Magnitude

Magnitude is the physical size of an earthquake. In *figure 1*, notice the magnitude scale in correspondence to the earthquake's energy equivalence.

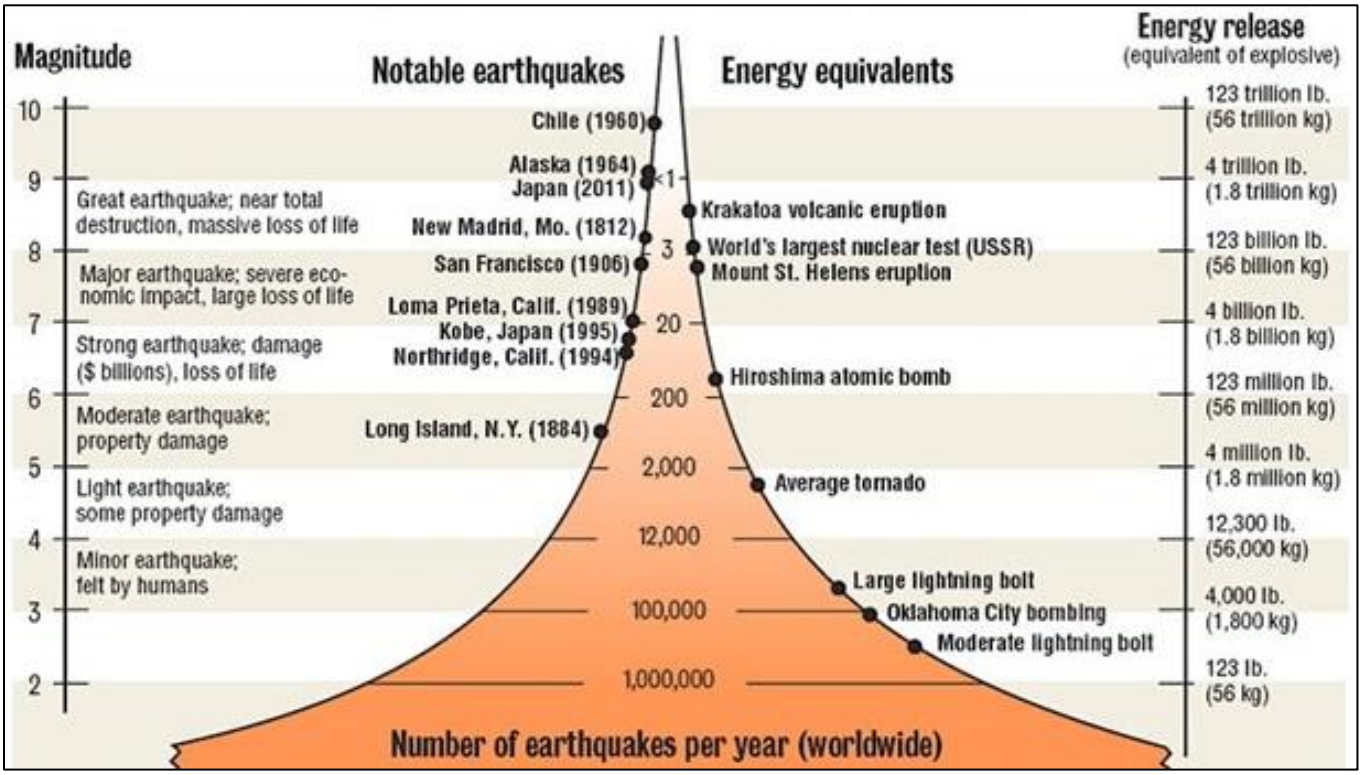

Figure 1: Seismic wave energy in earthquakes and energy equivalents. (Figure adapted from (Incorporated Research Institutes for Seismology, IRIS))

Both seismic moment and moment magnitude (**Mw**) can be calculated using GeoGateway's moment magnitude calculator. As shown in *figure 2*, **seismic moment** equates to the product of the shear modulus, rupture area, and slip length, and **moment magnitude** equates to the product of two-thirds the log base of seismic moment, subtracted by 10.73.

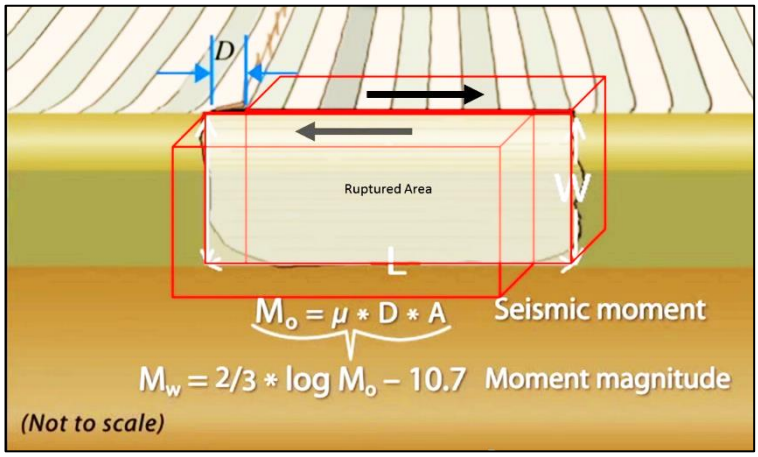

Figure 2: Represents the seismic moment and moment magnitude equations. (Figure adapted from (Vista Heights Middle School))

The shear modulus (μ) is

3.2×10^{11} dynes/cm^2 in the crust
7.5×10^{11} dynes/cm^2 in the mantle

The area (km^2) as shown in *figure 2* can be found by using the length (L) and width (W). The slip (meters) is the average displacement (D) of the rupture.

Step 1: To begin calculations, click on the "Magnitude" tab

Step 2: Once the tab is open, input the fault length that ruptured in kilometers

Step 3: Input the fault width that ruptured, in units of kilometers

Step 4: Input the distance the fault moved (slip), in units of meters

Step 5: Input the shear modulus in units of $\frac{10^{11} dyne}{cm^2}$

Step 6: Click on Calculate

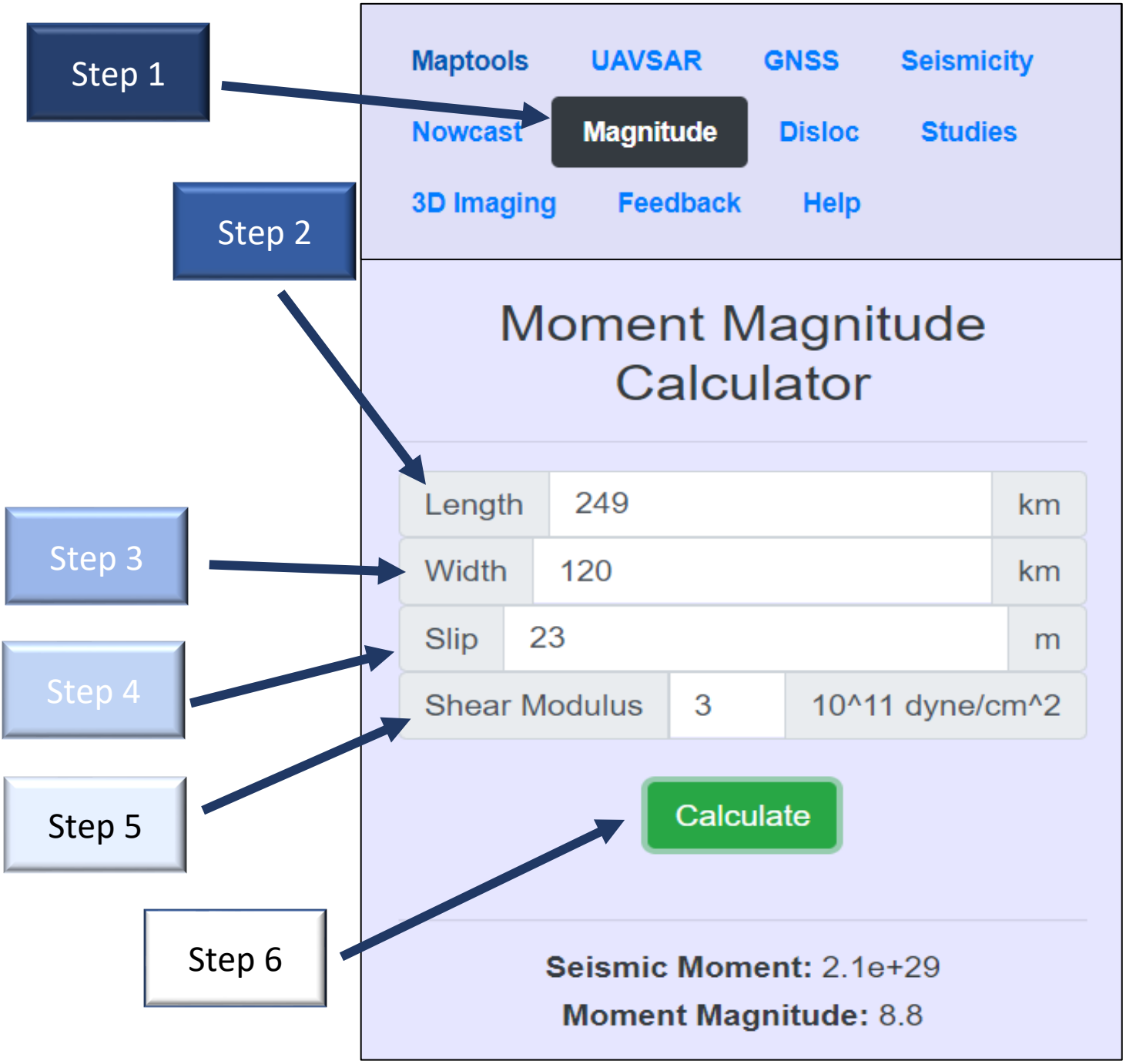

Figure 3: Calculating seismic moment and moment magnitude of 2011 Tohoku-Oki earthquake.

GeoGateway has set the moment magnitude 9.0 Tohoku-Oki earthquake as default. The results indicate a seismic moment of 2.1x10^{29} dyne*cm and a moment magnitude of 8.8.