Annual Report of ICCES

(2011.5-2012.4)

Zhaohui Lin

International Center for climate and Environment Sciences
Chinese Academy of Sciences
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I. ICCES Brief Introduction

- Founded in **1991** with support from both CAS and Ministry of Science and Technology of China (MOST);

- **Center Organization**

  ICCES currently has **46** staffs in total, with **40** research scientists, and **6** supporting staff. Besides, there are **7** Adjunct professors.

  As for 2012, there are **1** Postdoc, and **33** graduate students studying in ICCES.
II. Major Research Fields

- **Development of Dynamical Earth System Model and Numerical Simulation**
- **Meteorological and Environmental Forecast and Related Disaster Assessment Theory and Technique**
- **Data Assimilation Theory and Methodology**
- **Earth System Theories and Natural Cybernetics**
II. On-going Projects

- On-going Projects

  • 61 on-going research projects in total, including domestic research projects as well as international collaborative projects;

  • Within the 61 projects, 14 are newly established in 2011-2012;

  • Funds of the new projects are over 35,000,000 CNY in total
<table>
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<th>Project Name</th>
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<td>Projects of National Natural Science Foundation of China</td>
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<td>National Basic Research Program of China (973)</td>
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<td>The National High Technology Research and Development Program</td>
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<td>National Science and Technology Support Program of China</td>
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<td>The Special Funds for Meteorology Scientific Research on Public Cause</td>
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<td>Research Project of CAS</td>
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<td>International Collaborative Projects</td>
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Key Ongoing Projects

• National key Basic research Program for global change (973): Development of the ecological and environmental process model and its improvement
  (30,000,000 CNY, 2010-2014) (~ 4.6 Million USD)

• National Basic Research Program of China (973): Development and evaluation of high-resolution climate model
  (10,440,000 CNY, 2010-2014) (~ 1.6 Million USD)

• Subproject of CAS Strategic Priority Research Program “Uncertainties for the climate simulation and projection using CAS Climate System Model”
  (30,000,000 CNY, 2011-2015) (~ 4.6 Million USD)
Key Ongoing Projects

• National key Supporting Project for Science and Technology development: Monitoring, prediction and warning system for the extreme weather and climate disasters
  (2,000,000 CNY, 2010-2014)

• Development of the second-generation Short-Term Climate Prediction System in National Climate Center
  (1,780,000 CNY, 2010-2013)

• International Collaborative Project supported by MOST China: Characteristics and mechanism of the extreme climate events under the climate change background
  (1,000,000 CNY, 2012-2015)

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II. On-going Projects --- Key Project

- Climate System Model Development and the related uncertainties on the climate simulation and projection

1. Development of the CAS climate system model
2. Model evaluation and attribution of past climate change
3. Projection of future climate change and its sensitivity study

- Total Budget: 30 Million CNY (~ 120 Million USD)
- Funding Duration: 2011-2015

- CAS Strategic Priority Research Program- Climate Change: Carbon Budget and Relevant Issues
- Total Budget: 800 Million CNY (~ 120 Million USD)
Progress of the Project

- Officially launched on April 26, 2011
- 5-year project during 2011.1-2015.12

2011 Annual Meeting
III. Current Research Progress

Changes of global averaged T for RCP8.5, RCP4.5 experiment

- Scenario for CO2 concentration
- Projected Temperature Change

增温1.7K

RCP4
Development of the CAS Earth System Model

Framework of CAS-ESM

Climate System Model

Internal Coupling

Land Surface Model

AGCM

OGCM & Sea Ice

External Coupling

DGVM

Terrestrial BGC

Aerosol / Atmospheric Chemistry Model

Ocean BGC

Internal Coupling

Ecological / Environmental System Model
In DGVM, establishment refers to a sequence of biological processes including flowering, fertilization, seed production, germination, and the establishment of new individuals. In addition, it leads to large uncertainties in DGVM:

- determining the balance of population density
- influencing the size of individual crown area
- the establishment rate distribution of different PFTs is a key factor leading to uncertainties

CLM-DGVM assumes that all the woody PFTs (trees and shrubs) have the same establishment rate (although some of them cannot survive);

\[
\Delta P_i = \left[ \Delta P_{\text{max}} \left(1 - e^{-5(1-FPC_{\text{woody}})} \right) \left(1 - FC_{\text{woody}} \right) \right] \cdot \frac{g_i}{\sum_{k=1}^{n_{\text{est,woody}}} g_k}
\]

\[
g_i = 1
\]

Actually, establishment rate should be relative to the current status of vegetation (e.g., fractional coverage, NPP etc.)
The improvements of population dynamical parameterization in DGVM

The variance in tree fractional coverage when PFT number decreasing

In the default scheme, the removal of PFTs with small fractional coverage results in large variances in fractional coverage of dominant PFTs (i.e., the red line, the tree fractional coverage increases by about 8%, and the gap between two dominant PFTs’ fractional coverage increases by about 1%);

In the new scheme, the variances of the two variables are slight (blue line).
New fire parameterization

Advantages:
1. New basic function to improve burned area simulation in regions where fire occurs frequently
2. Parameters calibrated based on satellite data and field data
3. New fire spread scheme to remove unreasonable assumptions and functions in earlier fire schemes
4. Introduce the estimation of trace gas and aerosol emissions due to biomass burning

(Li et al. 2012, BGD)
Li and Zeng, 2011, 16th Annual CESM Workshop
New fire parameterization in NCAR’s CLM
Global performance in IAP-DGVM

Evaluation period: 1997-2004
Mod-new: new fire parameterization Glob-FIRM: Thonicke et al. 2001
Mod-old: old fire parameterization in CLM-DGVM (Levis et al. 2004)

- Mod-new is good agreement with observations, and more skillful than Glob-FIRM and Mod-old.
- Ref: 1997-2004 CLM-CN simulations with CTEM-FIRE (300Mha/yr, Cor=0.19) and its revised version (182Mha/yr, Cor=0.52) (Kloster et al. 2010)
IAP Dust modeling and predcition system

**WRF Preprocessor (WPS)**

- Gridded meteo data
  - Soil moisture, T, P, winds, SST
- Geographical datasets
  - Topography, Albedo, Soil texture, Dust source area, Vegetation cover

**ARW Solver**

- Physics driver
  - /parameterizations/
  - Boundary layer
  - Land surface
  - Microphysics
  - Convection
  - LW/SW radiation
- Dynamics driver
  - IC/BC, Nesting, Advection
- Numerical integration

**Regional scale output**

- Wind speed, Friction velocity
- Moisture, Roughness length

**Chemistry driver**

- Size resolved dust emission
- Dust deposition
- Dust transport
- Dust 4D concentrations

**Multi dust emission schemes:**

- GOCART based (Ginoux et al., 2001)
- Marticorena & Bergametti (1995)

**GIS datasets:**

- Soil texture
- Dust source

Dust modelling system based on WRF/Chem
IAP Seasonal Prediction System for real-time drought/flood predictions

Framework of IAP Seasonal Prediction System
IAP’s Climate Forecast System

- CGCM
- ENSO
  - ENSO forecast system
- IAP-2L AGCM
- IAP-9L AGCM
- Atmospheric Signals
- Snow Cover
- SSTAs
- Statistical Method
  - circulation
  - Precipitation anom.
- Seasonal Forecast
Ensemble forecast results provided to “National Climate Discussion” in China (is OBS)
Updated prediction for 2012 – *Nino3.4 index*

100 ensemble member

Ensemble Spread

Ensemble Forecast SSTA at Nino3.4

Nino3.4 index (°C)

Time

Ensemble Forecast SSTA at Nino3.4

Nino3.4 index (°C)

Time
Real-time prediction of Summer rainfall anomalies over China (2012)

More than normal rainfall over lower reach of Yellow river and huaihe River Basin

Less than normal rainfall to the South of Yangtze river basin

More than normal rainfall over Southern part of Southeast China

Percentage Summer rainfall anomalies

Forecast was issued in the end of March, 2012
Research Outcome for Public Consultation

Prediction results was adopted by the central government of China
Ocean Reanalysis Dataset (AIPOcean 1.0)

Model: HYCOM
Model domain (color shade): including Indian and West Pacific oceans with the horizontal resolution of 1/4x1/4 and with vertical 22 layers and nested in a large outer region with the resolution of 3/4x3/4.

Assimilation method: EnOI (ensemble optimal interpolation)

Reanalysis period: 1993-2006
Comparison with sea surface drifters

Observed sea surface drifters (red dot is the origin of drifter) and AlPOcean1.0 sea surface current stream in the Indian ocean in Nov. 2006
III. Awards

◆ Outstanding Science and Technology Achievement Prize of the Chinese Academy of Sciences 2011.

◆ Dr. Tian from ICCES was awarded "CAS Lujiaxi Young Talent Award" in 2011.
IV. International Cooperation

Statistics:

- More than 20 foreign experts visited ICCES in 2011.
- 11 professors from ICCES went aboard as short-term visiting scholar.
- Researchers and professors from ICCES attended 24 international conferences covering more than 9 countries and regions.
- More than 60 experts from over 13 countries, mostly from developing countries attended 2011 CTWF in Beijing.
IV. International Cooperation

Big Events:

- Prof. Romain Murenzi, TWAS Executive Director, visited ICCES
- 2011 CTWF-COMSATS International Training Workshop was successfully held in Sep 26-29, Beijing, China, with the organization of ICCES and COMSATS.
- Princess Maha Chakri Sirindhorn from Thailand visited ICCES in April, 2012.
- CAS-CSIRO Cooperative Research Program between IAP and CSIRO from Australia, Researchers from ICCES participated in this project.
Prof. Romain Murenzi visited ICCES

Gave a talk on "TWAS and Importance of Science, Technology and Innovation for Development"

Agreed to serve as Chairperson of CAS-TWAS-WMO Forum on climate sciences in representative of TWAS
More than 60 participants attended the 2011 CTWF, including 27 representatives from 13 overseas institutions and government departments.

**Time:** September 26-29, 2011  
**Venue:** Beijing Friendship Hotel, China.
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<td>Regional climate changes</td>
<td>Prof. Guoyu Ren</td>
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<td>Dr. Chandima Gomes</td>
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<td>and the detection</td>
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<td>Mr. Saleh Alsaleem</td>
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<td>Session II:</td>
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<td>Impact of climate change</td>
<td>Prof. Qiuhong Tang</td>
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<td>Dr. Rijan Bhakta Kayastha</td>
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<td>on regional water</td>
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<td>Dr. Thanapakpawin Porraneel</td>
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<td>Impact of climate change</td>
<td>Prof. Yinlong XU</td>
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<td>Dr. Shahina Tariq</td>
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<td>on agriculture</td>
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<td>Mr. Ruba Ajjour</td>
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<td>Impact of climate change</td>
<td>Prof. Xiaodong Zeng</td>
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<td>Mr. Athula Kumara</td>
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<td>on ecosystem</td>
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<td>Karunanayake</td>
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<td>Mr. Shaofeng Shen</td>
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<td>Session IV:</td>
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<td>Application of regional</td>
<td>Prof. Xunqiang Bi</td>
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<td>Dr. Surajate B. Aroonnet</td>
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<td>climate model on the</td>
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<td>Mr. Waheed Iqbal</td>
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2011 CTWF-COMSATS International Training Workshop
Princess Maha Chakri Sirindhorn Visited ICCES on April 5th, 2012

CAS-CSIRO Cooperative Research Program:
“Variability of East Asian-Australian Monsoon and Climate Change Impact on Water Resource”

Hydrological response to the projected climate change over Huaihe River basin during 2046–2065
Basic Information:

1. Tentative date: August 27-30, 2012,
2. Venue: Beijing, China
3. Theme: Terrestrial Ecosystems in a Changing World

Chinese Academy of Sciences (CAS)
The Academy of Sciences for the Developing World (TWAS)
World Meteorological Organization (WMO)
THANK YOU!

Prof. Dr. Zhaohui Lin
Director of ICCES
Email: lzh@mail.iap.ac.cn
http://www.icces.ac.cn