

Development of Climate System Model and Prediction System in KORDI

Jong-Seong Kug
Korea Ocean Research and Development Institute





IPCC AR4 Participating Models

| Model ID | Model, Country | Pre industr. control | Present day control | 20th century | Commitment | SRES A2 | SRES A1B | SRES B1 | 1% to 2xCO ₂ | 1% to 4xCO ₂ |
|----------|-------------------------------------|----------------------|---------------------|--------------|------------|---------|----------|---------|-------------------------|-------------------------|
| 1 | BCC-CM1, China | | 2 | 4 | | 2 | | 2 | 1 | 1 |
| 2 | BCCR-BCM2.0, Norway | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | CCSM3, USA * | 2 | 1 | 9 | 5 | 5 | 7 | 8 | 1 | 1 |
| 4 | CGCM3.1(T47), Canada | 1 | | 5 | 5 | 5 | 5 | 4 | 1 | 1 |
| 5 | CGCM3.1(T63), Canada | 1 | | 1 | | | 1 | 1 | 1 | 1 |
| 6 | CNRM-CM3, France | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | CSIRO-MK3.0, Australia | 2 | | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | ECHAM5/MPI-OM, Germany | 1 | | 4 | 3 | 3 | 4 | 3 | 1 | 1 |
| 9 | <u>ECHAM5/MPI-OM, Germany/Korea</u> | 1 | 1 | 5 | 3 | 3 | 3 | 3 | 1 | 1 |
| 10 | FGOALS-g1.0, China | 3 | | 3 | 4 | 1 | 3 | 3 | 1 | 1 |
| 11 | GFDL-CM2.0, USA | 1 | | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| 12 | GFDL-CM2.1, USA | 1 | | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| 13 | GISS-AOM, USA | 2 | | 2 | | | 2 | 2 | | |
| 14 | GISS-EH, USA | 1 | | 5 | | | 4 | | 1 | |
| 15 | GISS-ER, USA | 1 | | 9 | 1 | 1 | 5 | 1 | 1 | 1 |
| 16 | INM-CM3.0, Russia | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 17 | IPSL-CM4, France | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| 18 | MIROC3.2(hires), Japan | 1 | | 1 | | | 1 | 1 | 1 | 1 |
| 19 | MIROC3.2(medres), Japan | 1 | | 3 | 1 | 3 | 3 | 3 | 1 | 1 |
| 20 | MRI-CGCM2.3.2, Japan | 1 | 1 | 5 | 1 | 5 | 5 | 5 | 1 | 1 |
| 21 | PCM, USA | 1 | 1 | 4 | 3 | 4 | 4 | 4 | 5 | 1 |
| 22 | UKMO-HadCM3, UK | 2 | | 2 | 1 | 1 | 1 | 1 | 1 | |
| 23 | UKMO-HadGEM1, UK | 1 | | 1 | | | 1 | 1 | 1 | |

From IPCC Climate Change Report (2007)



Research Program of Climate System Model

◆ **GAIA Project**

from Ministry of Education, Science and Technology

PI : Dr. Jae-Hak Lee

Total Budget: 1,400,000 USD (Year 2009)

Ocean Observation (40%), Climate Modeling (60%)

Period: Sep. 2009 ~ Sep. 2019 (10 years)

Mission (Modeling)

:Develop Korean climate system model and prediction system

: Participate in IPCC AR6

◆ **KORDI Internal Program [Matching Fund]**

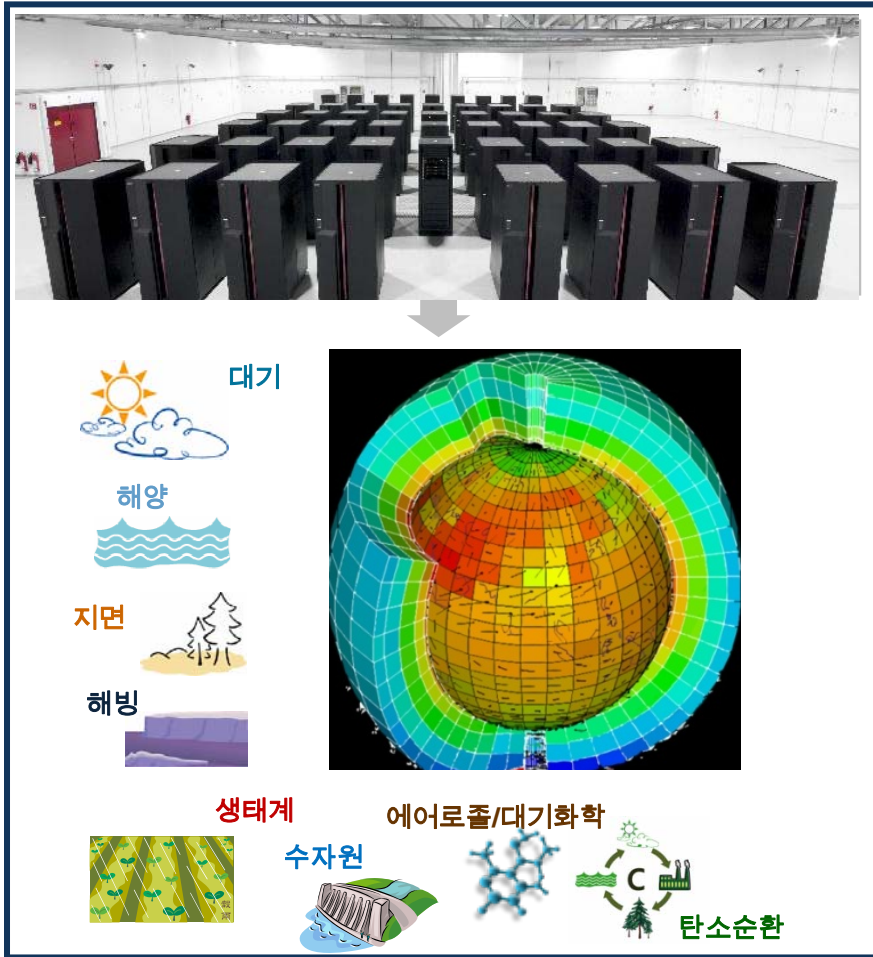
PI : Dr. Jong-Seong Kug

Total Budget: about 500,000 USD (Year 2010)

Period: Jan. 2010 ~ Dec. 2012 (3 years)



KORDI Climate System Model



◆ Model Components

◆ Atmosphere

Dynamics: Finite Volume (Lin 2004)
Physics : mainly from SNU AGCM

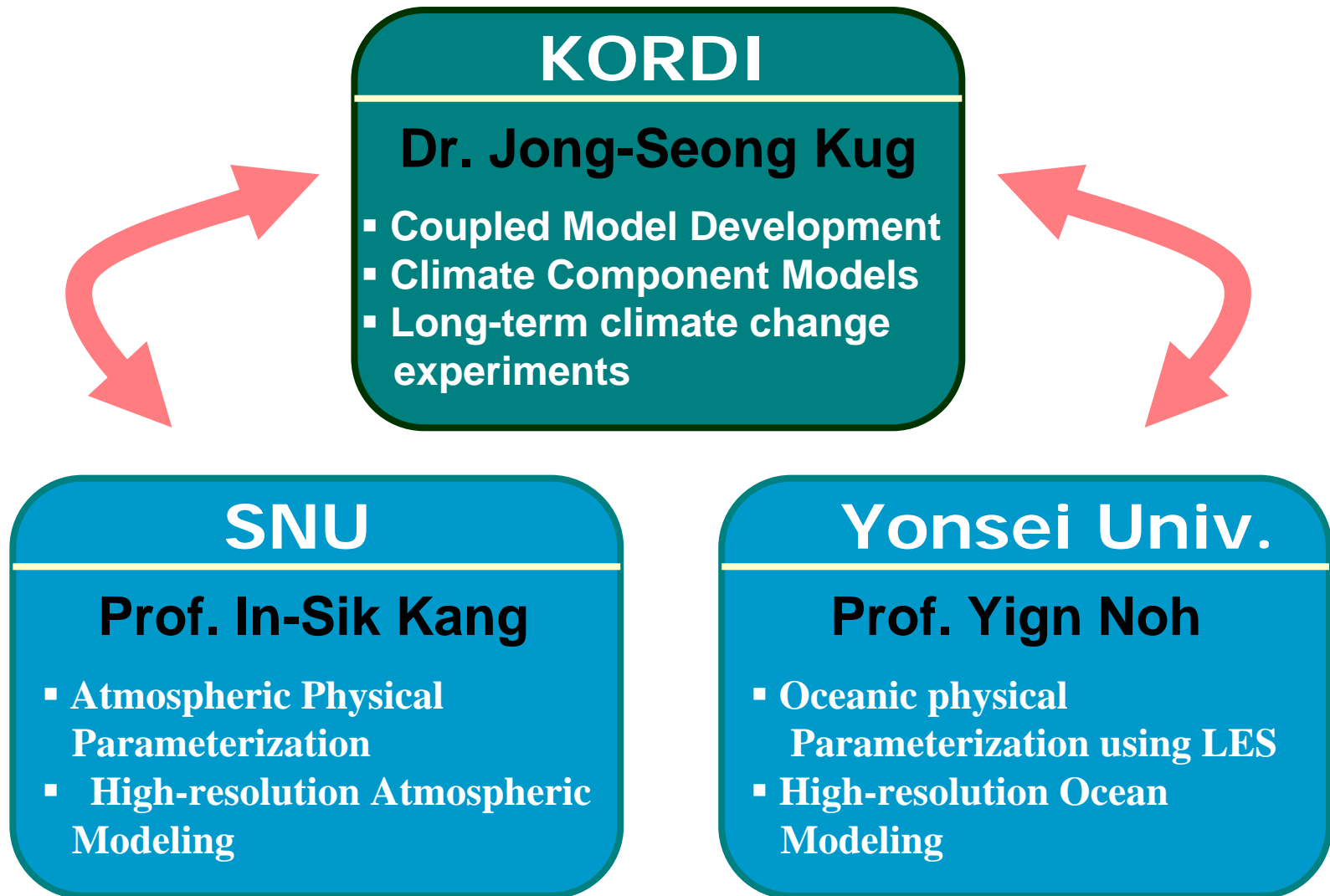
◆ Ocean

MOM4 + Noh Parameterization

◆ Sea Ice

Sea Ice Simulator (SIS)

Domestic Collaboration on Model Development



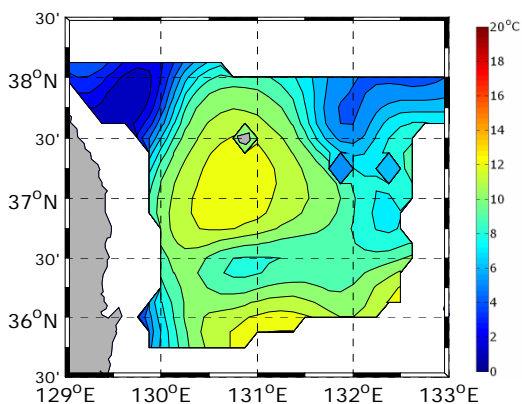


Global DATA Assimilation System

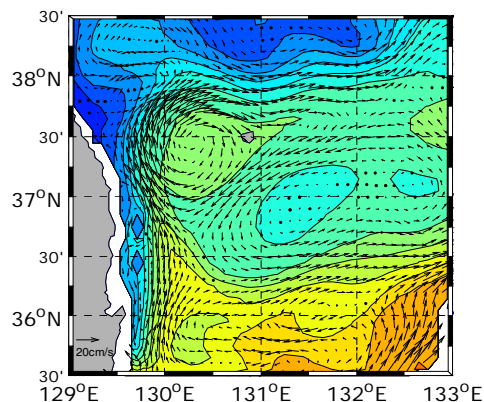
Development of Global Data assimilation and initialization system

- 3D-VAR
- Ensemble Kalman Filter

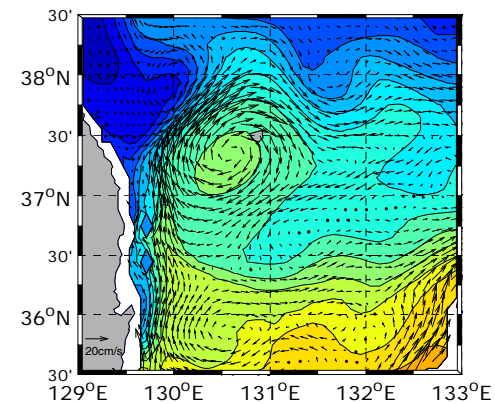
Regional Ocean (100m Temperature and Currents)



**Observation
(PIES)**



EnKF

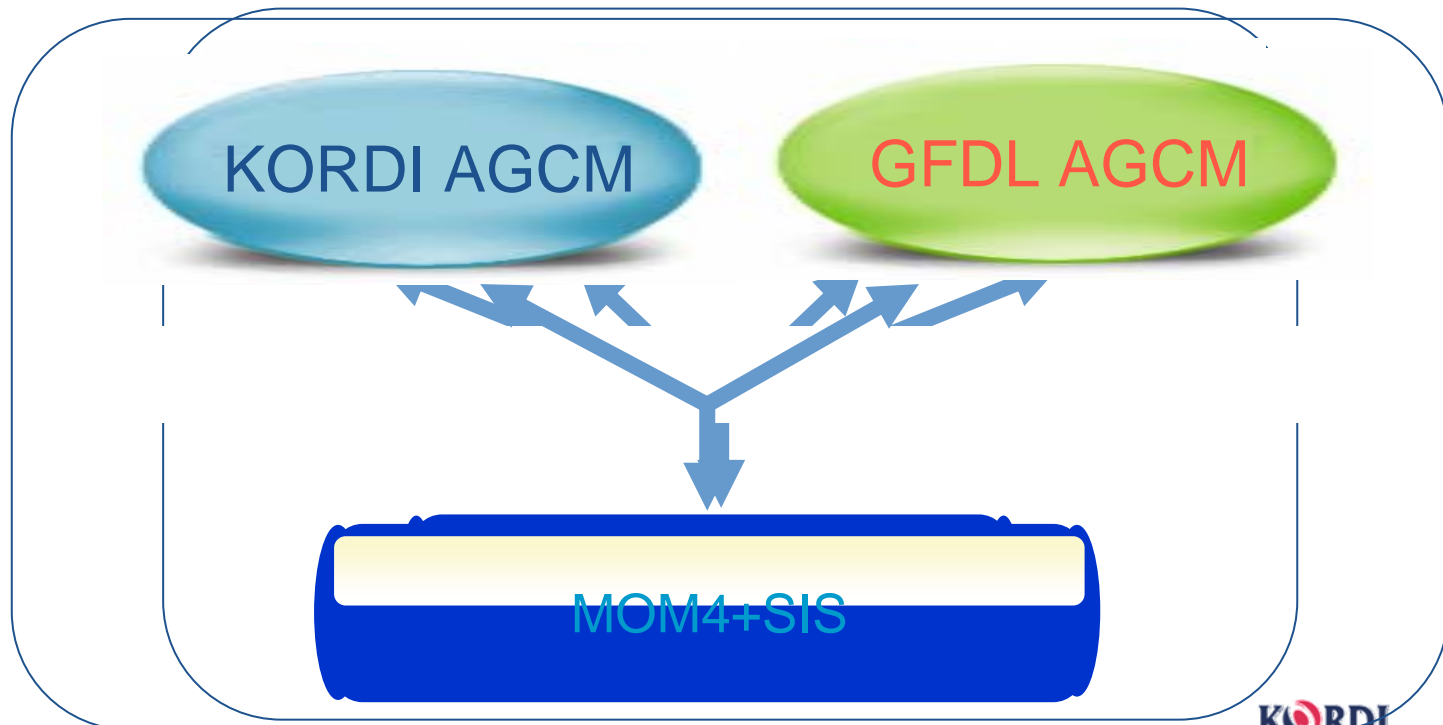


3DVAR

❖ Interactive Ensemble Coupled Model (IEM)

- To couple multiple realization of AGCM to single OGCM (Kirtman and Shukla, 2002)
- Ensemble mean give better representation of the flues at the surface
- Improve model systematic biases

Interactive Ensemble Model





Time Table

