E.C. No. 273

260

ESTIMATES COMMITTEE
1961-62

HUNDRED AND SIXTY-EIGHTH REPORT

(SECOND LOK SABHA)

MINISTRY OF TRANSPORT AND COMMUNICATIONS

(Department of Communications & Civil Aviation)

INDIA METEOROLOGICAL DEPARTMENT

LOK SABHA SECRETARIAT
NEW DELHI

March, 1962/Phalguna, 1883 (Saka)

Price : 60 *nP.*

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INTRODUCTION

I, the Chairman, Estimates Committee having been authorised by the Committee to submit the report on their behalf, present this Hundred and Sixty-Eighth Report on the Ministry of Transport and Communications (Department of Communications & Civil Aviation) on the subject "India Meteorological Department'.

2. A statement showing an analysis of the recommendations contained in this Report is also appended to the Report (Appendix VII).

3. The Committee wish to express their thanks to the Secretary of the Ministry of Transport and Communications (Department of Communications & Civil Aviation) and other officers of the Ministry for placing before them the material and information that they wanted in connection with the examination of the estimates.

NEW DELHI-1;
March 19, 1962
Phalguna 28, 1883 (*Saka*).

H. C. DASAPPA,
Chairman,
Estimates Committee.

I

ORGANISATION AND STAFF

A. *Introductory*

First Set Up.

India Meteorological Department was first set up on an all India basis in 1875 to co-ordinate, combine and extend the work of various provincial meteorological organisations which had been established in the years between 1865 and 1871. Before 1865, the provincial authorities asked administrative or medical officers in the districts, to note temperatures, pressure and rainfall but there was at that time no arrangement to collect the records systematically and turn the data to account.

Functions.

2. The main function of the Department on its formation was "the systematic study of the climate and weather of India as a whole and the application of the knowledge thus acquired to the issue of storms and other warnings and daily weather forecasts". In the course of time, many more duties like weather warnings for farmers, fishermen, ships, meteorological briefing for aviators, etc., have been added and some subjects other than Meteorology such as Astronomy, Astrophysics, Ionospheric Physics etc. have come under the jurisdiction of the Department. A statement showing the functions of the Department on the service side as well as on the scientific side is enclosed as Appendix I.

B. *Organisational Set Up*

Organisation.

3. The head of the India Meteorological Department is the Director General of Observatories with his headquarters at New Delhi. He is assisted by four 'functional' Deputy Directors General two at Delhi (Deputy Director General, Administration and Deputy Director-General, Instruments) and two at Poona (Deputy Director-General, Forecasting and Deputy Director-General Climatology and Geophysics). The country is divided into five meteorological regions each under a Regional Director with headquarters at Bombay, Calcutta, Madras, Nagpur and New Delhi. A chart showing the organisational set up of the Department is given in Appendix II.

Reorganisation of the Department.

4. The representative of the Department informed the Committee that the present pattern of organisation of the Department came into existence nearly 15 years ago. The

Department was thinking of the following schemes to strengthen the organisation:—

(i) To strengthen the research organisation by setting up an Institute of Tropical Meteorology in Poona and a Northern Hemispheric Analysis Centre at New Delhi during the Third Plan;

(ii) to increase the posts of Directors from 11 to 19 so that each Director is functionally in charge of a particular subject;

(iii) to have the same scales of pay for the higher posts in the Department as obtain in other scientific departments and laboratories for similar posts;

(iv) to split up Calcutta region into two so as to have a separate region for Assam, which was considered to be a difficult area and had special problems.

The Committee were, however, not furnished with further details including the financial implications of these proposed measures.

Delegation of Powers.

5. The Committee learn that a number of administrative and financial powers have been delegated to the Regional Directors which by and large were considered adequate. A statement showing the details of delegated powers is enclosed as Appendix III.

The Committee understand that at present Ministry's sanction for travel by air for non-gazetted staff was required in individual cases for travelling between Pasighat and Mohanbari even though the only means of transport between these two stations was by aeroplane. Another instance noticed by them was in regard to the delays caused by the procedure of issuing formal sanctions for the expenditure incurred by the Regional Directors on the purchase of books and journals already approved by the Director General. *The Committee suggest that the feasibility of delegating the following powers to the Regional Directors may be examined*:

(i) *to sanction air travel of non-gazetted staff between Pasighat and Mohanbari; and*

(ii) *for purchase of books and of journals and periodicals approved by the Director General.*

Headquarters of Seismological Organisation.

6. The Committee were informed that the headquarters of the seismological organisation was shifted from Shillong to New Delhi in August 1958. Earlier the headquarters

were at Poona and had been shifted from Poona to Shillong for the reason that Shillong was in the seismic zone. The main reasons for the later shifting of the headquarters to New Delhi were stated to be the unsuitable climatic conditions and communication difficulties.

Tabulation and Analysis of Seismological Data.

7. The Committee are surprised to learn that even after the transfer of headquarters to New Delhi, the recordings of various seismological observatories are still sent to the Central Seismological Observatory, Shillong for tabulation. The tabulated data is then sent to the headquarters at New Delhi for printing in the form of a bulletin. The existing process of compilation and printing is stated to take over two months. *The Committee see no justification for continuing the work of tabulation and analysis of data in Shillong when the headquarters of the seismology has been shifted to New Delhi. Besides, the present process involves avoidable delay in analysis and printing of the data. As agreed to by the representative of the Department in his evidence, the work of tabulation and analysis of data may be progressively undertaken at New Delhi itself.*

C. *Staff*

Temporary Employees.

8. The Table below indicates the number of permanent and temporary posts and the number of permanent, officiating and temporary staff working against them in the Meteorological Department as on the 1st April of 1959, 1960 and 1961:—

As on 1st April	Number of Posts		Number of employees in position		
	Permanent	Temporary	Permanent	Officiating	Temporary
1959 .	2,351	1,048	1,735	97	1,331
1960 .	2,351	1,429	1,803	172	1,519
1961 . . .	2,688	1,111	1,819	162	1,519

The representative of the Ministry informed the Committee during evidence that in accordance with the orders issued by the Ministry of Home Affairs two years ago, a number of temporary posts had been converted into permanent ones and action was being taken to confirm the eligible staff against them.

Budget and Expenditure.

9. A table showing the budgeted provision and the actual expenditure for the last three years together with the budget estimates for 1961-62 is placed below:—

Year	Budget Estimates Rs.	Actual Expenditure Rs.
1958-59	1,61,46,000	1,54,87,870
1959-60	1,62,47,000	1,54,76,297
1960-61	1,85,29,000	1,65,09,402
1961-62	2,00,09,000	Not available.

Welfare of Staff.

10. The Committee understand that no budget provision is made for staff welfare in the budget estimates of the India Meteorological Department. However, expenditure has been incurred from the sanctioned budget grant in the form of grants-in-aid to Recreation Clubs formed by members of staff at sub-offices and units of the Department outside Delhi. The grant-in-aid is also given to the Recreation Club of the Headquarters Office at Delhi out of the provision made in the Ministry of Home Affairs for the purpose and disbursed by the Ministry of Transport and Communications. The amounts sanctioned during the last three years are as under:—

Year	Grants-in-aid to sub-offices and units of Deptt. outside Delhi	Grants-in-aid to the Recreation Club of Headquarters Office	Total
	Rs.	Rs.	Rs.
1958-59	1,076	1,110	2,186
1959-60	1,495	850	2,345
1960-61	2,002	1,373	3,375

The Committee note that the expenditure on welfare of over 3,500 non-gazetted employees amount to Rs. 3,375 which works out to less than Re. 1/- per head, whereas the expenditure on welfare in P. & T. Department and Railways amounts to Rs. 3 to Rs. 4 per non-gazetted employee per pear. *As the meteorological department is widely scattered and many of its establishments are situated away from the cities*, the Committee suggest that the desirability of finding more funds for welfare of the non-gazetted staff of the Department may be examined.*

*Transport facilities for school-going childern at concessional rates and free transport and medical treatment in case of emergencies are provided to the staff of the Meteorological Department at aerodrome stations on the same lines as for the staff of the Civil Aviation Department.

11. The Committee were informed that it was proposed to provide quarters for 80 per cent. of the staff working at aerodrome stations and other stations which were far away from the town. Only 50 per cent. of the staff had, however, been provided with quarters so far. *The Committee suggest that a scheme may be drawn up to provide quarters for the staff within a stipulated period.*

Staff Quarters.

II

GENERAL WORKING

A. *Introduction*

Primary Aim of Meteorological Organisation.

12. The primary aim of any meteorological organisation should be to give advance information about the forthcoming weather. These 'forecasts' are based on the observations made at the various stations within the country and the observational data received from other countries on land, sea and air.

It was stated that recent analysis and experience have shown that the weather 24 hours hence at any locality is influenced to an appreciable extent by the weather situation prevailing at places as far away as 3,000 Km. from it. For instance it is found that the weather situation over the Indian area 24 hours hence is influenced by the present weather situation over the Persian Gulf, the Russian Turkestan, over the Chinese Waters, and over the South Indian Ocean as far south as Mauritius. Forecasts for longer periods ahead require collection of data over much wider areas of the globe.

Weather Forecasts.

13. The Committee were informed that the weather forecasts were usually issued two to three days in advance by the various forecasting offices of the India Meteorological Department. The Poona Weather Centre issued through the radio a generalised and condensed All India Weather Summary and forecasts in non-technical language. Each of the five regional meteorological centres also issued similar forecasts for their regions. Aviators, domestic and foreign, were supplied detailed weather information vital for safe and economic operation of aircraft. For the farmers, special forecasts called Farmers' Weather Bulletins, were issued through the press and the radio and in addition messages of special interest to farmers were sent to the Community Project officials.

n of Forecasts.

14. The Committee were given to understand that non-aviation forecasts for four days spread over each of the four seasons of the year selected at random were checked by the Deputy Director General (Forecasting), Poona, but there was no procedure laid down for regular review. A summary of results of such verification for the year 1959 and 1960 is enclosed as Appendix IV. On the basis of

such verification the forecasts issued by the India Meteorological Department were stated to be accurate upto 70 to 80 per cent. As the forecasts verified constituted a very small sample it was stated that from 1962, warnings issued over one whole month in each of the four seasons would be verified. *While this is an improvement, the Committee consider that it would be desirable to enjoin on the head of each forecasting office to undertake every day a general review of forecasts given on the previous day so that the margin for subjective error creeping into forecasts is reduced to the minimum, if not altogether eliminated. From time to time meetings could also be held in each forecasting office to discuss the result of such reviews so that constant efforts are made at all levels to improve the accuracy of forecasts.*

B. *Statistical Forecasting*

15. The Committee understand that long range forecasts of the nature of monsoon rainfall and of winter precipitation in the different broad regions of the country are given. These are based solely on statistical studies. The representatives of the Department stated in his evidence that the long range seasonal forecast was not really serving any useful purpose for the reasons that not only the area for which the forecast was issued was too large but the forecast itself was worded in too broad terms to be really of any practical utility. *The Committee are of the view that there is imperative necessity of improving the methods and technique for long-range forecasting.*

Long-range Seasonal Forecasts not useful.

C. *Collection and Dissemination of Information*

16. In India, data from the basic observatories are transmitted through landline telegrams to the appropriate regional centres from which they are disseminated through teleprinter channels, which connect all the five regional centres, to the Meteorological Communications Centres at Bombay. Data collected at the regional centres are also broadcast simultaneously on four frequencies by wireless in morse code by the All India Meteorological Broadcast Centre, Delhi for the benefit of forecasting centres in India as well as in the neighbouring countries.

System in the Country.

17. A Northern Hemispheric Exchange Centre, as a part of the international programme of World Meteorological Organisation, for exchange of meteorological data of the Northern Hemisphere has been recently established at New Delhi with a two-way radio-teletype link between New Delhi and Moscow and New Delhi and Tokyo. New Delhi is thus one of the five centres in the world (*i.e.* Moscow, New Delhi, Tokyo, New York and Frankfurt) which are interlinked with each other and where meteorological data on

Northern Hemispheric Exchange Centre.

the whole of Northern Hemisphere are collected and exchanged. It provides valuable data not only for forecasting weather conditions in the Indian area and its neighbourhood but also for catering for long distance international high altitude jet aircraft flights.

Collection of Internal Data.

18. The Committee were informed that an efficient communication system was the *sine qua non* of an effective forecasting service and that in India improvement was called for in the matter of speedier channels of communication both for collection of basic observational data as well as dissemination of weather forecasts and warnings. It was explained during evidence that much time was taken by the basic observatories in sending messages by the land-line telegrams to the forecasting offices. Though such telegrams were marked "express weather telegrams" and carried high priority they reached the forecasting offices on an average in two hours. The representative of the Department urged that the transmission time may be reduced to half-an-hour. He pointed out that at Delhi data from Japan reached much ahead of data from Rajasthan, Mysore and other States. He also pointed out that this deficiency could be eliminated by having a meteorological teleprinter network with which all meteorological stations were connected. *The Committee suggest that steps may be taken immediately to minimise the delays* en-route *to weather telegrams till these could be eliminated by having a meteorological teleprinter net-work.*

Dissemination of Information.

19. The Committee were informed that the various All India Radio stations broadcast weather-news for the whole of India in the evening cycle of news bulletins in English and in different Indian languages. AIR New Delhi broadcast a weather summary and forecast for the different regions in the morning cycle of news also. Many of the AIR stations broadcast in the morning a local forecast for the city in which the broadcasting station was situated.

The representative of the Department stated that the number of daily weather broadcasts through radio in big cities of the country was not considered adequate. While in the United States there were hourly weather broadcasts in certain cities, in India it was only twice a day. He was of the view that it was desirable to increase the number of daily weather broadcasts from two to four per day in big cities of the country. *The Committee suggest that the feasibility of increasing the number of daily weather broadcasts may be examined in consultation with the Ministry of Information and Broadcasting.*

D. *Service to Aviation*

20. Weather plays an important role in aviation. The conditions near the ground are important at the time of take off and landing while those at the flight levels are important during the rest of the flight. Role of Weather in Aviation.

21. Asked about the quality of service provided by the Meteorological Department for aviation, the representative of the Department stated that the aviators were quite satisfied with it but they had suggested certain improvements such as giving of forecasts in the form of prognostic charts as done elsewhere in the world instead of written memoranda. Improvement Required.

It was stated that to prepare high level weather analysis for the use of jet aircrafts a good network of observatories was required. The existing number of upper air observatories in the country was not adequate and it was proposed to increase the number from 13 to 30 in the Third Five Year Plan. The forecasting centres at Dum Dum and Santacruz airports were also being suitably augmented to prepare prognostic charts on a regular basis. *The Committee consider that earnest efforts should be made to make up the leeway and provide on efficient and modern service to aviation in this jet age.*

E. *Observatories*

22. The basic data for meteorological purposes is obtained from a network of observation stations from where the observers make detailed reports at definite times of the day and night. The Committee were informed that the number of meteorological observatories in the country was 77 in 1875 when the Department was founded. More and more observatories were then gradually established to fill up the gaps in the network over the country and to extend the observations to the land areas around India and to island stations in the Indian seas. At present there are 436 surface observatories, 52 pilot balloon observatories, 249 hydrometeorological observatories, 102 agrimeteorological observatories, 13 radio-sonde stations, 12 radio-wind stations, 7 radar observatories, and 12 seismological observatories in the country. Number of Observatories.

23. There have been considerable shortfalls in the physical targets in the Second Plan under the scheme of 'Moderni- Shortfalls in the Second Plan.

sation of Observational Outfit at Important Observatories' as may be seen from the table below:

	Target	Achieved	Shortfall
Opening of Storm Detecting Radar Stations	10	7*	3*
Opening of Radio-Sonde Stations . .	6	1	5
Opening of Radio-Wind Stations . .	8	2	6
Opening of Sferic Stations . . .	6	2	4
Installation of Ceilometers at aerodromes .	10	1	9
Installation of Transmissiometers at aerodromes	10	..	10

The Committee observe that though out of Rs. 32.60 lakhs allocated for the scheme, Rs. 31.51 lakhs were spent during the Second Five Year Plan, there was considerable shortfall in the achievement of physical targets. It was explained that a substantial portion of the expenditure was incurred on meeting the cost of equipment ordered in 1955-56 and in purchasing some other essential modern equipment required to meet operational needs of weather forecasting offices and aerodrome station.

The details of works contemplated under the scheme of 'Modernisation of Observational Outfit' during the Third Plan is enclosed as Appendix V. The Scheme includes the setting up of 8 storm detecting radar stations, 18 rawin|radio-sonde stations, 3 sferic stations, provision of facsimile transmission and reception, wave analyser etc. *The Committee suggest that earnest efforts should be made from the very beginning to ensure that the targets in the Third Plan are achieved.*

Inspection of Observatories.

24. Surface observatories, pilot balloon observatories, hydromet. observatories, agrimet. and phenological observatories etc. are required to be inspected, as far as possible, once a year and other stations once in alternate years for purposes of instrumental comparison and instructions to observers. The following are the number of observatories in existence and the number inspected during the last three years:—

Observatories/Stations	1958-59		1959-60		1960-61	
	No. of Obser.	No. of Obser. inspected	No. of Obser.	No. of Obser. inspected	No. of Obser.	No. of Obser. inspected
Surface . .	381	145	387	133	436	167
Pilot Balloon . .	55		53		52	
Hydromet . .	184	126	242	102	249	79
Agrimet . . .	85	64	97	69	102	95
Phenological . .	283	64	283	69	283	95
Radio-Sonde . .	13	8	13	12	13	9
Rawin . . .	12	7	12	11	12	8
Storm-Detecting Radar	5	5	6	6	7	7

* 2 more radars were obtained but had not been set up.

The Committee regret to note that not even 50 *per cent of the surface observatories and phenological observatories have been inspected during these years. They recommend that the periodicity of inspection of diverse observatories should be laid down in relation to the requirements and strictly followed.*

III
FLOODS

Recent Floods.

25. Floods have been very much in the news in recent years. At the beginning of the monsoon season of the year 1961, parts of Kerala, Madras and Mysore States which are normally not subject to heavy flooding, experienced severe floods as a result of heavy and concentrated rainfall. A grave situation arose in Poona city following breaches in the Panset and the Khadakvasla Dams. Some lives were lost and vast areas in the city were flooded and widespread damage caused to property and communications. Subsequently during the months of August-October 1961, some States especially Bihar and Uttar Pradesh experienced very severe floods.

A. *Rain Warnings*

Heavy Rain Warnings.

26. The Committee were informed that India Meteorological Department gave only heavy rainfall warnings and did not undertake flood forecasts which involved measuring of river discharges and co-ordinating it with the rainfall. The latter work at present was handled by the Ministry of Irrigation and Power and the State Governments.

The representative of the Department informed the Committee during evidence that suitable warnings regarding heavy rainfall were given about two to three days in advance of the rains leading to the recent floods in Lucknow, Bihar, Poona etc. From the results of sample verification of non-aviation forecasts undertaken by the Department (Appendix IV) the Committee observe that the percentage of accuracy in case of heavy rainfall warnings has been about 35% in 1959 and 53% in 1960, and for other forecasts about 70% in 1959 and 80% in 1960. It was stated that the inaccuracy in the forecasts of heavy rainfall was mostly in the nature of over warnings. *Since heavy rainfall is an important factor contributing to the occurrence of floods, the Committee feel that the warnings of heavy rainfall should be reasonably accurate to be depended upon by the local authorities for letting out water stored in dams, anicuts, etc. They suggest that an analysis may be made of the methods and technique followed in issuing heavy rain warnings with a view to effecting improvement and increase the accuracy to the extent feasible.*

Raingauges in the Country.

27. The Committee are given to understand that in addition to the raingauges maintained by the India Meteorological Department, each of the States maintains a network of raingauges within its boundaries. The total number of such

raingauges whose data are being published at present is 3440. Besides, there are about 2325 raingauges maintained by the various railway administrations and other official agencies in the different States whose data are at present not being published in the State Rainfall Tables.

Need for more Raingauges.

28. The Committee were informed that in order to assess accurately the water power potential of various rivers for flood control purposes, the all India network of ordinary and self-recording raingauges and evaporimeters in the country had been examined for adequacy with regard to the collection of representative rainfall data. Installation of 1200 more ordinary raingauges and 200 more self-recording raingauges had been recommended by the Meteorological Department for implementation by the various States. The representative of the Department stated that the State Governments had been asked to complete the installation of raingauges by the end of the Third Plan. *The Committee hope that the work will be completed as scheduled and that only standard tested instruments will be used for the purpose.*

Inspection of Raingauges.

29. The Committee learnt that all the raingauges were expected to be visited once in three to four years by the inspectors of the India Meteorological Department for check and comparison with a standard gauge. During 1959-60 (October 1959 to March, 1960) 271 raingauges were inspected and in 1960-61 the number was 970. Considering that there are over 5,700 raingauges all over the country to be inspected, the number covered is rather small. While the period of 3 to 4 years prescribed for completing one round of inspection of all the gauges is itself large, it does not seem possible at the present rate for the Department to cover all the raingauges. *The Committee suggest that the inspection machinery may be so geared up as to complete inspection of all the raingauges within the stipulated period.*

Of the raingauges inspected by the India Meteorological Department as many as 53% were found to be either unsatisfactory or of non-standard type. This shows that more frequent inspection of the raingauges is necessary and that arrangements for maintenance of raingauges need to be improved. *The Committee suggest that the Department may stress on the State Governments the need for providing adequate arrangements for maintenance and repair of defective raingauges.*

B. *River Gauge Recordings and Discharge Observations*

Present system of Flood Forecasting.

30. The representative of the Department stated during evidence that the system of taking river gauge recordings and discharge observations had not been adequately developed in the country so far. The methods followed in the country for flood forecasting were characterised as empirical and unscientific. The example of the United States Weather Bureau which had developed scientific and modern methods of flood forecasts using electronic and other automatic equipment was cited in evidence. The Committee were informed that in the absence of the elctronic devices, it would be necessary to have for each major river basin main and subsidiary river forecast centres which would be responsible for maintaining a continuous river watch, preparing forecasts and improving the methods. In addition, the rainfull observations in the catchment areas of the rivers were to be taken and transmitted speedily to these centres.

Automatic gauge and discharge observations were stated to be inadequate at present. The Central Water and Power Commission was stated to be taking action through various River Commissions to draw up master plans for each river basin which included installation of suitable number of gauge and discharge observation stations.

Automatic Weather Equipment.

31. It is also proposed in the Third Plan to undertake the designing, development and manufacture of simple automatic weather equipment in the departmental laboratories and workshops. A small beginning has been made in the designing of radio-operated raingauge that can be used for measurement of rainfall in remote areas and the transmission of data over radio to collecting centres. A prototype unit has been constructed and is to be put on trial operation. *While commending the progress made by the Department in developing automatic raingauge stations, the Committee hope that equipment for automatic weather stations will also be manufactured within the country early.*

Storm Analysis Unit.

32. The Committee were given to understand that a Storm Analysis Unit in the Meteorological Department was established in January, 1961 and after some preliminary planning and pilot studies had started working on the problem of finding out the maximum possible storm for different regions of India. The progress of work of this Unit, however, suffered considerably due to non-availability of foreign exchange for purchasing a few computing machines which were indispensable tools for analysing and processing the data. The staff had to do work manually and thereby much more time was taken in processing the data. The representative of the Department stated during evidence that they were trying to obtain computing machines through the State Trad-

ing Corporation. *The Committee suggest that all efforts should be made to procure the computing machines at an early date.*

33. The representative of the Department stated during evidence that in the United States of America flood forecasting and warnings for rivers were done by the Meteorological Department. He was of the view that flood forecasting in the country should ultimately be taken up by the Meteorological Department for the following reasons:— Scientific Flood Forecasting.

(i) Actual meteorological observations from observatories were required for flood forecasting. As these observatories were under the India Meteorological Department, collection of such data presented no difficulty. Flood forecasting centres could also be easily established in collaboration with hydrological engineers.

(ii) For accurate flood forecasting, soil moisture conditions have to be evaluated. As soil moisture was estimated by careful evaporation and soil temperature measurements, the work could be done better by the India Meteorological Department who had experience of such observations.

(iii) Only the meteorological organisation could develop methods for issue of medium range forecasts based on synoptic situation, upper air moisture conditions etc. for the upper reaches of the rivers. These forecasts were necessary to assess the flood levels at points in the lower reaches.

The Committee hope that the Government would examine the matter in all its aspects and would ensure that a scientific and effective system of flood forecasting is brought into force in the country at an early date.

C. *Frequency of Droughts*

34. The Committee were informed that the reported drought of 1960 in the districts of Telengana Division of Andhra Pradesh was analysed with respect to drought conditions in the previous 70 years and an attempt had been made to find out the frequency of droughts in those districts. The representative of the Department stated during evidence that these were purely statistical studies and could be undertaken for all the States. He added that such studies ought to be done for the whole of India. *The Committee hope that necessary action will be taken to undertake such studies.* Statistical Studies.

IV

AGRICULTURAL METEOROLOGY

A. *Introduction*

Agriculture and Weather.

35. It is well known that the healthy growth and normal yield of crops depend upon certain optimum conditions of rainfall, temperature, humidity, wind, cloudiness etc. A foreknowledge of the occurrence of deviations from the optimum conditions helps the farmer to take precautionary measures designed to minimise the losses caused by them.

Growth of Agricultural Meteorology in India.

36. It was the Royal Commission on Agriculture, 1928, which drew pointed attention to the need for undertaking the scientific study of influence of weather on crops. It observed:

> "The present is a specially opportune time to undertake an examination of the action which should be taken to promote the investigations of the problems of Agricultural Meteorology and to describe which departments shall be responsible for the different branches of the work."

In pursuance of this recommendation a unit to study Agricultural Meteorology was set up at Poona in 1932. Work on the various aspects of the micro-climates of crops, on soil physics, plant physiology in relation to meteorological factors, phenology, crop weather relationship and on analysis of meteorological data having a bearing on crops is done by this unit.

B. *Weather Service to the Farmer*

Early Efforts.

37. A weather service for the farmer was started on an experimental basis by the Central Forecasting Office in Poona in 1936 and tried out for a few years in Bombay State. There was a temporary set back to this activity in the early years of World War II. Under the scheme, as developed thereafter, special Farmers' Weather Bulletins were prepared by the Regional Forecasting Offices of the Meteorological Department and supplied to the stations of the All India Radio for broadcasting in regional languages in their daily rural programme.

Crop Weather Calendars.

38. The Committee learn that the role of the Agricultural Meteorology Section in this scheme lay in the preparation of volumes of district-wise and crop-wise Crop Weather Calendars, showing the dates of commencement

and duration of the various phases of crop-growth, the normal weather requirements and the critical conditions of weather for which warnings are required to be issued during each of these phases. These calendars are based on the information supplied by the Agricultural Departments in response to questionnaires circulated to them for this purpose by the Section of Agricultural Meteorology. They are usually reviewed every year as also when the State Departments of Agriculture suggest certain changes.

The Committee understand that the Forecasting Officers' Conference held in April, 1960 had recommended the printing of crop-weather calendars in view of their utility to agricultural interests. It was stated during evidence that the work could not be undertaken due to lack of staff as this scheme was not included in the Plan. The representative, however, added that as it was considered that crop-weather calendars would be useful, it was proposed to undertake the work by making adjustment of staff within the Department. *The Committee hope that the crop-weather calendars will be brought out at an early date.*

Weather Warnings to Community Development Centres.

39. The Committee were informed that weather warnings were being sent, since 1-6-1956 by high priority land-line telegrams to certain Community Development Centres. At present 386 Community Project Centres distributed all over India were getting such warning messages regarding occurrence of heavy rain, setting in of monsoon, break in monsoon, revival of monsoon etc.

Utility of the Messages.

40. The representative of the Department stated in his evidence that delays were occurring *en route* in transmission of the telegrams to the Community Project Centres. There were even greater delays in dissemination of information to the villagers by the Community Project Centres due to communication difficulties and/or unsatisfactory arrangements made at the receiving end for the dissemination of information. *The Committee feel that if the warnings are to be of any use, they should reach the villager in time and steps directed to this end should be taken in consultation with the Development Commissioners of the States. They would also suggest that the agency of the panchayat may be utilised for disseminating information to villages.*

Visits to Community Project Centres.

41. Community Project Centres are visited by the officers of the Department making personal contacts and obtaining first-head knowledge of the reaction of the cultivators to Weather Warning messages. The number of

centres visited by the officials of the Department during the last three years is as under:—

April, 1958 to March, 1959—70

April, 1959 to March, 1960—42.

April, 1960 to March, 1961—28

The Committee observe that the number of Centres visited has been going down every year and is also very small considering that there are 386 *centres to which weather warnings are sent. They recommend that visits to the Community Project Centres by the officers of the Department should be increased considerably so as to cover all the Centres within a stipulated period.*

Reports from Community Project Centres not reliable.

42. Besides the visits of the officers of the Department to the Community Project Centres, monthly reports are required to be sent by the Centres. It was stated during evidence that such reports were not being received regularly and their reliability was also open to doubt.

According to the representative of the Department, the small agriculturist and the village farmer were apparently not utilising the weather warnings and they were going on in the traditional way.

Assessment of Farmers' Weather Bulletins and Weather Telegrams.

43. Asked if an assessment could be made of the accuracy and utilisation of the Farmers' Weather Bulletins and Weather Telegram Service by the farmers, the representative of the Ministry stated that such a study could be made by the State Departments of Agriculture who were concerned with the dissemination part of it. He, however, admitted that a sample survey could be made on an all India basis to study the impact of the forecasts on the farmers and to make suggestions as to how best they could benefit therefrom. *The Committee are of the view that in the absence of proper assessment about the utilisation of weather warning service by the farmers, a sample survey may be undertaken to find out as to how far the information supplied by the India Meteorological Department was being utilised by the agriculturists. In the light of the survey steps may be taken to improve the service and increase its utility to the maximum extent to the farmers.*

Farmers' Weather Bulletins.

44. Farmers' weather bulletins giving district-wise forecast of weather during the next 36 hours, with a further outlook for the following two or three days, are issued on the basis of the crop weather calendars taking into account the weather requirements of individual crops. The representative of the Department informed the Committee during evidence that sometimes these bulletins were quite long

because all the districts of one State had to be covered in each bulletin. *The Committee suggest that the feasibility of dividing a big State into parts for preparing such bulletins and putting them out from different stations of All India Radio in the area may be examined in consultation with the Ministry of Information and Broadcasting.*

C. *Agricultural Meteorological Observatories*

Existing set up.

*45. There are at present 102 Agricultural Meteorological Observatories which are working under the technical guidance of the Division of Agricultural Meteorology. The expenditure in connection with their setting up and maintenance and for the recording staff is met by the State Departments of Agriculture and other concerned institutions. The data recorded by these stations are received in the Division of Agricultural Meteorology of the Department for scrutiny, tabulation and analysis.

The Committee were informed that the existing 102 agrimet, observatories need to be augmented by 15 to 20 more observatories. They suggest that the Department may pursue the matter with the State Governments particularly Assam and Rajasthan where the need is keenly felt so that this gap in observation data is filled early.

Reporting Stations.

46. The Committee understand that the number of daily weather reporting stations (observatories) is insufficient in some parts of the country and for that reason, while preparing the Farmers' Weather Bulletins it has been necessary to deal with groups of districts instead of individual districts. The representative of the Department informed the Committee during evidence that reporting stations of the India Meteorological Department had been set up so far in 239 districts of the country and that reporting stations were to be established in the remaining 66 districts during the Third Plan. It is also proposed to establish a forecasting centre at the capital of each of the States where it does not exist at present in order to ensure better coordination with the State Departments of Agriculture, Community Development etc. *The Committee hope that the above targets for establishing reporting stations and forecasting centres would be achieved during the Third Plan period.*

D. *Agricultural Meteorology Division*

Assessment of working.

47. The Committee were given to understand that the Indian Council of Agricultural Research made an assessment of the working of the Agricultural Division of the India Meteorological Department in 1954. Since then no such assessment has been made due to paucity of outside experts. *The Committee are of opinion that a review of the working of the Division in collaboration with the Indian Council of Agricultural Research may be undertaken early.*

V

WORKSHOPS, RESEARCH TRAINING & MISCELLANEOUS

A. *Workshops*

Existing Position

48. The Meteorological Department maintains two workshops respectively at New Delhi and Poona for the manufacture of instruments. The New Delhi Workshop mainly caters for instruments and equipment for upper air observatories such as pilot balloon, radio sonde, radars, sferics observatories etc. and the Poona Workshop for surface observatories. There are two smaller workshops at Kodaikanal and Shillong. The workshop at Kodaikanal is exclusively meant for catering to the needs of the Kodaikanal Observatory. The workshop at Shillong was being used for undertaking repairs of seismographs in use in that region and for manufacturing some strong motion seismographs.

New Delh and Poona Workshop:

49. The table below shows the total value of instruments produced in Delhi and Poona together with the expenditure incurred on staff:

	Total Expenditure on staff	Total value of instruments manufactured	Ratio of Col. 1 to Col. 2
	1	2	3
1958-59			
Delhi	2,79,724	10,71,682	1 : 3·83
Poona	1,86,432	3,20,000	1 : 1·72
1959-60			
Delhi	2,80,986	8,69,891	1 : 3·09
Poona	2,07,260	3,40,000	1 : 1·64
1960-61			
Delhi	3,29,478	7,22,201	1 : 2.19
Poona	2,50,620	4,00,000	1 : 1·58

Productivity.

It will be seen that the productivity expressed in terms of value of instruments manufactured to expenditure on staff, has come down at New Delhi Workshop from 3.83 in 1958-59 to 2.19 in 1960-61. Similarly productivity for Poona Workshop has come down from 1.72 in 1958-59 to 1.58 in

1960-61. The Committee were informed that the main reason for increase in expenditure on staff was the addition made to the staff for the increased activities in connection with installation, maintenance, repair, overhaul etc. of equipment such as radio theodolies, storm-detecting radars, sferics equipment etc. Another important contributory factor was stated to be increase in development and investigational work for meteorological instrumentation that was being carried on in the Workshop. It was claimed that the cost of production of instruments had come down progressively from year to year on the introduction of new methods and techniques of production and as a result of the development of economical designs of instruments. *The Committee feel that introduction of efficient methods of production employing mass production techniques taking advantage of automatic machinery and improved gadgets should have resulted in increased production. They feel that there is scope for effecting economy and for increasing productivity in Workshops.*

Potential Foreign Market.

50. The Committee understand that there is potential market for supply of meteorological instruments to countries in South-East Asia and other neighbouring countries. Occasional enquiries regarding supply of meteorological instruments have been received from meteorological services of some of the neighbouring countries *viz.* Ceylon, Burma, Afghanistan, Egypt, Thailand etc. It was stated that these requests could not be complied wih since the production barely met in full the local needs and since increased production to meet the export demand would have needed additional foreign exchange for procuring imported raw material and additional machinery.

The Committee regret to learn that no market assessment for export of meteorological instruments has been made so far, though the point about existence of a potential market for the instruments all over South Asia was brought up as early as in 1958 in the Directors' Conference. The then Director-General of Observatories had stated as under in his opening address of 1958:

> "....there have been very fruitful enquiries from neighbouring countries in Asia who want to develop their meteorological institutions. They would like India to be a source of supply for them. This adds to the potential market, and it would do well for the Government to do all it can so that India does not lose this potential market."

The representative of the Ministry admitted during evidence that the Ministry of Finance had never been approached with a programme of manufacture with export in

the offing. He added that foreign exchange could have been allocated if a certain amount of export could be guaranteed. He was of the view that exports should be encouraged even at the sacrifice of some of the requirements within the country. *The Committee suggest that an assessment of the demand for meteorological instruments in the neighbouring countries of South East Asia, Middle East and Africa etc. may be made and that in the light thereof the production of meteorological instruments in the workshops be geared up to meet the demand for exports.*

B. *Research*

Its needs.

51. The Third Plan proposals of the Department stress the need for intensive investigation and research both of a fundamental and applied nature in meteorology and allied subjects. It has been pointed out therein that the meteorological phenomena of the tropics and the neighbouring subtropics, in which India is situated have special characteristics different from those of the higher latitudes. It has been generally recognized since the last War that weather forecasting in the tropics present problems which are quite different from regions in higher latitudes and needs therefore special study.

Existing Position.

52. At present small sections dealing with Investigation and Development existed in the offices of the Deputy Director General (Forecasting) and Deputy Director General (Climatology) but these were not considered as having been very effective. In the Third Five Plan an Institute of Tropical Meteorology was proposed to be set up at Poona. The existing Investigation and Development sections were to be merged in one of the divisions of the Institute.

Institute of Tropical Meteorology.

53. The Institute of Tropical Meteorology is intended mainly for researches in theoretical and applied meteorology with particular reference to the tropics and sub-tropics. It is planned to consist of the following divisions together with an administrative unit:

1. Forecasting Research
2. Climatology & Hydrometeorology
3. Physical Meteorology & Aerology
4. Instrumental & Observational Techniques
5. Radio Meteorology
6. Advanced Training
7. Library, Information & Publication.

The Committee were informed that at the time of framing the Third Plan, it was intended to start the Institute of Tropical Meteorology in 1961 with the facilities available at the Poona Workshop and labortories and with a small amount of additional equipment which might be provided by purchase in India and abroad at a cost of Rs. 3.15 lakhs. Later it was considered that the usefulness of the Institute would be enhanced if modern equipment including an electric computer could be obtained through United Nations Special Fund Assstance. A detailed scheme was worked out in consultation with the World Meteorological Organisation in 1961. The scheme was stated to be under consideration of the Ministry of Finance. *The Committee hope that an early decision will be taken to set up the Institute and that efforts will be made to obtain assistance from the United Nations Special Fund for this purpose.*

Tropical Cyclones.

54. A representative of the Department informed the Committee during evidence that meteorological studies on the following two important subjects needed to be taken up early:

1. to detect and study tropical cyclones which bring in devastation to the coastal areas; and
2. to carry out meteorological reconnaissance into tropical cyclones with the assistance of the Indian Air Force.

Three schemes have been evolved to study tropical cyclones during the Third Plan. *The Committee hope that the Government will take an early decision in the matter.*

Research by Universities

55. The Committee understood from the representative of the Department that considerable amount of research work in the meteorology is done by Universities in America. In India only a few universities have introduced meteorology as a subject. *The Committee hope that extension lectures on meteorological subjects would be held in universities so as to rouse interest among the students.*

C. *Training*

Courses of Study.

56. The Training Section of the Meteorological Department at Poona provides three courses of study for trainees known as 'Elementary', 'Intermediate' and 'Advanced' courses. The 'elementary' course is of 4 months' duration and is taken by all trainees. A further intensive course of 2½ months (intermediate course) is given for Scientic Assistants There is another advanced course of 2½ months' duration for Professional Assistants etc. A statement showing the number of trainees (departmental and

non-departmental) who were admitted in the various courses during each of the last three years is given below:

Year	Elementary Course		Intermediate Course		Advanced Course	
	Depttal.	Non-Dept.	Depttal.	Non-Dept.	Depttal.	Non-Dept.
1958-59 . . .	64	1	17	..	11	2
1959-60 . . .	63	..	13	..	10	3
1960-61 . . .	65	..	7	..	16	2

Training Facilities not adequate.

57. The representative of the Department stated during evidence that considering the strength of staff in the Department, the training facilities were very meagre. He added that only 25 per cent. of the staff working at radio-sonde and rawin stations were trained in meteorology with the result that readings taken by them were not always accurate. A scheme for doubling the training facilities was stated to have already been put up to the Ministry and was expected to be sanctioned soon. The Committee hope that the scheme would be finalised at an early date and that it would meet adequately the training requirements.

D. *Miscellaneous*

Weather Warnings to Fishermen Scheme.

58. The representative of the Department informed the Committee that the Weather Warnings to Fishermen Scheme which had originally been initiated in Madras State was proposed to be extended to Kerala and Mysore States also. Under the Scheme, winds and weather for about 50 miles off the coast were broadcast so that fishermen may limit their operations accordingly. *The Commtitee hope that the Meteorological Department would extend the service to other maritime States also.*

Technical Enquiries.

59. The Committee are given to understand that many organisations and industries require meteorological data for various kinds of studies. Past weather records can help planners to decide upon suitable places for further expansion of the different kinds of industries. Insurance Companies, legal interests, etc. also require actual weather that might have occurred over specified areas on particular dates to enable them to settle claims based on damage alleged to have been caused by adverse weather.

Charges for Technical Enquiries.

60. The number of technical enquiries of all types received by the Meteorological Department during the three years, from April, 1958 to March, 1961, totalled about 7,000. No charges are, however, levied for answer-

ing such enquiries. The representative of the Department stated during evidence that the income of the United States Weather Bureau by levy of fees on such enquiries was about 2 million dollars a year. He was, however, of the view that for the next 10 years no charge might be levied for enquiries as meteorology was still to be popularised in the country. *The Committee recommend that the feasibility of charging at least a nominal fee from non-government institutions and members of public might be examined. They also recommend that the Government Departments and Public Undertakings may be circularised about the availability of technical service with the Meteorological Department.*

Projected Forecasting Manual delayed for years.

61. The Committee learnt that the Forecasting Officers' Conference held in May 1956 recommended production of a forecasting manual. *Inspite of a lapse of about 6 years since the matter was first raised in May, 1956, the Committee regret that no progress has so far been made in the preparation of the manual. Since such a manual is obviously desirable, they suggest that its compilation may be taken up and completed at an early date.*

Forecasting Officers' Conference.

62. The Committee are given to understand that the first Forecasting Officers' Conference was held in 1951, the second in May 1956 after an interval of five years and the third in April 1960 after a period of four years. Such conferences of officers who are engaged in weather forecasting work are stated to be useful for exchange and discussion of technical ideas and experience so as to improve weather forecasting. *The Committee recommend that as agreed to by the representative of the Department during evidence such conferences should be held every two years.*

Telescope at Kodaikanal Observatory.

63. The Committee were informed that the stellar work at Kodaikanal Observatory had been seriously hampered during the past decade due to the lack of a good medium aperture telescope. There were plans of acquiring a 100" aperture telescope during the Second Plan which would have cost about Rs. 1 crore with all its accessories. Because of lack of funds involving foreign exchange, this proposal was revised to a 60" telescope and was postponed from the Second to the Third Plan. The representative of the Department stated during evidence that even the proposal to acquire a 60" reflecting telescope during the Third Plan seemed difficult to materialise due to the tight foreign exchange position. The latest idea was to acquire at least a 48" telescope, which was likely to cost about Rs. 12 lakhs, from East European countries.

64. The Committee understand that a scheme is being devised for maintaining on scientific lines duplicates of important records which have been gathered by the Meteorological Department since its inception. *The Committe hope that the scheme would be finalised early.* Duplicates of Important Records.

NEW DELHI-1;
March 19, 1962.
Phalguna 28, 1883 (*Saka*).

H. C. DASAPPA,
Chairman,
Estimates Committee.

APPENDIX I

(*Vide* para 2)

Statement showing the functions of the India Meteorological Department on the service side as well as on the Scientific side.

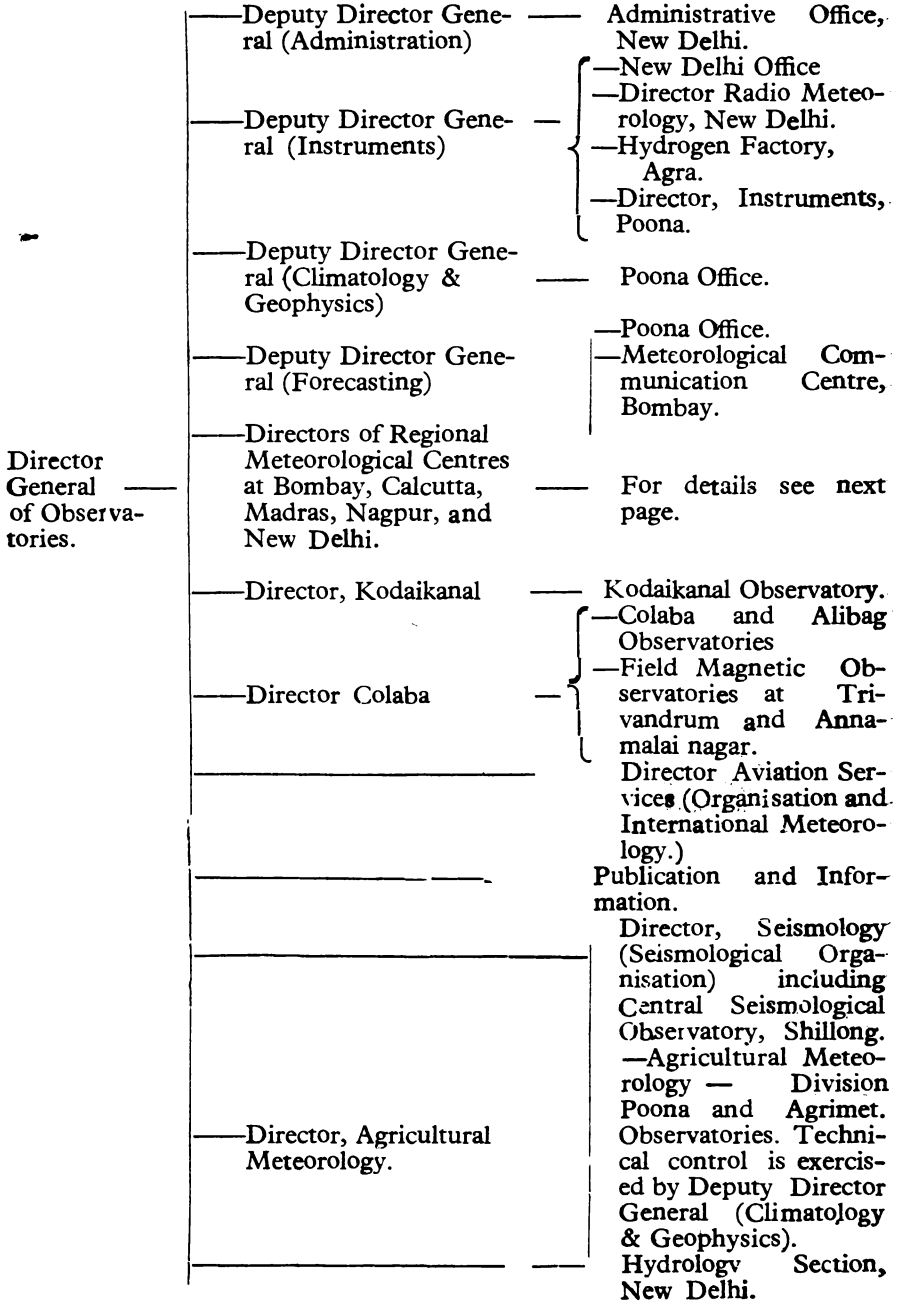
On the service side, the functions of the department include the organisation and maintenance of the basic network of meteorological stations—both surface and upper air—preparation and issue of day-to-day weather reports, forecasts and warnings for a large variety of interests like aviation, shipping, various Government departments and the general public, the issue of special warnings of storms, heavy rainfall, ground frost etc., the issue of Farmers' Weather Bulletin—containing also an outlook of weather for two to three days—for the benefit of agriculturists, the publication of seasonal forecasts of rainfall during the monsoon and the cold weather periods, the compilation of meteorological statistics pertaining to the country and the supply of climatological data to diverse users.

On the scientific side, the activities of the department include studies in Meteorology and Climatology, in Astronomy, Astrophysics, Ionospheric Physics, Terrestrial Magnetism and Seismology. Poona is the main centre for carrying out studies in Climatology in all its aspects including Hydrology and Agricultural Meteorology. The Seismological Organisation with its headquarters at New Delhi, is the coordinating centre for seismological work in the country. Colaba and Alibag Observatories (Bombay) deal with Terrestrial Magnetism and Atmospheric Electricity. The Astrophysical Observatory at Kodaikanal is equipped for studies in Solar and Stellar Physics, Ionosphere, Atmospheric Ozone, etc. "Indian Ephemerics and Nautical Almanac" is prepared at Calcutta. Finally, the activities of the department include the development and manufacture of various types of instruments used for meteorological and allied observations. There are two workshops at Delhi and Poona where most of these instruments are developed and manufactured. A third workshop at Kodaikanal specialises in the design and construction of Astronomical instruments. It also includes an optical workshop.

APPENDIX II

(*Vide* para 3)

Present Organisational setup of the India Meteorological Department



APPENDIX III

(*Vide* para 5)

Statement showing the Administrative and Financial Powers delegated to the Regional Directors

Nature of power	Extent of Powers	When delegated
(1)	(2)	(3)
Appointments . . .	Appointment to posts below the cadre of Scientific Assistant and certain other equivalent posts, both temporary and permanent.	1945
Leave	Grant of leave upto 2 months and 29 days to Professional Assistants and Scientific Assistants for whom the D.G.O. is appointing authority.	1957
Transfer . . .	Transfer of Professional Assistants and Scientific Assistants within the respective region.	1948
Note:—The Regional Directors enjoy all powers in respect of posts below the cadre of Scientific Assistant which they acquire by virtue of their being the appointing authority for these posts.		
Expenditure on items not specified.	Recurring Rs. 15 in each case subject to a limit of Rs. 200 per annum.	1960
	Non-recurring Rs. 500 in each case with annual limits of Rs. 2,500.	1960
Bicycles	Repairs—Rs. 30 per cycle per annum on an average.	1960
Conveyance hire . .	Actual Bus or Tonga charges. Scooter, motor, Rickshaw charges may also be reimbursed where exigency of work demands.	1960
Electric, Gas and Water charges	. Full powers	1960

(1)	(2)	(3)
Freight charges . . .	Full powers	1960
Demurrage charges . .	Rs. 10 in each case	1960
Hire of office furniture, electric fans, heaters, coolers, clocks, call bells.	Rs. 500 per annum	1960
Instruments, minor equipment and apparatus.	Rs. 250 per annum	1960
Municipal taxes . .	Full powers. The expenditure shall be incurred in accordance with the rules for the payment of municipal rates and taxes on buildings in the appendix to the Annexure to Schedule V, D.F.P. Rules, 1958.	1960
Charges for issue of letters, telegrams etc.	Full powers	1960
Stores required for working of an establishment.	Rs. 500 in each case subject to an annual limit of Rs. 2,500.	1960
Supply of liveries . .	Full powers	1960
Telephone charges	Full powers for payment of rent and call charges in respect of telephone connection (Office and residence) already sanctioned by the competent authority. Expenditure on shifting shall be sanctioned by the D.G.O.	1960
Staff paid from contingencies	Full powers. Remuneration of such staff should be regulated in accordance with general or special orders issued by the President in this behalf.	1960
Purchase of stationery stores .	Rs. 500 per annum	1960
Fixtures and Furnitures .	Rs. 300 per annum per office subject to such conditions and scales as may be prescribed by Ministry of Works, Housing and Supply.	1959

(1)	(2)	(3)
Purchase of publication.	Rs. 50 per annum subject to the restrictions laid down in column 4 against item 17 in the annexure to schedule V of Delegation of Financial Power Rules, 1958.	1959
Administrative approval to constructional work	Upto Rs. 1000 in each case if executed through the PWD and upto Rs. 400 in each case if executed departmentally.	1956
Maintenance and upkeep of Motor Vehicles (For Regional Director, Calcutta only).	Rs. 50 on each occasion subject to a maximum of Rs. 500 per annum.	1959
Authorisation for investigation of arrear claims.	Arrear claims which are more than one year old but less than 3 years old in respect of these posts for which he is the appointing authority.	1950

APPENDIX IV

[*Vide* Paras 14 & 26]

Summary of results of sample verification undertaken by the India Meteorological Department of non-aviation forecasts

	1960				1959			
	Total number of Forecasts verified	Percentage correct	Percentage partially correct	Percentage wrong	Total Number of Forecasts verified	Percentage correct	Percentage partially correct	Percentage wrong
1. Regional Forecasts valid for 36 hours .	1856	79	16	5	1852	68	28	4
2. Farmers' Bulletins for next 48 hours .	448	76	18	6	438	74	22	4
3. Outlook for subsequent 2 days .	448	87		13	444	81		19
4. Heavy rainfall warning for farmers . .	60	53	27	20	66	35	35	30
5. Fleet forecasts .	62	84	16		64	67	33	..
6. Forecasts for merchant shipping .	64	83	17		64	73	27	
7. Heavy rainfall warning issued to other warnees . . .	419	53	39	8	353	37	16	47
8. Port warnings . .	125	85	..	15	91	64	32	4
9. Local forecasts (morning) . .	192	84	16		192	60	38	2
10. Local forecasts (evening). . .	136	80	19	1	140	74	26	..

APPENDIX V

[*Vide* Para 23]

Details of works contemplated in the Third Five Year Plan under the scheme 'Modernisation of Observational Outfit at important Observatories.'

Modernisation of observational outfit at important observatories

Under this scheme, it is proposed:

(*a*) to establish, as recommended by the Joint Meteorological Committee in which the Civil Aviation Deptt., the I.A.F. and the Navy are represented, 18 additional rawin/radiosonde stations distributed all over India to improve the existing network of such stations to obtain data which will enable rendering of satisfactory meteorological service to high-level jet aircraft flights over India. Data from this improved net-work of upper air stations will also assist in weather forecasting generally for all other interests besides aviation ;

(*b*) to install storm detecting radars at 8 stations in addition to the 7 stations at which they will be installed in the Second Five Year Plan. This will provide storm detecting radars at all the important aerodromes in India, including 2 or 3 aerodromes in the Assam area. Installation of storm detecting radars at aerodromes is of the utmost importance for the safety of air navigation;

(*c*) to arrange for facsimile transmission by W/T of weather charts and reception by facsimile recorders at 16 forecast centres. This will facilitate transmission of weather analyses charts and data from main forecast centres to smaller forecast centres and will contribute towards improvement in weather forcasting generally and for aviation in particular;

(*d*) to establish 3 sferics stations in addition to the 3 established under the Second Five Year Plan to locate the positions of thunderstorms over wide areas and study their general movement. This will help in weather forcasting, specially for aviation;

(*e*) to install wave recorders at 8 coastal stations, 4 on the east coast and 4 on the west coast, and a wave analyser at Poona to record, analyse and study the amplitudes and spectra of sea waves. These waves are related to development and movement of cyclonic storms in the sea and as the waves travel much faster than cyclones, they have a prognostic value and their studies are expected to assist in the forecasting of the development, progress and movement of cyclones.

APPENDIX VI

Summary of recommendations/conclusions

Sl. No.	Reference to Para No.	Summary of recommendations /conclusions
1	2	3
1	5	The Committee suggest that the feasibility of delegating the following powers to the Regional Directors may be examined :— (i) to sanction air travel of non-gazetted staff between Pasighat and Mohanbari ; and (ii) for purchase of books and of journals and periodicals approved by the Director General.
2	7	The Committee see no justification for continuing the work of tabulation and analysis of data in Shillong when the headquarters of siesmology has been shifted to New Delhi. The work of tabulation and analysis of data may be progressively undertaken at New Delhi itself.
3	10	As the meteorological department is widely scattered and many of its establishments are situated away from the cities, the Committee suggest that the desirability of finding more funds for welfare of the non-gazetted staff of the Department may be examined.
4	11	The Committee suggest that a scheme may be drawn up to provide quarters for the staff within a stipulated period.
5	14	The Committee consider that it would be desirable to enjoin on the head of each forecasting office to undertake every day a general review of forecasts given on

1	2	3
		the previous day so that the margin for subjective error creeping into forecasts is reduced to the minimum, if not altogether eliminated. From time to time meetings could also be held in each forecasting office to discuss the result of such reviews so that constant efforts are made at all levels to improve the accuracy of forecasts.
6	15	The Committee are of the view that there is imperative necessity of improving the methods and technique for longrange forecasting.
7	18	The Committee suggest that steps may be taken immediately to minimise the delays *en route* to weather telegrams till these could be eliminated by having a meteorological teleprinter net-work.
8	19	The Committee suggest that the feasibility of increasing the number of daily weather broadcasts may be examined in consultation with the Ministry of Information and Broadcasting.
9	20	The Committee consider that earnest efforts should be made to make up the leeway in the net-work of upper air observatories and in the preparation of prognostic charts and thus provide an efficient and modern service to aviation in this jet age.
10	23	The Committee suggest that earnest efforts should be made from the very beginning to ensure that the targets under the scheme of 'Modernisation of Observational Outfit at Important Observatories' in the Third Plan are achieved.
11	24	The Committee regret to note that not even 50 per cent. of the surface observatories and phenological observatories have been inspected during the last three years. They recommend that the periodicity of inspection of diverse observatories should be laid down in relation to the requirements and strictly followed.
12	26	Since heavy rainfall is an important factor contributing to the occurrence of floods, the Committee feel that the warnings of heavy rainfall should be reasonably accurate to be depended upon by the local authorities for letting out water stored in dams, anicuts, etc They suggest that an analysis may be made of th methods and technique followed in issuing heavy rain

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		warnings with a view to effecting improvement and increase the accuracy to the extent feasible.
13	28	The Committee hope that the work of installation of 1200 more ordinary rain-gauges and 200 more self-recording raingauges will be completed as scheduled and that only standard tested instruments will be used for the purpose.
14	29	The Committee suggest that the inspection machinery may be so geared up as to complete the inspection of all the raingauges within the stipulated period.
15	29	The Committee suggest that the Department may stress on the State Governments the need for providing adequate arrangements for maintenance and repair of defective rain-gauges.
16	31	While commending the progress made by the Department in developing automatic rain-gauge stations, the Committee hope that equipment for automatic weather stations will also be manufactured within the country early.
17	32	The Committee suggest that all efforts should be made to procure the computing machines for the Storm Analysis Unit at an eary date.
18	33	The Committee hope that the Government would examine the matter of flood forecasting in all its aspects and would ensure that a scientific and effective system of flood forecasting is brought into force in the country at an early date.
19	34	The Committee hope that necessary action will be taken to undertake statistical studies regarding frequency of droughts for all the States.
20	38	The Committee hope that the crop weather calendars will be brought out at an early date.
21	40	The Committee feel that if weather warnings are to be of any use, they should reach the villager in time and steps directed to this end should be taken in consultation with the Development Commissioners of the States. They would also suggest that the agency of the panchayat may be utilised for disseminating information to villages.

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22	41	The Committee recommend that visits to the Community Project Centres by the officers of the Department should be increased considerably so as to cover all the Centres within a stipulated period.
23	43	The Committee are of the view that in the absence of proper assessment about the utilisation of weather warning service by the farmers, a sample survey may be undertaken to find out as to how far the information supplied by the India Meteorological Department was being utilised by the agriculturists. In the light of the survey steps may be taken to improve the service and increase its utility to the maximum extent to the farmers.
24	44	The Committee suggest that the feasibility of dividing a big State into parts for preparing Farmers' Weather Bulletins and putting them out from different stations of All India Radio in the area may be examined in consultation with the Ministry of Information and Broadcasting.
25	45	The Committee suggest that the Department may pursue the matter of establishing more agrimet. Observatories with the State Governments particularly Assam and Rajasthan where the need is keenly felt so that this gap in observation data is filled early.
26	46	The Committee hope that the targets for establishing reporting stations and forecasting centres would be achieved during the Third Plan period.
27	47	The Committee are of opinion that a review of the working of the Agricultural Division of the Department in collaboration with the Indian Council of Agricultural Research may be undertaken early.
28	49	The Committee feel that introduction of efficient methods of production employing mass production techniques taking advantage of automatic machinery and improved gadgets should have resulted in increased production. They feel that there is scope for effecting economy and for increasing productivity in Workshops.
29	50	The Committee suggest that an assessment of the demand for meteorolgoical instruments in the neighbouring countries of South East Asia, Middle East and Africa etc. may be made and that in the light thereof the

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		production of meteorological instruments in the Workshops be geared up to meet the demand for exports.
30	53	The committee hope that an early decision will be taken to set up the Institute of Tropical Meterology and that efforts will be made to obtain assistance from the United Nation Special Fund for this purpose.
31	54	The Committee hope that the Government will take an early decision in the matter of taking up the following meteorological studies : 1. To detect and study tropical cyclones which bring in devastation to the coastal areas ; and 2. to carry out meteorological reconnaissance into tropical cyclones with the assistance of the Indian Air Force.
32	55	The Committee hope that extension lectures on meteorological subjects would be held in universities so as to rouse interest among the students.
33	57	The Committee hope that the scheme for doubling the training facilities would be finalised at an early date and that it would meet adequately the training requirements.
34	58	The Committee hope that the Meteorological Department would extend the service of weather warnings to fishermen which is operating at present in Madras State to other maritime States also.
35	60	The Committee recommend that the feasibility of charging at least a nominal fee for answering technical enquiries from non-government institutions and members of public, might be examined. They also recommend that the Government Departments and Public Undertakings may be circularised about the availability of technical service with the Meteorological Department.
36	61	The Committee regret that no progress has so far been made in the preparation of the forecasting manual. Since such a manual is obviously desirable, they suggest that its compilation may be taken up and completed at an early date.
37	62	The Committee recommend that as agreed to by the representative of the Department during evidence Forecasting Officers' Conferences should be held every two years.
38	64	The Committee hope that the scheme of maintaining duplicates of important records on scientific lines would be finalised early.

APPENDIX VII

Analysis of recommendations contained in the Report

I. CLASSIFICATION OF RECOMMENDATIONS

A. Recommendations for improving the organisation and working.

1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27, 28, 31, 33, 34, 36.

TOTAL = 27

B. Recommendations for effecting economy (including those for augmenting income).

29, 35.

TOTAL = 2

C. Miscellaneous

4, 5, 14, 20, 21, 30, 32, 37, 38.

TOTAL = 9

II. ANALYSIS OF MORE IMPORTANT RECOMMENDATIONS DIRECTED TOWARDS ECONOMY

Sl. No.	No. as per Summary of Recommendations	Particulars
1	29	There is scope for effecting economy and for increasing productivity in Workshops.
2	35	Feasibility of charging nominal fee for answering technical enquiries from non-government institutions and members of public may be examined.