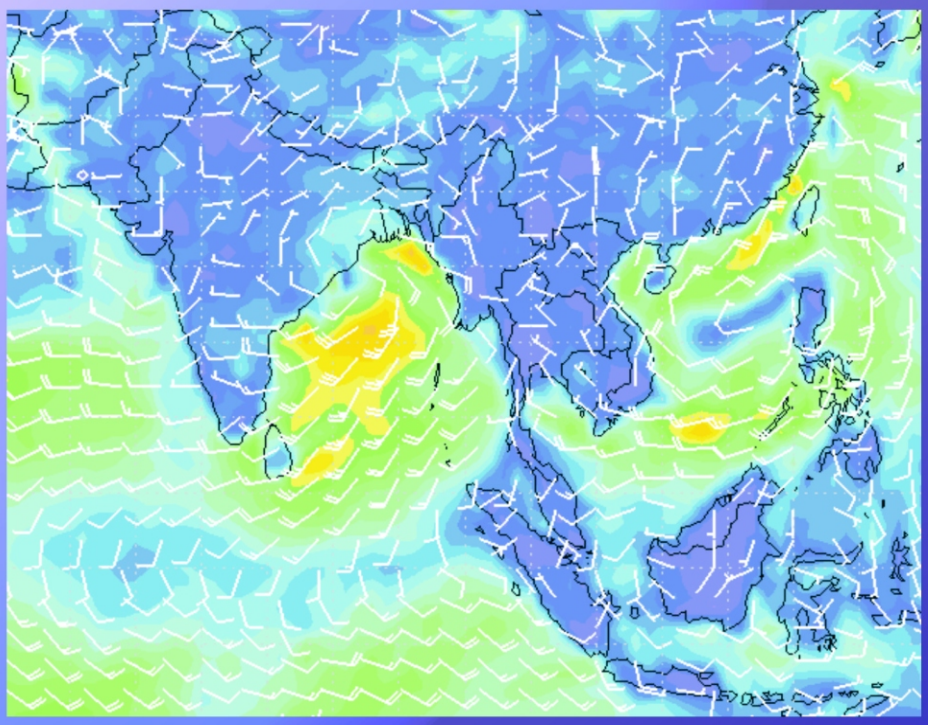

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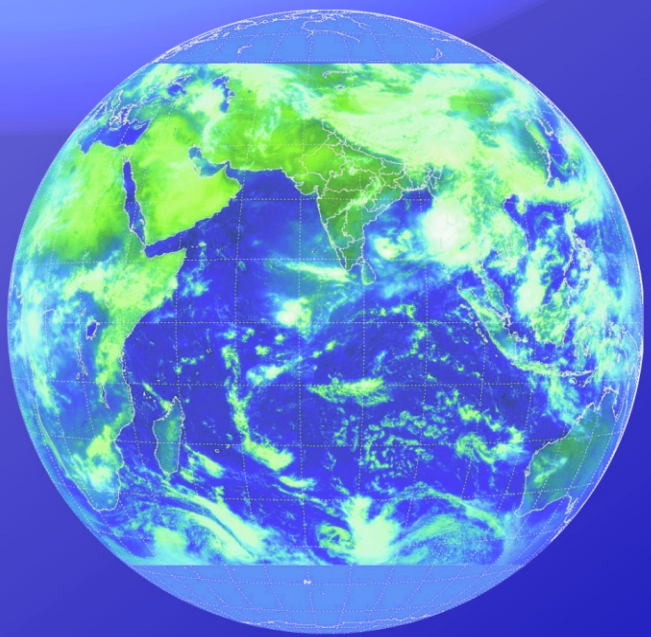

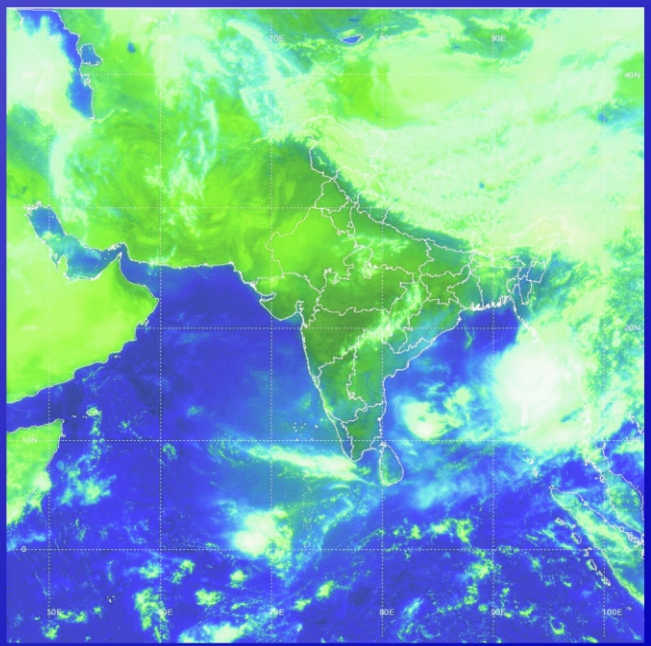

O/o Deputy Director General of Meteorology (Weather Forecasting)
India Meteorological Department
Pune - 411005

FORECASTERS' GUIDE

O/o Deputy Director General of Meteorology (Weather Forecasting)
India Meteorological Department
Pune - 411005

एयर वाईस मार्शल डॉ अजित त्यागी
वी.एस.एम. (सेवा निवृत्त)
मौसम विज्ञान के महानिदेशक
Air Vice Marshal Dr. Ajit Tyagi
V.S.M. (Retd.)
Director General of Meteorology

भारत सरकार
भारत मौसम विज्ञान विभाग
लोदी रोड, नई दिल्ली-110003

Government of India
India Meteorological Department
Lodi Road, New Delhi-110003

FOREWORD

Operational weather forecasting is one of the principal mandates of India Meteorological Department (IMD). In order to fulfill this mandate effectively IMD, since its inception way back in the 19th century, has been issuing a large number of instructions and technical regulations from time to time, as an aid to the forecasters. The basic purpose of such circulars is to maintain a specific standard and to bring about uniformity among all forecasting offices in their functioning.

The present publication entitled as '**Forecasters' Guide**' is a compilation of these instructions, in the form of forecasting circulars, which are relevant at present. In order to serve as a ready reference for the field forecasters, these circulars are classified under various sub-titles and an elaborate index is provided for the appendices.

This publication has been prepared and edited by Dr. A. B. Mazumdar, DDGM (WF), and Dr. Medha Khole, Director, Weather Central, Pune. I hope this compilation shall serve as a comprehensive source of information to weather forecasters on the procedures involved in all aspects of operational non-aviation weather forecasting.

14 May 2008

(Ajit Tyagi)
Director General of Meteorology

Tel.: (Off.) (+91) (11) 24611842, (Res.) (+91) (11) 24633692; Telefax : (+91) (11) 24611792
Fax : (+91) (11) 24699216
Email : dgmet@imdmail.gov.in

FORECASTERS' GUIDE

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INDEX OF APPENDICES (FORECASTING CIRCULARS)

DEFINITIONS

Pressure:

The pressure of the atmosphere at any point is the weight of the air column which stands vertically above unit area with the point as its centre. For meteorological purposes, atmospheric pressure is usually measured by means of a mercury barometer where the height of the mercury column represents the atmospheric pressure. The C.G.S. of pressure is the dyne per square centimetre but this is inconveniently small. The unit employed for reporting pressure for meteorological purposes, is, therefore, the hPa which is defined as equal to 1000 dynes/ Sq. Cm.

Temperature:

The temperature of a body is the condition which determines its ability to communicate heat to other bodies or to receive heat from them. Heat energy appeals to the sense of touch and the degree of hotness or coldness of a body is known as its temperature. In a system of two bodies, that which loses heat to the other is said to be at a higher temperature and is the hotter one. Meteorologists are interested in the temperature of the air, of the soil and of water bodies. Temperature is measured by means of a thermometer. Thermometers are graduated in different scales. The scale accepted for use in the India Meteorological Department is the Celsius scale giving temperature in degrees Celsius.

Maximum Temperature:

The highest temperature reached, since the time of the last setting of the maximum thermometer. The maximum thermometer is routinely set after the morning (0830 hrs. IST) observation.

Minimum Temperature:

The lowest temperature reached, since the time of last setting of the minimum thermometer. The minimum thermometer is routinely set after the morning (0830 hrs. IST) and afternoon (1730 hrs. IST) observations.

Relative Humidity:

Relative Humidity is the ratio of the actual mixing ratio of a sample of air at a given temperature and pressure to the saturation mixing ratio of the air at the same temperature and pressure.

It is usually multiplied by 100 and expressed in percent.

Dew Point Temperature:

It is defined as the temperature to which moist air must be cooled, during a process in which pressure and mixing ratio remain constant, in order that it shall become just saturated with respect to water.

Note that it is an isobaric process in which the pressure remains constant. No water vapour is added or subtracted from the sample of air and so its mixing ratio remains constant. However, the air becomes saturated at the dew point (temperature), and so the value of mixing ratio becomes equal to the saturation mixing ratio at this temperature.

Precipitation:

Precipitation whether it is rain or snow is expressed as the depth to which it would cover a horizontal projection of the earth's surface, if there were no loss by evaporation, run–off or infiltration and if any part of the precipitation falling as snow or ice were melted.

Rainfall:

It is assumed that the amount of precipitation collected in the gauge is representative of a certain area around the point where the measurement is made. The choice of the instrument and the site itself, the form and exposure of the measuring gauge, the prevention of loss of precipitation by evaporation and the effects of wind and splashing are some of the important points to be considered in the correct measurement of precipitation.

Snowfall:

Snowfall is measured either as the depth of snow which has fallen in a stated period, or melted and measured as water. The depth of snow is usually measured in millimetres and its water equivalent in millimetres and tenths obtained by dividing the snow depth by 10, assuming the density of snow as 0.1. This value is however, only a rough approximation and varies very much with the depth and texture of the snow. For accurate measurement of precipitation at stations where snowfall is likely, special snow gauges are used.

Wind:

Wind is defined as air in motion and is expressed in terms of direction and speed. Wind direction is regarded as the direction from which it blows and speed as the rate of movement of air in its instantaneous direction.

Wind direction is determined with reference to true north and is expressed to the nearest 10 degrees or to 16 points of the compass. Wind speed is measured in knots (nautical miles per hour) or in kilometres per hour.

FORECASTING ORGANISATION (NON-AVIATION)

The Organisation for providing different types of non-aviation forecasts and warnings is given in the table below :-

S.No.	Category/ Meteorological Offices issuing Weather Forecasting	Details of Service	User Interest
1.	**Marine** RSMC New Delhi	(i) Tropical weather outlooks and Tropical cyclone advisories	Countries in the WMO/ESCAP Panel region bordering the Bay of Bengal and the Arabian Sea
	DDGM (CW) New Delhi Cyclone Warning Centres at Kolkata (Alipore), Mumbai (Colaba), Chennai (Nungambakkam), Ahmedabad, Bhubaneswar & Visakhapatnam (6)	(i) Forecasts for Bay of Bengal & Arabian Sea. (ii) Coastal forecasts (iii) Cyclone Warnings (iv) Port Warnings	Ships Ships, Govt. Deptts. Maritime State & Public Ports
	Cyclone Warning Centre at Mumbai, Kolkata & INOSHAC, Pune	Fleet Forecast twice a day, frequency of bulletins increases to four during tropical storm period for Arabian Sea, Bay of Bengal and Indian Ocean upto 10°S (60°E to 100°E). Issuance of sector wise fleet forecast of wind speed, wind direction and weather over the regions 5°N - 10°S, 60°E-100°E	Indian Navy
	Global Maritime Distress and Safety System (GMDSS), ACWCs Mumbai, Kolkata & Indian Ocean and southern hemispheric Analysis Centre, Pune.	Bulletins twice a day are issued for Met. area VIII N for Arabian Sea, Bay of Bengal and Indian Ocean. To north of Equator, the frequency increases to six during tropical storm period	All ships.

S.No.	**Category/ Meteorological Offices issuing Weather Forecasting**	Details of Service	User Interest
2.	**Fisheries** Cyclone Warnings Centres at Kolkata (Alipore), Mumbai (Colaba), Chennai (Nungambakkam), Ahmedabad, Bhubaneswar, Visakhapatnam (6)	(i) Adverse weather along coast, 4 times daily (including nil warnings) (ii) Cyclone Warning	(i) Fishing Craft through A.I.R. (ii) Fisheries
3.	**Agriculture** (a) Regional Met. Centres/ Met. Centres at Ahmedabad, Bangalore, Bhopal, Mumbai, Bhubaneswar, Kolkata, Guwahati, Hyderabad, Jaipur, Lucknow, Chennai, Nagpur, New Delhi, Patna, Srinagar, Thiruvananthapuram and Chandigarh (17).	(i) Farmer's weather Bulletins, (2 bulletins are issued daily during all seasons) (ii) Agricultural advisory message	Message for Farmer's broadcast from A.I.R. stations in local languages.
	(b) Meteorological Offices at Ahmedabad, Bangalore, Bhopal, Bhubaneshwar, Kolkata, Chandigarh, Shimla, Gangtok, Guwahati, Hyderabad, Jaipur, Lucknow, Chennai, New Delhi, Patna, Pune, Srinagar & Thiruvananthapuram, Dehradun and Raipur.	Agromet Advisory service Bulletins (weekly/bi-weekly)	Advisories for Farmer's broadcast/ Telecasts in local languages through AIR/ Doordarshan
4.	**Floods** Agra, Ahmedabad, Asansol, Bhubaneswar, Guwahati, Hyderabad, Jalpaiguri, Lucknow, New Delhi & Patna (10)	(i) Quantitative precipitation forecasts (ii) Prevailing Synoptic situation (iii) Heavy rainfall warning (iv) Realised Average precipitation for each sub-basin during past 12/24 hours (v) Point rainfall data of selected stations.	Water Resources Flood Forecasting Division of CWC (Total No. 19)

S.No.	Category/ Meteorological Offices issuing Weather Forecasting	Details of Service	User Interest
5.	**Reservoir Management** (a) Kolkata (Alipore) (b) Bhubaneswar (F.M.O.) (c) Mumbai (Colaba)	Forecasts of rainfall in :- Damodar Valley Mahanadi Catchment Godavari Catchment	DVC Management Hirakund Dam Project Authorities Maharashtra Govt.
6.	**General** Mumbai (Colaba) Pune (Weather Central)	 Wind, weather visibility, sea, swell and cyclone warnings. All India Weather forecasts	 Oil and Natural Gas Commission. Newspaper and AIR.
	Pune (INOSHAC)	(i) Weather Bulletins are issued twice a day describing salient features between 20°E and 155°E and between 45° N and 5°S based on 00z and 12z. (ii) Fleet forecast issued twice a day for sea area between 60°E to 100°E and 5° N to 10° S. The frequency increase to four during tropical Storm period. (iii) Daily two bulletins of GMDSS originated w.e.f. 1.10.98 for Met. area VII (N) to the north of Equator on regular basis. During tropical cyclones, four additional special bulletins are also originated.	Departmental Offices.

S.No.	Category/ Meteorological Offices issuing Weather Forecasting	Details of Service	User Interest
	Ahmedabad, Bangalore, Bhubaneswar, Bhopal, Mumbai, Kolkata, Guwahati, Chandigarh, Hyderabad, Jaipur, Lucknow, Chennai, Nagpur, New Delhi, Patna, Srinagar & Thiruvananthapuram (17). **RMC New Delhi**	(i) Forecasts for one or more States for next two days. (ii) Local forecasts for Capital cities. (iii) Warnings against adverse weather. (i) Weather forecast is provided 3 times daily to State Govt. authoritiees to regulate Amar Nath ji Yatra during 40 days period. (ii) Weather forecast is provided to Govt. to regulate Kailash Mansarovar yatra during the 3 month period. (iii) Weather forecast information is provided on IVRS by dialing Toll free No. 1600-180-1717 from Met. Office Safdarjung for 200 important cities.	Public, Newspapers, AIR and Govt. officials, about 1500 officials registered with different offices.
		(c) Forecasts for seasonal (June to September) rainfall over four broad rainfall homogeneous regions of India viz. Northwest India, Northeast India and Central India and South Peninsula issued by the end of June/ first of week of July.	

S.No.	Category/ Meteorological Offices issuing Weather Forecasting	Details of Service	User Interest
		(d) Forecast for July rainfall over the country as a whole issued by the end of June/ first of week of July. (e) Forecast for northeast monsoon season (October-December) rainfall over Southern Peninsula issued in the first week of October. (f) Forecast for rabi season (October to March) rainfall over Northwest India issued in the first week of October. (g) Forecast for winter season (January – March) precipitation issued in the first week of January.	Govt. Officials Public and Media. Govt. officials

CHAPTER I

INTRODUCTION

1.1 Seasons & associated Weather Phenomena

As per IMD's criteria, a calendar year is divided into 4 distinct seasons, viz.

Winter (Cold Weather Season)	January, February
Pre-monsoon (Hot Weather Season)	March, April, May
Southwest monsoon (Rainy Season)	June, July, August, September
Post-monsoon (NE monsoon Season)	October, November, December

During winter season, NW India, especially Jammu & Kashmir and Punjab receive significant amount of rainfall due to western disturbances. Also, the southeast peninsula receives rainfall, mainly due to easterly waves. Cold wave conditions manifest over various parts of the country, especially, over the northern and central regions. Also, widespread Fog occurs over major parts of the country.

The rainfall during the Hot Weather Season is essentially due to mesoscale systems like thunderstorms and hailstorms. Also dust storms occur over NW India. The activity of these meso-scale systems is often regulated by western disturbances. The important synoptic scale system, which causes damage during this season, is the tropical cyclones, which in most cases, originate in the latitude belt of 10ºN to 15ºN over the oceanic regions and often re-curves towards Myanmar coast. Also, heat wave conditions develop over major parts of the country during the mid-season, which often persist until the monsoon advances over the region.

India receives the major part of its annual rainfall during the SW Monsoon season. The main components of southwest monsoon over India are Mascarene HIGH, Somali low level jet, Heat Low, Tibetan anticyclone and Tropical easterly jet. The location and intensity of these components govern the strength and spatial distribution of rainfall over India. Also, the semi-permanent feature of southwest monsoon viz. monsoon trough with embedded vortices control the rainfall activity. The major weather systems contributing to the rainfall during the season are: Monsoon lows & Depressions, Off shore trough and vortices and Mid tropospheric cyclonic circulations.

During Post monsoon season, cyclonic storms, forming over the Bay of Bengal as well as over the Arabian Sea, which move inland and the easterly waves which move westwards across the peninsula are the important rain producing systems. In the earlier part of October, the storms originate in the latitude belt to the north of 15°N, travel north or northeastwards and cause widespread and heavy rainfall in West Bengal and Assam. Later during the season, they mostly form in the latitude belt 10°N to 15°N and strike Tamil Nadu and Andhra Pradesh coasts and produce heavy rainfall along their tracks. Tamil Nadu also receives rainfall during this season due to cyclonic wind shear in northeasterly winds.

1.2 General Objectives of the forecasting services

Weather plays an important role in almost all aspects of the life on earth. Hence, its accurate and timely forecasting has got wide implications ranging from increasing the Agricultural Production to reducing the damage to life and property.

Currently, forecasting services are rendered to farmers, fishermen, shipping, air navigation etc., apart from the general public. The main objective is to forewarn people so

as to reduce the death and damage from impending natural disasters like floods, cyclonic storms and other inclement weather.

The services rendered by forecasting offices are of three types:

1. Monitoring
2. Preparation of Climatology.
3. Forecasting

1.3 Types of forecasts

Depending on the spatial and temporal scales of atmospheric systems and the details of the accuracy desired, the weather forecasts are divided into the following categories.

(i) Now casting - in which the details about the current weather and forecasts upto a few hours ahead are given.

(ii) Short range forecasts (1 to 3 days) - in which the weather (mainly rainfall) in each successive 24 hr intervals may be predicted upto 3 days. This forecast range is mainly concerned with the weather systems observed in the latest weather charts, although generation of new systems is also considered.

(iii) Medium range forecasts (4 to 10 days) – Average weather conditions and the weather on each day may be prescribed with progressively lesser details and accuracy than that for short range forecasts.

The forecaster has to be more dependent on NWP products for issuing medium range forecasts.

(iv) Long range /Extended Range forecasts (more than 10 days to a season).

There is no rigid definition for Long Range Forecasting, which may range from a monthly to a seasonal forecast.

Appendix 1 gives the 36 meteorological sub-divisions, currently in existence.

CHAPTER 2

SYNOPTIC OBSERVATIONS, WEATHER CHARTS AND ANALYSIS

2.1 Synoptic Observations and other tools

The basic requirement of a weather forecaster is a 3-dimensional picture of the meteorological parameters of a domain a bit larger than his region of interest. For this, one depends mainly on the synoptic charts, which are prepared on a routine basis in all forecasting offices.

The tools currently in use for short/ medium range weather forecasting are enlisted below :

- Synoptic observations of various meteorological parameters plotted on appropriate charts viz., mean sea level pressure chart, wind observations at constant pressure levels, geopotential heights, temperature, etc.
- Auxiliary charts prepared out of derived parameters, for example, dew point temperature, pressure tendency, anomaly charts of pressure, maximum & minimum temperatures etc.
- Satellite imageries
- Satellite bulletins
- Various derived products from satellite observations, viz. Cloud Top Temperatures, Cloud Motion Vector (CMV) winds, water vapour derived winds, Outgoing Longwave Radiation (OLR), Quantitative Precipitation Estimates (QPE), divergence-convergence patterns of lower & upper levels, wind shear tendency, etc.
- The AWS plotted charts and other products of numerical weather prediction models available on the ftp server.
- Some more products of numerical weather prediction models available on Internet from IMD and NCRMWF and other worldwide centres such as UKMO, ECMWF, COLA, NOAA, NOGAPS, JTWC, etc.
- Ships and buoy observations
- Weather Radar and Doppler Weather Radar Observations.
- Current Weather Observations (CWOs), Aircraft Reports (AIREPs)

2.2 Weather Codes

All the surface and upper air observations are being transmitted in the Internationally accepted weather codes of WMO. Appendix 2 (2.1, 2.2 & 2.3) gives the modifications made in the RADAR, SHIP & TEMP and SYNOP codes respectively. The code books on Surface Observations, PILOT, TEMP, SHIP and RADAR observations have been revised recently incorporating these changes by the O/o DDGM (WF).

2.3 Weather charts and analysis

Surface charts and constant pressure charts are prepared on a routine basis for all the four main synoptic hours. Auxiliary charts indicating the weather realised, maximum, minimum and dew point temperatures, their 24 hours changes and departures, 24 hour

pressure tendency and pressure anomaly are also prepared twice daily for the purpose of forecasting.

Types of weather charts prepared at various met. centres differ according to the types of forecasts, for which they are made use of. For example, the charts prepared by ACWCs/ CWCs, met. offices attached with Aerodromes and other met centres differ widely. The charts used by the cyclone warning centres are described in Chapter 4 entitled as 'Weather Charts and analysis and other records' of 'Cyclone Manual'.

The objective of analysis is to understand the atmosphere for the purpose of forecasting. The basic principles and procedures to be followed in the analysis of weather charts, especially the upper level charts, are discussed authentically in the forecasting manual No. II-4, Methods of Analysis – Analysis of wind fields and FMU No. V-1, Techniques of High Level analysis and prognosis – Organisation and methods of analysis. Also some of the features of tropical analysis is dealt by Asnani (2005) in his book Tropical Meteorology, Chapter 1.

After performing isobaric analysis on the mean sea level charts, surface positions of troughs, ridges, lows, highs, etc, are demarcated. By doing this, the pressure gradient for issuing the wind forecast for the coastal stations is obtained directly from the sea level charts.

From the analysed upper air charts, cyclonic/ anticyclonic circulations, convergence/ divergence of streamlines, vertical extent of a system, trough/ ridge positions, depth of westerlies, strength and position of jetstreams, cyclonic/ anticyclonic shear etc., can be assessed without any quantitative calculations. Convergence zones are hatched on the chart before issuing the forecast.

Constant pressure charts are prepared for the standard isobaric levels of 925, 850, 700, 500, 300, 250, 200, 150 and 100 hPa. The elements plotted are geopotential thickness, temperature, dew point depression, wind, etc. An analysis is done for contour values, temperature and wind speed. Contour lows and contour highs are demarcated. Isotherms will help to identify the thermal structure of the atmosphere and also for thermal wind computations, cold/ warm air advection, etc. Isotachs give the strength of the jetstream, position of its core, development of easterly jetstream, etc. Moreover, upper air streamline analysis (done separately on pilot wind charts) during cyclone situations is useful, while employing the steering concept, to see the Col/ Ridge/ Anticyclone positions.

The departure from normal charts give information on why the actual conditions differ from the normal. Vertical cross section charts, though not prepared on a routine basis, give the depth/ strength of westerlies and moisture field at a particular longitudinal section. Vertical time section charts are helpful in delineating the strength of winds, easterly wave activity over the southern peninsula etc. Also T-ϕ grams are prepared from the routine Radio/ Rawin ascents and are analysed to obtain stability/ instability layers of the atmosphere, convective activity, inversions, moisture levels, etc. and thus is of very much use in issuing the local forecast of a specific area.

The forecasting circulars related to weather charts and analysis are given in Appendices 2.4 to 2.8

2.4 Other tools for weather forecasting

The dependability on NWP products is increasing day-by-day.

The model outputs as available in the ftp server (current IP Id 202.141.140.210 with the user name and password as provided by NHAC) be made use of judiciously.

Apart from this, various other numerical model outputs available in the internet, for example by ECMWF, UKMO, COLA, NOGAPS, GUAM, wave model forecasts etc. also are consulted as the situation demands.

The Doppler Weather Radar products are made use of to their maximum possible extent for nowcasting purposes.

Apart from these, a regional model with appropriate nesting be run by the forecasting centres, for providing location specific weather forecasts as per the user requirements.

CHAPTER 3

TERMINOLOGIES IN WEATHER FORECASTING

The meteorological terminology which are to be used in the operational forecasts as well as in the weather summaries and other reports are described in this Chapter.

3.1 Rainfall

Terms used to describe the intensity and spatial distribution of rainfall have been evolved through time. They have undergone many modifications according to the need for translating into various local languages.

The latest practices to be followed and the terms used for denoting the percentage departures in weekly and seasonal summaries are given in Appendix 3.1

3.2 Temperature

The specifications for declaring the heat/cold wave conditions have been revised three times so far, viz., in 1978, 1989 and finally in 2002.

The revised criteria prevalent with effect from 1st March 2002 along with some additional circulars on comfort Index based temperature forecast, description of 24 hour temperature tendency etc are available in Appendix 3.2 .

3.3 Synoptic systems

Based on wind speed over the oceanic area, IMD has classified the low pressure systems into 7 categories, i.e. from low pressure area to super cyclonic storm. The category of super cyclonic storm came into existence since the cyclone season of 1998.

Also two more forecasting terminologies are added in this section in order to describe the synoptic features.

3.4 Time as parts of the day

The terminology used for describing different parts of the day attains importance while describing the probable /occurred landfall of cyclonic storms, their intensification, weakening etc. (Appendix 3.4)

3.5 To describe sky condition

To describe the sky condition in local forecasts and other inferences, the terminology as given in Appendix 3.5 may be made use of.

CHAPTER 4

WEATHER FORECASTS, BULLETINS & WARNINGS

4.1 Forecasts and bulletins issued by various met. centres.

The responsibility of issuing forecasts , bulletins and warnings by various met. offices differ widely. The ACWCs and CWCs involved in the cyclone warning work have an additional set of bulletins and forecasts to be issued by them, which are elaborately described in Chapter 9 of the Cyclone Manual, viz., 'Bulletins and Warnings'. Similarly, those met. offices attached to the aerodromes are to follow an entirely different routine of Bulletins and Warnings to ensure the safety, regularity and efficiency of air navigation, the details of which are readily available in the 'Manual on Meteorological Services for Aviation in India', 3rd edition brought out by the O/o DDGM(WF) in 2006.

The forecasting responsibilities of all other Met. Centres, Regional Met. Centres, Weather Central, Pune and NHAC, New Delhi, are also well defined and differ from one another. All these centres are to issue forecasts twice in a day based on the morning and evening charts. Weather Central Pune issues the India Weather Bulletin (IWB) twice a day and All India Weather Summary on a daily basis. NHAC New Delhi, considering inputs from all the regional inferences, IWB and on consulting the numerical model outputs, issues the National air news to the media twice daily.

4.2 Weather Warnings:

Each RMC/MC has a list of designated/registered users (previously known as Album Page Warnees). This list needs to be kept updated and registers should be maintained for the warnings issued.

4.3 Dissemination of Bulletins & Warnings:

This is the most important part of weather forecasting services. Our forecasts should reach the public and user agencies in time and without any distortion. For this purpose, forecasting offices may make use of all the available means including mobile phone, internet services, etc. as the situation demands.

Some of the circulars containing instructions regarding the preparation of various bulletins, weather reports, etc., and their dissemination to user agencies are given in Appendices 4.1 to 4.8.

CHAPTER 5

IMPORTANT PROCEDURES DURING THE MONSOON SEASON

The agrarian economy of India depends mainly on the southwest monsoon rainfall and hence this is a period of crucial importance to weather forecasters. In order to avoid mistakes and omissions in our duties, a certain set of procedures and regulations, evolved in time are enclosed in the appendix.

5.1 Onset/ Withdrawal of Monsoon

The arrival of monsoon current over the Andaman Seas, its onset over the mainland and further advance need to be monitored closely.

During the onset/ withdrawal phase, bulletins are issued by Weather Central, Pune, RCs and MCs which will be posted on their respective websites as well as disseminated by the media. To avoid contradictory bulletins to the public from various met. offices, Weather Central, Pune, will issue an advisory bulletin at about 1130 hrs IST by Fax/ AMSS to RCs/MCs regarding the advance/ withdrawal of monsoon from different met-subdivisions as and when occasion arise. This will be prefixed by the wordings, 'tentative bulletin dated - ……' and will be based on the 0000 UTC and 0300 UTC charts as well as telephonic discussions among Director, Weather Central, Director-in-Charge of the concerned RCs and NHAC New Delhi. (Appendix 5.1.1)

Onset Phase : The monitoring commences from 10th May onwards.

MC Thiruvananthapuram, DGM SATMET (New Delhi) and DGM (NHAC) New Delhi are required to send the specified data, as given in the forecasting circular No. 1/2006 (Appendix 5.1.2) to the O/o DDGM(WF) via e-mail/Fax on a regular basis, till the onset is declared over Kerala.

5.2 Strength and performance of monsoon

The procedures for describing the activity of monsoon, mentioning the temperature conditions when the situation arises and the criteria followed in declaring the withdrawal etc. are provided in the respective forecasting circulars. (Appendices 5.2.1 to 5.2.6)

Each forecasting office shall prepare a checklist on all these procedures to be followed along with a list of warnees (and phone numbers of disaster mitigation agencies) and keep it handy prior to the starting of the season.

5.3 Commencement / cessation criteria for NE monsoon

Almost similar procedures need be followed during the NE monsoon period over the southern peninsula. The respective instructions are added in Appendix 5.3.

CHPATER – 6

PROCEDURES DURING THE CYLONE PERIOD

Bulletins and Warnings Issued by ACWCs and CWCs

List of Bulletins and Warnings

The following is the list of Bulletins and Warnings issued by the ACWCs and CWCs for their respective areas of responsibility:

- Weather and Sea Bulletins
  - [@] (a) for shipping on the high seas; and
  - (b) for ships plying in coastal waters
- [@*] Bulletins for Indian Navy
- [*] Bulletins for departmental exchanges
- Port warnings
- Fisheries warnings
- Pre-cyclone watch and post landfall outlook (issued by Cyclone Warning Division)
- Bulletins for A.I.R.
- CWDS bulletins
- Warnings for registered/ designated users
- Bulletins for Press
- Aviation warnings (issued by concerned Aviation Meteorological Offices)

The issue of bulletins and warnings by the various ACWCs/CWCs is exhaustively dealt with in Chapters 9 and 12 of the Cyclone Manual which may be referred to for more details. A brief description of the various bulletins and warnings is given here.

Sea area bulletins and fleet forecasts

Weather and sea bulletins for shipping and Navy: These are issued only by ACWCs Mumbai and Kolkata. The weather and sea bulletins for shipping in the high seas, is meant for merchant shipping and is broadcast from the DoT coastal radio stations at Mumbai and Chennai, the bulletins for the Indian Navy (technically called the 'Fleet Forecasts') issued by ACWCs Mumbai (for Arabian Sea), Kolkata (for Bay of Bengal) and INOSHAC (for a portion of the Indian Ocean) are broadcast from the Naval W/T station at Mumbai. The areas of the Arabian Sea and Bay of Bengal covered in the fleet forecasts are slightly larger than in the bulletins for merchant shipping.

Sea area forecast for area covering west of Long. 62^{o} E and area between Lat. 5^{o} N and 12^{o} N transmitted to DGM (NHAC) by ACWC Mumbai at the time of Daily I and Daily II for inclusion in GMDSS bulletin.

Naval bulletins based on Daily one & two are sent to ACWC, Mumbai by CWC Ahmedabad for further transmission. Porbandar bulletins are also sent to ACWC Mumbai.

Bulletins for Departmental Exchanges

The sea area bulletins for departmental exchanges are issued by all the three ACWCs (Mumbai, Kolkata and Chennai). While the bulletins of Mumbai and Kolkata cover Arabian Sea and Bay of Bengal respectively, Chennai issues for both Arabian Sea and Bay

[@] Issued by ACWCs Mumbai and Kolkata only
[*] Issued by ACWCs Mumbai, Kolkata and Chennai

of Bengal. However, the additional bulletins on disturbed weather days will be issued by Chennai only so long as the coasts of Chennai region are affected by the system.

The other types of messages, issued by all the ACWCs and CWCs for their respective areas of responsibility.

Coastal Bulletins

Weather and sea bulletins for ships plying in coastal waters: These are for the benefit of ships sailing close to the coast and are issued by the ACWCs Kolkata, Chennai, Mumbai and CWCs Visakhapatnam, Bhubaneswar and Ahmedabad for the different coastal areas under their responsibility. These bulletins are broadcast in Morse code as well as by NAVTEX stations in plain language from the 10 coastal DoT radio stations – 6 on the west coast, 3 on the east coast and 1 in Andaman & Nicobar Islands.

From CWC Ahmedabad, coastal bulletins are issued twice daily to ACWC Mumbai and Mumbai Radio (landline) for both South Gujarat and North Gujarat coast.

Warnings to Ports

Hoisting of signals

The India Meteorological Department (through the ACWCs/CWCs) maintains a port warning service by which the port officers are warned by high priority telegrams about disturbed weather likely to affect their ports. On receipt of the warning telegrams from the ACWC/CWC, the port officers hoist appropriate visual signals prominently on signal masts so that they are visible from a distance. Mariners and other sea-faring people, including fishermen who may not be literate, are generally aware of the meaning of these signals and the port authorities are always ready to explain them whenever necessary. At some ports, the meanings of the signals are displayed in English as well as in the local languages prominently on a notice board. While the India Meteorological Department is responsible for issuing the warnings, the port authorities arrange the display of signals. In addition to hoisting the signals, the port officers have, in most cases, make arrangements for disseminating the warnings received by them, to country craft and sailing vessels in the harbours.

Frequency of Issue

Ports in the maritime States are warned 5 to 6 times a day during periods of cyclonic storm by landline telegram. The warnings contain information about the location, intensity and expected direction of movement of the storm or depression, the part of the coast where it is expected to strike and the type of signal which the port should hoist. As landline communication between the port and the CWC may break down during a cyclone, provision exists for using state and inter-state police W/T channels wherever available for passing on the warnings.

Warnings for Fisheries

Warnings for fishing interests are issued by the ACWCs/CWCs whenever the wind speed is expected to exceed 45 kmph (i.e. for squally weather, gales, strong monsoon and off shore winds) and state of sea very rough or above. These warnings are transmitted by landline telegram or over telephone to the AIR stations (about 30 in number) in the maritime states. These warnings are broadcast as a routine four times a day (morning, mid-

day, evening and night) from the AIR stations in the local language. During a cyclonic storm, such warnings are covered in the cyclone bulletins sent to the AIR stations at hourly or 3 hourly intervals for frequent broadcast. The fishermen can listen to these broadcasts through portable radio receiving sets.

Warnings through telegrams

In addition to warnings broadcast by AIR stations, direct warning messages are also sent by landline telegrams to a large number of officials belonging to the fisheries departments in maritime states.

Pre-Cyclone Watch and Post landfall outlook

Pre-Cyclone Watch

Pre-cyclone watch is an early warning issued about 72 hrs. in advance of the commencement of bad weather (implemented with effect from the cyclone season of April – May 1999). This is being issued by the H. Qrs. and is addressed to the Cabinet Secretary and other senior officers of the Govt. of India including the Chief Secretaries of concerned Maritime States, media persons and ACWCs/CWCs.

Cyclone Alert and Cyclone Warning

Cyclone warnings are issued to the Chief Secretaries of the maritime states and the Collectors of the coastal districts and the immediate interior districts expected to be affected by the cyclone and some designated railway officials and defence personnel, by high priority landline telegrams, under what is known as a *Two Stage Warning System*. *Cyclone Alert* is issued, as far as possible, 48 hours before the expected commencement of adverse weather and a subsequent warning called *Cyclone Warning* 24 hours before the onset of adverse weather. After this, cyclone warnings are issued to above officials twice a day by high priority telegrams/FAX/Mobile/Internet based on 0830 IST and 1730 IST charts till the weather improves. In addition, these officials are also advised to listen to AIR stations/TV broadcasts in their respective areas for the warnings.

Post landfall outlook

Post landfall outlook is issued at least 12 hours in advance of the landfall by the concerned ACWCs/CWCs w.e.f. the 1999 cyclone season. On the basis of this outlook, the concerned RMCs/MCs which are likely to be affected will also issue cyclone warnings for the interior areas. This is part of the regular cyclone warning.

By Telephone

The Chief Secretary of the concerned state is also kept informed over telephone/mobile/fax/internet by the Meteorologist of the ACWC/CWC about the location movement and intensity of the storm and the areas expected to experience severe weather.

Digital Cyclone Warning Dissemination System

In addition to the existing mode of dissemination of cyclone warnings to various state Govts., Port Officials, etc. through telephones and telefax /mobile/internet by IMD, a scheme, Digital Cyclone Warning Dissemination System (DCWDS) using INSAT/ Kalpana1 has been established for coastal areas. The system is being extensively used on operational basis during cyclone. State Govt. officials of coastal states found this scheme very useful as the scheme is more reliable during severe weather conditions and cyclones particularly when

terrestrial links are disrupted. The cyclone warning message is originated from ACWC Chennai, Kolkata and Mumbai whenever a storm is observed. Warning messages are received in local languages directly by DCWDS receivers located in areas likely to be affected by the cyclone.

Warnings by Police W/T

As telegraphic/telephonic communication often breaks down during cyclones, the warnings meant for the Chief Secretary and Collectors of coastal districts are passed on to these officials through police W/T channels, in addition to landline telegrams or by telephone to ensure that the warnings reach these officials quickly to enable them to take precautionary measures promptly (Appendix 6.1).

In addition, as a part of State Level Disaster Management Plan, VHF set is installed at RMC Mumbai for quick communication to State Control Room. VHF is also installed at CWC Bhubaneswar, provided by Orissa State Disaster Mitigation authority. Police W/T personnel are made available with their equipments installed at ACWC Kolkata and Chennai for transmission of warning messages to State Govt. authorities during cyclone and monsoon seasons (mid-April to mid-December) every year.

Bulletins for all India Radio

AIR Bulletins

As a back-up to the arrangements referred to above, cyclone warnings are also broadcast through AIR stations. After issuing the *Cyclone Alert* to the Chief Secretary and Collectors by Fax/mobile/internet, the first *Cyclone Warning* is issued to these officials by fax/mobile/internet as stated in above and also passed on to the concerned AIR stations for broadcast. In the *Cyclone Alert* message, the recipients are informed that the subsequent cyclone warnings will be broadcast from the concerned AIR station. When the cyclone is beyond the range of the coastal cyclone detection radar, that is, more than 400 km away from the coast, cyclone warnings are issued 6 times a day to the AIR stations and each warning is broadcast at frequent intervals interrupting the routine programme. When the cyclone comes within the radar range and is tracked by the radar hour to hour, cyclone warnings are issued every hour to AIR stations. During cyclone periods, the concerned AIR stations keep round the clock watch for broadcasting cyclone warnings.

Coastal Bulletins for AIR news cycle

In addition, arrangement has also been made with AIR New Delhi for broadcast of coastal weather bulletins for the different coastal belts, in Hindi, English and the local languages in the AIR news cycles three times a day, viz., in the morning, mid-day and at night. These bulletins contain information on the location, intensity and expected direction of movement of the cyclone, state of sea off the coast and expected adverse weather (heavy rain, gales and tidal waves) in the coastal districts.

Registered/designated warnees :

Warnings for heavy rain and gales are also issued by landline telegram, FAX/ e-mail/mobile to officers of the Revenue, P.W.D., Irrigation and Highways, DoT, Railways etc., who are on the warning list of the ACWCs/CWCs. CWC Visakhapatnam gives these warnings from depression stage while MC Hyderabad issues during other periods. In addition the warnings are kept in the Website for information.

Press Bulletins:

Special press bulletins are issued during periods of cyclonic storms to local newspapers for giving publicity to the warnings.

Aviation Warnings:

Warnings for airports and flight operations likely to be affected by tropical cyclones are issued by the concerned Aviation Meteorological Offices.

Basis of CWC warnings

The CWCs issue the bulletins and warnings on the basis of the sea area bulletins from their parent ACWCs. However, when a cyclone comes within the range of the cyclone detection radars at Visakhapatnam, Paradip and Bhuj and these radars are able to track the cyclone with accuracy and confidence, then the CWCs may issue the warnings on their own without waiting for the bulletins from their parent ACWCs at Chennai, Kolkata and Mumbai respectively. Also, when there is a communication breakdown between the CWC and the ACWC, the CWC can issue the bulletins on their own.

Watch Hours

The ACWCs/CWCs maintain round the clock watch.

Other Functions of ACWCs/CWCs
Pre-cyclone Exercise

The following are the instructions for action to be taken in the months preceding the pre- and post-monsoon cyclonic storm seasons (i.e. by about April and September) of each year.

Communications

(1) The Director-in-charge at the ACWC/CWC will contact personally the General Manager-Telephones, General Manager-Maintenance and Senior officials in-charge of telegraph, teleprinter and telefax/mobile/internet communication systems at their respective stations and ensure that :

a) The local communication links at the ACWC/CWC consisting of T/P/Telephone/Telex/Telefax/mobile/internet connections are maintained in good working condition, especially during the days of cyclonic storms.

b) T/P circuits connecting the station to other Meteorological Offices are maintained at highest efficiency. They may also be requested to designate local DoT officers to serve as liaison officers for this purpose so that they can be contacted at times of breakdown to ensure quick service.

(2) T/P, Telex and Telefax machines
T/P, Telex and Telefax machines at the stations should be maintained in good working condition. Essential spare parts should be requisitioned well in time and kept in store so that no breakdown occurs in the crucial time for want of these; maintenance staff also should be available on the spot during days of disturbed weather for immediate rectification of faults.

(3) Police W/T

Any action required in connection with the issue of warnings through Police W/T should be completed. In particular, any shortcomings in this mode of communications noticed in the previous storm season should be discussed with the State Government authorities and remedial action taken.

Publicity and Broadcast of Warnings

Through posters and films

The ACWCs/CWCs should write to the State Government officials concerned for giving publicity to the people in the coastal districts about cyclones through cyclone posters and exhibition of the film on cyclones.

Radio and TV Talks

Talks on radio and television should be arranged by the ACWCs and CWCs on the hazards of cyclones and precautionary measures to be taken before, during and after the storms. The system of warnings should be explained.

All India Radio

The station Directors of All India Radio station in the concerned State(s) should be alerted about the broadcasts of cyclone warnings through AIR and to ensure that the stations keep extended watch for broadcast of additional weather bulletins whenever required. They should be requested to include storm warning bulletins in their Vividh Bharati broadcasts and FM Channel also at frequent interval as these have popular appeal.

Newspapers

Proper liaison should be established with local newspapers for prompt publication of latest warnings.

Observational data and Organisation

Inspection of coastal observatories

All the coastal observatories and co-operative cyclone reporting network of stations (as well as Police W/T stations in Tamil Nadu) should be inspected once in a year during April or September to ensure that the instruments at these stations are in good condition and the observers are familiar with correct recording and reporting of observations. If any persistent error is noticed in the recording or reporting, the observer should be immediately instructed. Similarly, the communication aspects between the observatory and RMC/MC should also be checked up.

Radar and SDUC

Any deficiency in the operation of the cyclone detection radars, RS/RW and SDUC stations in the region should be immediately brought to the notice of DDGM (UI)/ DGM (Satellite Meteorology) by the MC/RC concerned for immediate rectification. Maintenance of SDUC equipment and satellite equipment should be done by DGM (Sat. Met.) New Delhi.

Reference publications and forms

Relevant reference publications, such as, *Code of storm warning signals for use at Indian maritime ports*, *Weather services to shipping, fishing vessels and maritime interests*,

the *tide tables* for the year, *storm track atlas*, *code books, cyclone manual* and required *nomograms* and *T-classification tables* for interpreting and assessing storm intensity from satellite pictures, etc., should be made readily available for storm warning work. Sufficient stock of all special type of charts and forms required for cyclone work should be kept at the ACWCs/CWCs.

Cyclone Manual

As a part of the pre-storm season exercise, the officers and staff of ACWCs/CWCs engaged in storm warning work may go through the chapters of Cyclone Manual before each storm season and refresh themselves with the various procedures, so that procedural mistakes are totally avoided in operational work. A few informal classes may also be conducted if necessary for the benefit of persons newly posted to storm warning work. All the officers and members of staff should make themselves familiar with the list of various types of warnees to be warned and the formats in which these warnings are to be issued. The Action Books may be checked up to ensure that all the items listed there are updated. The formats of the various warnings should also be kept ready for reference.

Telephone Numbers

The telephone, V-Sat, Fax, E-mail, mobile nos., addresses etc. of different ACWCs/CWCs/ Radar stations and other concerned offices such as local Doordarshan, AIR, Chief Secretary, Revenue Secretary, SRC, State Disaster Mitigation Authority, Port offices, Fisheries officials should be readily available.

Staff Matters

Reserve Personnel

For relieving the heavy stress and strain on the forecasters in storm warning centres during storm period, ACWCs/CWCs may build up a reserve of personnel in the cadre of officers at these centres by training personnel working in the other units in storm warning work. For this purpose, all these persons may attend the forecasting work one day in a week by turn. Similar steps may be taken in CDRs to train reserve personnel wherever possible.

Staff

It is also essential that the staff posted at ACWCs/CWCs and coastal observatories are quite familiar with the various procedures connected with the cyclone warning work. The best available staff may be utilised in connection with storm warning work in view of its importance to the public. Sanctioning of leave to the staff engaged in operational forecasting work may be regulated to ensure availability of required number of trained and experienced persons for storm warning work.

Circular letter to warnees

Warnees to listen to AIR

A circular letter is issued every year by about March or April and September by the ACWC/CWC informing the warnees that whenever they receive the first warning for cyclone by telegram, they may commence listening to the regional All India Radio Stations for latest information about the storm and its further movement and intensification.

Action taken by warnees

The action taken by the warnees on receipt of our warning messages may also be obtained from them by asking them through a circular letter to send the monthly statements in the required proforma (OBS 213 forms). Such action as may be necessary on these statements have to be taken by the concerned ACWC/CWC. The warnees have to be supplied with the forms every year.

Circular letter to Chief Secretaries

A circular letter may be sent to the Chief Secretaries of maritime states for designating officers of these states for liaison with the storm warning centres on behalf of the State Government during cyclone periods. In case of ACWC Kolkata, Principal Secretary Relief is the liaison officer for West Bengal and SRC for Orissa.

Circular letter to the Port Officers

In the beginning of each cyclone season, the port officers are informed through a circular letter that they would be getting port warning messages from the ACWC/CWC whenever occasion demands. After the receipt of the first message at the port, the ports are expected to get at least one message in 24 hours in the case of distant signals or more frequently whenever local signals are hoisted, till the advice for lowering the signals is received. In case, a port officer fails to receive such messages in time after the receipt of the first message, he has to take the initiative in contacting the ACWC/CWC to find out the actual position.

Ports

Visit to ports

The ports are visited at least once in two years by officers who are well conversant with storm warning work. Usually, one of the officers of the ACWC/CWC proceeds on these tours as he will be in the best position to keep liaison with ports receiving storm warnings. He will also examine the arrangement for display of storm warning signals and also find out how effectively the storm warning system functioned particularly during periods of depressions or storms. The visiting officer will see that all the day and night signals are available and in proper condition, ready to be hoisted when warning telegrams to hoist them are received. After each visit, the officer submits a report about his visit incorporating his suggestions for the improvement of the warning system. The form of Hand-book of Ports is also filled up by the Officer and these reports are to be sent to the concerned ACWC for consolidation and submission to DDGM(WF) with suitable recommendations for further action.

Guidelines

The following guidelines in connection with the visits to ports may be followed:

i) Every port exhibiting signals should normally be visited once in two years.
ii) The visits to the ports without signals are to be undertaken primarily to ensure that satisfactory arrangements exist at these ports for the reception of warnings and their prompt communication to the people concerned. It may, therefore, be useful to visit these ports also, say at least once in four or five years.
iii) Ports affected by a storm may also be specially visited as and when considered necessary in order to ascertain how the warning system functioned during the storm.

iv) The visits to ports are to be treated more or less on a par with the inspection of observatories and may therefore be arranged for by the DDGM at their discretion.

v) The programme of visit to ports may be forwarded to DDGM(WF)'s office before the tours are actually undertaken.

vi) In case, DDGM(WF)'s office at any time considers that a particular port should be visited for a special reason, the R.M.C. concerned will be advised.

Early action

Action as suggested by the visiting officers in their inspection reports should be examined for early implementation as may be found necessary.

Meeting with the Chief Secretaries of the Maritime States

Participation in the Annual conference of Collectors

The Officer-in-charge of the ACWCs/CWCs/MCs connected with storm warning work will meet the Chief Secretaries of the concerned States every year to apprise them of our storm warning service. The Chief Secretaries of the maritime States may also be requested to invite the DDGM (RMCs) of Mumbai, Kolkata and Chennai for participating in the Annual conference of Collectors so that they can explain to the Collectors the functioning of the storm warning organisation and other details regarding the issue of warnings, etc., There can also be discussions between the Storm Warning Officers on the one hand and the State Government officials on the other for a better understanding and improvement of the storm warning system particularly regarding the dissemination of storm warning messages.

Meeting Chief Secretary

The officers-in-charge of ACWCs/CWCs/MCs connected with storm warning work should also meet the Chief Secretary whenever a new incumbent takes office.

Visit to coastal radio station

When an official proceeds on tour to observatories, they may visit the coastal radio stations (if it functions there) and impress on the staff, the need to receive as many ships' observations as possible and to pass them promptly to the Meteorological offices through the C.T.O.

Reports on cyclonic storms

Post cyclone reports

After a storm has crossed coast or weakened, a report has to be prepared by the concerned ACWC/CWC on the action taken in connection with the storm and sent to DDGM(WF) and DGM. This is to enable DGM to keep the Government informed about the timeliness, adequacy and accuracy of the warnings issued by the department for answering parliamentary questions and other enquiries from the public which may come up.

Visit of officer to storm affected areas

A detailed survey of the storm affected areas will also be done by an officer to collect more scientific information about the storm as well as to obtain from the concerned warnees their opinion about the effectiveness of the warnings issued.

Special observations from surface observatories – land stations

Need for special observations

Except for 03 and 12 UTC charts, the network of coastal observations at the other hours is not sufficient for cyclone warning work. During periods of disturbed weather out at sea, observations from all the coastal and island observatories may be required at synoptic hours other than 03 and 12 UTC also. Therefore, it will be necessary to call for special observations on such occasions from observatories at some of the synoptic hours at which they may not take routine observations. Requisitions for special observations can be sent both by ACWCs & CWCs. Sometimes hourly observations are also required.

General instructions

The following are the general instructions for calling special observations from surface observatories.

During depression stage

Special observations are to be called from coastal and island stations for the preparation of 1800 UTC chart from the depression stage onwards (for the issue of Dew Drop bulletin) or even when a depression is expected to form.

During storm stage

When a depression has intensified into a cyclonic storm, additional special observations are to be called at all the other synoptic hours (00, 06, 09, 15 and 21 UTC) also for the preparation of special charts for the issue of Electron, Formula and Gasbag bulletins.

When landfall is expected within 24 hrs.

However, if a cyclonic storm is within striking distance from the coast and the landfall is expected within the next 24 hrs, hourly special observations may be called from a restricted coastal area towards which the storm is heading, for determining the position of the storm, its intensity as well the place and time of landfall etc., from the sequence of hourly changes at these coastal stations.

Discretion of Storm Warning Officer

It is left to the discretion of the Storm Warning Officer to decide how frequently the special observations are to be called; he should consider each case on its merits.

Extra regional observations

It is not necessary to restrict the requisitioning of special observation to stations within the region only. Stations outside the region may also be requested directly for special observations. When an observatory station receives request from more than one Cyclone Warning Centre for special observations, the station will comply with each request independently according to the frequency and duration for which the special observations are called for.

METARs

Whenever special observations or even the routine observations from extra Indian coastal stations are not available at an ACWC/CWC, the METARs and SPECIEs of the

airports of these stations may be obtained through the Aviation Meteorological Offices and utilised for storm warning purposes. Similarly, on such occasions, the FIR warnings issued by the foreign Meteorological offices may also be useful.

Discontinuance

After the system has crossed coast and special observations are no longer needed, the observatories concerned should be informed immediately to discontinue the special observations. Special care should be taken to see that the observations are not received after instructions to discontinue them have been issued. Further messages to stop the observations have to be issued to such observatories which still continue to send the special observations.

Other Record

Record Management

The strain of cyclone work may lead to errors of judgement and mistakes in execution. These are likely to creep in if care is not taken to systematize the work. All warning action is to be reduced to writing and be subject to a check by an independent person immediately afterwards. Any action taken in connection with the storms, over phone should also be recorded in writing. Records should be in permanent, bound registers with numbered pages and should not be kept in loose paper which could either be lost or tampered with.

Action Books

Three types of action books, which are bound in registers with numbered pages are in use in the various CWCs/ACWCs. In general the texts of the inferences / messages/ forecasts/warning should be entered in the appropriate headings and details of the addresses to which these are despatched, the time of issue/despatch and the mode of transmission like, telephone, W/T or messenger are also entered. The text of the messages initially drafted should be copied immediately into the register by the duty assistant and approved by the duty officer. Then these should be transmitted by the prescribed channels to the concerned addresses and after having been checked by another assistant, the time of despatch as noted in the office copies of the messages should be entered in the register. One page is to be devoted for forecasts pertaining to a single synoptic hour. After action is over the register is to be put up to the Duty Officer who will check the entries and put up the register to the Director-in-charge of the storm warning centre.

Action book 'A' pertains to Regional inferences, forecast, general description of warnings, for Heavy rain, gale, surge etc. Farmer's bulletin, outlook, AIR bulletins, routine, special and for All India News Cycles. Action book 'B' pertains to 2 stage warnings and Inland warnings for cyclones, Heavy rain, gales, (Low temperature, Monsoon onset) etc. Albums are maintained in which the individual pages give the address of the registred warnees, the area for which warnings are necessary and the phenomena, and the limits (Like Heavy Rainfall amount or wind speed) of the warning elements are specified. The Album page numbers pertaining to the warnings sent should be entered in the action work against the addresses. Care should be taken to see that the individual warnings conform generally to the relevant general warning for the public broadcast through AIR. Action book 'C' pertains to the sea bulletins, Coastal bulletins issued to the Coastal Radio Station, and sea bulletins exchanged within the departmental centres, as well as Fisheries Warnings, Port Warnings and other action pertaining to storm warning work like requisitioning of special observations from surface, upper air and Radar stations and from ships out at sea. At Chennai ACWC two separate 'C'; registers are maintained one for Bay and one for Arabian Sea.

Other Registers

Though the above three action books form the backbone of the records, other registers are necessary. Those include the Log Register of telephonic discussion by the Director-In-Charge with DDGM, NHAC other CWC/ACWC concerned with the area, Satellite Centres for technical discussions, State Government officials, like, Chief Secretary, Revenue Secretary, Coastal Collectors, Relief Commissioner and the Commissioner of Police. Police Wireless Officer and Railway, DoT and AIR officials are also often telephoned to make special communication arrangements, like, provision of mobile W/T, extension of AIR watch hours, etc. The time and substance of the conversation should be entered by the duty officer then and there who may be attending to similar enquiries or arrangements. These also should find place in the officers log.

Registers showing ships' corrections, etc.

Since ships' observations play a vital role in Cyclone Warning Work, a separate register should be maintained where pressure corrections if any for individual ships based on consistency with the isobaric situation is entered. During storm time, if any systematic correction has been found for a ship in the past consideration should be given whether the same correction could be applied to the current observation. Whether the barometer of the ship had been compared during its visit to the Ports should also be mentioned in the register, lest too old corrections are unnecessarily applied.

Notices of the ships movement, circulated by the Shipping Companies, Port Trust, etc., should be kept filed in a separate folder and this should be consulted to determine which of the ships are likely to be in the field or vicinity of the cyclonic storms so that these ships could be requested by individually addressing them for special observations. The WMO publication giving names and call signs of the VOF should also be kept handy.

Register for Press Bulletins

A special register should be maintained for recording the Press bulletins issued from time to time during the course of the storm and for the final bulletin summerising the progress of the warnings and their efficiency at the end of the storm.

Proforma for Cyclone action and report

A new format (enclosed in Annexure I) has been adopted in the ACR meeting of 1983 in which particulars of the cyclone warnings as and when issued by the ACWC/CWC are to be entered. This helps to keep track of warnings already issued and also for issue of further warnings in order of priority. Further this format will be useful to answer any parliamentary/Government queries immediately and also in sending the preliminary/ final storm report to NHAC/DDGM (WF) in time.

Filing of copies of warnings

Office copies of individual warnings and messages issued as well as advisories and other important information received should be kept filed neatly in separate folders. Folders for the following items should be maintained:

Issue

1. Port Warning messages
2. 4 stage warnings (including pre-cylone watch & post landfall outlook)
3. AIR bulletins
4. Fisheries Warnings
5. Sea bulletins
6. Press bulletins
7. Coastal bulletins
8. Messages through police radio
9. Messages through Railway Microwave
10. Requisition for special observations.

Receipts

1. All ships observations
2. Radar Observations
3. Special observations from coastal stations
4. Satellite bulletins
5. Inferences from other offices

Check list for procedures

Due to the very heavy work load at the time of cyclone situations, utmost care should be taken not to miss any aspect of storm warning work. It is therefore essential to have a check list so that warnings issued, etc., are systematically checked. Format given in Annexure II should be used as check list to ensure issue of appropriate warnings.

Check list for decision making

The very process of the detection and forecasting of the cyclonic storm should be made logical, all technical features should be identified and given due place in reaching conclusions so that no snap decisions based on preconceived notions are taken. The conclusions should be arrived at step by step. It is essential therefore that a check list for decision making should be devised and the forecaster meticulously fills in all the technical details available and skillfully draws conclusions. A part of the check list based mainly on the one suggested in FMU Part III 4.1 is given below which may be adopted to suit local needs.

Date : Time of Chart:

Intensity of disturbance: 24 hour earlier deseriation with central pressure.

Present Intensity :
Tendency : Weakening / intensifying / no change

Nearest ship report :	Pressure	Wind	Position
(1)	_____	_____	_____
(2)	_____	_____	_____

Coastal Station : Name Surface Wind 0.9 kms.

(1) _____ _____ _____
(2) _____ _____ _____
(3) _____ _____ _____

Satellite evidence : CF_____ BF _____ T./CI Number _____ D or W ____

Radar evidence : No. of spiral bands eye width Tendency

_____ _____ _____

Microseisms: _____

Aircraft reconnaissance: _____

Weather / Wind distribution:

(a) distance of outermost spiral band from centre :
(b) Outermost radius of Hurricane Wind : Gale Wind:
(c) Maximum wind :
(d) Lowest Pressure :
(e) Surge height from

Location of Centres:

		Lat.	Long.
(a)	Ships reports :		
(b)	Coastal stations : Surface, Upper air:		
(c)	Satellite : (1) INSAT/METSAT position		
	(2) Locally estimated from picture:		
	(3) Washington position 24 hrs. earlier:		
(d)	Radar position :from (station) at time :		
(e)	Aircraft reconnaissances / Guam bulletin		
(f)	Finally agreed official position :		
(g)	Confidence: Tolerance of Fix.		

Forecast Intensity change:

(a) Pressure changes:
(b) Upper divergence:
(c) Is the area climatologically favourable for intensification:
(d) Elapsed time in days: since depression stage – Cyclonic storm stage
(e) Satellite evidence : (1) Cirrus outflow straight/curved
(2) No. of feeder bands
(3) above feeder bands developing/dissolving
(f) Radar evidence : (1) eye diameter decreasing/increasing
(2) organisation of spiral bands

Past movement : Climatological vectors: Analouge storms from storm tracks.

(a) past 24 hrs. from 2½ degree square Dates :
(b) Past 12 hrs.

Forecast movement 12 hrs. 24 hrs. 48 hrs.

(accurate to 0.1 of a degree)

		Lat.	Long.	Lat.	Long.	Lat.	Long.
(a)	Extrapolation present movement						
(b)	Climatology vector						
(c)	Positions from forecast						
(d)	Based on 200 – 150 hPa flow						
			Direction		Speed		
(e)	Pressure changes :						
(f)	Position of 200 hPa Ridge line:						
(g)	Position of westerly trough if any:						
(h)	Possibility of recurvature in 24 hrs. 48 hrs.						
(i)	Other parameters.						

Finalised position 12 hrs. 24 hrs. 48 hrs.

		Lat.	Long.	Lat.	Long.	Lat.	Long.
	Distance from known land mark						

lace and time of landfall if any during forecast period :

Dstricts affected in : 24 hrs. 48 hrs.

for Gale }
Heavy rain }
Storm Surge }

Annexure I

FORMAT OF CYCLONE WARNING ISSUED BY ----------ACWC/CWC

S. No.	Date	Time of issue in hrs. IST	Time of chart based on	Warnee	Mode of transmission with priority	Text of message	Time of receipt with warnee (if available)	Remarks

Total number of warnings issued to :

1. State Agencies:
2. Ports:
3. AIR Stations:
4. AIR New Delhi:
5. T.V. Doordarshan
6. Designated/Registered warnees:
7. Fisheries officials:
8. Aviation warnings:
9. Any other warnees:

Annexure-II

CYCLONE WARNING CHECK LIST

S.No.	***Item***	***Gas bag based on 15UTC***	***Dew drop based on 18UTC***	***Electron based on 00UTC***	***Aurora based on 03UTC***	***Formula based on 09UTC***	***Balloon based on 12UTC***	***Hexagon based on***
1	2	3	4	5	6	7	8	9
1.	Inference							
2.	Coastal Bulletin							
3.	Port Warnings							
4.	2 Stage Warnings							
5.	AIR Bulletins							
6.	Gale Warnings (designated/registered page)							
7.	HRW (Designated/registred page)							
8.	Request for special observation or their discontinuance							
9.	Fisheries bulletin to AIR							
10.	Bulletin for AIR News cycle							
11.	CQ for OBS from ships							
12.	Tentative Aurora							
13.	Daily weather Report							
14.	Routine midday AIR Bulletin							
15.	Press Bulletin							
16.	Modification of local forecast							

A detailed information regarding the procedures and checklists are available in Chapter 9 of the Cyclone Manual.

All the revised cyclone warning format and a few other forecasting instructions are given in Appendices 6.2 to 6.7. Boundaries of the sea areas used in weather bulletins are also given in Appendix. 6.8 [Fig. (map) showing the oceanic areas]

CHPATER 7

LOCAL FORECAST

A detailed forecasting circular (No. 1/2000) has been issued regarding the issuance of local forecast in user friendly language in the year 2000.

Later on, there have been some modifications on the terminologies for rainfall, sky conditions, etc. Incorporating these changes, the instructions related to the issuance of local forecast are given in Appendix 7.1

Also, there was an AMR decision on Comfort Index based local forecasts, in order to enhance their utility during the hot weather season. It is given in Appendix 7.2.

The instructions given in Appendix 7.3 restrict the usage of may, chance and similar words resounding uncertainties in local forecasts.

CHAPTER 8

FORECAST VERIFICATION

8.1 Evaluation of the procedure

In order to document the evolution of the forecast verification procedures, the first ever formulated set of instructions in IMD regarding the same is included as Appendix 8.1. The present practice of verification of forecasts which exists for sub-divisional rainfall dates back to 1962 (Appendix 8.1).

Some of the subsequent circulars suggesting minor modifications to the prevailing practices are appended (Appendices 8.2 & 8.3).

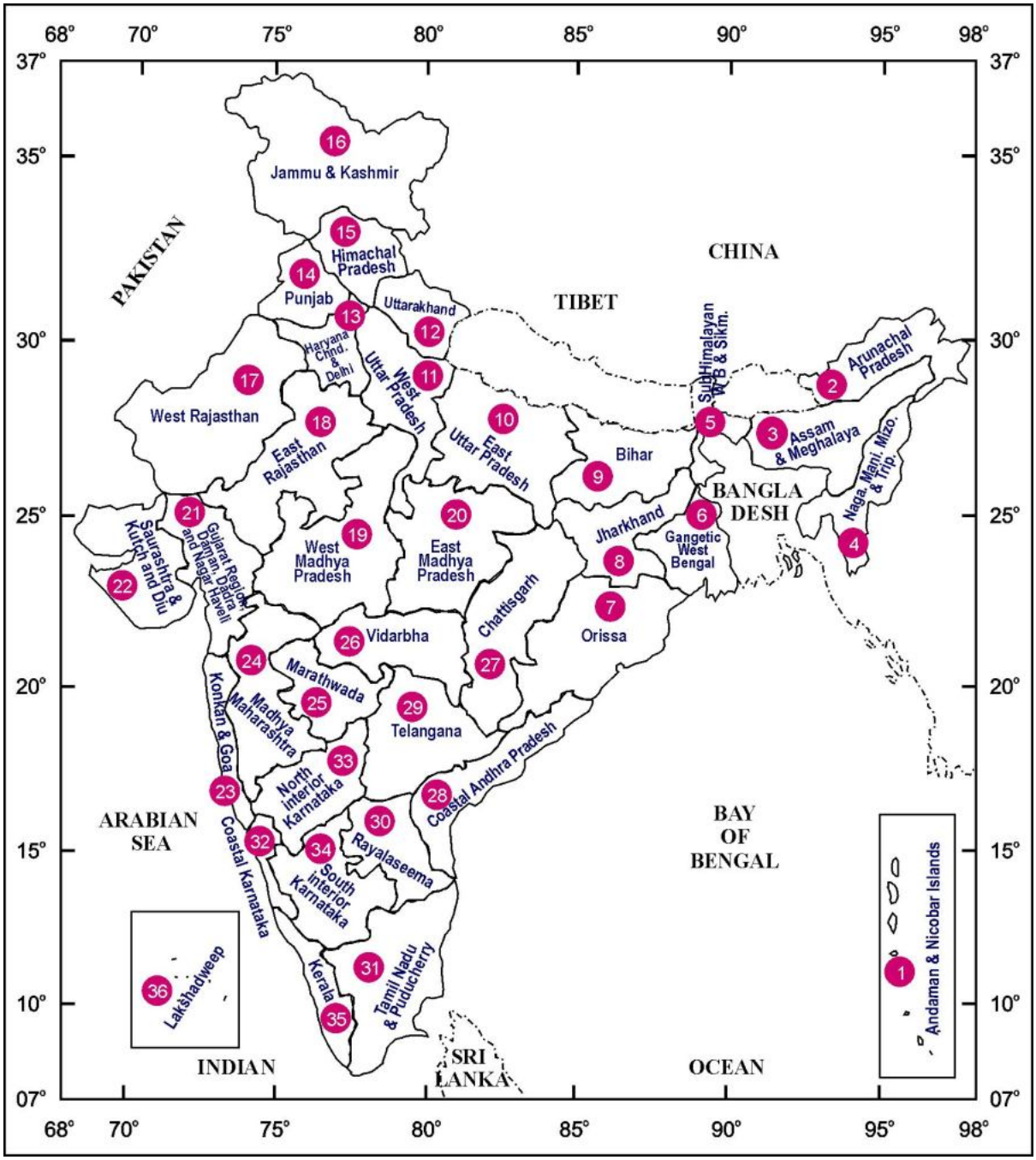
8.2 Current Verification Methodology

It was decided by the Annual Monsoon Review Meeting – 2007 to make the forecast verification results, more quantitative in order to present it in terms of various skill scores.

Accordingly, a set of instructions has been formulated describing the methodology by which various skill scores to be calculated and also a schedule for the issuance and verification of the local forecasts. This is available in Appendix 8.4.

APPENDIX 1

MAP SHOWING THE 36 METEOROLOGICAL SUB-DIVISIONS



APPENDIX 2

2. SYNOPTIC OBSERVATIONS, WEATHER CHARTS & ANALYSIS:

2.1 MODIFICATION TO CYREP

Forecasting Circular dated 26 April 1989.

Ref.: (i) DDGM (IP) UOI No. RDR-13804 dt.7-4-1989

(ii) DDGM (WF) UOI No.W-72010/ dt.24-3-1984.

The following modification may kindly be carried out in the 'modified code for reporting radar observations relating to cyclonic storms', which was sent to you alongwith the letter under reference (ii) above. This may be kindly brought to the notice of all forecasting offices of your region.

Add the following paragraph at the end of page7 – "As per the decision taken in the ACR meeting, 1989 held at Madras (Chennai) RMR (Radius of maximum radar reflectivity) will be reported by adding the word 'RMR' followed by the radius in digits in kms at the end of CYREP message".

The following two limitations which were pointed out by the Working Group on Reporting of Radius of Maximum Reflectivity are given below :

1. Radius of maximum reflectivity is only approximately equal to the radius of maximum winds and there could be a difference of a few kilometers.
2. In view of various sources of error in the determination of the radius of maximum reflectivity, it should be taken only as an approximate figure and not as an absolute value. These aspects may be kept in view by all forecasting offices.

Sd/

(D. S. Desai)

For D.D.G.F.

2.2 CHANGES IN SHIPS' AND UPPER AIR CODES

DDGM (WF) UOI NO.W-318/ dated 19 November 1991.

As per recommendation of Extra-Ordinary Session of W.M.O. held at London from 24-9-1990 to 5-10-1990 the following changes in the ships and upper air codes have been introduced with effect from 0001 UTC of 1st November, 1991.

1) All ships equipped with raingauge will report 7 R_{24} R_{24} R_{24} R_{24} group giving rainfall in mm during the past 24 hours at the time of observations. At present this group is not used by I.V.O.F.

2) All upper Air Observatories, in India will report winds at 925 hPa in part TTAA of temp-message as standard level. 92 is an indicator for 925 hPa level and is followed by height in gpm. Then the temperature and wind groups are reported for this level as per the usual practice. All forecasting offices will prepare C.P. charts for 925 hPa level and analyse them following the usual procedure.

Sd/

(M. R. Tikhe)

For D.D.G.F.

2.3 SQUALL REPORT IN A SYNOP MESSAGE

Forecasting Circular No.2/ dated Nov.1999 (regarding squall).

As per the Rec. No.27 of the FOs' meeting of 22-8-1998 held in Pune, it may be noted that in case of higher speed is reached during a squall exceeding the speed satisfying the squall criteria, initially, the same may be appended to SYNOP message in plain language.

Sd/

(D. S. Desai)

For D.D.G.F.

2.4 ANALYSIS OF UPPER AIR CHARTS.

Forecasting Circular 1970/1/ Dated 7 August 1970

In supersession of instructions contained in Forecasting Circular 1969/2 and Forecasting Circular 1969/7, the following practices are to be followed by all D.M.Os and Storm Warning Centres in respect of plotting and analysis of constant pressure charts with effect from 16th August 1970.

Plotting :

Constant pressure data (contour height, dry bulb and dew point temperatures) will be plotted on the usual upper wind charts along with the winds for the entire area of the chart as shown below :

i. DMOs : 850, 700 and 500 hPa levels.

ii. Weather Sections at Alipore, Colaba and Madras:
850, 700, 500 and 300 hPa levels.

Analysis :

i. Contour analysis is to be done at all the levels as indicated above.

ii. Isopleths of contour heights should be at intervals of 20/ 40/ 80 meters depending on the gradient and will be drawn in ordinary black pencil. Interval may be chosen to delineate significant features.

iii. Isotherms will be drawn at intervals of 2/5^{O} C in red pencil, depending on the gradient. Interval may be chosen to delineate significant features.

iv. Streamline analysis is to be done for all the other levels.

v. Streamline analysis may be meshed with the contour analysis to bring out small scale/ feeble systems.

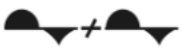
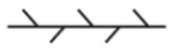
vi. The above instructions are only in the nature of general guidance laying down the minimum number of levels for which constant pressure analysis is to be done in order to introduce certain uniform practices at all the Forecasting Offices. There is no restriction on the additional levels for which constant pressure data are to be plotted and for which contour analysis is to be done.

Sd/
(M. S. V. Rao)
Director
Performing current duties of DDGF

2.5 MARKING OF WIND DISCONTINUITIES, TROUGH LINES, FRONTS ETC. ON THE WORKING CHARTS.

Forecasting Circular No. 1 of 1972 Dated the 20th January 1972

The following symbols for indicating the analytical features, viz. Wind discontinuities, trough lines, fronts etc. over the Indian Region will be used on working charts.

Analytical features	Symbol Used: Monochromatic	Symbol Used: Polychromatic	
1. Cold front at the surface			Blue
2. Cold front above the surface			
3. Cold front frontogenesis			
4. Cold front frontolysis			
5. Warm front at the surface			Red
6. Warm front above the surface			
7. Warm front frontogenesis			
8. Warm front frontolysis			
9. Occluded front at the surface			Purple
10. Occluded front above the surface			
11. Quasi-stationary front at the surface			
12. Quasi-stationary front above the surface			Alternate red or Blue
13. Quasi-stationary front frontogenesis			
14. Quasi-stationary front frontolysis			
15. Instability line			Black
16. Shear line			
17. Convergence line			Solid Orange Line
18 Inter-tropical convergence zone			Orange

Note : The separation of the two lines gives a qualitative representation of the width of the zone; the hatched lines may be added to indicate areas of activity.

19. Inter-tropical discontinuity			Alternate red and green
20 Axis of trough			Black
21 Axis of ridge.			

2. When areas of precipitation, thunderstorm, etc. are to be marked on the working charts or charts for display, the symbols given below should be used. However, during the monsoon and in the field of tropical storms and depressions, no distinction need normally be made between rain and shower and the whole area of precipitation may be shaded green as for continuos rain.

	Analysis features	Monochromatic	Polychromatic
1.	Zones of continuous precipitation	 Solid Shading or cross hatching	 Solid shading or cross hatching Green The W symbol appropriate to the type of precipitation may be distributed over the zone e.g. for drizzle ❟ , rain • or snow ✱ .
2.	Zones of intermittent precipitation.	 Single hatching	 Single hatching Green The appropriate weather symbol may be distributed over the zone
3.	Areas of showers	Large shower symbols distributed over the area with the symbol for rain, snow or hail added as appropriate e.g., ❟ ∴ ▵▿	As monochromatic system but in green.
4.	Areas of thunderstorms	Large thunderstorm symbols distributed over the area with the symbol for rain, snow or hail added as appropriate. e.g. ✱ ↯	As monochromatic system but in red.
5.	Areas of fog	Large fog symbols distributed over the area.	 Solid shading in yellow
6.	Areas of duststorm, sandstorm or dusthaze.	Large symbols for the appropriate phenomenon distributed over the area	 Solid brown shading with the appropriate weather symbol distributed over the area.

Note : In all cases, the extent of the area affected by the phenomenon may be delineated by a thin boundary line of the same colour. The shading, hatching or superimposed symbols should not obliterate the plotted data.

3. *REPRESENTATION OF THE ANALYSIS ON SPECIFIC CHARTS*

The symbols indicated under various sub-paras below will be in addition to the symbols given in para 1.

3.1 Surface charts

3.1.1 Isobars ——— thin black line. Isobars are to be drawn at 2 hPa intervals in tropics, 4 hPa intervals in extra-tropical areas. (In areas of weak gradient, in the tropics, isobars may be drawn at 1 hPa intervals).

3.1.2 Isolines of dew point ——— thin green line.

3.1.3 Pressure centres

Feature	Wind speed observed or estimated (knots)	Symbols Monochromatic	Polychromatic	
Low	Not exceeding 17 kts.	L	L	Red
Depression	17 – 27 kts.	D	D	Red
Deep depression	28 – 33 kts.	DD	DD	Red
Cyclonic storm	34 – 47 kts.	CS	CS	Red
Severe cyclonic storm	48 – 63 kts	SCS	SCS	Red
Very Severe Cyclonic Storm	64 – 119 kts	VSCS	VSCS	Red
Super Cyclone	120 kts and above	❦	❦	Red
High	--	H	H	Blue

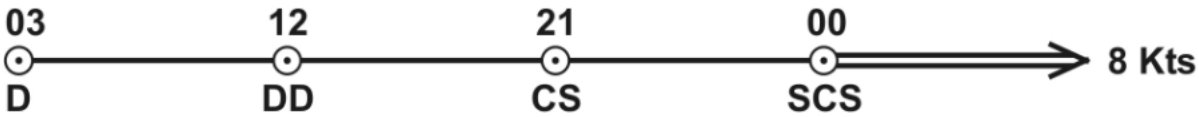
Note : On all facsimile charts for transmission and on charts included in documentation for international flights, the following international practice may be adopted.

Feature	Wind speed observed or estimated (knots)	Symbols Monochromatic	Polychromatic	
Low	Not exceeding 17 kts.	L	L	Red
Tropical Cyclonic Circulation	B. F. 5 to 11.	❧	❧	Red
Tropical Cyclonic Circulation	B. F. 12 or more	❦	❦	Red
High	--	H	H	Blue

3.1.4 *Tracks of pressure centres*

All the previous positions from depression stage may be marked and the track shown as follows :

The expected movement may be shown by a double arrow with the speed included at the head of the arrow.



3.2 Auxiliary charts :

3.2.1 Isopleths of pressure change/ departure:

These isopleths may be drawn at 2 hPa intervals (1 hPa, if necessary)

	Symbols Monochromatic	Polychromatic	
Zero line	———	═══	On +ve Blue
	– – – – –	———	On -ve Red
Negative change or departure	– – – – –	———	Red
Positive change or departure	———	———	Blue
Area(s) of lowest pressure change	F	F	Red
Area(s) of highest pressure change	R	R	Blue
Area(s) of lowest pressure departure	L	L	Red
Area(s) of highest pressure departure	H	H	Blue

3.2.2 Isopleths in Maximum, Minimum and Dew Point Temperature Charts :

	Symbols		
	Monochromatic	Polychromatic	
Lines of equal max./min/dew point temperature (to be drawn at 5°C intervals)	———	———	Black
Max/Min/Dew point temperature change/ departure (to be drawn at 2°C intervals)	———	———	Black
Area(s) of highest max/min/dew point temperature change.	H	H	Blue
Area(s) of lowest max/min/dew point temperature change.	L	L	Red
Area(s) of highest max/min/ temperature departure.	W	W	Red
Area(s) of lowest max/min temperature departure	K	K	Blue

3.3 Upper air charts and vertical time sections.

	Symbols		
	Monochromatic	Polychromatic	
i. Stream lines	→→	→→	Black
ii. Isotachs (10/20/40 kt intervals)	— — — — —	———	Blue
iii. Cyclonic Circulation	C	C	Red
iv. Anticyclonic circulation	A	A	Blue
v. a) Contours (20,40,80 gpm intervals)	———	———	Black
b) Isopleth of tropopause levels (25/50 hPa intervals)			
vi. Jet axis	⟶⟶	⟶⟶	Blue
vii. Wind discontinuity	=========	=========	Black
viii. Isotherms (2/5/10°C intervals)	· · · · · · · · ·	———	Red
ix. Dew Point lines (2/5/10°C intervals)	•——•——•	———	Green
x. Contour low	L	L	Red
xi. Contour high	H	H	Blue
xii. Area(s) of highest temperature	W	W	Red
xiii. Area(s) of lowest temperature	K	K	Blue

This supercedes instructions contained in T. C. F. / 24 dated 27.8.57.

Poona 5
Dated the 20 January 1972
File W-394

(C. A. George)
for D. D. G. M.

Note : This circular is modified as per the classification in Forecasting Circular No. 1/1998 which is available in Section 5.7. The air pressure unit 'mb' is also replaced with 'hPa'.

PREPARATION OF CONSTANT PRESSURE CHARTS BY FORECASTING OFFICES, OTHER THAN NHAC AND EAPCS.

Forecasting Circular No.2 of 1972, dated April 1972

1. All Forecasting Offices will prepare and analyse the CP charts in respect of 00 and 12 Z daily for the levels 850, 700, 500, 300, 250, 200, 150 and 100 hPa.

2. These will be plotted on 4 in 1 charts in each Office (Alipore, Madras (Chennai) and Guwahati will use W4(a); Delhi and Colaba WS will use W2(a) charts and all other FOs will use W3(a) charts).

3. Upper wind charts will be prepared in respect of levels upto and including 400 hPa on the existing 9 in 1 charts.

4. All data received through RTT/ T-P (AMSS, INTERNET, V-Sat, DMDD at present) including data from neighbouring countries should be plotted and analysed.

5. The elements to be plotted and method of analysis will be as per Forecasting Circular No.1 of 1970. While drawing isotherms, the thermal field qualitatively delineated by the vertical wind shear between the surface immediately below and above the pressure surface to be analysed must be kept in view, and the isotherm based on the actual values must be so drawn as to bring out warm and cold regions. Contour gradients must be adjusted as far as possible to the winds, with the help of a geostrophic scale, over regions north of Lat.20^{O}N.

6. In order to derive maximum forecasting value from CP analysis, it is necessary to prepare a thickness chart upto 500 hPa. For this purpose, the thickness and vertical wind shears between 850 and 500 hPa level may be worked out in respect of all available data within India and neighbourhood and plotted in red on the 500 hPa chart. The thickness lines may be drawn at the same intervals as for the contours at this surface. The solenoids between the contours and thickness lines may be shaded lightly in the blue and red to indicate the type of cold or warm advection respectively.

Sd/
(P. K. Das)
For D.D.G.F.

2.7 W3 CHARTS

DDGM (WF) UOI No.W-396/dated 22 December 1984

Rec. No. 55 of IX F.O's Conference.

After carefully examining this recommendation it has been decided that

(i) All MCs and RCs should use W3 charts only instead of using Regional charts with effect from 1st January 1985.

(ii) The present practice of basing the morning inference on 0300 Z may continue.

All RCs/ MCs are requested to acknowledge this letter and take action as suggested above.

Sd/
(M. R. M. Rao)
For D.D.G.F.

2.8 ROUNDING OFF THE RAINFALL AMOUNT

FORECASTING CIRCULAR NO. 1/2003

Sub : Rounding of the rainfall amount.
Ref : AMR Rec. No. 9/2003

It is decided henceforth to follow the met. Convention (preference to odd digit) while decoding and plotting the rainfall amounts on charts.

The same practice may be followed in all departmental documentations like daily summary, IDWR, RDWR, SDWR etc.

The amended table of forecasting circular No. W-969/4496 –4570 Dt. 20 August 2002 is enclosed as replacement page.

An example is given below for further clarification.

At 00 UTC the group 6065/ is decoded as 65 mm and plotted as 7 cm since as per met. Convention, 6.5 ≈7. Subsequently at 03 UTC, if the rainfall amount comes out to be 64.5 or 64.9 mm. In the group $OR_{24}R_{24}R_{24}R_{24}$, which is counted as 65 mm and would also be plotted on chart as 7 cm as per this procedure.

(A.B. Mazumdar)
Director
for DDGM(WF)

DDGM(WF) UOI No. W-969/ 2836-2887 dated Pune-5; the 28 May 2003

Copy to ADGM(R) Pune/ DDGM(SI), Pune/ DDGM(Ag), Pune.

Copy to CATC, Bamrauli.

(A.B. Mazumdar)
Director
for DDGM(WF)

DDGM(WF) UOI No. W-969/ 2836-2887 dated Pune-5; the 28 May 2003

Note: For the replacement page, kindly see 3.1.3

3. TERMINOLOGY:

3.1 RAINFALL

3.1.1 PHRASEOLOGY USED FOR DESCRIBING SPATIAL DISTRIBUTION OF RAINFALL IN WEATHER BULLETINS AND THE LIMIT OF MINIMUM REPORTED RAINFALL FOR DESCRIBING THE SPATIAL DISTRIBUTION IN RDWR.

DDGF UOI No.W-969/ dated April 1971

Recommendation No.8 of VI FOs Conference is approved by DGO.

Accordingly

(1)The existing phraseologies for describing spatial distribution of rainfall in General Weather Bulletins will continue.

(2)The term 'isolated' will be used in "Farmers Weather Bulletins" as in the case of General Weather Bulletins.

(3)Distribution of rainfall amounts of less than 2.5 mm and more than "trace" should also be described in non-monsoon months as indicated below, keeping in view instructions contained in DDGF UOI No.W-338 dated 4-6-65.

Distribution	Description
i. Widespread/ fairly widespread very light rain plus isolated light rain.	i. Widespread/ fairly widespread very light to light rain.
ii. Widespread/ fairly widespread very light/ light rain plus isolated moderate rain.	ii. Moderate rain has been isolated in (name of sub-division). Very light/ light rain has also been widespread/ fairly widespread.

iii. In the case of a scattered distribution of light or higher intensities of rainfall, the distribution of very light rain in the same sub-division will not be described as it may not be significant.

The above modifications will come into effect from 1-6-71.

Sd/
(K. K. Ramamurthy)
For D.D.G.F.

3.1.2 DEFINITION OF THE TERMS HEAVY, VERY HEAVY AND EXCEPTIONALLY HEAVY RAIN.

DDGF UOI No.W-696/ dated May 1971

Recommendation No.9 of the VI Fos' Conference on the above subject has been approved by DGO.,

2. The remarks recorded by DGO in this respect are quoted below for your guidance.

"When record rainfall has occurred, it should be highlighted suitably. Statistics of extreme values of rainfall are available and these should be useful in describing the rainfall as exceptional or otherwise. DDGC's office has prepared isopleths of highest rainfall. These maps should be of help in making such descriptions".

3. Copies of Technical Circular Forecasting No.23 dated the 29th December 1956, inclusive of all previous amendments and the present amendment are enclosed for your guidance. The present amendment will be effective from 1-6-71.

Sub.: Copy of Technical Circular Forecasting, No.23 dated the 29th December 1956, as amended on 1st June 1971. Specifications for description of rainfall, temperatures and strength of monsoon.

It has been decided that with effect from 1-1-1957 rainfall and temperatures will be mentioned in metric units in all the weather bulletins, reports, forecasts and Farmers' Weather Bulletins issued by the India Meteorological Department.

3.1.3 INTRODUCTION OF EXTREMELY HEAVY RAINFALL TERMINOLOGY. FORECASTING CIRCULAR NO.2/ 2006

Ref: AMR Rec. No. 10/ 2006.

As per the above referred recommendation it is decided to include the additional terminology viz. "Extremely heavy rainfall" for rainfall amounts exceeding 25 cm. and also to bring out slight amendment in the definition of "exceptionally heavy rainfall".

Thus for indicating rainfall amounts, the following terminologies may be used henceforth.

Rainfall amount in mms	Plotted on charts as	Descriptive term used.
0.0		No rain*
0.1 to 2.4	. . .	Very light rain
2.5 to 7.5	-	Light rain
7.6 to 15.5	1	Moderate rain
15.6 to 24.4	2	
24.5 to 35.5	3	
35.6 to 44.4	4	Rather heavy
44.5 to 55.5	5	
55.6 to 64.4	6	
64.5 to 75.5	7	Heavy rain
75.6 to 84.4	8	
84.5 to 95.5	9	
95.6 to 104.4	10	
104.5 to 115.5	11	
115.6 to 124.4	12	
$\geq$ 124.5 to 244.4	13 to 24	Very heavy rain
$\geq$ 244.5	$\geq$ 25	Extremely heavy rain
when the amount is a value near about the highest recorded rainfall at or near the station for the month or season. However, this term will be used only when the actual rainfall amount exceeds 12 cm.		Exceptionally heavy rain.

The amounts for heavy and untimely rainfall warnings will be determined by the requirements of the individual warnees. In cases where the requirements of warnees are available in inches, corresponding whole cms may be taken.

*** "No rain" should strictly relate to occasions of zero rainfall at all reporting stations.**

These instructions supercede the earlier instruction in the matter.

(N. Jayanthi)
DDGM (WF)

DDGM(WF) UOI No. W-630(AMR)/ Dt. Pune-5 ;The May, 2006

3.1.4 NORMS FOR WEEKLY/ SEASONAL RAINFALL DISTRIBUTION.

DDGM (WF) UOI No.W-689/ dated 9 February 1990

An extract from the minutes of the Annual Monsoon Review (AMR) meeting, 1989 is given below for information and necessary action.

2.9 It was decided in the meeting that the description presented in the monsoon summary of short (Weekly) as well as long term (seasonal) rainfall distribution over a meteorological sub-division should have only one norm instead of two as at present. From the current monsoon season, norm to be followed for describing weekly as well as seasonal rainfall distribution in all the summaries are as follows :

1. Excess (E) + 20% and above.
2. Normal (N) + 19% to – 19%
3. Deficient (D) - 20% to – 59%
4. Scanty (Sc) - 60% or less
5. No rain - 100%

Sd/
(D. S. Desai)
For D.D.G.F.

3.1.5 TERMINOLOGY OF RAINFALL DISTRIBUTION

DDGM (WF) UOI No.W-199/ dated 4 May 1998.

In pursuance of decision No.25 of AMR meeting 1998 it has been decided to change the terminology of rainfall distribution as given below. This may be introduced in Summary, Bulletin, RDWR, DWR and WWR with immediate effect.

Existing	New	New Hindi Version
Almost at all the places	At most places	YkxHkx lHkh LFkkuks aij
At many places	At many places	vusd LFkkuksa ij
At a few places	At a few places	dqN LFkkuks aij
At one or two places	isolated	dgha dgha

Sd/
(D. S. Desai)
For D.D.G.F.

3.2 TEMPERATURE

3.2.1 CRITERIA FOR DECLARING HEAT WAVE/COLD WAVE

SUB : Criteria for declaring of Heat/ Cold Wave.

As per decisions of AMR-2002, it has been decided that the following revised criteria for declaring of Heat/ Cold Wave may kindly be introduced w.e.f. 1st March 2002.

1. Criteria for Heat Wave:

1.1 Heat wave need not be considered till maximum temperature of a station reaches at least 40° C for Plains and at least 30° C for Hilly regions.

1.2.1 When normal maximum temperature of a station is less than or equal to 40° C

Heat Wave	**Departure from normal is 5°C to 6°C**
Severe Heat Wave	**Departure from normal is 7°C or more**

1.2.2 When normal maximum temperature of a station is more than 40°C

Heat Wave	**Departure from normal is 4°C to 5°C**
Severe Heat Wave	**Departure from normal is 6°C or more**

1.2.3 When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat wave should be declared.

1.3 Hot day

In the northern plains of the country, dust in suspension occurs in many years for several days, bringing minimum temperature much higher than normal and keeping the maximum temperature around or slightly above normal. Sometimes increase in humidity also adds to this discomfort. Nights do not get cooled and become uncomfortable. To cover this situation, *hot day* concept has been introduced as given below :

Whenever, the maximum temperature remains 40°C or more and minimum temperature is 5°C or more above normal, it may be defined as *Hot Day*, provided it is not satisfying the heat wave criteria given above.

1.4 Criteria for describing *Hot Day* for coastal stations

When maximum temperature departure is 5°C or more from normal, *Hot Day* may be described irrespective of the threshold value of 40°C. If the threshold value of 40°C is reached *Heat Wave* may be declared.

1.5 When a station satisfies both the Heat Wave and Hot Day criteria, then Heat Wave should be given higher priority and be declared.

1.6 Hot Wind

Hot wind reduces moisture causing dehydration and a prolonged exposure may prove to be fatal. The phenomena of *Loo* over the plains of northwest India is very well known. It is also described in the Weather bulletins and appropriate warnings are being issued at present. The present practice should continue.

2. Criteria for Cold Wave

2.1 Wind chill factor plays an important role and brings down the actual minimum temperature depending upon the wind speed. The actual minimum temperature of a station should be reduced to "wind chill effective minimum temperature (WCTn)" based on wind chill factor using the enclosed table (Enclosure I, WMO No. 331/ Tech note No. 123 on "The assessment of human bio-climate. A limited review of physical parameters , 1972).

For declaring "Cold Wave" and "Cold Day" WCTn should only be used.

2.2 (a) If WCTn is 10°C or less, then only the conditions for cold wave should be considered.

(b) When normal minimum temperature is equal to 10°C or more.

Cold Wave	**Departure from normal is -5°C to -6°C.**
Severe Cold Wave	**Departure from normal is -7°C or less**

(c) When normal minimum temperature is less than 10°C.

Cold Wave	**Departure from normal is -4°C to -5°C.**
Severe Cold Wave	**Departure from normal is -6°C or less.**

(d) When WCTn is 0°C or less, Cold Wave should be declared irrespective of normal minimum temperature of the station. However, this criteria is not applicable for those stations whose normal minimum temperature is below 0°C.

2.3 Cold Day

In the plains of north India, foggy conditions prevail during winter for several days or weeks. The minimum temperature on these days remain above normal, while maximum temperature remain much below normal. This creates cold conditions for prolonged period. To cover such situations the concept of "cold day" is introduced.

When maximum temperature is less than or equal to 16°C in Plains, it will be declared *"Cold Day".*

2.4 Cold Wave conditions for coastal stations

For coastal stations the threshold value of minimum temperature of 10°C is rarely reached. However, the local people feel discomfort due to wind chill factor which reduces the minimum temperature by a few degrees depending upon the wind speed. The *"Cold Day"* concept may be used following the criteria given below :

Criteria for describing "Cold Day" for coastal stations

i) Actual minimum temperature of a station be reduced to WCTn.

ii) This WCTn should be used to declare *"Cold Wave"* or *"Cold Day"*.

iii) When minimum temperature departure is -5°C or less over a station, *"Cold Day"* may be described irrespective of threshold value of 10°C

iv) However, when a threshold of 10°C is reached *"Cold Wave"* be declared.

v) When a station satisfies both the Cold Wave and Cold Day criteria, then Cold Wave has a higher priority and has to be declared.

3. Heat wave/ Cold Wave and hot Day/ Cold Day are area specific phenomena. Therefore they may be described for a Met. Sub-division or a part thereof, when at least two stations satisfy the criteria.

Wind-chill equivalent temperature (WCTn)

Wind velocity		Dry-bulb ambient temperature **(°F and °C)**												
		50 (10.0)	41 (5.0)	32 (0.0)	23 (-5.0)	14 (-10.0)	5 (-15.0)	-4 (-20.0)	-13 (-25.0)	-22 (-30.0)	-31 (-35.0)	-40 (-40.0)	-49 (-45.0)	-58 (-50.0)
(mph)	($msec^{-1}$)	**Equivalent temperature (°F and °C) (equivalent in cooling power on exposed flesh under calm conditions)**												
Calm	Calm	50 (10.0)	41 (5.0)	32 (0.0)	23 (-5.0)	14 (-10.0)	5 (-15.0)	-4 (-20.0)	-13 (-25.0)	-22 (-30.0)	-31 (-35.0)	-40 (-40.0)	-49 (-45.0)	-58 (-50.0)
5	2.2	48 (8.9)	38 (3.3)	27 (-1.7)	20 (-6.7)	10 (-12.2)	1 (-17.2)	-9 (-22.8)	-18 (-27.8)	-28 (-33.3)	-37 (-38.3)	-47 (-43.9)	-56 (-48.9)	-65 (-53.9)
10	4.5	40 (4.4)	29 (-1.7)	18 (-7.8)	7 (-13.9)	-4 (-15.6)	-15 (-26.1)	-26 (-32.2)	-27 (-38.3)	-48 (-44.4)	-59 (-50.6)	-70 (-56.7)	-81 (-62.8)	-92 (-68.9)
15	6.7	36 (2.2)	24 (-4..4)	13 (-10.6)	-1 (-18.3)	-13 (-25.0)	-25 (-31.7)	-37 (-38.3)	-49 (-45.0)	-61 (-51.7)	-73 (-58.3)	-85 (-65.0)	-97 (-71.7)	-109 (-78.3)
20	8.9	32 (0.0)	20 (-6.7)	7 (-13.9)	-6 (-12.1)	-19 (-28.3)	-32 (-35.6)	-44 (-42.2)	-57 (-49.4)	-70 (-56.7)	-83 (-63.9)	-96 (-71.1)	-109 (-78.3)	-121 (-85.0)
25	11.2	30 (-1.1)	17 (-8.4)	(-16.1)	-10 (-23.3)	-24 (-31.1)	-37 (-38.3)	-50 (-45.6)	-64 (-53.3)	-77 (-60.6)	-90 (-67.8)	-104 (-75.5)	-117 (-82.8)	-130 (-90.0)
30	13.4	28 (-2.2)	14 (-10.0)	1 (-17.2)	-13 (-25.0)	-27 (-32.8)	-41 (-40.6)	-54 (-47.8)	-68 (-55.6)	-82 (-63.3)	-97 (-71.7)	-109 (-78.3)	-123 (-86.1)	-137 (-93.9)
35	15.6	27 (-2.8)	13 (-10.6)	-1 (-18.3)	-15 (-26.1)	-29 (-33.9)	-43 (-41.7)	-57 (-49.4)	-71 (-57.2)	-85 (-65.0)	-100 (-73.3)	-113 (-80.6)	-127 (-88.3)	-142 (-96.6)
40	17.9	26 (-3.3)	12 (-11.1)	-3 (-19.4)	-17 (-27.2)	-31 (-35.0)	-45 (-42.8)	-59 (-50.6)	-74 (-58.9)	-87 (-66.1)	-102 (-74.4)	-116 (-82.2)	-131 (-90.6)	-145 (-98.3)
45	20.1	25 (-3.9)	11 (-11.7)	-3 (-19.4)	-18 (-27.8)	-32 (-35.6)	-46 (-43.3)	-61 (-51.7)	-75 (-59.4)	-89 (-67.2)	-104 (-75.5)	-118 (-83.3)	-133 (-91.7)	-147 (-99.4)
50	22.4	25 (-3.9)	10 (-12.2)	-4 (-20.0)	-18 (-27.8)	-33 (-36.1)	-47 (-43.9)	-62 (-52.2)	-76 (-60.0)	-91 (-68.3)	-105 (-76.1)	-120 (-84.4)	-134 (-92.2)	-148 (-100.0)
		Little Danger				Increasing Danger					Great Danger			

(Danger from freezing of exposed flesh (for properly clothed persons)

Note 1 - To temperature reproduced originally in °F, corresponding values in °C in brackets are added.

3.2.2 MODIFICATION TO THE CIRCULAR AT 3.2.1

SUB : Modification of the forecasting circular No. W-969/1304 to 1365 dated 27.2.2002 regarding Heat/Cold Wave criteria.

In the above circular regarding the revised criteria for heat wave, cold wave, etc. it is mentioned that for declaring cold wave conditions the actual minimum temperatures are to be reduced to wind chill effective minimum temperature WCTn. The cold wave conditions are to be considered only when WCTn ≤ 10°C. From the table enclosed with the above circular to estimate the WCTn, it is not possible to calculate WCTn values when the minimum temperatures encountered are slightly greater than 10°C. Under such conditions also one may experience cold wave conditions due to the windchill factor when comparatively strong wind is blowing. In view of this, the enclosed Table of the forecasting circular referred to above have been extended to include temperature upto 15°C. The modified table is enclosed herewith. The old table may kindly be replaced with the enclosed updated Table.

(A.B. Mazumdar)
Deputy Director General of Meteorology
(Weather Forecasting)

Wind-chill equivalent temperature (WCTn)

(Enclosure I Modified Table)

Wind velocity		Dry Bulb ambient Temperature (°F and °C)																	
		59	57	55	54	52	50	41	32	23	14	5	-4	-13	-22	-31	-40	-49	-58
(mph)	($msec^{-1}$)	(15.0)	(14.0)	(13.0)	(12.0)	(11.0)	(10.0)	(5.0)	(0.0)	(-5.0)	(-10.0)	(-15.0)	(-20.0)	(-25.0)	(-30.0)	(-35.0)	(-40.0)	(-45.0)	(-50.0)
		Equivalent temperature (°F and °C) (equivalent in cooling power on exposed flesh under calm condition)																	
Calm	Calm	59	57	55	54	52	50	41	32	23	14	5	-4	-13	-22	-31	-40	-49	-58
		(15.0)	(14.0)	(13.0)	(12.0)	(11.0)	(10.0)	(5.0)	(0.0)	(-5.0)	(-10.0)	(-15.0)	(-20.0)	(-25.0)	(-30.0)	(-35.0)	(-40.0)	(-45.0)	(-50.0)
5	2.2	57	56	54	52	50	48	38	27	20	10	1	-9	-18	-28	-37	-47	-56	-65
		(14.1)	(13.1)	(12.1)	(11.1)	(10.2)	(8.9)	(3.3)	(-1.7)	(-6.7)	(-12.2)	(-17.2)	(-22.8)	(-27.8)	(-33.3)	(-38.3)	(-43.9)	(-48.9)	(-53.9)
10	4.5	51	49	47	45	42	40	29	18	7	-4	-15	-26	-37	-48	-59	-70	-81	-92
		(10.5)	(9.3)	(8.2)	(7.0)	(5.8)	(4.4)	(-1.7)	(-7.8)	(-13.9)	(-15.6)	(-26.1)	(-32.2)	(-38.3)	(-44.4)	(-50.6)	(-56.7)	(-62.8)	(-68.9)
15	6.7	47	45	42	40	38	36	24	13	-1	-13	-25	-37	-49	-61	-73	-85	-97	-109
		(8.3)	(7.0)	(5.7)	(4.4)	(3.1)	(2.2)	(-4.4)	(-10.6)	(-18.3)	(-25.0)	(-31.7)	(-38.3)	(-45.0)	(-51.7)	(-58.3)	(-65.0)	(-71.7)	(-78.3)
20	8.9	44	41	39	37	34	32	20	7	-6	-19	-32	-44	-57	-70	-83	-96	-109	-121
		(6.7)	(5.3)	(3.9)	(2.6)	(1.2)	(0.0)	(-6.7)	(-13.9)	(-12.1)	(-28.3)	(-35.6)	(-42.2)	(-49.4)	(-56.7)	(-63.9)	(-71.1)	(-78.3)	(-85.0)
25	11.2	42	39	37	34	31	30	17	-	-10	-24	-37	-50	-64	-77	-90	-104	-117	-130
		(5.4)	(4.0)	(2.5)	(1.1)	(-0.4)	(-1.1)	(-8.4)	(-16.1)	(-23.3)	(-31.1)	(-38.3)	(-45.6)	(-53.3)	(-60.6)	(-67.8)	(-75.5)	(-82.8)	(-90.0)
30	13.4	40	37	35	32	29	28	14	1	-13	-27	-41	-54	-68	-82	-97	-109	-123	-137
		(4.5)	(3.0)	(1.5)	(0.0)	(-1.5)	(-2.2)	(-10.0)	(-17.2)	(-25.0)	(-32.8)	(-40.6)	(-47.8)	(-55.6)	(-63.3)	(-71.7)	(-78.3)	(-86.1)	(-93.9)
35	15.6	39	36	33	33	28	27	13	-1	-15	-29	-43	-57	-71	-85	-100	-113	-127	-142
		(3.8)	(2.2)	(0.7)	(0.8)	(-2.4)	(-2.8)	(-10.6)	(-18.3)	(-26.1)	(-33.9)	(-41.7)	(-49.4)	(-57.2)	(-65.0)	(-73.3)	(-80.6)	(-88.3)	(-96.6)
40	17.9	38	35	32	29.3	26	26	12	-3	-17	-31	-45	-59	-74	-87	-102	-116	-131	-145
		(3.2)	(1.6)	(0.0)	(-1.5)	(-3.1)	(-3.3)	(-11.1)	(-19.4)	(-27.2)	(-35.0)	(-42.8)	(-50.6)	(-58.9)	(-66.1)	(-74.4)	(-82.2)	(-90.6)	(-98.3)
45	20.1	37	34	31	28	25	25	11	-3	-18	-32	-46	-61	-75	-89	-104	-118	-131	-147
		(2.8)	(1.2)	(-0.4)	(-2.0)	(-3.6)	(-3.9)	(-1.7)	(-19.4)	(-27.8)	(-35.6)	(-43.3)	(-51.7)	(-59.4)	(-67.2)	(-75.5)	(-83.3)	(-91.7)	(-99.4)
50	22.4	37	33	31	28	25	25	10	-4	-18	-33	-47	-62	-76	-91	-105	-120	-131	-148
		(2.5)	(0.8)	(-0.7)	(-2.4)	(-4.0)	(-3.9)	(-12.2)	(-20.0)	(-27.8)	(-36.1)	(-43.9)	(-52.2)	(-60.0)	(-68.3)	(-76.1)	(-84.4)	(-92.2)	(-100.0)
		Little Danger									Increasing Danger			Great Danger					

Danger from freezing of exposed flesh (for properly clothed persons)

Note 1 To temperature reproduced originally in °F corresponding values in °C in brackets are added.
Note 2 For wind values < or = 1 m sec^{-1}, conditions are assumed to be calm
Note 3 The table indicates the limits of danger of frostbite even for appropriately dressed persons.

Replacement page vide DDGM(WF) UOI No. W-969/ dated

3.2.3 DESCRIBING NORMAL TEMPERATURE CONDITIONS

DDGM (WF) UOI NO.W-33808/ dated November 1978

A reference is invited to DDGF UO No.W-969/8302-22 dated 22-5-1971 forwarding Technical Circular No.23 on the subject of specification for describing rainfall, temperature and the strength of monsoon.

According to Rec.No.25 (i) of VIII FO's conference 1978, approved by DGM, the existing practice of defining cold and heat wave conditions based on temperature departures from normal may continue. But while describing temperature departures of + 1 to – 1 the word "Nearly" in the description "Nearly normal" should be dropped and the temperature should be described as "normal".

The above procedure may be followed with immediate effect.

Sd/
(A. R. Ramakrishnan)
For D.D.G.F.

3.2.4 RELEVANT PORTIONS OF THE RECOMMENDATION NO.13 OF XTH F.OS CONFERENCE REGARDING DESCRIPTION OF TEMPERATURE.

DDGM (WF) UOI No.W-969/ dated 14 October 1988

It has been decided that the following revised criteria may kindly be introduced with effect from 1st January 1989.

(a) Following criteria for describing departures from normal are proposed when normal maximum temperature of a station/ area is 40^{O} C or less:

Nomenclature	**Departure from Normal Temperature**
Normal	- 1^{O} C to 1^{O} C
Above normal	2^{O} C
Appreciably above normal	3^{O} C to 4^{O} C
Markedly above normal/	5^{O} C to 6^{O} C

When normal max. temperature is more than 40^{O} C

Normal	- 1^{O} C to 1^{O} C
Above normal	2^{O} C

(a) When the normal minimum temperature is 10^{O} C or more.

Nomenclature	**Departure from Normal Temperature**
Normal	1^{O} C to - 1^{O} C
Below normal	- 2^{O} C
Appreciably below normal	- 3^{O} C to - 4^{O} C
Markedly below normal	- 5^{O} C to - 6^{O} C

When the normal minimum temperature is less than 10^{O} C

Nomenclature	**Departure from Normal Temperature**
Normal	1^{O} C to - 1^{O} C
Below normal	- 2^{O} C

These instructions supercede the earlier instructions on the matter.

Sd/
(D. S. Desai)
For D.D.G.F.

3.2.5 DESCRIPTION OF 24 HRS TEMPERATURE CHANGES.

DDGM (WF) UOI No.W-969/ 6015 to 6024 dated 23 December 1988

Ref.: DDGM (WF) UOI No.W-969/ 4037 to 4065 dated 18 October 1988.

As per Rec. No. 13 of the Xth F.O.'s conference a set of new criteria for declaring heat wave/ cold wave conditions have been circulated vide letter under reference. Some offices pointed out anomalies in description of the 24 hrs temperature changes and the new criteria for heat wave/ cold wave conditions. Those anomalies are inevitable because of the existence of old set of limits for describing 24 hrs temperature changes and a new set for describing heat wave / cold wave conditions. All these aspects have been critically examined. To remove these anomalies the following revised criteria for describing the 24 hrs temperature changes shall be effective w.e.f. 1-1-1989.

A) Maximum temperature

(a) When the normal maximum temperature of a station is 40^{O} C or below.

Nomenclature	**Past 24hrs change**
Little change	-1^{O} C to 1^{O} C
Rise	2^{O} C
Appreciable rise	3^{O} C to 4^{O} C
Marked rise	5^{O} C to 6^{O} C
Large rise	7^{O} C or more

(b) When the normal maximum temperature of a station is more than 40^{O} C.

Nomenclature	**Past 24hrs change**
Little change	-1^{O} C to 1^{O} C
Rise	2^{O} C
Marked rise	3^{O} C to 4^{O} C
Large rise	5^{O} C or more

B) Minimum temperature

(a) When the normal minimum temperature of a station is 10^{O} C or more.

Nomenclature	**Past 24hrs change**
Little change	1^{O} C to -1^{O} C
Fall	-2^{O} C
Appreciable fall	-3^{O} C to -4^{O} C
Marked fall	-5^{O} C to -6^{O} C
Large fall	-7^{O} C or less

(b) When the normal minimum temperature of a station is less than 10^{O} C.

Nomenclature	**Past 24hrs change**
Little change	1^{O} C to -1^{O} C
Fall	-2^{O} C
Marked fall	-3^{O} C to -4^{O} C
Large fall	-5^{O} C or less

These instructions supercede the earlier instructions on the matter.

Sd/
(D. S. Desai)
For D.D.G.F.

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3.2 SYNOPTIC SYSTEMS

3.3.1 TERMINOLOGIES FOR LOW PRESSURE SYSTEMS

Forecasting Circular No. 1/ 1998

Ref.: Recommendation No.8 of ACR meeting 1997 discussed in ACR meeting 1998.

In pursuance of above recommendation the terminology “Severe Cyclonic Storm with a core of hurricane winds” is changed to “Very Severe Cyclonic Storm” for the wind speeds from 64 to 119 kts and a new terminology viz. “Super Cyclonic Storm” for the wind speeds 120 kts and above is introduced. Other terminologies remain unchanged.

The terminologies to be used are given below :

Type of Disturbance	**Associated Wind Speed**
Low Pressure Area	Less than 17 Kt.
Depression	17 – 27 Kt.
Deep Depression	28 – 33 Kt.
Cyclonic Storm	34 – 47 Kt.
Severe Cyclonic Storm	48 – 63 Kt.
Very Severe Cyclonic Storm	64 – 119 Kt.
Super Cyclonic Storm	120 Kts and above

Above terminologies are to be used with immediate effect.

These instructions supersede those contained in Forecasting Circular No. 1/1974.

Sd/
(D. S. Desai)
For D.D.G.F.

3.3.2 DESCRIPTION OF PRESSURE GRADIENT

DDGF UOI No.W-408/7072-76/ Dated 31 July 1970

In accordance with the Recommendation No.12 of the VI FO's conference, 1969, on the above subject, which has been approved by DGO, the criteria indicated below may be followed provisionally for description of "Pressure Gradient"

1 – 1.5 hPa per degree – Steep Pressure Gradient.

> 1.5 hPa per degree – Very Steep Pressure Gradient.

Studies may be undertaken by the Research Units in each RC to find out the pressure gradient values corresponding to B.F. 6 and above in different seasons in their region. The results of the findings may be communicated say, in another six months so that the criteria for description of pressure gradient may be revised, if necessary, for issue of a forecasting circular on the subject.

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3.3.3 NOT TO USE THE WORD "PROBABLY"

Forecasting Circular No. 1/dated 21 June 1999.

This supercedes instructions contained in DDGM (WF) UOI No.W-199/3044 – 3061/ dated 20-9-1988.

(Regarding Not to use the word "Probably" while describing the systems.

Ref. Resolution No.13 of Annual Cyclonic Review Meeting 1999

In pursuance of above resolution the word "Probably" may not be used while describing the systems. Hence terms like "Probably deep depression", "Probably Cyclonic Storm" and "Probably Severe Cyclonic Storm" may not be used while describing the low pressure systems. This will help to avoid the uncertainties in the description of the synoptic situation.

Sd/
(V. Krishnan)
For D.D.G.F.

3.4. NOMENCLATURE FOR DIFFERENT PARTS OF THE DAY IN FORECAST

Forecasting Circular dated 16 November 1983

It has been decided to change the expressions for the different parts of the day in forecast as follows :-

i) Early hours of (date)	0000 – 0400 hrs. IST
ii) Morning	0400 – 0800 hrs. IST
iii) Forenoon	0800 – 1200 hrs. IST
iv) Afternoon	1200 – 1600 hrs. IST
v) Evening	1600 – 2000 hrs. IST
vi) Night	2000 – 2400 hrs. IST

In addition to the above expressions like early morning (0400 – 0600 hrs. IST) around noon (1100 – 1300 hrs. IST) around midnight (2300 – 0100 hrs. IST) may also be used.

The above expressions may kindly be brought into use with immediate effect.

This supercedes the instructions contained in the Forecasting Circular 1969 / 1 on the same subject.

Sd/
(A. A. Ramasastry)
For D.D.G.F.

3.5 TERMINOLOGIES FOR SKY CONDITIONS

Forecasting Circular No.1/2004.

Ref: Rec. No.16 of AMR –2004.

In pursuance of the above Rec. the terminology 'mainly cloudy' for describing the sky conditions is changed to 'generally cloudy' in order to avoid confusion aroused by the term 'mainly cloudy'.

Accordingly the state of the sky are to be described as follows:

Cloud amount (Octa)	Description
0	Clear sky
1-2	Mainly clear
3-4	Partly cloudy
5-7	Generally cloudy
> 7	Cloudy

This circular supercedes all the previous instructions on the subject.

(A.B. Mazumdar)
Director
for D.D.G.M.(WF)

DDGM (WF) UOI NO.W-630 (AMR)/ PUNE-5 DT. JULY 2004.

4. WEATHER FORECASTS, BULLETINS AND WARNINGS

4.1 INTRODUCTION OF SECOND FARMER'S WEATHER BULLETIN

DDGF UOI No.W-96708/ dated 8th September 1977

As a result of the discussions held in our HQ with the Director, Farm and Home Service, AIR New Delhi on 6-6-77, it has been decided that a second Farmer's Weather Bulletin will be issued to the AIR stations at night based on 1200 Z chart for broadcast early in the next morning. Relevant extracts from the D.O. from D.A.S. to the Director, Farm and Home Service, AIR New Delhi dated 16-7-77 laying down the procedure for the issue of the second Farmers' Weather Bulletin are enclosed.

The issue of the second Farmers' Bulletin may be commenced from 1-10-77. The full text of the second Farmers' Weather Bulletin will be issued by about 2200 IST based on 1200 Z charts (or later based on 1800 Z charts, if special night watch is kept on any particular day), to all the AIR stations which receive the FWB at present. The second FWB will be issued daily during the monsoon months (June to September) and selected other months which are considered important for agriculturists in the different regions. As suggested in item (3) of the enclosure, the Meteorologists-in-charge may discuss with the farm and Home Service Unit of the local AIR and decide on the months outside the monsoon season during which the second FWB will be necessary and issue the second bulletin accordingly. This office may be informed about the non-monsoon months decided upon in respect of different AIR stations served by you.

Sd/
(V. Srinivasan)
For D.D.G.F.

Extracts from the D.O. from D.A.S. to the Director, Farm and Home Service, AIR New Delhi dated 16-7-1977.

The following procedure was agreed upon.

(1) A second Farmer's Weather Bulletin (FWB) should be issued during the monsoon months by all the forecasting offices of the Meteorological Department issuing these bulletins.

(2) The second bulletin will be based on the 1730 hrs. IST chart and will be issued by the concerned Meteorological offices by about 2200 hrs. IST. It will be broadcasted early next morning at a time depending upon the working hours of the different AIR stations so that maximum use of this bulletin could be made by the agriculturists/ farmers, who hear them before they begin their day's work.

(3) Further, as there are periods other than the monsoon months which are important in different parts of India for agricultural operations, e.g. (i) October – December in south – India when considerable rainfall occurs in these months, (ii) The winter months over northwest India when rains and cold waves occur in these parts of the country, it was decided that the second Farmer's Weather Bulletin may also be issued during the significant months other than the southwest monsoon season, the period being decided through mutual consultations between the representatives of the local Regional Meteorological Centres and AIR authorities at those places.

4.2 SECOND FARMER'S WEATHER BULLETIN (IN CONTINUATION OF DDGF UOI NO.W-96708 DT.8-9-1977)

DDGF UOI NO.W-96708/ dated 29 September 1977.

1. The second Farmer's Weather bulletin will have the preamble "Farmer's Weather Bulletin for ……(area) valid until the evening of …….(date). For example the FWB issued on the night of 3rd October for broadcast on 4th Morning will be valid upto 5th evening.
2. M.Cs/ R.Cs which keep regular night watch may base the second FWB on 1800 Z chart but ensure that the FWB will reach the A.I.R. Stations in time for the morning broadcast. MCs/ RCs which keep special night watch during periods of disturbed weather may also issue the second FWB based on 1800 Z charts on those occasions.
3. The date from which the second FWB has been introduced at your centre and the months during the non-monsoon seasons when the second FWB will be issued may kindly be intimated to this office.

Sd/
(R. Jambunathan)
For D.D.G.F.

4.3 PREPARATION OF WWR (DISTRICTWISE) BY MET. CENTRES

DDGF UOI No.W-97808/ 9228-41 dated 25th June 1975

All the Met. Centres are now preparing a Monthly Weather Report every month. In addition to this, many of the Met. Centres are also preparing districtwise weekly rainfall statement every week. It has now been decided to replace these two reports by a single report, viz. Weekly Weather Report for each state which will be on the same model as the Monthly Weather Report now being prepared by the Met. Centres and on the same lines as the first 2 pages of the WWR published by Weather Central, Poona. A specimen format is enclosed.

The description of the week's and season's rainfall will be districtwise and for this purpose isopleths of week's rainfall departure and season's rainfall departure (both in percentage) will be prepared on the special rainfall charts supplied to you. Under the heading "Chief Synoptic Features and associated Weather", spatial distribution of rainfall in the different Met. sub-divisions of the state during the week will also be briefly summarised. Activity of the monsoon, floods and damages caused will also be included under this heading.

On page 2, the stations will be arranged alphabetically against each district under the different Met./ Revenue sub-divisions as was done in the Monthly Weather Report. The stations on page 2 will include all the observatories in the state and state raingauge stations from which daily rainfall data are received and for which daily accumulated rainfall normals are enclosed or already available with you.

For computing the week's rainfall for all the stations, the daily rainfall of all the stations received by you should be tabulated in suitable registers, if such tabulation is not already being done.

The season's rainfall total for each station will have to be updated at the beginning of every month on receipt of the monthly total for the previous month from each station as well as for each week on receipt of late data of the previous week.

The first weekly weather report will be published by you on Thursday 3rd July 1975 for the week ending Wednesday 2nd July 1975. In this report, the season's rainfall will be for the period from 1-6-75 to 2-7-75. However, in the weekly weather report for the week ending 1-10-75, the weekly rainfall will be for the period of 7 days 25-9-75 to 1-10-75 but the season's rainfall will be only for the period 1-6-75 to 30-9-75. In the next weekly weather report dated 8-10-75, the week's rainfall will be for the week 2nd to 8th October and the season's rainfall will be for the period 1-10-75 to 8-10-75.

The weekly weather reports (without maps) will be supplied to the recipients to whom the Monthly Weather Reports are now being supplied. The recipients may be suitably instructed about this change. The Monthly Weather Report and the districtwise weekly rainfall statements will be discontinued from July onwards.

Sd/

(V. Srinivasan)

4.4. ISSUE OF WEEKLY WEATHER MAPS.

DDGM (WF) UOI NO.W-97808/ dated February 1979

At present weekly weather reports are being issued by you without any pictorial representation of the week's and season's rainfall. It is desirable that on occasions when significant rainfall occurs a few copies of coloured maps showing districtwise weekly rainfall departure from normal are prepared and supplied to a few VIPs like the Governor, the Chief Minister, Minister for Agriculture etc. You may, therefore, kindly introduce such arrangement utilising available resources. You may also arrange to publish these maps in the local press so that the public in general will become aware of the rainfall situation, particularly during the monsoon season. The maps included in the WWR published by this office may be referred to for guidance. Kindly acknowledge receipt

Sd/
(A. R. Ramakrishnan)
For D.D.G.F.

4.5 WARNINGS FOR THE DESIGNATED/REGISTERED USERS (ALBUM PAGE WARNEES)

DDGM (WF) UOI NO.W-630 (AMR)/ dated 13 October 1995

Decisions of annual monsoon review (AMR) meeting held at Pune on 22 February 1995.

A) Text of warning for heavy to very heavy rainfall issued to Album Page Warnees.

It has been decided that actual limits instead of "Your limit" may be included in the text of warning for heavy to very heavy rainfall and other parameters for which warnings are issued to the Album page warnees.

Example of Heavy Rainfall warning for Album Page Warnee whose requirement for rainfall is 5 cm is :-

Rather Heavy / Heavy rain/ very heavy rain may occur at one or two/ few/ many/ almost at all the places in your district when rainfall will exceed 5 cm or more till_____ hrs IST of _____ date".

[Ref.:- Decision No.1 on Working Paper No.3 of Agenda Item No. II of AMR – 95]

B) Inclusion of date and time of cessation of heavy rainfall warning.

It has been decided to mention ending time and date in the text of the heavy rainfall warnings.

Example :- Heavy rain/ very heavy rain may occur at one or two/ few/ many/ almost at all the places in _____ districts/ subdivisions till _____ hrs. IST of date".

These instructions supercede the earlier instructions on the matter and are effective with immediate effect.

Sd/
(D. S. Desai)
For D.D.G.F.

4.6. COMPACTNESS OF WEATHER BULLETINS SUPPLIED TO AIR.

Forecasting Circular 1969/4/ Dated October 1969

1. The Director General, All India Radio, has in a recent communication, drawn attention to the fact that the Weather Bulletins supplied by the various Offices of our Department to different AIR stations, are inordinately long.
2. On a scrutiny of the bulletins supplied by forecasting offices to the AIR, it is found that, in a few cases they are lengthy and with a little more attention they could be made brief and more appealing to the Public.
3. To make these bulletins brief and more appealing, it is suggested that the following guide lines may be adopted:
   (a) Messages should be edited in such a manner as to bring out the important features. Newspaper type featuring should be our guide in this respect.
   (b) Terms like rain or thundershowers should be avoided. In such cases the phenomenon is to be described as rain.
   (c) In describing spatial distribution if differences between some sub-divisons are only marginal, they can be suitably combined. It has to be remembered that spatial distribution determined from the few departmental observatories may differ to some extent from the state raingauge data.
   (d) When a large number of stations have reported heavy rainfall in the region the lower limit of rainfall amounts may be restricted so that a large number of stations need not be listed in the summary, ensuring however, that rainfall figures from all the Meteorological sub-divisions are given. On occasions when heavy rainfall reports are few, discretion may be used to select one or two significant amounts per meteorological sub-division, depending upon the number of such sub-divisions in the concerned RC.
   (e) In the summary of observations, the information in respect of changes or departures of maximum and minimum temperatures may be restricted to plus or minus $3^{O}C$ or above only.
   (f) When bulletins are becoming rather long, insignificant features, such as isolated rainfall in monsoon season, can be omitted.
   (g) Whenever monsoon is described as strong or vigorous in an area, it is not necessary again to mention spatial distribution of rainfall for that area.
   (h) Descriptions of temperature and rainfall distribution in the summary may be confined to the Meteorological sub-divisions without further dividing the sub-divisions for this purpose except when there is marked difference between parts of the same sub-division.
4. With the above modifications it is felt that the bulletins might become fairly brief and will still give a good idea of the past and forecast weather.

Sd/
(Y. P. Rao)
D.D.G.F.

4.7 FREE SUPPLY OF REGIONAL DAILY WEATHER REPORTS.

DDGF UOI No.W-96702/ 7391 – 98/ dated 17 December 1971

The question of regulating the free supply of Regional Daily Weather Reports, particularly to Govt. Officials (non-departmental) has been under examination in this office in the recent past. The following broad guide lines have been drawn up for facilitating the quick disposal of requests for free supply.

1. Free supply of RDWR to Government Officials (Non-departmental)
   - 1.1 Fresh free supply may be undertaken only on receipt of a specific request from the party.
   - 1.2 Exception may be made in the case of dignitories like the President of the Indian Union, Governors, Prime Minister, Chief Ministers, Ministers of the Central and State Governments who are directly or indirectly interested in Meteorology.
   - 1.3 Head of the concerned Postal Circle : According to existing rules of registration of newspapers for postal concession, a copy of the news paper has to be submitted to the head of the Postal circle.
   - 1.4 National libraries, to which all publications are supplied free.
   - 1.5 Officials/ Offices who are entitled to get weather information for operational reference/ research purposes.

   Under this category, the Army, Navy and Air Force establishments including the HQ of the three services and other Government Officials, who require weather data daily for their work are included. The Regional daily weather reports would be a convenient medium for supplying the weather information which they are normally entitled to receive. However, no two Officials/ Offices of the same Ministry/ Department stationed at the same place are normally entitled for free supply.
   - 1.6 Offices/ Officials to be supplied on exchange basis : This category would include mainly the meteorological services of the neighbouring countries. As meteorological information from these countries will be useful for the department, RDWR will have to be supplied to them in exchange for their reports.
   - 1.7 Agencies from whom the department gets free services, such as the heads of departments in charge of rain recording stations in States as the rainfall reports from the states are received by this department free of cost. These agencies may be supplied with the RDWR of the concerned region free of cost on request.

     Also, Honorary Superintendents of part-time observatories maintained by this department may be supplied on request, free of cost a copy of the RDWR in recognition of the free services rendered by them to the Department.
   - 1.8 The recipient may be supplied with the report of the region of his interest.
2. News papers and news agencies.

2.1 Free supply of the RDWR of the concerned region may be made to such news papers and news agencies, who are on the list of accredited news papers/ news agencies of the State Governments concerned, for providing publicity to weather reports. Free supply may be made on the understanding that the parties concerned make their own arrangements for collection of the report at no extra cost to the department. News papers getting a copy of the report should also supply a complementary copy of the paper to the office concerned for keeping a check on the weather data published.

2.2 The supply to a news paper/ news agency may cease when it stops publication of the report.

3. All fresh supplies will have to be undertaken only with the approval of the DDGF.
4. RCs may kindly adopt the above procedures for recommending to this office request for free supply of RDWR.
5. Hitherto RCs have been sending distribution lists of RDWR along with the distribution list of RWS, FWB and AIR schedules to DGO, New Delhi. With immediate effect, the distribution list of RDWR as on the 1st day of the year need not be sent to HQ office. However, this return and the quarterly changes will continue to be sent to DDGF as in the past. And also the returns about RWS/ FWB/ AIR schedules will continue to be sent to HQ office as well as to DDGF as at present.

Sd/
(C. A. George)
For D.D.G.F.

4.8 TO USE UNIFORM NORMALS

TECHNICAL CIRCULAR NO.1 / 2007

Sub. : Uniform normal figures for all the meteorological elements.

It is noticed that the normal values being utilized for categorising heat wave/ cold wave conditions, rainfall departures etc. vary from region to region and this is creating diversified statements and thus confusion in general. In order to bring in more objectivity and transparency, a unified normal period (viz. 1941 – 1990; the climatological period as per the WMO norms) is to be used for rainfall and a normal period of 1961 – 1990 for the met. elements like maximum temperature, minimum temperature and rainfall be adopted with immediate effect.

The action taken in this regard may kindly be intimated to this office, at the earliest.

(A. B. Mazumdar)
D.D.G.M.(W.F.)

DDGM (WF) UOI NO. W-969/ Pune-5; The March 2007.

5. MONSOON PROCEDURES

5.1 ONSET/ WITHDRAWAL OF MONSOON

5.1.1 TENTATIVE BULLETIN

DDGM (WF) UOI No.W-630/ dated 11 October 1985

In continuation of this office UOI No.W-630/8897 to 8913 dt.14-8-1985 kindly find below copy of DDGF UOI No.W-630/4426 to 4441 dt.27-9-1975 for your ready reference. The same instruction holds good for onset of Monsoon also.

Bulletins are issued by Weather Central Pune, RCs and MCs regarding the withdrawal of the monsoon to various AIR stations as well as to the press. To avoid contradictory bulletins to the public from the various met. offices this office will issue an advisory bulletin at about 1130 hrs. IST by TP to RCs/ MCs on the withdrawal of the monsoon from the different met. sub-divisions as and when occassions arise.

Sd/
(N. C. Biswas)
For D.D.G.F.

5.1.2 GUIDELINES FOR DECLARING THE ONSET AND ADVANCE OF SOUTHWEST MONSOON

FORECASTING CIRCULAR NO.1 / 2006

The guidelines to be followed for declaring the onset of monsoon over Kerala and its further advance over the country are enlisted below :

I. Onset over Kerala

a) Rainfall

If after 10th May, 60% of the available 14 stations enlisted, viz. Minicoy, Amini, Thiruvananthapuram, Punalur, Kollam, Allapuzha, Kottayam, Kochi, Trissur, Kozhikode, Talassery, Cannur, Kasargode and Mangalore report rainfall of 2.5 mm or more for two consecutive days, the onset over Kerala be declared on the 2nd day, provided the following criteria are also in concurrence.*

b) Wind field

Depth of westerlies should be maintained upto 600 hPa, in the box equator to Lat. 10°N and Long. 55°E to 80°E. The zonal wind speed over the area bounded by Lat. 5-10°N, Long. 70-80°E should be of the order of 15 – 20 Kts. at 925 hPa. The source of data can be RSMC wind analysis/satellite derived winds.

3. OLR

INSAT derived OLR value should be below 200 wm^{-2} in the box confined by Lat. 5-10°N and Long. 70-75°E.

* Station Locations shown in Annexure; also subject to modification considering the regularity of availability of observations on operational mode.

II Further advance of monsoon over the country.

a) Further advance be declared based on the occurrence of rainfall over parts/sectors of the sub-divisions and maintaining the spatial continuity of the northern limit of monsoon, further advance be declared.

The following auxiliary features may also be looked into.

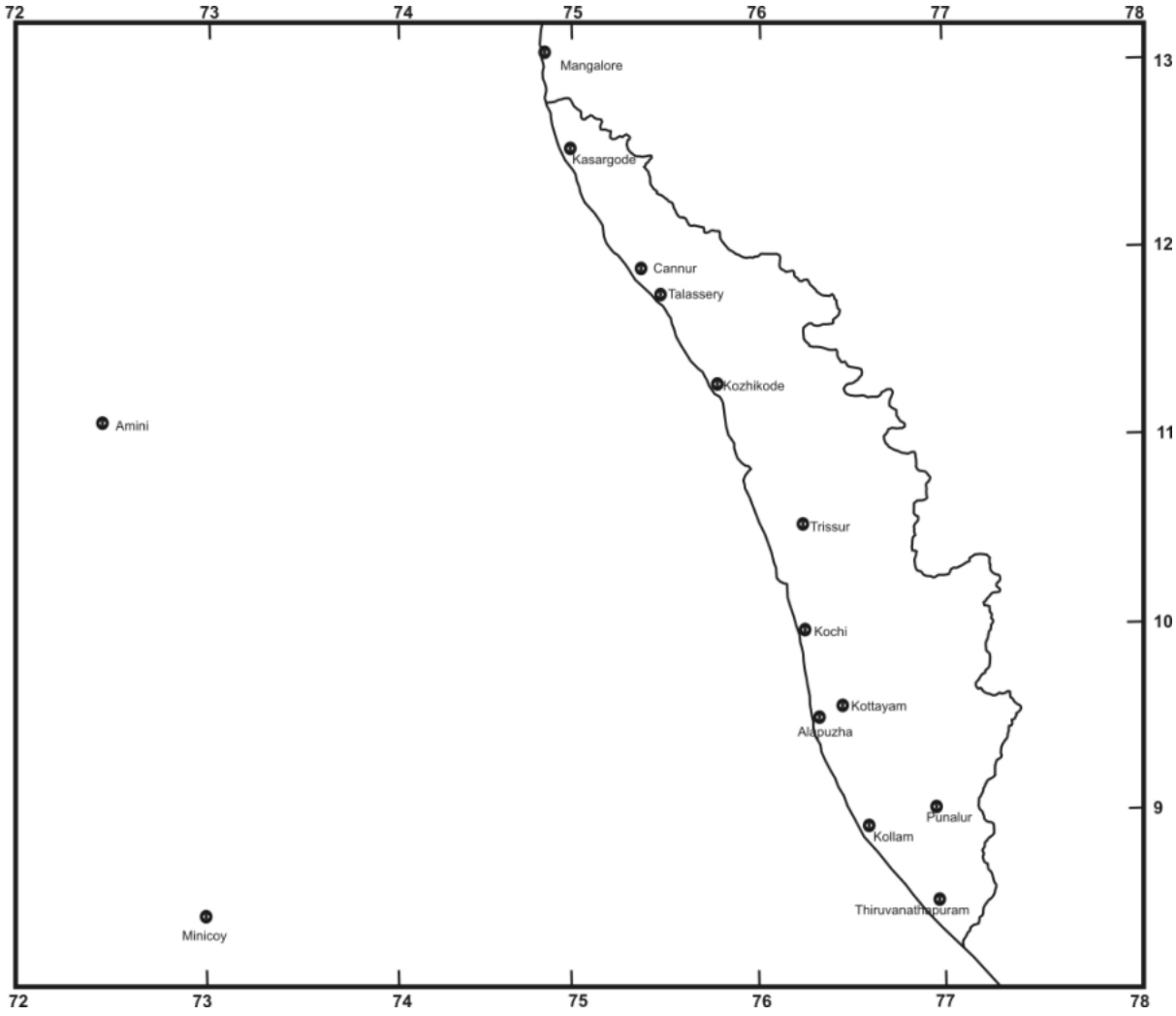
b) Along the west coast, position of maximum cloud zone, as inferred from the satellite imageries may be taken into account.

c) The satellite water vapour imageries may be monitored to assess the extent of moisture incursion.

This circular supercedes the earlier instructions in the matter.

(R. R. Lele)
Director
for D.D.G.M.(W.F.)

DDGM(WF) UOI NO. W-630 (AMR)/ Dt. Pune-5;The May 2006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Trissur
Kochi
Kottayam
Alapuzha
Punalur
Kollam
Thiruvanathapuram
Minicoy

5.2 ACTIVITY

5.2.1 STRENGTH OF MONSOON

Forecasting circular No.1/ Dated 5 January 1973 (Rec.No.9 of VII FO's Conf.)

In modification of previous instructions on the subject, the following criteria will be hence-forth adopted for describing the activity of the monsoon.

(a) DESCRIPTIVE TERM	OVER THE SEA. Wind speed (in knots) reported or inferred to be existing.
Weak monsoon	Upto 12 knots
Moderate monsoon	13 to 22 knots
Strong monsoon	23 to 32 knots
Vigorous monsoon	33 knots and above.

(b) DESCRIPTIVE TERM	OVER LAND AREA SPECIFICATION
Weak monsoon	Rainfall less than half the normal.
Normal monsoon	Rainfall half to less than 1½ times the normal (mention of 'normal' monsoon may not be necessary in general).
Active/ strong monsoon	i) Rainfall 1 ½ to 4 times the normal. ii) The rainfall in at least two stations should be 5 cm, if that sub-division is along the west coast and 3 cm, if it is elsewhere. iii) Rainfall in that sub-division should be fairly widespread to widespread.
Vigorous monsoon	i) Rainfall more than 4 times the normal. ii) The rainfall in at least two stations should be 8 cm if the sub-division is along the west coast and 5 cm if it is elsewhere. iii) Rainfall in that sub-division should be fairly widespread or widespread.

While describing the activity of the monsoon,

i) The normals of stations, whenever available should be used.

ii) Till normals for all the stations are available the following procedure should be adopted :

Number of stations in a sub-division with normals a

Normal for these stations	b
Average normal for the sub-division	b/a
Total number of stations reporting rainfall	c
Actual total rainfall reported by these stations	d
Therefore, the average rainfall for the sub-division	d/c

Compare d/c with b/a and describe the activity of the monsoon accordingly, other conditions being fulfilled.

3. i) In the sub-divisions, where the percentage of hill stations is high, the hill stations must be also taken into account for describing the activity of the monsoon. In other sub-divisions, the hill stations will be excluded.

   ii) The monsoon activity will be described in all the sub-divisions of northeast India as is done for sub-divisions of other regions.

   iii) The monsoon activity need not be described over the Bay Islands and the Arabian Sea Islands.

Sd/
(P. K. Das)
D.D.G.F.

5.2.2 MONSOON ACTIVITY IN DAILY WEATHER BULLETIN (ALL INDIA WEATHER SUMMARY

Forecasting Circular No.2/ dated 25th August 2000

Recommendation of AMR-2000.

Whenever a countrywide dry spell continues for more than three days and is expected to continue for atleast two more days, the description of monsoon activity should be described as "Weak or subdued Monsoon for the country as a whole". Further, RC level bulletins may also include this information. It was also decided that information on prolonged dry or wet spells over individual pockets should be included in the All India Weather Reports.

Sd/
(D.S. Desai)
Director

5.2.3 SUBDUED MONSOON ACTIVITY

FORECASTING CIRCULAR NO.3/ 2005

Based on the decision taken in AMR-2005, on WP No.6 for describing the sub-divisional monsoon activity, the Forecasting Circular No.2 dtd. 25th August 2000 is re-introduced with minor modifications w.e.f. from the current monsoon season as follows:

1. Whenever, a countrywide dry spell continues for more than 3 days and is expected to continue for atleast 2 more days, the description of monsoon should be given as 'weak or subdued monsoon for the country as a whole'. RC level bulletins may also include this information.
2. Information on prolonged dry spells/ subdued activity over the met. subdivisions also should be included in the RMC/ MC level bulletins if such a spell is persisting for 2 or more days and is expected to continue.
3. Monsoon activity for a sub-division might be considered subdued if the rainfall realised is less than ½ the normal.

This circular supercedes all the earlier instructions on this matter.

(A. B. Mazumdar)
Director
For D.D.G.M.(W.F.)

DDGM(WF) UOI No. W-670/ Dt. Pune-5;The June, 2005.

Instructions relating to Forecasting Circular No. 3/2005

In order to describe the subdued rainfall activity on a particular day, the following criteria be observed.

(i) Spatial distribution of rainfall remains mainly dry, isolated or scattered only for two consecutive days.

(ii) Mean actual rainfall of that particular sub-division remains less than the normal for the consecutive two days.

(iii) The Forecast issued for the next 48 hrs on the particular day for the sub-division is also mainly dry, isolated or scattered.

Upon satisfying all the above criteria simultaneously, monsoon activity be described as subdued on the second day.

(A. B. Mazumdar)
Director
For D.D.G.M.(W.F.)

DDGM(WF) UOI No. W-670/ Dt. Pune-5;The June, 2005.

5.2.4 ALL INDIA DROUGHT YEAR

TECHNICAL CIRCULAR NO.2/ 2007

Sub: Definition for *All India drought year.*

The recommendation put forth by the AMR – 2006 sub–committee on droughts, were accepted by and large by the AMR–2007 held at MC Hyderabad. Accordingly the following criteria hold good for declaring a drought year.

Defining all India drought year:

When the rainfall deficiency is more than 10% and when 20 to 40% of the country is under drought conditions, then the year is termed as ***All India Drought Year*** and when the spatial coverage of drought is more than 40% it will be called as ***All India Severe Drought Year.***

This circular supercedes the earlier instructions in the matter.

Kindly acknowledge receipt.

(A.B. Mazumdar)
D.D.G.M.(W.F.)

DDGM (WF) UOI NO. W-969/ Dt. Pune-5;The May, 2007.

5.2.5 HIGH TEMPERATURE EPOCHS WHICH NEED MENTIONING IN THE WEATHER BULLETINS WITHIN THE MONSOON SEASON

FORECASTING CIRCULAR NO.1/ 2007

Quite often, the weak or break monsoon conditions or some anomalous circulation features give rise to persistent high temperatures over some parts of the country which can have adverse influence on day to day activities.

These need to be foreseen and described in the weather reports/ bulletins, as per the following guidelines:

a) Whenever there is a high temperature epoch (expected to prevail for 3 days or more) within the monsoon period (i.e. after the advance and before the withdrawal) over a particular met. sub–division, with the temperature values reaching 40^{O} C or more (anomaly $+5^{O}$ C or more) for inland region, it should be suitably mentioned in terms of the comfort (heat) index in weather reports.

b) The threshold value may be 35^{O} C (anomaly $+5^{O}$ C or more) for the hilly regions and coastal areas.

c) The phenomenon being an area specific one, two or more stations should satisfy the above condition, in order that a particular sub–division or part of it will qualify to be mentioned in this regard.

d) The practice of declaring the heat wave, hot day etc. is to be continued as such, prior to the advance and after the withdrawal of monsoon from the particular region.

This circular supercedes the earlier instructions in the matter.

Kindly acknowledge receipt.

(A.B. Mazumdar)
D.D.G.M.(W.F.)

DDGM (WF) UOI NO. W-969/ Dt. Pune-5;The May, 2007.

5.2.6 WITHDRAWAL OF SOUTHWEST MONSOON AND COMMENCEMENT OF NORTHEAST MONSOON

FORECASTING CIRCULAR NO.3 / 2006

The report by the AMR-2005 sub-committee (based on recommendations No.4 & 5/ 2005) was accepted by the subsequent AMR held at Chennai, with minor modifications (Rec. No.6 & 14(b)). The guidelines to be followed for declaring the withdrawal of southwest monsoon and commencement of northeast monsoon, from the current season are enlisted below:

I] Withdrawal of SW Monsoon:

a) *Withdrawal from extreme Northwestern parts of the country should not be attempted before 1st September.*

b) *After 1st September:*

The following major synoptic features should be considered for the first withdrawal from the western parts of NW India.

i) Cessation of rainfall activity over the area for continuous 5 days.

ii) Establishment of anticyclone in the lower troposphere (850 hPa and below)

iii) Considerable reduction in moisture content as inferred from satellite water vapour imageries and tephigrams.

c) *Further withdrawal from the country:*

i) Further withdrawal from the country may be declared, keeping the spatial continuity, reduction in moisture as seen in the water vapour imageries and prevalence of dry weather for 5 days.

ii) SW monsoon should be withdrawn from the southern peninsula and hence from the entire country only after 1st Oct., when the circulation pattern indicates a change over from the southwesterly wind regime.

II] Commencement of NE monsoon rains:

For declaring the commencement of NE monsoon rains, the existing practice which is by and large based on the methodology suggested by the FO's conference of 1987 may be continued. They are

i) Withdrawal of SW monsoon upto Lat. 15°N.

ii) Onset of persistent surface easterlies over Tamil Nadu coast.

iii) Depth of easterlies upto 850 hPa over Tamil Nadu coast.

iv) Fairly widespread rainfall over coastal Tamil Nadu, south coastal Andhra Pradesh and adjoining areas.

This circular supercedes the earlier instructions in the matter.

(N. Jayanthi)
D.D.G.M.(W.F.)

DDGM(WF) UOI NO. W-969/ Dt. Pune-5; The August 2006

5.3 CRITERIA FOR DECLARING ONSET OF NORTHEAST MONSOON.

DDGM (WF) UOI No.W-969/ dated 7 June 1988

For declaring onset of Northeast Monsoon following criteria may be considered*.

(A) (1) withdrawal of south west Monsoon upto 15^{O} N.

(2) onset of persistent surface easterlies over Tamil Nadu coast.

(3) depth of easterlies upto 850 hPa over Tamil Nadu coast.

(4) fairly widespread rainfall over the coastal Tamil Nadu and adjoining areas.

(5) Onset is not to be declared before 10^{th} October even, if the conditions described above exist.

(B) Specifications for describing the activity/ strength of Northeast Monsoon.

Weak Monsoon : Rainfall less than half the normal.

Normal Monsoon : Rainfall half to less than one and a half (1½) times the normal.

Active Monsoon :
- i) Rainfall 1½ to 4 times the normal.
- ii) Rainfall in atleast two stations should be 3 cm in coastal Tamil Nadu and south coastal Andhra Pradesh and 2 cm elsewhere.
- iii) Rainfall in that sub-division should be fairly widespread or widespread.

Vigorous Monsoon :
- i) Rainfall exceeding 4 times the normal.
- ii) Rainfall in atleast two stations should be 5 cm in coastal Tamil Nadu and south coastal Andhra Pradesh and 3 cm elsewhere.
- iii) Rainfall in that sub-division should be fairly widespread or widespread.

Sd/
(N. C. Biswas)
For D.D.G.F.

*** modified later in Forecasting Circular No. 3/2006. (Appendic 5.2.6)**

Criteria for declaring onset of Northeast Monsoon. (Amendments)

DDGM (WF) UOI No.W-969/ dated 16 August 1988

Ref.: DDGM (WF) UOI No.W-969/160-177.

Following amendments may kindly be incorporated in the circular issued under UOI. referred above.

Rec.No.29 : Northeast Monsoon – Criteria for onset (over coastal Tamil Nadu and south coastal Andhra Pradesh).

Under Item (A). : 'Criteria for declaring onset of Northeast Monsoon' amend point No.4 as

4. Fairly widespread rainfall over coastal Tamil Nadu and south coastal Andhra Pradesh and their adjoining areas.

Under Item (B) : 'Specification for describing the activity/ strength of Northeast Monsoon' replace the present ones by

Weak Monsoon:	Rainfall less than half of the normal in any met sub-division in Northeast Monsoon Regime.
Normal Monsoon:	Rainfall half to less than one and a half (1½) times the normal in any Met. sub-division in Northeast Monsoon regime.
Active Monsoon:	ii) Rainfall in atleast two stations shall be 3 cm in coastal Tamil Nadu and south coastal Andhra Pradesh and 2 cm elsewhere over any other met sub-division in Northeast Monsoon Regime.
Vigorous Monsoon:	ii) Rainfall in atleast 2 stations should be 5 cm in coastal Tamil Nadu and south coastal Andhra Pradesh and 3 cm elsewhere in the Northeast Monsoon Regime.

Sd/
(D. S. Desai)
For D.D.G.F.

6. PROCEDURES DURING THE CYCLONE PERIOD

6.1. PROCEDURE FOR DISSEMINATION OF STORM WARNING MESSAGES OVER POLICE WIRELESS GRIDS.

Forecasting Circular 1969/3 / Dated 8 October 1969

Government of India, Ministry of Home Affairs, have approved the dissemination of storm warnings over the Police Wireless grid as per procedure given in the Annexure. The following additional instructions should be followed at the concerned FOs for dissemination of the warnings.

"In the warning messages booked with Police W/T, the telephone number of the party addressed should also be given to make it convenient for the Police W/T to telephone the warning. For this purpose, RCs will maintain an up-to-date list of the telephone numbers of the concerned parties at the appropriate met. offices which are required to book the messages."

Annexure

1. The facility of Police Wireless for transmission of storm warning messages will be utilised when the meteorological Tele-communication channels have either failed or when such channels do not exist between the storm warning offices and the places to which the messages are to be transmitted or are likely to be unduly delayed.

For the expeditious transmission of the messages from the Meteorological Offices to the various destinations it is necessary that there is minimum possible delay in passing on the messages from the Meteorological Offices to the Police Wireless at the originating station and the responsibility of handing over messages at Police Radio Stations will vest in the originating office. However, for this all help for expeditious collection may be given to the Meteorological Offices to the extent possible during this period.

When the meteorological telecommunication channels between the Meteorological offices fails, storm warning messages will be passed on to the concerned ISPW Station at Bombay/ Madras/ Calcutta for clearance on ISPW link in respect of States of Gujarat/ Mysore/ Goa/ Kerala/ Andhra Pradesh/ Orissa and Andaman and Nicobar Islands respectively. The messages after clearance on ISPW link (directly or through ISPW Control Station Delhi for Mysore/ Kerala/ Andhra Pradesh/ Orissa/ Goa and Andaman and Nicobar Islands) will be delivered immediately to the local Police Radio Control Rooms.

These messages on receipt by the State Police Control Room (Direct from Meteorological Department or through ISPW links) will be passed on the State Police Wireless links for delivery to the All India Radio Stations/ District Authorities/ port authorities concerned.

The India Meteorological Department will take action for installation of telephone connections between the Police Radio Stations and the addresses concerned at the destination stations, if such telephone connections are not already existing. On receipt of any storm warning messages the Police Radio Station will immediately intimate telephonically the text of such

messages to the concerned addresses who will arrange to collect confirmation copy of these messages from the Police Radio Stations. On occasions of telephonic breakdown, the warning messages will be sent by messenger to the District Officer by the Police Authority at the destination Stations but not at the expense of delivery of messages relating to law and order.

Due priority will be given to the Storm warning messages for transmission over Police Wireless, but these messages should not hamper the normally expeditious clearance of high priority Police traffic (of law and Order nature). Discretion will be used by the Police Radio Staff concerned to decide the sequence of priority traffic (according to Radio Procedure for Police Services). However, equal importance/ priority will be given to the Storm Warning messages for their speedy clearance in view of involvement of human lives.

Sd/
Y. P. Rao
(D.D.G.F.)

6.2. CRUCIAL OBSERVATIONS RESPONSIBLE FOR DECLARATION OF RAPID SYNOPTIC DEVELOPMENTS

Forecasting Circular 1969/5/ Dated 16 October 1969.

It was decided at a conference held at Calcutta on 6-9-1945 to discuss storm warning responsibilities of Madras and Calcutta in the Bay of Bengal that on occasions of rapid synoptic developments, the bulletins issued by the storm warning centres indicating intensification of depressions into cyclonic / severe cyclonic storms should state the crucial observations on which the originating storm warning offices based their bulletins. But it is often noticed that these instructions are not being followed. This often leads to embarrassing position as the observation or observations on which one office declares a cyclonic storm may not be available at the other office in time and the inference issued may therefore differ. It is, therefore, necessary that on occasions of rapid developments, the storm warning centres invariably draw attention to the crucial observations on which they decided to declare a cyclonic / severe cyclonic storm. The above instructions will apply to issue of "Hexagon" bulletins.

Sd/
(Y. P. Rao)
D.D.G.F.

6.3 CLASSIFICATION OF LOW PRESSURE SYSTEMS.

Forecasting Circular No.1/1974

The criteria regarding classification of low pressure systems over the sea area are given below:

Features	**Observed or inferred wind speed**		**Symbols**	
	Kt.	**B.F.**	**Mono-chromatic**	**Poly-chromatic**
Low pressure area	Less than 17	4	L	L Red
Depression	17 – 27	5,6	D	D Red
Deep Depression	28 – 33	7	DD	DD Red
Cyclonic Storm	34 – 47	8, 9	CS	CS Red
Severe Cyclonic Storm	48 – 63	10, 11	SCS	SCS Red
* Severe Cyclonic Storm, with a core of hurricane winds	64 and above	12 and above		Red

* was classified later on as Very Severe Cyclonic Storm and Super Cyclonic Storm vide circular No.1/1998.

For pressure systems over land areas, the above criteria may be applied subject to the condition that the wind should be that observed at 0.9 km a.s.l., instead of the surface wind.

2. When satellite pictures are available, the relationship between the intensity of the storm and the maximum sustained wind speed may be obtained by using Dvorak's Technique given in NOAA Technical Memorandum NESS 45. This can be used as a rough guide, till the relationship is verified by aircraft reconnaissance observations for storms in the Indian area.
3. The central pressure Po (in hPa) may be calculated by using Fletcher's formula viz. Vm = 16 (Pe– Po), where Vm is maximum wind speed in knots and Pe is the peripheral pressure in hPa.
4. An approximate relationship between maximum wind and pressure defect at the centre of the system, using the above formula is given in the table below for ready reference.

Pe – Po (hPa)	Maximum Wind
< 1.0 mb	< 17 kt
1.0 – 3.0 mb	17 – 27 kt
3.0 – 4.5 mb	28 – 33 kt
4.5 – 8.5 mb	34 – 47 kt
8.5 – 15.5 mb	48 – 63 kt
15.5 and above	64 and above

5. This circular supercedes all previous instructions on the subject.

6.4 PRE CYCLONE PROCEDURES

Forecasting Circular No. 1/ 1978

The following are the actions to be taken in the months preceding the post and pre-monsoon cyclonic storm seasons:

I-Communications :

1. The Met-in-Charge at the ACWC/ CWC may contact personally the General Managers, Telecom / telephones and General Manager, Maintenance, at their respective stations and ensure that
   a) The local communication links at the ACWC/ CWC consisting of T/P / Telephone / Telex connections are maintained in good working condition, especially during the days of cyclonic storms.
   b) Communication links connecting the station to other Met. offices are maintained at highest efficiency.
2. All communication equipments (including spare) at the stations should be maintained in good working condition. Essential spare parts should be requisitioned well in time and kept in store so that no break-down occurs in the crucial time for want of these. Maintenance staff also should be available on the spot during days of disturbed weather for immediate rectification of faults.
3. Any action required in connection with the issue of warnings through Police W/T should be completed. In particular, any shortcomings in this mode of communication noticed in the past should be discussed with the State Government authorities and remedial action taken.

II. Publicity and Broadcast of Warnings :

1. The ACWCs/ CWCs should write to the State Government Officials concerned for giving publicity to the people in the coastal districts about cyclones through cyclone posters and exhibition of the film on cyclones.
2. Radio talks should be arranged by the ACWCs and CWCs on the hazards of cyclones and precautionary measures to be taken before, during and after storms.
3. The station directors of AIR stations in the concerned State(s) should be alerted about the broadcasts of cyclone warnings through AIR and to ensure that the stations keep extended watch for broadcast of special weather bulletins whenever required.
4. Proper liaison should be established with local newspapers for prompt publication of the latest warnings.

III. Observational data :

1. All the coastal observatories and CDMC stations should be inspected once in a year during April or September to ensure that the instruments at these stations are in good working condition and the observers are familiar with correct recording and reporting of observations. If any persistent error is noticed in the recording or reporting, the observer should be immediately instructed suitably. Where the observatory sends its observations to the M.C./ R. C. through W/T or T/P or Telex, the communication aspects should also be checked up.

2. Any deficiency in the operation of the cyclone warning radar, RS/RW stations and APT Ground Station (along the coast or at an island station) should be immediately brought to the notice of DDGI/ Director Sat. Met. by the M.C./ R. C. concerned for immediate rectification.
3. Required nomograms and T-classification tables for interpreting and assessing storm intensity from satellite pictures should be readily available.
4. The centres and classification of disturbances as given in the Satellite Disturbance Summary of Washington and in the Cyclone Warnings of the Joint Typhoon Warning Centre, Guam should be regularly plotted.

IV. Ports :

1. Action on the reports of officers who have visited the ports should be completed.

V. Organisation and Staff matters :

1. Sufficient stock of all special type of charts and forms required for cyclone work should be kept at the ACWCs/ CWCs. Different code books, and reference material such as Tide Tables, Storm Track Atlas etc. should be readily available.
2. All the officers and members of staff should make themselves familiar with the list of various types of warnees to be warned and the formats in which these warnings are to be issued. The Action Book may be checked up to ensure that all the items listed there are updated. The formats of the various warnings should be got typed and kept ready for reference.
3. The telephone and telex numbers of the different ACWCs/ CWCs/ Radar stations and other concerned offices such as local AIR/ Chief Secretary to Government etc. should be readily available for quick consultation and exchange of views.
4. It is also essential that the staff posted at ACWCs/ CWCs and coastal observatories are quite familiar with the various procedures connected with the cyclone warning work. The best available staff may be utilised in connection with storm warning work in view of its importance to the public. Sanctioning of leave to the staff engaged in operational general forecasting work may be regulated to ensure availability of required number of trained and experienced persons for storm warning work.

6.5 WARNINGS FOR STRONG WINDS EXPECTED DUE TO A DEPRESSION/ DEEP DEPRESSION OVER LAND AREA.

Forecasting Circular dated 9 February 1990

It has been decided in the Annual Monsoon Review (AMR) meeting of 17th October, 1989 that whenever there is a depression or deep depression over land area, warning for expected strong winds should also be indicated in the weather bulletins along with the heavy rainfall warnings.

This may kindly be brought into use with immediate effect.

Sd/
(G. R. Gupta)
For D.D.G.F.

6.6 FINAL FORMAT OF CYCLONE WARNING BULLETINS

FORECASTING CIRCULAR NO. 1/2005

Ref.: ACR Rec. No. 22/2003 & ACR Rec. No. 16/2005

As per the above recommendation, the formats were modified taking into account the suggestions and comments from other offices. The final formats to be used from the ensuing cyclone season (i.e., Oct – Nov. 2005) are enclosed.

(A. B. Mazumdar)
Director
For D.D.G.M.(W.F.)

DDGM(WF) UOI No. W-720(CM)/ Dt. Pune-5;The May. 2005

- **Date and Time of Issue ……**
- **(Information on Cyclone)**

Cyclonic Storm lay over …… Bay of Bengal / Arabian Sea at a distance …… kms. ……from ……..at ……..hrs. IST on ……..(date)

Forecast:

- **Further intensification**
- **Direction of Movement**
- **Expected landfall area**
- **Expected time of landfall**

Warnings :

- **Wind**
- **Sea Condition**
- **Tidal Waves**

Storm Warning Signals at ports:

Advice and Action :

- **Fishermen not to venture into open seas OR**
- **Fishermen at Sea are advised to be more careful while approaching land.**

2. Format for Port Warning

- **Port Warning No.**
- **Date and Time of issue**

Information on cyclone:

The cyclonic storm lay over Bay of Bengal/Arabian Sea near Lat.__/Long. ____ at a distance _____ km. from _____ at _____ IST _____ Estimated Central Pressure _____ hPa.

Forecast :

- **Further intensification:**
- **Direction of Movement:**
- **Expected Landfall Area :**
- **Expected Time of Landfall :**

Advice for hoisting Storm Warning Signals:

3. Format of Cyclone Warning Bulletins with post-landfall outlook (to AIR)

CYCLONE WARNING:

Cyclone Warning Bulleting No. ….. issued by Area Cyclone Warning Centre ……. at…….. Hrs. IST on …….. (date) for repeated broadcast at hourly/half hourly intervals. Warning for …….. (districts). The ……. storm over …….. (section of sea area) moved …….. (direction) and lay centred at ……. Hrs. IST of …….. about …….. Kms. ……. (direction) of ……. (Place). System expected to move in a …….. direction and cross …….. Coast near ……. (place) around …….. (Time of the day) of …….. (date).

Under its influence tidal wave of …….. metres likely in …….. Districts at the time of storm crossing coast. Gales speed reaching …….. Kmph is also likely in …….. districts during the next ……. Hours. Gales speed reaching …….. Kmph also likely in …….. Districts during same period. Heavy to very heavy rain is also likely in …….. Districts during next 24 hours.

DAMAGE EXPECTED (Extract from Appendix I)

STORM WARNING SIGNALS (to be appended)

POST LANDFALL OUTLOOK

After landfall the system is likely to maintain cyclone intensity for another ……. hours and weaken gradually. Under its influence heavy to very heavy rainfall at most places is likely to commence over …….. (interior districts) districts from ……. Date/time. Gale speed reaching ……. Kmph also likely to prevail in these districts from …….. date/time for another …….. hours.

Damage expected for interior districts (Extract from Appendix I)

4. Format of Cyclone Warning Bulletins with post-landfall outlook (to 4 Stage warnees)

CYCLONE WARNING:

Cyclone Warning Bulleting No. ….. issued by Area Cyclone Warning Centre ……. at…….. Hrs. IST on …….. (date)

Warning for ……. (districts).

The ……. storm over …….. (section of sea area) moved …….. (direction) and lay centred at ……. Hrs. IST of ……. about …….. Kms. ……. (direction) of ……. (Place). System expected to move in a ……. direction and cross ……. Coast near ……. (place) around …….. (Time of the day) of …….. (date).

Under its influence tidal wave of …….. metres likely in ……. Districts at the time of storm crossing coast. Gales speed reaching ……. Kmph is also likely in ……. districts during the next ……. Hours. Gales speed reaching …….. Kmph also likely in ……. Districts during same period. Heavy to very heavy rain is also likely in ……. Districts during next 24 hours.

DAMAGE EXPECTED (Extract from Appendix I)

SUGGESTED ACTION (Extract form Appendix I)

STORM WARNING SIGNALS (to be appended)

POST LANDFALL OUTLOOK

After landfall the system is likely to maintain cyclone intensity for another …….. hours and weaken gradually. Under its influence heavy to very heavy rainfall at most places is likely to commence over ……. (interior districts) districts from ……. Date/time. Gale speed reaching ……. Kmph also likely to prevail in these districts from ……. date/time for another ……. hours.

Damage expected for interior districts (Extract from Appendix I)

SUGGESTED ACTION (Extract from Appendix I) [include if required only]

5. Format of post-landfall outlook bulletin (to interior districts)

POST-LANDFALL OUTLLOK

INFORMATION ON CYCLONE Bulletin No. ……. Issued by Area Cyclone Warning Centre ……. at……. hrs. IST on ……

Warning for …….. (districts)
The ……..storm over ……. (section of the sea area) moved ……. (direction) and lay centred at …….. hrs. IST of …… about ……. Kms. …….. (direction) of ……. (place). System expected to move in a ……. direction and cross ……. coast near ……. (place) around ……. (time of the day) of ……. (date)

After landfall the system is likely to maintain cyclone intensity for another ……. hours and weaken gradually. Under its influence heavy to very heavy rainfall at most places is likely to commence over ……. (interior districts) districts from ……. date/time Gale speed reaching …….. kmph also likely to prevail in these districts from …….. date/time for another ……. hours.

Damage expected for interior districts (Extract from Appendix 1)

NOTES :

a] In the bulletins for **general public** only information about "Expected damage" should be given, as the portion relating to "suggested action" will lead to confusion.

b] In the bulletins issued to Chief Secretaries, Collectors of maritime districts and other agencies under 4-stage warning system, **both these information may be included**. All these officials may be informed about the new procedure through correspondence and personal briefings during the pre-cyclone preparedness meetings.

c] The post-landfall outlook bulletin is to be issued by ACWC/CWCs 12 hours before the estimated landfall. The main idea of issuing post-landfall outlook is to bring to the notice of the collectors of interior districts that the districts are likely to be affected by the Cyclone, in the 'cyclone warning' phase, well in advance. At this time collectors of all maritime districts likely to be affected by the cyclone are already in the warning phase and will continue to receive numbered cyclone warning bulletins. Hence, post landfall outlook bulletins are not meant for them. Warnees in maritime districts will continue to get numbered cyclone warning bulletins till the system move away or weaken.

d] When post-landfall outlook bulletins are issued to cover interior districts, the Chief Secretary of concerned maritime states will also be informed, through cyclone warning bulletins issued to them, that a few interior districts are also included in the warning phase.

e] In the cyclone bulletins issued for the general public through media (AIR/DD), appropriate warnings for strong winds and heavy rainfall for interior districts will also be included.

f] The post landfall outlook issued for interior districts may be upgraded or downgraded, depending on the system intensity and its future track.

g) The final bulletins issued to 4-stage Warnees (maritime/interior) will be "de-warning message".

Appendix I

System Intensity	Damage Expected	Suggested action
Deep Depression (28-33 kts or 52-61 kmph)	Minor damage to loose and unsecured structures	Fishermen advised not to venture into the open seas.
Cyclonic Storm (34-47 kts or 62-87 kmph)	Damage to thatched huts. Breaking of tree branches causing minor damage to power and communication lines.	Total suspension of fishing operations.
Severe Cyclonic Storm (48-63 kts or 88-117 kmph)	Extensive damage to thatched roofs and huts. Minor damage to power and communication lines due to uprooting of large avenue trees. Flooding of escape routes.	Total suspension of fishing operations. Coastal hutment dwellers to be moved to safer places. People in affected areas to remain indoors.
Very Severe Cyclonic Storm (64-90 kts or 118-167 kmph)	Extensive damage to kutcha houses. Partial disruption of power and communication lines. Minor disruption of road and rail traffic. Potential threat from flying debris. Flooding of escape routes.	Total suspension of fishing operations. Mobilise evacuation from coastal areas. Judicious regulation of rail and road traffic. People in affected areas to remain indoors.
Very Severe cyclonic Storm (91-119 kts or 168-221 kmph)	Extensive damage to kutcha houses. Some damage to old buildings. Large-scale disruption of power and communication lines. Disruption of rail and road traffic due to extensive flooding. Potential threat from flying debris.	Total suspension of fishing operations. Extensive evacuation from coastal areas. Diversion or suspension of rail and road traffic. People in affected areas to remain indoors.
Super Cyclone (120 kts or more or 222 kmph or more)	Extensive structural damage to residential and industrial buildings. Total disruption of communication and power supply. Extensive damage to bridges causing large-scale disruption of rail and road traffic. Large - scale flooding and inundation of sea water. Air full of flying debris.	Total suspension of fishing operations. Large-scale evacuation of coastal population. Total suspension of rail and road traffic in vulnerable areas. People in affected areas to remain indoors.

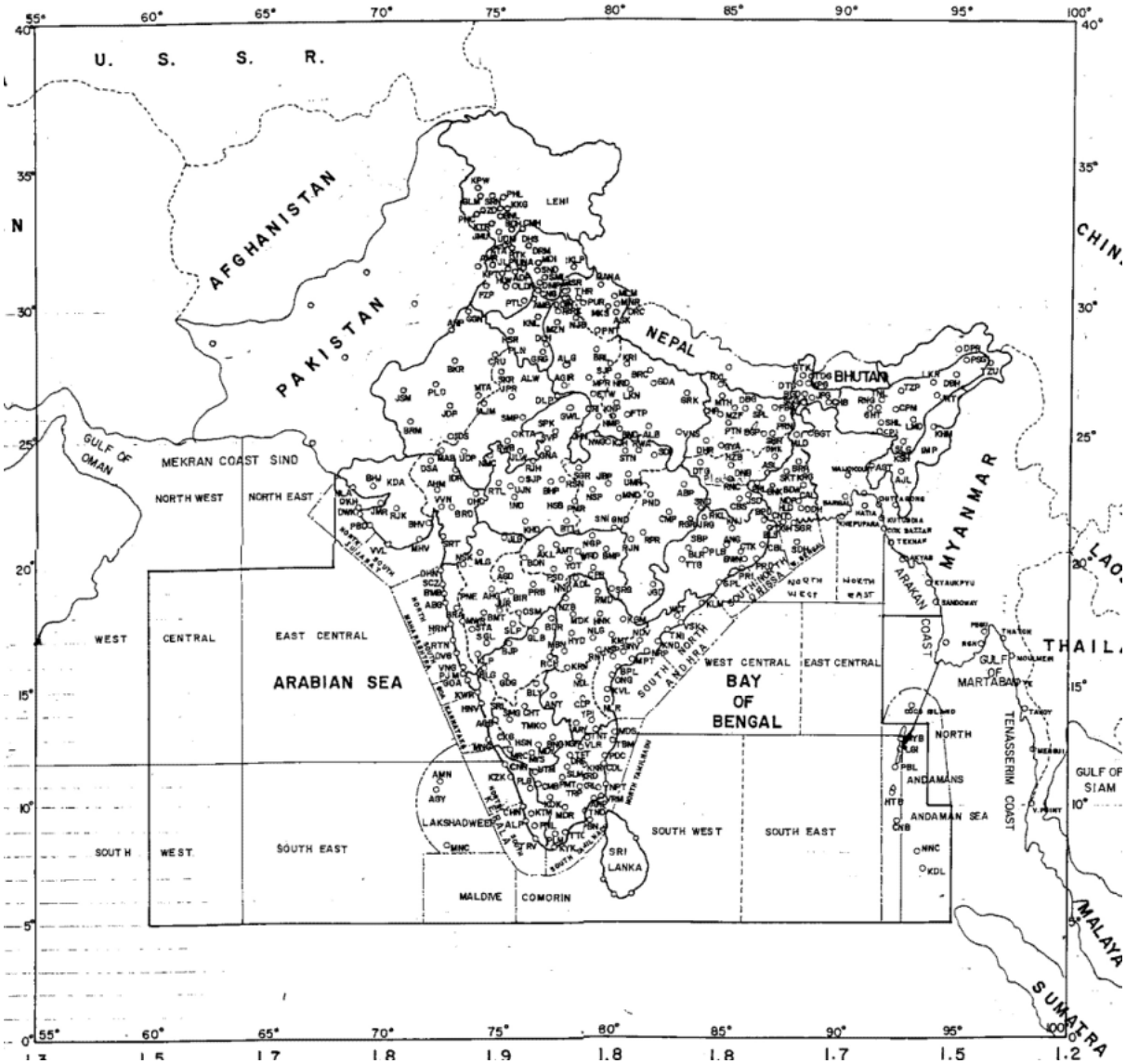
6.7 UNIFORMITY IN MAINTAINING THE INTENSITY AND POSITION OF THE SYSTEM.

IMD operates at various points like RMCs, MCs, ACWCs and CWCs. Officials of these centres have to interact with other officials at their levels. There is a need to have complete uniformity in bulletins issued from various centres. This could be achieved through brief telephonic consultation. However, if a consensus view cannot be arrived at, then H.Q.'s view would prevail. Information of local interest may, however, be added by ACWCs/ CWCs/ MCs/ RMCs in their own bulletins, if necessary.

All the concerned officers & Duty AM.II's may kindly note the above recommendations of AMR-2000 held at Ahmedabad for necessary action.

Sd/
(D. S. Desai)
Director

6.8 MAP SHOWING THE SEA AREA BOUNDARIES



6.9 INSTRUCTIONS FOR RMCS / MCS FOR ISSUANCE OF SPECIAL WEATHER BULLETINS WHEN THERE IS AN INTENSE LOW PRESSURE SYSTEM OVER LAND.

FORECASTING CIRCULAR NO. 1 / 2004

Kindly refer to W.P. NO. 2.1 and Rec. No. 3 of ACR – 2004. All RMCs / MCs are advised to follow the following set of instructions.

1. When there is a low pressure system as intense or higher than that of a depression over land, the concerned RMCs should track the system in consultation with O/o DDGM (WF), Pune and HQrs New Delhi, until it weakens into a low pressure area.
2. They should advise the concerned state government either directly or through respective MCs for special actions to be taken, I f any.
3. Special bulletins should be issued on the basis of 03, 09, 12 & 18 UTC charts – 4 bulletins per day – till the weakening of the system into a low pressure area.
4. The system intensity over land may be fixed as per the procedures indicated in DDGM (WF) UOI No. W – 72002 / 2244 to 2255 Dated. 30 April 2004; which are reproduced here for ready reference.
   (i) The upper winds, at 0.9 km a.s.l. central pressure, pressure departure, satellite or radar data are not always consistent with the system intensity.
   (ii) The system intensity over land is to be defined solely based on the number of closed isobars at the intervals of 2 hPa within 3^{o} radius from the centre of the low pressure system as classified below:
      (a) Low pressure area 1
      (b) Depression 2
      (c) Deep Depression 3 – 4
      (d) Cyclonic Storm 5 and above
   (iii) As regards the other land systems, viz., western disturbances, the criteria for classifying the system remains the same as per the FMU Manual Part III 1.1 under western disturbances. Accordingly, when two or more closed isobars at 2 hPa intervals are discernible on the sea level chart, the disturbance may be described as a Western Depression.

These instructions may be put into practice with effect from the date of issue of this circular.

(N. Jayanthi)

DDGM (WF)

DDGM(WF) UOI No.W-72002/ Pune-5.Dt.the April, 2004

7. LOCAL FORECAST

7.1 TO ISSUE LOCAL FORECAST IN USER FRIENDLY LANGUAGE.

Forecasting Circular No.1/2000

1. Introduction :

Many forecasting offices of the India Meteorological Department are supplying local forecasts for important cities to the public and different agencies through Press and Media. In the recent years the demand for such forecasts have increased many folds. This indicates that the public and different agencies are becoming more and more weather conscious and are taking increasing interest in the local weather conditions and the forecasts as they find them useful in their day to day activities. Considering the different types of users which cover a large canvas of our society, the subject of local forecast was discussed in detail in the 11th Annual Monsoon Review (AMR) meeting, held from 23rd to 25th February 2000 at Ahmedabad. Keeping in view the large canvas of the users, the AMR attempted to make our local forecasts user friendly. In persuance of the recommendations of the AMR, it has been decided to use clear and unambiguous terminologies for issuing the local forecast, so that the users can understand the forecast and derive benefits from it.

In local forecast, whenever any weather phenomenon is expected, its intensity, frequency and time of occurrence is indicated. In the absence of a weather phenomenon, the local forecast describes anticipated sky conditions. The other parameters for which the local forecast issued include, maximum temperature and/or minimum temperature, rainfall, wind and special phenomenon. Detailed instructions for issuing local forecast for different parameters are given below.

2. Temperature :

Information on maximum temperature will be indicated during April to June (till onset of monsoon)or minimum temperature during the period November to February and both maximum and minimum during March and October (after withdrawal of monsoon). Temperature description need not normally be given during monsoons (southwest and northeast), but on occasions when due to subdued monsoon, the maximum and minimum temperatures deviate much from normal, temperature description may be given. However, local forecast for maximum temperature during winter can also be indicated in addition to minimum temperature if forecasters feel that such a forecast will help the users. For example, in Delhi there are some days during December when minimum temperature over Delhi is 8^{O} C and maximum temperature is between 12 to 15^{O} C. In such situations forecast for maximum temperature is equally important. Similarly, during summer if forecasters feel that minimum temperature is important, local forecast for minimum temperature during summer may be issued in addition to local forecasts for maximum temperature. As the

public is interested to know about the fluctuations in temperature in summer or winter, the temperature trends viz. slight fall/ rise, significant fall/ rise etc may be indicated in local forecast.

The terms day (night) temperature and maximum (minimum) temperature are to be used in the context described below:

2.1 Maximum Temperature:

At present the change in maximum temperature is forecast in six categories; namely little change (-1^{O} C to +1^{O} C), rise (2^{O} C), appreciable rise (3^{O} C to 4^{O} C), marked rise (5^{O} C to 6^{O} C), large rise (7^{O} C or more). Keeping the forecast procedure same, the forecast for these categories may be described as given below:

Forecast for maximum temperature following present procedure	**Forecast to be issued**
Little change (-1^{O} to +1^{O} C)	Maximum temperature will be around T^{O} $\pm$ 1C. (where T indicates the today's maximum temperature in degrees Celsius).
Rise / Fall (2^{O} C)	Maximum temperature will be around (T $\pm$ 2 or 3^{O})C.
Appreciable rise/ fall (3^{O} to 4^{O} C)	Significant Rise/ Fall in day temperature and maximum temperature will be around (T $\pm$ 4, 5 or 6 ^{O})C.
Marked rise/ fall (5^{O} to 6^{O} C)	
Large rise/ fall (7^{O} C or more)	Large Rise/ Fall in day temperature and maximum temperature will be around T $\pm$ 7^{O} C or more.

(**Reference** : Recommendation No.10 of 11th AMR.2000).

2.2 Minimum temperature :

Forecast for minimum temperature following the present practice	**Forecast to be issued**
Little change (-1^{O} to +1^{O} C)	Minimum temperature will be around M + 1^{O}C. (M indicates the today's Minimum temperature in degrees Celsius).
Fall/ Rise (2^{O} C)	Minimum temperature will be around (M $\pm$ 2 or 3)^{O}C.
Appreciable fall/ rise (3^{O} to 4^{O} C)	Significant Fall/ Rise in night temperature and minimum temperature will be around (M $\pm$ 4 or 5 or 6)^{O}C.
Marked fall/ rise (5^{O} to 6^{O} C)	
Large fall / Large rise (7^{O} C or more)	Large Fall/ Rise in night temperature and

	minimum temperature will be around (M $\pm$ 7 or more)^{O}C *.

(**Reference:** recommendation No.10 of the 11th AMR, 2000).

* Detailed instructions are given in item 9.

3. Rainfall :

For indicating rainfall forecast, following terminologies may be used.

Rainfall amount in mms	**Plotted on charts as**	**Descriptive term used.**
0.0		No rain*
0.1 to 2.4	. . .	Very light rain
2.5 to 7.5	-	Light rain
7.6 to 15.5	1	Moderate rain
15.6 to 24.4	2	
24.5 to 35.5	3	
35.6 to 44.4	4	Rather heavy
44.5 to 55.5	5	
55.6 to 64.4	6	
64.5 to 75.5	7	Heavy rain
75.6 to 84.4	8	
84.5 to 95.5	9	
95.6 to 104.4	10	
104.5 to 115.5	11	
115.6 to 124.4	12	
$\geq$ 124.5 to 244.4	13 to 24	Very heavy rain
$\geq$ 244.5	$\geq$ 25	Extremely heavy rain
when the amount is a value near about the highest recorded rainfall at or near the station for the month or season. However, this term will be used only when the actual rainfall amount exceeds 12 cm.		Exceptionally heavy rain.

The amounts for heavy and untimely rainfall warning will be determined by the requirements of the individual warnees. Incases where the requirements of warnees are available in inches, corresponding whole cms may be taken.

*** Note :** "no rain" should strictly relate to occasions of zero rainfall at all reporting stations.

(**Reference :** Technical Circular Forecasting No.23 dated the 29th December 1956 as amended on 1st June 1971).

4. Wind :

For indicating forecast wind, following terminologies may be used

Strong winds or gusty winds of speed _____ kmph etc. may be appended.

Example :

(i) Thunderstorm in the evening accompanied with strong winds speed reaching _____kmph.

(ii) Rainfall during most parts of the day accompanied with gale winds speed reaching _____ kmph will occur.

(iii) A steep pressure gradient causing strong winds speed reaching _____ kmph in the afternoon/ evening etc.

(iv) Gusty surface winds speed reaching _____ kmph etc.

(**Reference** :Forecasting circular 1969/6 issued dated 3rd Nov.1969, W-39601/).

5. State of Sky :

For describing sky conditions, following terminologies may be used

Forecast for State of Sky (Octa)	Forecast to be issued
0	Clear sky
1-2	Mainly clear
3-4	Partly cloudy
5-7	Generally cloudy
> 7	Cloudy

6. Any other phenomenon:

Following terminologies may be used for describing different phenomenon.

(i) occurrence of mist/ haze in the morning.

(ii) Fog/ mist in the early morning leading to poor visibility.

(iii) Smog towards afternoon/ evening.

(iv) Poor visibility due to thick fog/ dense fog.

(**Reference :** Forecasting circular 1969/6 dated 3rd Nov.1969, W-39601/.)

7. Description of day :

For this purpose terminology like sunny day, sultry day and humid day may be used in the local forecast .

(Reference : *Recommendation No.10 of the 11th AMR, 2000.)*

8. Issue of local forecast:

In 24 hours, the local forecast is issued at 4 times. The first local forecast is issued in the early morning at about 0700 hrs IST based on 2100 and 0000 hrs UTC charts.

The second local forecast is issued at about noontime everyday based on 0300 UTC charts. This is published in the Daily Weather Summaries, Regional Weather Summaries. This is given to the Public, Press and all the users.

The third local forecast is issued at about 1730 hrs IST based on 0900 hrs UTC charts.

The fourth Local forecast is issued at about 2100 hrs IST based on 1200 UTC charts. This is again issued to the users, All India Radio and the press.

9. Format for issuing local forecast:

In local forecast, Maximum/Minimum temperature (depending upon the month) and other parameters like clouds, rainfall etc may be indicated as given above. The forecasters can use his discretion and ingenuity to frame the language of the forecast but he should ensure that all features of the local forecast are properly represented. However, in respect of maximum/minimum temperature the following format may be used. For example

(i) Local forecast issued at noontime on Sunday, the 26th March, 2000 based on 0300 hrs UTC charts

"Mainly clear skies, Maximum and Minimum temperatures will be around 39^{O} C and 20^{O} C respectively on Monday" or "Mainly clear skies; maximum and minimum temperatures will be around 39^{O} C and 20^{O} C respectively" (This means that minimum temperature likely to be realised on Monday early morning will be 20^{O} C and Maximum temperature likely to be realised on Monday afternoon will be 39^{O} C).

(ii) Local forecast issued at 1730 hrs IST on Sunday, the 26th March 2000 based on 0900 hrs UTC charts.

Same as given above in (I)

(iii) Local forecast issued at 2100 hrs IST on Sunday, the 26th March 2000 based on 1200 hrs UTC charts.

"Mainly clear skies; Maximum temperature will be around 39^{O} C on Monday, and Minimum temperature will be around 20^{O} C on Tuesday" or mainly clear skies; Maximum temperature on Monday and minimum temperature on Tuesday will be around 39^{O} C and 20^{O} C respectively.

(iv) Local forecast issued at 0700 hrs IST on Monday the 27th March based on 2100 and 0000 hrs UTC charts.

"Mainly clear skies; Maximum temperature will be around 39^{O} C on Monday and minimum will be around 20^{O} C on Tuesday" or mainly clear skies; maximum and minimum temperatures will be around 39^{O} C and 20^{O} C respectively.

10. Verification of local forecast:

An area of 50 km radius around a city may be used for verification of local forecast.

Maximum/Minimum temperatures and other elements are forecast in the local forecast. Local forecast issued, based on 0300 UTC charts is verified with the observed maximum/minimum temperature and other parameters of the next day. For example, local forecast issued on 10^{th} for maximum and minimum temperature and other elements is verified with the minimum temperature attained on 11^{th} morning and maximum temperature attained on 11^{th} afternoon and other elements realised on 11^{th}.

Local forecast issued in the night for maximum/minimum temperature and other elements is verified with the maximum temperature and other elements realised on the next day and the minimum temperature for the next to next day. For example: verification of local forecast for maximum/minimum temperature and other elements issued on 10^{th} is verified with maximum temperature and other elements realised on 11^{th} and minimum temperature realised on 12^{th} forenoon.

All the forecasting offices (RCs and MCs through RCs) may send the verification of second and fourth local forecasts (one based on 0300 UTC and other based on 1200 UTC charts) to the office of DDGM(WF) quarterly.

11. These instructions will come into force with effect from 1-5-2000.

Note : This circular supercedes all the previous circulars issued on the local forecasting terminologies.

Sd/
(V. Thapliyal)
D.D.G.M (WF)

7.2 COMFORT INDEX, BASED LOCAL FORECAST

Forecasting Circular No. 2/2004

As per the recommendation 11 of Annual Monsoon Review Meeting 2004 held at Kolkata on 19 Jan. 2004, it has been decided to replace the mere descriptions of maximum and minimum temperatures in weather reports and daily weather summaries by suitable comfort index, based on temperature and humidity as described below with reference to issuance of local forecast at forecasting centres.

1. Present procedure of issuing local forecast for meteorological parameters including heat and cold waves is to continue.

2. In addition to the above forecast, supplementary forecast based on human discomfort utilizing the Heat Index (HI) may be introduced on a trial basis for one year (HI chart enclosed for ready reference).

3. The HI is to be calculated based on the forecast maximum temperature and the forecast relative humidity. Suggested criteria and terminology for issuing human discomfort information are given below. For day time, the criteria will be considered only when departure of maximum temperature is above $2^{o}C$.

Range of HI (^{o}C)	RH (%)	Terminology
40 – 54	≤ 70	Uncomfortable hot day / night
	> 70	Uncomfortable sultry day / night
> 54	≤ 70	Highly uncomfortable day / night
	> 70	Highly uncomfortable sultry day / night

4. Regarding discomfort due to low temperatures during winter season, the present criteria using the wind chill index may continue.

5. The usage of issuing discomfort forecast will be reviewed after one year based on the feed back from users.

The research section of each RMCs may in addition, evaluate the utility of other indices such as Thom's Temperature – Humidity Index, Webb's Comfort Index etc. with respect to the stations under their RMCs, which issues local forecasts and may also suggest modifications if any with reference to the local needs

These instructions supercede the earlier instructions in the matter.

Kindly acknowledge receipt.

(Jayanthi N.)
D.D.G.M.(W.F.)

DDGM(WF) UOI NO. W-630(AMR)/ Dt. Pune-5;The August 2004

HEAT INDEX °F (°C)

	RELATIVE HUMIDITY (%)												
Temp	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
110 (17)	136 (68)												
108 (13)	130 (64)	137 (68)											
106 (41)	124 (51)	130 (54)	137 (58)										
104 (40)	119 (48)	124 (51)	134 (55)	137 (58)									
102 (39)	114 (46)	119 (48)	124 (54)	130 (64)	137 (68)								
100 (38)	109 (43)	114 (46)	118 (48)	124 (51)	129 (54)	136 (58)							
98 (37)	105 (41)	109 (43)	113 (45)	117 (47)	123 (51)	128 (53)	134 (57)						
96 (36)	101 (38)	104 (40)	108 (42)	112 (44)	116 (47)	121 (49)	126 (52)	132 (56)					
94 (34)	97 (36)	100 (38)	103 (39)	106 (41)	110 (43)	114 (46)	119 (48)	124 (51)	129 (54)	136 (57)			
92 (33)	94 (34)	96 (36)	99 (37)	101 (38)	106 (41)	108 (42)	112 (44)	116 (47)	121 (49)	126 (52)	131 (55)		
90 (32)	91 (33)	93 (34)	95 (35)	97 (36)	100 (38)	103 (39)	106 (41)	109 (43)	113 (45)	117 (47)	122 (50)	127 (53)	132 (56)
88 (37)	88 (31)	89 (32)	91 (33)	93 (34)	95 (35)	98 (37)	100 (38)	103 (39)	106 (41)	110 (43)	113 (45)	117 (47)	121 (49)
86 (30)	86 (29)	87 (31)	88 (31)	89 (32)	91 (33)	93 (34)	95 (35)	97 (36)	100 (38)	102 (39)	106 (41)	108 (42)	112 (44)
84 (29)	83 (28)	84 (29)	85 (29)	86 (30)	88 (31)	89 (32)	90 (32)	92 (33)	94 (34)	96 (36)	98 (37)	100 (38)	103 (39)
82 (28)	81 (27)	82 (28)	83 (28)	84 (29)	84 (29)	86 (29)	86 (30)	88 (31)	89 (32)	90 (32)	91 (33)	93 (34)	95 (35)
80 (27)	80 (27)	80 (27)	81 (27)	81 (27)	82 (28)	82 (28)	83 (28)	84 (29)	84 (29)	85 (29)	86 (30)	86 (30)	87 (31)

Category	**Heat Index**	**Possible heat disorders for people in high risk groups**
Extreme Danger	**130°F or higher (54°C or higher)**	**Heat stroke or sunstroke likely**
Danger	**105 -129°F (41 - 54°C)**	**Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/ or physical activity.**
Extreme Caution	**90-105°F (32-41°C)**	**Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.**
Caution	**80 - 90°F (27 – 32°C)**	**Fatigue possible with prolonged exposure and/or physical activity.**

7.3. LOCAL FORECAST TERMINOLOGY

Relevant portion of the minutes of meeting on Local Forecast held in "MAUSAM BHAVAN" New Delhi on 12 December 1990.

Terminology :

The working paper on terminology was circulated earlier by DDGM(WF) to all concerned. DGM said that the terminology should be clear and unambiguous so that public would understand it without any confusion. Dr. N. Sen Roy, ADGM(S) said that we cannot codify the terminologies but at the same time we should have innovations to make them more meaningful. Many participated in the discussions :

(i) Use of words like 'Chance' or 'Likely' be avoided in the local forecasts. Instead, the following terminology be used :

Probability of occurrence	Terminology to be used in the forecasts
< 25%	Could occur
26% - 50%	May occur
51% - 75%	Would occur
76% - 100%	Will occur

Action by all FOs

(ii) DDGM (WF) will circulate the instructions on terminology on Local Forecasts to all concerned immediately. If in any of these circulars, the word 'Chance' appears, then it may be replaced by another suitable word by DDGM(WF) in consultation with ADGM(S), whenever necessary.

Action by DDGM (WF)

(iii) In the weather bulletins statements like 'Data meagre', 'Data absent' etc. should not be used.

Action by all FOs

(iv) All RCs/ MCs may prepare terminologies for local forecast appropriate to their stations immediately and send to DDGM (WF).

These terminologies may be tried at their stations with immediate effect and monitor feedback from the press/ public/ media after every three months. Final terminologies can be prepared after one year in consultation with DDGM(WF)

Action RC/ MC/ DDGM(WF)

Expression of probability of forecast in percentage

The topic regarding appending of local forecast with probability of its occurrence so that public can plan their activities accordingly, like arranging a function or picnic etc. was discussed. Dr. N. Sen Roy, ADGM(S) opined that the public will get misguided and may misinterpret the forecast since they are not educated on the subject of probabilities. DGM and other delegates also agreed to this view.

Verification of Local Forecast

The working paper on 'Local forecast' containing all aspect of verification was discussed and many delegates participated in the discussion.

The following decisions were taken:

(i) An area of 50 km radius around a city may be used for verification of Local Forecast.

8. FORECAST VERIFICATION

8.1. OLD CIRCULAR ON FORECAST VERIFICATION

The subject of verification of forecasts was discussed by the Director's Conference – October 1955 where it was agreed that the initial checking of all forecasts should be done at the issuing centres, while the subsequent stages of checking of smaller percentage of forecasts would be the responsibility of higher offices like the offices of R.Ds. or D.D.G.F.

In accordance with the above recommendation of the Director's Conference, it has now been decided to have the stages of verification as in enclosure I. In each of the four seasons of the year, DDGF's office will select some seven (not necessarily consecutive) days for which the issuing offices will check all the forecasts issued during the period on the basis of objective criteria for which detailed instructions are enclosed (Encl.II). R.D. or D.D.G.F. as the case may be, will carry out a 40% check on these evaluations be the issuing offices, thereby ensuring uniform standard in the verification by the issuing officers.

D.D.G.F. will receive the reports from each Regional Centre and consolidate the material into a single report.

Soon after the end of the season, D.D.G.F's office will intimate the dates for which verification may be carried out by the issuing offices. The offices concerned should complete the verification within two months and submit the result to the R.D. or D.D.G.F. as per Enclosure I. After applying the 40% check, the R.Ds may forward the consolidated results in respect of all offices under them to D.D.G.F. Pune after averaging them for the region as a whole within the following two months, so that D.D.G.F's office would get the results of verification of forecasts for a particular season within at most five months after the end of the season. Results for the last season viz. The Post-monsoon October – December, may be accompanied by the annual averages in respect of each office. The format for tabulating the results of verification by each of the issuing offices and the RCs is given Encl. III. The time schedule is given in Encl. IV.

In addition to the above, DDGF's office will carry out a random assessment of critical situations. Two day's forecasts (all kinds) issued by the different offices will be called for, for each season, either for two situations or for two consecutive days of the same situation, and with the help of his different sections and the Director, Agrimet carry out the verification. The aim in this verification will be to examine whether the performance of each centre has been upto the standards possible under the existing circumstances.

The scheme is to be effected from this year itself. The dates for the winter and hot weather seasons for which verification may be carried out are being communicated separately. As a special case, the verification for both these seasons may be completed by the issuing offices by October and the results communicated to D.D.G.F. by the RCs by the end of December 1956.

Enclosure I

STAGES OF VERIFICATION OF FORECASTS

Type of forecast	Verification (Issuing Officer)	40% check on the verification to be carried out by
Inferences	MMO or Regional F.O. W.S. Poona	R.D. D.D.G.F.
F.W.B., Out-look, Warnings to farmers, Heavy Rainfall Warnings and Frost Warnings to farmers and others	M.M.O or Regional F.O.	R.D.
Sea bulletins and Port Warnings	M.M.O. or Regional F.O.	R.D.
Local forecasts including Airfield warnings and A.I.R. bulletins	D.M.O. M.M.O. W.S., Poona	M.M.O. R.D. D.D.G.F.
Route forecasts	D.M.O. M.M.O.	M.M.O. R.D.
Area forecasts and F.I.R. warnings	M.M.O.	R.D.

Enclosure II

Rules for verification of forecast

Contents

1. General
2. Criteria.
3. Forecast.
4. Modification to a forecast.
5. Aviation forecasts.
6. Regional forecasts and All India Weather Summary.
7. Farmer's Weather Bulletin
8. Outlook for Farmers.
9. Heavy Rainfall Warning issued to parties on the warning list.
10. Temperature Warnings issued to parties on the warning list.
11. Forecasts for sea areas.
12. Port Warnings.
13. Local forecasts issued to public (non-aviation).

Appendix : Stages of meteorological element and allotment of marks for verification of forecast.

RULES FOR VERIFICATION OF FORECASTS

1. General :

These shall be called as "Rules for verification of Forecasts". Amendments to these rules shall be issued under the heading "Amendment No. to the Rules for Verification of Forecasts".

1.1. Some of the specifications in these rules may not be identical with the specifications adopted by the Department for other purposes. These rules are applicable only for purpose of "Verification of Forecasts".

2. Criteria :

By suitable tests a forecast is placed in one of the three categories :

(a) Correct

(b) Partially correct

(c) Wrong

2.1 If a forecast has to be verified in parts, each part of it is placed in one of the three categories and marks assigned as shown below :-

Correct - 100%

Partially correct - 80%

Wrong - 0%

Marks for different constituent parts are then added up and the forecast as a whole judged by the following standard of aggregate score :-

Correct - If aggregate score is 90% or more;

Partially correct - If aggregate score is between 40% and 89% or equal to 40%;

Wrong - if aggregate score is less than 40%.

2.2 The Range of variation of a forecasted element is divided into different stages (Appendix). A forecast or a portion thereof is considered 'Correct' if the realised weather lies in the same stage; as the forecasted weather is 'Partially Correct' if out by one stage'; otherwise it is wrong. It is considered that with available observation can place the realised weather in one or the other category with reasonable confidence.

2.3 In each forecast of occurrence of weather elements (WW), marks are to be allotted in terms of the confidence expressed in the qualifying statement, specified in the following table.

2.4

Expression of confidence	Forecast materialised	Forecast not materialised
1. Unqualified	100%	20%
2. Likely, probabilities of occurrence (30%-70%)	80%	40%
3. Slight chance, possibility, may occur	60%	60%

Weather element not forecasted – 0% if it occurs.

2.5 Unless there are specific office orders to the contrary, a forecaster is supposed to forecast all the elements printed on standard forms. By omission of any item he loses marks.

If, however, some elements are to be omitted by prior arrangement, the total marks on the forecast are redistributed amongst other elements in proportion to the marks they are already carrying.

3. Forecast :

If one and the same forecast is issued to more than one party, it will be considered only as one forecast.

A forecast not given in writing but duly logged in the forecaster's log-book is also considered as a forecast.

4. Modification to a forecast :

In case of modification to a forecast, both the original forecast and the modification are to be assessed as two independent forecasts.

5. Aviation Forecasts :

These are divided into three classes.

(a) Route Forecasts, including flight forecasts, issued in code or plain language.

(b) Aerodrome forecasts and local forecasts in code or plain language including those for selected elements such as airfield warnings. [A local forecast, generally supplied to the local ATC., is supposed to cover an area of 100 kms (54 nautical miles) around the Forecasting Office, unless otherwise stated].

(c) Area forecasts including FIR warnings in code or plain language.

5.1 Route forecast

5.1.1 Sections of a route forecast carry marks roughly proportional to the distance covered by each section.

5.1.2 Each element is to be judged irrespective of other elements.

5.2 Aerodrome forecasts and local forecasts (Aviation)

5.2.1 The period of a local forecast is divided into 'unit' periods consisting of six hours. A forecast is supposed to spread over one unit period if it covers six hours or less over two

unit period if it covers one unit period if it covers six hours or less, over two unit periods if it covers more than six hours but not more than twelve hours, and so on,

Equal marks are assigned to each unit period, assessment being made for each unit period separately, if no specific mention is made in the local forecast about the variation of a forecasted element, the forecast is supposed to be the same for all unit periods.

5.3 Area Forecasts (Aviation)

5.3.1 An area forecast is to be judged as a whole. Sub-divisions of area, if any, carry marks roughly proportional to their area.

6. Regional forecasts and All India Weather Summary

6.1 The country is divided into Meteorological sub-divisions and forecast for each sub-division is regarded as a separate forecast.

6.2 During the winter and the summer 70% marks are to be allotted for precipitation forecasts and the other 30% temperature forecasts. Whenever specific temperature forecast are not mentioned in these seasons, all the marks will be allotted to the precipitation elements.

If heavy rain (3" or more as plotted on a chart) occurs in an area, and no heavy rain has been indicated, subtract 10% of the marks.

6.3 'Heavy Rainfall" and 'Low Temperature' warnings are considered as part of weather and temperature forecasts respectively.

7. Farmers Weather Bulletin

Remarks under 6.1, 6.2 and 6.3 apply for these forecasts also.

8. Outlook for Farmers

Same procedure as for Regional forecasts in para 6.

9. Heavy rainfall warning issued to parties on the warning list

9.1 Warning issued to each party is considered as a separate forecast.

9.2 When the area of a warnee is of the order of a circle with radius 100 kms or less, the element or spatial distribution of the forecast, if given, is not assessed.

9.3 When the area of a warnee is more than that of a circle with radius 100 kms, the forecast is to be verified in respect of both intensity and distribution.

10. Temperature warnings issued to parties on the warning list

10.1 Warning issued to each party is considered as a separate forecast.

11. Forecasts for sea areas (sea bulletins)

11.1 A sea bulletin is to be judged as a whole. Sub-divisions of the sea, if any, carry marks roughly proportional to their area.

11.2 Marks allotted to various elements in a merchant shipping bulletin are :

Wind	- 40
Weather	- 40
Visibility	- 20

11.3 Marks allotted to various elements in a fleet forecast are:-

Wind - 60

Visibility - 40

12. Port Warnings

12.1 Warning issued to each party is considered as a separate forecast.

12.2 For purpose of verification, weather occurring within a radius of 100 kms extending into the sea may be considered as the weather occurring at the port.

12.3 A forecast is considered 'correct' when the forecasted weather occurs in the same category as the actual weather; it is 'Partially Correct' when the forecasted weather differs by one category from the realised weather. Otherwise the forecast is deemed wrong.

12.4 For the purpose of this assessment, Distant Signals Nos. 1 and 2 (Arabian Sea and Bay of Bengal) as also the signals of extended System in Bay of Bengal are not regarded as forecasts.

13. Local forecast issued to public (Non-aviation)

13.1 The forecast is supposed to have been made for a radius of 100 kms (54 nautical miles) around the forecasting office.

13.2 For the purpose of weather, the period of validity of a local forecast is to be divided into two units, one lasting till dawn of the next day and the other for the remainder of the period of validity. Each unit is to carry equal weightage. For the time variation the forecast may be classified as :-

(a) Mostly continuous or intermittent – some rain during every 2 hour period.

(b) Occasionally, at times – some rain every six hour period.

(c) Temporary, a few, one or two – one or two showers during the period specified.

As often specified, when the weather realised, is one stage out, it is "Partially Correct", and becomes "wrong" when out by two stages.

50% marks are allotted to weather and 50% to temperature when both the elements are forecasted. When 'Weather' alone is forecasted, 100% marks are allotted to that element only. Of the marks allotted to "Weather", 50% are to be given for 'Occurrence" and 50% for 'time variation'.

APPENDIX TO "RULES FOR VERIFICATION OF FORECASTS"

Stages of Meteorological elements and allotment of marks for verification of forecasts

Marks

1. Route forecasts (aviation)

1.1 Upper wind

1.1.1 Direction **20**

(i) 'Correct' when the forecasted direction differs from the actual direction by 30^{O} or less;

(ii) 'Partially Correct' when it is out by more than 30^{O} but by less than 50^{O} ;

(iii) 'Wrong' when it is out by 50^{O} or more.

1.1.2 Speed **10**

(i) 'Correct' when the forecasted speed differs from the actual speed by 10 kts or less;

(ii) 'Partially Correct' when it is out by more than 10 kts but by less than 20 kts;

(iii) 'Wrong' when it is out by more than 20 kts.

If a range of wind has been indicated, the mean value is to be taken as the forecasted value.

Note :- (i) When the direction is out by more than 90^{O}, the speed is considered as 'Wrong' except when both the forecasted and actual wind speeds are less than 10 kts.

(ii) When the actual wind speed is more than 60 knots the above mentioned ranges for speed should be 15 knots and 30 knots.

1.2 Upper air temperatures **5**

(i) 'Correct' when the difference between the forecasted temperature and the actual is 3^{O}C or less;

(ii) 'Partially Correct' when it is out by more than 3^{O} C but less than 6^{O} C;

(iii) 'Wrong' when out by $6\ ^{O}$C or more.

Note: When the actual temperatures are less than $-30\ ^{o}$ C, the above ranges should be doubled.

1.3 Clouds The stages for assessment of the forecasts will be as follows (Vide para 2.2 of Criteria).

1.3.1 Low clouds.

1.3.1.1 Height of base. **4**

(i) Less than 150 meters (500ft)

(ii) 150 m – 299 metres (500 – 999 ft)

(iii) 300 m – 599 metres (1000 – 1999 ft)

(iv) 600 m – 1199 metres (2000 – 3999 ft)

(v) 1200.m – 2400 metres 4000 - 8000 ft)

1..3.1.2 Height of tops **4**

(i) Less than 1800 metres (6000 ft)

(ii) 1800 metres – 2999 metres (6000-9999 ft)

(iii) 3000 metres – 4999 metres (10000 – 16400 ft)

(iv) 5000 metres or more (16500 ft or more)

1.3.1.3. Amount **5**

(i) 0 – 2/8

(ii) 3 – 5/8

(iii) 6 – 8/8

1.3.2 Medium clouds.

1.3.2.1 Height of base. **2**

(i) Less than 3600 metres (12000 ft)

(ii) 3600 metres – 4999 metres (12000 – 164000 ft)

(iii) 5000 metres or more (16500 ft or more)

1.3.2.2 Height of tops. **2**

(i) 3600 metres – 4999 metres (12000 – 16400 ft)

(ii) 5000 metres – 6000 metres (16500 – 20000 ft)

(iii) More than 6000 metres (20000 ft)

13.3.2.3. Amount. **3**

(i) 0 – 2/8

(ii) 3 – 5/8

(iii) 6 – 8/8

1.4 Surface visibility. **10**

(i) Less than 1 Km (less than ½ n. Mile)

(ii) 1 to 2 Kms (½ - 1 n. mile)

(iii) 2 to 6 Kms (1 – 3 n. miles)

(iv) 6 to 12 Kms (3 – 6 n. miles)

(v) More than 12 Kms (more than 6 n. miles)

1.5 Weather

1.5.1 Occurrence of weather. **10**

1.5.2 Spatial distribution of weather. **10**

(i) Widespread or fairly widespread.

(ii) Local

(iii) Scattered, isolated.

Note: Qualifying terms will be interpreted as follows.

Qualifying words	Area denoted
Widespread, General or Fairly widespread, nearly general.	Roughly more than 2/ 3rds of distance or time of flight (Consider 50 miles on either side of the route for the assessment).
Local	Roughly for more than 1/3 but less than 2/3 of the distance or time of flight. (Consider 150 miles on either side of the route for the assessment)
Scattered, Isolated, at a few places, at one or two places.	At one or two places along the route. (Consider 150 miles on either side of the route for the assessment).

1.5.3 Intensity **5**

(i) Light

(ii) Moderate

(iii) Heavy

1.6 Freezing level **5**

(i) 'Correct' when the height is out by 500 metres (about 1600 ft or less)

(ii) 'Partially Correct' when it is out by more than 500 meters but by less than 999 meters (3000 ft.).

(iii) 'Wrong' when out by 1000 meters or more.

1.7 Lowest M. S. L. pressure. **5**

(i) 'Correct' when forecasted pressure is out by 2 mbs or less;

(ii) 'Partially Correct' when it is out by more than 2 mbs but by less than 4 mbs;

(iii) 'Wrong' when out by 4 mbs. or more.

2. Local and Aerodrome Forecasts (Aviation) including Air Field Warnings.

2.1 Surface wind

Same stages as under para 1.1.1

2.1.1 Direction **10**

2.1.2 Speed **5**

(i) 'Correct, when deviation is 5 knots or less.

(ii) 'Partially Correct' when deviation is above 5 knots but less than 10 kts.

(iii) 'Wrong, when in error by 10 kts or more.

Note : Winds are wrong when direction deviates by 90^{o} or more except when the forecasted and the actual wind speeds are less than 5 kts.

2.2 Upper wind

2.2.1 Direction **4**

Same as under 1.1.1

2.2.2 Speed **3**

Same as under 1.1.2

2.3 Upper air temperatures **3**

Same as under 1.2

2.4 Weather

(Consider an area within 100 kms of the airfield)

2.4.1 In each forecast of occurrence of weather elements (WW), marks are to be allotted in terms of the confidence expressed in the qualifying statement specified in the following table. **20**

Expression of confidence	Forecast materialised	Forecast not materialised
1. Unqualified	100%	20%
2. Likely, probabilities of occurrence (30–70%)	80%	40%
3. Slight, chance, possibility, may occur	60%	60%
Weather element not forecasted	0% if it occur	

2.4.2. Time variation of weather. **10**

The following table indicates the categories and tentative definitions of phrases commonly used in local forecasts.

Phrase	Specification	Category
1. Nearly continuous	Rain during 60% or more of the period	I
2. Intermittent rain	Rain 40% to 60% of the period	II
3. Occasionally, at times	20% to 40% of the period	III
4. Temporarily, a few, one or two	One or two showers during the period	IV

Forecast is 'correct' if the realised time variation has the same category as forecasted. It is 'partially correct' if its category is out by one stage; otherwise it is 'Wrong'

2.5 Visibility **15**

Same as in para 1.4

2.6 Clouds

2.6.1 Low Clouds

2.6.1.1 Height of base. **10**

Same as in para 1.3.1.1

2.6.1.2 Height of tops **5**

Same as in para 1.3.1.2

2.6.1.3. Amount **5**

Same as in para 1.3.1.3

2.6.2 Medium Clouds

2.6.2.1 Height of base **2**

Same as in para 1.3.2.1

2.6.2.2 Height of tops **1**

Same as in para 1.3.2.2

2.6.2.3. Amount **2**

Same as in para 1.3.2.3.

2.7 Freezing level **5**

Same as in para 1.6

3. Area forecasts (Aviation) including F.I.R. Warnings.

Marks allotted to different elements like weather, cloud, etc. are as in Route forecasts. Stages of various elements are also as in route forecasts. Steps of various elements are also as in Route forecasts.

4. Regional forecasts and All India Weather summary

4.1 The country is divided into Meteorological sub-divisions and forecast for each sub-division is regarded as a separate forecast.

4.2 During the winter and the summer, 70% marks are to be allotted for precipitation forecasts and the other 30% for temperature forecasts. Whenever specific temperature forecasts are not mentioned in these seasons, all the marks will be allotted to the precipitation elements. Of the total number of marks for precipitation, 50% are allotted to 'Occurrence' as in para 2.4.1 and 50% to 'Spatial distribution' as in para 1.5.2. If heavy rain 3" or more as plotted in a chart occurs in an area, and no heavy rain has been indicated, substract 10% of the marks.

4.3 Temperature :- Temperature forecast may be in terms of 'change in 24 hrs.' or as 'departure from normal'. The following table gives the specifications for descriptive terms as well as their category (stage) for the purpose of verification.

Magnitude of 'Change'		Description of change	Category (Stage)
^{O}F	^{O}C		
13 or more	8 or more	Large rise	(i)
9 to 12	5 to 7	Marked rise	(i)
6 to 8	3 to 4	Appreciably rise	(ii)
3 to 5	2	Rise	(ii)
2 to –2	1 to –1	Little change	(iii)
-3 to –5	-2	Fall	(iv)

-6 to –8	-3 to –4	Appreciably fall	(iv)
-9 to –12	-5 to –7	Marked fall	(v)
-13 or more	-8 or more	Large fall	(v)

5. Farmers' Weather Bulletin

Same stages as for Regional forecasts in para 4 above.

Occurrence and spatial distribution each carry 40% marks; 20% of marks to be given for intensity, stages of which are the same as those given in Technical Circular (Forecasting) No. 22 - (copy given in Encl. V) forwarded under DDGF UO No. W338 of Dec 1952.

(We may club together districts contiguous to other for which the same forecast in given)

6. Outlook for Farmers.

This is in general terms as 'increase of rainfall' 'decrease of rainfall', occurrence of heavy rainfall', etc. Here give 100% when it is correct, 0% when wrong.

7. Heavy Rainfall Warning issued to parties on the Warning List.

7.1 Intensity of precipitation

(i) 'Correct' when the actual rainfall during the specified period is 80% or more of the lower limit specified by the warnee;

(ii) 'Partially Correct' when the actual rainfall during the specified period is more than 50% but less than 80% of the lower limit specified by the warnee;

(iii) 'Wrong' when the actual rainfall is 50% or less of the lower limit specified by the warnee.

7.2 Spatial distribution of precipitation.

Same stages as in para 1.5.2.

Note: :- When the extent of a warnee's area justifies verification separately for 'intensity' and 'spatial distribution', equal marks are given to items 7.1 and 7.2.

8. Temperature warnings issued to parties on the Warning List.

(i) 'Correct' when out by 4^{O}F (2^{O}C) or less,

(ii) 'Partially Correct' when out by 5^{O}F to 8^{O}F (3^{O}C to 4^{O}C),

(iii) 'Wrong' when out by 9^{O}F (5^{O}C) or more.

9. Forecasts for sea area

9.1

Wind Speed	Symbolic representation on chart
(i) 12 knots or less	
(ii) 13 to 22 knots	
(iii) 23 to 32 knots	

(iv) 33 knots or more	or more

9.2 Weather

9.2.1 Intensity of weather

No rain Light rain Moderate rain Heavy rain	As shown by the present weather symbols in any of the ship reports of coastal reports	All drizzles being light rain

9.2.2 Spatial distribution of weather

Same as in para 1.5.2

Note : 'Intensity' and 'Spatial distribution' carry equal marks.

9.3 Visibility

Same as in para 1.4

10. Port Warnings – The categories (stages) of different states of weather are given below :-

Category	Sate of weather
0	Justifying no signal
(ii)	Justifying signal No. III
(iii)	Justifying signal No. IV
(iv)	Justifying signal No.V, VI or VII
(v)	Justifying signal No.VIII, IX or X

A signal (except No.IV) may be taken as hoisted if the appropriate message has been issued at least 4 hours before the commencement of the weather appropriate to the signal at (or even 100 kms, into the sea from) the port.

11. Local forecasts issued to public (Non-aviation)

11.1 Weather

For the purposes of weather, the period of validity of a local forecast is to be divided into two units, one lasting till dawn of the next day and the other for the remainder of the period of validity. Each unit is to carry equal weightage. For the time variation the forecast may be classified as :-

(a) Mostly continuous or intermittent-some rain during every 2 hour period.

(b) Occasionally, at times – some rain every six hour period.

(c) Temporary, a few, one or two – one or two showers during the period specified.

As often specified, when the weather realised, is one stage out, it is 'partially Correct', and becomes 'Wrong' when out by two stages.

50% marks are allotted to weather and 50% to temperature when both the elements are forecasted. When 'weather' alone is forecasted, 100% marks are allotted to that element only. Of the marks allotted to 'weather' 50% are to be given for 'Occurrence' and 50% for 'time variation'.

Enclosure III

RULES OF VERIFICATION OF FORECASTS

Forecasting Office : _____ Period : _____

Region year

	Total No. of forecasts	Correct %	Partially correct %	Wrong %
NON AVIATION Regional forecasts valid All India for 36 hours				
FARMER'S BULLETINS (a) Forecasts valid for 48 hours (b) Outlook for subsequent two days (c) Heavy rainfall warning				
LOCAL FORECASTS (a) Valid 36 hours on 0300 GMT chart (b) Valid 36 hours on 1200 GMT chart				
Fleet forecasts				
Forecasts for Merchant Shipping				
Heavy rainfall warnings				
Port warnings				
AVIATION FORECASTS Flight forecasts				
Rofors				
Tafors				
Local forecasts				
Area forecasts				
Airfield warnings				
F.I.R. warnings				
Landing forecasts				

Enclosure IV

SCHEDULE FOR THE VERIFICATION OF FORECASTS

	S E A S O N				Annual
	Winter	Hot w eather	Monsoon	Post-monsoon	
	Jan. - Feb.	Mar. – May	Jun. – Sept.	Oct. – Dec.	
DDGF to communicate selected dates to RCs and all MMOs & DMOs	10th March	10th June	10th October	10th January	
MMOs and DMOs to send the results of verification to RDs.	10th May	10th August	10th December	10th March	10th March
RDs to communicate results of verification to DDGF	10th July	10th October	10th February	10th May	10th May

Enclosure V

India Meteorological Department

Technical circular – Forecasting No. 22 Dated Poona-5, the 5th December 1952

Sub. Description of rainfall amounts in plain language.

In modification of previous instructions on the subject (Technical Circular forecasting No.18 dated 8-10-1945) the following descriptive terms will be used in all weather bulletins, reports, forecasts and farmer's Bulletins issued by the India Meteorological Department to indicate rainfall amounts lying within specified with effect from 1-1-1953.

Rainfall amount in inches	Amount as plotted on chart	Descriptive term to be used
0.00 0.01 to 0.09		Little or no rain
0.10 to 0.17		Very light
0.18 to 0.37	¼	Light
0.38 to 0.67 0.68 to 0.87 0.88 to 1.25	½ ¾ 1	Moderate
1.26 to 1.74 1.75 to 2.49	1 ½ 2	Rather heavy
2.50 to 3.49	3	Heavy
3.50 or more	4	Very heavy

2. The amounts for heavy and untimely rainfall warnings will be determined by the requirements of the individual recipients. It is nevertheless desirable to bring to the notice of all rainfall warnees the above convention regarding the description of rainfall amounts. Regional Centres may take necessary action.
3. The receipt of this circular may please be acknowledged.

8.2 LOCAL FORECAST VERIFICATION

FORECASTING CIRCULAR NO. 3/2004.

Ref. :- **Rec. No. 13 of AMR 2004.**

In pursuance of the above recommendation a format in which the local forecast is to be sent to us for verification of different elements is enclosed.

All Forecasting Offices issuing local forecast may send the forecast issued and weather realized for last 24 hrs. ending at 0830 hrs. IST of the day in the enclosed format daily to the O/o DDGM (WF), Pune to the e-mail address :- **localfc@yahoo.com** with immediate effect

The local forecast entered in the format (Excel file) may be sent as an attachment everyday positively by 1400 hrs.

The criteria for verification of individual elements of the local forecast is also enclosed herewith, for your kind information.

CRITERIA FOR THE VERIFICATION OF LOCAL FORECAST

1. The forecast evaluation is divided into three categories, viz., Correct, Partially Correct and Wrong. The individual elements of the local forecast would be verified separately with proportionate marks assigned to each one of them. (e.g., (a) when weather and maximum & minimum temperatures are forecast – weather will be 34% and each temperature 33%, (b) when weather and only maximum or minimum temperature is forecast - weather will be 50% and temperature 50%)

2. For the verification of maximum or minimum temperature Forecast,the tendency (rise or fall) would also be taken into account.

3. If the observed maximum or minimum temperature falls in the ±1ºC range, of the forecast value, the temperature forecast is verified as Correct.

4. If the observed maximum or minimum temperature falls in the ± 2 to 3ºC range, of the forecast value, the temperature forecast is verified as Partially Correct, only if the rise / fall tendency with reference to previous day's temperature is correctly forecast. Beyond this range, the forecast is Wrong.

5. Regarding Rainspells and State of Sky, the forecast one stage out will be verified as Partially Correct. (e.g., when occasional rain is forecast and the realized is only one spell, it would be verified as partially correct. Also when forecast is light to moderate rain but the actual occurrence is heavy rain it would be verified as partially correct)

6. If the forecast weather is realized, within the period of validity it is verified as Correct or else it is Wrong. When specific time of occurrence of weather is forecast and the actual occurrence is some time later or prior, but within the period of validity, it would be taken as partially correct. (e.g. - when forecast is Thunderstorm/rain in the afternoon/evening but the actual occurrence is in the morning hrs. it would be verified as partially correct.)

Format for Local Forecast issued at noon time based on 0300 UTC charts

Month : Station :

Element :	1		2		3		4		5		6		7	
	Max. Temperature		Min. Temperature		Rain Spell		Intensity of Rainfall		State of Sky		Weather		Time of commencement or cessation of weather	
Date	A	F	A	F	A	F	A	F	A	F	A	F	A	F

F : Forecast issued on the given date

A : Weather Realised during past 24 hours

Valid Entries

1	Maximum Temperature	:	Temperature Values rounded as per general met convention in ºC
2	Minimum Temperature	:	Temperature Values rounded as per general met convention in ºC
3	Rain Spell	:	I (Continuous / Intermittent) , O(Occasional) , F(Few / One or Two)

8.3 VERY LIGHT RAIN IN NON-AVIATION FORECAST VERIFICATION.

DDGM (WF) UOI NO.W-630 (AMR)/ dated 13 October 1995

It has been decided by AMR-95 that the threshold value of a rainy day as 2.5 mm will not be changed. But in the case of very light rains at many places, the fact may be indicated while describing the rainfall distribution and also in the forecast verification. This may also be indicated in the technical report while preparing the non-aviation forecast verification report. In such cases, if the forecast of rain is given it may be taken as correct. With the introduction of this procedure, the intensity verification procedure remains unchanged.

[Ref :- Decision No.1, 2, 3 of AMR – 95 on Decision No.2/ 94]

These instructions supercede the earlier instructions on the matter and are effective with immediate effect.

Sd/
(D. S. Desai)
For D.D.G.F.

8.4 REVISED FORECAST VERIFICATION METHODOLOGY

FORECASTING CIRCULAR NO.1/ 2008

Forecast verification procedures

A need had been felt for quite sometime that the forecast verification be made more quantitative, incorporating various skill scores. To meet this requirement, a sub-committee was constituted by AMR-2007. The sub-committee formulated a set of procedures for assessing the forecast performance in terms of various skill scores along with schedule of issuance of local forecast which has been accepted by the Annual Monsoon Review meeting – 2008. It is hereby instructed that the following procedures be followed in sending the verification reports from the ensuing SW monsoon season (Monsoon – 2008) onwards.

1. Verification of Local Forecast:

The local forecast be verified in terms of the following three parameters:

(a) **Temperature:** The forecasts for maximum and minimum temperature be issued throughout the year. The same be verified, with the existing criteria; in addition Root Mean Square Error (RMSE) also be computed. The temperature forecast issued based on 0300 UTC charts, for communication to Headquarters for the display in the IMD, New Delhi website and forecast based on 1200 UTC charts, which is to be communicated to the press, be considered for verification. The verification may be carried out for 24 hrs. and 48 hrs. forecasts, separately.

(b) **Rainfall and Significant/Special Weather Events:** The schedule for issuance of forecast for rainfall and significant / special weather events if expected, be the same as that for the issuance of temperature forecast, as given above.

(i) **Rainfall:** Rainfall verification be made in terms of its occurrence/non-occurrence (yes/no) using 2 X 2 Contingency table and computing various skill scores as in Annexure I.

(ii) **Significant/ Special weather events:** Forecasts of Fog, thunderstorm, dust storm, hail storm, haze, mist, smog, heat wave, cold wave, hot day, cold day, squall, heavy rain and sky conditions be verified based on the procedures mentioned above. Also in this connection, in order to bring about uniformity, the forecasts for IMD website, WMO website and that for IVRS need to be disseminated by 1130 hrs IST.

The performance of categorical forecasts like QPF, issued by FMOs for different river catchments and spatial distribution and intensity of rainfall over different meteorological subdivisions be verified using various Contingency tables.

The QPF issued for different river catchments be verified by computing Percentage Correct (PC), Heidke Skill Score (HSS) and Critical Success Index (CSI), from 6 X 6 Contingency table. The detailed procedure of this forecast verification technique is given in Annexure II.

3. Verification of sub-division wise forecasts

(a) The present verification method be continued in case of spatial distribution and intensity verification (Annexure III)

- Spatial distribution forecast without any intensity specification might be understood as that of light, moderate and rather heavy category.

(b) The verification be reported on subdivisional level. The present procedure of preparing a consolidated report at RC level be dispensed with. Hence RMCs are directed to communicate the forecast verification data on sub–divisional level to the O/o D.D.G.M. (W.F.)

Annexure I

DETERMINISTIC FORECAST

(E.G. FORECAST VERIFICATION OF HEAVY RAINFALL (≥ 7 CM)
OVER AT LEAST TWO STATIONS IN A SUB-DIVISION

OBSERVED	FORECAST	
	YES	NO
YES	A	B
NO	C	D

PROBABILITY OF DETECTION (POD) = A/ (A+B)
FALSE ALARM RATE (FAR) = C/ (C+A)
MISSING RATE (MR) = B/ (B+A)
CORRECT NON-OCCURRENCE (C-NON) =D/(C+D)
CRITICAL SUCCESS INDEX (CSI) = THREAT SCORE = A/ (A+B+C)
BIAS FOR OCCURRENCE (BIAS)= (A+C)/(A+B)
PERCENTAGE CORRECT (PC) = (A+D)/(A+B+C+D)*100 = HIT RATE * 100
TRUE SKILL SCORE (TSS) = A/(A+B) + D/(C+D)-1
HEIDKE SKILL SCORE (HSS) = 2(AD-BC)/ ((B2+C2+2AD+(B+C)(A+D))
FOR BEST/ PERFECT FORECAST, POD=1, FAR=0, MR=0,
C-NON=1, BIAS=1, CSI=1, TSS=1, HSS=1 AND PC=100%

The warning for heavy, very heavy and extremely heavy rainfall, cold wave, heat wave etc. also be verified using the above 2 X 2 Contingency table.

Annexure II

CATEGORICAL FORECAST(QPF)

Observed range (mm)	Forecast range (mm)						
	0	1-10	11-25	26-50	51-100	>100	Total
0	a	b	c	d	e	f	A
1-10	g	h	i	j	k	l	B
11-25	m	n	o	p	q	r	C
26-50	s	t	u	v	w	x	D
51-100	y	z	aa	ab	ac	ad	E
>100	ae	af	ag	ah	ai	aj	F
Total	G	H	I	J	K	L	T

PC = ((a+h+o+v+ac+aj)/T)*100

CSI = a/(A+G-a), h/(B+H-h), o/(C+I-o), v/(D+J-v), ac/(E+K-ac), aj/(F+L-aj)

HSS=(a+h+o+v+ac+aj)-(AG+BH+CI+DJ+EK+FL)/T)/(T-(AG+BH+CI+DJ+EK+FL)/T)

The POD, FAR, MR, CSI, BIAS, PC, TSS and HSS, etc, for each category be calculated by reducing the above 6x6 Contingency Table into 2 x 2 Contingency table for Yes / No forecast. The final skill score be the average of these values.

Annexure III

VERIFICATION OF SPATIAL DISTRIBUTION FORECAST

Observed Range	Forecast range					
	Dry	Isol	Scatt	Fairly widespread	Widespread	Total
Dry	a	b	c	d	e	J
Isolated	f	g	h	i	j	K
Scattered	k	l	m	n	o	L
Fairly widespread	p	q	r	s	t	M
Wide spread	u	v	w	x	y	N
Total	O	P	Q	R	S	T

PC = ((a+g+m+s+y)/T)*100
CSI = a/(J+O-a), g/(K+P-g), m/(L+Q-m), s/(M+R-s), y/(N+S-y)
HSS= (a+g+m+s+y - (JO+KP+LQ+MR+NS)/T)/ (T-(JO+KP+LQ+MR+NS)/T)

CONVERSION OF CATEGORICAL FORECAST INTO DETERMINISTIC FORECAST

The POD, FAR, MR, CSI, BIAS, PC, TSS and HSS etc for each category be calculated by reducing the above 6x6 Contingency Table into 2x2 Contingency Table for yes/no forecast. The final skill score be the average of these values.

VERIFICATION OF INTENSITY OF RAINFALL

Observed range (mm)	Forecast range (mm)						
	Light	Moderate	Rather Heavy	Heavy	Very heavy	Extremely heavy	Total
Light	a	B	C	d	e	f	A
Moderate	g	H	I	j	k	l	B
Rather heavy	m	N	O	p	q	r	C
Heavy	s	T	U	v	w	x	D
Very heavy	y	Z	Aa	ab	ac	ad	E
Extremely heavy	ae	Af	Ag	ah	ai	aj	F
Total	G	H	I	J	K	L	T

PC = ((a+h+o+v+ac+aj)/T)*100
CSI = a/(A+G-a), h/(B+H-h), o/(C+I-o), v/(D+J-v), ac/(E+K-ac), aj/(F+L-aj)
HSS=(a+h+o+v+ac+aj)-(AG+BH+CI+DJ+EK+FL)/T)/(T-(AG+BH+CI+DJ+EK+FL)/T)

The POD, FAR, MR, CSI, BIAS, PC, TSS and HSS, etc, for each category be calculated by reducing the above 6x6 Contingency Table into 2x2 Contingency Table for yes/no forecast. The final skill score be the average of these values.