

An Introduction to Climate Science (G523)



Tutor(s)

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Overview

This course provides an introduction to climate science, with a particular focus on the physical science of climate change across a range of timescales – past, present and future. The course will begin with an overview of the modern climate system, then examine the science of climate change, including the patterns and causes both in the past and at present. A particular focus will be on recent ‘global warming’ and some of the observed changes in the atmosphere and ocean, together with some of the most serious impacts of a warming planet. This will include observed changes in the cryosphere (glaciers, permafrost, sea ice) and associated sea level rise, but will also cover some of the human health impacts, including extreme weather events such as drought and heatwaves, and efforts to address the current climate ‘emergency’ (e.g. the Paris Climate Agreement). The course will end with a consideration of how climate science is communicated and the role of the media, including discussion of some of the major misconceptions / controversies around anthropogenic climate change.

Duration and Logistics

Classroom version: A 1.5-day course comprising a mix of lectures, case studies and exercises. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Three 3.5-hour interactive online sessions presented over 3 days. A course handbook and exercise materials will be distributed to participants before the course. Some reading and exercises are to be completed by participants off-line and in preparation for sessions.

Level and Audience

Fundamental. The course is intended for industry professionals and those interested in climate science from both the public and private sectors, or with a personal interest in understanding climate change. It is suitable for penultimate-year undergraduate university students and above.

Objectives

You will learn to:

1. Understand the physical science underpinning past, present and future climate change, including the attribution of recent warming to human activities.
2. Understand how and why global climate has changed and will change, and be able to assess uncertainties.
3. Describe the key impacts of climate change on various physical systems (e.g. the oceans and cryosphere), the linkages between them and their relevance to human activities.
4. Understand how climate change impacts extreme weather events and human health.

5. Evaluate and interpret various climate and paleoclimate datasets, including future climate scenarios and their associated uncertainties.
6. Critically evaluate the various misconceptions and controversies around 'global warming', including the role of the media and efforts to communicate climate science.
7. Assess the effects and importance of mitigation scenarios (such as the Paris Climate Agreement) on global climate change and the role of the IPCC (Intergovernmental Panel on Climate Change).

Course Content

Course Details

This course will provide an introduction to the physical science underpinning our understanding of past, present and future climate change, and explain some of the most serious impacts.

Session 1: The modern climate system and climate change - past, present and future

- The modern climate system and an introduction to the science of climate change
- Reconstructing paleoclimates
- Recent climate change and 'global warming' (and 'wetting')
- Arctic amplification
- The role of anthropogenic forcing in recent climate warming
- Exercise in analysing climate data and climate change
- The role of the Intergovernmental Panel on Climate Change (IPCC)

Session 2: Impacts of recent climate change ('global warming')

- Observed changes in the oceans (warming, circulation changes and acidification)
- Observed changes in mountain glaciers and snow cover
- Observed changes in the polar ice sheets (Antarctica and Greenland)
- Observed changes in sea ice (Arctic and Antarctica)
- Observed changes in permafrost
- Observed changes in global mean sea level (and relative sea level change)

Session 3: Future climate change (adaptation, mitigation, communication)

- Future climate projections: emission scenarios and mitigations (e.g. Paris Climate Agreement)
- Extreme weather events and human health impacts
- Future changes in mountain glaciers and implications for geohazards, surface hydrology and water resource use
- Future changes in the polar ice sheets and their contribution to sea level rise
- Future changes in permafrost (including feedbacks with vegetation, the carbon cycle and surface hydrology)

Potential adaptation and mitigation scenarios and timescales of change – what next and is it too late?

Communicating climate science and the media