

Modern Tools for Climate Modeling and Forecasting (Elective)

Code DM-815	Credit Hours 3 – 0
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Course Description:

The course aims to introduce students to modern-era tools, techniques, and software for monitoring, archiving, modeling, and forecasting of climate parameters. It is also intended to train the students in applying contemporary soft techniques to understand and process climate data so that they can withstand the recent operational requirements of organizations related to climate change and disaster risk management.

Course Content:

Topics	Learning Outcomes
Weather and Climate Models	El Nino and La Nina, North Atlantic Oscillations, Monsoon patterns, Types of weather and climate prediction techniques, Primitive equation models, Initial and boundary conditions, Global and regional Climate models, Predictability and uncertainties in weather and climate prediction
Global and Regional Circulation Models	Introduction to and algorithms of GCMs and RCMs
Advancements in Climate Monitoring and Modeling	Contemporary techniques of climate monitoring including remote sensing- and model-based estimation of climate parameters
Global Climate Data Centers	ECMWF, NCEI, CDO, WDC Climate, CDS, CORDEX, etc.
Tools for Processing, Modeling, and Forecasting the Climate	AI-, ANN-, ML- and GA-based modeling and forecasting tools

Data	
Term project on Climate Modeling and Forecasting using tools like AI, ML, etc.	

Textbooks:

No textbook for this course. The course will be based on different reference books, reports, and conference and journal publications.

Reference Material:

1. James R. Holton (1992): An Introduction to Dynamic Meteorology, Third Edition, Academic Press, New York
2. Washington W.M., Parkinson, C.I. (2000): An Introduction to Three-Dimensional Climate Modelling, Oxford University Press, Oxford
3. Smith et al. (2009): Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) “reasons for concern,” Proc. National Academy of sciences of USA. Vol 106(1), p. 4133-4137.
4. Lenton et al. (2008): Tipping elements in the Earth’s climate system, Proc. National Academy of sciences of USA. Vol 105(6), p. 1786-1793.
5. Reid Basher (2006): Global early warning systems for natural hazards: systematic and people centered. Philosophical Transactions of the Royal Society, 364, p. 2167-2182.

Pre-requisite: None

Assessment System

Quizzes	15%
Assignments	10%
Mid-Semester Exam	25%
Term Project/Paper	10%
End Semester Exam	40%