49th Annual Session of Typhoon Committee

2016 CMA Typhoon Forecast Performance and Operational Challenges

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Outline

Part 1: Main Characteristics of 2016 Tropical Cyclones over the Western North Pacific

Part 2: Verification of 2016 CMA Official Tropical Cyclone Forecasts

Part 3: Operational Challenges and Future Works





There were a total of 26 typhoons formed over the WNP in 2016, one less than the long-term average (1949~2015, based on CMA TC best track data). 8 typhoons made landfall over China in 2016, one more than normal.



No TC genesis in the first half of 2016

From January to June of 2016, no typhoon genesis was registered over the northwestern Pacific and the South China Sea, or 4.6 incidences less compared with the same period of a normal year.

□ Very late genesis of 1601 typhoon

NEPARTAK, the number one typhoon in 2016, recorded the second latest typhoon genesis in history (since 1949) in terms of its debut timing. NEPARTAK was named on July 3, compared with typhoon NICHOLE forming on July 9 as the first typhoon in 1998.





year	date of NO.1 TC genesis	total TCs	number of landfalling TCs
1973	July 1	24	9
1983	June 25	23	5
1998	July 9	14	4
2016	July 3	26	8
average	March 6	27	7

- □ More TC genesis in 2016 autumn season than average
 - In autumn season of 2016 (September, October and November) · there were a total of 13 TC genesis over the WNP, which is 2.7 more TCs than normal.
- □ More TCs making landfall in 2016 autumn season
 - 4 TCs made landfall over China in autumn season of 2016, which means 1.5 more than normal.
- □ Higher landfall intensity TCs in 2016 autumn season
 - 4 typhoons, Meranti, Megi, Sarika and Haima, made landfall over China in September and October with Severe Typhoon Category (max. winds up to 42m/s or above), which is much higher than the average of 33m/s.



Q: why were there no TC genesis in the first half of 2016? In the first half of 2016, EL NINO began to decline, with decreasing warmer SST in the eastern Pacific near the equator. Warmer SST also existed over North Indian Ocean. Powerful anticyclone formed and maintained over the western North Pacific, keeping TC activity under normal in the first half of 2016



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Blue: TC genesis distribution in 2015Red: TC genesis distribution in 2016



Part 2: Verification of 2016 CMA Official Forecasts



CMA official 24-120h TC track forecast errors in 2016 are 66, 127, 213, 292 and 364 km respectively

note: the verification is made based on operational data, not on best track data.



Part 2: Verification of 2016 CMA Official Forecasts



Tropical cyclones making landfall over China in 2016

Comparison of track forecast errors between all TCs (in blue) and TCs making landfall (in red) in 2016



Part 2: Verification of 2016 CMA Official Forecasts



CMA official 24-120h TC intensity forecast errors during 2000-2016



□ Long Lead-time (day 4 and day 5) TC track forecast

- **TC** Intensity Forecast (Rapid Intensification)
- **TC** Quantitative Precipitation Forecast
- □ Challenges from Amateur-Forecasters and We-Media





□ Long lead time (day 4 and day 5) TC track forecast



CMA official track forecast errors during 1991-2016



day 4 forecast errors distribution in 2014-2016



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day 5 forecast errors distribution in 2014-2016

Part 3: Operational Challenges and Future WorksLong lead time (day 4 and day 5) TC track forecast



Nepartak(1601) was the first named TC in 2016 and also was the first TC that made landfall over China in 2016

Nepartak made landfall over Taiwan Island at 2150UTC, 7 July 2016, with maximum wind speed up to 55 m/s and a minimum pressure 920hPa,



CMA official forecast at 06 UTC, 5 July 2016



Part 3: Operational Challenges and Future WorksLong lead time (day 4 and day 5) TC track forecast





□ Long lead time (day 4 and day 5) TC track forecast



Official 24-96h track forecasts for Meari (1623) initiated at its genesis time of 00 UTC of 3 Nov. 2016





Long lead time (day 4 and day 5) TC track forecast



Official 24-120h track for cast for Dujuan (1521) initiated at its genesis time of 18 UTC of 22 Sept. 2015







CMA developed TYTEC, a subjective TC track forecast method based on selected "good" members of ensembles

TC Intensity Forecast







TC Intensity Forecast







NEPARTAK got rapid intensification from 12UTC 4 July to 03UTC 6 July 2016, with maximum winds from 20m/s up to 68m/s and minimum pressure from 995hPa to 905hPa

Note: black line with typhoon symbols is the intensity observation, other lines with dots are forecasts



TC Intensity Forecast





MERANTI(1614) intensity observation and forecasts

MERANTI(1614) was the strongest TC in 2016 in the whole globe with peak intensity of max. winds 70m/s and min. pressure 900hPa. MERANTI experienced RI process during 06UTC 11 Sept. to 06UTC 12 Sept. 2016, the max. winds increased from 25m/s up to 62m/s.

□ The top intensity of MERANTI was underestimated

□ The rapid intensity rate was underestimated

one of the RI definition: $\Delta V_{24h} = 15 \text{m/s}$



TC Intensity Forecast



AERE formed on 6 Oct. 2016 and reached peak intensity of 28m/s. It made a looping route over the northeastern SCS and decreased to be a tropical depression in the evening of 10 Oct. 2016.



1619(AERE) 中央台强度预报



TC Quantitative Precipitation Forecast



Lead time							
	TC QPF	General QPF	TC QPF	General QPF	TC QPF	General QPF	
24h	0.494	0.295	0.388	0.22	0.175	0.14	
48h	0.463	0.257	0.287	0.174	0.143	0.094	
72h	0.368	0.225	0.244	0.139	0.107	0.056	家。 NAL MET

missing

TC Quantitative Precipitation Forecast



Each time when a typhoon is likely to make landfall over China, Besides the routine TC forecast, QPF and TC warning, CMA will provide a accumulated precipitation forecast for the whole process of the typhoon activity 2 or 3 days prior to the landfall, to the State Council and the State Flood Control and Drought Relief Headquarters





TC Quantitative Precipitation Forecast



The total rainfall forecast for NEPARTAK



One of the main reason for the false rainfall forecast is that the inland intensity decreasing rate was underestimated



TC Quantitative Precipitation Forecast



The total rainfall forecast for NEPARTAK

The other reasons for the false rainfall forecast may be that the water supply diverts to the east of NAPARTAK; and the lack of "pumping effect" related with the upper level jets.





□ Challenges from Amateur-Forecasters and We-Media

In the era of information, the availability of weather data is becoming more and more easily, which motivates more and more Amateur-Forecasters to make forecasts, to spread their voices on various platforms of We-Media.

- They describe the weather forecasts in much more popular or more humorous languages
- > They can speak earlier than the official meteorological voices
- They can make longer forecasts than the official forecasters
- They can speak as they want, to draw the public "eye balls", without consideration of the forecast uncertainty
- They are circling more and more public fans (one of the most famous meteorological blog in the mainland of China- <u>the Chinese Meteorological</u> <u>Amateur</u> now has nearly 8 million fans)

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So, how could we continue to maintain our NHMS's authority?



Future works:

- □ Continue to develop and improve NWP
- Continue to develop and improve interpretation and application techniques, including objective and subjective methods, to improve TC track, intensity, QPE, and further, TC impact forecasts
- Try to promptly respond to severe weather, hot-topic weather and high impact weather, by using "big data" technique, to announce our official voices



Thanks a lot for your attention!

