



Hands-on Session: GRIMs-RMP

Orientation

Myung-Seo Koo

Korea Institute of
Atmospheric Prediction Systems
(KIAPS)



Schedule for hands-on session

Tuesday, 7 July 2015

- 14:00 – 15:30
- 16:00 – 17:30

orientation/Introduction
model structure/Environmental setup

Wednesday, 8 July 2015

- 14:00 – 15:30
- 16:00 – 17:30

Tutorial(1): SVN download/code compile
Tutorial(2): pilot run

Thursday, 9 July 2015

- 14:00 – 15:30
- 16:00 – 17:30

Tutorial(3): configuration (source code, run script)
Tutorial(4): simulations of RMP and RSIM

Friday, 10 July 2015

- 09:00 – 10:30
- 11:00 – 13:00
- 14:00 – 15:30
- 16:00 – 17:30

Tutorial(5): check and repetition of simulations
Tutorial(6): post-process/evaluation
Tutorial(7): evaluation (own simulation)
Tutorial(8): presentation

Saturday, 11 July 2015

- 09:00 – 10:30
- 11:00 – 13:00

Presentation by participants (1)
Presentation by participants (2)





Scope of this hands-on session

- It's okay **not** to know **everything**.
- The **only thing** you should learn **in this tutorial** is **how to run** the GRIMs model, especially **RMP**.
- This tutorial is appropriate **for beginners**, so please be patient even though it is too easy for you.

Ms. Yeomin JEONG (APCC)



Mr. Changmook LIM (APCC)



Ms. Hyun-Hee PARK (Kongju Univ.,)



Account	Users (21 people from 12 nations)		
tuser01	Myung-Seo Koo		
tuser02	Claudia Cruz Silva	Antonios Mekhiel	Sourabh Shrivastava
tuser03	Ferdika Amsal	Jose Rizal	Wido Hanggoro
tuser04	Yahya Darmawan	Iman Babaeian	Mat Kamaruzaman
tuser05	Davaadorj Amarsaikhan	Enkhchineg Jantsan	Munkhtsetseg Erdenebayar
tuser06	Eniola Ajani Olaniyan	Farah Ikram	Sajjad Haider
tuser07	Peter Tuju	Winai Chaowiwat	Diep Le Duy
tuser08	Luu Nhat Linh	Minh Ha Truong	Pham Thi Cham



Greeting



Hands-on Session: GRIMs-RMP

Introduction

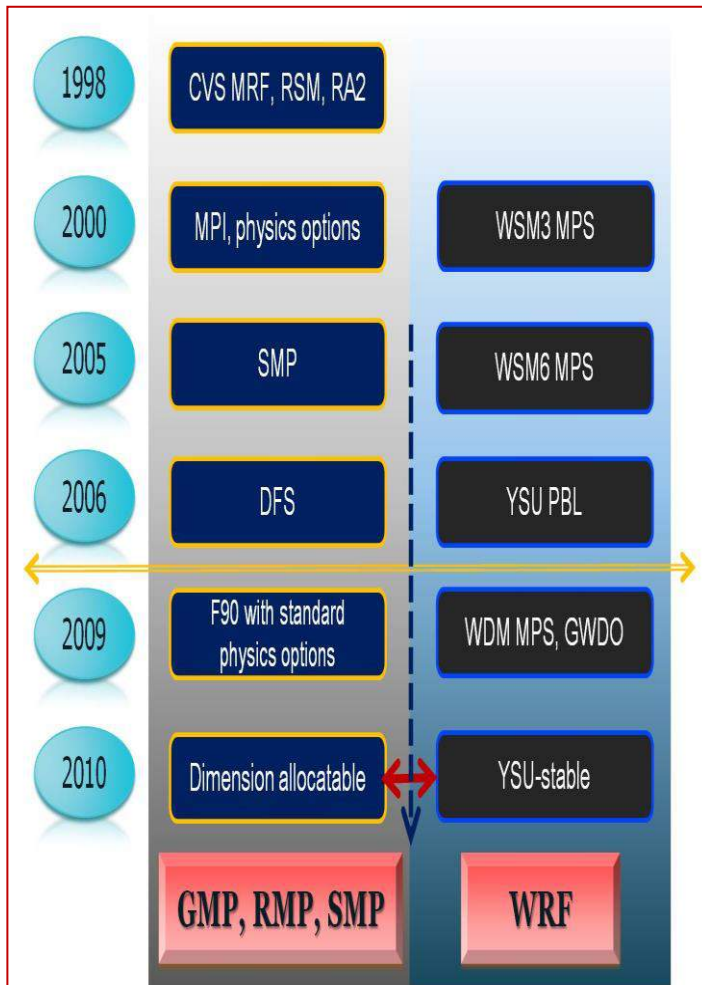
Myung-Seo Koo

Korea Institute of
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(KIAPS)



Global/Regional Integrated Model system (GRIMs)

- The **Global/Regional Integrated Model system (GRIMs; Hong et al. 2013, <http://grims-model.org>)** is an **atmospheric model system** that has been created for numerical weather prediction, seasonal simulations, and climate research projects, from global to regional scales.
- The GRIMs not only keeps the advantages of the **predictability of the operational model** but also includes the **advanced dynamics and physics schemes that have been developed in research communities, i.e., WRF model.**
- The GRIMs is greatly flexible with **multi-platforms from a personal computer to super-computers**, with either a thread mode or a message-passing interface (MPI) mode.
- Within Fortran 90 programs with C-preprocessor source codes, a **global model program (GMP)**, a **regional model program (RMP)**, and **single-column model program (SMP)** can be selected.
- In addition, the MOM3 and ROMS for **global and regional ocean/atmospheric model programs (GOP and ROP)**, respectively, were combined for climate prediction and mechanism studies.



- The GRIMs is based on the dynamic features and physics parameterization of the **NCEP seasonal Forecast Model, CVS MRF** (Kanamitsu et al. 2002, BAMS).

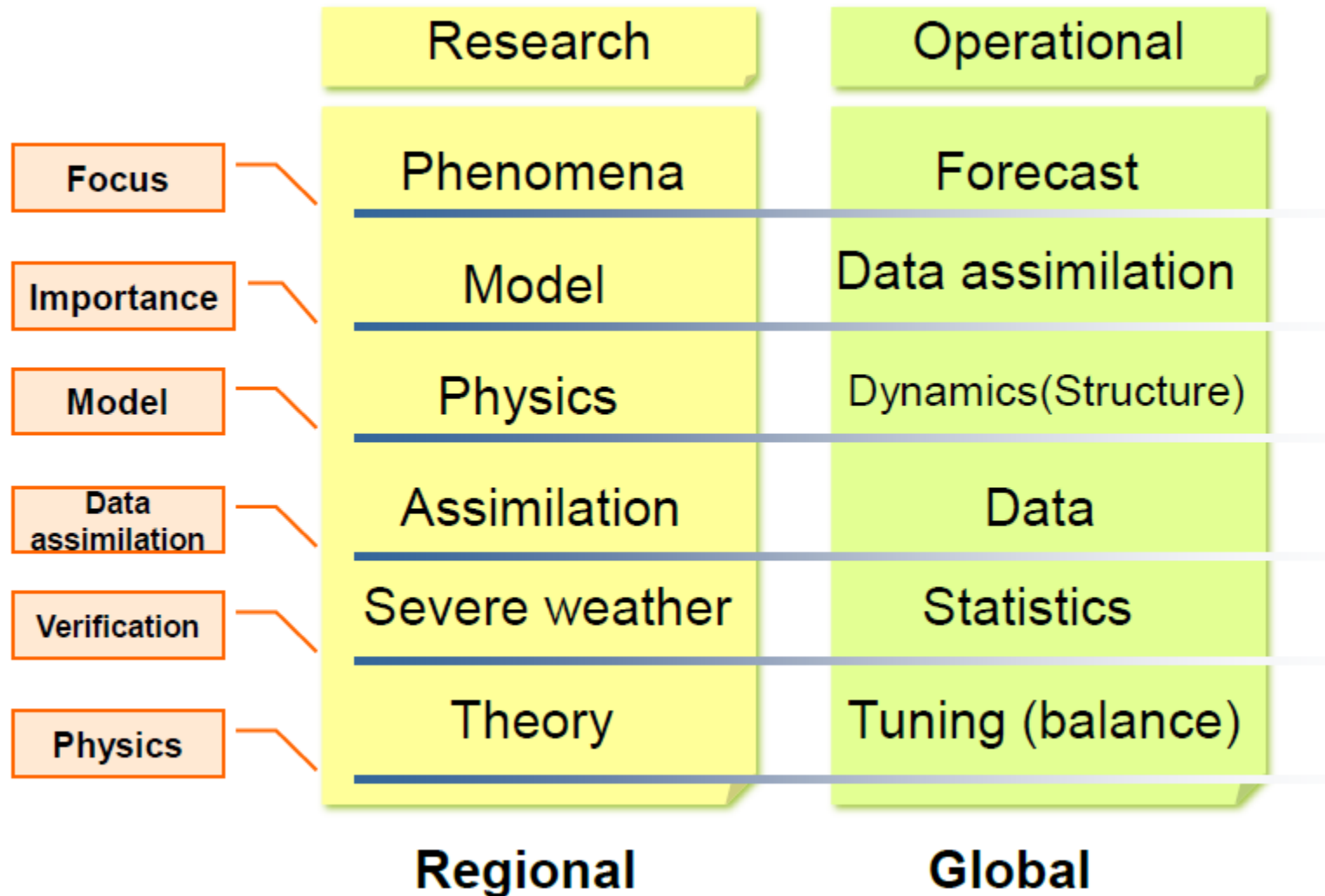
➔ Keeps the advantages of the predictability of the operational model

- Since 2000, the Numerical Modeling Laboratory in Yonsei University has developed **the advanced dynamic core and physical processes**.

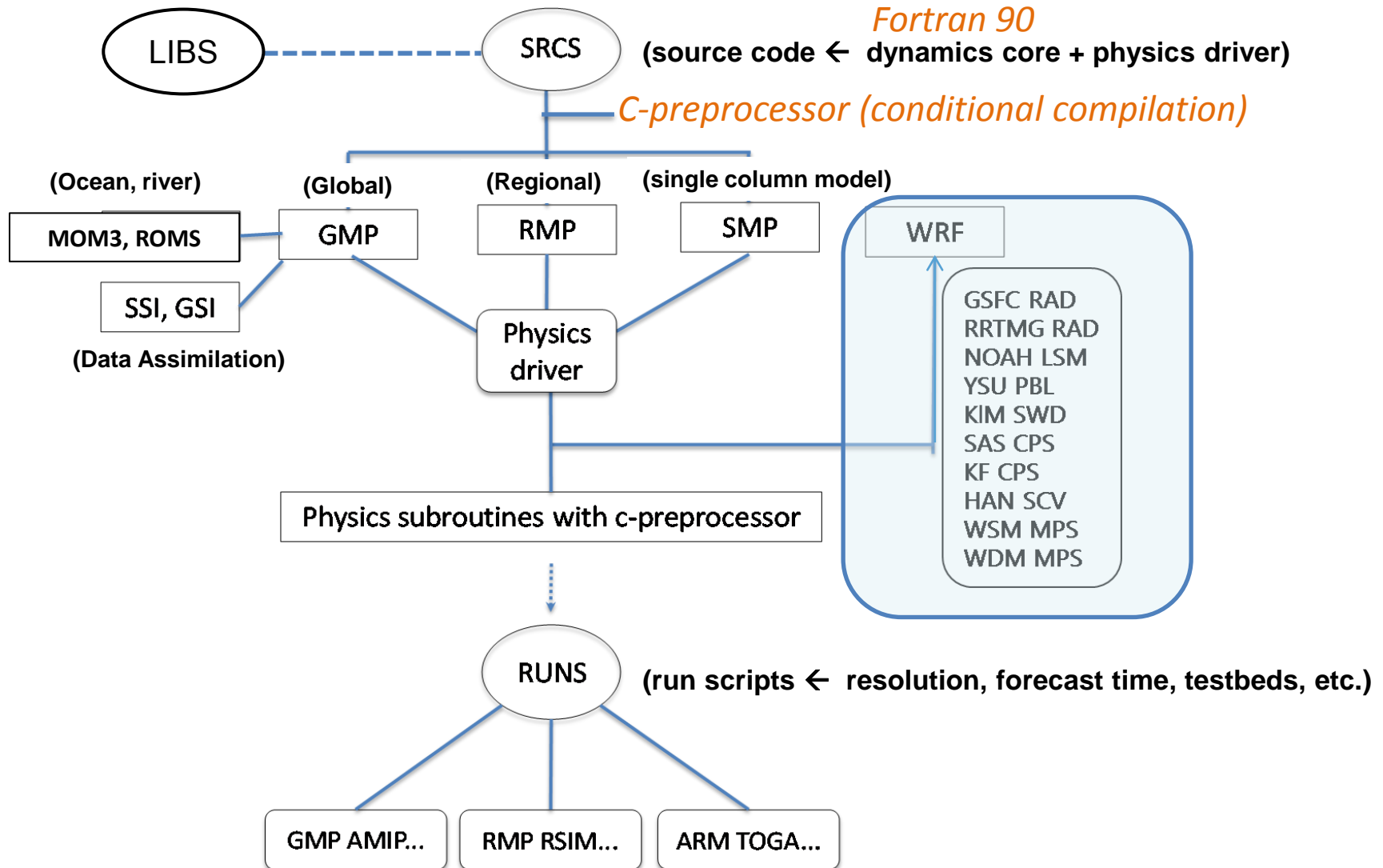
➔ Takes on a research model

- Now, the GRIMs has been utilized as a **reference model** for developing a new global operational model in the KIAPS.

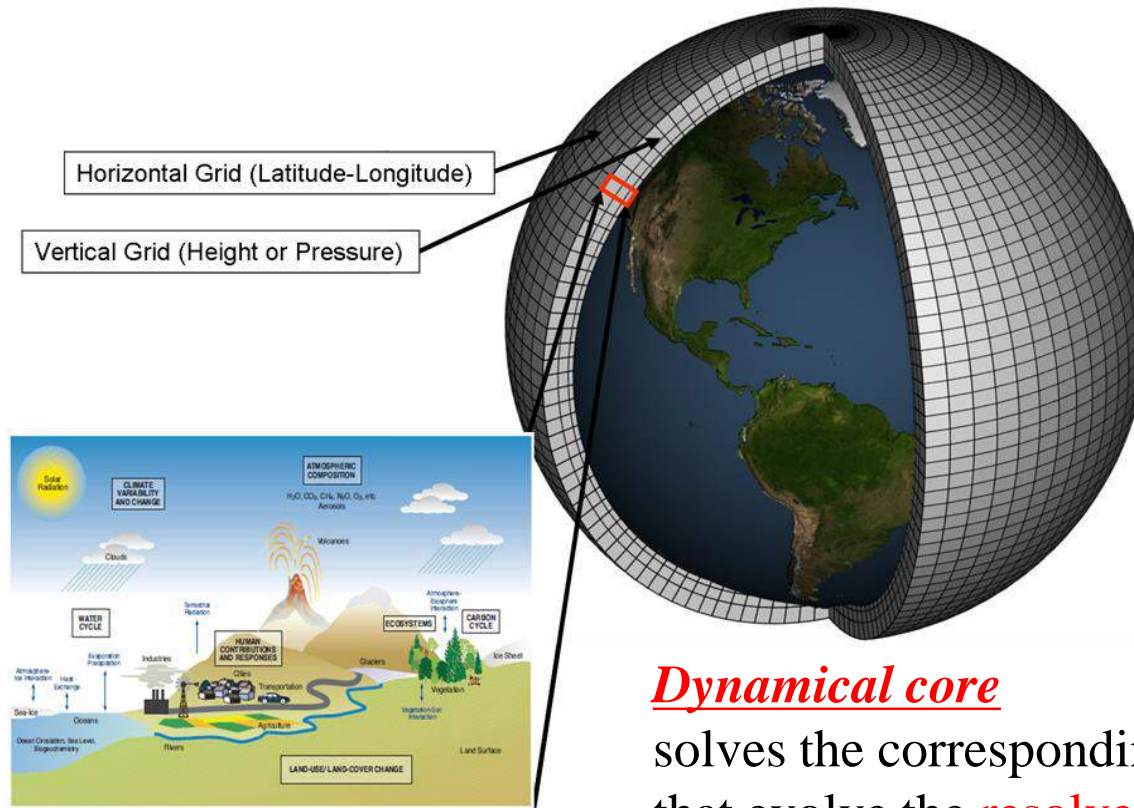
Different point of views



GRIMs structure (LIBS+SRCS+RUNS)



Schematic for atmospheric model



Dynamical core

solves the corresponding algorithms that evolve the **resolved** scales of motion.

Physical parameterization

provides estimates of the grid-scale effect of processes that take places at **unresolved** subgrid-scales.

$$\frac{\partial U}{\partial t} = -\frac{1}{a \cos^2 q} \frac{\partial}{\partial t} \left[U \frac{\partial U}{\partial \lambda} + V \cos q \frac{\partial U}{\partial \phi} \right] - \hat{s} \frac{\partial U}{\partial s} + fV - \frac{1}{a} \frac{\partial}{\partial \lambda} \left[\frac{F}{\cos q} + R_d T_v \frac{\partial \ln p_s}{\partial \lambda} \right] + P_U + K_U$$

$$\frac{\partial V}{\partial t} = -\frac{1}{a \cos^2 q} \frac{\partial}{\partial t} \left[U \frac{\partial V}{\partial \lambda} + V \cos q \frac{\partial V}{\partial \phi} + \sin q (U^2 + V^2) \right] - \hat{s} \frac{\partial V}{\partial s} - fU - \frac{\cos q}{a} \frac{\partial}{\partial \phi} \left[\frac{F}{\cos q} + R_d T_v \frac{\partial \ln p_s}{\partial \phi} \right] + P_V + K_V$$

$$\frac{\partial T_v}{\partial t} = -\frac{1}{a \cos^2 q} \left[U \frac{\partial T_v}{\partial \lambda} + V \cos q \frac{\partial T_v}{\partial \phi} \right] - \hat{s} \frac{\partial T_v}{\partial s} + kT_v \left(\frac{\partial \ln p_s}{\partial t} + \vec{v} \cdot \vec{\nabla} \ln p_s \right) + \frac{H}{C_p} + P_T + K_T$$

$$\frac{\partial q}{\partial t} = -\frac{1}{a \cos^2 q} \frac{\partial}{\partial t} \left[U \frac{\partial q}{\partial \lambda} + V \cos q \frac{\partial q}{\partial \phi} \right] - \hat{s} \frac{\partial q}{\partial s} + P_q + K_q$$

$$\frac{\partial \ln p_s}{\partial t} = -\vec{v} \cdot \vec{\nabla} \ln p_s - D - \frac{\partial \hat{s}}{\partial s}$$

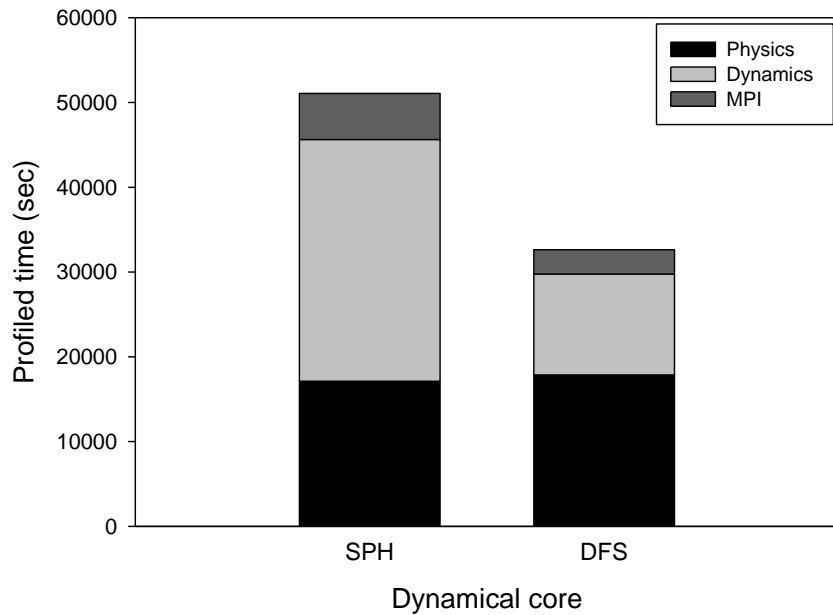


GRIMs global dynamical cores

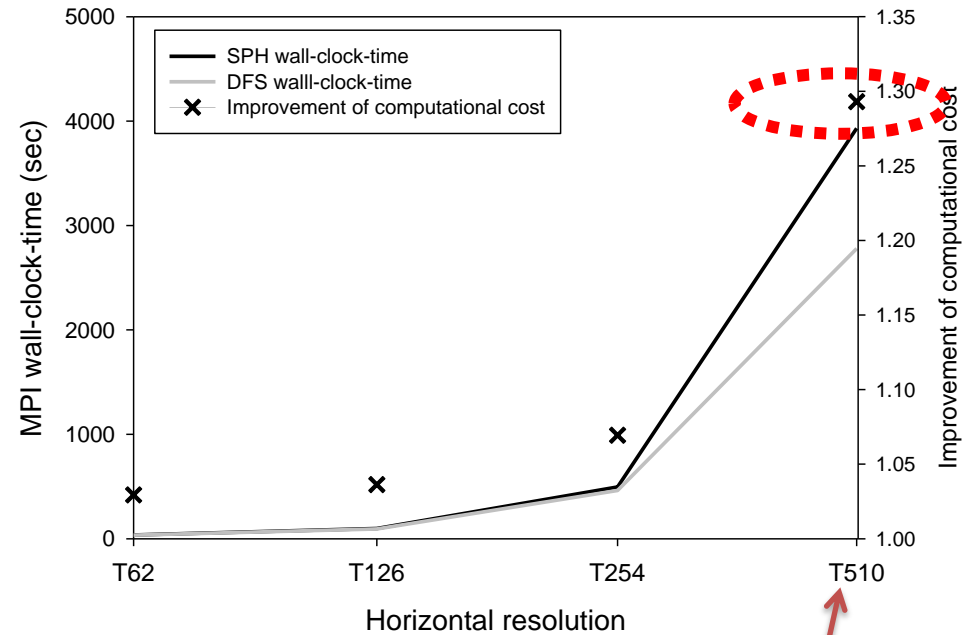
Spectral dynamics	SPH (Juang 2005; Kanamitsu et al. 2002)	DFS (Cheong 2006; Park et al. 2013)
Horizontal discretization	Spherical harmonics	Double Fourier series
Vertical discretization	Sigma (Lorenz) or hybrid (sigma-pressure; Lorenz)	
Prognostic variables	Horizontal winds	Divergence/Vorticity
	Virtual temperature	Perturb. of virtual temp.
	Specific humidity	
Hydrostatic or non-hydrostatic	Hydrostatic	
Grid system	Latitude-Longitude	
Horizontal diffusion	4 th order	
Time integration	Semi-Implicit (leap-prog)	
Moisture advection	Spectral Semi-Lagrangian	

GRIMs global dynamical cores: SPH versus DFS

Profiling analysis (T254, 256 CPUs)



MPI-wall-clock-time



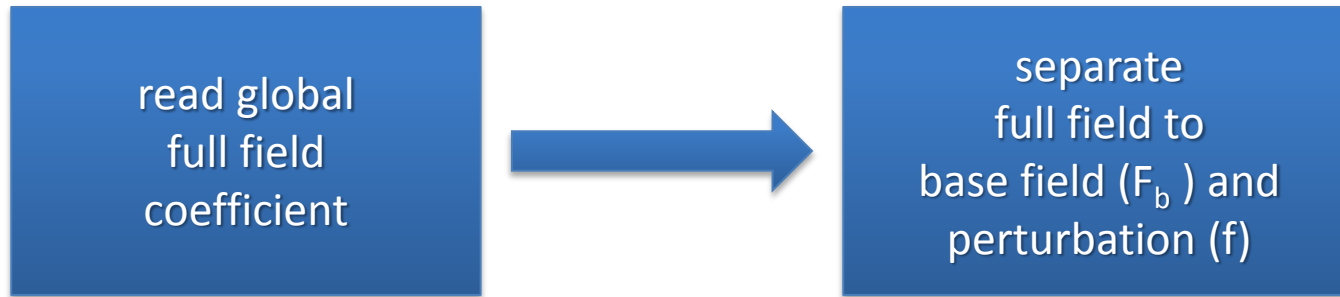
~30% computational efficiency

GRIMs regional dynamical core (perturbation model)

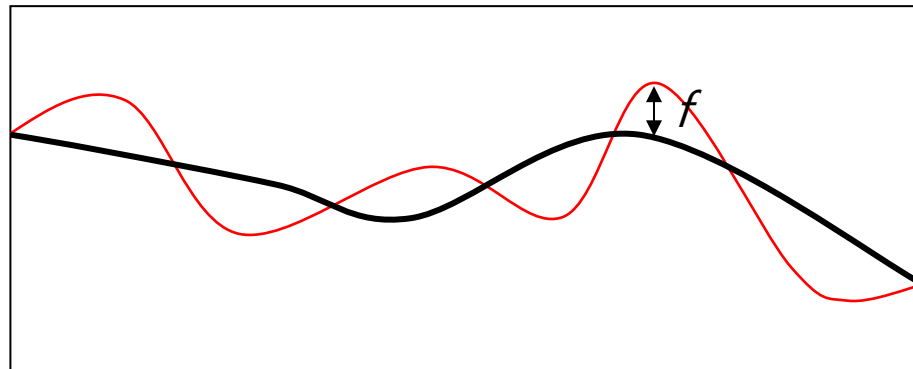
::: GRIMs Regional Model Program (RMP) has the same model physics and model structure as Global Model Program (GMP).

::: GRIMs RMP uses spectral transformation only for perturbation.

→ good for long-range climate simulations



$$F = F_b + f$$



(RSM, Juang and Kanamitsu 1994)

— Base field F_b
— perturbation f

GRIMs physics packages

Physical Parameterization	V1.0 (NCEP RA2)	V2.0 (NCEP CFS)	V3.0 (GRIMs Development)	V3.1 (ROKAF operation)	V3.2 (V3.2.3) (Current default)
Radiation	SW: 1-albedo LW: GFDL	SW: 4-albedo (GSFC) (Chou et al., 1999) LW (Chou and Lee, 2005, Chou and Suarez, 1999)			
Surface	M-O similarity (Hong and Pan, 1996)	+ ZOT and Vsfc (Seol and Hong, 2006)	+ WRF OML (Pollard) (Kim and Hong, 2010) + Diurnal SST (Zeng and Beljaars, 2005)	+ OML climatology value (Kim and Hong, 2010)	
LSM	OSU1 (Mahrt and Pan, 1984)	OSU2 (Kang and Hong, 2008)	NOAH (Seol et al., 2012; Chen and Dudhia, 2001)		
PBL	MRF (Hong and Pan, 1996)	YSU (Noh et al, 2003; Hong et al., 2006)	YSU + stable BL (Hong, 2010)		
Orographic gravity wave drag	Alpert et al. (1988)		Hong et al. (2008), Kim and Arakawa (1995)		
Convective gravity wave drag	None		Jeon et al. (2010), Chun and Baik (1998)		
Deep convection	SAS (Hong and Pan, 1998; Park and Hong, 2007)	RAS (Moorthi and Suarez, 1992)	SAS + CMT (Hong and Pan, 1998; Byun and Hong, 2007)		
Shallow convection	TDK (Tiedtke, 1988)			GRIMs SCV (Hong et al., 2012)	
Microphysics	WSM1 (Hong et al., 1998)				
Cloudiness	Implicit (Campana et al., 1994)		Implicit (Ham et al., 2009; Hong et al., 1998)		
Vertical coordinate	Sigma			Hybrid (Koo and Hong, 2013)	
Moisture advection	Spectral				Semi-Lagrangian
Chemistry	Diagnostic			Prognostic ozone	

GRIMs (phys_pbl_ysu.F90) → WRF (module_bl_ysu.F)

```

!
!
#define WRF
#undef EXPLICIT
#undef oned
#undef debug
!
#define LEMONE
!
#ifndef WRF
#include <define.h>
#endif
#ifdef WRF
#undef clean
#endif
!
#define STABLE_BL
#define PFAC_Q 2.0
!
#define XKZMIN 0.01
#define new_pbl
#undef rlamdz
!
#define nontq
#define nonuv
#define brcr_05
#define t_excess

```

```

!
!
!
!
!
!
module module_bl_ysu
contains
!
!
!-----
!
subroutine ysu(u3d,v3d,th3d,t3d,qv3d,qc3d,
  rublten,rvblten,rthblten,
  rqvblten,rqcbkten,rqiblten,flag_qi,
  cp,g,rovcp,rd,rovg,ep1,ep2,karman,
  dz8w,psfc,
  znu,znw,mut,p_top,
  znt,ust,hpbl,psim,psih,
  xland,hfx,qfx,gz1oz0,wspd,br,
  dt,kpbl2d,
  exch_h,
  u10,v10,
  ids,ide, jds,jde, kds,kde,
  ims,ime, jms,jme, kms,kme,
  its,ite, jts,jte, kts,kte,

```



GRIMs evaluation (Test-beds)

Resolution: grid size from 200 m to T62 (200 km)

Model: GMP(SPH, DFS), GOP(GMP+MOM3), RMP, and ROP (RMP+ROMS)

Single column Model : Direct impact of the new physics

TOGA COARE, ARM, etc.

Regional NWP : Impact on daily forecast

14-15 July 2001, 13-15 July 2006 heavy rainfall

Regional climate : RCM with reanalysis boundary condition

Asian monsoon climate, 30-yr climatology

Global NWP : Heavy rainfall events – initial impacts

Cold and warm start runs for January 2010, August 2010

Seasonal simulation : Stability of the scheme, tropical precipitation

1996, 1997, 1999 summer and winter , 30-yr AMIP run



Model applications with GRIMs



Global Model Program (GMP): Short-range forecast

❖ Precipitation (mm/6 hrs) : Resolution sensitivity

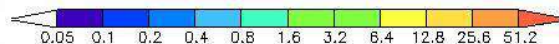
T62L64 (~200 km)

T126L64 (~100 km)

TMPA
(OBS, ~30 km)

T254L64 (~50km)

T510L64 (~25km)

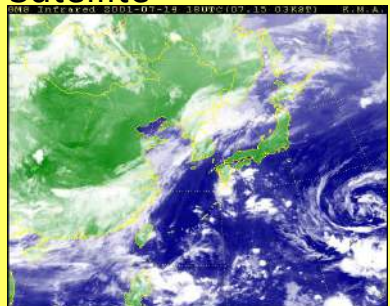


Global Model Program (GMP): Case study for heavy rainfall

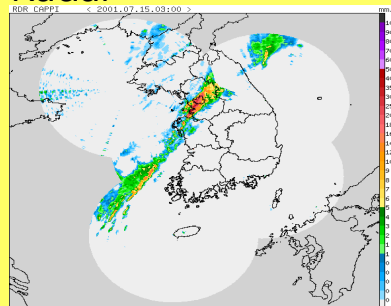
06 UTC 14 – 00 UTC 15 July 2001

OBS
(18 UTC 14)

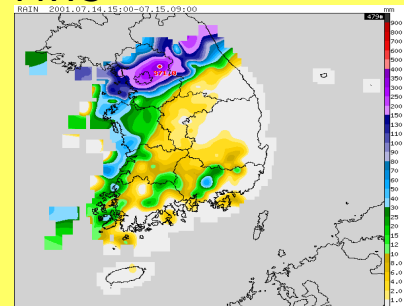
Satellite



Radar

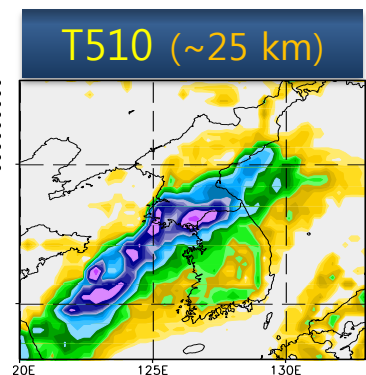
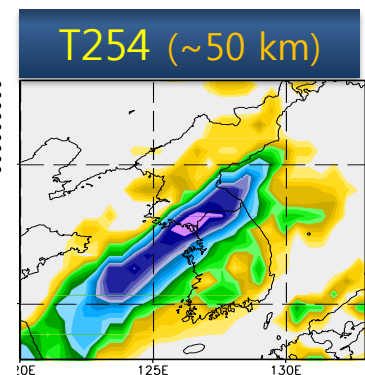
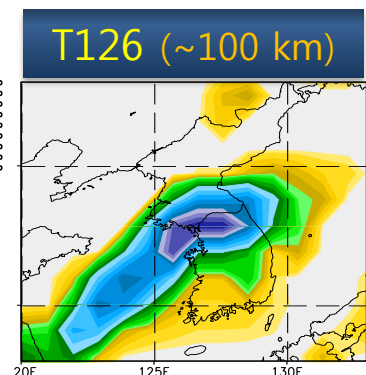
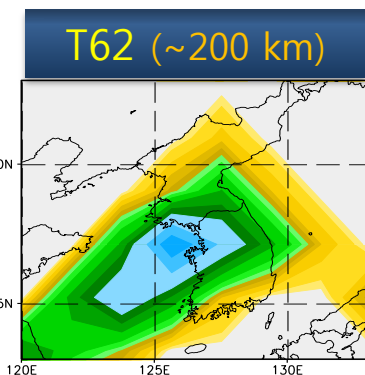


AWS

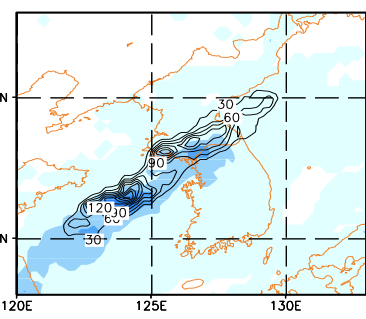
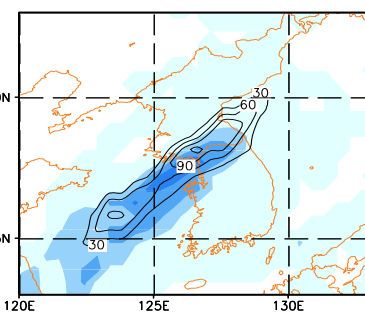
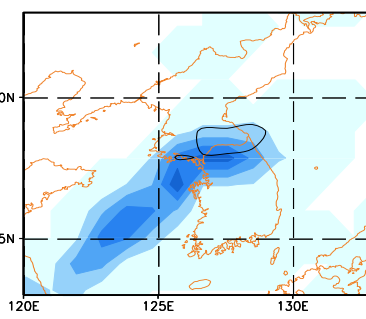
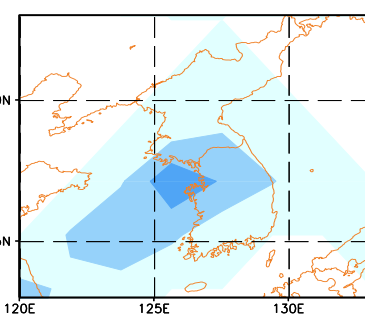


❖ Simulated precipitation with different resolutions (mm/18h)

Accumulated
surface
precipitation



Accumulated
explicit/implicit
precipitation

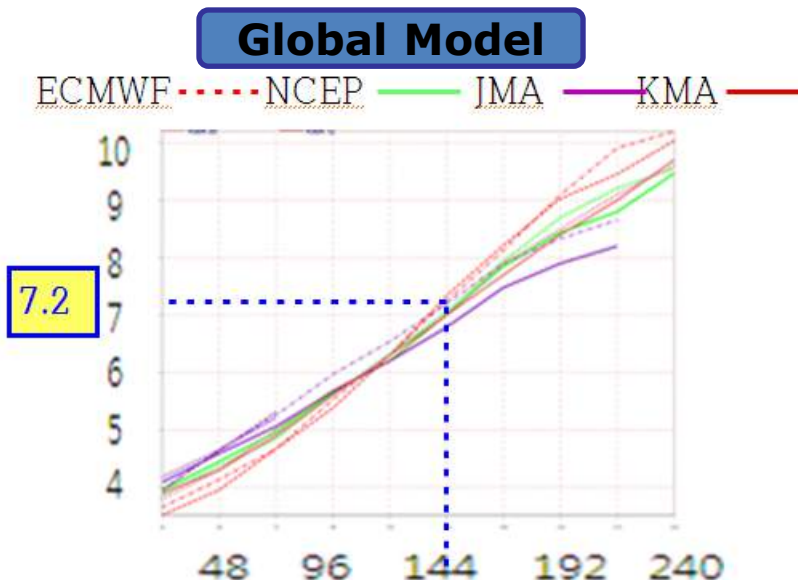
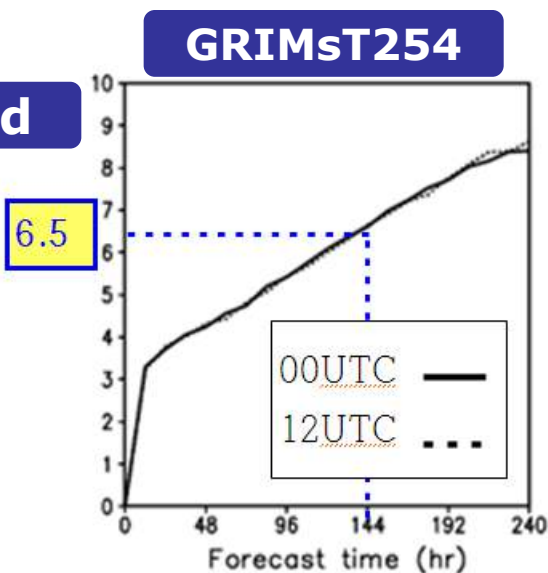


* explicit (contour)
* implicit (shaded)

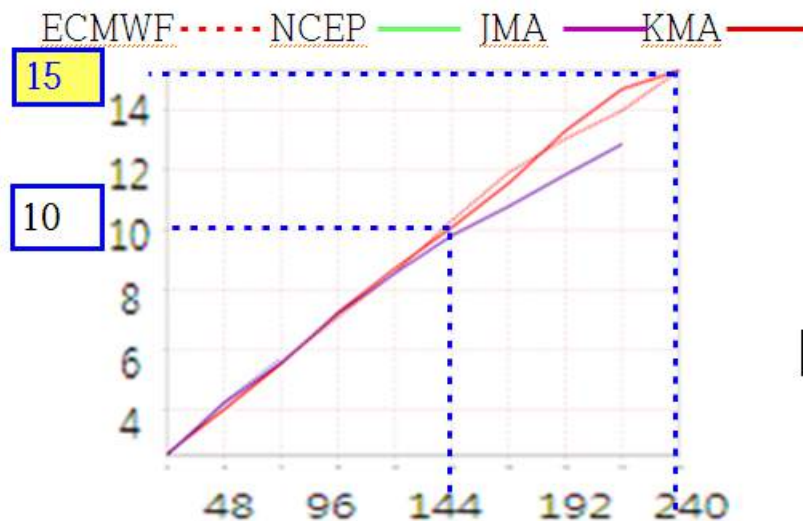
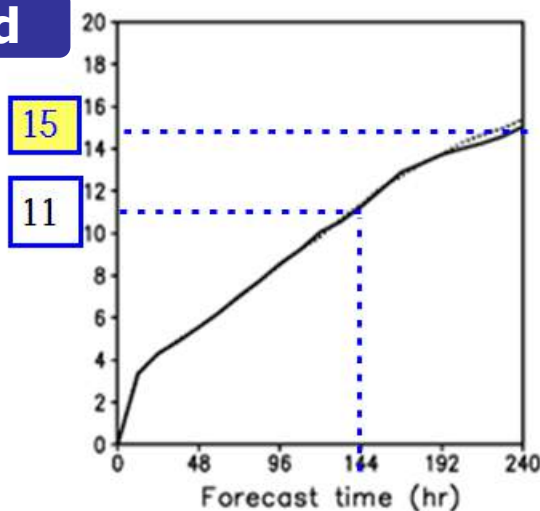
Global Model Program (GMP): Medium-range forecast

- RMSE

850hPa Wind

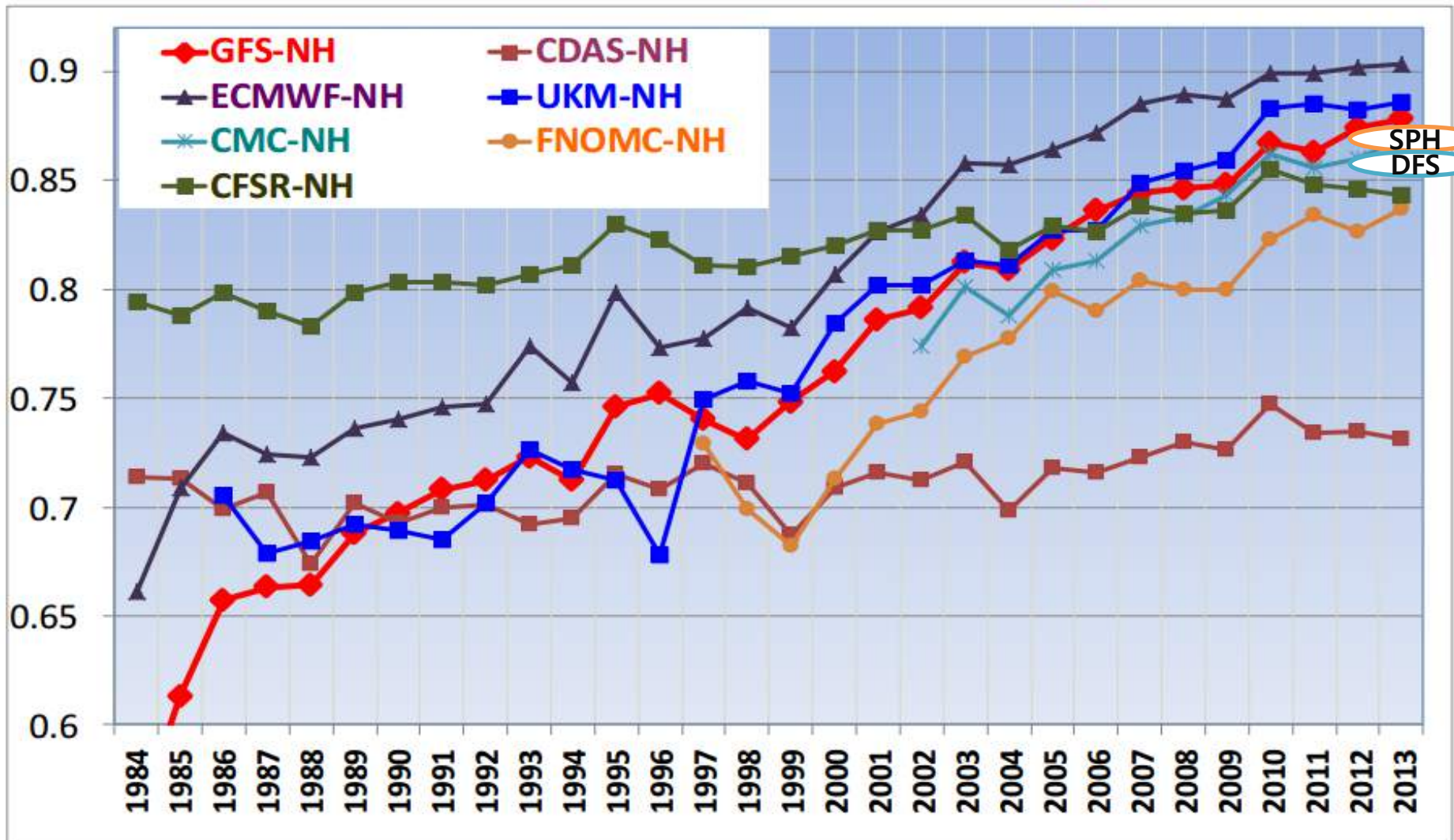


500hPa Wind



Comparison of skill score

Annual Mean NH 500hPa HGT Day-5 AC



Global Model Program (GMP): AMIP climatology (T62, 1979-2008 JJA)

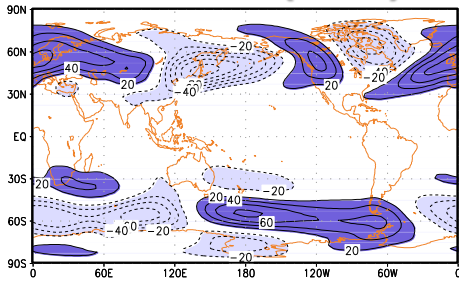
❖ 500 hPa Z Standing eddies

Pattern Correlation		
SPH_V1	SPH_V3	DFS_V3
0.89	0.93	0.91

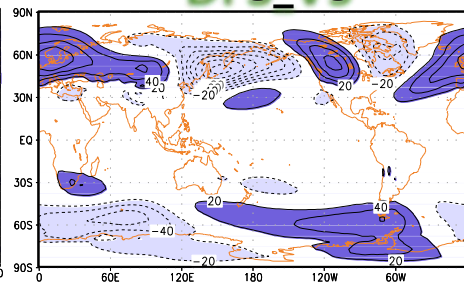
❖ Precipitation (mm/mon)

	SPH_V1	SPH_V3	DFS_V3
MEAN (mm/mon)	105.64	95.57	89.10
Pattern Correlation	0.84	0.86	0.75

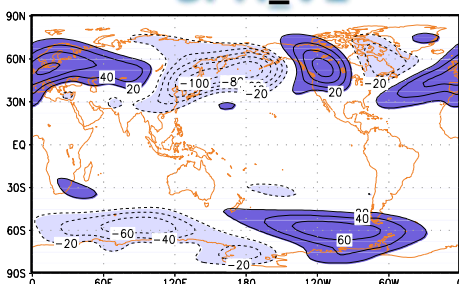
RA2 (OBS)



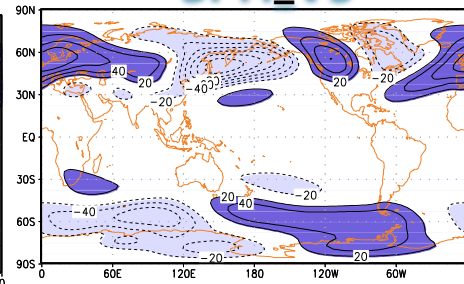
DFS_V3



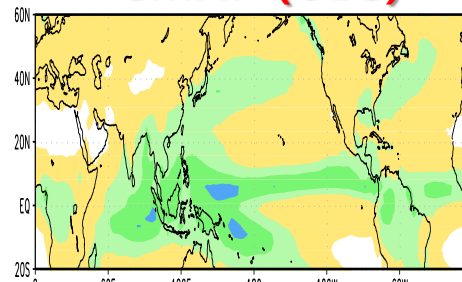
SPH_V1



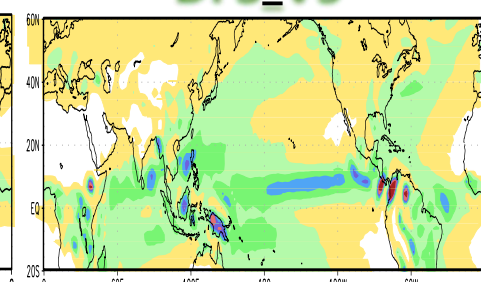
SPH_V3



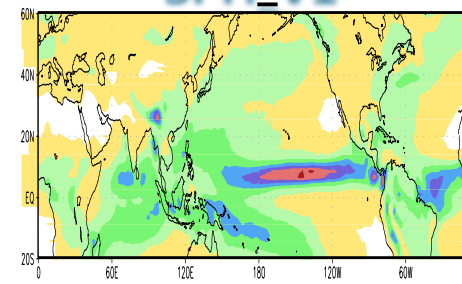
CMAP (OBS)



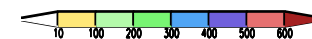
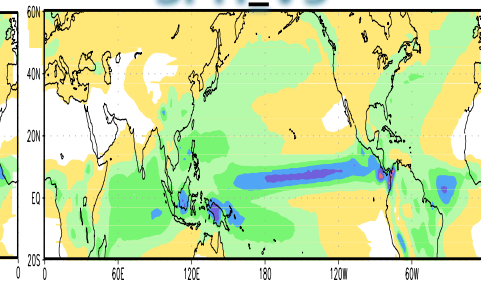
DFS_V3



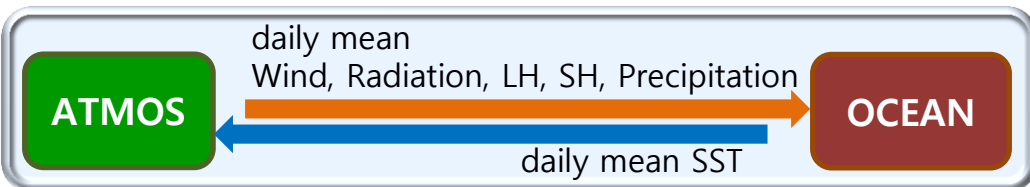
SPH_V1



SPH_V3

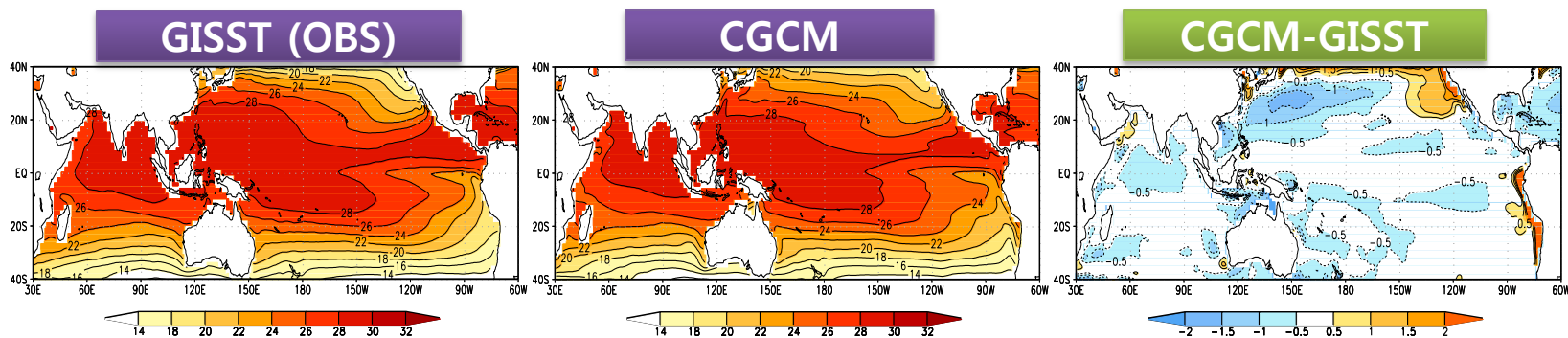


Global Ocean Program (GOP): GMP+MOM3 (Coupled Climate)



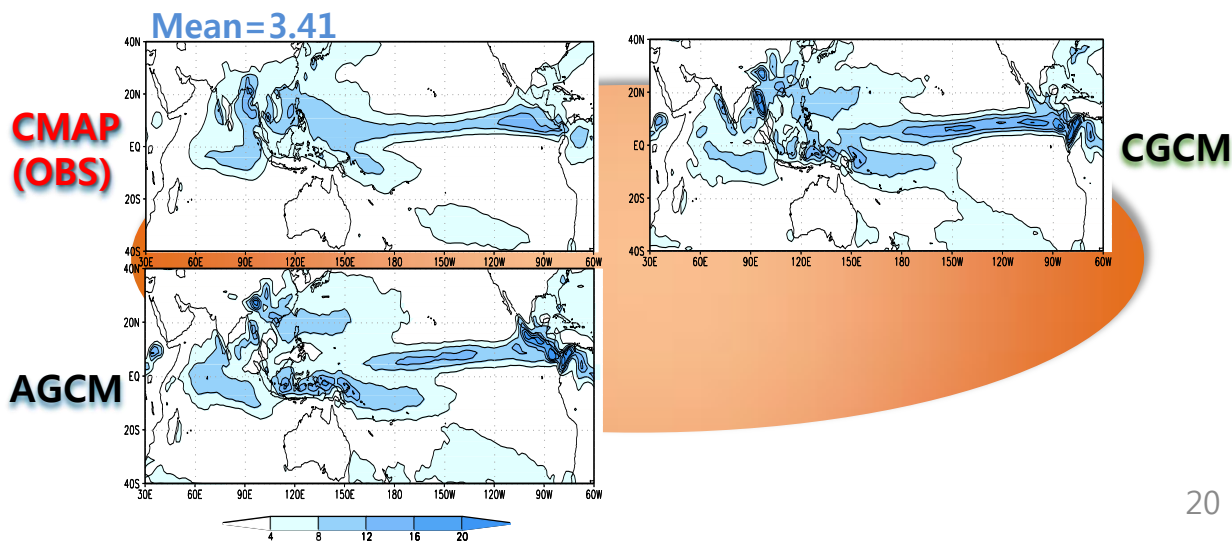
Exp.	Descriptions
AGCM	GRIMS GMP
CGCM	GRIMS GMP + MOM3 (daily coupled)

❖ SST (°C)



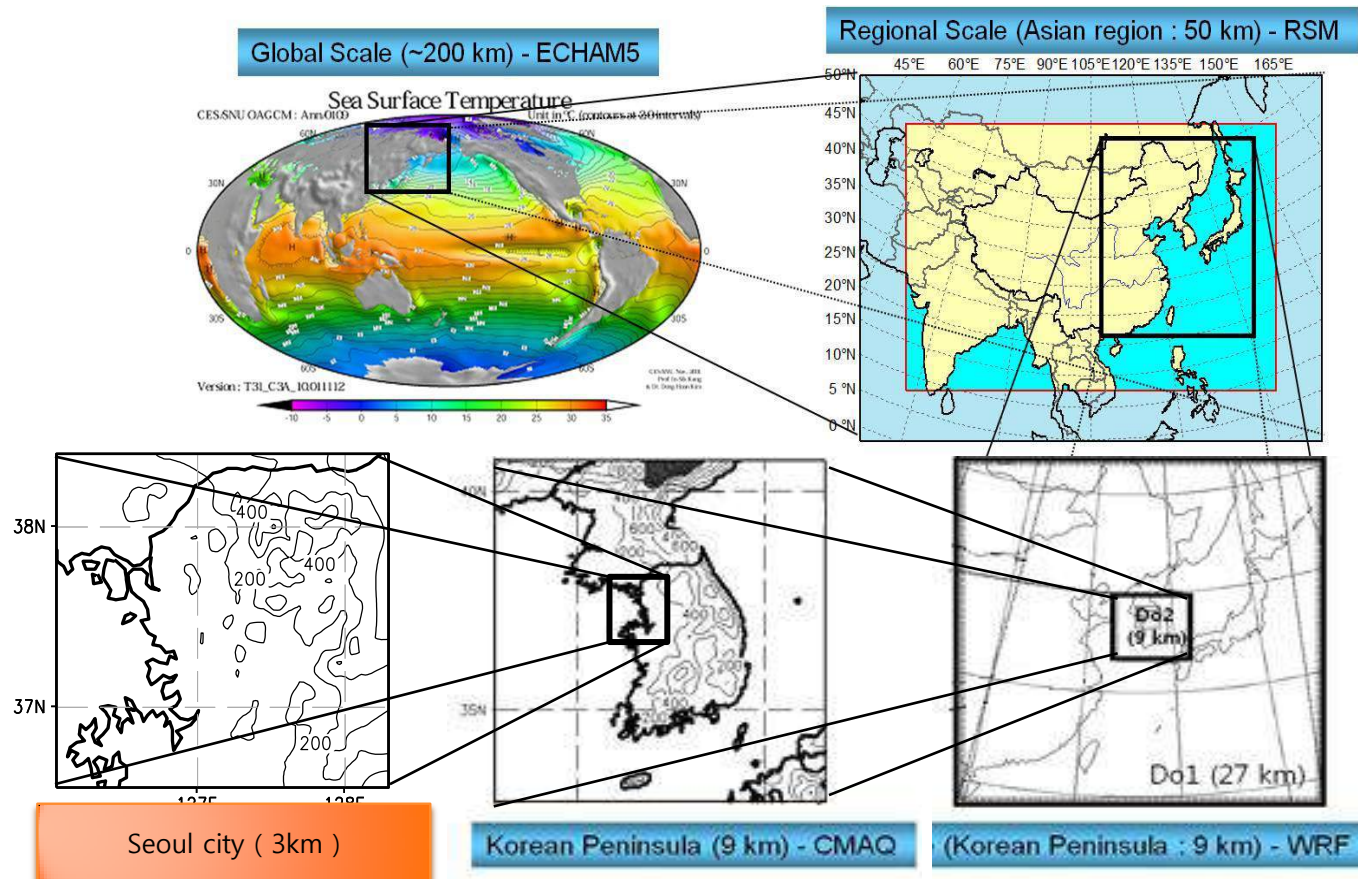
❖ Precipitation (mm/day)

	AGCM	CGCM	
MEAN	4.02	4.08	
Pattern Corr.	0.77	0.82	



Regional Model Program (RMP): Dynamical downscaling

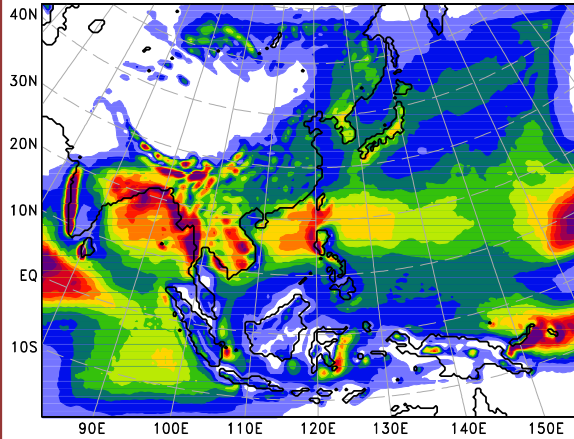
❖ Cloud-resolving scale scenario downscaling with multi-regional models (RMP+WRF)



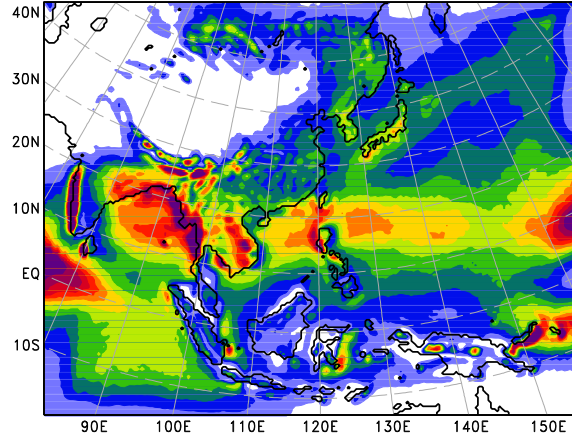
Regional Model Program (RMP): Regional climate

JJA

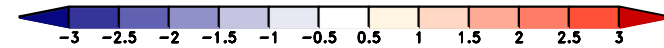
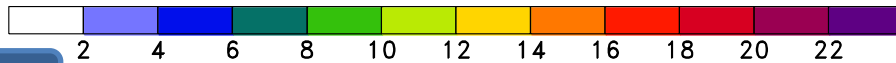
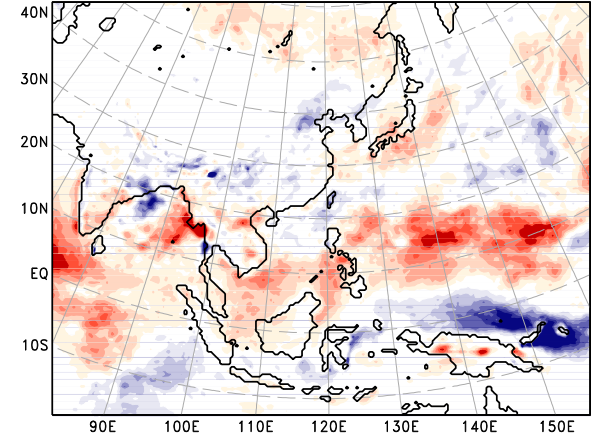
20C (1980-2000)



A1B (2040-2070)

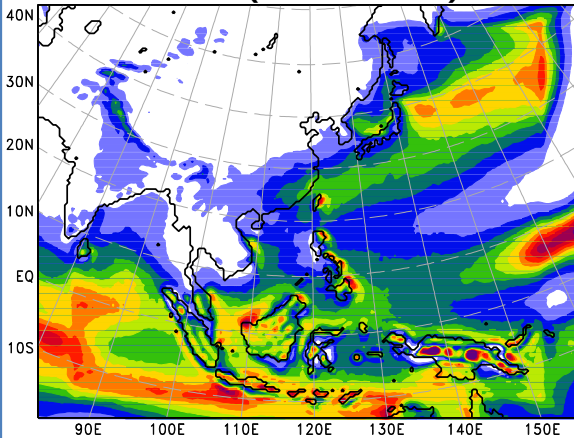


A1B - 20C

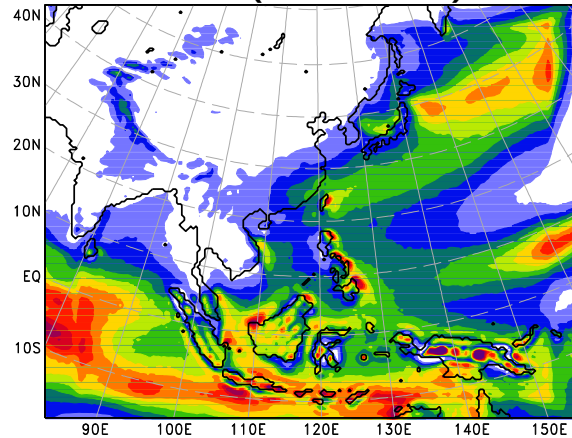


DJF

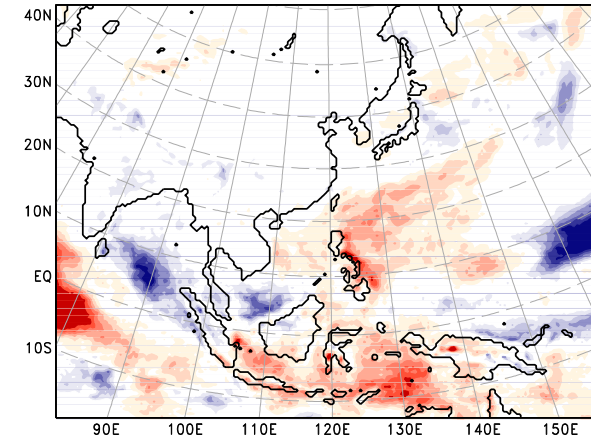
20C (1980-2000)



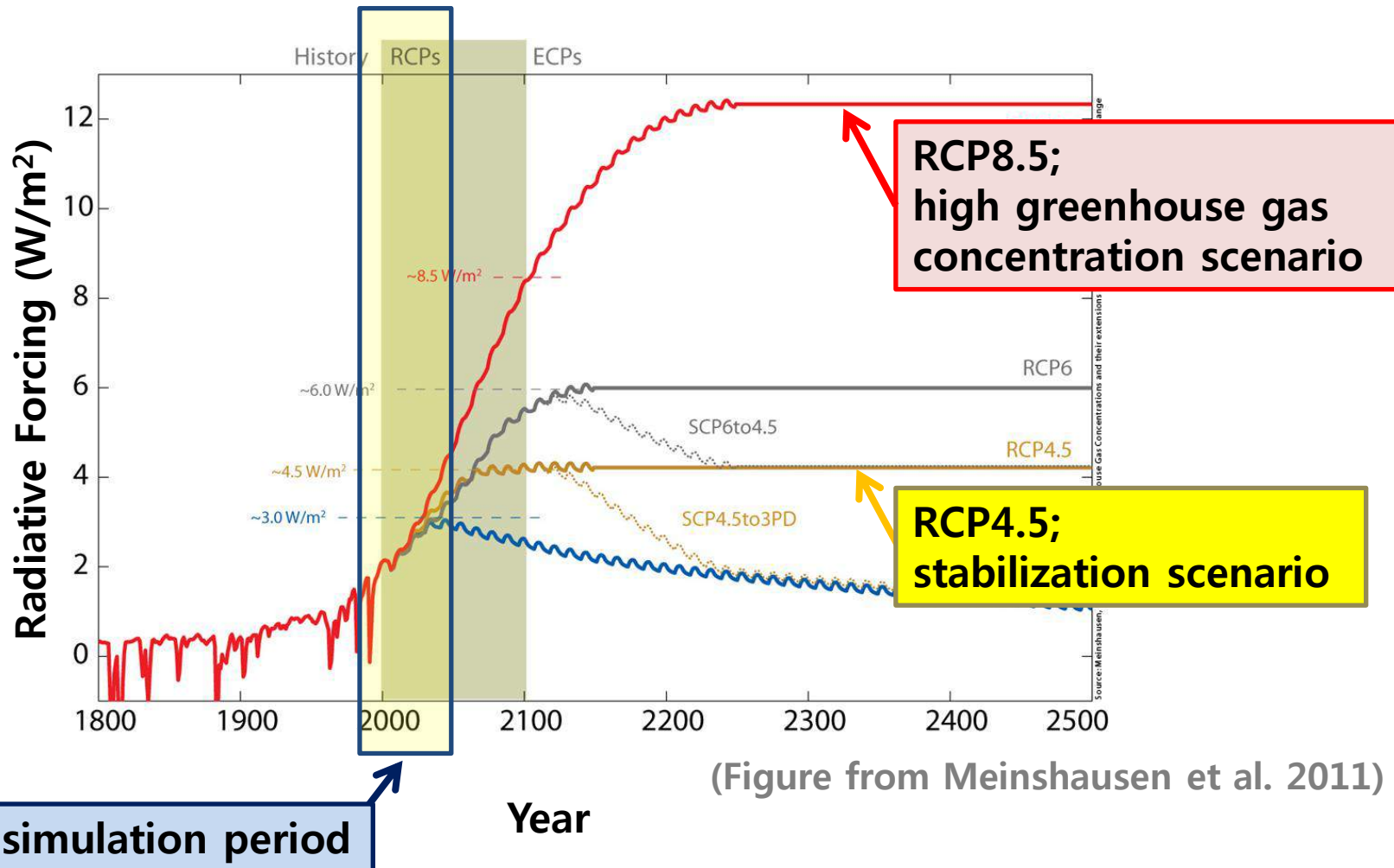
A1B (2040-2070)



A1B - 20C



Regional Model Program (RMP): Regional climate

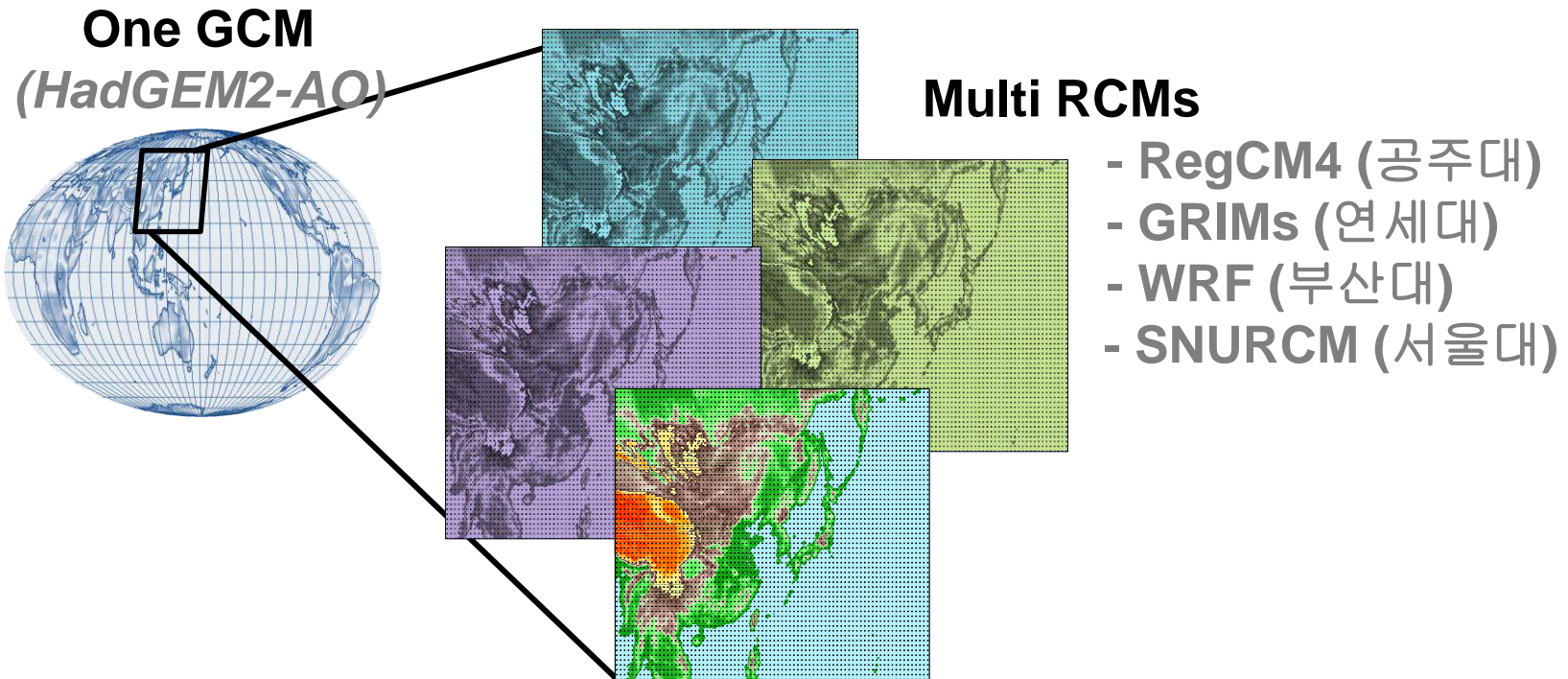


Regional Model Program (RMP): Regional model intercomparison

Regional Downscaling Project



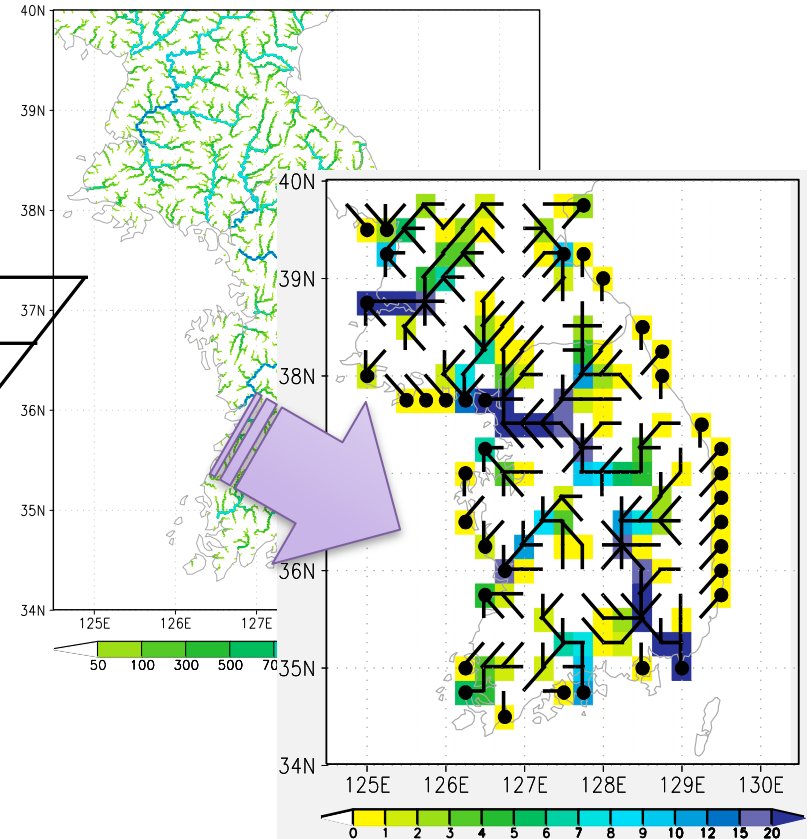
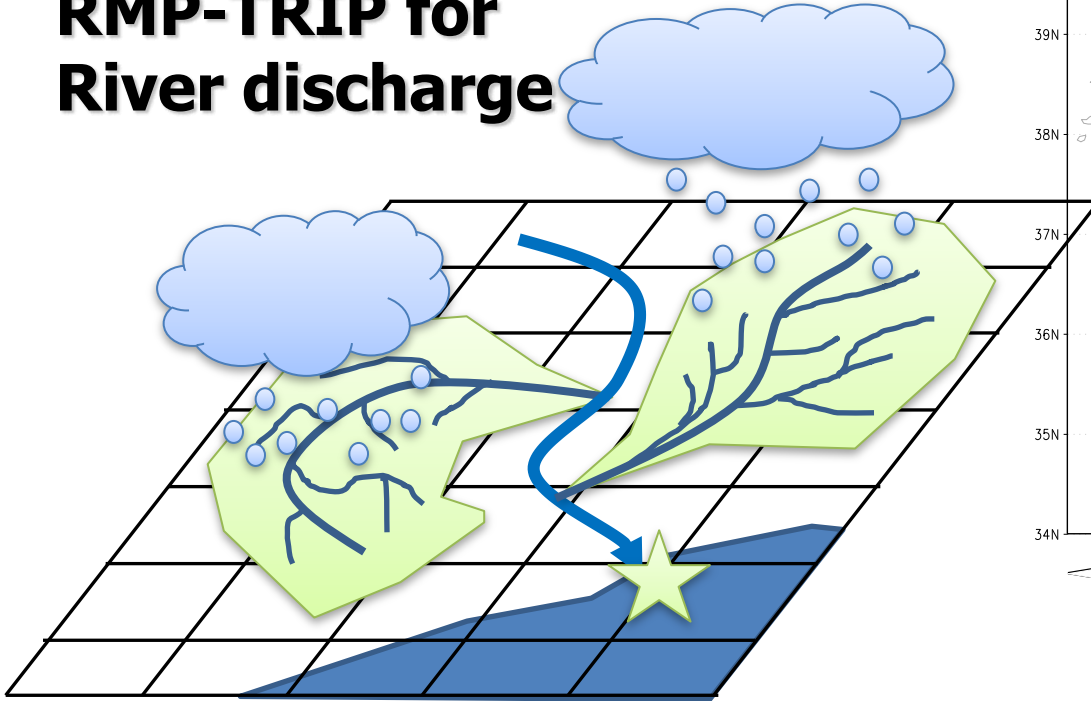
“RCP 시나리오를 이용한 한반도 상세 기후변화 전망자료 산출”



2009 ~ 2011 : CORDEX domain with dx 50km

2012 ~ 2014 : Korea domain with dx 12.5 km

RMP-TRIP for River discharge

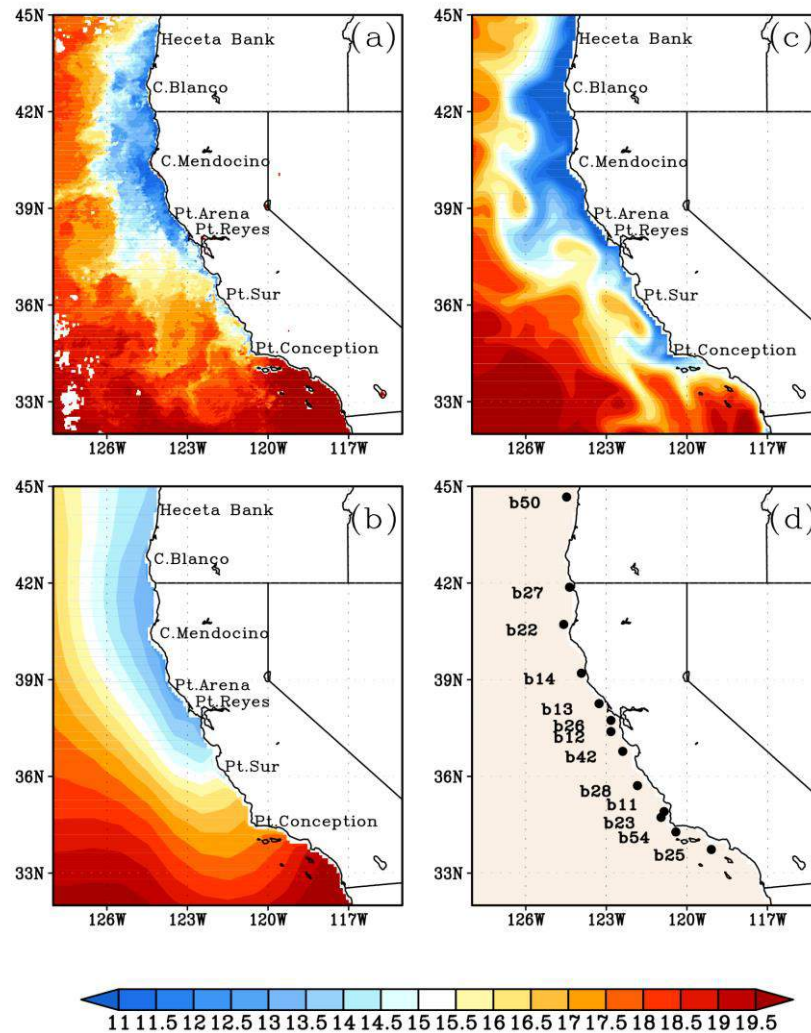


Runoff : at each grid point (output of land surface model in RCM)

River discharge : amount of gathered water over the basin

Regional Ocean Program (ROP): RMP+ROMS (Coupled simulation)

Li, Kanamitsu, Hong (2012, JGR)



→ coupling impact on
the regional-scale
atmospheric analysis

Fig. 4 August 2005 monthly mean SST ($^{\circ}\text{C}$) from (a) the 4-km AVHRR, (b) NCEP, and (c) the CPL run. The distribution of buoy stations is displayed in (d).

- **WRF and MPAS (NCAR)**
WSM3, 5, 6, WDM5, 6, YSU PBL, GWDO
- **ECPC G-RSM (ECPC) → FSU**
SMP, WSM MPS, YSU PBL, ROM
- **NIM development (NOAA)**
Physics modules and test
- **KAF-GRIMs**
Operational since March 2012
- **KOPRI-GRIMs**
Sensitivity to sea-ice in polar region
- **KISTI-GRIMs**
Web-based atmospheric model browser (web portal)
- **Hanyang Univ.**
Climate and Asian monsoon studies
- **APCC-GRIMs**
Regional climate

<http://grims-model.org>


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Global/Regional Integrated Model system

GRIMs

About GRIMs



The Global/Regional Integrated Model system (GRIMs) is a multiscale atmospheric/oceanic model system for use in numerical weather prediction, seasonal simulations, and climate/environment research projects, from global to regional scales.

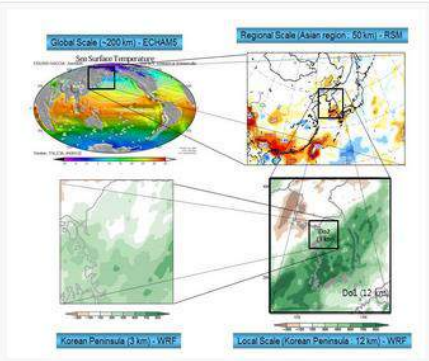
Notice
GRIMs

The 3rd GRIMs Workshop [2013.01.10]

LOGIN

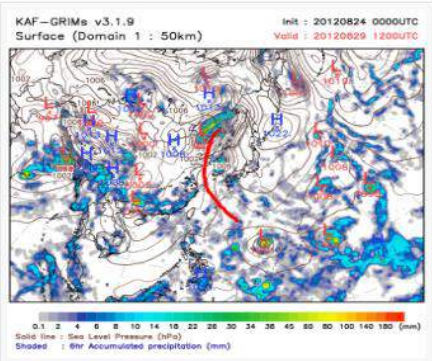
Register | Forgot your Password?

Climate change




Weather prediction

KAF-GRIMs v3.1.0 Init : 20120824 0000UTC
 Surface (Domain 1 : 50km) Valid : 20120829 1200UTC



Solid line : Sea Level Pressure (hPa)
 Shaded : 6hr Accumulated precipitation (mm)


KIAPS

Web-based portal for WRF & GRIMs (KISTI)



KSC-WRF Web-based Portal for Weather Research & Forecasting Model

USER ID:

PASSWORD:

LOG IN

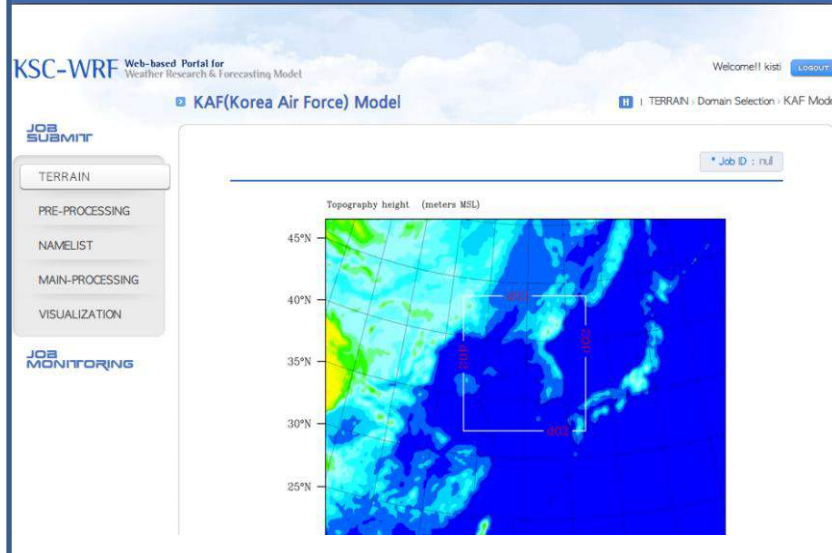
MEMBER JOIN FORGOT ID / PASSWORD

For more information

The Korea Supercomputing Center
<http://www.ksc.re.kr/eng>

Weather Research and Forecasting Model
www.wrf-model.org

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KSC-WRF Web-based Portal for Weather Research & Forecasting Model

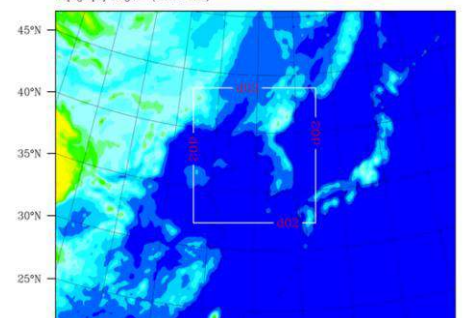
Welcome!! kisti Logout

KAF(Korea Air Force) Model

TERRAIN Domain Selection KAF Model

Job ID : null

Topography height (meters MSL)



45°N 40°N 35°N 30°N 25°N

JOB SUBMIT

- TERRAIN
- PRE-PROCESSING
- NAMLIST
- MAIN-PROCESSING
- VISUALIZATION

JOB MONITORING



KSC-GRIMs Web-based Portal for Global & Regional Integrated Modeling System

USER ID:

PASSWORD:

LOG IN

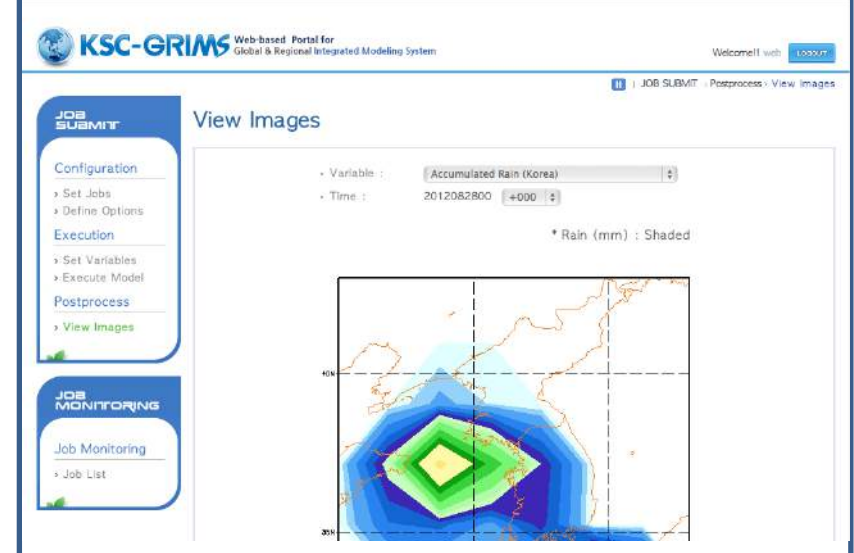
01 ADMIN LOGIN 02 FORGOT ID / PASSWORD GO

For more information

The Korea Supercomputing Center
<http://www.ksc.re.kr/eng>

The Global & Regional Intergrated Modeling System
<http://rml.yonsei.ac.kr/grims/introduction.saa>

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KSC-GRIMs Web-based Portal for Global & Regional Integrated Modeling System

Welcome!! web Logout

JOB SUBMIT Postprocess View Images

JOB SUBMIT

Configuration

- Set Jobs
- Define Options

Execution

- Set Variables
- Execute Model

Postprocess

- View Images

JOB MONITORING

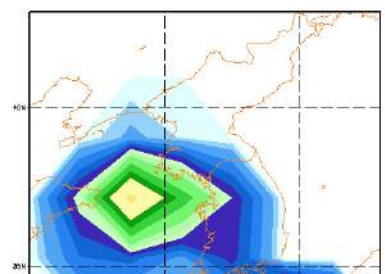
- Job Monitoring
- Job List

View Images

Variable : Accumulated Rain (Korea)

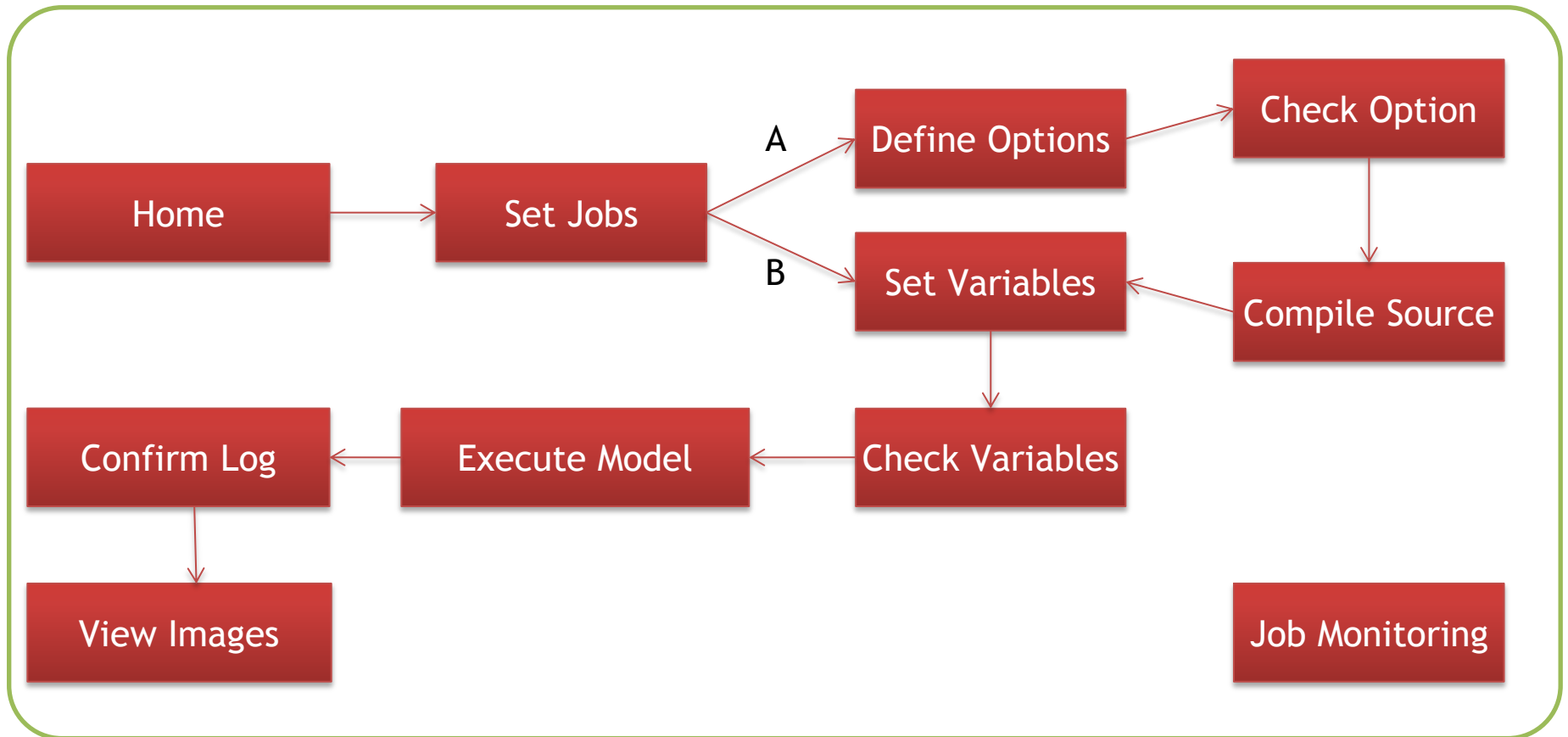
Time : 2012082800 +0000

* Rain (mm) : Shaded



Contents	Description
Model	Global/Regional Integrated Modeling System (GRIMs)
Version	V3.1 (Physics package option)
Server	KISTI Tachyon2 (/home01/jeunan/GRIMs, /scratch/msjoh/GRIMs)
Download	svn co svn://165.132.26.154/[target code] [directory name] ex) svn co svn://165.132.26.154/libs_gmp libs
Compiler & Software	PGI-9.0-4, OpenMPI-1.4.2, NetCDF4, grads-2.0.1

Workflow of KSC-GRIMs



A : Change physical options and compile source files

B : Make a copy of compiled execution files

Gathering the initial data

- Automatic and quasi-real time gathering the initial data

Contents	Description
Data	GFS+GDAS
Frequency	Twice per day (06UTC, 18UTC)
Time interval	12 hour (00UTC, 12UTC)
Filename	gfs.txxz.sanl gfs.txxz.sfc anl gdas1.txxz.sstgrb.grib2 gdas1.txxz.snogrb.grib2 gdas1.txxz.engicegrb.grib2

```

gfs.2012071212/  gfs.2012072500/  gfs.2012080612/  gfs.2012082100/
gfs.2012071300/  gfs.2012072512/  gfs.2012080700/  gfs.2012082112/
gfs.2012071312/  gfs.2012072600/  gfs.2012080712/  gfs.2012082200/
gfs.2012071400/  gfs.2012072612/  gfs.2012080800/  gfs.2012082212/
gfs.2012071412/  gfs.2012072700/  gfs.2012080812/  gfs.2012082300/
gfs.2012071500/  gfs.2012072712/  gfs.2012080900/  gfs.2012082312/
gfs.2012071512/  gfs.2012072800/  gfs.2012080912/  gfs.2012082400/
gfs.2012071600/  gfs.2012072812/  gfs.2012081000/  gfs.2012082412/
gfs.2012071612/  gfs.2012072900/  gfs.2012081012/  gfs.2012082500/
gfs.2012071700/  gfs.2012072912/  gfs.2012081100/  gfs.2012082512/
gfs.2012071712/  gfs.2012073000/  gfs.2012081112/  gfs.2012082600/
gfs.2012071800/  gfs.2012073012/  gfs.2012081200/  gfs.2012082612/
gfs.2012071812/  gfs.2012073100/  gfs.2012081212/  gfs.2012082700/
gfs.2012071900/  gfs.2012073112/  gfs.2012081300/  gfs.2012082712/
gfs.2012071912/  gfs.2012080100/  gfs.2012081512/  gfs.2012082800/
gfs.2012072000/  gfs.2012080112/  gfs.2012081600/  gfs.2012082812/
gfs.2012072012/  gfs.2012080200/  gfs.2012081612/  gfs.2012082900/
gfs.2012072100/  gfs.2012080212/  gfs.2012081700/  list/
gfs.2012072112/  gfs.2012080300/  gfs.2012081712/
gfs.2012072200/  gfs.2012080312/  gfs.2012081800/
gfs.2012072212/  gfs.2012080400/  gfs.2012081812/
    
```

Time

- Start date

2012 09 26 00

- Length of model integration in hour

24

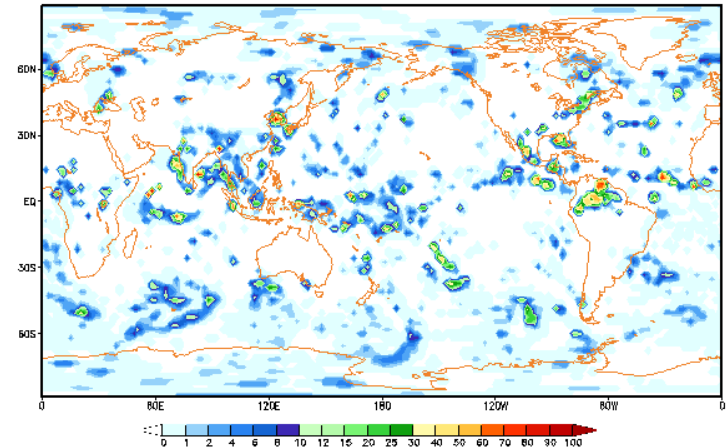
- Time interval to create output file

6

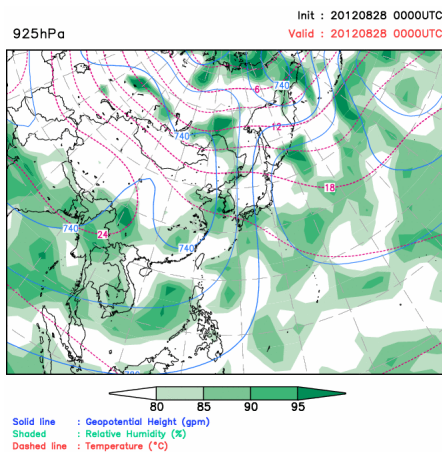
✳ Time lists in web-portal consist of the data list in the directory of the supercomputer.

Contents	Image
YSU	Accumulated rain(Korea & Global), RH & wind at 850 hPa, HGT & T at 500 hPa, HGT & wind at 200 hPa, vertical cross section of zonal wind
KAF	Surface wind & 1000 hPa HGT, SLP & Accumulated precipitation, HGT & RH & T at 925 hPa, HGT & RH & T at 850 hPa, HGT & Vorticity & T at 500 hPa, HGT & isotach & T at 300 hPa,

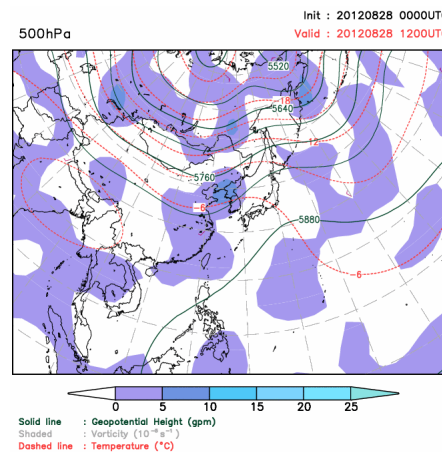
Accumulated rain over the whole region



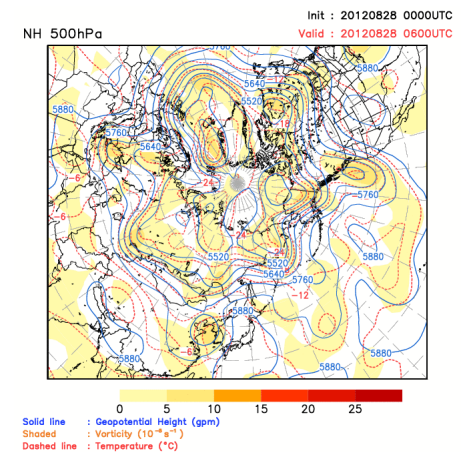
HGT & RH & T at 925 hPa



HGT & Vorticity & T at 500 hPa



North Hemisphere 500 hPa



KSC-GRIMS Web Portal

안캠코더 oncamcorder

150.183.249.136:8080/grims/index.jsp

KSC-GRIMS Web-based Portal for
Global & Regional Integrated Modeling System

USER ID

PASSWORD

LOG IN

01 ADMIN LOGIN 02 FORGOT ID / PASSWORD GO

For more information

The Korea Supercomputing Center
<http://www.ksc.re.kr/eng>

The Global & Regional Intergrated Modeling System
<http://nml.yonsei.ac.kr/grims/introduction.saaa>

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KIAPS

KOREA INSTITUTE OF
ATMOSPHERIC PREDICTION SYSTEMS

Thank you for your listening



www.kiaps.org



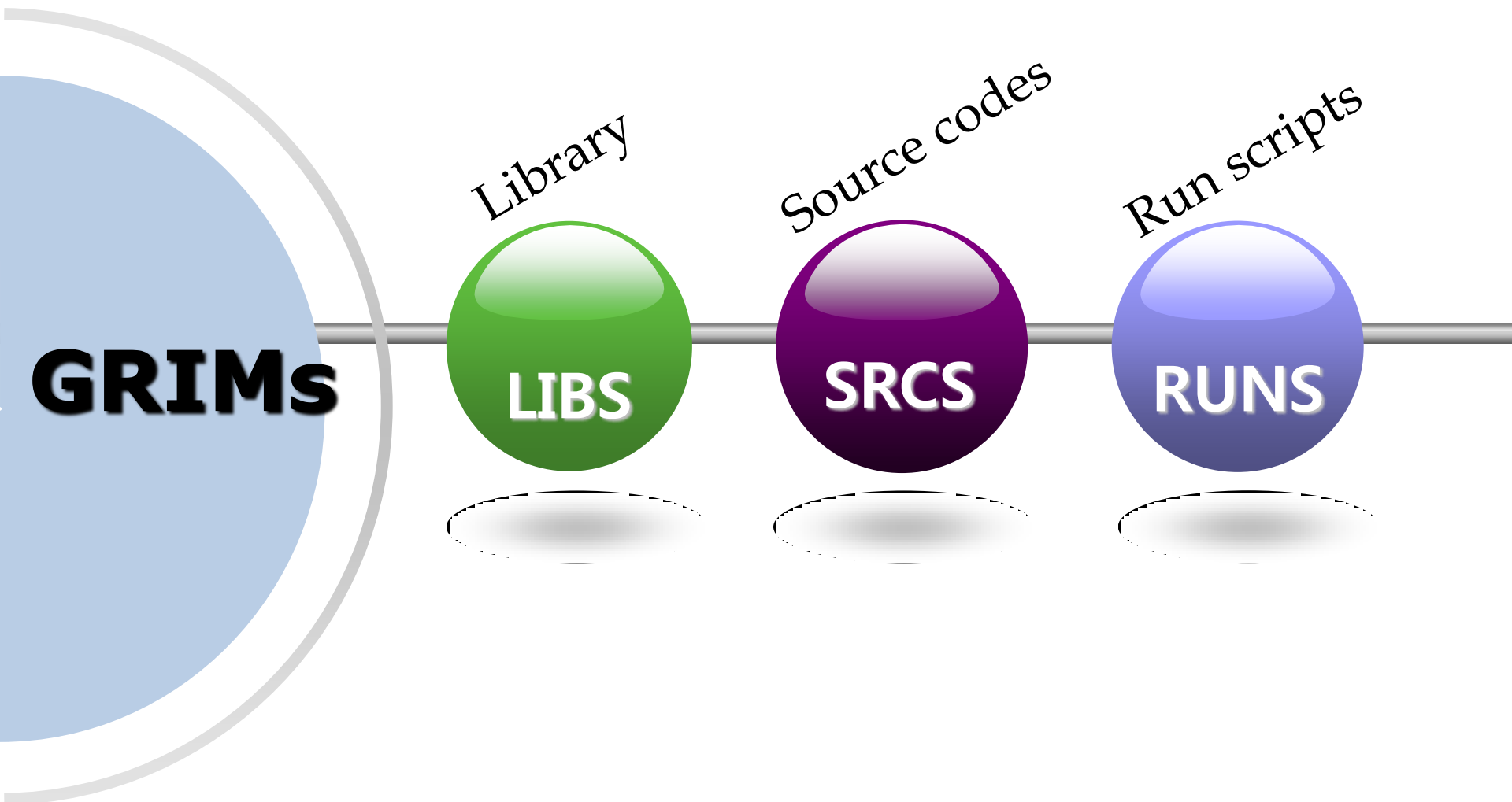
Hands-on Session: GRIMs-RMP

Structure

Myung-Seo Koo

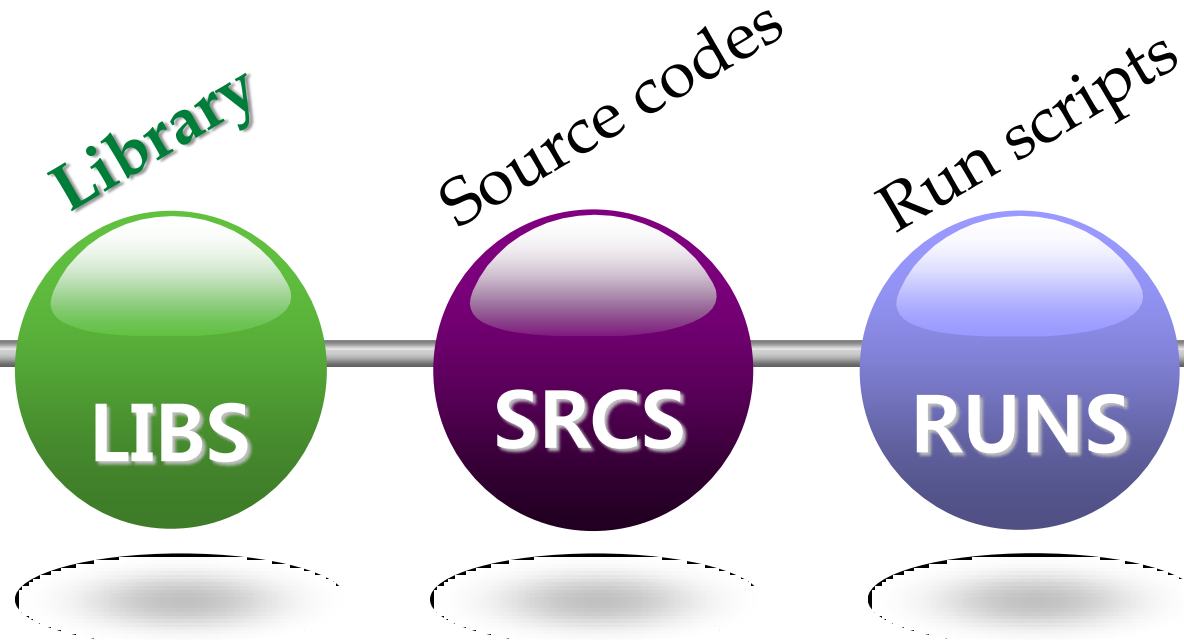
Korea Institute of
Atmospheric Prediction Systems
(KIAPS)







GRIMs



- include model library, utilities, climatology and topo data ...
- assign compilation options for source codes
- not depend on the resolution
but depend on the machine/system types (dec, linux, ibm...)
and model type (GMP/RMP, SMP, GSI)

libs

srcs

runs

Directory	Memo
configure-lib	configuration for compiling library
makefiles/	template makefile scripts
con/	initial data, climatology and topo data
etc/	Programs kits for pre- and post-processing <i>e.g.</i> gribinterp, grmap, grmean, maketime...
lib/	>> modelib/ : Fourier transform and matrix >> w3lib_\$(system)/ : GRIB decoding and creation
opt_libs/	compilation options due to machine types

libs

srcs

runs

1. Modify the

libs/opt-libs/options-linux_pgi-mpi

```

#
# Change the following
# MACHINE=[sgi/
# MARCH=[single
# INSTITUTION=
#
MACHINE=linux_pgi
MARCH=mpi
INSTITUTION=nm
USERNAME=baram
#
#-----
#
# If special options
#
OPTIONS_FILE=./c
if [ -s $OPTIONS_FILE ]
  cp $OPTIONS_FILE
fi
#
# Model compiler options (except fcst related)
#
F77=pgf90
F77_FCST=mpif90
INLINE="share.il"
FC_FLAGS="-r8 -fastsse -DLINUX -byteswapio -module ../include -mcmmodel medium"
EXTRAC_FLAG="${FC_FLAGS} -Mextract=size:20"
EXTRA_FORT_FLAGS="-
Minline=../share/fpvs.il,../share/fpvs0.il,../share/fpvsx.il,../share/fpvsx0.il -Minfo=inline"
FORT_FLAGS="${FC_FLAGS}"
LOAD_FLAGS="${FC_FLAGS}"
EXTRA_LIBS=
#
# UTILS is normally same as the model options
#
UTIL_F77=pgf90
UTIL_FORT_FLAGS="-r8 -fastsse -DLINUX -byteswapio -mcmmodel medium"
UTIL_LOAD_FLAGS="-r8 -fastsse -DLINUX -byteswapio -mcmmodel medium"
#
W3LIB_F77=pgf90
W3LIB_FORT_FLAGS="-DLINUX -byteswapio -mcmmodel medium"
W3LIB_LOAD_FLAGS="-DLINUX -byteswapio -mcmmodel medium"

```

libs

srcs

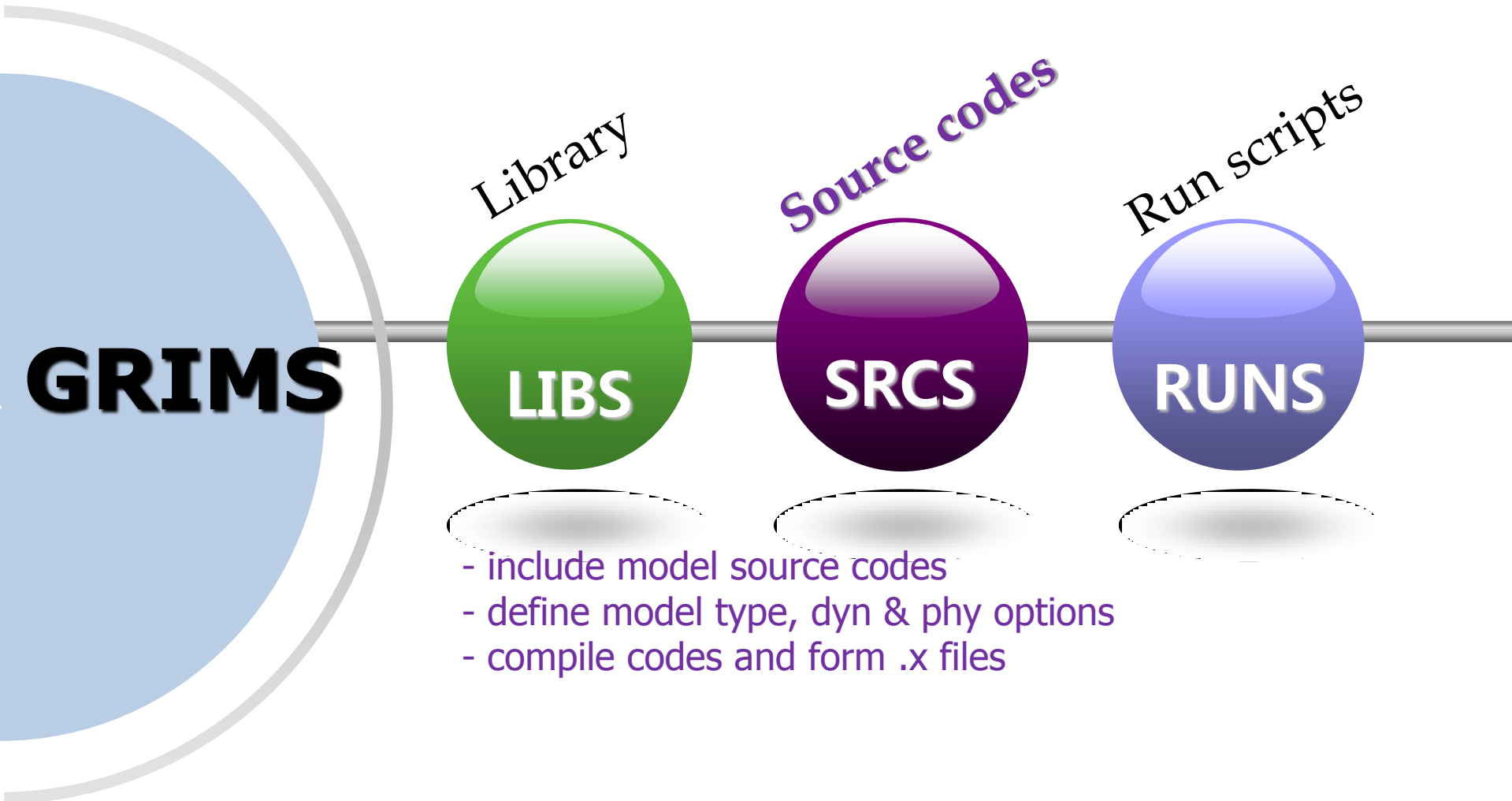
runs

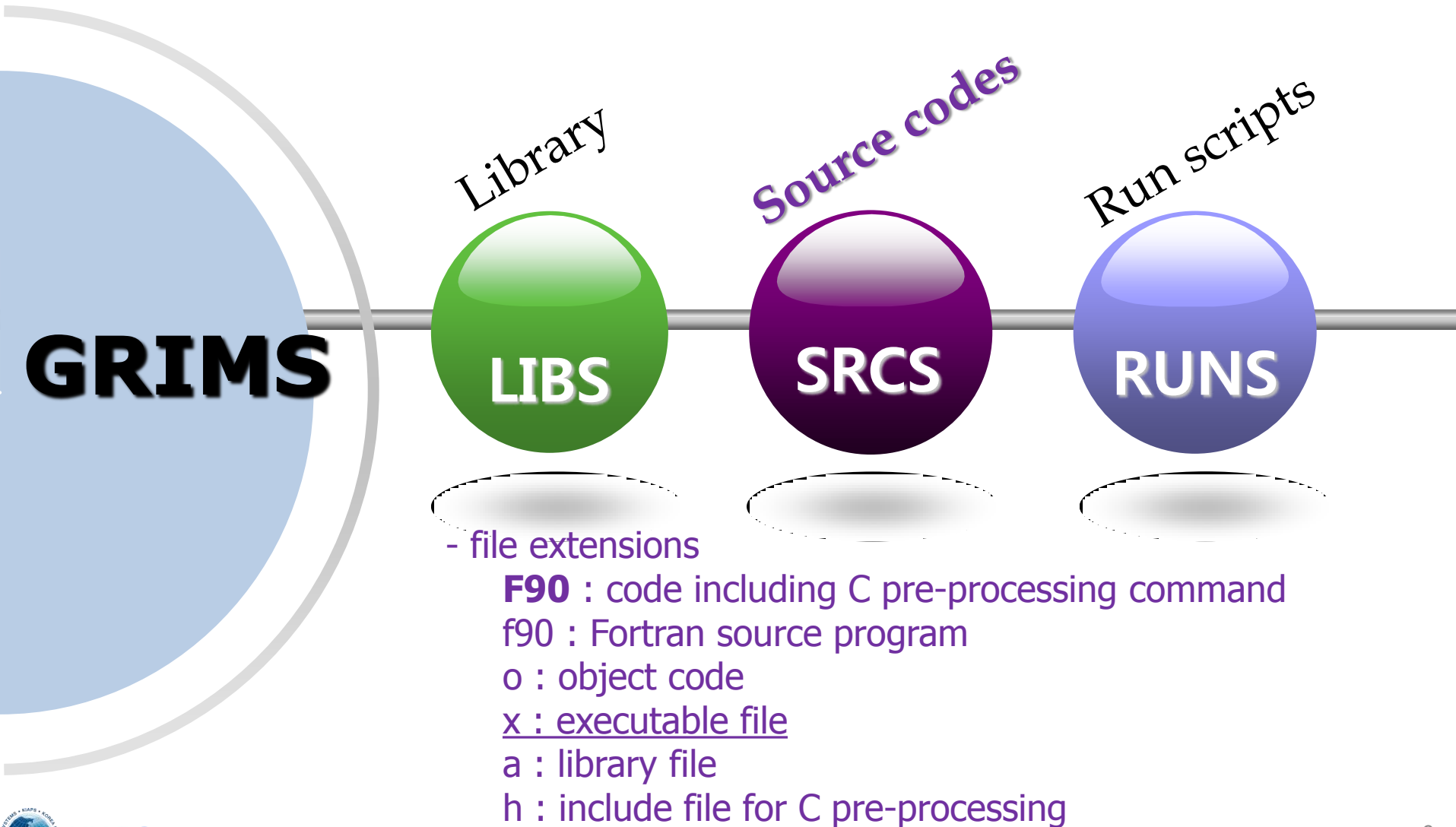
2. Compile

./configure-lib

configure-libs con/ env/ etc/ lib/ makefiles/ opt_libs/

configure-libs con/ env/ etc/ lib/ makefiles/ opt_libs/
machine.h Makefile seddat_libs






libs

srcs

runs

Directory	Memo
 <i>configure-src</i>	configuration script
src/	model source programs
def/	include files (.h) for model options
makefiles/	initial form of makefile for srcs directory
bin/	executable files (.x and .a)

libs

srcs

runs

1. Modify the configure file

```
vi configure-src
```

```
#  
LIBS_DIR=/disk4/shong/SVN/libs  
#  
#  MODEL .... sph, dfs, rmp, smp, ssi, gsi, gop, rop  
#  
MODEL=rmp  
#  
# define model version  
#   = /v1.0/v2.0/v3.0/v4.0/v5.0 (see doc/readme files for sub-versions)  
#  
VERSION=v3.2  
#  
#  MARCH      .... select from single/mpi/thread/hybrid  
#  
MARCH=mpi
```

libs

srcs

runs

2. Produce Makefile and define.h

./configure-src

```
configure-src def/ doc/ env/ makefiles/ src/
```

```
configure-src def/ doc/ env/ makefiles/ src/  
bin/ define.h cvar.env machine.h Makefile makefiles
```

Choose physics options

vi define.h

libs

srcs

runs

"define.h"

```
/* ----- grims-gmp global spherical harmonics (sph) setup ----- */

#undef RMP          /* rmp option off*/
#undef GDAS        /* GDAS option off */

/* dynamics options */
#define GRIMS      /* GRIMS or WRF */
#define REDUCE_GRID /* reduced grid for sph. defined if _jcap_ > 42 */
#define DIFFQ     /* horizontal diffusion of moisture */
#define HYBRID    /* vertical cordiate with hybrid sigma-pressure */
#define MTN4MIN   /* use global 4 min mountain instead of 8 min */
#undef GTOPO30    /* use original gtopo 30 data for mountain in RSM */
#undef SETMTNZERO /* set orography to zero over ocean */

.....
```

“define.h”

```

#undef DBG                /* debugging option */
#undef NOPRINT           /* suppress print out */
#undef MRG_POST         /* merge postprocessor into forecast code */
.....

/* physics options */
#undef R2                /* simulate Reanalysis-2 physics */
#define LWRMDC           /* M-D Chou long wave radiation */
#undef SWRMDC           /* M-D Chou short wave radiation */
#undef RAD_SMOOTH_CLOUD /* smooth clouds in radiation */
#undef CLDADJ          /* empirical cloudiness adjustment */
.....

#define Z0T              /* thermal roughness length */
#define VSGD            /* subgrid surface wind velocity scale */
#define ICECHECK        /* sea-land-ice mask cheking flag */
#define LNEWSFC        /* surface cycling option logical flag */
#define SFCMRG         /* surface merge flag of guess and climatology */
#undef OSULSM1         /* OSU version 1 soil model with homogeneous data */
#undef OSULSM2         /* OSU version 2 soil model with heterogeneous data */
#define NOALSM1        /* NOAH land scheme */
.....

```

libs

srcs

runs

“define.h”

```

#define YSUPBL      /* ysu pbl scheme or mrf scheme */

#define KAGWD      /* Kim Arakawa orography gravity wave drag */
....
#define SAS        /* Simplified Arakawa Schubert cumulus convection */
#define UV_CMT     /* Convective momentum transport in SAS */
#define NCEP2010   /* Include the gfs changes in july 2010 */
#define RAS        /* Relaxed Arakawa Schubert cumulus convection */
#define RASV2      /* RAS with downdraft */
#define CCMCNV     /* Zhang McFarlane cumulus convection */
#define KF2        /* Kain-Fritsch convection cumulus */

#define MRFSCV     /* Tiedke shallow convection */
#define CCMSCV     /* Hack shallow convection */
#define HANPANSCV /* Han and Pan shallow convection */

#define WSM1       /* diagnostic microphysics */
#define WSM2       /* prognostic qci microphysics */
#define WSM3       /* prognostic qci qrs microphysics */
#define WSM5       /* prognostic qc qr qi qs microphysics */
#define WSM6       /* prognostic qc qr qi qs qg microphysics */
.....

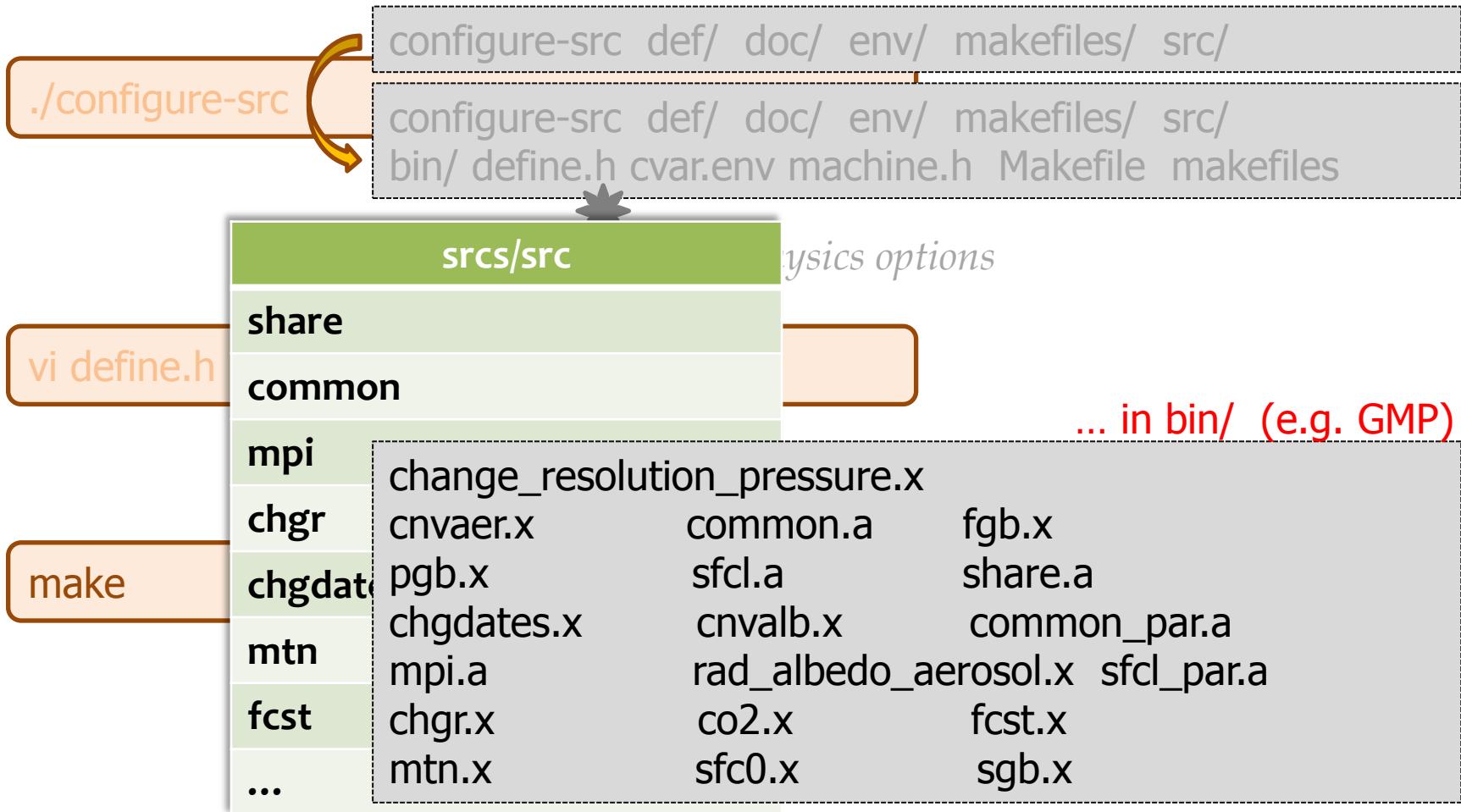
```

libs

srcs

runs

2. Produce Makefile and define.h



libs

srcs/src

runs

Global Model Program (GMP)


File name	Memo
<i>Configure-src</i> <i>Makefile.in</i>	Configure file and makefile
share	constants, parameter, share functions/routines
common common_par	common variables and modules
mpi mpi_dfs	mpi system library
chgr	change resolution
chgdates	change dates
co2	co2 interpolation
mtn	global model orography program

libs

srcs/src

runs

Global Model Program (GMP)

File name	Memo
sfco sfcl sfcl_par	interpolating and merging surface files
 fcst	global spectral model sources
pgb	gribbing program source at pressure levels
sgb	gribbing program sources at sigma levels
fgb	converting to GRIB
p2sig	creating model initial data from pressure data
include	include files and .mod files

libs

srcs/src

runs

Regional Model Program (RMP)

File name	Memo
Makefile.in	makefile
share	constants, parameter, share functions/routines
common common_par	common variables
mpi mpi_dfs rmpi	mpi system library
chgr	change resolution
chgdates rchgdates	Changing initial date to initial forecast time
co2	co2 interpolation
mtn rmtn	global model orography program

libs

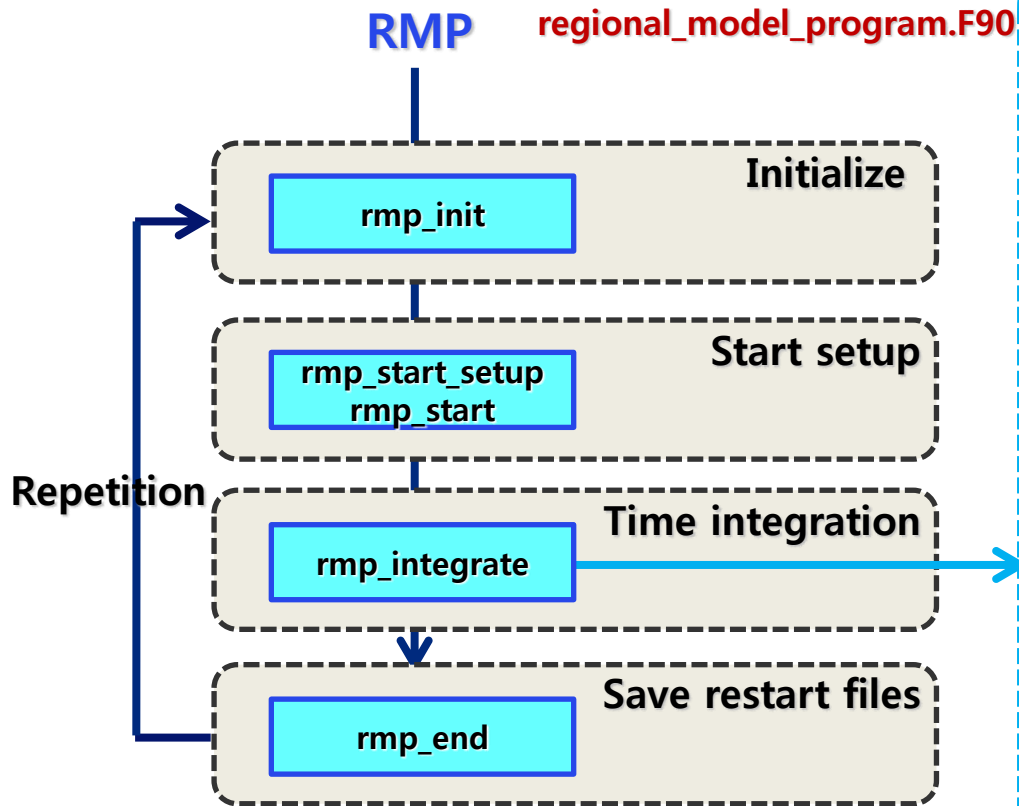
srcs/src

runs

Regional Model Program (RMP)

File name	Memo
ringg	global → regional grid / coarse → fine grid
sfco sfcl sfcl_par	interpolating and merging surface files
fcst rgmp rgmp_par	global spectral model sources
rmpl rmpl_par	regional spectral model dynamics and I/O
rfcst rfcst_par	regional spectral model sources
pgb rpgb	gribbing program source at pressure levels
sgb	gribbing program sources at sigma levels
fgb	converting to GRIB
include	include files and .mod files
p2sig	creating model initial data from pressure data

System framework



rmp_dynamics_driver
calculate non-linear tendencies

rmp_semi_nonhydro
rmp_semi_hydro
semi implicit time integration

rmp_update_boundary
update global base field

rmp_update_variables
update variables with tendencies

rmp_horizontal_diffusio
n
horizontal diffusion

rmp_time_filter1
time filter

rmp_physics_main_drive
r
physics parameterization

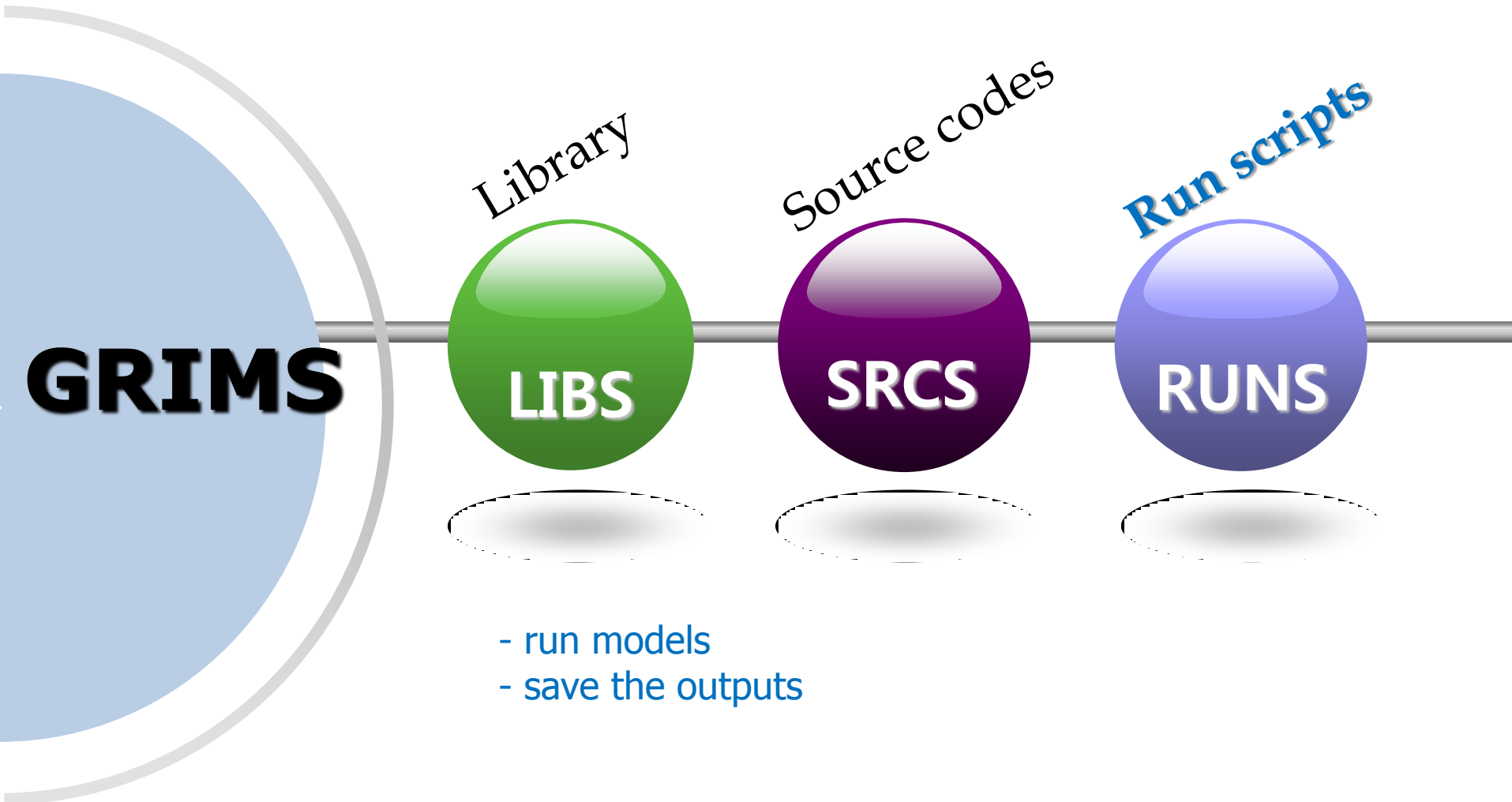
rmp_spectral_damping_divo
r
Spectral nudging for vorticity and divergence

rmp_time_filter2

libs

srcs

runs



libs

srcs

runs

configure-run

env/configure-run

expscr/

NAME	Description
amip.in	AMIP-type model forecast (for GMP)
gsim.in	seasonal forecast (for GMP)
gmp.in	short-range forecast (for GMP)
rmp.in	short-range forecast (for RMP)
rsim.in	seasonal forecast (for RMP)
smp.in	single column model forecast (for SMP)

runscr/

main run script (* see manual)

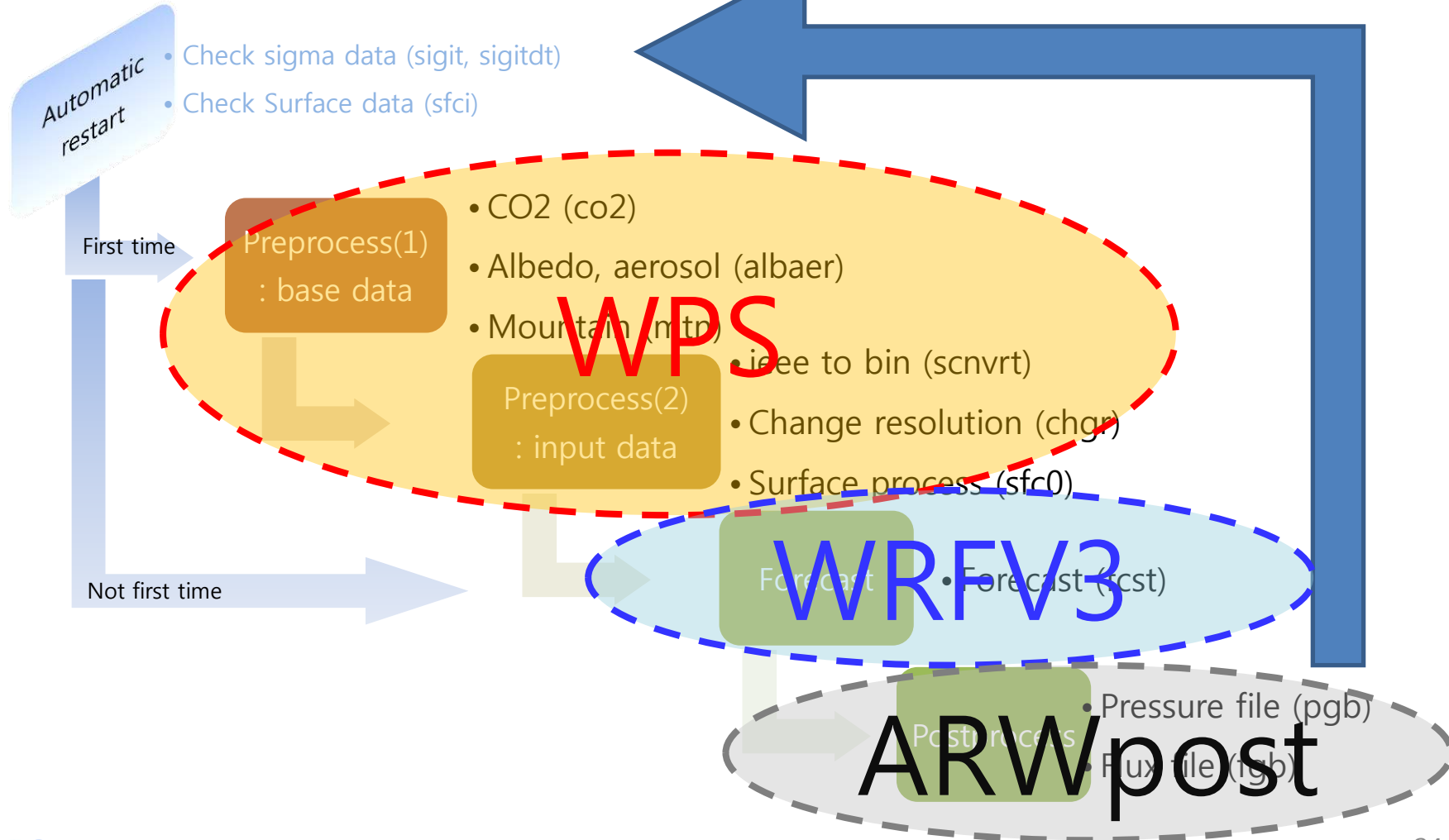
rsm_domains/

check regional domains (r_grid.sh)

libs

srcs

runs



libs

srcs

runs

1. Modify the configure file

```
vi configure-run
```

```
#
#   SRCS_DIR      .... Model executable directory is $SRCS_DIR/bin.
#
SRCS_DIR=`pwd`/../../srcs
OUTPUT_DIR=`pwd`
POST_DIR=`pwd`/post
#
# set the environmental variables
#
. ./env/env.s
#
#
#   Need to select rmp map projection data.. see ../rmp_domain for more options
#
RMP_MAP=../rmp_domain/rmp_108x85_60km_nps.korea
#
if [ $model = rmp ]; then
  IGRD=108      # rmp grid selection (I
  JGRD=85      # 54/55, 81/67, 81/87,
  CIGRD1=1
  CJGRD1=1
fi
```

Directories

RMP map data
RMP resolution

libs

srcs

runs

vi configure-run

```
#  
# input surface & sperical wave file resolution  
#  
# T42 (128,64), T62 (192,94), T126 (384,194), T170 (512,256),  
# T214 (648,324), T254 (768,384), T320 (968, 484), T426 (1280, 640),  
# T510 (1536,768), T1020 (3072,1536), T2046 (6144,3072)  
#  
ILONF=192 # for SFC file  
ILATG=94 # for SFC file  
IJCAP=62 # for SIG file  
ILEVS=28 # for SIG file
```

Input resolution

```
#  
# For DFS, NCOL should be less than MODEL_LAYER,  
# more than 2*NPES/JCAP.  
#  
if [ $march = mpi ] ; then  
NPES=4 # number of cpus or threads (  
NCOL=2 # number of column (when MARC  
fi  
#  
NCPU_PER_NODE=8 # number of cpus per node
```

Processor number

libs

srcs

runs

vi configure-run

```
#  
# BATCHsuffix to obtain JOB ID  
#  
if [ $INSTITUTION = kisti -a $SYSTEM2 = linux ]; then  
    sed "s/@BATCHsuffix@/| awk '{print \$3}'/g" $script > $script.a  
elif [ $INSTITUTION = kisti -a $SYSTEM2 = ibmsp ]; then  
    sed "s/@BATCHsuffix@/| awk -F\"'\"' '{print \$2}' | awk -F. '{print \$1\".\"\\\"\$5}'/g" $script > $script.a  
elif [ $INSTITUTION = kaf ]; then  
    sed "s/@BATCHsuffix@/| awk -F. '{print \$1}'/g" $script > $script.a  
else  
    sed 's/@BATCHsuffix@//g' $script > $script.a  
fi
```

For BATCH job ID
(when using PBS)

vi runscr/envset.in

```
#  
# Environmental variables for mpi mode  
#  
if [ @MARCH@ = mpi ]; then  
  
if [ @INSTITUTION@ = nml -a @SYSTEM2@ = linux ] ; then  
    FCSTENV='mpirun -machinefile $PBS_NODEFILE -np @FCST_NPES@'  
    BATCHQUE='qsub'  
    BATCHdepend='-W depend=afterok:'  
    BATCHtype='pbs'  
    BATCHstatus='qstat'
```

MPI, BATCH environment

libs

srcs

runs

2. Produce run script & namelist (e.g., rmp.in)

```
./configure-run rmp
```

3. Run the script

```
./rmp (or qsub rmp)
```

namelist.gmp

```
&paralist  
  ncpus_ = 1,  
  jcap_ = 254,  
  levs_ = 64,  
  ilonf_ = 192,  
  ilatg_ = 94,  
  ijcap_ = 62,  
  ilevs_ = 28,  
  ko_ = 17,  
  npes_ = 24,  
  ncol_ = 2,  
/  
  
&modlsig  
  delmdl =.....  
/  
  
&postpres  
  po = .....  
/
```

libs

srcs

runs

- In "expscr" directory

Script	Description	Default period
gmp.in (rmp.in)	Short-range forecast (basic program)	2-day starting from 2001.7.14.
gsim.in (rsim.in)	Seasonal ensemble forecast (5 member; but not for rsim)	4-month forecast starting from 1996.5.1. ~ 5.5
gmp_cold.in	Operational short-range forecast	10-day forecast for 1-month starting from 2006. 7.1.
gsim.in	Seasonal ensemble forecast (5 ensemble)	4-month forecast starting from 1996.5.1. ~ 5.5
amip.in	AMIP-type model forecast	30-years forecast starting from 1979.1.1.
...



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Hands-on Session: GRIMs-RMP

Tutorial

Myung-Seo Koo

Korea Institute of
Atmospheric Prediction Systems
(KIAPS)



Account	Users		
tuser01	Dr. Koo		
tuser02	Claudia Cruz Silva	Antonios Mekhiel	Sourabh Shrivastava
tuser03	Ferdika Amsal	Jose Rizal	Wido Hanggoro
tuser04	Yahya Darmawan	Iman Babaeian	Mat Kamaruzaman
tuser05	Davaadorj Amarsaikhan	Enkhchineg Jantsan	Munkhtsetseg Erdenebayar
tuser06	Eniola Ajani Olaniyan	Farah Ikram	Sajjad Haider
tuser07	Peter Tuju	Winai Chaowiwat	Diep Le Duy
tuser08	Luu Nhat Linh	Minh Ha Truong	Pham Thi Cham

APCC Supercomputer

IP address : 210.98.49.132
Username : tuser01 to tuser07 (enter)
Password : tuser??@2015@! (enter)

Example)

```
> > ssh tuser02@210.98.49.132  
password: tuser02@2015@!
```

※ When you use Xmanager,
/usr/bin/xterm -ls -display \$DISPLAY

For compilation, you need

- 1) Fortran compiler
- 2) MPI library

To check module loaded,

```
>> module list
```

To see module available,

```
>> module avail
```

To change module,

```
>> module purge
```

```
>> module load pgi/10.9
```

```
>> module load mvapich2/1.7
```



Download

```
mkdir {your_name}          (enter)
```

```
cd {your_name}            (enter)
```



```
cp -r /scratch/TUTORIAL_2015/GRIMs/libs_rmp .  
cp -r /scratch/TUTORIAL_2015/GRIMs/srcs_rmp .  
cp -r /scratch/TUTORIAL_2015/GRIMs/runs_rmp .
```

```
svn co svn://210.106.80.229/libs_rmp  
svn co svn://210.106.80.229/srcs_rmp  
svn co svn://210.106.80.229/runs_rmp
```

Download library

(in your working directory, /home/tuser01
or /home/tuser01/mskoo

mkdir RMP

cd RMP

svn co svn://210.106.80.229/libs_gmp libs (enter)

** For the first download **only**, you should login.*

Password for 'id': (enter)

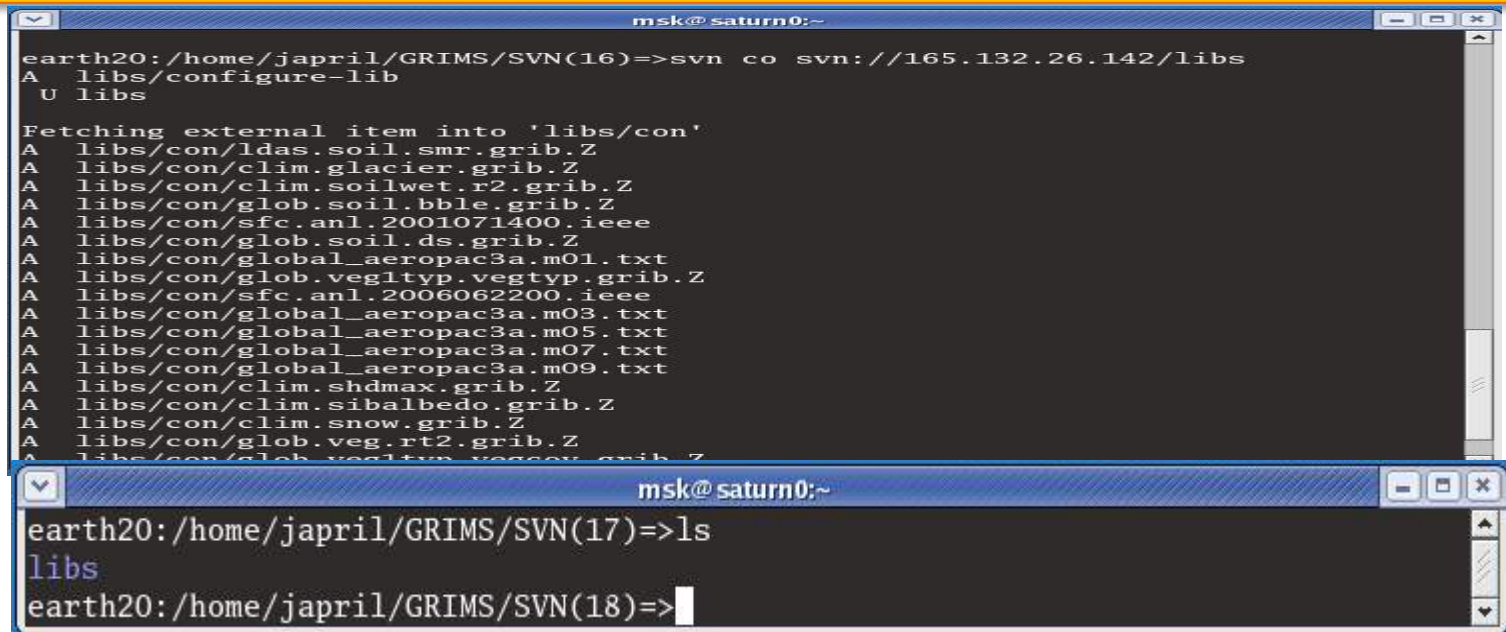
*Username : **guest** (enter)*

*Password for 'grim' : **guest123** (enter)*

*Unencrypted (yes/no)? **yes** (enter)*

~ing

end



```
msk@ saturn0:~  
earth20:/home/japril/GRIMS/SVN(16)=>svn co svn://165.132.26.142/libs  
A libs/configure-lib  
U libs  
  
Fetching external item into 'libs/con'  
A libs/con/ldas.soil.smr.grib.Z  
A libs/con/clim.glacier.grib.Z  
A libs/con/clim.soilwet.r2.grib.Z  
A libs/con/glob.soil.bb1e.grib.Z  
A libs/con/sfc.anl.2001071400.ieee  
A libs/con/glob.soil.ds.grib.Z  
A libs/con/global_aeropac3a.m01.txt  
A libs/con/glob.veg1typ.vegtyp.grib.Z  
A libs/con/sfc.anl.2006062200.ieee  
A libs/con/global_aeropac3a.m03.txt  
A libs/con/global_aeropac3a.m05.txt  
A libs/con/global_aeropac3a.m07.txt  
A libs/con/global_aeropac3a.m09.txt  
A libs/con/clim.shdmax.grib.Z  
A libs/con/clim.sibalbedo.grib.Z  
A libs/con/clim.snow.grib.Z  
A libs/con/glob.veg.rt2.grib.Z  
A libs/con/glob.vegtyp.vegtyp.grib.Z  
  
msk@ saturn0:~  
earth20:/home/japril/GRIMS/SVN(17)=>ls  
libs  
earth20:/home/japril/GRIMS/SVN(18)=>
```

Download source code

```
svn co svn://210.106.80.229/srcs_rmp srcs (enter)
```

~ing

```
msk@saturn0:~  
earth20:/home/japril/GRIMS/SVN(35)=>svn co svn://165.132.26.142/srcs_rmp srcs  
A srcs/configure-src  
U srcs  
  
Fetching external item into 'srcs/def'  
A srcs/def/cvar.F  
A srcs/def/model  
A srcs/def/model/define_smp.h  
A srcs/def/model/define_sph.h  
A srcs/def/model/define_dfs.h  
A srcs/def/model/define_rmp.h  
A srcs/def/Makefile.in  
A srcs/def/grims-depend.h  
A srcs/def/grims-v1.0.h  
A srcs/def/grims-v2.0.h  
A srcs/def/function.h  
A srcs/def/grims-v3.0.h  
A srcs/def/grims-v3.1.h  
A srcs/def/grims-v4.0.h  
A srcs/def/grims-v5.0.h  
Checked out external at revision 187.
```

end

```
msk@saturn0:~  
earth20:/home/japril/GRIMS/SVN(54)=>ls  
libs srcs  
earth20:/home/japril/GRIMS/SVN(55)=>
```

Download run scripts

```
svn co svn://210.106.80.229/runs_rmp runs (enter)
```

~ing

```
msk@ saturn0:~  
earth20:/home/japril/GRIMS/SVN(66)=>svn co svn://165.132.26.142/runs  
A runs/configure-run  
U runs  
  
Fetching external item into 'runs/expscr'  
A runs/expscr/rsim.in  
A runs/expscr/scm_sfc.in  
A runs/expscr/dfs_cold.in  
A runs/expscr/gdas.in  
A runs/expscr/gfs_cold_ini.in  
A runs/expscr/rsm_k01_50.in  
A runs/expscr/rcases.in  
A runs/expscr/gfs_cold.in  
A runs/expscr/scm.in  
A runs/expscr/amip.in  
A runs/expscr/gsm.in  
A runs/expscr/gsm_cold.in  
A runs/expscr/gsm_o3.in  
A runs/expscr/cmip.in  
A runs/expscr/smip2.in
```

end

```
msk@ saturn0:~  
earth20:/home/japril/GRIMS/SVN(59)=>ls  
libs runs srcs  
earth20:/home/japril/GRIMS/SVN(60)=>
```

Cf. Setup env.

For .bashrc,

```
export GRIMS=svn://210.106.80.229
```

For .cshrc,

```
setenv GRIMS svn://210.106.80.229
```

```
svn co svn://210.106.80.229/libs_rmp libs (enter)
```

```
→ svn co $GRIMS/libs_rmp libs (enter)
```



Due to lots of traffic...

Just copy!!!

```
cp -r /scratch/TUTORIAL_2015/20150301/libs {ur_work_dir}
cp -r /scratch/TUTORIAL_2015/20150301/srcs {ur_work_dir}
cp -r /scratch/TUTORIAL_2015/20150301/runs {ur_work_dir}
```



Compile & Run



1. Library: configure-lib

cd libs

vi configure-lib

Modify MACHINE

```
msh@saturn0:~  
earth20:/home/japril/GRIMS/SVN/libs/opt_libs(75)=>ls  
options-cray-single  options-ibmsp-single  options-macPRO-mpi  options-sgi-single  
options-cray-thread  options-ibmsp-thread  options-macPRO-single  options-sun-single  
options-dec-mpi      options-intel-mpi     options-mac-single   options-t3e-mpi  
options-dec-single   options-intel-single  options-nec-hybrid   options-t3e-single  
options-dec-thread   options-intel-thread  options-nec-mpi      options-t3e-thread  
options-es-mpi       options-linux-mpi     options-nec-single   options-t90-single  
options-es-single    options-linux-single  options-nec-thread   options-t90-thread  
options-es-thread    options-linux-thread  options-origin-mpi   options-xle-mpi  
options-hp-single    options-linux-thread_7.2  options-origin-single  options-xle-single  
options-ibmsp-mpi    options-mac-mpi       options-origin-thread  options-xle-thread
```

```
# Change the following  
#  
# MACHINE=[sgi/origin/ibmsp/sun/dec/np/cray/t90/t3e/linux_pgi/linux_intel/xle]  
# MARCH=[single,thread,mpi,hybrid,mac]  
# INSTITUTION=[nml,kisti,kma,kesti]  
#  
MACHINE=linux_pgi  
MARCH=mpi  
INSTITUTION=nml  
USERNAME=baram  
#  
#  
# If special options for compilation is needed, change below  
#  
OPTIONS_FILE=./opt_libs/options-$MACHINE-$MARCH  
if [ -s $OPTIONS_FILE-$INSTITUTION ]; then  
  cp $OPTIONS_FILE-$INSTITUTION $OPTIONS_FILE  
fi
```



1. Library: configure-lib

./configure-lib

```
earth20:/home/japril/GRIMS/SVN/libs(77)=>ls  
con configure-lib env etc lib makefiles opt_libs
```



end

```
earth20:/home/japril/GRIMS/SVN/libs(82)=>ls  
con configure-lib env etc lib machine.h Makefile makefiles opt_libs seddat_libs
```

1. Library: make

make

~ing

```
grim00@saturn0:~/GRIMs/libs
cd lib ; make || exit 8
make[1]: Entering directory `/home/grim00/GRIMs/libs/lib'
cd w3lib_linux_pgi ; make || exit 8
make[2]: Entering directory `/home/grim00/GRIMs/libs/lib/w3lib_linux_pgi'
pgf90 -DLINUX -byteswapio -mcmodel medium -c aea.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c assign.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c datimx.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c gbyte.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c gbytes.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c getgbss.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c iw3jdn.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c iw3pds.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c pdsens.f90
pgf90 -DLINUX -byteswapio -mcmodel medium -c pdseup.f90
```

end

```
if [ linux_pgi = mac ] ; then \
    zcat ldas.veg1typ.vegcov.grib.Z >ldas.veg1typ.vegcov.grib || exit 8 ; \
else \
    gunzip -c ldas.veg1typ.vegcov.grib.Z >ldas.veg1typ.vegcov.grib || exit 8 ; \
fi
if [ linux_pgi = mac ] ; then \
    zcat flwdirGSWP2.hlf.asc.Z >flwdirGSWP2.hlf.asc || exit 8 ; \
else \
    gunzip -c flwdirGSWP2.hlf.asc.Z >flwdirGSWP2.hlf.asc || exit 8 ; \
fi
make[1]: Leaving directory `/home/grim00/GRIMs/libs/con'
```

2. Source codes: configure-src

```
cd srcs ; vi configure-src ;  
Modify LIBS_DIR, MODEL, VERSION, MARCH
```



```
LIBS_DIR=/home/tuser01/mskoo/rmp/libs  
#  
# MODEL .... sph, dfs, nim, mul, rmp, smp, ssi, gsi, gop, rop  
#  
# SPH : spherical harmonics gmp  
# DFS : double fourier spectral gmp  
# NIM : non-hydrostatic icosahedral model (noaa/esrl)  
# MUL : aqua-planet testbed - neale and hoskins (2001, asl)  
# RMP : regional model program  
# GOP : global ocean model program  
# ROP : regional ocean model program  
# SMP : single column model program  
# SSI : spectral statistical interpolation data assimilation  
# GSI : grid point statistical interpolation data assimilation  
#  
MODEL=rmp  
#  
# define model version  
# = /v1.0/v2.0/v3.0/v4.0/v5.0 (see doc/readme files for sub-versions)  
#  
VERSION=v3.2  
#  
# MARCH .... select from single/mpi/thread/hybrid  
#  
MARCH=mpi
```

2. Source codes: configure-src

./configure-src

```
[grim00@saturn0 srcs]$ ls
bin          cvar.env  define.h   doc  machine.h  makefiles  src
configure-src  def      define_mpi.h  env  Makefile   options
```

```
[grim00@saturn0 def]$ ls
cvar.F      grims-depend.h  grims-v2.0.h  grims-v3.1.h  grims-v3.99.h  grims-v5.0.h  model
function.h  grims-v1.0.h   grims-v3.0.h  grims-v3.2.h  grims-v4.0.h   Makefile.in
```

*If you want,
modify define.h*

2. Source codes: define.h

vi define.h

Cumulus
convection
scheme

Shallow
convection
scheme

```
grim00@saturn0:~/GRIMs/srcs
#define SAS /* Simplified Arakawa Schubert cumulus convection */
#undef SIGN_CORRECTION /* Correction of acrtfct */
#undef UV_CMT /* Convective momentum transport in SAS */
#undef NCEP2010 /* Include the gfs changes in july 2010 */
#undef SAS_CCN /* CCN number concentration in SAS */
#undef RAS /* Relaxed Arakawa Schubert cumulus convection */
#undef RASV2 /* RAS with downdraft */
#undef CCMCNV /* Zhang McFarlane cumulus convection */
#undef KF2 /* Kain-Fritsch convection cumulus */
#undef KUO /* Kuo cumulus convection */
#undef CPS_ENS /* Cumulus convection scheme ensemble */

#undef MRFSCV /* Tiedke shallow convection */
#define GRIMSCV /* Explicitly coupled shallow convection and radiation */
#undef CCMSCV /* Hack shallow convection */
#undef HANPANSCV /* Han and Pan shallow convection */
```

CPS	SCV
SAS	MRFSCV
RAS	GRIMSCV
CCMCNV	HANPANSCV
KF2	
KUO	

1) Choose different CPS

```
#undef SAS
```

....

```
#define RAS
```

2) NO "Spectral Nudging"

```
#undef STDAMP
```

```
#undef STDAMP3
```

```
#undef STDAMP_VER
```

Physics package by group

ID	Spectral nudging	CPS	SCV	MPS
tuser01	Yes	SAS	GRIMs	WSM1
tuser02	Yes	RAS	GRIMs	WSM1
tuser03	Yes	CCM	GRIMs	WSM1
tuser04	Yes	SAS	MRF	WSM1
tuser05	Yes	SAS	HANPAN	WSM1
tuser06	No	SAS	MRF	WSM1
tuser07	No	SAS	GRIMs	WSM1
tuser08	No	RAS	GRIMs	WSM1

2. Source codes: make

make

```
[grim00@saturn0 bin]$ ls  
change_resolution_pressure.x  cnvalb.x      fcst.x  pgb.x      sfcl_par.a  
chgdates.x                   co2.x         fgb.x   rad_albedo_aerosol.x  sgb.x  
chgr.x                       common.a      mpi.a   sfc0.x     share.a  
cnvaer.x                    common_par.a  mtn.x   sfcl.a
```

end

3. Run scripts: configure-run

Requirements

- initial data
 - atmospheric forcing (i.e., U,V,T,Q)
 - surface boundary (i.e., sea surface temperature)
 - lateral boundary (for limited-area model)
- horizontal resolution and vertical layers
- domain of interest
- integration period
- number of processors

3. Run scripts: configure-run

vi configure-run

```
# SRCS_DIR      .... Model executable directory is $SRCS_DIR/bin.  
#  
SRCS_DIR=`pwd` ../srcs  
OUTPUT_DIR= /scratch/TUTORIAL_2015/tuser01/mskoo  
POST_DIR=`pwd` /post
```

Output resolution (wave for GMP)

```
# Need to select resolutions  
#  
WAVE=62      # define wave number = 62,126,170,214,254,320,426,510,1020,2046  
MODEL_LAYER=28 # define number of vertical layer = 18, 28, 42, 64, 128  
POST_LAYER=17 # define number of pressure output file  
#           = 12 (rmp), 17(ra2), 21(ra2+4), 26(fnl), 30(fnl+4)
```

Model resolution

```
tuser01:/home/tuser01/mskoo/rmp/runs/rmp_domain=> ls  
r_grid.f      r_map.contour  r_map.n          rmp_162x141_50km_lcc.rmip    rmp_240x197_50km_lcc.cordex  
r_grid.sh     r_map.grid     rmp_108x107_60km_nps.polar  rmp_192x157_50km_lcc.rmip    rmp_54x55_50km_lcc.korea  
r_map.conrec  r_map.grid_korea rmp_108x85_60km_nps.korea   rmp_200x181_12.5km_lcc.korea  
tuser01:/home/tuser01/mskoo/rmp/runs/rmp_domain=> |
```

```
#  
# Need to select rmp map projection data.. see ../rmp_domain for more options  
#  
RMP_MAP=../rmp_domain/rmp_108x85_60km_nps.korea  
#  
if [ $model = rmp -o $model = rop ]; then  
    IGRD=108      # rmp grid selection (IGRD/JGRD)  
    JGRD=85      # igrd: product of integer powers 2,3,5; jgrd: odd number  
                # = 54/55, 81/67, 81/87, 108/69, 108/85, 128/85, 162/105  
    CIGRD=0      # define number of coarse regional x-axis grids (only for C2R)  
    CJGRD=0      # define number of coarse regional y-axis grids (only for C2R)
```



\$work/runs/rmp_domains directory contains pre-set domain namelist files

```
rmp_108x85_60km_nps.korea  
rmp_162x141_50km_lcc.rmip  
rmp_192x157_50km_lcc.rmip  
rmp_240x197_50km_lcc.cordex
```

user can add own domain setup in this directory

✓ rules for naming of namelist file

ex) rmp_108x85_60km_nps.korea → brief description for the domain

number of grids
for x and y direction

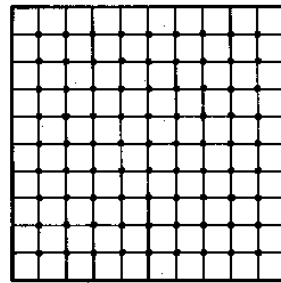
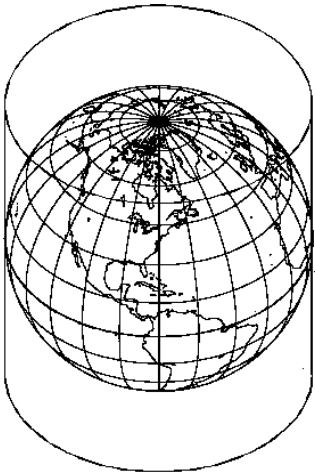
horizontal resolution
at true latitude

map projection
nps : North Polar Stereographic
lcc : Lambert Conformal
mer : Mercator

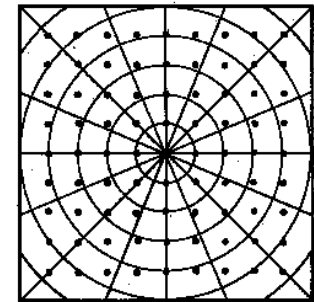
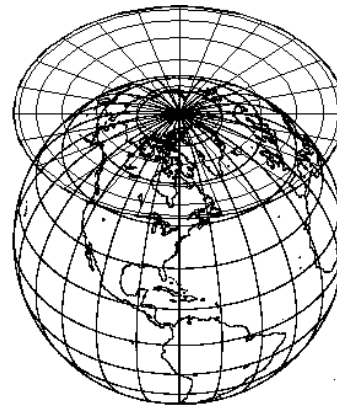
Map projection

a map projection is a **systematic transformation** of the latitudes and longitudes of locations on the surface of a sphere or an ellipsoid into locations on a plane.

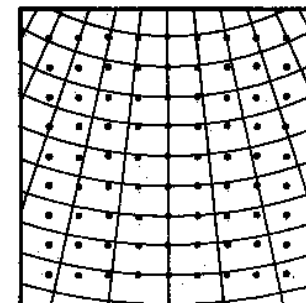
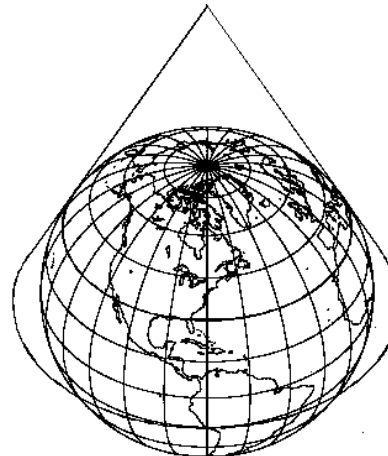
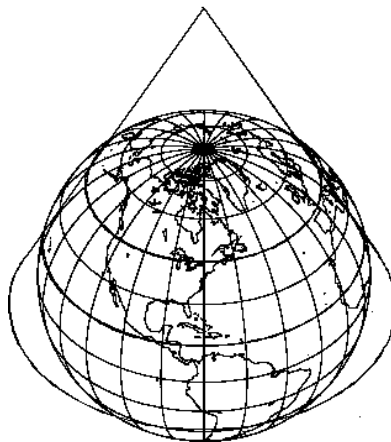
Mercator



Polar stereographic



Lambert conformal



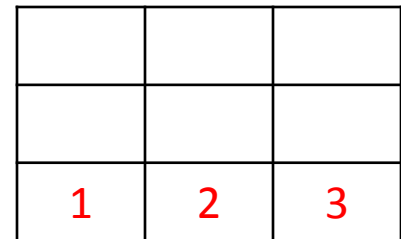
Model resolution for RMP

ex) rmp_108x85_60km_nps.korea

```
$rdomain
igrd = 108
jgrd = 85
proj = 1.
truth = 60.0
cotru = 60.0
orient = 127.5
delx = 60000.
dely = 60000.
cenlat = 90.
cenlon = 0.
xleftgrd = 55.0
botmgrd = 140.0
$end
```

igrd : number of regional x-direction (west-east) **volume grids**
should be a product of integer powers 2, 3, 5

jgrd : number of regional y-direction (south-north) **volume grids**
should be an odd number



red : volume grids

blue : grid points in model

ex) rmp_108x85_60km_nps.korea

```
$rdomain  
igrd = 108  
jgrd = 85  
proj = 1.  
truth = 60.0  
cotru = 60.0  
orient = 127.5  
delx = 60000.  
dely = 60000.  
cenlat = 90.  
cenlon = 0.  
xleftgrd = 55.0  
botmgrd = 140.0  
$end
```

proj : Mapping projection index

0 = Mercator projection (MP)

1 = North Polar stereographic projection (NPS)

-1 = South Polar stereographic projection (SPS)

2 = North Lambert conformal conic projection (NLCC)

-2 = South Lambert conformal conic projection (SLCC)

truth : latitude where the map plane cuts through the earth's surface

cotru : latitude where the map plane cuts through the earth's surface
(only for Lambert conformal conic projection)

orient : domain orientation longitude

delx : grid spacing in meter for x-direction at true latitude

dely : grid spacing in meter for y-direction at true latitude

ex) rmp_108x85_60km_nps.korea

```
$rdomain
igrd = 108
jgrd = 85
proj = 1.
truth = 60.0
cotru = 60.0
orient = 127.5
delx = 60000.
dely = 60000.
cenlat = 90.
cenlon = 0.
xleftgrd = 55.0
botmgrd = 140.0
$end
```

cenlat : Reference latitude

domain center latitude for MP

90 for NPS, NLCC

-90 for SPS, SLCC

cenlon : Reference longitude

domain center longitude for MP

0 for NPS, SPS, NLCC, SLCC

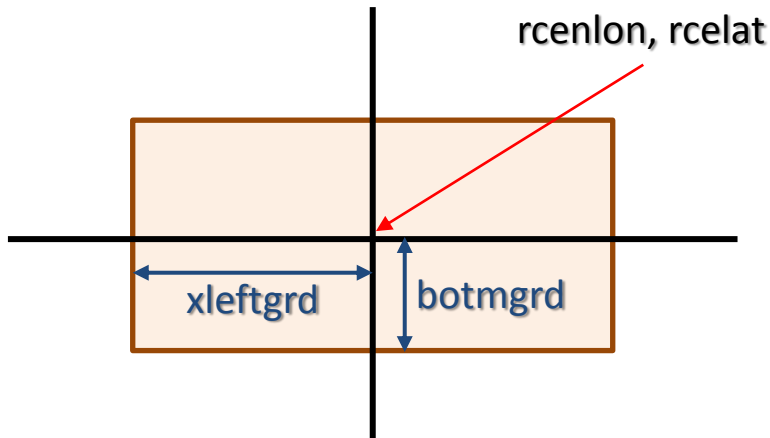
xleftgrd : x-direction grid number from orient to left-lower corner

botmgrd : y-direction grid number from center to domain bottom (MP)

y-direction grid number from pole to domain bottom

(PS, LCC)

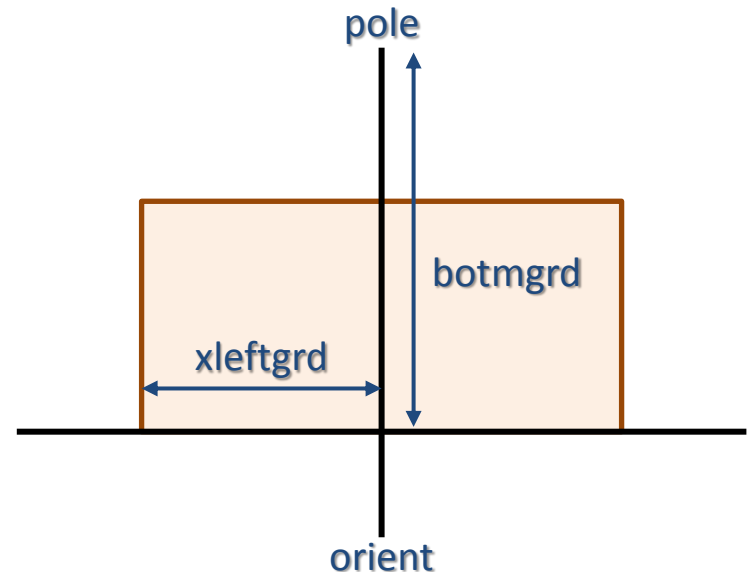
Mercator projection



For symmetric domain setup with respect to the orient,

$$xleftgrd = \frac{igrd}{2} + 1$$

Polar stereographic Lambert conformal conic projection



For PS and LCC, "botmgrd" can be estimated as

$$2\pi \times R_e \times \frac{90^\circ - \theta}{360^\circ} = botmgrd \times dely$$

\$work/runs/rmp_domains/r_grid.sh

domain setup visualization shell-script

usage: r_grid.sh [domain namelist file]

```
earth20:/home/agfe/GRIMs/cvs_update/20101101/srcs/src/rmap> r_grid.sh rmp_108x85_60km_nps.korea
```

```
+ PROG=r_grid
```

```
+ cp r_grid.f map.f
```

```
+ ncargf90 map.f
```

```
pgf90 -O map.f -L/usr/local/ncarg4_pgi/lib -L/usr/X11R6/lib64 -lncarg -lncarg_gks -lncarg_c -lX11
```

```
map.f:
```

```
+ rm gmeta
```

```
rm: cannot remove `gmeta': No such file or directory
```

```
+ ./a.out
```

```
...
```

```
DELX X00 Y00 60000.00 -3239999. -8340001.
```

```
flat00 flon00 16.07150 106.2694
```

```
flat01 flon01 47.84583 82.50002
```

```
flat10 flon10 16.07149 148.7306
```

```
flat11 flon11 47.84582 172.5000
```

```
flat_cen flon_cen 38.30066 127.5000
```

```
true cotru rot 60.00000 60.00000 127.5000
```

```
FORTRAN STOP
```

```
+ rm ./a.out
```

```
+ echo 'idt?(y/n)'
```

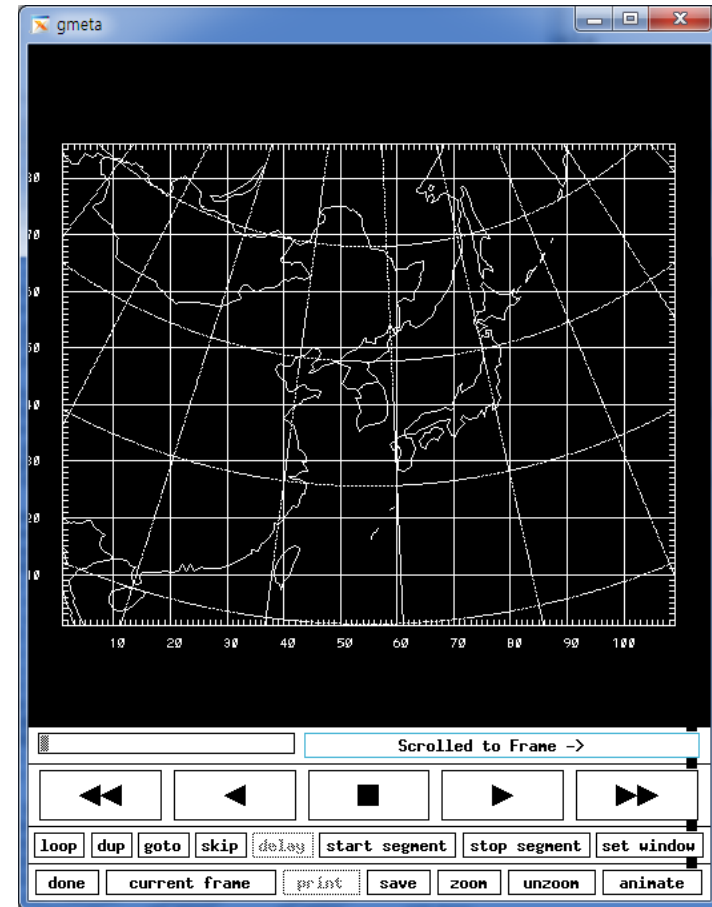
```
idt?(y/n)
```

```
+ read ans
```



```
$work/runs/rmp_domains/r_grid.sh
```

```
+ echo 'idt?(y/n)'
idt?(y/n)
+ read ans
y
+ '[' y = y ']'
+ idt gmeta
+ echo 'lpr?(y/n)'
lpr?(y/n)
+ read ans
n
+ '[' n = y ']'
+ echo 'Postscript?(y/n)'
Postscript?(y/n)
+ read ans
y (write gmeta.ps file)
+ '[' y = y ']'
+ ctrans -d ps.mono gmeta
+ rm gmeta map.f DCNSM.nml fort.72
```



3. Run scripts: configure-run

vi configure-run

```
## input surface & sperical wave file resolution
#
# T42 (128,64), T62 (192,94), T126 (384,192), T170 (512,256),
# T214 (648,324), T254 (768,384), T320 (968,484), T426 (1280,640),
# T510 (1536,768), T1020 (3072,1536), T2046 (6144,3072)
#
```

```
ILONF=192 # for SFC file
ILATG=94 # for SFC file
IJCAP=62 # for SIG file
ILEVS=28 # for SIG file
```

```
if [ $1 = gmp_gfs -o $1 = gmp_gfs2 -o $1 = gmp_kaf ]; then
```

```
ILONF=1760
ILATG=880
IJCAP=574
ILEVS=64
```

```
fi
```

```
#
# For DFS, NCOL should be less than MODEL_LAYER,
# more than 2*NPES/JCAP.
#
```

```
NCPUS=1 # number of pes (when MARCH = thread)
NPES=64 # number of cpus or threads (when MARCH = mpi or hybrid)
NCPU_PER_NODE=8 # number of cpus per node
NCOL=2 # number of column (when MARCH=mpi or hybrid)
```

Input resolution

Number of processors

3. Run scripts: configure-run

```
# Define DELTAT
DELTAT=""
if [ $model = rmp ]; then
  grdsiz=`echo $delx | cut -d'.' -f1`
  if [ $grdsiz -ge 60000 ]; then
    DELTAT=240
  elif [ $grdsiz -ge 30000 ]; then
    DELTAT=120
  elif [ $grdsiz -ge 10000 ]; then
    DELTAT=60
  elif [ $grdsiz -ge 5000 ]; then
    DELTAT=10
  elif [ $grdsiz -ge 2000 ]; then
    DELTAT=6
  elif [ $grdsiz -ge 1000 ]; then
    DELTAT=3
  elif [ $grdsiz -ge 500 ]; then
    DELTAT=1
  fi
else
  if [ $jcap -eq 0 ]; then
    DELTAT=600
  elif [ $jcap -le 20 ]; then
    DELTAT=3600
  elif [ $jcap -le 40 ]; then
    DELTAT=1800
  elif [ $jcap -le 42 ]; then
    DELTAT=1800
  elif [ $jcap -le 62 ]; then
    DELTAT=1200
  elif [ $jcap -le 126 ]; then
    DELTAT=600
  elif [ $jcap -le 170 ]; then
    DELTAT=480
  elif [ $jcap -le 214 ]; then
    DELTAT=360
  elif [ $jcap -le 254 ]; then
    DELTAT=300
  elif [ $jcap -le 320 ]; then
    DELTAT=270
  elif [ $jcap -le 372 ]; then
    DELTAT=240
  elif [ $jcap -le 426 ]; then
    DELTAT=180
  elif [ $jcap -le 510 ]; then
    DELTAT=120
  elif [ $jcap -le 1022 ]; then
    DELTAT=90
  elif [ $jcap -le 2046 ]; then
    DELTAT=60
  fi
fi
```

If model blow up,
You can change deltat.

3. Run scripts: exp script

vi expscr/rmp.in

starting and ending time

```
# rfcst control statement
#
YYYYS=2001
MMS=07
DDS=14
HHS=00
YYYYE=2001
MME=07
DDE=15
HHE=00
ENDHOUR=`/home/grim00/GRIMs/libs/etc/maketim $YYY
YS$MMS$DDS$HHS -d $YYYYE$MME$DDE$HHE` || exit 8
#
FCST_RESTART=yes
DELTAT_REC=240
NESTING_HOUR=6
INCHOUR=$NESTING_HOUR
RELX_REC=1800
SWHR_GBI=3
LWHR_GBI=3
SWHR_REG=1
LWHR_REG=1
SFC_CYCLE=yes
SFC_CYCLE_HOUR=24
INTSFCY=$SFC_CYCLE_HOUR
INTOMIX=24
sfc_freq=$SFC_CYCLE_HOUR
INTRESTART=24
INTSIG=6
INTPOST=$INTSIG
```

model integration time
nesting time interval
from global files

3. Run scripts: exp script

```
# ----- do not change below -----  
#  
mkdir -p $EXECDIR 2>/dev/null  
#  
INITIAL_SIGMA=@CON_DIR@/sig.anl.$SDATE.ieee  
INITIAL_SFC=@CON_DIR@/sfc.anl.$SDATE.ieee  
INITIAL_SFC_FILE_TYPE=osul  
#  
# blank means use guess (in the sfc file).  
#  
SST_ANL_T0=@CON_DIR@/gisst22.$SYEAR.daily  
ICE_ANL_T0=@CON_DIR@/clim.ice.r2.1979-1998.grib  
SNO_ANL_T0=@CON_DIR@/clim.snow.r2.1979-1998.grib  
SCV_ANL_T0=  
#  
licegrb0=1           # 0 : use guess, 1 : use grib file  
isnogr0=0  
isstgrb0=1  
ism2grb0=0  
#  
SST_ANL=@CON_DIR@/gisst22.$SYEAR.daily  
ICE_ANL=@CON_DIR@/clim.ice.r2.1979-1998.grib  
SNO_ANL=@CON_DIR@/clim.snow.r2.1979-1998.grib  
SCV_ANL=  
#
```

3. Run scripts: make script & run

configure-run rmp (for seasonal ensemble prediction, rsim)

```
[grim00@saturn0 runs]$ ls  
configure-run  cvar.env  env  expscr  gmp  namelist.gmp  options  runscr
```

./rmp (or ./rmp >& prt.prt &)

```
[grim00@saturn0 runs]$ ls  
configure-run  cvar.env  env  expscr  g_000  gmp  namelist.gmp  options  runscr
```

You should submit two jobs !!

1) rmp (short-range simulation)

```
../runs>> ./configure-run rmp
```

```
../runs>> ./rmp
```

2) rsim (seasonal simulation)

```
../runs>> ./configure-run rsim
```

```
../runs>> ./rsim
```

```

#
# Initial year, month, day, hour
#
SYYYYYMMDDHH=2010060100
YYYYS=`echo $SYYYYYMMDDHH|cut -c1-4`
MMS=`echo $SYYYYYMMDDHH|cut -c5-6`
DDS=`echo $SYYYYYMMDDHH|cut -c7-8`
HHS=`echo $SYYYYYMMDDHH|cut -c9-10`
#
# ending year, month, day, hour
#
EYYYYYMMDDHH=2010061000
YYYYE=`echo $EYYYYYMMDDHH|cut -c1-4`
MME=`echo $EYYYYYMMDDHH|cut -c5-6`
DDE=`echo $EYYYYYMMDDHH|cut -c7-8`
HHE=`echo $EYYYYYMMDDHH|cut -c9-10`

```

```

#
# specification of initial condition
#
#
SIGDIR=/scratch/TUTORIAL/GRIMS/DATA/r2/6hour/sig_sfc
SSTDIR=/scratch/TUTORIAL/GRIMS/DATA/SST
#
INITIAL_SIG_PLATFORM=$host_head
INITIAL_SIG_FTP=$transfer
INITIAL_SIG_GLB=$SIGDIR/$YYYYS/sig.anl.$SYYYYYMMDDHH.ieee
INITIAL_SFC_GLB=$SIGDIR/$YYYYS/sfc.anl.$SYYYYYMMDDHH.ieee
INPUT_RESOLUTION=t62k28
INITIAL_SFC_FILE_TYPE=osu1
#
# Base field analysis sigma files
#
BASE_SIG_PLATFORM=$host_head
BASE_SIG_FTP=$transfer
BASE_SIG=$SIGDIR/\$YYYYYF/sig.anl.\$YYYYYF\$MMF\$DDF\$HHF.ieee
BASE_RESOLUTION=t62k28
#
# sst/ice/snow
#
SST_PLATFORM=$host_head
SST_FTP=$transfer
SST_ANL=$SSTDIR/gisst22.\$YYYYYF.daily
SST_ANL_T0=$SSTDIR/gisst22.$YYYYYS.daily

```

1. Reanalysis sig/sfc data

http://nomad3.ncep.noaa.gov/ncep_data/index.html

- sig : Reanalysis-2 spectral sigma analyses
- sfc : Reanalysis-2 sfc anl (to run model)

2. Daily SST

www.grims-model.org

→ Download



KIAPS

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Thank you for your listening



www.kiaps.org



Hands-on Session: GRIMs-RMP

Post-process/Evaluation

Myung-Seo Koo

Korea Institute of
Atmospheric Prediction Systems
(KIAPS)





RMP



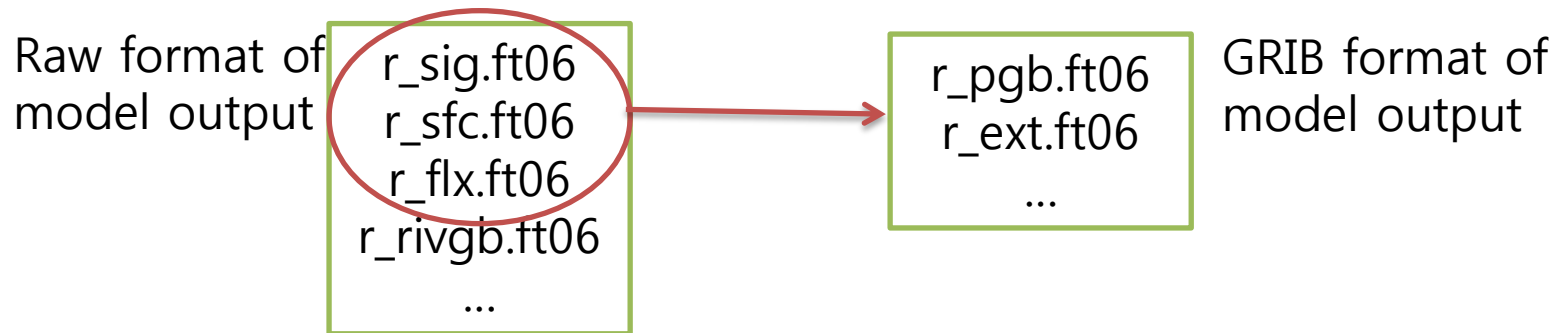
Check output files in output directory

```
#  
# post processing  
#  
if [ yes = yes ] ; then  
    /home/tuser01/mskoo/rmp/runs/runscr/r_pgb $h $hx $INTPOST || exit 8  
elif [ no = yes ] ; then  
    /home/tuser01/mskoo/rmp/libs/etc/cas_pgb  
fi
```

r_pgb.ft* (pressure and flux file)

: post-processed GRIB file created from the sigma binary file

- prognostic fields on several pressure level at forecast hour *
- flux fields on surface level at forecast hour *



Prepare for plotting (make ctl for GrADS)

1. Make ctl file for r_pgb file

In output directory of rmp run

```
cd /scratch/tuser20/RMP/runs/r_000
```

```
r_pgb.ft00  
r_pgb.ft06  
r_pgb.ft12  
r_pgb.ft18  
r_pgb.ft24
```

Make .ctl file

```
/scratch/tuser20/RMP/libs/etc/grmap r_pgb.ft%f2
```

```
(or) grmap r_pgb.ft%f2
```

```
r_pprs.ctl  
r_pprs.idx
```

Download post script in your directory

```
svn co svn://118.128.66.149/post (enter)
```

```
cd post/rmp/_script/_out  
ln -sf /home/grim00/GRIMs/runs_rmp/r_000 r_000
```

Draw figures (rmp)

in_gs directory

1. rain_kor.gs
2. train_kor.gs

```
*=====*
```

```
* 12z14-12z15 Averaged Total Rain
```

```
*          grid : 109 x 86 (22 53 110 145) *
```

```
*=====*
```

```
'reinit'
```

```
*----- set parameters -----*
```

```
exp = r_000
```

```
grdir= '/home/tuser01/jwlee/rmp/post/rmp/_script/./_GS/_gslib'
```

```
*-----*
```

```
psdir= './_plt'/exp
```

```
!mkdir -p 'psdir'
```

```
pname = '1.rain.korea.ps'
```

```
fname = './_ct/r_pgb.exp.ctl'
```

```
*-----*
```

```
* region : ea (East Asia) / kor (Korea)
```

```
region=kor
```

```
*-----*
```

```
*
```

```
'open 'fname''
```

```
'enable print 'psdir'/fig.plt'
```

Post-process (automatic script for default setup)

including step in previous page

1. Download post script in your directory

```
svn co svn://118.128.66.149/post (enter)
```

```
tuser01:/home/tuser01/jwlee/rmp/post==> ls  
rmp rsim  
tuser01:/home/tuser01/jwlee/rmp/post==> cd rmp  
tuser01:/home/tuser01/jwlee/rmp/post/rmp==> ls  
_GS README _script
```

GrADS
script

all.sh, make_ctl.sh

Post-process (automatic script for default setup)

2. Modify "all.sh"

```
#-----  
# exps : experiment names  
#       (experiment names should be the same as fcst output directory names)  
#  
# mdir : main directory for gmp analysis  
# ldir : GRIMs library directory  
# odir : output directory  
# grdir : GrADs library directory  
#-----  
# change the following variables  
exps="r_000" ← experiment name  
  
mdir=/scratch/TUTORIAL/GRIMs/tuser15/TEST/post/rmp ← current dir.  
ldir=/scratch/TUTORIAL/GRIMs/tuser15/TEST/libs ← library dir.  
odir=/scratch/TUTORIAL/GRIMs/tuser15/TEST/runs ← run dir.  
  
# pause before plotting the next figure; on/off  
pause=on  
#-----
```

Post-process (automatic script for default setup)

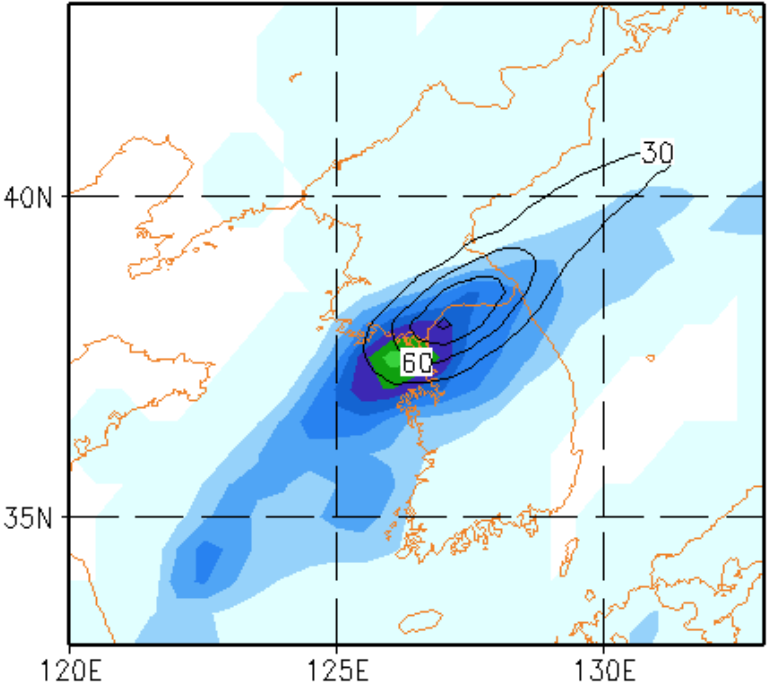
3. run "all.sh"

```
Thanks for flying Vim
+ sed s,@MAINDIR@,/home/tuser01/jwlee/rmp/post/rmp,g aa.txt
+ sed s,@GRADSDIR@,/home/tuser01/jwlee/rmp/post/rmp/_script/../../_GS/_gslib,g
+ rm -rf aa.txt bb.txt
+ for script in '$gscript'
+ sed s/Y04/r_000/g ../../_GS/4,850_rh_wind,GS
+ sed s,@MAINDIR@,/home/tuser01/jwlee/rmp/post/rmp,g aa.txt
+ sed s,@GRADSDIR@,/home/tuser01/jwlee/rmp/post/rmp/_script/../../_GS/_gslib,g
+ rm -rf aa.txt bb.txt
+ for script in '$gscript'
+ sed s/Y04/r_000/g ../../_GS/5,500_hgt_T,GS
+ sed s,@MAINDIR@,/home/tuser01/jwlee/rmp/post/rmp,g aa.txt
+ sed s,@GRADSDIR@,/home/tuser01/jwlee/rmp/post/rmp/_script/../../_GS/_gslib,g
+ rm -rf aa.txt bb.txt
+ for script in '$gscript'
+ sed s/Y04/r_000/g ../../_GS/6,200_wind_hgt,GS
+ sed s,@MAINDIR@,/home/tuser01/jwlee/rmp/post/rmp,g aa.txt
+ sed s,@GRADSDIR@,/home/tuser01/jwlee/rmp/post/rmp/_script/../../_GS/_gslib,g
+ rm -rf aa.txt bb.txt
+ '[' on = on ']'
+ an=
+ an2='*'
+ cat
+ grads -pc first.gs

Grid Analysis and Display System (GrADS) Version 2.0.1
Copyright (c) 1988-2011 by Brian Doty and the
Institute for Global Environment and Society (IGES)
GrADS comes with ABSOLUTELY NO WARRANTY
See file COPYRIGHT for more information

Config: v2.0.1 little-endian readline printim grib2 netcdf hdf4-sds hdf5 op
Issue 'q config' command for more detailed configuration information
GX Package Initialization: Size = 8.5 11
-----1/6
No hardcopy metafile open
All files closed; all defined objects released;
All GrADS attributes have been reinitialized
Notice: Implied interpolation for file ../../ctl/r_pgb.r_000.ctl
Interpolation will be performed on any data displayed from this file
Hardcopy output file is closed
Number of frames = 1
====> Push "Enter" button for the next figure[]
```

GrADS 2.0.1



Press Enter for next figure

Post-process (automatic script for default setup)

4. check outputs and plotted figures

after run "all.sh", 4 directories are generated in post/rmp directory

(e.g., /home/tuser01/jwlee/rmp/post/rmp)

all.sh

make_ctl.sh

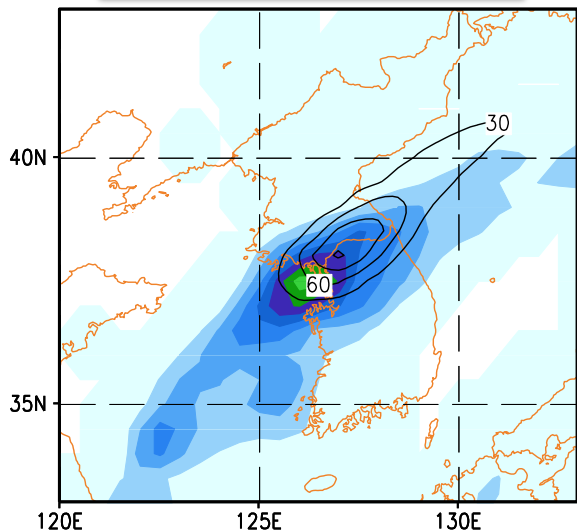
./_out : model output directory

./_ctl : control files for GrADS

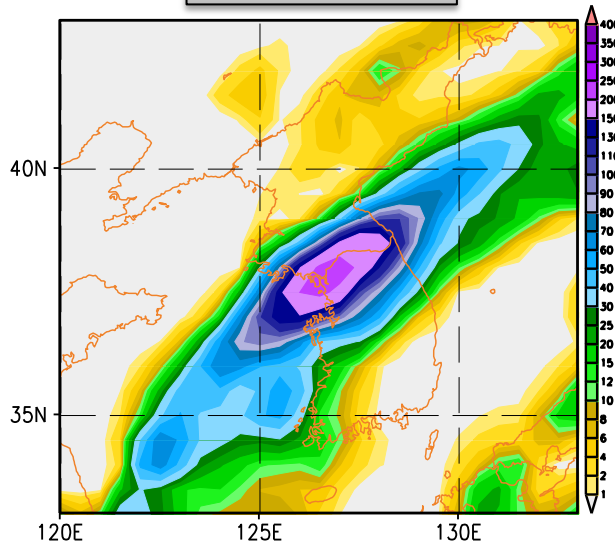
./_gs : GrADS scripts for each figures

./_plt : figures in '.ps' format

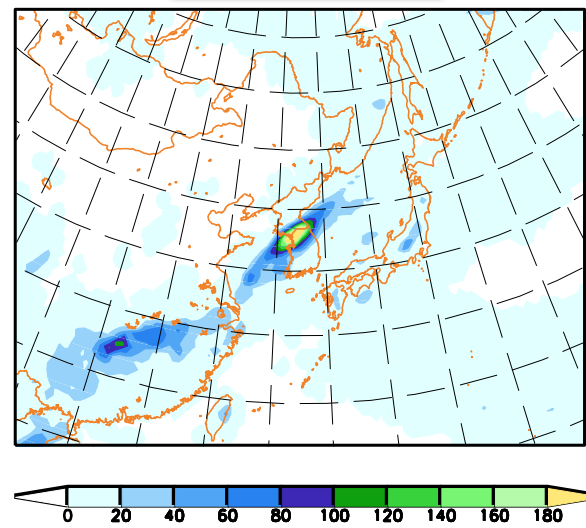
1. Conv/Nconv rain



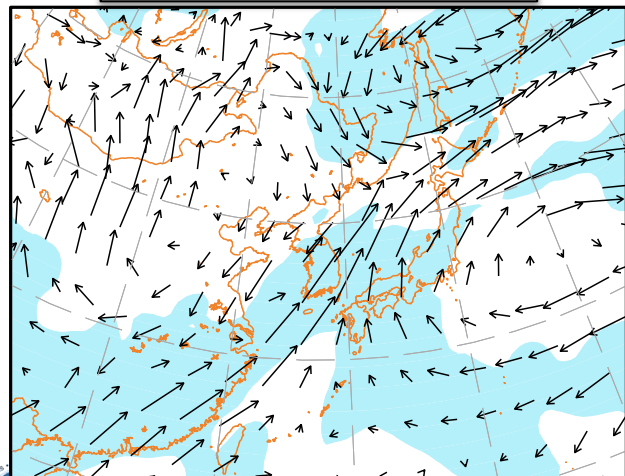
2. total rain



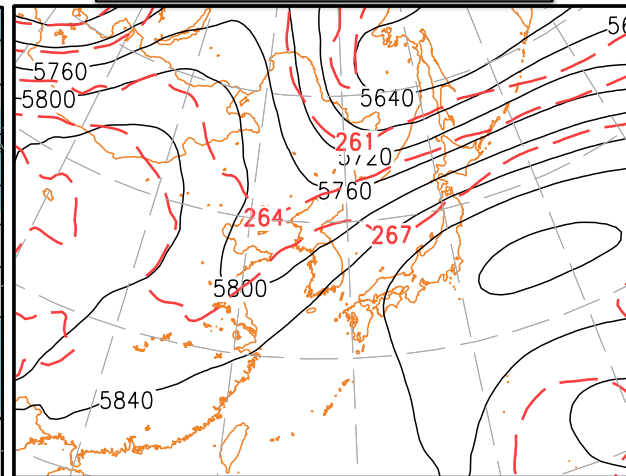
3. total rain



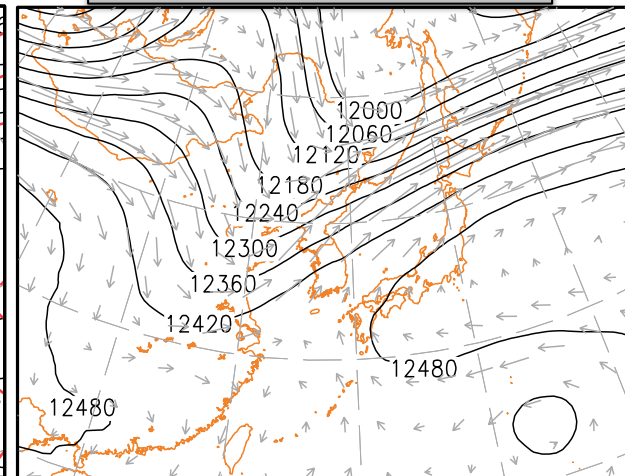
850 hPa; RH & wind



500 hPa; HGT & TMP



200 hPa; HGT & wind

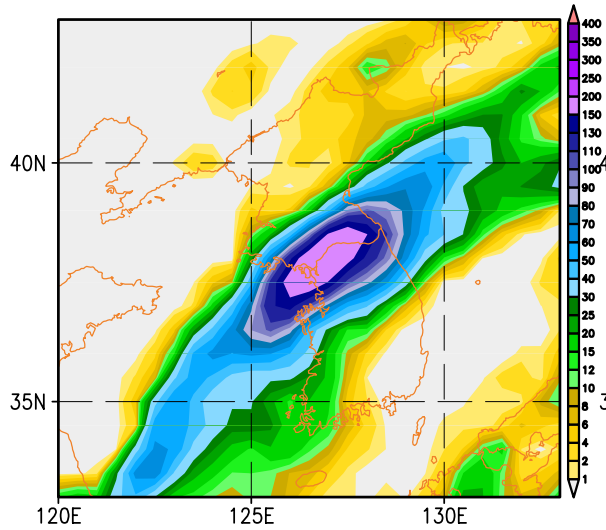




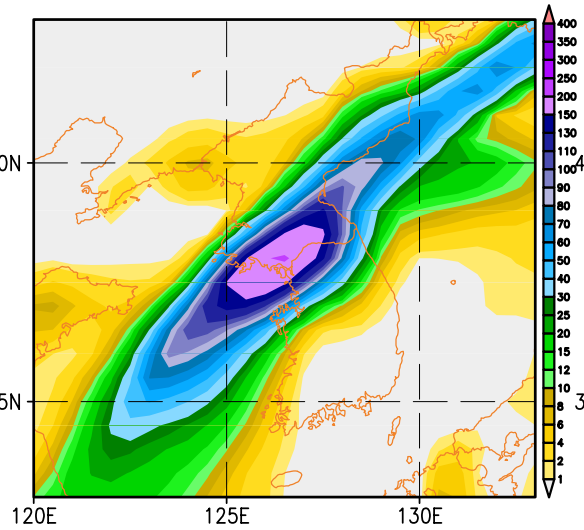
CPS sensitivity

Total rainfall (mm) 12z14-12z15 July 2001

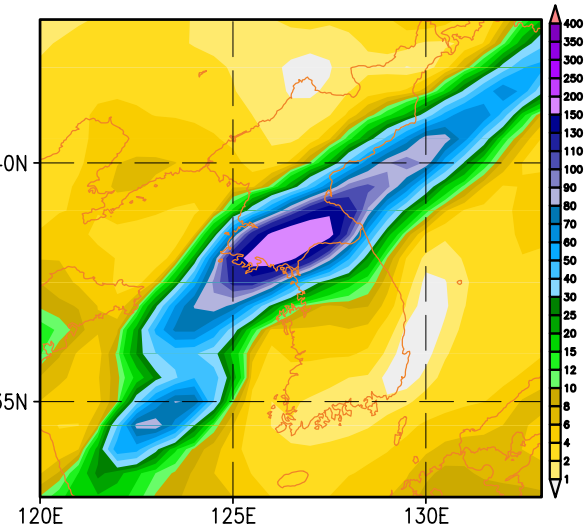
CTL



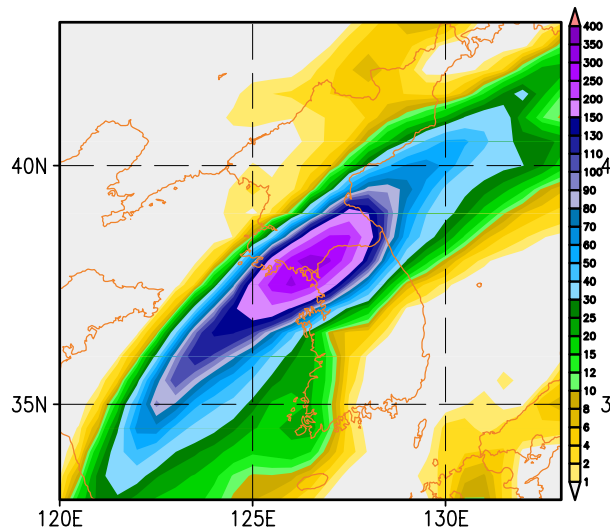
RAS



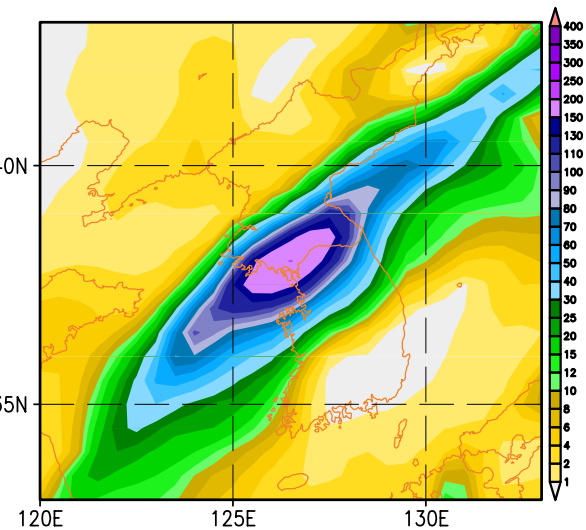
CCM



KF2

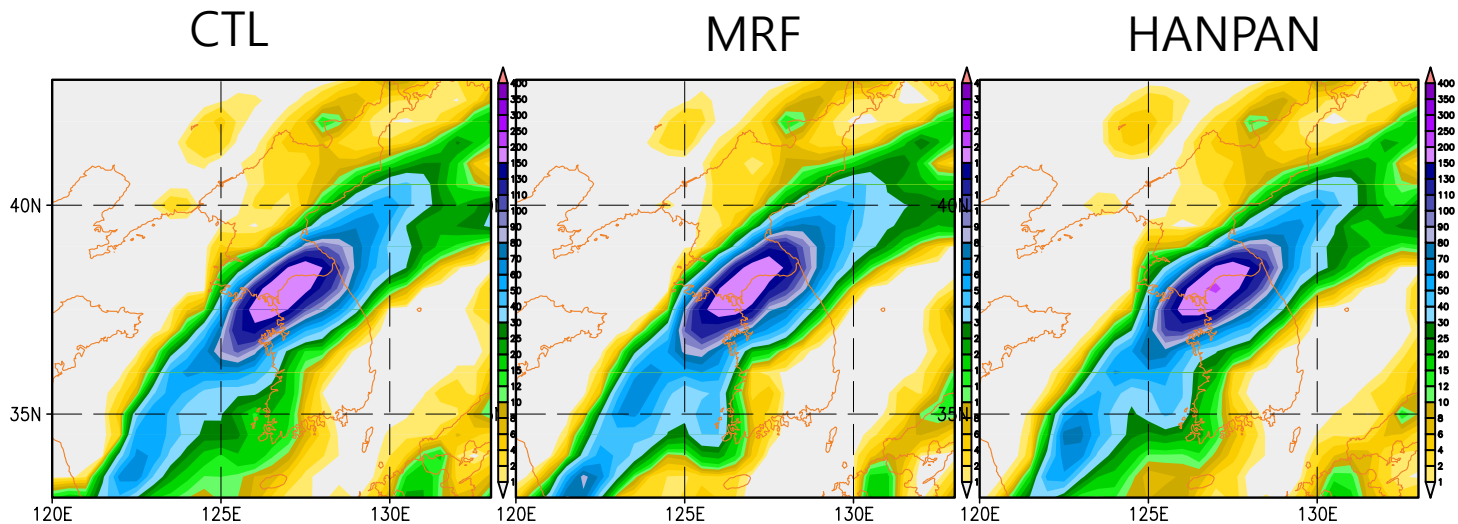


ENS



SCV sensitivity

Total rainfall (mm) 12z14-12z15 July 2001



RMP_NOSTDAMP

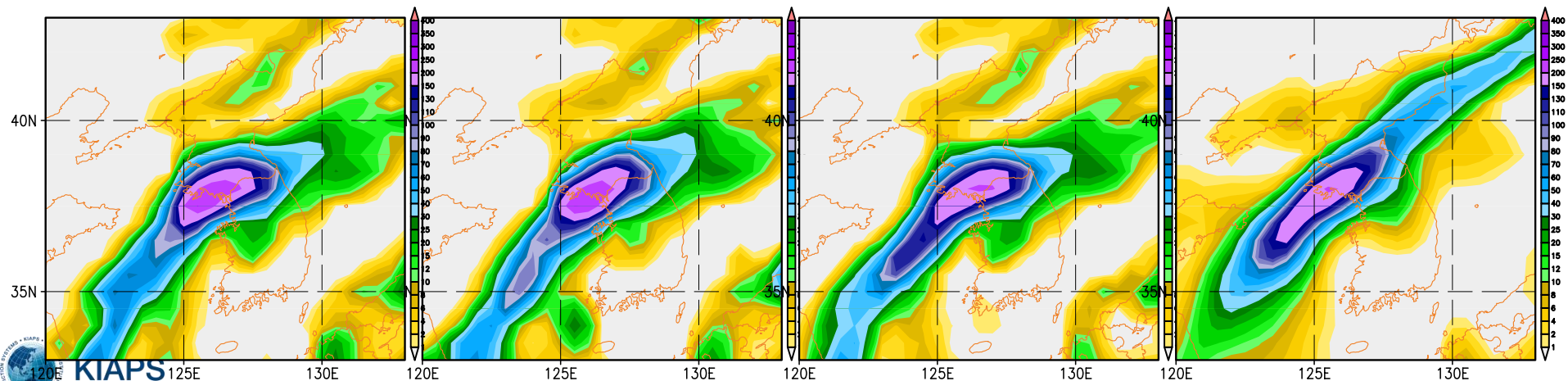
(For no spectral nudging,
SCV and CPS sensitivity)

NOSTDAMP

NOSTDAMP_MRF

NOSTDAMP_HANPAN

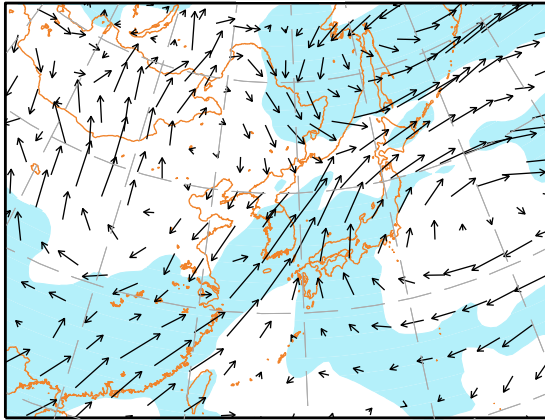
NOSTDAMP_RAS



CPS sensitivity

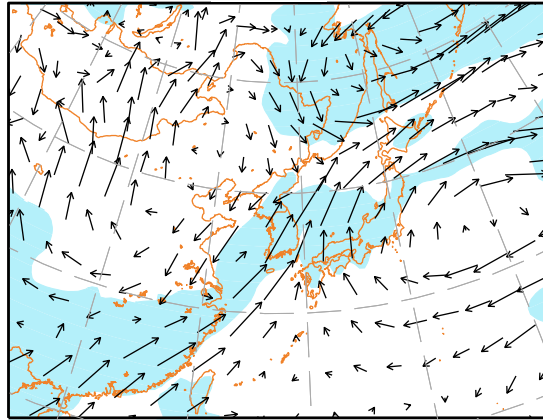
850 hPa RH and Wind 06z14-00z16 July 2001

CTL



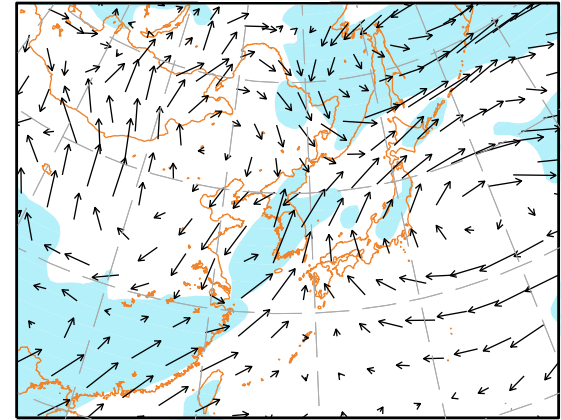
15 →

RAS



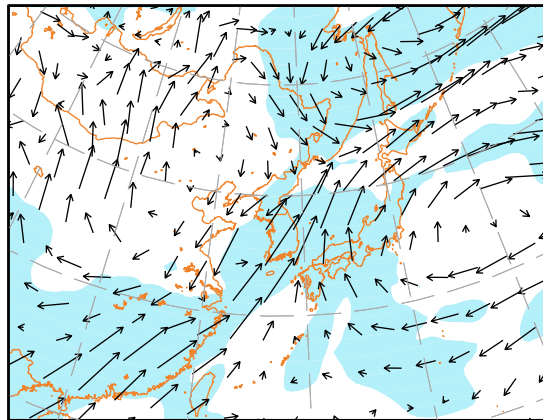
15 →

CCM



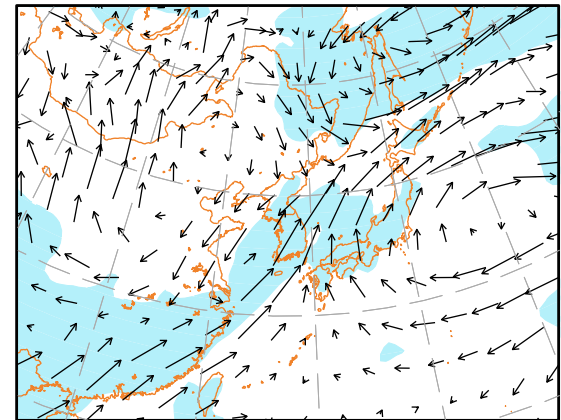
15 →

KF2



15 →

ENS

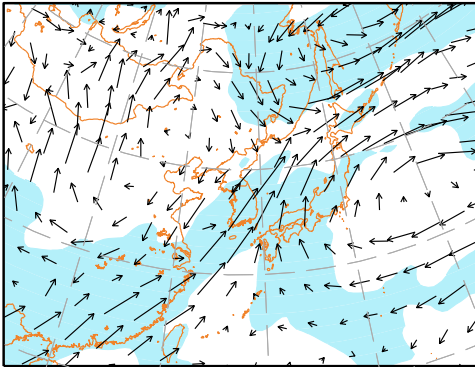


15 →

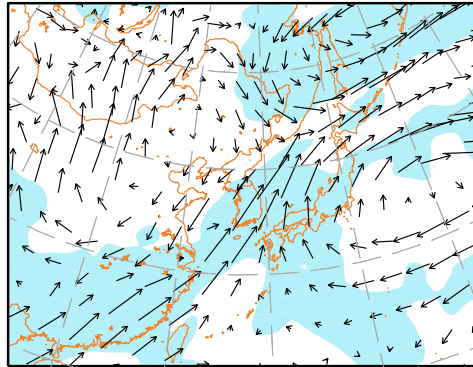
SCV sensitivity

850 hPa RH and Wind 06z14-00z16 July 2001

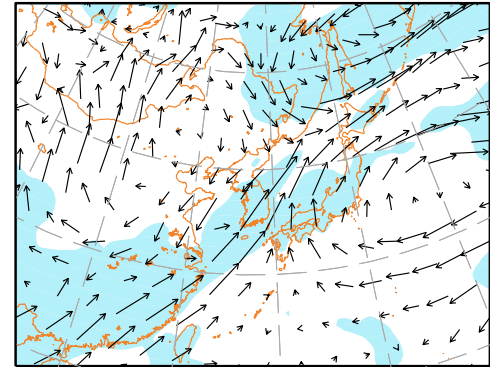
CTL



MRF



HANPAN



15

15

15

RMP_NOSTDAMP

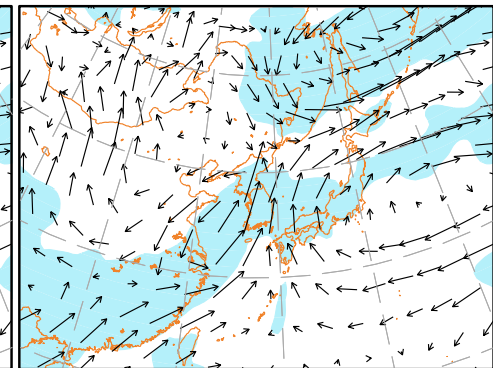
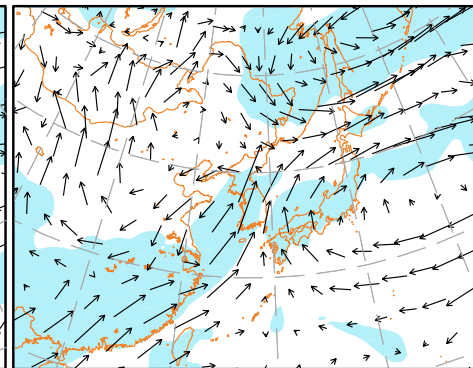
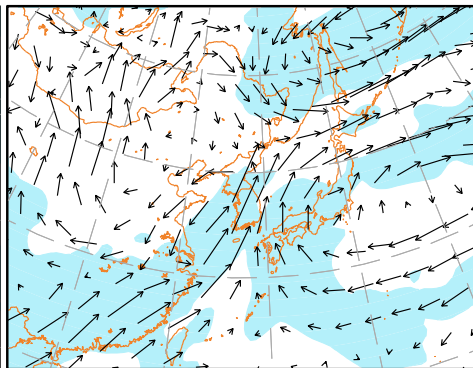
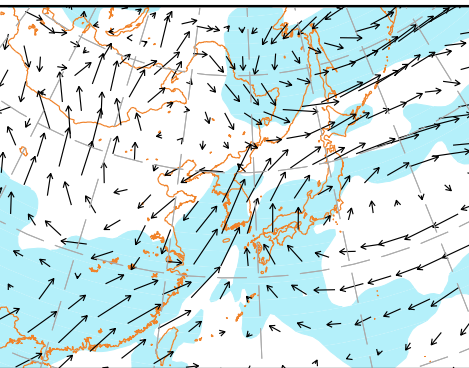
(For no spectral nudging,
SCV and CPS sensitivity)

NOSTDAMP

NOSTDAMP_MRF

NOSTDAMP_HANPAN

NOSTDAMP_RAS



15

15

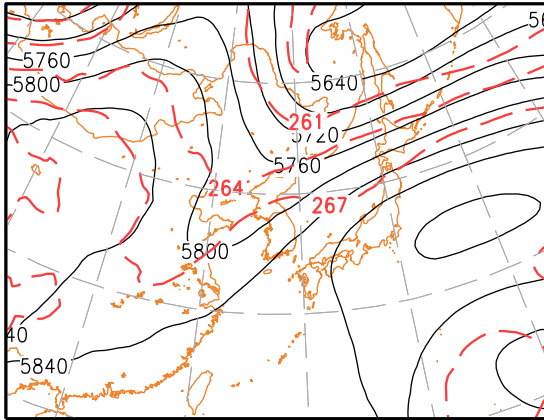
15

15

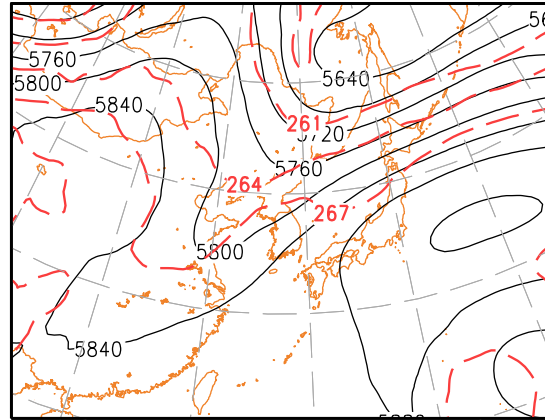
CPS sensitivity

500 hPa HGT and Temp 06z14-00z16 July 2001

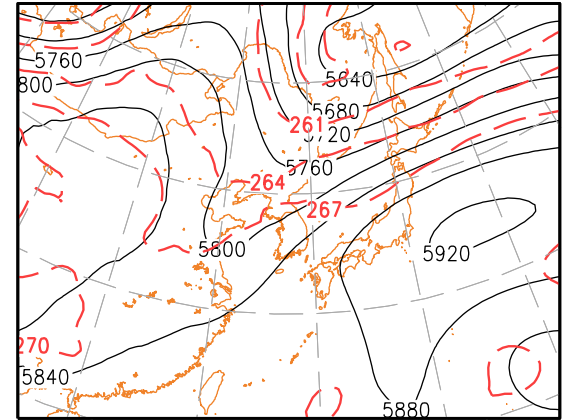
CTL



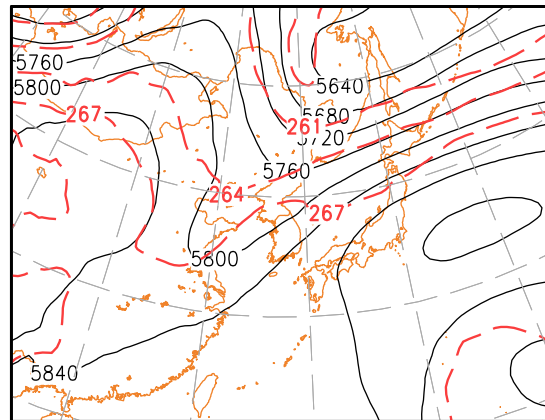
RAS



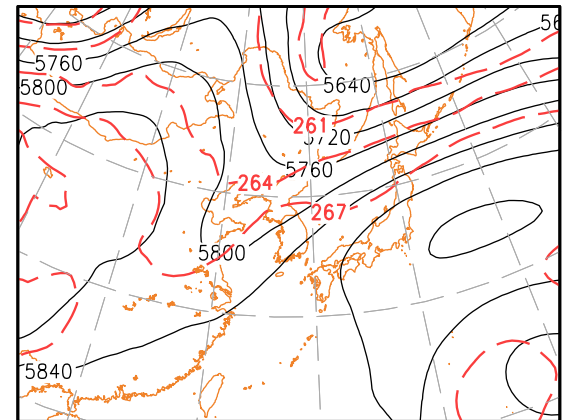
CCM



KF2



ENS



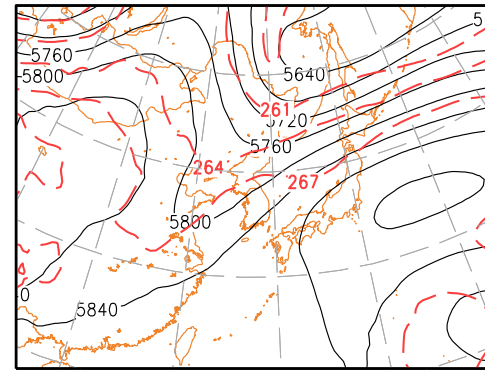
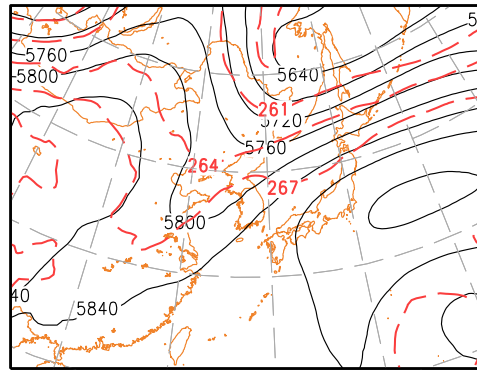
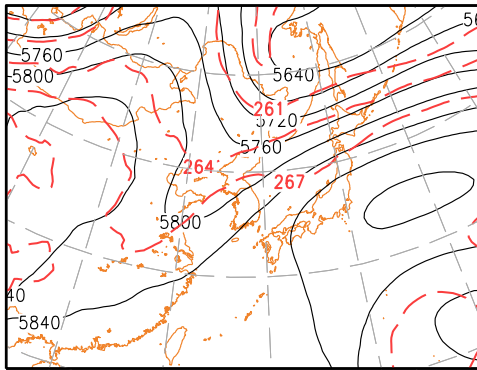
SCV sensitivity

500 hPa HGT and Temp 06z14-00z16 July 2001

CTL

MRF

HANPAN



RMP_NOSTDAMP

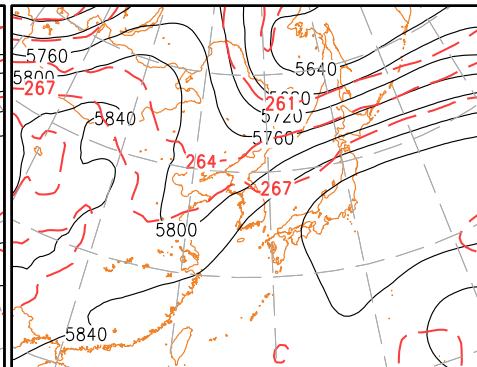
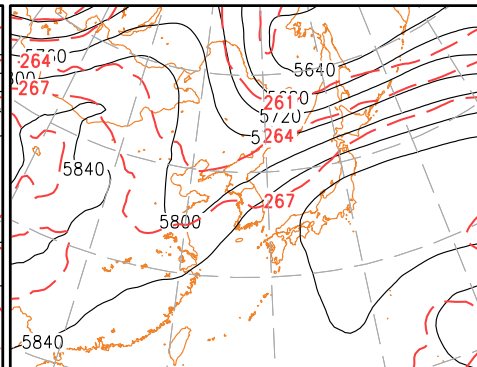
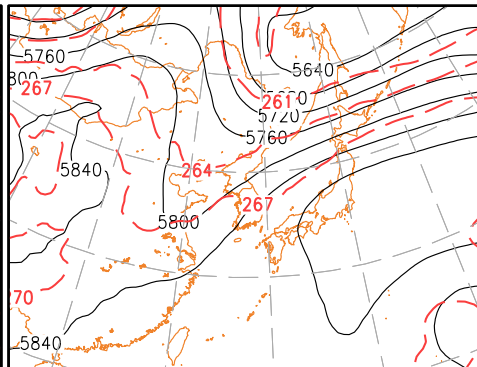
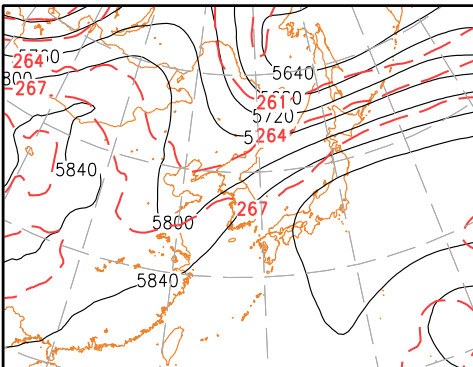
(For no spectral nudging,
SCV and CPS sensitivity)

NOSTDAMP

NOSTDAMP_MRF

NOSTDAMP_HANPAN

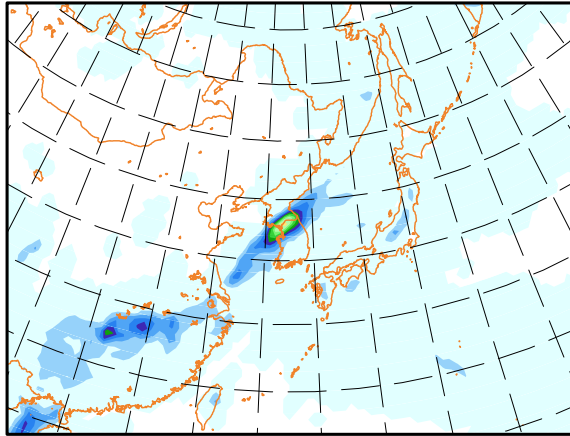
NOSTDAMP_RAS



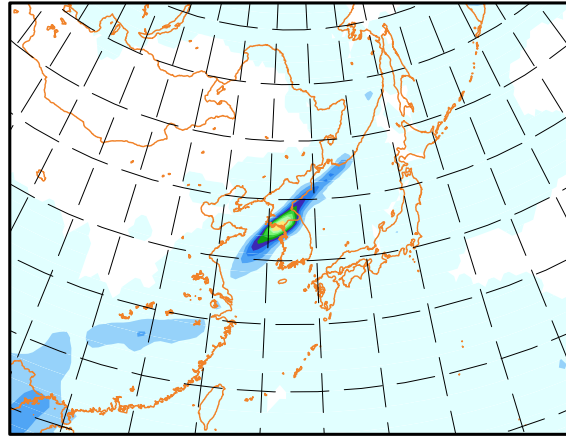
CPS sensitivity

Total rainfall (mm) 12z14-12z15 July 2001

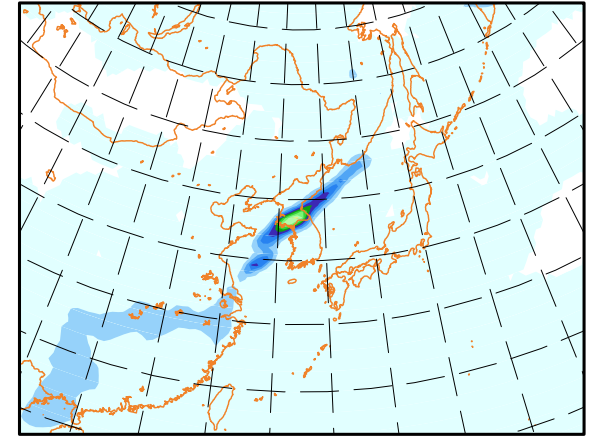
CTL



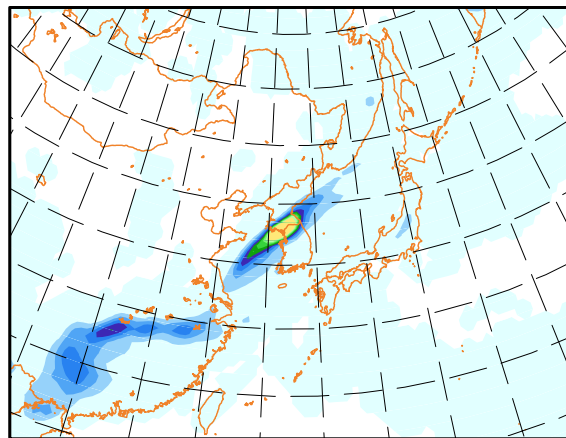
RAS



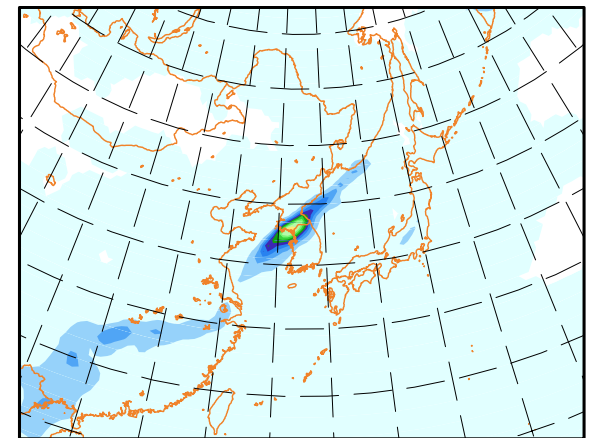
CCM



KF2



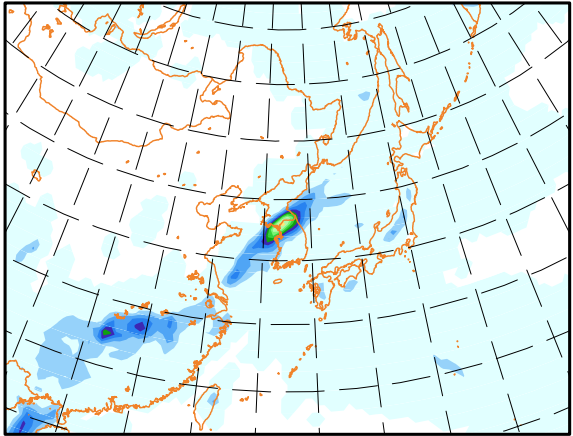
ENS



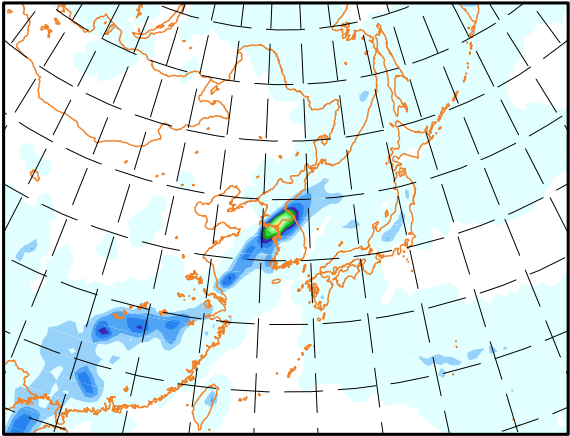
SCV sensitivity

Total rainfall (mm) 12z14-12z15 July 2001

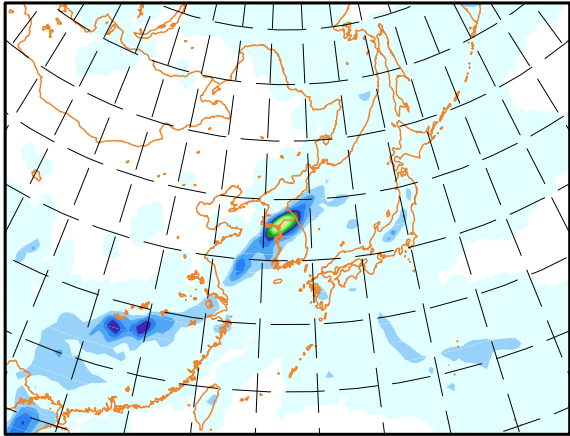
CTL



MRF



HANPAN

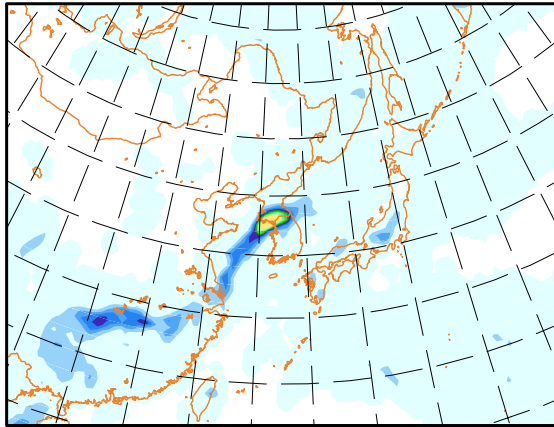




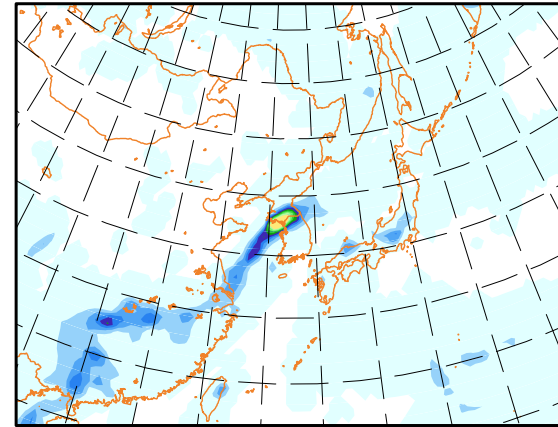
For no spectral nudging, (SCV and CPS sensitivity)

Total rainfall (mm) 12z14-12z15 July 2001

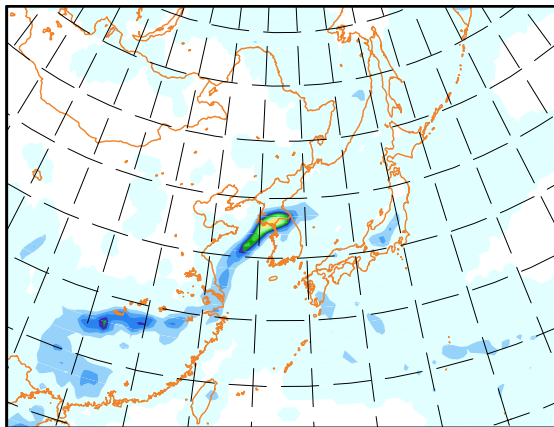
NSTDAMP



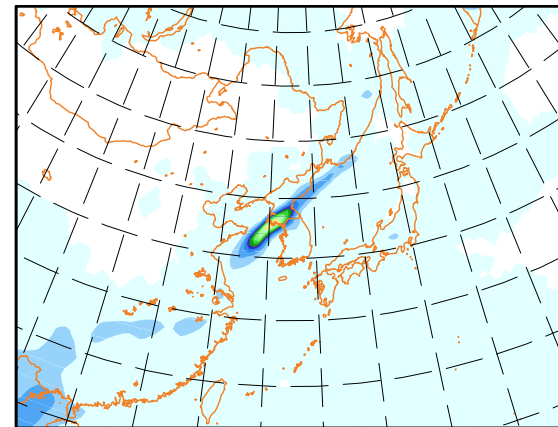
NSTDAMP_MRF



NSTDAMP_HANPAN



NSTDAMP_RAS





RSIM



Check output files in output directory

```
#  
# post processing  
#  
if [ yes = yes ] ; then  
    /home/tuser01/mskoo/rmp/runs/runscr/r_pgb $h $hx $INTPOST || exit 8  
elif [ no = yes ] ; then  
    /home/tuser01/mskoo/rmp/libs/etc/csr_pgb  
fi
```

r_pgb.yyyymmddhh (pressure and flux file)

: post-processed GRIB file created from the sigma binary file

- prognostic fields on several pressure level at forecast hour *
- flux fields on surface level at forecast hour *

Prepare for plotting (make ctl for GrADS)

1. Make ctl file for r_pgb file

In output directory of rmp run

```
cd /home/tuser01/GRIMs/runs/rsim_000
```

```
r_pgb,2001060718 r_pgb,2001061906 r_pgb,2001063018  
r_pgb,2001060721 r_pgb,2001061909 r_pgb,2001063021  
r_pgb,2001060800 r_pgb,2001061912 r_pgb,2001070100  
r_pgb,2001060803 r_pgb,2001061915 r_pgb,2001070103  
r_pgb,2001060806 r_pgb,2001061918 r_pgb,2001070106  
r_pgb,2001060809 r_pgb,2001061921 r_pgb,2001070109  
r_pgb,2001060812 r_pgb,2001062000 r_pgb,2001070112  
r_pgb,2001060815 r_pgb,2001062003 r_pgb,2001070115  
r_pgb,2001060818 r_pgb,2001062006 r_pgb,2001070118  
r_pgb,2001060821 r_pgb,2001062009 r_pgb,2001070121  
r_pgb,2001060900 r_pgb,2001062012 r_pgb,2001070200  
r_pgb,2001060903 r_pgb,2001062015 r_pgb,2001070203  
r_pgb,2001060906 r_pgb,2001062018 r_pgb,2001070206  
r_pgb,2001060909 r_pgb,2001062021 r_pgb,2001070209  
r_pgb,2001060912 r_pgb,2001062100 r_pgb,2001070212  
r_pgb,2001060915 r_pgb,2001062103 r_pgb,2001070215  
r_pgb,2001060918 r_pgb,2001062106 r_pgb,2001070218  
r_pgb,2001060921 r_pgb,2001062109 r_pgb,2001070221
```

Make .ctl file

```
/home/tuser01/GRIMs/libs/etc/grmap r_pgb.%y4%m2%d2%h2
```

```
r_pprs.ctl  
r_pprs.idx
```



* Down post script in your directory

```
svn co svn://118.128.66.149/post (enter)
```

```
cd post/rsim/_script/_out  
ln -sf /home/tuser01/GRIMs/runs/rsim_000 rsim_000
```

Draw figures (rmp)

in_gs directory

3. train_ea.gs

```
*=====*
```

```
* 3-mon (JJA 2001) Averaged Total Rain
```

```
*=====*
```

```
'reinit'
```

```
*----- set parameters -----*
```

```
exp = rsim_000
```

```
grdir= '/home/tuser01/jwlee/rmp/post/rsim/_script/./_GS/_gsl'b'
```

```
*-----*
```

```
psdir= './_plt'/exp
```

```
!mkdir -p 'psdir
```

```
pname = '3.rain east asia.ps'
```

```
fname = './_ctl/r_pgb.exp'.ctl'
```

```
*-----*
```

```
* region : ea (East Asia) / kor (Korea)
```

```
region=ea
```

```
* season : jja / djf / ann
```

```
season = jja
```

```
* start and end year
```

```
syear = 2001
```

```
eyear = 2001
```

```
nyear = eyear - syear + 1
```

Post-process (automatic script for default setup)

including step 2) in previous page

1. Download post script in your directory

```
svn co svn://118.128.66.149/post (enter)
```

```
tuser01:/home/tuser01/jwlee/rmp/post==> ls  
rmp  rsim  
tuser01:/home/tuser01/jwlee/rmp/post==> cd rmp  
tuser01:/home/tuser01/jwlee/rmp/post/rmp==> ls  
_GS  README  _script
```

GrADS
script

all.sh, make_ctl.sh

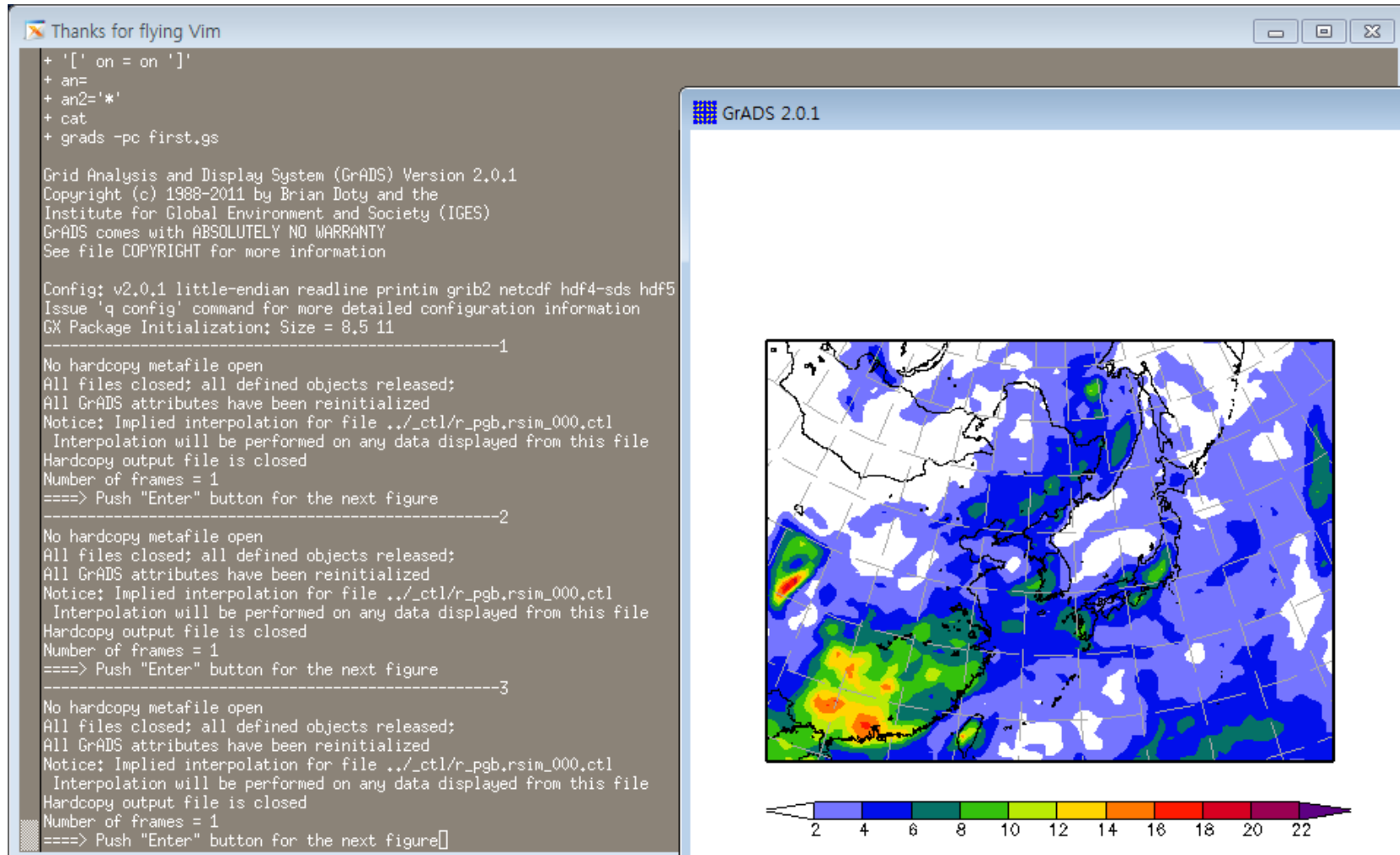
Post-process (automatic script for default setup)

2. Modify "all.sh"

```
#-----  
# exps : experiment names  
#       (experiment names should be the same as fcst output directory names)  
#  
# mdir : main directory for gmp analysis  
# ldir : GRIMs library directory  
# odir : output directory  
# grdir : GrADs library directory  
#-----  
# change the following variables  
exps="rsim_000"           ← experiment name  
year=2001               ← experimental year  
  
mdir=/home/tuser01/jwlee/rmp/post/rsim ← current directory  
ldir=/home/tuser01/jwlee/rmp/libs     ← library directory  
odir=/scratch/tuser01/jwlee         ← output directory  
  
# pause before plotting the next figure; on/off  
pause=on  
#-----
```

Post-process (automatic script for default setup)

3. run "all.sh"

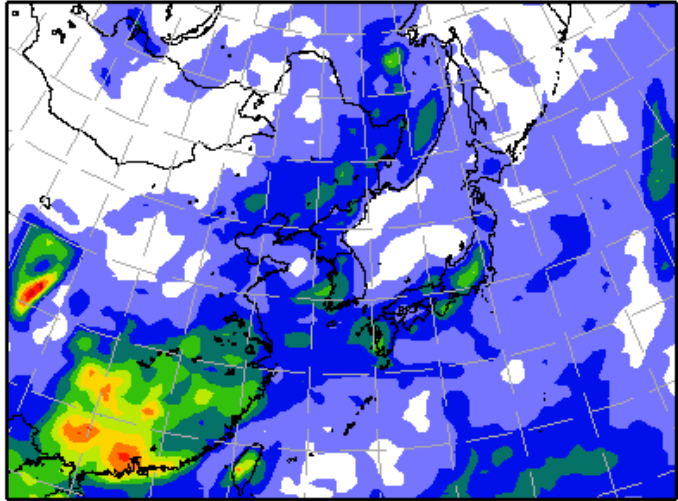


```
Thanks for flying Vim
+ '[' on = on ']'
+ an=
+ an2='*'
+ cat
+ grads -pc first.gs

Grid Analysis and Display System (GrADS) Version 2.0.1
Copyright (c) 1988-2011 by Brian Doty and the
Institute for Global Environment and Society (IGES)
GrADS comes with ABSOLUTELY NO WARRANTY
See file COPYRIGHT for more information

Config: v2.0.1 little-endian readline printim grib2 netcdf hdf4-sds hdf5
Issue 'q config' command for more detailed configuration information
GX Package Initialization; Size = 8,5 11
-----1
No hardcopy metafile open
All files closed; all defined objects released;
All GrADS attributes have been reinitialized
Notice: Implied interpolation for file ../ctl/r_pgb.rsim_000.ctl
Interpolation will be performed on any data displayed from this file
Hardcopy output file is closed
Number of frames = 1
====> Push "Enter" button for the next figure
-----2
No hardcopy metafile open
All files closed; all defined objects released;
All GrADS attributes have been reinitialized
Notice: Implied interpolation for file ../ctl/r_pgb.rsim_000.ctl
Interpolation will be performed on any data displayed from this file
Hardcopy output file is closed
Number of frames = 1
====> Push "Enter" button for the next figure
-----3
No hardcopy metafile open
All files closed; all defined objects released;
All GrADS attributes have been reinitialized
Notice: Implied interpolation for file ../ctl/r_pgb.rsim_000.ctl
Interpolation will be performed on any data displayed from this file
Hardcopy output file is closed
Number of frames = 1
====> Push "Enter" button for the next figure[]
```

GrADS 2.0.1



2 4 6 8 10 12 14 16 18 20 22

Press Enter for next figure

Post-process (automatic script for default setup)

4. check outputs and plotted figures

after run "all.sh", 4 directories are generated in post/rmp directory

(e.g., /home/tuser01/jwlee/rmp/post/rmp)

all.sh

make_ctl.sh

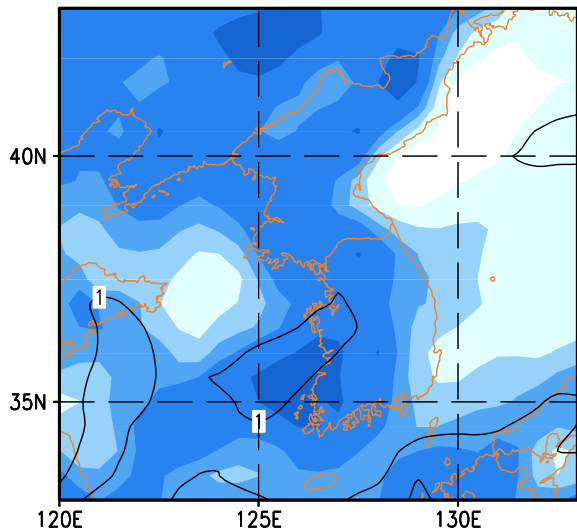
./_out : model output directory

./_ctl : control files for GrADS

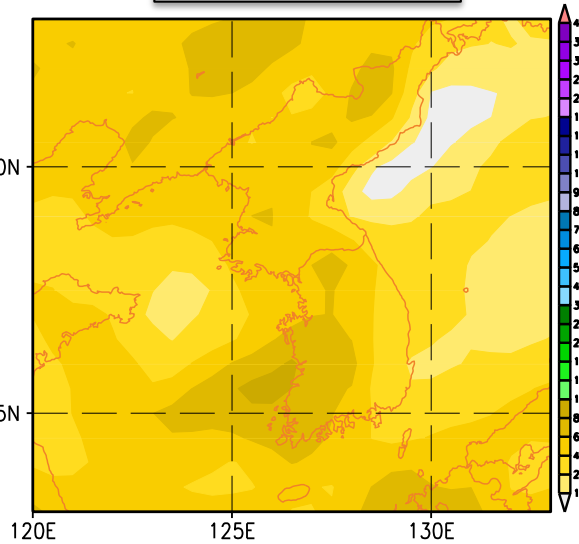
./_gs : GrADS scripts for each figures

./_plt : figures in '.ps' format

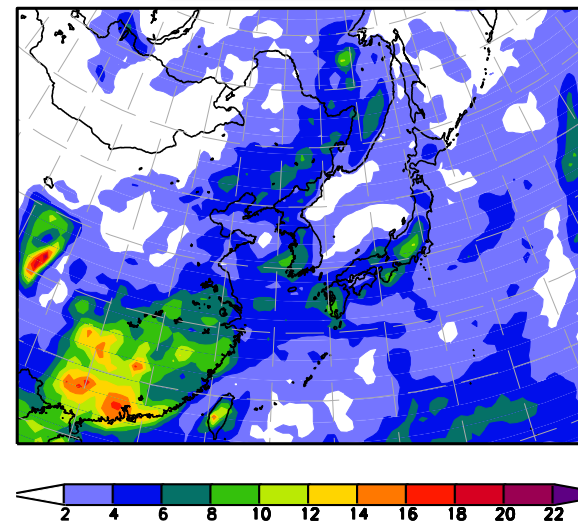
1. Conv/Nconv rain



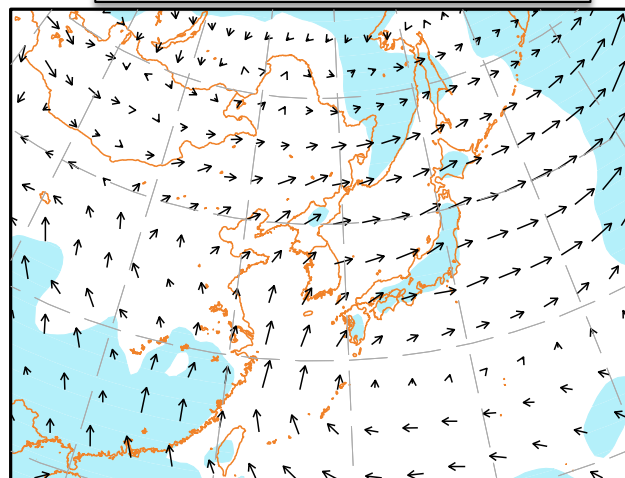
2. total rain



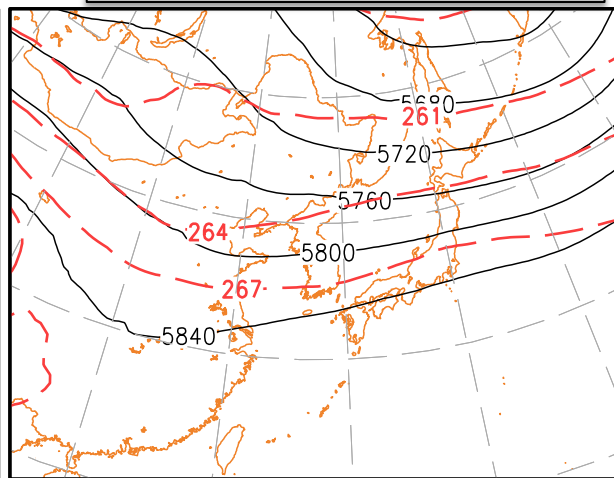
3. total rain



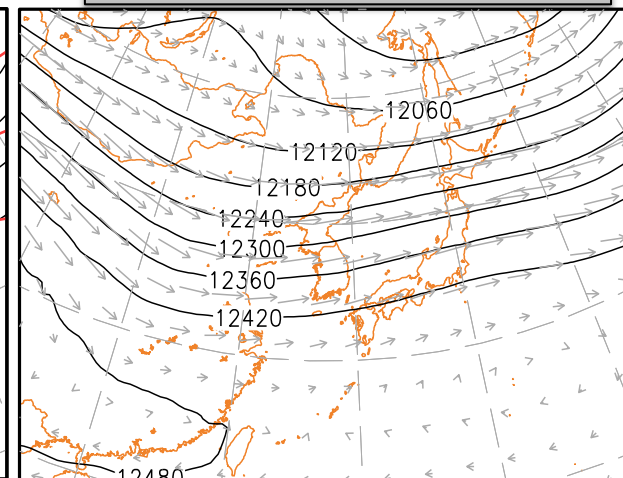
850 hPa; RH & wind



500 hPa; HGT & TMP



200 hPa; HGT & wind





KIAPS

KOREA INSTITUTE OF
ATMOSPHERIC PREDICTION SYSTEMS

Thank you for your listening



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