Environmental Science (ENSC) 620

Environmental Data Analysis (Revision 1)

Status:	Replaced with new revision, see the **course listing** for the current revision
Delivery mode:	**Grouped study**
Credits:	3
Area of study:	Science
Prerequisites:	This course is written for a graduate or advanced undergraduate student. You should have a background in undergraduate statistics, calculus, computer science, and environmental science (e.g., **MATH 216, MATH 265 , COMP 210**). If you are concerned about not meeting the prerequisite for this course, contact the course instructor before you register.
Precluded:	None
Faculty:	**Faculty of Science and Technology**
	This is a graduate level course, and students must apply and be approved to one of the

Notes:	graduate programs or as a non-program **School of Computing and Information Systems** graduate student in order to take this course. Minimum admission requirements must be met. Undergraduate students who do not meet admission requirements will not normally be permitted to take this course.
Professor:	**Dr. Junye Wang**

Overview

Environmental Science 620: Environmental Data Analysis introduces data analysis—the discipline of extracting meaning from inherently complex data. This rapidly evolving field draws principles and approaches from a variety of disciplines, such as computer science, chemical and mechanical engineering, and mathematics. Data analysis has a significant impact on many fields—like business, health, and smart cities—and it can play an important role in Earth and environmental sciences. Data analysis provides a rich variety of new tools to assist in gaining greater knowledge of the natural environment and in developing applications to effectively mitigate and adapt to environmental pollution and climate change.

Environmental data analysis presents additional challenges for data science, particularly in terms of complexity, spatial and temporal reasoning, and uncertainty management. In this course, you will conduct a variety of case studies in environmental data analysis to gain a better understanding of the subject. Completing an environmental data analysis course can enhance your understanding of the techniques and tools used to analyze environmental data and make decisions based on evidence. This can help you to take informed and effective action on environmental issues.

Outline

- Unit 1: Overview of Data Treatment

- Unit 2: Case Studies in Environmental Pollution Research
- Unit 3: Typical Environmental Challenges
- Unit 4: Generating Environmental Data
- Unit 5: Time Series Analysis
- Unit 6: Root-Finding Method
- Unit 7: Environmental Study using Numerical Differential Analysis
- Unit 8: Numerical Integration Application to Environmental Data
- Unit 9: Numerical Interpolation Application to Environmental Data
- Unit 10: Machine-Learning Application to Environmental Data
- Unit 11: Review of Environmental Numerical Models

Learning outcomes

Upon successful completion of this course, you should be able to

- explain the main concepts of data science, different data source types, and data analysis and treatment. Describe key environmental data qualities, such as volume and velocity, variety, and veracity (accuracy/precision).
- determine the main environmental analysis areas, including the geosphere, hydrosphere, biosphere, and atmosphere.
- explain the main environmental challenges that affect human life. Discuss different characteristics of various types of environmental pollution.
- discuss details of a variety of techniques for detecting and collecting environmental data and when and why to implement them based on their essential characteristics. Additionally, have extensive knowledge of the problems, shortcomings, safety precautions, and modelling and experimental issues associated with the most widely used methods for gathering environmental data.
- discuss and acknowledge a variety of environmental situations or features with a wide range of challenges in environmental science, including thermal comfort, rainfall, deforestation, overpopulation, natural disasters, climate change, and unsustainable waste generation.
- determine and acknowledge the main challenges related to data analysis. Learn the complexity and variability of the underlying data sources in data

analysis.

- apply modelling techniques and approaches to analyze environmental problems, including time series analysis, root-finding techniques, integration, interpolation, and numerical differential analysis.
- explain and apply different environmental models, such as the NOGAPS-ALPHA model, Global Environmental Multiscale Model (GEM), European Centre for Medium-Range Weather Forecasts (ECMWF) model, Unified Model (UKMO), Weather Research and Forecasting (WRF) model, fifth-generation mesoscale model, etc.
- develop clear technical writing skills through essays and reports.

Evaluation

To **receive credit** for ENSC 620, you must achieve a cumulative course grade of at least **B– (70 percent)** , an average grade of at least 60% on the assignments, and at least 60% on the final project.

Your cumulative grade is based on the following assessment activities:

Activity	Weight
Assignment 1	10%
Assignment 2	15%
Assignment 3	15%
Assignment 4	30%
Final Project	30%
Total	**100%**

Materials

Digital course materials

Links to the following course materials will be made available in the course:

Emetere, M. E. (2022). *Numerical methods in environmental data analysis*. Elsevier.

Important links

- **Future Course Offerings**
- **Important Dates and Deadlines**
- **MSc IS Contact Information**

Athabasca University reserves the right to amend course outlines occasionally and without notice. Courses offered by other delivery methods may vary from their individualized study counterparts.

Opened in Revision 1, December 22, 2023

Updated January 31, 2025