Cyclonic Storm "BUREVI" over the Bay of Bengal (30th November - 05th December 2020): A Preliminary report

1. Brief Life History:

- The cyclonic storm, 'Burevi' originated as a Low Pressure area in the equatorial easterly wave over South Andaman Sea and adjoining areas of Southeast Bay of Bengal & Equatorial Indian Ocean on 28th November 2020, which became a Well Marked Low pressure area over Southeast Bay of Bengal & adjoining areas of South Andaman Sea and Equatorial Indian Ocean on 29th.
- Under favourable environmental conditions, it concentrated into a Depression in the early morning (0530 hrs IST / 0000 UTC) of 30th November 2020 over Southeast Bay of Bengal.
- Moving nearly westwards, it intensified into a Deep Depression in the early morning of 01st December 2020 over Southwest and adjoining Southeast Bay of Bengal.
- Subsequently it moved west-northwestwards and intensified into Cyclonic Storm 'Burevi' over Southwest Bay of Bengal in the evening (1730 hrs IST / 1200 UTC) of 01st December 2020.
- Continuing the west-northwestward movement, it crossed Sri Lanka coast close to north of Trincomalee near Lat. 8.85°N and Long. 81.0°E between 2230 and 2330 hrs IST (1700 & 1800 UTC) of 2nd December 2020 as a Cyclonic Storm with maximum sustained wind speed of 80-90 kmph gusting to 100 kmph.
- Moving across northern parts of Sri Lanka, it emerged into Gulf of Mannar in the morning and lay centred close to Pamban around noon (1130 hrs IST / 0600 UTC) of 03rd December. It crossed Pamban area around 0800 UTC of 3rd. Continuing to move west-northwestwards, it weakened into a Deep Depression over the same region in the evening (1200 UTC) of 03rd December.
- Thereafter the movement slowed down significantly and it remained practically stationary over Gulf of Mannar close to Ramanathapuram district coast for nearly 18 hours and further weakened into a Depression in the evening of 04th December over the same region.

- Further remaining stationary at the same place for subsequent 18 hours, it gradually weakened into a well marked Low pressure area around noon (1130 hrs IST / 0600 UTC) of 05th December.

- This system during its initial stage as a Low pressure area had caused fairly widespread rainfall with isolated very heavy falls over Andaman & Nicobar Islands on 29th November.

- Under the influence of this system, widespread rainfall with heavy to very heavy falls at a few places & extremely heavy (≥ 20 cm) falls at isolated places occurred over Tamil Nadu during 02nd – 04th December.
- The observed track of the system during 30th November to 05th December is presented in Fig. 1.

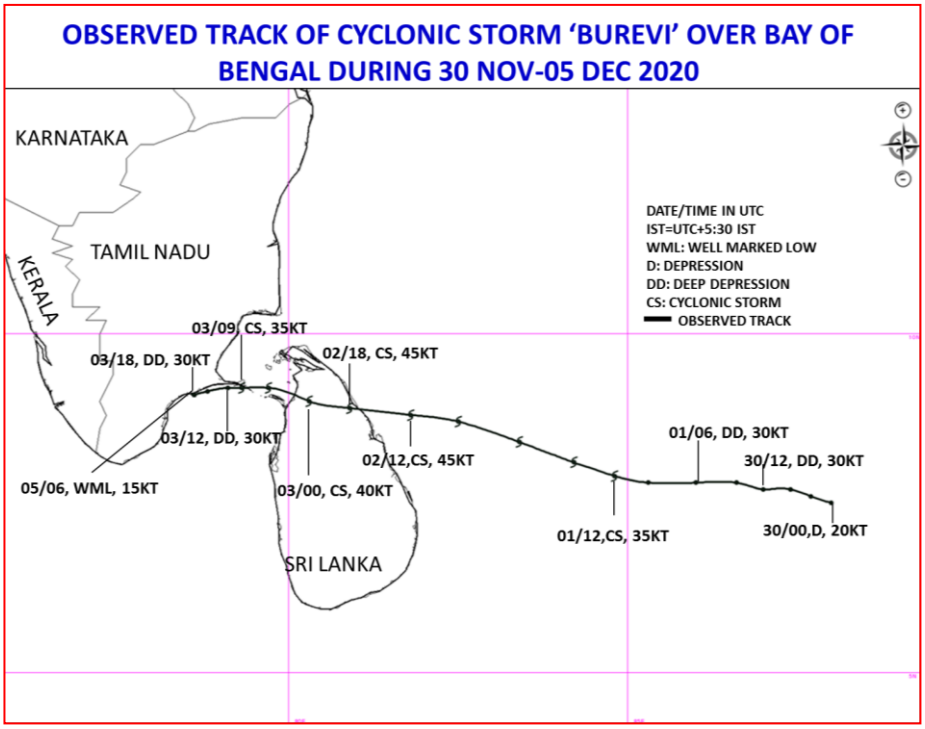

Fig.1: Observed track of cyclonic storm "BUREVI" over Bay of Bengal

2. Salient features:

- Burevi, after weakening, remained practically stationary for nearly 36 hours over Gulf of Mannar close to Ramanathapuram district. It is mainly due to the fact that it came under the regime of very light steering winds in the middle & upper tropospheric levels over this region, sandwiched between two upper level anticyclonic circulations to it's northeast and northwest. In meteorological parlance, such a region is known as a 'col' region.
- It could intensify only upto cyclonic storm stage, due to following reasons
  - It's predecessor very severe cyclonic storm "NIVAR" caused upwelling over the Sea region in which Burevi matured. As a result there was relative cooling of sea surface and thus couldn't get enough energy from the Sea for further intensification.
  - Also the cyclone Burevi had originated near equatorial region leading to lower Coriolis force. Higher coriolis force which is directly proportional to the latitude of occurrence of the cyclone favours intensification
  - The interaction with the land surface as it lay close to Sri Lanka and south Tamil Nadu coasts also limited its intensification
  - The vertical wind shear remained moderate to high as it approached towards the coast. The high wind shear is unfavourable for intensification.
- Climatologically, during the recorded history (1891-2019), out of a total of 58 cyclonic storms & above intensity storms developing over Bay of Bengal in the grid (5^0N - 10^0N & 75^0E -80^0E) during October-December, total 11 (about 19%) reached the state of Kerala. Out of these 11, 3 crossed Kerala after emerging from Sri Lanka and remaining 8 reached Kerala after crossing Tamil Nadu (Fig. 2 a).
- Also, during the period 1891-2019, there have been 13 cyclonic storms and above intensity storms that crossed the east coast of Sri Lanka (Fig. 2 b). Out of these, 10 emerged into Gulf of Mannar-Comorin area & crossed Tamil Nadu coast (7 near Pamban, 3 near Kanniyakumari) and 2 weakened over Sri Lanka with 1 moving west-southwestwards towards southeast Arabian Sea. Considering season-wise distribution, out of 13 cyclonic storms and above intensity storms that crossed east coast of Sri Lanka, 11 crossed the east Sri Lanka coast during post monsoon season (October to December) (Fig. 2 c) and remaining 2 crossed east Sri Lanka during January, 1906 and March, 1907 (Fig. 2d).

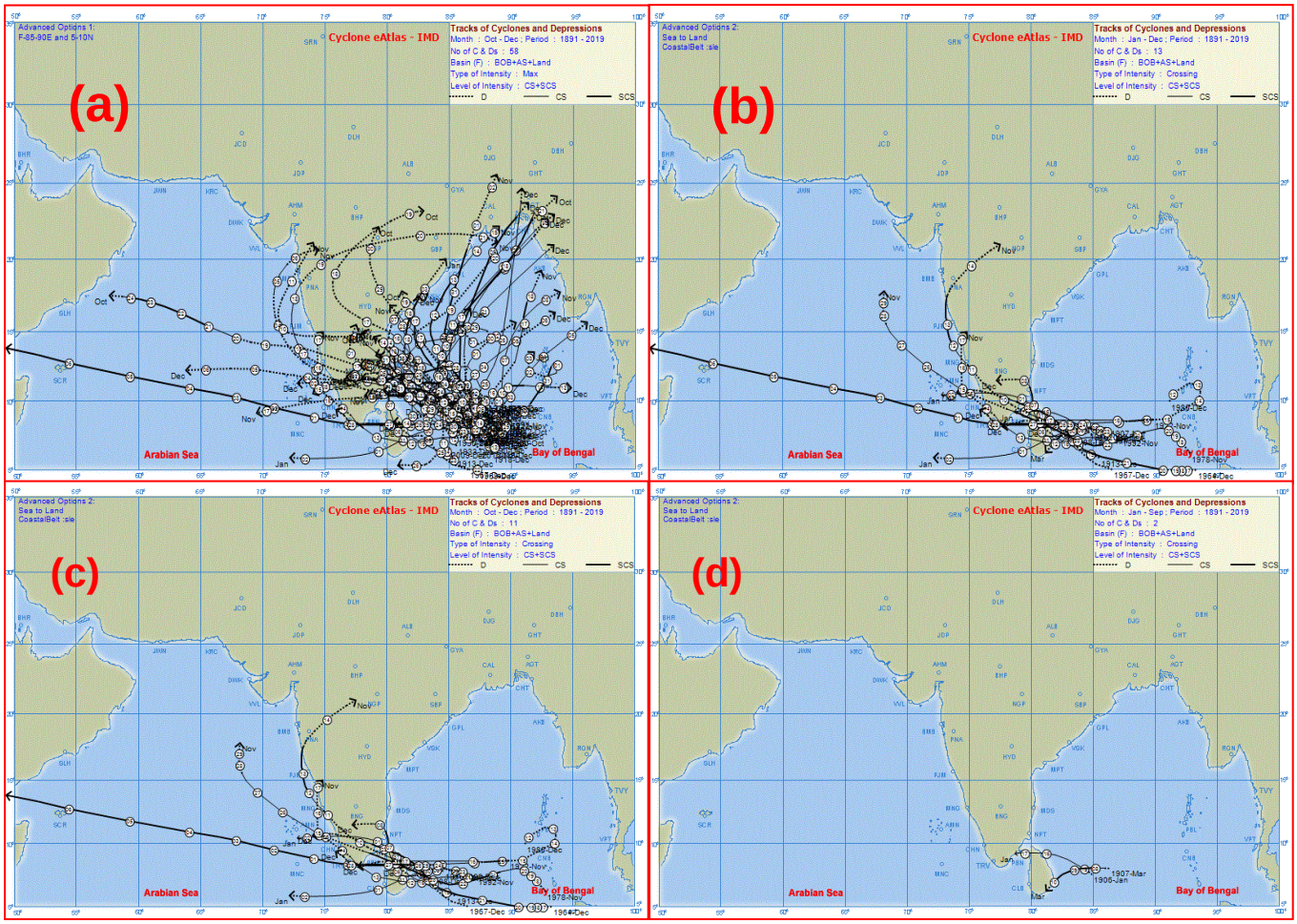

Fig. 2: Number of cyclonic storms and above intensity storms during 1891-2019 (a) developing in the grid (5^0N - 10^0N & 75^0E -80^0E), (b) developing over Bay of Bengal & crossing East Sri Lanka coast, (c) cyclones developing over Bay of Bengal and crossing East Sri Lanka coast during October-December and (d) cyclones developing over Bay of Bengal and crossing East Sri Lanka coast during January-September

- Track of the Cyclonic Storms which crossed south Tamil Nadu coast are given in Fig. 3. It may be noted that, the monthly frequency of Cyclonic storms crossing south Tamil Nadu coast during 1891 – 2019 has been 01 in January and 4 each during November & December. Rest of the months (viz., February to October) has not witnessed any cyclone crossing south Tamil Nadu. This also implies that no cyclone so far has crossed south Tamil Nadu coast during the pre-monsoon months. Thus Sri Lanka and south Tamil Nadu coasts are more prone to cyclonic activity during post-monsoon season, especially during November and December.

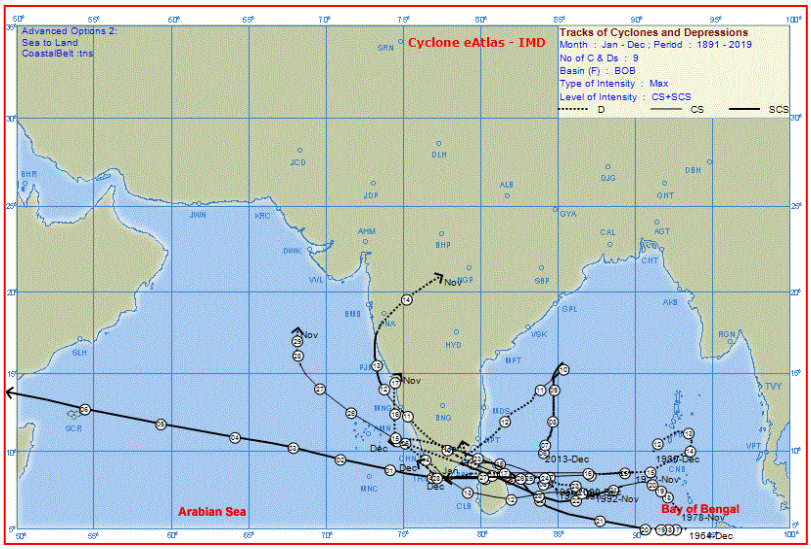

Fig.3: Track of Cyclonic Storms & Severe Cyclonic Storms which crossed south Tamil Nadu coast during 1891- 2019

- During 1891 – 2019, a total of 09 Cyclonic Storms crossed south Tamil Nadu coast & 58 crossed north Tamil Nadu coast.
- There were 5 years in which 2 or more number of systems crossed Tamil Nadu coast viz., 1906, 1964, 1966, 1978 & 2000. But none of these events were within a span of a week's time as occurred during this year when the Very Severe Cyclonic Storm 'NIVAR' (22nd – 27th November 2020) crossed Tamil Nadu coast, near Puducherry on 25th November and the Cyclonic Storm 'BUREVI' (30th November – 05th December) after moving across Sri Lanka, crossed Pamban area of south Tamil Nadu coast on 03rd December.

  Salient features of the past systems, when 2 or more Cyclonic Storms crossed Tamil Nadu coast is enlisted in the table below:

Sl. No	Year	Period	Characteristics
1	1906	15-17 Jan	Crossed Sri Lanka coast, emerged into Gulf of Mannar & weakened
		26-27 Dec	Crossed north Tamil Nadu coast & weakened
2	1964	4-8 Nov	Crossed north Tamil Nadu coast as Cyclonic Storm
		17-24 Dec	Crossed north of Pamban, weakened into a Depression and re-emerged into southeast Arabian Sea off Kerala coast
3	1966	28April	Formed over southeast BoB, crossed north Tamil

		– 4 May	Nadu coast, moved across Karnataka as a Depression, re-curved over to Madhya Maharashtra and weakened.
		01 – 11 Nov.	Formed over Andaman Sea, crossed north Tamil Nadu coast, weakened into a Depression, moved west-southwestwards, moved across Kerala, emerged into southeast Arabian Sea, moved westwards, re-intensified into a Severe Cyclonic Storm over south Arabian Sea, moved west-northwestwards and crossed south Oman coast as an SCS on 11th Nov.
		08- 14 Nov	Formed over southwest BoB, crossed as a CS over northeast coast of Sri Lanka, emerged close to Pamban as a Depression, moved across Karnataka coast close to Mangaluru, re-intensified into an SCS over east-central Arabian Sea, re-curved northeastwards, crossed south Maharashtra coast, weakened into a Depression and dissipated over Marathwada.
		25 Nov – 4 Dec	Formed over Andaman Sea, crossed north Tamil Nadu coast close to Chennai as a Severe Cyclonic Storm, moved inland, weakened into a Cyclonic Storm, moved across Karnataka as a Depression & weakened over Goa.
4	1978	03-13 Nov	Formed over southwest BoB, crossed north Tail Nadu coast as a Depression, intensified into Severe Cyclonic Storm only after re-emerging into the Arabian Sea across north Kerala. After re-intensification, re-curved & crossed north Gujarat coast.
		18-29 Nov	Formed over southeast BoB, crossed northeast coast of Sri Lanka as an SCS, re-emerged & crossed south Tamil Nadu coast close to Pamban as SCS, weakened into a Depression, moved across Kerala coast, close to Kochi, re-emerged into the Arabian Sea, re-intensified into a Cyclonic Storm, moved

			north-westwards and weakened over east-central Arabian Sea.
5	2000	26-30 Nov	Formed over south Andaman Sea, crossed north Tamil Nadu coast as SCs, moved inland and weakened.
		23-28 Dec	Formed over southeast BoB, crossed north Sri Lanka as SCS, emerged into Gulf of Mannar, moved across Kanniyakumari, weakened into a Depression and moved along south Kerala coast.

- A system analogous to that of CS 'BUREVI' occurred during 15-17 January 1906 which crossed the east coast of Sri Lanka, close to north of Trincomali and moved across Pamban area and weakened near Ramanathapuram district coast. After 113 years, this is the first Cyclonic Storm following a similar track & intensity characteristics. However unlike the previous one, it remained practically stationary for about 36 hrs near the coast.
- Considering the extraordinarily long stationary period of cyclone Burevi, during past 30 years (1990-2020), last such stationary behaviour was witnessed during 1999, Odisha Super Cyclone which remained stationary over land for 30 hours. However, cyclonic storm Burevi crossed that record and remained stationary over Gulf of Mannar close to Ramanathapuram for 36 hours.
- Plausible reasons for this stagnation probably could be attributed to the weakened dynamics of the system and the light steering environment as stated above. A few of the physical & dynamical features experienced by the system are re-produced below.

(a) Shallow vertical extention & small horizontal scale.

Cyclonic Storm (BUREVI) emerged into Gulf of Mannar, after crossing north Sri Lanka. The topography of Sri Lanka is re-produced in the map (Fig.4). It may be noted that though the stretch of land across which the system moved is narrow, subsequent to the re-emegence, the system underwent land interaction, causing the system to loose momentum.

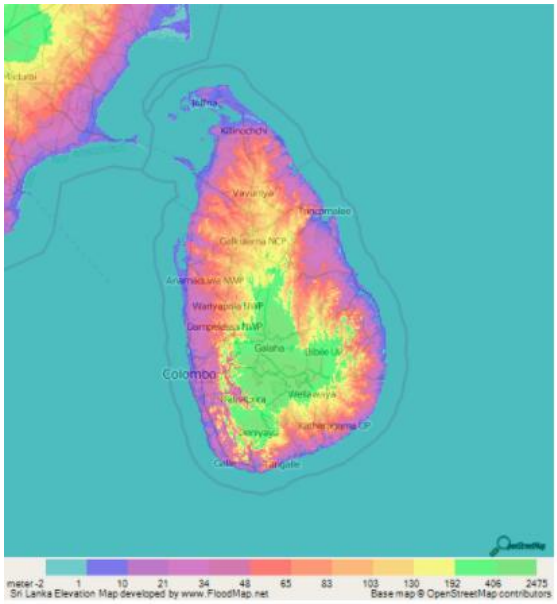

Fig.4: Topograhic features surrounding Gulf of Mannar.

Thus the vertical extention & horizontal scale of the system, reduced significantly after re-emerging into Gulf of Mannar. Vertically the cyclonic circulation extended roughly upto 7.6 km above mean sea level (400 hPa) and it had a rapidly expanding radius of maximum winds, implying weakening. (Figures not given).

(b) Less Ocean Thermal Energy

Tropical Cyclone Heat Potential (TCHP) is a measure of the integrated vertical temperature from the Sea surface to the depth of 26ºC isotherm. It is a measure of the Potential energy associated with the heat content available to any tropical cyclonic disturbance for resulting in intensity changes.

The slowing down of the cyclonic disturbances over the tropical Oceans cause an increase in momentum exchange from the cyclonic system to the Sea surface. This would lead to deeper vertical mixing and enhanced Sea surface cooling. As a consequence, the heat flux would decrease from the Ocean to the cyclonic disturbance, thereby inhibiting its further intensification. (Liu etal 2007, Lin etal 2009, Mei etal 2012, Horman etal 2014, Kim etal 2020). Fig. 5 shows the average

Tropical Cyclone Heat Potential (TCHP) analysis (30th November – 10th December) from INCOIS analysis.

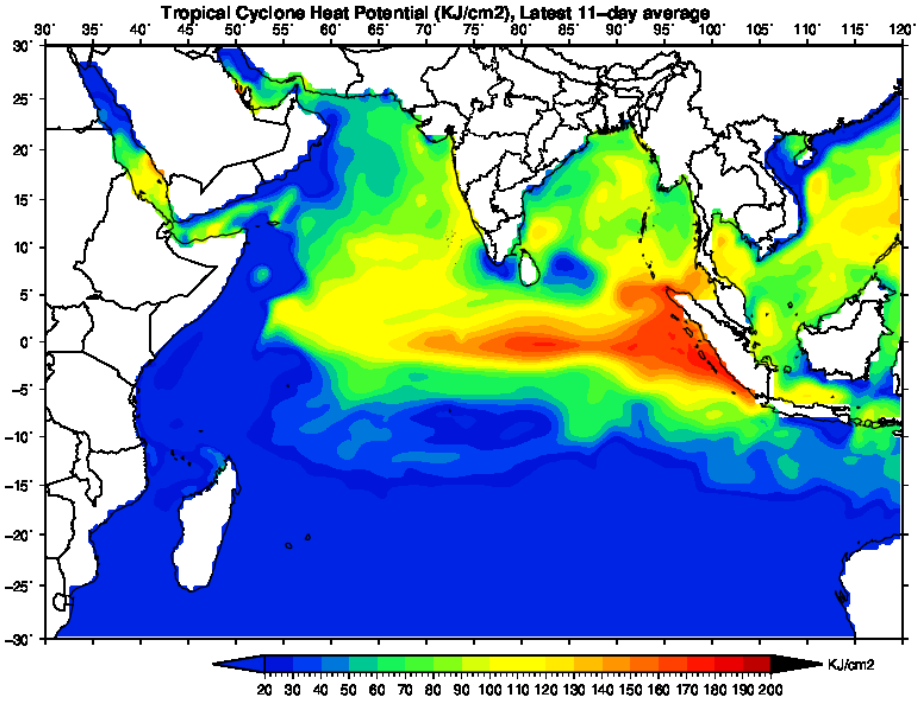

Fig. 5: TCHP pattern (Latest 11 day average ending on 10th December 2020) by INCOIS

(c) Vertical wind shear

The vertical wind shear (both directional as well as speed) during the life cycle of the system is given in Fig.6. It may be noted that the ssytem originated in the equatorial easterly wave regime and had reamined under the mid & upper level easterly steering influence and hence under low vertical wind shear field upto the early morning of 04th December.

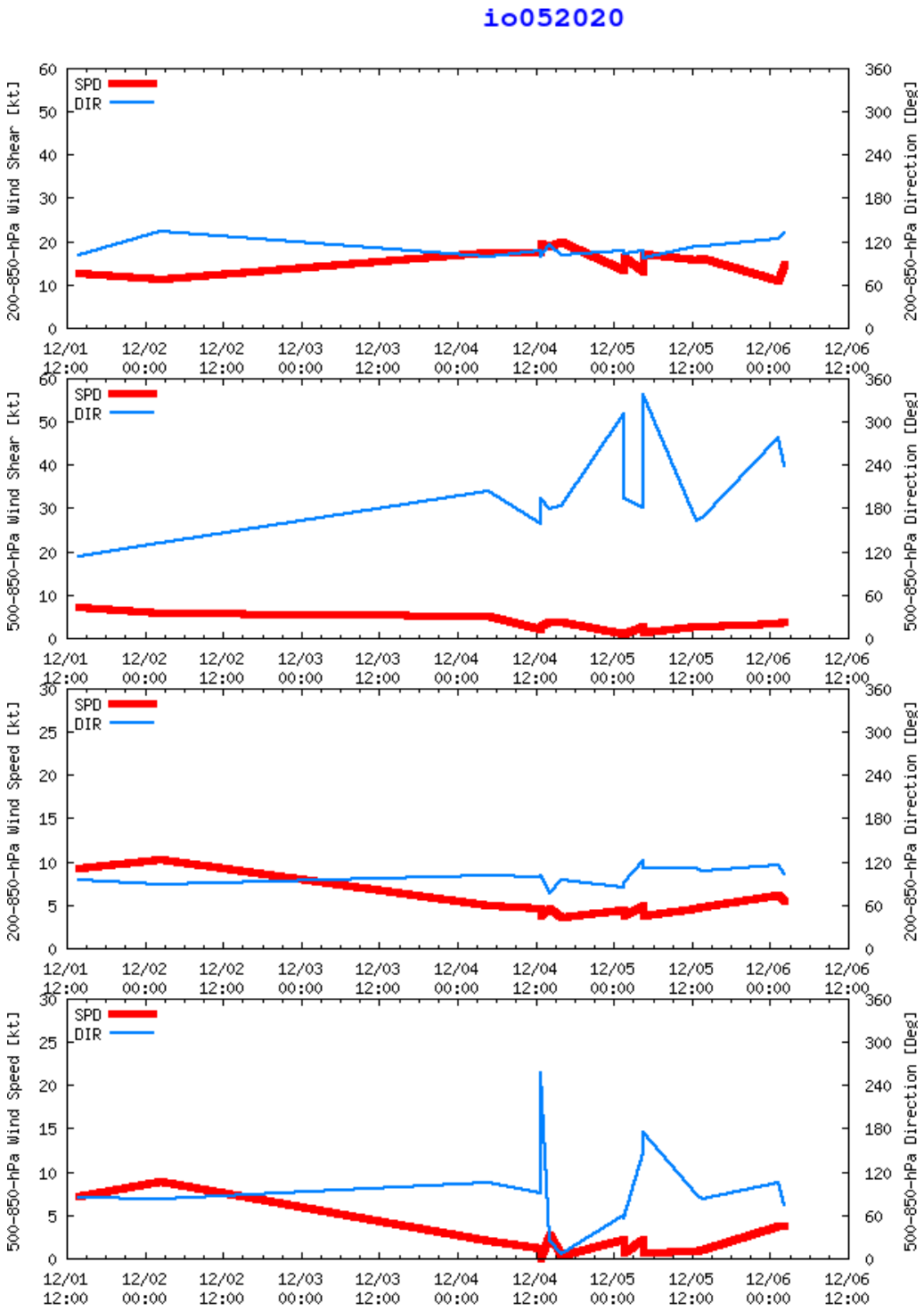

Fig. 6: Vertical wind shear associated with Cyclonic Storm BUREVI (courtsey: Cooperative Institute for Research in the Atmosphere website)

(d) Latent heat release due to the intense convection & heavy rainfall to the northeast of the system over coastal Tamil Nadu

Role of the mid-level warming as is evidenced in Fig.7, owing to the Latent heat of condensation associated with the meso-scale convective complex generated to the north of the system (resulting in extremely heavy rainfall) prior to & during the stagantion period needs to be further adressed.

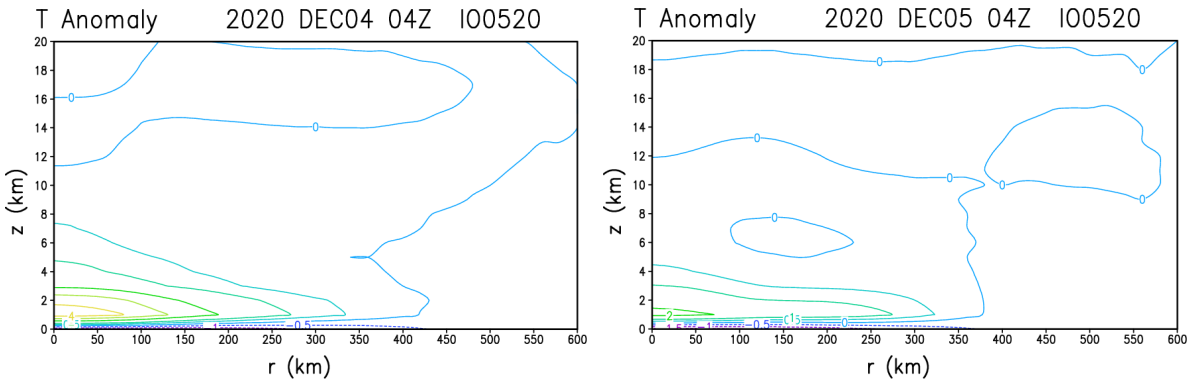

Fig. 7: Vertical thermal structure associated with Cyclonic Storm BUREVI (courtsey: Cooperative Institute for Research in the Atmosphere website)

All the above preliminary analyses indicate that due the prevailing middle to upper tropospheric environment with a COL region due to two anticyclones on either side to northeast and northwest of the cyclone over Gulf of Mannar, the system remained practically stationary for about 36 hrs. Further persistence over this land-locked region of Gulf of Mannar led to cooling of Gulf of Mannar through continuous rainfall and upwelling over the region and hence cooling of the sea region. Further the increased wind shear and interaction of land surface favoured the weakening.

However this persistence of the system over Gulf of Mannar for such a long period led to extremely heavy rainfall over Tamil nadu and Puducherry for a longer period and the rainfall was confined to Tamil Nadu and Puducherry only.

3. Monitoring of "BUREVI":

India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean and the cyclone was monitored since 26th November, about 03 days prior to the formation of low pressure area over Southeast Bay of Bengal & Equatorial Indian Ocean on 28th November 2020 and 05 days prior to the formation of depression over southeast BoB on 30th November. The cyclone was monitored with the help of available satellite observations from INSAT 3D and 3DR, SCATSAT, polar orbiting satellites and available ships & buoy observations in the region. The system was also monitored by Doppler Weather RADARs (DWR) Chennai, Karaikal and Thiruvananthapuram (ISRO). Various numerical weather prediction models run by Ministry of Earth Sciences (MoES) institutions (IMD, IITM, NCMRWF, INCOIS), global models and dynamical-statistical models were utilized to predict the genesis, track, landfall and intensity of the cyclone. A digitized forecasting system of IMD was utilized for analysis and comparison of various models' guidance, decision making process and warning products generation. Typical satellite and radar imageries are presented in Fig. 8.

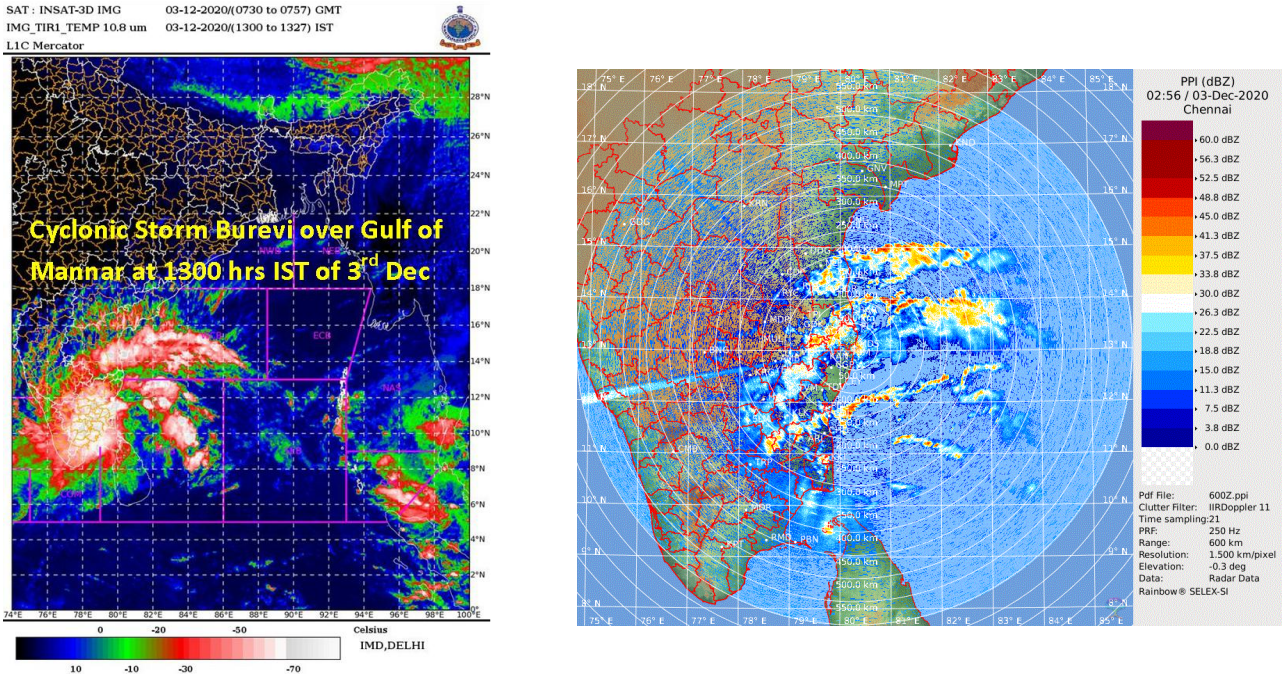

Fig.8: Typical satellite imagery of CS "BUREVI" & Doppler Weather RADAR Chennai - reflectivity image (PPZ (600KM and maximum range) product of 3rd December.

4. Forecast Performance:

4.1. Genesis, track, landfall and intensity forecast:

- The extended range outlook issued on 26th November, indicated that there is a 'High' (68 – 100 %) probability for cyclogenesis over southwest Bay of Bengal during the second half of week (27th November – 03rd December). Actually, the Depression formed over southeast BoB on 30th November.
- First information that a low pressure area would form over southeast Bay of Bengal around 28th November with high (76-100%) probability of it's intensification into depression around 30th was issued in the Tropical Weather Outlook at 1130 hrs IST of 27th November. Actually low pressure area formed over south Andaman Sea on 28th November (0830 hrs IST) and it concentrated into a depression over southwest Bay of Bengal on 30th (0530 hrs IST).
- The information that a low pressure area would form over southeast Bay of Bengal around 29th November was also provided in the Press Release issued at 1600 hrs IST of 27th November. All warnings w.r.t. heavy rainfall, strong wind, state of Sea and advisory for fishermen was issued in the Press Release. Extremely heavy rainfall warning over Tamil Nadu & Puducherry on 2nd & 3rd December was also indicated in the Press Release. Special bulletins were issued by Area Cyclone Warning Centre, Chennai and Cyclone Warning Centre, Thiruvananthapuram also.
- In the first Press Release issued on 27th November, it was also indicated that the system would intensify further and move towards Tamil Nadu-Puducherry coasts.
- The bulletin issued at 0930 hrs IST of 30th, indicated that the system would intensify upto cyclonic storm stage, cross Sri Lanka coast between 7.5-9.0 degree N around evening of 2nd December. It was also indicated that the system would emerge into Gulf of Mannar and Comorin area on 3rd December morning. Actually, the system crossed Sri Lanka coast as a cyclonic storm near 08.85 N and Log 81.0 E during 2230 – 2330 UTC of 02nd December 2020. It emerged into Gulf of Mannar during forenoon of 3rd December.
- The warnings were further updated and at 0210 hrs IST of 1st December, it was indicated that the system would emerge into Gulf of Mannar- Comorin area on 3rd December morning and move towards south Tamil Nadu coast.
- The warnings were further updated and at 1430 hrs IST of 1st December, it was indicated that the system would emerge into Gulf of Mannar and adjoining Comorin area on 3rd December morning and cross south Tamil Nadu coast between Kanniyakumai and Pamban around early morning of 4th December.
- At 1130 hrs IST of 2nd December, it was further indicated that the system would be centered very close to Pamban around noon of 3rd December and it's impact over Ramanathapuram district will commence from 3rd December forenoon.

- The observed and forecast track of cyclonic storm “BUREVI” based on 0000 UTC of 30th November and 0000 UTC of 2nd December along with cone of uncertainty and wind distribution are presented in Fig. 9 and Fig.10.

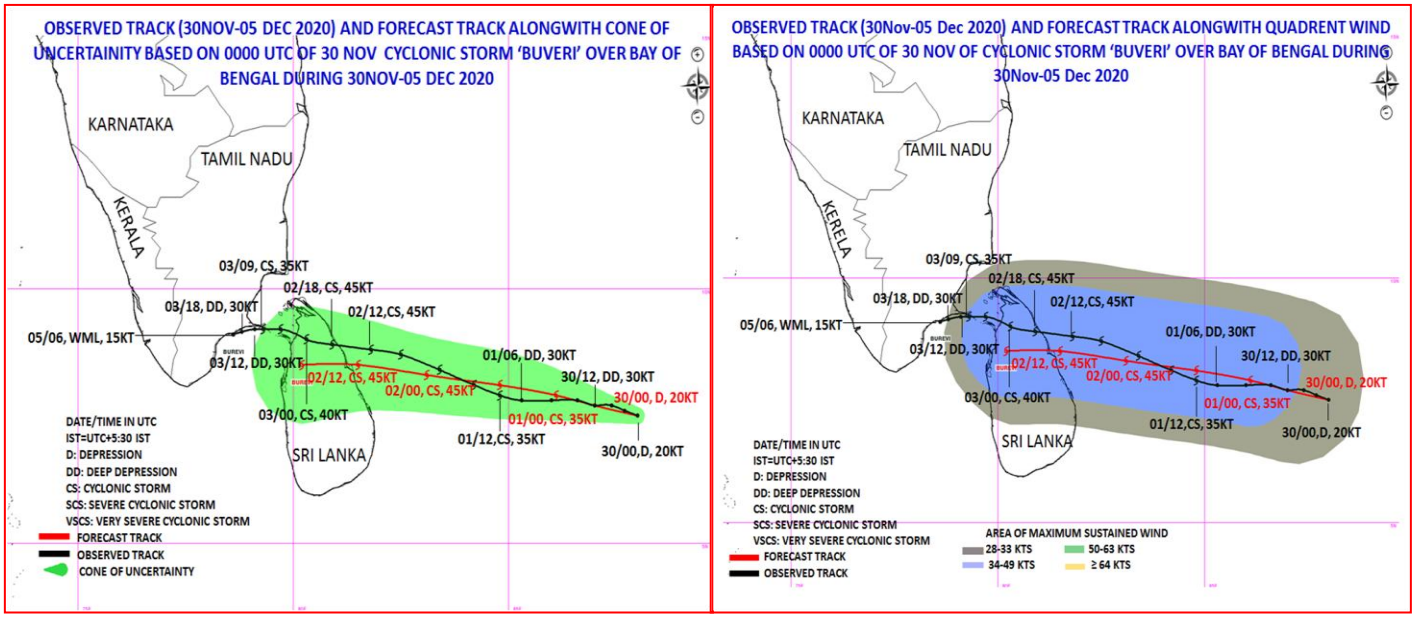

Fig. 9: The observed and forecast track of cyclonic storm “BUREVI” based on 0000 UTC of 30th November demonstrating accuracy in landfall, track and intensity prediction (about 60 hrs prior to landfall over Sri Lanka)

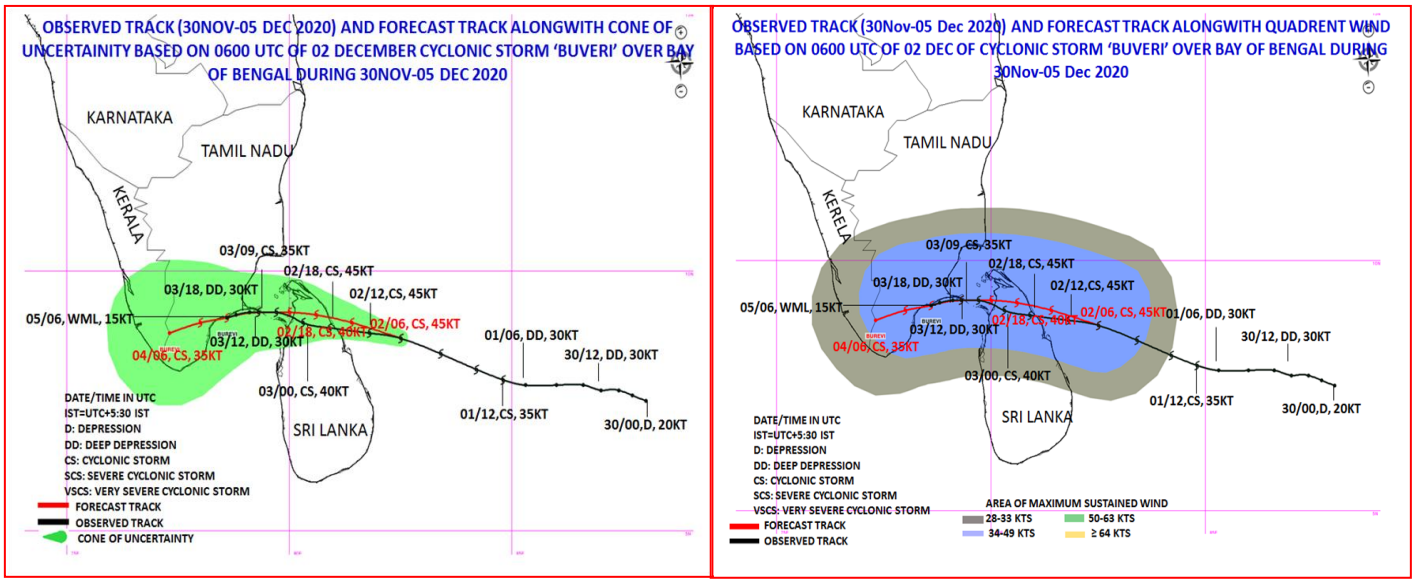

Fig. 10: The observed and forecast track of cyclonic storm “BUREVI” based on 0600 UTC of 2nd December demonstrating accuracy in landfall, track and intensity prediction (about 24 hrs prior to landfall over Pamban Area)

4.2 Landfall forecast error

Cyclonic storm 'BUREVI" made landfall over Sri Lanka coast close to north of Trincomalee near latitude 08.85^{0}N and longitude 81.0^0 E, during 1700 – 1800 UTC of 02nd December 2020 and Pamban area near latitude 09.2^{0}N and longitude 79.35^0 E during 0800 UTC of 03rd December 2020.

The landfall point and time forecast errors compared to long period average (LPA) errors during 2015-19 for landfall over Sri Lanka are presented in Fig. 11 (a-b). The landfall point forecast errors for 12, 24, 48 and 60 hrs lead period were 20, 25, 35 and 44 km respectively against the LPA errors (2015-19) of 25, 45, 69 and 99 km during 2015-19 respectively. The landfall time forecast errors for 12, 24, 48 and 60 hrs lead period were 1.5, 4.0, 2.0 and 3.0 hours respectively against the LPA errors (2015-19) of 1.5, 3.0, 5.4 and 5.5 hours during 2015-19 respectively. **For all lead periods, the landfall point and time errors were exceptionally less than the LPA errors during 2015-19.**

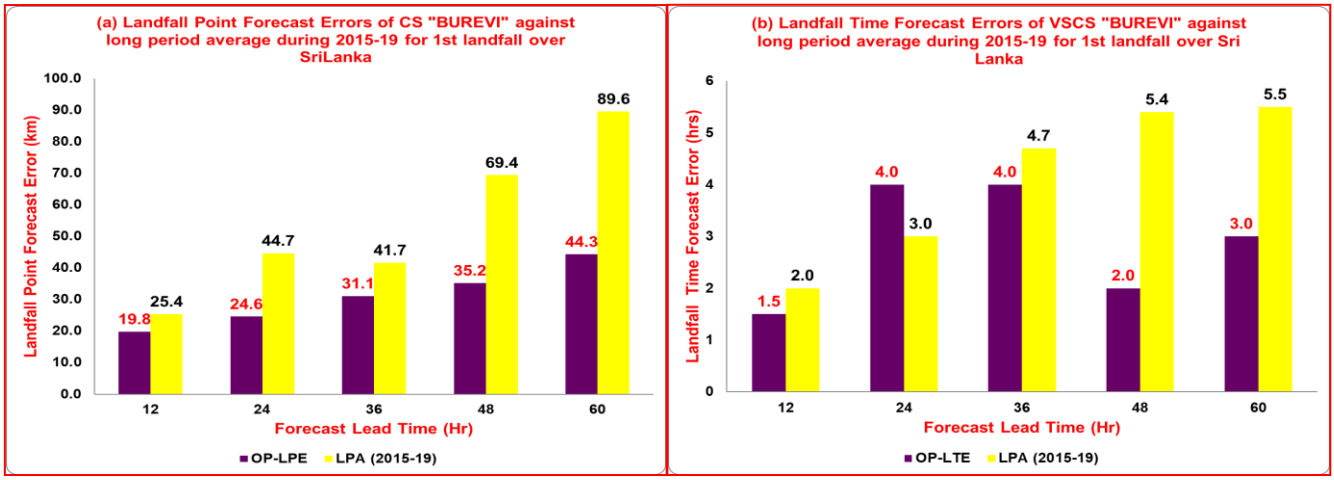

Fig.11: Landfall (a) point and (b) time forecast errors of CS 'BUREVI" as compared to long period average (2015-19) for landfall over Sri Lanka

The landfall point and time forecast errors for second landfall of "BUREVI" over Pamban area compared to long period average (LPA) errors during 2015-19 are presented in Fig. 12 (a-b). The landfall point forecast errors for 12, 24 and 48 hrs lead period were 0, 0 and 150 km respectively against the LPA errors (2015-19) of 25, 45 and 69 km during 2015-19 respectively. The landfall time forecast errors for 12, 24 and 48 hrs lead period were 1.0, 2.5, and 8.0 hours respectively against the LPA errors (2015-19) of 2.0, 3.0, and 5.4 hours during 2015-19 respectively. The landfall over Pamban area could be successfully predicted **24 hours prior to landfall and the errors in prediction were exceptionally less than the LPA errors during 2015-19.**

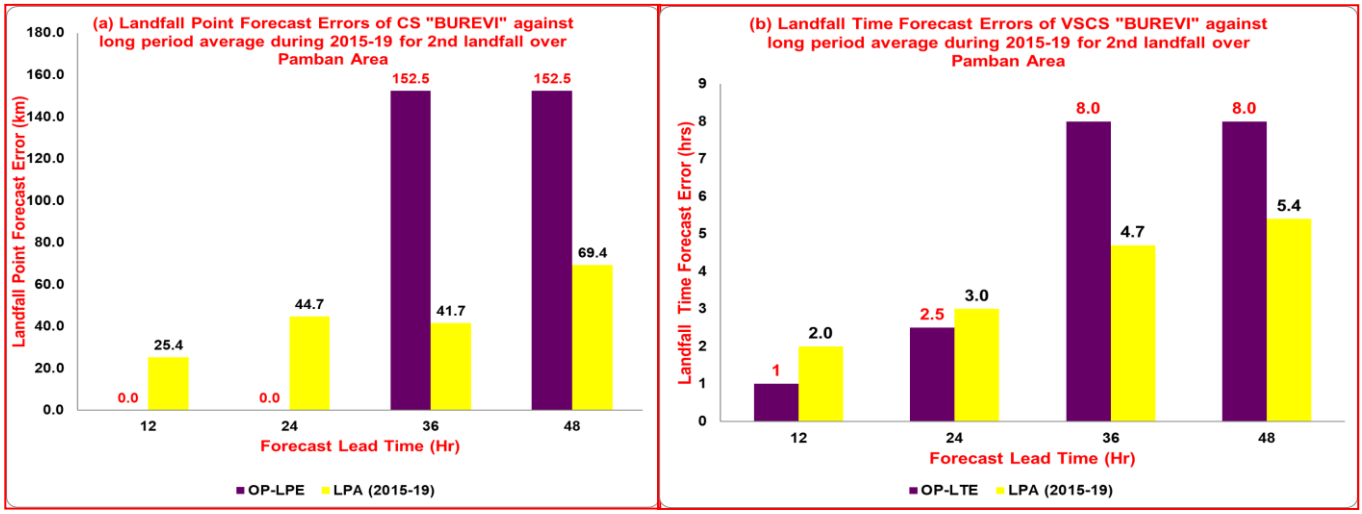

Fig.12: Landfall (a) point and (b) time forecast errors of CS 'BUREVI" as compared to long period average (2015-19) for landfall over Pamban Area

3.3 Track forecast error and skill

The track forecast errors (Forecast position – Actual position of Cyclone centre) and skill as compared to Climatological and Persistence forecast are presented in Fig. 13 (a-b). The track forecast errors for 24, 48 and 72 hrs lead period were 55.3, 61.6, and 131.2 km respectively against the LPA errors (2015-19) of 80.6, 125.5, and 171.2 km respectively (Fig.7a). The track forecast skill was about 67%, 78%, and 72% against the LPA skill of 61%, 73%, and 74% for 24, 48 and 72 hrs lead period respectively (Fig.7b).

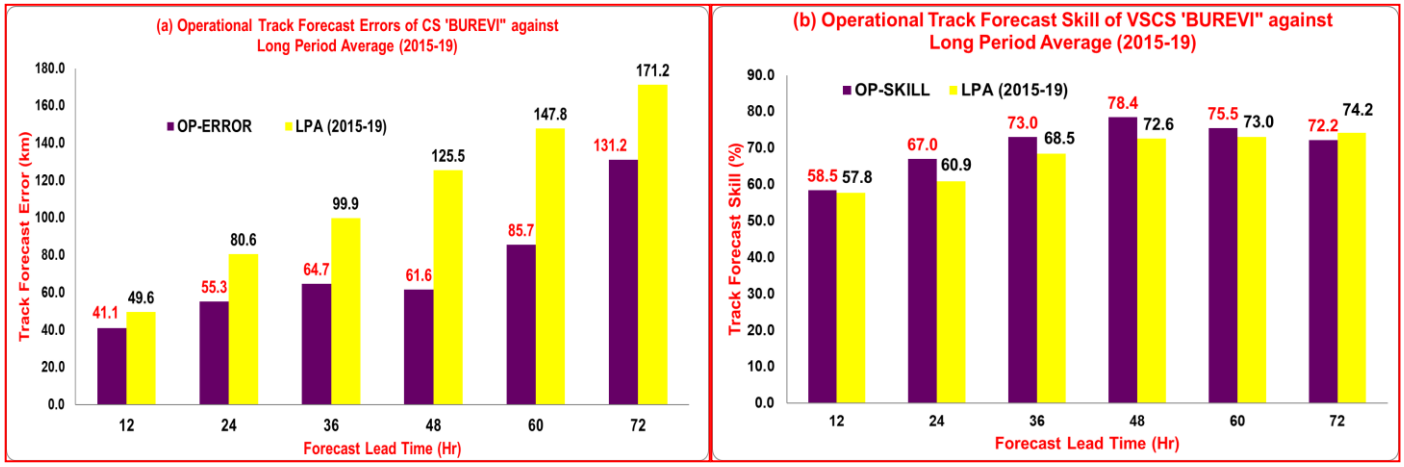

Fig.13: Track forecast (a) errors and (b) skill of CS 'BUREVI" as compared to long period average (2015-19)

3.4 Intensity forecast error and skill

The intensity forecast errors (Forecast wind – Actual wind) and skill based on absolute errors and root mean square errors are presented in Fig. 14 & 15 respectively. The absolute error (AE) of intensity (wind) forecast for 24, 48 and 72 hrs lead period were 4.2, 4.7 and 9.3 knots against the LPA errors of 8.9, 13.0, and 15.4 knots during 2015-19 respectively (Fig. 14a). The root mean square error (RMSE) of intensity (wind) forecast for 24, 48 and 72 hrs lead period were 5.2, 5.9 and 9.7 knots against the LPA errors of 11.5, 16.7, and 19.2 knots respectively (Fig. 14b). The skill (%) in intensity forecast as compared to persistence forecast based on AE for 24, 48 and 72 hrs lead period was 47%, 78% and 66% against the LPA of 45%, 69% and 72% respectively (Fig. 15a). The skill (%) in intensity forecast based on RMSE for 24, 48 and 72 hrs lead period was 56%, 70% and 77% against the LPA of 49%, 63% and 76% respectively (Fig. 15b).

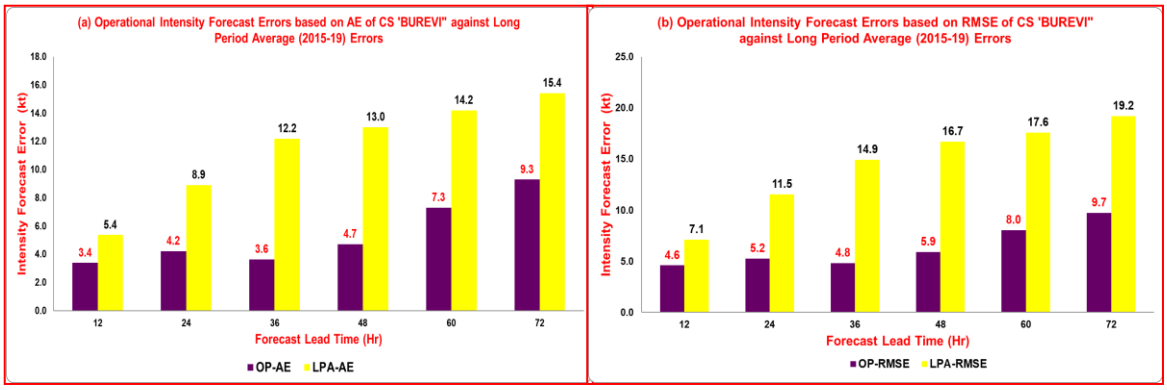

Fig.14: Absolute errors(AE) and Root Mean Square errors(RMSE) in intensity forecast (winds in knots) of CS 'BUREVI" as compared to long period average (2015-19)

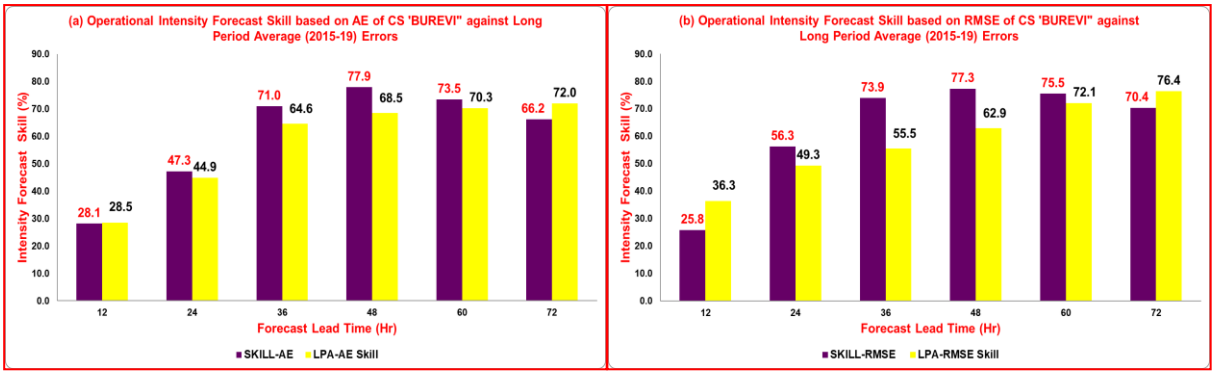

Fig.15: Skill (%) in intensity forecast based on (a) Absolute errors (AE) and (b) Root Mean Square errors (RMSE) of CS 'BUREVI" as compared to long period average (2015-19)

5. Warning & advisories issued by IMD

- Regular press release since 27th November (before formation of low pressure area over southeast Bay of Bengal) till 6th December
- **Pre-Cyclone watch** for South Tamil Nadu and South Kerala issued at 0930 IST of 30th November, from the stage of a Depression itself (**about 72 hrs before the CS reached near Pamban**)
- **Cyclone Alert** for South Tamil Nadu and South Kerala issued at 1130 hrs IST of 1st December, when the system was a Deep Depression (**about 48 hrs before the CS reached near Pamban**)
- **Cyclone Warning** for South Tamil Nadu and South Kerala issued at 1130 hrs IST of 2nd December (**about 24 hrs before the CS reached near Pamban**)
- Extremely heavy rainfall warnings for Tamil Nadu & Puducherry on 2nd, 3rd were issued since 0930 hrs IST of 30th November
- Seven bulletins were issued by Director General of Meteorology to Prime Minister Office, Control Room Ministry of Home Affairs & National Disaster Management Authority, Cabinet Secretariat, Minister of Science & Technology, Headquarter Integrated Defense Staff, Director General Doordarshan, All India Radio, National Disaster Response Force, Press Information Bureau, Ministry of Railways, Shipping & Surface Transport, Chief Secretary to Government
- Total No. of national Bulletins to the Control Room, Ministry of Home Affairs & National Disaster Management Authority, Cabinet Secretariat, Minister of Science & Technology, Headquarter Integrated Defense Staff, Director General Doordarshan, All India Radio, National Disaster Response Force, Press Information Bureau, Chief Secretaries to the Government of Tamil Nadu, Puducherry, Kerala, Andhra Pradesh, Odisha, West Bengal and Administrator Lakshadweep Islands-35
- Total No. of special tropical weather outlooks and tropical cyclone advisories to 13 WMO/ESCAP member countries including Maldives and Srilanka-35
- Total No. of tropical cyclone advisory bulletins for international civil aviation to Met Watch offices in Asia Pacific regions and middle east through GTS to issue Significant Meteorological information for International Civil Aviation and WMO's Aviation Disaster Risk Reduction (ADRR), Hong Kong-12

6. Realised rainfall:

Realized 24 hrs accumulated rainfall (≥7cm) over Tamil Nadu, Puducherry & Karaikal during the life cycle of the system is presented below:

2nd December:

Vedaranyam (dist Nagapattinam) - 20, Karaikal (dist Karaikal)- 16, Thalaignayer (dist Nagapattinam) & Tirupoondi (dist Nagapattinam) -15 each, Nagapattinam (dist Nagapattinam)- 14, Thiruthuraipoondi (dist Tiruvarur) -13, Mayiladuthurai (dist

Nagapattinam) , Rameswaram (dist Ramanathapuram)- 12 each, Mudukulatur (dist Ramanathapuram) - 11, Sirkali (dist Nagapattinam), Kodavasal (dist Tiruvarur) , Adirampatnam (dist Thanjavur) , Manjalaru (dist Thanjavur) - 10 each, Tiruvarur (dist Tiruvarur) ,Aduthurai (dist Thanjavur) , Tambaram (dist Chengalpattu) , Pattukottai (dist Thanjavur) - 9 each, Nannilam (dist Tiruvarur), Marakkanam (dist Villupuram), Pamban (dist Ramanathapuram), Thiruvidaimaruthur (dist Thanjavur), Thirukalukundram (dist Chengalpattu), Puducherry (dist Puducherry), Valangaiman (dist Tiruvarur) -8 each, Manalmedu (dist Nagapattinam), Kollidam (dist Nagapattinam), Kelambakkam (dist Chengalpattu), K.M.koil (dist Cuddalore), Vanur (dist Villupuram), Mannargudi (dist Tiruvarur), Taramani (dist Chennai), Madukkur (dist Thanjavur), Parangipettai (dist Cuddalore), Ayyampettai (dist Thanjavur), ThanjaiPapanasam (dist Thanjavur), Cuddalore (dist Cuddalore), Needamangalam (dist Tiruvarur) -7 each

3rd December:

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

4th December:

Nagapattinam (Nagapattinam) and Karaikal (Karaikal)-16 each, Kodavasal (Tiruvarur) and Bhuvanagiri (Cuddalore)- 15 each, Sethiyathope (Cuddalore)-14, Tarangambadi

(Nagapattinam)-13, Sirkali (Nagapattinam), DGP Office (Chennai), Vembakkam (Tiruvannamalai) and Srimushnam (Cuddalore)- 12 each, Rameswaram (Ramanathapuram), Anna University (Chennai), Tirupoondi (Nagapattinam) and Kayalpattinam (Toothukudi)-11 each, Sriperumbudur (Kancheepuram), Kollidam (Nagapattinam), Mgr Nagar (Chennai) and Pelandurai (Cuddalore)-10 each, Uthukottai (Tiruvallur), Chembarambakkam (Tiruvallur), Tuticorin (Toothukudi), Thalaignayer (Nagapattinam)-9 each

5th December:

Muthupet (dist Tiruvarur)-10, Mahabalipuram (dist Chengalpattu)-7 each, Kodavasal (dist Tiruvarur), Nannilam (dist Tiruvarur) & Thalaignayer (dist Nagapattinam)-6 each and Thiruthuraipoondi (dist Tiruvarur), Cheyyur (dist Chengalpattu), Kollidam (dist Nagapattinam), Cholavaram (dist Tiruvallur), Tirupoondi (dist Nagapattinam) and Chidambaram (dist Cuddalore) 5 each.

6th December:

Maniyachi (dist Toothukudi) -16, Vaippar (dist Toothukudi) -12, Kadambur (dist Toothukudi) -11, Kayathar (dist Toothukudi), Sirkali (dist Nagapattinam), Karaikal (dist Karaikal), Chittar–(dist Kanyakumari) - 9 each, Thalaignayer (dist Nagapattinam), Mayiladuthurai (dist Nagapattinam), Valinokam (dist Ramanathapuram), Needamangalam (dist Tiruvarur) - 8 each, Kodavasal (dist Tiruvarur) , Manalmedu (dist Nagapattinam), Palayamkottai (dist Tirunelveli), Vilathikulam (dist Toothukudi) - 7 each

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