



The risk of flood hazards: the hydraulic aspects of rivers

Modules:

Water cycle

**The impact of human
intervention on river ecosystem**

Hydrogeological Risk

River management

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Total duration: 4 hours

Field work: No

List of materials:

PC, beamer (IWB)

Smartphones

Internet

Worksheets: 1

Students' age: 16-18

Use of apps/software: GIS

Brief disciplinary introduction

The Directive 2007/60/EC of the European Parliament and Council of the EU (23/10/2007) establishes a framework for the assessment and management of flood hazards (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060>), aiming at the reduction of the adverse consequences for human health, environment, cultural heritage and economic activities in the Community associated with possible floods. The students will investigate the maps produced and published by Public bodies (central, regional or local authorities) responsible for policy-making regarding flood risk, and will study the hydraulic hazard and risk in their town. The results can be integrated, analyzed and presented using GIS. The hidden rivers are cemented and covered water courses. They determine an increase in water speed and energy and the water flows in a fixed section. These hydraulic aspects explain why the hazard increases in the places where the rivers are covered. Studying the phenomena, it will be easy to understand how the power of the water flow decreases and the hydraulic hazard is reduced when daylighting rivers.



Objective of the learning unit

To learn about:

- ✓ Landscape studies using Math and Physics
- ✓ Hydraulic risk meaning and management
- ✓ Risk and hazard
- ✓ Covered rivers

To be able to:

- ✓ Work in groups
- ✓ Plan a scientific experiment
- ✓ Use devices
- ✓ Retrieve public thematic spatial information from cartography.

Introduction (orientation)

Time estimated: 30 minutes

Where the activity takes place: in the classroom, using PC, beamer and Internet

Method (how the students have to work): class brainstorming

Instructions for the teacher:

1) Introduction to the topic

The hazard maps are the representation of the hydraulic model of terrain and the blue area represents where the water could move in case of flood.



a) Search on the web for national maps of hydraulic hazards.

Greece

<http://floods.ypeka.gr/index.php/xartes-kindynoy> (for hazard maps of Greece)

Spain

<https://www.miteco.gob.es/es/agua/temas/gestion-de-los-riesgos-de-inundacion/mapa-peligrosidad-riesgo-inundacion/> (for hazard maps of Spain)

Italy

<http://www.adbcampaniacentrale2.it/psai-cartografia/> (for hazard maps of Sarno)

(Ex: http://www.adbcampaniacentrale2.it/documenti/psai/ri/RI_448163.jpg)

<https://geodata.appenninosettentrionale.it/mapstore/#/viewer/openlayers/988>

Turkey

[http://www.dsi.gov.tr/docs/sempozymlar/ta%C5%9Fk%C4%B1n-strateji-eylem-plan%C4%B1-kapsam%C4%B1nda-dsi-%C3%A7al%C4%B1%C5%9Fmalar%C4%B1-\(y-darama\).pdf?sfvrsn=2](http://www.dsi.gov.tr/docs/sempozymlar/ta%C5%9Fk%C4%B1n-strateji-eylem-plan%C4%B1-kapsam%C4%B1nda-dsi-%C3%A7al%C4%B1%C5%9Fmalar%C4%B1-(y-darama).pdf?sfvrsn=2)

b) Show the map to the students and find the school's position on them. The map legend gives a visual explanation of the symbols used on the map. The legend will show the situation, as it is known and used by the authorities administrating the territory.

Conceptualization

Time estimated: 30 minutes

Where the activity takes place: in the classroom

Method (how the students have to work): group-work or single students

Instructions for the teacher:

The students, divided in groups, discuss about the information they have from the maps and on how they can use it to evaluate the risk and the consequence of flood.

As an example, the students could identify an area that would be the most suitable place to build a school, considering that it is a highly vulnerable structure.

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Investigation

Time estimated: 60 minutes

Where the activity takes place: in the classroom and outdoor

Method (how the students have to work): group-work or single students

Instructions for the teacher:

In the classroom, the students are divided in groups.

1) Planning

In the classrooms show the hazard map. To better conduct the activity, it is suggested to read the legend and some explanation texts related to the maps.

For instance, initially the activity should stress the difference between risk and hazard.

“The risk is represented by the possibility that a natural phenomenon or an event induced by human activities may cause harmful effects on the population, housing and facilities and infrastructures, within a particular area, in a given period of time. Therefore, risk and hazard are not the same thing: the hazard is represented by the calamitous event that can hit a certain area (the cause), the risk is represented by its possible consequences, i.e. the damage that may be expected (the effect)”.

To assess a risk, therefore, it is not enough to know the hazard, but we must carefully evaluate the elements of the territory that may be involved in an event, and their vulnerability.

The risk can be translated into the formula:

$$R = H \times V \times E$$

H = Hazard: the probability that a phenomenon of a certain intensity will occur over a certain period of time, in a given area.

V = Vulnerability: the vulnerability of an element (people, buildings, infrastructures, economic activities) is the propensity to suffer damage as consequence of the stresses induced by an event of a certain intensity.

E = Exposure or Expected Value: is the number of units (or "value") of each element at risk placed in a given area, such as human lives or settlements."

2) Performing and analyzing

- a) From the website indicated above in the introduction section, download the map of the hazard and/or risk and introduce it to the students.
- b) Ask some questions about the territory to involve the students in the analysis of the map with their personal devices, then ask the question:
"Do you recognize a relation between the landscape structure and the distribution of the risk/hazard?"
- c) The students in groups will study a specific part of the territory to identify the most important elements in the area in order to define the level of risk. For examples: hospital, schools, police stations....
"What are the changes in the velocity and energy of the water flow when a river is hidden?"
Use Worksheet 1

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Conclusion

Time estimated: 60 minutes

Where the activity takes place: in the classroom

Method (how the students have to work): group-work

Instructions for teacher:

The students think about useful solutions to reduce the risk in the areas. I.e.: displacement of important structures, decreasing the danger by raising the height of river banks or uncovering the watercourse, raising up the entrance of buildings.

Each group writes a note about their research and explain the result using images projected in the class.

Discussion

Time estimated: 60 minutes

Where the activity takes place: in the classrooms

Method (how the students have to work): class discussion

Instructions for teacher:

The discussion can be animated with these questions:

"When was the last flood?"

"What do you know about that event?"