies on Mount Kenya Baseline station during the periods 6th to 15th June 1977 and 10th to 16th January 1978. During this period four Radiosonde/Wind ascents were done each at 0000, 0600, 1200 and 1800 GMT.

It also participated in an experiment to monitor surface/Upper winds and temperatures in the Nairobi City and environments for the period 6th to 19th March, 1978.

During this period a total of 789 ascents were attempted with only 60 unsuccessful ascents. The highest level achieved was 013 mb while the

lowest level achieved was 210 mb.

### Pilot Balloon Ascents

Apart from the radiosonde/wind ascents, thirteen stations do two pilot balloons daily using the optical theodolite. The release of these pilot balloons depends on the weather conditions. An attempt is made to release two pilot balloons a day at 0600 and 1200 GMT respectively.

The following is a table showing the number of ascents done by each station during the period:

STATION	NUMBER POSSIBLE	NUMBER MADE	%	NUMBER ABOVE 15000'	%	HIGHEST	DATE
Voi	730	187	25	42	22	41 890	5. 4.78
Nakuru	730	317	43	270	85	78 141	2.10.77
Wajir	730	54	7	11	20	54 800	1.12.77
Meru	730	138	19	70	50	48 600	15. 7.77
Embu	730	184	25	76	42	51 400	10. 1.78
Mombasa	730	442	60	80	17	36 186	21.11.77
Mandera	730	172	23	34	19	55 255	11.11.77
Kitale	730	208	28	142	68	47 250	4.11.77
Kisumu	730	267	36	180	67	55 269	27. 7.77
Narok	730	105	14	90	86	51 200	13. 9.77
Makindu	730	312	43	74	23	53 070	18.12.77
Lodwar	730	80	11	31	39	46 190	11. 4.78
Malindi	730	71	10	33	46	57 070	25.10.77

#### *4.3.3 Rainfall Observations and Inspection*

During this period it was difficult to obtain the raingauges and measuring cylinders. The inspecting officers had difficulties in getting transport also. As a result only four inspection safaris were made covering four hundred and fourteen stations. During the visits the inspectors corrected the mistakes which were being made by observers when observing and recording. There are over one thousand, five hundred rainfall stations all over the country.

#### **4.4 Services to the Public including Enquiries and Show:**

Enquiries were made in person, by letter and by telephone and were answered as required. There were some geological enquiries which could not be answered by the section and were referred to the relevant Departments.

On the whole the Climatology Section answered about one thousand, two hundred and fourteen enquiries most of which were concerned with rainfall.

The Department participated in the Nairobi International Show in 1977 under the office of the President – Community Affairs.

#### **4.5 Instrument Section:**

This section lost quite a number of its technicians after the break-up of the East African Community.

Mr. Jay Dickson, a Canadian team leader and adviser on training completed his tour of service. During his period of stay he revised the following:

Barometry, Thermometer Calibration and Raingauge Calibration. Mr. Peter Kahutu was attached to Mount Kenya Baseline Project on continental Pollution. The section participated in airport development meeting for Nairobi, Mombasa and Kisumu.

In Jomo Kenyatta Airport several instruments were installed. Among these were the AH—mast which was installed at the mid-runway and also the installation of new anemometers. Field equipment for RVR (Transmissometers) were not installed.

During this period the instrument officers visited Coast Province and inspected the instruments for Makindu, Voi, Mombasa and Malindi.

The section assisted other Organizations such as Medical Research, ICIPE, University of Nairobi and Irrigation Board (Holo) in repairing and calibrating their thermohygrographs. A new station was installed for South Nyanza Sugar Company.

#### **4.6 Printing Section:**

The Printing Section of the Kenya Meteorological Department is responsible for printing operational forms and publishing meteorological memoirs, pamphlets, agrometeorological data, summary of rainfall, weather of East Africa, monthly farming weather bulletins and other documents connected with meteorology. The Printing Section continued to print meteorological forms for Kenya, Uganda and Tanzania.

During the year under review different types of publications and forms were produced, as follows:

- (a) Five research reports – 1,600 copies.
- (b) Kenya Library Association newsletter No. 1 – 250 copies.
- (c) Eight Hydromet Survey books 540 copies.
- (d) Thirty four meteorological forms – 364,990 copies.

- (e) Weather of East Africa for the year 1973 – 350 copies.  
Weather of East Africa for the year 1974 – 350 copies.
- (f) Rainfall in Kenya, Uganda and Tanzania for 1973 – 1,050 copies.
- (g) Meteorological data in Kenya and Uganda – 700 copies.
- (h) Hydrometeorological form book – 575 copies.

The binding section bound four hundred and twenty nine books.

### Promotion

During this period, nobody was promoted from the Printing Section.

## **5. EAST AFRICAN INSTITUTE FOR METEOROLOGICAL TRAINING AND RESEARCH (EAIMTR)**

### **5.1 Administrative and Support Services:**

#### *5.1.1 Staffing*

Following the collapse of the East African Community some of the non-Kenyan Instructors left the Institute. As a result of their departure the remaining instructors had to do extra teaching duties during the second half of the year 1977 to keep the course continuing. The World Meteorological Organization (WMO) Class I meteorologists who left the Institute during this transition period were Messrs M.T. Mushi, P. Gwage and P. Maitwe.

During the same period Dr. A Todorov, a WMO instructor in Agrometeorology, Mr. C.C. Reyes, a WMO instructor and Mr. J. Findlater who was seconded to the Department by the British Government left the Institute after the expiry of their contracts.

#### *5.1.2 Accounts and the Stores*

During the period under review, the revenue collected at the Institute was as follows:

Hotel charges	–	KShs. 443,104.00
Tuition fees	–	KShs. 149,054.00
Sale of meals	–	KShs. 18,034.00
Sale of Departmental Publications (by library)	–	KShs. 7,500.00

### **5.2 General Service:**

#### *5.2.1 Library Services*

The Kenya Meteorological Department Library is housed in the E.A.

Institute for Meteorological Training and Research building off Ngong Road, at Dagoretti Corner, Nairobi. The Library provides a comprehensive coverage on literature in meteorology and associated subjects. It serves mainly the staff of the Department, researchers and pupil meteorologists, but it is also open to other professional users outside the Department.

During the period under review, the East African Community collapsed. As a result of this, Tanzania and Uganda branch libraries broke away from the Headquarters main library. The Kenya branch library was moved to the Headquarters and became an operational branch library which now keeps and maintains all operational documents published by World Meteorological Organization, International Civil Aviation Organization and other Government agencies. This branch library caters for the operational staff and the directorate. A reference library was also established.

During this period there was a great demand for Departmental publications mainly from research Institutions, industrial and commercial Organizations, research students and from individuals. The Departmental Publications dating as far back as 1930's were bound and preserved for reference.

Mr. A.L. Alusa, the Assistant Director (Institute) delivered to visiting Librarians, a paper entitled "Meteorology and the National Development: How Libraries can contribute to it". This paper was then submitted for publication in Maktaba, an official journal of the Kenya Library Association.

The Librarian Mr. Vincent Saropa attended a course on "Design and Administration of Information Systems" at the Management Institute, Arusha, Tanzania. Messrs Maraigua and Sakwa, both Library Assistants, attended a six month library course leading to a certificate in Library Science at the "Hammaraskjold Memorial Library".

#### 5.2.2 *Library Statistics*

New books accessioned	–	1,300
Copies of Departmental Publications distributed and sold	–	5,000
Value of Departmental Publications sold	–	See 5.1.2 above

#### 5.2.3 *Departmental Publications issued in the year 1977/78*

##### Periodical Publication

Issued weekly	–	Rainfall at selected stations in East Africa.
Issued monthly	–	Farming Weather



Issued — Meteorological data recorded at Agricultural, Hydrological and Synoptic stations in Kenya, Tanzania and Uganda during the year 1974.  
The weather of East Africa during the year 1973

#### Research Papers Published as Departmental Publications

- (a) Special distribution of precipitation in Mombasa area of Kenya — by R.E.A. Okoola. Research report No. 1/78, published in June 1978.
- (b) The occurrence of dry spells during the East African long rains — by A.L. Alusa and P.M. Gwage. Research report No. 2/78, published in June 1978.
- (c) A note on the onset of rains in East Africa — by A.L. Alusa. Research report No. 3/78, published in June 1978.
- (d) Influence of Maize plant density or radiation, soil temperature and soil moisture distribution — by J. Kagia Njihia.
- (e) Global solar radiation measurements over East Africa — by P.A. Mwingira.

### 5.3 Training:

It has not been possible to purchase text books for students within a short time. Some trainees from outside Kenya arrive two to three weeks late. This has adversely affected the smooth running of the courses at the Institute.

During this period various courses were conducted in the Institute. Most of the courses were geared to train the professional meteorologists while others were for non-professional meteorologists. The non-professional trainees offered courses by the Institute were the Air Traffic Controllers and Telecommunications personnel. Others were trainees from the Ministry of Water Development who were given a special course on General Meteorology and Instruments.

Besides the courses organized by the Institute, there were also others which were organized by other organizations. These were:

Computer Application course for Hydromet Personnel,  
Regional Seminar on Background Air Pollution Monitoring  
and The UNESCO/NORAD Third Regional Training Course  
for Hydrology Technicians.

5.3.1 DETAILED SUMMARY OF THE COURSES HELD WITHIN THE PERIOD OF THE REPORT

COURSE

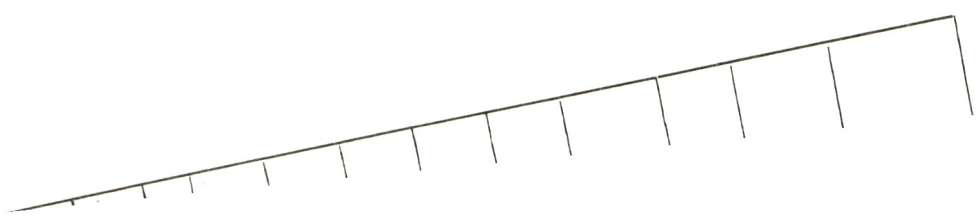
COURSE	Kenya	Uganda	Tanzania	Malawi	Zambia	Botswana	Senegal	Lesotho	N. Yemen	Seychelles	Gambia	Ethiopia	Somalia	Sudan	Burundi	Egypt	Total No.	Successful No.
	WMO Class IV Course B. 37 16.1.78 to 12.5.78	59									2							61
WMO Class IV Course B. 38	8	14				6		1		2							31	31
Operational Training Course (OTC) 18.7.77 to 3.12.77	15		3														18	12
WMO Class II Course No. 12	5	10	3		2		2	2	1	1	1						27	22
WMO Class II Course No. 13	9	1	12														22	22
WMO Class II Course No. 14	1		7	4	2												14	13
WMO Class II Course No. 16 18.1.78		1			2			1		3			1				8	7
Specialized Course in Agromet Course No. A - 3 16.1.78 to 13.7.78											2	2					4	4
Computer Application Course for Hydromet Personnel	1	3	2											3	1	2	12	12

From English speaking countries

Regional Seminar on Background  
Air Pollution  
Monitoring 21.11. to 25.11.77

There were 27 participants from twelve English speaking countries

The UNESCO/NORAD third  
Regional Training Course for  
Hydrology Technicians  
3.10.77 to 16.12.77



#### 5.4 Research Activities:

Some of the research work was completed and published as Departmental publications. Other research works are continuing under the guidance of Prof. G.C. Asnani of the University of Nairobi, Department of Meteorology. Research seminars were held at the East African Institute for Meteorological Training and Research to discuss the results of the completed work.

Some of the research works still in progress are:

- (a) Numerical simulation of Barotropic instability.
- (b) A study of the mean upper tropospheric horizontal motion in the near equatorial region.
- (c) The Nairobi Heat Island.
- (d) Divergence profile in the Nairobi area.
- (e) Analysis of pentad rainfall for agriculture purposes in Kenya.
- (f) Diurnal and seasonal variations of precipitation in East Africa.
- (g) Seasonal rainfall probabilities and persistence in East Africa.
- (h) Measurements of diffuse solar radiation at Dagoretti Comer.
- (i) Net radiation over vegetative cover and its relation to global radiation.
- (j) Atmospheric turbidity over Kenya.
- (k) Detemination of the Agrohydrological properties of soils at Nyeri and Kisii.
- (l) A study of the regime and balance of soil moisture in maize fields.
- (m) Diagnostic mesoscale study of Lake Victoria Circulation system and its interaction with large scale flow.
- (n) Agriculture potential estimated from the ratio of actual, to potential evapotranspiration.
- (o) Use of statistics in rainfall climatology.
- (p) Forecasting minimum temperature at the Jomo Kenyatta Airport.
- (q) Strong westerlies over Nairobi in the Upper troposphere.
- (r) Mesoscale studies of hailstorms in the Kericho Nandi Hills area.
- (s) Evaluation of hail suppression activities in the Kericho Nandi Hills area.

## **6. ADMINISTRATIVE FINANCE AND SUPPLY**

### **6.1 Staff Administration:**

After the collapse of the East African Community, all the officers who opted to be absorbed in Kenya Civil Service were absorbed. Twenty four officers opted to retire on abolition of office.

Because of a shortage of local staff especially in meteorologists, meteorological officers and engineering cadre, local contracts were given to thirty two non-nationals who were working with the defunct East African Community.

One of the major problems experienced during this period is the resignation of technical staff especially in Engineering section, to join the Private Sector. The main reason was due to low salaries in the Civil Service. It is imperative that something should be done to alleviate this problem if we have to run the services affectively.

### **6.2 Accounting Services:**

Following the collapse of the East African Community, the Accounts Section prepared various types of returns such as a list of all Kenyans serving on permanent and pensionable terms, including their salaries and house allowance earned as at 30th June, 1977. Returns of officers of other nationalities and their allowances were also prepared. The returns of advances for refrigerators, cookers, bicycles, imprests and hotel allowance recoveries were also made. Frozen leave was paid in cash.

During the period under review seven officers who were non-nationals were relieved of their duties, three officers resigned while three others joined the section.

After the Department was taken over by the Government the staff had to get acquainted with new code of Regulations, Financial orders, Circulars etc. They experienced some difficulties at first but later on they overcame them.

### **6.3 Planning and Development:**

A hostel to cater for local and foreign students was completed in July 1977 and was opened by the Minister for Power and Communications. The Construction of an extension to the Meteorological Department Headquarters was completed. This extension has accommodated the Regional Telecommunications Hub, a teleprinter workshop and offices for the section heads on the ground floor. The first floor accommodated the Regional Meteorological Centre and the offices for the divisional head and sectional heads and some Kenya Region units which moved to Headquarters in July 1977.

Some junior staff houses at the Headquarters were improved. The one bedroomed houses were extended to two bedrooms. The water and electricity meters for individuals were installed. The leaking roofs were repaired and they were painted both internally and externally. The roofs of the Headquarters, Engineering and Auditorium buildings were repaired for leakages. The transmitter station was fenced and a road leading to the station was repaired.

Although efforts have been made to develop at least five outstations every year, only one station was developed. This was caused by the delays from the Ministry of Works. An office and five staff quarters were constructed in Lodwar. During this period the money allocated to the Department for development was not spent due to various problems emanating from Ministerial and Central Tender Boards.

#### 6.4 Supplies:

The Supplies Section of the Department is charged with the responsibilities of procurement, i.e. acquiring all the necessary stores, storekeeping which involves the safe custody of all that which has been procured, their records and finally distribution to the users as and when required.

The procurement aspect was planned to be operative in two lines:

- (a) Procurement of Common User Stores (stores obtainable from Ministry of Works Supplies Branch).
- (b) Non-common user items.

After the collapse of the East African Community, the Government procedures for acquiring stores from the Ministry of Works, Supplies Branch were introduced. These new changes were unfamiliar to the Supplies Officers working in this section. As a result there was a shortage of essential equipment. The transfer of Mr. C.M. Richu and the retirement of Mr. N. Ochieng, both of whom had considerable experience in the technicalities of the acquisition of the departments unique stores, also contributed a lot to the shortages of the consumable stores.

Acquisition of stores and particularly tendering for equipments was not successful. Many tenders were rejected by the Central Tender Board (CTB) on the grounds of lack of proper specification – but where they went through, validity period had expired.

The section was visited by the Treasury's Stores verification Unit.



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