

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 682
ANSWERED ON 05/02/2026

ACCURACY OF CYCLONE FORECASTS

682. SHRI RANDEEP SINGH SURJEWALA:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) the year-wise analysis of accuracy of cyclone forecasts issued by the India Meteorological Department (IMD) during the last five years, including lead time and track/intensity prediction accuracy;
- (b) the number of cyclones making landfall in India each year during that period and the number of lives lost in each of these events, district-wise; and
- (c) the steps taken to strengthen real-time forecasting, impact-based warnings, community dissemination systems and infrastructure resilience in cyclone-prone regions?

ANSWER

THE MINISTER OF STATE (INDEPENDENT CHARGE) FOR
MINISTRY OF SCIENCE AND TECHNOLOGY
AND EARTH SCIENCES
(DR. JITENDRA SINGH)

- (a) The year-wise analysis of the accuracy of cyclone forecasts, including track, intensity, and landfall, issued by the India Meteorological Department (IMD) for the period 2016–2025 is provided in Annexure-1.

There has been significant improvement in cyclone forecast accuracy during the last decade due to the continuous upgradation of observations, analysis, and prediction tools & techniques, improvements in numerical modeling, including enhanced data assimilation, higher resolution, improved physics, warning products generation and dissemination, etc. There is an improvement in track forecast accuracy by 20 to 25%, landfall and intensity (Maximum Sustained Wind- MSW) forecast accuracy by 35 to 45% in the recent five years (2021-2025) compared to the previous five years (2016-2020).

- (b) The latest data on deaths due to cyclones in the State/UT-wise during 2014-2023, as available from the National Crime Records Bureau (NCRB), Ministry of Home Affairs (MHA), is given in Annexure-2 along with the number of cyclones making landfall in India (last row). The early warnings by the IMD and the timely action taken by the Government (Central & State) have significantly reduced the loss of life due to cyclones in recent times.
- (c) IMD's cyclone forecasting and warning system is distinguished by its high accuracy in track and intensity prediction, achieved through the use of state-of-the-art numerical weather prediction models, multi-model ensemble, advanced data assimilation techniques, and continuous monitoring using satellites, Doppler Weather Radars (DWRs), ocean buoys, coastal observational networks and finally the in-house developed Decision Support System (DSS) for the generation forecasts and warnings.

In order to further improve the monitoring, forecasting, and dissemination of warning infrastructure, the Government of India has launched Mission Mausam in early 2025, which aims to expand and modernise India's weather observation network and forecasting systems. This includes increasing the number of weather stations, upgrading radar networks, and using machine-learning and modern models to improve forecasting accuracy, with coherent support from High Performance Computing Systems (HPCSs) and intelligent Decision Support Systems (DSSs).

Annual average track forecast errors (km) during 2016-2025:

Year	12-hr	24-hr	36-hr	48-hr	60-hr	72-hr	84-hr	96-hr	108-hr	120-hr
2016	59.7	96.1	129.6	185.1	238	291.7	330.4	379.5	344.1	438.3
2017	43.7	61.4	87.2	107.6	190.1	189.6	292.5	304.2	158.7	159.7
2018	55.4	87.5	99.2	124.2	131.2	134.3	165.8	189	220.8	247.6
2019	41	68.6	87.8	103.7	120.4	148.6	177.7	217.8	261.3	337.5
2020	50.3	72.5	76.4	85.3	89.1	111.4	105.5	88.8	86.3	93.3
2021	43.7	62.9	82.6	91.4	105.7	164	248	15.3		
2022	42.3	77.5	108	167.1	204.2	315.3	378.2	535.3	576.5	
2023	48.3	76.5	98.4	120.7	138.8	147.2	157.3	176.8	181.5	224.8
2024	37.6	65.6	76.9	83.5	100.3	114	70	153		
2025	42	80	102	120	169	204	245	129		

Annual average intensity forecast errors (kt) during 2016-2025:

Year	12-hr	24-hr	36-hr	48-hr	60-hr	72-hr	84-hr	96-hr	108-hr	120-hr
2016	4.6	7.2	8.5	8.3	9.7	11.2	14	18.4	9.5	5
2017	4.3	5.7	10.8	12.4	9	8.2	9	7.8	5	3.7
2018	4.8	8.2	12	11.6	12.8	12.9	12.9	13.8	13.3	9.2
2019	5.5	8.7	11.7	12.7	14.7	17.4	19.3	19.8	19.9	21.2
2020	5	7.1	8.7	8.8	9.7	9.3	10.8	13.9	8.7	4.3
2021	3.5	6.2	8.6	9.5	9.3	10.8	18.8	21		
2022	2.4	3.8	4.2	4	3.8	5	5.6	6.7	10.3	
2023	3.7	7.3	9.1	10.7	11.3	12.5	13.9	16.5	15.3	18.3
2024	2.3	4.1	5.2	5.3	4.7	5	5	5		
2025	1.7	3.1	4.7	2.7	3.5	3.9	2.9	1		

1 kt = 1.85 kmph

Annual average landfall point errors during 2016-2025:

Year	12-hr	24-hr	36-hr	48-hr	60-hr	72-hr	84-hr	96-hr	108-hr	120-hr
2016	7.8	14.1	71.6	127.2	129.2	180.1	253.2	286	403.4	
2017	19.1	50.4	29.8	59						
2018	26.7	44	42.1	40.3	56.4	67.6				
2019	8.9	27.1	21.9	34.7	15	37.2				
2020	10	17.6	53.5	69.7	27.7	43	77	47	47	
2021	6.8	16.4	10.6	19.8	97	158.5				
2022	16.5	14.8	21.7	24.5	20.2	4.5	4.9			
2023	13.0	17.0	31.2	48.8	65.8	65.7	66.6	71.1	9.1	
2024	5.4	14.4	19	24	18	2.2	1.1	1.1		
2025	71	76	113	82	113	121	128			

31	D&N Haveli and Daman&Diu @+	0	0	0	0	0	0	0	1	0	0
32	Delhi UT	0	0	0	0	0	0	0	0	0	0
33	Jammu & Kashmir @*	0	0	0	0	1	0	2	0	0	0
34	Ladakh @	-	-	-	-	-	-	0	0	0	0
35	Lakshadweep	0	0	0	0	0	0	0	0	0	0
36	Puducherry	0	0	0	0	0	0	0	0	0	0
	Total Number of Deaths (in 8 UTs)	0	0	0	0	1	0	2	3	0	1
	Total deaths in the country	62	15	15	133	125	33	37	118	9	2
	Number of Cyclones that made landfall	1	0	1	0	3	2	4	3	1	1

Source of data regarding number of deaths: National Crime Records Bureau (NCRB), Ministry of Home Affairs (MHA).

As per the data provided by the State/UTs

‘+’ Combined data of erstwhile D & N HAVELI AND DAMAN & DIU UT during 2014-2019

‘*’ Data of erstwhile JAMMU & KASHMIR State, including LADAKH, during 2014-2019

‘@’ Data of the newly created Union Territory
