1.3 Topic 1: World at Risk

Overview

This topic considers the physical processes that cause natural hazards, as well as the relationship between 'hazard' and 'disaster'. A key theme is investigating the distribution on natural hazards and trends in both hazard events and disasters. Hydro-meteorological hazards are frequently linked to global warming, but this topic also allows for an in-depth study of climate natural change on longer timescales as well as a consideration of the consequences of, and responses to, a warming world today and in the future.

1.3.1 Global hazards	**Enquiry question: What are global hazards and what causes them?**
Key idea	**Detailed content**
Natural hazards are caused by geophysical processes	• Plate tectonics and volcanic processes cause geophysical hazards (earthquakes, volcanic eruptions, tsunami). • Landslides and avalanches are complex hazards caused by slope processes, often triggered by weather or tectonic events.
Natural hazards are caused by hydro-meteorological processes	• Short-term meteorological conditions cause hydro-meteorological hazards (cyclones, floods). • Drought is caused by medium-term trends in rainfall; ENSO cycles can be linked to weather hazards (flooding, drought) (🌍 Pacific basin).
Disaster risk can be explained by the relationship between hazards, vulnerability and capacity to cope	• The relationship between natural hazards and disasters and how the magnitude of hazard events can be measured using different scales (Moment Magnitude, Saffir-Simpson, VEI, flood discharge). • The disaster risk equation (Risk = hazard x vulnerability/ capacity to cope) can help explain contrasting disaster profiles. (1)

1.3.2 Global hazard distribution	**Enquiry question: Which areas are affected by geophysical and hydro-meteorological hazards and disasters?**
Key idea	**Detailed content**
The distribution of hazards is uneven, and related to both physical and human factors	• The geographical distribution of natural hazards (hydro-meteorological and geophysical) can be related to the physical processes that cause them. (2) • Human factors (level of development, population density, accessibility and governance) can help explain patterns of disaster impact globally and regionally. (3)

1.3.2 Global hazard distribution (continued)	**Enquiry question: Which areas are affected by geophysical and hydro-meteorological hazards and disasters?**
Key idea	**Detailed content**
Some locations are especially vulnerable to multiple hazard processes	• The concept of multiple hazard zones and why some locations are considered hazard hotspots due to the frequency of different hazards events (🌍 Philippines and California). • The human and economic costs of disaster events in multiple hazard zones may have an effect on economic development and potential (🌍 Philippines and California).
Rare, high magnitude disaster events can have regional or global significance	• The concept of mega-disasters (tsunami, earthquakes, regional drought) that affect more than one country with unusually large human and economic impacts. • The implications for regional economies and the global economy of mega-disasters both in terms of impacts and the scale of the required response (🌍 2004 Asian tsunami or 2011 Japanese tsunami). (4)

1.3.3 Global hazard trends	**Enquiry question: What are the global trends in hazard occurrence and disaster impacts?**
Key idea	**Detailed content**
Some types of natural hazard are increasing in magnitude and frequency	• Evidence for trends in the occurrence of hydro-meteorological hazards (floods, drought and cyclones). (5) • Explanations for these trends include both physical (changing weather patterns, climate change) and human (deforestation, desertification) factors.
There are complex global trends in terms of disaster occurrence and impacts	• Disasters and their impacts can be defined and measured using data on economic losses, deaths and numbers affected which reveal contrasting trends for different disaster types. (6) • Explanations of disaster trends need to account for rising economic losses, rising numbers of people affected but falling death tolls.
There are differences in degree of predictability and effectiveness of hazard response	• Prediction and monitoring technology can reduce the impact of some disasters (volcanic eruption prediction, tsunami warning, cyclone tracking) but not others (earthquakes). • Warning, evacuation, hazard resistant design, community preparedness, land-use zoning and aid can all reduce disaster impacts but are not universally available (🌍Selective reference to developed, emerging and developing country place contexts).

1.3.4 Climate change	**Enquiry question: How and why has climate changed in the past and how significant is recent global warming?**
Key idea	**Detailed content**
There is evidence that the global climate has changed significantly in the past	• Tree rings, ice and ocean sediment cores provide evidence for long-term changes to Earth's climate during the Quaternary period, with repeated glacial and interglacial cycles. • Evidence for medium-term, smaller climate fluctuations (Little Ice Age, Medieval Warm Period) comes from a range of sources (pollen records, historical sources, art).
Natural climate change has a number of causes	• Milankovitch Cycles (orbital eccentricity, axial tilt and precession and cooling/warming feedback mechanisms) provide an explanation for long-term climate cycles. • Variations in solar output (11 year and longer sunspot cycles) and the impact of volcanic emissions can provide an explanation for medium and short-term climate changes.
Recent global warming needs to be set within a longer climate context	• Reconstructed past climate temperature records can be compared with climate warming since 1960 in terms of magnitude and pace of change. • The reliability, geographical coverage and accuracy of past and more recent climate data and predictions can be questioned.

1.3.5 The causes and impacts of global warming	**Enquiry question: How significant are the current and future impacts of global warming in contrasting locations?**
Key idea	**Detailed content**
Rising emissions are widely blamed for contemporary global warming	• Changes in atmospheric composition (CO2, CH4, NOx) since 1960 show trends in concentrations of greenhouse gases, which are linked to an enhanced greenhouse effect. (4) • There are variations in the sources of these emissions by economic activity, countries (including change over time) both in absolute and per capita terms (developed, emerging and developing countries).
There are large uncertainties about the future climate	• The range of projections of future global warming and sea level rise (IPCC models) are uncertain due to multiple factors (future population and economic development, mitigating efforts). (7) • Uncertainty also results from physical feedback mechanisms (ice albedo feedback, ocean carbon sinks, forest 'die-back'), which could lead to climate tipping points.

1.3.5 The causes and impacts of global warming (continued)	**Enquiry question: How significant are the current and future impacts of global warming in contrasting locations?**
Key idea	**Detailed content**
Global warming is a significant risk in some locations	• Sea-level rise represents a major risk to some low-lying countries that are physically and economically vulnerable, and many coastal cities (Maldives or Asian mega-deltas). • Shifts in the location of climate belts represent risks to farmers in terms of precipitation levels, especially in rain-fed, low-income locations (Sahel).

1.3.6 Managing global climate risk	**Enquiry question: How can the risks from global warming be managed globally and locally?**
Key idea	**Detailed content**
Mitigation of emissions has a mixed record of success	• Action to mitigate carbon emissions has happened at a national scale (renewable energy, carbon taxes, recycling) in some but not all countries. • Global actions (Montreal 1987, Kyoto 1997, Paris 2015) have had variable success both in terms of reaching agreement and actual emissions reductions.
Adaptation to future climates is possible, but carries risks	• Adapting to rising sea levels and increased flood risk requires costly engineering, which is possible in some locations but unaffordable in others (Bangladesh and Netherlands). • Farming adaptations (irrigation, crop changes, drought resistant crops) require investment, which may not be available to subsistence producers.
Attitudes to global warming vary, and some may see it as an opportunity	• Globally, and within countries, attitudes to the degree of threat posed by global warming vary between different groups and organisations. • Global warming may provide new economic opportunities in some high-latitude locations (Arctic), and is not universally accepted as 'real' or a threat.