

第七届气候系统与气候变化国际讲习班

**The Seventh International Seminar on Climate System and  
Climate Change (ISCS)**

# 学 员 手 册

ISCS 讲习班会务组

2010年7月19—30日 北京



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# 第七届气候系统与气候变化国际讲习班 (ISCS)

## 学员须知

### (一) 讲习班时间

2010年7月19-30日

7月19日 09:30 开幕式

中国气象局气象科技大楼会议中心报告厅 (二楼)

### (二) 注册

● 时 间: 7月18日 15:30—18:00

7月19日 08:20—10:30

● 地 点: 中国气象局气象科技大楼会议中心一楼大厅

● 注册费: 500元/人

● 注册顺序: 交纳注册费, 领取学员证、课程表、学习材料、餐卡等, 填写相关信息。

### (三) 食宿

● 住 宿: 中国气象局招待所; 北京神州商旅酒店

宿费自理

● 用 餐: 注册费包括200元餐卡, 可在局职工食堂 (点餐)、北食堂、南食堂、湘风餐厅、局招待所、培训中心食堂、育园餐厅就餐, 也可在上述食堂小卖部购买商品。

### (四) 活动安排

● 招 待 会: 7月23日晚 18:00—20:00 (地点待定)

● 参观活动: 7月24日参观, 注册时登记

地 点: 密云上甸子大气本底站、古北口司马台长城

### (五) 课程安排

● 开幕式、闭幕式、授课及中文辅导课教室在中国气象局气象科技大楼会议中心学术报告厅 (二楼); 英文辅导课教室在第10会议室 (二楼); 专题讨论在会议中心其他会议室 (会务组另行通知)

● 为保证授课效果, 讲习班安排国内相关领域的专家进行中文串讲和辅导, 并按主题分组讨论。学员注册时可就感兴趣的内容, 选择主题讨论单元组。

● 为保证学习效果, 讲习班实行考勤制度。学员每天上下午分别签到, 不得补签、代签, 出勤情况将作为评选优秀学员条件之一。

- 专家授课时，学员须关闭手机或置于静音状态，不要频繁出入报告厅或在报告厅内接打电话。

- 为便于国际学员和京外学员网上查询和下载相关资料，撰写学习论文，计算机教室于 7 月 19-30 日 17:15-20:00，7 月 29 日 14:00-20:00 对学员开放（周六、周日休息），地点在局培训中心 706 教室（白色高层大楼），进入时需出示学员证。

- 其他事宜请咨询会务组。

#### **(六) 讨论主题**

- 主题一：冰冻圈在气候系统和气候变化中的作用

The role of cryosphere in climate system and climate change

- 主题二：大气化学与气溶胶的气候效应

Atmospheric chemistry and climate effect of aerosol

- 主题三：地球生物化学循环

Biogeochemical cycle

- 主题四：气候模式在气候变化研究中的应用

Climate system models and their application in climate change studies

- 主题五：气候变化的减缓与适应对策及社会可持续发展

Strategy of climate change mitigation and adaptation, and social sustainable development

#### **(七) 学习材料**

- 根据授课教师提供的参考文献清单，复印装订后发给学员。

- 其它相关材料。

- 授课教师参考文献可在相关网站查询。

#### **(八) 结业要求**

- 认真听课，积极提问和参加讨论，学员在讲习班结束前需提交一篇小论文，并在讨论课上做约 5-10 分钟陈述。教学辅导小组及专题讨论小组将综合考评（包括考勤），评出优秀学员。闭幕式上颁发证书和纪念奖品。

#### **(九) 小论文**

小论文主要反映学员对授课内容或某一问题的理解或心得体会，也可结合自己的专业知识，联系实际问题进行剖析。小论文不包括已发表或待发表的专业论文、毕业论文，及与讲习班授课内容无关的论

文等。请于7月29日晚前提交电子版，如需打印请17点前提交并标明。

提交方式：[zhangy@cma.gov.cn](mailto:zhangy@cma.gov.cn)

(十) 结业证书

- 闭幕式为学员颁发结业证书。

(十一) 问卷调查

● 注册时领取《问卷调查表》，请认真填写，7月29日前提交会务组。

(十二) 会务组

- 讲习班期间会务组设专人值班，如有问题请与值班人员联系。
- 讲习班临时通知将在会场外的白板公布。
- 联络人：张雁 孙源

单 位：国家气候中心科技处

地 址：北京市海淀区中关村南大街46号，100081

ISCS 网址：<http://ncclcs.cma.gov.cn/>

<http://ncc.cma.gov.cn/ISCS/>

电 话：010-58995876；010-68400093

E-mail：[zhangy@cma.gov.cn](mailto:zhangy@cma.gov.cn)；[sunyuan@cma.gov.cn](mailto:sunyuan@cma.gov.cn)

ISCS讲习班会务组  
二〇一〇年七月十八日

**Tentative Schedule of the Seventh International Seminar on Climate System and Climate Change**  
**19-30 July 2010, Beijing, China**

Date	19(M)	20(T)	21(W)	22(T)	23(F)
Morning	09:30-09:50 Opening ceremony	Claude Boutron 09:00-10:20 Lecture 3: Natural changes in the occurrence of heavy metals in Antarctic ice during the past 670 kyr	Ned Helme 09:00-10:20 Lecture 1: emissions trading experience in Europe and the US	Ned Helme 09:00-10:20 Lecture4: global prospects for climate policy in the various global markets	Klaus Fraedrich 09:00-10:20 Lecture 3: Continuum climate variability: long term memory, extremes, predictability
	09:50-10:10 Photo-taking			Francis Zwiers:	
	10:30-12:00 Claude Boutron Lecture 1: Drilling snow and ice cores in Antarctica , Greenland and high altitude temperate areas	10:40-11:40 Questions/Discussions	10:40-12:00 Lecutre 2: competitiveness effects of climate policy on both China and developed countries' energy intensive/trade exposed industries	10:40-11:40 Teaching assistance in Chinese	
Afternoon	14:00-15:20 Lecture 2: Analysing snow and ice cores for heavy metals at extremely low concentration levels	14:00-15:20 Lecture 4: Man induced changes in heavy metals since the Antiquity documented in snow and ice cores	Ned Helme 14:00-15:20 Lecture 3: CDM, sectoral crediting and offsets policies	Klaus Fraedrich 14:00-15:20 Lecture 1: Climate, Chaos, and Catastrophes Lecture 2: Three bridges: the Europe - Asia connection	Klaus Fraedrich 14:00-15:20 Lecture 4: A suite of global circulation models
	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions
	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese
Evening					Reception for students

24(S)	25(S)	26(M)	27(T)	28(W)	29(T)	30(F)
Technical Tour	Steven John Ghan 09:00-10:20 Lecture 1: Aerosol effects on clouds	John A. Ogren 09:00-10:20 Lecture 1: Atmospheric Cycle of Elemental Carbon	John A. Ogren 09:00-10:20 Lecture 3: Climate Sensitivity and Aerosol Forcing	Nakajima Teruyuki 09:00-10:20 Lecture 1: Role of radiation in the climate system	Nakajima Teruyuki 09:00-10:20 Lecture 4: Global warming and various feedback system in the climate system	09:00-12:00 Group Discussion and Exchange (3-4 groups) Oral presentation and paper submission
			Lecture 4: Biogeochemical cycles of greenhouse gases		Lecture 1:	
	10:40-11:40 Questions/Discussions	10:40-12:00 Steven John Ghan Lecture 3: Effects of black carbon on climate	10:40-12:00 Steven John Ghan Lecture 4: Impacts of climate change on mountain snow	10:40-12:00 Lecture 2: Signature of climate change from space	10:40-11:40 Teaching assistance in Chinese	
	Steven John Ghan 14:00-15:20 Lecture 2: Toward a minimal representation of aerosol effects on climate	John A. Ogren 14:00-15:20 Lecture 2: Measurement Techniques for Aerosol Climate- forcing Properties	John A. Ogren 14:00-15:20 Lecture 4: Haze and Clouds: Interactions of Aerosols and Water	Nakajima Teruyuki 14:00-15:20 Lecture 3: Aerosols and clouds in the climate system	14:00-20:00 Preparation of oral presentation (Computer room: Room 706, CMA Training Center)	14:00-15:50 Oral presentation and paper submission
	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions	15:40-16:10 Questions/Discussions		16:00-16:30 Closing ceremony
	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese	16:10-17:10 Teaching assistance in Chinese		

Evening: 17:15-20:00 ( Mon.-Fri.), Computer room: Room 706, CMA Training Center





## Curriculum vitae of Prof. Dr. Claude Boutron

Laboratory of Glaciology and Geophysics of the Environment,  
University Joseph Fourier of Grenoble/CNRS, 54, rue Molière, 38400  
Saint Martin d'Hères (France)

Phone : 33 4 76 82 42 00 ; E-mail : [boutron@lgge.obs.ujf-grenoble.fr](mailto:boutron@lgge.obs.ujf-grenoble.fr)

Born 26 June 1947, Gap (France), Married, 3 children

### University studies

Physics/Geophysics, University Joseph Fourier of Grenoble, France; Master (1969);  
Doctorat de 3e cycle (1971); Doctorat d'Etat (1978)

### Research positions

- 1969-1970: Research Assistant, Atomic Energy Commission, Fontenay aux Roses, France
- 1970-1988: Assistant, Maitre-Assistant and Maitre de Conférences, University Joseph Fourier of Grenoble, France,
- 1981 and 1984/1985: Visiting Research Associate, California Institute of Technology, Pasadena, California, USA (Division of Geological and Planetary Sciences)
- 1988-present: *Professor, University Joseph Fourier of Grenoble, France. At present "Professeur classe exceptionnelle 2e échelon"*
- 1992, 1994, 1995 and 1997: Contract Professor, University Ca' Foscari of Venice, Italy
- 1993 and 1994: Visiting Professor, Curtin University of Technology, Perth, Australia
- 1999, 2002, 2004 and 2005: Contract Professor, University of Ancona, Italy
- 1995-2005: *Senior member of the Institut Universitaire de France, Paris*

### Field experience

- Scientific leader in Antarctica of two traverses of the International Antarctic Glaciological Programme (total: 6 months).

### Main present and past collaborations

- California Institute of Technology, Division of Geological and Planetary Sciences, Pasadena, USA (Prof. Clair C. Patterson) (total: 18 months in Pasadena as Visiting Research Associate),
- Institute of Spectroscopy, Russia Academy of Sciences, Troitzk, Russia (Profs. Vsevolod Koloshnikov and Michael Bolshov) (total: 2 months in Troitzk),
- University of Connecticut, Department of Marine Sciences, Groton, Connecticut, USA (Prof. William Fitzgerald),
- University of Antwerpen, Department of Chemistry, Micro and Trace Analysis Center (Prof. Freddy Adams),
- Curtin University of Technology, Department of Applied Physics, Perth, Australia (Prof. Kevin Rosman) (total: 4 months in Perth as Visiting Professor),
- University Ca Foscari of Venice, Department of Environmental Sciences, Italy (Profs. Carlo Barbante and Paolo Cescon)
- Korea Polar Research Institute and Inha University, Incheon, South Korea (Prof. Sungmin Hong)
- Ohio State University, Byrd Polar Research Center, Columbus, USA (Prof. Lonnie Thompson and Dr. Paolo Gabrielli)

- University of Leeds, School of Chemistry, Leeds, United Kingdom (Prof. John Plane)
- GKSS Research Center, Departement for Environmental Chemistry, Geesthacht/Hamburg, Germany (Prof. Ralf Ebinghaus)
- Paul Scherrer Institute, Laboratory of Radio Chemistry and Environmental Chemistry, Villigen, Switzerland (Prof. Heinz Gaggeler and Dr. Margit Schwikowski)

#### **Awards and Honours**

- 1995-2005: Senior Member of the Institut Universitaire de France.
- Since 2005: Honorary Member of Institut Universitaire de France
- 2002: Theurlot, Durand-Claye, Alexandre Darracq and Coron-Thevenet Prize of the french Academy of Sciences
- 2003 : Gold Medal of the University Joseph Fourier
- 2006 : International Prize “Felice Ippolito” of the Accademia Nazionale dei Lincei, Rome
- 2007 : Alfred Wegener Medal of the European Geosciences Union (Union Medal)
- Since 2007: Honorary Member of the European Geosciences Union
- 2007: Co-laureate of the Descartes Prize of the European Union (European Project for Ice Coring in Antarctica)
- 2010: Honoris Causa Doctorate of the University of Luneburg, Germany

## EDWARD ALFRED HELME



Proposed role in the project: Key Expert 1: Team Leader

Family name: Helme

First names: Edward (Ned)

Date of birth: 23 August 1947

Nationality: United States

Civil status: U.S. Citizen

Education:

Institution (Date from - Date to)	Degree(s) or Diploma(s) obtained:
Haverford College 9/65-6/69	Masters of Public Policy in Economics and Energy
University of California, Berkley 9/75-5/77	B.A. in Political Science and Psychology

### 1. Membership of professional bodies:

Mr. Helme is a member of the following bodies: the U.S. Transportation Research Board, British Petroleum (BP) Alternate Energy Advisory Board, past adjunct lecturer at Johns Hopkins Krieger School of Arts and Sciences, Board of Directors of CCAP Action Fund, CCAP-Europe.

2. **Other skills:** Competent in Microsoft Office Suite of applications, skilled in international diplomacy, with over 25 years of negotiating with U.S. and international policymakers on clean air and climate change policy.

3. **Present position:** President, Center for Clean Air Policy

4. **Years within the firm:** 25

5. **Key qualifications:** (Relevant to the project)

- Ned Helme is the founder and president of the Center for Clean Air Policy (CCAP). As a leading expert on climate and air policy, he advises Members of the U.S. Congress, state and international governments, the European Commission and developing countries on these issues. He is the author of more than 50 key studies on climate change, air quality, electricity regulation, and transportation policy. With more than twenty-

five years experience in climate and air policy, Mr. Helme has a broad and deep understanding of cap-and-trade programs and other market and nonmarket approaches to addressing climate change.

- **Global Sectoral Study (2008-Present):** Directs a project, undertaken by a consortium led by CCAP-Europe and financed primarily by the European Commission's DG-Enterprise, to provide a proof-of-concept of sectoral approaches to GHG emissions mitigation in developing countries. This study involves mitigation and cost analysis, barrier identification, assessment of capacity-building needs, policy design, and modelling of competitiveness impacts related to the development of sector-wide mitigation programs for energy-intensive sectors in China, Mexico and Brazil.
- **Assisting Developing Country Climate Negotiators Through Analysis and Dialogue (2005-Present):** Directs a project, financed by the UK DFID and Tinker Foundation, to work with leading researchers in Brazil, China, India, and Mexico to analyze the costs and implications of policies to reduce greenhouse gas (GHG) emissions in these countries.
- **Dialogue on Future International Actions to Address Global Climate Change (2003-Present):** Directs a dialogue, financed by more than 15 countries, that combines analysis, policy development, and dialogue to identify, discuss, and consider options for future international actions to address climate change. The process brings together climate change negotiators from more than 30 developed and developing countries for semi-annual, informal, off-the-record dialogue sessions.
- **Technology Transfer and Investment Risk in International Emissions Trading (2005-2007):** Worked with the Center for European Economic Research (ZEW) of Germany, Ecoplan of Switzerland, the Energy Research Center of the Netherlands (ECN), and Natsource-Tullet Europe (NTE) of the United Kingdom to explore the economic and industrial impacts, as well as the prospects for achieving technology transfer, associated with the implementation of the Kyoto Protocol's flexible mechanisms.
- **Innovations in Sustainable Energy in LAC and Potential Linkages to the Carbon Market (2006):** Assisted Inter-American Development Bank in designing a plan to facilitate the mainstreaming of clean energy considerations into its lending practices and increase its investment portfolio of clean energy projects in Latin America and the Caribbean.
- **Assessment of the Effectiveness of European Air Quality Policies and Measures (2003-2004):** Contributed to a project conducted to analyze the effectiveness of European air quality policies and measures as a part of the Commission's Clean Air For Europe (CAFE) program. As a part of this effort, led the CCAP team that analyzed the effectiveness of air quality policies in the U.S., Canada, and Japan.
- **Monitoring, Reporting, and Verification Protocols for the EU Trading System (2001-2003):** In collaboration with experts from TNO in the Netherlands and the Foundation for International Environmental Laws and Development (FIELD) in the UK, worked to define the monitoring, reporting and verification (MRV) systems necessary to support the groundbreaking GHG cap-and-trade program for the European member states.

- **Design of an Emissions Trading System in the European Community (1998-2000):** Oversaw and played a leading role on the international, multi-disciplinary team that worked to design a greenhouse gas emissions trading system for the Environment Directorate General (DGXI) of the European Commission (EC) for their consideration as an option for addressing Kyoto commitments. As part of this initiative, the Center developed three papers presenting options for points of regulation (e.g., upstream, downstream, hybrid), methods of allocating allowances, and a gradual phase-in of a trading system.
- **Greenhouse Gas Emissions Trading Braintrust (1996-2003):** Oversaw and directed, multi-year project to analyze and develop a greenhouse gas emissions trading system for the U.S. Facilitated the process and contributed to a number of reports and presentations, including the Airlie Carbon Trading papers.
- **Development of the First Joint Implementation Project under the UNFCCC in Decin, Czech Republic (1993-1995):** Together with three U.S. utilities, brokered the conversion of a district heating plant from coal to natural gas cogeneration resulting in major local air quality benefits. It won approval as the first project in the world to generate carbon credits to the investors and was the model used for the 1997 Kyoto Protocol's JI and CDM provisions.
- **Developing the Acid Rain Trading Program (1986-1990):** Pioneered, through a stakeholder dialogue process, an innovative, phased cap-and-trade approach to acid rain control legislation and created a powerful political coalition of U.S. Governors, corporate leaders, and environmentalists that successfully lobbied Congress and the Bush Administration to enact legislation in 1990 based on a trading approach.
- Other relevant CCAP projects include:
  - **European Dialogue on the Energy and Climate Challenge (2007-Present)**
  - **California Climate Change Policy Development (2004-Present)**
  - **Building the Capacity of Chile's Transportation Sector to Participate in the CDM (2002-2005)**
  - **Preparing Accession Countries for Participation in the EU Trading System (2002-2003)**
  - **Clean Development Mechanism Dialogue (2000-2003)**
  - **Identifying Opportunities for Industrial Energy Efficiency and CDM Project Development in Brazil (2000-2001)**
  - **Regional Capacity Building & Policy Development in the Caribbean (1999-2001)**
  - **Climate-Change Capacity Building and Policy Development in Mexico (1998-2000)**

**6. Specific experience in the region:**

Country	Date from - Date to
Mexico	1998-2000, 2006-present
China	February 2005 – present
India	February 2005 – present
Brazil	2000-2001, February 2005 – present
Indonesia	August 2009 - present

**7. Professional experience**

Date from - Date to	Location	Company & reference person <sup>1</sup> (name & contact details)	Position	Description
1985-Present	Washington, DC	Center for Clean Air Policy (reference: Tony Earl, Chairman of the Board of Directors, 608- 283-2471)	President	Director of the Center for Clean Air Policy's International, Domestic and Transportation Programs and their projects.
1977-1985	Washington, DC	National Governor's Association (reference: Human Resources, 202- 624-5300)	Director, Natural Resources Program	Built grassroots coalitions on energy conservation programs in the Midwest and on coal strip mining legislation, along with numerous legislative coalitions. Developed a number of strong policy recommendations for the Alliance for Acid Rain Control and Energy Policy on Clean Air, energy and global warming bills.
1972-1976	Washington, DC	US Representative Ken Hechler (D- WV) (reference: Ken Hechler, 304- 395-4323)	Legislativ e Director	Drafted major alternative coal strip mining control legislation and directed grass roots environmental coalition which won adoption of legislation after 4 year battle

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<sup>1</sup> The Contracting Authority reserves the right to contact the reference persons. If you can not provide a reference, please provide a justification.

## Klaus Fraedrich



### **Resumé:**

Klaus Fraedrich is a truly multi-faceted and insightful scientist. His contributions include, but are not restricted to the following:

Regional climates (1970s): Identification of the River Nile's source (nocturnal circulation over Lake Victoria) and the Andes/Altiplano outflow anticyclone (detection and impact) are subjects that more recently found the attention of researchers.

Parametrisation of convection (1970-80s): The cloud life cycle, vorticity source and the first stochastic cloud model were introduced into the literature.

Dynamical concepts for climate change (1970-80s) have now become part of the present day teaching on catastrophes, resilience and thresholds in simple climate system models.

Non-linear systems analysis (1980-90s) is applied to weather data, pioneering phase space analysis of weather dynamics and its predictability.

Dynamics and stochastics (90s): The cooperation between two storm tracks and the resonance effects in ocean and atmosphere provide insight into the low-frequency dynamics of atmosphere (North Atlantic Oscillation) and ocean (spatial resonance); coherence resonance is a new subject in the possible impact of stochastics on dynamic feedbacks.

Maximum entropy production (MEP): First application of the MEP principle in a constrained dynamical environment and its possible use in climate dynamics.

Tropical dynamics: Madden-Julian Oscillation (new theory), tropical cyclones (new track forecast system applied by Australian Weather Service), the theory of the 26-degree sea surface temperature threshold are all new approaches to old subjects.

Dynamical concepts for low-frequency climate variability (last ten years): Long-term memory, 1/f-noise (diffusion and adjustment) has been introduced to climate analysis and model inter-comparison.

Modelling (last ten years): Building a user-friendly and freely available GCM hierarchy that includes, in turn, SAM, the Shallow Atmosphere Model; PUMA, the Portable University Model of

the Atmosphere, with adjoint diagnostics; and PlaSim, the Planet Simulator (towards a user-friendly Planet-System Model).

His seminal ideas have had a most significant impact on the cognoscenti, i.e., he is a scientist's scientist. Outside Europe, Fraedrich has a truly important presence in China, including Tibet and Xinjiang, and in Australia. His many and talented students include people with rapidly budding careers in the US (Philip Sura) and the UK (Christian Franzke). Fraedrich's distinctions so far include Distinguished Overseas Scientist (Melbourne, Australia, 1982-1983), the Max-Planck/Humboldt Prize (1994), the Gay-Lussac Prize (France, 2004), a Max-Planck Fellowship (2007) and Fellow, Hamburg Academy of Sciences (2008). He was President of the Nonlinear Dynamics Section (European Geophysical Society, 1994–1996) and was on the Editorial Board of Nonlinear Processes in Geophysics (1994–1998).



## Steven J. Ghan



Staff Scientist, Climate Physics Group, Pacific Northwest National Laboratory  
Mail Stop K9-24, PO Box 999, 3200 Q Avenue, Richland WA 99252  
Phone: 509-372-6169 email: [steve.ghan@pnl.gov](mailto:steve.ghan@pnl.gov)  
<http://www.pnl.gov/atmospheric/staff.asp>

### **General Research Interests:**

Cloud-Aerosol Interactions. One of the largest sources of uncertainty in simulations of climate change is in the radiative forcing due to the effects of aerosols on clouds. Cloud droplet number concentration is strongly influenced by the aerosols upon which droplets form, but the influence depends on competition for water in cloud updrafts. Dr. Ghan and colleagues showed that this influence can be expressed analytically, thus laying the foundation for physically-based treatments of the influence in global climate models. More recently, Dr. Ghan's interests have expanded to the much more complex problem of aerosol effects on ice clouds. He is now working with PNNL colleagues to address this challenge with a combination of laboratory studies, field experiments, and modeling.

Aerosol Modeling. Simulating the global distribution of aerosols and aerosol properties requires a balance between the need for realism and the requirement to complete simulations in a reasonable time. Both the composition and the size distribution of the aerosol must be represented, which requires multiple species of a variety of sizes. Century simulations must be completed within months. Dr. Ghan and his PNNL colleagues have achieved such a balance in a model that treats all aerosol processes that are important for climate change. Dr. Ghan is now working to apply the model to studies of the impacts of aerosols on climate change.

Climate in Complex Terrain. The horizontal grid size of global climate models is typically 100 km, which is far coarser than the size of all individual mountains and most mountain ranges. Climate models therefore only poorly resolve the influence of complex terrain on the spatial distribution of climate. The weakness greatly limits the application of global climate models to impacts of climate change on water resources in regions with complex terrain. To address this weakness, Dr. Ghan and

his PNNL colleague Ruby Leung developed a treatment of the subgrid influence of surface elevation on climate. The treatment works amazingly well. Dr. Ghan has already used the scheme to investigate the impact of global warming on global water resources for a full century. His future ambitions are to support this scheme as it is adopted as a permanent feature of the NCAR Community Climate System Model and then use it to simulate the demise of the Greenland Ice Sheet.

**Career Highlights:**

- B.S. in Atmospheric Science (*cum laude*), University of Washington, 1979
- M.S. in Meteorology, Massachusetts Institute of Technology, 1981
- Ph.D. in Meteorology, Massachusetts Institute of Technology, 1988
- 90 peer-reviewed publications (32 as first author)
- Citations: 3118
- Mean citations per publication: 35
- Hirsch index h (# papers with at least h citations): 32
- Atmospheric Scientist, Lawrence Livermore National Laboratory, 1984 – 1990
- Visiting professor, University of Louvain-la-Neuve, Belgium, April 1989
- Atmospheric Scientist, Pacific Northwest National Laboratory, 1990 – present
- Affiliate Associate Professor, University of Washington, 1994-2005
- Lecturer, Advanced Studies Summer Colloquium on Clouds and Climate, NCAR, July 1993
- Principal Investigator:
  - DOE Atmospheric Radiation Measurement program, 1991 – 2009
  - NASA Aerosol Interdisciplinary Science Program, 1993 – 1997
  - NASA EOS Interdisciplinary Science program, 1997 – 2003, 2007–present
  - DOE Climate Change Prediction Program, 1999 – 2001
  - DOE Atmospheric Science Program, 2004 – 2009
  - All of PNNL Research for DOE ARM and ASP programs, 2007– 2009.
  - All of PNNL Research for DOE Atmospheric Systems Research program, 2009 -
  - Co-Investigator, DOE Scientific Discovery through Advanced Computing: Climate Change Prediction Program, 2001 – present
- Developed an instability theory for aerosol radiative-dynamical interactions (Ghan, 1989a,b)
- Coupled atmosphere, ocean, aerosol models to estimate climate impact of nuclear war (Ghan, 1991)
- Showed that cloud microphysics parameterizations developed for cloud-resolving models can be easily adapted for stratiform clouds in GCMs (Ghan and Easter, 1992).
- Developed an aerosol activation parameterization based on Kohler theory and log-normal aerosol size distribution (Ghan et al., 1993)
- Introduced droplet number as a prognostic variable in a global model (Ghan et al., 1997).
- Co-developed a parameterization of the subgrid influence of orography on clouds, precipitation, and land surface processes (Leung and Ghan, 1995).
- Used the orography parameterization in a regional model to estimate a 30-70% reduction in Cascade snowpack in response to doubled CO<sub>2</sub> (Leung and Ghan, 1999)

- Applied the orography parameterization to a global circulation model (Ghan et al., 2002)
- Used the orography parameterization in the global circulation model to estimate global snow reduction in mountain snowpack for IPCC A1B scenario (Ghan and Shippert, 2006).
- Developed DOE strategy for improving the treatment of aerosols in climate models (Ghan and Schwartz, 2007)
- Editor, *Journal of Geophysical Research-Atmospheres*, 2007-present.
- Editorial board member, *Climatic Change*, 1992 - 1998.
- Editorial board member, *Northwest Science*, 1996 - 2006.
- Contributing author, *Climate Change 1995*, Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change.
- Contributing author, Chapters 5 and 6, *Climate Change 2001: The Scientific Basis*, Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change.
- Steering committee, DOE Atmospheric Radiation Measurement Cloud Parameterization and Modeling working group, 1999 – 2004.
- Advisory panel, NSF Climate Process Team, 2003 – 2006.
- Science Steering Committee, DOE Atmospheric Science Program, 2005 – 2009.
- Scientific Steering Committee, NCAR Community Climate System Model, 2006 – present.
- Convener, session on cloud effects on aerosol, AGU Fall 2007 and 2008 Meetings.
- Leader, PNNL Aerosol Climate Initiative, 2007 – present.
- Key contributions to DOE Climate Change Research Division Strategic Plan, 2007.
- Key contributions to Science Plan for DOE Atmospheric Systems Research Program, 2009
- Principal Investigator, Indirect Semi-Direct Aerosol Campaign, Barrow, Alaska, April 2008.
- Co-leader of the Cloud-Aerosol-Precipitation Interactions working group and member of Science and Infrastructure Steering Committee for the DOE Atmospheric Systems Research program, 2009 – present
- Member of ARM Climate Research Facility Science Board, 2010 - present



**Prof. Dr. John A. Ogren**

BORN: 30 September 1952, Troy, New York, USA

CITIZENSHIP: USA

Email: [jogren@cmdl.noaa.gov](mailto:jogren@cmdl.noaa.gov)

**EDUCATIONAL HISTORY:**

1975 BS Harvey Mudd College Engineering

1975 ME Harvey Mudd College Engineering

(Thesis: The contribution of the stratosphere to ozone levels in the Los Angeles basin)

1983 PhD University of Washington Civil Engineering

(Dissertation: Elemental carbon in the atmosphere)

**AWARDS AND HONORS:**

1974-1975 Henry T. Mudd Fellowship

1975 Graduation with distinction and departmental honors

1977-1980 National Science Foundation Graduate Fellowship

1981 Valle Scandinavian Exchange Program Scholarship

**RELATED WORK EXPERIENCE:**

1975-1977 Research Engineer, Meteorology Research, Inc., Altadena, California

1978-1982 Research Assistant, Civil Engineering, University of Washington, Seattle, Washington

1983-1985 Research Associate, Department of Meteorology, University of Stockholm, Sweden

1985-1989 Research Assistant Professor (oav1? docent), Department of Meteorology, University of Stockholm, Sweden

1989-1991 Associate Professor (h?olelektor), Department of Meteorology, University of Stockholm, Sweden

1991- Physical Scientist, National Oceanic and Atmospheric Administration, Climate Monitoring and Diagnostics Laboratory, Boulder, Colorado

1994- Affiliate Faculty, Department of Atmospheric Sciences, Colorado State University, Ft. Collins, Colorado

**MEMBERSHIPS:**

American Geophysical Union.

American Association for Aerosol Research.

**Teruyuki Nakajima, Prof.**



Director, Center for Earth System Dynamics  
Atmosphere and Ocean Research Institute, The University of Tokyo  
5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8568, Japan  
Tel: +81-(0)4-7136-4398, 6325; Fax: +81-(0)4-7136-4375  
E-MAIL ADDRESS: [teruyuki.nakajima@aori.u-tokyo.ac.jp](mailto:teruyuki.nakajima@aori.u-tokyo.ac.jp)

**EDUCATIONAL RECORD:**

1973	B.S.	Tohoku University, Sendai, Japan; in Physics
1975	M.S.	Tohoku University, Sendai, Japan; in Geophysics
1981	Sci.D.	Tohoku University, Sendai, Japan; in Geophysics

**PROFESSIONAL RECORD (INCLUDING POSITIONS HELD):**

1977-1980 Teaching assistant, Geophysical Institute, Tohoku University  
1981-1990 Assis. prof., Upper Atmosphere and Space Research Laboratory, Tohoku U.  
1987-1990 Senior visiting associate, NRC and USRA at NASA/Goddard Space Flight Center  
1990-1991 Assoc. prof., Center for Atmospheric and Oceanic Variation, Tohoku U.  
1991-1994 Assoc. prof., Center for Climate System Research, U. Tokyo  
1994-2010 Professor, Center for Climate System Research  
2004-2010 Director, Center for Climate System Research  
2010- Professor, Director, Center for Earth System Dynamics, Atmosphere and Ocean Research Institute

**MEMBERSHIP OF SCIENTIFIC COMMITTEES AND SOCIETIES:**

Japan Meteorological Society, executive member  
Japan Remote Sensing Society, member  
American Meteorological Society, member  
American Geophysical Union, member  
Science Council of Japan, member (2008-)  
Journal of Korean Meteorological Society, Editor (2007-)  
Atmospheric and Oceanic Science Letters, China, Editor (2008-)  
WCRP Radiation Panel, member (1991-1999)  
IGAC DARF focus, convener (1995-1998)  
IAMAS International Radiation Commission (IRC), member (1993-); president (2000-2008)  
Science Council of Japan, Associate member (2006-2008); member (2008-)

IPCC lead authors for TAR (2001), Special Report for Aviation and the global atmosphere (1999) and AR5 (2010); Review editor for AR4 (2007)  
WCRP JSC member (2009-)

**AWARDS:**

1987-1989: Senior Scientist of National Research Council at NASA/Goddard Space Flight Center  
1995 : Japan Meteorological Society Award  
2000 : Nissan Science Award  
2009 : A milestone paper in the 50 year history of J. Quantitative Radiat. Spectrosc., Elsevier Press

**EXPERTISE/SCIENTIFIC FIELD:**

**Atmospheric radiative transfer theory of the earth-atmosphere system:** Development of the world's first matrix method for the coupled atmosphere-ocean system [Tanaka and Nakajima 1977; Nakajima and Tanaka, 1983], a new truncation method for accelerating the radiance calculation [Nakajima and Tanaka 1988]. This fast algorithm is also used in the NASA/DISORT package and also in the AERONET operational system. A general purpose radiative transfer code *Rstar* is used by many users in the world.

**Remote sensing of aerosols and clouds from satellite and ground-based instruments:**

Development of the world's first two channel algorithm for global retrieval of the aerosol optical thickness and Ångström exponent from AVHRR (Nakajima and Higurashi 1998), and also aerosol indirect radiative forcing evaluation from AVHRR-retrieved aerosol and cloud parameters (Nakajima and King, 1990; Nakajima et al. 2001). Development of sun-sky photometry for retrieving aerosol microphysical parameters; One of NASA/AERONET founders (Nakajima et al., 1996; Holben et al., 1998), ADEOS-II/GLI satellite sensor team PI, an active contributor to IGAC/ACE-Asia, JST/APEX, and UNEP/ABC regional experiments (Nakajima et al., 2007).

**Climate modeling of aerosol and cloud microphysical processes in GCMs and meso-scale models:**

MSTRN radiation code and SPRITNARS aerosol model have been built by his group and used intensively in several models. The results for the radiative forcing evaluation of aerosol direct and indirect effects are referred by IPCC-TAR and AR4 (Nakajima and Higurashi 1997; Takemura et al. 2005).

## 第七届气候系统与气候变化国际讲习班（ISCS）

### 学员名单

No	姓名	职称/职务	单位	E-mail
1	李 琰	硕士研究生	北京大学城市与环境学院	sh-zhao@urban.pku.edu.cn
2	汪言在	博士研究生	北京师范大学资源学院	wyz2003qu@gmail.com
3	蒋昕昊	研究生	北京师范大学资源学院	jxha87@mail.bnu.edu.cn
4	郭元喜	博士研究生	北京师范大学资源学院	guoyx1983@163.com
5	常世彦	助理研究员	清华大学低碳能源实验室	changshiyang@mail.tsinghua.edu.cn
6	张王滨	硕士研究生	南京大学	zhang_wang_bin@126.com
7	胡轶佳	讲 师	解放军理工大学气象学院	huyijiacat0214@163.com
8	韦露斯	硕士研究生	河海大学水文水资源学院	ysron@hhu.edu.cn
9	许月萍	副教授	浙江大学建工学院水文水资源所	yuepingxu@zju.edu.cn
10	杜 银	讲 师	南京信息工程大学	ydu@nuist.edu.cn
11	温 娜	讲 师	南京信息工程大学	wenna@nuist.edu.cn
12	宋耀明	讲 师	南京信息工程大学	songym@nuist.edu.cn
13	王志福	讲 师	南京信息工程大学	zfwang@nuist.edu.cn
14	陈 练	博士研究生	南京信息工程大学	chenlian198508@126.com
15	王 慧	博 士	南京信息工程大学	jinger0517@163.com
16	岳岩裕	硕士研究生	南京信息工程大学	yueyy_08@nuist.edu.cn
17	牛 斌	硕士研究生	南京信息工程大学	niubin1018@163.com
18	周奇越	硕士研究生	南京信息工程大学	zqy717cc@sina.com
19	陈思宁	博士研究生	南京信息工程大学	siningchen@126.com
20	古 月	硕士研究生	南京信息工程大学	qxguyue@126.com
21	杨 浩	硕士研究生	南京信息工程大学	yanghao0202@126.com
22	刘 樱	硕士研究生	南京信息工程大学	yuhoubohui@sina.com
23	王亚男	在职研究生	南京信息工程大学	wangyanan19871120@163.com
24	李 慧	硕士研究生	南京信息工程大学	lihui100.com@163.com
25	吴 萍	硕士研究生	南京信息工程大学	zhou@nuist.edu.cn
26	崔慧慧	硕士研究生	南京信息工程大学	huihuismile2008@126.com
27	王宗明	硕士研究生	南京信息工程大学	youzhivvb@163.com
28	郭 媛	硕士研究生	南京信息工程大学	gsguoguo@163.com
29	方 玉	硕士研究生	南京信息工程大学	jessica.215@qq.com

30	刘长坤	硕士研究生	南京信息工程大学	liuchangkunair@163.com
31	谈丰	硕士研究生	南京信息工程大学	crazy1170@sina.com
32	孙建元	硕士研究生	南京信息工程大学	sunjianyuan.good@163.com
33	徐康	博士研究生	南京信息工程大学	xukang@cams.cma.gov.cn
34	郭玲	硕士研究生	南京信息工程大学	guoling1014@126.com
35	周文友	硕士研究生	南京信息工程大学	zwytanki@126.com
36	陈懿妮	硕士研究生	南京信息工程大学	nini927@sina.com
37	廖芷仪	硕士研究生	南京信息工程大学	liao3zhi3yi3@yahoo.com.cn
38	黄路	硕士研究生	南京信息工程大学	huanglu1987js@yahoo.com.cn
39	沈志超	硕士研究生	南京信息工程大学	szcsds@126.com
40	孙秀宝	硕士研究生	南京信息工程大学	sun_2005009@126.com,
41	范思睿	硕士研究生	成都信息工程学院	fansr110@163.com
42	张志薇	硕士研究生	兰州大学大气科学学院	zhangzhiw09@lzu.cn
43	曾思栋	博士研究生	武汉大学水利水电学院	zsdwhu@gmail.com
44	杜鸿	博士研究生	武汉大学水利水电学院	amydh2005@163.com
45	秦琳琳	硕士研究生	武汉大学水利水电学院	jiouhui123@126.com
46	宋霁云	硕士研究生	武汉大学水利水电学院	sjyqueen@163.com
47	王晓娟	讲师	常熟理工学院	mouse0903@126.com
48	徐忠峰	助研	中国科学院大气物理研究所	xuzhf@tea.ac.cn
49	李琳	研究生	中国科学院大气物理研究所	llen1983@163.com
50	马轩龙	博士研究生	中科院地理科学与资源研究所	imxslw@gmail.com
51	杨晓亚	博士研究生	中科院地理科学与资源研究所	yangxy.08b@igsrr.ac.cn
52	赵刚	博士研究生	中科院地理科学与资源研究所	zhaog.09b@igsrr.ac.cn
53	李敏姣	研究生	中科院地理科学与资源研究所	Lmj7908@126.com
54	刘晓洁	助研	中科院地理科学与资源研究所	liuxiaojie_sd@163.com
55	余敦先	博士研究生	中科院地理科学与资源研究所	shedunxian@sina.com
56	李传金	博士研究生	中科院寒区旱区环境与工程所	chuanjinli605@163.com
57	张彦成	硕士研究生	中科院寒区旱区环境与工程所	zhangych08@lzb.ac.cn
58	高明杰	研究生	中科院寒区旱区环境与工程所	gaomingjie521@163.com
59	高红凯	研究生	中科院寒区旱区环境与工程所	Gaohongkai2005@126.com
60	赵淑雨	研究生	中科院寒区旱区环境与工程所	zhaoshuyu722@163.com
61	李新周	工程师	中科院地球环境研究所	lixz@ieccas.cn



62	解小宁	博士研究生	中科院地球环境研究所	xnxie@ieecas.cn
63	石正国	博士研究生	中科院地球环境研究所	Shizg@ieecas.cn
64	舒舍玉	硕士	中科院城市环境研究所	ssy512517@163.com
65	侯西勇	研究员/副主任	中科院烟台海岸带研究所	xyhou@yic.ac.cn
66	于良巨	助研	中科院烟台海岸带研究所	lju@yic.ac.cn
67	文蓉	硕士研究生	中科院青藏高原研究所	ganggangkaishi@126.com
68	李浩	工程师	长江科学院	lhfirst@163.com
69	李春花	首席研究员	国家海洋环境预报中心	lch@nmefc.gov.cn
70	杨清华	助研	国家海洋环境预报中心	yqh@nmefc.gov.cn
71	李明	研实	国家海洋环境预报中心	lim@nmefc.gov.cn
72	隋俊鹏	助工	国家海洋环境预报中心	sjp@nmefc.gov.cn
73	李荣滨	助工	国家海洋环境预报中心	lrb@nmefc.gov.cn
74	田忠翔	硕士研究生	国家海洋环境预报中心	tzhx@live.com
75	蒋三乃	高工/副处长	国家林业局造林绿化管理司	jiangsannai@sina.com
76	张国斌	副教授	国家林业局调查规划设计院	Guobin0861@sina.com
77	梁宏	助研	中国气象科学研究院	liangh@cams.cma.gov.cn
78	王伟	研究生	中国气象科学研究院	wangwnuist@yahoo.cn
79	曹玉静	博士研究生	中国气象科学研究院	cyj_gpsmet@hotmail.com
80	沈斌	研究生	中国气象科学研究院	tony830201@163.com
81	张书萍	硕士研究生	中国气象科学研究院	zsp@cams.cma.gov.cn
82	沈晓琳	硕士研究生	中国气象科学研究院	shenxiaolin_1986@126.com
83	张若楠	硕士研究生	中国气象科学研究院	xiaoruo5201314@126.com
84	李明	硕士研究生	中国气象科学研究院	limdawn@163.com
85	王婷婷	硕士研究生	中国气象科学研究院	ihsrr@163.com
86	祝丽娟	硕士研究生	中国气象科学研究院	zljchina@yahoo.com.cn
87	李润祥	研究生	中国气象科学研究院	eoeoeopha@hotmail.com
88	吴东丽	副研究员	中国气象局气象探测中心	Wudongli666@126.com
89	赵秀兰	副研究员	国家气象中心	zhaoxl6864@yahoo.cn
90	辛晓歌	助研	国家气候中心	xinxg@cma.gov.cn
91	彭冲	研究生	国家气候中心	ichpch@gmail.com
92	邵颀	硕士研究生	国家气候中心	robertshao2007@sina.com
93	马金玉	博士研究生	国家气候中心	mjy0525@163.com

94	夏 坤	博士研究生	国家气候中心	xiakun@cma.gov.cn
95	尹宜舟	博士研究生	国家气候中心	yinyz@cma.gov.cn
96	马丽娟	工程师	国家气候中心	malj@cma.gov.cn
97	王 鹏	硕士研究生	国家气候中心	rongzhu@cma.gov.cn
98	方艳莹	硕士研究生	国家气候中心	rongzhu@cma.gov.cn
99	张 焕	硕士研究生	国家气候中心	huan1824@yahoo.com.cn
100	叶海英	工程师/责编	中国气象局公共气象服务中心	yehy@weather.com.cn
101	张慧媛	助工/编辑	中国气象局公共气象服务中心	zhanghy@weather.com.cn
102	屈 雅	高工/副主任	中国气象局公共气象服务中心	quya@vip.sina.com
103	王海波	助 工	中国气象局公共气象服务中心	blueseawave@163.com
104	刘东贤	副馆长	中国气象局培训中心	liudx@cma.gov.cn
105	郑秋红	副研究员	中国气象局培训中心	qhz518@163.com
106	王 冀	高 工	北京市气候中心	wangji_zl@163.com
107	马京津	工程师	北京市气候中心	majingjin@126.com
108	张英娟	工程师	北京市气候中心	yingjuanzh99@163.com
109	赵普生	博 士	北京城市气象研究所	pszao@ium.cn
110	王笑影	副研/主任	沈阳大气环境研究所	wangxy_0917@yahoo.com.cn
111	李忆平	助 工	兰州干旱气象研究所	pingping532@yahoo.com.cn
112	李 刚	助 研	兰州干旱气象研究所	leeligang@gmail.com
113	吕桅桅	博 士	武汉区域气候中心	yueyang826@yahoo.com.cn
114	邓学良	工程师	安徽省气象科学研究所	dengxueliang9989@yahoo.com.cn
115	王辛方	工程师	河南省鹤壁市气象局	wxf0530@163.com
116	向 亮	助 工	河北省气候中心	xiangliang1981@126.com
117	占明锦	助 工	江西省气候中心	hellorm@126.com
118	尤 莉	正研高工	内蒙古气候中心	nmyouli@126.com
119	何 春	工程师	重庆市气候中心	everfast@126.com
120	郑 慧	助 工	深圳市国家气候观象台	
121	王彦明	工程师	厦门市气象局	angla2569@yahoo.com.cn

## International Students of ISCS 2010

<b>Names</b>	<b>Nationalities</b>	<b>Occupation</b>	<b>Tel</b>	<b>Email</b>
SHUM Kit-ying	Chinese HK	Experimental Officer, HKO		kyshum@hko.gov.hk
Mohammad Redzuan bin Abdul Moin	Malaysia	Asistant Director, Regional Forecast Office, MMD	+609-538 4971	redzuan@met.gov.my
SURYANTI	Indonesia	Center for Climate Change and Air Quality Meteorological, Climatological and Geophysical Agency	(021) 4246321 ext.4202	yanti@bmg.go.id
MUHAMMAD AFZAAL	Pakistan	Institute of Atmospheric Physics, CAS	+86 13699123013	afzaalkarori@yahoo.com
KhurruM Waqas Haider	Pakistan	Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI - CAS)	15117298973	kwh.met@gmail.com
ZANEER AHMAD BABAR	Pakistan	Pakistan Meteorological Department (PMD)	15251700694	zaheer_a_babar@hotmail.com
MUHAMMAD TAHIR KHAN	Pakistan	Pakistan Meteorological Department (PMD)	15251706094	ddplanningpmd@yahoo.com
MUHAMMAD HASAN ALI BAIG	Pakistan	Pakistan Meteorological Department (PMD)	15251705047	mhasanbalg@gmail.com
MUHAMMAD FAHIM AHMAD	Pakistan	Pakistan Meteorological Department (PMD)	15005197954	fahimpmd@gmial.com
MUHAMMAD ATHAR HAROON	Pakistan	Pakistan Meteorological Department (PMD)	15251701841	m.athar.haroon@gmail.com
TEKE SOLOMON RAMOTUBEI	Lesotho	Lesotho Meteorological Department	13921420941	ramotubei@gmail.com
BOB ALEX OGWANG	Uganda	Uganda Meteorological Department	13401997034	bob_ogwang@yahoo.com
OLIVIER NZOSABA	Burundi	Burundi Education Ministry	15850750433	olinzo11@yahoo.com
ABOUBACAR DIALLO	Guinea	Guinea Meteorological Department	15850738344	aboubaki40@hotmail.com
BENTO INACIO CAMBULA	Mozambique	National Meteorological Institute of Mozambique	15805142240	beuto_c@iuom.gov.mz
CALVIN ALUIN GAYE	Liberia	Liberia University	15295516214	meteorologist317@yahoo.com
EDWARD BEFORB WISSEH	Liberia	Liberia Communication Ministry	13921443382	mottow2000@yahoo.com
BATHSHEBA MUSONDA	Zambia	Zambia Meteorological Department	15295741928	bbeshishi@gmail.com
LOROUGNON JEAN FERNAND TAPE	Cote d'ivoire		13655160247	tape.lorougon_ferrand@yahoo.fr
VILHO SHATYOHA MBA NDEUNYEMA	Namibia	Namibia Meteorological Department	15951007644	NDEUNYEMA@yahoo.com
ELMOUSTAPHA SIOIABDALLAH	Mauritania	Mauritania Meteorological Department	15161486174	EOEHANE@yahoo.com