

4. Thesis advisory committee

A thesis advisory committee, composed of three(3) to five(5) members with ranks of assistant fellow/ professor and above, shall be formed by the thesis advisor with input from the student to guide the student and evaluate his/her doctoral dissertation research. The composition of the thesis advisory committee must be approved by the Curriculum Committee.

5. Study plan

A student must submit a study plan before the end of the first year. A study plan must include a course plan, a dissertation research theme, a proposed timeline of events toward the degree. The study plan must be approved by the thesis advisory committee. Before the study plan is approved, a student can not apply to take the Qualifying Exam.

6. Annual progress report

The annual progress report shall be made out by the thesis advisor and the thesis advisory committee. The report shall be sent to ESS office before Aug. 20th of every year. (The TIGP stipend will be renewed annually another two years upon evidence of satisfactory progress towards the degree.)

7. Qualifying Examination

Students are expected to have successfully completed the qualifying examination and advanced to candidacy for the Ph.D. degree by the end of the third year of study in the program.

A. Written exam

After completing at least one academic year of work in the program, a student may apply to the curriculum committee to take the written section of the qualifying examination with the approval of his or her thesis advisor. A student has only two chances to pass this section of the qualifying examination. If a student fails the written section for the first time, s/he may apply to the curriculum committee for re-taking it as early as the next time when it is offered. Students who fail the written section of the qualifying examination twice will be dismissed from the ESS Program. The scope, questions, and grades of written exam will be determined by the thesis advisory committee, based on the student's courses taken and research interest.

B. Oral exam

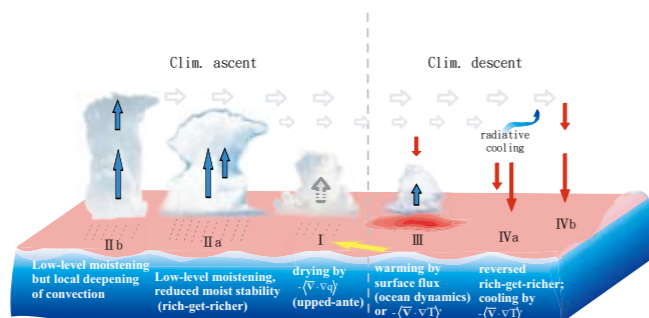
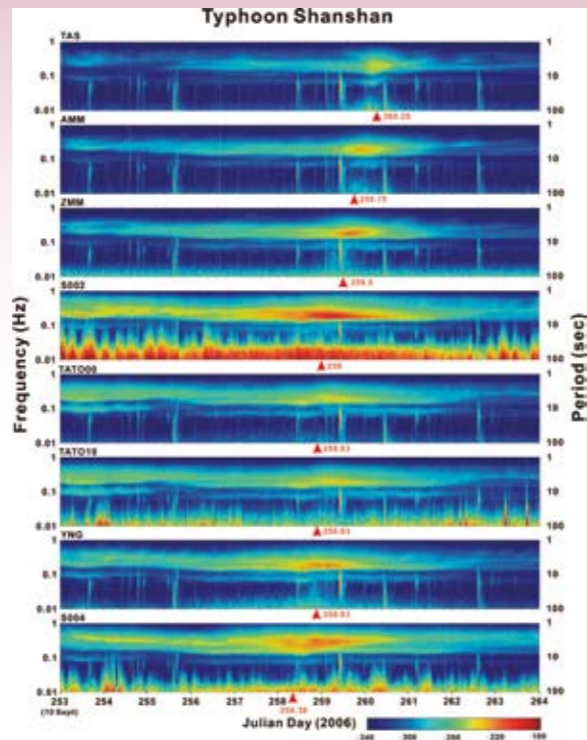
After passing the written section of the qualifying examination, a student should submit a research proposal to the curriculum committee for evaluation within 1 year. The oral section of the qualifying examination is based predominantly on this research proposal. An examining committee, consisting of at least five faculty members, will be appointed by the curriculum committee. During the oral section of the qualifying examination, the student should be prepared to present to and discuss with the members of the examining committee the justifications and plans for his or her thesis work, including relevant literature, and his or her progress on the thesis work to date. A student has only two chances to pass this section of the qualifying examination. If a student fails this section for the first time, s/he may apply to the curriculum committee for re-taking it as early as the next time when it is offered. Students who fail the oral section of the qualifying examination twice will be dismissed from the ESS Program.

8. Advancement to Candidacy

A student who has passes both the oral and the written section of the qualifying exam advances to candidacy. He or she will devote full time to independent study and research on his or her thesis topic.

9. Publication

A Ph.D. candidate must have at least one manuscript



published or accepted for publication as the first author in a SCI (Scientific Citation Index) listed journal, before s/he can apply to the faculty committee to take the oral defense of his/her thesis work before the members of an examination committee.

10. Thesis Defense

This defense will take the form of a thesis seminar followed by an oral examination on the thesis research. The examination committee is appointed by the curriculum committee and is consisted of at least five faculty members whose expertise is closely linked to the candidate's area of research. The Ph.D. candidate's thesis advisor may not chair the examination committee.

Admission to the Ph.D. Program

The Program admits students to the fall semester only. Application materials are available in and applications can be submitted through the TIGP web site. The application deadline for fall 2012 is March 31st, 2012. It is to the advantage of the students to apply as early as possible. There is no charge for the application for admissions. Students (either international students or students from within Taiwan) with a B.S. or M.S. degree from an accredited institution will be considered for admission. The following criteria/material will be used to evaluate the applicant's qualifications for admission:

1. Undergraduate and graduate academic records or transcripts.
2. The General Test of the Graduate Record Examination (GRE) General and Subject scores are optional but applicants

are strongly encouraged to provide it. Applicants, who fail to submit GRE scores for evaluation, should provide supplementary information (e.g. M.S. thesis, research publication, description of research experiences, etc) that can demonstrate potential in research.

3. English proficiency: All applicants whose first language is not English must submit the English test score, except those applicants who have recently completed two or more years of study in an English-speaking country.
 - (1) TOEFL: scores of 550 on the paper based (or 213 on the computer based or 79 on the New Internet-based TOEFL (TOEFL-IBT)) or higher; (Our institution CODE & NAME are: 7142 Academia Sinica) Only ETS International TOEFL will be accepted. Institutional TOEFL will not be accepted.
 - (2) GEPT: Instead of TOEFL, applicants in Taiwan may take the General English Proficiency Test (GEPT) administered by the Language Training and Testing Center. Applicants are required to submit their high-intermediate level certificate when applying for admissions;
 - (3) IELTS (International English Language Test System): Scores of 5.5 or higher on the Academic Test is required.
4. Three letters of recommendation commenting on the applicant's personal character, and qualifications for independent study, including intellectual ability, research potential, and scientific motivation.
5. Statement of purpose (Plan and reason for graduate study) The submitted application materials for evaluation will not be returned to the applicants.

Student Status and Degree Conferral Policy

Degree candidates in the ESS program must be officially registered students of the College of Earth Sciences of the National Central University. Students who enter the ESS program with a B.S. degree will enroll first as a pre-Ph. D student till they are approved to enroll in the Ph. D program. Upon graduation, a student will be conferred a Ph. D. degree and will receive a diploma from the National Central University as well as a certificate from the Academia Sinica.

Cost of Study

The payment of tuition fees (basic fee + credits fee, about NT\$54,000/US\$1,800 per semester) for international students should be made on Student Registration Day.



Fellowship Support and Stipends

The TIGP will provide full fellowship for all incoming graduate students during the first year of their enrollment at about NT\$32,000 (about US\$1050) per month. The support will be extended for another two years upon evidence of satisfactory

progress towards the degree. In subsequent years, the financial support will be provided by the student's thesis advisor(s). The amount of the support will be at the discretion of the advisor. Medical Insurance

As soon as the students receive their student I.D., they are qualified to join the "Taiwan National Health Insurance Program". The students are expected to pay the same premium (about US\$200 per year) as all the Taiwan citizens and will be entitled to the same medical coverage.

Living and Housing Costs

Options include on-campus housing and off-campus housing. On-campus self-catering student dormitory providing single study bedrooms is available to TIGP students at reasonable costs (for details please visit our website at <http://www.tigp.sinica.edu.tw/dorm.html>). Off-campus private housing is generally more expensive. Rents for off-campus apartments range from NT\$5,000-15,000 per month.

Meals are available at modest costs at various eateries within the campus of the Academia Sinica.

The Sport Center on campus, which is equipped with indoor jogging track, gym, swimming pool, aerobic court, and so on, is also available to students at modest costs.

Correspondence and Information

For information concerning this program, please contact:

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Research Center for Environmental Changes
and
Institute of Earth Sciences
Academia Sinica
in cooperation with
College of Earth Sciences
National Central University



ACADEMIA SINICA
Taiwan International Graduate Program

TIGP

<http://tigp.sinica.edu.tw>



Taiwan International Graduate Program
Earth System Science Program

Introduction

Academia Sinica has established the Taiwan International Graduate Program (TIGP) in collaboration with a consortium of the key national research universities in Taiwan. The purpose of the program is to develop the research manpower pool in those modern multidisciplinary fields that are important in the future economical and social development and to enhance the innovative potential and academic standards of research in these and related fields.

TIGP will offer Ph.D. programs only in selected disciplines agreed upon between Academia Sinica and the national research universities. It is the intent of the Program to offer Ph.D. degree programs only in inter-disciplinary areas in the physical sciences, applied sciences, engineering, biological and agricultural sciences, health and medical sciences, and humanities and social sciences. Academia Sinica will assume principal oversight of the academic options of the Program. It will provide the intellectual leadership, the research resources, and the research and physical facilities. Qualified and interested faculty members of the participating national research universities are invited to join the various programs as affiliated faculty of the Program, and participate in the teaching of courses, supervision of research, and mentoring of the international graduate students.

The TIGP Program on "Earth System Science"

Earth System Science is the science that focuses on understanding the interdependence and interconnections among the fundamental components of the Earth: the lithosphere, atmosphere, hydrosphere, and biosphere, through the interactions among chemical, physical, biological and dynamical processes that extend over spatial scales from sub-micron to the size of the planets, and over time scales of less than a second to billions of years. The phenomena involved are frequently not only intellectually challenging but also socio-economically relevant and significant. At the Academia Sinica, the research interests of the investigators in this subject field are far ranging, including the evolution of the Earth's atmosphere, the effect of human activities on regional climate, changes in the biogeochemistry of the ocean and global climate in response to the increase in atmospheric CO₂, the effects of atmospheric processes on ocean biogeochemistry, changes in fluvial input to the oceans under climate change, the physical and chemical processes that govern the dynamical evolution of the solid Earth, the processes occurring within the lithosphere, especially those operating around subduction zones, within orogenic belts, and in the lower part of the continental crust, the mechanism and wave propagation of earthquakes, transport and fate of atmospheric pollutants, and the health risks of environmental contaminants. We welcome young inquisitive minds to join us in exploring these interesting phenomena in our Ph.D. program in the Earth System Science.

Faculty and Staff

Academia Sinica

Research Center for Environmental Changes

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Ph.D., University of Pittsburg
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Climate variation and change

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Ph.D., National Taiwan University
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Ph.D., National Central University
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Ph.D., State University of New York at Stony Brook
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Dr. Benjamin Fong Chao
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Dr. Yu-Chiang Liou
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Radar meteorology , Four dimensional data assimilation



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Atmospheric chemistry , Environmental pollution

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Ph.D., Massachusetts Institute of Technology
Air-sea interaction, Theoretical and numerical hydrodynamics

Dr. Ming-Jen Yang
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Precipitation physics and forecasting, Atmospheric modeling

Graduate Institute of Space Science
Dr. Lin-Ni Hau
Ph.D., Rice University
Space Plasma Physics, Magnetospheric Physics

Dr. Jann-Yenq Liu
Ph.D., Utah State University

Mass-spectrometer Equipments at AS/IES



Ionospheric Physics, Space Physics

Research Topics

There are three areas of concentration in this graduate program.

1. Aquatic Sciences
The primary research emphasis in the aquatic sciences is on the global biogeochemical cycle: processes that affect the sources, transport, transformation and fate in the cycling of material among the hydrosphere, atmosphere, lithosphere and biosphere. Present research activities focus on the role of the ocean and the impacts of human activities on this cycle. Some specific examples are: the contribution of the marine carbon cycle to the global carbon cycle and its behavior under rising atmospheric CO₂, coupling of atmospheric processes to the biogeochemistry of the oceans, the role of fluvial inputs to the marine biogeochemical cycle, marine nutrient dynamics and its relationship to the marine carbon cycle, the role of microbial activities in the marine biogeochemical cycle and the effect of trace metal availability and speciation on photosynthetic activities in the ocean.

2. Atmospheric Sciences
(1) Atmospheric Chemistry
This subject currently focuses on studies of middle atmospheric chemistry (centered on ozone chemistry) and tropospheric chemistry (pollution chemistry). Remotely sensed observations are used to study the chemistry of species such as ozone, water, nitrous oxide, carbon monoxide, and methane. Global and regional models are used to interpret the observations. In-situ measurements in polluted cities are made for monitoring the sources and sinks of toxic compounds such as ozone which can cause serious human health effects. Heterogeneous chemistry and aerosol production pathways are parts of the program. Research programs on the physicochemical properties of atmospheric aerosols and their implications on regional climate changes, and the exposure and risk assessments of toxic compounds on public health and ecosystems are under active development.

(2) Atmospheric Dynamics
This topic currently focuses on the climate and meteorological system of the earth. Global and regional models are used to simulate the cycling of water and other material through the atmosphere. Climate variability and climate change, including monsoon dynamics, air-sea interaction, tropical meteorology, cloud-radiation and global warming, are central components of the global modeling. The regional studies place a primary focus on the dynamical processes in East Asia. The research on the hydrological cycle attempts to gain insight into processes that control the rate of precipitation. The distributions of atmospheric chemicals are used to constrain the dynamical processes in the upper troposphere, stratosphere, and mesosphere, including stratosphere-troposphere and mesosphere-stratosphere exchange processes. Paleo-climate and future climates are also a focus of the program.

3. Solid Earth Sciences
The interior of the earth is a mixture of rocks and fluid that are constantly churning, transforming, and breaking. To understand these processes, a variety of geophysical approaches can be used. Today seismology has enabled us to see almost every corner of the earth, while potential methods such as gravity and magnetic analyses sample the earth's strata as a whole. On the one hand, earthquakes serve as a powerful tool, for probing the inner-working of the Earth. On the other hand, understanding them so as to mitigate their hazards has become an essential task in a modern society. The program in the Solid Earth Sciences is focused on using and advancing geophysical methods to explore the structure and evolution of our dynamic planet, and to integrate and apply the knowledge on the Earth system for its sustainable development in order to satisfy societal needs.

Course Offerings

Four types of courses are being offered: (1) Required courses (2) Core courses in each area of concentration (3) Elective courses (4) Elementary Chinese.

1. Required courses:
A. Introductory Earth System Science (3 credit units)
B. Seminar and Research Discussion (1 credit unit)

2. Core courses: (3 credit units each)
A. Aquatic Sciences
I. Marine Biogeochemistry
II. Physical Oceanography
III. Marine Ecology
B. Atmospheric Sciences



I. Atmospheric Chemistry
II. Atmospheric Dynamics
III. Aerosols and Air Pollution
C. Solid Earth Sciences
I. Global Seismology
II. Geology and Tectonics
III. General Geophysics

3. Elective courses: (3 credit units each)
A. Methods for Atmospheric Monitoring
B. Space Weather
C. Atmospheric Chemical Models
D. Health Risk Assessment for Environmental Pollution Issues
E. Introduction to Planetary Atmospheres and Astrobiology
F. Marine Biogeochemical Cycle
G. Marine Organic Chemistry
H. Aquatic Chemistry
I. Isotopic Geochemistry
J. Marine Biogeochemistry Laboratory
K. Marine Biogeochemical Models
L. Computational Seismology (2 credit units)
M. Strong Motion Seismology (2 credit units)
N. Observational Seismology (2 credit units)
O. Tectonic Geomorphology (2 credit units)
P. Crustal Deformation (2 credit units)
Q. Geophysical Inverse (2 credit units)
R. Earthquake Source Mechanism (2 credit units)
S. Seismic Exploration (2 credit units)
T. Special Course on Seismic Studies on Atmospheric, Hydropheric, and Lithospheric Processes (2 credit units)
U. Discussions On Contemporary Issues: Aquatic Photochemistry (2 credit units)
W. Directed readings in oceanography (1 credit unit)
X. Discussion of Marine Trace metal biogeochemistry (2 credit units)
Y. Mesoscale meteorological modeling and analysis
Z. Discussions On Contemporary Issues: Broadband Seismic observation
4. Other required course:
1-yr Elementary Chinese (required for overseas students only)

Highlights of curriculum philosophy

• The program emphasizes research training and developing the student's self-reliance and self-confidence for independent work.
• Entering students without an identified thesis advisor are invited to rotate through the mentorship of several faculty members until an advisor can be identified. This process

should take place preferably within the first two semesters of the enrollment of a student in the program.

• Whenever pedagogically advantageous, the program adopts a team-teaching system, whereby each faculty member teaches the subsection in a course in his or her area of primary expertise.

• In keeping up with the international stature of the program, all courses will be offered in English.

Requirements for the Ph. D. Degree

1. Course Work

Credit requirement

The overall course requirements for the Ph.D. in all the areas of concentration are similar. Students, who enter the program with an earned Master's degree, must complete a minimum of 18 credit units of course work, excluding seminars and research. Students, who enter the program without an earned Master's degree must complete a minimum of 34 credit units of course work, excluding seminars and research. All international students are also required to take one year of Elementary Chinese, but credit units in these courses cannot be used to satisfy the overall credit requirement.

Course distribution

A student must declare an area of concentration among the three offered in this program upon admission into the program.

The typical course distribution is as follows:

- (1) Required course for all students –Introductory Earth System Science.
- (2) Core courses in declared area of concentration – 2 courses out of the list of 3 courses in the declared area of concentration of the student.
- (3) Elective courses – any number of the remaining courses offered by the ESS program as approved by the thesis advisor.
- (4) Seminar and Research discussion – to be taken for at least four times. It is the responsibility of the advisor to assist each student in formulating a program of study that will best satisfy his or her personal needs and fulfill the graduation requirements. Depending on the background of the incoming student, a prescribed program of additional courses for making up background deficiencies might be required as part of the degree requirements.

Time schedule
Students are expected to complete at least 6 courses (at least 18 credit units) within the first two years of enrollment. Students are also required to take a one-credit course on "Seminar and Research Discussion" in each semester, for a total of four credit hours, during the initial two years of their enrollment in the program.

2. Research skill requirement

Students who have declared the Aquatic Sciences as their area of concentration are required to have at least 5 days of cumulative sea-going experience on research vessels.

3. Selection of Thesis Advisor

Incoming students are expected to identify a thesis advisor by the end of the first six months, and in no case later than the end of the first year, of study in the program. Every incoming student is expected to become familiar with the research work of a number of laboratories before proposing a specific faculty member as the prospective thesis advisor. The process might involve attending a series of seminars on faculty research in the program, or a series of laboratory rotations. The formal assignment of an identified faculty member as a thesis advisor requires the agreement of the faculty member to serve in such a capacity and the final approval by the Curriculum Committee.