Boscastle Floods; A Natural Disaster?

Heavy seasonal rainfall is a common feature of the climate of South West England and has been documented many times, sometimes it has little affect on the landscape and just drains away but very occasionally it has far more destructive effects. On the 16th of August this year, massive amounts of rainfall over the North Cornish coast caused a disaster on a scale that has not been seen since 1952. A flash flood devastated the small coastal town of Boscastle, this investigation will highlight the causes, effects and responses seen in the event.

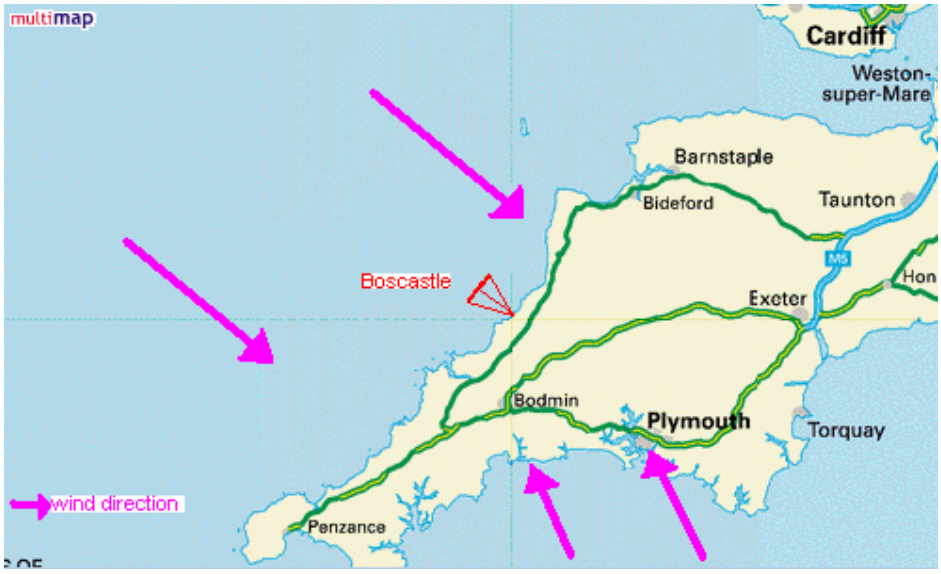
Heavy Rainfall

The root cause of the flood is heavy rainfall; to understand all the effects of this we must examine the cause of the heavy rainfall.

Thunderstorms are common in Britain, they are usually small and short and while they may generate a lot of rainfall in a short time it is not normally a problem. The thunderstorm over Boscastle was slightly different, it is a phenomenon only seen roughly once a decade and very rarely with such devastating results.

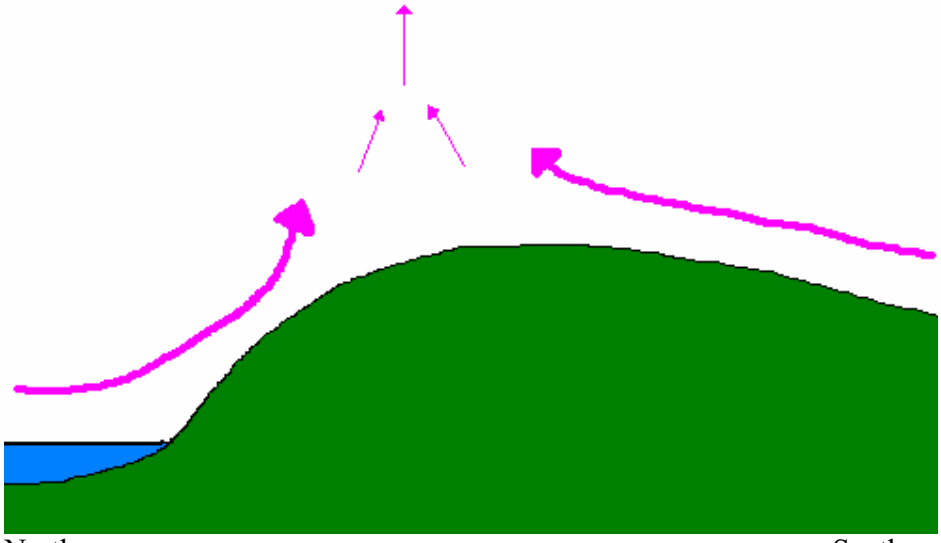
Thunderstorms are caused by huge masses of warm, wet air rising high into the atmosphere to form cumulonimbus clouds. The updraft that is generated by the air being heated near the ground causes the air to rise taking the moisture with it, it then cools and condenses causing a downdraft that carries a lot of precipitation. Boscastle is an exceptional example of this however; the amount of precipitation involved is an indicator of how rare an event it was.

The first of the unique conditions was the wind direction, onshore winds from both the north and the south were bringing air into the low pressure zone that was located over Cornwall, this low pressure zone was due to the air over the land being heated and rising higher into the atmosphere throughout the day.



Here you can see the direction of the wind during the day.

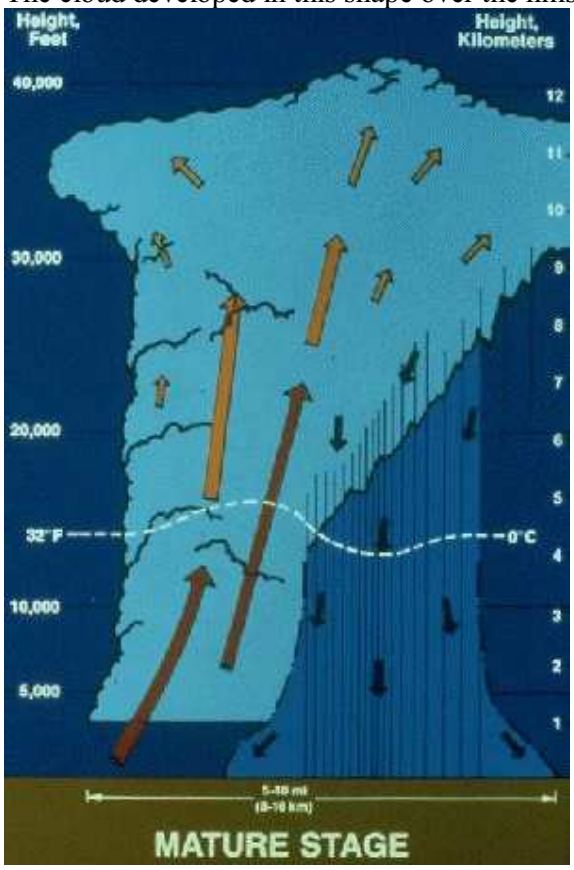
As the day went on the evaporation rate in the areas of sea increased as the water was heated by the sun, this lead to an increase in the humidity of the air, especially in the south where the air was warmer. These masses of air then continued to be dragged inland to fill the air void over Cornwall. As the air was going in opposing directions it would meet at one point and rise. This diagram shows the pattern of the air movement over Cornwall.



North South

As the air from the North hits the coast it is forced to rise by the steep sloping coast, this causes relief rainfall as the air rises and cools, this air was then met by the wind from the south. The air blown by this wind was significantly warmer due to the south being warmer and it travelling across the land in the south and being heated. As the two met their movements cancelled each other out in the north to south direction. The air then started to rise, caused to do so by it being heated and by the updraft generated by the hills. Normally the air would rise until it hit the top of the troposphere where the troposphere meets the stratosphere, normally at about 10000 feet. Here it would mushroom out sideways, giant cumulonimbus clouds being formed in the process. However this day was an exceptional example, the stratosphere being located at around 40000 feet. This gave the clouds far more room to develop; much more air could be sucked from over the oceans and into the cloud.

The cloud developed in this shape over the hills above Boscastle:



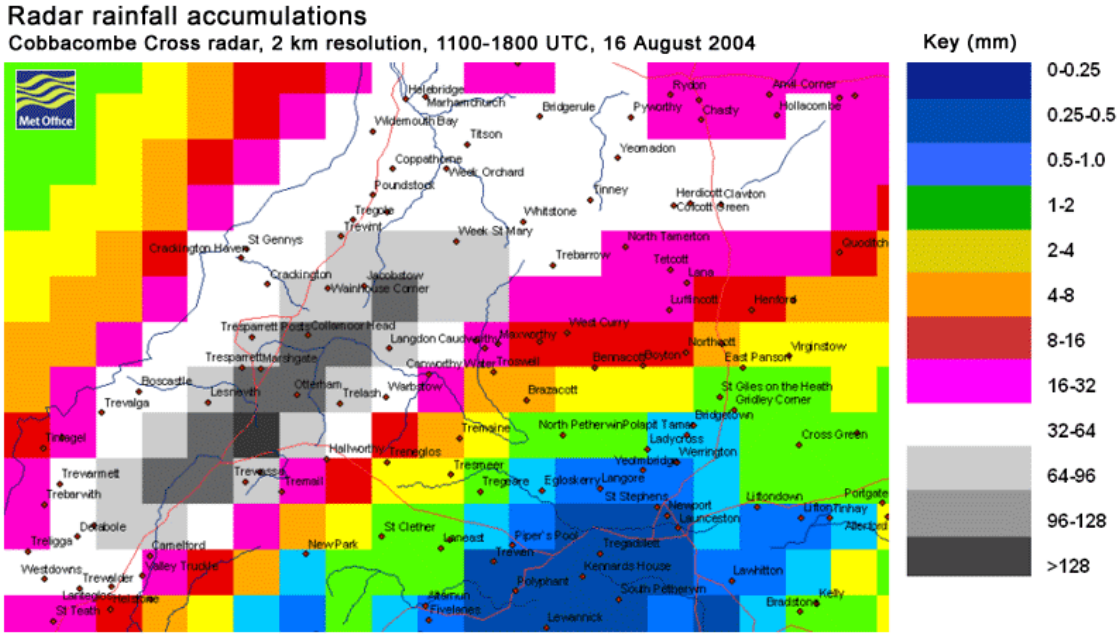
The original updraft bought enough moisture into the air to cause precipitation as it passed the condensation point at about 10000 feet, the position on the stratosphere magnified the effect allowing a lot more air to rise upwards, this had the effect of massive rainfall, the root cause of the Boscastle disaster. This type of extremely heavy thunderstorm is not that uncommon in this part of the world, the more important aspect of the disaster are the other causes.

Causes

The causes of the Boscastle flood, apart from the heavy rain, can be split into 2 categories, anthropogenic and natural.

Natural Causes

One on the main factors was the intensity of the rainfall; nearly 1 months of rain fell in 2 hours in the hills above Boscastle. This radar map showing rainfall intensity shows the position of the storm; directly over the drainage basin of the rivers Vallenci and Jordan, which converge in the centre of Boscastle.



This shows just how intense the rainfall was on the 16th of august.

The problem of the sheer amount of water was exacerbated by the topographic profile of the area. The rivers have carved deep, steep sided valleys into the hills surrounding Boscastle, straight through the igneous bedrock. The hills are now massive impermeable masses with a thin layer of soil over the top. This means that when it rains heavily the ground becomes saturated very quickly; this leads to increased levels of both through flow and overland flow. This allows the water to travel to the main river channels much faster than normal causing a much shorter lag time, which causes flash floods.

Anthropogenic Causes

There may be little man can do to prevent the heavy rainfall that occurred on the 16th of August this year but more extreme weather conditions are said to be an effect of global warming, a term known as the El Nino effect. If man can do nothing before the water hits the ground, what can we do once the water is on the ground?

One on the largest problems in areas such as this is the lack of vegetation on hillsides around areas like this, we remove trees from the slopes to provide areas for pastoral farming and development but this causes all sorts of problems. In a similar way to the thin soil and impermeable rock a reduction in vegetation on hillsides decreases lag time because of the reduction in water stores allowing through flow and overland flow rates to increase. It also leads to instability of the soil so mudflows can be more common as the soil reaches saturation point. The solution to this problem would be to stop felling trees and possibly re-plant some of the hillsides.

When the water reached the town it arrived very quickly, a 3m wall of water rushing down the bottom of the valley at great speed due to the steepness of the riverbed as well as the valley. When the water reached the town it was funnelled through the

narrow streets of the town, this increased the velocity of the water giving it more force to destroy building and move cars.

A bridge across the river in the centre of the town clogged up with debris causing a debris dam to form, this causes the water to back up and it can no longer flow in the river bed, this increased the amount of water that was pushed through the streets.

The fact that the streets were tarmaced and there was very little open space meant that water could not dissipate into the soil, the only way for the water to get to the sea was through the village. This is a common problem with increased urbanisation; percolation is no longer possible, which results in increased overland flow. The only way to reduce this is to implement drainage systems, but as can be seen here, these systems can easily be overwhelmed.

Impacts

Luckily there were no casualties in Boscastle unlike the last similar incident in Lynmouth, 52 years previously, where 32 people died in the disaster. This can be directly attributed to the effectiveness of the emergency services. This means that the anthropogenic toll in Boscastle can be measured in pounds rather than lives. The toll on nature is somewhat more.

Natural Effects

The floods did not only affect humans, the water will have washed through the homes and habitats of many ground dwelling mammals, much like the residents of Boscastle. The soil has also been swept from hillsides along with many trees and other plant growth causing a decrease in food for animals.

Pollution is also a problem, in any flood situation raw sewage ends up in the floodwater. This taints the land so plant life either cannot grow or is not healthy. Seawater is also affected, with increased levels of toxins that max kill fish and other aquatic life.

Anthropogenic Effects

The TV images shown of Boscastle show a huge mass of water rushing through Boscastle and one of the most shocking things in the items that are held in suspension in the water. Cars and vans are washed down the street by the water and smashed together and into buildings. From the pictures it is easy to see why so much damage has been caused. The water has destroyed the homes of almost all the residents of the village along with the businesses and the possesions of holidaymakers. This effect can be very mentally disruptive as well and financially crippling. A condition known as Psychological Dislocation can be common in these cases, because every possession and memory of a person is swept away they loose their identity. This can cause to depression and possible suicide.

Any goods damaged by the floods such as peoples houses and cars may be liable to an insurance payout although many of the cars will only have 3rd party insurance which will not cover the car and insurance companies are notoriously ruthless in finding ways not to pay people's claims. Even when people have managed to re-build their

homes they will then have to pay far higher insurance premiums because of the area is now seen as higher risk.

The town of Boscastle is a popular tourist resort as it is full of historic buildings and has not been greatly modified for many years. Many of these historic buildings have now been destroyed, this loss of a national treasure could be crippling for the economy of Boscastle, and if it looses its charm it also looses its soul method of income, as commercial fishing is no longer viable. If the town cannot be rebuilt in a manor that is sympathetic to the original it may never recover its economic stability.

Financially this kind of disaster is a huge waste, the money that must now be expended to rebuild the town and rebuild the lives of the residents cannot be recuperated in any way. This leads to thoughts of prevention, it might be a good idea to try to prevent a similar event occurring but in reality with this kind of event being both rare and non lethal it is not economically viable. The cost of protecting every small town along the North and South coasts of Cornwall would be prohibitive assuming it is actually possible. It also raises other issues, such as where to stop? Do you protect every costal town and village in the country, or just in the south, or just with over a certain number of residents? Such schemes will never really be viable so we must come to terms with the fact that sometimes we are going to have to deal with a situation like Boscastle every now and then, we are better off saving the money to help people or spending it on the emergency services that allow a massive flood such as this to not cause any casualties.

Response

The emergency services played a huge part in these floods; they helped people to escape from on top of their cars and houses before they were swept away or covered by floodwaters. There was not a single casualty as Boscastle compared to the 32 fatalities at the similar flood in Lynmouth in 1952. This can be attributed to our sophisticated emergency services. The use of seven emergency helicopters to airlift people out of areas where land forces could not reach them was vital to lowering the number of fatalities. The police, fire, ambulance and army forces were all called to the scene to help with the rescue effort and their combined efforts managed to rescue all the stranded victims.

From here it was then down to the less high profile secondary responses. All the rescued and homeless people were taken to a village hall 10 miles south of Boscastle where they were given clean dry cloths, food and a place to stay for the night. This response is just as vital is the primary ones as people would be highly susceptible to thirst, hunger and the cold if they were left to fend for themselves.

After the floodwaters subsided it was down to contractors bought in by the government and insurance companies to clean up the area of all the soil and debris deposited by the floodwaters and then begin to rebuild the houses.

Due to the event being quite high profile there has been a big response form the British public to help the victims, charities have been set up by companies such as the BBC to help out the victims. The current BBC sum is around 100thousand pounds raised to help out the most needy people.