Can Humans Cause Earthquakes?

Many scientists believe earthquakes can be triggered more often near waste injection and geothermal water injection sites across the country. When water is injected into the ground by means of these two processes, water can reduce the normal stress on a fault, making a fault more likely to slip, causing an earthquake. Shane Cooper, who is studying at the University of Oregon, says, “A good way to think of this is to imagine water ‘lubing’ a fault and reducing the friction present, so slip is more likely to occur.” California and Oregon have many geothermal plants to help produce energy the states need. Midwestern states like Oklahoma rely on waste injection to help store the byproducts of hydraulic fracturing used in oil exploration. If earthquakes are more likely to occur near these areas, this could be an important safety issue for the surrounding communities. Prague, Oklahoma was struck by a magnitude 5.7 earthquake in 2011, causing damage to homes, and was linked to a nearby waste injection well.

In addition to water injection, Shane Cooper will also be studying the effect earth tides and remote triggering have on causing Earthquakes. “Earth tides and remote triggering are two different ways earthquakes can be triggered. Earth tides are similar to regular ocean tides, except the moon’s gravitational force is applied to a rock, and remote triggering is when distant earthquakes are able to ‘set off’ nearby earthquakes due to slight shaking in the ground.” While studying at Oregon, Shane will try to link the cause earthquakes near water injection sites to remote triggering and earth tides.

Shane Cooper has set aside thirteen areas where geothermal and waste injection is taking place, which spans from California all the way to the Midwestern states of Colorado, Texas, and Oklahoma. Using catalogs that record all the earthquake activity within a given area, Shane has created Schuster plots that show how much earthquake occurrence is correlated with the earth tide’s daily tidal periods, and also gives a probability of whether or not earth tides directly influence earthquake activity. A Schuster plot works by plotting all the periods within a time span of a day. The Schuster plot should record a spike at the strongest tidal period of 12.4 hours, because, in theory, this is when force on a given fault is the strongest, so earthquakes are more likely to occur at this time. More analysis is needed from Shane for a conclusion.

In addition to earth tides, large remote earthquakes above a certain magnitude might be able to shake the ground just enough to set off earthquakes near a water injection site. Remote triggering is similar to regular aftershocks, but the amount of shaking cannot be felt by humans. However, it might be enough to trigger earthquakes due to the force that shaking causes on nearby faults. After a large earthquake, such as the magnitude 9.1 that hit Japan in 2011, waves will travel across the world and cause small amounts of shaking in places as far as California. This could set off a series of earthquakes in the area, which will be further investigated by Shane.

Although remote triggering and earth tides can set off earthquakes anywhere, areas near water injection sites are especially vulnerable because the amount of force needed to set off an earthquake is reduced in these areas because wells are actively pumping water into the ground.

Below is a figure of where each of the thirteen test sites are located across the United States.

