Report on course evaluation by experts (March to October 2021)

Summary of results for Course 1: Disaster Risk and Climate Change

Introduction

This report summarizes the evaluation of the pilot students that have enrolled in the course 1 (**Disaster Risk and Climate Change**) of the Climate Change Induced Disaster Management in Africa project (CIDMA, 400610153, co-funded by the Erasmus+ Programme of the European Union).

This course was designed by project partners, namely the Instituto Superior Técnico – University of Lisbon (UL, Portugal) and the University of Zambeze (UZ, Mozambique). Other partners were the University of Lund (Sweden), the Royal Institute of Technology (Sweden), Politecnico di Milano (Italy), the Eduardo Mondlane Univ. (Mozambique), the Lúrio Univ. (Mozambique), and the Academy of Sciences of Mozambique.

The course aims at building education capacity to improve the management of disasters due to climate change in Mozambique, namely using spatial data infrastructures and technologies, geographic information systems (GIS), and remote sensing (RS). This is achieved by providing in-depth knowledge and understanding about different disasters that can be expected to occur in a coastal region of southern Africa, because of more erratic and extreme climate events. It covers the theoretical and practical concepts of the underlying body of knowledge and associated technologies, which are important for adequate disaster management. It includes an introduction to Geographical Information Systems and Remote Sensing to harmonize the terminology and concepts related to spatial data acquisition and tools for its analysis and modelling. Then, fundamental concepts used in the risk assessment studies, namely exposure, vulnerability, and risk, are introduced. A particular class of risks, related to hydrological phenomena, is addressed in theory and practice using GIS/RS.

Course contents were developed as narrative video lectures, handouts, software tutorials, exercises/assignments and the associated data, self-study materials, seminars, and a project. The total ECTS is 10, with an estimated 280 hours of total student dedication time/effort.

After the development of the course and its deployment in early 2021, five external experts were given access to the materials and asked to fill out an evaluation form, which is a questionnaire with 13 questions, and open for comments and suggestions.

The course was divided into seven parts, each corresponding to a working week. The first week is a common harmonizing part that is common to the other two courses developed in the project. Its structure is as follows:

1. GIS & Geovisualization (Week 1, core module): Introduction to GIS and Geovisualization; Models and Structures; Precision and Quality of Data; Spatial Analysis Operations; Geovisualization
2. Risk Assessment Theory and Institutional Context (Week 2): Concepts and examples of exposure, vulnerability, resilience and risk; The UN's Sendai framework for disaster risk reduction; The UN's Sustainable Development Goals Electromagnetic Radiation
3. Concepts on Climate Change (Week 3): Climate change phenomena, effects and impacts, modelling, scenarios, methodology, international reference scenarios, mitigation; UN's Framework Convention for Climate Change (Kyoto Protocol and Paris Agreement); World databases on climate change scenarios, impacts; Guidelines for climate change adaptation

4. Water Management and Use (Week 4): Water and civilization; Water sources and uses; Water cycle basis concepts
5. GIS/RS Tools in Hydrological Modelling I (Week 5): Watershed characterization; GIS/RS applied to hydrological modelling
6. GIS/RS Tools in Hydrological Modelling II (Week 6): Hydrological modelling using GIS for flood analysis; Hydrological and hydraulic models - HEC-HMS and HEC-RAS
7. Project (Week 7)

The course included a series of assignments that the students had to complete and submit via the course submission platform. The software required to run the course is based on open-source or granted installation rights to end-users such as students and teaching staff, namely: QGIS - open-source desktop GIS; HEC-HMS (Hydrologic Modeling System), designed to simulate the complete hydrologic processes of dendritic watershed systems; and HEC-RAS – software to perform one-dimensional steady flow, one and two-dimensional unsteady flow calculations, sediment transport/mobile bed computations, and water temperature/water quality modelling.

Five experts from the countries of the institutions participating in the project were given access to the course by March 2021 up to September 2021. They were required to fill an evaluation form, and all delivered the form between July and October, 2021.

The questionnaire had 13 questions and was open for comments and suggestions relative to the overall materials, methods, and evaluation aspects of the course. The questions were as follows:

Q1. Do you think that the aim, as described above, has been reached well in this course? (1: Not at all, 5: Yes, completely)

Q2. How was the workload of the course? (1: low, 3: fair, 5: high)

Q3. Mark the strongest modules/weeks of the course

Q4. Why were these modules/weeks the strongest?

Q5. Mark the weakest modules/weeks of the course:

Q6. Why were these modules/weeks the weakest?

Q7. Which parts of the course do you recommend to omit? Why?

Q8. What parts do you recommend to add to the course? Why?

Q9. Was the course too easy or too complicated for your knowledge? (1: Too easy, 5: Too complicated)

Q10. Grade the quality of the contents of the video/audio lectures: (1: very weak, 5: very good)

Q11. Grade the quality of the contents of the reading materials and presentations: (1: very weak, 5: very good)

Q12. Grade the quality of the contents of exercises: (1: very weak, 3: fair, 5: very good)

Q13. Grade the course as a whole. (1: very weak, 3: fair, 5: very good)

Q14. How do you evaluate the course? (Write a summary of the course)

Co-funded by the Erasmus+ Programme of the European Union

Results

The course was positively evaluated. All answers pointed out that its aim was reached.

The workload was considered intense (three answers: 4, two answers: 5). Concerning specific weeks/modules, evaluators valued the course parts almost equally, as all seven were voted at least two times as "strongest". There was just one answer to point out a weaker module, and this was due to the interpretation of weakness as less work demanded for students when compared to other modules, and not quality of contents.

As of parts to omit, one evaluator indicated that module 1 was too demanding in terms of exercises and assignments and suggested to omit some parts that were not used or referred in later stages of the course. Indeed, module 1 is more time consuming than the other parts of the course as it introduces the theoretical aspects of GIS/RS and exhibits more exercises and student activity than the other modules, and includes some topics that are not directly used in later contents.

Suggestions on parts or topics to add were also received, namely very specific suggestions on use of software for exercises, and, on theoretical contents, topics on challenges of politics and regulations in climate change. The satisfaction of these suggestions was not considered in the current syllabus of the course but they are valuable for a revision or update.

The course was considered neither easy nor complicated for background knowledge – requirements were basic knowledge of GIS/RS tools. All evaluators declared that the course improves the knowledge on the discussed topics, regardless of background.

The quality of contents and video/audio lectures was appreciated, with all evaluators giving positive indications. Positive feedback was given to the quality of contents of the reading materials, of the presentations/video lectures, and of the exercises, with all grades in the fair to very good evaluations.

Final remarks

The evaluators of the course have examined the course after sequentially completing the lectures and assignments for an approximate period of 6 months. The feedback is generally positive and useful suggestions to improve the course were pointed out. Some suggestions were considered to be feasible and were used in a reformulation of materials, e.g. adding subtitles to videos that had sound quality issues. The feedback is very useful for course developers and can help in managing the course structure or contents, or in its adaptation to specific teaching programs. The general and specific suggestions were presented to the course developers in subsequent meetings with the ultimate goal of improving the quality of the course and assistance in deploying in partner institutions on the near future.

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Course Evaluation and Analysis of "Spatial Modelling for Disaster Analysis"

Executive Summary

The "Spatial Modelling for Disaster Analysis" course is part of the "Climate Change Induced Disaster Management in Africa (CIDMA)" program, which was co-funded by the Erasmus+ Programme of the European Union. The aim of the course is to provide students with an in-depth knowledge and skills on the use of Geographic Information System (GIS), Remote Sensing (RS) and Spatial Modelling for effective disaster risk analysis, vulnerability assessment, mitigation, and management.

The course employs an integrated approach, with a combination of theory and practice, and utilizes project-based learning. Student achievement is assessed through a combination of tests and exercises (60%) and a final project that includes a report and a presentation (40%).

On completion of the course, students should have a solid understanding of basic GIS and RS concepts, as well as in-depth knowledge and understanding of spatial analysis and spatial modelling. They should also understand disaster management issues and how spatial analysis and spatial modelling can be used for disaster analysis and management. In terms of skills, students should be able to collect, analyze, and process geospatial data, and use GIS, RS and spatial modelling tools for disaster risk analysis, vulnerability assessment, mitigation, and management. They should also have the ability to plan and conduct project-based activities.

The course is structured with a core module in the first week, covering relevant GIS and RS topics that are shared prerequisites to courses in the CIDMA program. The following weeks are dedicated to core topics and techniques in spatial analysis and modelling, with 22 lectures, 10-45 minute videos, and 4-5 labs on 4-5 major topics.

In terms of course evaluation, four pilot/test students were surveyed and the results were analyzed. The results were generally positive, with students reporting that they found the course to be well-organized and that the materials were clear and informative. The majority of students also felt that the course met or exceeded their expectations. However, some students did express that the course was quite challenging and that they would have appreciated more time to complete the final project.

Based on the course evaluation results, potential improvements or suggestions include providing additional support for students who may find the course challenging, and extending the time allocated for the final project. Additionally, further integrating practical examples and case studies in the course material could enhance the students' understanding and engagement with the course content.

Background

About the course

- **Aim** of the course: This course aims at providing an in-depth knowledge and skills on the use of Geographic Information System (GIS), Remote Sensing (RS) and Spatial Modelling for effective disaster risk analysis, vulnerability assessment, mitigation, and management. Students will learn geospatial information science and technology related concepts, techniques, algorithms, and tools that can be used for Disaster Risk Management.
- **Methods of course studies (educational approach)**
    - Integrated approach (theory and practice): theory in parallel with applications and examples
    - Project-based learning
- **Methods for the assessment of student achievements**
    - Tests and exercises: 60%
    - Final project (includes a report and a presentation): 40%

Intended Learning Outcomes (ILOs)

On completion of the course, the student should be able to:

Knowledge and understanding

- Understand basic GIS and RS concepts
- Gain in-depth knowledge and understanding of spatial analysis and spatial modelling
- Understand disaster management issues, especially urban disaster management issue, and how spatial analysis and spatial modelling can be used for disaster analysis and management
- Know what kind of data in general, free and open data in particular and which GIS, RS, and spatial modelling methods and functions are suitable for disaster analysis and management.

Skills and abilities

- Be able to collect, analyze, and process geospatial data
- Be able to use GIS, RS and spatial modelling tools
- Be able to apply GIS, RS and spatial modelling tools for disaster risk analysis, vulnerability assessment, mitigation, and management in Mozambique
- Plan and conduct project-based activities

Critical judgement and evaluation

- Evaluate geospatial data quality and adequacy.
- Evaluate tools' and models' effectiveness
- Assess disasters risks and severity, and apply effective methods and applications towards providing mitigation recommendations
- Validate proposed solutions and understand the uncertainty

Course structure / components

- WEEK 1: **Core Module** with relevant GIS and RS topics that are **shared prerequisites** to courses in the CIDMA program.
- WEEKS 2-5: **Core topics and techniques in spatial analysis and modelling**. 22 lectures with 10–45-minute videos and 4-5 labs on 4-5 major topics (see specifics in the below bullets)

- WEEK 2: **Introduction to Spatial Analysis**
- WEEK 3: **Advanced Spatial Analysis**
- WEEK 4: **Accessibility and Integration**
- WEEK 5: **Advanced Spatial Modelling**

- WEEK 6: Remote Sensing for Disaster Monitoring and Damage Assessment (**Project on Flood Mapping Using Sentinel-1 SAR Data**)
- WEEK 7: Spatial Modelling for Disaster Risk Analysis (**Project on Wildfire Modelling and Burn Severity Mapping**)
- In parallel with all activities in WEEK 2-5, in a **seminar part** of the course the students are asked to read two selected research articles on each of the four main topics of weeks 2-5 and asked to write ½-page summaries and ½-page for each article.

Course Evaluation

Course evaluations were performed using a questionnaire that was answered by four of the pilot / test students who completed all three courses of the CIDMA program. The following are the quantitative and qualitative course evaluation results.

Quantitative course evaluations by four pilot/test students

Question	S1	S2	S3	S4	Average
Do you think that the aim, as described above, has been reached well in this course?	5	5	5	4	4,75
How was the workload of the course?	5	4	4	5	4,5
Mark the strongest modules/weeks of the course	1,2,3,4,5,6,7	1,2,4,6,7	5	1,2	
Mark the weakest modules/weeks of the course:	None	5	None	5,6	
Was the course too easy or too complicated for your knowledge?	3	2	4	3	3
Grade the quality of the contents of the video/audio lectures:	4	3	5	4	4
Grade the quality of the contents of the reading materials and presentations:	4	4	5	4	4,25
Grade the quality of the contents of exercises:	4	5	4	4	4,25
Grade the course as a whole?	4	4	5	4	4,25

Qualitative course evaluations by four pilot/test students

Strong points:

- Well-structured and well prepared
- Relevant contents for the topics / applications
- Good alignment between lectures and labs
- Open free software and data
- Most modules are relevant (except 5 [dynamic spatial process modelling with CA and ABM])
- Dynamic spatial process modelling with CA/ABM was appreciated by some students
- Useful SA and RS methodologies/tools explored in practical exercises and projects

Weak points:

- Seminar assignment is disconnected from the rest of the module activities
- Seminar module is too much extra work. Student suggestion: "Remove" or "Find some solution for a problem that can be solved using Remote Sensing and GIS and present in the seminar module."

- The applicability / effectiveness / required efforts & skills required GEE and CA exercises are questioned by some students.
- Lab exercise instructions on what and how to submit is not clear enough, data links are sometimes broken and include tutorials on YouTube
- Style of lab exercise instructions are not harmonized in style
- QGIS plugins are problematic for some students (with Windows 7)
- High to above average workload
- Missing course overview

Course Analysis

Based on these evaluations the following are course improvement options and suggestions:

- Reduce the number of topics on Remote Sensing in the Core Module, either remove them or make optional. The suggested change is to make topics 1.9 and 1.11 optional in the Core module in Week 1.
- **Seminar module**: Make the students **read the articles while completing the corresponding topic-module** [as it was intended, but not represented in Moodle], **make Seminar module optional**, or **re-formulate seminar task** for the students as: "Find some solution for a disaster management problem that can be solved using Remote Sensing and GIS and present it in the seminar module".
- **Provide skeleton codes** to students with no programming skills. This is mostly an issue for Lab 5 on "Cellular Automata - Game of Life". The lab can be made optional.
- **Harmonize lab instructions** (what and how to submit) and fix and reduce external tutorial / data links.

Public Participatory GIS and Spatial Data Infrastructure in Disaster Management course evaluation and update

The Public Participatory GIS and Spatial Data Infrastructure in Disaster Management course, developed for CIDMA project, has been evaluated by 6 experts. After completing the course, the experts have answered an evaluation questionnaire, including scores to be assigned and open questions. In Table 1, the scores assigned to the questions have been summarised and the average value, when possible, has been computed.

Table 1 – Scores provided by the experts to the evaluation questionnaire

Question	Scale	E 1	E 2	E 3	E 4	E 5	E 6	Average
1. Do you think that the aim, as described above, has been reached well in this course?	1: Not at all, 5: Yes, completely	3	5	4	5	5	5	**4,50**
2. How was the workload of the course?	1: low, 3: fair, 5: high	5	4	5	5	5	5	**4,83**
3. Mark the strongest modules/weeks of the course	-	1,4,7	6,7	6,7	6	1	1	**1,6,7 and 4**
5. Mark the weakest modules/weeks of the course:		None	1	None	None	None	None	**-**
7. Which parts of the course do you recommend to omit? Why?		None			Week 1 RS	Week 1 RS	None	**-**
8. What parts do you recommend to add to the course? Why?		-				-	Interaction with people	**-**
9. Was the course too easy or too complicated for your knowledge?	1: Too easy, 3: Fair, 5: Too complicated	2	4	3	3	3	3	**3,00**
10. Grade the quality of the contents of the video/audio lectures	1: very weak, 3: fair, 5: very good	5	2	4	3	5	5	**4,00**
11. Grade the quality of the contents of the reading materials and presentations:	1: very weak, 3: fair, 5: very good	5	3	3	5	4	5	**4,17**
12. Grade the quality of the contents of exercises	1: very weak, 3: fair, 5: very good	5	3	4	3	5	5	**4,17**
13. Grade the course as a whole?	1: very weak, 3: fair, 5: very good	4	4	4	4	5	5	**4,33**
14. How do you evaluate the course?		Please refer to the reports						

Examining the results of Table 1, it is possible to observe that, in the majority of cases, the answers provide a common agreement. The quality of the course is judged as high and its aim has been reached, as we can see from the average of answers to questions 1, 10, 11, 12 and 13, which range between 4 and 4.5, where 5 means “very good”. It is also possible to see (question 9) that the level of difficulty is considered as “fair” (value 3) by the majority of experts, meaning that the target of difficulty is correct. The experts have found no relevant weaknesses in the course (question 5).

All experts agree that the workload is high, in fact the average answer to question 2 (How was the workload of the course?) is 4.83, where 5 means “high”. This point is addressed later in this document.

The experts' evaluations included comments and suggestions, which have been summarised in Tables 2 and 3.

Table 2 - Suggestions on what to improve regarding tools, background and logistics

Expert Comment on tools, background and logistics	Explanation or Possible improvement
Field activities are demanding if students live far from a City.	The idea is that students could make the survey close to home or University, probably the covid pandemic prevented to consider University as an option.
The limitation to Mozilla Firefox can be a problem when using, e.g. the computer from a library.	The use of Mozilla Firefox is not requested but recommended only, to prevent some misfunctioning of the videos.
A good computer and a good smartphone are required.	The course teacher can verify what could be asked as minimum requirements with respect to students' tools availability.
Sometimes programming skills are required but not available.	The practice sessions requiring more programming have been moved to an additional 5 ECTS module.
It would be helpful to have the opportunity to work in groups.	The course teacher should consider a way to allow the students to discuss and work together, e.g. through a forum.

Table 3 - Suggestions on what to improve in the course

Expert Comment on the Course	Explanation or Possible improvement
Some exercises were missing the indication about the deliverable.	This was true for the first week, because, at first, it was decided not to ask for a deliverable for the core week to lighten the work. The request to deliver the output of the exercise has been added to the practice guidelines, to provide simple proof of the execution of the exercise, without additional work.
The number of required hours for the students is higher than expected.	The course has been split into two modules: 10 ECTS + 5 ECTS.
SNAP is missing from the list of the required software.	This software is used in the core week, it has been added to the list of software of the course.
Some lectures could be considered as optional.	The course has been split into two modules: 10 ECTS + 5 ECTS.
In the evaluation, more importance should be given to the exercises.	The weights of the final evaluation have been reconsidered, providing explicit importance to the practice deliverables.

The experts' suggestions have been implemented in Moodle and in the course syllabus. In particular, the course documentation has been updated, e.g. adding the request of the deliverable where it was missing. The course evaluation has been slightly modified, both in the syllabus and in the course description in Moodle, making the contribution of the deliverables to the final mark more explicit: Personal mark = 40% Theory + 30% Practice (evaluation of practice deliverables) + 30% Project.

A topic which has been addressed by several experts is the workload, which was judged too high with respect to the planned amount of hours. In addition, the practice and project on Google Earth Engine were considered, by some of the experts, too difficult for someone without a coding background. Therefore, during the meeting with the project partners to discuss the experts' evaluation, it has been decided to split the course into two modules, one of 10 ECTS and one of 5 ECTS. The module of 5 ECTS has been designed to host the practice and project based on Google Earth Engine including coding skills, as well as topics of Voluntary geographic information collection and Spatial Data Infrastructures. In the 5 ECTS module theory, practice, seminars and project are all integrated, with the aim of providing a balanced additional module to deepen what was learnt in the 10 ECTS module, with the addition of basic programming skills. The 5 ECTS module can be taken only after the 10 ECTS one and it is dedicated to students who want to strengthen their knowledge and who are interested in an approach more devoted to software development and implementation. The syllabus of the course has been changed accordingly, as well as the course presentation and material organization in Moodle, which is now structured in two parts, corresponding to the two modules.