GEOSCIENCE FOR LEAVING CERTIFICATE GEOGRAPHY

Continuing Professional Development Course 2021

SEISMIC ACTIVITY MODULE

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iCRAG
SFI RESEARCH CENTRE IN APPLIED GEOSCIENCES

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

An Roinn Comhshaoil, Aeráide agus Cumarsáide
Department of the Environment, Climate and Communications

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Module plan: Seismic activity

Contents

Module plan: Seismic activity

Links to curriculum

Core unit 1 Tectonic cycle

- Seismic activity and measurements of seismic activity
- Tsunami activity national and international level
- Causes and effects of seismic activity

Core unit 1 Landform development

- Mass movement in the form of submarine landscapes-
- How the 18th century tsunami impacted Ireland.

Core unit 1 Human Interaction

Learning Outcomes

Students should be able to:

- Understand the causes of seismic activity.
- Understand how seismic activity can be measured.
- Understand how we measure seismic activity in Ireland.
- Understand earthquake damage and the effects of earthquakes.
- Understand what is meant by a tsunami and the causes of.
- Develop an understanding of international examples of tsunamis and the effects.
- Understand how seismic activity is measured off the coast of Ireland.
- Understand the historical impact of seismic activity off the Irish coast- examples of earthquakes that have affected coastal landforms.
- Understand the ways a tsunami could possibly happen off the coast of Ireland in the future.
- Understand the impacts of a tsunami in the cork harbour and coastal area.

Keywords and definitions

Seismology	The study of earthquakes.
Seismologist	A person who studies earthquakes.
Seismic belt	An area of earthquake activity, mainly found at plate boundaries.
Convergent boundary	Where plates collide, also known as destructive boundaries.
Divergent boundary	Where plates separate, also known as constructive boundaries.
Transform boundary	Where plates slide past each other, also known as conservative boundaries.
Focus	Point beneath the surface at which an earthquake starts.
Epicentre	The point directly above the focus on the earth's surface, where most damage occurs.
Fault lines	A large fracture between two blocks of rocks.
Escarpment	An area separating two level land surfaces that occur as a result of faulting.
Fracking	The process of drilling down into the earth before a high-pressure water mixture is directed at the rock to release the gas inside.
Quarrying	The process of extracting rock from the earth's surface.
Fissures	A small-scale fracture in rock.
Seismometer	An instrument used to measure earthquakes.
Magnitude	The strength of an earthquake.
Population density	The number of people per square kilometre.
Geology	The study of the earth, it's composition and processes relating to and acting upon it.
Liquefaction	The process of turning something liquid.
Tsunami	A large tidal wave.
Contamination	The action or state of making or being made impure by polluting or poisoning
Submarine landslide	Mass movement of sediment across the continental shelf into deeper water
Continental shelf	Area of seabed around a land mass where the water is relatively shallow.
Pyroclastic flow	A fast-moving flow of volcanic material ejected during an eruption, can contain lava, ash, rock etc.
Caldera	Volcanic crater caused by the collapse of the mouth of a volcano.
Mega tsunami	Very large wave caused by displacement of water in the ocean- waves of 50m + at source.

Learning activities

- Video clips – questionnaires
- Project development
- GIS – maps
- Field trip

Extra info and files

All info and files are attached in the PowerPoint presentation.

- https://www.researchgate.net/publication/323199042_The_1755_Lisbon_Earthquake-Tsunami_and_the_West_Cork_Coast
- https://www.dias.ie/2010/10/19/geophyicsrobertmallet/?option=com_content&view=article&id=3961:geophysicsmalletbook&catid=148
- https://www.insn.ie
- https://www.usgs.gov/faqs/can-nuclear-explosions-cause-earthquakes?qt-news_science_products=0#qt-news_science_products
- https://shakenet.raspberryshake.org/#?net=AM&sta=RF7A3
- https://sea-seis.ie/2018/08/08/project-sea-seis/
- http://geoserver.iris.edu/stations/view/SIE#zoom=3&lat=44.18516&lon=-25.26855&layers=TFFBFFFFFFFFFF
- https://www.ga.gov.au/scientific-topics/community-safety/tsunami
- https://www.gsi.ie/en-ie/geoscience-topics/natural-hazards/Pages/Tsunami.aspx
- https://www.gsi.ie/en-ie/geoscience-topics/natural-hazards/Pages/Tsunami.aspx
- https://imarl.ie/about/
- https://www.gsi.ie/en-ie/programmes-and-projects/geohazards/activities/Pages/Irish-National-Seismic-Network.aspx
- https://www.mdpi.com/2076-3263/10/6/226/htm
- https://www.valleyrovers.com/news_detail/368057/
- http://www.deepmapscork.ie/past-to-present/climate/1755-lisbon-earthquake-tsunami-west-cork-coast/
- https://www.gsi.ie/en-ie/programmes-and-projects/geohazards/activities/Pages/Tsunami-Hazard-and-Response.aspx

Videoclips

- https://youtu.be/JypTLDLABzM
- https://youtu.be/13TEKNP7lBY
- https://youtu.be/ILlyfwDwJVs
- https://youtu.be/AXHN14IHtLY
- https://youtu.be/feXClfatJYo
- https://www.rte.ie/archives/2019/0617/1055768-east-coast-earthquake/
- https://youtu.be/Ht0W2E9g8cA
- https://youtu.be/zqcdeMmJy1E
- https://youtu.be/N0lN_f4JijE
- https://youtu.be/Nomlo8X58PY

Resources provided

- PowerPoint

Materials needed

- iPad or computers
- Google classroom – access to links
- A2 paper
- Printers
- Shoe box
- Markers
- Strips of paper
- Elastic bands
- Foam

Methodologies

- Talk and discussion
- Use of open questioning- higher order
- Guided and discovery learning- investigation
- Collaborative learning- peer assessment

Assessment

- Self-assessment – evaluation worksheet
- Teacher observation – project development
- Teacher questioning – higher and lower order questions.

Linkage and Integration

Linkage

- Numeracy – problem solving
- STEM – I.T. Research. Use of PowerPoints for presentation.
- Art – labelled diagrams.
- S.P.H.E. – working together co-operatively
- Literacy – writing of project.
- English- presentation
- History- local history

Differentiation

- Through question
- Worksheets
- Support
- Tasks

Teacher Notes

Introduction to teacher notes

At this stage, students would have already studied the tectonic cycle. They should be aware of the global distribution of the different types of plates- divergent (both oceanic crust (o)/oceanic crust – focus on the North American and Eurasian- and continental crust (c)/continental crust- focus on the African Rift Valley), convergent (o/o, c/c and o/c), and transform. This may form part of the project that the students will develop as the module progresses.

Lesson one: causes of seismic activity

Learning outcome:

- Understand the causes of seismic activity.

This will take part the format of recapping what is meant by the term earthquake and revising the different plate boundaries.
The use of visual images and animations can be used here.
Possible questions: use both higher and lower order question as a form of differentiation based on student ability.

An experiment from https://www.mtu.edu/geo/community/seismology/learn/earthquake-cause/ Can be used also.

Students will then look at the further causes of earthquake activity such as human interaction. This will take the form of discussion and use of visual imagery (all sources credited in the PowerPoint attached).

Students will then look at natural processes as a cause. Volcanic eruptions and mass movement.
If students want to develop a better understand of volcanic eruption earthquakes- http://www.mshslc.org/activity/volcano-seismicity/ .
In class students will watch the following video clip:
https://youtu.be/JypTLDLABzM discussion or work sheet will follow.

Students will look at human activity as a cause- a brief discussion on this should occur- this can be done using the visual image in the PowerPoint as a starting point- asking students what they might already know about these activities and how they might cause seismic activity. Student or groups will then be assigned one to research.

Activity:
Students will start the project: this can be done as a group project or as an individual assignment.
The aim at the end of the module would be to present the work to the class.
Task one is too research and develop a PowerPoint or info graph on the causes of seismic activity.
This will be added after each lesson. Research can be done during class time and as part of a homework assignment.
Students should first state what is meant by seismic activity.
List the different causes of seismic activity.
Briefly explain the causes. Focus on plate tectonics and how either convergent or transform boundaries create earthquakes. Focus on one of the natural process causes in a bit more detail. One of the human causes.

Lesson two: measurement of seismic activity

Learning outcomes:

- Understand how seismic activity can be measured.
- Understand how we measure seismic activity in Ireland.
- This lesson will start off with a recap of the previous lesson. Key terms will be checked through higher and lower order questioning. This can be differentiated based on student ability. Students will have a opportunity to ask questions about terms they still feel unsure on and hear oee4 responses and explanation of the key terms. Later in the lesson as the activities are taking place the students project work can be checked up on too.
- Next student will look at the concept of what is a seismometer. This will be done looking a visual Imagery and a short video clip.
- A map will then be used to show where seismometers are located both internationally and at a more local level.
- The different scales will then be looked at. The three scales that are focused on make up part of the leaving cert geography course. Richter scale, Mercalli scale, moment magnitude scale.
- How earthquakes are predicted will form then next part of the lesson. Students will be asked do they know how earthquakes are predicted before going through how scientists can help determine when an earthquake can occur.

Activities:

There are three activities linked to this lesson.
Take a trip to the local primary school where a seismometer might be present.
Make a seismometer.
As part of the project- talk about what is a seismometer.
Look and where they are located both in Ireland and abroad.
Why do you think they are located here?
Pick one of the scales mentioned and write up how they work.

Activity one would work well in areas that are located close to primary schools with seismometers. A list can be found here:

Activity two: involves using a shoe box, strips of paper and elastic bands. The ideas is to show the basic idea behind how a seismometer can pick up vibrations of movement.

Activity three: again, the research project is the main way in which students will be assessed in this module. Building on the project after every lesson allows the students to focus on key elements of each lesson and help to further the understanding and knowledge of the topic.

Lesson three: earthquake damage and the impact of earthquakes

Learning outcome:

- Understand earthquake damage and the effects of earthquakes.

The class will start with a recap of the previous lesson, looking at key terms.
Students will then be asked a question- what factors might lead to earthquakes being more or less destructive in different areas.
After putting together a discussion board the different factors will be discussed in more detail through the use of visual imagery and different case studies. i.e. Haiti and Japan.

Students will then look at the concept of both short- and long-term impacts in relation to earthquakes. These will be looked at in relation to the social, economic, and environmental. These will form the structure of the next part of the student project. See the activity below.

Class work activity:
You are a county councillor or emergency services worker.
think of the impacts from the perspective of the character/role they are playing?
Write down your answers.
Discuss with the person next to you.
Discuss with the class group.

Activity: project work
When did this earthquake occur?
Where did this earthquake occur?
Why did this earthquake occur?
What was the measurement of this earthquake?
Look at the impacts this specific earthquake had- look at this under the headings short term and long-term impacts in relation to social, economic and environmental impacts.

Lesson four: tsunamis and the causes of

Learning outcomes:

- Understand what is meant by a tsunami and the causes of
- Develop an understanding of international examples of tsunamis and the effects.

The class will begin with a discussion board- if opened in explain everything the board can be written on using a interactive pen and saved as a pdf form of the presentation.
Students will be asked to name all the points they know about tsunamis and what causes them.

Students will look at the different causes of tsunamis. This will be done through video links and discussion after each one.

The lesson will then move on to how a tsunami occurs looking at the 5 stages-

What activated the tsunami? Cause
How did it build up?
The formation.
How it changed as it approached the shore.
The impact once it hit the shoreline. Destruction.

Finally, students will be Introduced to the idea of a tsunami effecting an Irish coastline. In preparation for the next lesson.
Activity: project work
When did this tsunami occur?
Where did this tsunami occur?
What caused this tsunami to occur?

What were the short-term and long-term impacts of this tsunami on the area? Look at this under the headings social, economic, and environmental impacts

Lesson five: the impact of seismic activity in Ireland

Learning outcomes:

- Understand how seismic activity is measured in Ireland.
- Understand the historical impact of seismic activity off the Irish coast- examples of earthquakes that have affected coastal landforms.
- Understand the ways a tsunami could possibly happen off the coast of Ireland in the future.
- Understand the impacts of a tsunami in the cork harbour and coastal area.

The lesson will start with a discussion board where the students are asked to think about is Ireland effected by seismic activity.

Once students have discussed what they know they will be introduced to the iMarl deep ocean listening project through the about page, found in the link attached to the PowerPoint.
The first activity of the lesson involves the students researching the project on the website.

Students will next be introduced to the concept of seismic activity in Ireland and the historical impact of this on the Irish coastline.

Students will look at the Irish plan for tsunami impacts.

Activity:
This is the final aspect of the project.
Students are asked to look at tsunamis that have affected the Irish coast.
Look at:
When they occurred.
What was the cause.
What was the impact on the Irish coastline?
Students are then asked to research the Irish tsunami action plan.
Students are asked to look at other factors that may cause a tsunami on the Irish coast and what might be the impact on their local area.
Students will then be allocated class time to present their individual or group project.