SOFIE
SINO-FRENCH INSTITUTE FOR EARTH SYSTEM SCIENCE
PEKING UNIVERSITY CEA VERSAILLES ST QUENTIN UNIVERSITY

Progress and News

Sino-French Institute for Earth System Science (SOFIE)

One year ago, the CEA/LSCE and the UVSQ welcomed the Chinese delegation from Peking Univerisity (Beida) to France for discussions around the foundation of a common research institute between Beijing University in China and the Laboratoire des Sciences du Climat et de l'Environnement, a joint research laboratory of CEA, CNRS and UVSQ in France. The need for addressing the challenge of quantifying and understanding the key interactions in the Earth System between biogeochemical cycles, the physical climate system and human induced changes was clearly shown through the numerous presentations. The scientific focus of the (virtual) institute in its early development phase will be the study of regional and global feedback loops between the terrestrial carbon cycle, atmospheric composition changes and climate variability and trends. The approach will rely on process based numerical models, empirical models and analysis of past and present Earth Observations. The institute will facilitate bilateral cooperation on cutting-edge research in the field of global change and Earth System Sciences, foster creative and outstanding scientific output, facilitate the exchange of young and promising scientists between the different institutions, and strengthen scientific research leadership and capacity of Peking University in Earth System studies.

A Statement of Interest between the PKU, CEA and the UVSQ was signed on February 14, 2012, with PKU Vice President Li Yansong and Director of the Biogeochemical Research Group at the LSCE, Pr. Philippe Ciais in attendance. This agreement allows the respective institutions to formally enter into the future work plan of the Sino-French Institute for Earth System Sciences (SOFIE).

1st annual winter school of the Sino-French Institute for Earth System Science

The first annual winter school was held from February 13-16, 2012 at Peking University, Beijing, China. Jointly organized by Peking University and the Laboratoire des Sciences du Climat et de l'Environnement part of the Institut Pierre Simon Laplace (LSCE). This winter school aimed at strengthening collaboration and cooperation between the two institutions on Earth System studies, and providing training of graduate and under-graduate students in this field. In the opening ceremony on the morning of February 13th, PKU Vice President Li Yansong and head of the Atmospheric Composition Group at the LSCE, Pr. Philippe Ciais made opening remarks. More than 50 students attended the winter school. The organizers are very grateful for the attendance of Mr. Patrick Nedellec and Mr. Philippe Arnaud from the CNRS Bureau in China on the opening day who gave a presentation on CNRS programs and various Sino-French scientific collaboration instruments.

The four-day winter school focused on Earth System Sciences, divided into four (daily) subtopics: Global Biogeochemistry, Atmospheric Chemistry/Aerosols, Earth System coupled climate-biogeochemical cycles Modelling, and Data Assimilation. Twenty lectures were given by 16 experts from Peking University, IPSL-LSCE and IPSL-LMD. Approximately 50 students from Peking University, Fudan University, Beijing Forestry University, the Chinese Academy of Sciences, and the Chinese Academy of Meteorological Sciences participated in the winter school. Fundamental theories and simulation results in Earth System studies were presented via lectures and video-conferencing. The program also included student topical presentations to facilitate scientific discussions and exchange.

Further plans will be discussed during the Spring semester of 2012, to establish a science workplan for on-going scientific collaboration as well as for planning the exchange of students and researchers among the respective institutions.

For more information on the Sino-French Institute for Earth System Science (SOFIE) and to view winter school presentations:

https://wiki.lsce.ipsl.fr/pku/doku.php?id=home

Brief summary of the courses offered

Feb. 13, 2012		
Speaker	Topic	Brief summary
Nicolas Viovy	Modeling the Global biogeochemical cycle in the terrestrial biosphere: progress and limits.	The objective of this introducing lecture was to show how terrestrial biosphere modeling improved during last decades and the main improvement expected for the future including agrosystems, N and P cycles and traits based approaches
Ben Poulter	Coupling the carbon and water cycles in global vegetation models	Earth system models use relatively similar biophysical representations of photosynthesis via the Farquhar model. This lecture provided an introduction to modeling carbon uptake from photosynthesis and its relationship to stomatal conductance and water limitations.
Valentin Bellasen	Modelling forest management in global vegetation models	This course describes the two standard approaches to simulate forest management at stand scale: gap models and growth-and-yield models. It then discusses the necessary adaptations of these two approaches to scale up at continental or global scale. Finally, the course presents one concrete example, ORCHIDEE-FM, and two applications that derive directly from this added layer of complexity in a GVM.
Shilong Piao	Impacts of climate change on vegetation growth over NH	We review changes in vegetation growth over northern hemisphere during the last three decades, discussing the contribution of climate change and rising atmospheric CO2 to the change in vegetation growth. The current state of model simulations for vegetation productivity is also discussed with an emphasis on the uncertainties.
Hongyan Liu	Vegetation dynamics in drylands: simulations and observations	Three fundamental ecological problems in the drylands: tree growth decline and die-off, trading water for carbon, and woody encroachment into grassland were simulated with DGVMs and tested with observations in the field
Feb. 14, 2012		
Yves Balkanski	Aerosols and Climate	Aerosols are atmospheric particles in the liquid or solid phase that coexist with gases. The chemical nature and the aerodynamic size of these particles determine how they interact with the incoming solar and outgoing infrared radiation. We explain these interactions and quantify how they have influenced surface temperature from the preindustrial period to nowadays. We also show projection for the XXIst century obtained with the IPSL-CM5A model.
Philippe Bousquet	Interactions between atmospheric chemistry and	After a brief introduction on atmospheric chemistry, ozone chemistry in the troposphere is presented.

	climate	Then, impact of atmospheric species on climate is shown. Finally, examples of impact of climate on ozone chemistry is presented, with a link to the next IPCC AR5.
Junfeng Liu	Photochemistry of smog and secondary aerosol formation	Two types of smog are introduced briefly at the beginning. Followed by a detailed discussion on the photochemical chain reactions of HOx and ROx in present of NOx and VOCs, which lead to the accumulation of ozone and production of secondary aerosols. Finally, mechanisms of secondary organic aerosols (SOA) formation in both gas and liquid
François-Marie Breon	(Video-conference) Aerosol and Cloud Remote Sensing from Space	Methods used to monitor aerosols and clouds from space. Description of the satellite orbits, the history of aerosol remote sensing, and the pros and cons of various measurement techniques. Passive instruments such as MODIS and Parasol allow a detailed description of the aerosol distribution on the horizontal, while the active Calipso instrument adds the vertical dimension, but with limited sampling.
Philippe Ciais	Role of methane and carbon monoxide in the carbon cycle	Presentation of the current estimate of frozen carbon pools, was followed by description of 1-D model of soil carbon decomposition for saturated / unsaturated C-rich northern soils. Upscaling of CO2 fluxes using ORCHIDEE model simulations published by Koven et al. was discussed, alongside with critical processes that may accelerate / slow down the response of frozen C to future high latitude warming trends
Feb. 15, 2012		
Philippe Ciais	Carbon-climate feedbacks in the next century	The interactions between climate change and CO2 change in the next century will modulate the atmospheric CO2 and temperature future evolution. Description of the mechanisms of carbon-climate feedbacks, and results from C4MIP coupled models was given. Discussion of processes not accounted for in current generation of models, and uncertainties was provided, including discussion of the importance of nutrients in controlling future land C uptake and possible sources of negative (stabilizing) feedbacks
Mathieu Roy Barman	Tracing the present and past ocean carbon cycle	The ocean is main carbon reservoir at the surface of the Earth. Carbon isotopes (13C, 14C) as well as natural radioactive and radiogenic tracers (230Th, 143Nd/144Nd) provide a wealth of information on the thermodynamic and biological carbon ocean pumps. Analysing these tracers in marine sediments allows reconstructing the ocean carbon cycle during the past glacial times, hence providing strong constrain to test climate models.
Philippe Ciais	Permafrost carbon: A vulnerable pool in a warmer climate ?	The space and time gradients of atmospehric CO2 observed by the surface network of stations, is related to the distribution of sources and sinks. Presentation of the evolution of observing networks, and of the main characteristics of the atmospheric CO2 field was given. Introoduction to inverse modelling and results from coarse regions inversions was provided, with discussion of transport errors, and elements for regional inversions.
Laurent Li	Modelling climate change: From global to regional	After an introduction on the general approach for modelling climate change and impact, the IPSL earth

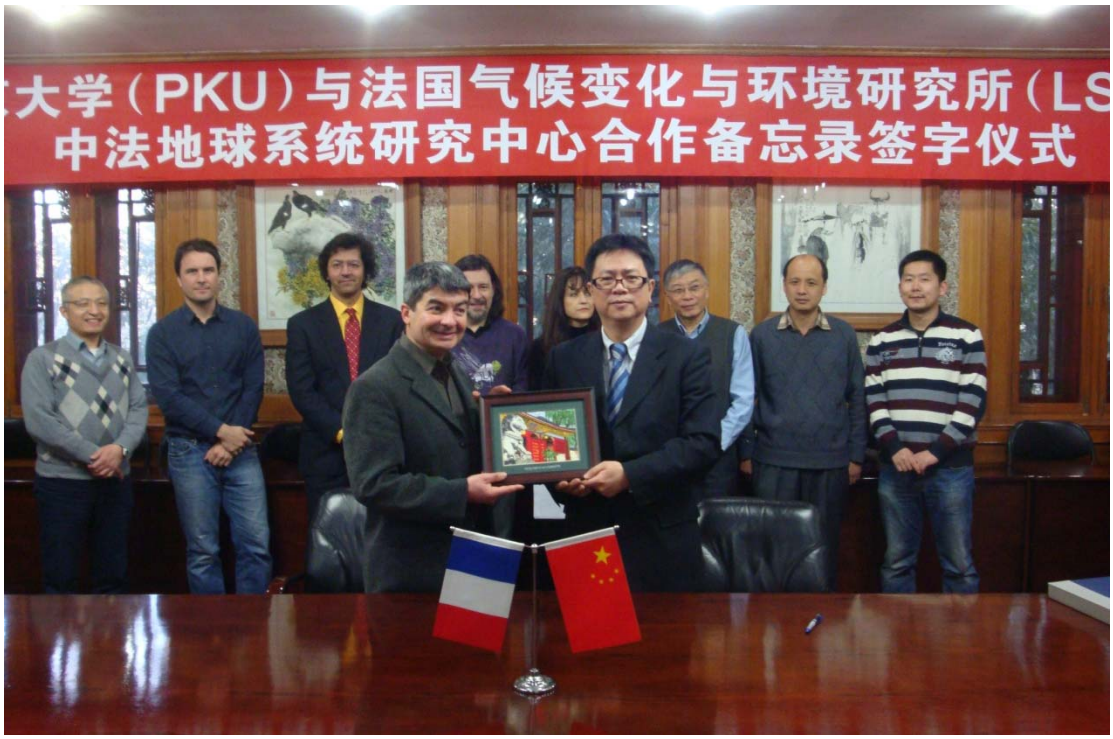
		system model is presented. The rest of the talk is mainly on climate downscaling with physically-based models and their added value in terms of simulated extreme events. A few examples are presented for studies performed over China and over the Mediterranean Basin, including an afforestation experiment.
Ben Poulter	Global data sets and archives and access	Earth system data represent novel challenges for data processing due to their large temporal and fine-scale temporal domains. A survey of Unix and Windows-based software tools, and their theoretical basis, for analysis and visualization was presented.
Feb. 16, 2012		
Frédéric Chevallier	Uncertain carbon cycle	This talk provided a general introduction to the concept of uncertainty. It defined the notion of chance, examined the meaning of the normal distribution, explored Bayes' theorem and showed some applications of this knowledge in the fields of numerical weather prediction, climate modeling and carbon flux modeling.
Philippe Bousquet	An overview of the recent methane cycle: convergences and remaining questions	After an introduction on methane sources and sinks and on the different methods to estimate them at present times, the mais results obtained at LSCE about methane budgets, interannual variability and trends are shown with a special focus on the analysis of the recent increase in the atmosphere.
Philippe Peylin	(Video-conference) Potential of a multi data stream assimilation system for the land carbon cycle	The Course was intended to describe the potential of Carbon Cycle Data Assimilation Systems (CCDAS) based on model parameter optimization to produce relevant estimates of global to regional carbon fluxes over land ecosystems. Particular attention was paied to describe the strenghs and weaknesses of CCDAS approaches compared to classical atmospheric CO2 inversion
Valentin Bellassen	Measuring greenhouse gas fluxes: From scientific research to carbon markets	After a short introduction of the principles of the climate economy, the course presents how the monitoring of emissions is conducted at the three relevant scales: country, sector and project. It then discusses the pros and cons of replacing the current monitoring method - mainly based on activity data and emission factors - by estimates based on actual measurements of GHG concentration, integrated in data assimilation systems.
Frédéric Chevallier	Data assimilation for large state vectors	Data assimilation for large state vectors This talk made an overview of data assimilation methods for large state vectors, from the point of view of CO2 flux inversion. It went through three generic approaches to apply Bayes' theorem: the analytic formulation, the variational formulation and the Monte Carlo formulation. It gave a series of diagnostics to monitor inversion systems and finished by giving some prospects for these systems.

Annex 1 Highlights from the SOFIE winter school

Officers and experts at the opening ceremony of the winter school

PKU Vice President Wang En'ge delivering a welcome speech at the Welcome Dinner

Real time distance learning during the winter school



The signed Statement of Interest between PKU and the LSCE establishing the Sino-French Institute for Earth System Sciences

Annex 2 – Institutional Descriptions

The Laboratoire des Sciences du Climat et de l'Environnement (LSCE) is joint research Unit (JRU) between National center for Scientific Research (CNRS), the Atomic Energy Commission (CEA), and the University of Versailles-Saint-Quentin (UVSQ), based at Gif-sur-Yvette, France. With approximately 150 permanent staff, 40+ PhD students, and 50 postdoctoral researchers, the LSCE is leading cutting-edge research in the field of global carbon cycle, Earth system modeling, and paleoclimate reconstruction. It has taken the lead of or been involved in a number of international and EU projects, and has more than 200 scientific publications annually, published in top academic journals such as *Nature* and *Science*.

The College of Urban and Environmental Sciences at Peking University started from the establishment of the Department of Geology and Geography in 1952. The College now has five departments, two research institutes, and eight research centers covering diverse fields. The college currently consists of 90 faculty and staff members, 400 undergraduates, 530 graduates and 30 postdoctoral researchers. Members of the college pursue the excellence in research, education, and outreach in environment-related fields. Equipped with world-class research facilities and field stations, many faculty members are working towards the frontiers of environmental, ecological, and geographical sciences, and have more than 200 scientific publications annually, of which around 90 in international journals.

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