OCEAN NETWORKS CANADA

Ocean Sense
Program

Lesson 3

Module:

Waves of Knowledge

Time:

30 minutes

Learning pillars:

- Ocean science
- Data exploration

Grade & curriculum connection:

- **BC Science 8**
  "The theory of plate tectonics is the unifying theory that explains Earth's geological processes."

Created in partnership with:

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A UNIVERSITY OF VICTORIA INITIATIVE

Earthquake Data

Examine real data with Ocean Networks Canada's interactive earthquake data dashboard. Meet some of the scientific instruments providing critical information about earthquakes that are part of the NEPTUNE major observatory, a Canadian subsea fibre optic cabled network of sensors operated by Ocean Networks Canada.

Earthquakes originate at an epicentre and their size can be measured and compared by the **magnitude** ranking system. In order to provide accurate information about earthquake event timing, scientists use **Universal Coordinated Time (UTC)**. **Accelerometers** and **seismometers** are two instruments that provide data about earthquakes.

Learning objectives

- Observe, measure, and record data with accuracy and precision.

Materials

- Computer with internet connection
- Projector and screen
- Slide deck: **Waves of Knowledge (bit.ly/SlidesWOK)**
- Internet connected device for small groups of students
- Worksheet: Earthquake Data Dashboard Exploration
- Access to the **Earthquake Data Dashboard (bit.ly/oncearthquakedata)**

Teacher preparation

- Preload the slide deck: **Waves of Knowledge (bit.ly/SlidesWOK)**
- Copy the worksheet *Earthquake Data Dashboard Exploration*

Classroom instructions

Hook

1. Share slide 32 and ask students what they see, think, and wonder as they view the image (Harvard Graduate School of Education, 2022). Define the prompts as follows:
    a. See is objective, common knowledge that everyone can agree on.
    b. Think is subjective, what you think based on your opinion.
    c. Wonder is subjective, in the form of a question based on your thoughts.
2. Record their responses to the prompts to come back to at the conclusion of the lesson.
3. Share that the image is a screenshot of Ocean Networks Canada's earthquake data dashboard. Guide the students to notice the following:
    a. Each red circle represents an earthquake.
    b. The centre of each circle is approximately the epicentre of the earthquake.
    c. The size of the circles represent the magnitude of the earthquake.
    d. Tectonic plates are shown in light blue.
    e. Earthquakes occur all around the world, with particular concentration at tectonic plate boundaries.

Step-by-step process

4. Share slides 33–36 to show how the data dashboard features the magnitude, date (in UTC), location, and signal of earthquakes.
5. Share slide 37 to show the **NEPTUNE** network, which is the data source for the earthquake data dashboard.
    a. Note the location of the Endeavour in the bottom left area of the image as this subsea station will be referenced in the worksheet.
6. Share slide 38 with the shortened url for the earthquake data dashboard. Invite the students to use their internet connected devices to explore the dashboard. The dashboard will work on phones, tablets or desktop browsers.
7. Complete the worksheet, *Earthquake Data Dashboard Exploration.*
8. Share slides 39 and 40 to show two of the instruments that gather the data.
9. Return to the questions students asked as part of the see, think, wonder during the lesson hook. If students came up with questions which were not answered during the lesson, we invite you to email them to learning@oceannetworks.ca.

Modifications and adaptations

- Complete the worksheet *Earthquake Data Dashboard Exploration* as a whole class or small group assignment.

Final remarks to the educator

The interactive earthquake data dashboard allows users to explore recent earthquakes near Vancouver Island and around the world. Strong magnitude earthquakes are displayed on a world map with corresponding waveform data recorded from Ocean Networks Canada's offshore seismic monitoring stations.

Assessment

- What are some important aspects of earthquake data?

Extensions

- Invite students to convert UTC to their specific time zone.

Glossary

Accelerometer: Measures the acceleration, or rate of change in velocity, of an object.

Magnitude: A ranking system used to measure and compare the size of earthquakes.

NEPTUNE: North East Pacific Time-series Undersea Networked Experiments is approximately 850km of subsea fibre optic cable that provides power and Internet connectivity to thousands of sensors. High resolution, continuous, free, open data from these sensors can be accessed via ONC's digital infrastructure Oceans 3.0.

Seismometer: Detects movements in the Earth's surface.

UTC: Universal Coordinated Time; the global standard of reference for current time across the globe. UTC is particularly useful for international communication and scientific research.

References

Harvard Graduate School of Education. (2022). See, Think, Wonder. https://pz.harvard.edu/resources/see-think-wonder

Name: _____

Earthquake Data Dashboard Exploration

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1. Use Ocean Networks Canada's **Earthquake Data Dashboard (bit.ly/oncearthquakedata)** to find the following:

	Magnitude	Data	Time (in UTC)	Location
The largest earthquake				
The smallest earthquake				
The earthquake closest to us				
The most recent earthquake				
The oldest earthquake				
The most interesting earthquake to you				

2. Using your responses from #1 above, why do you think the smallest earthquake is above a magnitude of 4?

_____

_____

_____

3. Using your responses from #1 above, why do you think the oldest earthquake is no older than one year ago?

4. Looking closely at the distance from ONC's subsea station at Endeavour, pick five different earthquake events and use them to fill in the table. You may find the map view helpful in selecting earthquakes that are greater than and less than 6,000km from Endeavour (KEMO). Record your observations with as much detail as you can. The first one has been done for you as an example.

	Distance to earthquake from Endeavour (KEMO)	Magnitude	Date	Location	Notes on the signal shown in the column "ONC Data Gathered for the Selected Earthquake"
Distance to Endeavour (KEMO) is GREATER than 6000km	12,338	6.3	June 7, 2025	212 km WSW of Riverton, New Zealand	The signal is very "wiggly" and it's hard to see the start and finish of the earthquake. All four receivers have similar signals.
Distance to Endeavour (KEMO) is LESS than 6,000km					

5. Using your responses from #4 above, how do the signals compare from earthquakes that are greater than and less than 6000km from Endeavour (KEMO)? What might you conclude about the relationship between earthquake signals and the distance from ONC's subsea stations?

6. How does the Earthquake Data Dashboard tool help you answer this question:
How do people observe, experience, and share information about major geological events of local significance?

Answer Key

1. Charts 1 + 4: ANSWERS WILL VARY
2. The Earthquake Data Dashboard only shows earthquakes that are greater than or equal to a magnitude of 4.0. This is because earthquakes happen all over the world every single day without catastrophic damage. The dashboard shows earthquakes are more likely to be felt by humans.
3. The Earthquake Data Dashboard only shows earthquakes in the past year in order to make it easier to navigate.
5. Earthquakes that are closer to NEPTUNE have a clearer signal because the waves are closer to the scientific instruments.
6. Answers will vary. Earthquake data can include the time, location, and magnitude. This helps us learn more about earthquakes which may contribute to better safety precautions for humanity.