AAMP Modeling

Akio Kitoh (MRI/JMA)

- JRA-55 & AMY-RA
- TIGGE and MJO
- High-resolution climate models
- CMIP5 and AAMP
  - Asian Monsoon Metrics
Overview of JRA-55

providing a fundamental data set for

- researches on climate change and decadal variability in the last half century
- real-time climate monitoring
- verification of seasonal forecast and climate models
- atmospheric forcing fields for ocean data assimilations
- chemical transport simulations
- carbon cycle simulations
- water resource management
- estimation of renewable energy resources
- severe weather risk assessment
- and much more
Application of JRA-55
Isewan Typhoon Reanalysis and Reforecast

Isewan Typhoon(Vera) 21 - 27 Sep. 1959
Deadliest Typhoon in 20 Century Japan which killed 5098

Flowchart of the experiment

Aircraft data

Global Model (60km)

Initial

Regional Model (20km)

Downscaling

Initial/Boundary

Regional Reanalysis (5km)

Initial/Boundary

Regional Model (5km)

Initial

Tidal Model (4km)

Boundary

Extended Forecast

Aircraft data

Regional Forecast

Storm Surge Forecast
Typhoon Vera (Pseudo Images)

JMA’s first satellite, GMS was launched in 1977

S-band radar on Mt. Fuji started observation in 1964
Forecast of wind and rainfall (17-22 JST)

Wind speed (m/s) 3-hour rainfall amount (mm/h)

Strong wind
- southern off shore and deep inside bays (Ise-wan, etc)
- inland after landing

Heavy rain
mainly affected by the land
ex. Kii Peninsula (above 100mm/3h)
Results of Experiment

Global model (upper left figure)
All members predict landing

Regional model (upper right figure)
Accurate prediction of track and strength

Tidal model (lower figure)
Accurate prediction of storm surge
AMY-RA

- AMY-RA performed at MRI/JMA
- With all AMY-IOP observations as possible
- Target Period: Jan 2008 ~ Dec 2009
- Resolution: ~ 60km, 3 hour
  dynamical downscaling to 20km also planned
- Product distribution in FY2012
Use of TIGGE data

THORPEX Interactive Grand Global Ensemble

The Observing System Research and Predictability Experiment under WWRP

To improve the accuracy of 1-day to 2 week high-impact weather forecasts

Ensemble forecast data from 10 global NWP centers
Welcome to a gallery of THORPEX Interactive Grand Global Ensemble (TIGGE)!

The TIGGE is a key component of the THORPEX project, which provides operational global ensemble forecast data quasi-operationally (2 days behind). The TIGGE portals provide the TIGGE data freely for research and education purposes. For details, see WMO THORPEX website or TIGGE website. This page is operated for an advertisement of TIGGE by Dr. Mio Matsueda (JAMSTEC, Japan) in cooperation with Dr. Tetsuo Nakazawa (MRI/JMA). This page is updated every day (4 days behind).

Enjoy the TIGGE data!

Information of TIGGE data

- Latest details of operational global ensemble prediction system in TIGGE portals [pdf]

Monitor and verification pages of TIGGE data

- Spaghetti diagram, ensemble mean, and ensemble spread for Z500 over NH  Updated every day!
- Seasonal RMSE and ensemble spread for Z500 over NH and SH (verification scores [pdf])
- Daily RMSE and ensemble spread for Z500 over NH and SH
- Scatter diagram between daily RMSE and ensemble spread for Z500 over NH
- Seasonal-mean Z500 bias over NH and SH
- Blocking frequency in NH (blocking index [pdf])

http://tparc.mri-jma.go.jp/TIGGE/
TIGGE: THORPEX Interactive Grand Global Ensemble

TIGGE MJO forecasts

Initiated time:
Year.Month [2009.12]
Day 20

-1 Day +1 Day latest

http://tparc.mri-jma.go.jp/TIGGE/tigge_MJO.html
High-resolution models
Time-Slice Experiments

CMIP3 AOGCMs → Time slice experiments → Projection of regional climate by one-way nested NHM

20km, 60km AGCM

NHM5k

Time slice experiments

Projected SST

Nested in the AGCM20km

Regional Climate Model

NHM5k

Nested in the NHM2/1km

SST

O

Lower B.C.

1979 ~ 2003

1979 ~ 2003

2015 ~ 2039

2075 ~ 2099

Year

SST

Present

Near Term

Future

NWP models as climate models
TC detection is adjusted so that the total global number of formations is equal to that of observed number.

Western North Pacific

- Blue: January - March
- Green: April - June
- Red: July - September
- Orange: October - December
Present climate simulation of TC formation & tracking distribution by 20km Atmos. Model (25 years)

Annual Number of Tropical Storm Genesis for Each Latitude Belt

Best Track (over 34kt)
Models (by Oouchi et.al(2006))

- Overestimating
- Considerably improving
- Improving
- Improving a little

Observation
Earlier model
Updated model

Tendency of formation at more eastern locations
Super-high resolution (20 km) global atmospheric modelling
(by MRI group under a MEXT project)

Earth Simulator

Some of major outcomes

- Projection of increased strength of Typhoons & Hurricanes (new finding)
- Projection of regionally detail extreme events (heat waves, droughts, etc.) under sufficient regional geographic effects
- Projection of temporally detail behaviour such as diurnal precipitation change

IPCC
Assessment Reports (AR4 & AR5)

Working Group I (Physical Science)
Working Group II (IAV*)

Synthesis Rep.

Sound Scientific Basis for Adaptation Measures

[WB funds, JICA funds]

(* IAV = Impact, Adaptation and Vulnerability)