

मौसम सांख्यिकी
अण्डमान तथा निकोबार द्वीपसमूह

**METEOROLOGICAL STATISTICS
ANDAMAN & NICOBAR ISLANDS**

2010

आर्थिक एवं सांख्यिकी निदेशालय
अण्डमान तथा निकोबार प्रशासन
पोर्ट ब्लेयर

**Directorate of Economics & Statistics
Andaman & Nicobar Administration
Port Blair**

प्रस्तावना

अण्डमान तथा निकोबार द्वीपसमूह के मौसमी सांख्यिकी से संबंधित यह मौजूदा अंक आर्थिक एवं सांख्यिकीय निदेशालय द्वारा प्रकाशित संस्करणों के क्रम में तेरवां है । इस संशोधित संस्करण में 'वर्षा', 'तापमान', आर्द्रता, 'हवा की गति और भूकम्प नामक शीर्षक से इस संघ शासित क्षेत्र की जलवायु की स्थिति पर 2008 से 2010 तक के मौसम आँकड़े उपलब्ध हैं।

इस प्रकाशन में दर्शाए आँकड़ों को उपलब्ध कराने के लिए मौसम विभाग, पोर्ट ब्लेयर द्वारा दिए गए सहयोग के लिए मैं उनके प्रति अपना आभार प्रकट करता हूँ ।

श्री बी.मोहन सांख्यिकीय अधिकारी के सम्पूर्ण निगरानी में श्री मार्टिन एक्का, श्री एम. पी. मुत्तप्पा और श्रीमती डी.सुसैअम्माल, वरिष्ठ अन्वेषकों द्वारा किए गए अथक प्रयासों के कारण ही इस प्रकाशन का कार्य पूरा हो सका ।

इस प्रकाशन में त्रुटियों तथा और अधिक सुधार लाने के लिए आपके बहुमूल्य सुझाव आमंत्रित हैं ।

गौरंग मिश्र

निदेशक

आर्थिक एवं सांख्यिकी निदेशालय

PREFACE

The present edition of Meteorological Statistics of Andaman & Nicobar Islands is the Thirteenth in the series being published by the Directorate of Economics & Statistics, Andaman & Nicobar Administration. This edition contains data from 2008 to 2010 on the climatic condition of the Union Territory of Andaman and Nicobar Islands viz. Rainfall, Temperature, Humidity, Wind Speed and Earthquake.

I express my profound gratitude to the co-operation extended by the Meteorological Department, Port Blair in making available the data presented in the publication.

The publication is the result of devoted efforts put in by Shri. Martin Ekka, Shri M.P.Muthappa & Smti. D.Susaiammal, Senior Investigators under the overall supervision of Shri. B. Mohan, Statistical Officer (Pub).

Any error or omission and suggestions for improvement of this publication may be brought to the notice this Directorate.

Gaurang Mishra
Director of Economics & Statistics

Geographical- Description

Andaman and Nicobar is an Archipelago, situated in the Bay of Bengal in the longitude between 92 Degree to 94 Degree East and in the Latitude between 6 Degree to 14 Degree North. This is a long and narrow broken chain as part of a continuous ridge from Cape Negrais in Burma through the Preparis and Coco Islands to the Andaman and Continued further South to the Nicobar and Sumatra.

The dreaded 10 Degree Channel which is 90 miles wide and 400 fathoms deep separates the Andaman group of Islands and Nicobar group of Islands from each other.

The Andaman group has at the extreme north, land fall Island followed by the three main Islands – North Andaman, Middle Andaman and South Andaman. All of them separated from each other by shallow seas. Further South, at a distance of 40 miles from South Andaman lies Little Andaman.

The Nicobar group extends from 6 Degree to 10 Degree North latitude. The northern most Island is Car Nicobar, which lies 75 miles to the South of little Andaman and the southern Island is Great Nicobar barely 91 miles from Sumatra.

The total area of Andaman & Nicobar Islands is 8249 Sq.Km of which, the area of Andaman group is 6408 Sq. km. and the Nicobar group is 1841 Sq. Km. There are about 556 Islands, Islets and rocks with a Coastal line of about 1962 Kms.

As per 2011 Census (Provisional), the population of Andaman & Nicobar Islands is 379944 and District-wise population is 237586 in South Andaman District, 105539 in North & Middle Andaman District and 36819 in Nicobar District.

The Climate of the Islands can be defined as humid, tropical, coastal climate, proximity to the equator and the sea ensures a hot, humid uniform climate. The Islands are frequently hit by tropical storms and cyclones. The Islands have very little annual variation in temperature, the variation being 3° to 5° for mean minimum temperature and 4° to 7° F for mean maximum temperature. Extremes of summer and winter are practically unknown as also the frost. The relative humidity is also high, average being 80%. The weather is always warm and very sultry, but is tempered to some extent by the pleasant sea breeze.

The Island receives rainfall from both the monsoons viz. south west monsoon from May to October and northeast monsoons from November to January. The average rainfall is 120", but varies from place to place, decreasing as one goes towards the north. Stormy weather prevails at the change of monsoons. Calm weather prevails from October to April. The climate of Nicobar is said to resemble that of the Malay Peninsula. The differences between wet and dry season is not very marked and the rainfall is better distributed. In both the Andaman and the Nicobar group of Islands, March and April are the driest month of the year and the wet months are May to September.

Analysis

Data upto 2009 is available on the website (www.and.nic.in/stats/index.htm) as meteorological statistics 2009. While searching the old publications of this directorate it was found that first meteorological statistics was published in 1984 and we chanced upon the rainfall data from 1947 onwards for Port Blair. That was 3485.5 mm in 1947 and 3369.5 in 1948.

A. RAINFALL

The Rainfall of India & Andaman and Nicobar Islands during 2010 month-wise is given below in Table 1 for comparison.

Table 1: Normal & Actual Rainfall (mm) in 2010

Period	India		A & N Islands
	Normal	Actual	Actual
January	20.9	7.5	99.9
February	23.0	17.0	11.8
March	31.4	14.0	0.5
April	38.8	39.0	22.0
May	63.5	73.8	301.5
June	163.5	138.0	449.0
July	292.3	300.5	511.4
August	261.9	274.7	523.5
September	175.5	197.4	260.1
October	78.9	69.0	380.9
November	29.8	58.0	306.7
December	17.8	22.4	259.3

Period	India		A&N Islands
Winter season	43.9	24.5	111.7
Pre-monsoon season	133.7	126.7	324.0
Monsoon season	893.2	910.6	1744.0
Post-monsoon season	126.3	153.2	946.9
Annual	1197.1	1215.0	3126.6

In any season the rainfall remains higher for A & N Islands compared to India as a whole, as is evident in table-1. The Year-wise Average Annual rainfall recorded in **Andaman & Nicobar Islands** from 1967 to 2010 is given in table 2 below.

Table 2:- AVERAGE ANNUAL RAINFALL (mm) in A & N ISLANDS

Year	Rainfall	Year	Rainfall	Year	Rainfall
1967	2975.7	1982	2069.9	1997	2396.7
1968	2705.4	1983	2669.6	1998	2751.9
1969	2714.1	1984	2492.3	1999	2693.8
1970	3222.9	1985	2503.8	2000	2429.0
1971	2970.1	1986	2177.1	2001	2800.7
1972	2979.6	1987	2277.8	2002	2287.1
1973	2980.7	1988	2913.8	2003	2483.6
1974	2961.0	1989	2493.4	2004	2436.7
1975	3529.6	1990	2265.1	2005	2714.5
1976	3166.6	1991	2585.4	2006	2538.6
1977	2458.4	1992	2290.2	2007	2665.3
1978	2676.9	1993	2390.6	2008	3254.8
1979	1950.3	1994	3044.0	2009	2531.6
1980	3278.2	1995	3016.5	2010	3126.6
1981	2778.9	1996	3206.5		

It is observed that earlier to 1967 the data for Port Blair only used to be depicted however since 1967 onwards the separate data was available for A&N Islands and Port Blair etc.

During 1967 to 2010, it is observed that the lowest rainfall recorded was 1950.3 mm in 1979 and the highest rainfall recorded was 3529.6 mm in 1975.

District-wise Average Annual Rainfall

From 1967-2006, the lowest average annual rainfall was 1335.8 mm during 1982 in Nicobar District and the highest was 3923.8 mm during 1975 in Nicobar District. After the bifurcation of Andaman District into two Districts viz. North & Middle Andaman District and South Andaman District the lowest average annual rainfall was 1896.7 mm during 2009 in Nicobar District and highest was 3789.3 mm in North & Middle Andaman District during 2008.

The District wise highest and lowest average annual rainfall

From 1967 to 2006

District	Highest rainfall	Lowest rainfall
Andaman	3651.1 (1972)	1774.3 (1979)
Nicobar	3923.8 (1975)	1335.8 (1982)

Andaman District was bifurcated into 2 Districts during August 2006 therefore the districtwise high and low rainfall are given below.

District -2007 to 2010	Highest rainfall	Lowest rainfall
North & Middle Andaman	3789.3 (2008)	2849.8 (2007)
South Andaman	3561.1 (2008)	2325.2 (2009)
Nicobar	3028.5 (2010)	1896.7 (2009)

Station wise Rainfall

From 1967 to 2010, It is observed that the highest rainfall was recorded as 4886.9 mm in Car Nicobar during 1975 whereas the lowest rainfall was recorded as 1002.4mm in Hut Bay during 1984. The station wise highest and lowest rainfall from 1967 to 2010 is given in the table below:-

Station	Highest	Year	Lowest	year
Mayabunder	4441.1	2010	1522.3	1990
Long Island	3539.5	1972	1418.1	2006
Port Blair*	4362.4	1961	1541.4	1979
Hut Bay	3784.3	1996	1002.4	1984
Car Nicobar	4886.9	1975	1367.2	1982
Nancowrie	3489.8	1975	1036.8	1982
Kondul**	3708.0	1971	1139.7	1987

*Rainfall from 1947 - 2010

**data is upto 2004 only as the station was closed after tsunami.

Rainy days

The highest number of rainy days was 209 during 1999 and the lowest was 118 days during 1969.

B. TEMPERATURE

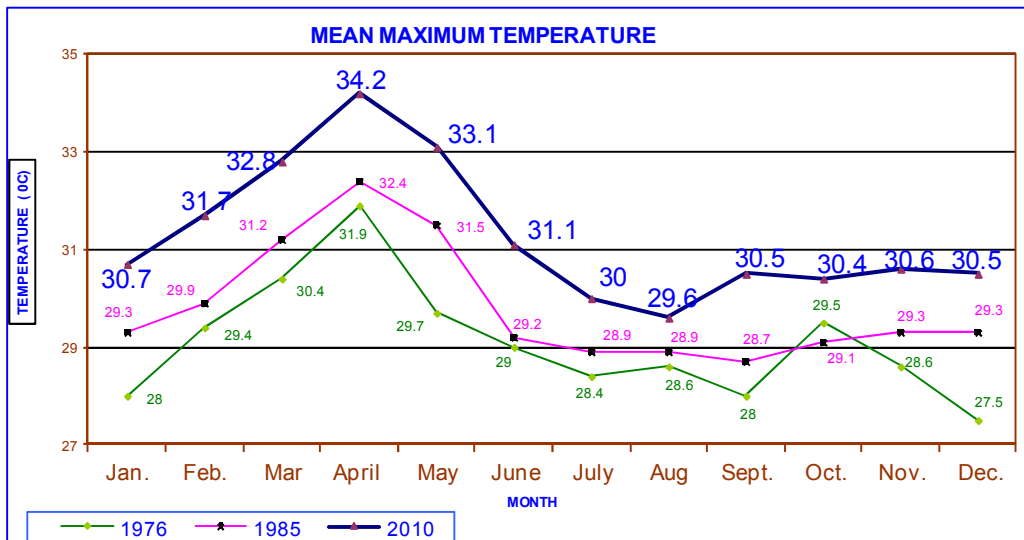
The year 2010 was recorded as the warmest year since 1901 as per the press release of the meteorology department. In 2010, annual mean temperature averaged over the country as a whole was +0.93°C. The temperature ranking in India is shown in the table given below:-

Temperature ranking in India 2001-2010

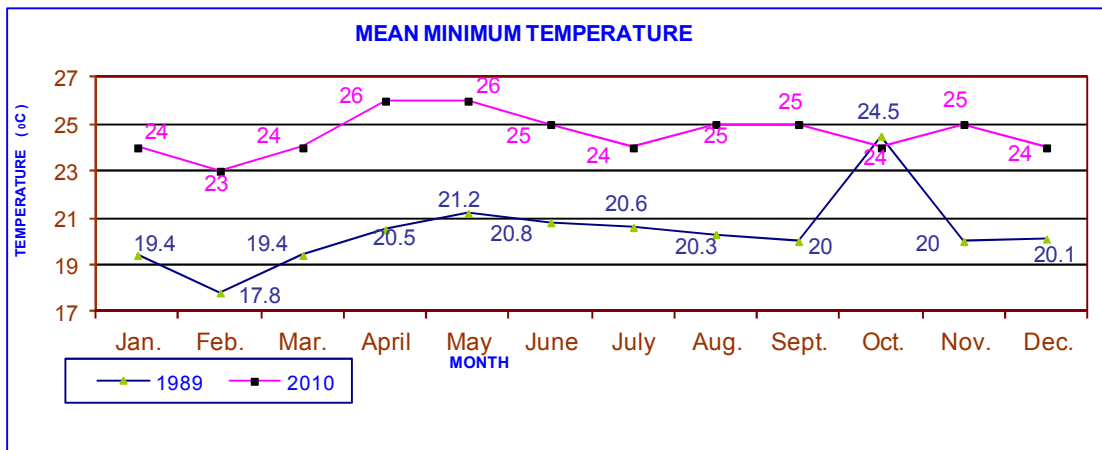
RANKING (2001-2010)	INDIA	
	YEAR	TEMPERATURE (°C)
WARMEST	2010	25.8023
2	2009	25.7876
3	2002	25.7366
4	2006	25.5024
5	2003	25.4720
6	2007	25.4430
7	2004	25.4232
8	2001	25.3848
9	2005	25.2800
COLDEST	2008	25.2562

Andaman & Nicobar Islands

Graph I



Graph II



At Port Blair from 1949 to 2010, the lowest Mean Maximum Temperature was recorded as 29.1⁰ Celsius during 1976 & 1985 and the highest Mean Maximum Temperature was recorded as 31.3⁰ Celsius during 2010 as shown in the Graph I. Similarly lowest Mean Minimum Temperature was recorded as 20.4⁰ Celsius during 1989 and the highest Mean Minimum Temperature was recorded as 24.6⁰ Celsius during 2010 (Graph II).

Over the years, it was observed that at Port Blair highest temperature remains in the month of April. The maximum temperature recorded at Port Blair was 34⁰ Celsius during April 1964.

C. HUMIDITY

The lowest mean relative humidity at 0830 hrs was recorded as 75% during 1957, 1958, 1993 and the highest was recorded as 82% at 0830 hrs during 1961. Similarly the lowest mean relative humidity at 1730 hrs was recorded as 78% during 1976, 1979, 1983 & 1993 and the highest as 87% at 1730 hrs during 1961. Highest monthly average relative humidity was recorded as 93% at 1730 hrs in September 2006.

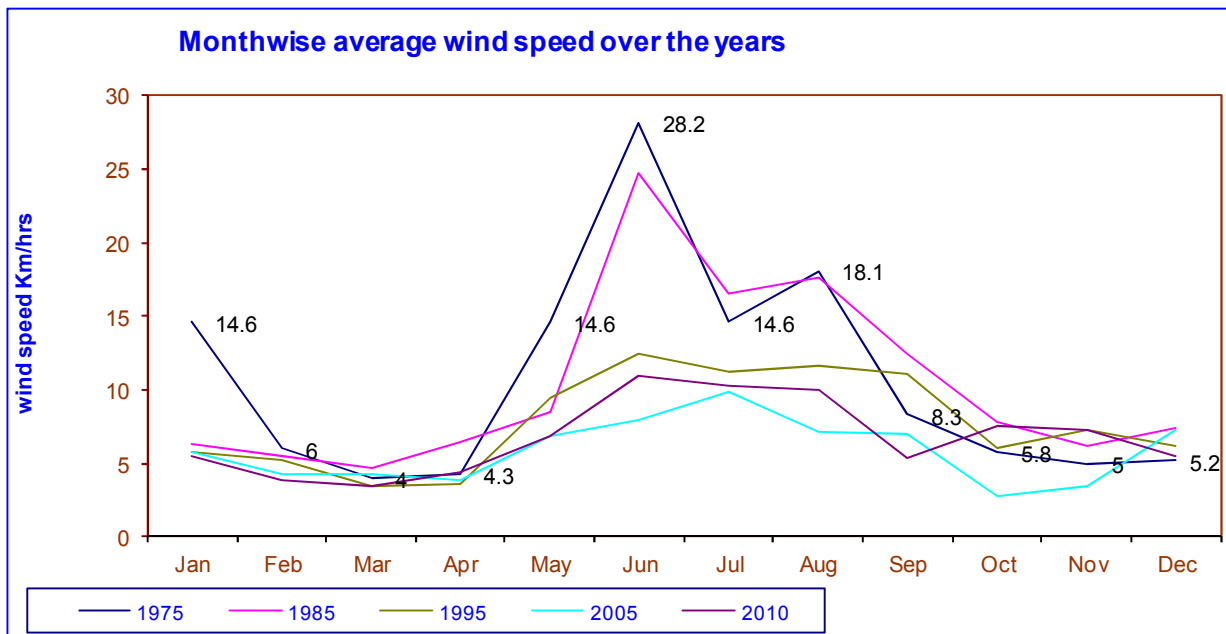
Difference between the mean relative humidity at 0830 hrs and 1730 hrs was found to be highest during the years 1966 to 1972 and minimum difference was found during 1973 to 1980.

In the years 1978 & 1989 the difference between relative humidity recorded at 0830 hrs and 1730 hrs was 1%. Whereas the maximum difference of 5% in both measure of relative humidity was recorded in the year 1966, 1968, 1972 & 1981.

High relative humidity has been observed during the period of August, September & October over the years. But earlier to 1980 higher humidity were also recorded during June & July. *Thus, it is clear that there was a shift observed after 1980.* However there is need to have more in depth analysis and need to correlate the data from Fisheries, Agricultural production to see the statistical significance of this shift in meteorological behaviour.

D. WIND SPEED :- Since 1975 to 2010, the lowest mean wind speed was recorded as 5.8 Km/Hrs during 2005 and the highest mean wind speed was recorded as 11.6Km/Hrs during 1976.

Year	1975	1985	1995	2005	2010
Jan	14.6	6.3	5.7	5.8	5.5
Feb	6.0	5.5	5.2	4.2	3.8
Mar	4.0	4.7	3.4	4.2	3.5
Apr	4.3	6.5	3.6	3.9	4.4
May	14.6	8.5	9.4	6.8	6.8
Jun	28.2	24.7	12.5	7.9	11.0
Jul	14.6	16.5	11.2	9.8	10.2
Aug	18.1	17.7	11.6	7.1	10.0
Sep	8.3	12.4	11.1	7.0	5.4
Oct	5.8	7.8	6.1	2.7	7.6
Nov	5.0	6.2	7.2	3.4	7.2
Dec	5.2	7.4	6.2	7.3	5.5



From the above chart it is evident that mean wind speed remains high during the months of May to September coinciding with the High rainfall.

It was observed that highest monthly average wind speed was recorded as 28.2 km/hrs in the month of June 1975. High wind speed has been recorded in the month of June - August over the years.

E. EARTHQUAKE

Andaman & Nicobar Islands falls under the Seismic Zone V and is susceptible to earthquakes. A devastating Tsunami struck these Islands on 26th December 2004 after a massive earthquake measuring 8.6 on Richter Scale hit West Coast of Sumatra Island of Indonesia.

Other than the damages, it caused destruction to Coastal line and ecosystem. At some places land mass is permanently submerged under Sea. From 2004 to 2010 the highest number of shocks i.e above 5 magnitudes were recorded as 195 during 2005.

During the year 2010, total 18 (eighteen) shocks of magnitude 5 (five) and above were recorded, out of which the highest was of 7.8 magnitude recorded at off coast of Nicobar Island on 12th June 2010 at 12.57 hrs.

A. RAINFALL

TABLE- I :- MONTHLY AVERAGE RAINFALL (in mm) IN A & N ISLANDS

YEAR \ MONTH	2008	2009	2010
January	21.68	28.68	99.88
February	67.78	9.28	11.77
March	125.61	43.37	0.53
April	218.10	141.62	21.95
May	495.55	338.03	301.46
June	429.45	553.50	449.00
July	468.68	294.50	511.38
August	435.70	352.65	523.55
September	305.78	337.83	260.13
October	249.45	251.90	380.90
November	336.60	90.52	306.70
December	100.38	89.68	259.33
Total	3254.76	2531.56	3126.58

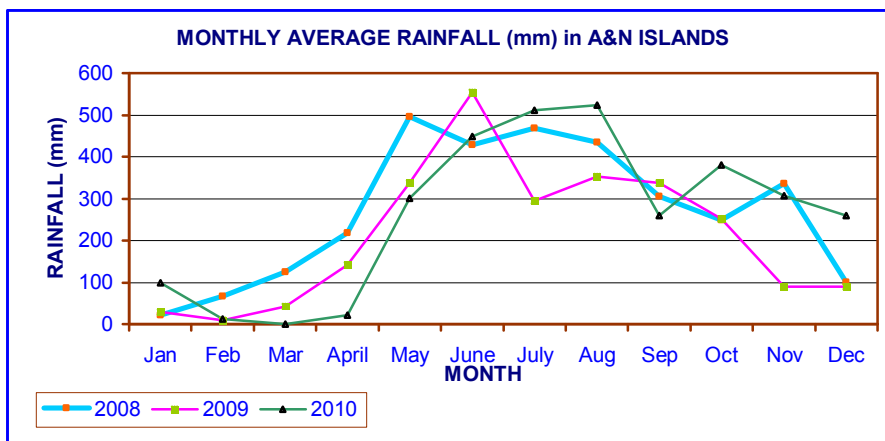


TABLE II: DISTRICT WISE AVERAGE ANNUAL RAINFALL (mm) & VARIATION

District \ Year	North & Middle Andaman		South Andaman		Nicobar	
	Rainfall	Variation	Rainfall	Variation	Rainfall	Variation
2007*	2849.8	-	2709.2	-	2437.0	(-) 260.6
2008	3789.3	(+) 939.5	3561.1	(+) 851.9	2414.1	(-) 22.9
2009	3372.7	(-) 416.6	2325.2	(-)1235.9	1896.7	(-)517.4
2010	3403.9	(+) 31.2	2947.9	(+)622.7	3028.5	(+)1131.8

* Due to bifurcation of Andaman District into south Andaman and North & Middle Andaman District during August 2006.

TABLE III - DISTRICT WISE/STATION WISE ANNUAL RAINFALL

Station \ YEAR	2007	2008	2009	2010
	Rainfall (mm)			
North & Middle Andaman District				
MAYABUNDER	3021.7	4139.4	3958.5	4441.1
LONG ISLAND	2677.9	3439.1	2786.9	2366.6
AVERAGE	2849.8	3789.3	3372.7	3403.9
South Andaman District				
PORT BLAIR	2556.0	4152.6	2496.7	3116.6
HUT BAY	2862.5	2969.5	2153.8	2779.2
AVERAGE	2709.2	3561.1	2325.3	2947.9
Nicobar District				
CAR NICOBAR	2760.8	2789.1	1987.4	3076.6
NANCOWRIE	2113.2	2039.0	1806.1	2980.4
AVERAGE	2437.0	2414.1	1896.8	3028.5

Station-wise rainfall

STATION \ YEAR	2007	2008	2009	2010
	Rainy Days			
North & Middle ANDAMAN DISTRICT				
MAYABUNDER	126	132	121	134
LONG ISLAND	116	154	131	128
SOUTH ANDAMAN DISTRICT				
PORT BLAIR	145	158	151	159
HUT BAY	118	143	138	166
NICOBAR DISTRICT				
CAR NICOBAR	118	144	127	162
NANCOWRIE	128	117	135	151

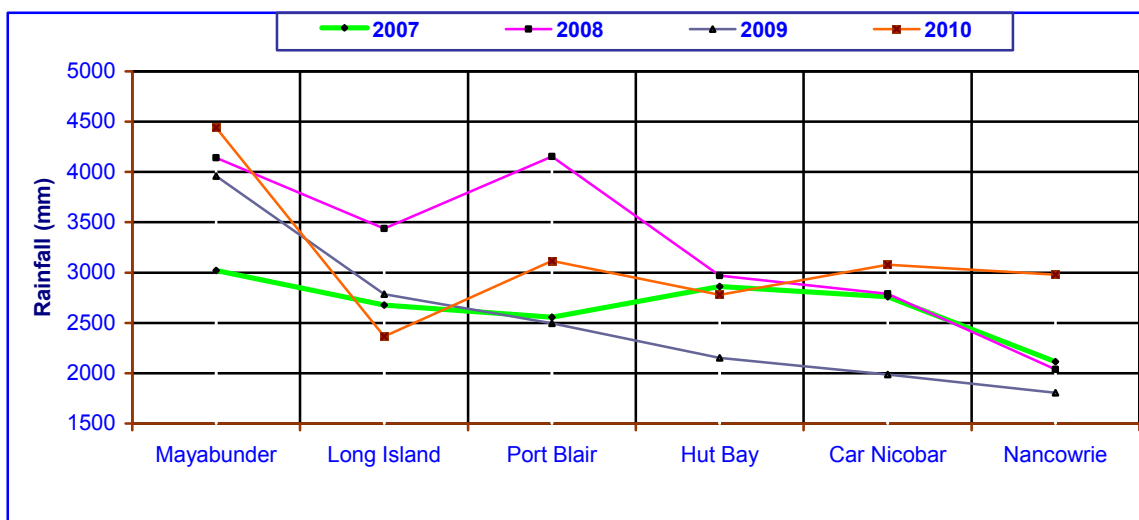


TABLE IV
RAIN FALL(mm) & RAINY DAYS (No.) at MAYABUNDER

Year Month	2008		2009		2010	
	Rainfall	Rainy days	Rainfall	Rainy days	Rainfall	Rainy days
January	0.0	0	0.0	0	203.0	5
February	187.4	04	0.0	0	0	0
March	71.0	05	4.0	02	0	0
April	132.0	06	92.0	07	5.0	1
May	526.0	17	70.0	07	504.0	15
June	738.1	20	1020.5	23	634.0	17
July	720.3	23	749.0	22	806.0	25
August	748.4	22	744.0	17	993.1	23
September	426.5	16	629.0	21	394.0	15
October	401.0	11	562.0	15	662.0	22
November	188.7	08	35.0	06	77.0	5
December	0.00	0	53.0	01	163.0	6
Total	4139.4	132	3958.5	121	4441.1	134

*1.5mm and above rainfall is considered as one (1) rainy day as per Meteorological Dept.

TABLE V
RAINFALL(mm) & RAINYDAYS (No.) at LONG ISLAND (mm)

Year Month	2008		2009		2010	
	Rainfall	Rainy days	Rainfall	Rainy days	Rainfall	Rainy days
January	43.0	02	0.0	0	46.0	4
February	76.0	03	0.0	0	0	0
March	72.0	05	2.0	01	0	0
April	189.0	07	128.2	09	5.0	1
May	823.4	17	220.0	15	344.0	16
June	627.6	20	985.7	23	155.0	16
July	621.2	27	395.0	18	390.2	18
August	230.7	24	379.8	20	583.0	22
September	422.4	19	342.2	24	191.0	11
October	74.0	12	262.0	13	427.6	22
November	246.8	16	21.0	04	112.4	9
December	13.0	02	51.0	04	112.4	9
Total	3439.1	154	2786.9	131	2366.6	128

TABLE VI: RAINFALL(mm) & RAINYDAYS (No.) at PORT BLAIR

Year Month	2008		2009		2010	
	Rainfall	Rainy days	Rainfall	Rainy days	Rainfall	Rainy days
January	10.5	01	0.0	0	89.2	4
February	43.0	04	0.0	0	0	0
March	102.7	08	27.2	03	0	0
April	287.9	10	157.4	10	7	1
May	976.0	22	405.1	18	320.1	15
June	374.4	16	505.4	23	390.8	18
July	631.0	26	178.8	22	600.2	25
August	521.5	23	418.5	21	423.0	28
September	479.8	19	416.2	24	314.5	17
October	282.1	15	237.6	15	420.7	22
November	443.0	14	88.6	09	222.3	14
December	0.7	0	61.9	06	328.8	15
Total	4152.6	158	2496.7	151	3116.6	159

TABLE VII : RAINFALL(mm) & RAINYDAYS (No.) at HUT BAY

Year Month	2008		2009		2010	
	Rainfall	Rainy days	Rainfall	Rainy days	Rainfall	Rainy days
January	2.0	01	0.0	0	75.6	6
February	68.1	05	0.0	0	0	0
March	143.4	07	64.1	04	0	0
April	229.2	11	150.0	10	16.4	3
May	274.0	18	402.7	18	184.5	15
June	272.3	17	509.3	21	481.3	20
July	411.0	25	98.3	18	378.2	23
August	507.1	17	253.8	18	453.0	24
September	312.2	14	294.8	23	172.8	17
October	233.1	12	220.5	12	332.1	20
November	341.1	13	60.6	07	374.9	24
December	176.0	03	99.7	07	310.4	14
Total	2969.5	143	2153.8	138	2779.2	166

TABLE VIII: RAINFALL (mm) & RAINYDAYS at CAR NICOBAR

Year Month	2008		2009		2010	
	Rainfall	Rainy days	Rainfall	Rainy days	Rainfall	Rainy days
January	38.5	02	8.0	01	46.4	7
February	32.2	04	43.6	02	0	0
March	159.0	09	81.4	05	0	0
April	233.3	18	259.6	14	35.4	2
May	177.2	12	599.8	19	269.3	18
June	354.5	15	167.8	18	467.3	19
July	204.3	16	90.8	11	425.9	22
August	421.0	12	125.4	12	337.0	19
September	108.0	11	183.3	13	295.8	19
October	426.3	17	141.9	15	250.8	16
November	424.7	20	156.6	09	561.3	22
December	210.1	08	129.2	08	387.4	18
TOTAL	2789.1	144	1987.4	127	3076.6	162

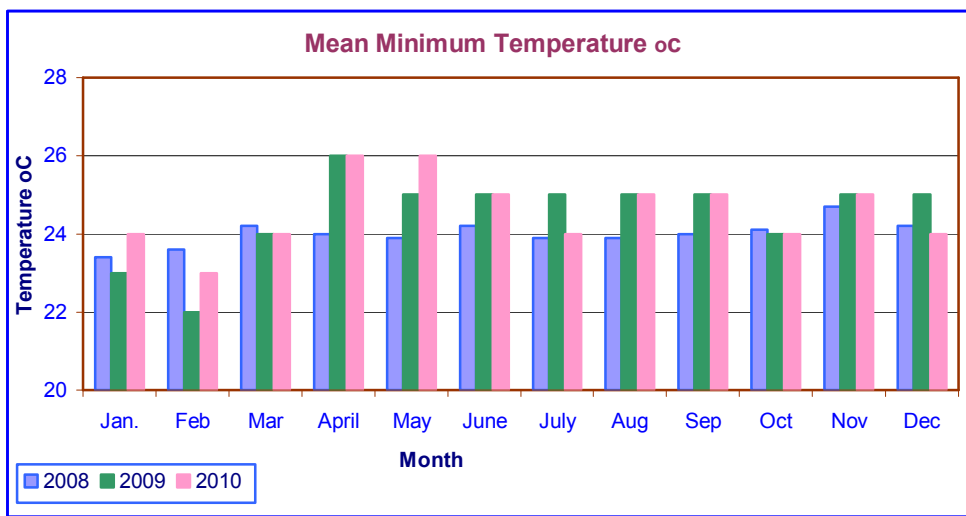
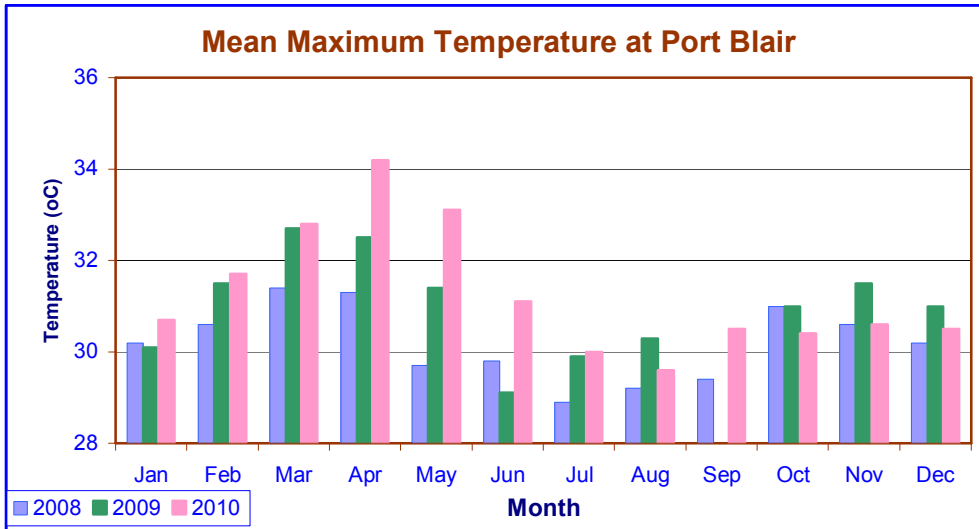
TABLE IX: RAINFALL (mm) & RAINYDAYS (No.) at NANCOWRIE

Year Month	2008		2009		2010	
	Rainfall	Rainydays	Rainfall	Rainydays	Rainfall	Rainy days
January	36.1	07	164.1	06	139.1	9
February	0.0	0	12.1	02	70.6	4
March	205.6	11	81.5	08	3.2	1
April	237.2	11	62.5	08	62.9	4
May	196.7	09	330.6	20	186.9	12
June	209.8	14	132.3	13	566.4	22
July	224.3	13	255.1	11	467.8	19
August	185.5	11	194.4	17	352.2	17
September	85.8	07	161.5	11	192.7	14
October	80.2	09	87.4	10	192.2	15
November	375.3	16	181.3	17	492.4	19
December	202.5	09	143.3	12	254.0	16
Total	2039.0	117	1806.1	135	2980.4	152

B. TEMPERATURE

TABLE X: MEAN MAXIMUM & MINIMUM TEMPERATURE at PORT BLAIR (in °C)

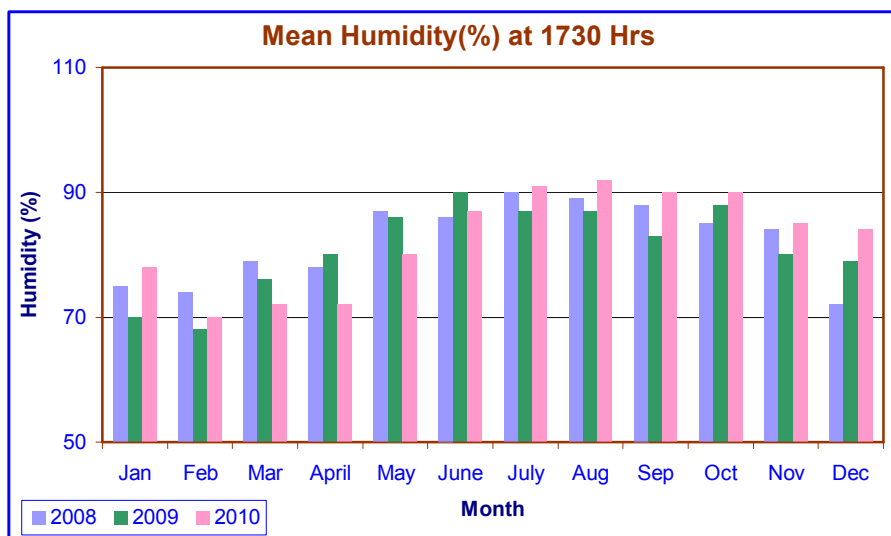
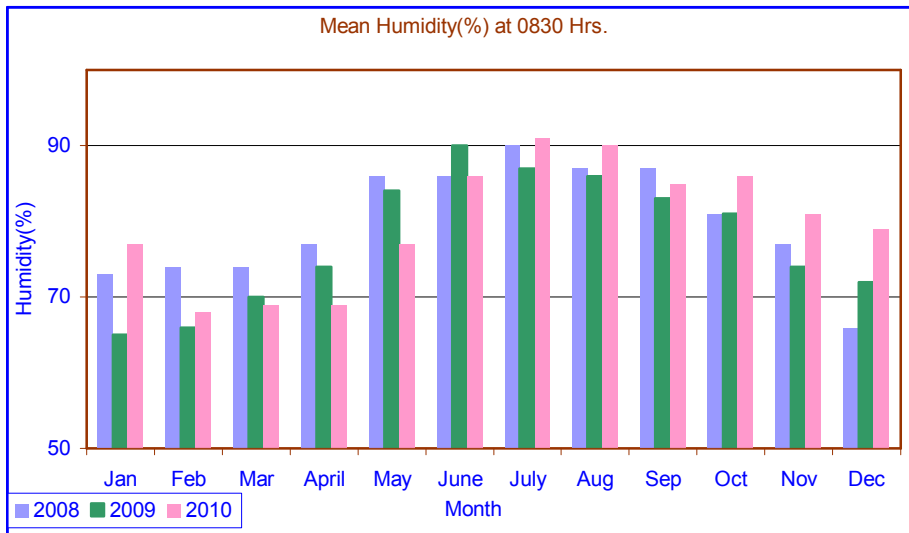
YEAR MONTH	2008		2009		2010	
	Maximum	Minimum	Max.	Min.	Max.	Min.
JANUARY	30.2	23.4	30.1	23.0	30.7	24.0
FEBRUARY	30.6	23.6	31.5	22.0	31.7	23.0
MARCH	31.4	24.2	32.7	24.0	32.8	24.0
APRIL	31.3	24.0	32.5	26.0	34.2	26.0
MAY	29.7	23.9	31.4	25.0	33.1	26.0
JUNE	29.8	24.2	29.1	25.0	31.1	25.0
JULY	28.9	23.9	29.9	25.0	30.0	24.0
AUGUST	29.2	23.9	30.3	25.0	29.6	25.0
SEPTEMBER	29.4	24.0	27.8	25.0	30.5	25.0
OCTOBER	31.0	24.1	31.0	24.0	30.4	24.0
NOVEMBER	30.6	24.7	31.5	25.0	30.6	25.0
DECEMBER	30.2	24.2	31.0	25.0	30.5	24.0
AVERAGE	30.2	24.0	30.7	24.5	31.3	24.6



B. HUMIDITY

TABLE XI: MEAN RELATIVE HUMIDITY (%) at PORT BLAIR

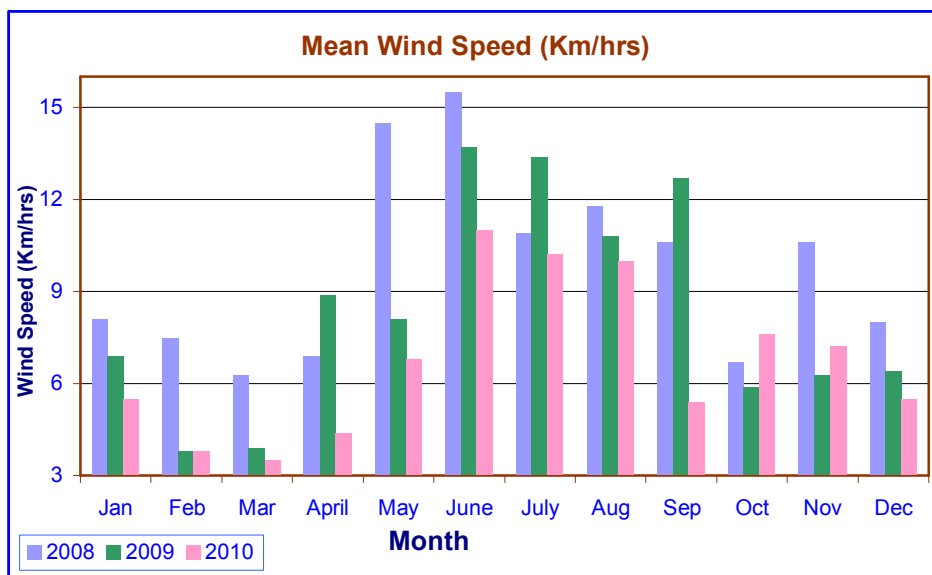
Year \ Month	2008		2009		2010	
	0830 hrs	1730 hrs	0830 hrs	1730 hrs	0830 hrs	1730 hrs
January	73	75	65	70	77	78
February	74	74	66	68	68	70
March	74	79	70	76	69	72
April	77	78	74	80	69	72
May	86	87	84	86	77	80
June	86	86	90	90	86	87
July	90	90	87	87	91	91
August	87	89	86	87	90	92
September	87	88	83	83	85	90
October	81	85	81	88	86	90
November	77	84	74	80	81	85
December	66	72	72	79	79	84
Average	80	82	78	81	80	83



D.WIND SPEED

TABLE XII : MEAN WIND SPEED (km/hrs) at PORT BLAIR

MONTH/YEAR	2008	2009	2010
January	8.1	6.9	5.5
February	7.5	3.8	3.8
March	6.3	3.9	3.5
April	6.9	8.9	4.4
May	14.5	8.1	6.8
June	15.5	13.7	11.0
July	10.9	13.4	10.2
August	11.8	10.8	10.0
September	10.6	12.7	5.4
October	6.7	5.9	7.6
November	10.6	6.3	7.2
December	8.0	6.4	5.5
AVERAGE	9.8	8.4	6.7



E . EARTHQUAKE

TABLE XIII:SHOCKS OF MAGNITUDE 5.0 AND ABOVE ON RICHTER SCALE(2010)

SL	DATE	TIME (IST)	LATITUDE (°N)	LONGITUDE (°E)	MAGNITUDE (ON RICHTER SCALE)	APPROX. GEOGRAPHICAL LOCATION
1	25/2/10	9.22	14.4N	93.1E	5.0	Northern Island
2	30/3/10	22.25	13.8N	92.8	6.8	North coast of Andaman Island
3	14/4/10	1.45	7.9	91.9E	5.4	Off coast of Nicobar Island
4	16/5/10	14.26	14.5	93.2	5.3	North Andaman Island region
5	1/6/10	1.22	11.2N	93.7	6.6	Andaman & Nicobar region
6	12/6/10	12.57	7.9	91.7	7.8	Off coast of Nicobar Island
7	19/6/10	4.39	13.4	93	6.0	Off coast of Andaman Island
8	25/6/10	12.59	7.7	91.9	5.3	Nicobar Island region
9	2/7/10	23.53	9.9	91.8	5.2	Andaman sea
10	8/7/10	19.17	14.5	93.2	5.3	Off coast of North Andaman Island
11	12/7/10	2.37	7.9	92.2	5.1	Nicobar Island region
12	3/8/10	7.18	11.2	93.2	5.2	Andaman Island
13	17/8/10	7.09	11.7	95	5.2	Andaman Island
14	2/9/10	5.47	12.9N	92.5E	5.3	Andaman Island
15	11/9/10	17.13	7.8N	94.2E	5.4	Nicobar Island, felt report Campbell bay
16	3/10/10	8.28	14.3N	92.9E	5.0	Andaman Island
17	17/10/10	1.22	6.8N	94.5E	5.4	Off coast of Nicobar Island
18	17/10/10	15.45	13.2	92.5E	5.1	North Andaman Island

Annexure

Annual Climate Summary of India during 2010

Source:- Indian Meteorological Press release 13th January 2011
 Website .www.imd.gov.in.

Salient features

- Mean annual temperature for the country as a whole during 2010 was +0.93^oC above the 1961-1990 average. It was slightly higher than that of the year 2009, thus making the year 2010 as the warmest year on record since 1901.
- Considering different seasons, Pre- Monsoon season (March-May) in 2010 was the warmest since 1901 with mean temperature being 1.8^oC above normal
- The annual total rainfall for the country as a whole was normal during the year 2010 with actual rainfall of 121.5 cm against the long period average (LPA) of 119.7 cm.
- Seasonal rainfall during monsoon season (June to September) contributes about 75% of total annual rainfall for the country as a whole. Seasonal monsoon rainfall during 2010 was 102% of its LPA of 89 cm. Out of 597 meteorological districts for which data are available, 29% of the districts (173 districts) received excess rainfall, 40% (240 districts) received normal rainfall, 29% (173 districts) received deficient rainfall and the remaining 2% (11 districts) received scanty rainfall during the season.
- The north Indian Ocean witnessed the formation of eight cyclonic disturbances (depression & above) during 2010 which was far below the normal of 13 disturbances. However, five cyclones formed during 2010 which is the first such year after 1998 when six cyclones formed. There was no depression during monsoon season.
- Out of five cyclones, three cyclones made landfall with atleast cyclonic storm intensity. Out of these three, only one (severe cyclonic storm, LAILA, 17-21 May 2010) crossed Indian coast (crossed Andhra Pradesh coast near Bapatla on 20th May evening).
- Abnormally warm conditions (heat wave) prevailed over major parts of the country during March and April months.
- Severe cold wave conditions prevailed over northern plains in January and during first fortnight of February. Maximum temperature over a number of stations over the northern plains was 5 to 10^oC below normal on many occasions during January.
- A Tornado like situation with strong winds estimated to be more than 100 kmph raged havoc in West Bengal and Bihar on 13 April, 2010.
- A cloud burst in early hours of 6 August in Leh (J&K) during 2010.

Characteristic features of various weather and climatic conditions over India during 2010

Temperature :

□ **Annual Mean Temperature**

In 2010, annual mean temperature averaged over the country as a whole was +0.93^oC above the 1961-1990 average The year 2010 was the warmest year on record since 1901. The other warmer years on record in order are 2009 (0.92), 2002(0.71), 2006(0.6), 2003(0.560), 2007(0.553), 2004(0.515), 1998(0.514), 1941(0.448), 1999 (0.445), 1958(0.435), 2001(0.429) and 1987(0.413). Details are given in Table 1 (Next Page).

Table 1: Temperature ranking 2001-2010

RANKING (2001-2010)	YEAR	TEMPERATURE (°C)	ANOMALY (°C)
WARMEST	2010	25.8023	0.9319
2	2009	25.7876	0.9172
3	2002	25.7366	0.7084
4	2006	25.5024	0.6016
5	2003	25.4720	0.5600
6	2007	25.4430	0.5528
7	2004	25.4232	0.5143
8	2001	25.3848	0.4292
9	2005	25.2800	0.4096
COLDEST	2008	25.2562	0.3857

Considering spatial pattern, mean annual temperature were generally above normal throughout the country. These anomalies (Departure from normal) were more than 1.0 °C over most parts of the central and northern India.

The analysis of both maximum and minimum temperatures indicates that both these temperatures contributed to the rise in mean temperature over India.

• **Monthly Mean Temperature**

Mean monthly temperature over the country as a whole was the highest since 1901 for March (2.27 °C), April (2.02 °C) and November (1.17 °C) 2010 and the second highest for May 2010 (1.17 °C). Abnormal warm conditions (minimum temperature exceeding the normal by 5 °C on many days) prevailed over the peninsular/ central parts during November making it record warmest since 1901.

Both maximum and minimum temperatures contributed for record warming of March, April and May months, while above normal minimum temperatures were apparently responsible for record high temperature in November.

□ **Decadal variation of temperature**

The mean temperature during different decades over the of 1901-2010 are shown in Table 2. It is found that the decade 2001-2010 has been the warmest decade with a temperature anomaly of 0.40 C.

Table 2: Decadal variation of temperature

Decade	Mean Temperature (°C)	Anomaly with respect to 1961-1990 (°C)
1901-1910	25.1	-0.2
1911-1920	25.2	-0.2
1921-1930	25.3	-0.1
1931-1940	25.2	-0.2
1941-1950	25.5	-0.1
1951-1960	25.7	0.0
1961-1970	25.7	-0.1
1971-1980	25.7	0.0
1981-1990	25.9	0.1
1991-2000	26.1	0.2
2001-2010	26.3	0.4

Rainfall features

The annual total rainfall for the country as a whole was normal during the year 2010 with actual rainfall of 121.5 cm against the long period average (LPA) of 119.7 cm (Table 3). However, there was large spatio-temporal variation of rainfall. While the rainfall for the country as a whole was normal during pre-monsoon season and post-monsoon seasons, it was deficient during winter and excess during post-monsoon season respectively. The rainfall during 2010 was excess/normal over most part of the country except Punjab, east Madhya Pradesh, east Uttar Pradesh, Bihar, Jharkhand and Gangetic West Bengal where it was deficient.

Deficient rainfall over these sub-divisions except Punjab was mainly due to deficient rainfall during monsoon season and that over Punjab was mainly due to scanty and deficient rainfall during winter and post monsoon season respectively. Details of rainfall distribution during different months and seasons are given in Table.3.

Table 3. All India rainfall (mm) during 2010

Period	Actual	Normal	% Departure
January	7.5	20.9	-64
February	17.0	23.0	-26
March	14.0	31.4	-56
April	39.0	38.8	00
May	73.8	63.5	16
June	138.0	163.5	-16
July	300.5	292.3	03
August	274.7	261.9	05
September	197.4	175.5	12
October	69.0	78.9	-13
November	58.0	29.8	95
December	22.4	17.8	26
Winter season	24.5	43.9	-44
Pre-monsoon season	126.7	133.7	-05
Monsoon season	910.6	893.2	02
Post-monsoon season	153.2	126.3	21
Annual	1215.0	1197.1	01

□ **Winter Season (Jan-Feb 2010):**

The rainfall during winter season was deficient (44% below the LPA) for the country as a whole. Considering different meteorological sub-divisions, the seasonal rainfall was excess/normal over Jammu & Kashmir, Karnataka, Maharashtra, Goa, Andhra Pradesh and Andaman & Nicobar Islands. It was deficient/scanty over the remaining parts of the country.

□ **Pre-Monsoon Seasons (March-May 2010):**

The rainfall during pre-monsoon season was near normal over the country as a whole. However, considering meteorological subdivisions, the seasonal rainfall was excess/normal over Tamil Nadu, Puducherry, Andhra Pradesh, south Karnataka, Orissa, West Bengal, northeastern states, Bihar and Jammu & Kashmir. It was deficient/scanty over remaining parts of the country.

□ **Monsoon Season (June-September 2010):**

The 2010 southwest monsoon season rainfall over the country as a whole was normal. Rainfall activity for the country as whole on even on daily scale was generally normal to above normal on most of the days during the season, except during the last 10 days of June, middle of July, first week of August and last week of September.

Onset of southwest monsoon took place over Kerala on 31 May, a day ahead of the normal date (1 June) and the monsoon regularly advanced westwards and northwards up to 18 June covering Peninsular, northeastern / eastern parts of the country. Subsequently, there was a prolonged hiatus of about two weeks and further progress of the monsoon started only on 1 July. It regularly and rapidly, covered the remaining eastern and entire northern/northwestern parts of the country and thus the entire country by 6th July, about 9 days ahead of its normal date (15 July).

For the country as a whole, seasonal rainfall at the end of the southwest monsoon season (June to September) was 102% of its LPA.

During the season, out of 36 meteorological subdivisions, 14 received excess rainfall, 17 received normal rainfall and remaining 5 subdivisions received deficient rainfall. Out of 597 meteorological districts for which data are available, 29% of the districts (173 districts) received

excess rainfall, 40% (240 districts) received normal rainfall, 29% (173 districts) received deficient rainfall and the remaining 2% (11 districts) received scanty rainfall during the season. The annual monsoon rainfall during 1901-2010. There is no significant trend in monsoon rainfall over the years. However, there has been three all India drought years during the recent decade, viz., 2002, 2004 and 2009. All other years during the decade (2001-2010) has been normal rainfall years.

• **Post-Monsoon Season**

Rainfall for country as a whole was 121% of the normal value. All five sub-divisions viz: Tamil Nadu, Rayalaseema, coastal Andhra Pradesh, south interior Karnataka and Kerala (core regions receiving northeast monsoon rainfall) received excess rainfall. Seasonal rainfall over these sub-divisions was 155% of the normal value. The remaining parts of south India as well as west and east India also received excess to normal rainfall.

Cyclonic disturbances

- The north Indian Ocean witnessed the formation of eight cyclonic disturbances during 2010 which was far below the normal of 13 disturbances. However, five cyclones formed during 2010 which is the first such year after 1998 when six cyclones formed.
- Out of eight disturbances six cyclonic disturbances formed over the Bay of Bengal and two over the Arabian Sea.
- Out of the six cyclonic disturbances over the Bay of Bengal, one intensified upto the stage of very severe cyclonic storm (GIRI), two upto the stage of severe cyclonic storm (LAILA & JAL), one upto the stage of deep depression and rest two upto the stage of deoression. Out of two cyclonic disturbances formed over the Arabian Sea, one intensified upto the stage of very severe cyclonic storm (PHET) and the other (BANDU) upto the stage of cyclonic storm.
- Tracks of the cyclonic disturbances formed over the north Indian Ocean during the period.
- There were no cyclonic disturbances formed over the north Indian Ocean during monsoon season. Comparing with past records (1891-2009), there was only one such year viz. 2002. On an average, 7 cyclonic disturbances formed over the north Indian Ocean during the monsoon season. While the year 2002 was an all India drought year, the year 2010 was a normal rainfall year. It was mainly because of the fact that the absence of cyclonic disturbances was compensated by the number of low pressure areas over the region. There were 13 low pressure areas during the season against the normal of 6. Considering low pressure systems including lows and cyclonic disturbances (depression and above), about 13.5 such systems developed normally during monsoon season.
- Out of five cyclones, three cyclones made landfall with atleast cyclonic storm intensity. Out of these three, only one (severe cyclonic storm, LAILA, 17-21 May 2010) crossed Indian coast (crossed Andhra Pradesh coast near Bapatla on 20th May evening). It caused death of 6 person and loss of property. It was the first ever severe cyclone to cross Andhra Pradesh coast after 1990 in the month of May. A very severe cyclone crossed Andhra Pradesh coast near the same area during May, 1990.
- The cyclone Phet over the Arabian Sea had the rarest of the rare track with two landfall points over Oman and Pakistan and longest track in recent years.
- Cyclonic Storm, 'BANDU' over the Arabian Sea (19-23 May 2010) moved west wards and dissipated over Gulf of Aden.
- Very Severe Cyclonic Storm, 'GIRI' over the Bay of Bengal (20-23 October, 2010) crossed Myanmar coast near Kyaukpyu on 22nd October evening. No severe cyclone crossed Arakan coast prior to cyclone, GIRI during the month of October, as evident from the data of 1891-2009.
- Severe Cyclonic Storm, 'JAL' (04-08 November, 2010) weakened before the landfall and crossed north Tamil Nadu and Andhra Pradesh coast to the north of Chennai on 7th November evening, as a deep depression. The convective clouds were sheared to the west to a large extent on the date of landfall leading to more rainfall over interior parts than the coastal regions and caused flood.