

Asian Institute of Technology
School of Environment, Resources and Development (SERD) and
School of Engineering and Technology (SET)
Disaster Preparedness, Mitigation and Management (DPMM)

IN84.03 Climate Hazards and Early Warning Systems 3 (3-0)

Semester: January

Course Objective:

Climate hazards are one of the important triggers to disasters, and are likely to gain further prominence with changing climate. Weather and climate information also constitute key starting points for many Early Warning Systems. Early Warning Systems consist of climate prediction and translation of the severe weather/climate information into potential hazards understood by the users. The course is designed in five modules covering basic understanding of earth's climate system, introduction to weather and climate forecasting, and the architecture of Early Warning Systems in the context of hydro-meteorological hazards.

The course aims to provide a clear understanding of basic aspects of weather and climate hazards, along with frameworks of meteorological observational and forecasting systems. It will also introduce various operational forecasting products generated that are crucial to disaster preparedness and management.

Learning Outcomes:

Upon the completion of this course, the students will be able to:

- Effectively use weather and climate information to assess climate and disaster risks
- Apply methods for collection and monitoring of climate data as per international protocols and standards
- Design a framework for early warning systems for hydro-meteorological hazards
- Apply the knowledge of climate change to reduce disaster risks

Prerequisite: None

Course Outline:

I. Introductory Climatology

1. Earth's climate system
2. Atmospheric composition, Global Energy Balance
3. General circulation and global climatology
4. Variation of meteorological parameters in different time-scales
5. Concepts of Climate Change and Climate Variability

II. Weather and Climate

1. Meteorological Observational Systems
2. Approaches to weather and climate predictions
3. Weather forecasting
4. Climate information and services
5. Global and regional climate models

III. Climate Extremes

1. Extremes in climate variables
2. Role of El Nino and other similar oscillations
3. Thunderstorms, tornadoes and tropical cyclones/typhoons

IV. Climate Change

1. Changing atmosphere

2. Observed trends at global and regional scales
3. Future climate change
4. Understanding causes and impacts

V. Early Warning Systems

1. Early warning system concepts
2. Flood forecasting and warning systems
3. Drought early warning systems
4. Cyclone Early-warning systems
5. Heat health early warning systems

Laboratory Session(s): None

Learning Resources:

Textbooks:

1. C. Donald Ahrens (2015), *Essentials of Meteorology – An invitation to the Atmosphere*, 7th Edition, Cengage Learning, USA.
2. Peter Hobbs and Michael Wallace (2006), *Atmospheric Sciences: An Introductory Survey*, 2nd Edition, Elsevier, UK & USA.

Reference Books:

1. James Holton (2004), *An Introduction to Dynamic Meteorology*, 4th Edition, Academic Press, USA.
2. John Houghton (2015), *Global Warming – The Complete Briefing*, 5th Edition, Cambridge University Press, Cambridge, UK.
3. McGuffie and Henderson Sellers (2014), *The Climate Modelling Primer*, 4th Edition, Wiley-Blackwell, UK.
4. Sue Roaf, David Crichton and Fergus Nicol (2009), *Adapting Buildings and Cities for Climate Change – A 21st Century Survival Guide*, 2nd edition, Architectural Press, Elsevier, Oxford.

Journals and Magazines:

1. *Theoretical and Applied Climatology*, Springer
2. *International Journal of Climatology*, Royal Meteorological Society, Wiley
3. *Journal of Climate*, American Meteorological Society
4. *Geophysical Research Letters*, American Geophysical Union, Wiley
5. *Natural Hazards*, Springer
6. *Climatic Change*, Springer
7. *Climate Dynamics*, Springer
8. *Nature*, Macmillan

Others:

1. IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*
2. IPCC, 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
3. <https://www.wmo.int> [website of the World Meteorological Organization headquartered in Geneva, Switzerland with links to all the operational meteorological services]
4. <http://www.rimes.int/> [website of the Regional Multi-hazard Early-warning System for Asia-Pacific and Africa with links to climate forecasts and weather hazard resources]
5. <http://www.cru.uea.ac.uk/> [website of the Climatic Research Unit, University of East Anglia, Norwich, UK with links to global climate data resources and study material]
6. <http://www.wri.org/> [website of the World Resources Institute headquartered in the US with links to research publications on various issues related to climate adaptation and change]

7. <http://www.tmd.go.th/en/> [official web site of the Thailand Meteorological Department with links to resources of climate and weather forecasts, satellite and radar observations for Thailand]

Teaching and Learning Methods:

Lectures, Assignments (Term Paper and Forecast Data Exercise), Presentations and Case Study Analysis

Time Distribution and Study Load:

Lectures: 45 hours

Self-study: 135 hours

Assignments, presentations and group activities: 18 hours

Evaluation Scheme:

Mid-Semester exam: 20%

Final exam: 20%

Term paper assignment 1: 20%

Term paper assignment 2: 20%

Presentation of the assignment 2 paper: 10%

Forecast data exercise: 10%

Both Mid-semester and Final examinations will be closed book.

An “A” would be awarded if a student demonstrates excellent knowledge and analytical skills in assignments, and communicating results related to the subject area. A “B” would be awarded if a student shows an overall good understanding of all given topics. A “C” will be given if the student shows below average competency. An “D” will be given if the student is very poor in comprehension of the subject matter is very.

Instructor(s): Dr. G. Srinivasan (RIMES)