








GCE 2008

6GEO2 Unit 2 Geographical Investigations - Student Guide: Extreme Weather

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-  4. Investigating extreme weather
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1. Overview

- Unit 2 has four components, but you are only required to study two of these.
- In the **75 minute** exam you answer one question based on your two chosen topic areas. This means there is no choice.
- This exam is designed to test both knowledge and understanding of geographical concepts as well as geographical skills.
- Fieldwork, research and the enquiry process lie at the heart of this exam.
- The most important ways of ensuring the highest possible grades in this module is (i) being able to focus on the question set, (ii) to be able to use resources effectively, and (iii) to get your fieldwork in a form that works for the exam.

UNIT 2: The Paired Options -you only study one in each pair!

The 'Physical' Pair

1. Extreme Weather
2. Crowded Coasts

The 'Human' Pair

1. Unequal Spaces
2. Rebranding



UNIT 2 - Assessment overview and structure

- Normally the first part of each question starts with a data stimulus element.
- The fieldwork and research elements are related directly to work you have carried out during a field trip AND may involve questions about how you processed, interpreted etc what you found.
- The remaining question is more management and issues based. Here case study knowledge will be required.

3 COMPONENTS

Data stimulus
Describe and explain

a,b,c in
any order

Fieldwork and research focus
Describe and explain

10,10,15 marks
in any order

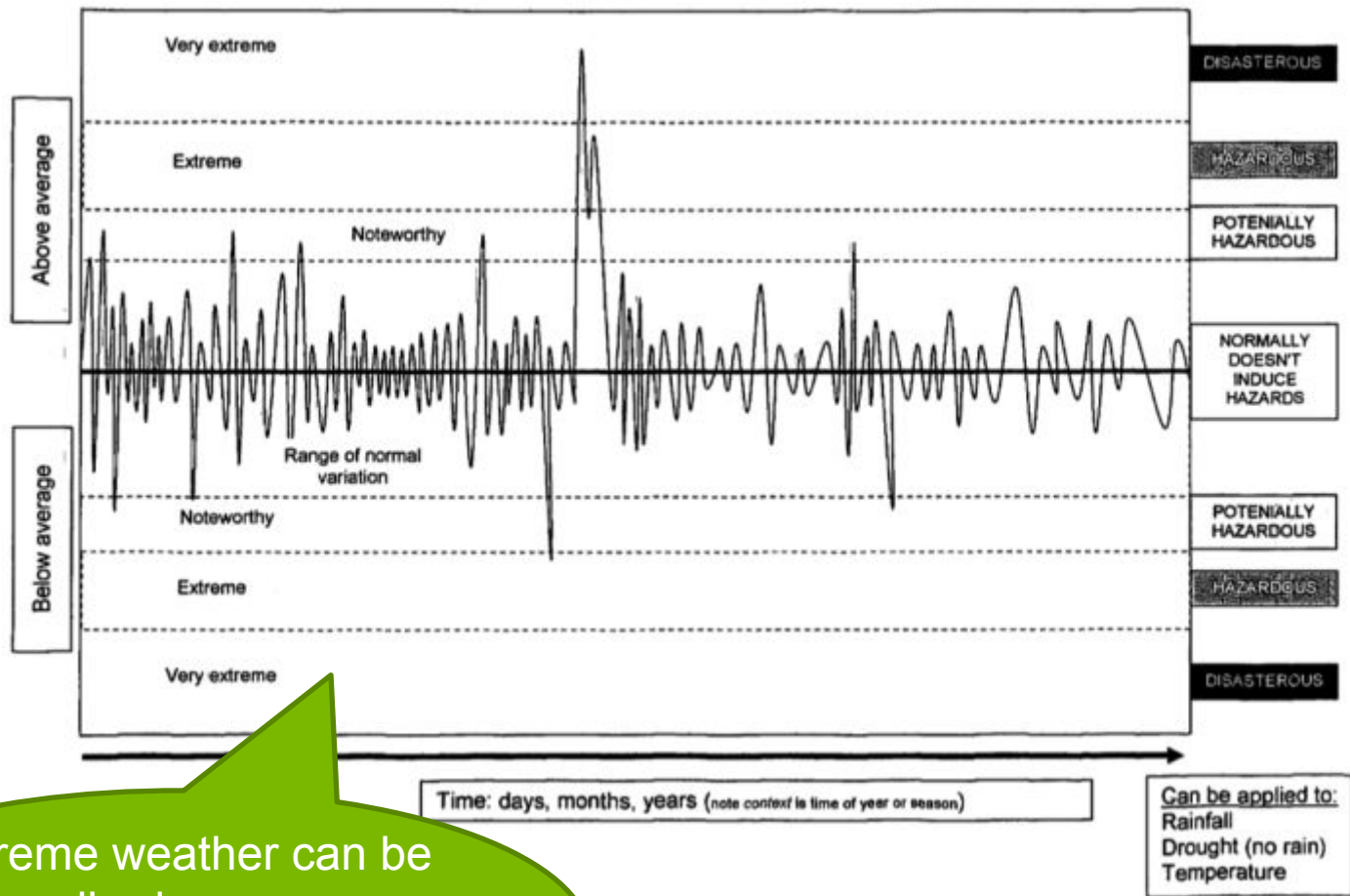
Management focus
Examine / Explain

- The data stimulus is unlikely to be the 15 mark question
- Data stimulus with an analysis element is possible



What do we mean by extreme weather?

Notice how weather naturally varies (spikes on graph). It is only when it becomes noteworthy, extreme or very extreme that it is usually a hazard



Extreme weather can be described as severe, unexpected or at record levels.



Extreme weather at Malham Tarn (Source: Field Studies Council)

Records

Temperature

	2006		Ever (1959-2005)		
	Date	Amount	Date	Amount	
Warmest day	18 July	27.0 °C	3 Aug 1990	28.2 °C	Highest air temperature recorded
Coldest day	4 March	-7.4 °C	5 Mar 2001	-13.5 °C	Lowest air temperature recorded
Warmest month	July	21.9 °C	Aug 1995	20.6 °C	Highest average of all Max Thermometer readings
Coldest month	Feb/March	-0.9 °C	Feb 1986	-5.6 °C	Lowest average of all Max Thermometer readings
Lowest grass temperature	4 March	-11.2 °C	5 Mar 2001	-20.1 °C	
Lowest 10 cm temperature	12 March	-1.0 °C	14 Dec 1999	-7.1 °C	
Lowest 30 cm temperature	8 March	1.0 °C	28 Feb 1994	0.6 °C	

Rainfall

Wettest day	12 December	46.2 mm (1.8 in)	31 Jan 2002	135.4 mm (5.3 in)
Wettest month	December	263.5 mm (10.4 in)	Feb 2002	364.1 mm (14.3 in)
Driest month	June	21.78 mm (0.9 in)	Jan/Feb 1979	No rain
Highest total rainfall for the year	2005	1508.4 mm (59.4 in)	2000	2097.9 mm (82.6 in)

Sunshine

Sunniest day	9 June	13.6 hours	7 May 1985	15.7 hours
Sunniest month	July	257.5 hours	Aug 1995	246.2 hours
Least sunny month	January	18.9 hours	Jan 1997	No sun

How does this extreme weather data compare with where you live, or nationally?

2006 in graphs

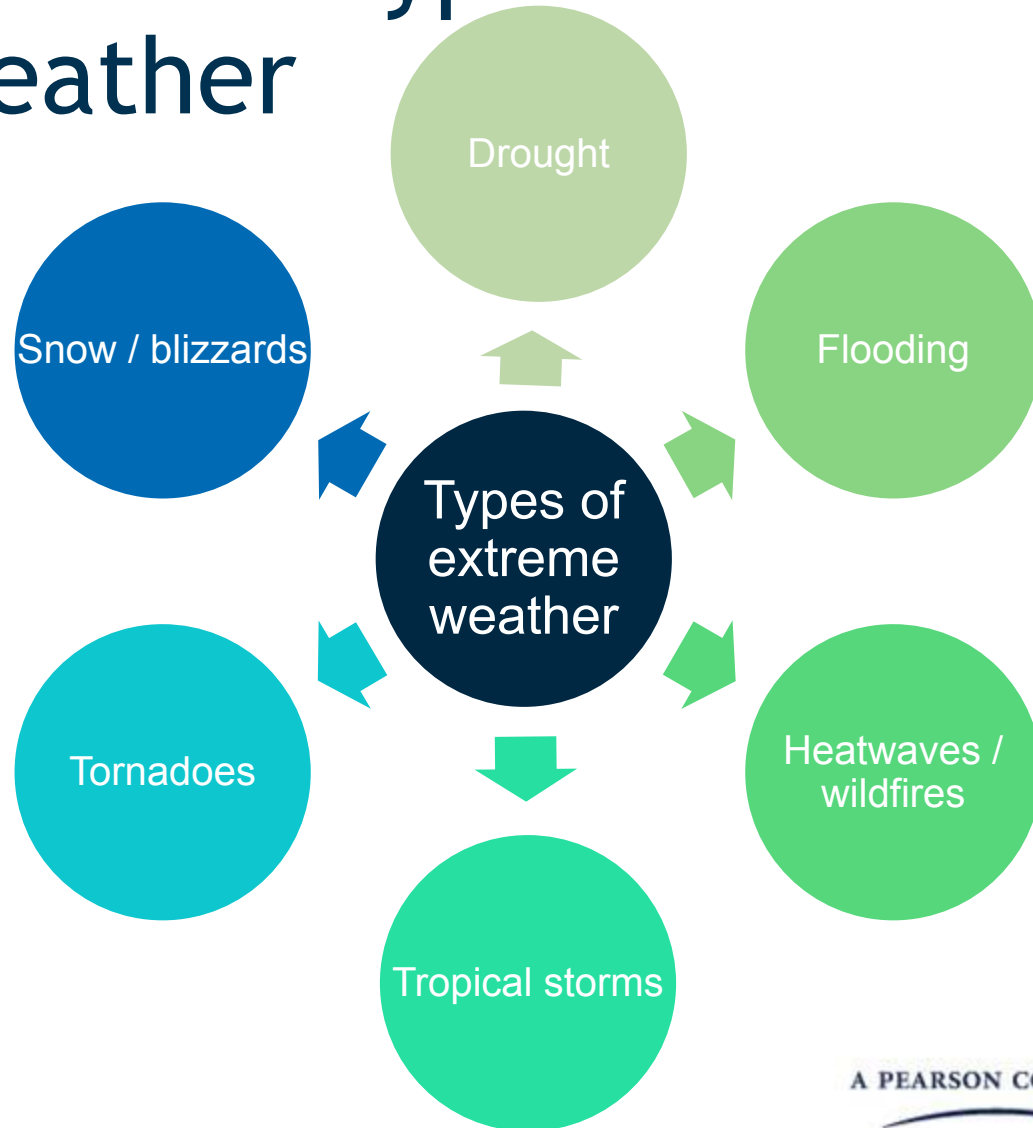
▲ Data for 2006

△ Average values 1961-90



There are various types of extreme weather

You don't need to know a great deal of depth and detail about all of these types of extreme weather. More often, questions could be linked to a resource, or how we manage the impacts of a type of extreme weather, e.g. drought.



How can extreme weather events be classified?

Think 'time'

- An **immediate** disastrous weather event - e.g. a tornado or hurricane such as Katrina.
- A **subsequent** hazard - e.g. flash flooding such as in Carlisle.
- A **longer term trend** or condition - e.g. heat wave such as in France or a drought in Australia.

In August 2004 at Boscastle 60mm rain fell in 3 hours. This was a trigger factor for a 1 in 300 yr flood.



The 2005 hurricane season in USA was extreme with 249 storms and 13 hurricanes. Three were the worst on record.



Is extreme weather getting worse?

This is complex and controversial. The graph shows that there is an increase in the number of some weather (hydrometeorological) related disasters globally (e.g. flood), but far it is far from clear. Think about the **magnitude** of impacts, **frequency**, number of **deaths**, **economic toll** etc. How does this vary with a countries level of development?

Number of natural disasters by type
 1970-2005



Global deaths from weather-related hazard events (1997-2007)

The data in red is weather related hazards. What are the patterns emerging here? How do deaths from extreme weather compare to other hazards(e.g. earthquakes & tsunami). How do differences in development influence deaths from weather hazards?

Hazard Type	High Levels of Development	Medium Levels of Development	Low Levels of Development	TOTAL
Avalanche & landslide	365	6953	546	7864
Droughts & famine	0	842	220879	221721
Earthquakes & tsunami	2625	306845	82140	391610
Extreme temperatures	48235	11041	973	60249
Floods	3471	73490	13276	90237
fires	197	259	4	460
Volcanic eruptions	52	10	200	262
Windstorms	5813	51411	5186	62
SUBTOTAL HYDRO-METEOROLOGICAL	58,081	144,447	240,864	443,392
SUBTOTAL GEOPHYSICAL	2,677	306,855	83,340	391,872
TOTAL Natural disasters	60,758	451,302	323,204	835,264

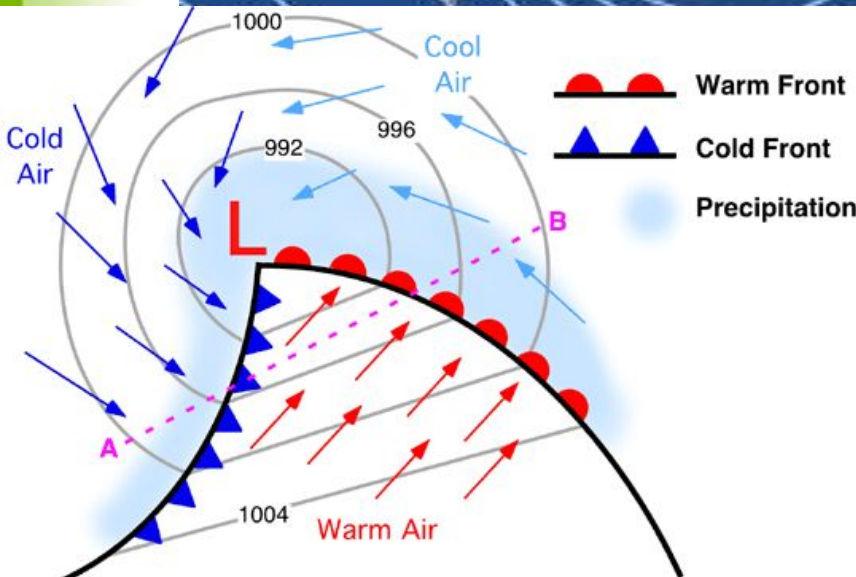
Source – International Committee of the Red Cross



Some basics - An Atlantic sequence. How could this lead to extreme weather?



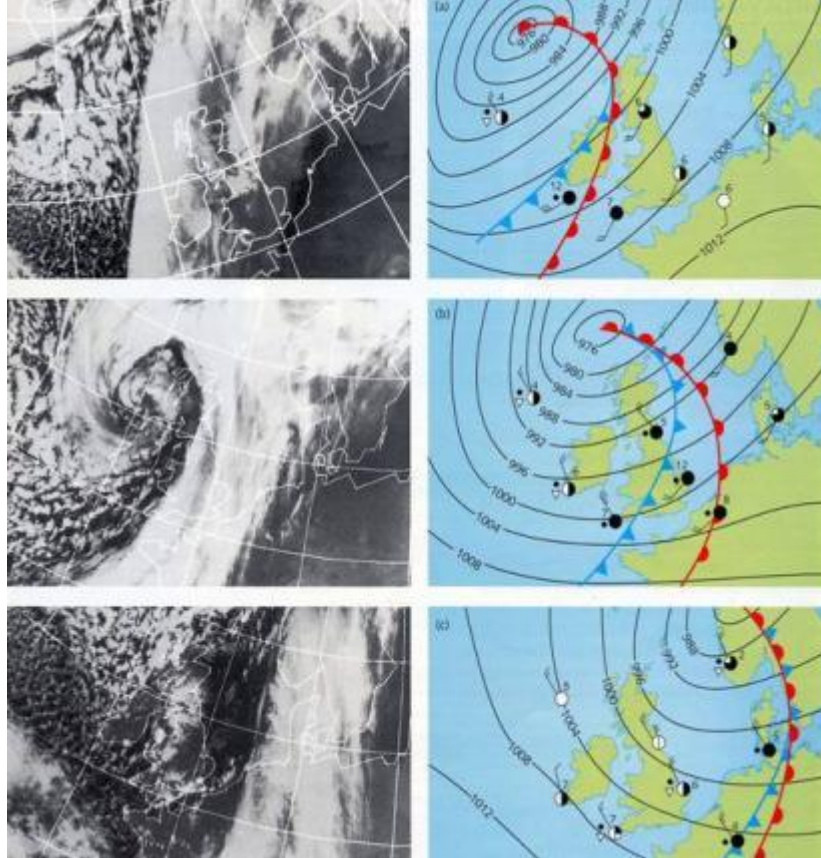
Warm front - when a warm moist air mass rises above a cold air mass, a warm front forms. The gradient of the front is very shallow. Warm fronts occur at the forward edge of a depression (a low-pressure system).



Cold front - a cold front marks the advance of colder air undercutting warm air. The gradient of the cold front is steeper than that of a warm front, and the rainfall is usually heavier. Thunderstorms sometimes form along a cold front.

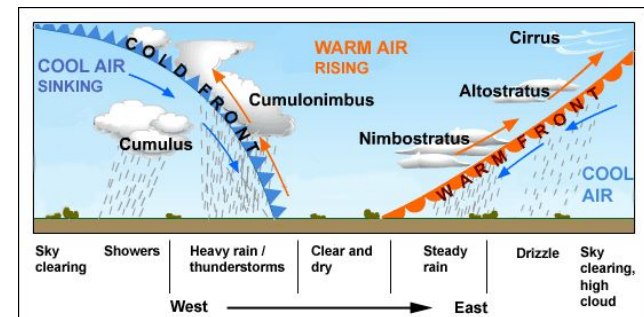


Deep depressions - possible impacts



- High winds and gales (numerous examples)
- Coastal floods and storm surges
- Sometimes violent thunderstorms
- High intensity rainfall = possible flooding
- Sequence can saturate ground = further flooding

It may be important to understand the passage of a depression. When are the conditions most risky?



Winter and summer anticyclones

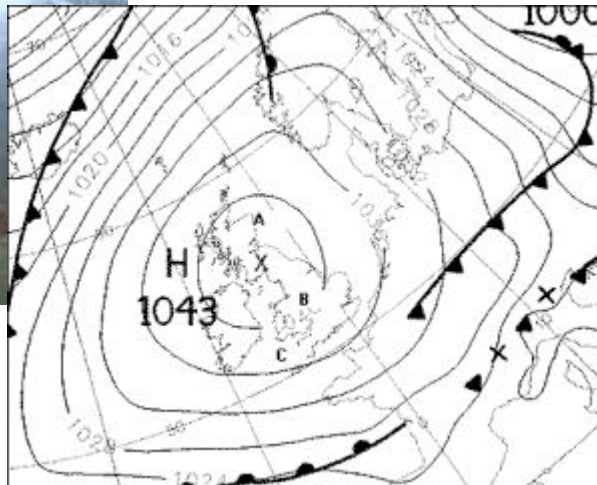
Winter

- Winter smog forms as pollutants are trapped by temperature inversions
- Clear skies lead to radiation cooling and freezing conditions
- Effects on health (asthma)
- Road accidents increase (pile-ups)
- Hypothermia risk increases (elderly)
- Wildlife suffers (birds)
- Power demand increases



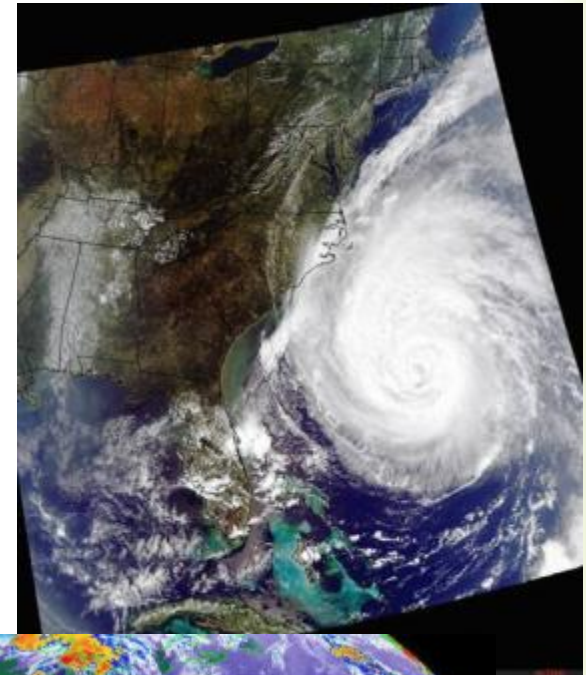
Summer

- Effects on health (heatstroke, dehydration)
- Cancer & cataracts risks
- High pollen count (asthma, hay fever)
- Fire damages property and wildlife
- Water shortages (agriculture and amenity losses)



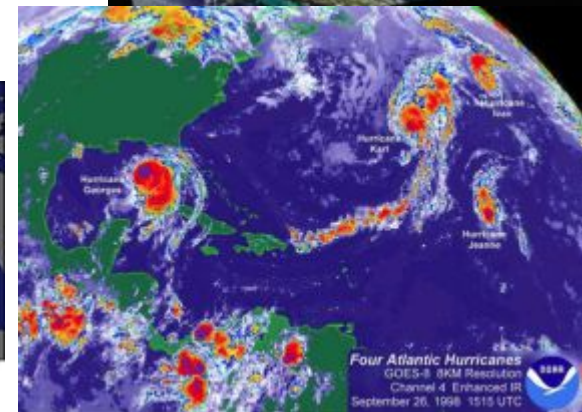
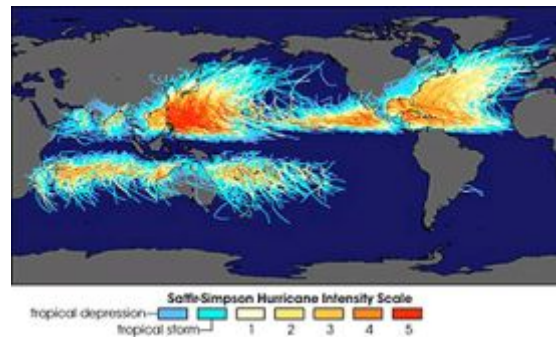
Risks associated with hurricanes

- Hurricanes are predictable in terms of their spatial distributions, but the risks and impacts can be much harder to forecast. Depends on a number of physical and human factors, e.g.



Physical	Human
Intensity of the storm	Population density
Speed of movement of storm	Community preparedness
Physical geography of coastal impact zone	Quality and construction of local buildings

Questions may look at patterns, distributions and then link to risks and impacts



Extreme weather and drought

- There are other types of extreme weather that need to be studied for the exam, e.g. tornadoes, drought, development of snow and ice etc.
- These could form part of a data stimulus response, or could be required as case study detail.

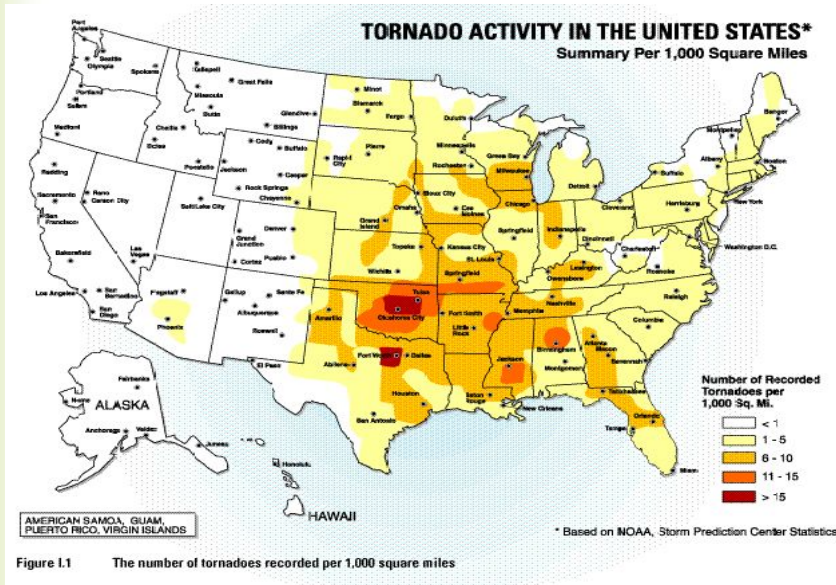
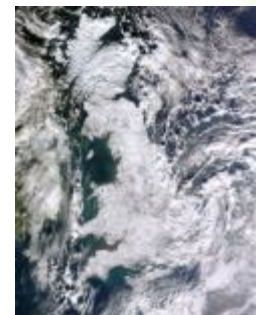
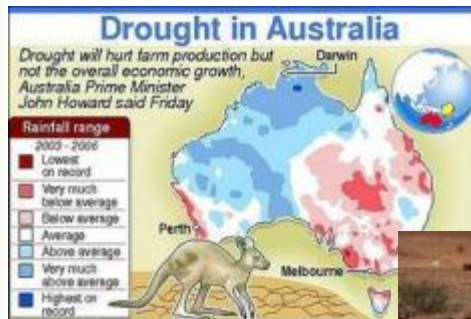


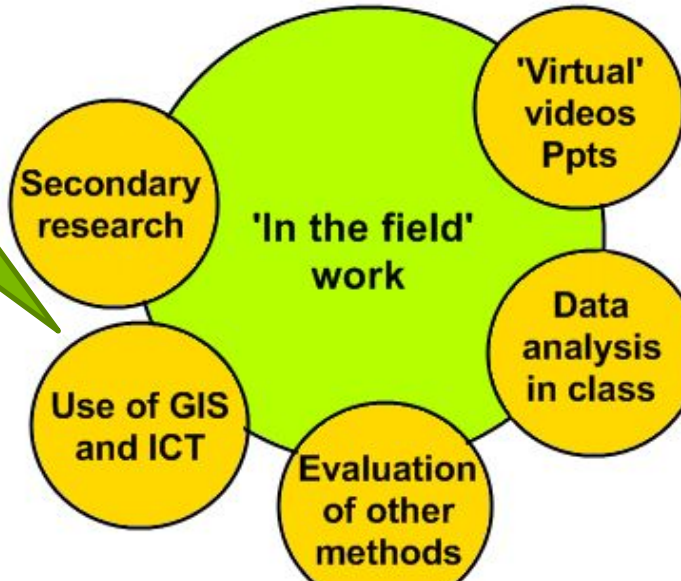
Figure 1.1 The number of tornadoes recorded per 1,000 square miles



Investigating extreme weather

Thinking about fieldwork and research

'In the field' can mean a variety of things. 'Top-up' from other sources if necessary to give coverage



When preparing notes for revision don't just list what you did. Add depth with places and examples of **EQUIPMENT**, **NUMBER** of surveys, details of **LAND USE MAPS**, even talk about **SAMPLING**. The best answers often to refer to real fieldwork and real places

Key fieldwork + research focuses



Extreme weather watch

- Weather diary / record



Extreme impacts

- Impacts of an event / hazard



Increasing risks

- Increasing flood risk



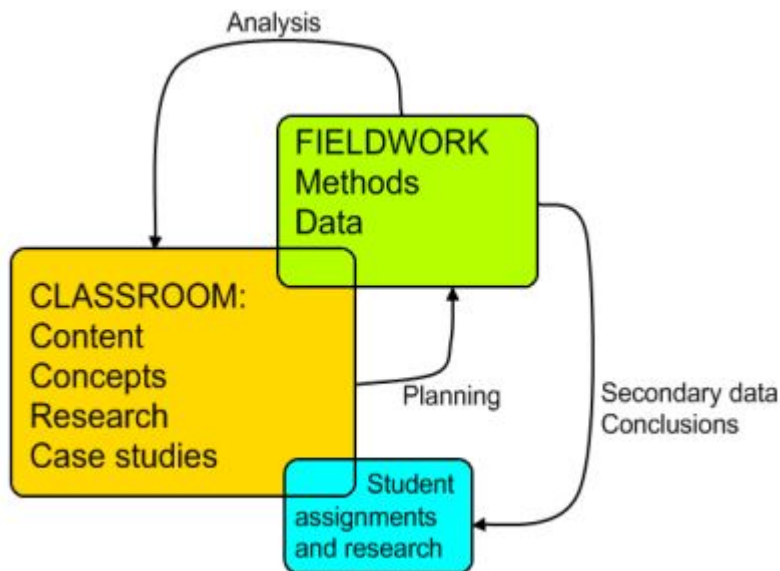
Managing extreme weather

- E.g. Managing floods + hurricanes



Auditing the specification for extreme weather

<p>1) Using primary and secondary sources to monitor and understand how differing weather patterns relate to underlying meteorological conditions</p>	<p>2) Using primary and secondary sources to investigate impacts on homes, businesses, health, lives, infrastructure, production and habitats</p>	<p>3) Using primary and secondary sources to investigate and analyse a range of causes of increased flood risks at a local scale including, eg:</p> <ul style="list-style-type: none"> • heavy/prolonged precipitation or snowmelt, • geology, vegetation and slopes • land use & management. 	<p>4) Using primary and secondary sources to investigate strategies such as USA hurricane warning, Environment Agency flood protection and risk assessments at a local scale.</p>
<p>Weather Diary</p>	<p>Impacts Enquiry</p>	<p>Hydrology Enquiry</p>	<p>Management Enquiry</p>



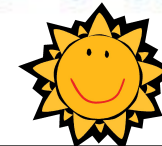
The 4 topics above link to strands within the specification. These are areas that can be examined. You will have to use a mixture of fieldwork, individual / group research and class work to get prepared for the exam.









Example weather diary



Recording the weather twice per day for a continuous period using some the following instruments (or from the web)



Date	Temperature	Anemometer	Wind Direction	Barometer	Cloud Type & Cover	Rain Gauge
Monday Am Time:						
Additional Comments						
Monday Pm Time:						
Additional Comments						

Date	Thermometer	Wind Speed	Weather Vane	Pressure	Cloud Type Chart	Precipitation	
Tuesday Am Time:							
Additional Cor							
Tuesday Pm Time:							
Additional Cor							

Some of these techniques may be relevant to other core fieldwork in this topic, e.g. linking rainfall to flooding

Assessment of the Impacts of flooding

Where do you live? _____

Have you or your family ever been affected by floods? Y / N

Environmental

Were local roads kept open? Y / N *How long were they closed?*

Were flooded roads effectively cleaned up afterwards? Y / N

Are you aware of any health implications associated with the floods? Y / N

Social

Were any local services affected by the floods? Y / N

Shops Schools Doctors Others

Are you aware of the *Floodline* automatic call facility? Y / N

Have you signed up to receive calls? Y / N

How do you keep yourself informed about floods? *Radio TV Internet Other*

Do you know of any emergency shelters opened for homeless flood victims? Y / N

Economic

How long did flooding affect of your work/business?

Has flood risk affected your family's insurance premiums? Y / N

Has your local authority implemented flood alleviation schemes? Y / N

What do you think about the schemes?

Investigating Flood impacts?

Example questionnaire to look at flood impacts.

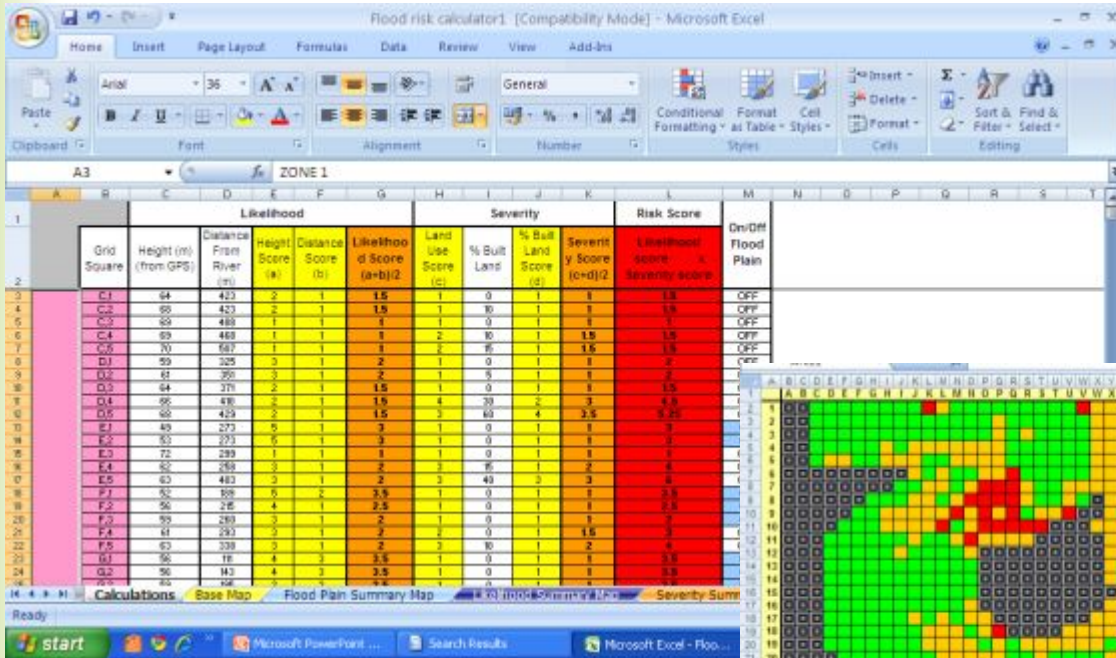
A range of closed questions have been used in this questionnaire, grouped into social, economic and environmental. How might you improve this questionnaire and could you justify all the questions that have been set?



The Environment Agency website has online GIS flood risk maps



Flood impacts spreadsheet, interviews and research



A spreadsheet is a good way of collating land-use, altitude and flood risk data, and then producing a flood risk map.



You may have to find out about flood 'players' also. More qualitative approaches required here.

- Interviews**
 - The ideal way would be to conduct an interview with representatives from the Environment Agency or the local council
 - try to 'dig' for information from local residents and visitors.
- Research**
 - You should use the web to research who is involved in developing and managing projects flood alleviation schemes. What are the options? Cost benefit analysis?

Example equipment for flood fieldwork

Record evidence of the surrounding land use – this is strongly linked to potential flood risk



Tape Measure - width

You may be using a range of fieldwork equipment to measure a the characteristics river, which is linked to increasing flood risk.



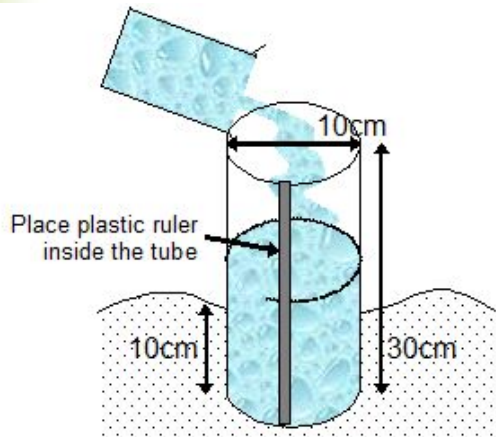
Flow Meter – Velocity at different depths

Stop Watch – for timing floats



Dog biscuit– surface velocity

It may be possible to calculate the discharge of the river and compare to its regime (see National Rivers Flow Archive). How might channel efficiency (hydraulic radius) have an impact on flood risk?

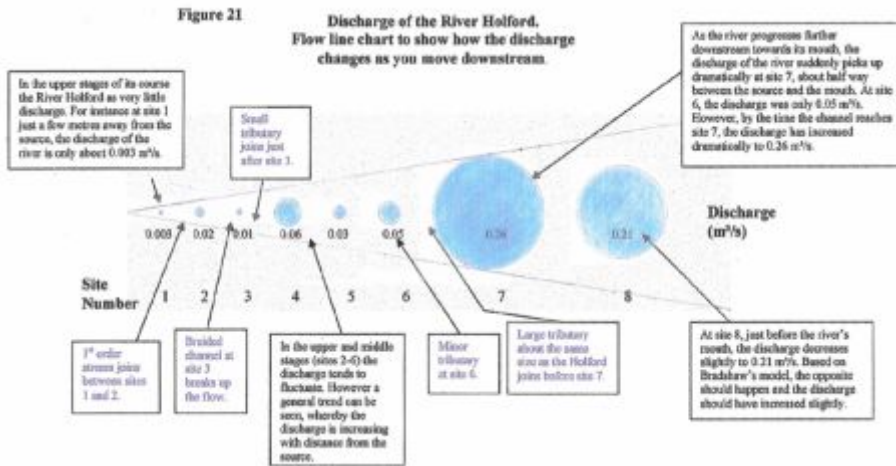


Infiltration rates

Infiltration rates can be linked to antecedent conditions and therefore flood risk

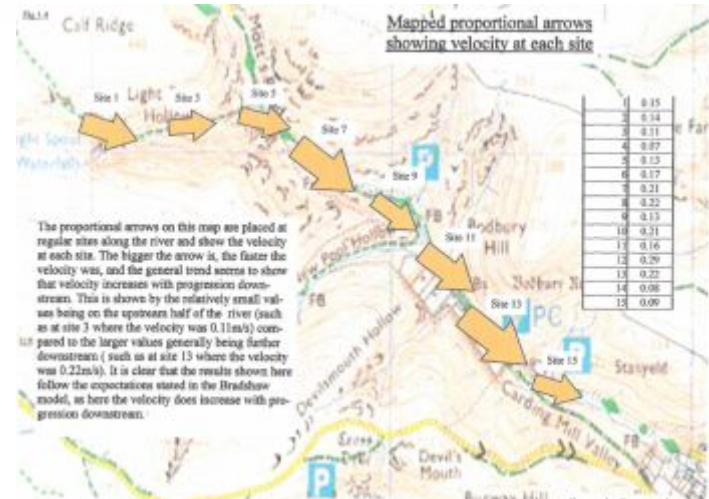
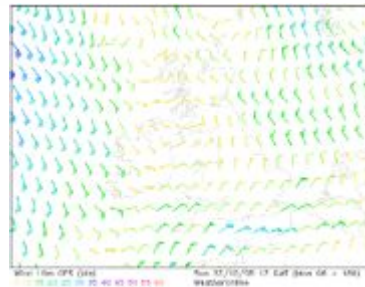
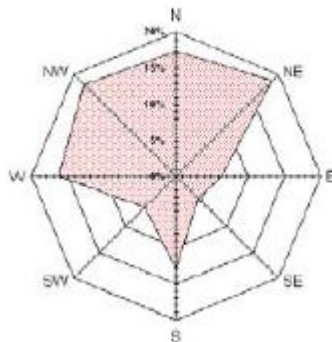


Examples of data presentation



The extreme weather topic provides a range of opportunities for presentation information. You may have to describe how and why you used particular approaches in an exam.

Percentage Time vs Wind Direction



Describing and justifying more complex techniques should get higher marks. Not all pies charts and bar graphs!



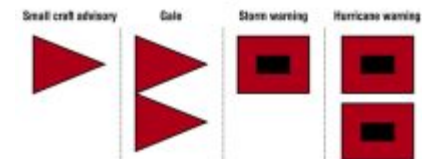
Fieldwork linked to managing and responding to extreme weather events

- An obvious piece of fieldwork here is to look flood protection, building on ideas from flood risk assessment in earlier sections. A useful exercise would be to evaluate the success of existing flood management strategies in a small area, and suggest how these might be developed or improved in the future. This could be achieved using various bi-polar surveys and detailed photographic evidence.
- This type of approach might also involve questionnaires and interviews linked to perception of flood risk and management options.
- Alternatively, the management of other weather hazards can be researched. e.g. success of hurricane warning and other strategies used in the USA to cope with these major storm events.



COAST GUARD WARNING DISPLAY SIGNALS

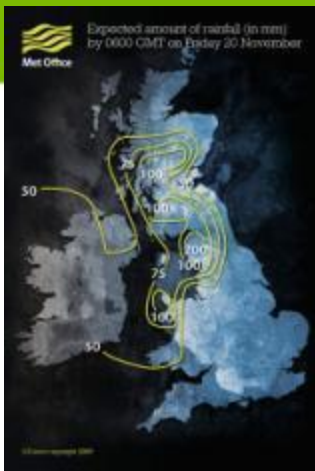
After 18 years, the Coast Guard is revising a set of warning flags designed to tell boaters when weather conditions could be come dangerous.



Source: National Oceanic & Atmospheric Administration

©2001 B&H/CST/STAFF





Opportunities for research



Source: Ordnance Survey – Strategic Flooding Document 2007© Environment Agency Licence A809



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LANDMAP Case Study 12
CATCHMENT MANAGEMENT PLANS

Case Study Profile

Location: Flood Risk Management
Summary: This case study supports an assessment of how 'LANDMAP' could be implemented in support of the CCMF. It also provides an overview of 'LANDMAP' in supporting CCMF in the context of a range of different factors affecting flood management.
Scale: National
Author: National Flood Management
Project Lead: National Flood Management
Case Study Contact: National Flood Management

Introduction

Flood risk is a major issue in the UK. The Environment Agency (EA) is responsible for the management of flood risk and the protection of the public from the risk of flooding. The EA is also responsible for the management of flood risk in the context of a range of different factors affecting flood management. The EA is also responsible for the management of flood risk in the context of a range of different factors affecting flood management.

Aims of the Case Study

- Flood risk is a major issue in the UK. The EA is responsible for the management of flood risk and the protection of the public from the risk of flooding.
- The EA is also responsible for the management of flood risk in the context of a range of different factors affecting flood management.
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Old photos and other documentary evidence (e.g. flood reports, specialist books) can help reveal the **scale** and **impact** of floods. You may also find evidence of ways in which flooding is trying to be managed (e.g. hard defences).

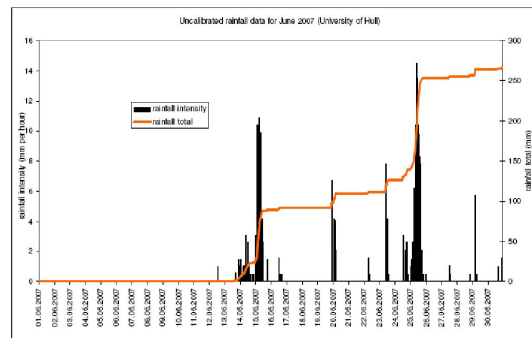


Figure 1.2. Rainfall over Hull for June 2007. Data from an uncalibrated rain gauge on the Coburn Building, University of Hull.



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Following-up the weather fieldwork?

A range of fieldwork follow-up options may be appropriate in order to better prepare for the exam. The most important activities are in the light green boxes

ACTIVITY 1 - METHODOLOGY WRITE-UP. Give a focus on the techniques and approaches used, how the sites were selected, justification etc. Remember to include both fieldwork and research ideas.

ACTIVITY 2 - PRESENTATION and ANALYSIS. Give a focus on the range of techniques used to present the data and say why you used them. Also include a description of how and why data was analysed (including qualitative, e.g. Annotation of photographs etc).

ACTIVITY 3 - RESULTS, CONCLUSIONS and EVALUATION. Give a focus on what you found, including some locational detail. You should also give details of selected results, and provide an evaluative framework, e.g. limitations, reliability of results etc.

Peer review of other modeled exam responses. Use highlighting, annotation etc to learn from other peoples work. This could be linked to a mark scheme,

A **fieldwork glossary**...very useful to help with technical language in the exam. This could be linked to a techniques matrix (see next slide).

A **GIS / Google Earth** map showing the locations visited as place marks.

Mock exam questions completed under timed conditions , linked to each of the three activities above.

A **PowerPoint presentation** , to focus on giving a ‘virtual tour’ of the locations / and or findings.



Summary

- Revise your personal fieldwork and research on extreme weather thoroughly.
- When relevant, know details on sampling, surveys, presentation, analysis and conclusions.
- Know the location(s) and why it experienced extreme weather.
- How were sites selected and did you use any specialist equipment?
- Be clear about ways to reduce the impacts of extreme weather and if they worked.

Write your name here	
Surname	Other names
Centre Number	
Candidate Number	
Edexcel GCE	
Geography	
Advanced Subsidiary	
Unit 2: Geographical Investigations	
Monday 19 January 2009 - Afternoon	Paper Reference
Time: 1 hour	6GE02/01
You must have:	Total Marks
Resource Booklet.	

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **ONE** question in Section A and **ONE** question in Section B.
- Answer the questions in the spaces provided – there may be more space than you need.

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets – use this as a guide as to how much time to spend on each question.
- The quality of your written communication will be assessed in **All** your responses – you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Spend approximately 30 minutes on Section A and 30 minutes on Section B.
- Check your answers if you have time at the end.

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