

Extreme weather hazards in the UK (Parts I & II)



Teacher guidance

Part I

This lesson requires student access to computers and the internet. However, the tasks do lend themselves to group work, if computers are scarce.

Task 1 will work best if students do not spend too long looking at just one or two extreme weather events from the website. The website does show a lot of detail and the important skill here is for students to be able to seek out the main points of information – namely the regions affected by each event.

If it is anticipated that students will find this challenging, individuals or pairs could be asked to research the events that occurred in one particular year, allowing them to look through the information at their own pace. They could even search websites such as BBC news for archived reports on particular extreme weather events. The class results can then be collated to complete Figure 1.

If it is necessary for students to be able to interpret synoptic maps, this would be a useful focus prior to competing Task 1. Many of the webpages describing previous extreme weather events include synoptic maps and the exercise could facilitate the use of these or not, as preferred.

If students need to know how different types of extreme weather in the UK are linked to low and high pressure systems, then this could also be covered in advance of the exercise. Even if detailed knowledge of synoptic systems is not required, it may still be useful to introduce the following table. It distinguishes events according to whether they are associated with low or high pressure and the time of year they are most likely to occur.

Low pressure (depression)	High pressure (anticyclone)
Heavy rainfall (all year round)	Drought (usually summer)
Strong winds (all year round)	Heatwave (usually summer)
Storm surges (all year round, but in combination with high spring tides)	
Blizzards (usually winter)	



Teacher guidance (continued)

Task 2 is only straightforward, if Task 1 is completed well. Teachers may want to make sure that students only add an extreme weather symbols to regions that have experienced this type of event more than once.

Task 3 questions focus on reviewing the completed tasks 1 and 2.

Part I and II of the exercise contain words printed in bold type to show that they are included in the glossary contained in the teaching pack.

Part II

Students do not need access to a computer or a web connection in order to complete this exercise, although ICT could be integrated into the presentation of information in Task 2.

The PowerPoint presentation that forms part of this teaching pack could be used to give an introduction to climate projections and general circulation models, so that students know a little about the basis for the UKCP09 projections used in this exercise. Terms highlighted in bold red type in the presentation are included in the glossary.

The answers for Task 2 are not likely to match the students' exactly. The evaluation of hazard risk from the maps is partly subjective and the answer given here is to help check that students are approaching the task in the correct way. It might also be worth pointing out in Task 2 that the West Midlands region is landlocked so cannot experience a storm surge - no matter what happens to sea level!

The idea behind the extension exercise is to bring together everything that the student has learned in the exercise and to write about it in a clear, succinct manner. It might be an interesting homework task.



Part I, Tasks 1 and 2

Northern Scotland

Heatwave, Summer 2003
Record rainfall, Autumn 2000
Blizzard, March 1947

Eastern Scotland

Record rainfall, Autumn 2000
Drought, Sept 2002

North East England

Heavy rainfall, Sept 2008

Western Scotland

Heatwave, Summer 2003
Heavy rainfall, Jan 2005, Feb 2002
Record rainfall, Autumn 2000
Drought, Sept 2002

Yorkshire & Humberside

Record rainfall, May-Jul 2007
Heavy rainfall, June 2005, Mar 1944

Northern Ireland

Record rainfall, May-Jul 2007

East Midlands

Record rainfall, May-Jul 2007
Heavy rainfall, Jul-Aug 2002

North West England

Heavy rainfall, Jan, Jun 2005,
Feb, Sept 2002, Oct 2001
Strong winds, Feb 2002
Record rainfall, Autumn 2000
Blizzard, Feb 1963

East of England

Heavy rainfall, Oct 2002, Oct 2001
Strong winds, Oct 2002
Storm surge, Jan 1953

West Midlands

Record rainfall, May-Jul 2007

London

Drought, Nov 2004-Jul 2006,
Summer 2003
Heatwave, Aug 2003
Storm surge, Jan 1953

Wales

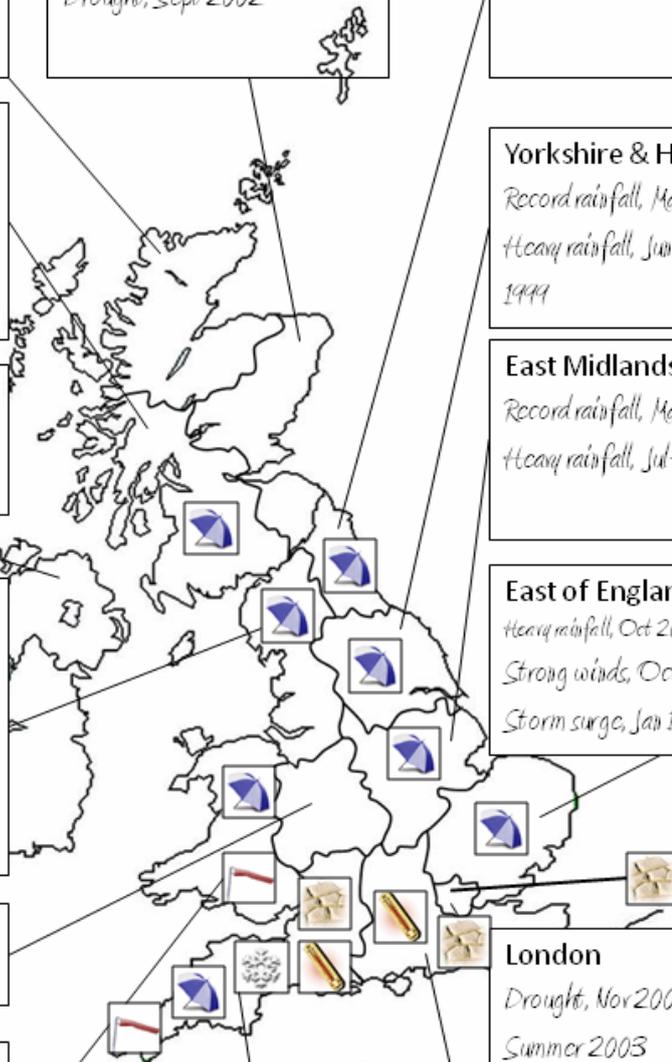
Heavy rainfall, Sept 2008, Oct 2002, Jul 2001
Strong winds, Mar 2008, Oct 2002, Feb 2002, Jan 1940
Record rainfall, Autumn 2000
Drought, Sept 2002
Blizzards, Dec 1962

South West England

Strong winds, Mar 2008, Oct 2002, Jan 1990
Drought, Nov 2004-Jul 2006, Summer 2003, Sept 2002
Heatwave, Jul 2003, Summer 1976
Heavy rainfall, Aug 2004, Oct 2002
Record rainfall, Autumn 2000
Blizzard, Dec 1962, Jan 1947

South East England

Drought, Nov 2004-Jul 2006,
Summer 2003
Heavy rainfall, Nov 2003
Heatwave, Aug 2003, Summer 1976





Part I, Task 3

- (a) South West England appears to be the most hazardous region, affected by hazards related to extreme hot, cold, wet and dry weather. Wales and North West England have also been affected by many extreme weather hazard events in the past.
- (b) Factors including *population density, population structure* (particularly age structure), *housing density, housing type, average number of storeys, road networks, rail networks, land use* (e.g. residential/industrial/agricultural), *presence of extreme weather management* (e.g. flood defences), *risk perception, preparation for extreme events* (personal or business, e.g. sandbags), *nearest emergency services, nearest hospital, availability of temporary housing or shelter, public information campaigns* and many more.
- (c) Expectation on this answer will depend on content already covered, but some themes for discussion are given below:
- A range of management schemes are required to cope with different extreme weather hazards. This means that funds, government focus, and scientific/engineering expertise will have to be spread across several threats.
 - Some types of extreme weather hazard may occur simultaneously, making them very difficult to cope with. For example, a deep low pressure system in combination with a high spring tide may result in strong winds, heavy rainfall and a storm surge.
 - More types of extreme weather mean more opportunities for conflicts of interest. For example, a hotel-owner might not want flood defences to affect the beauty and desirability of an area for tourists. Or it might be difficult to convince landowners to support a scheme to build a reservoir to safeguard against drought.
 - The range of extreme events that affect the UK contribute to a continuous threat. This is quite different from say the hazard presented in areas affected by monsoon rains. These are seasonal and do not threaten people all year round.
 - The presence of several types of extreme weather affects people's risk perception as they are not geared up to one particular threat. This differs from areas dominated by one type of hazard, e.g. San Francisco, where people treat earthquake risk as a way of life.



Part II, Task 1

- (a) Winter mean precipitation
- (b) Summer mean precipitation
- (c) Summer mean temperature
- (d) Winter mean temperature, winter mean precipitation
- (e) Winter mean wind speed, sea level change



Part II, Task 2

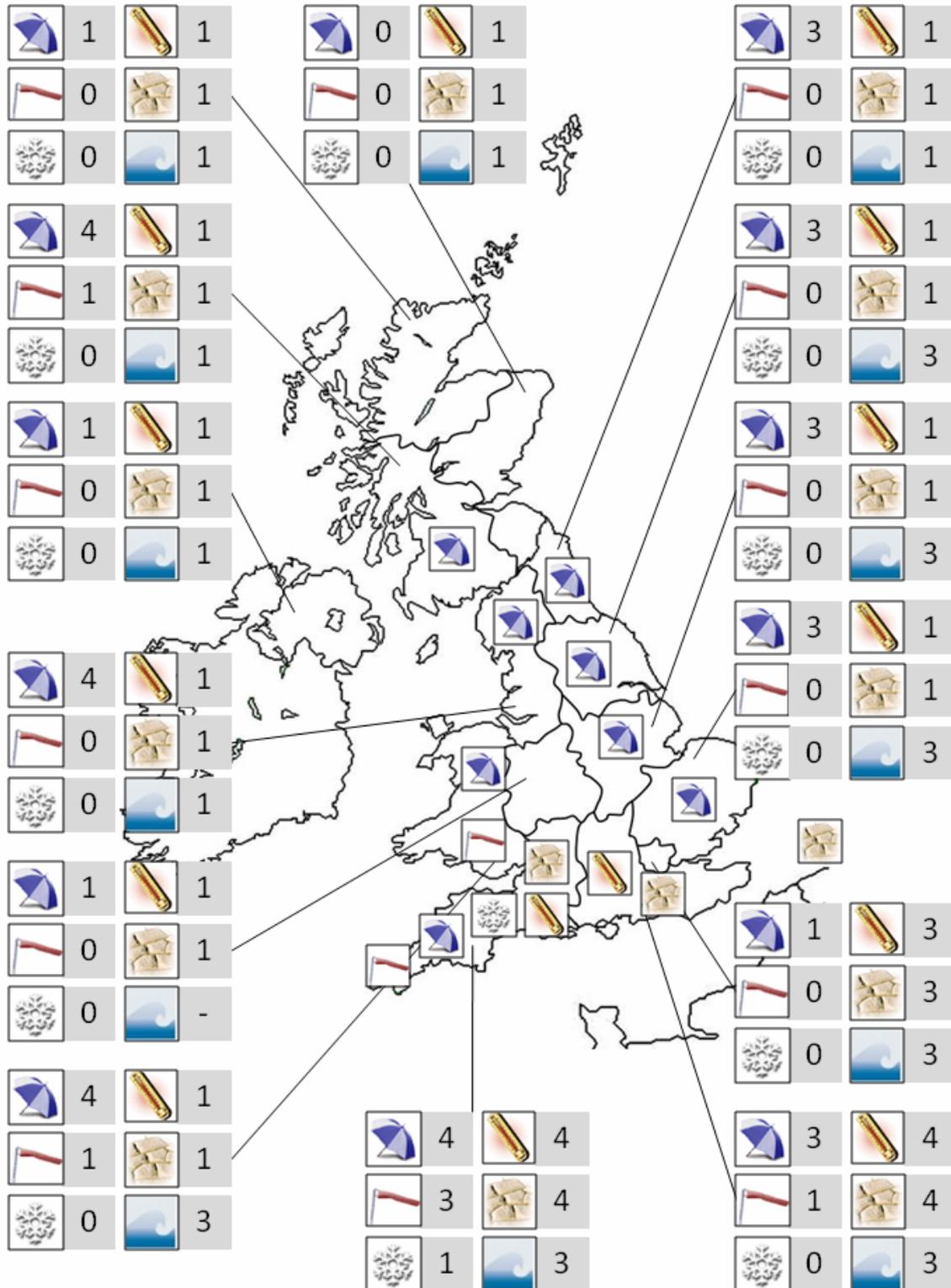
- (a) Add up the scores for all six types of extreme weather hazard for each region.
- (b) South west England.
- (c) Blizzards, due to the warmer winter temperatures predicted for the 2080s.
- (d) The main issue is that you cannot predict weather from a prediction of climate. The projection is telling you about how long term climatic conditions are likely to change, not the occurrence of extreme weather. For example, winter mean precipitation may increase in the 2080s, but this projection does not tell us how this rain will come. If it is evenly spread through the winter, the landscape might be able to cope. If it all arrives in a few heavy episodes it could cause problems. Similarly, a heatwave requires a prolonged period of excessively hot weather. Warmer mean summer temperatures by the 2080s could be achieved in a relatively few very hot days scattered through the summer, rather than in long spells of warm weather.

At the moment, general circulation models are not powerful or sophisticated enough to predict weather events in the distant future. In fact, it is unlikely that this will ever be achieved due to the unpredictable nature of the weather. This is why weather forecasters sometimes give inaccurate predictions for the next day's weather!



Answers

Part II, Task 2 (continued)





Part II, Task 3

- (a) Who knows! This is just a mind-showering question.
- (b) (i) Clean technologies mean less CO₂ is released. Services and information economies would be less energy intensive than, say, manufacturing. Compact cities with public transport should mean less personal vehicles and shorter commuting distances, thus reducing CO₂ emissions. Less energy should be needed in production if we consume less by reusing and recycling. These ways of limiting greenhouse gas emissions will ensure that enhanced greenhouse warming is less severe and temperature increases are 2-4°C by the 2080s.
- (ii) Rapid economic growth based on fossil fuels will result in high CO₂ emissions. Large, sprawling cities with high car ownership means more personal vehicles travelling longer commuting distances, thus more CO₂. A lifestyle based on consumption requires a lot of energy and therefore more greenhouse gases. This will intensify the enhanced greenhouse effect causing more pronounced warming by the 2080s, in the order of 4-6°C.
- (c) The low scenario world will be better placed to cope with extreme weather hazards for many reasons including:
- Service and information industries are largely footloose, whereas more traditional industries might need to be located in hazard areas e.g. next to the river for cooling water, coastal location for shipbuilding.
 - In compact cities, it should be easier to cope with extreme weather events – there would be less chance of infrastructure gridlock, less people to be evacuated or rehoused etc.
 - Protected areas could be used as temporary water storage during floods, with no threat to people or property.
 - A society less dependent on fossil fuels might actually benefit from some extreme weather. For example, strong winds could be harnessed as wind power, heatwaves present ideal conditions for solar heating and pv.
 - A resource friendly lifestyle means people are more adaptable and innovative and able to manage their own problems.
 - It is easier to distribute warnings and advice in an information economy.
 - The services economy would have a market for hazard management services such as flood insurance, hazard risk surveys and hazard-proof building design.
 - Low input agriculture is less dependent on water during a drought, and causes less environmental problems (e.g. leaching of applied chemicals during a flood).
 - A society less dependent on transport and with a lower density of transport networks should be less prone to disruption in an extreme weather event.
 - An economy based on services and information should be more resilient to heatwaves and associated decline in working conditions than the manufacturing industry.