



Cumbria Floods November 2009



Where? Using the map below and an atlas:

1. Label the places that were worst affected by the floods:

Cockermouth	Burneside
Workington	Eamont Bridge
Keswick	Southwaite
Seathwaite	Carlisle

2. Locate and draw on the following rivers that flooded:

River Cocker	River Kent
River Derwent	River Eamont
River Greta	River Eden

3. Give the map a title



Cumbria: November 2009 rainfall totals in millimetres

Location	17-18 November (08-08 UTC)	18-19 November (08-08 UTC)	19-20 November (08-08 UTC)	3 day total	1-20 November	November average (1971-2000)
Shap	55.4 mm	50.2 mm	91.2 mm	196.8 mm	444.2 mm	196 mm
St Bees Head	23.4 mm	13.6 mm	40.6 mm	77.6 mm	140.8 mm	100 mm
Keswick	41.8 mm	39.4 mm	107.8 mm	189.0 mm	375.0 mm	182 mm
Isle of Walney	17.6 mm	8.0 mm	47.6 mm	73.2 mm	169.4 mm	106 mm
Carlisle	19.6 mm	7.8 mm	14.4 mm	41.8 mm	137.0 mm	77 mm

Devise a graphical way of showing total rainfall (1-20 November) and average November rainfall on the map below. Use the same scale throughout. (You may wish to cut the map out and remount it in your book.)

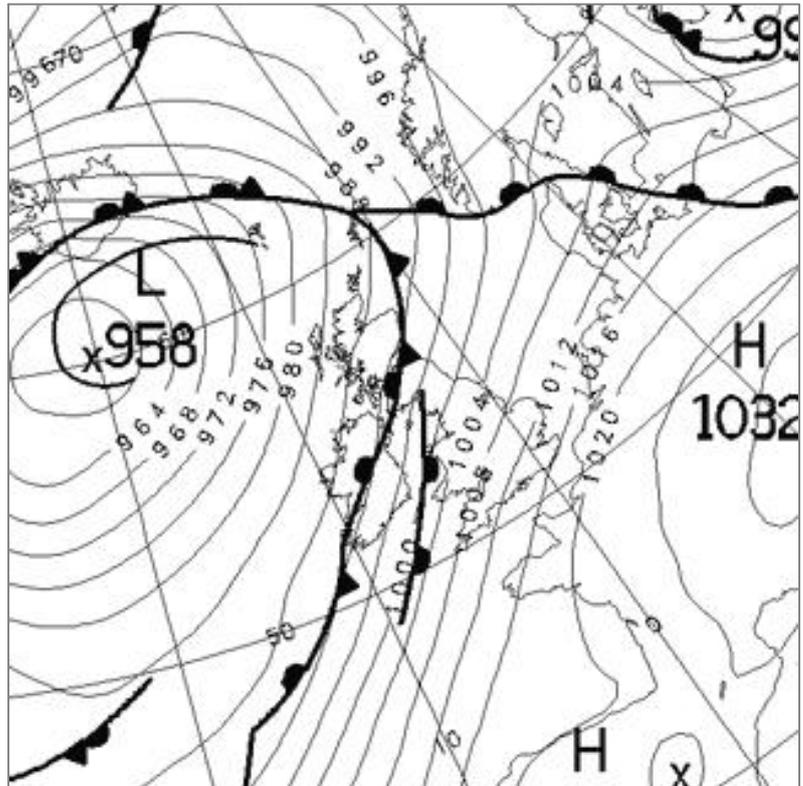


Meteorological Office Weather Report 20 November 2009

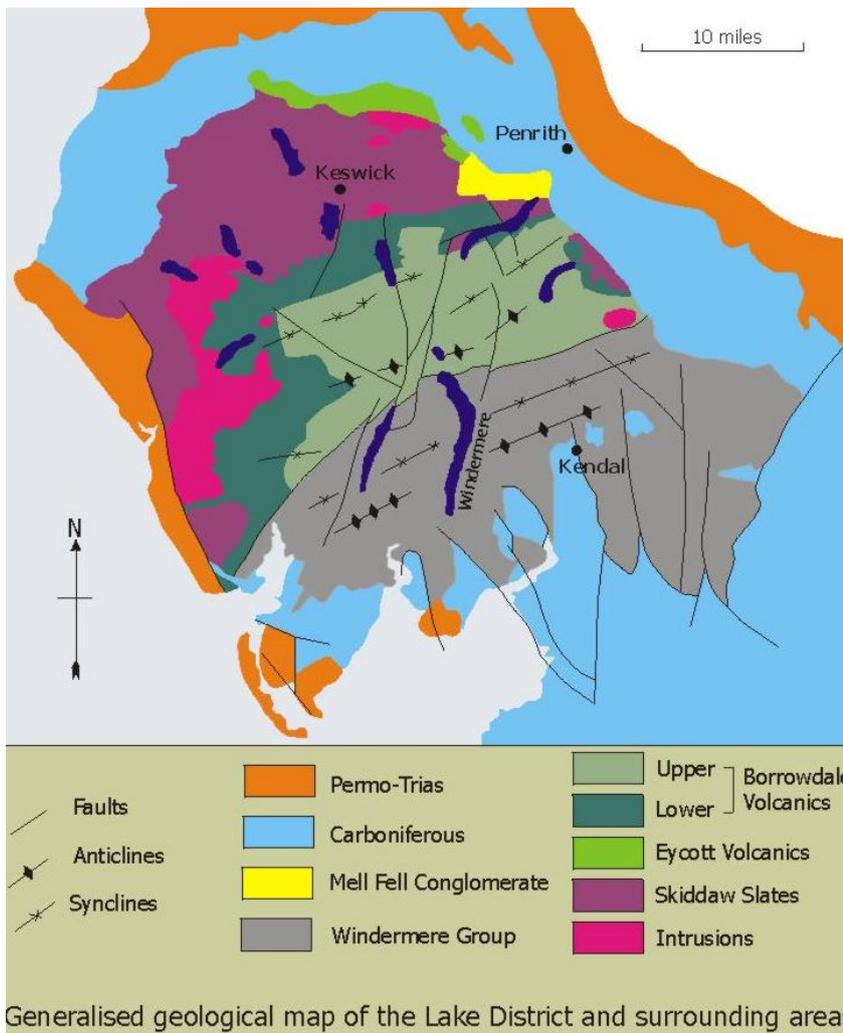
The last few days has seen heavy rain affecting parts of north-west Britain. This was caused by an Atlantic weather front becoming almost stationary across Northern Ireland, Cumbria and south-west Scotland.

In Cumbria, there has been 372.4 mm of rain at Seathwaite and 361.4 mm of rain at Honister between 0800 on Wednesday 18 November and 0400 on Friday 20 November.

Provisionally, the 24-hour total at Seathwaite (ending 0045 on Friday 20 November) of 314.4 mm is a UK record for a single location in any given 24-hour period. Records going back to 1914.



How did the weather contribute towards the flood?



Generalised geological map of the Lake District and surrounding areas

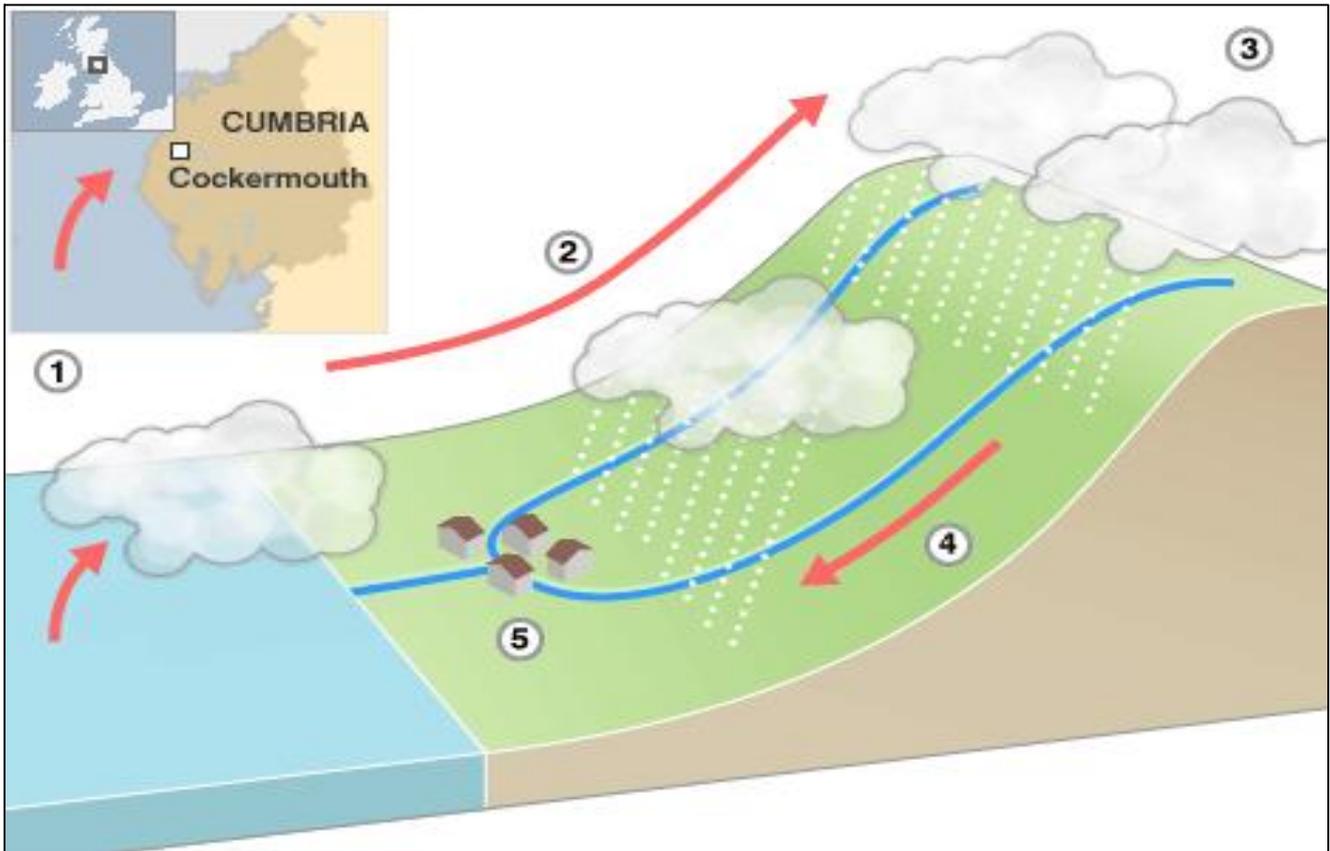
Geology

Some rocks are more permeable than others. Permeable rocks allow rainwater to soak in. If the rocks are impermeable, the water is far more likely to flow across the surface as 'surface runoff' into rivers.

On the map shown, only some of the Carboniferous rocks and Permo-Triassic Rocks are permeable. The rest are impermeable.

1. How might the geology of Cumbria affect the risk of flooding?
2. How might the steep slopes of the Cumbrian Mountains affect the risk of flooding?

Physical Causes of the Cumbrian Floods



Match the description in the box below to the correct number from the diagram

Description	Number on Diagram
As rivers met at confluences, their channels filled completely to bank full. Unable to retain the water, significant amounts of flooded on to the rivers' floodplains. Flooding occurred in several locations including Keswick, Cockermouth and Workington.	
A 'conveyor' of warm, very moist sub-tropical air was carried towards Britain from south of the Azores, meeting and rising over much cooler air from the polar region. As the warm air was lifted, water vapour in it condensed, causing cloud and heavy rainfall.	
Heavy rain cannot all infiltrate into saturated soils or into the impermeable rocks below. The grassland 'fells', which have been cleared of woodland for sheep and cattle pasture, could not retain (hold back) much water.	
A warm front 'conveyor' became stuck over Cumbria for 34 hours. A steady stream of warm, moist air was brought in from the Atlantic Ocean. This led to steady and sometimes heavy downpours, particularly over northern Cumbria.	
Unable to infiltrate the saturated soils, rainwater flowed overland as surface runoff, into rills and gullies. Accelerated by the steep terrain it quickly entered the region's swelling rivers flowing towards the coast.	

There are two types of causes of flooding. **Physical** and **Human**.

Try to explain the human causes of flooding.



What were the impacts?



Using different colours and the **table** below:

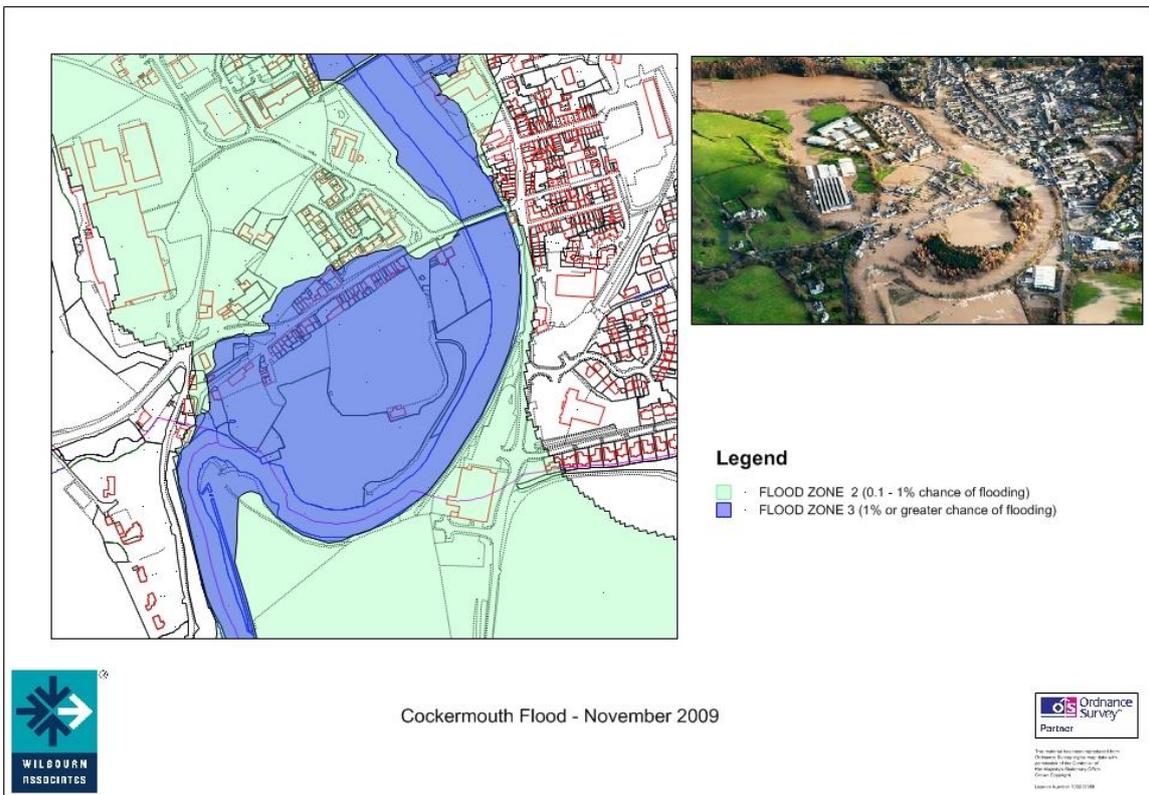
Shade the impacts according to whether they are primarily **Economic**, **Social** or **Environmental** factors (Some items may fall into more than one category).

39 schools were forced to close across the region.	Weather Station in Seathwaite records Britain's heaviest rainfall since records began in 1914.
1,200 people were left without electricity. Telephone lines down.	Wordsworth House (where the poet William Wordsworth spent his formative years) lay under water.
More than 200 people rescued by boat and helicopter in Cockermouth. They spent the night in emergency reception centres at local schools and leisure centres.	Many roads and bridges were closed.
PC Bill Barker was killed when Northside Bridge over the River Derwent in Workington collapsed.	Old bridges were more vulnerable than modern structures and collapsed.
Politicians such as Gordon Brown and David Cameron visited Cumbria. It was announced that an extra 1 million would be made available.	River Greta bursts its banks, rising 1.5m. The town of Keswick was shut off and up to 250 homes were without power.
All over Cockermouth passers-by offered help and comfort to the worst-affected.	Cockermouth, at the confluence of the rivers Cocker and Derwent, suffered the worst flooding. Water was up to 2.5m in places.
The Ambulance Service, Cumbria Police, Mountain Rescue, The Lifeboat Institution, The RAF, RSPCA and a civilian army of volunteers helped.	Many trees and branches were uprooted and dumped where the waters had left them. Cars were overturned.
314mm of rainfall fell on to the Lake District in 24 hours. This new record was recorded at the Environment Agency gauge at the hamlet of Seathwaite, near the River Derwent.	Furniture from the town's restaurants was overturned and lay discarded amongst smashed glass from dozens of broken windows. Many businesses were ruined.
A temporary railway station to the river's north is constructed - the railway line being the only surviving route across the Derwent in Workington - in a bid to keep the community intact.	Fire crews worked hard to pump water out of people's homes.

Don't forget to complete the key.

Economic Social Environmental

Study the photograph below and the map showing flood risk.



If you were working for the Environment Agency, giving advice to planners for the future development of Cockermouth, how would you suggest the land should be used:

- outside the Flood Zones
- in Flood Zone 2,
- in Flood Zone 3