UK Hydrological Bulletin: May 2015 – July 2015

The spring and early summer of 2015 saw an exaggeration in the normal north-west to south-east rainfall gradient across the UK. Notably high rainfall in western Scotland, accompanied by spate conditions in many catchments, contrasting with much drier conditions to the south. Parts of eastern, central and southern England registered their second driest February-June since 1976. The associated rapid increases in soil moisture deficits, particularly during April and June, resulted in a likely termination to the recharge season across most aquifer outcrop areas and seasonally steep declines in both reservoir stocks and groundwater resources across much of the country. However, the legacy of successive wet winters meant that, whilst flows in some rivers – mostly draining impervious catchments were depressed – reservoir stocks generally remained well within the normal summer range at the end of June. With the exception of a few responsive aquifer units this was also true of groundwater levels. Synoptic patterns were much less settled in July and episodes of flash flooding were reported from many parts of the UK, culminating on the 24th when a number of localities in southern England reported >40 mm of rainfall. As autumnal weather patterns continued to predominate the previously parched landscape across much of southern and eastern Britain took on a much less arid complexion.

May is often a transitional month in relation to the water resources outlook: wet conditions can extend the reservoir and groundwater replenishment season, a factor of particular importance in the driest parts of England where water demand is generally greatest. However in 2015, whilst parts of Scotland and Northern Ireland registered more than twice the average monthly rainfall – contributing to outstanding six-month rainfall accumulations in western Scotland – May rainfall totals across much of central and southern England was generally well within the normal range. Importantly however, notably high late-April soil moisture deficits mitigated against any reversal in the normal seasonal runoff decline. In Scotland, where soils remained very close to saturation, the river Ness reported its 2nd highest May runoff in a series from 1973 and, in Northern Ireland, the Mourne registered its 3rd highest since 1986. Elsewhere, many rivers draining largely impermeable catchments in southern England registered well below average May runoff totals and, for the spring (March-May) as a whole, runoff totals were seasonally low

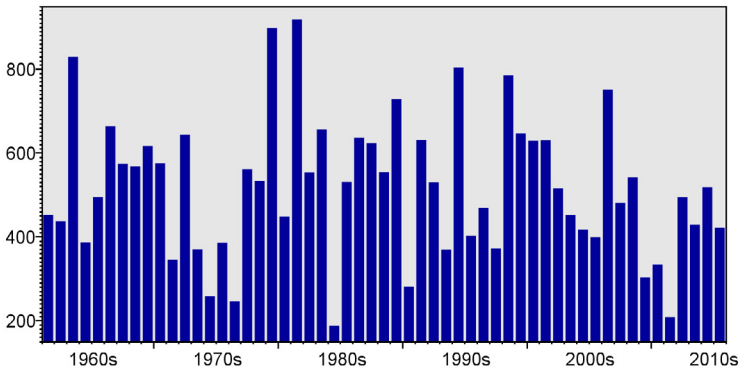

Fig 1 *A guide to average March-May outflows (m3s-1) from Wales 1961-2015*

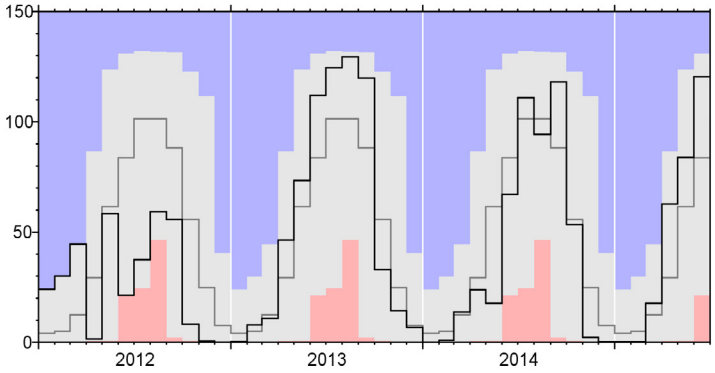

Fig 2 *End-of-month soil moisture deficits (mm) averaged across the Chalk outcrop (grey trace is the long term average; the blue and pink envelopes define the long term max. and min.)*

Data source: MORECS

across most of southern Britain, and particularly so in catchments where groundwater provides little baseflow support. Moderate spring runoff has been a common theme in recent years, particularly for some western areas. Wales, for example, has witnessed an uneven decline in spring runoff during the 21st century (see Fig 1) but, given the inherent variability of the runoff time series, the recent trend is of limited statistical significance. Nonetheless, if it were to prove enduring it would have important hydrological and water resources implications, for example steeper river flow recessions and an earlier onset of the seasonal depletion of reservoir stocks.

Runoff patterns during June exhibited exceptional spatial and temporal contrasts across the country. Whilst Scotland again registered above average rainfall, England reported its 2nd driest May since 1995 with parts of East Anglia and the South East

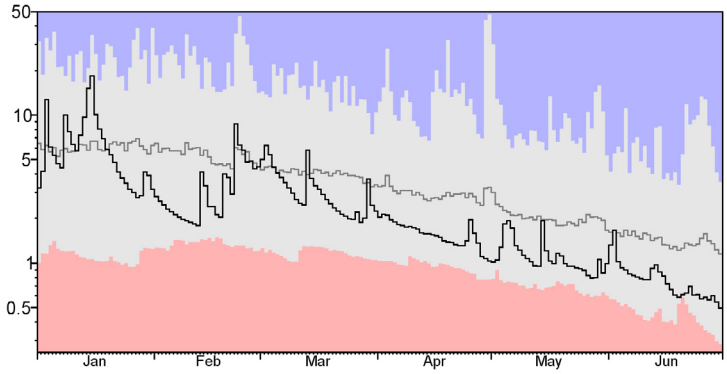

Fig 3 *2015 Daily mean flows (m3s-1) for the River Tone at Bishops Hull together with the long term average (grey trace) and the long term daily max. and min.*

registering less than 30% of the 1981-2010 mean. Much of Northern Ireland was also notably dry. However, an intense low pressure system, centred to the north of Scotland made for a boisterous and wet start to the month; a rainfall total of 64 mm was recorded at Rest and Be Thankful (Argyll) for the 24-hrs ending at 09.00 on the 2nd June. Most northern and many western rivers were in spate during the first week but elsewhere soil moisture deficits again rose sharply and, by month-end, were approaching seasonal maxima across much of eastern England (see Fig 2). Correspondingly, protracted river flow recessions became established in most regions and were most persistent in eastern and southern catchments where, by month-end, flows in some rivers were less only 40-60% of the late-June average. For the River Tone (Somerset) end-of-June flows fell to their lowest since the extreme drought of 1976. Flow rates also declined steeply in Wales but, generally, runoff rates remained well above drought minima entering July. The limited June rainfall and arid soil conditions across most aquifer outcrop areas implied a corresponding absence of significant aquifer recharge and, by month-end, groundwater levels were moderately depressed in some, mostly southern, areas. At Tilshead, a very responsive borehole in the Chalk of Salisbury Plain, June levels were the second lowest since 1997. In contrast, groundwater levels remain well above average in some of the slowest-responding Permo-Triassic sandstone wells in the Midlands where the benefits of exceptional groundwater replenishment over the winters of 2012/13 and 2013/14 are still very evident. Heatwave conditions, which began in the final week of June, continued into July and a record monthly temperature (36.7 C) was registered at Heathrow on the 1st. Parched soil conditions across central, southern and eastern England early in the month contributed to the outbreak of forest fires (e.g. at Thetford, Norfolk) and an increases in spray irrigation demands. Subsequently, however, weather patterns became much more unsettled with notable storms triggering a series of pluvial and fluvial flood episodes. On the 4th, urban drainage capacities were overwhelmed by intense overnight rain in coastal districts of southern England (e.g. near Bognor, West Sussex) and three days later a well-forecast convective storm (>40 mm, most falling in two hours) caused severe flooding in Aberdeen. Thunderstorms were common on the 16th, particularly in a zone from Hampshire to the Wash; a storm total of 55 mm reported for Stevenage, triggering a Flood Warning on the Stevenage Brook. In Scotland, two-day rainfall totals exceeding 60 mm on the 16/17th caused widespread spates and severe flooding at Alyth in Perthshire. By contrast in many eastern and southern parts of England rainfall deficiencies continued to increase until the fourth week when, unusually for mid-summer, successive Atlantic low pressure systems caused extensive surface flooding across southern Britain (particularly on the 24th when flood alerts were in operation in many urban streams (e.g. in London and Swindon) and some other rivers draining impervious catchments (e.g. the Loddon in Berkshire). To the relief of the farmers and growers, soil moisture deficits also declined sharply.

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