Flood hydrology facts

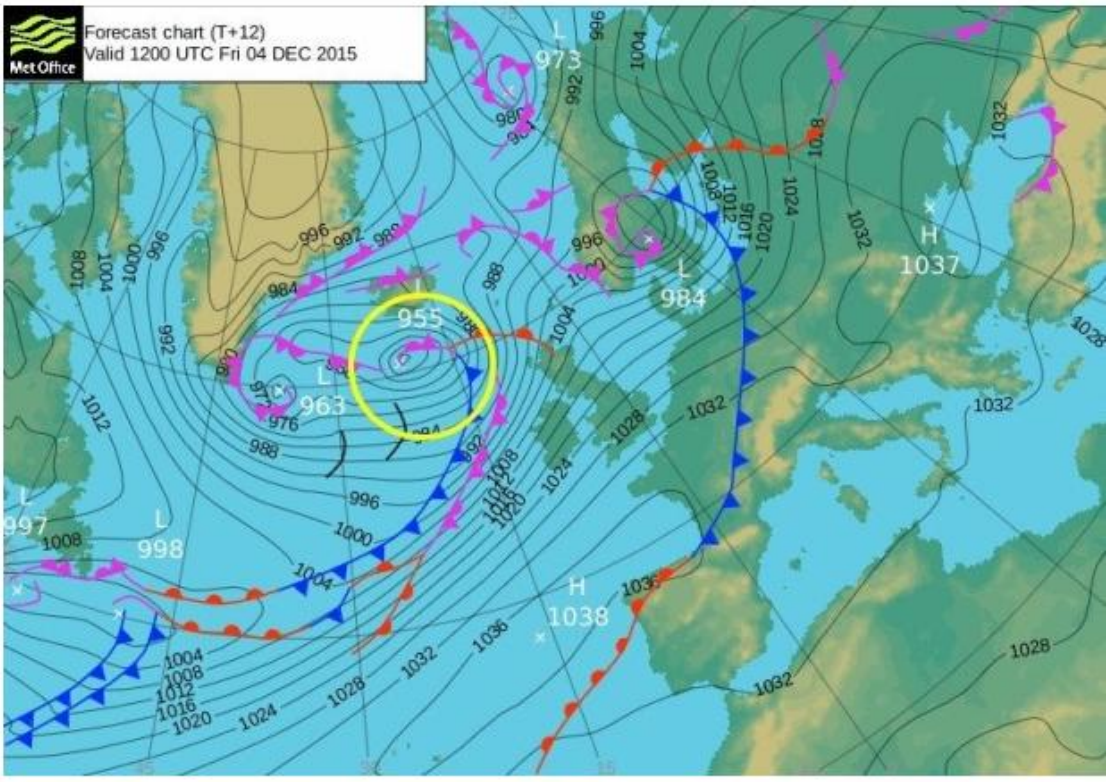
Northumberland, Durham & Tees Area

Fact sheet 16: Storm Desmond : 4th to 6th December 2015

This flood hydrology fact sheet contains data and information that is supported by analysis and can confidently be communicated to our customers. However it should be noted that the data has not yet been validated. It is a selection of sites in the Northumberland, Durham & Tees area and further information is available from the hydrology team.

Storm Desmond was a low pressure system which passed well to the northwest of the UK, close to Iceland but it brought periods of severe gales with damaging gusts affecting northern England on Friday afternoon and into the night. The frontal systems associated with Storm Desmond resulted in persistent rain falling over parts of northern Britain with the heaviest rain in the NDT area falling over the west facing hills of the South Tyne. Strong winds drove the rain against the Pennines where orographic (1) enhancement produced persistent heavy rainfall which lasted for well over a day.

The chart below is taken from the Met Office website and shows the forecast for the position of Storm Desmond at 0000 on Saturday 5th December.



(1) Orographic rainfall is caused when moist air pushed by strong winds is forced up the side of hills and mountains. The lift of the air results in cooling, condensation and increased precipitation.

Table 1 below shows the best rainfall data currently available. The rainfall figures cover the period 4th to 6th December, providing return period estimates and percentage of long term average over a range of storm durations.

NDT - Peak Intensities 04/12/2015 - 06/12/2015	North Tyne		South Tyne				Tyne		Wear
	Chirdon	Kielder Ridge End	Alston S.Wks	Garrigill Noonstones Hill	Haltwhistle	Nenthead Mill Cottage	Hexham Firtrees	Knarsdale	Burnhope Reservoir
peak rainfall accumulation (mm)									
6 hour total	30	23.4	35	62	29.2	47	17.8	27.8	37
12 hour total	56.2	43.4	61.6	112.4	50.6	82.8	31.2	48.4	61.6
18 hour total	75	58.6	87	138.6	70.8	123.6	45.2	72.8	91
24 hour total	94	77.2	99.8	151.4	89.2	140.4	57.6	87.8	105.8
36 hour total	122.2	99.6	122.4	186	105	175.8	75.2	110.6	131.8
48 hour total	122.2	100.6	122.8	187	105.2	176.6	75.6	111	132.4
return period (years)									
peak 6 hour total	6	2	6	30	4	15	1	3	5
peak 12 hour total	31	6	20	127	15	57	3	7	11
peak 18 hour total	57	10	46	172	36	191	7	17	30
peak 24 hour total	100	20	52	161	68	226	13	21	36
peak 36 hour total	181	30	66	221	80	>250	25	26	47
peak 48 hour total	106	17	38	136	50	235	17	13	27
% December LTA									
peak 6 hour total	29.1	20.7	28.0	40.8	30.4	45.2	25.7	23.2	27.2
peak 12 hour total	54.6	38.4	49.3	73.9	52.7	79.6	45.0	40.3	45.3
peak 18 hour total	72.8	51.9	69.6	91.2	73.8	118.8	65.2	60.7	66.9
peak 24 hour total	91.3	68.3	79.8	99.6	92.9	135.0	83.1	73.2	77.8
peak 36 hour total	118.8	88.1	97.9	122.4	109.4	169.0	108.5	92.2	96.9
peak 48 hour total	118.8	89.0	98.2	123.0	109.6	169.8	109.1	92.5	97.4

Return Period	50-100	100-200	200+
% LTA >75%			

Table 1: Peak rainfall intensities in Northumberland, Durham & Tees

Quoting the rainfall return period needs care as it is specific to the rain gauge and may not be typical of the whole catchment. Figure 1 below shows heavy rain was widespread over the South and North Tyne catchments but dropped off considerably in the lower Tyne. Rainfall return periods are also quoted for specific storm durations and so cannot be used directly to represent the flood return period.

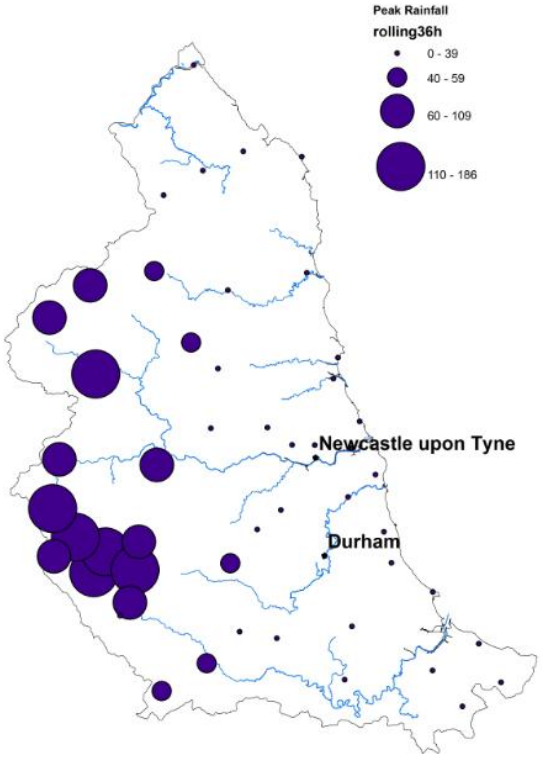


Fig 1: Peak 36 hour rainfall accumulations in Northumberland, Durham & Tees.
Note that due to the high winds associated with this event there will have been a degree of under catch.

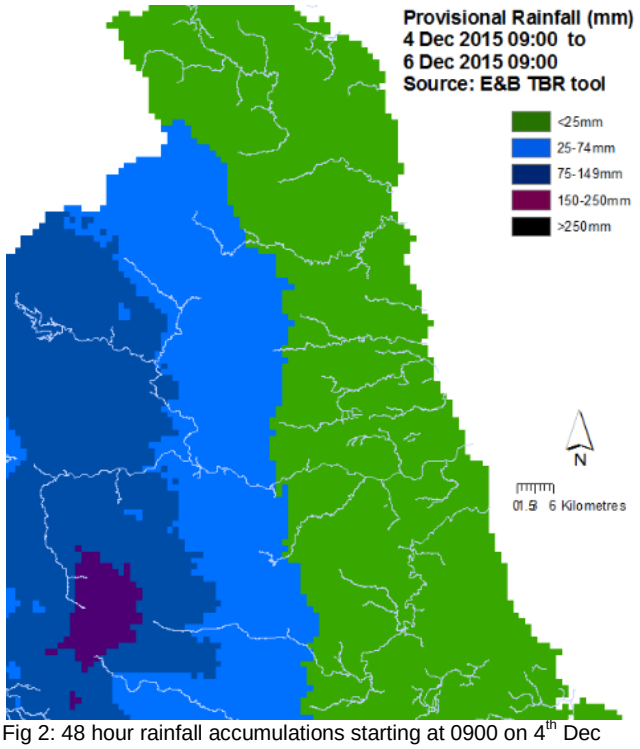


Fig 2: 48 hour rainfall accumulations starting at 0900 on 4th Dec

Contact:Hydrology team, WE Assessment, Environment &Business
nationalhydrology@environment-agency.gov.uk
Northumberland, Durham & Tees Hydrology

Figure 2 below shows how the South Tyne and Tyne river levels responded quickly to this rainfall as the event had been preceded by rain falling during Thursday 3rd December. Levels had not had time to return to normal and so the event began with above normal flows and saturated catchments.

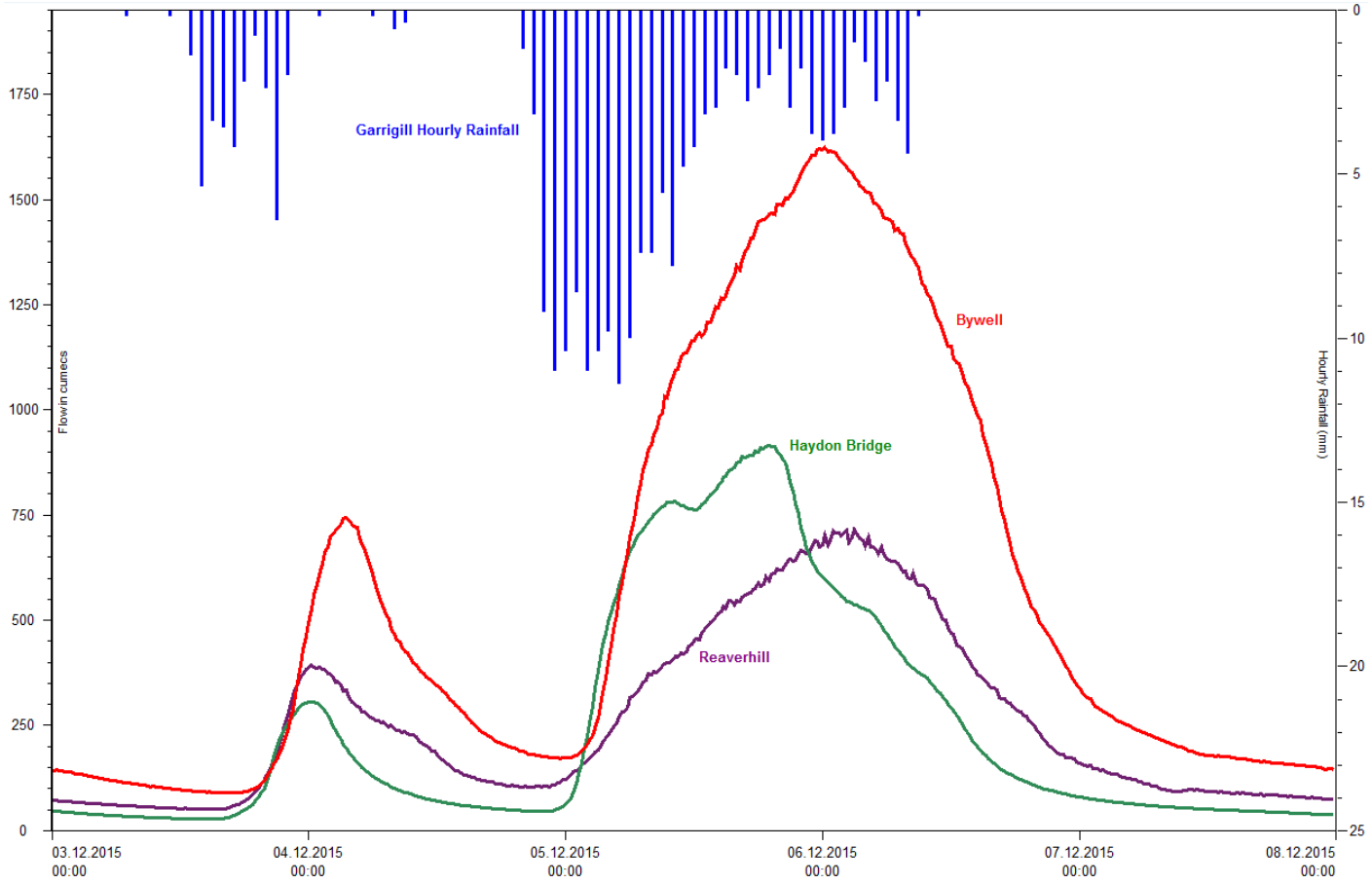


Fig 2: Garrigill rainfall and river flow response in the North, South and main Tyne

Table 2 below gives the peak river level at a selection of sites across the Northumberland, Durham & Tees area, together with an indication of where the peak ranked in the Annual Maximum (AMAX) record for each site. The rank is influenced by the length of record at individual sites, however those selected all have records of at least 10 years and most have more than 30 years of record, so peaks ranked in the top five can be considered relatively rare events.

Catchment	Gauge	River level (m stage)	Date	Rank (in record)	Record length
Tyne	Bywell	6.959	06/12/2015	1	61
Tyne	Corbridge	5.759	05/12/2015	1	14
Tyne	Riding Mill	5.991	05/12/2015	1	33
Tyne	Hexham	34.843 mAOD	05/12/2015	1	18
North Tyne	Ugly Dub	2.573	05/12/2015	1	31
North Tyne	Reaverhill	5.072	06/12/2015	1	57
North Tyne	Bellingham	3.83	05/12/2015	1	13
North Tyne	Falstone	3.338	05/12/2015	1	10
North Tyne	Chollerford	3.403	05/12/2015	1	18
North Tyne	Rede Bridge	3.045	06/12/2015	3	38
North Tyne	Otterburn	3.454	05/12/2015	5	17
South Tyne	Warden Bridge End	5.71	05/12/2015	1	10
South Tyne	Haydon Bridge	4.646	05/12/2015	2	49
South Tyne	Haltwhistle	3.27	05/12/2015	2	17
South Tyne	Featherstone	2.462	05/12/2015	3	51
South Tyne	Alston	2.472	05/12/2015	5	40
Wear	Wearhead	1.523	05/12/2015	2	16
Wear	Burnhope	2.342	05/12/2015	2	31
Wear	Stanhope	3.432	05/12/2015	3	56
Wear	Witton Park	4.088	05/12/2015	4	41
Tees	Croft	5.483	05/12/2015	1	18
Tees	Darlington Broken Scar	3.187	05/12/2015	5	36
Tees	Barnard Castle	2.542	05/12/2015	4	26
Tees	Langdon	1.408	05/12/2015	3	17
Tweed	Sprouston	4.529	06/12/2015	4	47

Table 2: Peak river levels in Northumberland, Durham & Tees

A previous study following the large Tyne flood in 2005[(2)] looked in detail at the historic flood series both before and after construction of Kielder reservoir, including records of flood levels dating back to the great flood of 1771. Using this information it is believed that the 2015 event on the main Tyne ranks second only to this flood of 1771, with an associated return period of 90-150 years.

(2) Assessment of the severity of the extreme River Tyne flood in January 2005 using gauged and historical information – Archer, DA, Leesch, F and Harwood, K (2007).