WGNE intercomparison of Tropical Cyclone Track forecast, 2012

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STANDARD VERIFICATION

Verification of Global Models

History of the Project

- 1991 : commencement with three centers: ECMWF, UKMO and JMA. The verification area was only western North Pacific.
- 1994 : CMC joined.
- 1999 : Verification for the North Atlantic started.
- 2000 : DWD joined. Verification for the eastern North Pacific started.
- 2002 : Verification for 2 Southern Hemispheric regions, north Indian Ocean and the Central Pacific started.
- 2003 : NCEP and BoM joined. A website for this intercomparison project was launched.
- 2004 : Meteo-France and CMA joined.
- 2006 : CPTEC and NRL joined.
- 2011 : KMA joined. CMA came back.

2013: 11 NWP centers participated in the project.
〔BOM CMA CMC DWD ECMWF JMA KMA France NCEP NRL UKMO 〕

Specification of Data

NWP centers	Participate Year	Bogus data / Relocation	Horizontal Res. of provided data	Model Res. as of 2012
BoM	2003	-	1.25x0.833(~Mar 27) 0.562x0.375(Mar 28~)	80kmL50 (~Mar 27) 40kmL70 (Mar 28~)
CMA	2004	used	1.25x1.25	T_L639L60
CMC	1994	-	1.0x1.0	33km L60
DWD	2000	-	0.25x0.25	30kmL60 (~Feb 29) 20kmL60 (Mar 01~)
ECMWF	1991	-	0.125x0.125	T_L1279L91
JMA	1991	used in WNP	0.25x0.25	T_L959L60
KMA	2011	used	0.3515x0.2345	25kmL70
France	2004	used*1	0.5x0.5	T_L798C2.4L70
NCEP	2003	used in NH	1.0x1.0	T574 L64 EnKF/Var
NRL	2006	used	1.0x1.0	T319L42
UKMO	1991	used*2	0.3515x0.2345	25kmL70

*1 except for South Pacific and north Indian-Ocean
*2 terminate the use of bogus data on July 17, 2012

Method of TC verification using MSLP

TCs to be verified

TCs which intensity reached tropical storm (TS) with the maximum sustained wind of 34 knots or stronger are set as targets for this verification. The tropical depression (TD) stage of the targeted TCs is also included in this verification. However, the TCs which stayed at TD level all through their life are excluded.

1. Tracking Method

local pressure minimum;

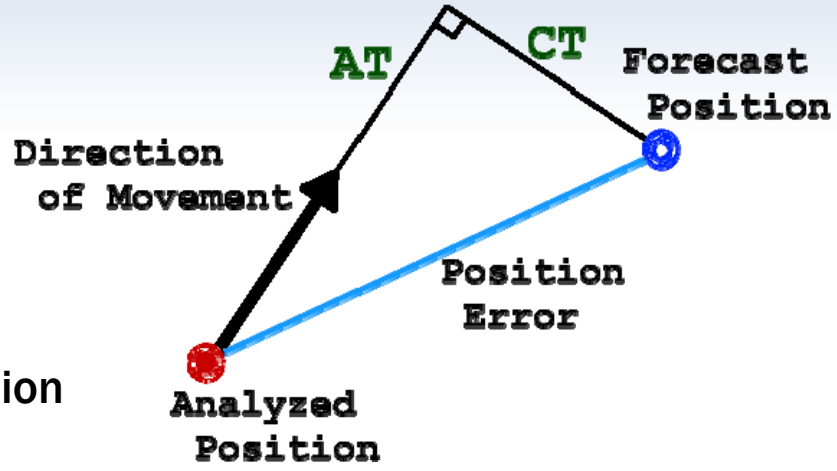
a) First position (FT +0hr) : search from the best track position
b) Second position (FT +12hr) : search from the first position
c) Third and after (FT +24hr~) : search from estimated position from the latest two positions

(all position searched within 500km radius)

2. Verification Method

・Position Error〔km〕

The distance between
the best-track (analyzed) position
and the forecast position.



・Along Track – Cross Track bias

AT(along-track)-bias : The bias in the direction of TC movement

CT(cross-track)-bias : The bias in the rectangular direction of TC movement

・Detection Rate

Detection Rate (t) = A(t)/ B(t)

A(t) : *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(t) : *The number of forecast events in which a TC is analyzed at forecast time t.*

TC Verification

TC tracks on 2012 season

Northern-Hemisphere [2012/01/01 to 2012/12/31]

Southern-Hemisphere [2011/09/01 to 2012/08/31]

Number of TCs , [best-track data provider]

25 western North-Pacific [RSMC Tokyo]

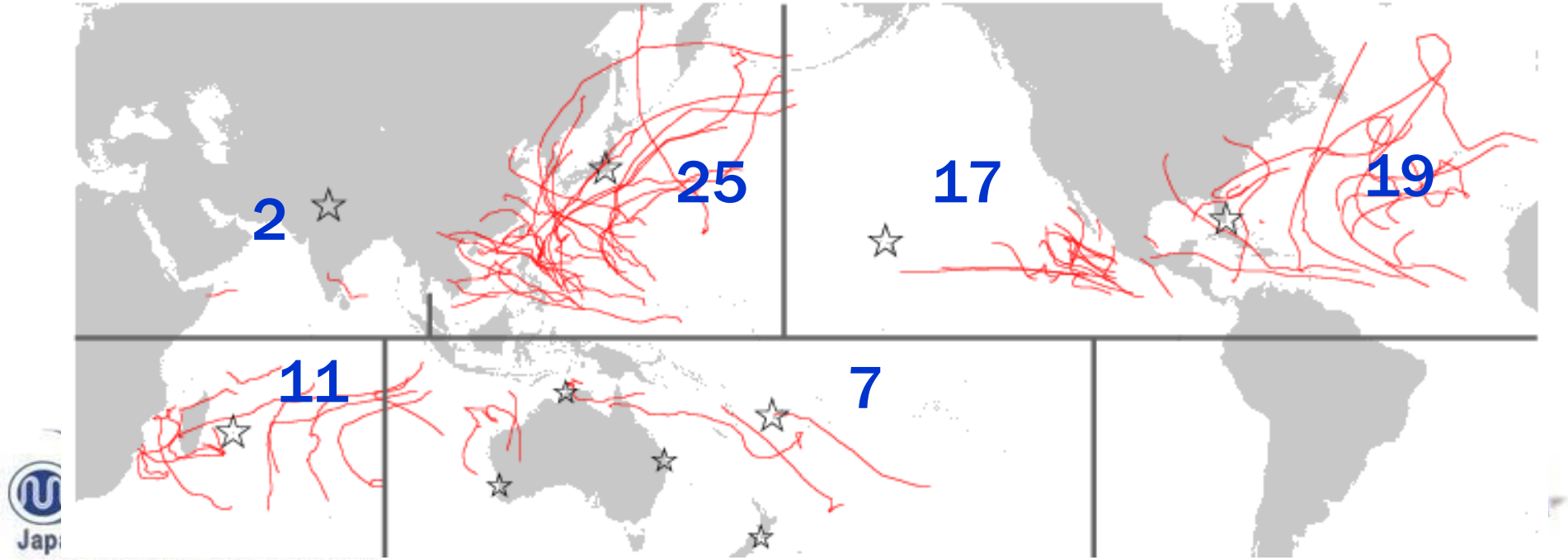
17 eastern North-Pacific (including Central-Pacific) [RSMC Miami, Honolulu]

19 North Atlantic [RSMC Miami]

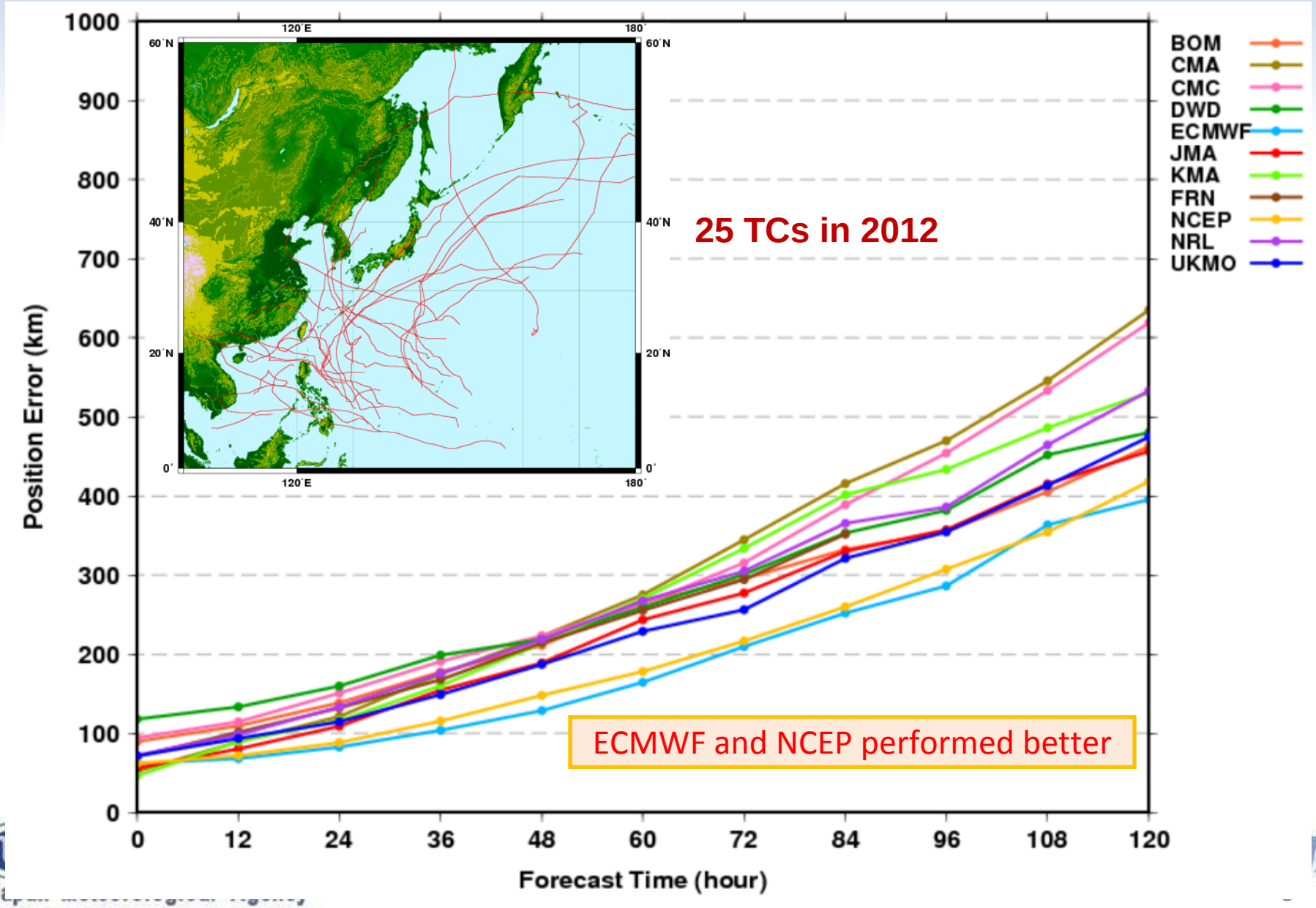
2 north Indian-Ocean [RSMC New-Delhi]

11 south Indian-Ocean [RSMC La-Reunion]

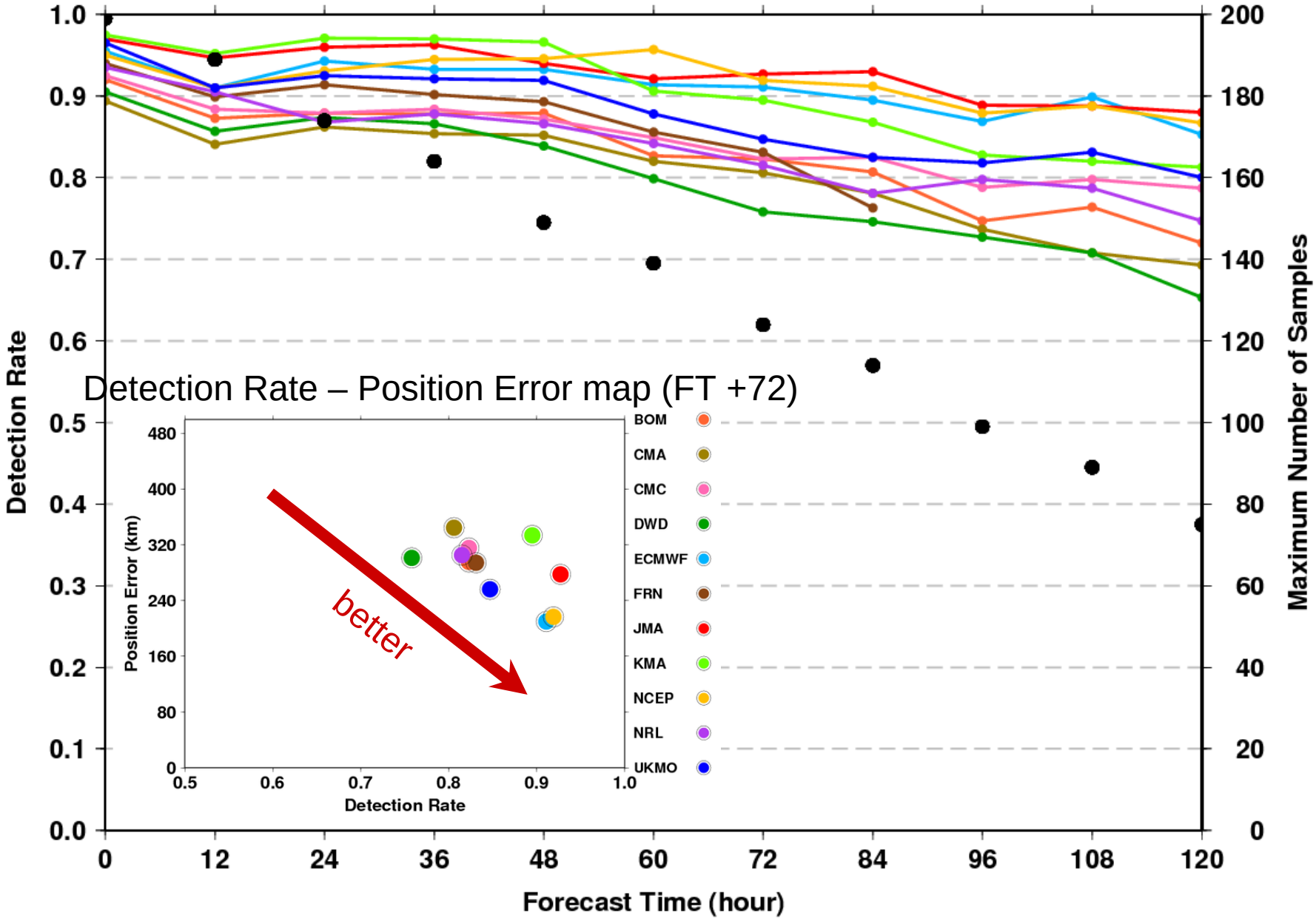
7 around Australia [RSMC Nadi and 4 TCWCs]



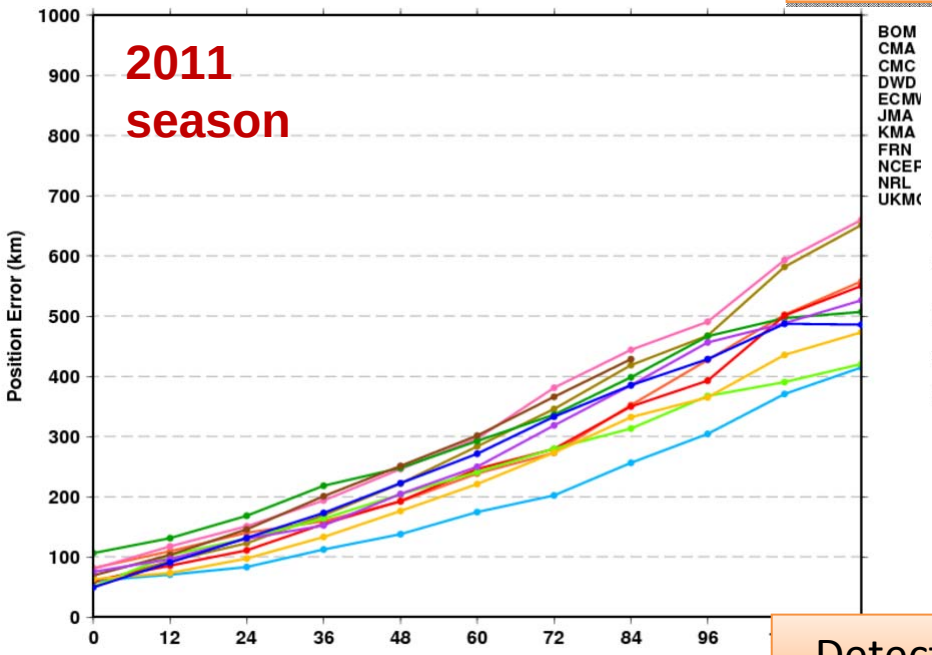
(a) western North-Pacific (WNP) domain Position Error

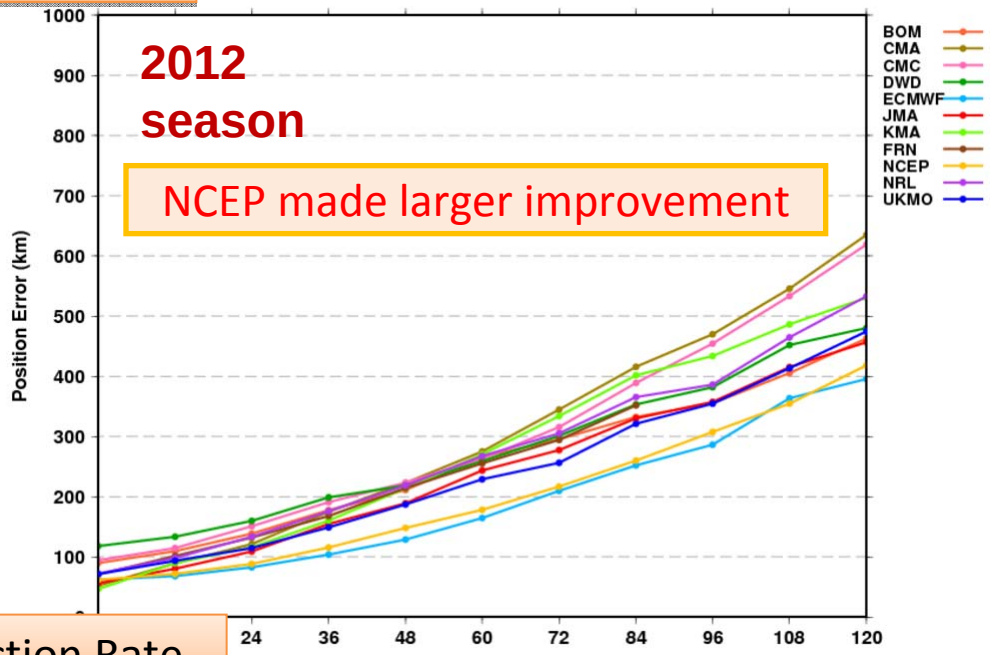


(a) WNP domain Detection Rate

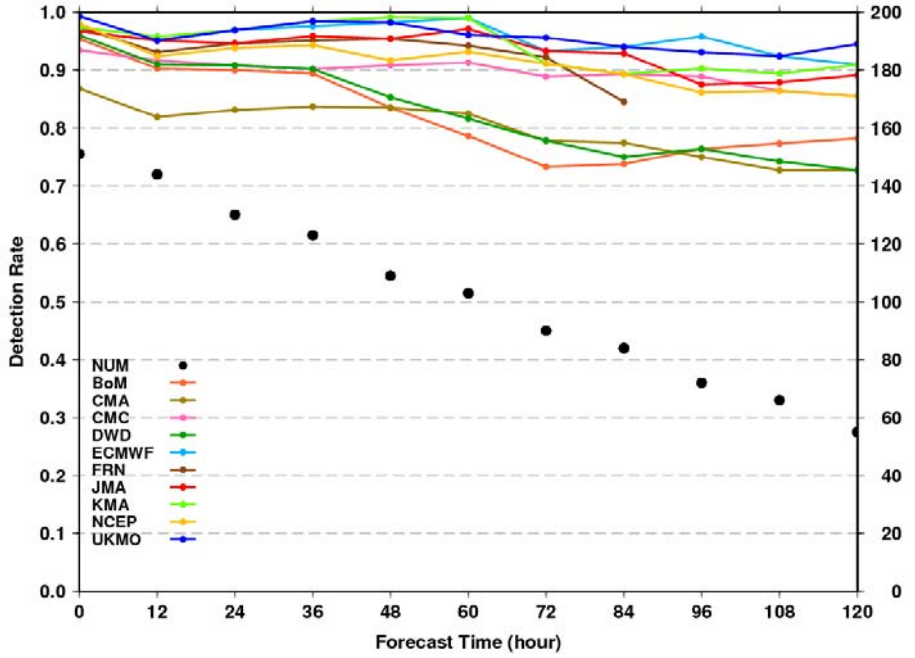


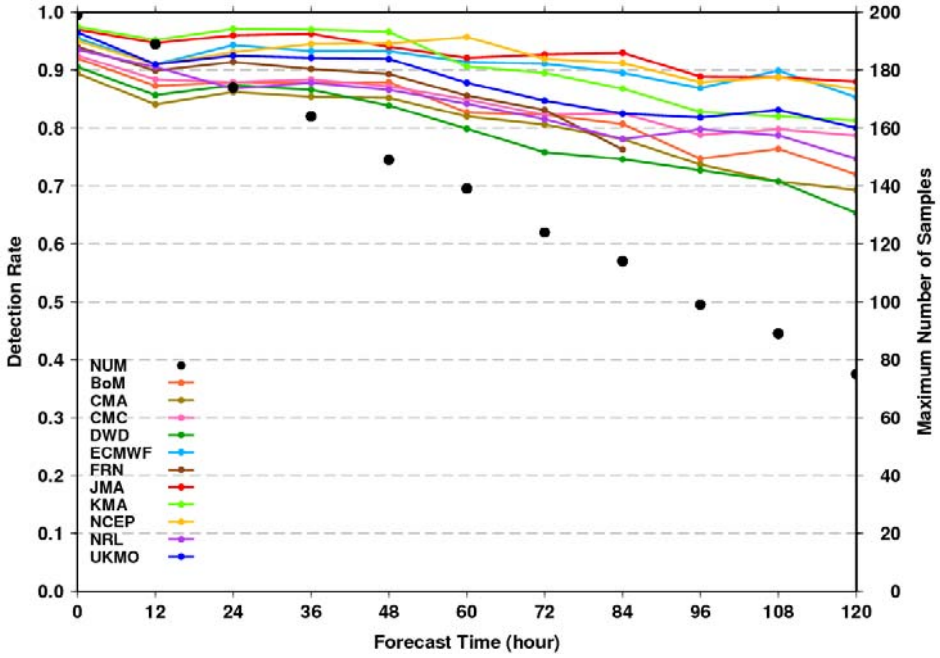
Position Error



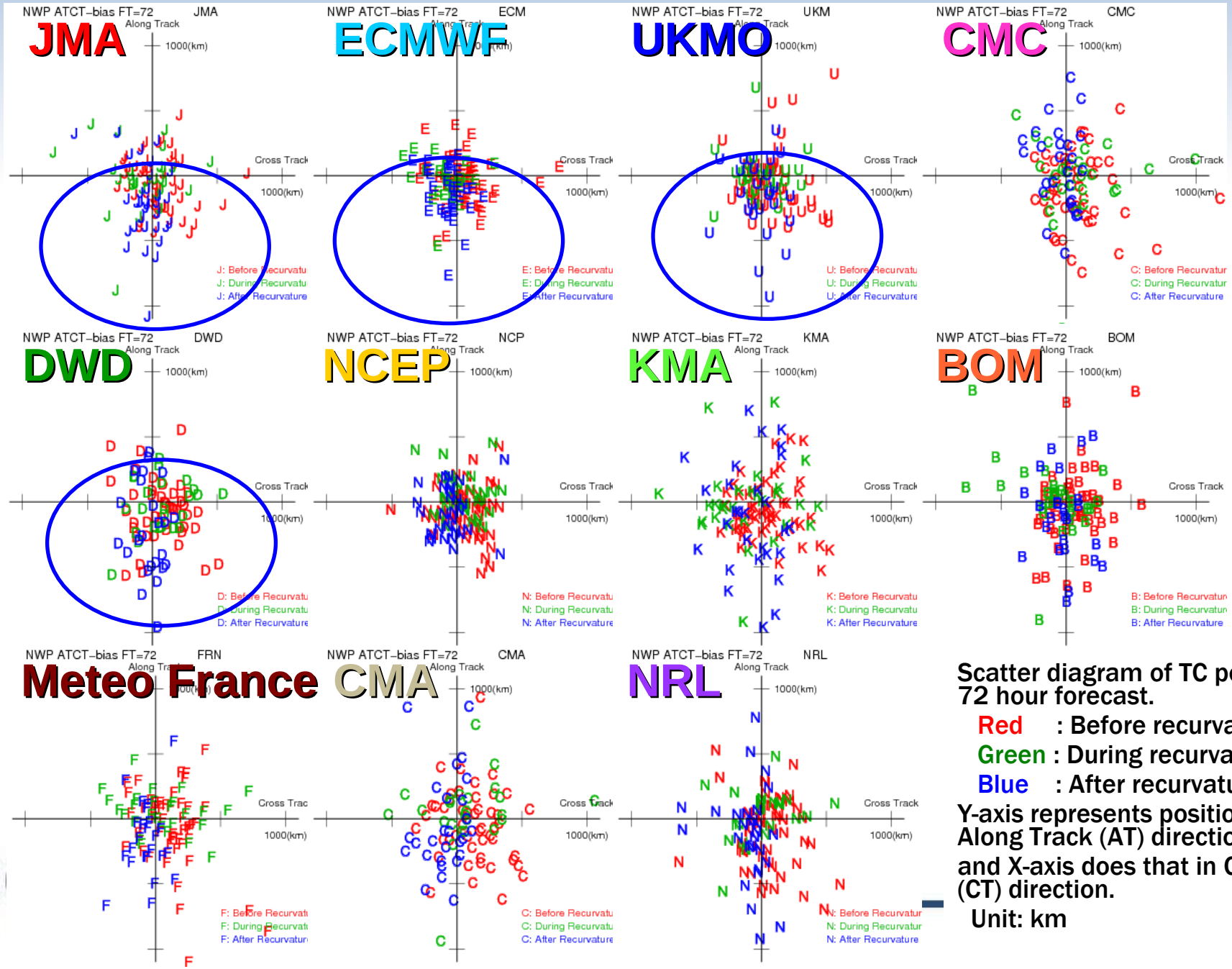


Detection Rate





(a) WNP domain AT-CT bias map (FT +72)



Scatter diagram of TC positions at 72 hour forecast.

Red : Before recurvature

Green : During recurvature

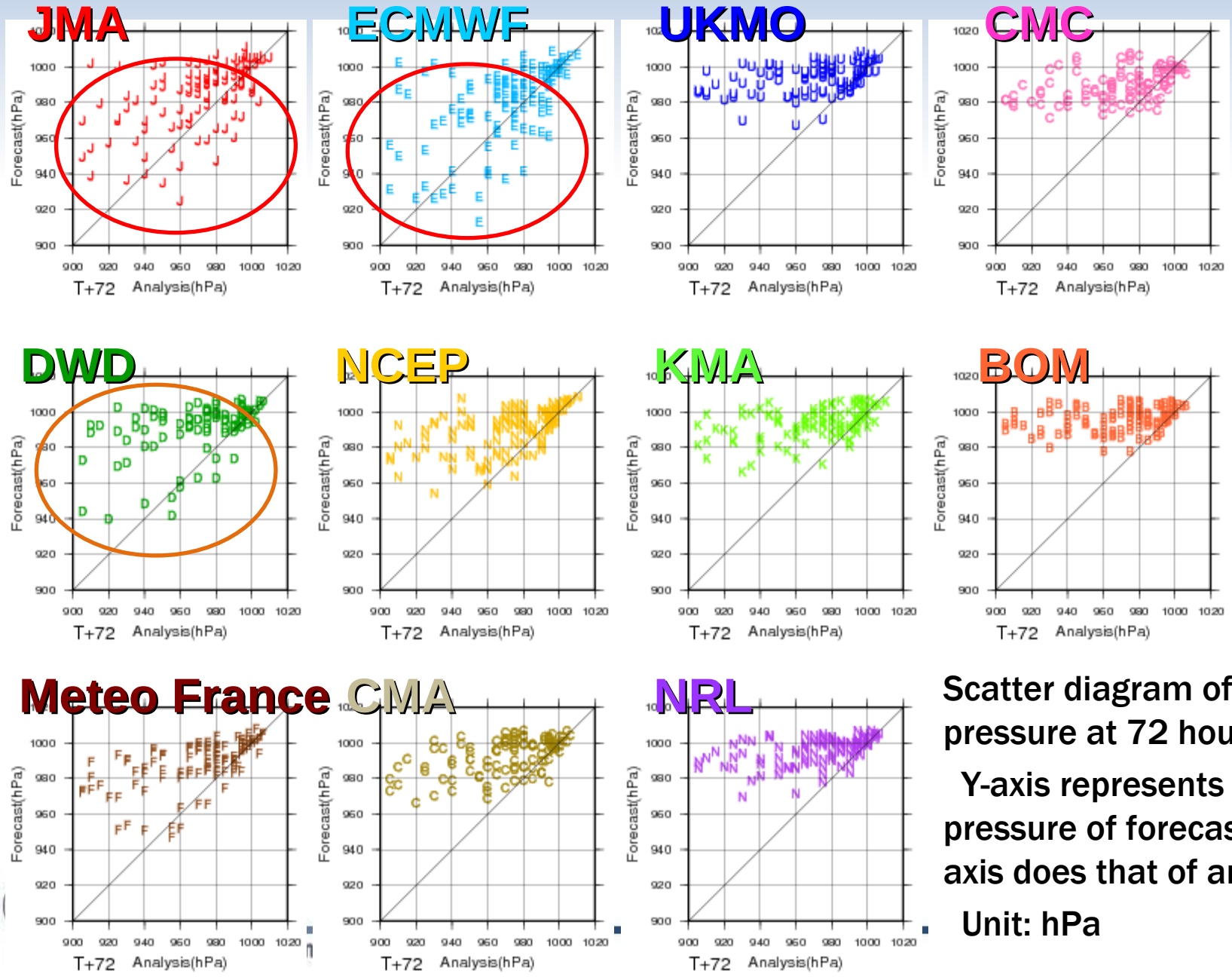
Blue : After recurvature

Y-axis represents position errors in Along Track (AT) direction

and X-axis does that in Cross Track (CT) direction.

Unit: km

(a) WNP domain Central Pressure scatter diagram (FT +72)

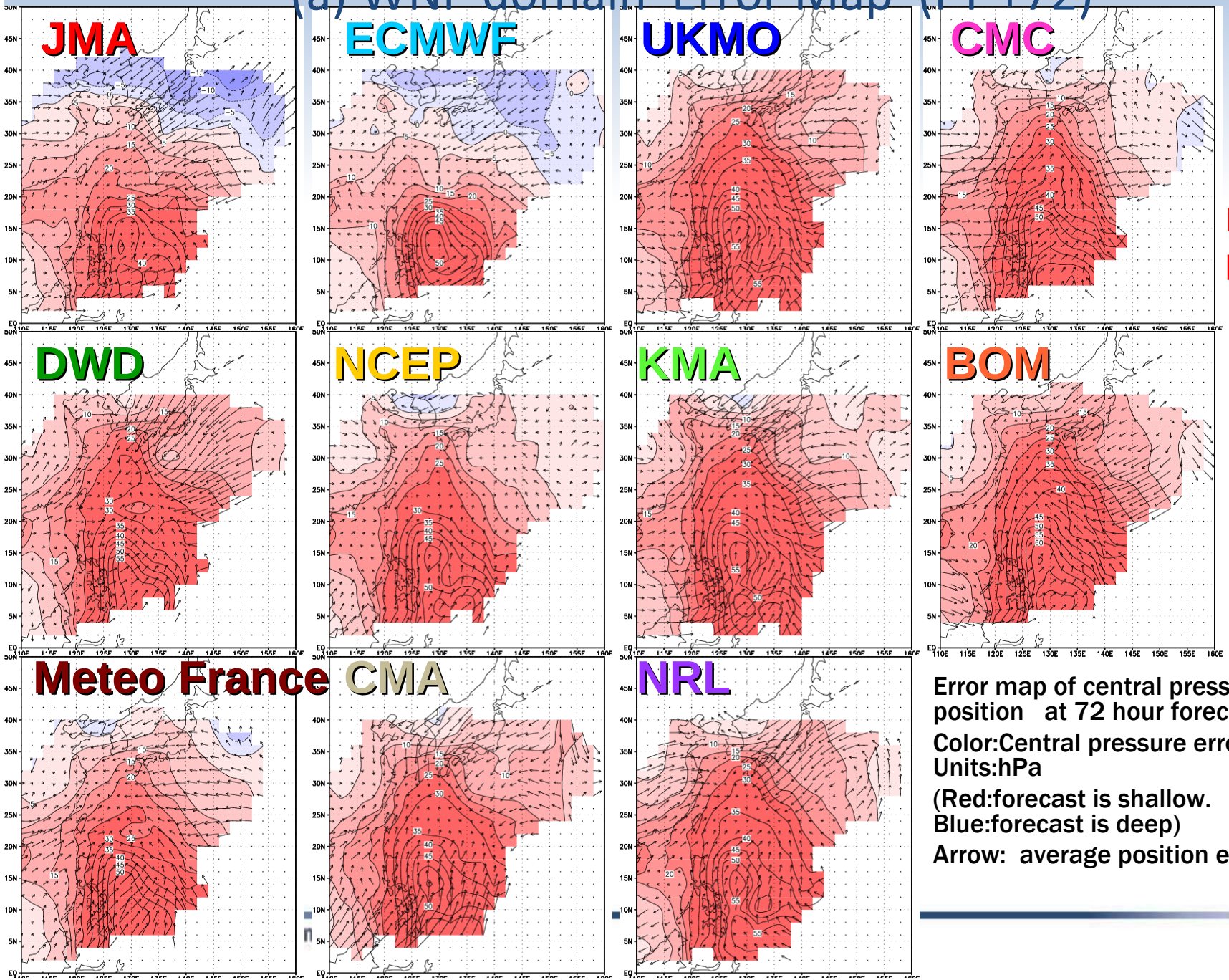


Scatter diagram of central pressure at 72 hour forecast.

Y-axis represents central pressure of forecast and X-axis does that of analysis.

Unit: hPa

(a) WNP domain Error Map (FT +72)



Forecast position

Analysis position

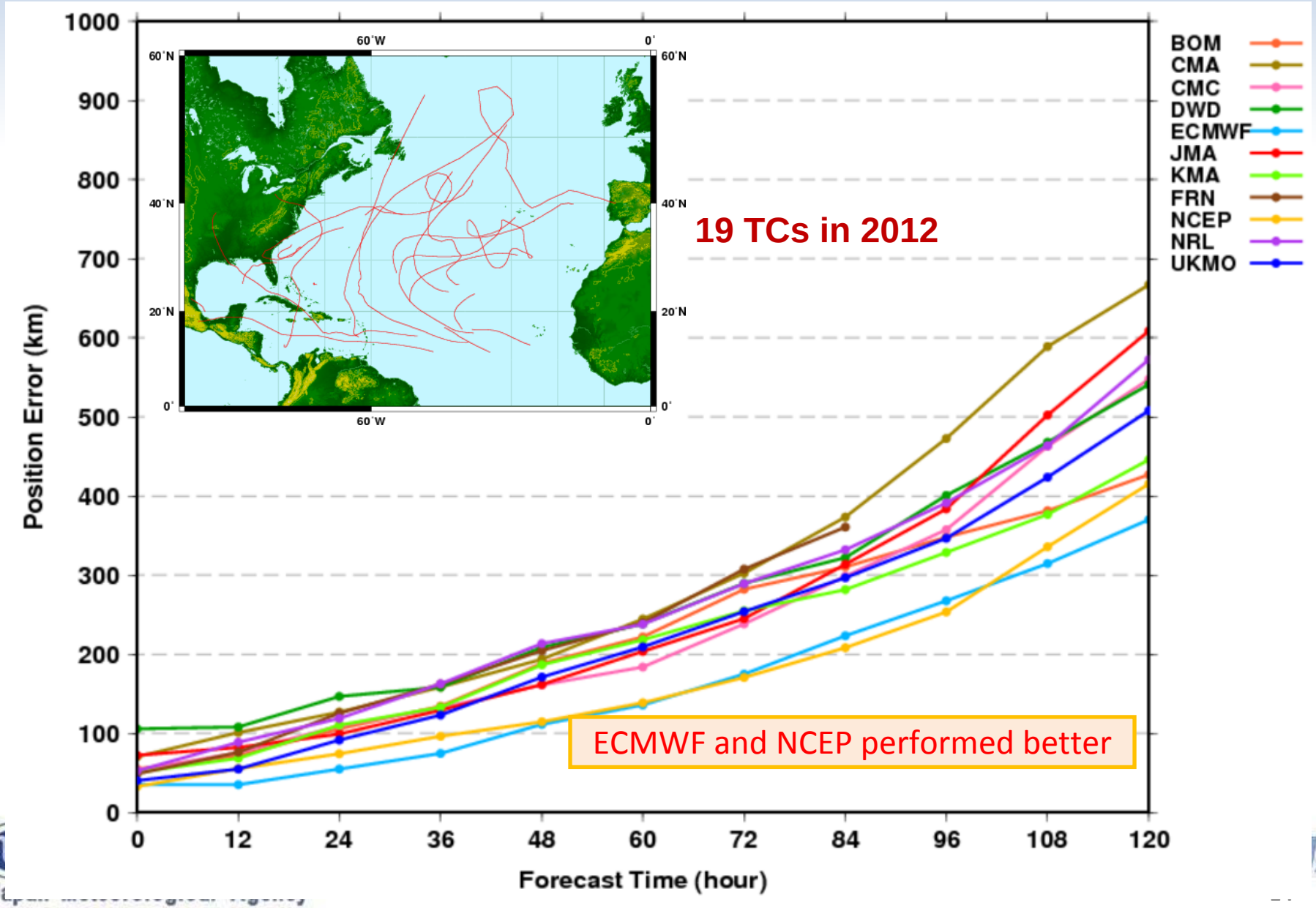
Error map of central pressure and position at 72 hour forecast.

Color:Central pressure error
Units:hPa

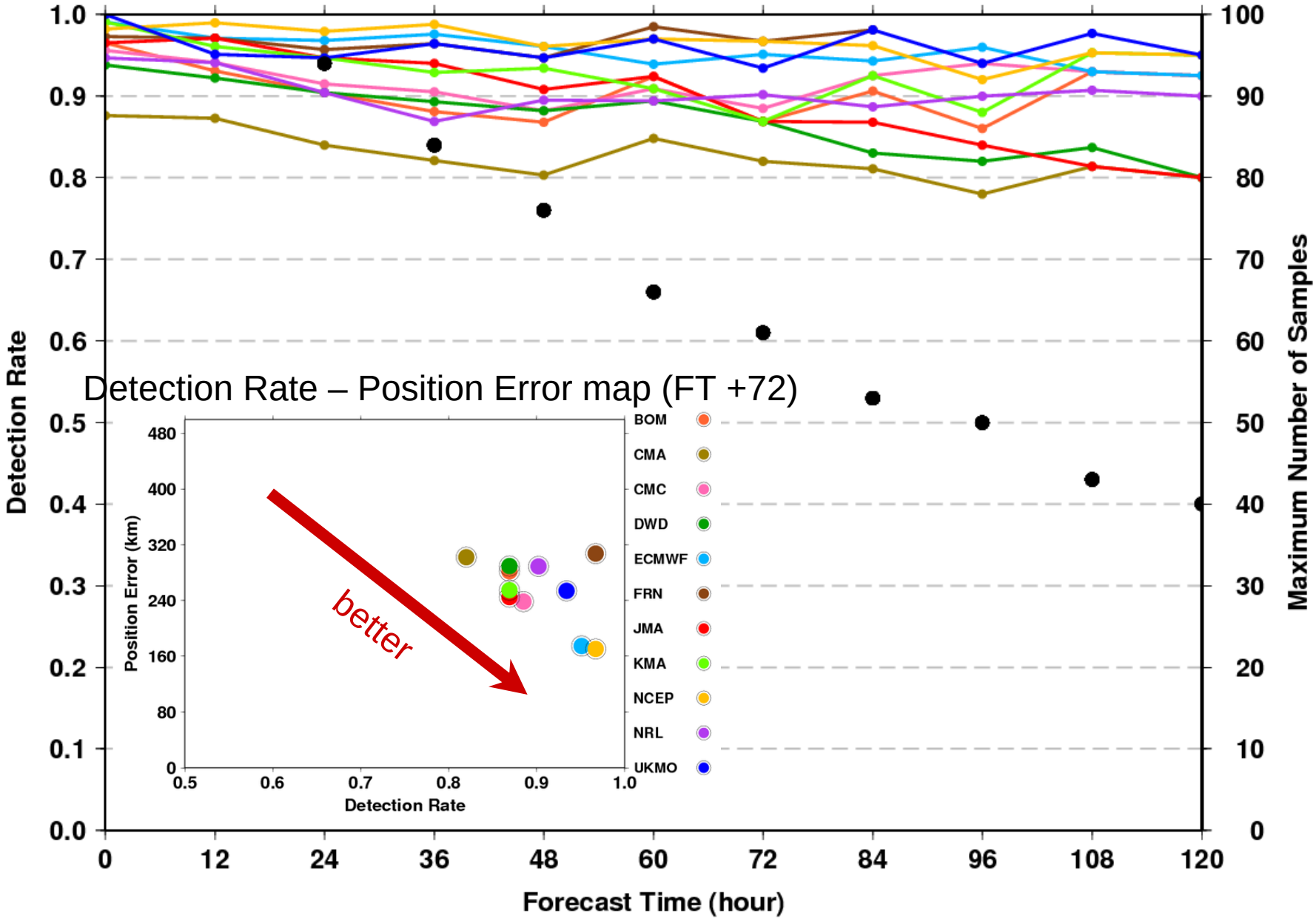
(Red:forecast is shallow.
Blue:forecast is deep)

Arrow: average position error

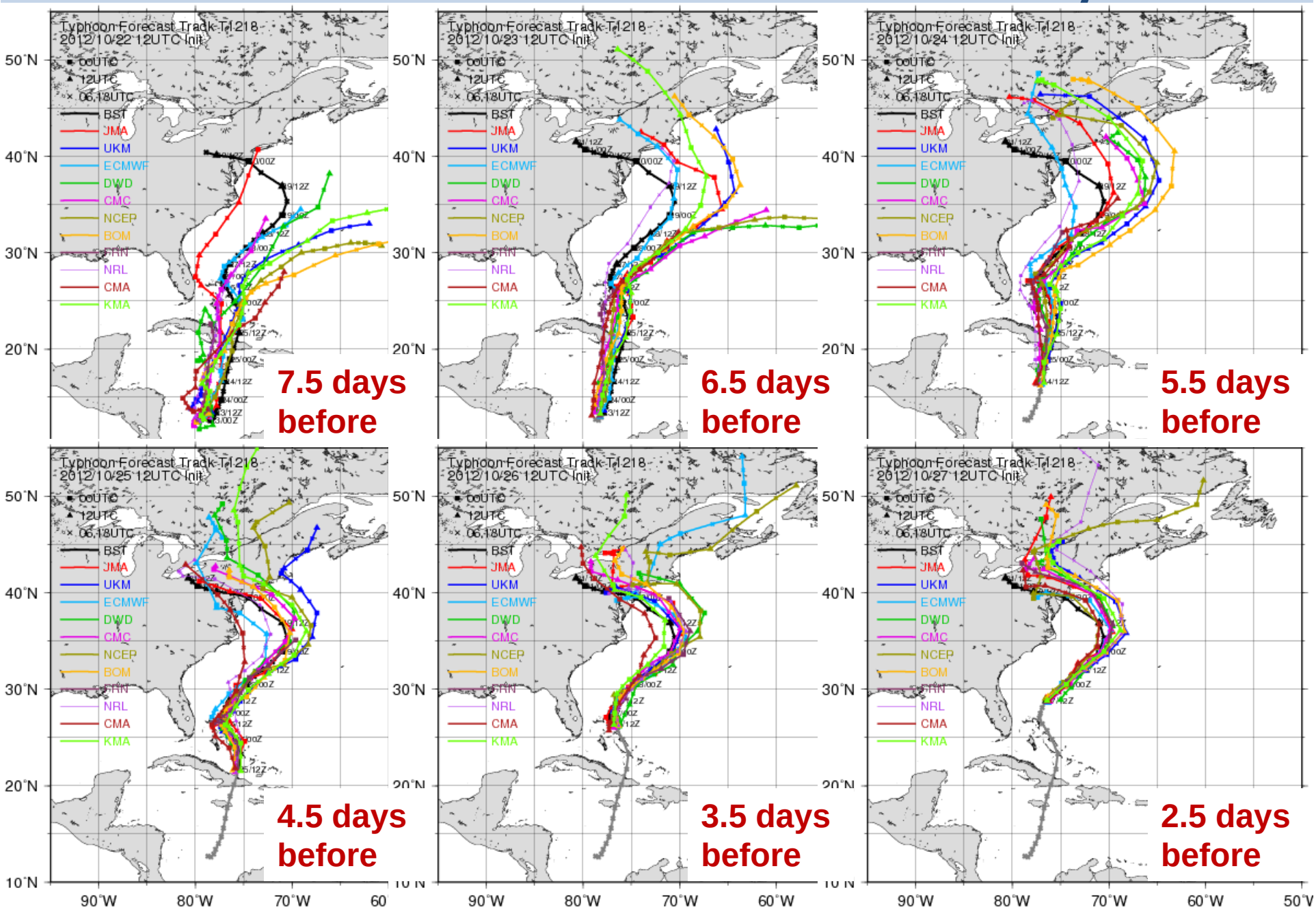
(b) North-Atlantic (NAT) domain Position Error



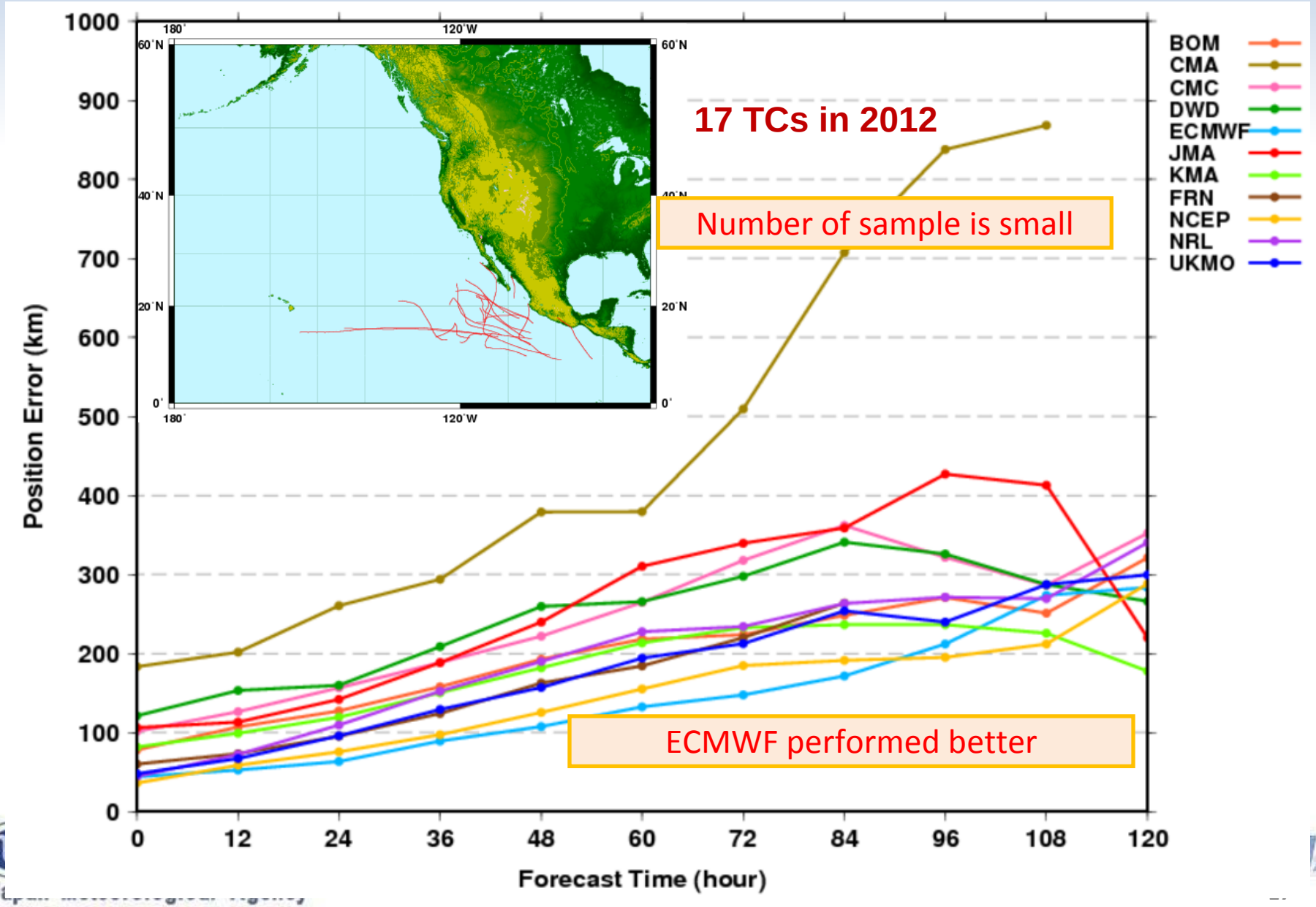
(b) NAT domain Detection Rate



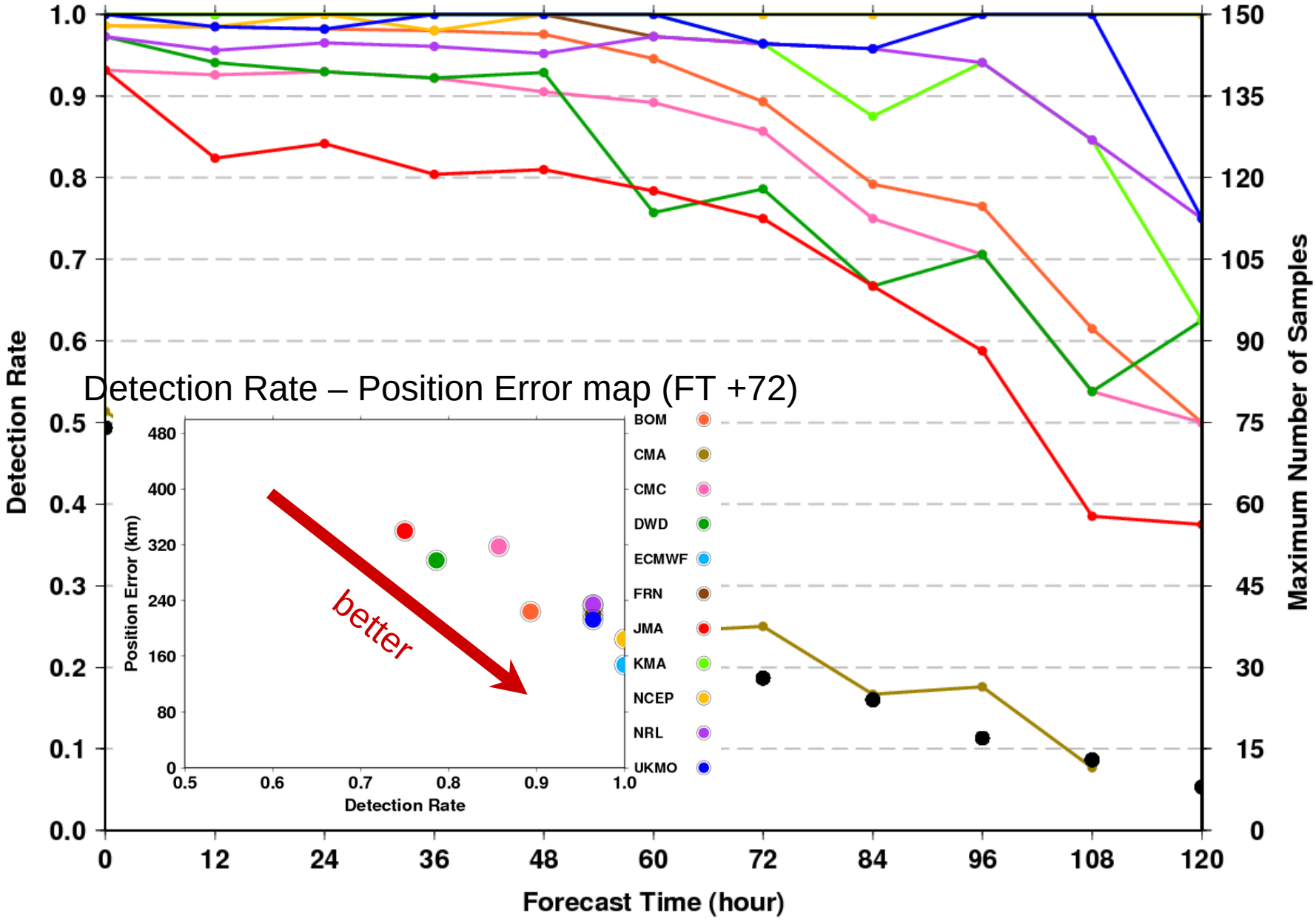
Forecast of Hurricane Sandy



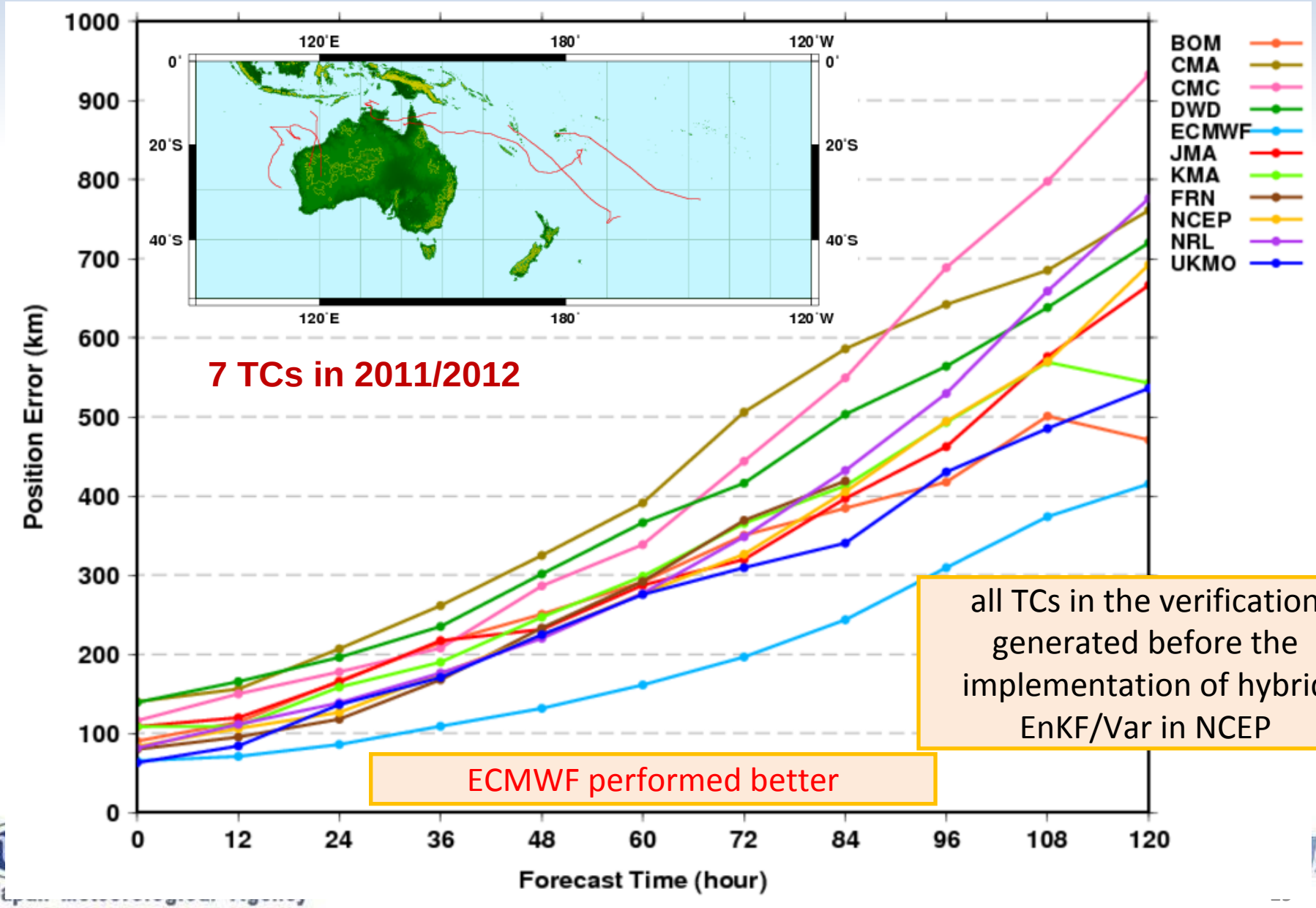
(c) eastern North-Pacific (ENP) domain Position Error



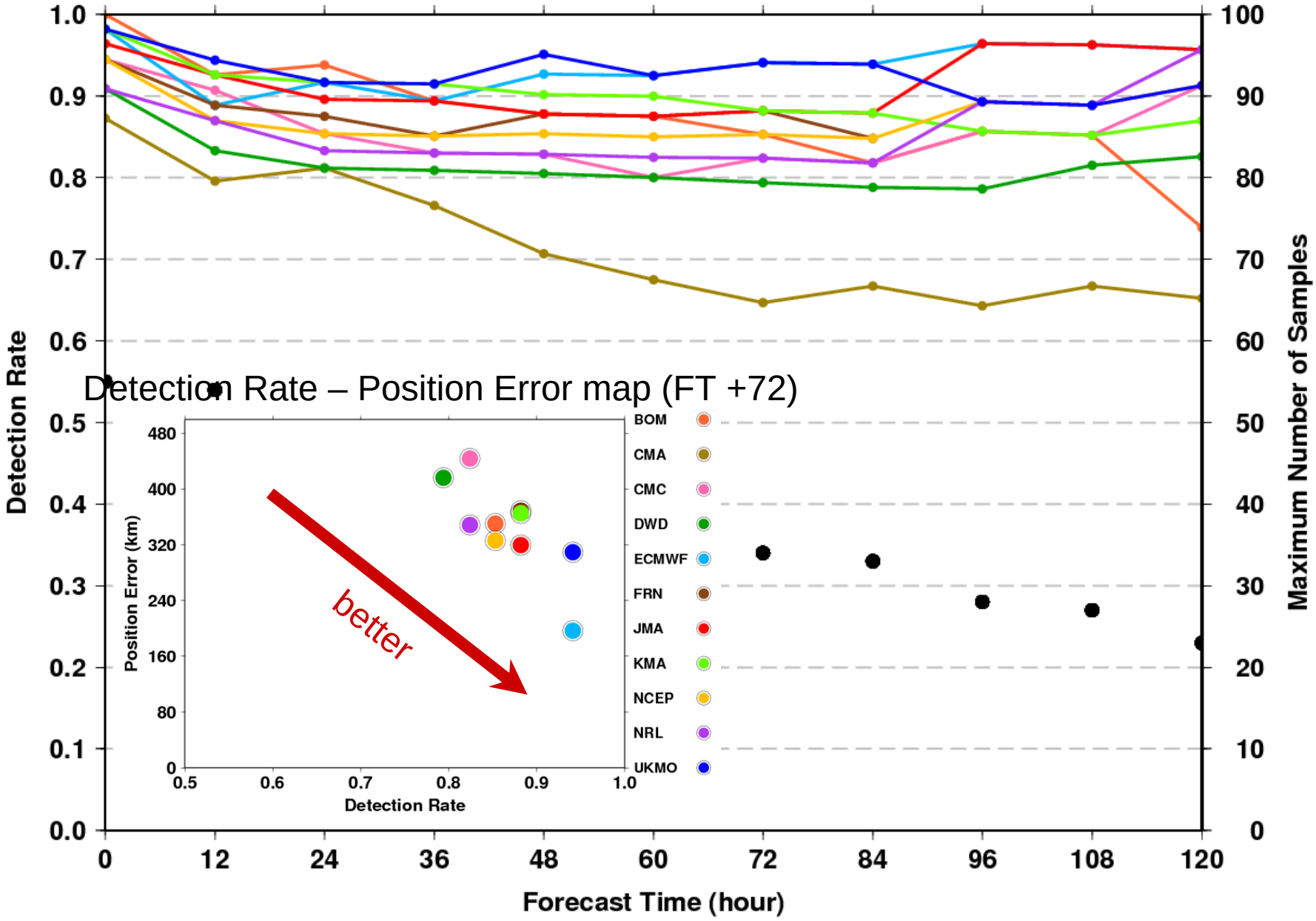
(c) ENP domain Detection Rate



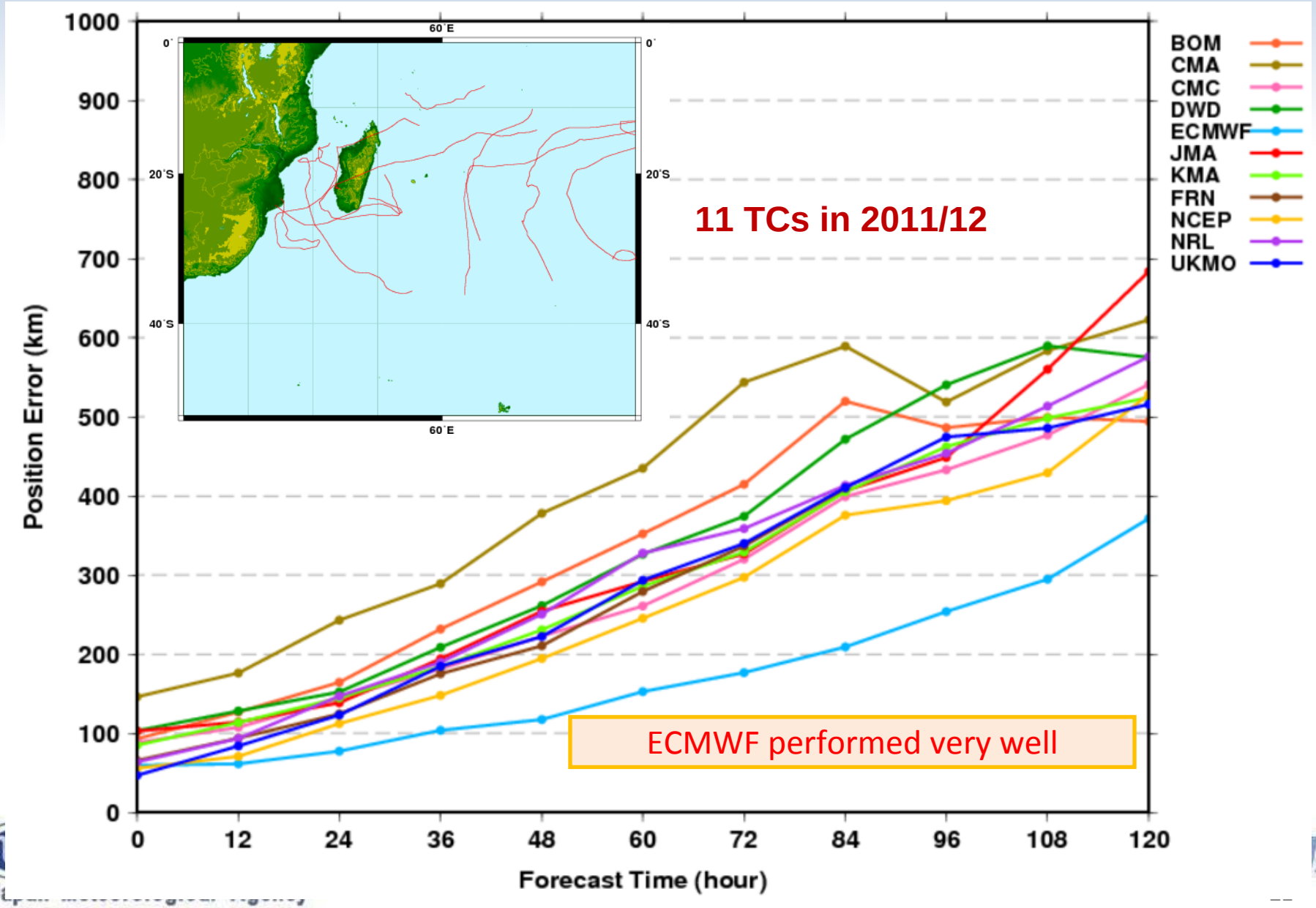
(d) “around Australia” (AUR) domain Position Error



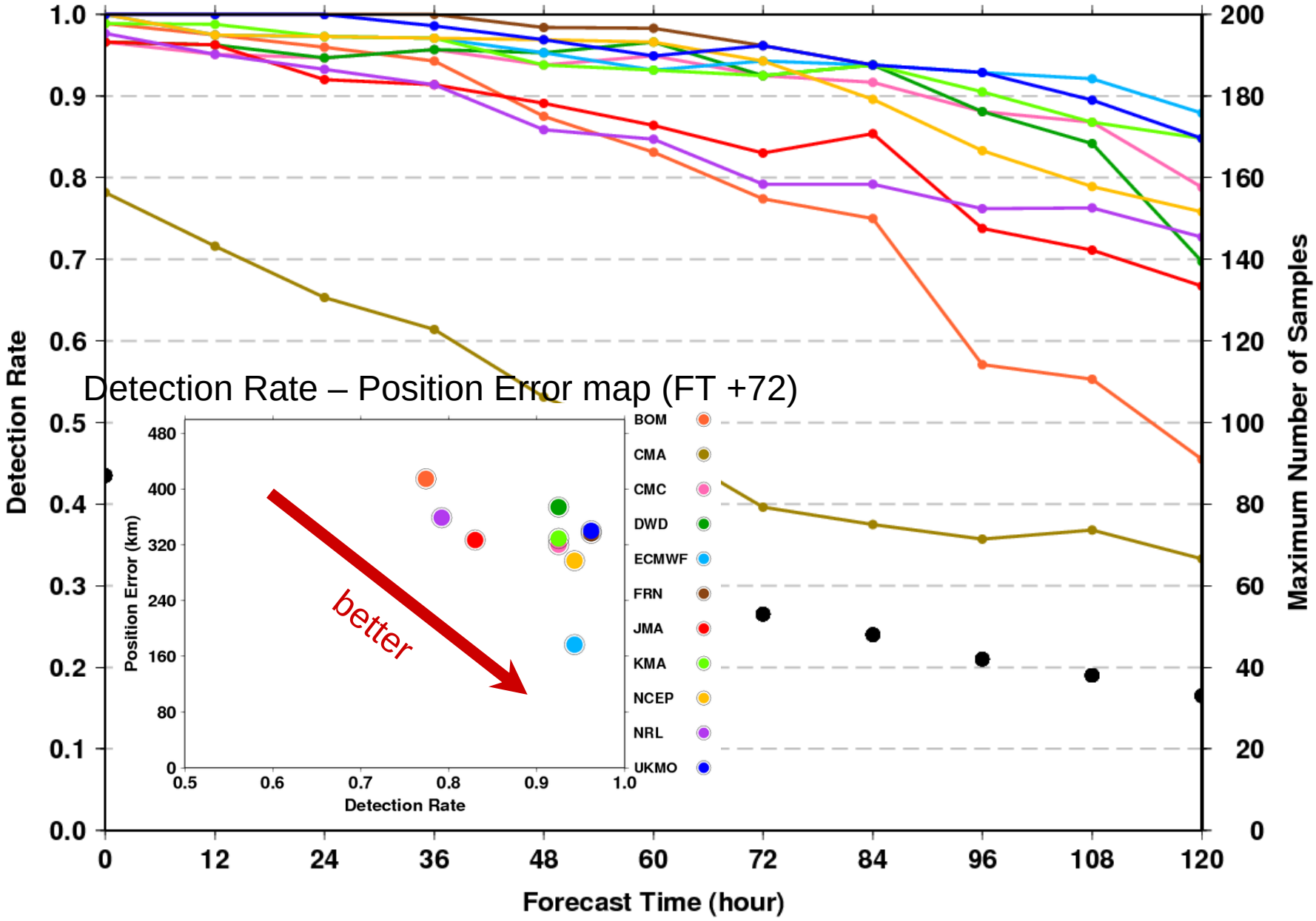
(d) AUR domain Detection Rate



(e) South Indian Ocean (SIO) domain Position Error



(e) SIO domain Detection Rate



visualization with “pie-chart”