Course Change Request

New Course Proposal

Date Submitted: 05/01/18 9:37 am

Viewing: **CLIM 670 : Earth System Modeling**

Last edit: 05/01/18 9:37 am

Changes proposed by: bklinger

Are you completing this form on someone else's behalf?
No

Effective Term: Spring 2019

Subject Code: CLIM - Climate Dynamics **Course Number:** 670

Bundled Courses:

Equivalent Courses:

Catalog Title: Earth System Modeling

Banner Title: Earth System Modeling

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit (NR)

Default Grade Mode: Graduate Regular

Recommended Prerequisite(s): computer programming experience

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description: An Earth system model is composed of models simulating the evolution of the atmosphere, ocean, cryosphere, biosphere, and other components. Course introduces the component models, their interactions, and how they are used to predict the behavior of weather and climate on time scales that range from hours to centuries. Students will learn technical and scientific skills necessary to run an Earth system model and evaluate its output.

Justification:

In Workflow

1. **AOES Chair**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Graduate
5. Registrar-Courses
6. Banner

Approval Path

1. 05/07/18 1:51 pm Jim Kinter (ikinter): Approved for AOES Chair

Currently Climate Dynamics doctoral students learn about Earth System modeling primarily through their research. However, many students - especially those who enter from other fields such as physics or math - would benefit from the more comprehensive understanding of the topic represented by an entire course. This can also make them more efficient when starting research.

The proposed masters program in Climate Science is designed to graduate students with the ability to utilize Earth system models and/or analyze climate data. The proposed course is a key component of core skills for the Climate Modeling concentration and a valuable elective for students in the Climate Data concentration.

The course takes advantage of the status of AOES and GMU's Center for Ocean-Land-Atmosphere Studies (COLA) as one of the major concentrations of climate modeling expertise in the country. proposed course

Does this course cover material which crosses into another department? No

Learning Outcomes:

1. Students will learn the basic technical and scientific skill necessary to run an earth system model, evaluate its output, and compare with observations.
2. Students will understand how Earth system models are typically used for climate prediction and projections.
3. Students will understand the strengths and weaknesses of climate models so that they can critically assess Earth system model results from their own and other's work.

Attach Syllabus (PDFs only) clim670syllabus2.pdf

Additional Attachments (PDFs only)

Staffing: All climate dynamics faculty in department (approximately 10).

Relationship to Existing Programs: Elective for Climate Dynamics PhD.
For proposed Climate Science MS: requirement for "Climate Modeling" concentration, elective for "Climate Data" concentration.

Relationship to Existing Courses: CLIM 715 Numerical Methods for Climate Modeling teaches the mathematical theory of how climate models solve the partial differential equations governing the fluid mechanics of the atmosphere and ocean. The proposed course gives a holistic view of how climate models are assembled from components governing fluid mechanics and other aspects of the climate system, and how such models are used and their output interpreted.

Additional Comments:

Reviewer Comments

Key: 15909

CLIM 670 Earth System Modeling

Instructor: Dr. Kathy Pegion
Location: Research Hall 260
Email: kpegion@gmu.edu

Catalog Description

An Earth system model is composed of models simulating the evolution of the atmosphere, ocean, cryosphere, biosphere, and other components. Course introduces the component models, their interactions, and how they are used to predict the behavior of weather and climate on time scales that range from hours to centuries. Students will learn technical and scientific skills necessary to run an Earth system model and evaluate its output.
Course Credits: 3 *Prerequisites:* computer programming experience.

Overview & Motivation

Global models are the primary tools used to make predictions and projections of climate. A solid understanding of what is included and not included in these models, how they represent climate variability on a variety of space and timescales, and an introduction to how to run an Earth system model are basic skills needed to engage in climate research.

This class will be laboratory and discussion focused. Students will read and discuss sections of the IPCC report and relevant journal articles. Students will also learn how to run an earth system model and evaluate data from seasonal predictions and climate projections.

Grading

Class Participation (30%)
- Leading and participating in class discussion
- Presenting journal article/portion of IPCC report

Homework (30%)
- Computer/Data Analysis Lab (3 assignments)

Semester Project (40%)
- Written paper
- Oral presentation

Required Reading

There is no required text for this course. All required readings will be provided and will consist of journal articles and parts of the IPCC report.

Goals

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3. Students will understand the strengths and weaknesses of climate models so that they can critically assess Earth system model results from their own and other's work.

Course Outline

1. Introduction & Background
   a) Climate Predictions & Projections
      i) Review: what is the difference between weather and climate?
      ii) What is the difference between weather and earth system models?
      iii) What is the difference between predictions and projections?
   b) What is an Earth System Model?
      i) Introduction to NCAR/CESM
      ii) Tutorial on how to run NCAR/CESM
2. Seasonal Climate Predictions
      i) Introduction to seasonal prediction
      ii) The National Multi-model Ensemble
      iii) Seasonal prediction Skill
      iv) How well do seasonal prediction models represent the mean climate and its variability?
3. Climate Projections
      i) Introduction to IPCC and projection scenarios
      ii) The CMIP5 Models
      iii) How well do the CMIP5 models represent the mean climate and its variability in the 20^{th} century?
      iv) How similar or different are CMIP5 model projections of future climate?
4. Current Topics
      i) Decadal Prediction
      ii) Subseasonal Prediction
      iii) High resolution modeling