Haiti 2010 Earthquake

Date	12th January 2010	
Magnitude on Richter scale	7.0	
Depth	13 km	
Distance to nearest city	25 km WSW of Port-au-Prince (the capital of Haiti)	
Cause of the disaster	• Haiti sits amongst a complex set of plate margins. • 2 conservative plate boundaries between the N.American & Caribbean plates. It was movement in the Enriquillo-Plantain Garden fault system, in the south of the country, that caused the 2010 earthquake. • The plates moved 1.8m, 13km deep and 24km from the capital • 6.1 aftershock (52 shocks over 4.5 in total) – 20th January 2010	

Social impacts	Death toll	approx. 230,000
	Injured	approx. 300,000
	Number of people displaced/ homeless	approx.1.2 million
	Other social impacts	6900 cholera deaths with 500,000 cases – believed to originate from Nepal UN aid. Government – unable to prevent lawlessness – 4000 prisoners escaped
Economic impacts	Buildings damaged/ destroyed	Approx. 280,000 buildings collapsed. Also, the Presidential Palace & the Port-au-Prince Cathedral were significantly damaged
	Cost of damage	The estimated cost of damage was $7.8 billion
	Other economic impacts	Loss of crops meant food prices rapidly increased
Other impacts	Environmental impacts	Slumping, sliding and subsidence from liquefaction

Responses	Immediate	• Neighbouring Dominican Republic was amongst the first to give aid, sending in supplies of water, food and heavy lifting machinery to help rescue people from beneath collapsed buildings. They also made their own hospitals available and permitted people to cross the border to receive help. Iceland had an emergency response team in the country within 24 hours. As days passed it became difficult for relief planes to land, as only part of the airport was usable and there were queues in the skies above Port-au-Prince. • Six international and 8 Haitian medical teams addressed health needs of the survivors through mobile medical clinics. • The Red Cross and other agencies sent a convoy of trucks carrying aid which included a 50-bed field hospital, surgical teams and an emergency telecommunications unit. • The UK government gave £20 million for the humanitarian response to provide food, shelter, health and relief work. • Millions of pounds of private donations also poured into appeals such as that launched in the UK by the Disasters Emergency Committee. • The United States sent planes full of rescue workers, an aircraft carrier and three amphibious ships with thousands of soldiers, along with a team to restore air traffic control to the airport. • Huge graves, some taking more than 100 bodies, were dug in rural areas just outside the capital, while in the shantytown of Carrefour, local authorities said more than 2,000 corpses had been burned. • The logistics of distributing aid was a nightmare, and problems were compounded by damaged roads and broken phone lines.
	Long-term	• Support for people without jobs, which equates to nearly 70% of the population, through cash/ food-for-work projects • Water and sanitation eventually supplied for 1.7 million people • Schools rebuilt and new teachers have been trained • Rubble on the road was gradually cleared • Some people still live in aid camps, even many years after the earthquake

WHY WAS IT SO DISASTROUS?

Physical factors

- Haiti has suffered from other natural hazards which has increased its vulnerability and reduced its capacity to cope. It sits in the direct path of hurricanes.
- In 2004, 3,000 people were killed in Haiti due to the impact of Tropical Storm Jeanne.
- The following factors increased vulnerability and reduced resilience:

Human factors

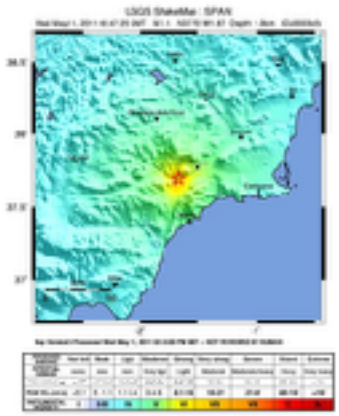
- Poverty - In Haiti, in 2010, 72.1% of the population were living on less than $2 a day. (BBC, 2010).
- Overcrowding
- Corruption - Foreign aid has not always reached those in need. According to a UN report, of the $9billion dollars given in aid, 85% went to non-Haitian organisations, which have been difficult to control and monitor, leading to concerns about corruption and mismanagement of funds. (twitter, 2015)
- Mismanagement of aid and the spread of cholera - However, foreign aid helped to reduce the loss of life, however help from richer countries was criticised for being slow and not reaching the areas where it was most needed. Mismanagement of funds, poorly coordinated aid efforts, continued poverty and poor hygiene led to the spread of the cholera epidemic, which claimed more than 8000 lives. (Guardian, 2012).

New Zealand, 2010 and 2011 Earthquakes

Two major earthquakes occurred within 6 months of each other, affecting Christchurch, South Island.

		Darfield earthquake, NZ	Lyttleton Aftershock, NZ
Background facts	Date	4th Sept 2010	22nd February 2011
	Magnitude on Richter scale	7.0	6.1
	Depth	5 km	5.9 km
	Distance to nearest urban area	45 km W of Christchurch	6 km from Christchurch
Causes	The earthquakes took place on a shallow oblique-reverse fault on or near the boundary between the Pacific and Australia plates. An oblique-reverse fault occurs when two tectonic plates are drifting towards each other, resulting in a build-up of tension. Eventually, one of the plates will slip over the other, causing an earthquake.		
Social impacts	Death toll	0	181
	Injured	2	1,500
	Buildings damaged/ destroyed	six bridges and many buildings damaged in the Christchurch area	100,000
Economic impacts	Cost of damage	$3.5 billion	$8 billion
Responses/ Management:	• New Zealand, being a developed nation, has a well-developed hazard resilience programme, known as the Natural Hazards Platform, set up in 2009. This programme helped to minimise the impacts of tectonic events.		
Responses and management to 2011 New Zealand earthquake	• After the 2011 aftershock a national state of emergency was issued, lasting 5 days. A full Emergency Plan was in action within two hours, coordinated by the National Crisis Management Centre in Wellington. This helped reduce the impacts, such a secondary deaths. • St John's ambulance had 16 ambulances operational within half an hour of the earthquake. • International aid was provided in the form of money (around $6-7 million) and aid workers. • $898 million has been paid out in building claims. • Damaged buildings had different coloured cards placed on them to indicate how damaged they were (Green: Safe, through to Red: Unsafe, must be demolished). • Earthquake commission funds Geonet which funds programs for people to Quakesafe their homes. • Geonet detects and monitors earthquakes and can provide emergency services with info within a few minutes of an earthquake. • The AMI stadium has been reinforced by10m stone columns which can stop liquefaction. In New Zealand regular earthquake drills are carried out to ensure people know what to do. Plus, all buildings are made life safe to ensure that they will not collapse in case of an earthquake and any old buildings have been refitted/rebuilt to withstand future earthquakes. • Homes are no longer being rebuilt in seismically dangerous zones. The government has instigated purchases of both land and houses in high risk zones and works with insurance companies to accelerate safe recover.		

Lorca 2011 Earthquake

Date	11th May 2011	
Magnitude on Richter scale	5.1	
Depth	1 km	
Distance to nearest city	30km from Murcia	
Cause of the disaster	The earthquake was estimated to be a direct result of strike-slip faulting near the major Alhama de Murcia fault. It is an intra-plate earthquake	

Social impacts	Death toll	9
	Injured	403
	Number of people displaced/ homeless	approx. 1000
Economic impacts	Buildings damaged/ destroyed	Tourist attractions destroyed and shut including all 13 churches and the castle
	Cost of damage	$300 million
Responses/ Management:	Lack of preparation: As earthquakes are infrequent in Spain, the population was not aware that they were at risk. People had no training and were not earthquake prepared so there was chaos. 9 people died and 403 were injured, which could have been lower if some had known what to do (e.g. avoid narrow streets where the risk of falling objects in greater) Emergency response: 340 members of the Military Emergencies Unit, a branch of the Spanish Armed Forces responsible for providing disaster relief were dispatched to Lorca. A field hospital was set up by the Military Emergencies Unit in the Plaza del Ayuntamiento where those injured were attended to by members of Protección Civil and the Red Cross.	

Asian tsunami, 2004

Background facts	Countries affected	14 countries in South Asia and East Africa.
	Date	26th December 2004
	Magnitude on Richter scale	9.1
	Depth	30 km
	Distance to nearest coastline	250 km SSE of Banda Aceh, Sumatra, Indonesia
Causes	It was the result of the Indio-Australian Plate subducting below the Burma Plate. It was caused by an earthquake measuring more than magnitude 9. 1600km of fault slipped 15m along the subduction zone displacing 30km^3 of water along the 1600km fault (not just one point). The earthquake caused the seafloor to uplift, displacing the seawater above. Displacement created up to 30m tall waves, a 1.5m wave reached South Africa 16hours later – after travelling 8500km.	
Social impacts	Death toll	227,898
	Number of people displaced	1.7 million
	Number of villages destroyed	Over 1500
Economic impacts	Buildings damaged/ destroyed	460000
	Economic damage	$10.7 billion
	Damage to industries	Fishing and tourist industry severely damaged – 80% reduction in Phucket tourist income
Other impacts	Environmental impacts	Severe damage has been inflicted on ecosystems such as mangroves, coral reefs, forests, coastal wetlands, vegetation and sand dunes. The spread of solid and liquid waste and industrial chemicals has led to water pollution
Management/ Responses	Immediate	13.6 billion dollars was raised in international aid
	Long-term	A tsunami early warning system (TWS) has been set up in the Indian Ocean

Tohoku earthquake and tsunami, 2011

Background facts	Countries affected	2 - Japan and USA
	Date	11th March 2011
	Magnitude on Richter scale	9.0
	Depth	30 km
	Distance to nearest coastline	129 km east of Sendai
Causes	Subduction at the Pacific-North American plate boundary. 32km deep earthquake moved Honshu 2.4m east. Located near 4 converging plates (Eurasian and Philippine as well). The ocean floor moved up or dropped down depending on location – 130km from Sendai. Up to 10m tsunami waves impacting 3000km of coastline.– 6m waves appeared in 10 minute.	
Social impacts	Death toll	15,703
	Number of people displaced	340,000
	Other social impacts	Shortages of food, water and accommodation in first few days Entire towns wiped out e.g Ayukawahama
Economic impacts	Buildings damaged/ destroyed	1.2 million
	Economic damage	$574 billion
	Other economic impacts	0.5% fall in GDP Roads, 17 bridges, railways, airport, harbours, sewage treatment and water supplies damaged
Other impacts	Environmental impacts	Meltdown in 2 nuclear reactors at Fukushima – releasing radioactive material Up to 15km inland was flooded Saltwater contamination
Management/ Responses	$1billion from red cross (UK) aid 30km exclusion zone around Fukushima Billions injected by the government into financial systems to maintain stability	

Montserrat Volcanic Eruptions, 1995-1997

Background facts	Countries affected	1
	Date	1995-1997
Causes	**Causes** Over time subduction of the North American plate (O) beneath the Caribbean plate (O) created volcanic eruptions which formed the Lesser Antilles island arc, specifically, Chances Peak in the Soufriere Hills (a composite volcano) on the 10 by 16km island Montserrat. **Eruptions** In 1995 earthquakes, lahars and small eruptions began 25th June 1997 the main eruption occurred and the volcanic dome collapsed creating large pyroclastic flows. 4-5million m3 of material released over 20 minutes with 200km/h pyroclastic flow reaching with 50m of the 5.5km away airport at 300-400°C 11 Feb 2010 -15km ash column & a 10% collapse of the lava dome made a pyroclastic flow.	
Social impacts	Death toll	19 deaths
	Number of people displaced	over 5000
	Other social impacts	7 injured Hundreds homeless 12,000 pop. fell to 2500 before increasing to 5000 (4000 to UK rest to Antigua & USA)
Economic impacts	Buildings damaged/ destroyed	Fires destroyed infrastructure – government and police buildings and petrol stations 1996 city of Plymouth entirely evacuated with the rest of the south
	Economic damage	Loss in value of homes and investments worth £1 billion
	Other economic impacts	20 villages and 2/3 homes destroyed. 3/4 of infrastructure destroyed. Tourists stayed away and businesses were destroyed, disrupting the economy, before returning to see the volcano Schools, hospitals, ports and airports destroyed
Other impacts	Environmental impacts	12m of mud and ash cover the capital and large areas Vegetation and farmland destroyed Volcanic ash has improved fertility of the soil
Management/ Responses	Evacuation of the south to the safe north in 1995. Evacuee shelters built Temporary roads and electricity supplies and infrastructure built £17million UK aid for emergency Local emergency services supported for search and rescue Risk map crated the exclusion zone still in effect today £41million UK long term development aid for the north with new houses, airport and docks as well as the new capitals development – Little Bay Montserrat Volcanic Observatory set up to predict future eruptions	

Eyjafjallajokul, Iceland, 2010

Background facts	Countries affected	Iceland and most of Western Europe
	Date	March 2010
Causes	A constructive boundary with the North American and Eurasian plates diverging and a hotspot are located under Iceland. In March 2010 a 150m long fissure opened with 10 to 12 erupting craters emitting 1000°C, slow basaltic and viscous lava 150m high, but only travelling 4000m away. Ash only rose 4km high. The second phase (VEI4) on 14th April 2010 was explosive with ash reaching 8km high, deflected eastwards by PFJS – unusually stable in a SE direction towards Europe Jokulhlaups were created as the volcano melted the glacier of Eyjafjallajokul.	
Social impacts	Death toll	0
	Number of people displaced	800 people evacuated from the remote area, no deaths.
	Other social impacts	Jokulhlaups damaged roads, bridges and farms Long term damage to farms in Raufarfell due to a thick, wet and compact layer of ash 10million passengers disrupted
Economic impacts	Economic damage	European air traffic shut down for 6 days due to ash potentially causing engine failure. £1.3 to £2.2 billion cost due to disruption of aviation
Other impacts	Environmental impacts	The eruption beneath 200m of glacial ice created a Jokulhlaups, water flowed back into the volcano along meltwater channels, the rapid vaporising increased explosivity of the eruption and fast cooling lava created glass rich ash– particularly bad for aircrafts.
Management/ Responses	Over the previous weeks small earthquakes had been recorded, so warnings were made 500 farmers evacuated overnight and roads expected to flood were closed Royal Navy warship collected returning Afghan soldiers and Spanish holidaymakers Preparation: Iceland was well prepared due to its high frequency of volcanic events Low eruption frequency across Europe meant it was unprepared – leading to reviews of whether plains had to be grounded or could have been re-routed	

Mt Merapi, Indonesia, 2010

Background facts	Countries affected	Indonesia
	Date	Between 25th-26th October 2010 Mt Merapi erupted three times
Causes	It is located on the subduction zone of the Indo-Australian and Eurasian plates. It is one of the most active volcanoes in Indonesia and has been erupting frequently since 1548. Since 1920 there have been 10 eruptions that have caused human fatalities. Typically, smoke can be seen emerging from the top of the volcano 300 days in the year. Mt Merapi is 9551ft tall and is an active composite volcano and has andesitic lava. It is cone-shaped with a narrow base and steep sides, which are made of alternate layers of lava and ash from previous eruptions. Eruptions have become much more explosive and often generate lava domes. The collapse of these domes have often caused pyroclastic flows and longer explosions.	
Social impacts	Death toll	353
	Number of people displaced	200,000 people were made homeless by the eruption and 320,000 people were displaced.
	Other social impacts	People suffered from breathing difficulties from contaminated air (ash and acidic fumes)
Economic impacts	Economic IMPACTS	Vegetable prices increased because of damage to crops. Planes were grounded in Western Australia because of the risk of damage to aircraft from the ash cloud. Lava flows damaged ski lifts.
Other impacts	Environmental impacts	Ash, rock and lava deposited on the sides of the volcano was washed down into towns by rainfall creating a lahar. Sulphur dioxide was blown across Indonesia as far South as Australia. Water contaminated with acidic lava and ash.
Management/ Responses	**Short Term** Thousands were evacuated from a 20km radius around the slopes of the volcano. 210 evacuation centres were set up either as tents, in schools, churches, stadiums or government offices. 1600 people, either volunteers or military were part of the national aid response. International aid was offered from organizations such as the Red Cross. **Long Term** Formal evacuation centres were eventually set up because building such as schools and government offices were needed for their official uses. 2682 people had been moved to new safer houses permanently. The government is making money available to farmers to help replace their livestock. The government has set up a special task force to support people that have been affected by the volcano either by family issues, or because they have lost their jobs.	
Prediction	The monitoring of Mt Merapi began in 1942 using Seismometers. Some of these volcano monitoring stations are still around today. The monitoring systems have been updated as technology and scientific understanding has progressed. During the 1950s and early 1960s many of the stations were deprived of equipment sue to lack of funds, yet by the 1970s considerable improvement occurred with the supply of new equipment. Other measurements on the volcano are magnetic measurements and tilt measurements. Small changes in local magnetic fields have been found to coincide with eruptions and tilt measurements show the inflation of the volcano as magma rises.	