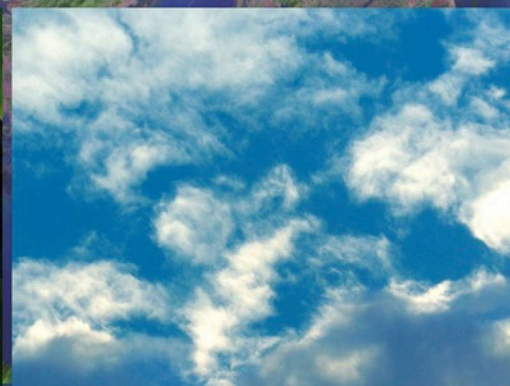




地球系統科學

EARTH SYSTEM

SCIENCE PROGRAMME



Earth System Science Programme

地球系統科學課程

Tel: 3943 9624

Fax: 3942 0970

Email: essc@cuhk.edu.hk

香港中文大學理學院
Faculty of Science, CUHK

如果你...

- 想瞭解地球系統如何運作
- 想擁有良好數理基礎，又可應用科學知識參與解決21世紀的一些重大環境問題（如全球環境變化、氣候轉變、空氣及水污染、自然與地質災害、能源開發）

If you want to...

- Understand how the Earth system operates
- Acquire good quantitative skills and apply scientific principles to solve some of the most pressing environmental problems (e.g., global climate change, pollution, natural and geological hazards, energy resources)...

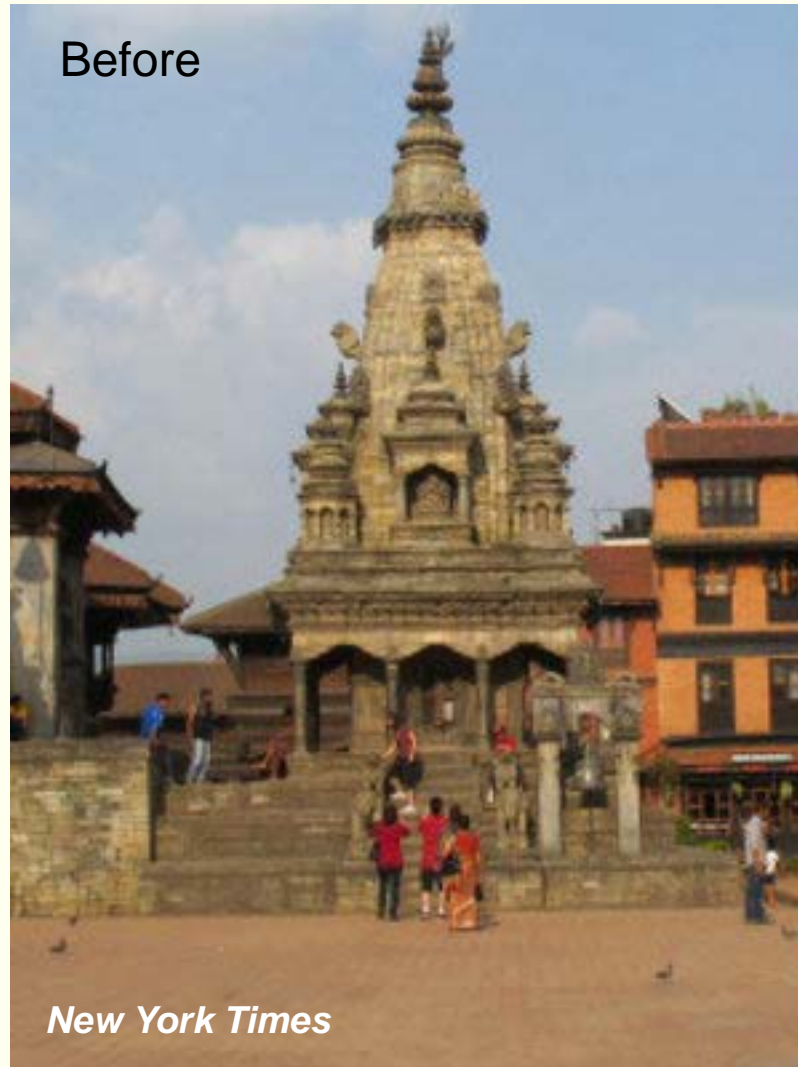
地球系統科學 Earth System Science

全球暖化與北極海冰融化



地球系統科學 Earth System Science

尼泊爾地震 2015 年4月



地球系統科學 Earth System Science

Typhoon Mujigae 颱風彩虹 2015 年10月



地球系統科學 Earth System Science

Beijing 北京 2014 年11月



SERENH DONG/CNN



“APEC Blue”

Getty Images

(source: CNN)

全球環境變化 Global Environmental Change



氣候變化



空氣污染



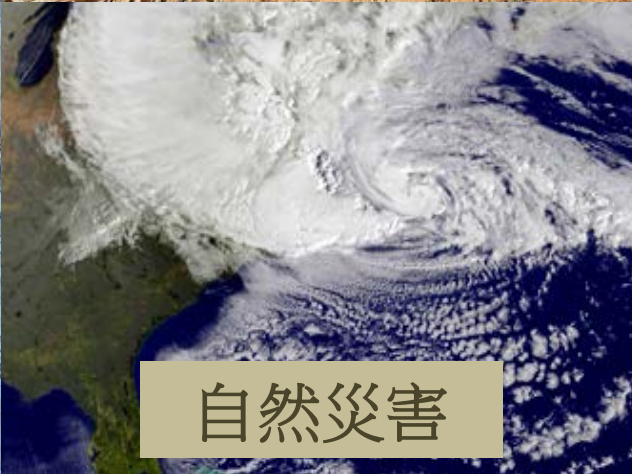
糧食危機



公共衛生



水污染



自然災害



生物多樣性

如果你...

- 想瞭解地球系統如何運作
- 想擁有良好數理基礎，又可應用科學知識參與解決21世紀的一些重大環境問題（如全球環境變化、氣候轉變、空氣及水污染、自然與地質災害、能源開發等）

地球系統科學就是對的選擇

If you want to...

- Understand how the Earth system operates
- Acquire good quantitative skills and apply scientific principles to solve the some of the most pressing environmental problems (e.g., global climate change, pollution, natural and geological hazards, energy resources)...

ESSC is the right choice for you!

Two Paths to Join This New and Unique Programme

兩種途徑選讀這個嶄新獨特的本科主修課程：

- 🌐 2016年開始, 已有明確主修意向的同學, 可以直接透過『**地球科學系統**』收生計劃 (JS4633) 修讀
- 🌐 從2012年招收第一屆學生開始, 可透過『**理學**』大類收生計劃 (JS4601) 修讀

Earth System Science Undergraduate Curricula @ CUHK

2016 Applicants could join us via

- ✓ **JUPAS 4633 *Earth System Science Programme* → Atmospheric Science/ Geophysics**
- ✓ **JUPAS 4601 *CUHK Science Broad-based Admission Scheme* → ESSC Major**

🌍 學習和研究地球系統中各圈層的運作過程，以及它們之間的相互作用對地球環境所產生的影響。

🌍 **Study all “spheres” of the Earth system, and how their interactions shape the Earth’s environment**



課程內容 Curriculum

- 這些系統部份包括大氣圈、水圈、冰雪圈、岩石圈和生物圈等。透過學習這些部份的運作情況，可以瞭解及參與減輕自然和人為的環境威脅。

- The system consists of the atmosphere, hydrosphere, cryosphere, geosphere and biosphere. Via studying their processes, we understand and help mitigate natural and man-made environmental threats.

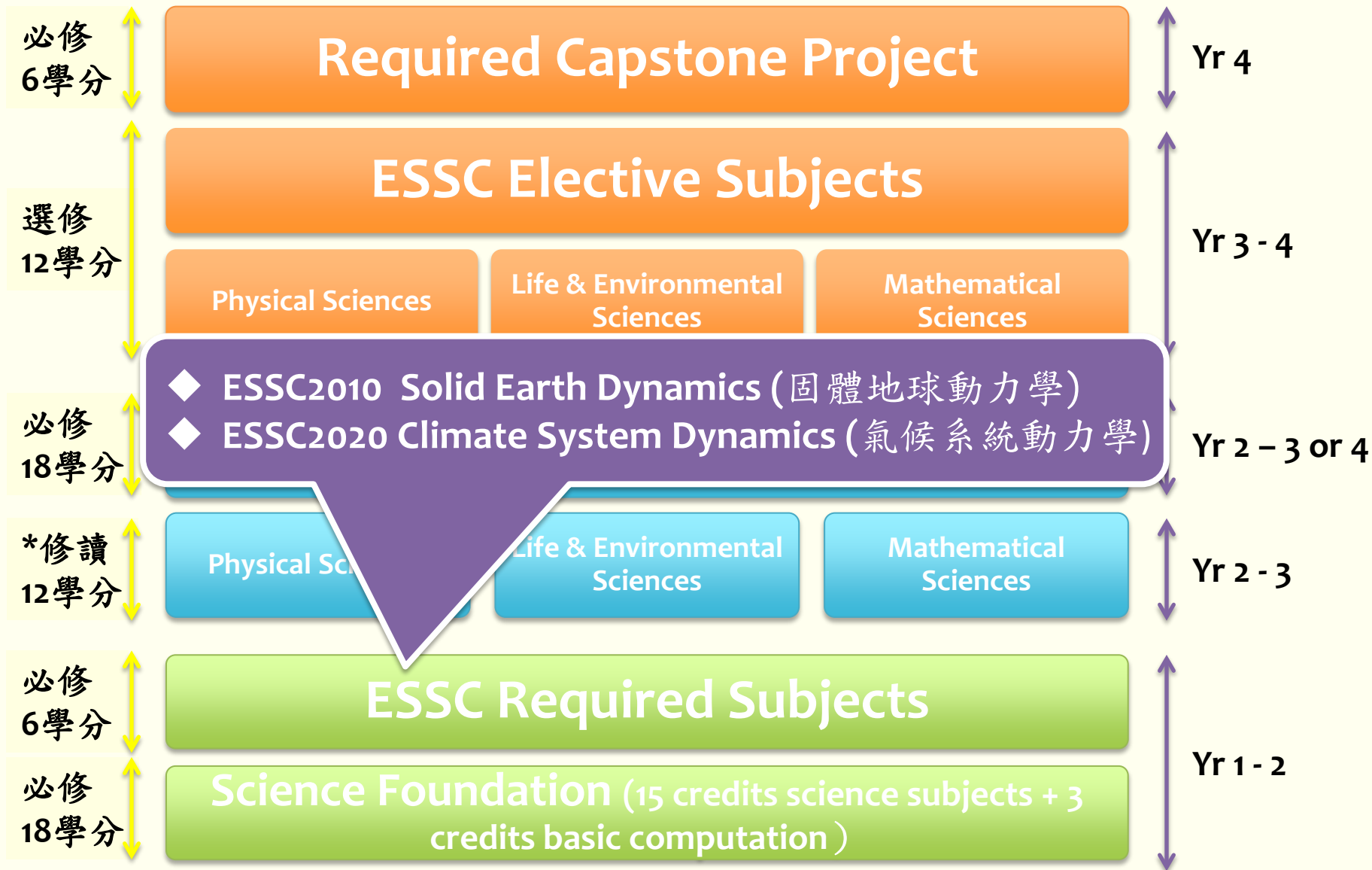


Curriculum Design

- ✓ Emphasizing basic sciences of the Earth System including, e.g., **geology**(地質學), **meteorology**(氣象學), and **oceanography**(海洋學), we aim to establish an exciting **interdisciplinary** science program.
- ✓ We aim to equip students with a solid foundation in **basic sciences** (physics, chemistry, biology), **quantitative skills** (statistics, computation), and **practical knowledge** of the Earth System, so that they are prepared to participate in tackling the various **environmental challenges** facing us today.

地球系統科學 Earth System Science

注：修畢以下72學分就可完成地球系統科學主修課程，修畢共123學分就可從本科畢業



A Stimulating Way to Start Your Journey

ESSC2010 Solid Earth Dynamics (固體地球動力學)

- ✓ Under the scientific framework of plate tectonics theory, this course explores the physics and chemistry of the Earth, and a diversity of geologic phenomena over a broad spectrum of temporal and spatial scales.
- ✓ Exciting topics include: earthquakes and volcanoes, mysteries of minerals and rocks, use of earthquake waves to probe interior of the earth.

- ✓ Excellent teacher and dynamic researcher:
Professor Lin Liu
(劉琳教授)



中大教授劉琳遠赴位於北極的格陵蘭島，考察冰川融化情況。

港專家冰川考察

拆解北極 氣候炸彈

新聞故事 高溫屢創新高，全球暖化危機加深。中大教授劉琳聯同一班科學家化身「氣候戰士」，傾盡六年的時光，研究世界最大的島嶼、北極圈的格陵蘭島冰川融化的危機。透過觀察衛星圖像變化，他發現格陵蘭島最後一片穩定的東北冰川，十年來以驚人速度大量消融，更有「崩塌危機」，隨時全部崩落海中成為「氣候炸彈」。

記者 麥凱琪

位於北極圈內的格陵蘭，是全球最大的島嶼，亦是繼南極洲後，全球第二大冰川，一直以來被視為全球暖化的指標。格陵蘭冰川出現融化危機，「過去二十年，全球海平面過去上升了三點二毫米，其中的六分一的海水是來自格陵蘭冰川。假如格陵蘭冰川全部消融，全球海平面會上升六米。我們首次發現，格陵蘭最後一片穩定的東北冰川，可能隨時崩塌。」中大教授劉琳說。劉琳與來自五個國家的十三位科學家，六年來用不同的方式觀察格陵蘭冰川的變化，他主力透過衛星雷達的影像，觀察冰川的流動，「我每月都會拍攝格陵蘭冰川的衛星照片，仔細比較冰川的流動距離，發現冰川在的流速在過去十年，從五百米加速至六百米。換言之，冰川正在不斷消失。另一方面，十幾公里厚的冰川，從二〇〇三年每年遞減一米，現加速至二〇〇六年起，每年遞減五米。」

劉琳說，格陵蘭的氣候將面臨崩潰。東北冰川崩潰會導致海平面上升。

冰川不但按年遞減，更有可能一瞬間內全部崩落瓦解，「冰川底部開始消融，大量的海水存於冰川之下，令冰川前端浮在水面，整個冰川變得不穩定，有可能整塊崩塌，誰也不知道這情況會在短時間內出現，這是個未知的問題，令人擔憂。」

劉琳說，過去五十年，北極暖化加劇，不但加速冰川融化，亦令北極生態大受影響，「原本冰可以反射太陽的輻射，但冰川融化後，原來冰的位置變成海水，直接吸收太陽的熱力，海水受熱膨脹後，水平面上升，加劇北極暖化，北極熊無可避免受影響。我們科學家都很驚訝北極的氣候及生態正快速地改變。」

監察青藏冰川變化

從事冰川研究多年的劉琳，有科學家的使命感，希望科學的方法有助解決氣候問題，「全球暖化的問題嚴重，身為科學家，我也想過過去去找解決的方法。近年，不同的科學家正努力試驗，想出不同的方法。除了繼續留意格陵蘭冰川，他正致力研究青藏高原上五萬塊冰川的變化，他說：「冰川的研究非常有意義，對人類有作用。近年青藏高原的冰川亦有顯著的變化，而這五萬塊冰川，每個的變化不一，很多未知的因素包含其中。」

A Stimulating Way to Start Your Journey

ESSC2020 Climate System Dynamics (氣候系統動力學)

- ✓ An integrated introduction to the climate system, emphasizing the dynamics of the atmosphere and its physical and chemical interactions with other Earth system components.
- ✓ Applies basic scientific and mathematical principles to explain the history, current state and future of weather and climate, natural hazards, and climate change under natural variability and anthropogenic influences.
- ✓ Excellent teacher and dynamic researcher :
Professor Amos Tai
(戴沛權教授)



注：修

必修
6學分

選修
12學分

- ◆ ESSC3100 Structural Geology (構造地質學)
- ◆ ESSC3120 Physics of the Earth (地球物理)
- ◆ ESSC3200 Atmospheric Dynamics (大氣動力學)
- ◆ ESSC3220 Atmospheric Chemistry (大氣化學)
- ◆ ESSC3300 Ocean and Climate (海洋與氣候)
- ◆ ESSC3320 Hydrogeology (水文地質學)
- ◆ ESSC3600 Understanding Our Biosphere (認識我們的生物圈)
- ◆ ESSC3800 Global Environmental Change (全球環境變化)

必修
18學分

*修讀
12學分

必修
6學分

必修
18學分

ESSC Required Subjects

Physical Sciences

Life & Environmental Sciences

Mathematical Sciences

ESSC Required Subjects

Science Foundation (15 credits science subjects + 3 credits basic computation)

Yr 2 - 3 or 4

Yr 2 - 3

Yr 1 - 2

- **Continuum Mechanics (連續介質力學)**
- **Geoscience Field Course (野外地質實習)**
- **Engineering Geology (工程地質學)**
- **Petrology (岩石學)**
- **Geomorphology (地貌學)**
- **Seismology (地震學)**
- **Land-Atmosphere Interaction and Boundary Layer Dynamics (邊界層動力學及地氣相互作用)**
- **Tropical Meteorology (熱帶氣象學)**
- **Aerosol Physics and Chemistry (氣溶膠物理與化學)**
- **Statistical Methods and Modeling (統計方法與模型)**
- **Geospatial Information Management and Analysis (地球空間信息管理與分析)**
- **Remote Sensing (遙感)**
- **Numerical Methods and Modeling for Earth System Science (地球系統科學的數值方法與模型)**

兩個專修組別 Two Specialized Streams

ESSC students can choose a specialized stream for more in-depth studies in one of two sub-disciplines.

❖ **Atmospheric Science Stream (大氣科學組)**

- ✓ **Students in this stream undertake in-depth studies related to Atmospheric Sciences.**
- ✓ **They will take advanced undergraduate level courses such as Atmospheric Dynamics, Ocean and Climate, numerical Methods and other meteorology-related courses.**

❖ **Geophysics Stream (地球物理組)**

- ✓ **Geophysics is a sub-field in ESSC that focuses on studying the Earth using gravity, magnetic, electrical and seismic methods.**
- ✓ **Students will acquire solid physical and mathematical foundations and quantitative understanding of the solid Earth: its surface and internal structures, its dynamics, geohazards and mitigation, exploration of mineral and natural resources.**

野外工作及校外實習 Field Work and Internship

To enhance the student's experience beyond a campus setting, internships and field trips are integral components of the curriculum.

Mannie Kam,
HKO Placement Programme,
2014



ESSC3110 Field Course, Wutaishan, 2014 Summer



Hong Kong Observatory, Sep 28, 2013

O-Night, Sep 16, 2015



野外考察 Field Trips

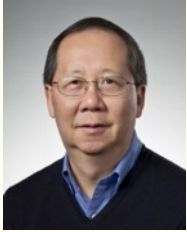
ESSC3110 Geoscience Field Course (地球科學野外課程)

- ✓ Study structural geology and petrology in the field. In 2014 and 2015 we collaborated with Peking University to conduct field course at Wutaishan, Shanxi.



地球系統科學 Earth System Science

Current Teaching Staff



Teng-fong WONG (黃庭芳), Professor & Program Director
Ph.D., MIT; Former Chair, Dept. of Geosciences, Stony Brook University
Areas: Earthquake mechanics, rock physics applied to natural resources, environmental hydrogeology.



Lin LIU (劉琳), Assistant Professor
Ph.D., U. of Colorado, Boulder; George Thomson Postdoctoral Fellow, Stanford
Areas: Remote sensing applied to earth system science, evolution of cryosphere, global environmental change



Hongfeng YANG (楊宏峰), Assistant Professor
Ph.D., Seismology, Saint Louis University
Areas: Subduction zone dynamics and megathrust earthquakes, High-resolution imaging of crustal fault zones and subsurface structure, Earthquake detection and location, Earthquake source mechanics



Jason Jian ZHANG (張健), Lecturer
Ph.D., HKU; Postdoctoral Fellow, U. of Waterloo
Areas: Structural geology, petrology, global tectonics

地球系統科學 Earth System Science

Current Teaching Staff



Gabriel N. C. LAU (劉雅章), Director, CUHK Institute of Environment, Energy and Sustainability; Professor by Courtesy

Ph.D., U. of Washington; Professor, GFDL/Princeton

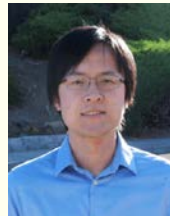
Areas: Dynamics of atmospheric circulation, atmosphere-ocean interactions, model simulations of atmospheric variability, impacts of climate change



Amos P. K. TAI (戴沛權), Assistant Professor

Ph.D., Harvard; Croucher Postdoctoral Fellow, MIT

Areas: Atmospheric chemistry & physics, climate-chemistry-biosphere interactions, impacts of global environmental change



Man-nin CHAN (陳文年), Assistant Professor

Ph.D., Caltech; Postdoctoral Fellow, Lawrence Berkeley Nat. Lab.

Areas: Atmospheric chemistry, composition and chemistry of organic aerosols, aerosol instrument techniques



Francis C. Y. TAM (譚志勇), Assistant Professor

Ph. D., Atmospheric and Oceanic Sciences, Princeton University

Areas: Climate dynamics, tropical meteorology, Seasonal climate prediction, Impact of climate change, Statistical and dynamical downscaling

地球系統科學 Earth System Science

- 學生將擁有深厚的科學及數理基礎，並對地球系統有深入的認識，而且掌握有關綜合分析及電腦的技能。
- 畢業生的出路廣泛：
 - 繼續進修地球系統科學或其他相關科學，投身教育及科研
 - 災害風險管理，需要具備資料搜集分析、資訊科技及影像處理等技能的工作
 - 氣候、天氣及環境的專業和服務，如天文台、政府、私營環保機關及環境評估顧問等
 - 石油、礦產、天然氣等天然能源的勘探與開發
 - 岩土工程及流體物理廣泛應用於房屋、市政、水利、氣象、航運交通、國防等行業

地球系統科學 Earth System Science

- **Students will acquire a solid scientific and mathematical foundation in the Earth system, as well as strong quantitative (analytical, computing) skills**
- **Graduates can embark on:**
 - **Further studies in Earth system and related areas; research and education**
 - **Information technology and image processing skills required for natural disaster risk management and related careers needing data mining and analytical skills**
 - **Weather, climate and environmental consulting and services, in the government and private sector**
 - **Exploration and development of natural resources including petroleum, minerals and natural gas**
 - **Geotechnical and fluid engineering as required in infrastructure, hydraulics, meteorology, aviation and defense**

Summary

2016 applicants can now join this new and unique programme via two different paths.

Earth System Science (ESSC) @ CUHK

❖ JUPAS 4633 *Earth System Science Programme.*

- ✓ In this accelerated scheme, you enter directly into the ESSC programme.
- ✓ You are expected to declare a stream (either Atmospheric Science or Geophysics) before end of Year 1.

❖ JUPAS 4601 *CUHK Science Broad-based Admission Scheme .*

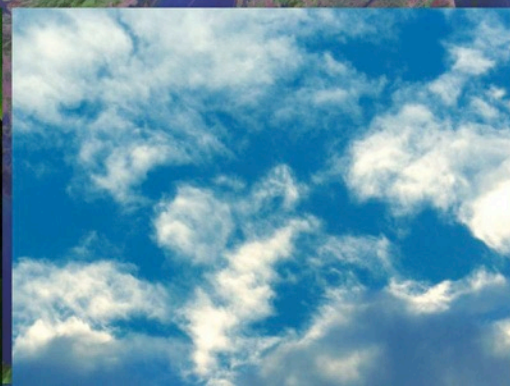
- ✓ In this JUPAS scheme, you can select and declare to be an ESSC major no later than end of Year 2.



地球系統科學

EARTH SYSTEM

SCIENCE PROGRAMME



Earth System Science Programme

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Tel: 3943 9624

Fax: 3942 0970

Email: essc@cuhk.edu.hk

香港中文大學理學院
Faculty of Science, CUHK