7A.1

Typhoon simulation with the JMA/MRI 20 km mesh high-resolution global spectral model

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Our Project (KAKUSHIN Team 3)

Projection of the change in future weather extremes using super-high resolution atmospheric models

A. Projection

Extreme event projection with very-high resolution atmospheric models

Meteorological Research Institute (MRI)
Japan Meteorological Agency (JMA)
Advanced Earth Science & Technology Org. (AESTO)

uncertainty information

data

B. Uncertainty

Evaluation and reduction of uncertainty in global warming projection

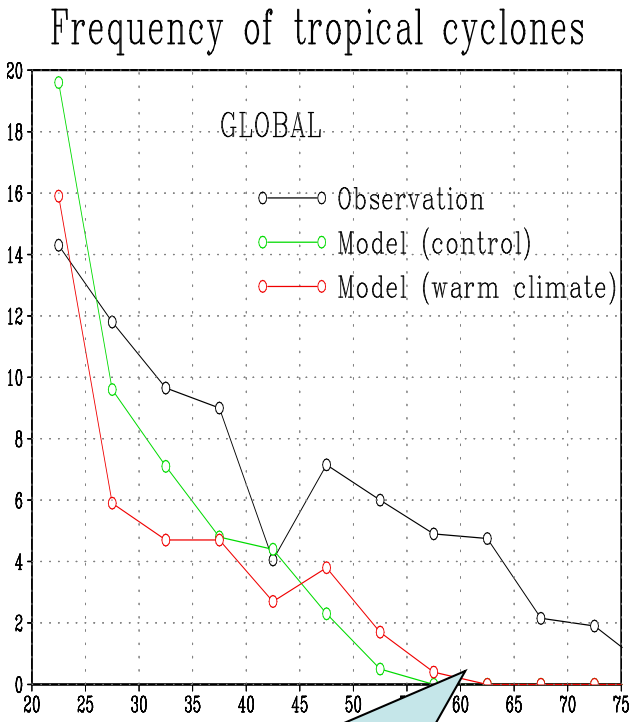
Meteorological Research Institute (MRI)
Japan Meteorological Agency (JMA)
Advanced Earth Science & Technology Org. (AESTO)

uncertainty information

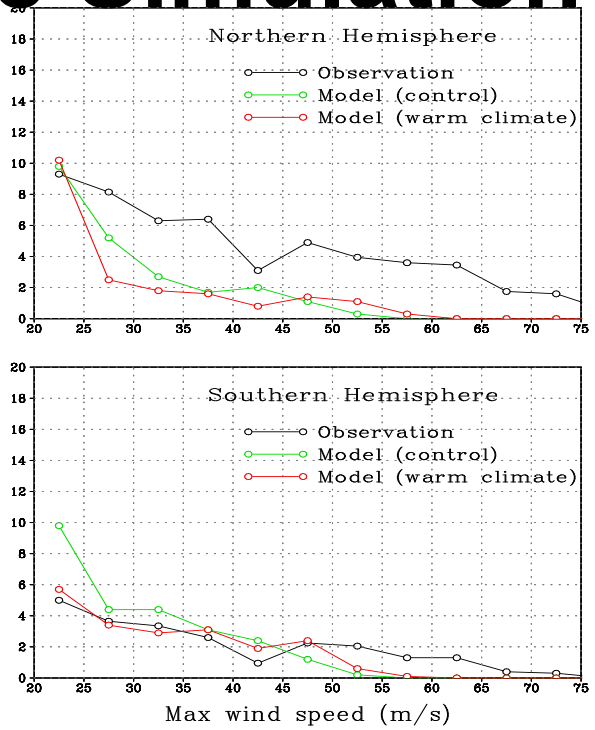
C. Risk assessment

- **Prediction and evaluation of disaster environment**
  Disaster Prevention Research Institute (DPRI), Kyoto University
- **Assessment of climate-change impacts on flood risk and its reduction measures on global and local scales**
  International Centre for Water Hazard and Risk Management (ICHARM), Public Works Research Institute

Tropical Cyclones by the Future Climate Simulation



counted when its intensity is maximum.
/fwindm20.gsp 2004-08 Jun Yoshimura



Frequency: Each TC is
clpc134: ~/UU/TL959/tc2/

In the case of warmer climate
TC's number will be decreased.
Stronger TCs will be generated.

Oouchi et.al(2006)

Purpose and Motivation

- Are those climate experiments reliable?
- Are tropical storms predictable with the 20 km global model? How about resolution difference?
- There is no NWP center using such a high resolution global model to predict tropical cyclones.

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Lets verify the predictability of the 20 km global model through medium-range forecasts.

Experimental Configuration

- Model

  20 km mesh global climate model (JM-AGCM;TL959L60,20km mesh)
  JMA operational global spectral model (GSM;T213L40,60km mesh)

- Observation

  Regional Specialized Meteorological Center Tokyo(RSMC-Tokyo) Best Track Data

- Target typhoons to be predicted

  12 typhoons between 2002 and 2005 over the Western North Pacific Ocean

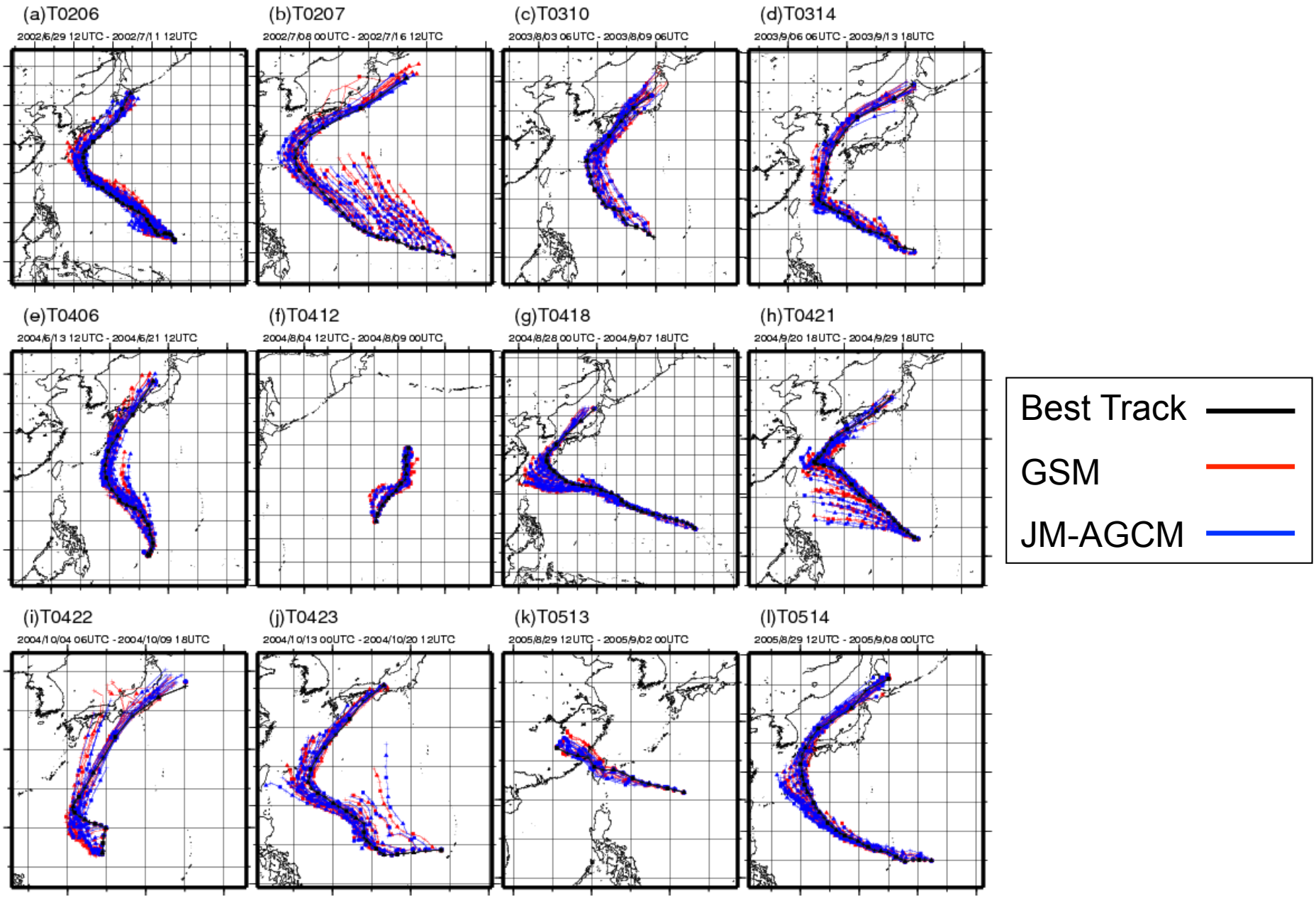
- Initial data

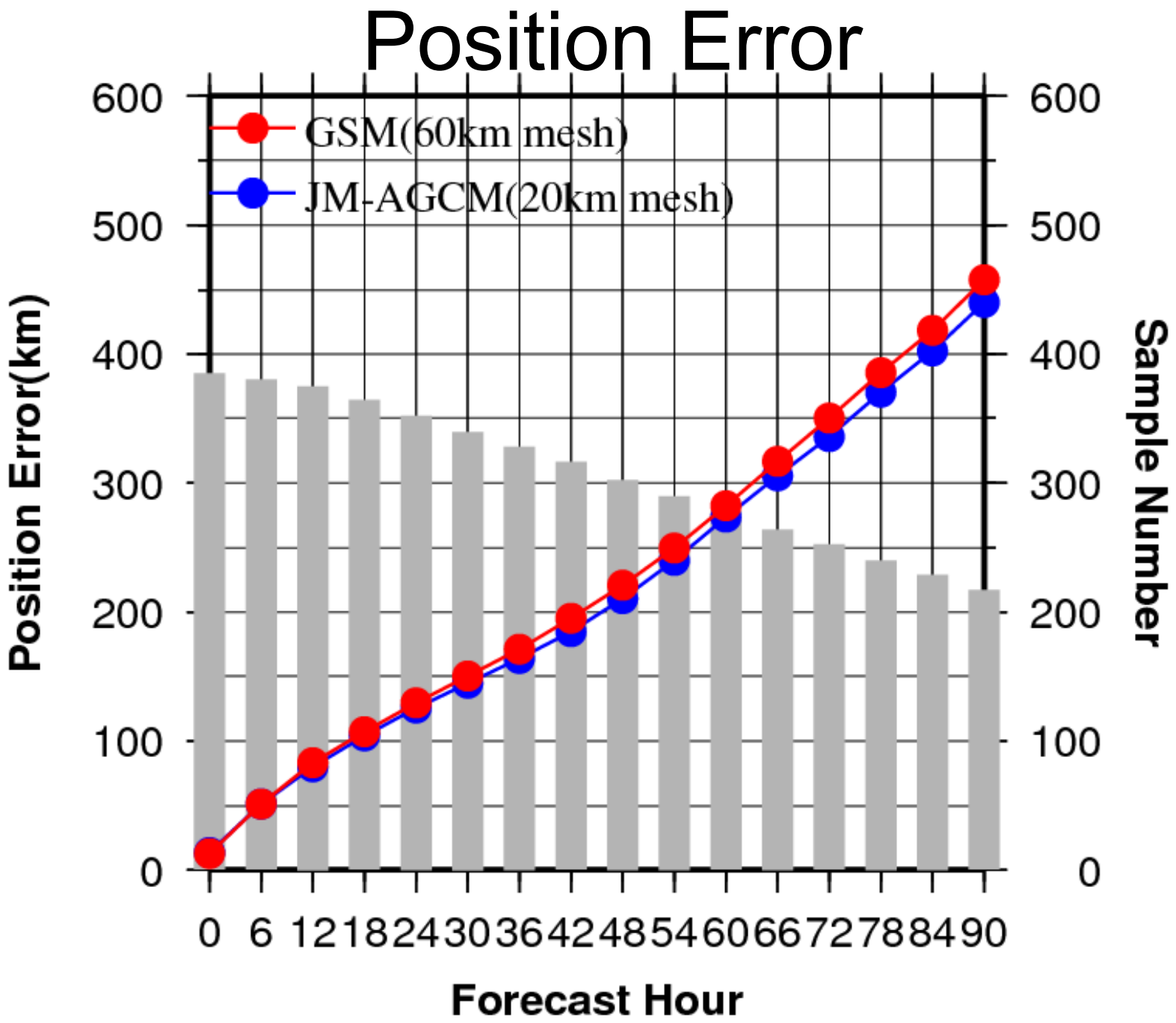
  JMA 60km mesh analysis was used by Interpolating into 20km mesh

- Integration

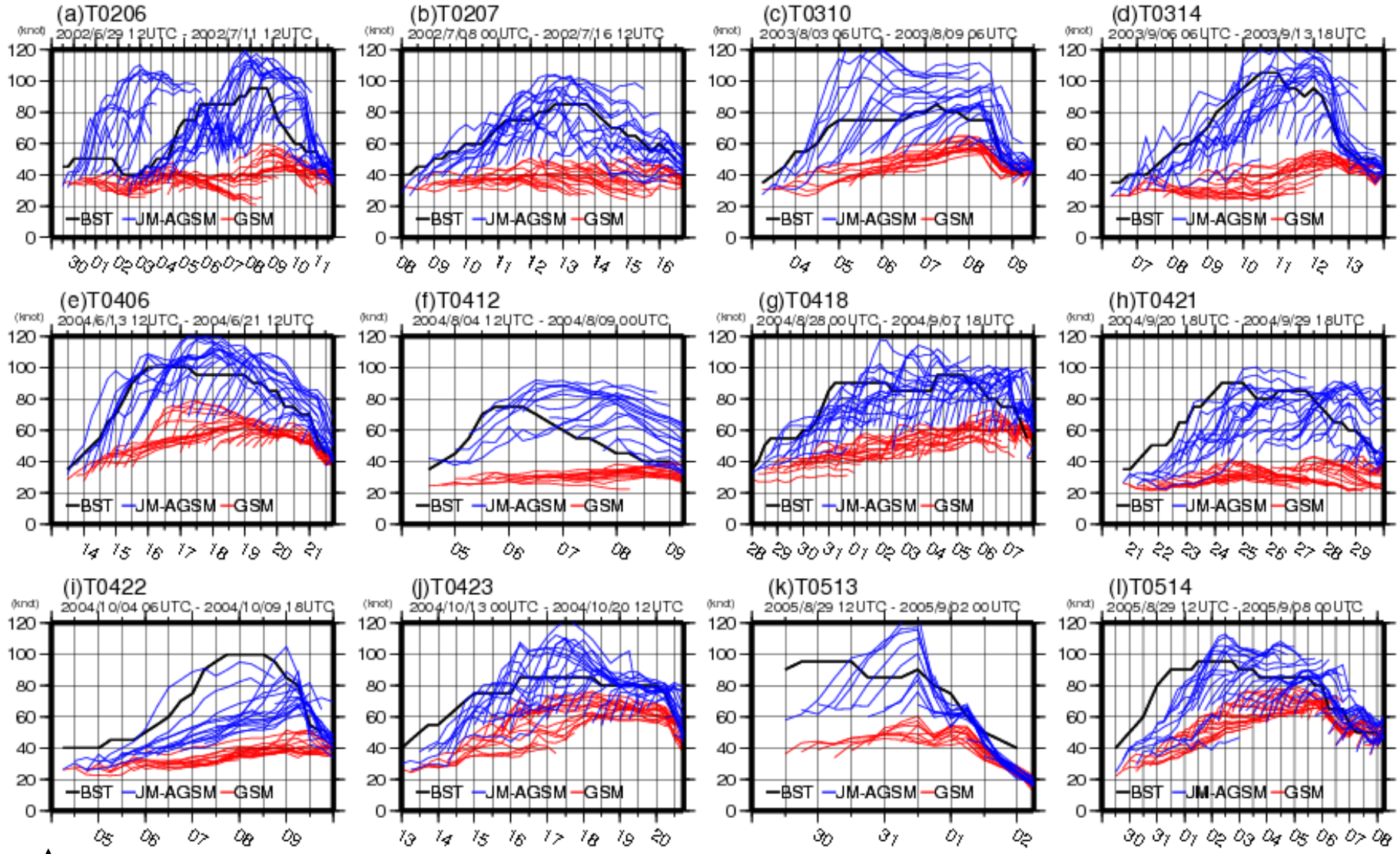
  393 cases (4 days forecast for each case)

Position Prediction

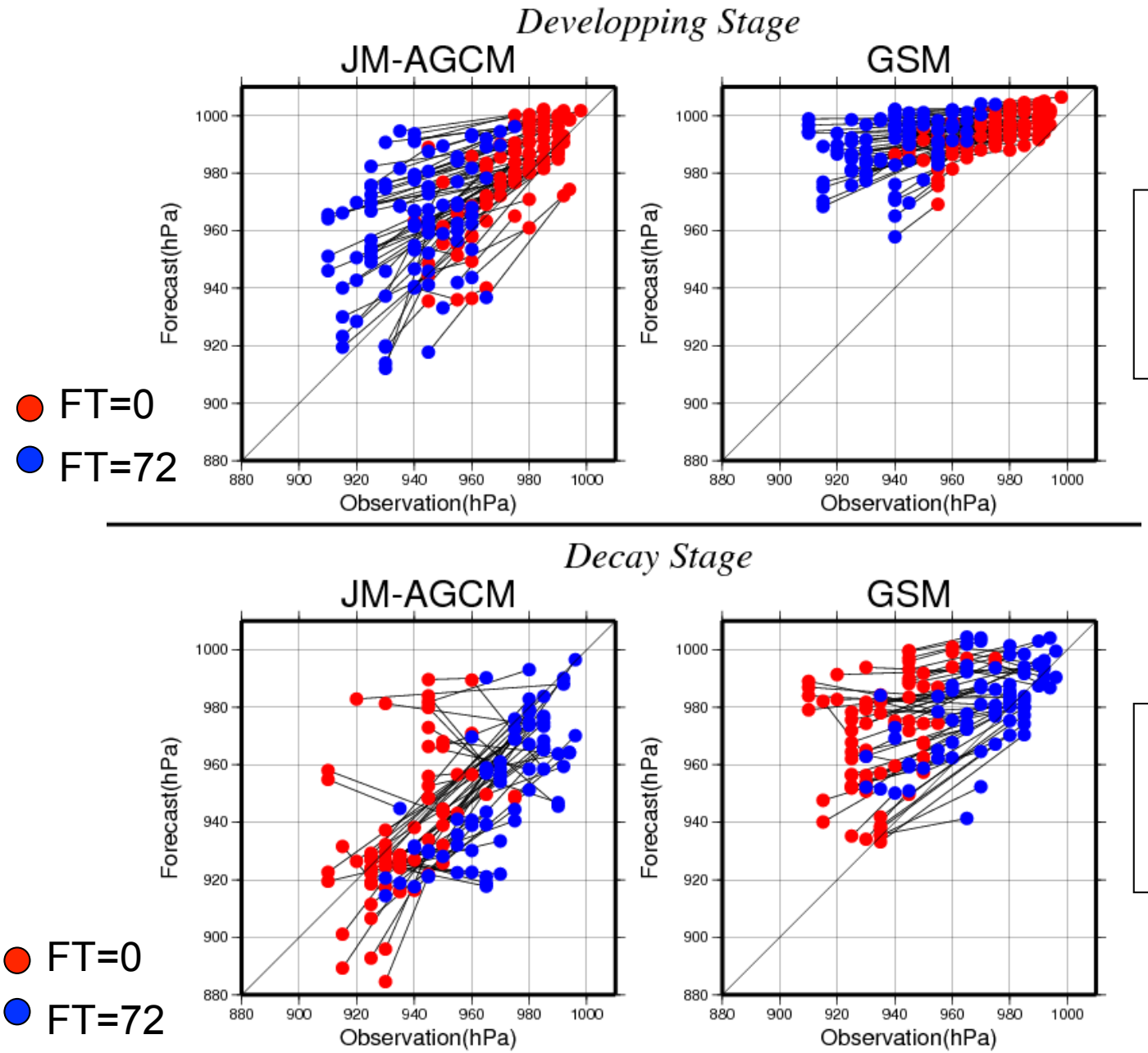



Position Error
GSM(60km mesh)
JM-AGCM(20km mesh)
Position Error(km)
Sample Number
Forecast Hour
0
100
200
300
400
500
600
0 6 12 18 24 30 36 42 48 54 60 66 72 78 84 90

Maximum Wind Prediction



Intensifing Tendency（Sea level pressure）



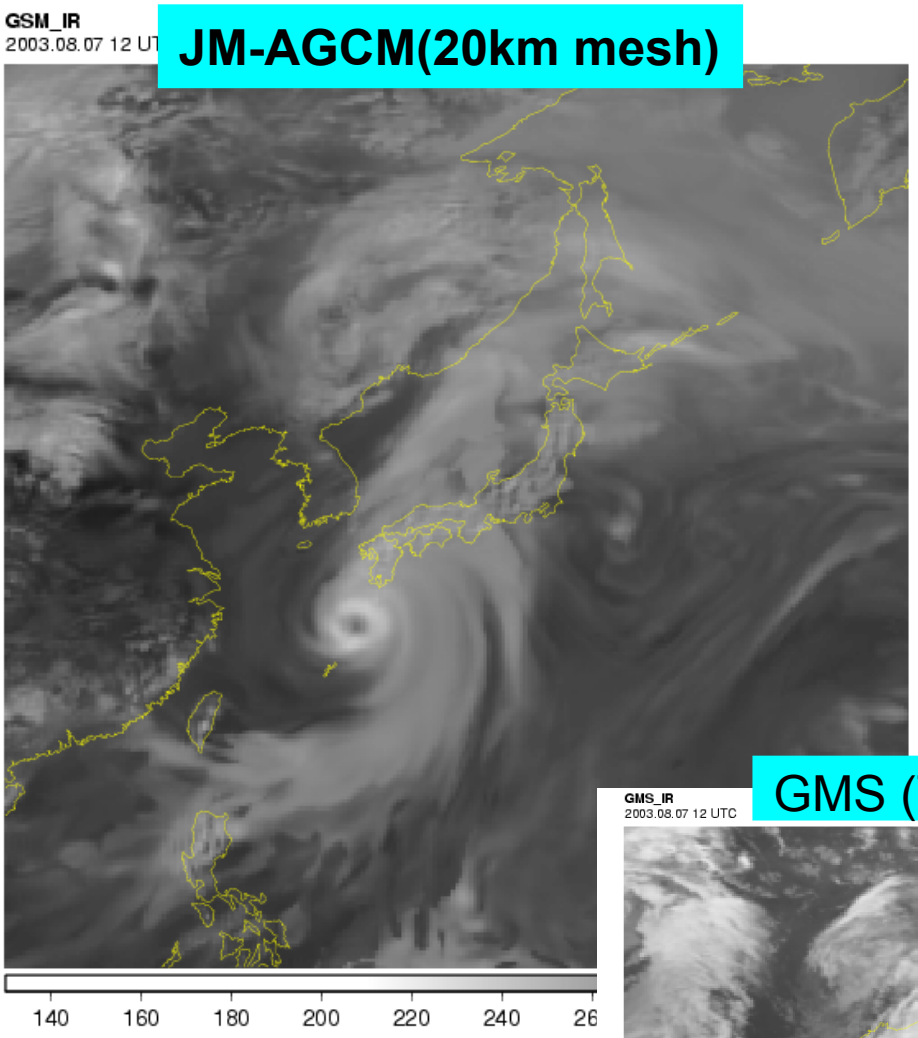
Developping Stage：

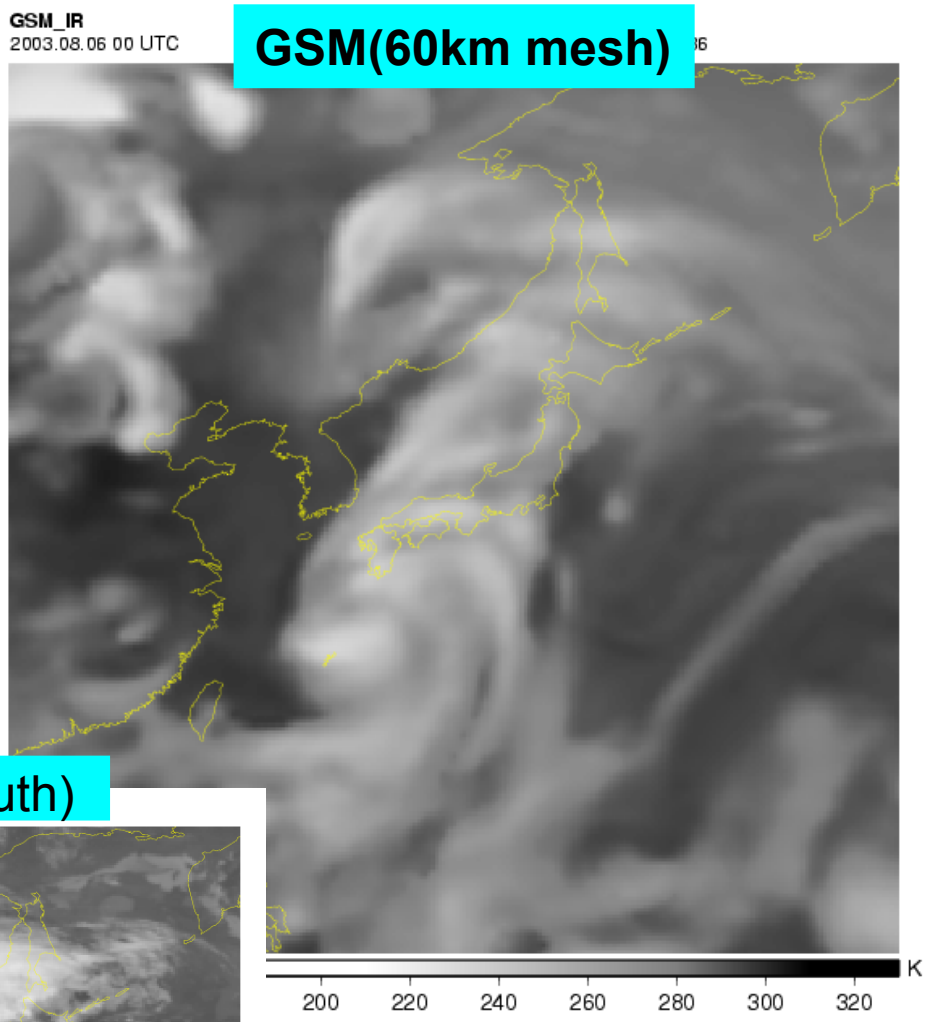
Observation decreases 10hPa between FT=0 and FT=72.

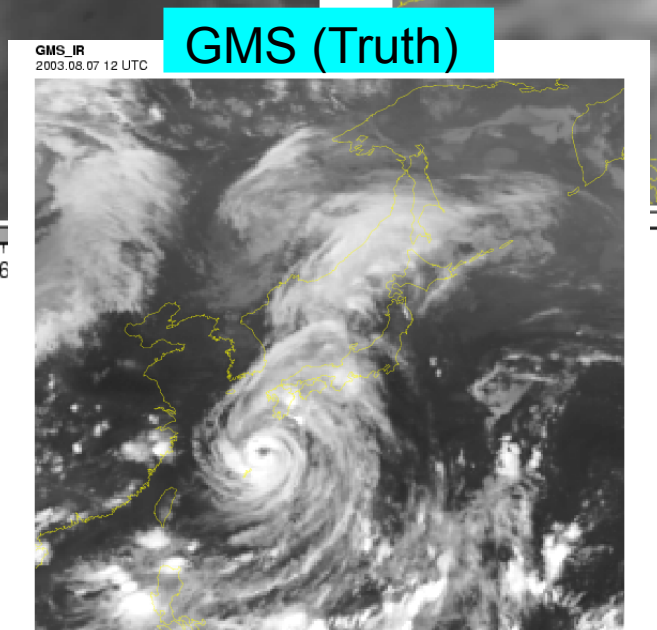
Decay Stage：

Observation increases 10hPa between FT=0 and FT=72.

Infrared Image by model outputs





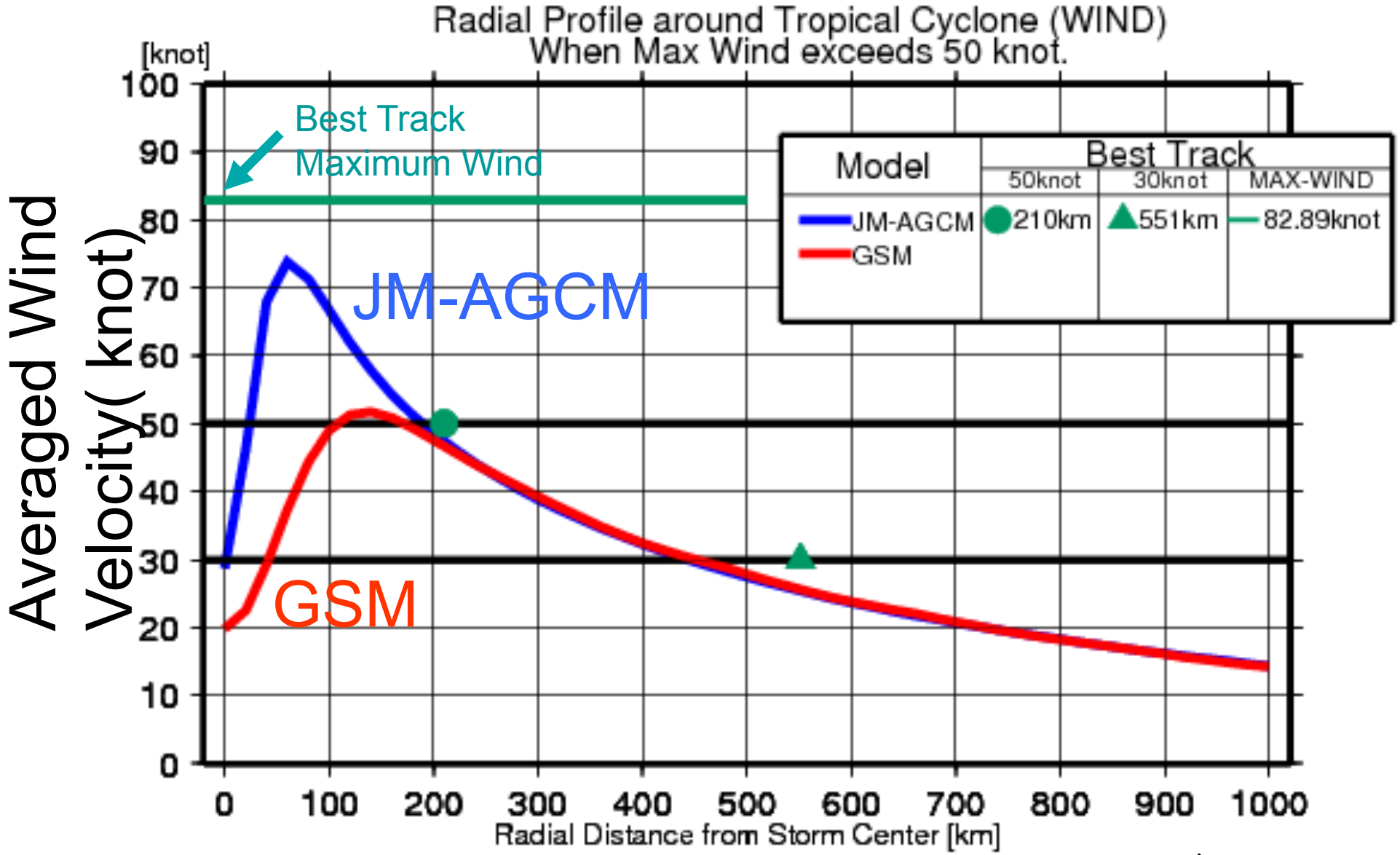


Infrared image

2003 08 07 12 Initial

FT=36

Difference in Wind Profile



1 knot = 0.514 m/s

Distance from Center（Km）

Summary

Our 20km mesh JM-AGCM can simulate

Typhoon Position

Typhoon Strength

Typhoon Structure

more realistically than the JMA(Japan Meteorological Agency) operational 60km mesh GSM.

20 km mesh global climate model and GSM

	20 km mesh global climate model	Global Spectral Model (GSM)
Horizontal Grids	1920x 960	640 x 320
Vertical Layers	60	40
Truncation Wave	TL959	T213
Grid Spacing	20km	60km
Top Layer Pressure	0.4hPa	
Dynamical frame	Semi-Lagrangian scheme	Eulerian scheme
Radiation Process	Shibata et al. (1999) Solar (every hour) Infrared (3 hourly)	
Precipitation Process	Prognostic Arakawa-schubert Large-scale condentation Prognostic cloud water content	
Gravity wave drug	Iwasaki et al (1989)	
Land surface	Simple Biosphere(SiB) model	
PBL and surface fluxes	Mellor-Yamada level 2 Moni-Obukhov similarity	