

IIT Mandi
Proposal for a New Course

Course Name: **Climate Change Analysis**

Course Number: MA 510

Credit: 3-0-0-3

Students intended for: UG/PG

Prerequisites: UG None

Elective or Compulsory: Elective

Semester: Odd/even

Course objective: This course reviews and expands upon core topics in climate modelling, analysis and inference through practice of data analysis. Computer programs are used to apply numerical methods to weather data and to evaluate dynamical processes on numerical grids. Meteorological graphics packages are used to analyse current weather data and numerical model output. It includes operational numerical models.

Course Modules

Statistical concepts in climate research:

20 hrs

- Misuses of statistics in climate research: testing hypotheses suggested by the data; serial correlation; using statistical recipes as “black-box” tools;
- Hypothesis testing Type I and Type II errors, significance, power, etc; historical developments and controversy around classical statistical significance test and its interpretation.
 - Basics of Bayesian statistics: Introduction to Bayesian statistics; Bayesian climate change assessment.
 - Advanced data analysis technique like functional data analysis and wavelet analysis to detect climate changes is discussed in detail.

Detection and attribution of anthropogenic climate change:

10 hrs

- To identify the causes of recent observed climate variations
- To evaluate the performance of climate models in simulating the observed climate variations over the last century
- To constrain the projections of future climate change

Climate science beyond the IPCC

6 hrs

- Univariate analysis of global mean temperature comparing change with internal variability
- Study of different causes that affect global radiation balance; increasing greenhouse gases, increasing solar irradiance
- Use the spatial pattern of the temperature response to differentiate between different causes and fingerprint analysis

Minor project/seminars

6 hrs

Text books

1. Montgomery, D., Jennings, C.L. and Kulahci, M. (2008) *Introduction to Time Series Analysis and Forecasting*, Hoboken, N.J. : Wiley-Interscience.
2. Chatfield, C., *The Analysis of Time Series*, Sixth Edition Chapman & Hall/CRC, 2004.

Reference Books:

1. Robert H. Shumway and David S. Stoffer, *Time Series Analysis and Its Applications with R Examples*, Third edition, Springer Texts in Statistics, 2006.
2. Hans von Storch, Francis W. Zwiers, *Statistical Analysis in Climate Research*, Cambridge University Press (2002)
3. Hartmann U., Ramirez F., *Real Time Detection of Turning Points in Financial Time Series*, GRIN Verlag , 2013.

Other Faculty Members interested in teaching this course: