Introduction of the JMA's models and their Products available via the DIAS

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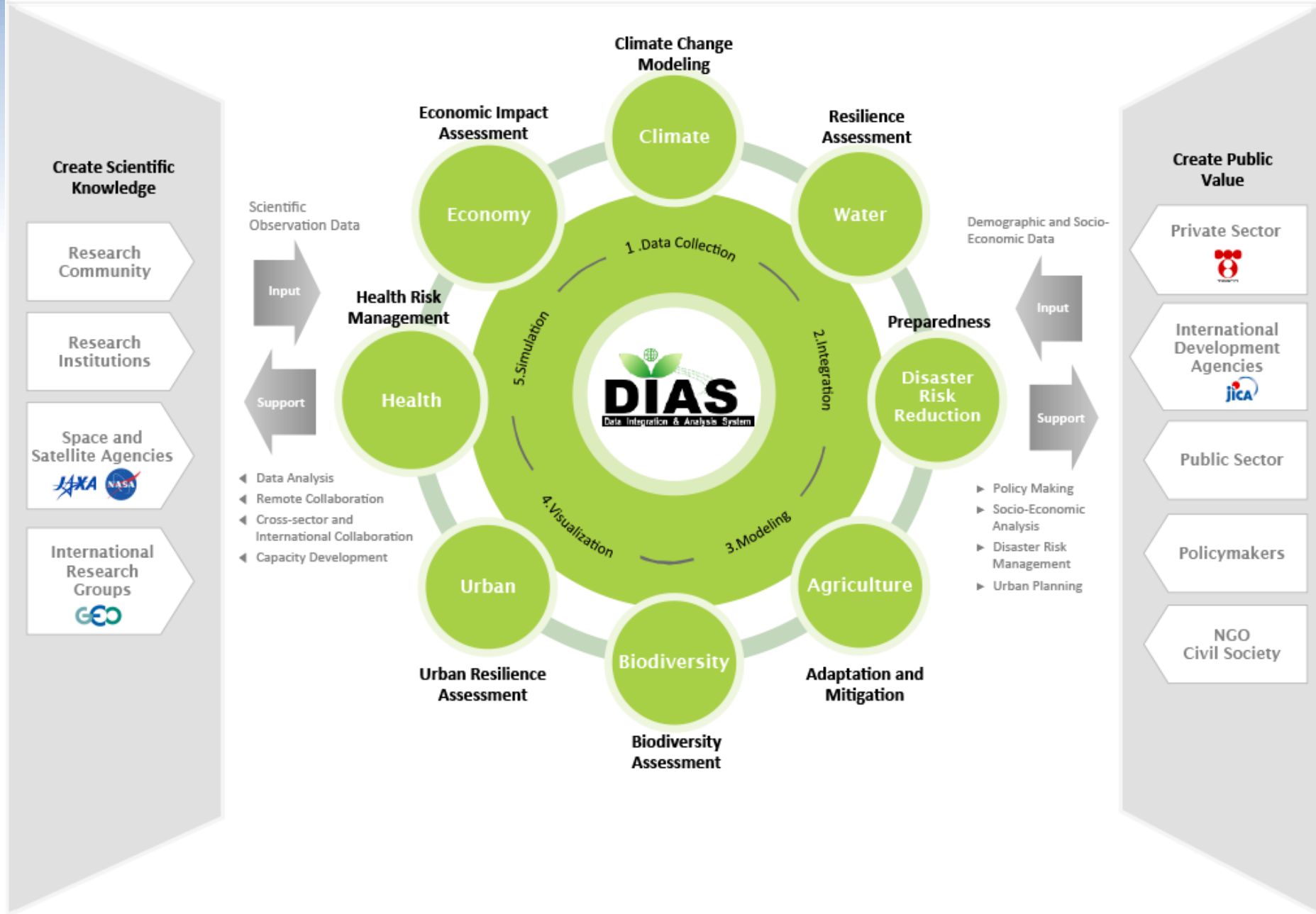
Office of International Affairs

Japan Meteorological Agency (JMA)



Source: http://www.diasjp.net/en/about/

Introduction: JMA's Goals

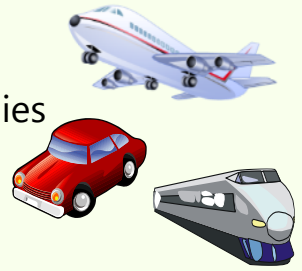
JMA implements its services with the following ultimate goals

Prevention and mitigation of natural disasters

Provide daily/monthly forecasts and warnings/Advisories for
- Preparation for disasters
- Evacuation
- Risk management

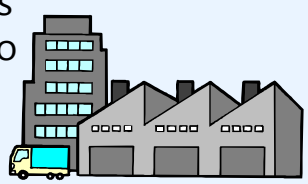
Safety of transportation

Provide meteorological information to
- Pilot and airline companies
- Road administrators
- Train companies



Development and prosperity of industry

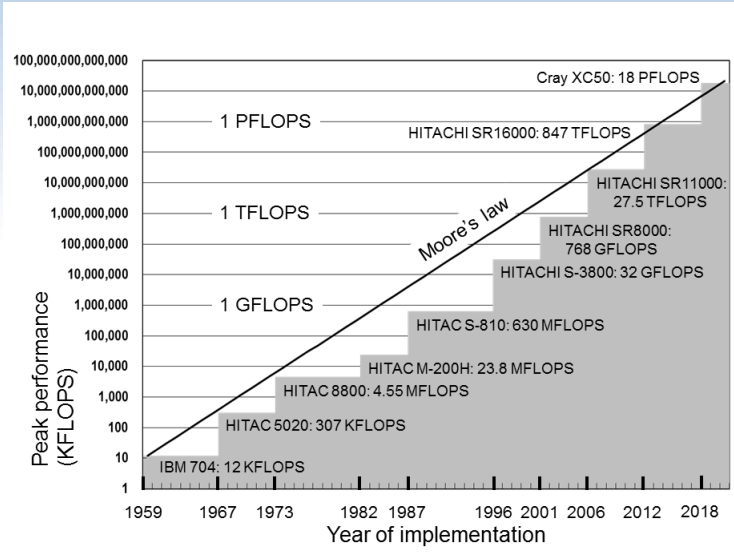
Provide weather forecasts and climatological data to
- Energy companies
- Agriculture
- Other industries



International cooperation

- International data exchange
- Technical support
- Sharing disaster information
- Collaboration to develop technics

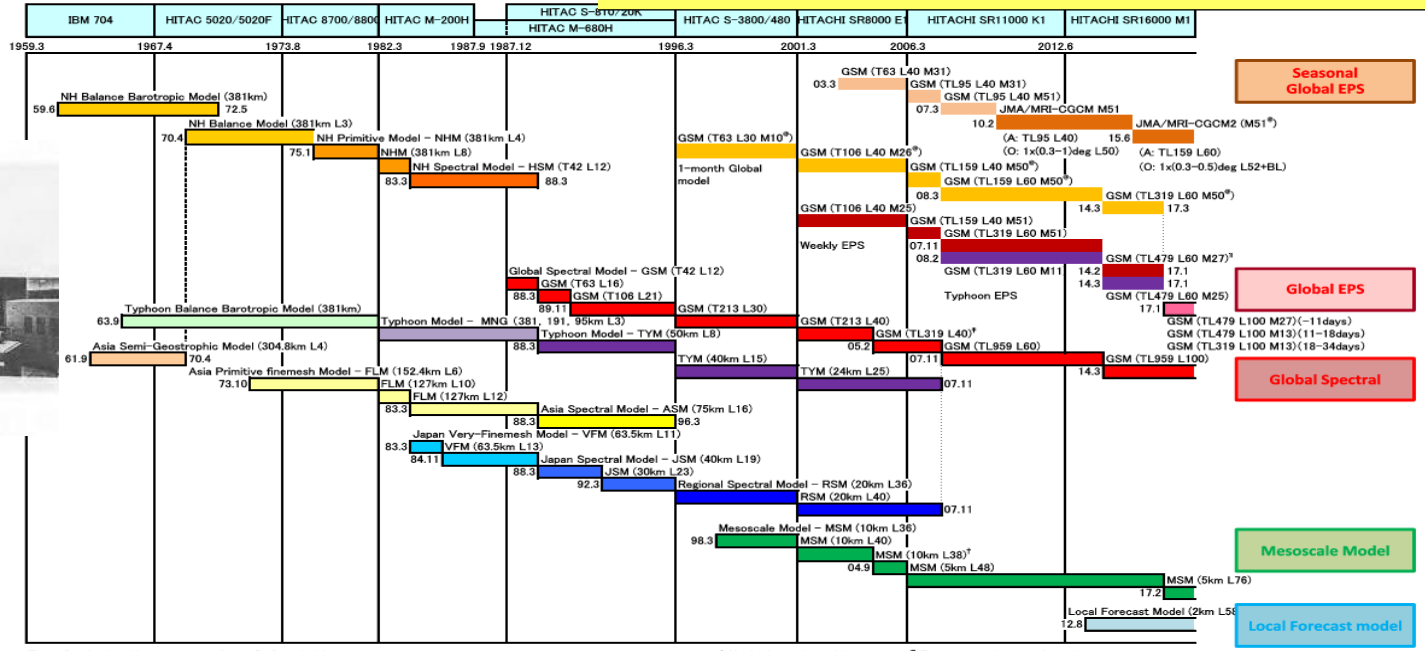
JMA operational NWP history for 60 years



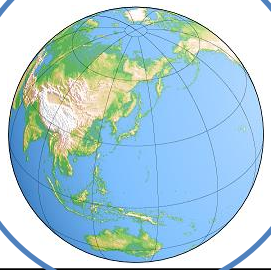
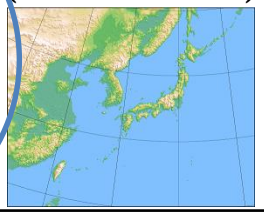
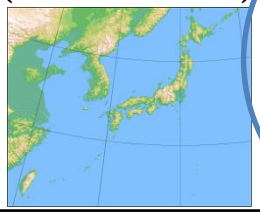
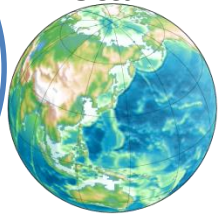
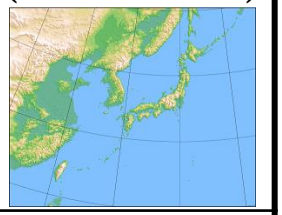
generation	Operation start	Main computer	Speed	Storage
Ⅰ	1959/3	IBM-704	84 μsec	8 KW (36bit)
Ⅱ	1967/4	HITAC-5020F	3.25 μsec	131 KW (32bit)
Ⅲ	1973/8	HITAC-8700/8800	0.22 μsec	2 MB
Ⅳ	1982/3	HITAC-M200H x2	0.084 μsec	16 MB
Ⅴ	1987/9	HITAC-M680	30 MIPS	32 MB
	1987/12	HITAC-S810	630 MFlops	64 MB + 512 MB(ES)
Ⅵ	1996/3	HITAC-S3800_480	32 GFlops	2 GB + 12 GB(ES)
Ⅶ	2001/3	HITACHI-SR8000E1	768 GFlops	640 GB
Ⅷ	2006/3	HITACHI-SR11000K1 x 2	21.5 TFlops	10 TB
Ⅸ	2012/6	HITACHI-SR16000M1 x 2	847 TFlops	108 TB
Ⅹ	2018/6	CRAY XC50	19.1PFlops	264TB

図 7. 16　IBM704 の全体機器（気象庁提供）

The First Super Computer System at JMA (1959)
IBM-704

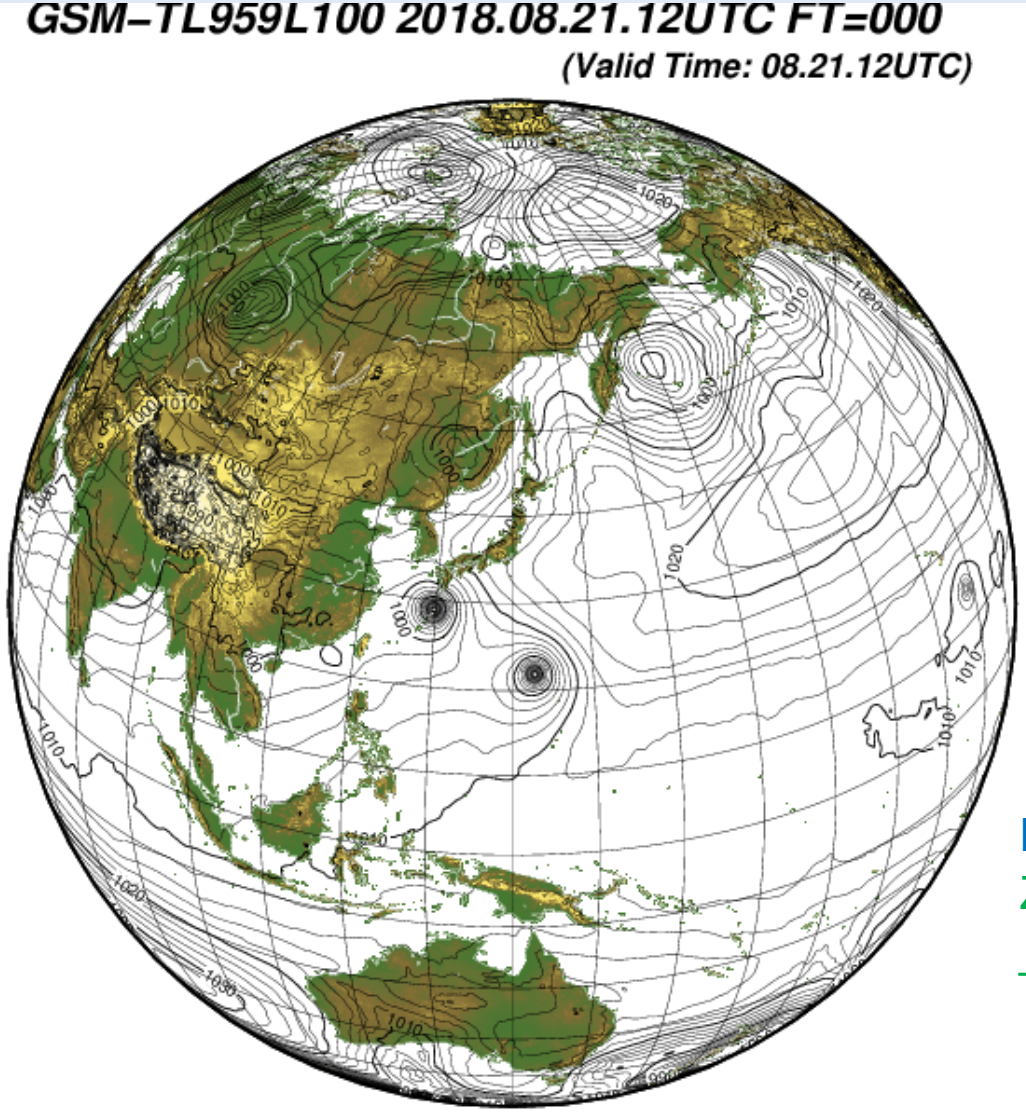


Current NWP models in JMA

	In Operation					On trial
	Global Spectral Model GSM	**Meso-Scale Model MSM**	**Local Forecast Model LFM**	**Global Ensemble GEPS**	**Seasonal Ensemble CPS2**	**Meso-scale Ensemble MEPS**
objectives	Short- and Medium-range forecast	Disaster reduction Aviation forecast	Aviation forecast Disaster reduction	One week forecast Typhoon forecast Early warning on extreme weather One-month forecast	Seasonal forecast (three month forecast, cold/warm season outlook) El Nino outlook	
Forecast domain	Global 	Japan and its surroundings (4080km x 3300km) 	Japan and its surroundings (3160km x 2600km) 	Global 	Coupled Global Atmosphere and Ocean 	Japan and its surroundings (4080km x 3300km) 
Horizontal resolution	~~TL959~~ (0.1875 deg)	5km	2km	TL479 / ~~TL319~~ (0.375 / 0.5625 deg)	Atmos.: 1.125 deg Ocean:0.3-0.5x1 deg	5km
Vertical levels / Top	100 0.01 hPa	76 21.8km	58 20.2km	100 0.01 hPa	Atmos.: 60 (~0.1 hPa) Ocean: 52 with BBL* *Bottom Boundary Layer	76 21.8km
Forecast Hours (Initial time)	132 hours (00, 06, 18 UTC) 264 hours (12 UTC)	39 hours (00, 03, 06, 09, 12, 15, 18, 21 UTC)	9 hours (00-23 UTC hourly)	264 h (00, 12 UTC) 132 h (06, 18 UTC)* 27 members Extend to 432 h (4times/week) 816 h (4times/week) 13 members	210 days (00UTC) 51 members / month	39hours (00,06,12,18 UTC) 21 members
Initial Condition	Global Analysis (4D-Var)	Meso-scale Analysis (4D-Var)	Local Analysis (3D-Var)	Global Analysis with ensemble perturbations (SV, LETKF)	JRA-55 with ensemble perturbations (BGM)	Meso-scale Analysis with ensemble perturbations (SV)

* when a TC of TS intensity or higher is present or expected in the RSMC Tokyo - Typhoon Center's area of responsibility (0º–60ºN, 100ºE–180º).

GSM(Global Spectrum Model) on DIAS



Domain : Global
Resolution : 0.5 deg.
Vertical Levels: 18

Initial	Forecast range	Time step	files
00,06, 18 UTC	0-132 hours	6 hours	23
12UTC	0-264 hours	6 hours	45

> Changed in June 2018

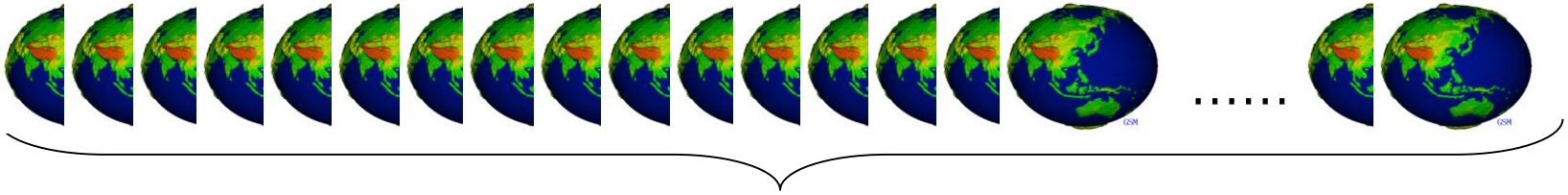
File name (for example)
Z__C_RJTD_yyyymmddhh0000_GSM_GPV_Rgl_FD0112_grib2.bin

Global Ensemble Prediction System (GEPS)for one-week forecasts on DIAS

Domain : Global
Resolution : 1.25 deg.
Vertical Levels: 5
Ensemble : 27 members

Initial	Forecast range	Time step	files
00,12 UTC	0-264 hours	6 hours	2 (0-192,198-264)

> Changed in June 2018



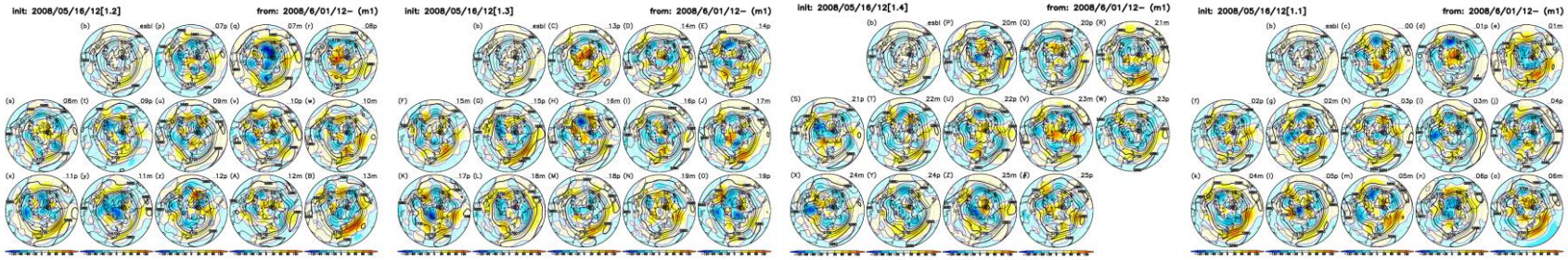
27 initial conditions are integrated by using a low-resolution version of the JMA GSM.

File name (for example):
Z__C_RJTD_20181021000000_EPSW_GPV_Rgl_FD0812-1100_grib2.bin

Global Ensemble Prediction System (GEPS)for one-month forecasts on DIAS

Domain : Global
Resolution : 2.5 deg.
Vertical Levels: 8
Ensemble : 50 members

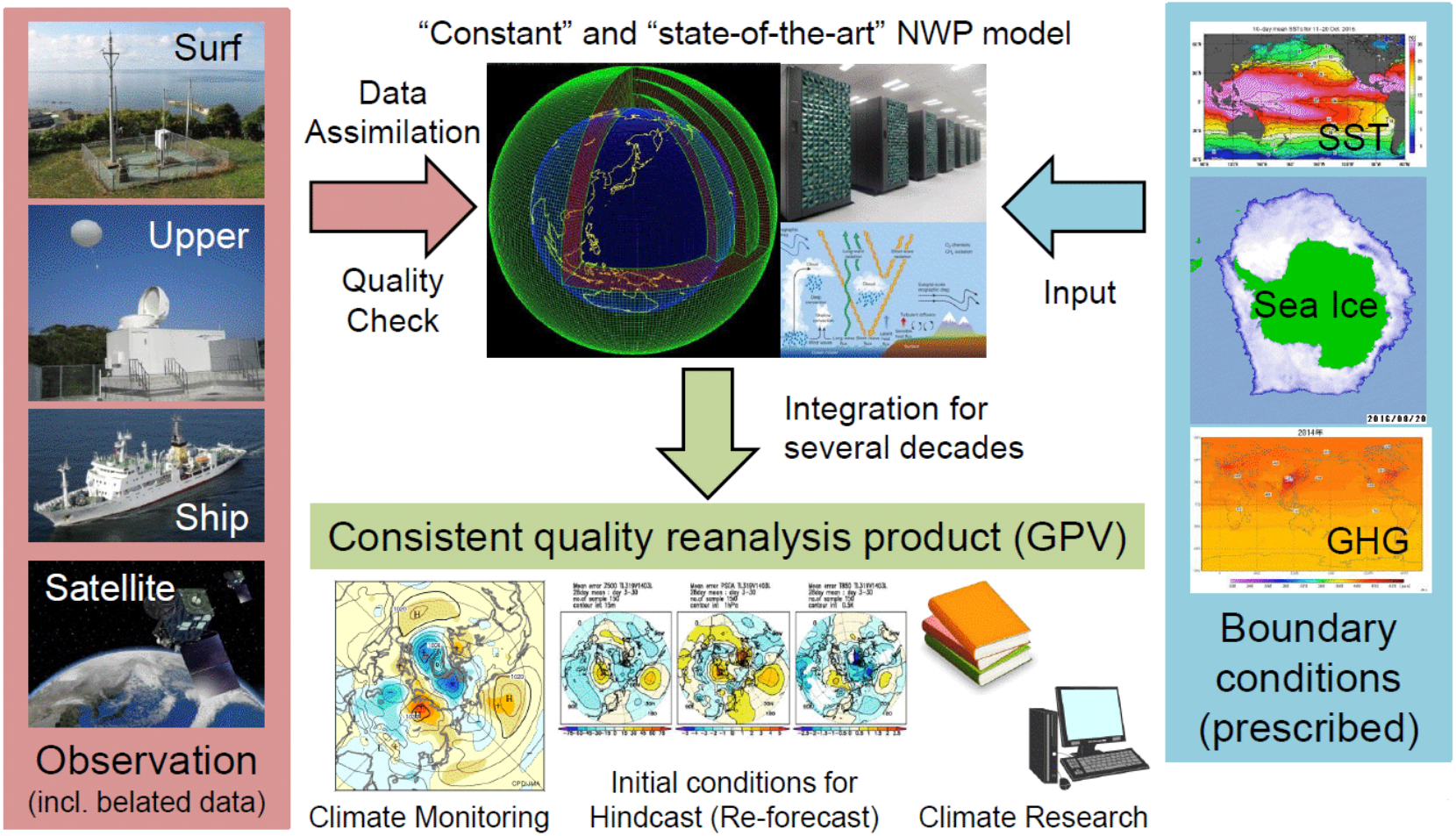
creation	Forecast range	Time step	files
Wednesday	33 days	1 day	38 (variables)
Sunday	16 days		



File name (for example):
Z__C_RJTD_20181017120000_EPS1_MGPV_Rgl_Lh2_Ptt_Emb_grib2.bin
Z__C_RJTD_20181021120000_EPS1_MGPV_Rgl_FD00-16_Lh2_Ptt_Emb_grib2.bin

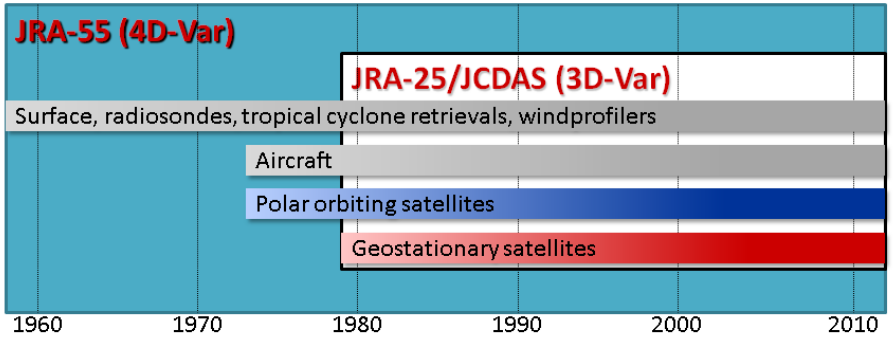
Reanalysis

"analysis of the past atmospheric conditions using a constant, state-ofthe-art NWP model and data assimilation system with the latest observation to produce a high-quality, spatially and temporally consistent dataset"



JRA-55 on DIAS

- The second JMA reanalysis (1958-2012: 55 years)
- The first comprehensive global atmospheric reanalysis that applies 4D-Var to the last half century
- Real time analysis after 2013 on going
- ～55km resolution, 60 levels



On DIAS web site:

Data access to JRA-55 (an atmospheric reanalysis) :
http://search.diasjp.net/en/dataset/JRA55

Data access to JRA-55C (an atmospheric reanalysis assimilating conventional observations only) :
http://search.diasjp.net/en/dataset/JRA55_C

Data access to JRA-55AMIP (JRA-55 AMIP-type simulation) :
http://search.diasjp.net/en/dataset/JRA55_AMIP

Other JMA products available on DIAS

- Global Wave Model
- Himawari8/9
- JMA Global Warming Projection
- Oceanic and Atmospheric Greenhouse Gases Observations on JMA Research Vessels
- JMA　Total ozone Dataset
- ……


Thank you!
Danke!
谢谢!
Merci!
Благодарю вас!
Obrigado!
ありがとうございました!

JMA 10th generation supercomputer system

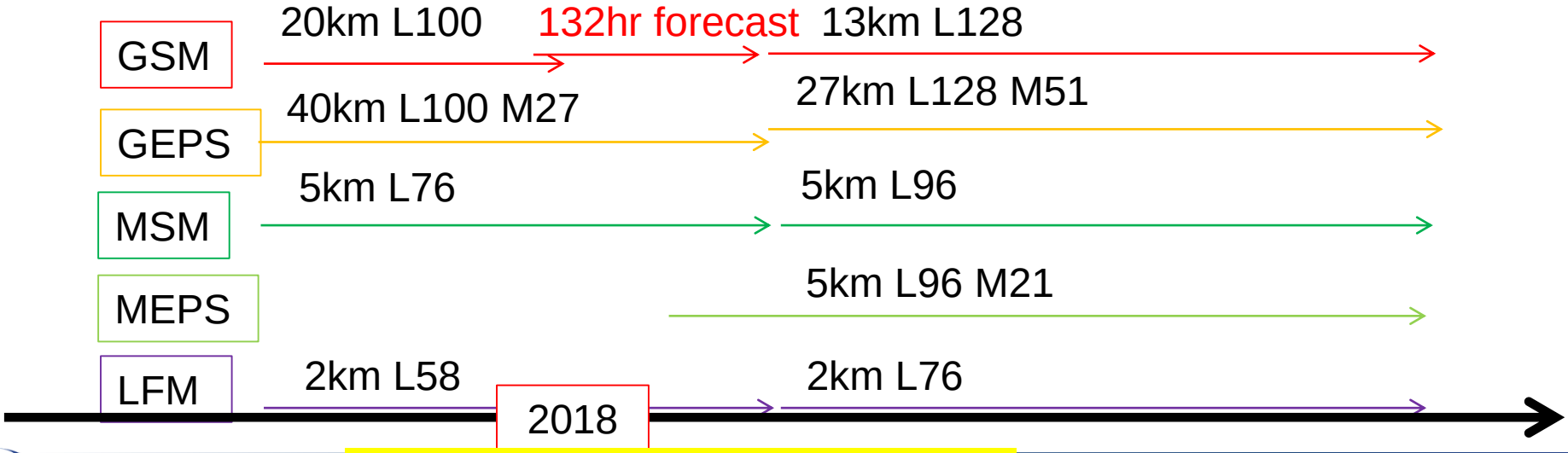
JMA began the operation of its new supercomputer system on 5 June 2018.

Effective computer capacity (in terms of meteorological calculation) was enhanced about 10 times.

25th and 26th rank at the Top 500 in June 2018

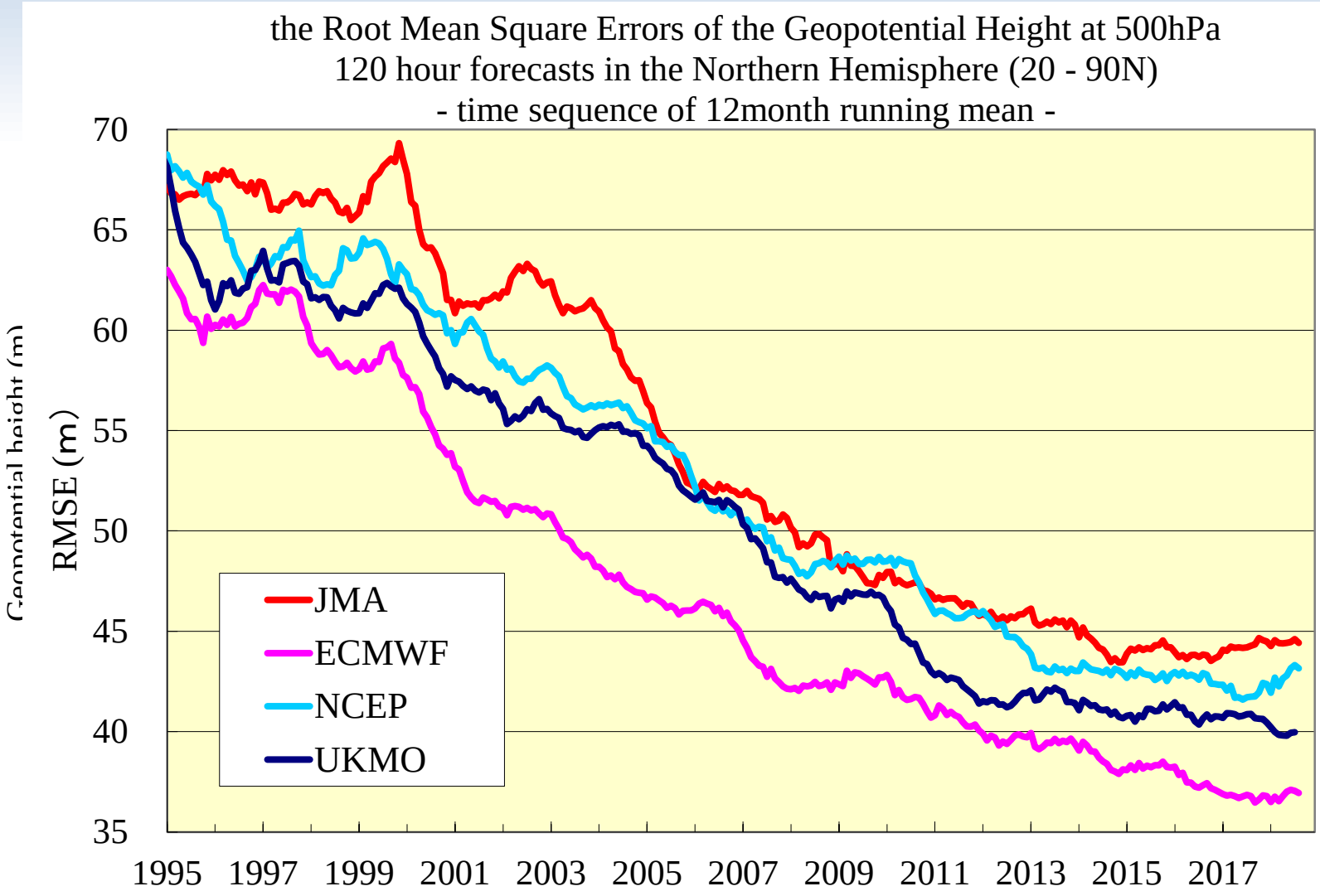
Comparison of Specifications

	Previous	New
Model	HITACHI SR16000/M1 (Vendor: Hitachi)	Cray XC50 (Vendor: Hitachi)
Theoretical Peak Performance	847 TFlops (*)	18,166 TFlops
Capacity of Main Memory	108 TBytes	528 TBytes
Capacity of Magnetic Disk	348 TBytes	10,608 TBytes



Replacement of Super Computer System (Jun 2018)

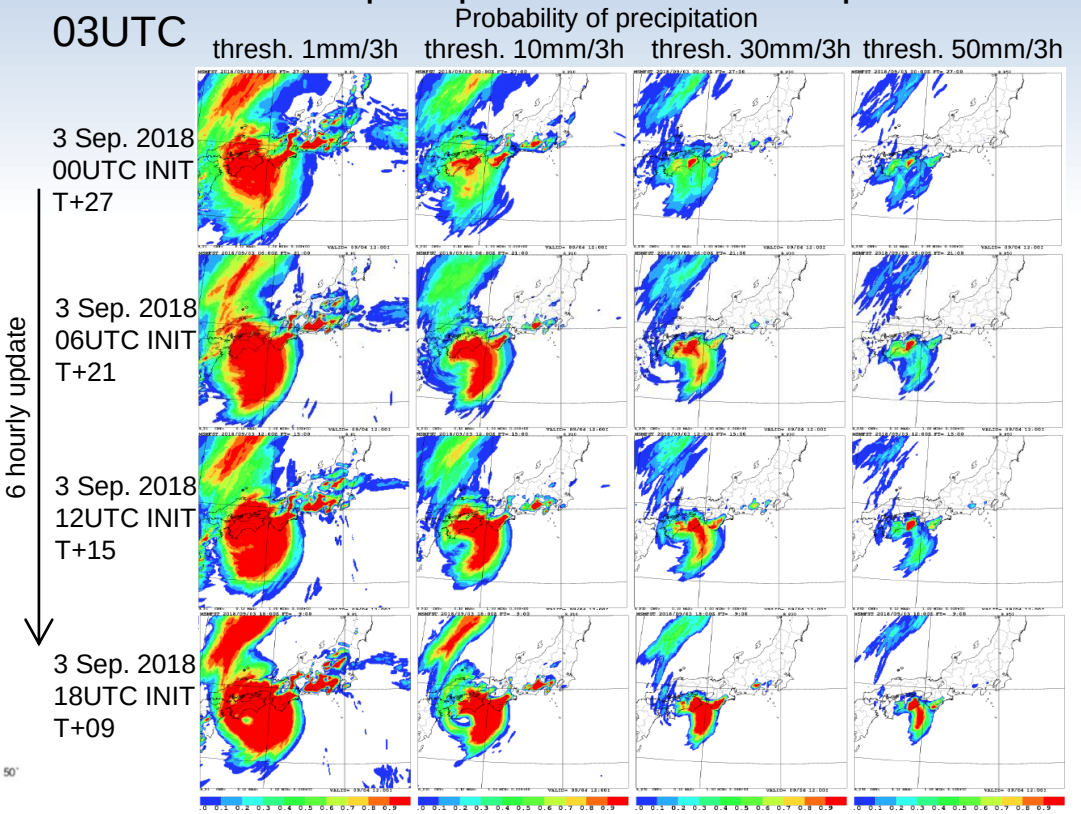
Accuracy of Global NWP model

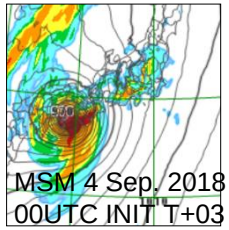


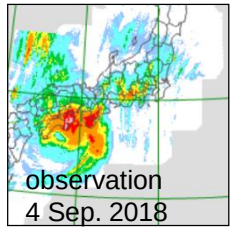
Enhancement of MEPS

- Development of MEPS, currently under trial, is in progress to provide uncertainty and probabilistic information of MSM.
- Full operation of MEPS is scheduled to start in 2019.
- Enhancement of MEPS was applied on 5 Jun. 2018.
  - ensemble size 11=>21
  - 1 run/day => 4 runs/day

3h accumulated precipitation valid at 4 Sep. 2018 03UTC



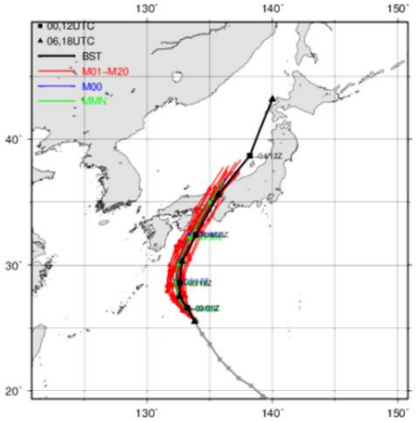




MEPS predicts regions of intense precipitation corresponding to the observations with gradually higher probabilities through updates of forecast. (The control run (MSM) gives a good forecast in this case.)

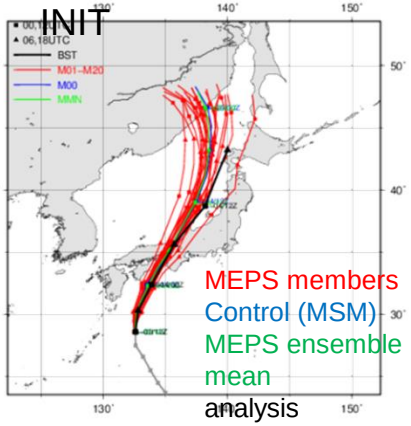
Typhoon track forecasts

2 Sep. 2018 18UTC INIT



Smaller deviation from the analysis => smaller dispersion

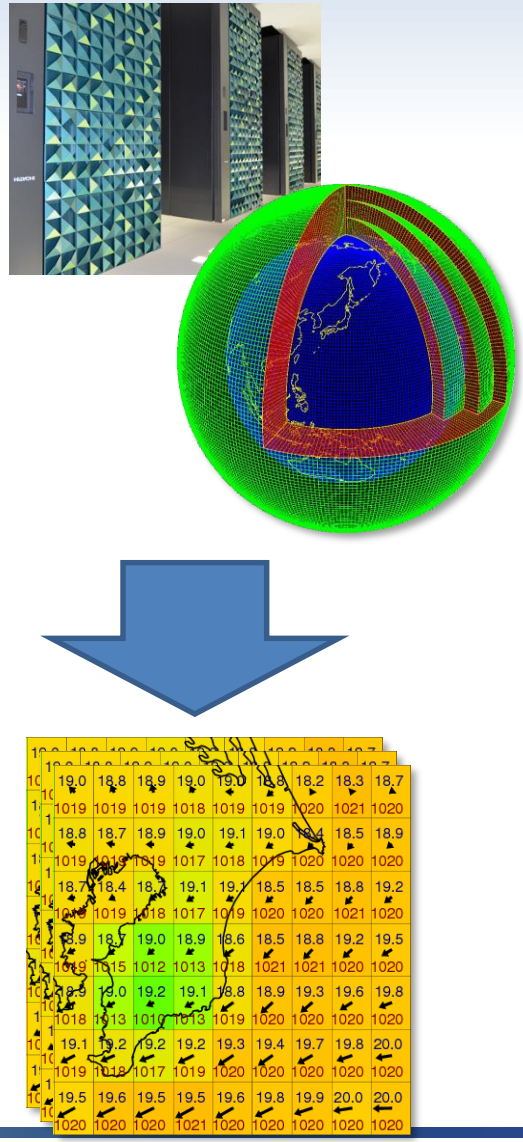
3 Sep. 2018 12UTC INIT



Larger deviation from the analysis => larger dispersion

2. Vision

- Innovation to ensure the safety and security of the people, and to realize a vibrant society
  - NWP products are fundamentals for weather and climate forecast.
  - NWP becomes a vital social infrastructure for the safety, security and wealth life.
  - JMA promotes its improvement to achieve higher accuracy to support various social service including disaster prevention directly and effectively.
  - ***NWP will be a new national common asset!***



3. Priority objectives

- Torrential Rain Disaster Prevention
  - Improve probability forecast for genesis and stagnation of torrential precipitation
- Typhoon Disaster Prevention
  - Improvement of forecast accuracy for torrential rain caused by typhoon and synoptic scale front
- Contribution to Socio-economic activities
  - Improvement of weather and climate forecast up to 6 months.
- Adaptation to Global Warming
  - Improvement to higher resolution of global warming information based on common scenario