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Cyclonic storms and Depressions over the north Indian Ocean during 2020*

1. Introduction

During 2020, in all 9 intense low pressure systems formed over the Indian Seas. These included; one Super Cyclonic Storm (AMPHAN), two Very Severe Cyclonic Storms (GATI & NIVAR), one Severe Cyclonic Storm (NISARGA), one Cyclonic Storm (BUREVI), one Deep Depression and three Depressions. Out of these 9 systems, 5 systems formed over the Bay of Bengal and 4 over the Arabian Sea.One Super cyclonic storm (SuCS) formed over the Bay of Bengal and one depression formed over Arabian Sea in Pre-monsoon season. Monsoon Season witnessed one Severe Cyclonic Storm (SCS) over the Arabian Sea.Two very severe cyclonic storms, one over Bay of Bengal and one over Arabian Sea; one cyclonic storm over Bay of Bengal; one deep depression over Bay of Bengal & two Depressions, one each over Bay of Bengal and Arabian Sea formed in the Post-monsoon season.

The details of these systems are summarised below, and also in Tables 1-3 and the tracks are shown in Fig. 1.

2. Details of the systems

2.1. *Super cyclonic storm 'AMPHAN'* over southeast Bay of Bengal *(16-21 May, 2020)*

2.1.1. Under the influence of the cyclonic circulation over south Andaman Sea and neighbourhood, a low pressure area formed over southeast Bay of Bengal and adjoining south Andaman Sea on 13th. It then lay as a **Well Marked Low Pressure Area** over southeast Bay of Bengal & neighbourhood on 14th and 15th. It concentrated into a **Depression** over southeast Bay of Bengal during the early morning (0000 UTC) of 16th May, 2020. It moved northwestwards and intensified into a **Deep Depression** and lay centred over the same region at 0900 UTC of 16th May. It remained practically stationary and intensified into **Cyclonic Storm 'AMPHAN'** (pronounced as UM-PUN) and lay centred over the same region at 1200 UTC of 16th May. It then moved slowly northwestwards and intensified into a **Severe Cyclonic Storm** and lay centred over the same region at 0300 UTC of 17th May. Moving slowly northwards, it further intensified into a **Very Severe Cyclonic Storm** and lay centred over central parts of South Bay of Bengal and neighbourhood at 0900 UTC of 17th May. It further moved northwards and lay centred at 1200 UTC of 17th Mayover central parts of South Bay of Bengal. Then it recurved north-northeastwards and lay centred at 1800 UTC of 17th May. It further intensified into an **Extremely Severe Cyclonic Storm** and lay centred at 2100 UTC of 17th May. It moved nearly northwards and lay centred at 0000 UTC of 18th Mayover westcentral and adjoining central parts of south Bay of Bengal. It further moved northwards and lay centred at 0300 UTC of 18th Mayover westcentral and adjoining central parts of South Bay of Bengal. It continued to move northwards and intensified into a **Super Cyclonic Storm** at 0600 UTC of 18th May and lay centered over westcentral and adjoining central parts of south Bay of Bengal. It further moved northwards and lay centered at 1200 UTC of 18th May. It moved nearly north-northeastwards and lay centred at 1800 UTC of 18th May. It continued to move north-northeastwards and lay centered at 0300 UTC of 19th May. It further moved northwards and lay centered at 0900 UTC of 19th May as an **Extremely Severe Cyclonic Storm**. It continued to move nearly northwards and lay centered at 1200 UTC of 19th May over the same region. It then moved north-northeastwards and lay centred at 1500 UTC of 19th May over northwest and adjoining westcentral Bay of Bengal. It moved northwards and lay centred at 1800 UTC of 19th May over the same region. It moved north-northeastwards and lay centred at 0300 UTC of 20th May over the same region. It continued to move north-northeastwards and lay centred at 0600 UTC of 20th May over northwest Bay of Bengal. It further moved north-northeastwards and crossed West Bengal - Bangladesh coasts as a **Very Severe Cyclonic Storm** with a speed of 155-165 kmph gusting to 185 kmph across Sundarbans, near Lat. 21.6° N / Long. 88.3° E and lay centred at 1200 UTC of 20th May over West Bengal coast. It continued to move north-northeastwards and lay centered at 1800 UTC of 20th May over Bangladesh and adjoining West Bengal near Lat. 23.3° N / Long. 89.0° E as a **Severe Cyclonic Storm**. It further weakened into a **Cyclonic Storm** and lay centered at 0300 UTC of 21st May over same region.It further moved north- northeastwards and weakened into a **Deep Depression** and lay centered at 0600 UTC of 21st May over Bangladesh. It moved slightly northwards and further weakened into a **Depression** and lay centred at 1200 UTC of 21st May over the same region. It continued to move slightly northwards and further weakened into a well marked low pressure area over north Bangladesh and neighbourhood by 1800 UTC of 21st May.

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TABLE 1

Brief Summary of Cyclonic Storms and depressions over Indian Seas and neighbourhood during 2020

S. No.	Category	Life Period	Place/Time of landfall	Lowest Estimated central Pressure (hPa)	Max. wind Estimated (kts)	Highest "T" No.
1.	Super cyclonic storm 'AMPHAN'	16 - 21 May	Crossed west Bengal- Bangladesh coast as a very severe cyclonic storm across Sundarbans between 1000 & 1200 UTC of 20th May. Weakened into well marked low pressure area over north Bangladesh and neighbourhood at 1800 UTC of 21st May	926	125	6.5
2.	Depression	29th May - 1st Jun	Weakened into well marked low pressure area over south coastal Oman and adjoining Yemen at 0000 hrs UTC of 1st June	1000	25	-
3.	Severe cyclonic storm 'NISARGA'	1 - 4 Jun	Crossed Maharashtra coast close to south of Alibaug as a very severe cyclonic storm across Sundarbans between 0700 & 0900 hrs UTC of 3rd June. Weakened into well marked low pressure area over Central parts of Madhya Pradesh at 1200 hrs UTC of 4th June	984	60	4.0
4.	Deep depression	11 - 14 Oct	Crossed north Andhra Pradesh coast close to Kakinada as a deep depression between 0100 to 0200 hrs UTC of 13th Oct. Weakened into well marked low pressure area over south Madhya Maharashtra and neighbourhood at 1200 hrs UTC of 14th October	996	30	2.0
5.	Depression	17 - 19 Oct	Weakened into well marked low pressure area west central Arabian Sea and neighbourhood at 0000 hrs UTC of 19th Oct	1003	25	1.5
6.	Depression	22 - 24 Oct	Crossed west Bengal and adjoining Bangladesh coast as a depression between 0600 to 0700 hrs UTC of 23rd Oct. Weakened into well marked low pressure area over central parts of Bangladesh at 0000 hrs UTC of 24th October	998	25	1.5
7.	Very severe cyclonic storm 'GATI'	21 - 24 Nov	Crossed north Somalia coast as a very severe cyclonic storm between 1400 to 1500 hrs UTC of 22nd November. Weakened into well marked low pressure area Gulf of Aden and adjoining Somalia at 0600 hrs UTC of 24th November	976	75	4.5
8.	Very severe cyclonic storm 'NIVAR'	22 - 27 Nov	Crossed Tamil Nadu and Puducherry coasts near Puducherry as a Very Severe Cyclonic Storm between 1800-2100 UTC of 25th November. Weakened into well marked low pressure area over south coastal Andhra Pradesh and adjoining west central Bay of Bengal at 0000 hrs UTC of 27th November	982	65	4.0
9.	Cyclonic storm 'BUREVI'	30th Nov - 5th Dec	Crossed Sri Lanka coast close to north of Trincomalee as a Cyclonic Storm between 1700-1800 hrs UTC of 2nd December Weakened into well marked low pressure area over Gulf of Mannar at 0600 hrs UTC of 5th December	996	45	3.0

2.1.2. *Other features observed*

The Maximum sustained wind of the cyclone was 240-250 kmph (130 knots) gusting to 275 kmph (145 knots) during 1800 UTC of 18th to 0000 UTC of 19th May over the westcentral Bay of Bengal. The lowest estimated central pressure was 920 hPa during the same period. Thereafter, the system started weakening over westcentral Bay of Bengal under unfavourable environment [increase in vertical wind shear (20-25 knots)] and low Ocean thermal energy. The system crossed West Bengal-Bangladesh coasts as a very severe cyclonic storm across Sundarbans, near Lat. 21.65° N / Long. 88.30° E during 1000-1200 UTC, with maximum sustained wind speed of 85 knots gusting to 100 knots.

2.1.3. *Realized weather*

Rainfall associated with **Super Cyclonic Storm 'AMPHAN'** in general had been the occurrence of heavy to very heavy rainfall at a few places over coastal Odisha & Gangetic West Bengal on 20th May, heavy rainfall at isolated places over Gangetic West Bengal & adjoining Bangladesh, Assam, Meghalaya & Arunachal Pradesh on

TABLE 2

Storms/Depressions statistics 2020

Name of the system	Winter		Pre Monsoon			Monsoon				Post Monsoon			Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Over the Bay of Bengal													
Depressions/deep depressions	-	-	-	-	-	-	-	-	-	2	-	-	**2**
Cyclonic storms	-	-	-	-	-	-	-	-	-	-	1	-	**1**
Severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-	-
Very severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	1	-	**1**
Extremely severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-	-
Super cyclonic storms	-	-	-	-	1	-	-	-	-	-	-	-	**1**
Land Depression													
Depressions/deep depressions	-	-	-	-	-	-	-	-	-	-	-	-	-
Over the Arabian Sea													
Depressions/deep Depressions	-	-	-	-	1	-	-	-	-	1	-	-	**2**
Cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-	-
Severe cyclonic storms	-	-	-	-	-	1	-	-	-	-	-	-	**1**
Very severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	1	-	**1**
Extremely severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-	-
Super cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand total (Nos.)	-	-	-	-	**2**	**1**	-	-	-	**3**	**3**	-	**9**

21st May and Assam, Meghalaya, Arunachal Pradesh, Sikkim, Nagaland, Manipur & Mizoram on 22nd May.

The chief amount of 24 hrs accumulated rainfall (≥7cm) ending at 0300 UTC of date during the life cycle of the system is presented below:

20 May 2020

Gangetic West Bengal : Contai 11, Digha 9

Odisha : Paradip 21, Balikuda 18, Kakatpur & Kujanga 16 each, Astaranga & Alipingal 14 each, Niali 12, Raghunathpur, Puri, Marsaghai, Nilgiri, Kantapada & Garadapur 9 each, Gop, Chandanpur, Betanati, Rajkanika, Jagatsinghpur, Tirtol & Baripada 8 each, Binjharpur, Satyabadi, Nischintakoili, Chandbali, Bhograi, Jajpur, Dhamnagar, Soro, Tihidi, Bari & Basudevpur 7 each

21 May 2020

Assam & Meghalaya : Williamnagar 23, Mawsynram 15, Sohra (RKM) 13, Bhaghmara 11, Sohra & Shillong 9 each

SHWB & Sikkim : Sevoke 7

Gangetic West Bengal : Alipore 24, Dum Dum20, Harinkhola & Debagram 13 each, Burdwan 10, Manteswar & Digha 9 each, Mohanpur, Kharagpur, Suri, Mangalkote, Bankura, Lalgarh & Midnapore 7 each

Odisha : Bhograi 13, Rajghat & Jaleswar 12 each and Chandanpur & Bangiriposi 11 each, Paradip, Samakhunta, Betanati & Baripada 9 each, Chandikhol, Joshipur & Danagadi 7 each

22 May 2020

Arunachal Pradesh : Bhalukpong 12, Bomdila 10, Itanagar & Ziro 9 each, Roing 8, Pasighat Aero 7

Assam & Meghalaya : Sohra (RKM) 25, Mawsynram 22, Sohra 21, Khliehriat 15, Goalpara 12, Nongstein, Dhubri & Mela bazar 10 each, Goibargaon, N. Lakhimpur/ Lilabari & Shillong 8 each, Tamulpur, Barapani, William-nagar, DRF & Tezpur 7 each

Nagaland, Manipur, Mizoram & Tripura : Sabroom 13

SHWB & Sikkim : Buxaduar 8

TABLE 3

Ships Observations during 1st January to 31st December, 2020

Call Sign	Date/ Time (UTC)	Position of the Ship		Wind		Pressure
		Lat. (Deg. N)	Long. (Deg. E)	Dir. (Deg.)	Speed (kts)	PPPP (hPa)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Supercyclonic storm 'AMPHAN' over southeast Bay of Bengal (16-21 May)						
9VHK7	160000	5.8	86.7	250	30	1013.9
DFKM2	160000	5.9	91.5	190	26	1000.5
DFKM2	161200	5.8	88.9	230	26	1003.1
VREK5	190600	14.9	82.4	280	20	1000.6
(B) Severe cyclonic storm 'NISARGA' over eastcentral& adjoining southeast Arabian Sea (1-4 June)						
VRFX5	010000	14.3	73.0	150	26	1008.6
9V2734	010000	17.5	67.0	310	18	1011.6
9V6386	010300	13.6	70.9	040	22	1006.3
C6AB9	011200	15.0	69.6	360	03	1012.0
VRAC9	011200	17.4	67.7	010	16	1010.5
V7BY3	020000	9.6	71.1	270	19	1008.0
WTAA	020000	18.4	67.2	-	-	1006.0
VRFX5	020300	19.3	70.0	340	12	1005.6
VRFX5	020600	19.8	69.7	350	08	1006.2
WTAA	020600	18.4	67.2	050	08	1007.2
(C) Very severe cyclonic storm 'GATI' over southwest Arabian Sea (21-24 November)						
S6LT8	211800	10.5	57.0	110	29	1025.0
9V9404	221200	12.7	50.8	050	25	1009.7
9V9373	230000	14.5	51.7	070	17	1016.0
S6LT8	230000	12.3	47.3	300	15	1024.0
9V9404	230300	12.7	54.7	080	20	1013.0
VRMX8	230600	12.5	47.4	040	43	1012.0
(D)Very severe cyclonic storm 'NIVAR' over southwest Bay of Bengal (22-27 November)						
S6LT3	222100	6.3	90.3	270	10	1011.0
AUBE	240000	-	-	190	18	1001.0
AUBE	241800	-	-	090	29	1009.5
AUZY	252100	13.7	81.0	340	37	1001.2
AUZY	260300	13.8	81.0	350	33	1004.4
AWWB	260300	14.4	85.1	120	28	1012.0
AUZY	261200			080	37	1003.1
(E) Cyclonic storm 'BUREVI' over southwest and adjoining southeast Bay of Bengal (30 November - 5 December)						
OWNQ2	300000	6.3	76.3	200	30	1007.0
DJDS2	301200	9.0	70.0	320	20	1007.7
TBWUK70	040300	18.6	68.6	140	15	1016.1

2.2. *Depression over the south coastal Oman and adjoining Yemen (29th May - 1st June, 2020)*

2.2.1. Under the influence of the cyclonic circulation over westcentral and adjoining southwest Arabian Sea, a **Low Pressure Area** formed over westcentral Arabian Sea on 28th May with the associated cyclonic circulation extended upto mid tropospheric levels. It then lay as a **Well Marked Low Pressure Area** over the same region on 29th morning. It then intensified into a **Depression** at 2100 UTC of 28th May over south coastal Oman and adjoining Yemen. It remained practically stationary and lay centred at 0300 UTC of 30th May. It remained practically stationary and lay centred at 0300 UTC of 31st May. It weakened into a well marked low pressure area over the same region at 0000 UTC of 1st June.

2.2.2. *Other features observed*

As per satellite data, maximum sustained winds of the order of 20 - 25 kts prevailed over south coastal Oman and adjoining Yemen during 29th - 31st May. No storm surge was reported in association with this system.

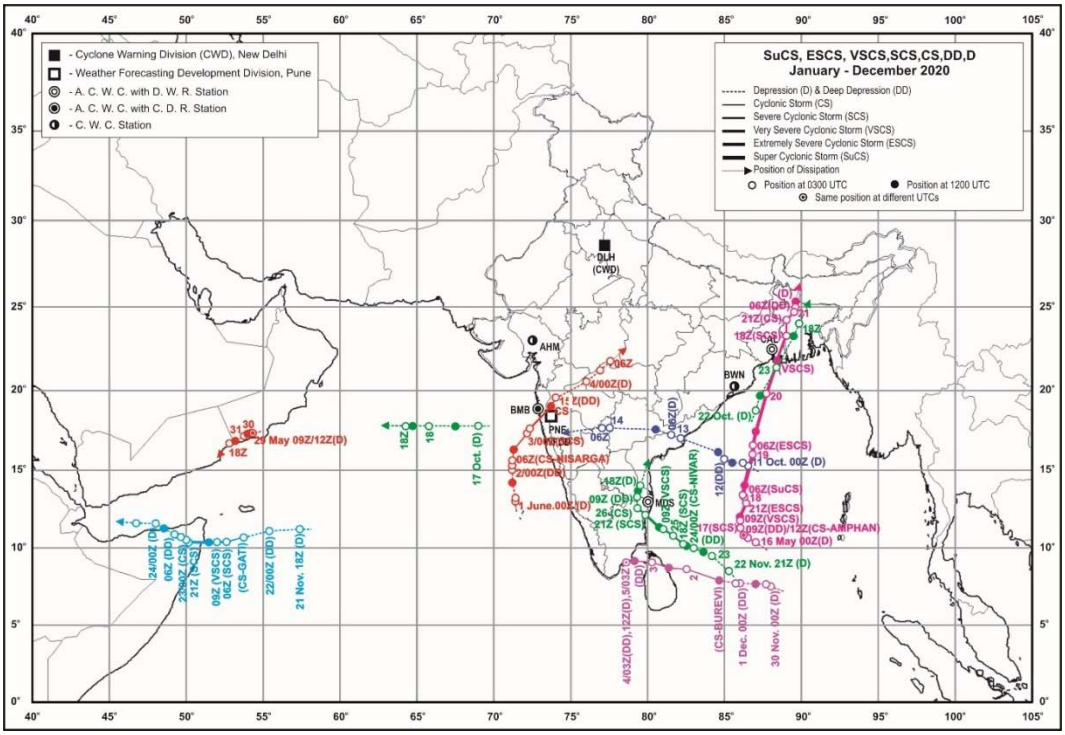

Fig. 1. Tracks of storms and depressions during the year 2020

2.2.3. *Realised weather*

Rainfall associated with depression over coastal Oman and Yemen indicated the occurrence of heavy to very heavy rainfall at few places with extremely heavy falls at isolated places during 29-31 May and heavy to very heavy rainfall at isolated places on 1st June over south coastal Oman and adjoining Yemen.

2.3. *Severe Cyclonic Storm 'NISARGA' over the Arabian Sea (1 - 4 June, 2020)*

2.3.1. Under the influence of a cyclonic circulation over southeast Arabian Sea off Kerala coast, a **Low Pressure Area** formed over southeast & adjoining eastcentral Arabian Sea and Lakshadweep area at 0000 UTC of 31st May. It then lay as a **Well Marked Low Pressure Area** over the same region at 1200 UTC of 31st May. It then concentrated into a **Depression** over eastcentral and adjoining southeast Arabian Sea and lay centred at 0000 UTC of 1st June. It moved nearly northward and lay centred at 0300 UTC of 1st June. Then it moved north-northwestwards and lay centred at 1200 UTC of 1st June over eastcentral Arabian Sea. It then moved northwards and intensified into a **Deep Depression** and lay centred at 0000 UTC of 2nd June over the same region. It further moved northwards and lay centred at 0300 UTC of 2nd June over eastcentral Arabian Sea. It further intensified into a **Cyclonic Storm 'NISARGA'** and lay centred at 0600 UTC of 2nd June over eastcentral Arabian Sea. It further intensified into a **Severe Cyclonic Storm** and moved northeastwards and lay centred at 0000 UTC of 3rd June over eastcentral Arabian. It further moved northeastwards and lay centred at 0300 UTC of 3rd June over eastcentral Arabian Sea. It further moved northeastwards and crossed Maharashtra coast close to south of Alibagh with a maximum sustained wind speed of 100-110 kmph gusting to 120 kmph between 0700 & 0900 UTC of 3rd June. It lay centred at 0900 UTC of 3rd June over coastal Maharashtra. It continued to move northeastwards and weakened into a **Cyclonic Storm** and lay centred at 1200 UTC of 3rd June over interior Maharashtra, near Lat. 19.0° N / Long. 73.7° E, 90 km east of Mumbai (Maharashtra) and 50 km north-northwest of Pune (Maharashtra). It moved north-northeastwards and further weakened into a **Deep Depression** and lay centred at 1800 UTC of 3rd June over Madhya Maharashtra, near Lat. 19.6° N / Long. 74.0° E, 40 km south of Nasik, 140 km west-southwest of Aurangabad and 120 km north-northeast of Pune. It then moved east-northeastwards and weakened into a **Depression** and lay centred at 0000 UTC of 4th June over western parts of Vidarbha. It further moved northeastwards and lay centred at 0300 UTC of 4th June over northwestern parts of Vidarbha and adjoining Madhya Pradesh. It further moved north-northeastwards and weakened into a well marked low pressure area over central parts of Madhya Pradesh at 1200 UTC of 4th June.

2.3.2. *Other features observed*

The Maximum Sustained Wind of the cyclone was 110-120 kmph (60 knots) gusting to 130 kmph (70 knots) during 0600 UTC to 0900 UTC of 3rd June over the eastcentral Arabian Sea. The lowest estimated central pressure was 984 hPa during the same period. The system crossed Maharashtra coast close to south of Alibag near Lat. 18.35° N / Long. 72.95° E, as a Severe Cyclonic Storm with maximum sustained wind speed of 110-120 kmph (60 knots) gusting to 130 kmph (70 knots) between 0700-0900 UTC of 3rd June.

2.3.3. *Realized Weather*

Rainfall associated with **Severe Cyclonic Storn 'NISARGA'** indicated the occurrence of heavy rainfall at isolated places over coastal Karnataka, Madhya Maharashtra & Marathwada on 1st June; heavy to very heavy rainfall at many places over Goa and at isolated places over Madhya Maharashtra on 3rd June; heavy to very heavy rainfall at many places over coastal Maharashtra & Goa and at isolated places over interior Maharashtra on 4th June and moderate rainfall at few places over Madhya Pradesh on 5th June.

The chief amount of 24 hrs.accumulated rainfall (≥7cm) ending at 0300 UTC of date during the life cycle of the system is presented below.

1 June, 2020

Coastal Karnataka	: Kota 10, Kundapur 7

3 June, 2020

Konkan & Goa	: Mormugao & Panjim 13 each, Quepem & Malvan 11 each, Valpoi & Sanguem 9 each, Sawantwadi, Dodamarg, Canacona & Devgad 8 each, Kudal 7
Madhya Maharashtra	: Khed & Rajgurunagar 7 each

4 June, 2020

Konkan & Goa	: Pen 16, Poladpur 15, Mangaon 14, Lanja, Mandangad & Dapoli 13 each, Tala 12, Vaibhavwadi & Alibag 11 each, Chiplun 10, Roha, Rajapur & Harnai 9 each, Guhagarh & Khed 8 each, Shahapur, Murud, Sangameshwar Devrukh, Khalapur, Jawhar & Ulhasnagar 7 each
Madhya Maharashtra	: Mahabaleshwar 19, Gaganbawada 15, Nashik 14, Sinnar, Bhusawal & Igatpuri 11 each, Akole, Devla, Satna Baglan & Chandgad 9 each, Javali Medha, Patan & Khed Rajgurunagar 8 each, Girnadam, Malegaon Camp, Sakri, Kalvan, Dindori, Yaval, Shahuwadi, Surgana & Radhanagari 7 each
Vidarbha	: Mangrulpir, Karanja Lad, Jalgaon Jamod & Washim 8 each, Manora & Malegaon 7 each

2.4. *Deep Depression over westcentral Bay of Bengal (11-14 October, 2020)*

2.4.1. A **Low Pressure Area** formed over north Andaman Sea & neighbourhood at 0000 UTC of 9th October. It lay over north Andaman Sea & adjoining eastcentral Bay of Bengal at 0300 UTC of 9th October. It lay over eastcentral Bay of Bengal and adjoining north Andaman Sea on 9th evening. It lay as a **Well Marked Low Pressure Area** over the same region on 10th morning. It concentrated into a **Depression** over westcentral Bay of Bengal and lay centred at 0000 UTC of 11th October. It then moved west-northwestwards and lay centred at 0300 UTC of 11th October. It further moved west-northwestward and lay centred at 1200 UTC of 11th October. It then lay centred at 0300 UTC of 12th October. It continued to move west-northwestwards and intensified into a **Deep Depression** and lay centred at 0600 UTC of 12th October. It lay centred at 1200 UTC of 12th October. It further moved west-northwestward and lay centred at 0000 UTC of 13th October. It crossed north Andhra Pradesh coast close to Kakinada (near Lat. 17.0° N / Long. 82.4° E) between 0100 & 0200 UTC of 13th October as a Deep Depression with maximum sustained wind speed of 55-65 kmph gusting to 75 kmph. It continued to move west-northwestwards and lay centred at 0300 UTC 13th October 2020 near Lat. 17° N / Long. 82.1° E, about 15 km west-northwest of Kakinada (Andhra Pradesh) and 200 km east-southeast of Khammam (Telangana). It further moved west-northwestward and weakened into a **Depression** and lay centred at 0600 UTC of 13th October, over Telangana, near Lat. 17.3° N / Long. 81.5° E, about 140 km east-southeast of Khammam (Telangana) and 90 km west-nothwest of Kakinada (Andhra Pradesh). It further moved west-northwestwards and lay centred at 1200 UTC of 13th October, over Telangana near Lat. 17.5° N / Long. 80.5° E, about 50 km east-northeast of Khammam (Telangana) and 110 km east-southeast of Hanamkonda (Telangana). It continued to move west-northwestward and lay centered at 0300 UTC

of 14th October, over north interior Karnataka and adjoining areas of Maharashtra and Telangana, near Lat. 17.7° N / Long. 77.5° E, about 80 km northwest of Gulbarga (north interior Karnataka) and about 160 km east of Solapur (Madhya Maharashtra). It further moved west-northwestward and weakened into a well marked low pressure area over south Madhya Maharashtra & neighbourhood at 1200 UTC of 14th October.

2.4.2. *Realized Weather*

Under the influence of this system, light to moderate rainfall at many places with heavy to very heavy & extremely heavy rainfall at isolated places occurred over Odisha, Coastal Andhra Pradesh & Yanam, Telengana and Coastal Karnataka on one day each, Heavy to very heavy rainfall at isolated places over Telangana on three days; over North & South Interior Karnataka and Marathwada on two days each; over Madhya Maharashtra, Coastal Andhra Pradesh & Yanam, Rayalaseema and Coastal Karnataka on one day each.

The chief amount of 24 hrs.accumulated rainfall (≥7cm) ending at 0830 hrs. IST of date during the life cycle of the system is presented below.

11th October

Coastal Andhra Pradesh (A.P.) & Yanam	: Racherla 10, Velairpad 8
Telangana	: Kothagudam 14
Rayalaseema	: Chinnamandem 13, Pakala 12, Badvel 10, Uravakonda, Orvakal, Atmakur, Gurramkonda &Kurnool 9 each, Atlur, Penagaluru, Pamidi & Sambepalle 8 each, Lepakshi 7

12th October

Coastal A.P. & Yanam	: Bheemunipatnam 17, Vishakhapatnam 15, Vishakhapatnam AP, Kakinada & Peddapuram 14 each, Yanam 11, Anakapalle & Amalapuram 10, Marripudi & Tuni 8 each, Prathipadu, Dowleshwaram & Yelamanchili 7 each
Telangana	: Kondapak & Ramayampet10, Ghattu, Mirdoddi, Bhiknur, Sarangapurand & Domakonda 7 each
Rayalaseema	: Simhadripuram 7
North interior Karnataka	: Hukkeri 13, Hungund 10, Khajuri & Bevoor 9

13th October

Odisha	: Mohana 14, Paralakhemundi 12, Nuagada 11, Berhampur & Aska 10 each, Kashinagar & Purushottampur 9 each, Mahendragarh & Chhatrapur8 each, R. Udaigiri & Gunupur 7 each
Coastal A.P. & Yanam	: Yanam 25, Amalapuram, Tanuku and Nuzvid 19 each, Tadepalligudem 18, Vijayawada A.P. & Bheemunipatnam 16, Kaikalur, Palasa, Ichchapuram & Tiruvuru 15 each, Yelamanchili 14, Chintalapudi, Sompeta, Gudivada & Mandasa 13 each, Narsapuram, Kakinada, Prathipadu, Koyyalagudem, Palakoderu & Bheemavaram 12 each, Dowleshwaram, Peddapuram, Bhimadole, Rajahmundry, Narsipatnam & Eluru 11 each, Vijayawada(ARG) & Tuni 10 each, Prakasam Barrage, Nandigama, Bondapalle, Anakapalle, Chodavaram & Vepada 9 each, Vishakhapatnam A.P., Vararamachandrapur, Therlam, Kukunoor, Paderu, Pathapatnam, Pusapatirega & Vishakhapatnam 8 each, Velairpad, Denkada, Palakonda, Ranastalam, Parvathipuram, Mangalagiri, Nellimarla, Mentada, Nandigama (ARG), Paleru Bridge, Koida, Gajapathinagaram, Garugubilli, Polavaram, Merakamudidam, Kalingapatnam, Garividi & Kunavaram 7 each

14th October

Odisha	: Aska 21, Purushottampur 19, Daspalla & Sorada 10 each, Daitari 9, Berhampur, Daringibadi, R. Udaigiri, Digapahandi, Brahmagiri, Mohana & Raikia 7 each
Coastal A.P. & Yanam	: Avanigada, Nandigama (ARG), Sattenapalle & Therlam 10 each,

	Macherla, Sompeta, Machilipatnam CDR & Narsapuram 9 each, Nandigama & Jangamaheswarapuram 8 each, Repalle & Bheemavaram 7 each
Telangana	: Hayathnagar 30, Jogipet 24, Ibrahimpatnam 23, Hakimpet IAF 20, Hyderabad A.P. 19, Golkonda, Manchal & Warangal 18 each, Tekmal & Marpalle 17each, Nalgonda & Kondapur16 each, Sangareddy, Kohir, Mominpet, Medchal, Dindigul, Chandur, Maheswaram, Shamirpet, Hathanoora & Narsapur 15 each, Nidamanur, Yacharam & Saroornagar 14 each, Munipalli, Naykal & Raikode 13 each, Peddemul, Doultabad & Medak 12 each, Sadasivpet, Palakurthi, Nawabpet, Alladurg, Chevella, Narmetta, Gajwel & Regode 11 each, Chegunta, Ghanpur, Kondapak, Kowdipalle, Ramayampet & Jagadevpur 10 each, Mahabubabad, Zaffergadh, Vicarabad, Aswaraopet, Mirdoddi, Tandur, Dubbak & Nanganur 9 each, Jangaon, Bejjanki, Marriguda, Huzurabad, Nagareddipet & Kamareddy 8 each, Sathupalle, Jukkal, Bhiknur, Doma, Mustabad, Jajireddigudem, Papannapet, Noothankal & Narayankhed 7 each
Marathwada	: Nilanga 13, Deoni & Umarga 8 each, Chakur & Ausa 7 each
Konkan & Goa	: Malvan 9, Dodamarg 7
North interior Karnataka	: Manthala and Basavakalyan 15 each, Humnabad, Kalaburgi obsy, Bidar PTO & Kalaburgi AWS 13 each, Chincholi & Khajuri 11 each, Aland & Aurad8 each, Afzalpur HMS &Raddewadgi ARG 7 each
South interior Karnataka	: Agumbe EMO 14, Kottigehara 9, Arasalu 7
Coastal Karnataka	: Kollur 24, Kota 17, Mulki 17, Mani & Mangaluru A.P. obsy 15 each, Mudubidre, Brahmavar AWS, Karkala & Udupi 13 each, Kundapur, Belthangadi, Puttur HMS, Mangaluru, Panambur obsy & Vitla ARG 12 each, Dharmasthala 11, Bhatkal & Sulya 10 each, Shirali PTO 9, Siddhapura ARG, Siddhapura & Subramanya 8 each, Uppinangadi 7

15th October

Marathwada	: Paranda 18, Tuljapur 14, Lohara 10, Shirur Kasar & Georai 7
Madhya Maharashtra	: Gaganbawada 17, Indapur, Barshi, Pandharpur & Jeur IMD Part time 16 each, Baramati & Sangli IMD obsy 15 each, Panhala & Malshiras 14 each, Mangalvedha, Mahabaleshwar IMD obsy & Kolhapur/Karvir IMD 13 each, Vita, Pune city IMD obsy, Bhor, Karad, Ambegaon & Ghodegaon 11 each, Patan, Palus, Lonavala agri, Shirala & Karmala 10 each, Tasgaon, Miraj, Kavathe Mahakal, Atpadi, Dahiwadi man, Khandala Bavda, Kagal, Daund, Wai, Kadegaon, Madha, Satara IMD obsy, Khatav Vaduj, Jat, Shirur & Ghodnadi 9 each, Sholapur IMD obsy, Shirol, Purandar, Sasvad, Khed & Rajgurunagar 8 each, Phaltan, Javali Medha, Junnar, Hatkanangale, Mohol, Velhe, Akole & Vadgaon maval 7 each
Konkan & Goa	: Alibag IMD part time & Lanja 15 each, Khed 14, Murud 13, Karjat agri, Vaibhavwadi, Khalapur, Pen, Ratnagiri IMD obsy, Matheran & Colaba IMD obsy 12 each, Rajapur, Sangameshwar & Devrukh 11 each, Poladpur & Panvel agri 10 each, Mandangad, Sudhagad Pali, Bhira IMD part time, Santacruz IMD obsy & Roha 9 each, Malvan, Chiplun & Tbia IMD part time 8 each, Shriwardhan, Mahad, Mhasla, Guhagarh, Tala, Dodamarg & Uran 7 each

2.5. *Depression over eastcentral & adjoining northeast Arabian Sea (17-19 October, 2020)*

2.5.1. The remnant **Well Marked Low Pressure Area** of the above system over south Madhya Maharashtra & neighbourhood on 1200 UTC of 14th October. It moved westwards and lay over south Madhya Maharashtra & adjoining south Konkan with associated cyclonic circulation extending upto midtropospheric levels on 15th morning. It moved west-northwestwards and lay centred at 1200 UTC of 15th October over Konkan and neighbourhood. It lay over eastcentral Arabian Sea off north Maharashtra coast on 16th morning. It moved west-northwestwards and lay centred over eastcentral & adjoining northeast Arabian Sea off south Gujarat coast at 1200 UTC of 16th October. It moved west-northwestwards and lay centred over eastcentral & adjoining northeast Arabian Sea at 0000 UTC of 17th October. It concentrated into a **Depression** and lay centred at 0300 UTC of 17th October over eastcentral & adjoining northeast Arabian Sea. It moved nearly westwards and lay centred at 1200 UTC of 17th October over eastcentral and adjoining northeast Arabian Sea. It further moved westwards and lay centred at 0300 UTC of 18th October over eastcentral and adjoining westcentral and north Arabian Sea. It continued to move westwards and lay centred at 1200 UTC of 18th October over the same region. It moved further westwards, weakened into a well marked low pressure area and lay centred at 0000 UTC of 19th October over westcentral Arabian Sea & neighbourhood.

2.5.2. *Other features observed*

Since the system moved away from the Indian coast, it did not cause any rainfall over the land area. The daily rainfall distribution ending at 0300 UTC of each date during 15-21 October, 2020 noted that the rainfall over Maharashtra on 15th and over coastal belt of Maharashtra on 16th October happened due to the presence of the remnant well marked Low pressure area over the region. The system caused heavy rainfall (64.5-115.5 mm) over parts of east-central & adjoining northeast Arabian Sea on 17th & 18th and over northern parts of central Arabian Sea on 19th October.

2.6. *Depression over northwest and adjoining westcentral Bay of Bengal (22-24 October, 2020)*

2.6.1. Under the influence of a cyclonic circulation over central parts of Bay of Bengal and neighbourhood, a **Low Pressure Area** formed over the same region on 20th October, 2020. It then lay as a **Well Marked Low Pressure Area** over westcentral Bay of Bengal and neighbourhood with the associated cyclonic circulation extended between 1.5 km & 5.8 km above m.s.l. tilting southward with height on 21st evening It then lay over northwest and adjoining westcentral Bay of Bengal off south Odisha-north Andhra Pradesh coasts on 22nd morning. It concentrated into a **Depression** over northwest and adjoining westcentral Bay of Bengal at 0300 UTC of 22nd October. It moved north-northeastward and lay centred at 1200 UTC of 22nd October. It further moved north-northeastwards and lay centred at 0000 UTC of 23rd October. It continued to move north-northeast wards and lay centred at 0300 UTC of 23rd October. It further moved north-northeastwards and crossed West Bengal and adjoining Bangladesh coasts near Lat. 21.8° N / Long. 88.5° E between 0600 & 0700 UTC of 23rd October as a depression. It moved across 24 Parganasdistricts of West Bengal and lay centred at 0900 UTC of 23rd October over Bangladesh near Lat. 22.5° N / Long. 89.1° E about 140 km northeast of Sagar Islands (West Bengal), 130 km west-northwest of Khepupara (Bangladesh) and about 190 km southwest of Dhaka (Bangladesh). It moved north-northeastward and lay centred at 1200 UTC of 23rd October, over Bangladesh. It continued to move north-northeastwards and lay centred at 1800 UTC of 23rd October over central parts of Bangladesh. It further moved north-northeastwards and weakened into a well marked low pressure area and lay centred over the same region at 0000 UTC of 24th October.

2.6.2. *Realized Weather*

The system caused heavy rainfall at isolated places over Odisha and heavy to very rainfall at few places with extremely heavy falls at isolated places over coastal Bangladesh on 23rd and Assam & Meghalaya on 24th. Heavy rainfall also occurred over Manipur, Nagaland, Mizoram & Tripura on 23rd & 24th October. As a consequence of these heavy rains, landslides also happened over northeastern states, affecting normal life.

The chief amount of 24 hrs accumulated rainfall (≥7cm) ending at 0830 hrs. IST of date during the life cycle of the system is presented below.

22nd October

Odisha	: Paradip & Tihidi 7 each

23rd October

Assam & Meghalaya	: Mawsynram 13, Sohra 12, Sohra (RKM) 11, Bakulia 8
Nagaland-Manipur - Mizoram-Tripura	: Sabroom 8, Lawngtlai 7
Odisha	: Kendrapara 7

24th October

Assam & Meghalaya	: Mawsynram 35, Sohra (RKM) 30, Sohra 29, Shillong C.S.O. 17, Nongstein 16, Shillong AWS 15, Barapani 13, Dharamtul & Kampur 10 each, Williamnagar, Numaligarh & Bhaghmara 7 each
Nagaland-Manipur - Mizoram-Tripura	: Kailashahar Aero 9, Gandecherra, Dharmanagar / Panisagar, Sonamura & Udaipur 7 each

2.7. *Very Severe Cyclonic Storm 'GATI' over the southwest Arabian Sea (21-24 November, 2020)*

2.7.1. Under the influence of a cyclonic circulation over southeast and adjoining southwest Arabian Sea, a **Low Pressure Area** formed over central parts of south Arabian Sea on 19th. It persisted over the same region on 20th. It then lay as a **Well Marked Low Pressure Area** over southwest Arabian Sea and neighbourhood on 21st morning. It concentrated into a **Depression** and lay centered at 1800 UTC of 21st November over southwest Arabian Sea, near Lat. 11.2° N / Long. 57.4° E, about 410 km east-southeast of Socotra (Yemen) and 730 km east of Alula (Somalia). It then intensified into a **Deep Depression** and lay centred at 0000 UTC of 22nd November, over southwest Arabian Sea. It moved further rapidly west-southwestwards and intensified into **Cyclonic Storm "GATI"** and lay centred at 0300 UTC of 22nd November over southwest Arabian Sea. It moved rapidly nearly westwards and intensified into a **Severe Cyclonic Storm** and lay centred at 0600 UTC of 22nd November over southwest Arabian Sea near Lat. 10.4° N / Long. 52.7° E and then further intensified into a **Very Severe Cyclonic Storm** and lay centred at 0900 UTC of 22nd November over southwest Arabian Sea near Lat. 10.4° N / Long. 52.0° E. It further moved westwards and lay centred at 1200 UTC of 22nd November over southwest Arabian Sea near Lat. 10.4° N / Long. 51.5° E, about 40 km east of Somalia coast and 90 km south-southeast of Ras Binnah (Somalia). It crossed north Somalia coast near Lat. 10.4° N around 1500 UTC of 22nd November as a Very Severe Cyclonic Storm with an estimated sustained maximum wind speed of 130-140 kmph gusting to 155 kmph. It further moved nearly westwards and weakened into a **Severe Cyclonic Storm** over the same region at 2100 UTC of 22nd November near Lat. 10.4° N / Long. 50.1° E. It further weakened into a **Cyclonic Storm** over the same region and lay centred at 0000 UTC of 23rd November, near Lat. 10.5° N / Long. 50.0° E, about 150 km south-southwest of Ras Binnah (Somalia). It continued to move westward and lay centered at 0300 UTC of 23rd November over the same region. It further moved nearly westward and weakened into a **Deep Depression** and lay centered at 0600 UTC of 23rd November over the same region near Lat. 10.7° N / Long. 49.2° E, about 220 km west-southwest of Ras Binnah (Somalia). Then it moved nearly northwestwards and lay centered at 1200 UTC of 23rd November over the Gulf of Aden and adjoining Somalia near Lat. 11.3° N / Long. 48.5° E, about 290 km west of Ras Binnah (Somalia). It moved west-southwestwards and weakened into a **Depression** and lay centered at 0000 UTC of 24th November over the Gulf of Aden and adjoining Somalia. It moved west-southwestwards and lay centered at 0300 UTC of 24th November over Gulf of Aden and adjoining Somalia near Lat. 11.6° N / Long. 46.8° E, about 480 km west-northwest of Ras Binnah (Somalia) and 230 km east-southeast of Aden (Yemen). It further weakened into a well marked low pressure area over the same region at 0600 UTC of 24th November.

2.7.2. *Realized weather*

Rainfall associated with **Very Severe Cyclonic Storm 'GATI'** indicated the heavy rainfall (7-12 cm) over Socotra Islands on 22nd, heavy to very heavy rainfall (7-19 cm) at many places over northeast Somalia with extremely heavy falls (≥20 cm) at a few places on 23rd and extremely heavy rainfall over Gulf of Aden and adjoining north Somalia on 24th November.

2.8. *Very Severe Cyclonic Storm 'NIVAR' over the southwest Bay of Bengal (22-27 November, 2020)*

2.8.1. Under the influence of the cyclonic circulation over Equatorial Indian Ocean and adjoining southeast Bay of Bengal, a **Low Pressure Area** formed over Equatorial Indian Ocean and adjoining central parts of south Bay of Bengal on 21st November. It then became a **Well Marked Low Pressure Area** over southwest and adjoining southeast Bay of Bengal on 22nd November. It concentrated into a **Depression** over southwest Bay of Bengal and lay centred at 2100 UTC of 22nd November near Lat. 8.6° N / Long. 85.2° E, about 700 km south-southeast of Puducherry and 740 km south-southeast of Chennai. It moved northwestward and lay centered at 0300 UTC of 23rd November over the same region near Lat. 9.5° N / Long. 84.2° E. It moved west-northwest-wards and intensified into a **Deep Depression** and lay centred at 1200 UTC of 23rd November over southwest Bay of Bengal near Lat. 9.9° N / Long. 83.3° E, about 450 km east-southeast of Puducherry and 480 km southeast of Chennai. It further moved west-northwest ward and intensified into **Cyclonic Storm 'NIVAR'** and lay centred at 0000 UTC of 24th November over southwest Bay of

Bengal near Lat. 10.0° N / Long. 83.0° E, about 410 km east-southeast of Puducherry and 450 km southeast of Chennai. It remained practically stationary and lay centred at 0300 UTC of 24th November over southwest Bay of Bengal. Then it moved westwards and lay centred at 1200 UTC of 24th Novemberover southwest Bay of Bengal near Lat. 10.0° N / Long. 82.4° E, about 320 km east-southeast of Cuddalore and about 350 km east-southeast of Puducherry. It continued to move westwards and further intensified into a **Severe Cyclonic Storm** and lay centred at 1800 UTC of 24th November over southwest Bay of Bengal. It further moved west-northwestwards and lay centred at 0300 UTC of 25th November over southwest Bay of Bengal near Lat. 10.7° N / Long. 81.7° E. Further moving west-northwestwards, it intensified into **a Very Severe Cyclonic Storm** and lay centred at 0900 UTC of 25th November over southwest Bay of Bengal near Lat. 11.2° N / Long. 81.0° E, about 90 km east-southeast of Cuddalore and about 150 km east-southeast of Puducherry. It moved northwestwards and lay centred at 1200 UTC of 25th November over southwest Bay of Bengal near Lat. 11.4° N / Long. 80.7° E, about 110 km east-southeast of Cuddalore and about 115 km east-southeast of Puducherry. It moved west-northwestwards and crossed Tamil Nadu and Puducherry coasts near Puducherry (near Lat. 12.1° N / Long. 79.9° E) during 1800 UTC to 2100 UTC of 25th November as a Very Severe Cyclonic Storm with estimated wind speed of 120-130 kmph gusting to 145 kmph. It weakened into a **Severe Cyclonic Storm** and lay centred at 2100 UTC of 25th November over coastal Tamil Nadu and Puducherry near Lat. 12.1° N / Long. 79.9° E, close to Puducherry. It moved nearly northwestward and lay centred at 0000 UTC of 26th November over north coastal Tamil Nadu near Lat. 12.4° N / Long. 79.6° E, about 50 km north-northwest of Puducherry. It moved northwestwards and weakened into a **cyclonic storm** and lay centred at 0300 UTC of 26th November over north coastal Tamil Nadu near Lat. 12.6° N/ Long. 79.4° E, about 85 km north-northwest of Puducherry and about 95 km west-southwest of Chennai. It moved north-northwestward and further weakened into a **Deep Depression** and lay centred at 0900 UTC of 26th Novemberover south Rayalaseema and neighbourhood near Lat. 13.4° N / Long. 79.2° E, about 50 km west-southwest of Tirupathi. It moved nearly northwards and lay centred at 1200 UTC of 26th November, over south Rayalaseema and neighbourhood near Lat. 13.6° N / Long. 79.3° E, about 30 km west-southwest of Tirupathi. It moved nearly northwards, weakened into a **Depression** and lay centred at 1800 UTC of 26th November over south coastal Andhra Pradesh and neighbourhood near Lat. 14.0° N / Long. 79.5° E, about 35 km nearly north of Tirupathi and 70 km south-southwest of Nellore. It further moved north-northeastwards and weakened into a Well Marked Low Pressure Area and lay centered over south coastal Andhra Pradesh and adjoining westcentral Bay of Bengal at 0000 UTC of 27th November.

2.8.2. *Realized weather*

Rainfall associated with **Vey Severe Cyclonic Storm 'NIVAR'** indicated heavy rainfall (7-12 cm) over coastal Tamilnadu on 24th, heavy to very rainfall at few places over coastal Tamilnadu on 25th, heavy to very heavy rainfall at many places over coastal Tamilnadu and south Andhra Pradesh on 26th and 27th with extremely heavy falls at isolated places.

The chief amount of 24 hrs.accumulated rainfall (≥7cm) ending at 0830 hrs IST of date during the life cycle of the system is presented below.

24 November, 2020

Tamilnadu, Puducherry & Karaikal	:	Tambaram 9, MGR Nagar, Chennai 8 each, Alandur 7

25 November, 2020

Tamilnadu, Puducherry &Karaikal	:	Chennai (Nungambakkam) 16, Anna University, Chennai (Meenambakkam) & Sholinganallur 15 each, Taramani, Anna University, DGP Office & MGR Nagar 14, Mahabalipuram, Alandur, Hindusthan University, Puzhal & Chembarambakkam 12 each, Tambaram & Ambathur 11 each, Perambur, Red Hills, Kolapakkam & Poonamallee 10 each, Ennore, Thirupporur, Cholavaram 9 each, Maduranthagam & Kelambakkam 8 each, Sriperumbudur 7

26 November, 2020

Andhra Pradesh	:	Kodur 25, Venkatagiri 24, Gudur 19, Rapur 16, Atmakur & Sullurpeta 15 each, Nellore, Kavali, Satyavedu & Sambepalle 14 each, Nagari, Rajampet & Tirupati 13 each, Thottambedu & Puttur 12 each, Palamaner & Srikalahasti, Tada 11 each, Penagaluru & Kalakada 10 each, Palasamudram, Royachoti & Amalapuram 9 each, Vinjamur, Udayagiri, Pullampeta & Pakala 8 each, Chittoor,

	Chinnamandem, Cuddapah & Madanapalle 7 each
Tamilnadu, Puducherry & Karaikal	: Tambaram 31, Puducherry 30, Vilupuram 28, Cuddalore 27, DGP Office & Chennai 26, Sholinganallur 22, Thamaraipakkam 19, Parangipettai 18, Pallipattu 17, Cholavaram 16, Gingee, Poonamallee, Ambathur, Tiruvallur, Mahabalipuram & Gummidipoondi 15 each, Tindivanam, Maduranthagam, Chembarabakkam, Anna University, Vanur, Kollidam & Bhuvanagiri 14 each, MGR Nagar, Kancheepuram, Kurinjipadi, Alandur, Chidambaram, Red Hills, Marakkanam, Chengalpattu, Tiruttani & Chidambaram 13 each, Ulundurpet, Poondi, Keelpennathur, Vadapudupattu, Koratur & Sirkali 12 each, Chennai Airport, Vandavasi, Sethiyathope, Vembakkam & Poonamalle, Arakonam, Thirukalukundram, Sriperumbudur & Panruti 11 each, Ponneri, Arcot, Taramani, Perambur, Uthiramerur, Sholingur & Cheyyur 10 each, Anna University, Chembarambakkam, Thiruvalangadu, Tirukoilur, Polur, Mayiladuthurai, Thirupporur, Kelambakkam, Karaikal, Manalmedu & Puzhal 9 each, Arani, Chennai (Nungambakkam), Vridhachalam, Vepur, Hindusthan University, Ammundi, Vellore, R. K. Pet, Kodavasal & Manjalaru 8 each, Uthukottai, Ambur, Kaveripakkam, Agaram Seegoor, Tiruttani, Tozhudur, Tarangambadi, Pelandurai, Tiruvannamalai, Srimushnam, Ennore, Needamangalam, Sendurai, Katpadi, Cheyyar & Aduthurai 7 each

27 November, 2020

Andhra Pradesh	: Kavali 27, Nambulipulikunta 25, Gurramkonda 21, Sambepalle 20, Royachoti, Madanapalle, Chinnamandem & Kalakada 18 each, Punganur, Udayagiri & Vinjamur 17 each, Atmakur, Pullampeta, Thambalapalle & Palamaner 16 each, Chapad, Chittoor, Proddutur, Arogyavaram, Avanigada, Ongole & Amalapuram 15 each, Yanam, Marripudi, Podili, Veligandla, Kandukur, Utukuru(A), Vempalle & Kamalapuram 14 each, Atlur 13, Kakinada, Palakoderu & Cuddapah 12 each, Bheemavaram, Bapatla, Vijayawada Airport, Gudivada, Narsapuram, Chimakurthi & Duvvur 11, Raju Palem, Pakala & Palasamudram 11 each, Vallur, Kodur, Rajampet, Karamchedu & Repalle, Seetharamapuram & Tanuku 10 each, Mundlamuru, Addanki, Mangalagiri, Tadepalligudem, Masulipatnam, Peddapuram, Kaikalur, Jammalamadugu, Badvel, Porumamilla & Puttur 9 each, Pulivendla, Muddanur, Lakkireddipalle, Konakanamitla, Cumbum, Bestavaripeta, Markapur, Nellore & Darsi 8 each, Vijayawada, Tuni, Anakapalle, Rapur, Santhamaguluru, Guntur, Bhimadole, Racherla, Prathipadu, Visakhapatnam, Eluru, Penagaluru, Kadiri, Tanakal & Venkatagiri Kota 7 each
Tamilnadu, Puducherry & Karaikal	: Sholingur 23, Vadapudupattu 16, Vellore, Ponnai Dam & Ammundi 14 each, Ambur & R.K. Pet 13 each, Alangayam & Katpadi12 each, Vaniyambadi, Tirupuvanam & Kaveripakkam 9 each, Wallajah, Gudiyatham & Virinjipuram 8 each, Devakottai, Vembakkam & Melalathur 7 each

2.9. *Cyclonic Storm 'BUREVI' over the southwest and adjoining southeast Bay of Bengal (30 November - 5 December, 2020)*

2.9.1. Under the influence of a cyclonic circulation over east Equatorial Indian Ocean & adjoining south

Andaman Sea, a **Low Pressure Area** formed over south Andaman Sea and adjoining areas of southeast Bay of Bengal & Equatorial Indian Ocean on 28th November. It lay as a **Well Marked Low Pressure Area** over southeast Bay of Bengal and adjoining areas of south Andaman Sea and Equatorial Indian Ocean on 29th November. It concentrated into a **Depression** and lay centered at 0000 UTC of 30th November over Southeast Bay of Bengal near Lat. 7.5° N / Long. 88.0° E, about 750 km east-southeast of Trincomalee (Sri Lanka) and 1150 km east-southeast of Kanyakumari (India). It moved west-northwestwards and lay centered at 0300 UTC of 30th November over the same region near Lat. 7.7° N / Long. 87.7° E, about 710 km eastsoutheast of Trincomalee (Sri Lanka) and 1120 km east-southeast of Kanyakumari (India). It moved westwards and lay centered at 1200 UTC of 30th November over the southeast and adjoining southwest Bay of Bengal near Lat. 7.7° N / Long. 87.0° E, about 640 km east-southeast of Trincomalee (Sri Lanka) and 1040 km east of Kanyakumari (India). It intensified into a **Deep Depression** and lay centered at 0000 UTC of 01st December over southwest and adjoining southeast Bay of Bengal near Lat. 7.8° N / Long. 86.0° E, about 530 km east-southeast of Trincomalee (Sri Lanka) and 930 km east-southeast of Kanyakumari (India). It moved nearly westwards and lay centered at 0300 UTC of the 1st December over the same region near Lat. 7.8° N / Long. 85.7° E, about 500 km east-southeast of Trincomalee (Sri Lanka) and 900 km east-southeast of Kanyakumari (India). It further moved westwards and lay centered at 0600 UTC of the 1st December over southwest Bay of Bengal near Lat. 7.8° N / Long. 85.3° E, about 460 km east-southeast of Trincomalee (Sri Lanka) and 860 km east-southeast of Kanyakumari (India). It moved west-northwestwards and intensified into **Cyclonic Storm 'BUREVI'** and lay centered at 1200 UTC of 1st December over the same region near Lat. 7.9° N / Long. 84.8° E, about 400 km east-southeast of Trincomalee (Sri Lanka) and 800 km east-southeast of Kanyakumari (India). It moved west-northwestwards and lay centered at 0000 UTC of 2nd December over the same region near Lat. 8.4° N / Long. 83.4° E, about 240 km east-southeast of Trincomalee (Sri Lanka) and 470 km eastsoutheast of Pamban (India) and 650 km nearly east-northeast of Kanyakumari (India). It further moved west-northwest-ward and lay centered at 0300 UTC of 2nd December over southwest Bay of Bengal near Lat. 8.6° N / Long. 83.0° E, about 200 km east of Trincomalee (Sri Lanka), 420 km east-southeast of Pamban (India) and 600 km nearly east-northeast of Kanyakumari (India). It moved west-northwestwards and lay centered at 1200 UTC of 2nd December over southwest Bay of Bengal near Lat. 8.8° N/ Long. 81.8° E, about 70 km east-northeast of Trincomalee (Sri Lanka) and 480 km east-northeast of Kanyakumari (India). It continued to move west-northwestward and crossed Sri Lanka coast close to north of Trincomalee near Lat. 8.85° N / Long. 81.0° E between 1700 and 1800 UTC of 2nd December as a Cyclonic Storm with a wind speed of 80-90 kmph gusting to 100 kmph. It further moved west-northwestwards and lay centered at 0300 UTC of 03rd December over north Sri Lanka and adjoining Gulf of Mannar near Lat. 9.1° N / Long. 80.2° E, about 30 km east-northeast of Mannar, 110 km east-southeast of Pamban and 310 km east-northeast of Kanyakumari.It moved westward and weakened into a **Deep Depression** and lay centered at 1200 UTC of the 3rd December over Gulf of Mannar near Lat. 9.2° N / Long. 79.1° E close to Ramanathapuram District coast, about 20 km southwest of Pamban and 210 km east-northeast of Kanniyakumari. It remained practically stationary and lay centered at 0300 UTC of 4th December over Gulf of Mannar near Lat. 9.1° N / Long. 78.6° E close to Ramanathapuram district coast, about 40 km southwest of Ramanathapuram, 70 km west-southwest of Pamban and 160 km northeast of Kanniyakumari. It further weakened into a **Depression** and lay centered at 1200 UTC of 4th December over Gulf of Mannar near Lat. 9.1° N / Long. 78.6° E close to Ramanathapuram district coast, about 40 km southwest of Ramanathapuram, 70 km west-southwest of Pamban. It remained practically stationary during past 33 hrs and lay centered at 0300 UTC of 5th December over Gulf of Mannar near Lat. 9.1° N / Long. 78.6° E close to Ramanathapuram district coast, about 40 km above m.s.l. southwest of Ramanathapuram, 70 km west-southwest of Pamban. It remained practically stationary and weakened into Well Marked Low Pressure Area and lay centered at 0600 UTC of 5th December over Gulf of Mannar.

2.9.2. *Other features observed*

The lowest estimated central pressure was 996 hPa during 0600 UTC to 1800 UTC of 2nd December. The lowest maximum sustained surface wind speed was 45 kts during the period with pressure drop of 10 hPa. There after, the pressure gradually increased till 1200 UTC of 3rd and the system maintained its intensity till 0000 UTC of 5th.

2.9.3. *Realized weather*

Rainfall associated with **Cyclonic Storm 'BUREVI'** indicated heavy rainfall (7-12 cm) over southwest Bay of Bengal during 30th November to 2nd December and heavy to very heavy rainfall (7-19 cm) at many places over coastal Tamil Nadu with extremely heavy falls (≥20 cm) at a few places during 2 - 5 December.

The chief amount of 24 hrs.accumulated rainfall (≥7cm) ending at 0830 hrs IST of date over Tamil Nadu,

Puducherry & Karaikal during the life cycle of the system is presented below.

2nd December : Vedaranyam 20, Karaikal 16, Thalaignayer & Tirupoondi 15 each, Nagapattinam 14, Thiruthuraipoondi 13, Mayiladuthurai & Rameswaram-12 each, Mudukulatur 11, Sirkali, Kodavasal, Adirampatnam & Manjalaru 10 each, Tiruvarur, Aduthurai, Tambaram & Pattukottai 9 each, Nannilam, Marakkanam, Pamban, Thiruvidaimaruthur, Thirukalukundram, Puducherry & Valangaiman 8 each, Manalmedu, Kollidam, Kelambakkam, K.M. Koil, Vanur, Mannargudi, Taramani, Madukkur, Parangipettai, Ayyampettai, Thanjai Papanasam, Cuddalore & Needamangalam 7 each

3rd December : Kollidam 36, Chidambaram 34, Parangipettai 26, Manalmedu & Kurinjipadi 25 each, Thiruthuraipoondi 22, Sirkali & Kodavasal 21 each, Rameswaram 20, Peravurani, Manjalaru, Bhuvanagiri & Mayiladuthurai 19 each, Karambakudi & Pattukottai 17 each, Madukkur 16, Srimushnam 15, Tindivanam, Nannilam & Thiruvidaimaruthur 14 each, Kumbakonam, Ayyampettai, Valangaiman, Panruti & Ulundurpet 13 each, Aduthurai, Alangudi & Pandavaiyar 12 each, Tiruvarur, Budalur, Mahabalipuram & Mannargudi 11 each, Vallam, Perambalur, Thanjavur, Thirumanur & Needamangalam 10 each, Sendurai, Tirukattupalli, Vilupuram, Mylam Aws, Cholavaram, Vanur, Gandarvakottai, Marakkanam, Chengalpattu & Gingee 9 each, Keeranur, Thalaignayer, Agaram Seegoor, Eraiyur, Gummidipoondi, Adirampatnam, Manamelkudi, Pullambadi, Annavasal, Samayapuram, Pamban, Perungalur & Tarangambadi 8 each, Labbaikudikadu, Tozhudur, Tirukoilur, Thuvakudi Imti, Uthukottai, Ariyalur, Anna UTY, Uthiramerur, Tirupoondi, Tirumayam, Tondi & TRP Town 7 each

4th December : Nagapattinam & Karaikal 16 each, Kodavasal & Bhuvanagiri 15 each, Sethiyathope 14, Tarangambadi 13, Sirkali, DGP Office, Vembakkam & Srimushnam 12 each, Rameswaram, Anna University, Tirupoondi & Kayalpattinam 11 each, Sriperumbudur, Kollidam, Mgr Nagar & Pelandurai 10 each, Uthukottai, Chembarambakkam, Tuticorin & Thalaignayer 9 each

5th December : Muthupet 10, Mahabalipuram 7

6th December : Maniyachi 16, Vaippar 12, Kadambur 11, Kayathar, Sirkali, Karaikal & Chittar 9 each, Thalaignayer, Mayiladuthurai, Valinokam & Needamangalam 8 each, Kodavasal, Manalmedu, Palayamkottai & Vilathikulam 7 each