SL IB Geography

Your notes

7.4 Future Resilience & Adaptation

Contents

7.4.1 Hazard & Disaster Trends

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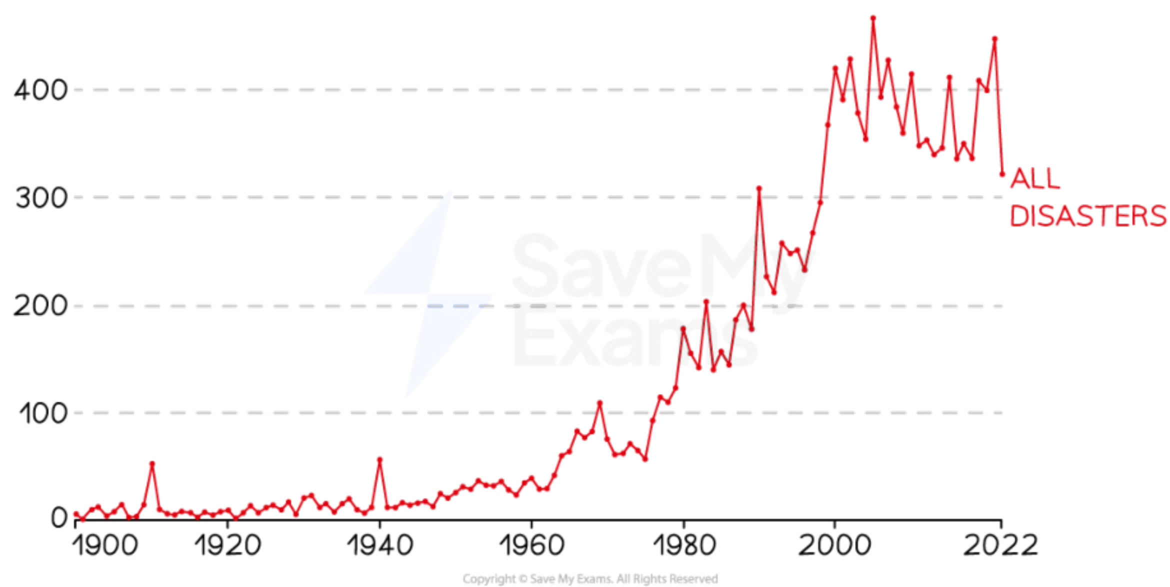
Hazard & Disaster Trends & Future Projections

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
- 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:

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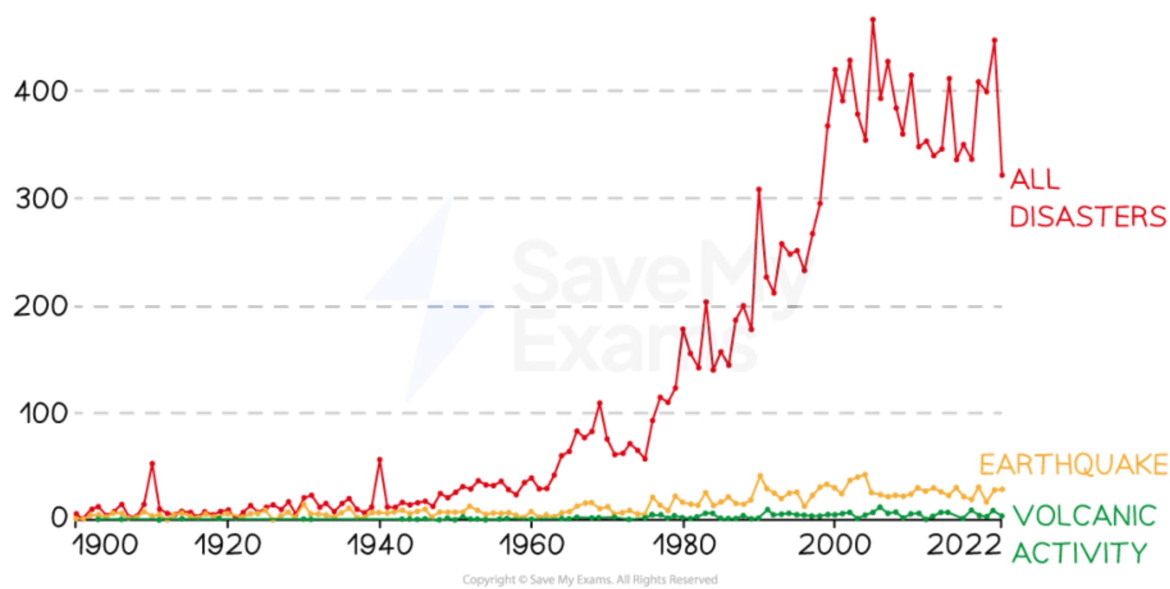
- Poor building design and construction
- Poverty
- Lower levels of education
- Poor governance

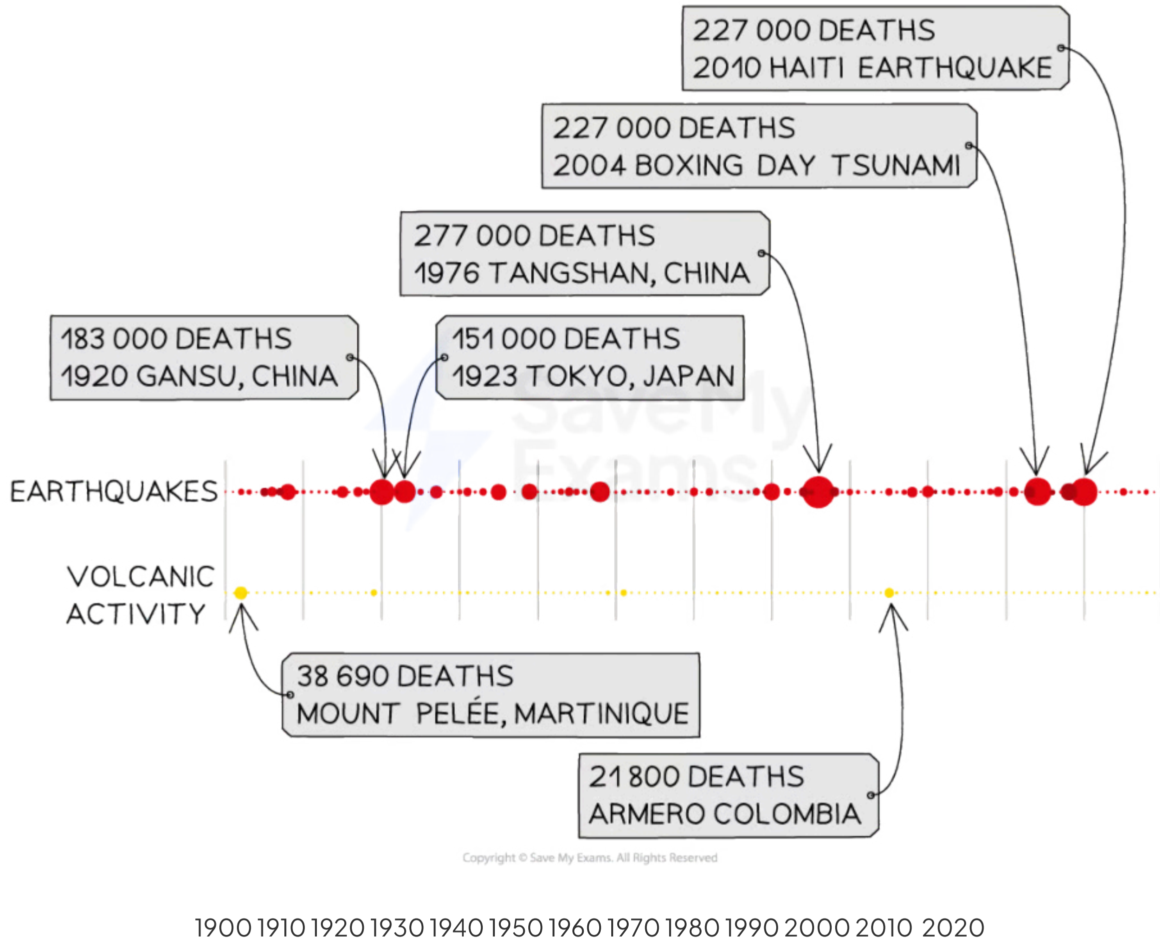
Global tectonic disasters 1900–2022



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

Deaths resulting from tectonic activity



Deaths resulting from tectonic activity

- 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

7.4.2 Hazard Adaptation

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Land Use Zoning

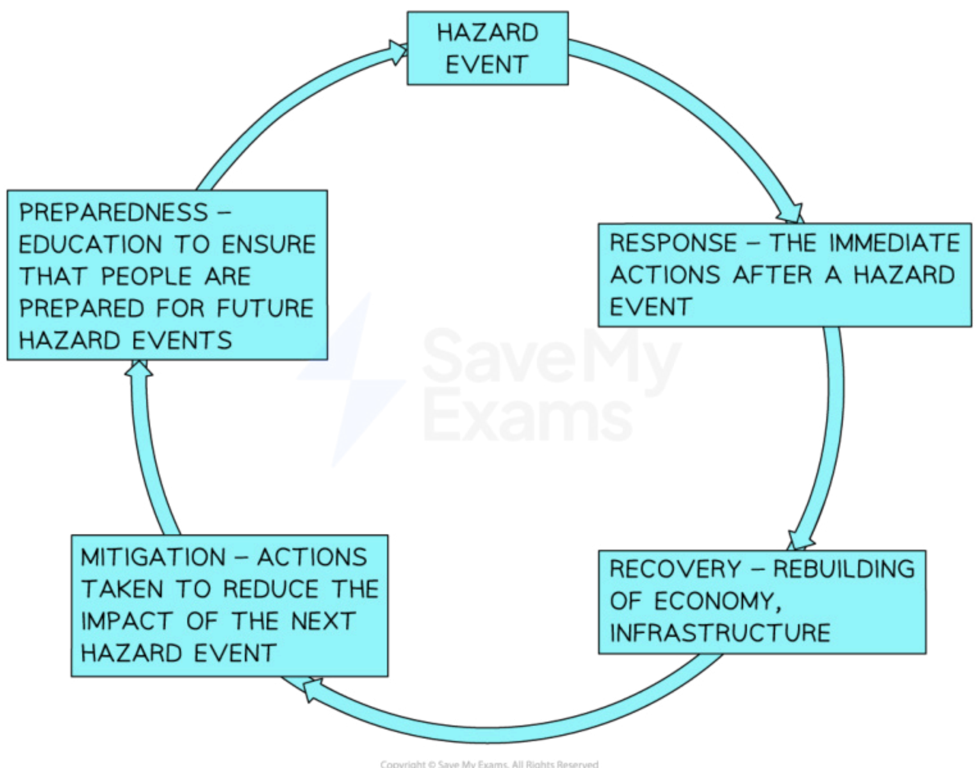
Geophysical hazard adaptation

- 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

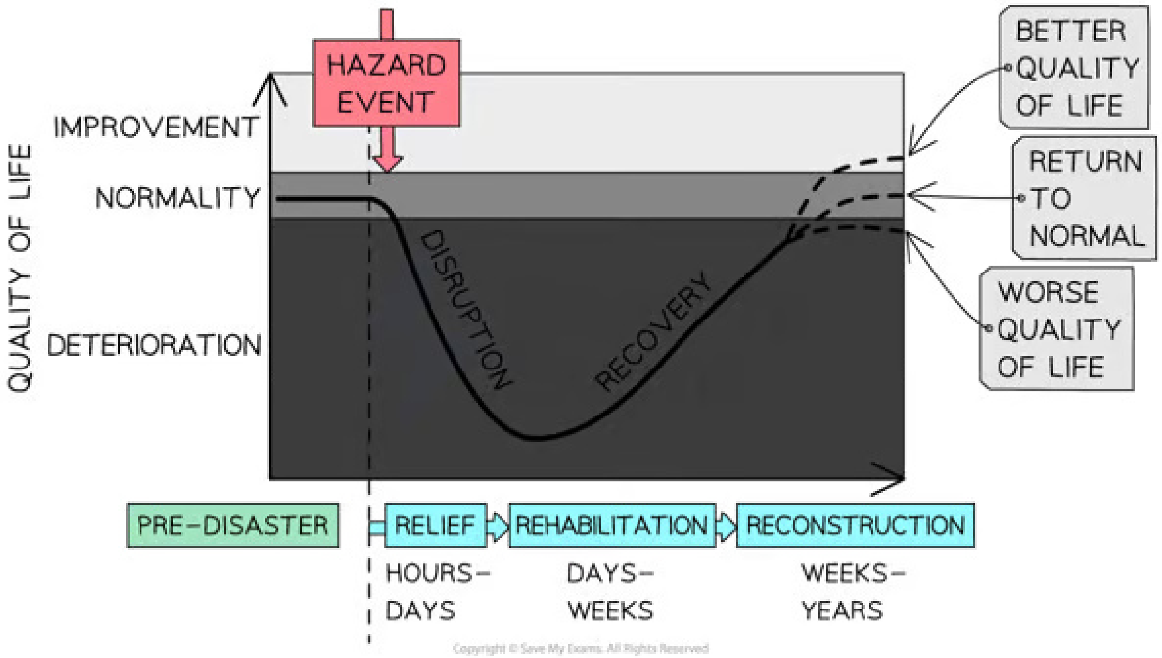


Hazard management cycle

- 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



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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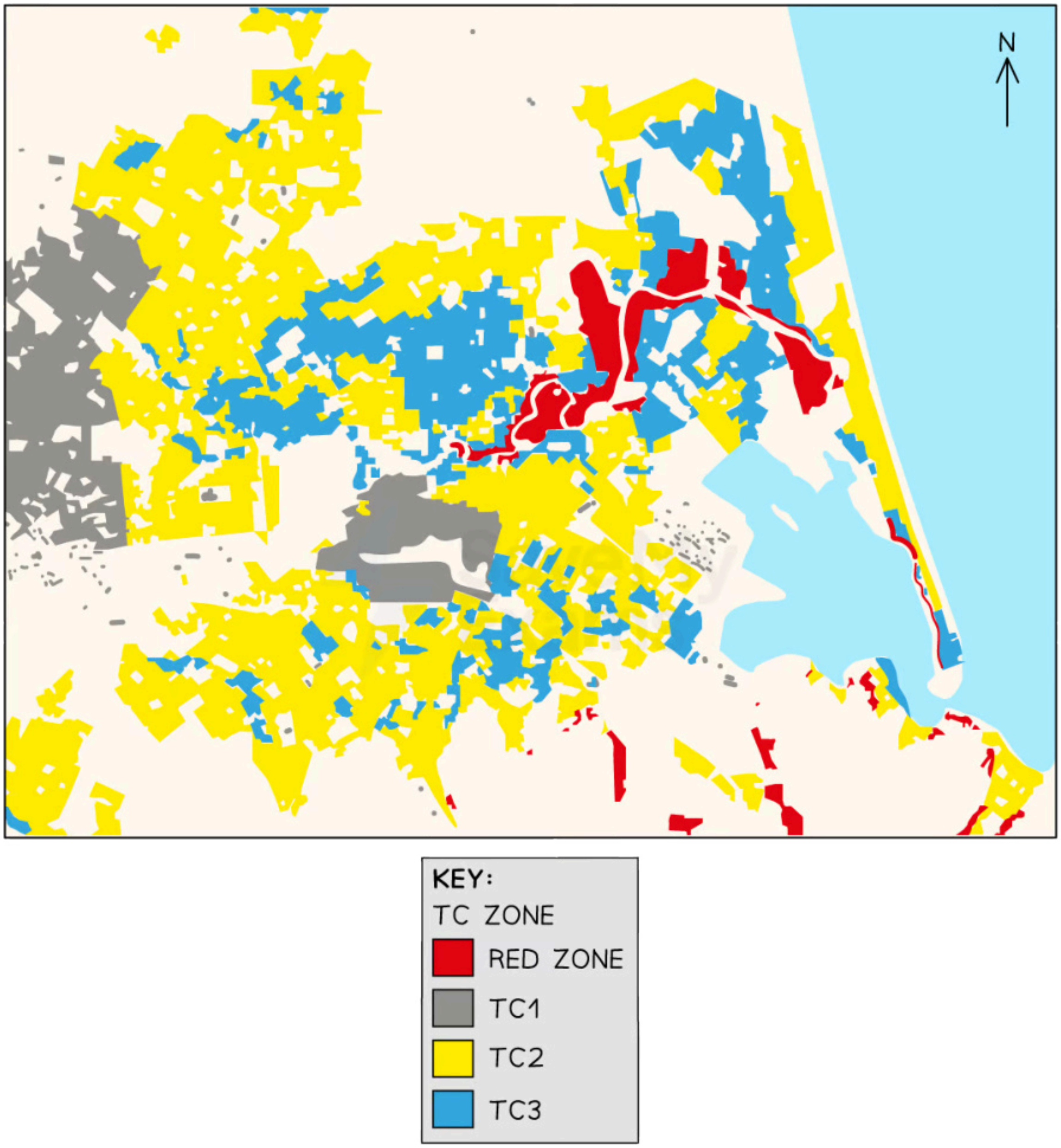

Land use zoning in Christchurch, New Zealand

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 (LNZ) 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

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 is higher if you are in a high-risk area; this can make it unaffordable for people on lower incomes

The cost of alternative accommodation is covered if you are not able to return to your property	The **excess** (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

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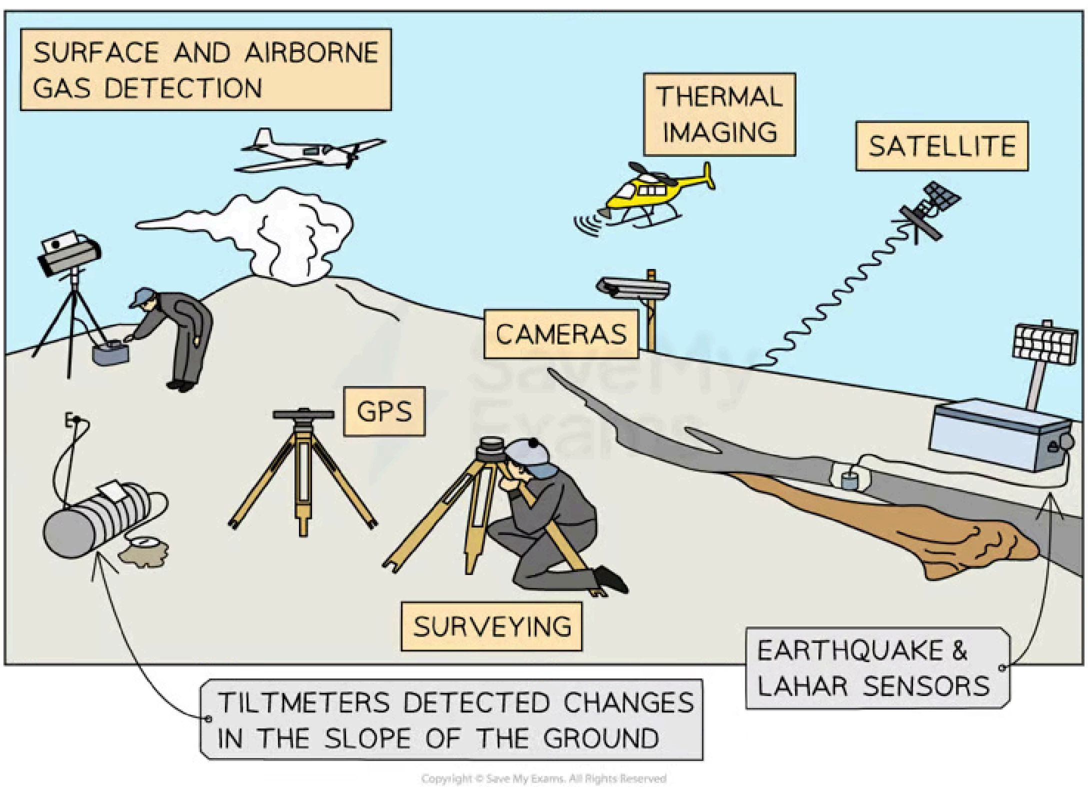
7.4.3 Management Strategies

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



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

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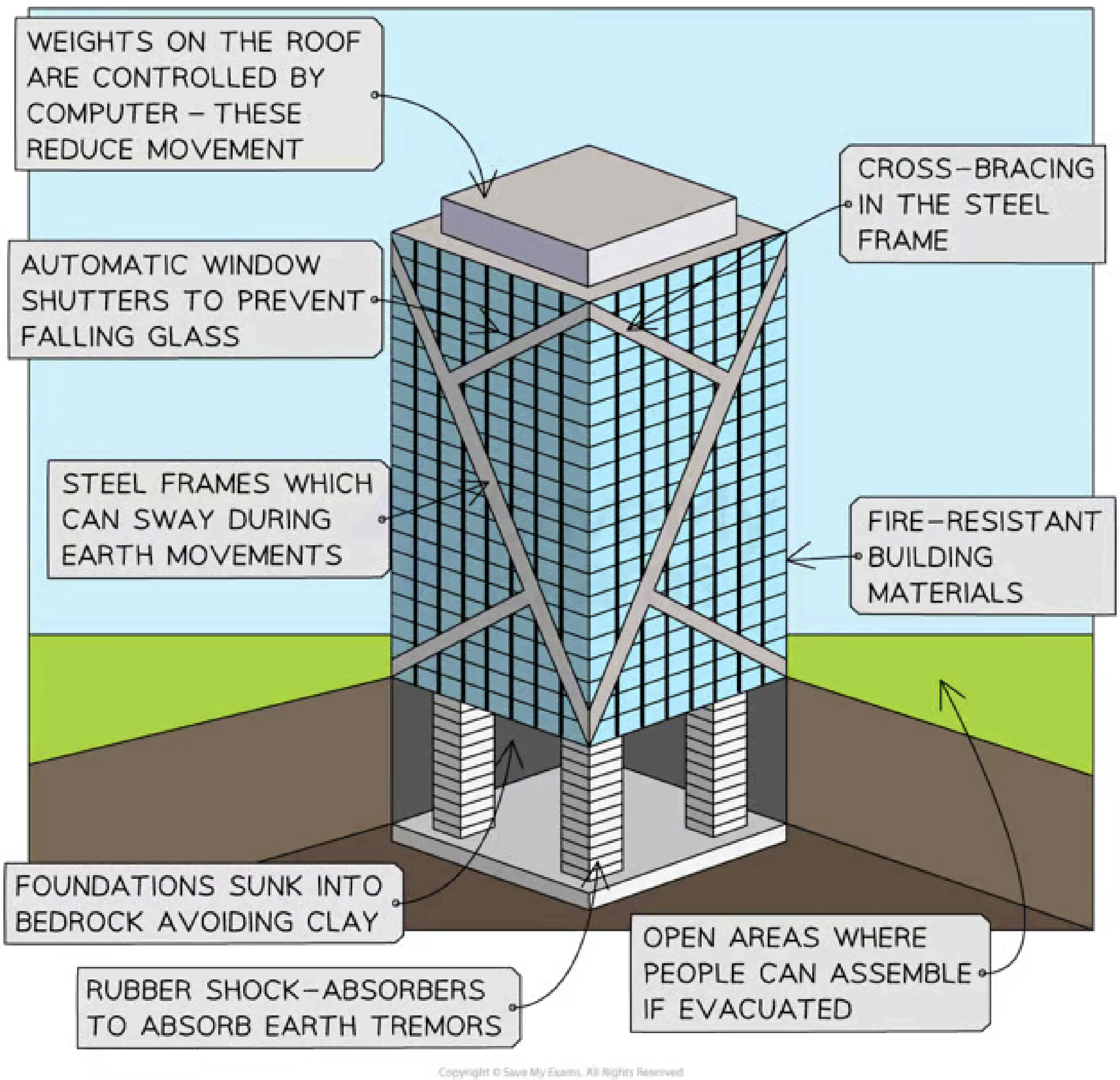
Pre-event Management Strategies - Earthquakes

- 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



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

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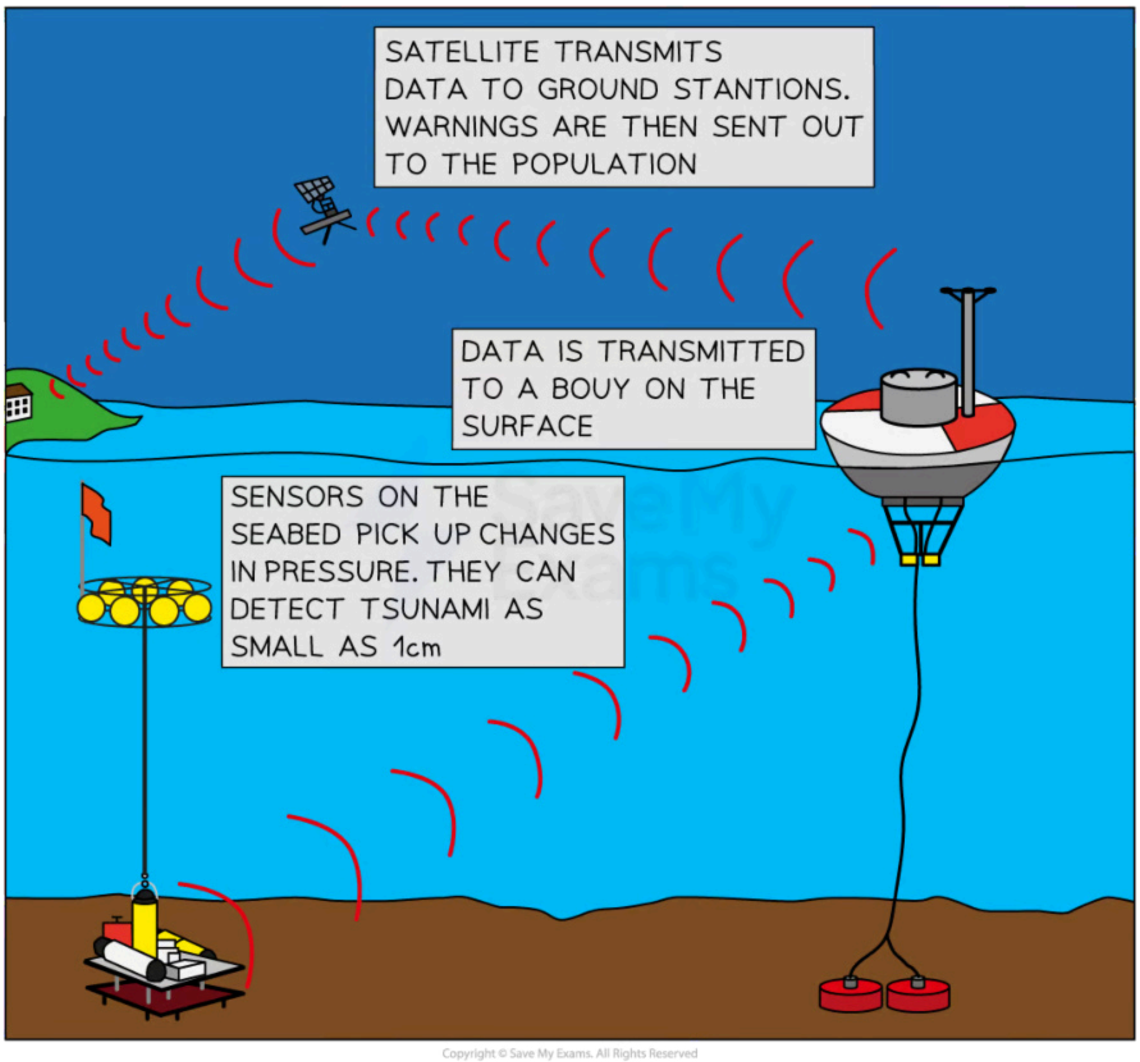
Tsunami

- 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

Tsunami warning system



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

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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