

“Measuring Earthquakes in Turkey”

The lesson plan was developed according to Turkey’s national curriculum

School level: Middle school

Grade, age of students: 8th grade, 13-14 years old

Approx. time needed: 135 minutes (3 Courses)

- Orientation phase: 15 minutes
- Conceptualization phase: 30 minutes
- Investigation phase: 45 minutes
- Conclusion: 45 minutes

Domain: Science

Sub-domain: Earthquake and Weather Cases / Earth and Universe

Classroom organization: Teams of 3-4 students

Students Gains:

- Students know the basic principles of earthquakes.
- Students measure earthquakes using data provided for them.

Science Process Skills:

- Students interpret data from seismogram.
- Students understand the pattern and relations from the findings obtained.

Means and materials:

For each student:

- Student Worksheet (you can find an indicative worksheet in the appendix)
- Seismogram paper

Activities description:

Orientation phase

If an earthquake occurred not a while ago, you can ask your students to mention experiences (what they felt, what and how they think it happened) or you can show a video or news broadcast about an earthquake event. After that you can ask the following questions: “Do you think earthquakes occur only in Turkey?” “Where do you think other earthquakes might occur and why?” “Why do you think we have so many earthquakes in Turkey?” “Do you know how scientists can measure the earthquakes?” “What kind of equipment and tools they use to determine the earthquakes?”. You

can have your students map their ideas about earthquakes and present some of them to the other students.

Conceptualization phase

In this phase, you can give information about tectonic plates, magnitude, intensity, earthquake focus, epicenter, faults, seismic waves and seismographs. You can have the students ask questions based on their observations, or if they are not familiar with the procedure, you can raise some of the questions. For example: “Where do earthquakes occur in relation to the tectonic plates?” “Why? (Observe the earth’s layers)” “Do you think the morphology of the places that earthquakes occur (plates boundaries) is the same everywhere?” “What do you think are the differences/similarities and why?” You can have your students add their ideas on their concept map.

Investigation phase

Each team works cooperatively to use seismogram paper. Each student use a work sheet that is provided in the appendix (you should adjust the work sheet according to your students’ needs and knowledge about the concept of the lesson and the processes of inquiry). Students label and describe types of seismic waves on the seismogram. Students also work like a seismologist. They observe and interpret data. Students determine the epicenter and magnitude of the earthquake.

During this phase, the teacher must have a guiding role. You can stop the teams when there is a need to discuss something altogether or you can add specific points to the working sheet so that students will know when they must stop and have a conversation with the whole class or call the teacher for a discussion within the team.

Conclusion phase

Students compare the data they collected during the previous phase with their concept map (initial ideas). They can add/delete/adjust (with a different color) what they have learnt and present it to the classroom (they can also do the same thing after they listen to all the teams or you can have a classroom concept map and teams can add to that).

Useful information for the teacher:

- The lesson plan was developed according to inquiry – based learning (you can find more about it in the Intellectual Output 1 of the SSE project)
- If your students are not familiar with inquiry you can follow a more structured type (e.g. give specific roles to the students of each team, have more structured activities during the investigation phase: provide them data, words they can use to explain certain things, examples, ways to organize their data)
- If they are familiar with inquiry and /or the concept you can choose a more open type of inquiry (e.g. they can organize their data in a form they choose is best)

The teachers can get further information about the earthquakes using the links below:

- <http://earthquake.usgs.gov/learn/topics/>
- <http://www.usgs.gov/>
- <http://scedc.caltech.edu/Module/module.html>
- <http://www.livescience.com/topics/earthquakes/>

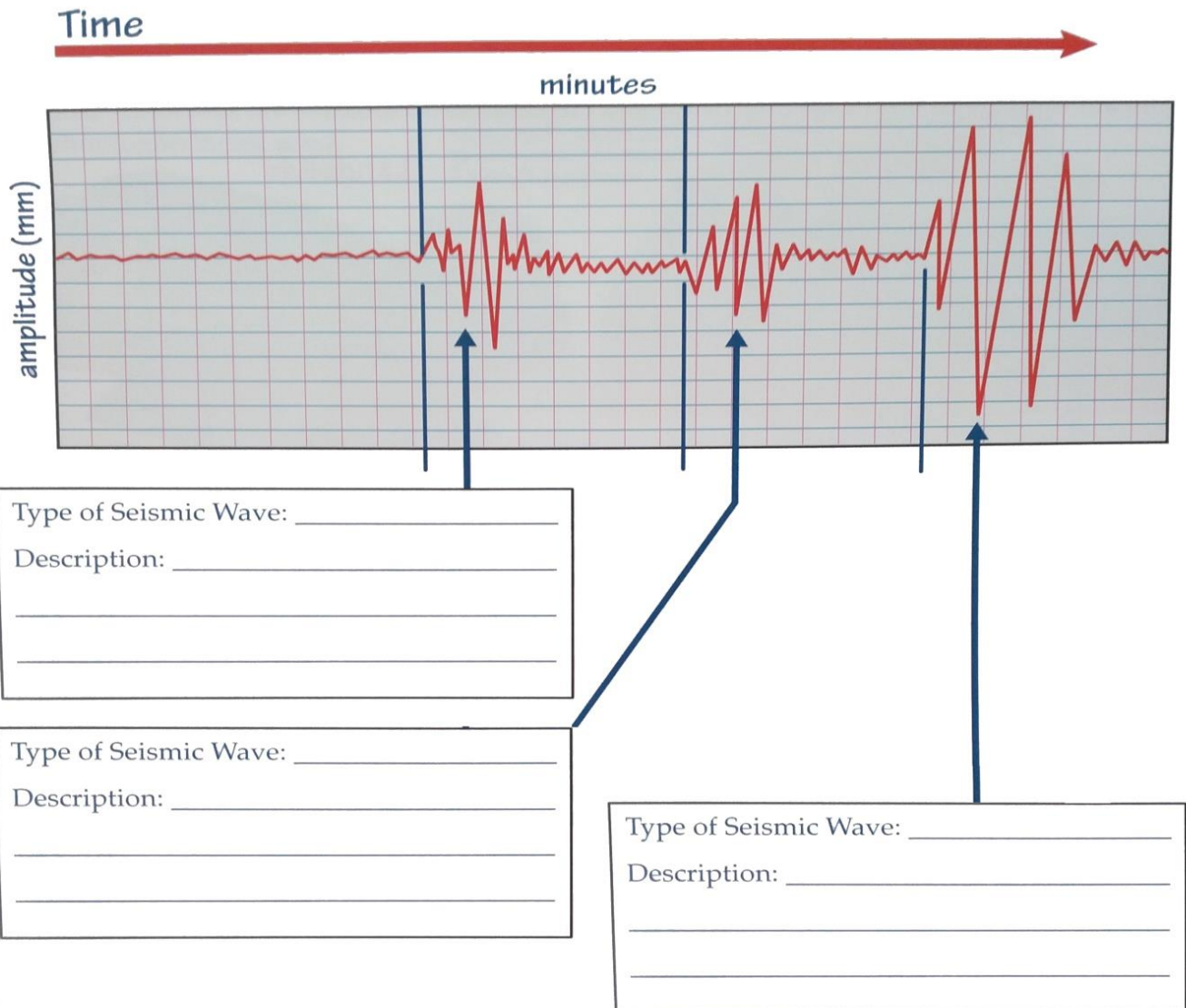
Appendix

Work sheet (investigation phase)

Seismogram paper

Pause and Review

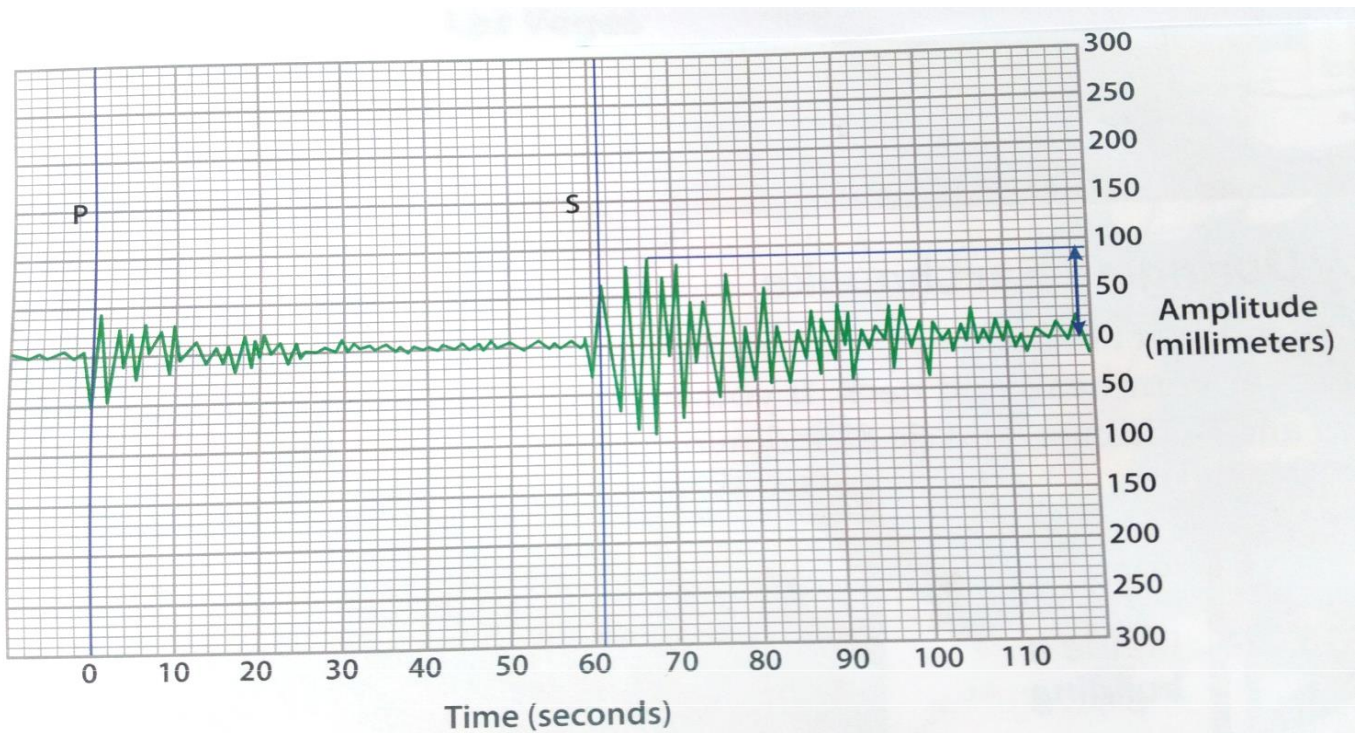
Label and describe the three types of seismic waves on this seismogram.



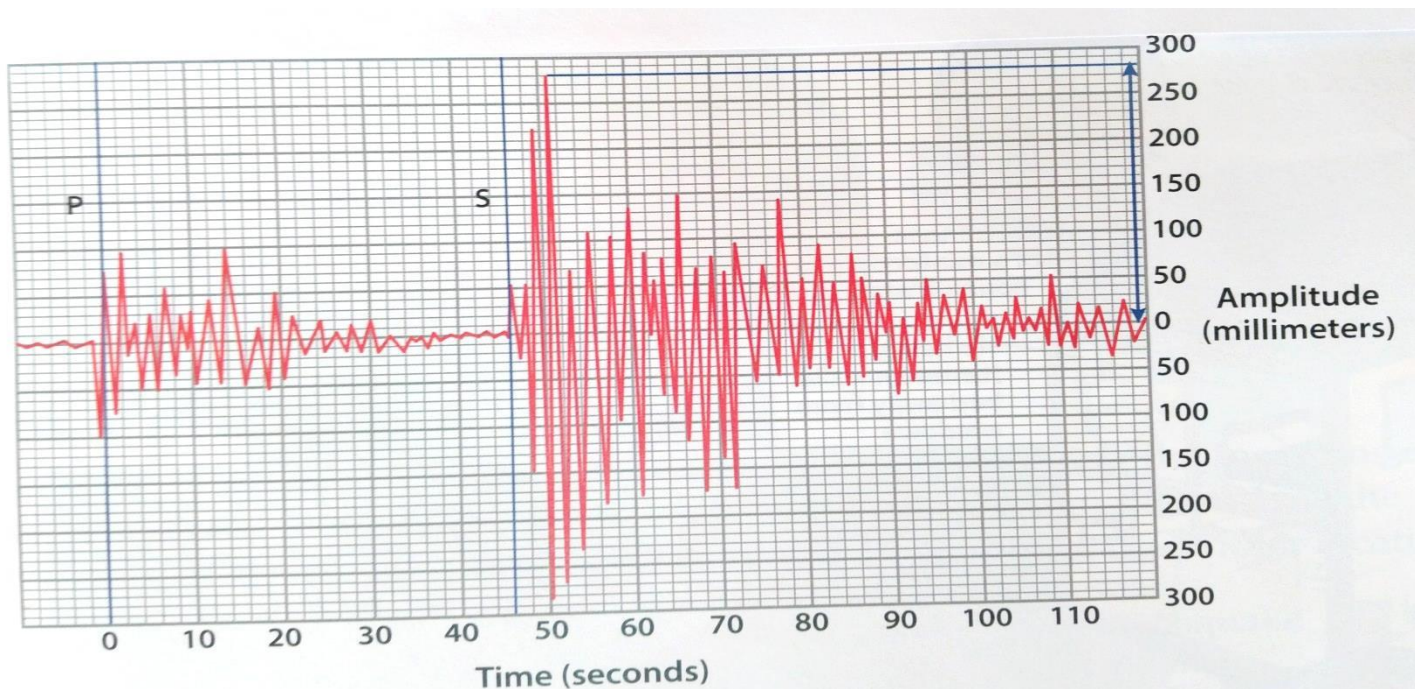
Observation & Data Collection

Study the seismograms. Determine the **S-P interval** for each seismogram. Add the data to the data table.

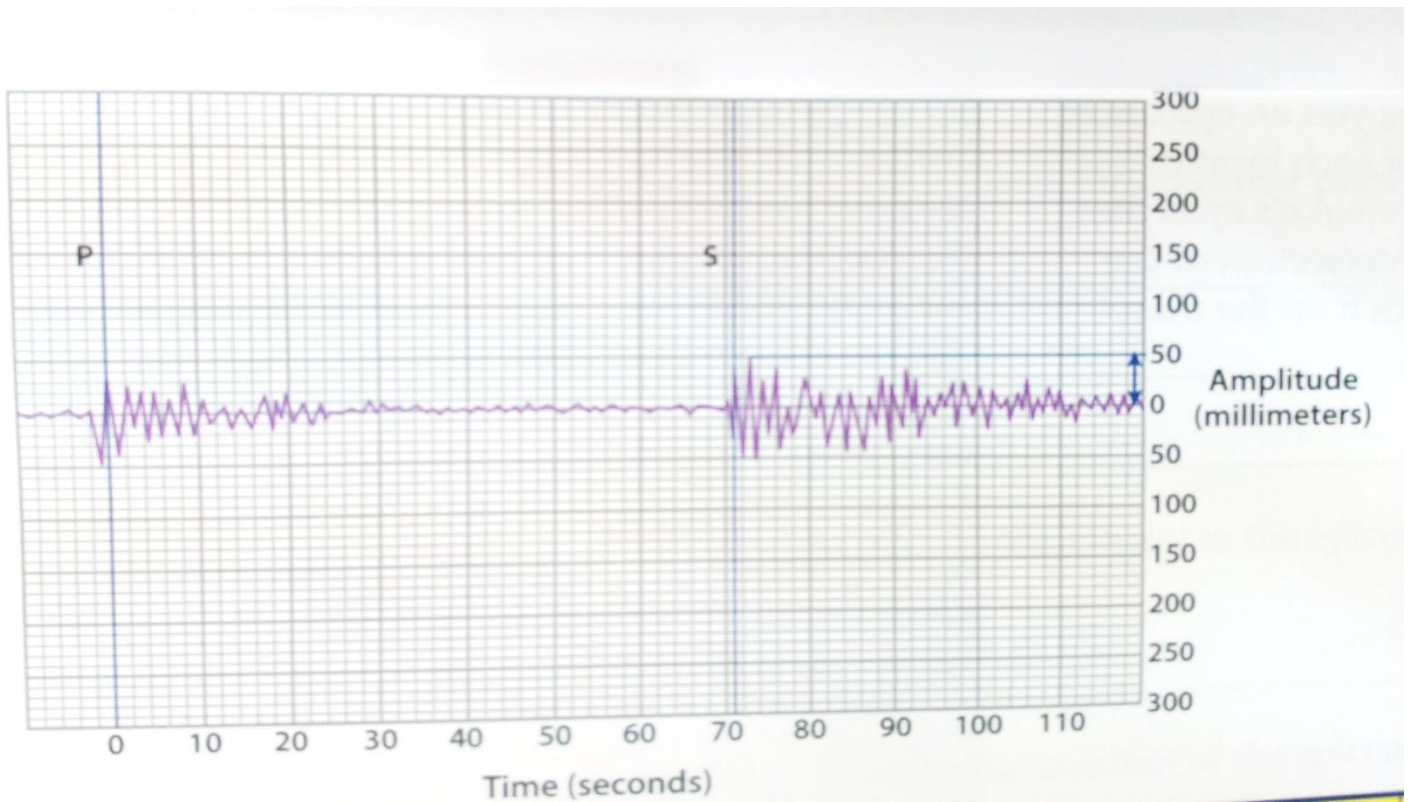
ESKISEHIR



IZMIR



TRABZON



City	S-P interval(sec)	Epicenter distance (km)	Amplitude (mm)

Use the interval times and this graph to determine the **epicenter distance** for each location. Add the distance to the data table.

