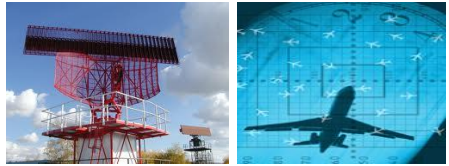
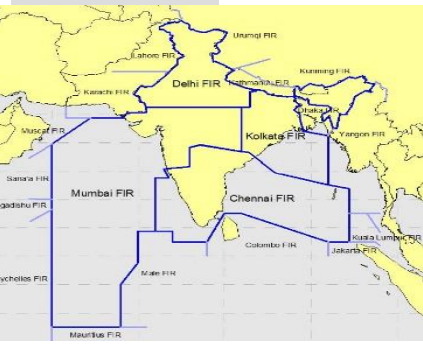




# Role of ATFM in managing adverse weather conditions

*Collaborative approach with neighbors & the role of cross border ATFM*

*A B Chatteraj & A B Joshi,  
Airports Authority of India*





# Topics discussed



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- A brief description of airspace being discussed
- A brief history of adverse weather in the airspace
- Sample case studies of cyclones
- The problems posed by adverse weather
- The possible solutions
- The role of XB ATFM in the solutions
- Other contingencies and role of XB ATFM.







# Indian FIRs (contd.)



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- Two oceanic airspaces over Arabian Sea and Bay of Bengal which are prone to adverse weather conditions, mainly Cyclonic storms, lie in Indian FIRs. A little portion of oceanic airspace is over Indian Ocean.
- Over the Arabian Sea, India has FIR boundary with Pakistan, Oman, Yemen, Somalia, Seychelles, Mauritius and Maldives. More than 600 flights overfly this airspace daily.





# Indian FIRs (contd.)



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- Over the Bay of Bengal, India has FIR boundary with Bangladesh, Myanmar, Malaysia and Indonesia. About 300 flights overfly this airspace daily.
- The means of communication in the airspace are HF, CPDLC & extended VHF and means of surveillance are pilot position reports, ADS-C and limited RADAR and ADS-B coverage.





# AS & BOB Cyclones

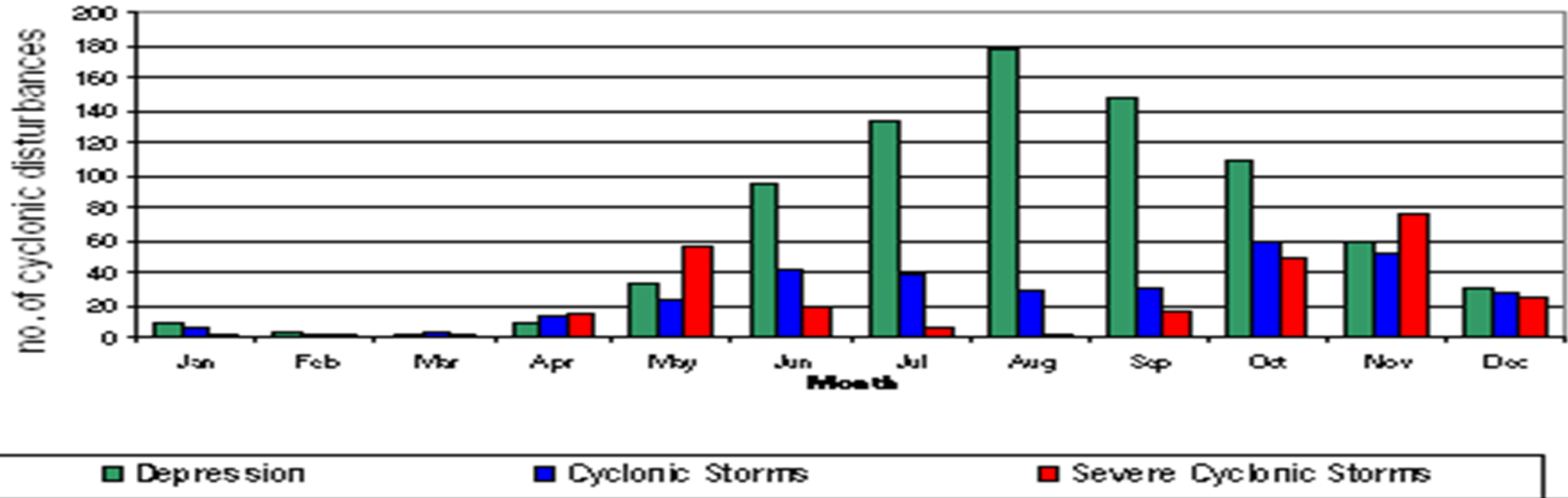


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- The average annual frequency is about 5 (about 5-6 % of the Global annual average)
- The frequency is more in the Bay of Bengal than in the Arabian Sea, the ratio being 4:1.
- Effect on flights: rescheduling, rerouting, deviations, diversions. Huge expenditures to airlines, inconvenience to passengers, workload for ANSPs and above all safety concerns for all.



# The frequency of Cyclonic systems over AS & BOB during 1891-2006.



The months of May-June and October-November-December are known to produce cyclones of severe intensity. During the monsoon months (July to September) cyclones are generally not so intense.

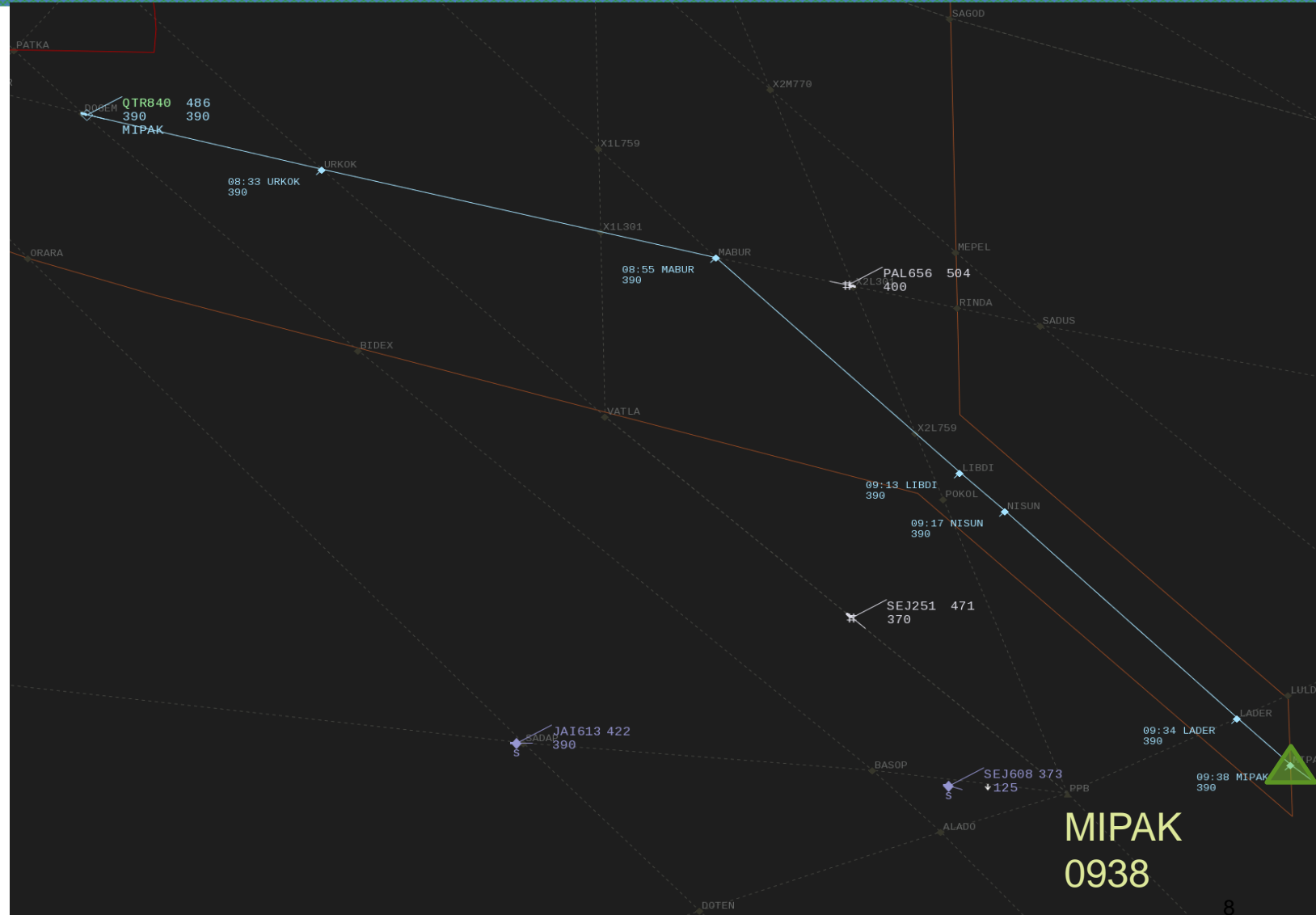


# Case study of BOB Storm Jul-Aug 2015



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- Though all aircraft were deviating left or right this QTR840 was to fly route L301 – MABUR – L759 – MIPAK
- When she entered FIR her exit point MIPAK estimate was 0938.



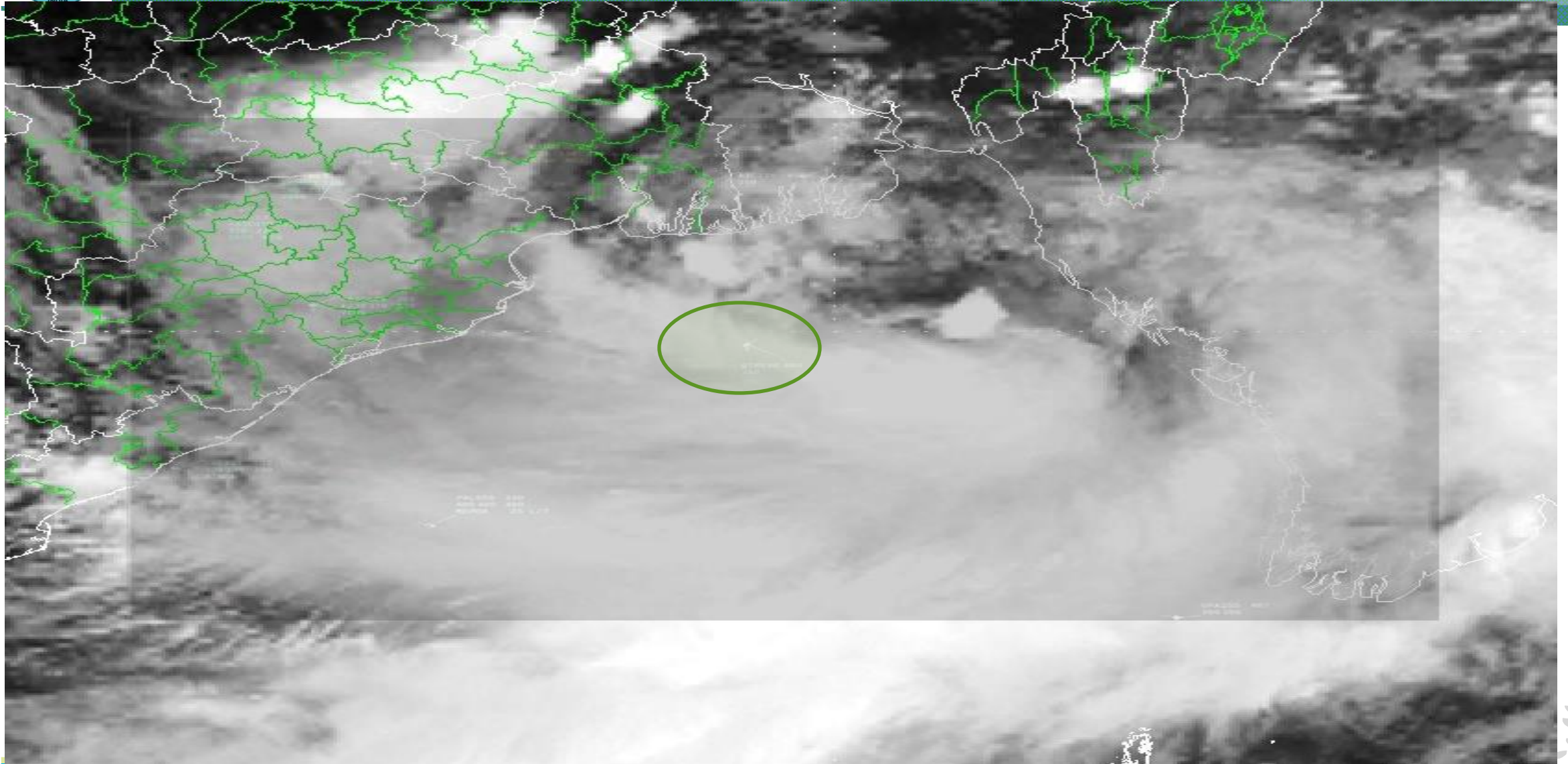




# Case study (contd.)



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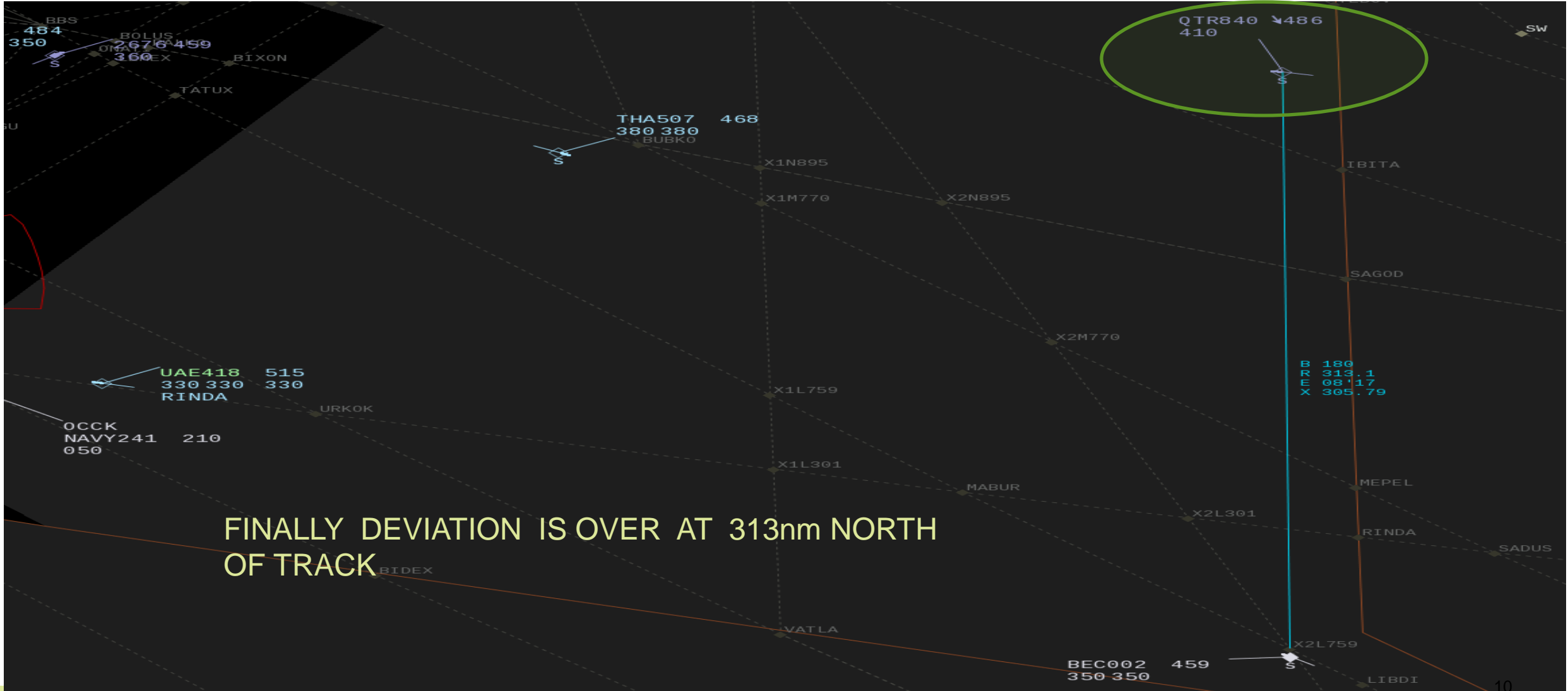




# Case study (contd.)



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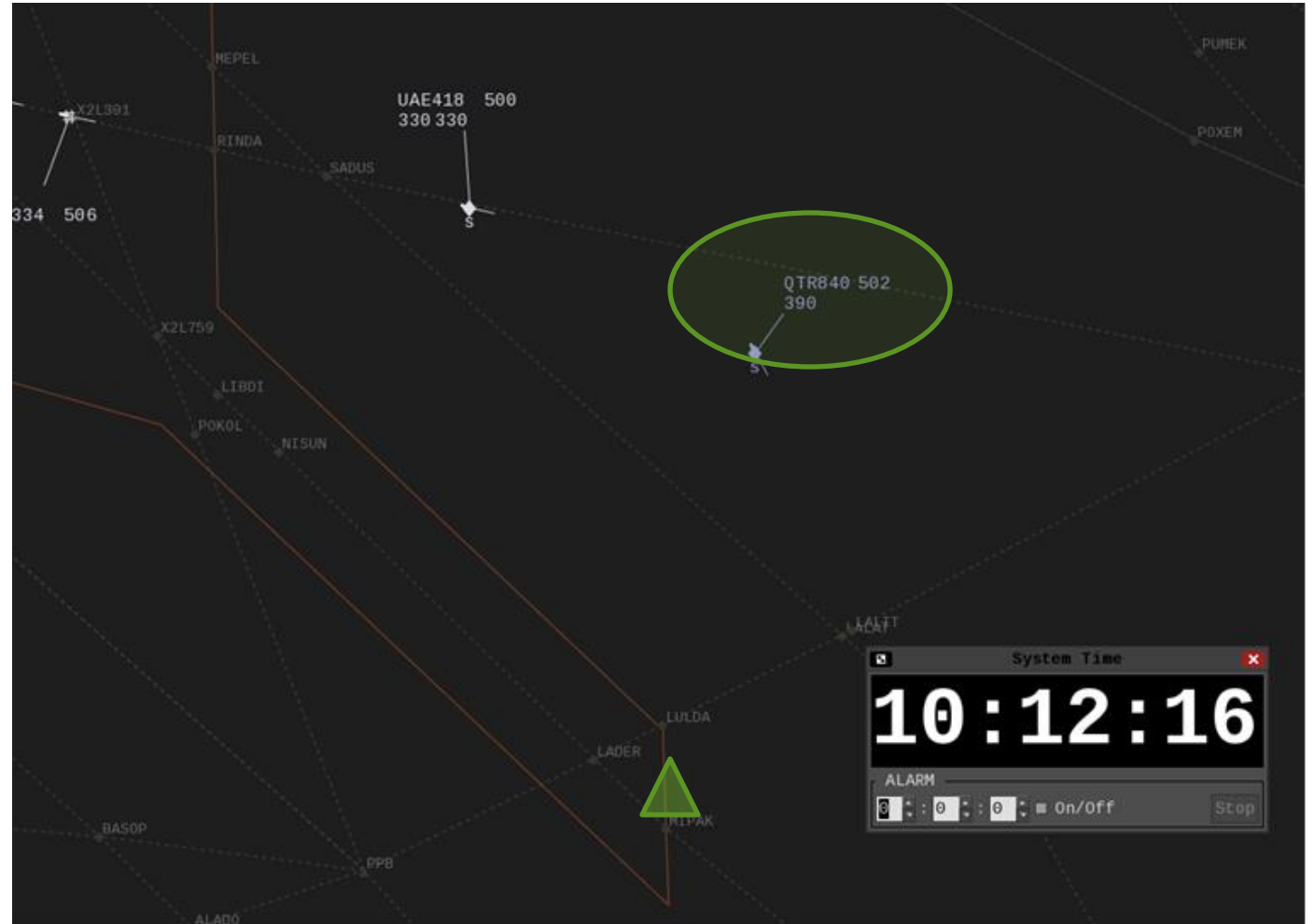


# Case study (contd.)



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- At time 10:12 QTR840 can be seen approx 80nm away from MIPAK. Total delay due Wx was 45-50 mins approx.
- Though this deviation was unusual but deviations of 150-200 nm are common in Kolkata due to line squalls.

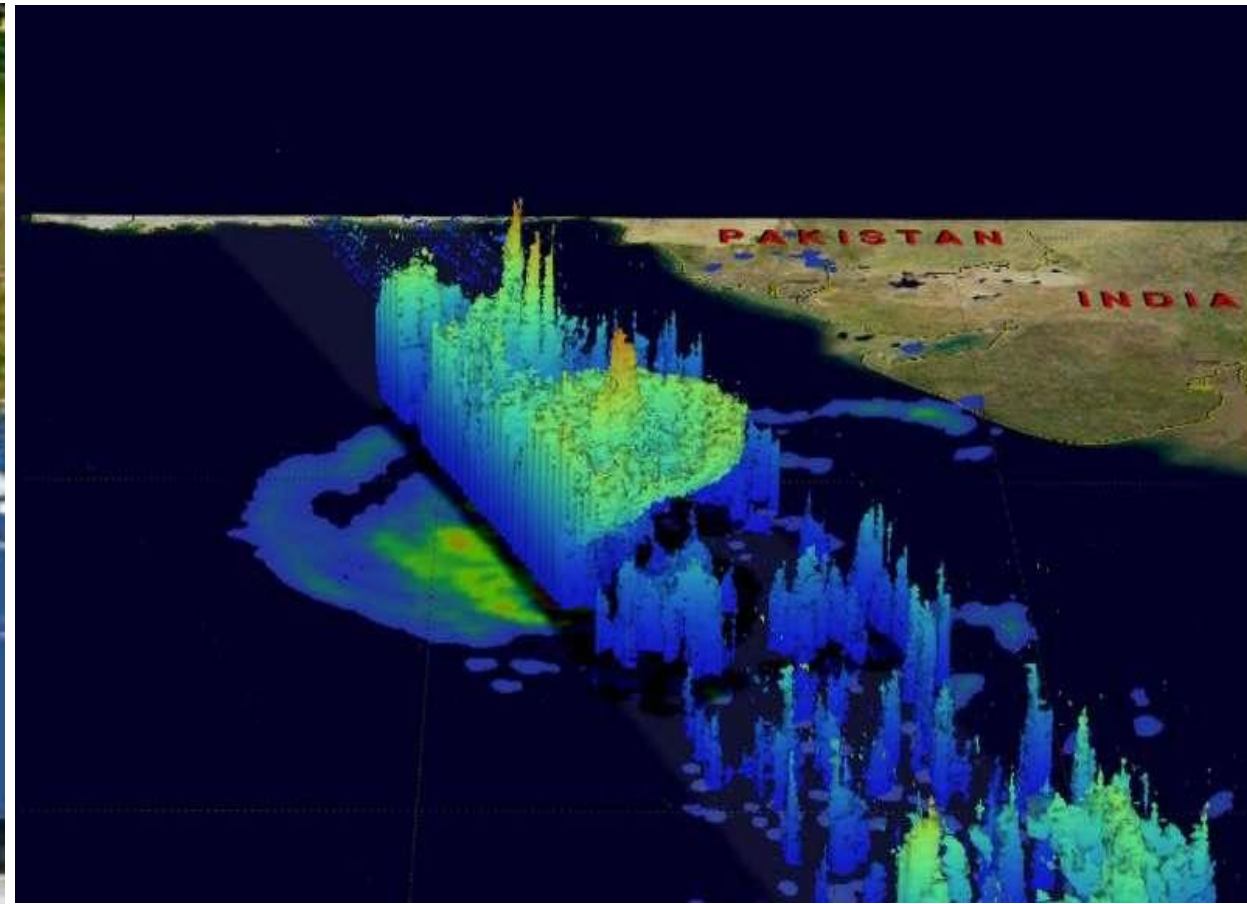
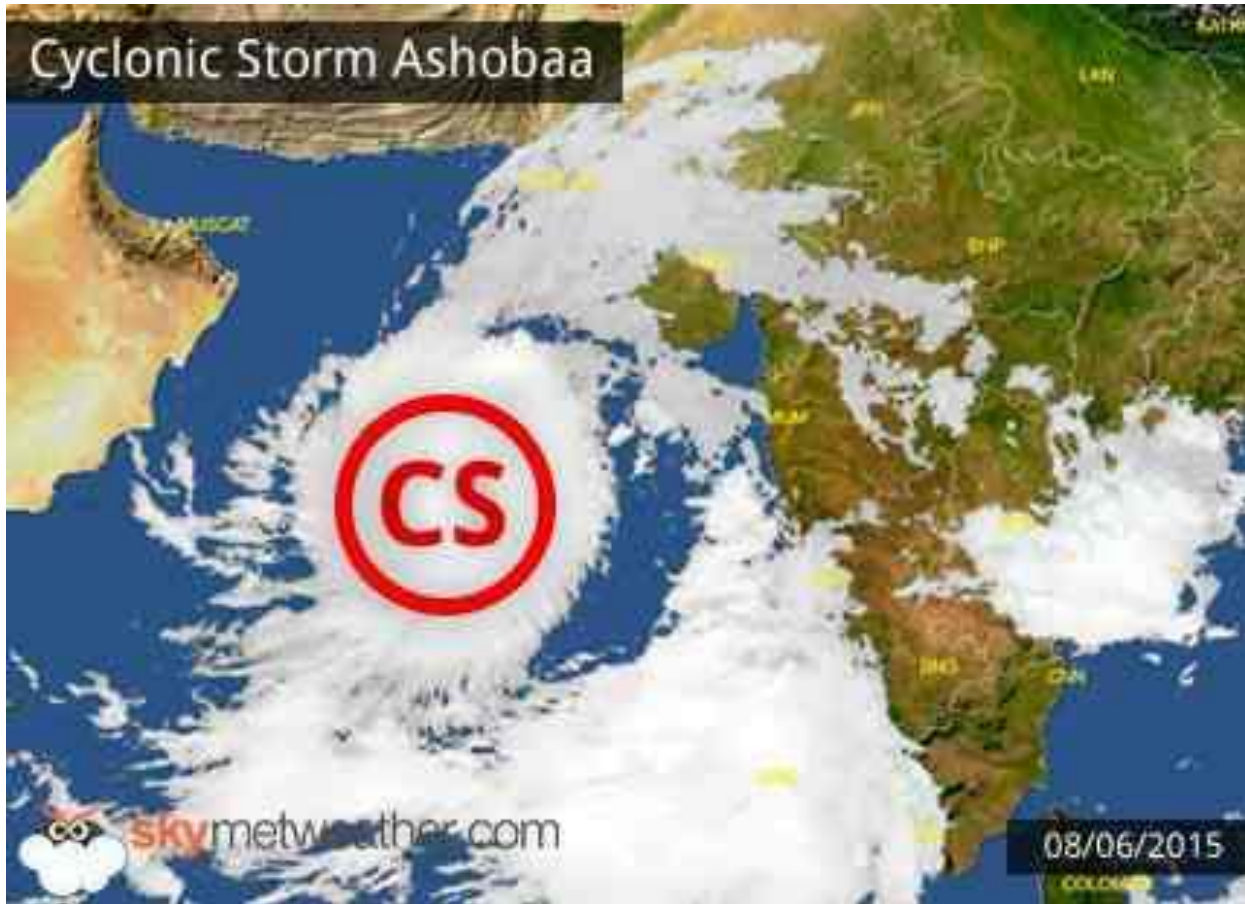




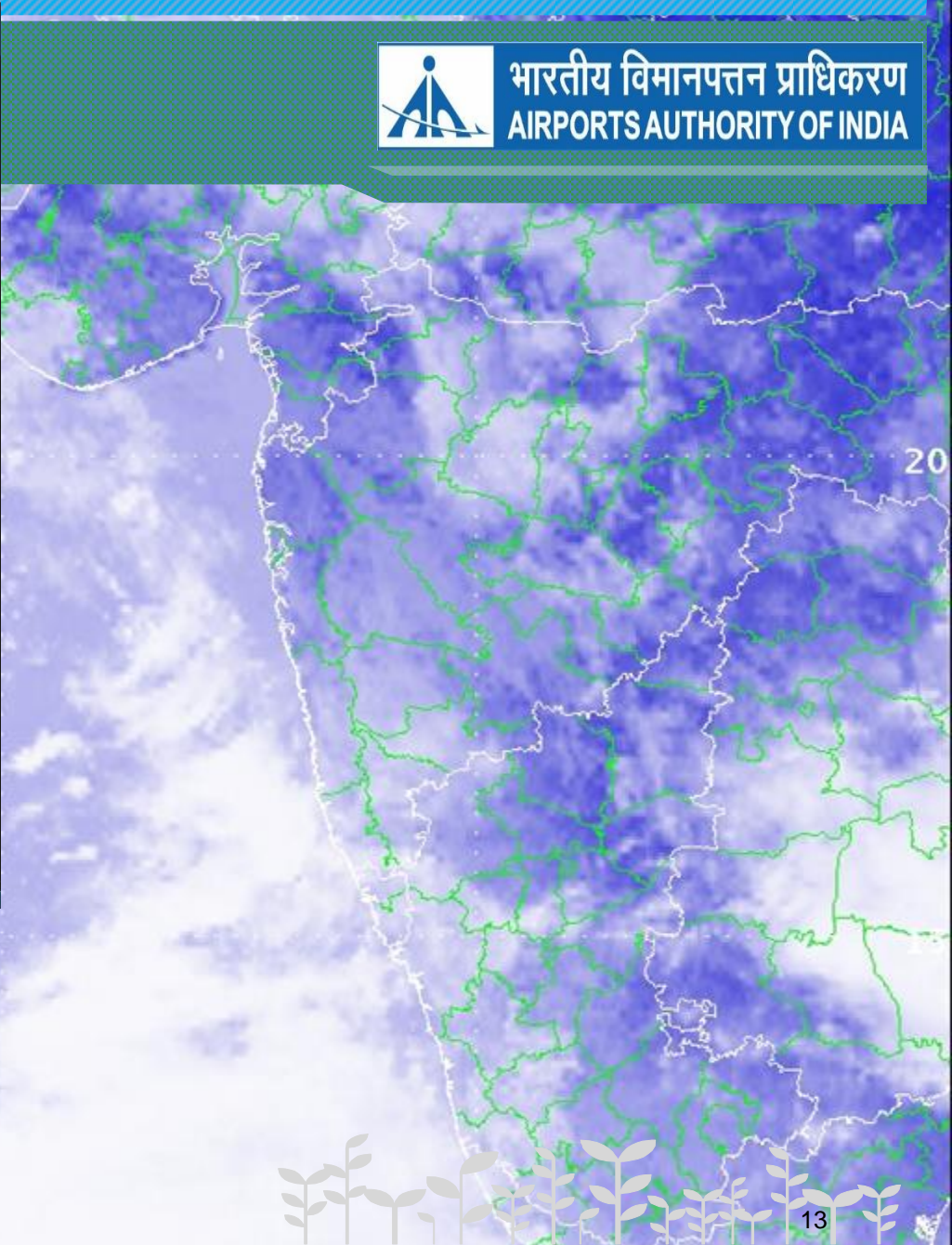
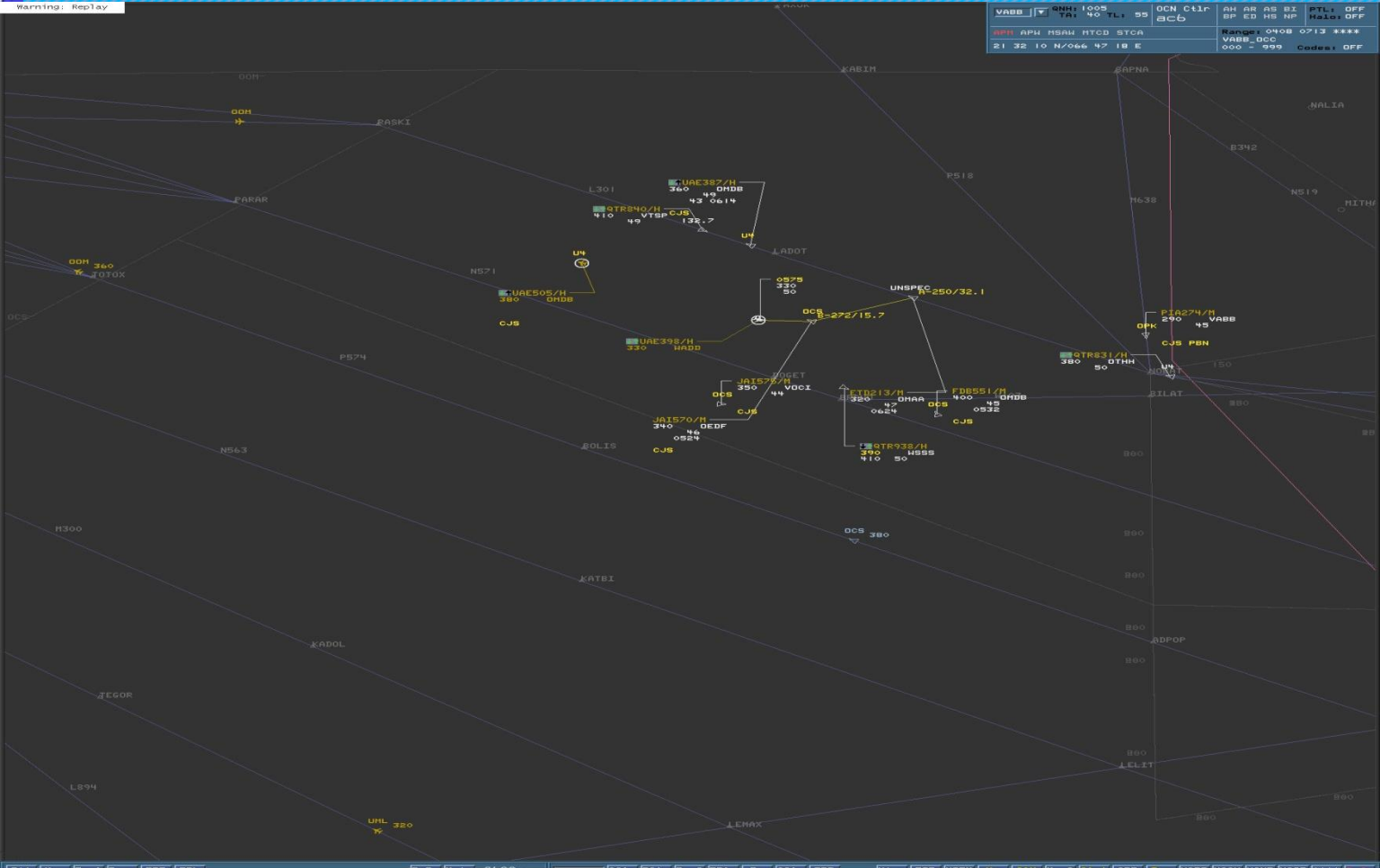
# Case study of AS Cyclone, ASHOBA, June 2015



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VABB	TAH	1005	OCN	CL1r	ACD	AH	AR	AS	BZ	PTL	OFF
APH	MSAU	HYCD	STCA			Range	0408	0713	****		
21	32	10	N/066	47	18	E	VABB_DCC	000	=	399	Codes: OFF



914 | Map | Top | Draw | FDE | FDL | Pr-Su | Main | 060004 | CC1r | FC1r | ParC | FPin | Pa | RC1r | TRD | HAc | FBF | NOTN | Un | ASH | MagS | AltT | CRD | Bys | VABB | VAAH | VANP | VAIID | \*\*\*\* | 2015





# NILOFAR: 29<sup>th</sup> October 2014, 0000



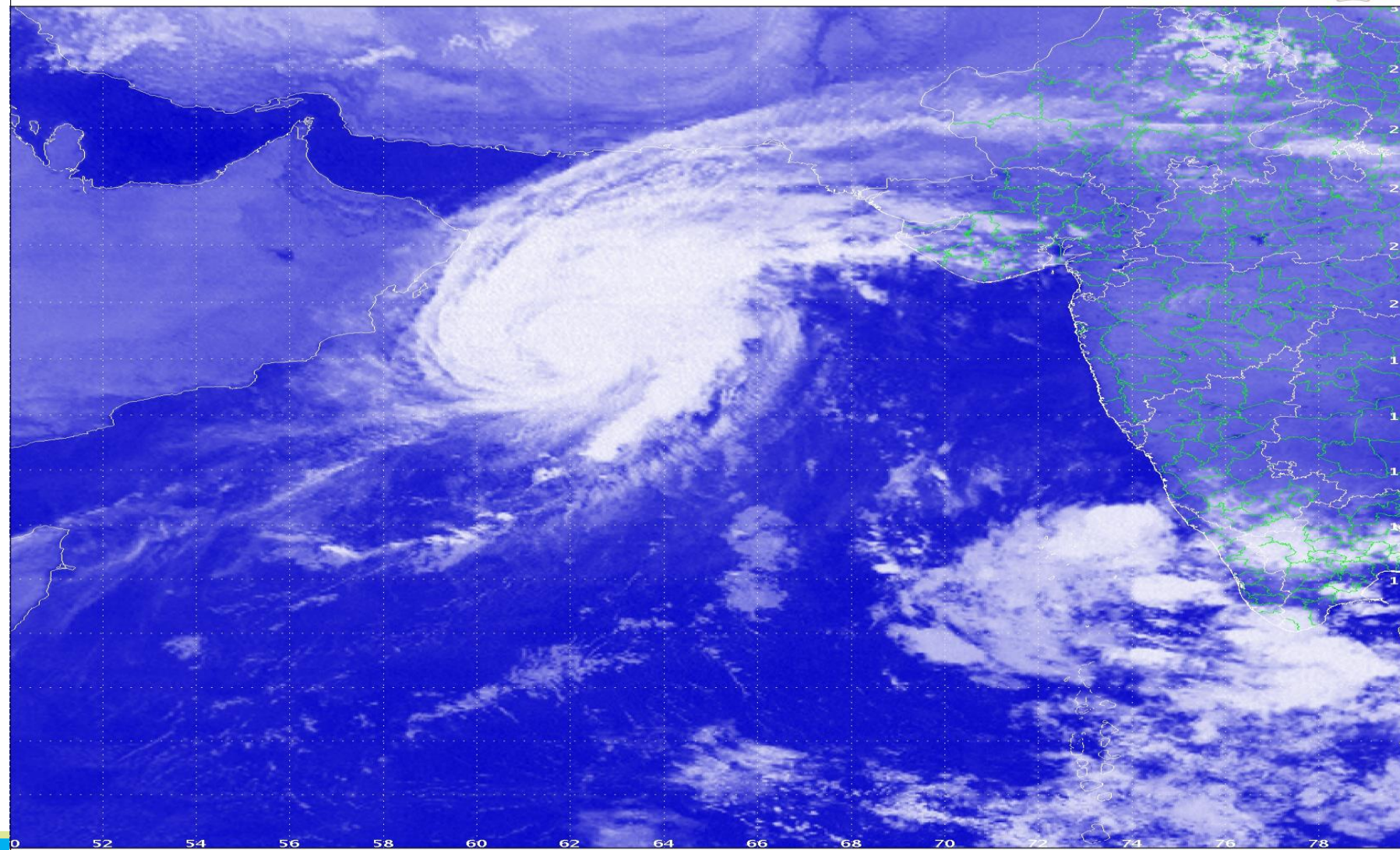
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SAT:INSAT-3D  
IMG\_MIR 3.9 um  
LIC SECTOR ARSEA\_CYCLONE Mercator

29-10-2014/00:00 GMT  
29-10-2014/05:30 IST



Blue



808 857.8 907.5 957.2 1007

IMD,DELHI





# Impact of NILOFAR – Rerouting/Rescheduling/Cancellations



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Waypoint	Route/s	Total flights on 1 <sup>st</sup> October 2014	Total flights on 29 <sup>th</sup> October 2014
RASKI	L301	231	446
PARAR	N571	152	136
TOTOX	P574	142	80
REXOD	N563	32	6
LOTAV	M300	178	6
KITAL	P570/L894/L516	95	6
Total flights		830	680



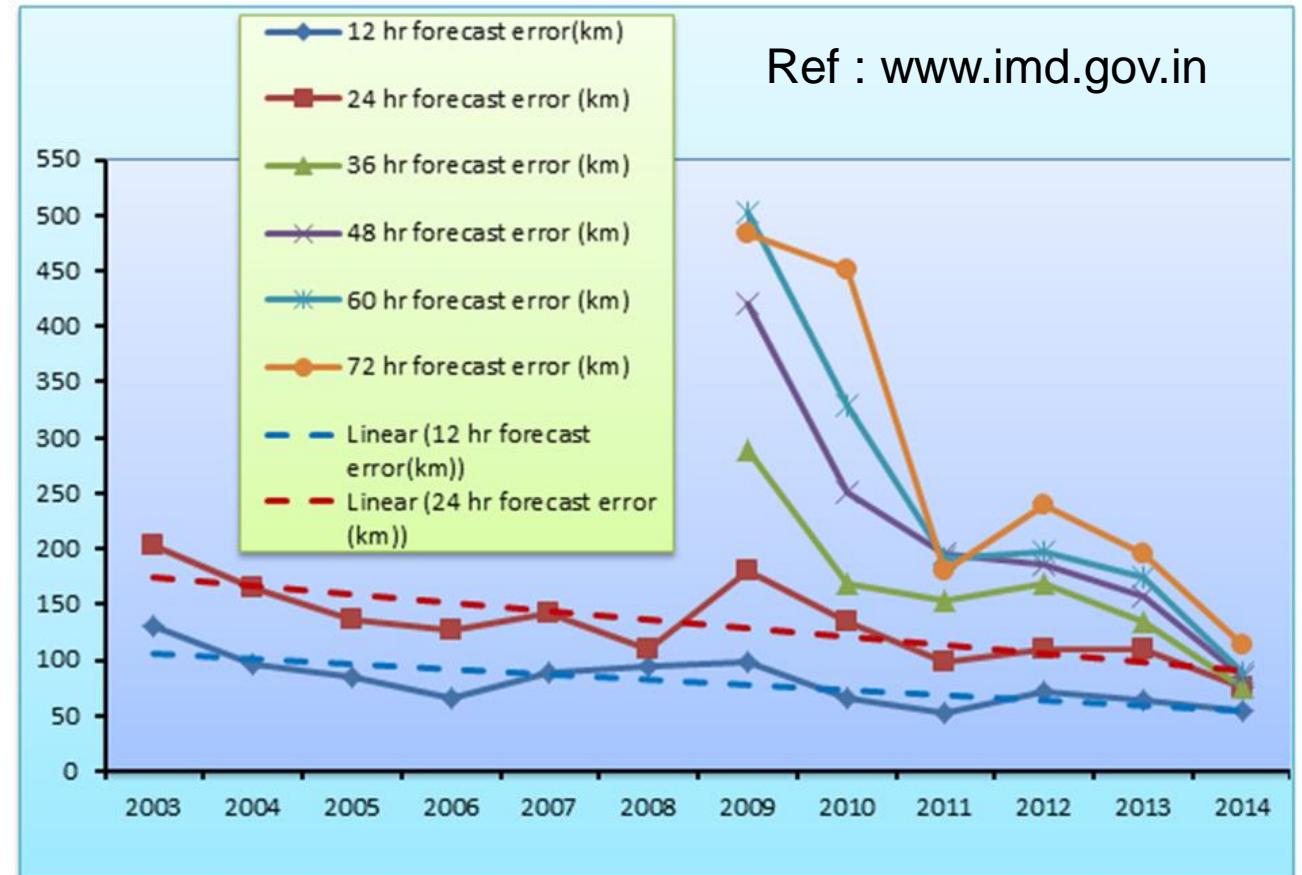


# The accuracy of forecasts.



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- In 2009 72hrs prior forecast was off by 400Kms (approx)
- In 2014 72hrs prior forecast was accurate to approx 60kms.
- 12hr forecasts were accurate within less than 50 kms in the last three years (i.e. 2012 onwards)







# The possible solutions



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- Predefined contingency routes
- User Preferred Routes
- Dynamic Airborne Rerouting Procedures





# Contingency routes



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## Advantages:

Better predictability and easier application of standard separations.

## Limitations :

- Weather systems are dynamic as such may affect Contingency route necessitating further re-planning of routes.
- Likely to affect strategically planned route for long haul flights.
- Long lead times owing to the process of design and promulgation of routes by ANSPs and flight planning by operators would mean reliance on less accurate forecasts





# UPRs and DARPs



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## Advantages:

- The User preferred routes would allow operators to flight plan a route avoiding the cyclones in a dynamic and flexible manner
- The lead time required would be lesser than that of contingency routes allowing to take into account recent forecasts.
- The UPRs would allow the operators to use the portions of airspace which they could not with conventional (straight line) route structure
- DARP would assist in avoiding weather by re-routings decided on the basis of recent forecasts and not rely on onboard weather RADAR only.





# UPRs and DARPs



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## Limitations :

- Requires active involvement and contribution of neighbouring states
- Complex and difficult to apply standard separations.

Cross border ATFM can help to overcome the limitations by providing longitudinal separations by way of slots for entry into UPR zone that will give better access to desired lateral and vertical profiles improving safety and efficiency





# The suggested solutions



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- During the major impact period the affected airspace and airspace around can be declared as UPR and DARP airspace.
- Build in the capacity in ATFM systems that will regulate UPR flights to enable a safe and efficient traffic flow circumnavigating the storm areas.
- A frame work for the UPR and DARP airspace listing CNS and ATM requirements (including ATFM) can be prepared.





## The rerouting of traffic due closure of SANA FIR and possible role of ATFM in such a contingency scenario.



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- The airlines and ANSPs were caught off guard as SANA FIR closed down suddenly.
- It required the flights in air to reroute via neighbouring FIRs to fly much longer and inefficient routes.
- The complexity of re-routings required multiple transitions from eastbound to westbound tracks and levels





# SANA FIR Contingency



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- Every day 40 flights were rerouted. A contingency route T101 was promulgated for north south traffic flow.
- The flights from Africa to East Asia which used to route via SANA FIR now all routed via Mogadishu FIR, ATS route G450 into Mumbai FIR in addition to the scheduled flights via Mogadishu FIR. All these 7/8 flights had schedules in such a manner that they entered and flew with inadequate longitudinal spacing requiring many flights to fly other on non optimal flight levels or 50 Nm offset.









# Contingency & ATFM



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- A cross border ATFM which would have been able to advise slight rescheduling of flights would have allowed flights to fly at optimal flight levels, without lateral offsets.
- For the north south traffic flow from Africa to Mideast Asia a contingency route was promulgated connecting Mogadishu FIR to Oman FIR through Mumbai FIR. But the flights from Seychelles and Mauritius had to fly longer routes.
- A cross border ATFM would have helped this traffic flow also by extending the contingency route to these FIRs as well.





# Conclusion



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- The cross border ATFM can provide strategic support to the tactical efforts of ATC thereby allaying all safety concerns.
- The cross border ATFM can help in the better utilisation of airspace in case of rerouting due to severe adverse weather conditions like cyclones or other contingencies.
- The cross border ATFM can help in efficient, safe and flexible flight trajectories.





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