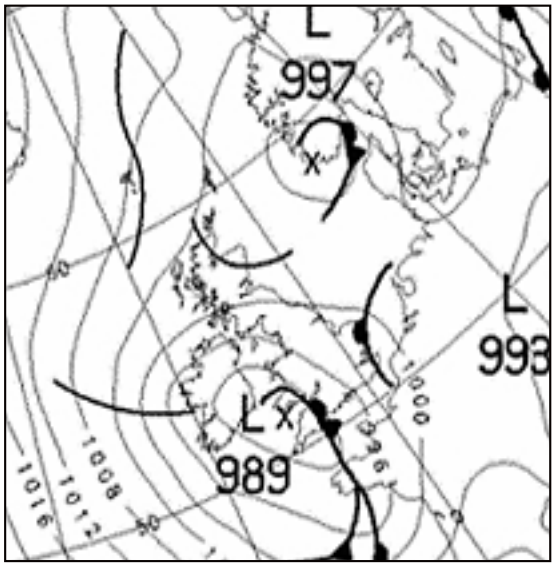
Met Office

Education case study
Hailstorm Ottery St Mary (October 2008)

Where is Ottery St. Mary?

During the early hours of 30 October 2008 the small East Devon town of Ottery St Mary (shown on map below (c) 2012 Google) experienced an extreme weather event in the form of an exceptional hailstorm.



Meteorological situation

The weather chart on the left is from midnight on 30 October 2008. An occluded front lies aligned north-south across SW England. To the rear of the front cold air of northerly origin is found.

The occluded front in this instance was particularly unstable (unstable air has a tendency to rise vertically).

Met Office forecasters were expecting some potentially heavy showers but what happened was unprecedented.

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We have all experienced hailstorms at some time or other but theis storm was truly exceptional.

A key factor in this event was the local topography. Ottery is situated by the River Otter which is aligned north-south. This moist southerly flow fed into the existing storm and was forced to rise over Woodbury Common.

Reports suggest that the size of the hailstones was unexceptional (pea-sized or smaller). What was very significant was the length of time that the hail fell over; roughly 2 hours.

What causes hail?

Hail consists of balls of ice typically measuring between 5 and 200mm. The larger hailstones are associated with severe thunderstorms. Hailstorms are associated with cumulonimbus clouds.

These clouds allow for deep and vigorous convection (vertical motion) and the temperature of the top of the cumulonimbus cloud must be colder than –20 °C.

Cumulonimbus clouds generally have an anvil shaped top with the top of the cloud spreading out horizontally due to increased wind speeds with height. Electrical activity in these clouds often leads to lightning. Thunder is the sound which accompanies lightning due the increasing temperature and pressure of the air.

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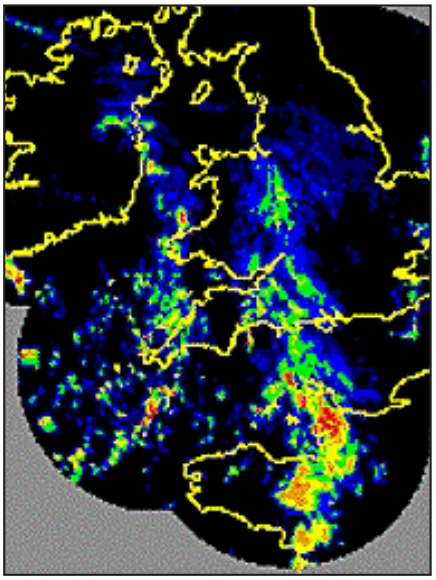
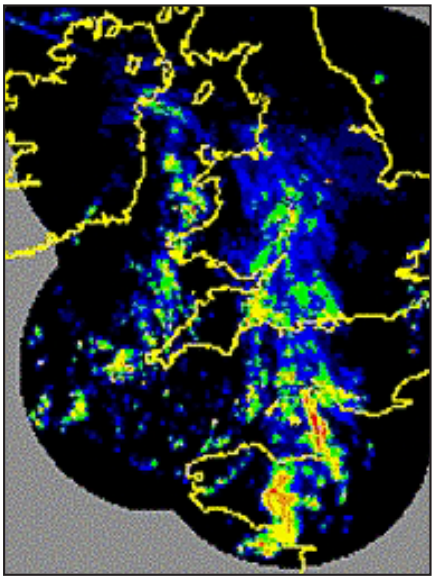
Rainfall amounts

Note the rainfall figures represent the values in the rain gauge once the hail had melted

Looking at actual figures recorded at Kings School, Ottery 187 mm fell in the 27 hour period between 0900 on 29 and 1200 on the 30 October. Analysis of this data suggests that in the three hour period between 0000 and 0300 160 mm fell. This has a return period of > 200 years.

The hail fell from around 2330 and persisted until around 0300.





The first radar image (above left) for 0030 shows the area of heaviest intensities are aligned North West – South East.

The second image (shown above right) from 0200, corresponds with the time of heaviest hail. It shows that this area is now aligned along the valley as discussed above.

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Impacts

If a rainfall event has a return period of 200 years then flooding is inevitable.

We have looked at the how local topography, i.e. higher ground to the west and the alignment of the Otter Valley was significant. The same topography was significant in exacerbating the flooding. 160 mm in 3 hours is a lot of rain to fall on any area. The falling hail was funnelled down the valley and led to flash flooding and erosion of river banks. The hailstones were fairly small and of a low density and were transported to the lowest parts of Ottery. Large amounts of hail helped to block watercourses and drains too. With blocked drains the hail was unable to drain away.

Such was the volume of hail reaching the town that the banks of hail were as deep as 1.2 m in places and actually resembled ice floes moving the town. Such was the depth of the hail that some media sources talked of snowdrifts. The final image (below) shows the extent of the hail banks. Gradually the hail melted and caused flooding.

The floods reached 1.5 m in places. Numerous calls were made to the emergency services. By 0500 Ottery was cut off and around 100 people had to be evacuated, some even had to be airlifted to safety.

There was substantial damage to roads, housing and to utilities networks.

It is estimated that the total cost of the clean-up and repairs cost about £1 million.

This event was regarded as a freak event with weather parameters and local topography combining. Our forecasters regularly forecast hail events and issue warnings. The Met Office had forecast heavy rain clearing to showers, heavy at times with a risk of hail and thunder. No forecaster would ever have been brave enough to say that some parts would receive 1.2 m depth of hailstones!

More information

BBC News - ‘Freak’ hail causes absolute chaos

BBC News - Hailstorm sparks ‘absolute chaos’

BBC News - In pictures: The Ottery and East Devon floods of 2008

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