

WGNE Intercomparison of Tropical Cyclone Forecasts using Operational Global Models

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1. Introduction

The CAS/JSC Working Group on Numerical Experimentation (WGNE) has conducted an intercomparison of Tropical Cyclone (TC) track forecasts using operational global models since 1991. WGNE recognized that the evaluation of TC track forecasts could revealingly indicate the performance of those models in the tropics and subtropics. As of in 2007, eleven NWP centers were contributing to this project.

2. Dataset

Table.1 shows the specification of the data provided by NWP centers, model resolutions and usage of TC bogus data in the analysis system. Table.2 gives a list of the responsible TC regional or warning centers providing analyzed TC position data (best track) for each basin.

Table.1 Specification of verification data provided by NWP centers

NWP center (Country)	Since	Horizontal resolution of provided data	Model resolution	TC bogus
JMA (Japan)	1991	1.25x1.25	T ₁ 319 L40	Use *1
ECMWF (Europe)	1991	0.25x0.25	T ₁ 799 L91	-
Met Office (UK)	1991	0.38x0.56	0.38x0.56 L50	Use
CMC (Canada)	1994	1.0x1.0	0.9x0.9 L28	-
DWD (Germany)	2000	0.5x0.5	40km L40	-
BoM (Australia)	2003	0.75x0.75	T ₁ 239 L33	-
NCEP (USA)	2003	1.0x1.0	T ₁ 382 L64	Use *2
Météo France	2004	0.5x0.5	T ₁ 359 C1 L41	Use *3
CMA (China)	2004	Not GPV data	T213 L41	-
NRL (USA)	2006	1.0x1.0	T239 L30	Use
CPTEC (Brazil)	2006	0.9376x0.9376	T126 L28	-

*1: used in western North Pacific

*2: used in rare cases

*3: used except south Pacific and North Indian Ocean

Table.2 Best-track data

Region	Data source
western North Pacific	RSMC-Tokyo
eastern North Pacific	RSMC-Miami
Central Pacific	RSMC-Miami
North Atlantic	RSMC-Miami
North Indian	RSMC-New Delhi
South Indian	RSMC-La Reunion
around Australia	TCWC-Perth/Darwin /Brisbane/Wellington and RSMC-Nadi

RSMC : Regional Specialized Meteorological Centre

TCWC : Tropical Cyclone Warning Centre

3. Verification

The same verification method as Sakai and Yamaguchi (2005) is adopted in this study. The performance of TC track forecasts is evaluated by position errors and detection rates.

The detection rate(T) is defined as A(T)/B(T). (T = forecast time), where

A : The number of forecast events in which a TC is analyzed at forecast time T on the condition that a NWP model continuously expresses the TC until the forecast time T.

B : The number of forecast events in which a TC is analyzed at forecast time T.

Systematic position errors are also monitored after being stratified (categorized) by stage with respect to recurvature : before, during and after recurvature.

The verification is conducted for each of the six regions where TCs are analyzed under the WMO Tropical Cyclone Programme. In this paper, the results for the western North Pacific, North Atlantic and around Australia regions with inhomogeneous sample (the number of track points is different in each NWP center) are shown.

4. Result for the western North Pacific region

The time series position error for 72-hour forecast from 1991 to 2006 are shown in Fig1(a). Fig1(b) indicates the position error growth and Fig1(c) does the detection rate descent as forecast time progresses in 2006. Fig2 shows the scattering diagram of position error for 72-hour forecast. The Y-axis represents the position error for Along Track (AT) direction and the X-axis does for Cross Track (CT) direction.

5. Results for North Atlantic and around Australia regions

Fig3 and Fig4 show the verification results of position error and detection rate for North Atlantic and around Australia regions, respectively.

Reference

- Tsuyuki, T. et al., 2002: The WGNE intercomparison of typhoon track forecasts from operational global models for 1991-2000. WMO-BULLETIN, vol.5, No.3, 253-257.
Sakai, R., and M. Yamaguchi, 2005: The WGNE Intercomparison of Tropical Cyclone Track Forecasts by Operational Global Models. CAS/JSC WGNE Research Activities in Atmospheric and Oceanic Modeling, Report No. 35, Jul 2005, WMO/TD No.1276, pp. 2.7-2.8.

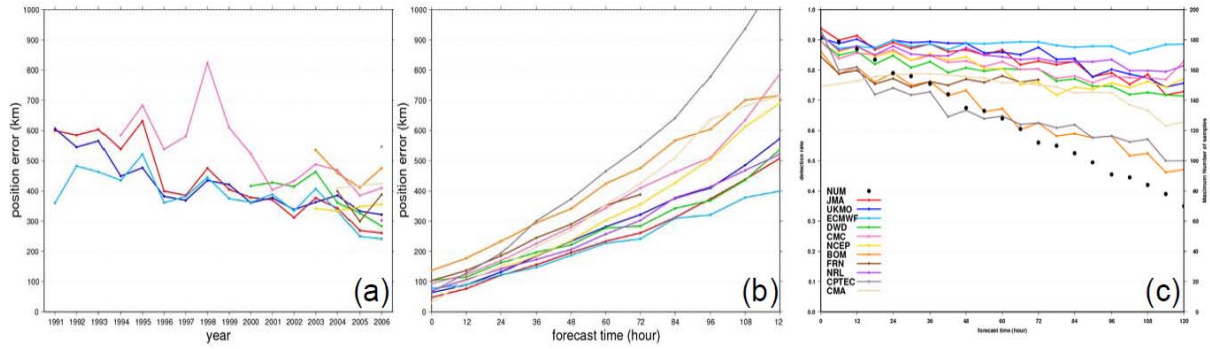


Fig.1 (a) Time series of position error for 72 hour forecast in western North Pacific (1991-2006). (b) Position error growth in western North Pacific in 2006. (c) Detection rate descent in western North Pacific in 2006.

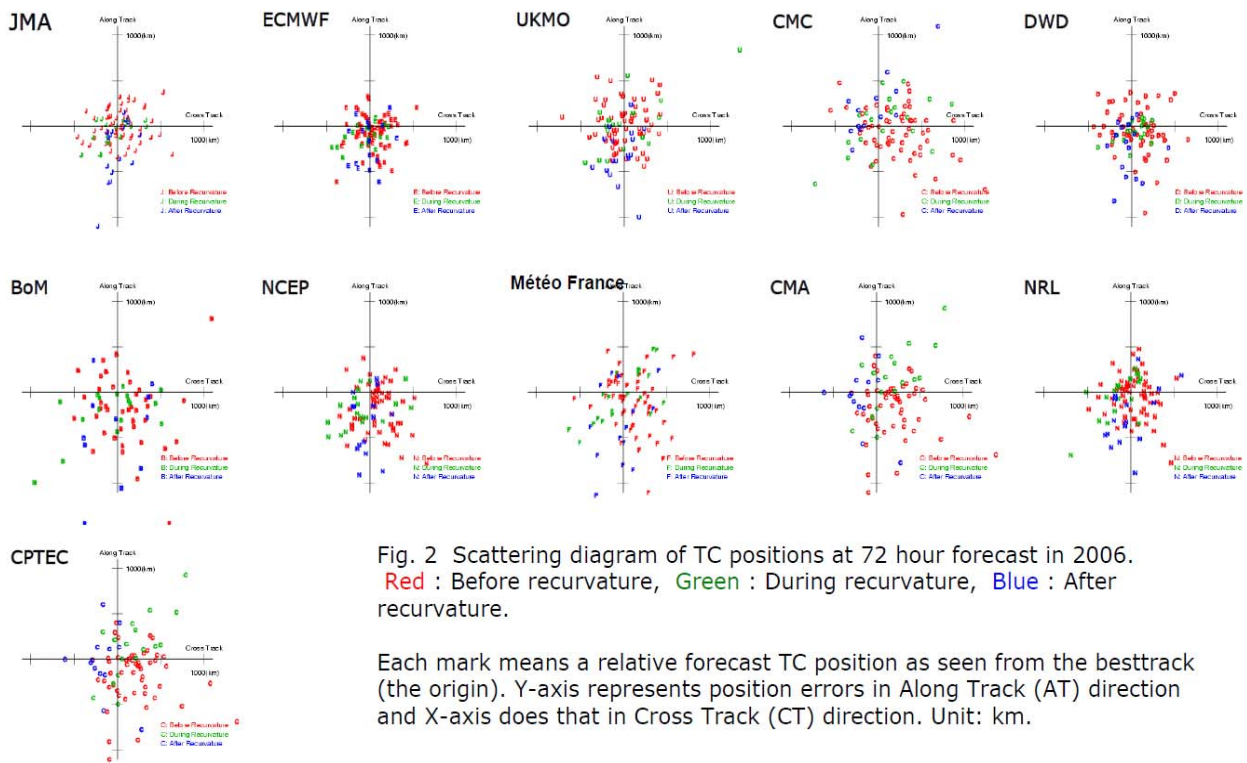


Fig. 2 Scattering diagram of TC positions at 72 hour forecast in 2006. Red : Before recurvature, Green : During recurvature, Blue : After recurvature.

Each mark means a relative forecast TC position as seen from the besttrack (the origin). Y-axis represents position errors in Along Track (AT) direction and X-axis does that in Cross Track (CT) direction. Unit: km.

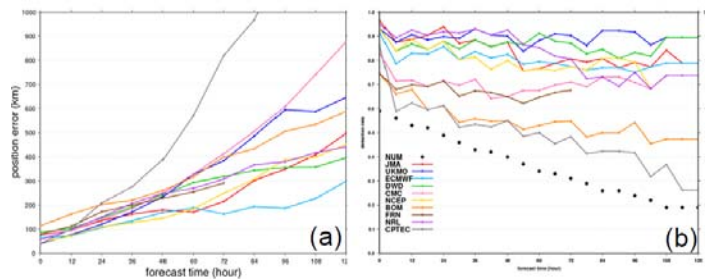


Fig. 3 : North Atlantic region in 2006
(a) Position error
(b) Detection rate
Legend is the same as Fig.1.

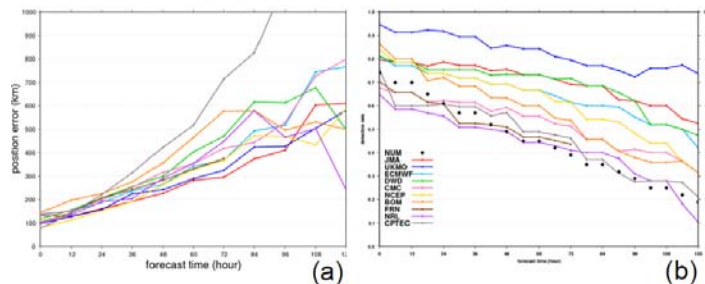


Fig. 4 : around Australia region in 2006
(a) Position error
(b) Detection rate
Legend is the same as Fig.1.