Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	
Semester/Trimester/Others (specify approx. Start/End date)	
Course Author * Faculty proposing/revising the course	Benoit Taisne (Assoc Prof);#1131
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Course Title	COMPUTATIONAL EARTH SYSTEMS SCIENCE
Course Code	ES2001
Academic Units	0
Contact Hours	78
Research Experience Components	

Course Requisites (if applicable)

Pre-requisites	MH1802
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

You will learn how to choose data visualization and analysis techniques that are relevant to the scientific challenge you are facing, and to create your own functions for performing these analyses. You will also learn to use a programing language that could serve as a basis to learning other languages. The goal is to give you a solid grounding in the basic statistics and programming techniques that will allow you to continue to build on these skills throughout the rest of your undergraduate training and careers, with a strong emphasis on critical thinking and developing skills that can be adapted in the future to suit a changing world, rapidly changing technologies, and increasingly varied sources of environmental and geoscience data.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Visualize and statistically analyze a range of data sets representative of those found in earth science and environmental fields
ILO 2	Develop your own computer code to read and analyse dataset of your choice
ILO 3	Interpret and communicate, both orally and in writing, your results
ILO 4	Reflect on the importance of computational thinking and how it applies to the wider world.

Course Content

The course will cover aspects of programming style and functionality, starting from the basics of variables, loops, reading and plotting external data sets, and writing simple functions. The course will use widely used programming language. Geospatial data and maps will be covered, including the benefits and pitfalls of different map projections and techniques for spatial interpolation of data. We will use time series from environmental data to teach techniques in statistical analysis of time series, such as investigating long-term rates and seasonal cycles. Other classes will ensure that students gain the knowledge and practice to assess the significance of their results, to apply best practices to assess and remove outliers, and to understand and quantify uncertainties in their data and results, as well as to fit simple models to the data.

Reading and References (if applicable)

Environmental data analysis with MATLAB, by Menke and Menke, 1st Edition, 2011, Elsevier Geostatistics explained; An introductory guide for earth scientists, by McKillup and Darby Dyer, 1st Edition, 2010, Cambridge University Press

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction to the class and programming skills	4		In-person	Assignment 1
2	Reading external file and plotting time series and histograms	1,2,3,4		In-person	Assignment 2
3	Conditional statements and loops	2; 4		In-person	Assignment 3
4	Map projection and plotting maps	1,2,4		In-person	Assignment 4
5	Continue on geospatial representation and tools	1,2,4		In-person	Assignment 5
6	Catch up week	3,4		In-person	Group discussion
7	Introduction to linear algebra	2,4		In-person	Assignment 6
8	Data analysis: best fitting	1,2,3,4		In-person	Assignment 7
9	Data analysis: correlation and cross-correlation	1,2,3,4		In-person	Assignment 8
10	Data analysis: least squares	1,2,3,4		In-person	Assignment 9
11	Catch-up week: topic of interest	3,4		In-person	Group discussion

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
12	Group work: teaching team available to provide guidance	2,4			Group Discussion
13	Presentation final projects	1,2,3,4		In-person	Individual report and group presentation

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Active learning	You will engage in active learning techniques periodically throughout lectures, and during tutorial sessions.
Independent learning	You are required to show self motivation and initiative in your learning process, such as preparation for tutorials and team work opportunities

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Others([class participation])	2;3;4	2;4	10	Individual		
2	Continuous Assessment (CA): Others([assignments (e.g. term paper, essay)] Continuous Assessment (weekly lab assignments))	1;2;3;4	1;2;3	50	Individual		
3	Continuous Assessment (CA): Others([group or individual projects/evaluations] Final project report)	1;2;3;5	1;2;3;5	30	Individual		
4	Continuous Assessment (CA): Others([presentations] Final project presentation)	1;3;4	1;2;3;4;5	10	Team		

Description of Assessment Components (if applicable)

Formative Feedback

The class will be given feedback after each weekly assignments. You will receive instant feedback during tutorial and labs. In addition, instructors will be available to answer questions regarding your final project at any time.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level

Course Policy

Policy (Academic Integrity)

Policy (General)

General

Students are expected to complete all assigned pre-class readings and activities, attend all classes punctually and take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements. Students are expected to participate in discussions and activities.

Policy (Absenteeism)

Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

Policy (Others, if applicable)

Follow the computer lab rules

These are posted in the lab. Please note the rules, and know that failure to comply by the rules could result in failure of the class and suspension of other privileges. The rules include bringing no food into the lab. Please also make sure that you turn off the wireless mice after you have finished using the computers.

Comment your code

You can never, ever have too many comments in your computer code. Make sure you also take good notes, so that you can come back to your code many years from now and still be able to use it. Also use plenty of whitespace and indentation, so that your code is easy to read.

Label everything

There should be no plots without labels, legend, title, etc. Any missing labels or missing units will result in points deducted on assignments.

Pay attention to units

Everything should be labeled with the correct units. Make sure you know what units you are working in. All units should be SI standard.

Group work

It's ok to help each other, and good to discuss your work together. In fact, people with prior experience can gain

extra credit by helping others.

Just make sure that

(a) You fully understand all your code/calculations by the time you turn it in.

(b) You acknowledge anyone who helped you.

(c) You write up your own reports and homework assigments by yourself.

Compulsory Assignments

You are required to submit compulsory assignments on due dates through the online system. The latest attempt will be the one graded, score will be considered in the course assessment.

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