UK Hydrological Bulletin: February – April 2013

The February–April period was dominated for long periods by winds from the north-east quadrant, resulting in very cold conditions with snow forming a significant component of precipitation totals across much of the country. The three months saw exceptionally wide variations in river flows, with widespread flood warnings at the beginning of February but depressed runoff rates in responsive rivers during March and substantial rainfall deficiencies in parts of Scotland. Nonetheless, the general water resources outlook was healthy entering April — in southern Britain a dramatic contrast with 12 months ago.

Weather patterns during the final week of January were very cyclonic with successive frontal systems bringing abundant rainfall across much of the country. With snowmelt augmenting runoff from saturated catchments, February began with total outflows from Britain close to the highest on record for the time of year. Flood warnings were very extensive as a further episode of flows at, or above, bankfull served oince again to underline the importance of floodplains as natural conduits for excess runoff.

February precipitation totals fell below 50% in parts of central Scotland and although the high proportion of snow (which normally implies an appreciable underestimation of total precipitation) makes for some uncertainty, it was very probably the driest month at the national scale since March 2012. Blizzard conditions were common in northern Britain during the first week and considerable snowfall extended down to parts of southern England on the 10/11th. By mid-month, spate conditions were extensive and flood alerts were in operation in all regions of England & Wales. Thereafter however the weather remained cold and largely dry; Oxford reported a rainfall total of less than 1 mm over the last 17 days of the month.

With many catchments frozen, river flow recessions in impermeable catchments were notably steep and previous late-February flow minima were closely matched in a number of very responsive rivers draining steep upland catchments (e.g. the Luss Water which drains into Loch Lomond). At the same time however, abundant outflows from springs and seepages contributed to a continuing high risk of groundwater flooding (e.g. in Dorset and the Berkshire Downs).

Notwithstanding the modest February precipitation, more than three-quarters of the index reservoirs across the UK were within 5% of capacity at month-end and groundwater resources were also very healthy, reflecting the outstanding recharge rates maintained throughout much of the latter half of 2012. The water resources outlook entering the spring was thus very healthy across most of the UK — parts of northern and western Scotland being the exception.

Synoptic patterns in March were again dominantly anticyclonic and the persistence of a bitter easterly airflow was reflected in the coldest March for the UK since 1962. Exceptional early spring snowfall, often associated with high winds, was very disruptive across most of the country (Guernsey Airport was closed by snowfall on the 11th). Early in the third week an Atlantic frontal system abutting against cold continental air to the east resulted in widespread and heavy snowfalls with considerable damage, transport disruption and temporary power loss.

Precipitation totals for the month were modestly above average across most of southern Britain but again meagre in parts of Scotland. The Highland Region registered its lowest February–March precipitation since 1975 and soil moisture deficits for the end of March were the second highest on record — the exceptionally dry soil conditions (for the early spring) were a contributory factor in a number of wildfire outbreaks (e.g. near Fort William). Soil temperatures, which rarely reached 6°C during March, were generally too low for crop growth, adding to the agricultural stress associated with livestock management in the freezing conditions — many sheep perished.

Some spring-fed streams and rivers aside, March runoff totals were seasonally depressed. Estimated March outflows from Scotland were the lowest in a series from 1961 with extremely low flows reported for some Highland rivers (see Figure 1).

For both Northern Ireland and Wales, 2013 was the fifth year in succession to register modest March runoff totals (see Figure 2). Correspondingly, overall reservoir stocks declined appreciably through the early spring, and more steeply in reservoirs where planned maintenance programmes were in operation. Early April stocks were generally in the normal seasonal range but considerably below average in parts of north-west Britain — however meltwaters from the substantial upland snow cover boosted inflows as temperatures slowly increased through April. The gradual thaw was beneficial in relation to flood risk during April but a series of active Atlantic frontal systems brought pulses of heavy rainfall

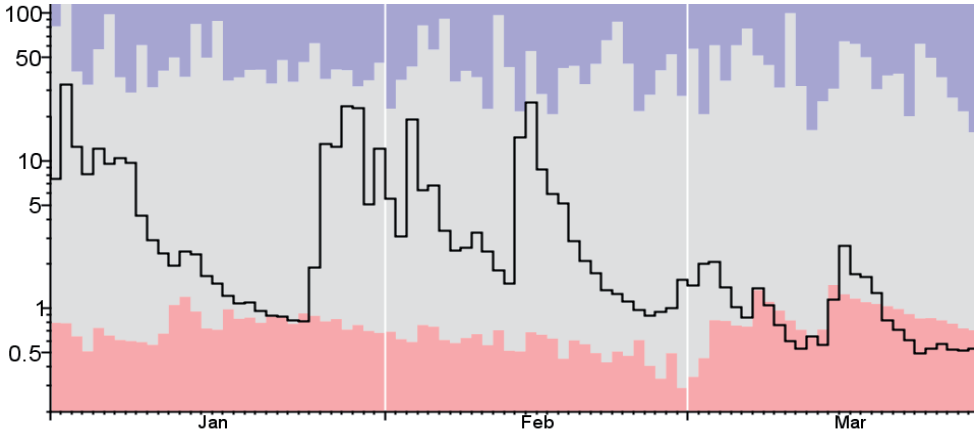

Fig 1 *Daily mean flows (m^3s^{-1}) for the River Nevis at Claggan; pre-2013 daily max. and min. flows are represented by the blue and pink envelopes*

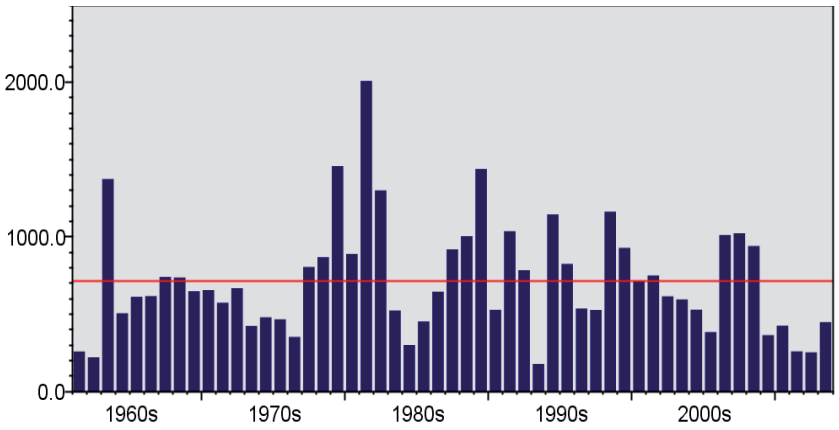

Fig 2 *Estimated average March outflows from Wales (in m^3s^{-1}); the red line is the long term average*

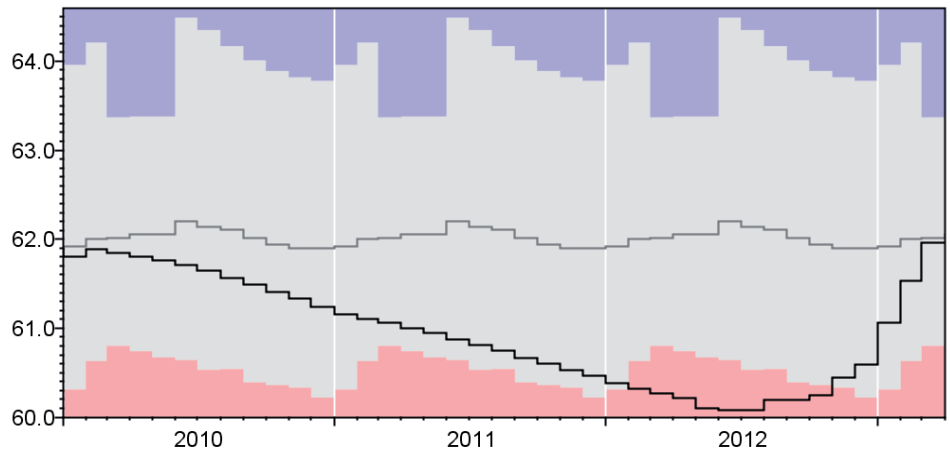

Fig 3 *Monthly mean groundwater levels for the Heathlanes borehole in the Permo-Triassic sandstones; pre-2012 monthly max. and min. levels are represented by the blue and pink envelopes, the grey trace is the long term monthly average.*

to western and northern areas in the third week — again triggering widespread spate conditions.

The late winter and early spring of 2012/13 have seen brisk declines in groundwater levels in responsive aquifers (e.g. in the Carboniferous limestone in Derbyshire) but early spring levels in most index boreholes remained within, or above, the normal range — with notably high levels characterising much of the central and eastern Chalk outcrops. Many groundwater flood alerts were still extant in April and high level springs were flowing very strongly (e.g. in the Chilterns and Berkshire Downs). The complexity of groundwater level responses to periods of rainfall excess or deficiency is well illustrated by the hydrograph for the Heathlanes borehole in the Permo-Triassic sandstones outcrop in Shropshire (Figure 3). Despite the record rainfall in 2012, the time taken for surface infiltration to descend through the unsaturated zone and, particularly, the high storage capacity of the sandstones, resulted in groundwater levels only returning to average in April this year.

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