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IMD releases a report on Super Cyclonic Storm "Amphan" that crossed West Bengal coast during 16th -21st May, 2020 as a very severe cyclonic storm across Sundarbans

The India Meteorological Department (IMD) has released a report on Super Cyclonic Storm "Amphan" that crossed West Bengal coast during 16th -21st May, 2020 as a very severe cyclonic storm across Sundarbans with maximum sustained wind speed of 155 – 165 kmph gusting to 185 kmph. The report discusses the life history, salient features, monitoring aspects, forecast performance and details of advisories issued in respect of Super Cyclonic Storm Amphan. The salient features of the system are described below:

Brief Life History:

- The Super Cyclonic Storm (SuCS) “AMPHAN” (pronounced as UM-PUN) was the first SuCS over the BoB, after the Odisha SuCS of 1999.
- It originated from the remnant of a Low Pressure Area which occurred in the near Equatorial Easterly wave over south Andaman Sea and adjoining southeast Bay of Bengal (BoB) on 13th May.
- It concentrated into a depression (D) over southeast BoB in the early morning of 16th May and further intensified into a deep depression (DD) in the same afternoon.
- It moved north- northwestwards and intensified into Cyclonic Storm over southeast BoB in the evening of 16th May, 2020. Moving nearly northwards, it further intensified into a Severe Cyclonic Storm (SCS) over southeast BoB in the morning of 17th May.
- It underwent rapid intensification during subsequent 24 hours and accordingly intensified into a Very Severe Cyclonic Storm (VSCS) by the afternoon of 17th, Extremely Severe Cyclonic Storm (ESCS) in the early hours of 18th and into a SuCS around noon of 18th May, 2020.
- It maintained the intensity of SuCS over westcentralBoB for nearly 24 hours, before weakening into an ESCS over westcentralBoB around noon of 19th May.
- Thereafter, it weakened slightly and crossed West Bengal – Bangladesh coasts as a VSCS, across Sundarbans, during 1530-1730 hrs IST of 20th May, with maximum sustained wind speed of 155 – 165 kmph gusting to 185 kmph. It lay over West Bengal as a VSCS, gradually moving north-northeastwards during late evening to night of 20th May. It moved very close to Kolkata during this period.
- Moving further north-northeastwards, it weakened into an SCS over Bangladesh & adjoining West Bengal around mid-night of 20th May, weakened further into a CS over Bangladesh in the early hours of 21st May, into DD over Bangladesh around noon of 21st May and into a D over north Bangladesh in the evening of the same day. It further weakened and lay as a well marked low pressure area over north Bangladesh and neighbourhood around mid-night of 21st May.

Monitoring of AMPHAN:

India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean and the system was monitored since 23rd April about three weeks prior to the formation of the Low Pressure Area on 13th May. In the extended range outlook issued on 7th May, IMD indicated possible cyclogenesis during the second week over south Andaman Sea and adjoining southeast Bay of Bengal. On 9th May, it was indicated that a Low Pressure Area would form over the region on 13th May (96 hours prior to formation of the system) under the influence of the remnant cyclonic circulation persisting over the region during 6th-12th. On 11th, it was indicated that cyclogenesis (formation of depression) would occur around 16th May (48 hours prior to formation of the Low Pressure Area and 120 hours prior to formation of depression) over the BoB. The cyclone was monitored with the help of available satellite observations from INSAT 3D and 3DR, polar orbiting satellites including SCATSAT, ASCAT etc. and available ships & buoy observations in the region. From 18th May midnight (1800 UTC) onwards till 20th May, the system was tracked gradually by IMD Doppler Weather Radars (DWRs) at Visakhapatnam, Gopalpur, Paradip, Kolkata and Agartala as it moved from south to north. IMD also utilised DWR products from 'DRDO Integrated Test Range', Chandipur, Balasore for tracking the system. Various numerical weather prediction models run by Ministry of Earth Sciences (MoES) institutions (viz.,IMD, IITM, NCMRWF & INCOIS), various global models and IMD's dynamical-statistical models developed in-house 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 guidance from various models, decision making process and warning product generation.

Forecast Performance:

i. Genesis Forecast

- The system was monitored since 23rd April about three weeks prior to the formation of Low Pressure Area over the southeast BoB on 13th May.
- In the extended range outlook issued on 7th May, cyclogenesis (formation of Depression) was predicted with low probability in the later part of week during 8th-14th May 2020. It was also predicted that the system would intensify further and move initially north-northwestwards and recurve north-northeastwards thereafter towards north BoB.
- In the Tropical Weather Outlook issued on 9th May, it was indicated that a Low Pressure Area would form over the region on 13th May (96 hours prior to formation of the system) under the influence of the remnant cyclonic circulation persisting over the region during 6th-12th.
- In the Tropical Weather Outlook issued on 11th May, it was indicated that cyclogenesis (formation of depression) would occur around 16th May (48 hours prior to formation of the Low Pressure Area and 120 hours prior to formation of depression) over the BoB. The Low pressure area formed on 13th May and concentrated into a Depression on 16th May morning.

ii. Track, Intensity and Landfall Forecast

- First information was provided in the extended range outlook issued on 7th May (about 6 days prior to formation of LPA, 9 days prior to formation of depression and 13 days prior to Landfall) indicated that the system would intensify into a cyclonic storm and move initially northwestwards and recurve north-northeastwards towards north BoB,
- In the Tropical Weather Outlook, Press release and informatory message to the Government of India issued on 13th April (on the day of development of LPA, 3 days prior to formation of depression and 7 days prior to Landfall), it was indicated that the system would intensify into a cyclonic storm by 16th evening and would move initially northwestwards till 17th and then recurve north-northeastwards towards north BoB.

- Actually, the depression formed in the morning (0000 UTC) of 16th, cyclonic storm in the evening (1200 UTC) of 16th and the system moved north-northwestwards till 17th evening (1200 UTC) followed by north-northeastward recurvature thereafter and crossed West Bengal coast on 20th Afternoon.
- In the first bulletin issued at 0845 IST of 16th May (104 hrs prior to landfall) with the formation of Depression, it was indicated that the system would intensify into a cyclonic storm and will move north-northwestwards till 17th May followed by north-northeastward re-curved towards West Bengal coast during 18th-20th May and cross West Bengal coast with maximum sustained wind speed of 155-165 kmph gusting to 180 kmph.
- In the bulletin issued at 1645 hrs IST of 16th May (24 hrs prior to rapid intensification), rapid intensification of the system was predicted and the system rapidly intensified from 17th afternoon onwards.
- In the bulletin issued at 0845 hrs IST of 17th May (80 hrs prior to landfall), it was precisely mentioned that the system would cross West Bengal-Bangladesh coasts between Sagar Island (West Bengal) and Hatiya Islands (Bangladesh coast) during afternoon to evening of 20th May with maximum sustained wind speed of 155-165 kmph gusting to 185 kmph. The predicted track indicated Landfall across Sunderbans on 20th Afternoon.
- IMD continuously predicted since 16th May that Amphan will cross West Bengal coast as a very severe cyclonic storm (VSCS) with wind speed of 155-165 kmph gusting to 180 kmph on 20th May.

Cyclone warnings

- In the first bulletin released at 0845 hrs IST of 16th May (104 hrs prior to landfall), Pre-cyclone Watch for West Bengal-north Odisha coasts was issued.
 - The warnings were further upgraded and Cyclone Watch for West Bengal and north Odisha coasts was issued at 2030 hrs IST of 16th May (92 hrs prior to landfall).
 - Cyclone Alert (Yellow Message) for West Bengal and north Odisha coasts was issued at 0840 hrs IST of 17th May (80 hrs prior to landfall).
 - Cyclone Warning (Orange Message) for West Bengal and north Odisha coasts was issued at 0845 hrs IST of 18th May (56 hrs prior to landfall).
 - Post landfall outlook (Red Message) for interior districts of Gangetic West Bengal, Assam and Meghalaya was issued at 2330 hrs IST of 19th May (17 hrs prior to landfall).
- Ø Thus IMD predicted accurately the landfall point and time, track and intensity as well as associated adverse weather like wind, rainfall and storm surge due to cyclone, Amphan. We also predicted 100-110 gusting to 120 kmph wind speed and associated adverse weather for north Odisha coast, well in advance.

India Meteorological Department (IMD) and RSMC New Delhi duly acknowledge the contribution from all the stakeholders and disaster management agencies who contributed to the successful monitoring, prediction and early warning service of SuCS AMPHAN. We acknowledge the contribution of all sister organisations of Ministry of Earth Sciences including National Centre for Medium Range Weather Forecasting Centre (NCMRWF), Indian National Centre for Ocean Information Services (INCOIS), National Institute of Ocean Technology (NIOT), Indian Institute of Tropical Meteorology (IITM) Pune, DRDO Integrated Test Range, Chandipur, research institutes including IIT Bhubaneswar, IIT Delhi and Space Application Centre, Indian Space Research Organisation (SAC-ISRO) for their valuable support. The support from various Divisions/Sections of IMD including Area Cyclone Warning Centre (ACWC) Chennai, Kolkata, Cyclone Warning Centre (CWC) Bhubaneswar, Visakhapatnam, Meteorological Centre (MC) Agartala, Doppler Weather Radar Stations at Visakhapatnam, Chandipur, Gopalpur, Paradip, Kolkata & Agartala and coastal observatories of Odisha & north Andhra

Pradesh. The contribution from Numerical Weather Prediction Division, Satellite and Radar Divisions, Surface & Upper air instruments Divisions, New Delhi and Information System and Services Division at IMD is also duly acknowledged.

/The report has been attached herewith.

The same is also available on IMD website at the link:

[https://mausam.ind.gov.in/Forecast/marquee_data/Summary%20Super%20Cyclonic%20Storm%20Amphan%20\(13062020\).1](https://mausam.ind.gov.in/Forecast/marquee_data/Summary%20Super%20Cyclonic%20Storm%20Amphan%20(13062020).1)

and RSMC New Delhi website at the link:

<http://www.rsmcnewdelhi.ind.gov.in/images/pdf/publications/preliminary-report/amphan.pdf>

NB/KGS/(IMD release)