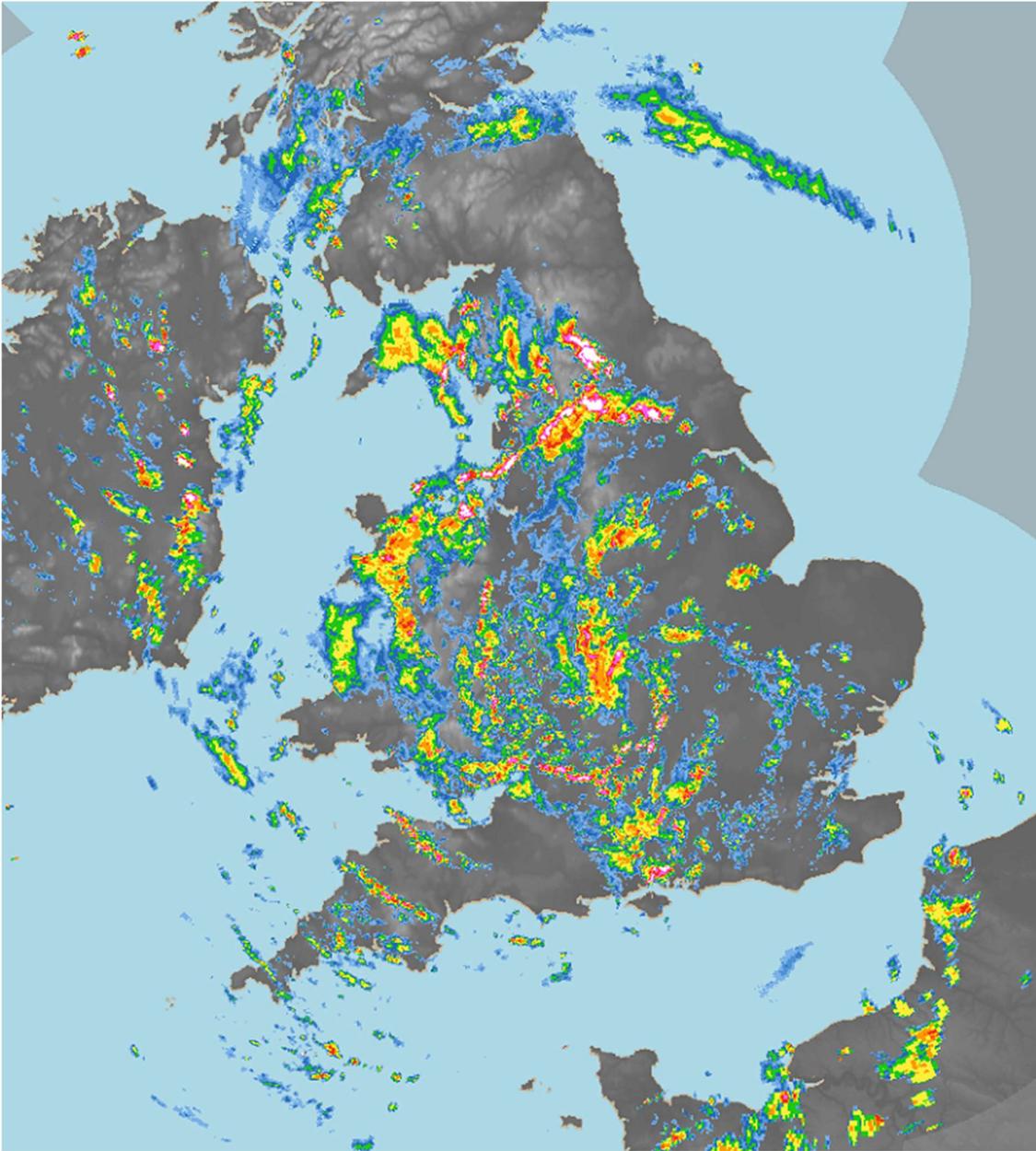
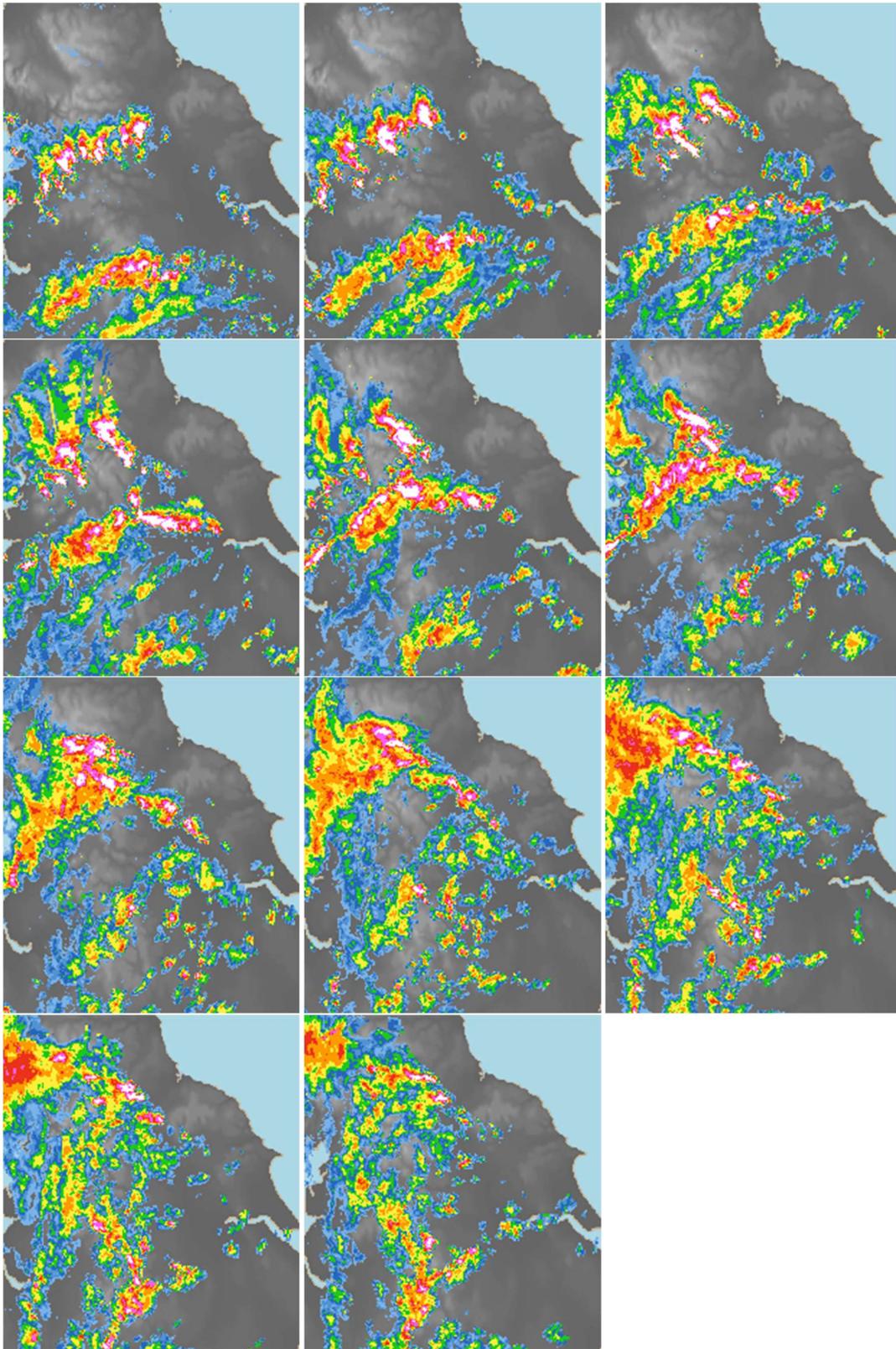


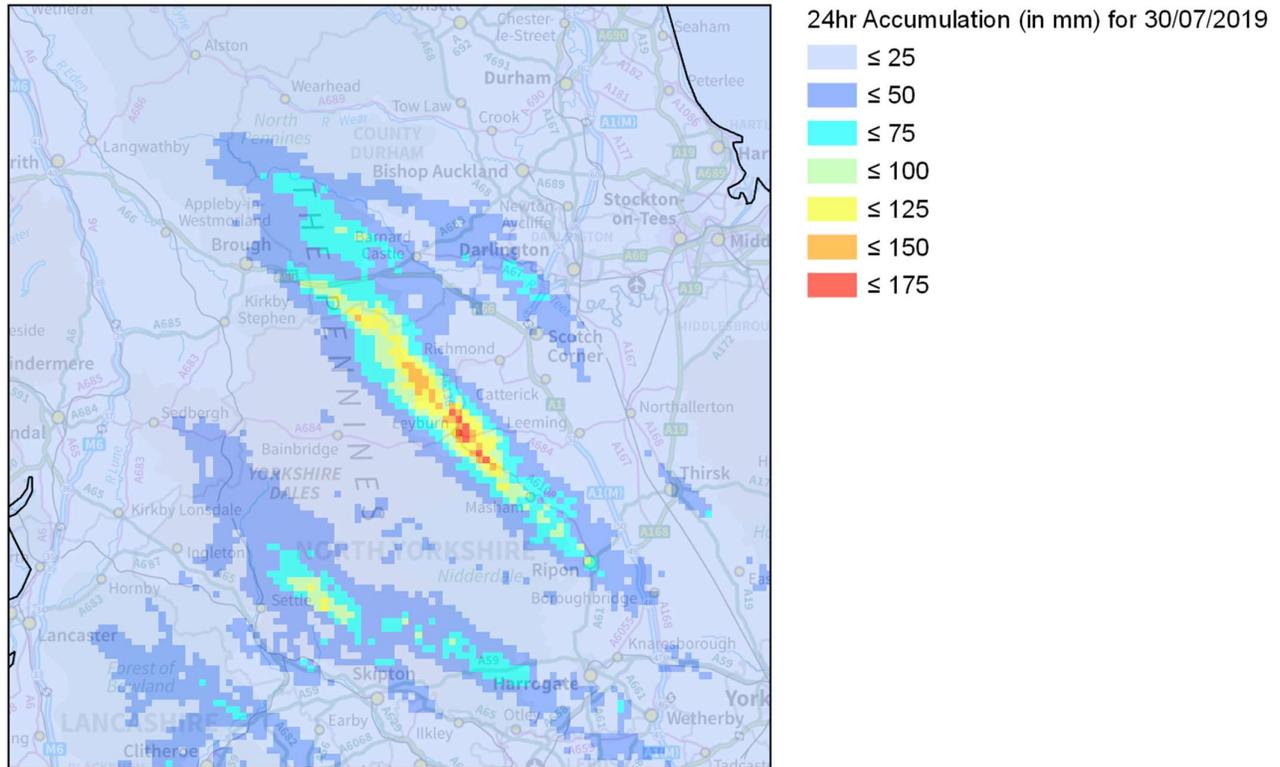
The rain-radar image at 1500 UTC 30 July 2019 shows areas of heavy rain from this area of low pressure across much of England and Wales, particularly focussed across the Pennines.



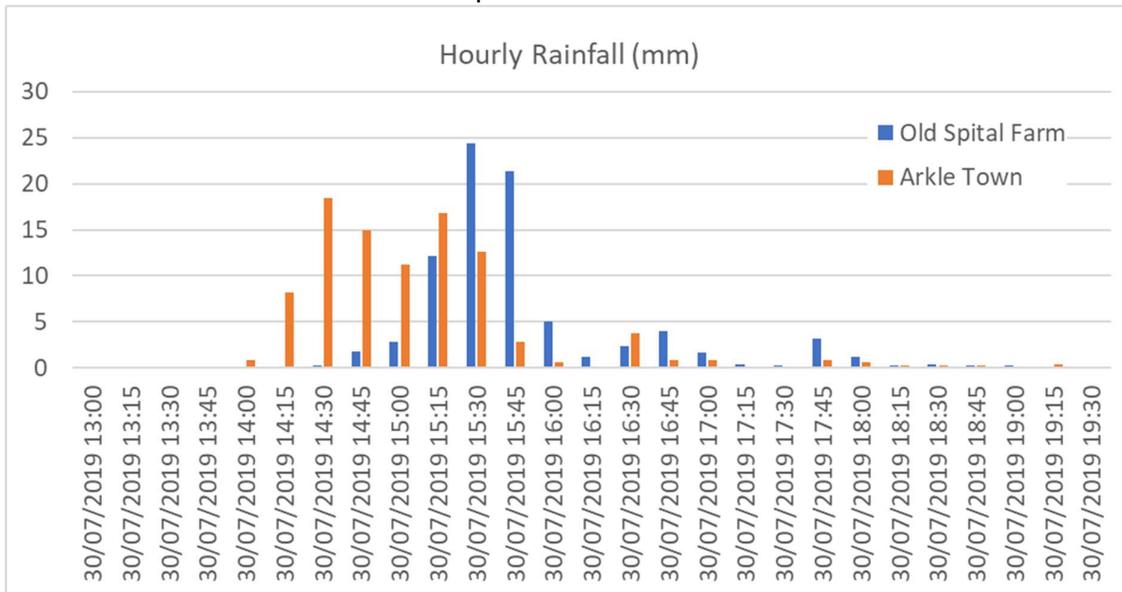
The panel of rain-radar images at 30-minute intervals from 1300 UTC to 1800 UTC 30 July 2019 shows the sustained nature of the intense downpours across the Yorkshire Dales. White colours indicate rain-rates exceeding 32 mm/hr.



The map below shows estimated rainfall accumulations from 0000 UTC 30 to 0000 UTC 31 July 2019. The highest totals were around 150mm in the Leyburn area.



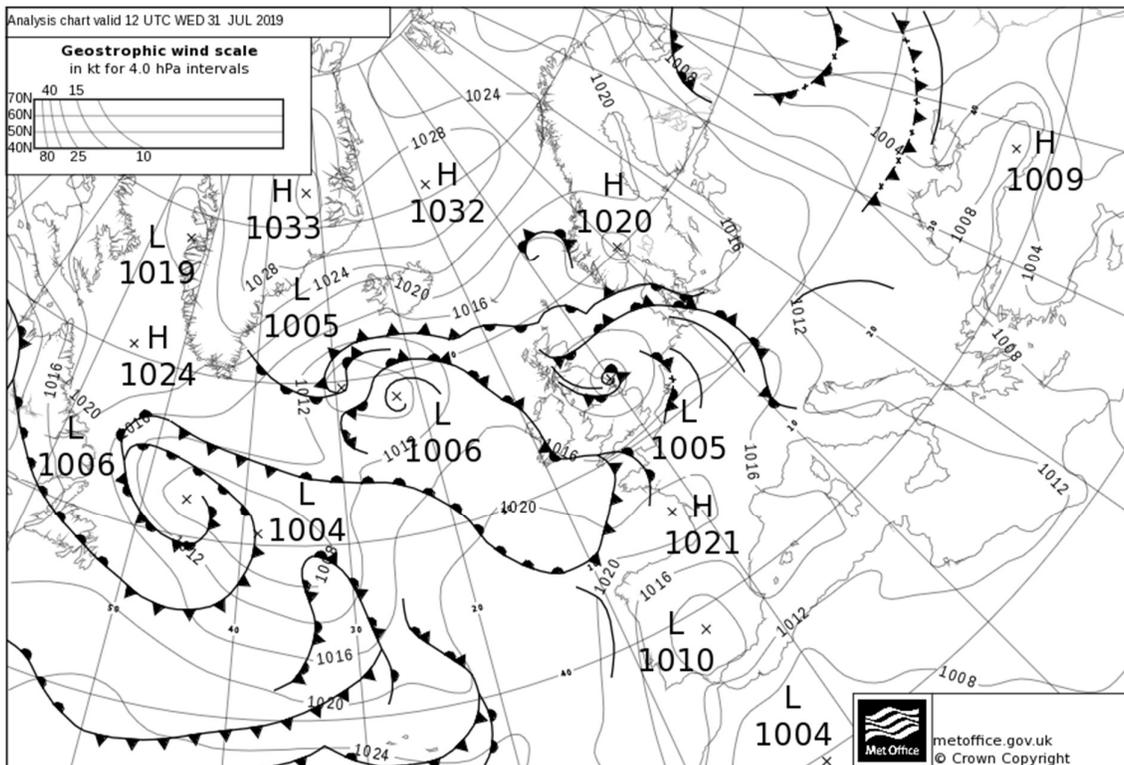
The chart below shows 15-minute rainfall totals from two rain-gauges in the North Pennines at Arkle Town (Arkengarthdale, Yorkshire Dales) and Old Spital Farm (A66, County Durham). Arkle Town recorded 58.0mm of rain in 45 minutes, and Old Spital Farm 82.2mm in 90 minutes, with rain-rates sustained at 10 to 20mm per 15-minute intervals.



The table below lists the highest hourly, two-hourly totals and daily totals at four rain-gauges in the official registered network across the North Pennines. The highest hourly totals were 40 to 60+mm, with two-hour totals of 60 to 80+mm and daily totals of 70 to 100+mm, most of which would have fallen within a few hours. 60mm per hour is equivalent to 1mm per minute. The highly localised nature of the rainfall means that other locations may well have recorded totals exceeding those from the official network listed in the table below.

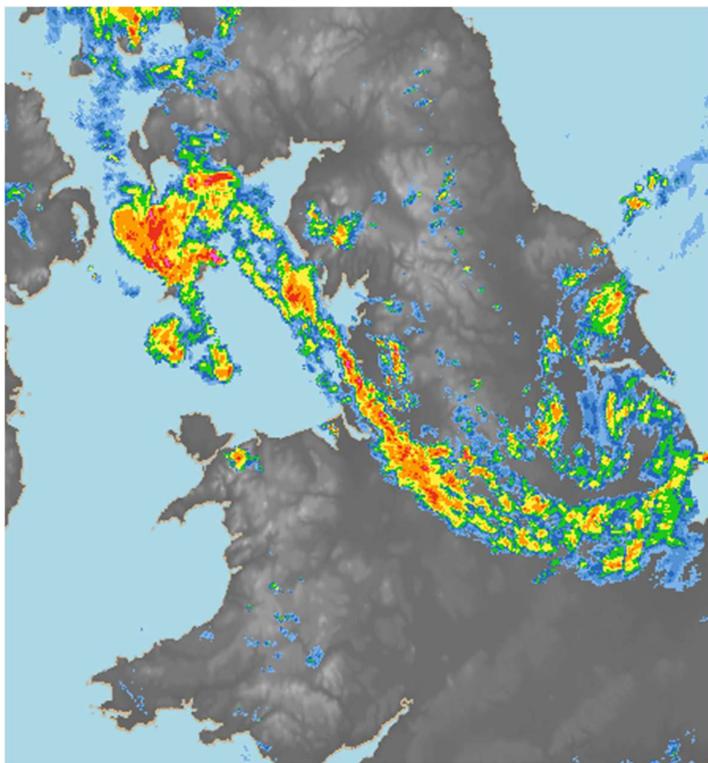
Station	Highest hourly total (mm)	Hour ending (UTC)	Highest 2-hour total (mm)	Hour ending (UTC)	Daily total 0900 UTC 30 to 0900 UTC 31 July
Old Spital Farm (County Durham)	63.0	1600	72.2	1700	95.0
Sedbergh (Cumbria)	55.4	1200	63.6	1200	77.0
Arkle Town (North Yorkshire)	52.8	1500	85.6	1600	103.1
Malham Tarn (North Yorkshire)	43.6	1400	66.6	1500	91.1

The analysis charts at 1200 UTC 31 July 2019 shows the area of low pressure moving off the Lincolnshire coast, with further intense downpours focussed in a band extending across Lancashire, Greater Manchester and Cheshire.

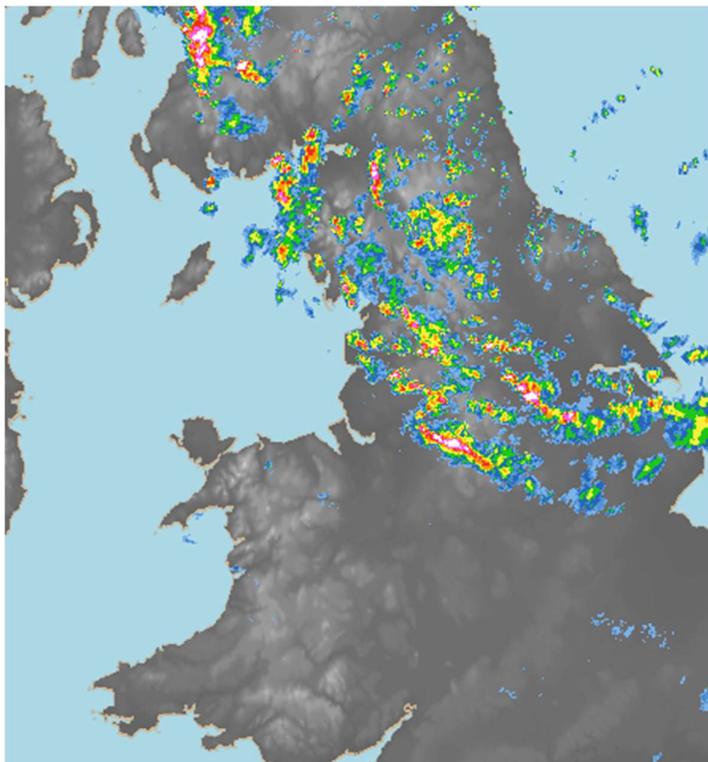


The rain-radar images below at 0000 UTC 31 July 2019 and 1500 UTC 31 July 2019 show heavy rainfall continuing in a band through the Cheshire Gap. After heavy rain overnight (a) the further heavy rainfall through the afternoon (b) falling on already saturated ground resulted in significant flash-flooding across parts of south Manchester and East Cheshire.

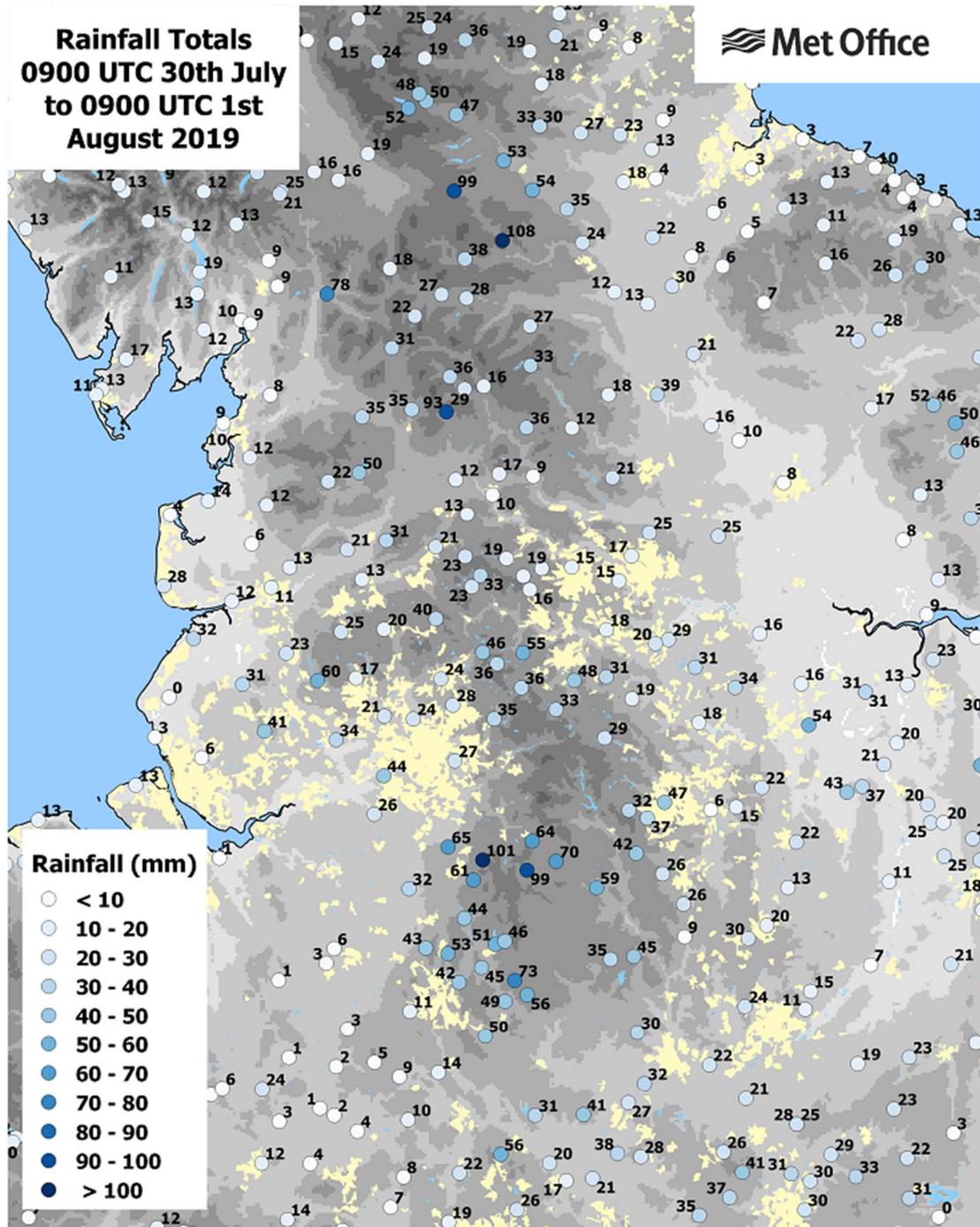
a) 0000 UTC 31 July 2019



b) 1500 UTC 31 July 2019

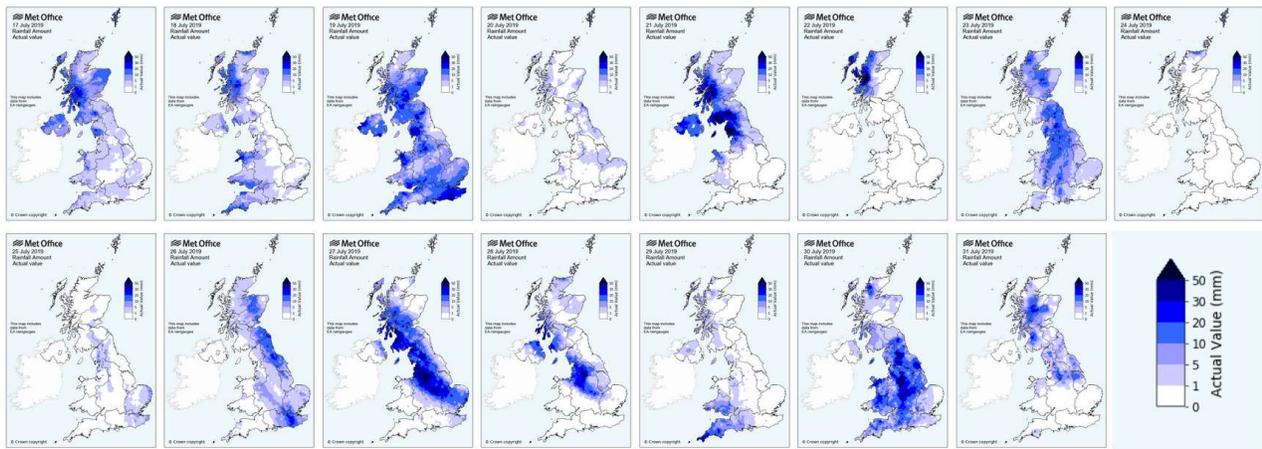


The map below shows 2-day rainfall totals 0900 UTC 30 July to 0900 UTC 1 August 2019, with around 100mm falling across parts of the north Pennines - mostly on the 30th - and 40 to 60mm or more falling across parts of the western Peak District (East Cheshire, Derbyshire and Staffordshire) – mostly overnight 30th and into 31st, with 98.6mm falling at Buxton over 2 days.

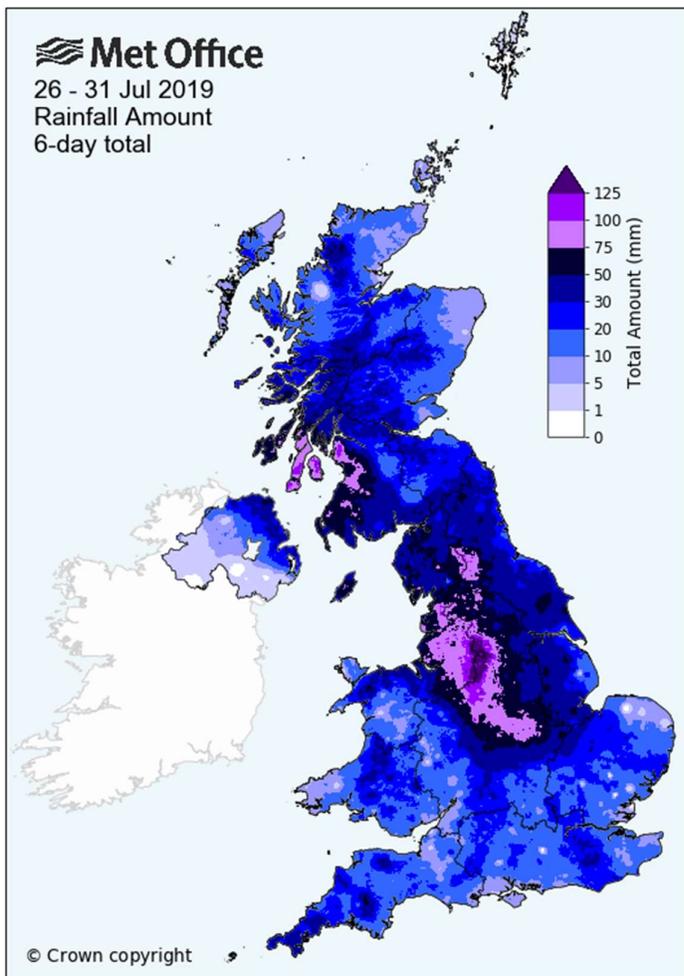


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The panel of maps below show daily rainfall totals across the UK for the second half of July 2019 (17th to 31st) indicating the unsettled and wet nature of the weather during the latter half of the month.



The map below shows the 6-day rainfall totals from 26 to 31 July 2019 inclusive. Over 75mm was recorded widely across the Peak District, north-west England and parts of the Pennines, with over 125mm across parts of the western Peak District – averaging around 20mm per day. Across the Peak District and parts of North Yorkshire this was 150 to 200% or more of the July long-term average rainfall in only 6 days.



Author: Mike Kendon, Met Office National Climate Information Centre

24hr rain-radar accumulations figure: Sharon Jewell, Met Office Observations R&D

Last updated 28/08/2019