



Tropical Cyclones Forecast Programme (TCFP)

**Monica Sharma
Scientist-D**

**India Meteorological Department
moniimd@gmail.com**

**भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT**

Forecast Demonstration Project

- ❖ World wide huge technological advancements have been achieved to observe the inner core of the cyclone.
- ❖ Accordingly, a programme was planned to monitor the genesis, track and intensity of tropical cyclones in 2008 as the Forecast Demonstration Project (FDP) over Bay of Bengal during 15 October – 30 November. It was implemented in 3 phases:
 - Pre Pilot Phase - 2008 to 2009
 - Pilot Phase – 2010 to 2011
 - Demonstration Phase – 2012 onwards
- ❖ This programme aimed to demonstrate the improvements in cyclogenesis, intensification and movement of tropical cyclones over the north Indian ocean with enhanced observations over the data sparse region during 15th October-30 November.



Multi-Institutional Mechanism

- ❖ Many research and observational inputs were received from various agencies:
- ❖ National Centre for Medium Range Weather Forecasting (**NCMRWF**)
- ❖ Indian Institute of Tropical Meteorology (**IITM Pune**)
- ❖ Indian Air Force (**IAF**) and Indian Navy (**IN**)
- ❖ Indian Institute of Technology (**IIT**)-Bhubaneswar
- ❖ Indian National Centre for Ocean Information Services (**INCOIS**)
- ❖ National Institute of Ocean Technology (**NIOT**)
- ❖ Space Application Centre- Indian Space Research Organisation (**SAC-ISRO**)



Multi-Institutional Mechanism

Within IMD:

- Cyclone Warning Division coordinates all activities and issues Daily detailed report discussing probabilistic cyclogenesis forecast during next 7 days.
- Satellite, Radar
- Numerical Weather Prediction Division
- Information System and Services Division (ISSD)
- ACWC Chennai, Mumbai & Kolkata
- Cyclone Warning Centres at Bhubaneswar, Thiruvananthapuram, Visakhapatnam and Ahmedabad
- All Meteorological observatories along the coast



Key Scientific Objectives & Goals for FDP

Key Scientific Objectives and Goals for FDP are:

- i) To demonstrate the ability of the Numerical Models using enhanced observation over the region including the measurements from the dropsonde's over the periphery of the cyclone and to assess overall accuracy limits in terms of the cyclone track, intensity and landfall for one to two Seasons.
- ii) To incorporate modification into the models which could be specific to the Bay of Bengal based on the in-situ measurements and following the actual track through Satellite and Radar observations

However, the aircraft probing could not be attempted in due to various technical reasons



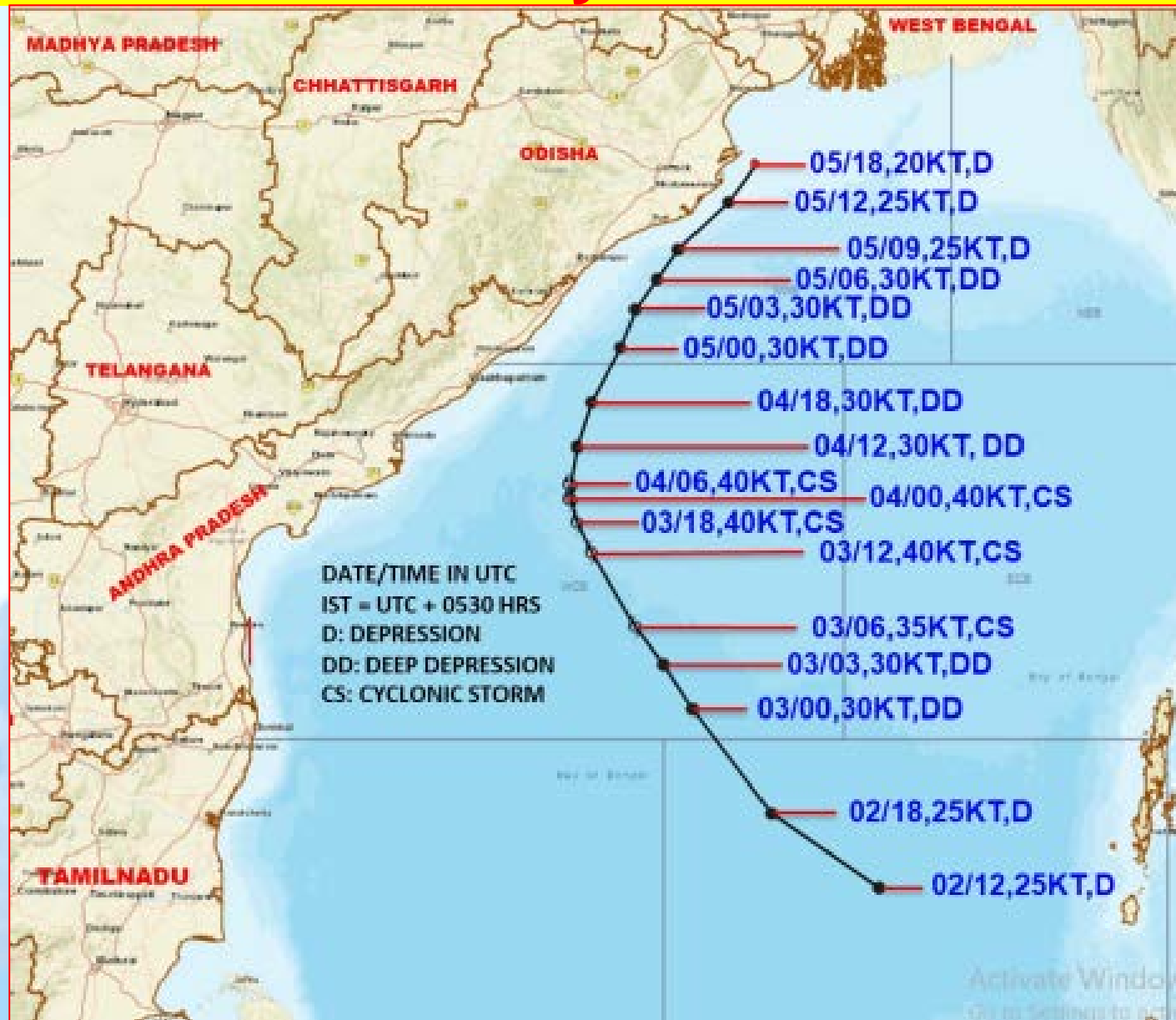
FDP Report Details

FDP Report discusses the:

- **Synoptic features at 0300 UTC**
- **Dynamical & Thermodynamical features (sea condition, environmental conditions, broad scale features like MJO, ridge, trough, anticyclones, equatorial waves etc.)**
- **Satellite observations**
- **Model Guidance (IMD GFS, IMD-WRF, NCUM (R), NCUM(G), GEFS, NEPS, ECMWF, ECMWF-EPS, NCEP GFS, GPP, JMA, IMD MME)**
- **Summary & Conclusion including probablistic cyclogenesis forecast for next 7 days**
- **Advisory about Intense Observation Phase (IOP)**



Case Study - CS Jawad



FDP report dated 21st November



Ministry of Earth Sciences
India Meteorological Department
Cyclone Warning Division, New Delhi

FDP (Cyclone) NOC Report Dated 21th November, 2021

Time of Issue: 1200 UTC

Synoptic features (based on 0900 UTC analysis):

- ❖ Yesterday's well marked low pressure area over eastcentral Arabian Sea (AS) moved gradually west-southwestwards and persisted over the same region at 0900 UTC of today, the 21st November. It is likely to move west-southwestwards during next 2-3 days and weaken gradually.
- ❖ A trough from the cyclonic circulation associated with the above Well Marked Low Pressure Area over Eastcentral AS now runs to Maharashtra coast and extends upto 1.5 km above mean sea level.
- ❖ A cyclonic circulation formed over south Andaman Sea & neighbourhood at 0300 UTC of today, the 21st November. Vertically, it extended upto 3.1 km above mean sea level. It persisted over the same region at 0900 UTC of today.
- ❖ Yesterday's cyclonic circulation over south interior Karnataka became less marked at 0830 hrs IST of today, the 21st November 2021.



FDP report dated 21st November

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) °C	29-31°C over entire BoB region.	28-29°C over eastern parts of AS. 26-27°C over western parts of AS off Somalia, Yemen & Oman coasts.
Tropical Cyclone Heat Potential (TCHP) kJ/cm ²	(a) 50-60 over southwest BoB, (b) 60-80 over major parts of central & north BoB (c) 100-120 over eastern equatorial Indian Ocean and adjoining south Andaman Sea & southeast BoB.	(a) 50-60 over eastern parts of central & north AS (b) 60-80 over south AS. (c) It is less than 50 over western parts of AS.
Cyclonic Relative vorticity ($\times 10^{-6} \text{s}^{-1}$)	40-60 over south Andaman Sea and adjoining southeast BoB with vertical extension upto 500 hPa level.	100 over central parts of south AS to the southwest of vortex with vertical extension upto 500 hPa level and oriented northeast to southwest. 40-60 over Comorin area.
Low Level convergence ($\times 10^{-5} \text{s}^{-1}$)	05-10 over southeast BoB Another convergence zone of 05 over south Andaman Sea.	Small zone of 05 over eastcentral AS to the north of vortex. Another zone of 05-10 over southwest AS to the southwest of system



FDP report dated 21st November

		centre. Another zone of 05 over southeast AS off Kerala coast.
Upper Level divergence ($\times 10^{-5} \text{ s}^{-1}$)	A large extended zone 05-10 over southeast Bay and adjoining east Equatorial Indian Ocean.	A large extended zone 05-10 over central AS upto Maharashtra coast over the system area.
Vertical Wind Shear (VWS knots)	Low to Moderate (05-20) over major parts of BoB and Andaman Sea. High to the south of 8°N .	Moderate (15-20 kt) over the vortex area and high to the west & southwest of vortex along the expected movement of system. High over all other parts of AS.
Wind Shear Tendency (knots)	Decreasing over major parts of BoB and Andaman Sea.	Decreasing over the vortex area. And expected track of system.
Upper tropospheric Ridge	Along 20.5°N .	Along 19.0°N .



FDP report dated 21st November

Satellite observations based on INSAT imagery (0600 UTC):

(a) Associated with well marked low pressure area over eastcentral Arabian Sea

At 0600 UTC, the vortex over eastcentral AS is characterized with intensity of T 1.0 and is centred near 12.8N and 66.8 E. The associated convection has decreased and disorganised during past 03 hrs. Scattered to broken low & medium clouds with embedded intense to very intense convection lay over central and adjoining south AS between latitude 10.0N & 16.0N and longitude 61.0E & 67.0E. Minimum cloud top temperature has reduced significantly and is minus 83°C at 0900 UTC, indicating decrease in depth of convection .

(b) Associated with convection over Bay of Bengal

At 0600 UTC, scattered low & medium clouds with embedded intense to very intense convection lay over central & southwest BoB and south Andaman Sea.

(a) Associated with convection over Arabian Sea

At 0600 UTC, scattered low & medium clouds with embedded intense to very intense convection lay over central & adjoining south AS between latitude 10.0N & 18.0N and longitude 60.0E & 70.0E.

M.J.O. Index:

MJO index is currently in Phase 4 with amplitude less than 1. It will continue in same phase for next 7 days with amplitude less than 1.

Storms and Depression over South China Sea/ South Indian Ocean:

An invest area is located near 11.5°S/106.0°E with associated maximum sustained wind speed of 20 kts.

NWP Input for FDP Cyclone based on 0000 UTC for the next 7 days

Model	BoB	AS
IMD-GFS	No cyclogenesis is indicated over the BoB region during next 7 days.	Indicates a well marked low pressure area over eastcentral AS with west-southwestwards movement during 21 st -22 nd becoming low pressure area over southwest AS on 23 rd -and reaching close to Somalia on 24 th . Becoming less marked thereafter.



FDP report dated 21st November

IMD-GEFS	No cyclogenesis is indicated over the BoB region during next 7 days.	Indicates a low pressure area over eastcentral AS on 21 st moving west-southwestwards, reaching southwest AS on 22 nd and becoming less marked thereafter.
IMD-WRF	A trough over south BoB on 21 st , LPA over southeast BoB on 22 nd and 23 rd with west-northwestwards movement. Seen as and LPA over southwest BoB off north Sri Lanka coast on 24 th .	Indicates a well marked low pressure area over eastcentral AS on 21 st , LPA over southwest AS during 22 nd & 23 rd , becoming less marked near North Somalia coast on 24 th .
NCMRWF-NCUM	A cyclonic circulation over southeast BoB and adjoining south Andaman Sea on 21 st moving west-northwestwards towards Sri Lanka by 25 th .	Indicates a WML over eastcentral AS on 21 st & 22 nd with west southwestwards movement towards southwest AS upto Somalia during 23 rd to 24 th and becoming less marked thereafter.
NCMRWF-NEPS	-Do-	Indicating similar trends in movement of system as other models. However, this model is also indicating slight intensification during 23 rd to 25 th over southwest AS. Further, it is also indicating system to reach Somalia coast on 26 th as an LPA. Becoming less marked thereafter.
NCMRWF-UM (Regional)	-Do-	Similar trends as NCUM
ECMWF	Indicates Cyclonic Circulation/LPA over south Andaman Sea on 21 st , southeast BoB on 22 nd , southwest BoB on 23 rd , close to Sri Lanka on 24 th with overall west-northwestwards movement.	Indicates WML over east-central AS on 20 th till 21 st with west-southwestward movement and gradual weakening from 22 nd onwards becoming insignificant on 24 th .



FDP report dated 21st November

ECMWF	Indicates Cyclonic Circulation/LPA over south Andaman Sea on 21 st , southeast BoB on 22 nd , southwest BoB on 23 rd , close to Sri Lanka on 24 th with overall west-northwestwards movement.	Indicates WML over east-central AS on 20 th till 21 st with west-southwestward movement and gradual weakening from 22 nd onwards becoming insignificant on 24 th .
ECMWF-EPS	Not available	Not available
NCEP-GFS	No significant cyclogenesis zone over BoB	Similar trends as IMD GFS.
IMD-GPP	A small potential zone of cyclogenesis over south Andaman Sea on 24 th and feeble potential zone over southwest BoB off Tamil Nadu coast on 27 th & 28 th .	No significant potential zone for cyclogenesis over AS during next 7 days.

GPP- Genesis Potential Parameter based on Dynamical Statistical model developed by IMD.

Summary and Conclusion:

- 1. For the Bay of Bengal:** Majority of the models indicate no cyclogenesis during next seven days. Models are also indicating development of low pressure area over southeast BoB during next 48 hours with subsequent west-northwestwards movement towards North SriLanka coast and no significant intensification.
- 2. For the Arabian Sea:** Most of models indicate that the well marked low pressure area would move west-southwestwards for next 4-5 days towards southwest AS off Somalia coast.



FDP report dated 21st November

Summary and Conclusion:

1. **For the Bay of Bengal:** Majority of the models indicate no cyclogenesis during next seven days. Models are also indicating development of low pressure area over southeast BoB during next 48 hours with subsequent west-northwestwards movement towards North SriLanka coast and no significant intensification.
2. **For the Arabian Sea:** Most of models indicate that the well marked low pressure area would move west-southwestwards for next 4-5 days towards southwest AS off Somalia coast.

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It may thus be concluded that,

1. No cyclogenesis is expected over the BoB and AS region during next 7 days.
2. The Well Marked Low Pressure Area over eastcentral Arabian Sea would move west-southwestwards for next 2-3 days and weaken gradually. The movement and intensification of the system is being continuously monitored.
3. The movement and intensification of cyclonic circulation over South Andaman Sea is being monitored.



FDP report dated 21st November

Probability of cyclogenesis (formation of depression and above intensity systems) over the Bay of Bengal and Andaman Sea during next 168 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
NIL	NIL	NIL	NIL	NIL	NIL	NIL

Probability of cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
NIL	NIL	NIL	NIL	NIL	NIL	NIL

Advisory:

1. The Well Marked Low Pressure Area over eastcentral Arabian Sea would move west-southwestwards for next 2-3 days and weaken gradually. Continuous monitoring of the movement and intensification of the system required.
2. Continuous monitoring of the movement and intensification of cyclonic circulation over South Andaman Sea is required.

No IOP is suggested for next 24 hours.



FDP report dated 25th November



Ministry of Earth Sciences
India Meteorological Department
Cyclone Warning Division, New Delhi

FDP (Cyclone) NOC Report Dated 25th November, 2021

Time of Issue: 1200 UTC

Synoptic features (based on 0900 UTC analysis):

- ❖ Yesterday's cyclonic circulation over southwest Arabian Sea (AS) became less marked over the same region at 0300 UTC of today, the 25th November.
- ❖ Yesterday's cyclonic circulation over southwest & adjoining southeast Bay of Bengal (BoB) lay over southwest BoB off Sri Lanka coast at 0300 UTC of today, the 25th November. It persisted over the same region at 0900 UTC of today.
- ❖ A Low Pressure Area is likely to form over south Andaman Sea around 29th November, 2021. It is likely to become more marked and move west-northwestwards during subsequent 48 hours.



FDP report dated 25th November

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) °C	29-31°C over entire BoB region.	28-29°C over eastern parts of AS. 26-27°C over western parts of AS off Somalia, Yemen & Oman coasts.
Tropical Cyclone Heat Potential (TCHP) kJ/cm ²	(a) 50-60 over southwest BoB, (b) 60-80 over major parts of central & north BoB (c) 100-120 over eastern equatorial Indian Ocean and adjoining south Andaman Sea & southeast BoB.	(a) 50-60 over eastern parts of central & north AS (b) 60-80 over south AS. (c) It is less than 50 over western parts of AS.
Cyclonic Relative vorticity ($\times 10^{-6} \text{ s}^{-1}$)	50-60 over southwest BoB off South Sri Lanka coast with vertical extension upto 500 hPa level. 40-50 over Gulf of Thailand at 850 hPa level with vertical extension upto 500 hPa level.	50-60 over Comorin area and southwest AS off Somalia coast.
Low Level convergence ($\times 10^{-5} \text{ s}^{-1}$)	10-15 over Gulf of Mannar. Also another zone of 10-15 over south Andaman Sea.	No significant zone.
Upper Level divergence ($\times 10^{-5} \text{ s}^{-1}$)	A large extended zone of 05-20 over south BoB and adjoining	A large extended zone 10-20 over southeast AS.
	Equatorial Indian Ocean. Also another zone of 05-15 over south Andaman Sea and adjoining equatorial Indian Ocean extending upto southeast AS..	
Vertical Wind Shear (VWS knots)	Moderate (05-20) over entire central BoB and adjoining south BoB and Andaman Sea. High to the south of 8°N and over north BoB.	Moderate (15-20 kt) over the central AS and southwest AS.
Wind Shear Tendency (knots)	Decreasing over north Andaman Sea.	Decreasing over south AS and Comorin Area.
Upper tropospheric Ridge	Along 11.0°N.	Along 17.0°N.



FDP report dated 25th November

Satellite observations based on INSAT imagery (0900 UTC):

(a) Associated with convection over south west Bay of Bengal off Sri Lanka coast

At 0900 UTC, scattered to broken low and medium clouds with embedded intense to very intense convection lay over southwest BoB, Sri Lanka, Palk Strait, Gulf of Mannar, Comorin area. Minimum cloud top temperature is minus 90 deg C.

(b) Associated with convection over Bay of Bengal:

At 0900 UTC, scattered to broken low & medium clouds with embedded intense to very intense convection lay over southwest BoB, Gulf of Mannar, Palk Strait and Andaman Sea. Scattered low & medium clouds with embedded moderate to intense convection lay over central and southeast BoB

(c) Associated with convection over Arabian Sea

At 0900 UTC, scattered to broken low & medium clouds with embedded intense to very intense convection lay over eastcentral off Kerala coast and Comorin area.

M.J.O. Index:

MJO index is currently in Phase 4 with amplitude close to 1. It will continue in same phase for next 3 days. Thereafter, it will move to phase 5 with amplitude remaining close to 1 for subsequent 4 days.

Storms and Depression over South China Sea/ South Indian Ocean:

Yesterday's invest area is located near 10.6°S/93.6°E with associated maximum sustained wind speed of 20 kts.



FDP report dated 25th November

NWP Input for FDP Cyclone based on 0000 UTC for the next 7 days

Model	BoB	AS
IMD-GFS	<p>Indicates a broad-scale low southwest BoB and adjoining Sri Lanka off south Tamil Nadu coast on 25th & 26th, off Tamil Nadu coast on 27th & 28th and weakening on 29th November.</p> <p>It is also indicating emergence of a Low pressure system from Gulf of Thailand as a Depression over south Andaman Sea & adjoining Malacca strait on 29th, its rapid intensification into an Extremely Severe Cyclonic Storm (ESCS) over southeast BoB and</p>	<p>Indicates a fresh LPA over southeast AS off south Kerala coast on 27th, as a broad-scale low over southeast AS off Kerala coast on 28th, its westward movement over to southeast AS on 29th, as a trough of Low over southeast & adjoining east-central AS on 30th November and further weakening and dissipation on 1st December.</p>

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	<p>adjoining Andaman Sea on 30th November and again as a Super Cyclone (SuCS) over southeast & adjoining east-central BoB on 1st December.</p>	
IMD-GEFS	<p>Forecasts are the same as that of the deterministic GFS upto 28th. The intensity of the fresh low pressure system over south Andaman Sea is only that of an LPA on 29th. However, further intensification is similar to that depicted above, but with large uncertainty.</p>	-Do-



FDP report dated 25th November

IMD-WRF	Persistence of a broad-scale low over southwest BoB upto 26 th , as an LPA over southwest BoB off east Sri Lanka coast on 27 th and over Sri Lanka on 28 th .	No fresh genesis predicted upto 28 th .
NCMRWF-NCUM	A feeble LPA emerging from Gulf of Thailand to south Andaman Sea on 1 st December, LPA over southeast BoB and adjoining Andaman Sea on 2 nd , as a Depression over southeast BoB on 3 rd .	No fresh genesis predicted.
NCMRWF-NEPS	Similar to NCUM	Similar to NCUM.
NCMRWF-UM (Regional)	No fresh genesis predicted upto 28 th .	No fresh genesis predicted upto 28 th .
ECMWF	An LPA emerging over Andaman Sea from Gulf of Thailand on 30 th November, becoming more marked over southeast Bay of Bengal and adjoining Andaman Sea on 2 nd December, moving northwestwards and concentrating into a Depression over east-central BoB by 1800 UTC of 3 rd and reaching north BoB by 5 th December.	No significant system over AS during next 7 days.
ECMWF-EPS	80-90 % probability of cyclogenesis over southwest BoB during next 2-3 days and also during 30 th November to 1 st December over south Andaman Sea.	NIL
NCEP-GFS	Indicating a broad-scale low / trough of low over southwest BoB upto 29 th Nov. Fresh feeble LPA over Thailand & adjoining Malacca strait on 29 th , an LPA over south Andaman Sea on 30 th , over south Andaman Sea & adjoining southeast BoB on 1 st December and as a Depression over southeast & adjoining east-central BoB on 2 nd .	LPA over southeast & adjoining east-central AS on 2 nd Dec.
IMD-GPP	Potential zone over Comorin area off south Sri Lanka coast on 25 th , NIL on 26 th & 27 th , over west-central BoB off south Andhra Pradesh coast on 28 th , NIL on 29 th , and over south Andaman	No significant potential zone for cyclogenesis over AS during next 7 days.



FDP report dated 25th November

Summary and Conclusion:

1. **For the Bay of Bengal:** Majority of the models indicate formation of a Low Pressure Area (emergence of a Low Pressure system from Gulf of Thailand) over south Andaman Sea around 29th with initial west-northwestward movement, deepening into a Depression around 2nd December, followed by northwestward movement towards north Bay of Bengal. All of them are also indicating further intensification of this system into a cyclonic storm during the subsequent 24-48 hours time span. However, there is large diversity in the direction of movement.
2. **For the Arabian Sea:** No significant development is indicated by any of the models during next 7 days.

It may thus be concluded that,

1. Emergence of a Low pressure system from Gulf of Thailand into south Andaman Sea is likely around 29th November. It is likely to move west-northwestwards with gradual intensification during 30th November & 1st December. Further it could move northwestwards and intensify into a Depression over east-central Bay of Bengal around 2nd December. Keeping account of the early morning of 2nd December, we are assigning a 'Low' probability for Cyclogenesis for the 144-168 hr forecast period.
2. No significant development is likely over the Arabian Sea during the next 7 days.

Probability of cyclogenesis (formation of depression and above intensity systems) over the Bay of Bengal and Andaman Sea during next 168 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
NIL	NIL	NIL	NIL	NIL	NIL	LOW

Probability of cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
NIL	NIL	NIL	NIL	NIL	NIL	NIL

Advisory: The emergence of a Low pressure system from Gulf of Thailand to Andaman Sea as a Low pressure area around 29th November and its subsequent intensification and movement to be monitored regularly.

IOP is suggested for Andaman & Nicobar Islands on 29th & 30th November.

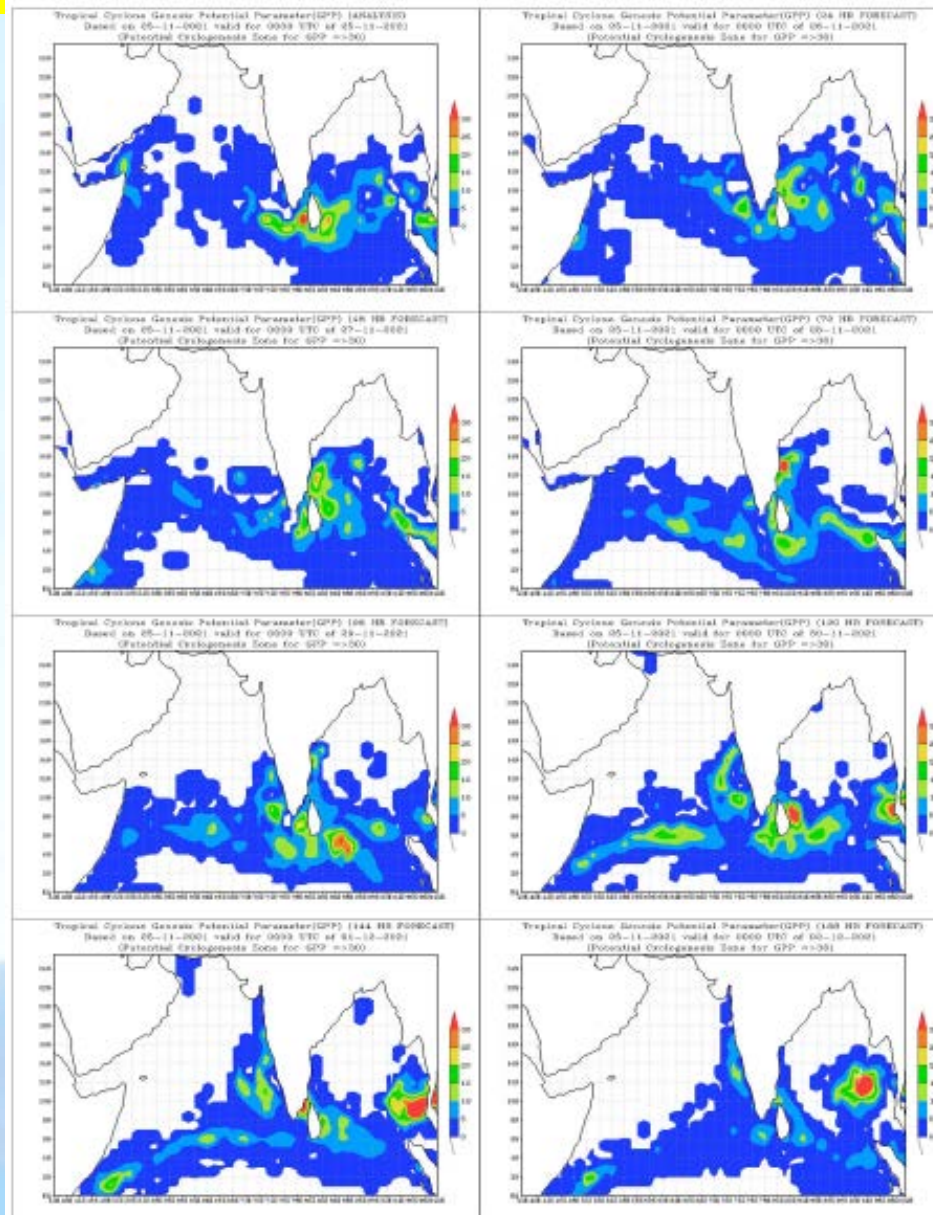
**Likely
Depression
around 2nd
December**

**Actually
depression
formed over
southeast BoB
at 1200 UTC of
2nd December**

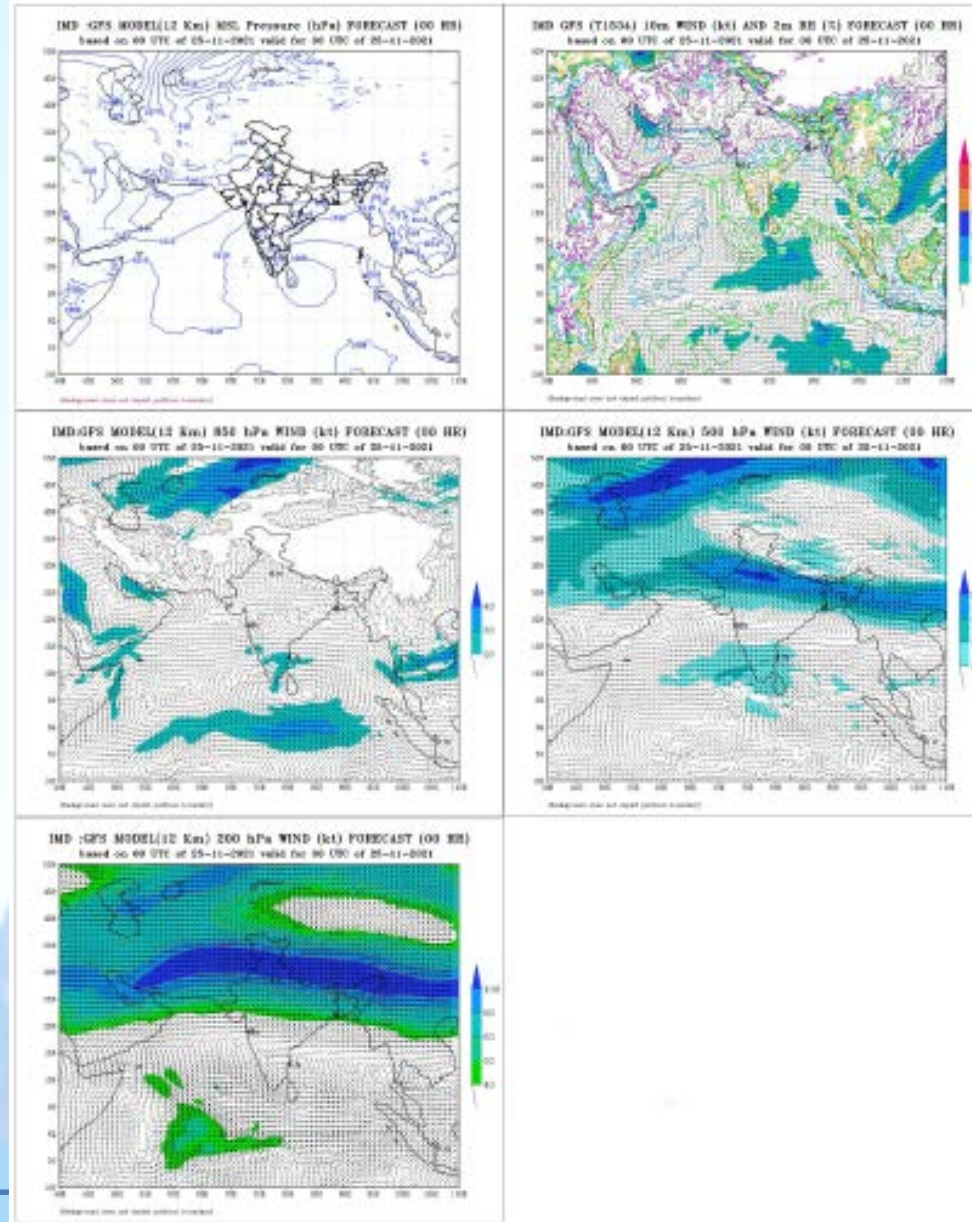
**Thus, about 7
days prior to
formation of
depression, first
trigger was
released**



FDP report dated 25th November



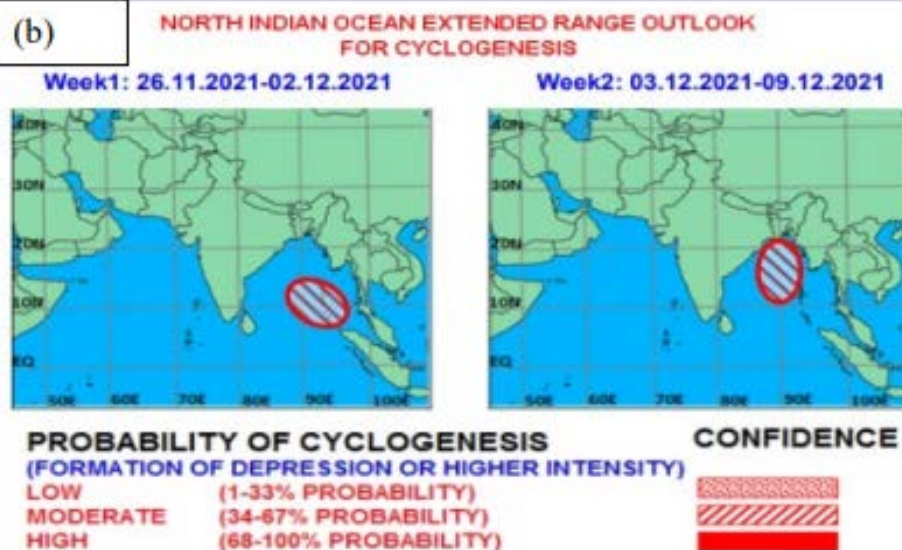
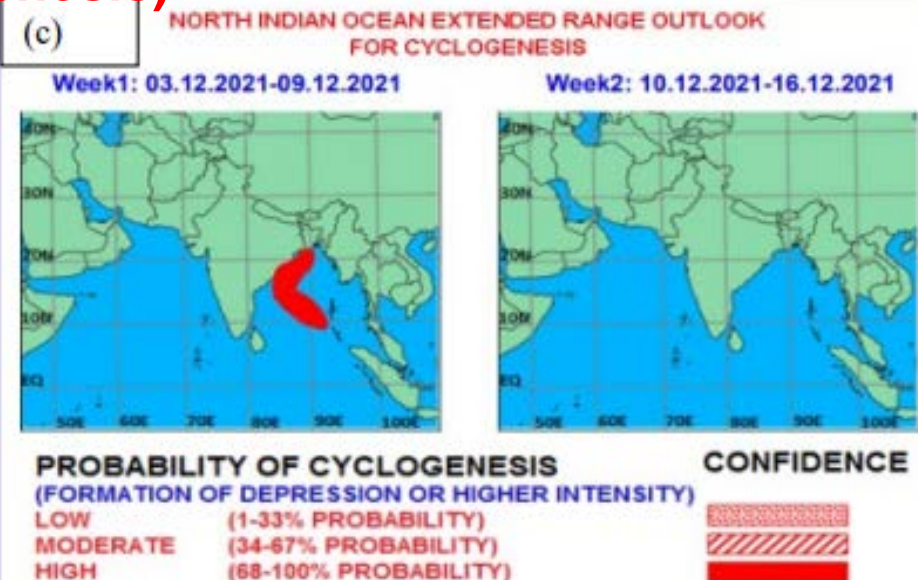
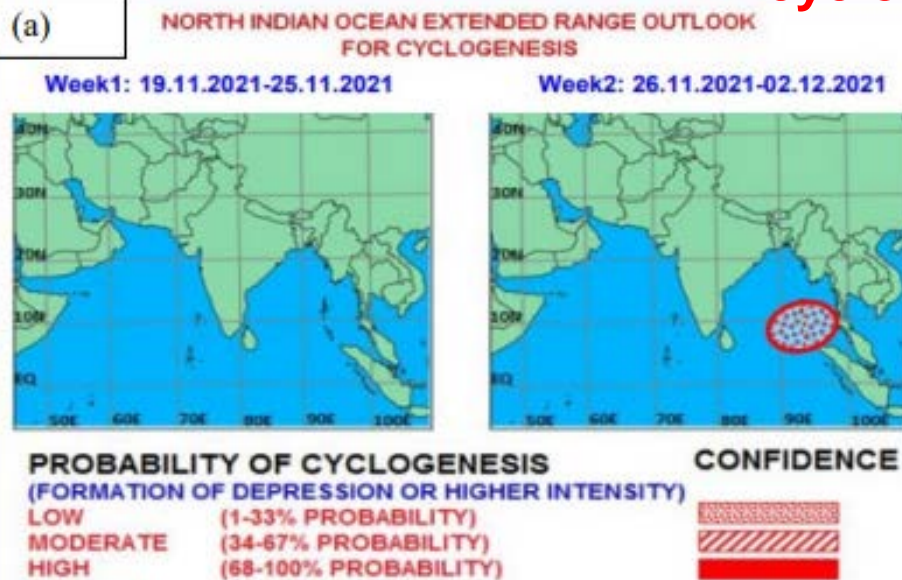
FDP report dated 25th November



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INDIA METEOROLOGICAL DEPARTMENT



Extended Range Outlook (Monitoring commenced 14 days prior to cyclogenesis)



Depression formed over southeast BoB at 1200 UTC of 2nd December

- EROC dated 18th Nov. indicated Low prob. of cyclogenesis over SE BoB during 30Nov.-2Dec
- EROC dated 25th Nov indicated Mod. prob. of cyclogenesis over SE BoB during 30Nov-2Dec and Mod. Over EC & NE Bay during 3-5 Dec (recurvature)
- EROC dated 2nd Dec. indicated High prob. Of cyclogenesis over SE BoB & NE recurvature



Outcome (Increased lead Period & Improved Forecast)

- First information about likely cyclogenesis (low probability: 1-33%) over southeast BoB was given in EROC on 18th November (12 days prior to the formation of LPA over south Thailand on 30th Nov. and 14 days prior to formation of depression over southeast BoB on 2nd Dec.
- EROC issued on 25th Nov. and 2nd Dec. indicated initial northwestwards movement and then north-northeastwards recurvature of the system while moving parallel to east coast of India close to Andhra Pradesh-Odisha coasts
- Since 25th Nov., fishermen warnings were issued for Andaman Sea area for 30th Nov. (even before the emergence of low pressure area over south Andaman Sea on 30th) in graphical form and also in the six hourly bulletins issued by National Weather Forecasting Centre, New Delhi.
- Fishermen warnings were subsequently issued for entire BoB region in association with CS Jawad.
- 1st **special message** for disaster managers issued at 1400 hours IST of 30th November on formation of **LPA over south Thailand at 0830 hours IST of 30th Nov.** indicating emergence into Andaman Sea and intensification into CS around 3rd December. It was also indicated that the system would reach near north Andhra Pradesh-Odisha coasts around 4th Dec. morning. On 30th November, heavy rainfall warnings were issued for Andaman & Nicobar Islands.



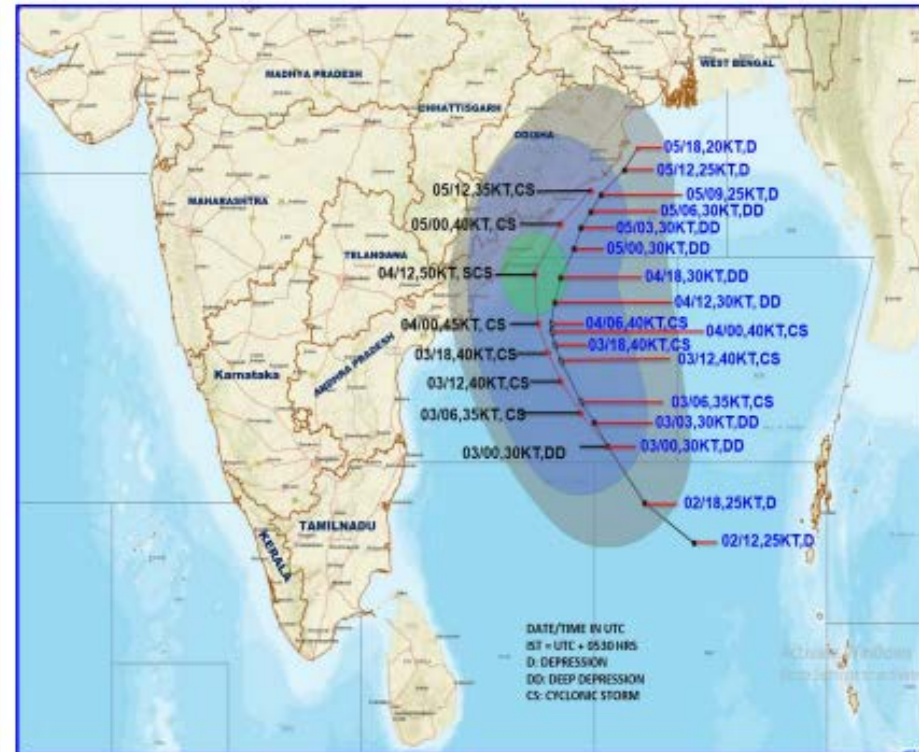
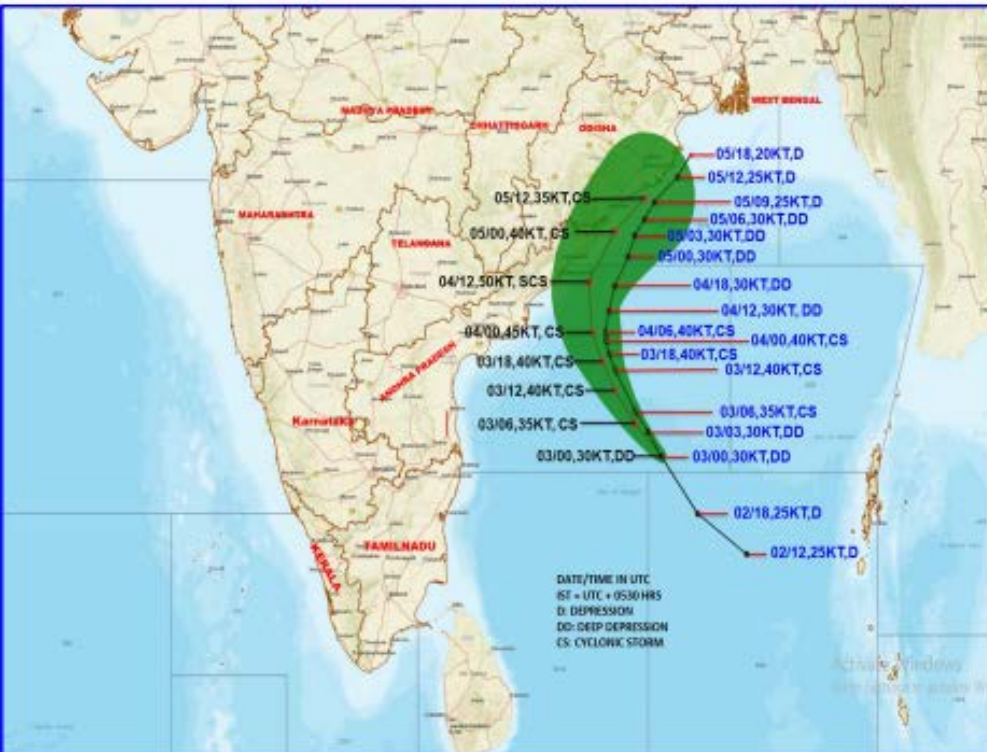
Outcome (Seasonal Improvement)

- During 2021, Pilot Phase of FDP on landfalling cyclones was conducted during 15th October to 7th December 2020.
- IOP declared for 30 days for various coastal states of India along the east & west coasts and member countries including Sri Lanka in association with depressions/deep depression over NIO.
- Daily bulletin prepared and circulated to all concerned.
- FDP helped in continuous monitoring of environmental conditions for cyclogenesis and monitoring of track, intensity and landfall of cyclonic disturbances over the region.
- Intense observations during IOP helped in better monitoring and prediction of cyclonic disturbances.
- Additional data collected during the FDP included enhanced Automatic Weather Station (AWS), High Wind Speed Recorder (HWSR) and Doppler Weather radar (DWR) network along the coast, eighteen activated buoy observations from NIO, coastal AWS, ships and microwave imagery products.
- An array of deterministic and probabilistic numerical weather prediction models were used for prediction purpose.



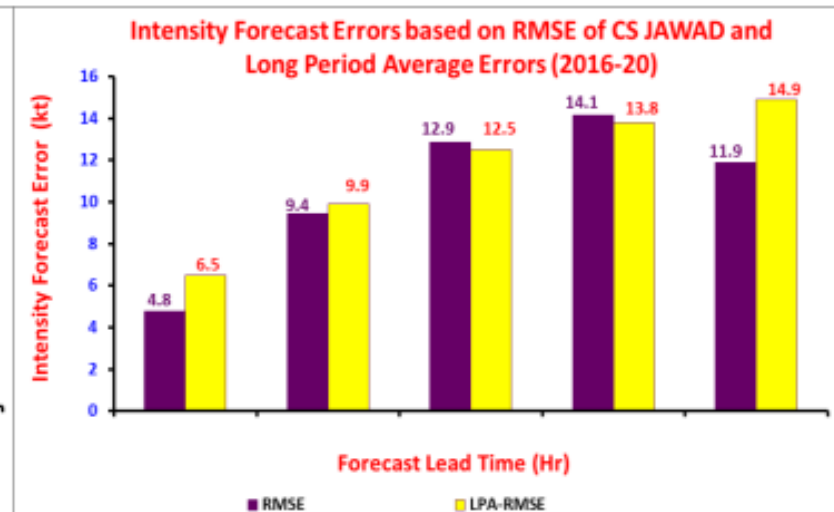
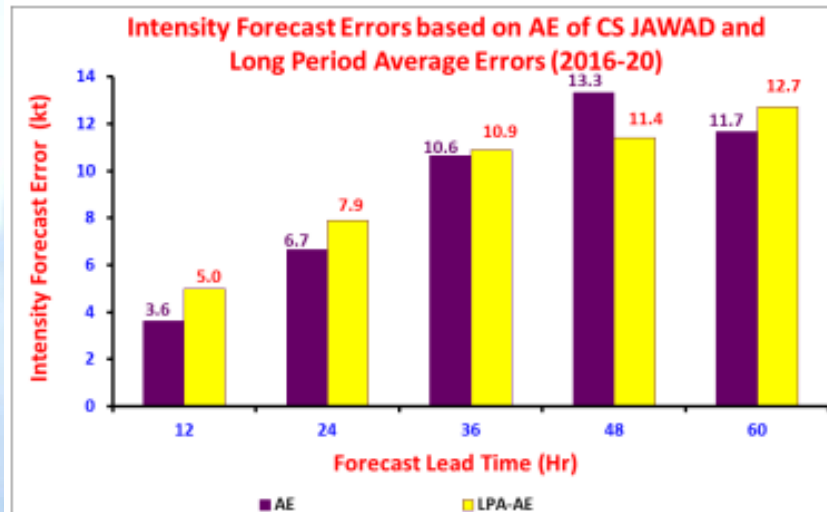
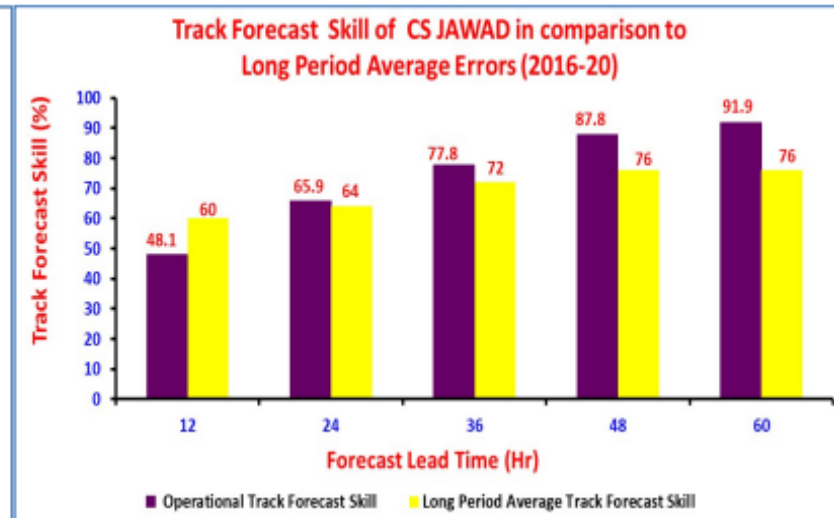
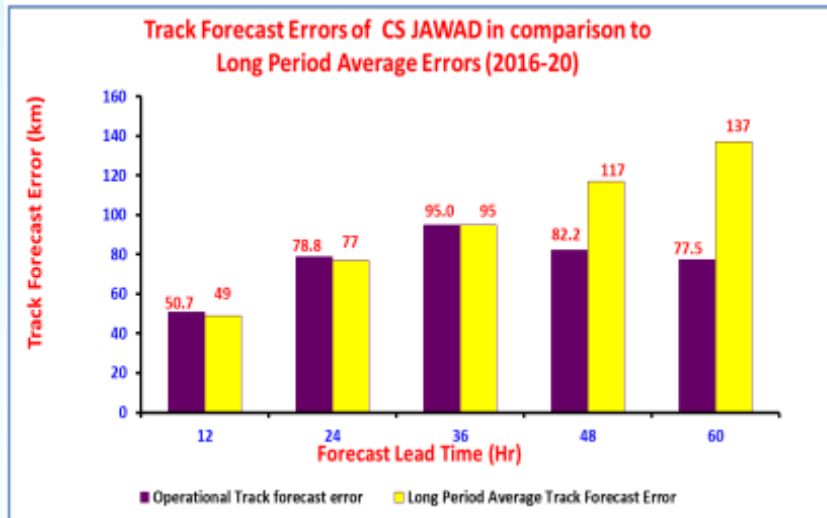
Outcome

Observed track & forecast track alongwith Cone of Uncertainty & Wind Distribution demonstrating accuracy in track & intensity forecast



Outcome

Operational Errors during CS Jawad less than LPA for all lead periods



Future Plans

- Better availability of consumables and other logistic support for the coastal observatories and ships to ensure good collection of data, GPS-sonde based upper air observations
- Better data reception from the coastal stations of all WMO/ESCAP Panel countries on real time basis, improved buoy network
- Improved NWP models and Ensemble Prediction System (EPS) guidance with better data assimilation and computational abilities, objective analysis of various cyclogenesis, intensification and track forecast parameters by preparing a check list and threshold values of various NWP products.
- Aircraft reconnaissance for better observations in the core



...Thank You

