# The Challenge of Natural Hazards: Tectonic Hazards

## What is a natural hazard?

An extreme event that occurs naturally and can cause loss of life, extreme damage to property and disrupt human activities. It can be tectonic (earthquakes, tsunamis and volcanic activity), geomorphological (avalanches and floods) biological (extreme temperatures, drought and wildfires), atmospheric (hurricanes) or biological (forest fire disease epidemics).

### What factors affect hazard risk?

Hazard risk is the probability of being affected by a natural event and may be affected by factors such as: geographical location, magnitude, duration, frequency, level of economic development, education and population density/distribution.

| Key Term                  | Definition   |
|---------------------------|--|
| Conservative plate margin | Tectonic plate margin where two tectonic plates slide past each other.   |
| Constructive Plate Margin | Tectonic plate margin where rising magma adds new material to plates that are diverging or moving apart.   |
| Destructive plate margin  | Tectonic plate margin where two plates are converging or coming together and oceanic plate<br>is subducted. It can be associated with violent earthquakes and explosive volcanoes.                             |
| Earthquake                | A sudden or violent movement within the Earth's crust followed by a series of shocks.  |
| Immediate responses       | The reaction of people as the disaster happens and in the immediate aftermath.   |
| Long-term responses       | Later reactions that occur in the weeks, months and years after the event.   |
| Monitoring                | Recording physical changes, such as earthquake tremors around a volcano, to help forecast when and where a natural hazard might strike.  |
| Plate margin              | The margin or boundary between two tectonic plates.  |
| Planning                  | Actions taken to enable communities to respond to, and recover from, natural disasters, through measures such as emergency evacuation plans, information management, communications and warning systems.       |
| Prediction                | Attempts to forecast when and where a natural hazard will strike, based on current knowledge. This can be done to some extent for volcanic eruptions (and tropical storms), but less reliably for earthquakes. |
| Primary effects           | The initial impact of a natural event on people and property, caused directly by it, for instance buildings collapsing following an earthquake.  |
| Protection                | Actions taken before a hazard strikes to reduce its impact, such as educating people or improving building design.   |
| Secondary effects         | The after-effects that occur as indirect impacts of a natural event, sometimes on a longer timescale, for instance fires due to ruptured gas mains resulting from the ground shaking.                          |
| Tectonic hazard           | A natural hazard caused by movement of tectonic plates (including volcanoes and earthquakes).  |
| Tectonic plate            | A rigid segment of the Earth's crust which can 'float' across the heavier, semi-molten rock below. Continental plates are less dense, but thicker than oceanic plates.   |
| Volcano                   | An opening in the Earth's crust from which lava, ash and gases erupt.  |



## **Types of Plate Margin**





Activity: Earthquakes and volcanoes

Activity: Earthquakes

## **Plate Movement**

The lithosphere is broken into tectonic plates which move very slowly. Three of the forces proposed as the main drivers of tectonic plate movement are: Convection currents; Ridge push; Slab pull

|   | Effects of Tecton   | ic Hazards  |   |
|---|---|---|---|
| Volcanic Eruptions  |   | Earthquakes   |   |
| mary Effects  | Secondary Effects   | Primary Effects   | Secondary Effects   |
| People and animals may be injured or killed.<br>Buildings and roads may be destroyed.<br>Crops are damaged and water<br>supplies contaminated.<br>Harmful gas emissions | <ul> <li>Respiratory problems</li> <li>Roads are blocked – aid and emergency<br/>services can't get through</li> <li>Possible flooding if ice melts</li> <li>Air travel may be halted due to volcanic ash</li> <li>Economy slows down.</li> <li>Tourism can increase as people come to watch.</li> <li>Ash breaks down leading to fertile farm land.</li> </ul> | <ul> <li>Property and buildings destroyed.</li> <li>People injured or killed.</li> <li>Ports, roads, railways damaged.</li> <li>Pipes (water and gas) and<br/>electricity cables broken.</li> </ul> | <ul> <li>Business reduced as money<br/>spent repairing property.</li> <li>Blocked transport routes hinder<br/>emergency services.</li> <li>Broken gas pipes cause fire.</li> <li>Broken water pipes lead to<br/>a lack of fresh water.</li> </ul> |

| Responses to Tectonic Hazards                  |   |  |  |  |  |
|--|---|--|--|--|--|
| Volcanic Eruptions                             |   | Earthquakes                            |  |  |  |
| mmediate                                       | Long Term   | Immediate                              | Long Term  |  |  |
| Issue warnings if possible.                    | Restore utilities.  | Search for survivors                   | <ul> <li>Improve building regulations.</li> </ul>        |  |  |
| Restrict access to areas and/or evacuate areas | Repair and re-build properties & infrastructure.          | Provide shelter and emergency supplies | Use appropriate technology to design                     |  |  |
| Rescue teams search for survivors.             | Resettle locals elsewhere.                                | Treat injured                          | earthquake resistant buildings.                          |  |  |
| Treat injured.                                 | Develop opportunities for recovery of economy.            | Recover bodies                         | <ul> <li>Monitor through use of seismographs.</li> </ul> |  |  |
| Provide shelter, food and drink.               | <ul> <li>Install monitoring technology.</li> </ul>        | Extinguish fires                       |  |  |  |
| Recover bodies.                                | <ul> <li>Improve building design to reduce the</li> </ul> |  |  |  |  |
| Extinguish fires.                              | risks from ash weight on buildings.                       |  |  |  |  |
|  | Educate locals  |  |  |  |  |
|  |   |  |  |  |  |





Activity: Earthquakes and volcanoes

## **Case Study: Volcanic Eruption**

High Income Country: Iceland

## High Income Country: **New Zealand**



Low Income Country: Guatemala

## Case Study: Earthquake

#### Low Income Country: Haiti

| 12 <sup>th</sup> Jan 2010 |
|---------------------------|
| 4.53pm                    |
| 7                         |
| 25km west of              |
| Port au Prince            |
| 421                       |



#### Effects

- · Over 220,000 people were killed.
- At least 300.000 people
- were seriously injured
- Cost \$14 billion
- · About 1.5 million were made homeless
- Many of Port-au-Prince's multi-story concrete buildings collapsed
- 3,978 schools were damaged or destroyed
- An outbreak of cholera in October 2010 resulted in 5.899 deaths with 216,000 people infected.

- Responses
- Over 600,000 people left their homes in Port-au-Prince
- · People were living in makeshift internally displaced persons (IDP) camps.
- Neighbouring Dominican Republic provided emergency water and medical supplies as well as heavy machinery to help with search and rescue but most people were left to dig through the rubble by hand.
- Emergency rescue teams arrived from a number of countries e.g. Iceland.
- Temporary field hospitals were set up by organisations like the International Red Cross to treat the injured.
- GIS was used to provide satellite images and maps of the area. to assist aid organisations.
- · United Nations troops and police were sent to help distribute aid and keep order.
- \$13.34 billion of aid was allocated by international agencies to assist in rebuilding.
- 'Cash for work' programmes paid Haitians to clear rubble.
- Small farmers were being supported to grow crops.
- Schools were rebuilt.

| otection         | Planning  |
|------------------|---|
| esistant<br>ture | <ul> <li>Prepare emergency supplies and plan<br/>location of emergency shelters.</li> <li>Training of emergency personnel</li> <li>Education of local population</li> </ul> |
|                  |   |
|                  |   |
| otection         | Planning  |

- Prepare an evacuation plan
- Provide details of plan to locals