SEMESTER AT SEA COURSE SYLLABUS

Colorado State University, Academic Partner

Voyage:	Spring 2019
Discipline:	Atmospheric Science
Course Number and Title:	ATS 150 Science of Global Climate Change
Division:	Lower
Faculty Name:	Mark Wenig
Semester Credit Hours:	3

Prerequisites: None

COURSE DESCRIPTION

Global Climate Change is one of the most pressing issues in modern times, posing a potential risk to human health and the balance of the ecosystem. This course covers the basic physics of radiation and energy as it applies to incoming solar and outgoing longwave radiation that determines the energy budget of the Earth and the forcing of climate change (greenhouse effect). Human perturbations to this balance will be considered, especially the emission of greenhouse gases by combustion of fossil fuels. The fate of anthropogenic emissions will be explored.

The students will learn about different measurement techniques (satellite remote sensing, monitoring networks, etc.) that produce those data modern assessments of global changes are based on. They will be taught how measurement uncertainties affect those assessments. Climate feedback processes and climate sensitivity to Radiative forcing will be explained. Numerical climate prediction models will be explained qualitatively, and the projections of future global change will be put in the context of past climate change. Climate impacts on ecosystems and economic systems will be considered, and options for mitigation and adaptation will be explored. We will look at the problems caused by global climate change to the different countries which we will visit during the voyage and their mitigation strategies.

LEARNING OBJECTIVES

By completing this course, at the end of the study voyage, the students will have acquired relevant knowledge in the science of climate change and gained the skills to be able to:

- understand the physical basis of the greenhouse effect.
- explain the connection between radiative forcing and global climate change.
- consider the effects of climate change on extreme weather events.
- appreciate ways to lower the human impact on the environment.
- distinguish the effects of different atmospheric pollutants on the environment.
- assess the influence of measurement uncertainties on climate predictions.
- recognize climate change effects and mitigation strategies in different countries.

REQUIRED TEXTBOOKS

AUTHOR: David Archer
TITLE: Global Warming: Understanding the Forecast
PUBLISHER: Wiley
ISBN #:978-0-470-94341-0
DATE/EDITION: 2011, 2nd Edition

TOPICAL OUTLINE OF COURSE

Depart Ensenada, Mexico — January 5

B1—January 8:
Introductions, Syllabus, and Overview of the Course
What is climate change and why is it important to observe our changing planet?
Assign student groups for the student presentations and group discussions
Readings: Chapter 1

B2—January 10:
The Earth's Atmosphere
Atmsopheric layering and composition

B3—January 12:
Electromagnetic Radiation (part 1)
radiation and energy quantities and the electromagnetic spectrum
Preparation for Honolulu

Honolulu, Hawaii—January 12

B4—January 15:
Electromagnetic Radiation (part 2)
Solar radiation and the interaction between radiation and the earth's atmosphere
Student presentation about Climate Change with respect to Hawaii
Student presentation about climate change using the example of Hawaii
Student presentation about the influence of climate change on Hawaii

January 16—International Date Line crossing (Lost Day)

B5—January 18:
Blackbody Radiation
Planck's Law applied to the sun and the earth
Readings: Chapter 2

Study Day (No Class)—January 19

B6—January 21:

Radiative Transport
How to calculate a radiation energy budget
Readings: Chapter 3

B7—January 23:
Greenhouse Gases
Sources and effects
Preparation for Kobe
Readings: Chapter 4

Kobe, Japan — January 24-28

B8—January 30:
Earth's Energy Budget (part 1)
How the greenhouse effect works within the temperature structure of the Earth's atmosphere
Student presentation about Climate Change with respect to Japan
Preparation for Shanghai and Hong Kong
Readings: Chapter 5

Shanghai, China — January 31 - February 1

In-Transit — February 2-3

Hong Kong, SAR — February 4-5

B9—February 7:
Earth's Energy Budget (part 2)
Other influences on global radiation, e.g. clouds, aerosols, etc.
Student presentation about Climate Change with respect to China
Preparation for Ho Chi Minh City

Ho Chi Minh City, Vietnam — February 8-13

B10—February 15:
Weather and Climate
How the weather affects the climate and vice versa
Extreme weather events
Student presentation about Climate Change with respect to Vietnam
Readings: Chapter 6

Community Programming (No Class)—February 16

B11—February 18:
Atmospheric Pollutants (part 1)
Other pollutants besides greenhouse gases and their effect on atmospheric chemistry
Preparation for Yangon

Yangon, Myanmar — February 19-23

B12—February 25:

Atmospheric Pollutants (part 2)
Urban climate and air quality
Student presentation about Climate Change with respect to Myanmar

B13— February 27:
Climate Sensitivity
Balance and Feedback Mechanisms
Preparation for Cochin
Readings: Chapter 7

Cochin, India — February 28 – March 5

Community Programming (No Class) — March 7

B14—March 8:
Climates of the Past
Student presentation about Climate Change with respect to India
Readings: Chapter 8

B15—March 10:
Fossil Fuel & Carbon Cycle
Preparation for Port Louis
Chapter 9 and 10

Port Louis, Mauritius — March 11

B16—March 13:
Atmospheric Measurement Techniques (Part 1)
How is the data set produced, climate assessments are based on
Atmospheric observations and sources of uncertainty
Student presentation about Climate Change with respect to Mauritius

B17—March 15:
Atmospheric Measurement Techniques (Part 2)
Measurement principles and Instrumentation for athmospheric observations

B18—March 17:
Atmospheric Measurement Techniques (Part 3)
What information is needed for climate assessments? How to measure temperature, pressure, wind, humidity, etc.
Preparation for Cape Town

Cape Town, South Africa — March 18-23

B19—March 25:
Atmospheric Measurement Techniques (Part 4)
Satellite observations and other remote sensing instruments
Student presentation about Climate Change with respect to South Africa

B20—March 27:
Atmospheric Measurement Techniques (Part 5)
Inversion and data processing techniques. How to observe atmospheric parameters that can not be measured directly

B21—March 29:
Atmospheric Modelling and Climate Predictions
How we predict future atmospheric parameters
Preparation for Tema and Takoradi
Chapter 11

Takoradi, Ghana — March 30 - April 1

Tema, Ghana — April 2-3

B22—April 5:
Anthropogenic Influences on Climate
How we effect the climate
Student presentation about Climate Change with respect to Ghana

B23—April 7:
Climate Change Impacts
How the changing climate effects us
Chapter 12
Hand in expedition logs

Study Day (No Class) — April 8

B24— April 10:
Comparing Impressions of the Different Countries on this Voyage Related to Climate Change
Discussion of expedition logs
Preparation for Casablanca
student presentation about Climate Change with respect to Morocco

Casablanca, Morocco — April 11-15

Study Day(No Class) — April 16

A25—April 18: Final Exam

Arrive Amsterdam, The Netherlands — April 21

FIELD WORK

Semester at Sea field experiences allow for an unparalleled opportunity to compare, contrast, and synthesize the different cultures and countries encountered over the course of the voyage.

In addition to the one field class, students will complete independent field assignments that span multiple countries.

Field Class & Assignment

The field class for this course is on Tuesday, 5 February in Hong Kong, SAR China.

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class. Field Classes constitute at least 20% of the contact hours for each course, and are developed and led by the instructor.

Weather and Urban Climate in Hong Kong

We will visit the Hong Kong Observatory (HKO) and learn about its history and current research for weather forecasting. The HKO has a long history of providing meteorological and geophysical services to the public and the shipping, aviation, industrial and engineering sectors. The scientists at the HKO conduct scientific studies to further improve their prediction models, often in collaboration with local universities. After our tour at the HKO we visit one of those universities, the City University of Hong Kong (CityU). The students will get an overview presentation of the weather and climate related research at CityU, as well as a lab tour. The students will have the opportunity to ask questions about the subjects presented and to get in contact with local students.

Learning Objectives:

1. learn about the development of the Hong Kong Observatory and University Research
2. observe how weather forecasts and urban climate simulations are made
3. understand the importance of weather prediction, e.g. for air traffic
4. gain understanding of the factors influencing weather and climate

Each student will write a 2-3 page paper highlighting how the field class fits into the topics covered during class (due 8 February).

Independent Field Assignments

Students are required to keep an expedition log for all days at sea and in ports. The log will include all available measurements and observations relevant for the course, e.g. weather, cloud cover, temperature, wind, etc. A photo of the sky should be taken every day to get an idea of the weather condition. Also document how the countries we visit seem to be effected by pollution and climate change and what mitigation strategies they implemented. The logs will be evaluated on the basis of completion and effort. At the end of the semester a collaborative expedition log will be assembled from all students' logs and discussed.

Port-of-call reports and student presentations:

Students in groups will be assigned one port-of-call country. In that country, students should note anything they find relevant to our course. Additional questions will be provided specific to their country.

Each group will prepare a 20 minutes power point presentation for their port and topic. Every student in the group should present a part of the talk. This presentation should include photos and sketches. Each group will also turn in an essay (1-2 pages of text). After the presentations the other students are encouraged to ask questions. In order to be able to participate in the discussion, all students should keep their eyes open in all ports we visit and notice differences to their assigned country.

The students will be graded on their creativity and ability to apply concepts that have been covered in class to their observations, as well as the quality of their essays and power point presentations.

METHODS OF EVALUATION

The contribution of the different evaluation methods is as follows:

Class participation (tutorial questions during most lectures, ≈1.5% each lecture for ≈20 lectures)	30%
Expedition log	10%
Group presentations and papers	20%
Field class	20%
Final exam	20%

GRADING SCALE

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework. Note that C-, D+ and D- grades are also not assigned on Semester at Sea in accordance with the grading system at Colorado State University (the SAS partner institution).

Pluses and minuses are awarded as follows on a 100% scale:

Excellent	Good	Satisfactory/Poor	Failing
97-100%: A+	87-89%: B+	77-79%: C+	Less than 60%: F
93-96%: A	83-86%: B	70-76%: C	
90-92%: A-	80-82%: B-	60-69%: D	

ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM

Attendance in all Semester at Sea classes, including the Field Class, is mandatory. Students must inform their instructors prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion. Instructors must make reasonable efforts to enable students to make up work which must be accomplished under the instructor's supervision (e.g., examinations, laboratories). In the event of a conflict in regard to this policy, individuals may appeal using established CSU procedures.

LEARNING ACCOMMODATIONS

Semester at Sea provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students, who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation.

A letter from the student's home institution verifying the accommodations received on their home campus (dated within the last three years) is required before any accommodation is provided on the ship. Students must submit this verification of accommodations to academic@isevoyages.org as soon as possible, but no later than two months prior to the voyage.

STUDENT CONDUCT CODE

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

Depending on the nature of the assignment or exam, the faculty member may require a written declaration of the following honor pledge: "I have not given, received, or used any unauthorized assistance on this exam/assignment."

ADDITIONAL RESOURCES

Students will require access to shipboard charts, oceanographic, and weather data.
Students will be expected to use internet resources while in port to augment their port-of-call reports and presentations.