

A SIMPLE EXPLANATION OF EARTHQUAKE MAGNITUDE AND INTENSITY



(using the Feb. 28, 2001 Nisqually, Washington earthquake to illustrate)

Everybody is familiar with an earthquake being reported as "Richter Magnitude such-andsuch", but few people know what that actually means. The Magnitude of an earthquake is a measure of its energy released at the earthquake's focus- at the precise point where a fault has ruptured. The focus may be many kilometres below the surface of the earth. It was about 53 km below the surface in the Nisqually earthquake. The point on the surface directly above the focus is called the epicentre. Seismographs are used to measure an earthquake's seismic waves, and from that information seismologists can determine the location of the focus, the epicentre and the magnitude.



Although Charles Richter developed the popular scale for describing magnitude, there are different ones in use today. These are still popularly referred to as "Richter" scale measurements, and the modern idea is similar. The important thing about magnitude is that an earthquake only has one of them! You cannot correctly say: "The quake was magnitude 6.8 in Seattle but was only magnitude 5 in Vancouver because of the distance from the epicentre."

The fact is, the farther away you get from an earthquake's focus, you can expect the energy (let's call it shaking) to be less, and generally that is true- although peculiar ground conditions can actually intensify shaking at quite some distance from the focus. Also, some buildings shake or sway more than others because of the way they are built.

And so we really care most about the effects of an earthquake at a given location, which is called Intensity. Remember that there is only one magnitude, but the intensity depends on where you are. Intensity is sometimes called "felt intensity" because it is related to what people feel and how buildings and structures are affected. Yes, there is a scale used to measure intensity too, called the "Modified Mercalli Scale".

Using intensities reported to them by both people and seismographs, seismologists make maps that show areas subjected to equal intensities. See the map at right produced for the Washington State Emergency Management Division. This information is useful to help forecast which conditions are hazardous, and also what could happen in a future earthquake.

Intensity model maps may be changed as new information becomes available, sometimes for weeks after an earthquake.



If the maps are made quickly enough, they can help emergency responders react to areas that need help most. Today, automated "shake maps" are being made in some areas of the US, and their usefulness is being evaluated. Below is the shake map for the Nisqually earthquake, from the University of Washington.



| PERCEVED | Not fait | Weak | Light | Mode rate | Strong | Very stiong | Severe | Violent | Extreme |
|------------------------|----------|---------|---------|------------|--------|-------------|----------------|---------|------------|
| POTENTIAL | none | none | none | Very light | Light | Moderate | Moderate/Heavy | Неачу | Very Heavy |
| PEAK ACC (%g) | <.17 | .17.1.4 | 14.3.9 | 3.9.9.2 | 9.2-18 | 19-34 | 34-65 | 65-124 | >124 |
| PEAK VEL(smb) | <0.1 | 0.1-1.1 | 1.1-3.4 | 3.4-8.1 | 8.1.16 | 18-31 | 31-00 | 60-110 | >110 |
| INSTRUMENTAL INTENSITY | I | 11-101 | N | ٧ | VI | VII | VIII | 1X | 8+ |