



国际气候与环境科学中心

*International Center for Climate and Environment Sciences*



# Annual Report of ICCES

CAS-TWAS Center of Excellence for  
Climate and Environment Sciences

**(2016.5-2017.4)**

Zhaohui Lin

**International Center for Climate and Environment Sciences  
Chinese Academy of Sciences**

# Outline

- ❑ **ICCES Overview**
- ❑ **Major Research Progress**
- ❑ **International Collaboration**
- ❑ **Future Plans**

# I. ICCES Overview

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ICCES was founded in 1991 with the research focus on the key scientific problems related with global climate and environmental changes.

ICCES is committed to solving the key scientific problems related with global climate and environmental changes and focuses on researches on earth system model development, climate and environmental disaster prediction, and the theoretical development and application of natural cybernetics.

Currently, there are about 60 staffs in ICCES, with 14 professors and 11 associate professors. There are more than 50 PhD and Master students, including 6 from developing countries with CAS-TWAS president's scholarship.

# I. ICCES Overview – Ongoing Projects

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**Currently, there are **60** on-going projects undertaken by ICCES. Among these projects,**

- 20 are funded by Ministry of Science and Technology (MOST) of China or Ministry of Finance (MOF) of China;
- 27 are funded by National Natural Science Funds of China (NSFC);
- 8 are funded by Chinese Academy of Sciences (CAS);
- 5 are respectively sponsored by provincial level government and other organizations.

# I. ICCES Overview – Honors and Awards

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## **ZENG Qingcun, founder director of ICCES, Fellow of TWAS, Academician of CAS, Wins the 61th International Meteorological Organisation (IMO) Prize**

Academician ZENG Qingcun, a member of ICCES, won the award for his contributions to satellite meteorological remote-sensing theory, numerical weather prediction theory, meteorological disaster prevention, as well as the earth system model.

The IMO Prize is the most important award in meteorology and is named after WMO's predecessor organization, the International Meteorological Organization. It is awarded annually to scientists that have made outstanding contributions to meteorology, hydrology and geophysical sciences.



## II. Major Research Progress

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### Research Focus

- ◆ **Development of CAS Earth System Model**
- ◆ **Meteorological and Environmental Forecast and Related Disaster Assessment Theory and Technique**
- ◆ **Data Assimilation Theory and Methodology**
- ◆ **Earth System Theories and Natural Cybernetics**

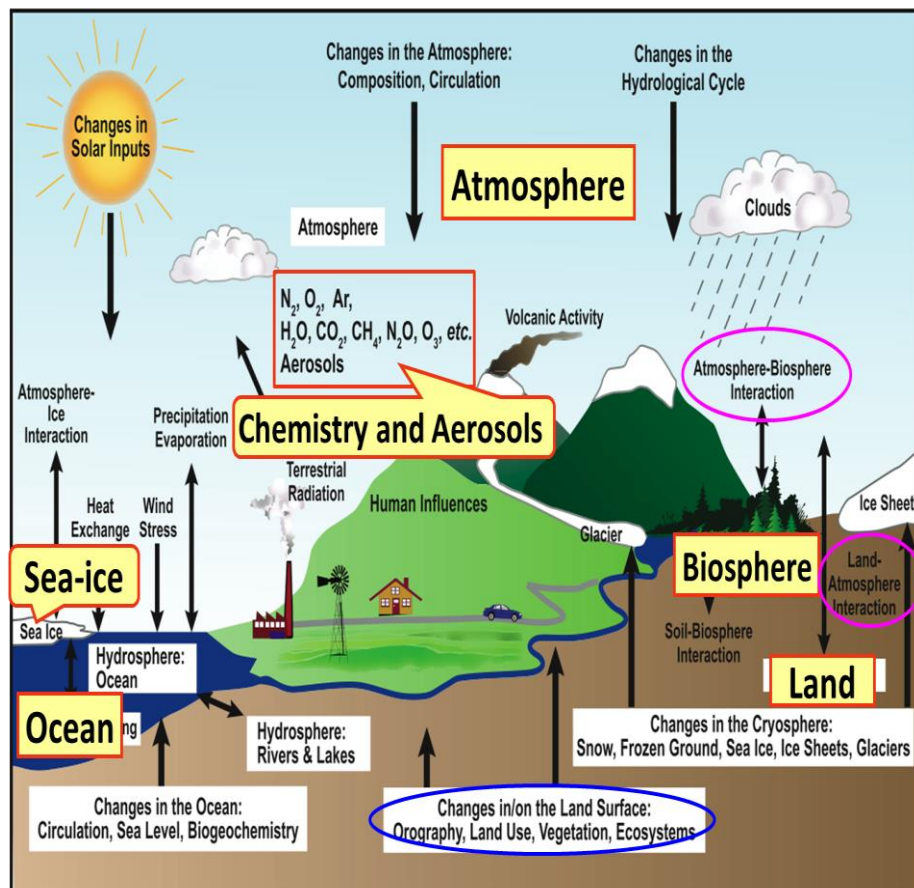


# CAS-ESM1.0 released conference

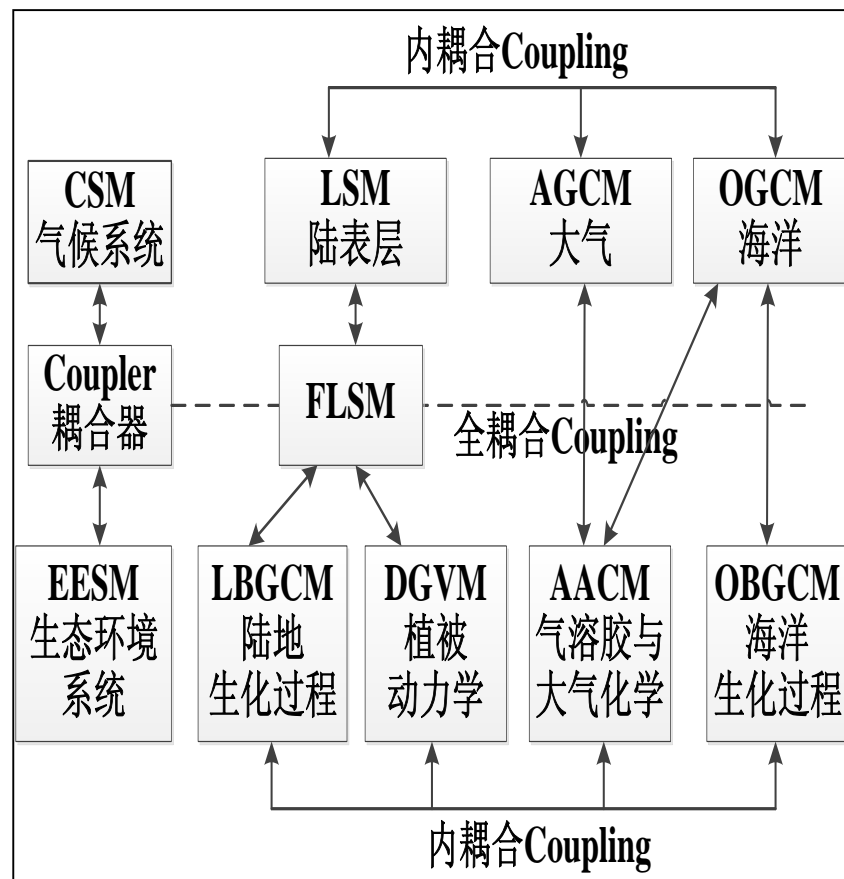


# CAS-Earth System Model

## Earth System



## CAS Earth System Model





# Applications of Earth System Model

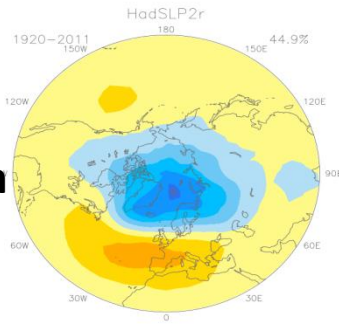


- **Simulate future climate change**
- **Impact on ecological and environmental systems**
- **Probabilistic forecasts of high-impact environmental events**
- **Mitigation and adaptation strategies to climate and environmental changes**
- **Integrate and assimilate observational data**
- **Scientific tool to study complex systems**

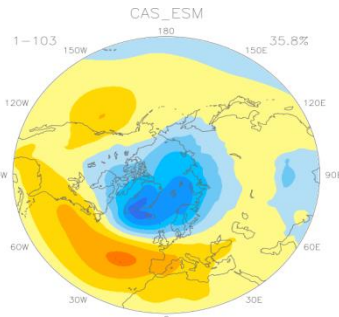
# CAS-ESM 100-year Coupled Simulation: Modes of Variability

## NAO: weekly and seasonal

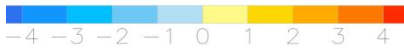
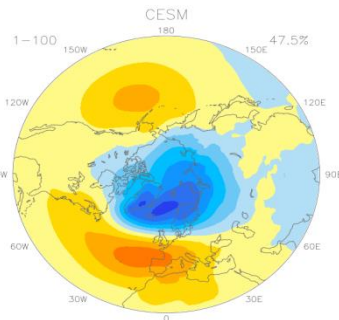
Observation



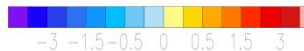
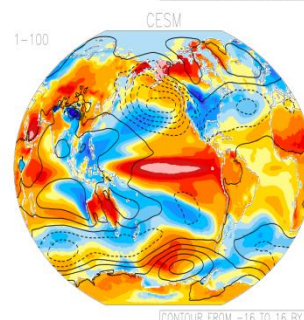
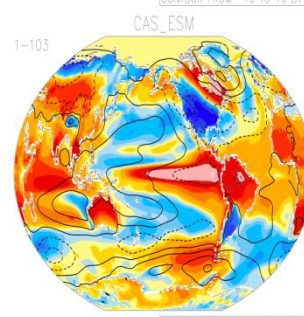
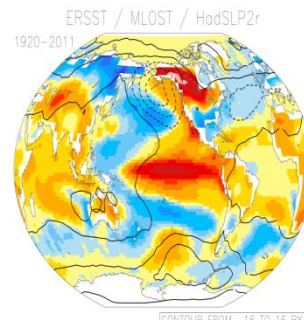
CAS-ESM



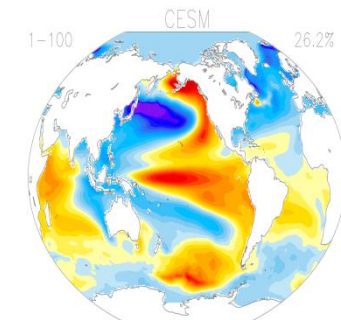
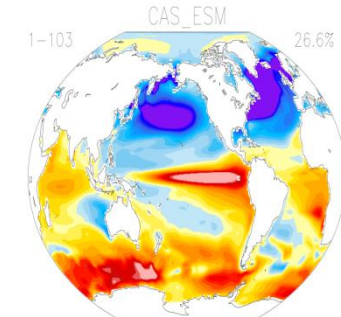
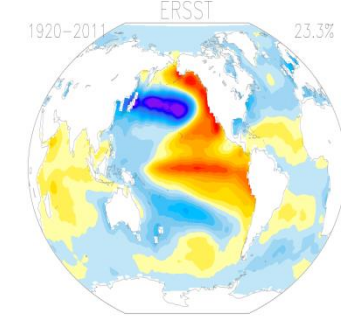
NCAR CESM



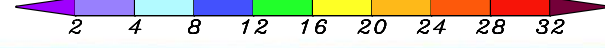
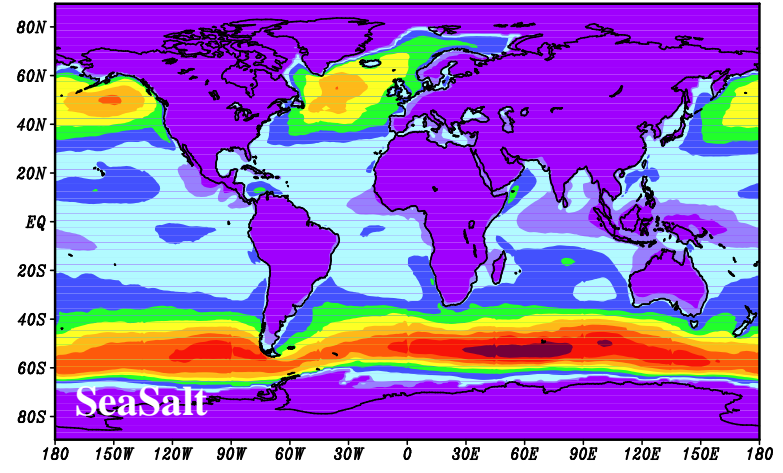
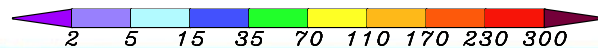
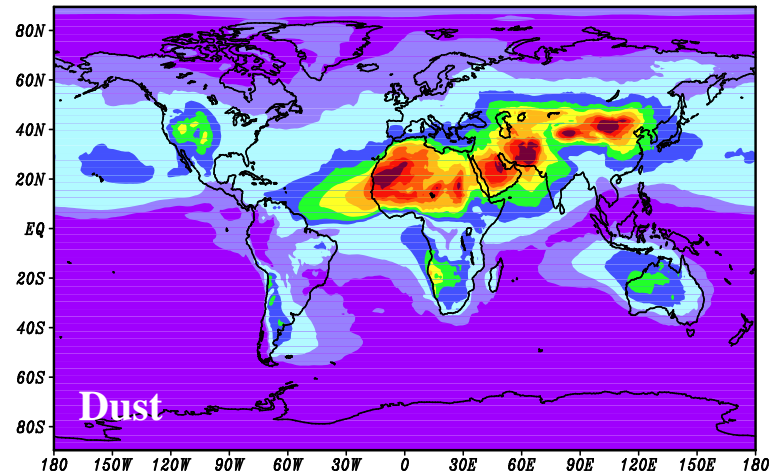
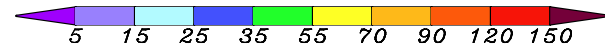
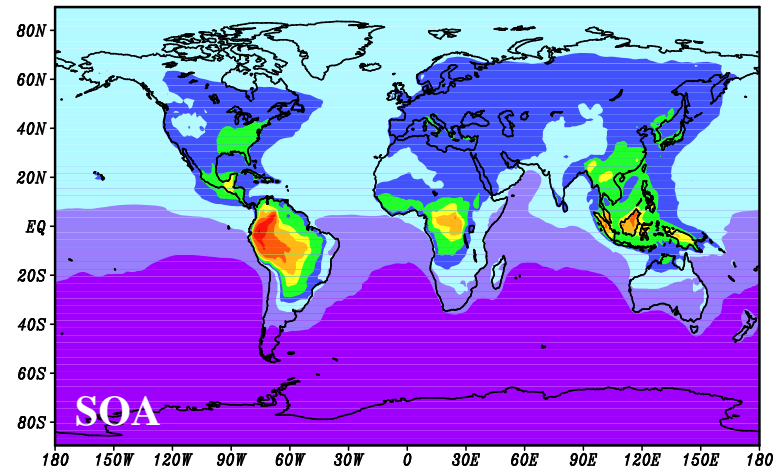
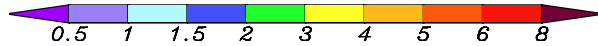
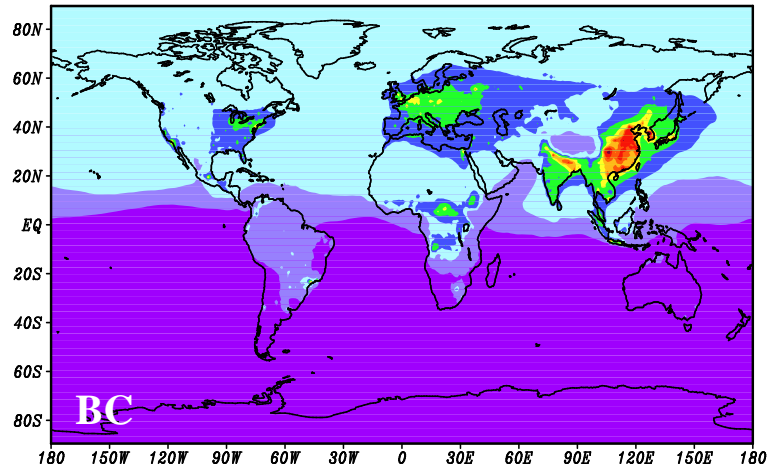
## El Nino: interannual



## PDO: multi-decadal



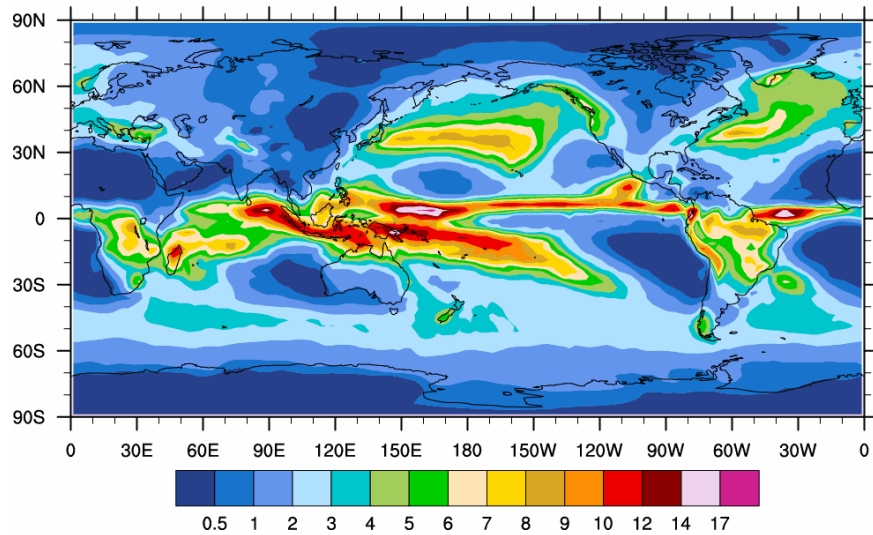
# CAS-ESM: AACM Simulated Concentrations of Aerosol Particles



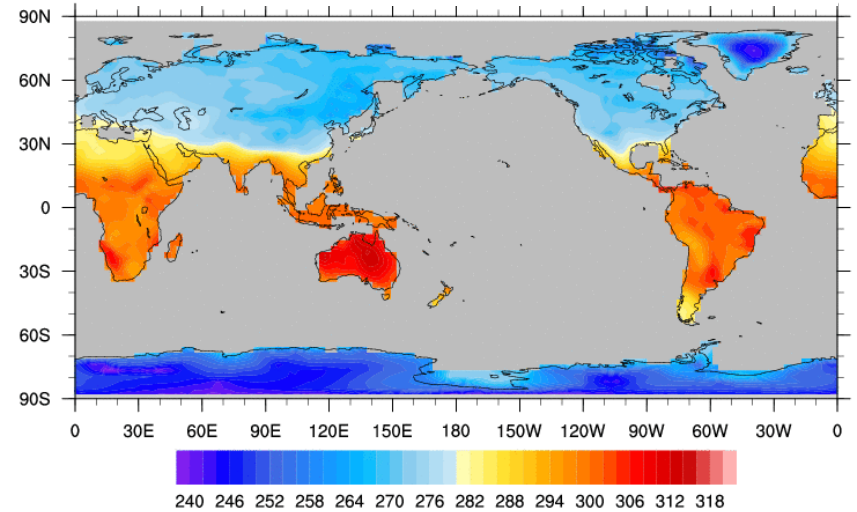


# Simulating Global Climate and Environment by CAS Earth System Model

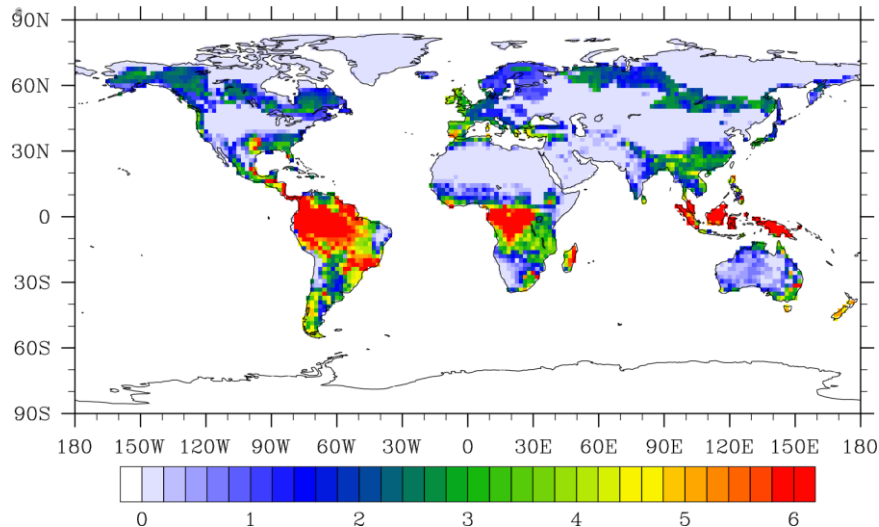
## Precipitation



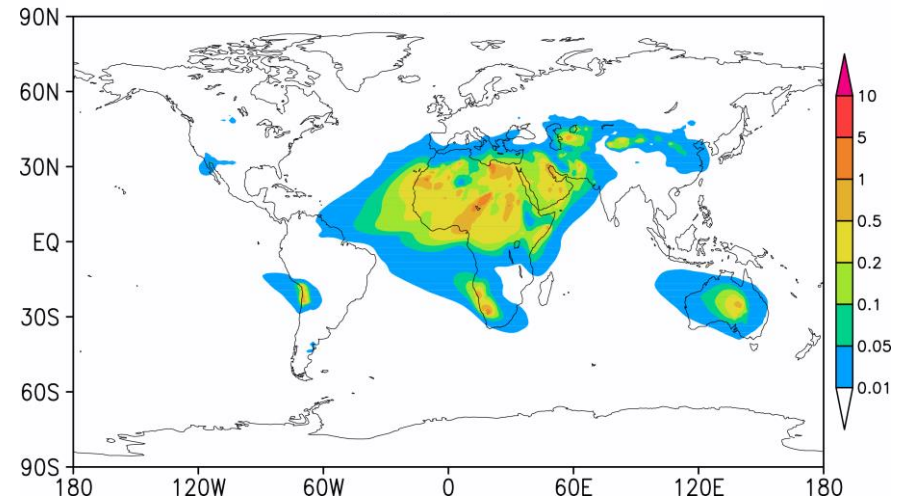
## Ground Temperature



## Leaf Area Index

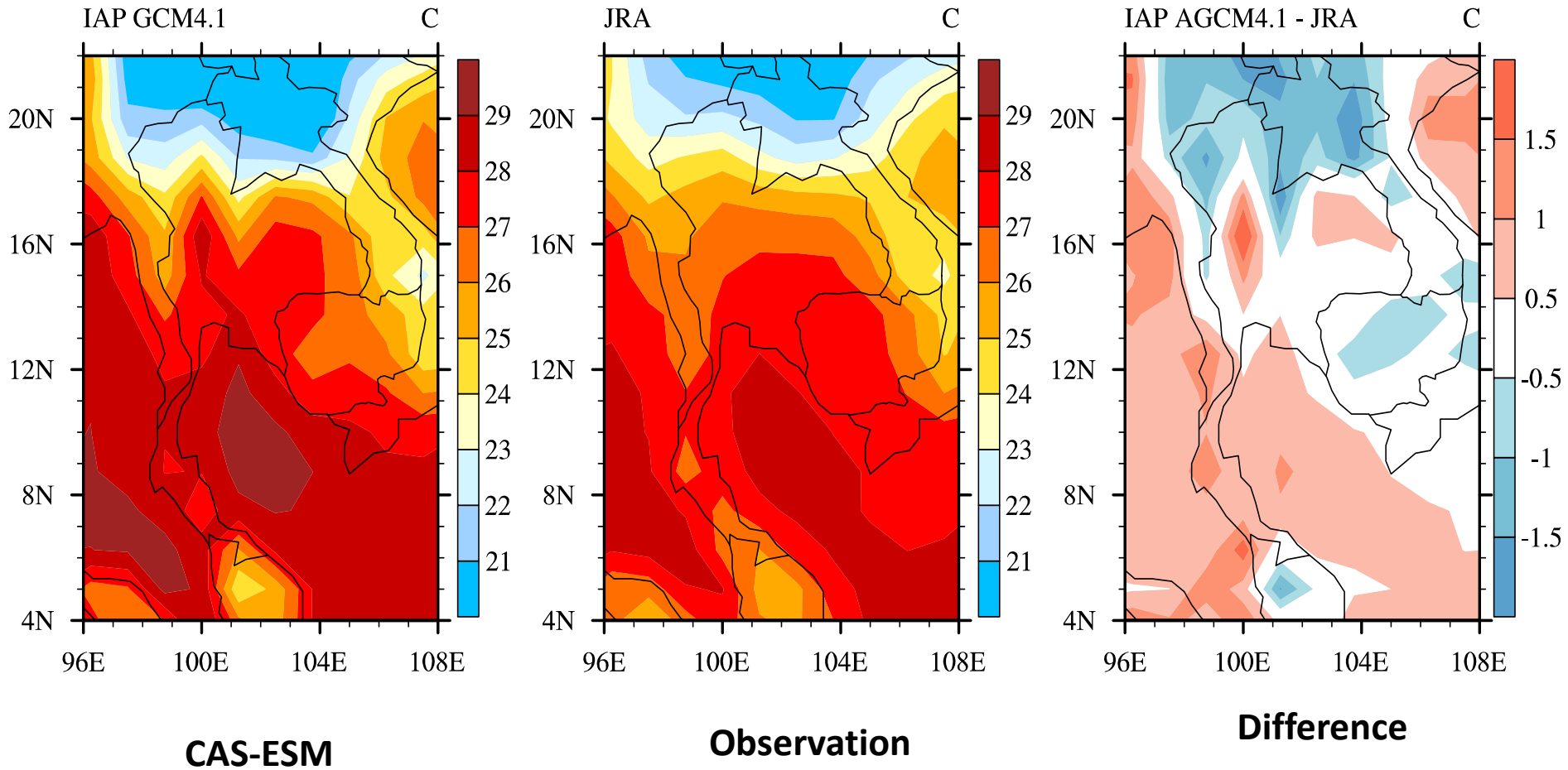


## Dust Concentration



# Regional Simulation ---Precipitation & Temp. over Thailand

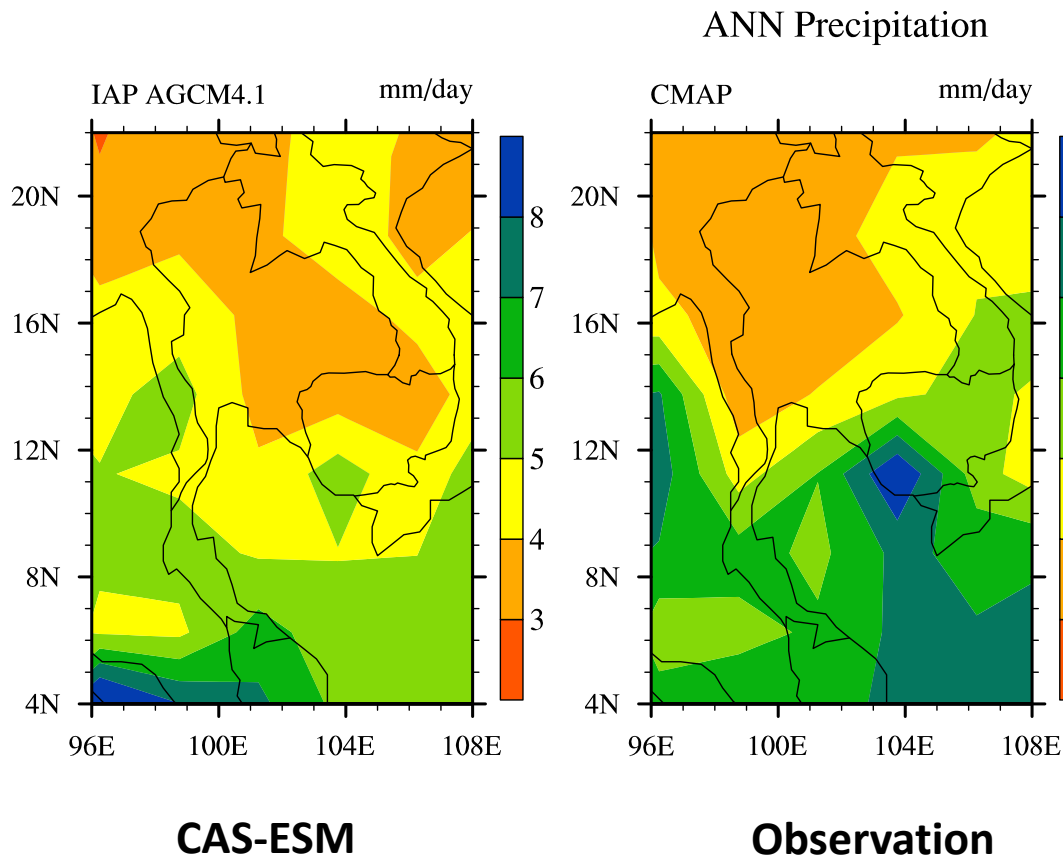
## ANN TS



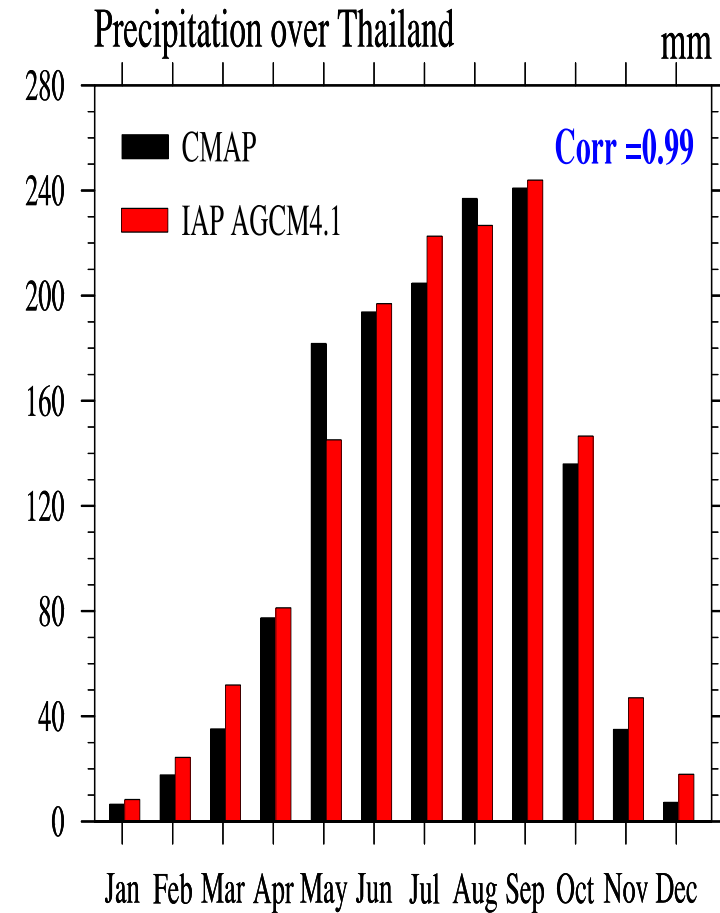


# Regional Simulation ---Precipitation & Temp. over Thailand

## Annual precipitation



## Seasonal cycle



# Participating IPCC AR6 with CAS-ESM

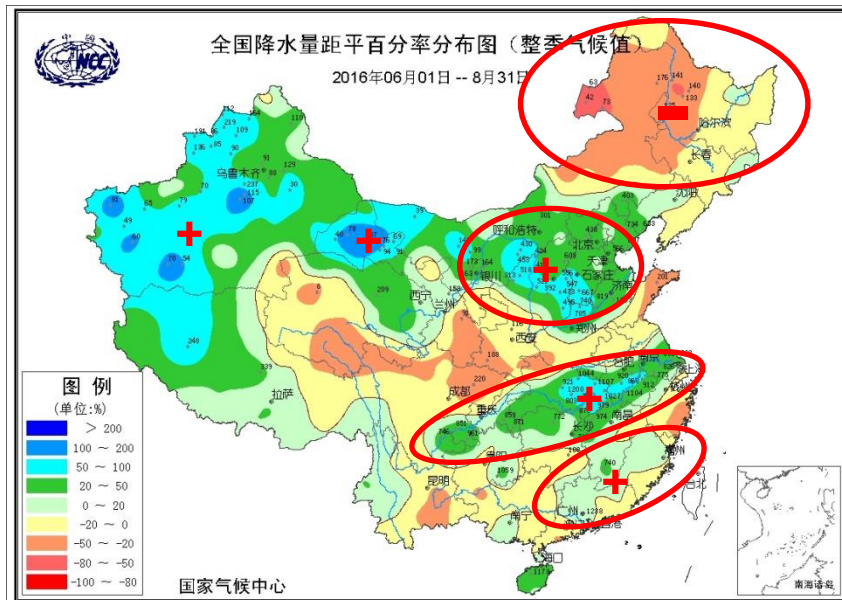
- ✓ Preparation for CMIP6 experiments (IPCC AR6)
- ✓ Participating MIPs

	Short name of MIP	CAS		Universities			CMA		SOA	Total	
		FGOALS	CAS ESM	THU	BNU	NUIST	BCC	CAMS	FIO		
1	AerChemMIP		X							2	
2	C4MIP		X							3	
3	CFMIP		X							5	
4	DAMIP		X							3	
5	DCPP		X?							4	
6	FAFMIP		X							0	
7	ISMIP6		X?							1	
8	GeoMIP		X							1	
9	GMMIP		X							8	
10	HighResMIP		X							3	
11	LS3MIP		X							2	
12	LUMIP		X							1	
13	SnowMIP		X							0	
14	DynVar		X							1	
15	OMIP		X							3	
16	PMIP		X?							2	
17	RFMIP		X							1	
18	ScenarioMIP		X							5	
19	SIMIP		X							3	
20	VolMIP		X							1	
21	CORDEX		X							2	

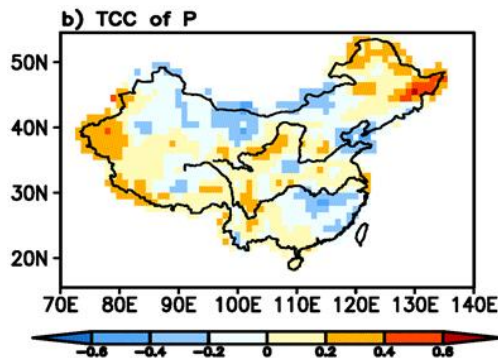
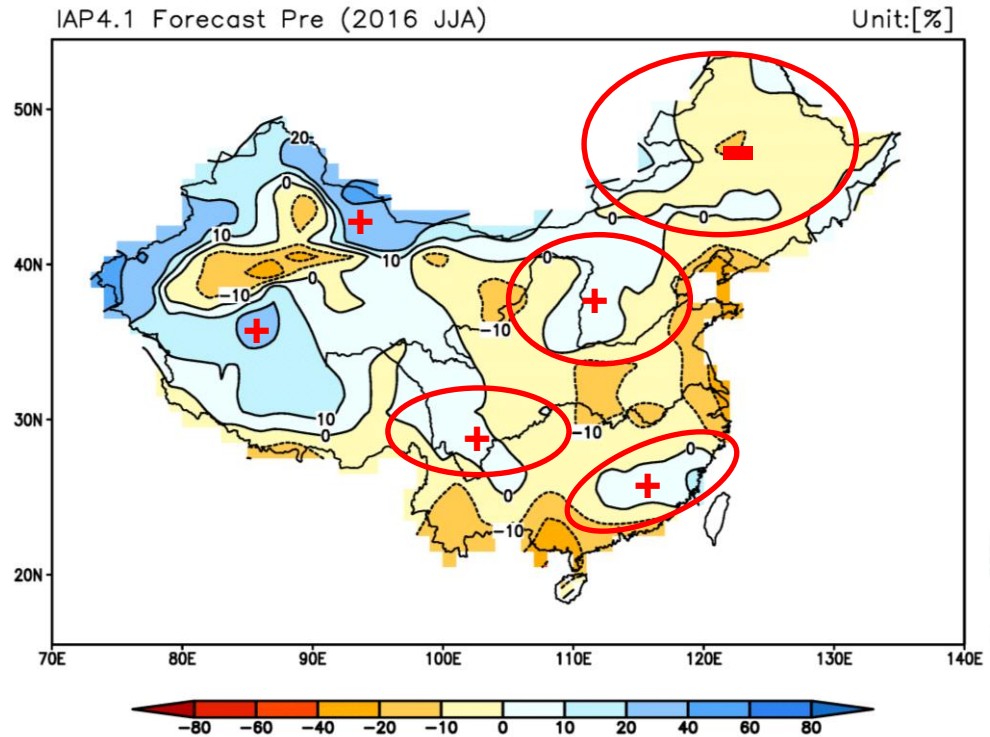


# Summer Rainfall Anomalies in 2016

## Obs



## Forecast (Initiated from Mar.)

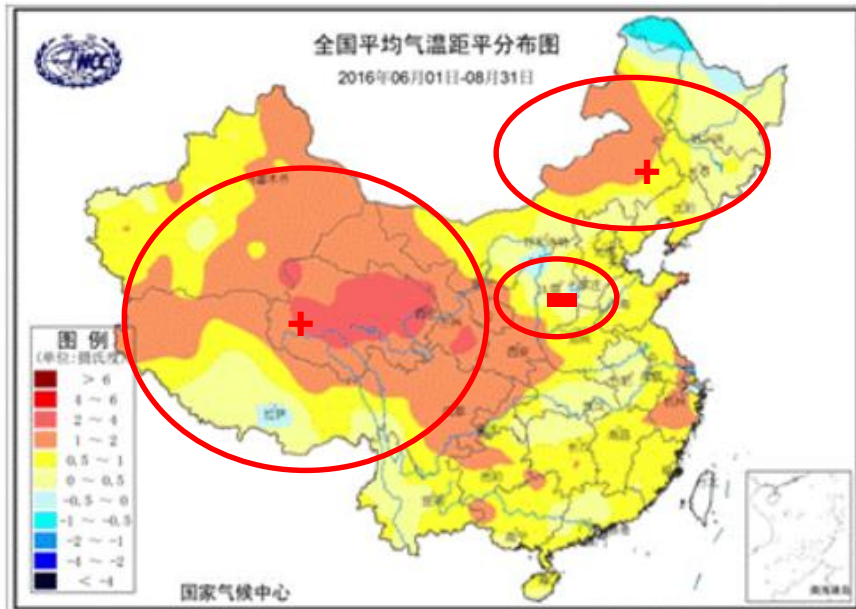


Skill Score: 70.5



# Summer Temp. Anomalies Prediction for 2016

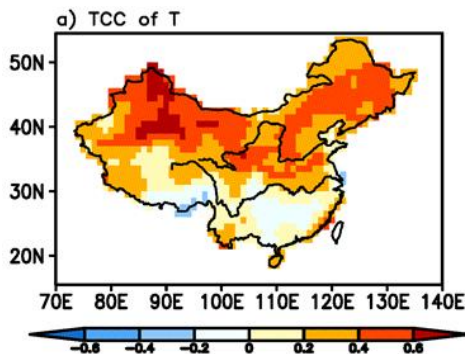
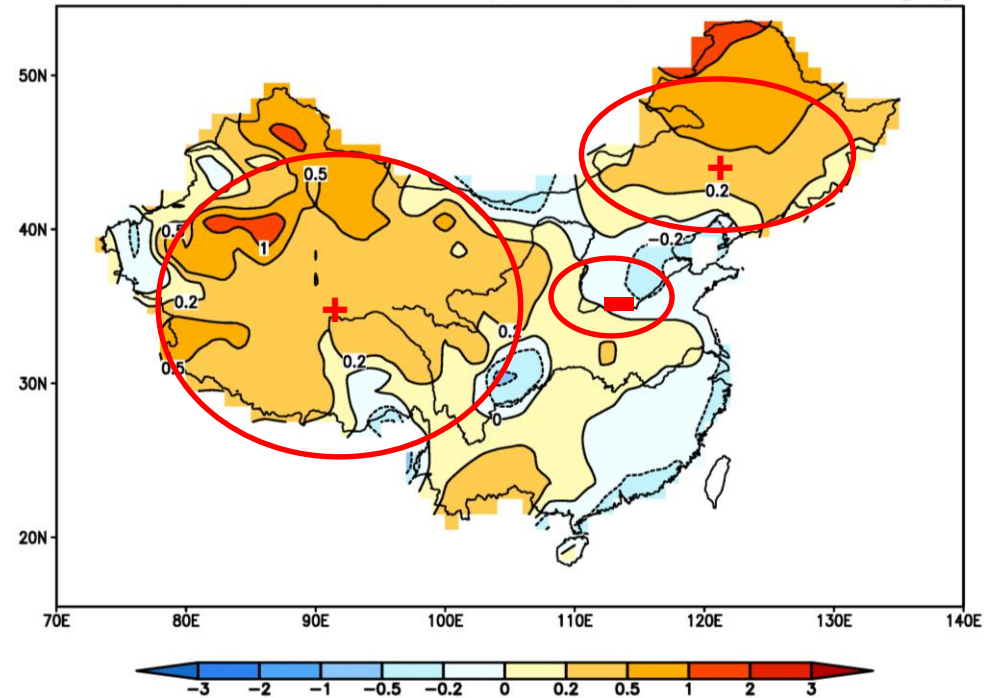
## Obs



## Forecast (Initiated from Mar.)

IAP4.1 Forecast Tm Anomalies (2016 JJA)

Unit:[°C]





# III. International Cooperation

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## ◆ International Conference

- ◆ The 15th CAS-TWAS-WMO Forum
- ◆ The 5<sup>th</sup> Meeting of COMSATS'ITRG on “Climate Change and Environmental Protection”
- ◆ The 2nd International Workshop of Meteorological Science and Technology in Central Asia
- ◆ First BRICS Workshop on Operational Oceanography
- ◆ The 6th International Conference on Sustainable Energy and Environment

## ◆ International programs

- ◆ China - Thailand Cooperative Research Project supported by NSFC and NRCT (National Research Council of Thailand)
- ◆ China-Sri Lanka Science & Education Cooperation project Under the Belt and Road Initiative
- ◆ Climate change research and observation program under the Belt and Road Initiative

## ◆ Capacity Building Activities

- ◆ International Students
- ◆ Visiting Scholar Programs

## ◆ Collaboration with other COMSATS CoEs



# 15th CAS-TWAS-WMO Forum

- ◆ The 15th CAS-TWAS-WMO Forum, the International symposium on “Atmospheric Aerosol” was held during September 19-24, 2016 in Beijing, China.
- ◆ 52 oral presentations and 80 poster presentations were made during the 6-day symposium, covering 8 topics: Global modelling of atmospheric aerosols (e.g., desert dust, organics, wildfire smoke, sea salt, sulfate, and nitrate); Remote-sensing aerosol amount and type retrievals; In situ observations of atmospheric aerosols; Ground-based, satellite, and model aerosol product



intercomparisons; Aerosol optics and radiative forcing; Aerosol effects on clouds and precipitation; Aerosol and atmospheric chemistry interactions; Aerosol and climate interactions. **Over 140 researchers from 22 countries attended this conference.**

## Meteorological Science and Technology in Central Asia



➤ The 2nd International Workshop of Meteorological Science and Technology in Central Asia was held in Beijing during September 28-29, 2016.

➤ This workshop is jointly organized by ICCES and IAP.



➤ More than 80 participants from China, Uzbekistan, Tajikistan, Kazakhstan and other central countries attended this meeting. Presentations covered 4 topics, including meteorological disaster monitoring technology, severe weather prediction and warning technology, evaluation of climate change and its influence, response of the water resources to the climate change.

# First BRICS Workshop on Operational Oceanography

- The first BRICS Workshop on Operational Oceanography was held on September 26-28, 2016 in Beijing. ICCES was the organizer of this workshop.

**23 Scientists from China, Russia, South Africa, and Brazil** attended the workshop and shared information on Ocean Service, Operational Oceanography activities.



# The 6th International Conference on Sustainable Energy and Environment

- The 6th International Conference on Sustainable Energy and Environment (SEE 2016) was held during November 28-30, 2016 in Bangkok, Thailand, in conjunction with 6th International Conference on Green and Sustainable Innovation(ICGSI 2016) and 1st International Conference on Climate Technology and Innovation(CTI 2016), with ICCES was one of the co-sponsors.

Prof.Zhaohui Lin was a member of International Advisory Committee, and was invited to give the keynote speech entitled “Development of CAS Earth System Model and Its Applications”.





# China - Thailand Cooperative Research Project supported by NSFC and NRCT (National Research Council of Thailand)

- ◆ The NSFC-NRCT joint international research project “Comparative risk assessment of hydrologic hazards and adaption policy in Jiulong River and Chao Phraya Watershed” was approved in 2016 and officially launched in 2017.
- ◆ This project is jointly applied by ICCES, Institute of Urban Environment, Chinese Academy of Sciences, and Asian Institute of Technology(AIT) in Thailand. ICCES undertakes the research of characteristic analysis and forecast of extreme water disaster in Jiulong River watershed.





# International Students

- ◆ Kritanai Torsri (Thailand), Victor Nnamdi Dike (Nigeria) and Sherly Shelton (Sri Lanka) continue their PhD program in ICCES.
- ◆ Farhan Saleem (Pakistan) joined ICCES as a PhD candidate in 2016.
- ◆ Dr. Worachat Wannawong (Thailand), working on couple data assimilation, continues his Postdoc research.
- ◆ Dr. Bushra Khalid from COMSATS Institute of Information Technology (CIIT), Pakistan, working on climate change impact on dengue fever, has finished her research and left ICCES at February, 2017 to continue her research work at Austria.



**Dr. Bushra Khalid from CIIT**

# Visiting Scholars

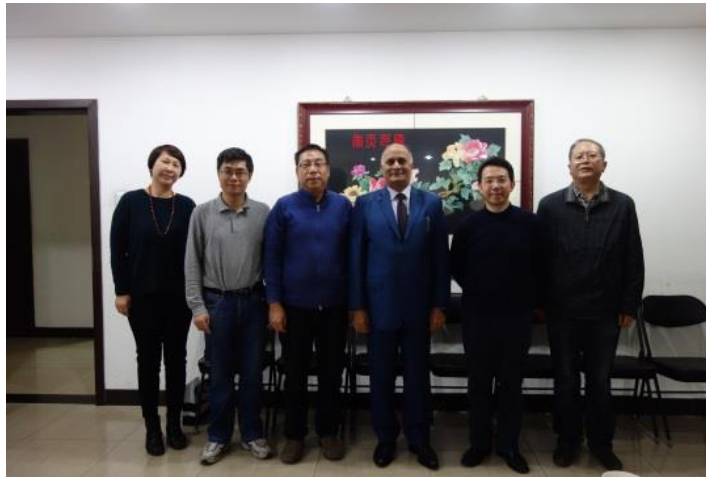
- ICCES invited **25** visiting scholars from institutes and universities of different countries, including leading scientists, senior researchers, PhD students and postdoc fellows from **Pakistan(CIIT), Nigeria (Imo State Uni., Uni. Of Ibadan), Thailand (CMU), Brazil (CPTEC/INPE), Sri Lanka, Australia, the United States, UK, Germany, France, Italy, Norway etc.**



# Pakistan

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- **Dr. Ghulam Rasul, director general of Pakistan Meteorological Department (PMD), visited ICCES in November 2018.**
- Dr. Rasul introduced that research on flood, drought and haze would be the work focus in PMD. Both parties agreed to deepen the collaboration in climate research and weather modification, particularly in the above-mentioned topics, as well as organizing joint international conferences, encouraging high-level visits, international collaboration proposals and capacity building etc.



# Thailand

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- **Dr. Somporn Chantara and Dr. Wan Wiriya from Chiang Mai University visited ICCES**, and they conducted joint research on Asian aerosol and its interaction with regional climate during September, 2016.
- Joint proposals for potential collaboration between ICCES and Chiang Mai University were developed, and a MoU between Chiang Mai University and ICCES was signed to promote the collaboration opportunities between the two parties.
- Dr. Chantara and Dr. Wiriya also attended the 15th CTWF International Symposium on Atmospheric Aerosol with oral and poster presentations, the International Lecture Courses on Atmospheric Aerosol, and the 5th COMSATS ITRG meeting.



# Brazil

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- **Prof. Paulo Nobre and Dr. Debora Alvim from National Institute for Space Research, Brazil visited ICCES in September 2016.**
- During this visit, Prof. Nobre introduced the climatic scientific research results and experience in Earth System Model development in Brazil. Chinese delegates also introduced the components, features and performance of CAS-ESM. Both parties expressed their willingness and expectations to make headway towards bilateral cooperation in joint international workshops, international collaboration proposals and co-supervision of international students.





# Nigeria

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- **Prof. Okechukwu Kelechi Nwofor from Imo State University, Nigeria made a three-month visit (from August 1st to October 29th, 2016) at ICCES under the CAS-TWAS PIFI Initiative.**
- **Prof. Nwofor's area of interest is aerosols, climate variability and environmental sustainability.**
- **During his visit, Prof. Nwofor studied the site measurements from the AERONET network, and revealed the spatio-temporal patterns of aerosol loading in West African Sahel, e.g., the attenuation in aerosol optical depth (AOD) and its seasonal variation associated with climatic factors such as wind and perceptible water. He further established the relations to important meteorological and socio-economic situations. The work contributed to the improvement of model quantification of the global aerosol effect.**



# Collaboration with COMSATS CoEs

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1. Collaboration with CIIT-Pakistan
2. Collaboration with NRC-Egypt
3. Collaboration with ITI-Sri Lanka
4. Collaboration with TWAS, UNESCO



# 1. Visiting Scholars from CIIT-Pakistan

- **Dr. Tahir Naeem, director of Planning, Development and Human Resource Development, COMSATS Institute of Information Technology (CIIT), and Dr. Bahadar Nawab Khattak, head of Department of Development Studies/Sustainable Sanitation, CIIT, visited ICCES in May, 2016.**



- Prof. Zhaohui Lin, director of ICCES, proposed a joint research on identifying features and impacts of climate change along the China-Pakistan Economic Corridor for the past 20 years by using and comparing meteorological data collected from both sides.
- Dr. Naeem and Dr. Nawab promised to encourage more eligible students from CIIT to apply for further study at ICCES, and envisioned more joint articles published through the future collaboration.

# Visiting Scholars from CIIT-Pakistan

- CIIT delegation leaded by Prof. Javaid Anwar and Dr. Muhammad Shahzad visited ICCES in April, 2017.
- After a thorough discussion, Prof. Javaid Anwar and Prof.Zhaohui Lin agreed that under the background of Belt & Road Policy and China-Pakistan corridor, ICCES and CIIT have more opportunities and more channels to cooperate, for instance applying common projects, resource and data sharing, academic exchange and capacity building. Both institutes should utilize its strength to apply for joint projects, especially related to topics of common interest such as extreme weather, dust and flood.



Mr. Asad Amin will be awarded the CAS PIFI fellowship for PhD students, who was the Master student of Dr. Wajid Nasim, Department of Environmental Sciences(CIIT),Vehari-PAKISTAN.



## 2. Visiting Scholars from NRC-Egypt

- **Prof. Dr. Ashraf Shaalan, President of NRC Egypt, Prof. Mohamed Ali, Vice President of NRC, and Prof. Mohamed Hashem, Vice President of NRC, were invited to attend the First International Science Forum of National Scientific Organizations on the Belt and Road Initiative during November 7-8, 2016 in Beijing, China.**



- **Prof. Zakaria Abdalla and Dr. Shaymaa Shedeed from NRC Egypt were invited to attend the 15th CTWF International Symposium on Atmospheric Aerosol, International Lecture Course on Atmospheric Aerosol, and the 5<sup>th</sup> meeting of COMSATS' ITRG organized by ICCES in September 2016.**

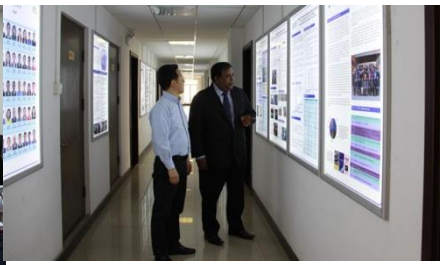


# 3. Collaboration with ITI-Sri Lanka

➤ Mr. Sherly Shelton from ITI, Sri Lanka, joined ICCES since year 2015 as a PhD candidate, under the supervision of Prof. Zhaohui Lin. Mr. Sherly Shelton is studying hydrological modelling and precipitation extreme events especially focused on Sri Lanka at ICCES.



➤ Honorable State Minister Lakshman Senewiratne, Ministry of Science, Technology and Research, Sri Lanka, also a member of the Sri Lankan parliament, visited ICCES and IAP on April 20, 2017.



## **4、 Nigerian Researcher visited ICCES under the TWAS-UNESCO Associateship**

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- **During September 6-November 26, 2016, Dr. Mojisola Adeniyi from University of Ibadan, Nigeria visited ICCES under the TWAS-UNESCO Associateship.**

**During her visit, Dr. Adeniyi applied the climate model IAP-AGCM4.1 to simulate the intra-seasonal variations and climatology of West Africa monsoon regime, and evaluated the model performance. Her visit had helped to lay a solid foundation for the popularization and application of IAP's climate system model in West Africa.**





# Future Plan ----New Opportunities

## Silk Road Economic Belt & 21st-Century Maritime Silk Road

- An open, **inclusive and balanced regional economic cooperation architecture** that benefits all
- Connectivity of Asian, European and African continents
- Broader and more in-depth regional cooperation of higher standards



- establish joint labs, research and education centers, technology transfer centers
- conduct joint research projects on issues of strategic importance
- promote the mobility and exchange of scientists and engineers



# Future Plan



## 1. Establishing the International Research Network on climate and environment sciences”, especially for B&R countries



Joint Research Center/Network on  
Climate & Environment Sciences  
Among COMSATS Member Countries

Opening ceremony of The Belt & Road Forum for International Cooperation, with 29 Head of State and government attending the meeting, 1500 participants from more than 130 countries.



Dr. Hussein Ibrahim, Culture Attaché  
at the Egyptian Embassy in China

# Future plan

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## 2. Enhancing collaborations between COMSATS member centers

- **Joint Research proposals**

- ✓ NSFC/PSF, NSFC/Sri Lanka
- ✓ Bilateral Agreement between MOSTs
- ✓ CAS international collaboration program
- ✓ Special funding ( APN, Word Bank, CPEC funding?)

- **Joint Conferences**

- ✓ Training workshops with specific focus
- ✓ International symposiums
  - 16th CTWF Forum on Seasonal Prediction in September, 2017.
  - International Symposium on Disaster Prevention, Prediction and Mitigation co-organized with China Association for Science and Technology (CAST)

# Future plan

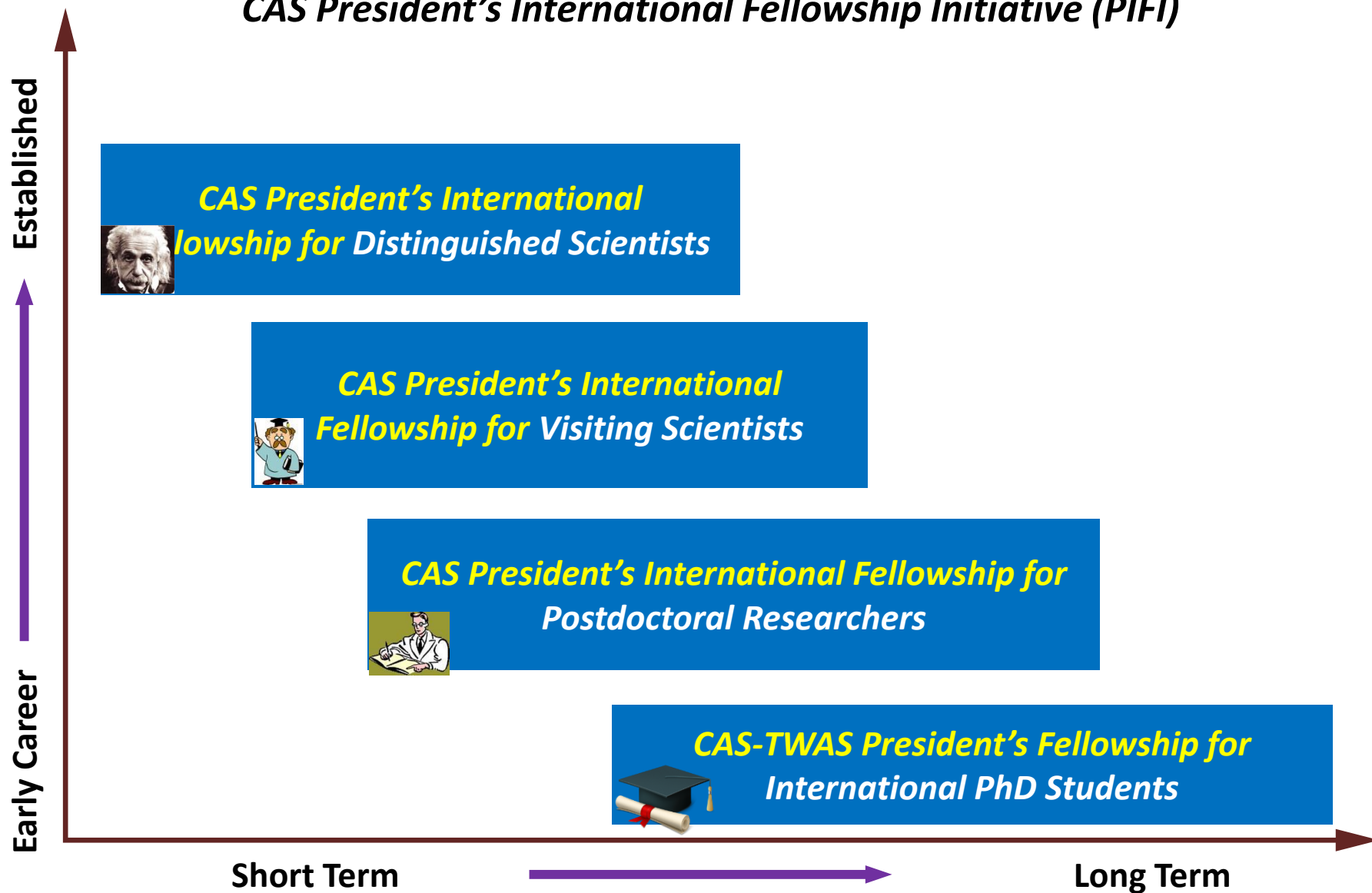
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## 3. Scientist exchange and Capacity building

- Invite young scientists and senior researchers from collaborative institutes to join short-term visiting programs
  - ✓ CAS FIFI program
  - ✓ TWAS-UNESCO
  - ✓ COMSATS?
  - ✓ ICCES
  
- Opportunity for PhD and Master students
  - ✓ CAS FIFI program
  - ✓ CSC scholarship
  - ✓ Scholarship program of Uni. Of CAS

## ***CAS President's International Fellowship Initiative (PIFI)***





# 16th CAS-TWAS-WMO Forum



## 16<sup>th</sup> CTWF International Symposium on Advances in Seasonal to Decadal Prediction

18-20 September 2017 Beijing, China



### Background :

Due to the considerable socio-economic and ecological impacts of the climate, many efforts have been made to predict year-to-year climate variability (e.g., ENSO) and climate changes over the past decades. In particular, advanced data assimilation techniques have been applied to weather-climate forecasting systems in order to generate realistic ensemble initial conditions for improved predictive skill. However, major challenges remain in reducing uncertainties in the initial conditions and errors in forecast models and external forcing, and in assessing predictability limit associated with multi-scale climate processes and nonlinearity. In this context, Advances in seasonal to decadal prediction have been selected as the topic for this year's international conference of CAS-TWAS-WMO Forum on Climate Science (CTWF).

The main goal of the conference is to bring together experts to exchange ideas, discuss scientific problems in depth, and consider suitable solutions to seasonal to decadal prediction issues through coordinated efforts. The meeting will consist of invited lectures followed by plenary discussions. There will also be sessions with contributed oral or poster presentations.

### Topics :

1. Novel data assimilation and ensemble forecast approaches for improving S2D predictions
2. Impact of model systematic error on forecasts, and approaches to alleviate them
3. Mechanisms for atmosphere-ocean variability
4. Understanding of the fundamental limits of predictability
5. Atmosphere-ocean observing system evaluation for S2D predictions
6. Practical application of S2D predictions

### Scientific Committee:

Francisco Doblas-Reyes (BSC, Spain)  
Yosuke Fujii (MRI/JMA, Japan)  
Noel Keenlyside (Univ. Bergen, Norway)  
Jing-Jia Luo (BOM, Australia)  
Amaranta Mariotti (NOAA, USA)  
Adam A. Scaife (Met Office, UK)  
Emilia Sanchez-Gomez (CERFACS, France)  
Fei Zheng (ICCES, IAP/CAS, China)

### Sponsors:

Chinese Academy of Sciences (CAS)  
The World Academy of Sciences for the advancement of science in developing countries (TWAS)  
Institute of Atmospheric Physics, CAS

### Contact:

MS. Xiao JIN; MS. Wencheng (Diane) CHEN

CAS-TWAS Center of Excellence for Climate and Environment Sciences (ICCES)  
Institute of Atmospheric Physics (IAP/CAS)

### Local Organizer:

CAS-TWAS Center of Excellence for Climate and Environment Sciences (ICCES)  
Institute of Atmospheric Physics (IAP), CAS

### Important Dates:

Deadline for On-line Registration: July 1, 2017  
Deadline for Abstract Submission: July 1, 2017  
Notice of Abstract Acceptance: July 31

P.O. Box 9804, Beijing 100029, China E-mail: ctwf@mail.iap.ac.cn  
<http://2017ctwf.csp.escience.cn> Tel: +86 10 82995124 Fax: +86 10 82995123

- Theme: **Advances in Seasonal to Decadal Predictions**
- Date: 18-20 September, 2017
- Location: Beijing, China
- Topics:
  - Novel data assimilation and ensemble forecast approaches for improving S2D predictions
  - Impact of model systematic error on forecasts, and approaches to alleviate them
  - Mechanisms for atmosphere-ocean variability
  - Understanding of the fundamental limits of predictability
  - Atmosphere-ocean observing system evaluation for S2D predictions
  - Practical application of S2D predictions

Visit conference website for further information: <http://2017ctwf.csp.escience.cn>

# THANK YOU!

Prof. Dr. Zhaohui Lin

Director of ICCES

Email: [lzh@mail.iap.ac.cn](mailto:lzh@mail.iap.ac.cn)

<http://www.icces.ac.cn>

