



Cyclone MAHASSEN

The tropical cyclone "Mahasen" was the first cyclone over the North Indian Ocean during the year 2013. 'Mahasen', travelled the longest distance over North Indian Ocean in recent period after the very severe cyclonic storm, Phet over the Arabian Sea (31 May-07 June, 2010). The cyclonic storm moved very fast at the time of landfall (about 40-50 km per hour on the day of landfall) and crossed Noakhali-Chittagong coast of Bangladesh near Sitakunda on 16th May 2013. Such type of fast movement of the cyclonic storm is very rare. The adverse weather due to the cyclonic storm was relatively less because of the faster movement of the cyclone. Three hourly media briefing was arranged at BMD for Cyclone Mahasen.



Fig:1 Press briefing by the Director of BMD during cyclone MAHASSEN

SYNOPTIC OVERVIEW OF CYCLONE MAHASSEN:

The tropical cyclone Mahasen was first detected as a low pressure area over southeast Bay of Bengal and adjoining area on 8th May 2013. The low pressure became a well marked low in the afternoon of 10th May 2013. The well marked low concentrated into a depression at night on the same day near latitude 5.0°N and longitude 92.0°E. The depression moved northwestwards and intensified into a deep depression in the evening of the same day. Continuing its northwestward movement, the deep depression further intensified into a cyclonic storm 'Mahasen' in the morning of 11th May 2013. Under the influence of the anticyclonic circulation lying to the east, the cyclonic storm changed its initial direction of movement from northwesterly to northerly and then to north-northeasterly on 13th and 14th May respectively. On 15th May, it further came under the influence of the mid

-latitude westerly trough prevailing roughly along 77°E, which further contributed in the north-northeastward movement of the cyclonic storm. As the cyclone Mahasen and the trough came closer to each other on 16th May, the translational speed the storm towards north-northeastward significantly increased to 40-50 kmph.

The cyclonic storm initially crossed Patuakhali(Khepupara) coast of Bangladesh at 09 A.M and moving further north-eastwards crossed Noakhali-Chittagong coast of Bangladesh near Sitakunda in the afternoon of 16th May 2013. After the landfall, it continued to move north-northeastwards, weakened gradually by giving precipitation and lay over Sitakunda, Feni, Khagrachari region of Bangladesh and adjoining Tripura of India as a land depression. It moved northeasterly direction further inland and weakened gradually.

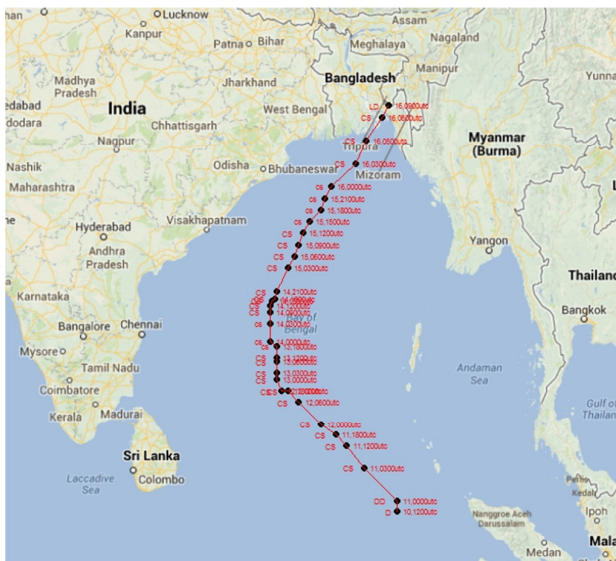


Fig:2 Observed track of cyclone MAHASSEN, plotted by using R. (Curtsey: Md. Bazlur Rashid, BMD)

Monitoring and Prediction

The cyclonic storm, Mahasen was monitored with several satellites like MTSAT of Japan, FY-2D & FY-2E of China and INSAT/ Kalpana of India supported by coastal and island observations. It was monitored by Doppler Weather Radar (DWR) of Khepupara, Cox's Bazar & Molvibazar, Conventional radar of Dhaka and DWR from Kolkata & Agartala of India on 15 & 16 May. The hourly synoptic observation from coastal and island stations were also used for monitoring of cyclonic storm during landfall time. Products of various numerical weather prediction (NWP) models from different centres including ECMWF, UKMO, NCEP, MSC, GSM of JMA, WRF and NHM at BMD were utilized to predict the track and intensity of the storm. There was large divergence in the NWP models with respect to intensification and many advanced centers predicted that Mahasen would cross Myanmar. Most of the models could not predict the very fast movement of the cyclone on the day of landfall, i.e. on 16th May 2013.

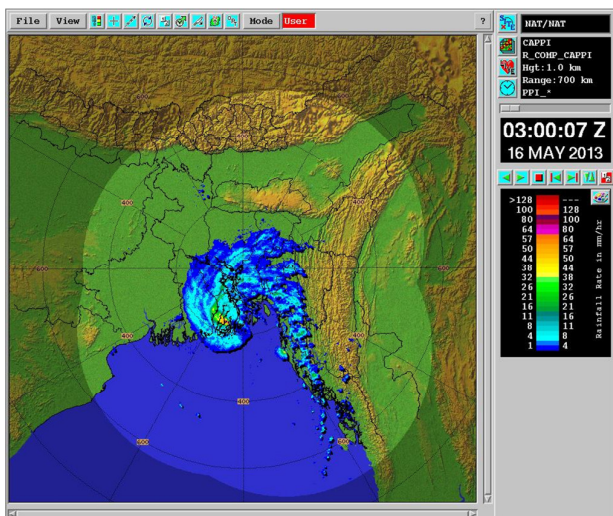


Fig:3 Composite Radar image of cyclone MAHASSEN from 4 Radar of BMD

Ensemble track and strike probability forecast showed that ECMWF, UKMO, MSC and NCEP predicted re-curvature. All the models predicted landfall over Myanmar except NCEP, which predicted better than other models.

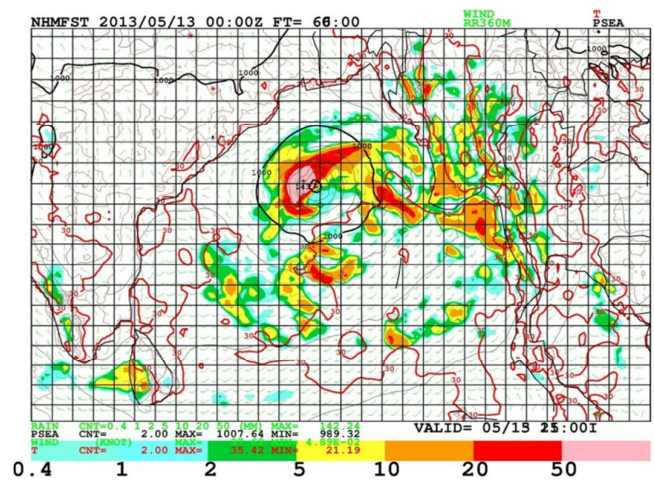


Fig:4 Cyclone MAHASSEN simulated by NHM at BMD. (Curtsey: Md. Shadekul Alam, BMD)

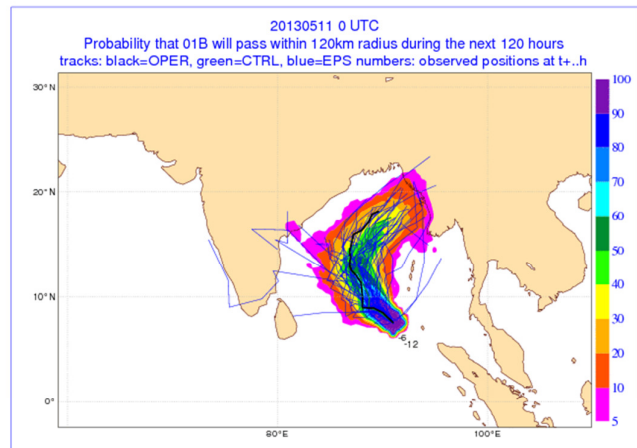


Fig:4 ECMWF generated Probability that the system will pass within 120km radius during the next 120 hours based on 20130511, 00UTC

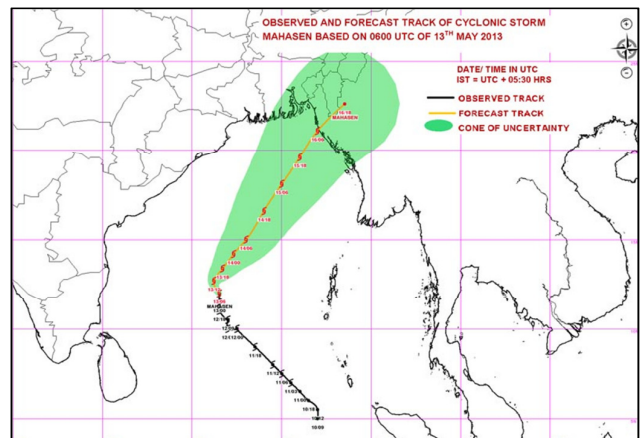


Fig:5 Observed and forecast track of cyclone MAHASSEN based on 0600 UTC of 13th May 2013 (IMD)

Weather at the time of landfall

Surface Wind:

Highest maximum surface wind gust of 100 kph was reported from Khepupara during the time of landfall of Cyclonic Storm, MAHASSEN against the forecast wind speed of 90-100 kph. Maximum surface wind was recorded at Patuakhali 93 Kph, Chittagong 59 Kph, Bhola 56 Kph, Barisal 50 Kph and Hatiya 43 Kph.

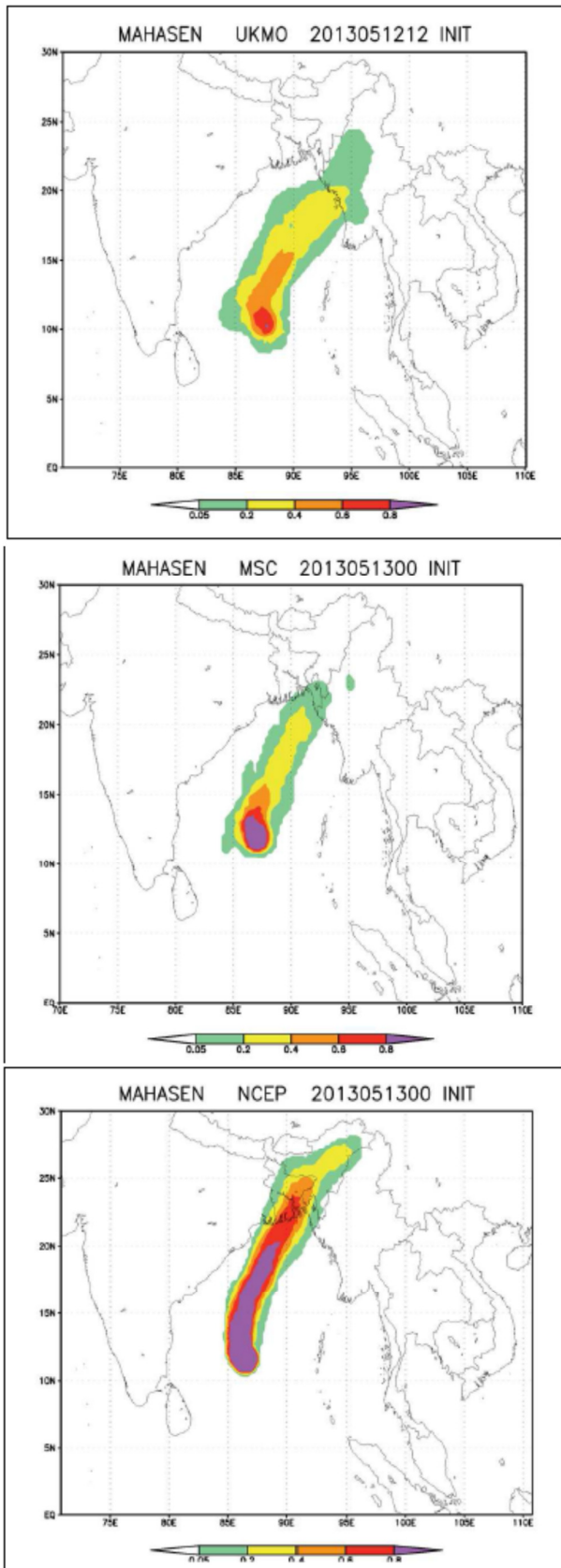


Fig:6 Strike probability forecast of UKMO, MSC and NCEP

Rainfall:

Widespread rainfall with isolated heavy to very heavy falls occurred over Bangladesh. Two Days (15 & 16 May) accumulated rainfall was recorded at Khepupara 290 mm, Patuakhali 245 mm, Barisal 210 mm, Madaripur 129 mm, Bhola 121 mm and Feni 113 mm.

Storm surge:

The maximum storm surge height of 1-1.5 metre above the astronomical tide was predicted by BMD, based on IIT-D model over Bangladesh coast at the time of landfall.

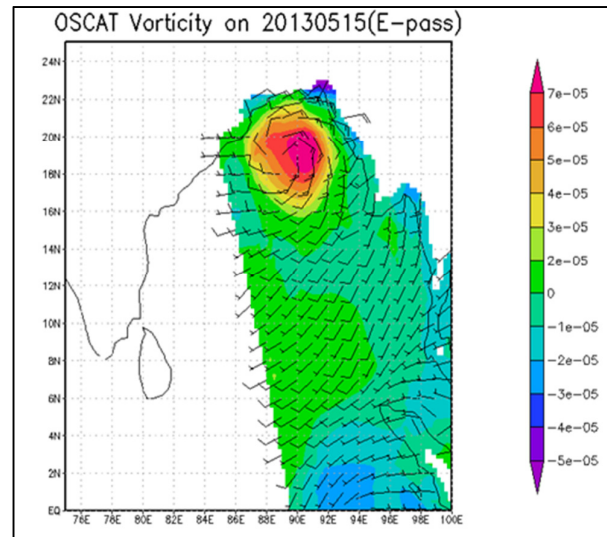


Fig: 7 The vorticity in the OSCAT passes. The background color represents OSCAT-derived relative vorticity. (Curtsey: Kh. Hafizur Rahman, BMD)

Maximum vorticity value was calculated during the life cycle of cyclone 'Mahasen' using OSCAT wind data. Initial vorticity signature (6.9×10^{-5}) on 09 May 2013 was much higher than the threshold value (4.5×10^{-5}), which was determined for the Bay of Bengal region for the genesis of a tropical cyclone. As time passes vorticity values was increasing and the highest maximum value (8.11×10^{-5}) of vorticity was found near 19.25°N & 90.75°E on 15 May 2013 during evening pass of OSCAT.

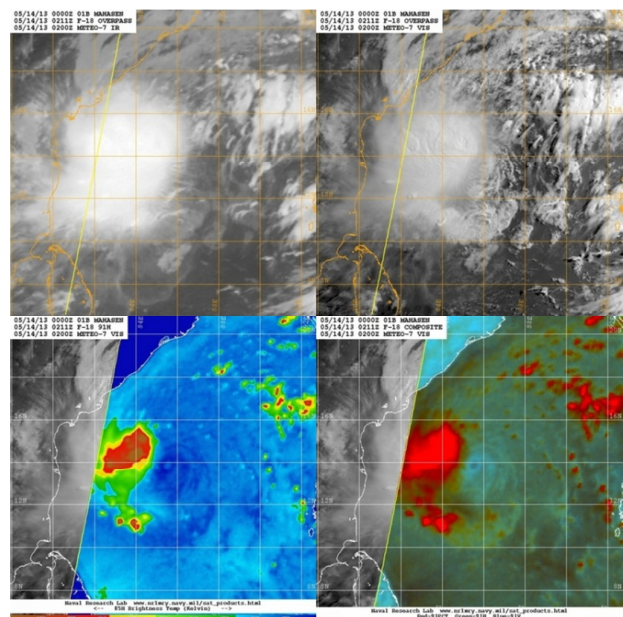


Fig:8 Infrared, Visible and Microwave satellite imagery of cyclone MAHASEN at 0200 UTC of 14 May 2013

Significant Wave Height(m),00Z of 16.05.13 +09H

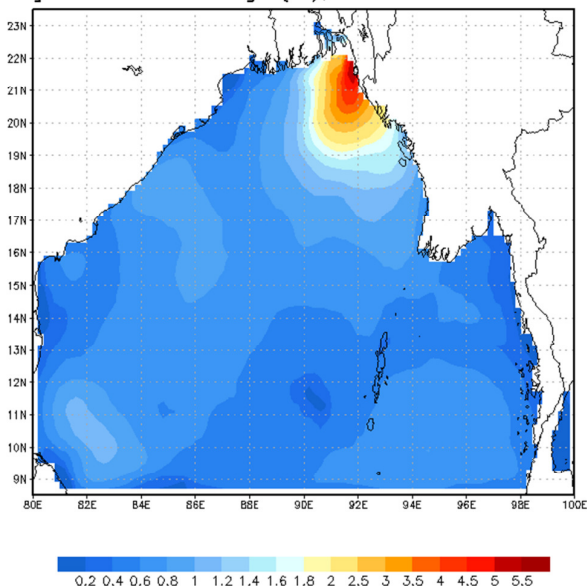


Fig:9 MAHASEN generated significant wave height (m) simulated by MRI Wave Model in BMD.

Total Rainfall on 16 May 2013 (GtsRad)

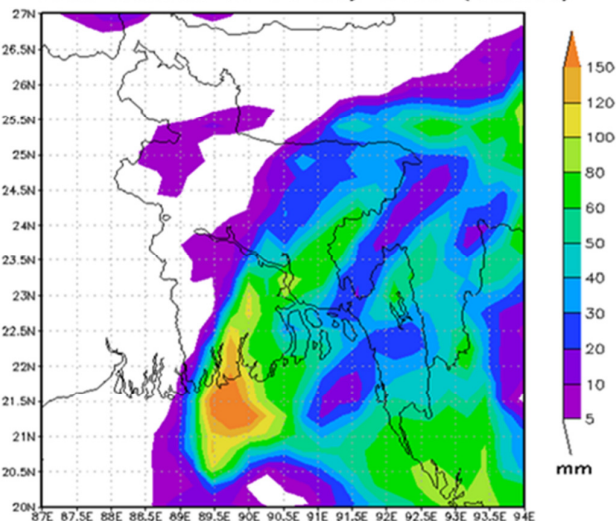


Fig:10 Simulation of Total Rainfall of cyclone MAHASEN using WRF Model (Curtsey: M. A.K Mallik, BMD)

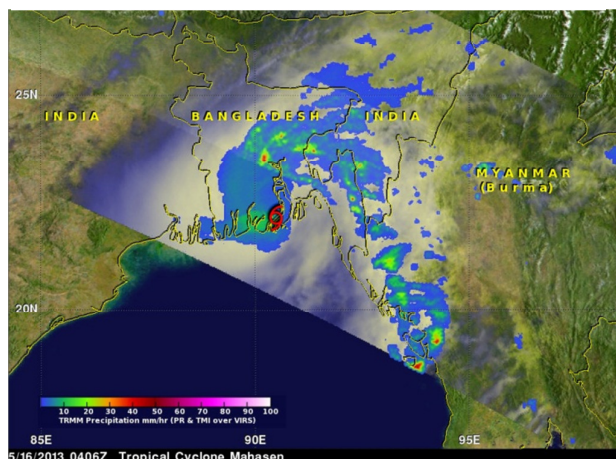


Fig:11 TRMM Microwave Imager (TMI) estimated rainfall on May 16 at 0406 UTC of Cyclone MAHASEN. Credit: NASA/SSAI, Hal Pierce

When NASA's TRMM satellite passed over Cyclone Mahasen on May 16 at 0406 UTC, the TRMM Microwave Imager (TMI) showed (Fig:11) the heaviest

rainfall was occurring in a band of thunderstorms, north of the center of circulation. The band of thunderstorms was already over southern part of Bangladesh and contributing as much as 50 mm of rain per hour along the coast.

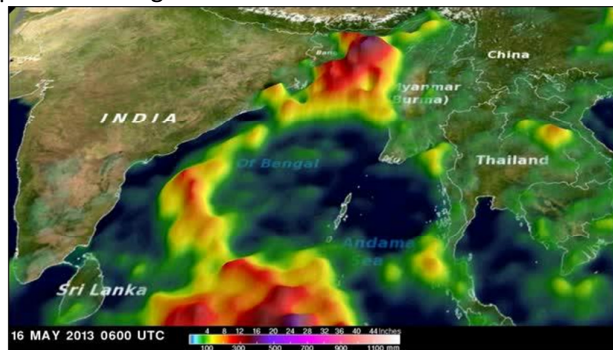


Fig:12 Simulated 3-D analysis of NASA's TRMM satellite's multisatellite Precipitation Analysis (TMPA).

Figure-12 shows a simulated 3-D analysis of NASA's Tropical Rainfall Measuring Mission (TRMM) satellite's Multisatellite Precipitation Analysis (TMPA). It showed rainfall that occurred with tropical cyclone Mahasen during the period from May 6-16, 2013 as tropical cyclone Mahasen was moving through the Bay of Bengal. TRMM's Precipitation Radar (PR) found rain within Mahasen falling at a rate of over 67mm/hour on May 15 and at a rate of over 57mm/hour on May 16. 544 mm rainfall was estimated from this analysis over Bangladesh and north-east India.

Damage and loss:

Districts	Affected people	Affected households		Affected Crops (acr)		Death	Injured
		Full	Partial	Full	Partial		
Chittagong	54295	50	2005			2	0
Bhola	514366	4957	19389	9965	37619	4	87
Barguna	518690	6856	61812	44395	30468	7	1979
Pirojpur	60000	448	5641			1	0
Noakhali	35127	1710	4968	250	1400	0	0
Patuakhali	70409	7540	18238			3	0
Satkhira	1000	0	50	0	0	0	0
Laxmipur	9890	120	359	0	0	0	0
Jhalokathi	64460	55	1934	0	2929	0	0

Source: DDM

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