

UK Hydrological Bulletin: February 2014 – April 2014

The mild and very cyclonic weather patterns which dominated the early winter of 2013-14 continued through February. Spatial rainfall variations in winter rainfall totals were large but provisional data indicate that 2013/14 vies with 2000/01 as the wettest winter for the UK in a series from 1910. More notably, England & Wales registered its highest December-February rainfall in a series extending back to 1766. With catchments close to saturation from mid-December flooding was extensive and remarkably protracted.

By the third week of February a gradual switch in focus from tidal and fluvial flooding to the risk of groundwater flooding was evident, particularly in central and southern England where groundwater levels rose to near-record maxima. A notable dry spell extended through much of March and April but the groundwater flooding persisted throughout much of the spring in some aquifer outcrop areas. Generally, flood alleviation measures worked well across the country and the overall number of properties flooded was modest in the context of the record rainfall. However the persistence of the flooding, its impact on transport infrastructure and agriculture, and on marooned communities – together with a continuing risk of coastal erosion, landslips and sink holes – underlined our vulnerability to extreme weather events and the priority need to determine how much that risk will change in a warming world.

February was another mild month – with snowfall largely confined to the Scottish Highlands – but a further sequence of intense frontal systems brought damaging gales and notably high rainfall across southern Britain particularly. The UK's fourth wettest February in the 115-year national series contributed to winter rainfall totals with estimated return periods exceeding 100 years across most regions of the country. Flood warnings were very extensive (with >300 Alerts operational in England & Wales during the third week) and, with coastal flood risk remaining high, the Thames Barrier was closed for a record 16th successive tide. Daily outflows from England & Wales

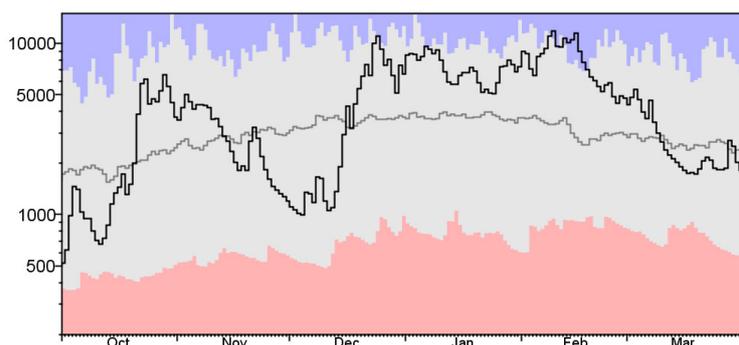


Fig 1 England & Wales daily outflows 2013-14 (the grey tract is the long term daily average; the blue and pink envelopes show the highest and lowest pre-2014 daily flows)

Table 1 Ranked 60-day maximum flows for the Thames at Kingston

| Rank | Outflow cumecs | Period |
|------|----------------|-------------------|
| 1 | 397.0 | Dec 2013-Feb 2014 |
| 2 | 306.7 | Dec 1928-Feb 1929 |
| 3 | 305.5 | Nov 1929-Jan 1930 |
| 4 | 305.3 | Jan 1937-Mar 1937 |
| 5 | 302.0 | Dec 1914-Feb 1915 |
| 6 | 301.8 | Dec 2000-Feb 2001 |
| 7 | 293.9 | Feb-Apr 1947 |
| 8 | 285.1 | Oct-Dec 1960 |
| 9 | 266.6 | Jan-Mar 1995 |
| 10 | 264.5 | Jan-Mar 1883* |

* The Thames flow series begins on 1/1/1883

exceeded previous daily maxima during mid-month (see Fig 1) and most index rivers across southern Britain eclipsed previous February runoff maxima. Generally, the flooding was most persistent in major basins (and the Somerset Levels) – the Severn and Thames particularly. For the latter, the 60-day maximum flow in early 2014 exceeded the previous maxima in a series from 1883 by a remarkable 30% (see Table 1). The influence of catchment geology on runoff patterns became increasingly evident through the month: Whilst steep recessions characterised most rivers draining impermeable catchments from mid-month, flows continued to increase in many groundwater-fed rivers, boosted by powerful outflows from springs and seepages. In Northern Ireland, where storage in Lough Neagh dampens the runoff response, a new record February runoff was also established. Following near-record winter recharge, groundwater levels were exceptionally across many outcrop areas. At Compton, in the Chalk of the South Downs, groundwater levels exceeded the previous February maximum by an appreciable margin and groundwater flooding (including on floodplains) was evident in most vulnerable areas of southern Britain.

After the tempestuous winter, weather patterns in March were more typical of a normal early spring. It



Plate 1 Groundwater flooding near Blewbury (Berkshire)
February 2014.

Photo: Jon Finch

was another notably mild month with high pressure dominating synoptic patterns and regional rainfall totals generally below average. Some parts of eastern and central England recorded sequences of 17 or more days with precipitation largely restricted to fog-drip. Soil moisture deficits began to build and modestly exceeded the average in some eastern areas by month end. Generally, river flows declined substantially through March but flows in many permeable southern catchments remained high and groundwater flooding persisted throughout the month in a number of areas (see Fig 2). By contrast, late-March flows were seasonally depressed in many impermeable catchments (e.g. the Mole in Surrey and Naver in northern Scotland). Despite the generally modest replenishment during March, stocks in all index reservoirs (or reservoir groups) remained more than 90% full entering April, and close to capacity

in many. Groundwater recharge was seasonally modest across most major aquifers in March but the legacy of the exceptional winter rainfall ensured that groundwater levels in most index wells and boreholes remain notably high for the early spring. Correspondingly, the water resources outlook is very healthy and particularly so across southern Britain. April began with low pressure centred to the south west of the country, drawing a mild sub-tropical airflow (and Saharan dust) across much of central and eastern England. On the 6th, heavy frontal rainfall triggered a flood alert on the Glaslyn in Wales and high spates on the Plym and Tavy in Devon. High pressure then dominated synoptic patterns over the next fortnight and some lowland areas registered less than a third of average rainfall over a six-week period; correspondingly, soil moisture deficits increased smartly. A return of cyclonic conditions early in the fourth week brought relief to farmers and growers but sharp downpours triggered localised flash flooding (e.g. in Gloucestershire) and a flood alert for the River Lodden (Berkshire). Of wider hydrological interest was the persistence of 19 groundwater flood alerts (e.g. in the Chilterns, Berkshire Downs and North Hampshire) some of which had been extant for 16 weeks or more. Initial analyses suggest that only in 2000/01 has groundwater flooding of a broadly comparable severity been experienced in the last 70 years at least.

Terry Marsh
Centre for Ecology & Hydrology