

EnvEng 6218 Measurement and Modeling of Climate Change

The course will focus on the science behind climate change, and specifically on physical processes at the earth surface, and the interactions between the ecosystem, human activities and climate change. Design of data analysis research project, testing hypotheses regarding climate change and its effects using observational data, hands-on climate data analysis experience through personal project.

Required or Elective: Elective

Lecture Schedule: 3 hours lecture

Credit Hours (and quarter(s) offered): 3 (Spring)

Textbook(s) and/or Other Required Material:

Articles will be read throughout the quarter.

Prerequisites: CE2060 or equivalent, Graduate

Instructors: Gil Bohrer, bohrer.17@osu.edu **Office:** Hitchcock Hall 405

Office Hours (tentative): TBD

Class Meeting Times (tentative): Tuesday and Thursday 12:45 to 2:05, On-line

Topics Covered (and approximate time):

- Week 1: History of climate change science. Climate politics. Tragedy of the commons.
- Weeks 2-3: Basic atmospheric physics – properties of the air, atmospheric pressure, definitions of temperature and humidity. Atmospheric boundary layer definitions and classifications. Relationships between boundary layer conditions and weather.
- Weeks 4-5: The surface energy balance and Atmosphere-Biosphere interactions. Radiation attenuation. Distribution of solar energy at the land surface. Surface fluxes – heat, water, CO₂. Role of vegetation in the surface energy budget. Global energy budget, climate change and greenhouse gasses.
- Week 6: Introduction to on-line sources of meteorological, ecosystem, and climatic data archives.
- Week 6: Greenhouse gas budgets of ecosystems. Ecosystem services of weather stabilization.
- Weeks 7-8: How are surface fluxes measured? Surface fluxes and eddy-covariance technique. Methods to identify and correct data errors, spikes and biases.
- Week 9: Data analysis – Averaging, smoothing and gap filling techniques. The effects of scale. Upscaling, downscaling
- Week 10-11: Modeling the boundary layer – Monin Obhukov similarity, K theory, Navier-Stokes equations, introduction of the modeling techniques: large eddy simulations and the turbulence closure problem

- Week 12 IPCC and the US SOCCR report. Societal valuation and costs of climate change.
- Week 13: Presentations of final projects – Application of meteorological, ecosystem or water/air quality data and analysis to practical research problems in Ohio.

Course requirements

- Attendance and participation. Attendance Minimum $\geq 80\%$ of meeting
Meaningful participation in class discussion 10%
- Speed talk – A 4 slides 5 minutes presentation of a contemporary topic related to climate change chosen by the student. Conducted by 1 student at the start of each class meeting 25%
- Final project Presentation – peer evaluated 30%
- Final project report 35%

Speed talks – Could include any weather/climate related topic from the personal work/life experience of the student, or from recent media coverage or recently published scientific paper.

Final project is individual. Must involve data analysis of some weather/climate related dataset relevant to Ohio, chosen by the student. The written component should be 10 pages long. Must be hypothesis based, and analyze a scientific question. Provide the broader impact and societal context of the findings of the analysis. The project presentation is a conference style 10-min long presentation, evaluated by peers for effectiveness, clarity and style.

Distribution of Hours toward Meeting the Professional Component:

Mathematics: 1
 Basic Sciences:
 Engineering Topics: 4
 General Education:

Relationship of Course to Program Objectives:

Civil and Environmental Engineering Program Objectives (1-3) Addressed: 1, 2, 3