

中興大學土壤環境科學系客座教授

Yoshimitsu Chikamoto

Assistant Professor

Department of Plants, Soils, & Climate, USU



課程名稱：氣候及氣候變遷
Climate and Climate Change

時間：

5/9~6/1期間每週二至週四 晚上18:20~21:00

(5/9、5/10、5/11、5/16、5/17、5/18、5/23、5/24、5/25、5/30、5/31、6/1，共36小時，2學分)

報名方式：

請於**4月28日前** Email至 soilenv@nchu.edu.tw

(標題註明：報名氣候及氣候變遷課程；內容：系級、學號、姓名)

備註：本課程採全英文授課，於112學年度第1學期選課。



An hourglass with a globe of the Earth in the top bulb and soil in the bottom bulb. The sand is falling from the globe into the soil.

Department of Soil and Environmental Science

Visiting Assistant Professor

Yoshimitsu Chikamoto

Assistant Professor

Department of Plants, Soils, & Climate, USU



Course name

Climate and Climate Change

Date

5/9、5/10、5/11、5/16、5/17、5/18、5/23、5/24、5/25、5/30、
5/31、6/1

18:20~21:00 (Total 36 hours, 2 credits)

How to apply

E-mail : soilenv@nchu.edu.tw

(Note : major、student ID and your name)

Deadline : **April 28th**

Note: This is a full English course.
Credits will be recognized in Fall
semester, 2023.



中興大學
土壤環境科學系

國立中興大學教學大綱

課程名稱 (course name)	(中) 氣候及氣候變遷						
	(Eng.) Climate and Climate Change						
開課單位 (offering dept.)	土壤環境科學系						
課程類別 (course type)	<input type="checkbox"/> 必修 <input checked="" type="checkbox"/> 選修	學分 (credits)	2	授課教師 (teacher)	Dr. Yoshimitsu Chikamoto		
選課單位 (department)	土壤環境科學系 碩士班	授課語言 (language)	英文	英文/EMI	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	開課學期 (semester)	下學期
課程簡述 (course description)	<p>【注意】本課程為先上課後選課之課程，未事先完成課程的同學請勿選課。 【NOTICE】Climate and Climate Change had been finished already. Please DO NOT register this course if you have not participated in this course. Thank you for your consideration.</p> <p>本課程在於了解全球氣候系統、氣候變遷及其如何轉換為區域氣候的過程。首先介紹關鍵物理原理和過程以及它們是如何表現於大氣和海洋。同時學習一些應用物理和氣象學的原則。然後介紹全球氣候系統的建構和研究，討論近年全球各地氣候的變遷。如何面對未來的溫室效應氣體排放量提高對氣候變遷的影響。最後整聚各區域氣候變異，檢視包括亞洲的主要氣候地區和世界其他地區。探討大氣及海洋控制這些區域氣候的動態模式結合氣象學及天氣圖做為整合解說。最後利用氣候模擬模式討論未來氣候的變化。</p> <p>This class is about understanding global climate system, climate change, and how the processes translate into important regional climates. It begins with key physical principles and processes and how they are manifested in the atmosphere and oceans. This involves learning some applied physics and principles of meteorology. The global climate system is then constructed and studied. Changes in climate in the recent geological past will be discussed. Then we confront the issue of increasing greenhouse gas emissions and effects on future global climate. Feedbacks in the system will be identified and discussed. Processes and simulations of the models that are well understood will be contrasted with areas of uncertainty. Then the focus changes to regional climates. A number of important regional climates will be examined, including major climate regions of Asia and other parts of the world. The dynamics of the atmospheric and oceanic processes that control each of these climate regions will be explored. Connections will be made with synoptic meteorology and weather maps will be used to show examples, and integrate knowledge. Finally, future changes in climate simulated by climate models will be discussed</p>						
先修課程名稱 (prerequisites)							

課程目標與核心能力關聯配比(%) (relevance of course objectives and core learning outcomes)		課程目標之教學方法與評量方法 (teaching and assessment methods for course objectives)		
課程目標	核心能力	配比(%)	教學方法	評量方法
Understanding Climate and Climate Change	Understand most recent development in Soil and Environmental Sciences	30	■ 講授 ■ 討論	■ 測驗 ■ 書面報告 ■ 口頭報告/課堂討論發表 ■ 出席狀況
	Incubate abilities to solve soil and environmental issues	20		
	Respect academic ethics, intellectual property rights, and have the ability to conduct independent research	20		
	In line with international standards and cultivate humanistic quality	30		
授課內容 (單元名稱與內容、習作/每週授課進度/考試進度、備註) (course content and homework/schedule/tests schedule)				
週次	授課內容			
第 1 週	Earth's Climate as a Dynamic System (6 hours) <ul style="list-style-type: none"> ●What is a climate system? ●How is climate defined? ●What comprises the climate system? ●How are humans affected by changes in the climate system? ●Atmospheric composition and vertical structure. 			
第 2 週	Observing Earth's Climate System (6 hours) <ul style="list-style-type: none"> ●What are the essential climate variables? ●How are observations of the essential climate variables collected? ●Who uses these datasets? 			
第 3 週	Tools for investigating Earth's Climate (6 hours) <ul style="list-style-type: none"> ●Which tools are useful to climate studies? ●What is a histogram and how can we understand it? ●What kinds of graphical descriptors are useful for data display? ●What type of graphical plots can we use? 			
第 4 週	Radiation and Heat in the Climate System (6 hours) <ul style="list-style-type: none"> ●Energy, heat, and radiation ●How does solar radiation transfer to the climate system? ●How is the radiation budget understood? ●What implication does the radiative budget have? ●How do the astronomical positions of Earth and Sun contribute climatic seasons? 			
第 5 週	Water in Earth's Climate System (6 hours) <ul style="list-style-type: none"> ●How is energy related to phase changes of water? ●What is a moisture relating variable? ●How is atmospheric wetness quantified? ●What is a relationship between temperature and humidity? ●How does the global hydrologic cycle contribute to making Earth's climate habitable? ●What are the main types of precipitation in the atmosphere? ●How does atmospheric stability affect cloud formation? 			
第 6 週	Global Atmospheric Circulation (6 hours) <ul style="list-style-type: none"> ●What is ITCZ? ●What types of meridional circulations are observed? ●How are wind and pressure related? ●What is pressure gradient? 			

	<ul style="list-style-type: none"> ●Coriolis effect ●Geostrophic and trade winds ●Polar Vortex
第 7 週	Global Ocean Circulation (6 hours) <ul style="list-style-type: none"> ●What role does the ocean play for climate? ●How are ocean surface currents characterized? ●What is the Ekman current? ●What role does Ekman transport play in ocean gyres and coastal zones? ●What is the geostrophic flow? ●What is the Atlantic Meridional Overturning Circulation? ●How is ocean density determined? ●Why ocean acidification matters in global warming?
第 8 週	Climate Models (6 hours) <ul style="list-style-type: none"> ●What are models? ●What kind of model is commonly used in climate science? ●How does dynamical model work? ●What is a difference between initial and boundary value problems?
第 9 週	Atmosphere-Ocean Relationships (6 hours) <ul style="list-style-type: none"> ●What is the El Nino Southern Oscillation? ●What processes are included in ENSO ●What are the differences between El Nino and La Nina conditions? ●How does the ENSO affect our society? ●Atmospheric teleconnections ●Climate variability and oscillations
第 10 週	Natural and Anthropogenic Drivers of Climate Change (6 hours) <ul style="list-style-type: none"> ●Climate change and carbon cycle ●Solar cycle, volcanic eruption, and orbital forcing ●How does the human activity affect the global carbon cycle and climate system? ●What greenhouse gases include the anthropogenic sources? ●What role does the aerosol have? ●How does land use change affect climate system? ●What is climate feedback?
第 11 週	Future Projections and Extremes of Climate (6 hours) <ul style="list-style-type: none"> ●Why an amount of anthropogenic carbon emission is important to predict future climate? ●What are the emission scenarios and how does it work? ●How does future climate projection look like? ●What is a signal-to-noise ratio? ●How climate change affects precipitation extreme? ●What is a general concept to connect climate change with climate extremes? ●What impact does climate change have in United States? ●Why extreme events have more damages to our human society?
第 12 週	Paleoclimate Investigations (6 hours) <ul style="list-style-type: none"> ●What happens to the paleoclimate at the geologic timescales? ●How is climate information reconstructed? ●What is paleoclimate proxy records? ●How are the paleoclimate proxy records obtained?

**學習評量方式
(evaluation)**

- Attendance 20%
- Problem Sets (Labs) 45%
- Midterm Examinations 15%
- Final Examination 20%

**教科書&參考書目(書名、作者、書局、代理商、說明)
(textbook & other reference)**

“Our changing climate: introduction to climate science” by Chad M. Kauffman & Joseph M. Moran, American Meteorological Society – this is an e-book

課程教材（教師個人網址請列在本校內之網址）
(teaching aids & teacher's website)

自編講義

課程輔導時間
(office hours)

Appointment

請遵守智慧財產權及性別平等意識，不得非法影印他人著作。

更新日期 西元年/月/日：2022 /12/28

列印日期 西元年/月/日：2022/12/28

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