

Introduction to Natural Disasters

- basic premise of the course: **“to provide a basic understanding of how internal and external earth processes give rise to natural disasters and how people interact with these hazardous processes” (Keller, 2000).**
 - Why is this important to me? (1) buying property; (2) vacation; (3) jobs: journalism, politics, engineering
1. Natural Hazards & Disasters
 - Earth is a dynamic planet with complex internal and external interactions that produce events such as EQ’s, volcanic eruptions, floods, landslides, hurricanes, etc (= **natural hazards**).
 - **Natural Disaster** = events that cause loss of human life and/or property damage.
 - **Impact** of an event is a complex function of both natural (e.g., magnitude and frequency, local geology) and human (e.g., population density, land use).
 - Benefits of natural hazards – soil fertility, water supply, new land, “cleansing” agent, landscapes.
 2. Disaster Prediction and Warning
 - **Location** – basically known.
 - **Timing** – essentially unknown. Use statistical methods. Can only calculate the probability of the occurrence of an event of certain magnitude that will occur at a particular location. Good for long-range “prediction”; essentially useless for short-term prediction and warning.
 - **Recurrence Interval** – the length of time between events of a certain magnitude. In general, large magnitude events are much less frequent than small events.
 - **Precursor Events** – many natural hazards are preceded by a series of events. Example: volcanic eruptions (Mt. Pinatubo, 1991).
 - **Forecasting** – some events (mostly weather related phenomena like floods, hurricanes) can be reasonably predicted mostly because they move slow and can be easily monitored.
 - **Warning** – scientists give the public (via regional/local gov’t) warnings. Cons- economic loss; Pros- save lives and property, disaster awareness.
 3. Human Response to Hazards
 - **Reactive** – emergency rescue, restoration, reconstruction (short- and long-term).
 - **Anticipatory** – deliberate adjustment and avoidance to minimize impact of natural hazards. Usually through **land use planning, insurance, evacuation, preparedness**. All based on societal perception of the hazard (the general public is usually not very well informed or too optimistic).
 4. Energy Sources for Natural Disasters
 - Gravity – gravitational force that exists everywhere all the time on Earth’s surface. Main driving force for all types of mass movements (“landslides”, mudflows, rock avalanches, etc.).

Newton’s Law: $F = ma$

Gravitational Force or weight (w) of an object: $w = mg$; where m is mass and g is the Earth’s gravitational acceleration (9.8 m/s^2).
 - Internal Energy – driving force for plate motions; plate tectonics (earthquakes, volcanoes).
Three main source of internal energy (heat). Much of this heat is left over from events that happened very early on in Earth’s history (4.6 to 4.4 billion years ago).
 - 1) **Asteriod impacts** – kinetic energy released from the impacting of asteroids.
 - 2) **Radioactive decay** – natural decay of radioactive isotopes of U, Th, and K inside the Earth releases energy. This process is still occurring today.
 - 3) **Gravitational collapse** – contraction of planetary material accreted to form the Earth.

- External (Solar) Energy – driving force for atmospheric and ocean processes; hydrologic cycle. (hurricanes, tornadoes, floods, severe weather).\

Water (H₂O) has a very high heat capacity. This means that water can store tremendous amounts of heat, in fact, 23% of the solar energy hitting the Earth is stored in water (mostly in the atmosphere). The storage (evaporation) and release (condensation) of this heat energy is what powers severe weather like hurricanes and tornadoes.