UK Hydrological Bulletin: August – October 2012

The UK climate is inherently variable and that variability has achieved an extreme expression in 2012. Dramatic drought terminations have occurred before, e.g. following the droughts of 1989, 1975/76 and 1959 but runoff and recharge recoveries sustained through the late spring and summer are extremely rare.

Cyclonic weather patterns continued to dominate well into the autumn and the associated very wet conditions contributed to the highest summer half-year (April–Sept) rainfall for England &Wales since the late eighteenth century. With soils remaining close to saturation, runoff response to the exceptional rainfall was similar to what would normally be expected in the winter and flood events, both fluvial and pluvial, were common particularly towards the end of September. Aquifer recharge, normally meagre at this time of year, has been very substantial and sustained through much of the last five months; water-table responses have, however, been spatially very variable reflecting, in large part, contrasting aquifer characteristics.

August was dry in much of north-west Scotland, where substantial rainfall deficiencies had built up since the early spring, but relatively dull and wet elsewhere — contributing to the wettest summer since 1912 for England & Wales. Correspondingly, soils remained very wet over wide areas through the late summer (see Figure 1) and, following the driest March soils on record, average soil moisture deficits through the April–August growing season were the lowest in a series from 1961.

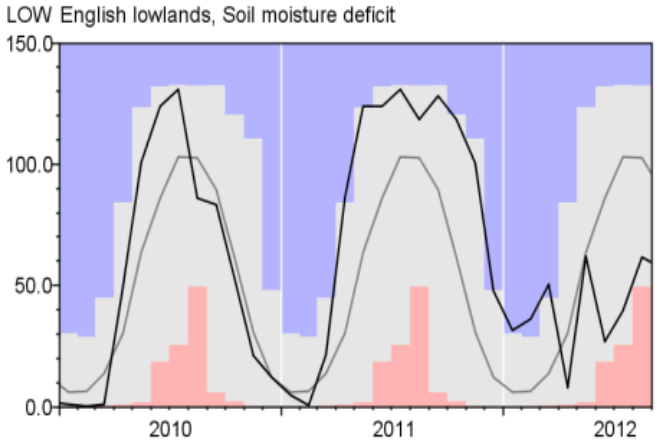

Fig 1 *Monthly soil moisture deficits with monthly max., min., and mean (based on the 1961–2010 record). Data source: MORECS*

This caused continuing problems for agriculture (e.g. reduced grain yields) but it is sobering to note that, prior to the 20th century, the impact of such seasonally wet soils on food production would have implied a widespread threat of famine. Near-saturated catchments ensured that many rivers responded rapidly to the August rainfall and moderate floodplain inundations were common; there was also a high incidence of flash flooding. Flood alerts were widespread e.g. on the 5th, 15–17th, 25–27th (when, in eastern Scotland, the River Earn exceeded its previous August peak flow) and the 29/30th (in Cumbria, the swollen River Ehen caused substantial damage at Egremont and flash flooding was severe in and around St Bees). August runoff totals were well above average in most index catchments but the residual impact of the drought was still evident in the below average flows in a number of spring-fed rivers and streams (e.g. the Winterbourne in the Berkshire Downs).

The seasonally exceptional summer runoff was very beneficial in water resources terms, ensuring that stocks in almost all index reservoirs remained well above the seasonal average. For the end of August, aggregated stocks for England & Wales were the highest on record; more remarkably, average stocks through the summer of 2012 exceeded those for all but the wettest winters. Late summer aquifer replenishment was also very exceptional and groundwater levels in most index wells and boreholes were within, or above, the normal early autumn range.

September was a generally a cool but sunny month with limited rainfall over the first three weeks. Thereafter, weather patterns became very unsettled. From the 24–26th, the most intensive September storm for 30 years (spawned from the remnant of Hurricane Nadine) resulted in 2–3 day rainfall totals exceeding the monthly average in many areas. At Ravensworth (North Yorkshire) a 3-day total of 130 mm was recorded and 24-hr totals of 98.2 mm at Killyane (Antrim) and 66 mm at Rhyl (Denbyshire) were also reported. River flows climbed rapidly, floodplain inundations were very widespread and many river flows remained close to, or above, bankfull for a week or more. In Yorkshire, the Ouse recorded its third highest level at York in a series extending back to the 1880s and several rivers, including the Swale, recorded peak flows above previously recorded maxima. In a few, mostly southern, areas flood risk was accentuated by seasonally very high groundwater levels — the associated heavy spring outflows contributing to sustained spate conditions (e.g. in Dorset). The Environment Agency estimates that around 4500 properties were flooded over the late-April to September period; in the absence of flood defences this figure would have exceeded 50 000.

Provisional data suggest that September outflows from England & Wales were the second highest since

1968 and the exceptional runoff late in the month reversed a belated seasonal decline in reservoir stocks. Early October stocks for England & Wales exceeded the previous monthly maximum (the fourth successive month in which this has occurred) and stocks in the great majority of index reservoirs were within 10% of capacity — a remarkable circumstance for the early autumn. An index of the singular nature of the seasonally anomalous runoff patterns experienced over the last year is provided by Figure 2 which compares the April–September runoff from England & Wales with that for the preceding October–March: the magnitude of the reversal in the normal partitioning of runoff between the half-years has no close modern parallel.

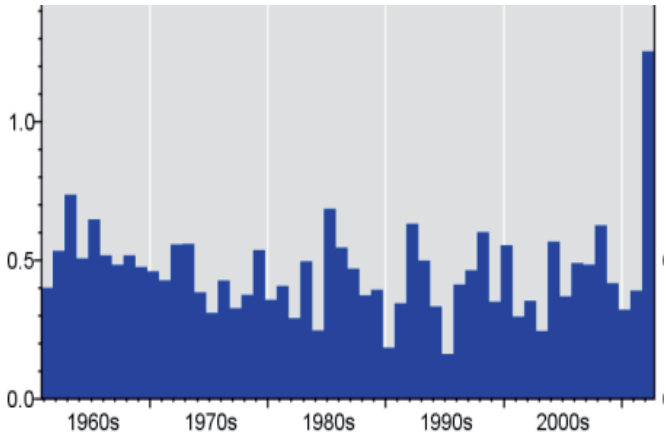

Fig 2 *Ratio of the April–September runoff from England and Wales to that of the previous October–March*

A westerly airflow continued to bring Atlantic frontal systems across most of the country through the first half of October, triggering further, mostly modest, floodplain inundations. On the 11th, a very intense storm (reportedly around 50 mm in an hour) triggered severe flash flooding at Clovelly (which clings to a very steep catchment on the north Devon coast) and, in west Cumbria, a landslip closed the Sellafield to Whithaven rail link on the 17th; the second such occurrence in six weeks.

Due to a combination of rainfall patterns, soil moisture conditions and, more particularly, aquifer storage characteristics, groundwater levels have presented a spatially variable picture through the autumn thus far.

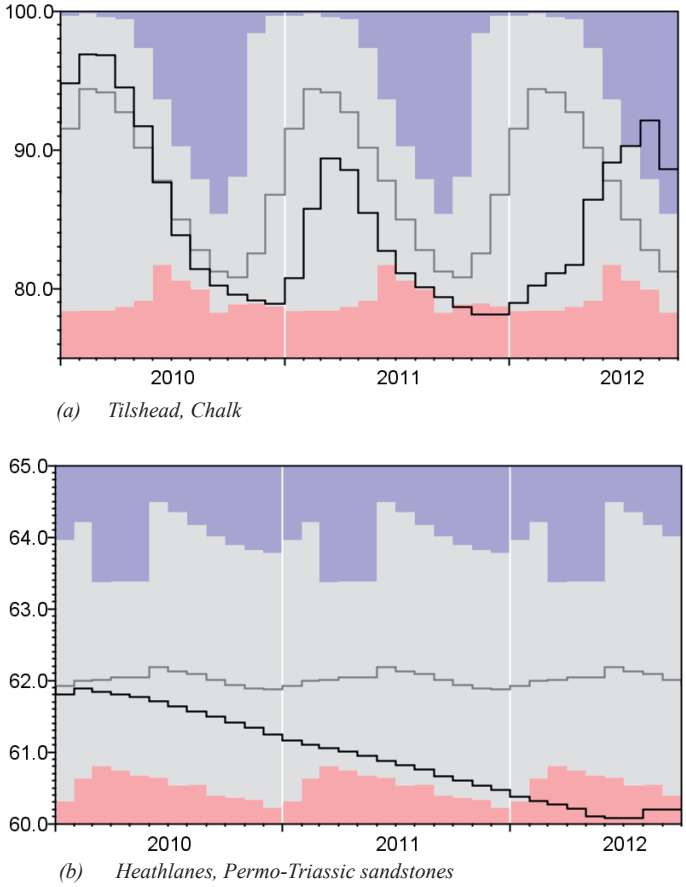

Fig 3 *2010–12 Monthly groundwater levels (with monthly max., min., and mean based on the 1961–2010 record)*

Early October groundwater levels in the generality of index wells were exceptionally healthy particularly in the western Chalk, e.g. at Tilshead where levels remained well above previous early autumn maxima (Figure 3a). By contrast, water-tables are still depressed in some of the slowest-responding aquifer units, particularly in the Midlands (Figure 3b) where surface infiltration in the Permo-Triassic sandstones outcrops can take many months to descend through the unsaturated zone. Nonetheless, overall water resources are very healthy for the time of year; a situation that could not have been envisaged during the early spring of 2012.

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