

# DP IB Geography: SL



Your notes

## Future Resilience & Adaptation

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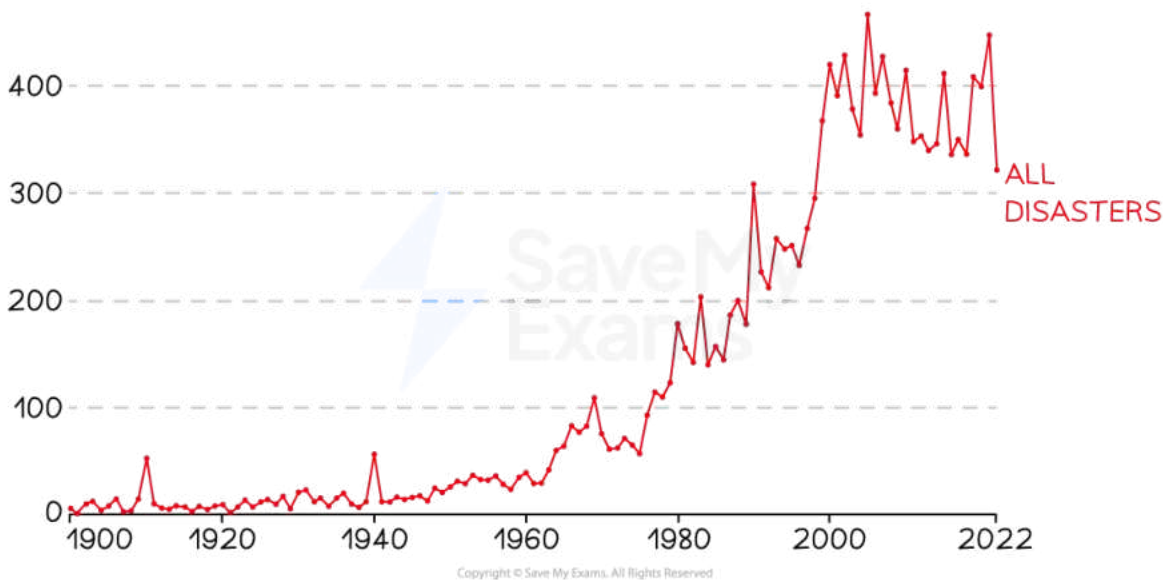
## Hazard & Disaster Trends

# Hazard & Disaster Trends & Future Projections

## Global disaster trends

- The number of recorded disasters has increased significantly since 1960
- There are a number of reasons for this, including:
  - Increased population – the world's population has grown from 3 billion to over 8 billion since 1960:
    - This means more people are likely to be impacted by any hazard event
    - Increased population density in urban and coastal areas increases the vulnerable population
  - Increased monitoring and reporting means more hazard events are recorded
- Most of the increase has been the result of floods and extreme weather

## Recorded global disasters 1900–2022



Recorded global disasters 1900–2022

## Geophysical hazard trends

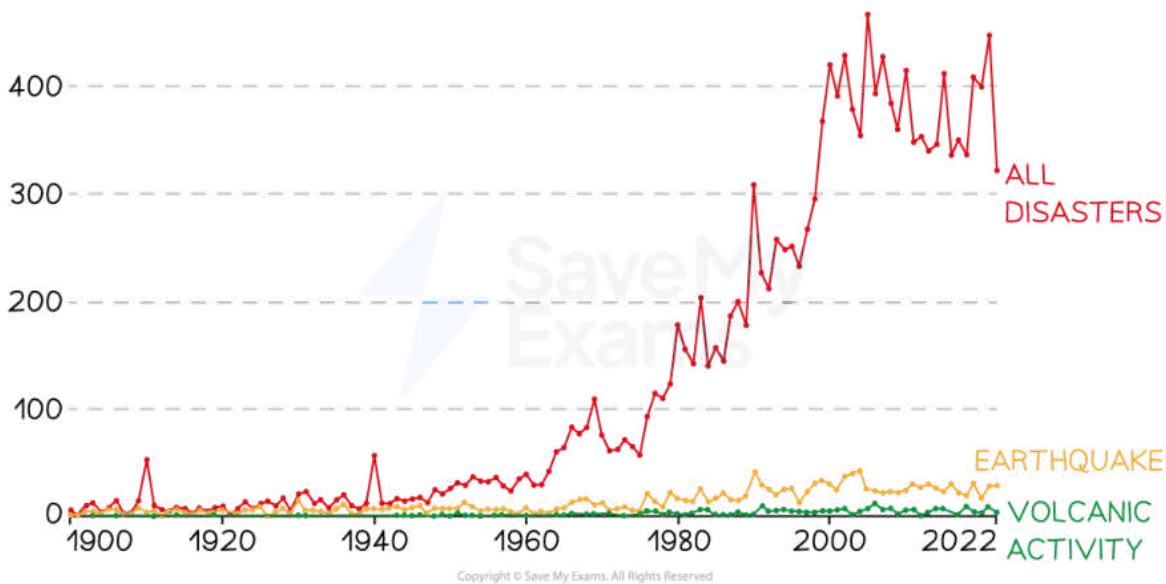
- The number of tectonic disasters has **fluctuated** since 1960 but has generally remained steady



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- The slight increase in the number of earthquake disasters does not mean there have been more earthquakes or higher magnitude earthquakes. It results from:
  - Greater **urbanisation** in seismic zones, which has led to higher population densities and increased building density
  - **Population growth**, which means more people are living in earthquake-prone regions
  - Population growth being focussed in some of the least developed countries, which are also the most vulnerable due to:
    - Poor building design and construction
    - Poverty
    - Lower levels of education
    - Poor governance

## Global tectonic disasters 1900–2022



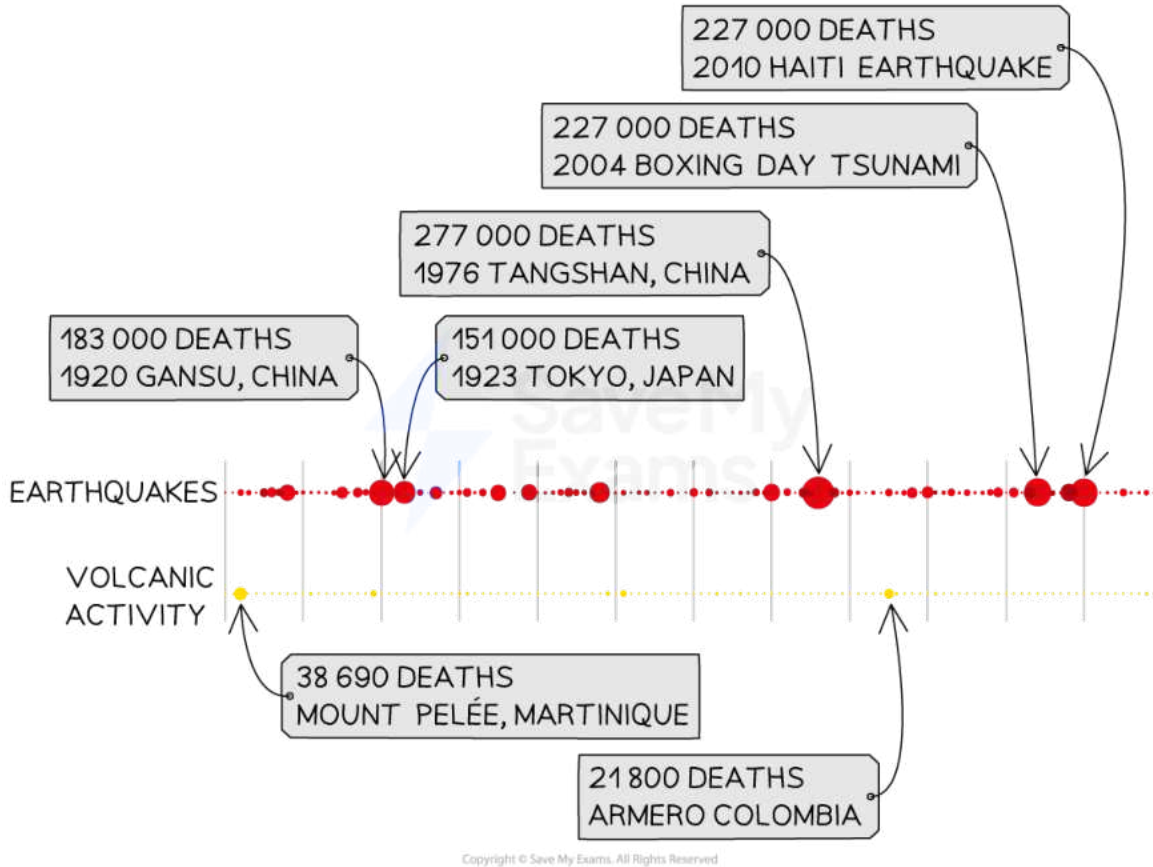
### Global tectonic disasters 1900–2022

- The number of deaths from tectonic hazards fluctuates depending on a range of factors, including:
  - Magnitude
  - Level of development
  - Location



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## Deaths resulting from tectonic activity



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### Deaths resulting from tectonic activity

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020

- The impact of a **mega-disaster** such as the Indian Ocean earthquake and tsunami may skew the overall trend because it leads to so many deaths
- Volcanic eruptions are less frequent than earthquakes and deaths from eruptions are now rare due to improved monitoring, exclusion zones and evacuation plans

## Hazard Adaptation



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## Land Use Zoning

### Geophysical hazard adaptation

- There are different levels of response to geophysical hazards; these are:
  - Individual
  - Community
  - National
  - International

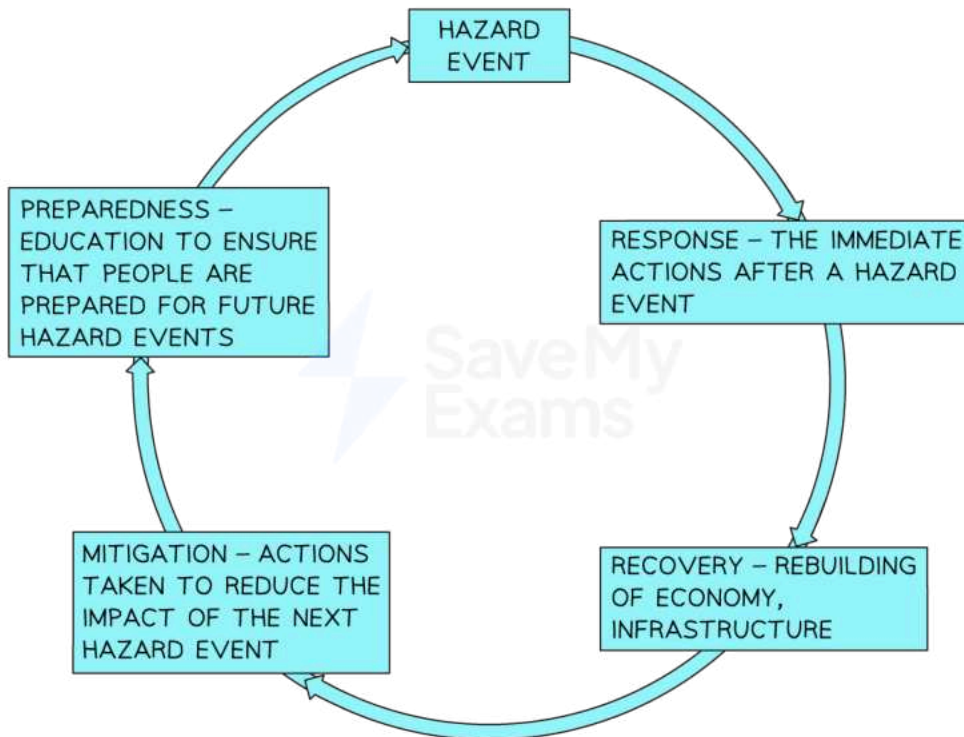
### Response and hazard management cycle

- The hazard management cycle is a model that shows how the events of one hazard event inform planning and preparation for the next hazard event

### Hazard management cycle



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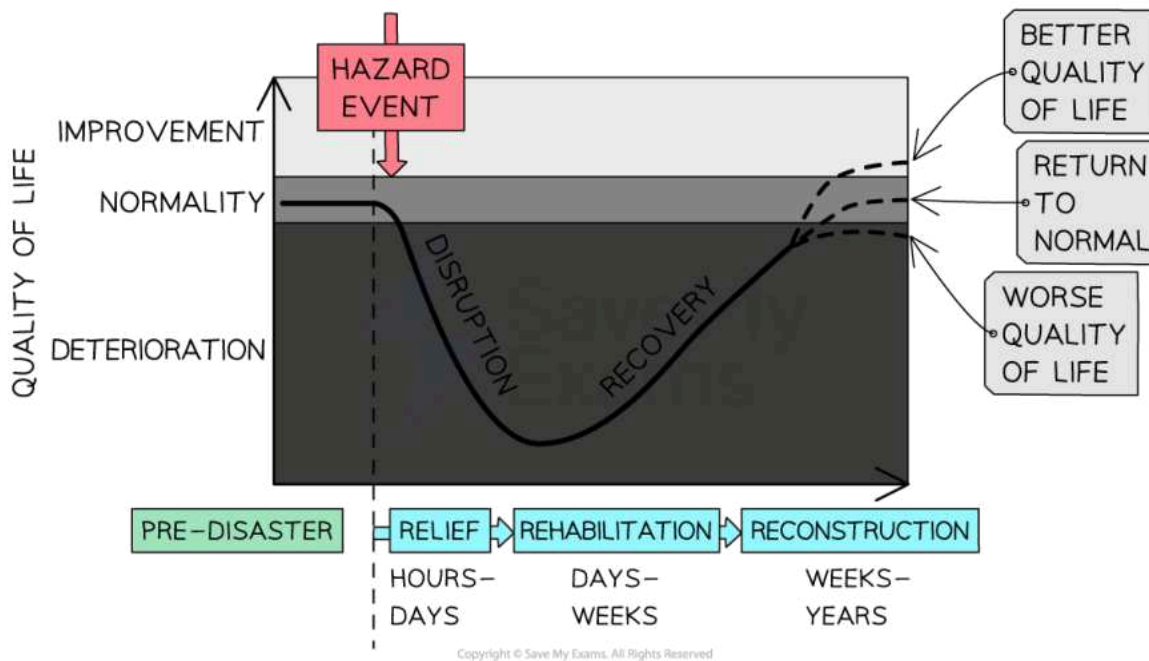
**Hazard management cycle**

- The response to a hazard will depend on a range of factors, including:
  - Past hazards and experiences
  - Level of development
  - Technology
  - Hazard perception
  - The type and magnitude of the hazard
- Park's model shows hazard response and its link to people's quality of life

## Park's model of hazard response



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*Park's model of hazard response*

- Increased government planning attempts to **mitigate** the impacts of hazard events
- **Land use planning or zoning** is one example of this

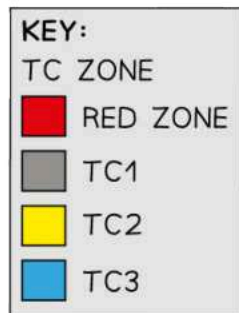
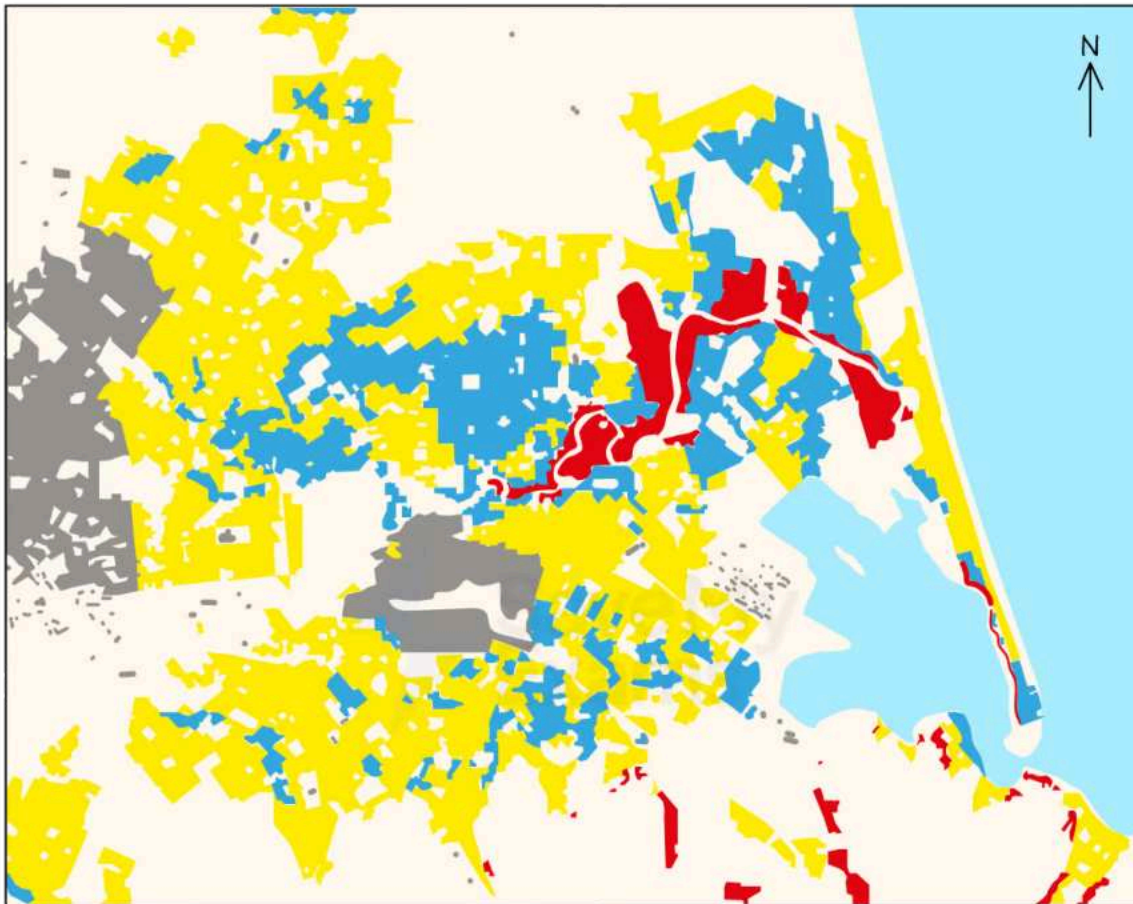
## What is land use zoning?

- **Hazard risk mapping** uses **Geographic Information Systems (GIS)** to identify areas at highest risk
- This is followed by **land use zoning** to prevent development in these areas
- Planning ensures that valuable services such as the fire service, hospitals and schools are not built in these areas
- Information can also be shared with the population
- In LICs, rapid urban growth means that illegal settlements may be built in high-risk areas due to a lack of awareness

## Land use zoning in Christchurch, New Zealand



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*Land use zoning in Christchurch, New Zealand*

## Land use zoning in Christchurch

- The 2010 and 2011 earthquakes in Christchurch, New Zealand led to the creation of red zones
- These are areas that suffered severe damage in both earthquakes



- In the red zones, rebuilding is not permitted
- Properties and land in the red zones were bought by the government:
  - Approximately 125 households opted to stay (2%)
  - These households no longer have insurance, postal or bus services
- The land is now managed by Land Information New Zealand (LINZ) and much of it has been turned into parkland



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## Personal Resilience

- In addition to government planning, people can take individual and community actions. These include:
  - Increased preparedness
  - Use of insurance
  - Adoption of new technology

## Increased preparedness

- Drills educate people about what to do during a hazard event. These increase resilience because:
  - People are more likely to take actions that will protect them during and after the event
  - In 2023 over 56.5 million people worldwide participated in the **Great ShakeOut** earthquake drills
- Building codes
  - Adherence to building regulations when constructing buildings decreases the number of buildings that collapse
  - In LICs people are less likely to follow building regulations due to:
    - Lack of education regarding the importance of building regulations
    - Cost of following building regulations
    - Lack of enforcement of the building regulations

## Use of insurance

- Insurance increases resilience because:
  - Payouts are usually faster and larger than government assistance
  - This increases the speed of recovery and the ability to rebuild/repair
  - It may encourage people to prepare and retrofit buildings to reduce the cost of insurance



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## Earthquake insurance

- **Earthquake insurance** covers damage to property and possessions as well as living expenses for temporary accommodation
- Standard insurance does not usually include coverage for earthquake events
- The cost of earthquake insurance increases with the risk:
  - In California the cost is high as the state is located on multiple fault lines
- The cost is also affected by the:
  - **Age of the building** – newer buildings are built of better materials and can be earthquake-resistant
  - **Number of stories** – taller buildings are at greater risk of collapse
  - **Materials used** – wood frames are more flexible and less likely to collapse
  - **Foundations** – raised foundations and foundations in sandy soil reduce the risk of collapse
- In Japan, residents can claim tax deductions on earthquake insurance, which reduces the cost

### Advantages and disadvantages of earthquake insurance

Advantages	Disadvantages
Property damage and loss of possessions are covered  In low-risk areas, the cost of insurance is lower  The cost of alternative accommodation is covered if you are not able to return to your property	The cost is higher if you are in a high-risk area; this can make it unaffordable for people on lower incomes  The <b>excess</b> (the amount paid by the insured person towards the costs) is higher for earthquake insurance – it may be a percentage of the value of the property

## Management Strategies



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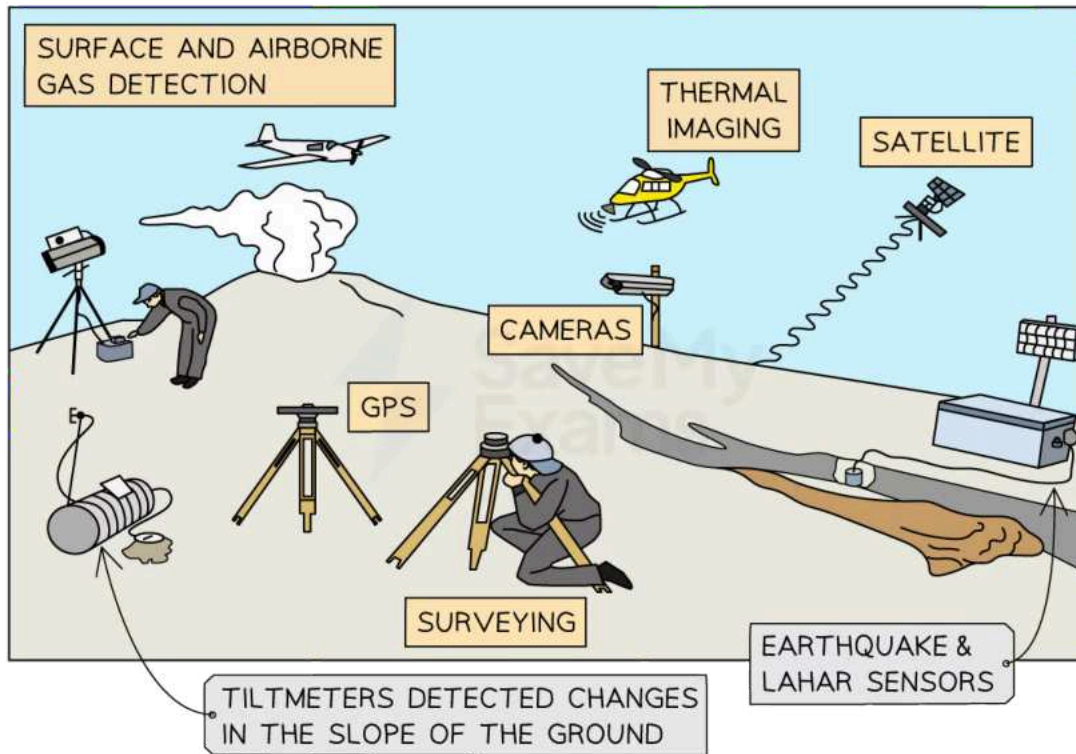
# Pre-event Management Strategies – Volcanoes

- There are signs warning of an eruption before most volcanic eruptions
- Pre-event management of volcanoes includes monitoring these signs so that people can be evacuated and warned
- Volcanologists (scientists who study volcanoes) monitor changes using GPS, tilt meters, satellites, seismometers and gas detection
- Signs of an eruption include:
  - Magma rising, which can be detected by heat sensors and satellites
  - Changes in surface level as rising magma causes bulges
  - Increased emissions of sulphur dioxide and other gases
  - Increased seismic activity caused by magma movement detected by seismometers

## Methods of monitoring volcanoes



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**Methods of monitoring volcanoes**

- Improved prediction of volcanic eruptions has led to a decrease in death tolls

## Diversion channels

- Lava flows can be managed by constructing diversion channels
- These are used to direct the flow away from economically valuable areas or areas of population

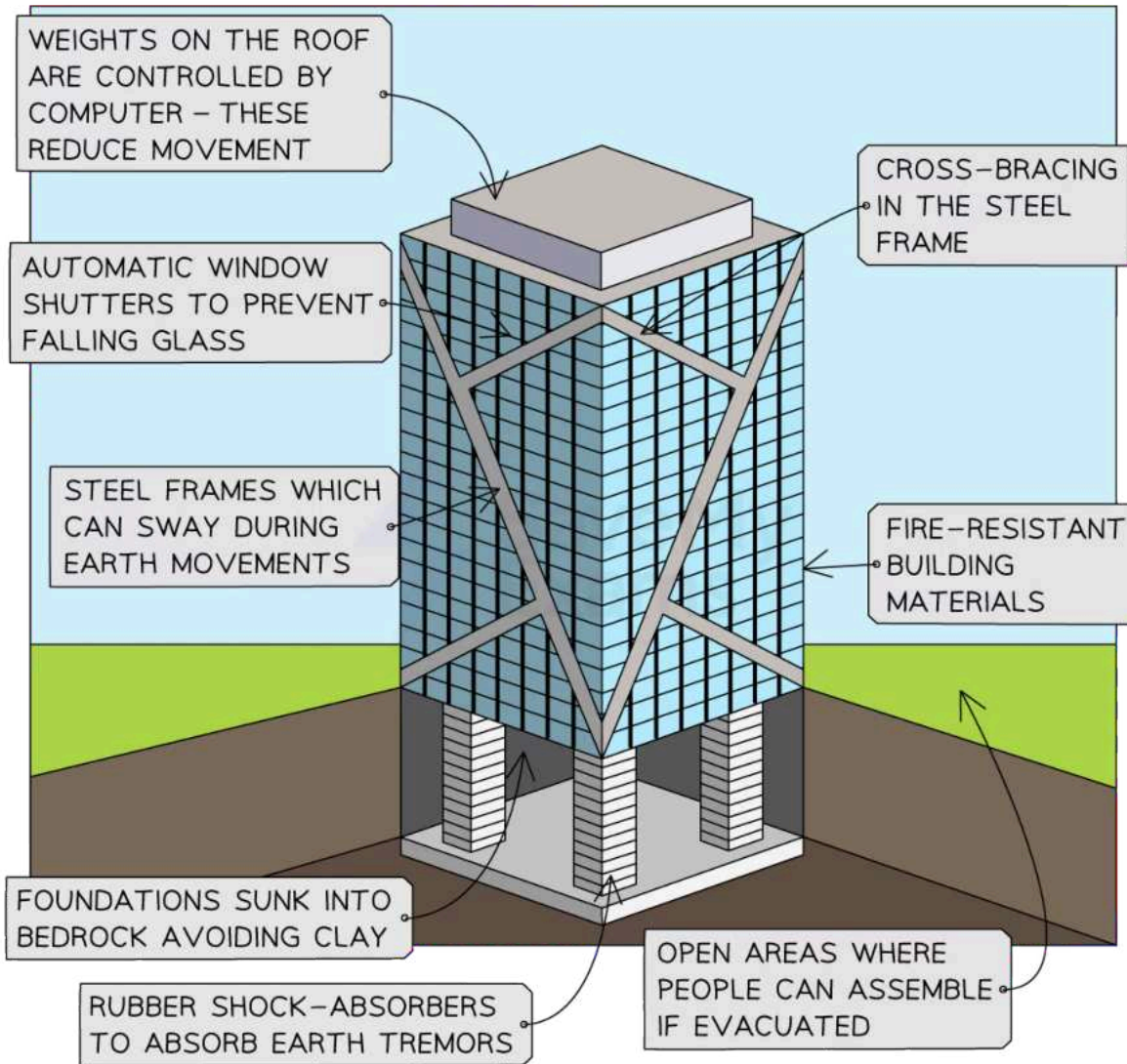
## Pre-event Management Strategies – Earthquakes

- It is not possible to predict earthquakes:
  - An understanding of tectonic activity can help scientists identify areas most at risk
  - Over 90% of earthquakes occur on or near plate boundaries
  - Building design and construction can be used to reduce the impact

## Earthquake resistant building design



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**Earthquake resistant building design**

- **Hazard mapping** can also be used to predict areas at highest risk
- **Land use zoning** can then ensure that valuable buildings are not built in these areas

**Tsunami**

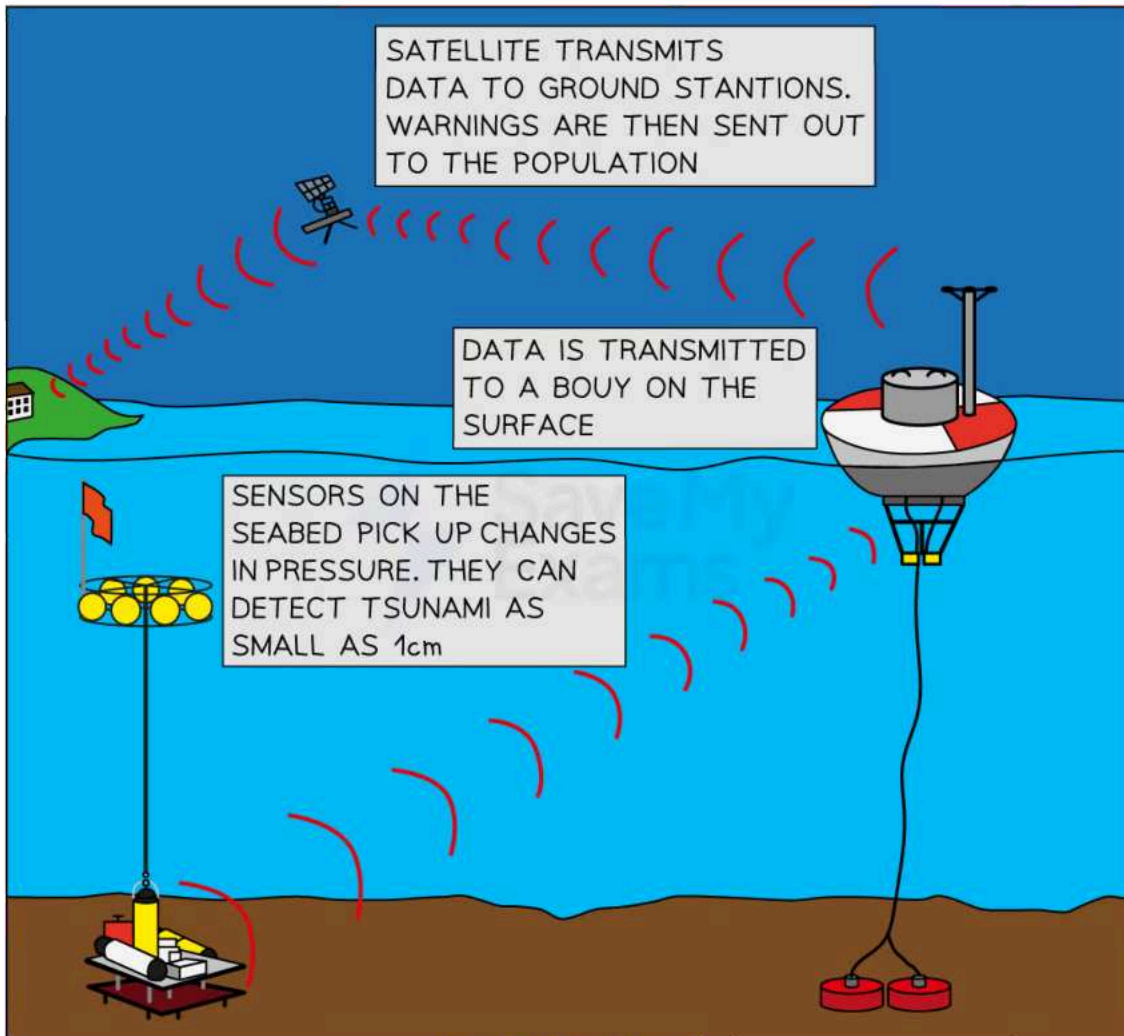
- For earthquake-induced tsunamis, scientists are unable to predict the earthquake itself
- When the earthquake happens, this will be detected by the global network of seismometers, which will locate the epicentre of the earthquake

- Ocean monitoring technology can then be used to detect a tsunami
- Warnings can then be issued to coastal areas that may be affected



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## Tsunami warning system



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**Tsunami warning system**

- Sea walls have also been built to reduce the impact of tsunami
  - After the 2011 Tokohu tsunami in Japan, the height of the sea wall was increased to over almost 15 meters in places

## Pre-event Management Strategies – Mass Movement



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- The management of mass movement needs to control the factors that affect the risks, including:
  - Slope angle and stability
  - Drainage
  - Human activities
  - Erosion

## Terracing or re-grading of slopes

- Terracing or re-grading reduces the angle of the slope

## Revegetation

- Stabilises the slope material, increasing the amount of stress that the slope can withstand
- Reduces slope saturation by take-up of water through the roots and increased interception
- Decreases erosion, which affects the stability of the slope

## Improving drainage

- Water makes slopes more unstable
- Improved drainage reduces saturation of the slope
- This reduces the weight of the material and therefore the risk of mass movement

## Stabilisation structures

- Use of pinning:
  - Steel rods are drilled into the slope to support the weight of the slope
  - Bolts can also be used to transfer the weight from the surface to the interior of the slope
- Pinning is often used in combination with netting, which contains any falling material
- Shotcrete shoring is when a mixture of cement and aggregate is applied to the slope; this strengthens the slope and reduces erosion
- Retaining walls and **gabions**, which hold the slope in place