Summary

The one-month outlook is for December flows to be above normal across most of northern and western Britain, with an increased likelihood of exceptional flows in some regions. These projections reflect the exceptionally wet November in much of northern Britain. In actuality, early December has already witnessed exceptional rainfall and flooding in northern England and parts of Scotland, so it is highly likely that December flows will be exceptional. With meteorological projections favouring wetter-than-average conditions over the next three months, there is an increased likelihood of above normal winter flows in many northern and western areas, and high groundwater levels are also likely in aquifers in these areas. In the south and east of England, winter river flows and groundwater levels are largely expected to be normal or above, although below normal levels are likely to persist in some eastern areas.

Note: Up-to-date flood warnings are available from the websites of the Environment Agency, Natural Resources Wales and Scottish Environment Protection Agency.

Rainfall: For December and December-January-February as a whole above-average precipitation is more probable than below-average. The probability that UK-average precipitation for December-January-February will fall into the driest of five equal categories is between 10% and 15% and the probability that it will fall into the wettest of five categories is 25% (the 1981-2010 probability for each of these categories is 20%).

River flows:
November river flows were mostly in the normal range in southern and eastern England and in the far north of Scotland, with below normal flows in a few catchments in the latter. Elsewhere in northern and western Britain, river flows were above normal, with exceptionally high flows in northern England and north Wales. The one month outlook is for a similar picture: river flows are likely to be above normal across most of northern and western Britain and there is an increased likelihood of exceptional flows in many places. In south-east England, normal to above normal flows are expected while in north-east Scotland flows are likely to be normal. The three month outlook is for a continuation of above normal flows in some northern and western regions, but in others (including Wales and much of Scotland) flows are more likely to return to the normal range. In south-east England flows are likely to be normal to above normal.

Groundwater:
In the Chalk, November levels were mostly in the normal range or below, with below normal levels mainly in eastern England. In other aquifers levels were mostly normal to above normal. The one month outlook is for a continuation of this situation, with mostly normal levels in the southern Chalk and normal to below levels further east, and above normal levels in parts of the Permo-Triassic sandstone. The three month outlook suggests a mixed pattern for the Chalk, with below normal levels in some eastern areas contrasting with above normal levels for the South Downs. Elsewhere normal to above normal levels are likely and parts of the Permo-Triassic sandstone in the north west may see exceptionally high levels. These increases reflect the wetter-than-average rainfall projections and the latter looks increasingly likely given early December rainfall in northwest England. However it should be noted that high levels in the Permo-Triassic sandstone do not play a significant role in flooding.
About the Hydrological Outlook UK

About the Outlook:
This document presents an outlook for the UK water situation for the next 1 – 3 months and beyond, using observational datasets, meteorological forecasts and a suite of hydrological modelling tools. The outlook is produced in a collaboration between the Centre for Ecology and Hydrology (CEH), British Geological Survey (BGS), the Met Office, the Environment Agency (EA), Natural Resources Wales (NRW), the Scottish Environment Protection Agency (SEPA), and the Northern Ireland Rivers Agency (RA).

Data and Models:
The Hydrological Outlook depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged. Historic river flow and groundwater data are sourced from the UK National River Flow Archive and the National Groundwater Level Level Archive. Contemporary data are provided by the EA, SEPA, NRW and RA. These data are used to initialise hydrological models, and to provide outlook information based on statistical analysis of historical analogues.

Climate forecasts are produced by the Met Office. Hydrological modelling is undertaken by CEH using the Grid-to-Grid, PDM and CLASSIC hydrological models and by the EA using CATCHMOD. Hydrogeological modelling uses the R-groundwater model run by BGS and CATCHMOD run by the EA. More information is available from the Outlooks website: http://www.hydoutuk.net/methods

Disclaimers:
This document aims to provide an indicative outlook for the water situation using the most comprehensive and up-to-date hydrological data, and modelling techniques. The Outlooks are intended to provide guidance on the likely water situation in the UK over the coming months, and should not be used in isolation, but alongside other sources of information such as flood warnings and meteorological forecasts (see links right).

Some of the features displayed on the maps contained in this report are based on the following data with permission of the controller of HMSO.

(i) Ordnance Survey data. © Crown copyright and/or database right 2005. Licence no. 100017897.
(ii) Land and Property Services data. © Crown copyright and database right, S&LA 145.
(iii) Met Office rainfall data. © Crown copyright.

All rights reserved. Unauthorised reproduction infringes crown copyright and may lead to prosecution or civil proceedings.

Further information:
For more detailed information about the Hydrological Outlook, and the derivation of the maps, plots and interpretation provided in this outlook, please visit the Hydrological Outlook UK website.

The website features a host of other background information, including a wider range of sources of information which are used in the preparation of this Outlook.

Contact:
Hydrological Outlooks UK
Centre for Ecology & Hydrology
Wallingford
Oxfordshire OX10 8BB

(t: 01491 692371
e: enquiries@hydoutuk.net

Reference:
Hydrological Outlook UK, 2015, December, Centre for Ecology and Hydrology, Oxfordshire UK,


Other Sources of Information:
The Hydrological Outlook should be used alongside other sources of up-to-date information on the current water resources status and flood risk.

Hydrological Summary for the UK: provides summary of current water resources status for the UK:
http://www.ceh.ac.uk/data/nrfa/nhmp/monthly_hs.html

Environment Agency Water Situation Reports: provides summary of water resources status on a monthly and weekly basis for England:
https://www.gov.uk/government/collections/water-situation-reports-for-england

Flood warnings are continually updated, and should be consulted for an up-to-date and localised assessment of flood risk:

UK Met Office forecasts for the UK:
www.metoffice.gov.uk/public/weather/forecast/#?tab=regionalForecast
The forecast presented here is for December and the average of the December-January-February period for the United Kingdom as a whole. The forecast for December will be superseded by the long-range information on the public weather forecast web page (www.metoffice.gov.uk/public/weather/forecast/#?tab=regionalForecast), starting from 4 December 2015.

This forecast is based on information from observations, several numerical prediction systems and expert judgement.

**SUMMARY - PRECIPITATION:**

For December and December-January-February as a whole above-average precipitation is more probable than below-average. The probability that UK-average precipitation for December-January-February will fall into the driest of our five categories is between 10% and 15% and the probability that it will fall into the wettest of our five categories is 25% (the 1981-2010 probability for each of these categories is 20%).

**CONTEXT:**

As discussed in the temperature section, the ongoing El Niño event, together with the westerly phase of the Quasi-Biennial Oscillation (QBO), increases the chance of a positive phase of the North Atlantic Oscillation (NAO) in early winter. At this time of year, the positive phase of the NAO is associated with above-average precipitation and an increased frequency of Atlantic depressions crossing the UK.

During December, the Met Office seasonal prediction system, along with systems from other global forecast centres, supports an increased risk of above-average rainfall. The left-hand graph in figure P2 highlights a clear shift towards above-average precipitation with a reduced probability of below-average precipitation and an increased probability of above-average precipitation compared to normal. Furthermore, the risk of spells of windy or even stormy weather is expected to be greater than usual for the time of year.

For the season as a whole (December-January-February) predictions are more uncertain. Through the first half of the period, wetter-than-average conditions are more likely than drier-than-average, given that the positive NAO phase is likely to prevail. Thereafter the uncertainty in precipitation increases, as this is dependent on the position of the blocked weather patterns which are more likely to develop later in the winter.

This Outlook provides an indication of possible temperature and rainfall conditions over the next 3 months. It is part of a suite of forecasts designed for contingency planners. The Outlook should not be used in isolation but should be used with shorter-range and more detailed (30-day, 15-day and 1-to-5-day) forecasts and warnings available to the contingency planning community from the Met Office.
Met Office 3-month Outlook

Period: December 2015 - February 2016  Issue date: 26.11.15

The forecast presented here is for December and the average of the December-January-February period for the United Kingdom as a whole.
The forecast for December will be superseded by the long-range information on the public weather forecast web page (www.metoffice.gov.uk/public/weather/forecasts/uk-regional/forecast), starting from 4 December 2015.

This forecast is based on information from observations, several numerical prediction systems and expert judgement.

SUMMARY - TEMPERATURE:

During December above-average temperatures are more likely than below-average temperatures. The likelihood of a prolonged spell of cold weather is relatively low compared to normal.

Predictions for UK-mean temperature for the whole of the winter season (December-January-February) show only a slight shift from the normal range of expected conditions. In this instance, however, there are reasons to believe that this unremarkable outlook conceals the likelihood of a switch from a mild start to winter towards colder conditions later on. These different phases balance the probability of above-and below-average conditions in the overall 3-month average, but that does not imply normal chances of weather impacts this winter. Specifically, we consider there to be an increased risk of storms and very wet conditions in the early part of the winter, and a greater risk of cold weather impacts in late winter.

Overall, the probability that the UK-average temperature for December-January-February will fall into the coldest of our five categories is 15% and the probability that it will fall into the warmest of our five categories is between 20% and 25% (the 1981-2010 probability for each of these categories is 20%). As stated above, however, these overall statistics disguise a shift in probabilities as winter progresses.

CONTEXT:

A strong, mature El Niño event continues in the tropical Pacific Ocean. Seasonal prediction systems suggest it will strengthen slightly before the end of the year. This El Niño is comparable in strength to the 1997-98 and 1982-83 events and is highly likely to rank among the three strongest on record.

El Niño is already creating wide-ranging weather impacts across the globe. The influence on UK weather, however, is more subtle. El Niño moderately increases the probability of the positive phase of the North Atlantic Oscillation (NAO) in early winter. At this time of year, the positive phase of the NAO is associated with milder- and wetter-than-average conditions, whilst the negative phase is associated with colder- and drier-than-average conditions. In late winter El Niño increases the probability of sudden stratospheric warming events occurring. These events disrupt the stratospheric polar vortex and, more often than not, bring cold weather to the UK.

The Quasi-Biennial Oscillation (QBO), an oscillation of the equatorial winds in the stratosphere, remains in a westerly phase. The QBO influences winter conditions over Western Europe by modulating the strength of the stratospheric polar vortex and thereby the phase of the NAO at the surface. The westerly phase of the QBO tends to favour a stronger stratospheric polar vortex, particularly in early winter, leading to a higher likelihood of a positive phase of the NAO.

During December, the factors described above suggest an increased likelihood of positive NAO, which is consistently supported by predictions from the Met Office seasonal prediction system along with systems from other global forecast centres. The left-hand graph in figure T2 shows a clear shift towards milder conditions. This does not preclude temporary incursions of colder weather, but the chance of a prolonged spell of cold weather taking hold in December is low compared to normal.

Through the first half of the 3-month period, milder-than-average conditions are more likely than colder-than-average. However later in the winter, particularly into February, several seasonal forecasting systems, including the Met Office system, are in good agreement in suggesting a shift towards more blocked weather patterns; these patterns increase the chance of cold northerly or easterly winds affecting the UK. Therefore, the right-hand graph of figure T2 does not tell the whole story and in late winter the probability of colder-than-average conditions is actually higher than normal. Thus we consider the greatest risk of cold weather impacts, such as snow, to be in late winter.

This Outlook provides an indication of possible temperature and rainfall conditions over the next 3 months. It is part of a suite of forecasts designed for contingency planners.

The Outlook should not be used in isolation but should be used with shorter-range and more detailed (30-day, 15-day and 1-to-5-day) forecasts and warnings available to the contingency planning community from the Met Office.
Outlook based on hydrological persistence and analogy

Period: December 2015 – February 2016

OUTLOOK BASED ON HYDROLOGICAL PERSISTENCE AND ANALOGY

Outlooks from hydrological analogues are based on a comparison of river flow during recent months with flows during the same months in previous years at a set of approximately 90 sites from across the UK. These sites are depicted on the two maps. Years with observed flows that most closely resemble current conditions are identified as the best analogues and the outlook is based on extrapolating from current conditions based on these analogues.

It is, however, often the case that a simpler forecast based on the persistence of river flow provides a better forecast than provided by analogy. This is particularly true for slowly responding catchments associated with aquifer outcrops.

Both methods are considered at each site and the forecast from the method with the higher confidence is presented. A simple classification of flows is used (high, medium and low) as indicated by the colours of the dots, with the confidence of the forecast being represented by the size of the dot. A tag on the dot indicates which method has been used in each instance.

The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Outlook based on hydrological persistence and analogy

Period: December 2015

Issued on 08.12.2015 using data to the end of November

These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

In each of the time series graphs the bold black line represents the observed flow during the past nine months. The grey band indicates the normal flow range (the normal band includes 44% of observed flows in each month). The selected analogues are shown as thin lines and the trajectories that flows took in the following month are also shown. The forecast is shown as the dashed red line, and in each plot it states whether this has come from the analogues or has been generated on the basis of persistence.

Outlook based on hydrological persistence and analogy

Site-based: 1 month outlook

December 2015

Period: December 2015

Issued on 08.12.2015 using data to the end of November

These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

In each of the time series graphs the bold black line represents the observed flow during the past nine months. The grey band indicates the normal flow range (the normal band includes 44% of observed flows in each month). The selected analogues are shown as thin lines and the trajectories that flows took in the following month are also shown. The forecast is shown as the dashed red line, and in each plot it states whether this has come from the analogues or has been generated on the basis of persistence.
Outlook based on hydrological persistence and analogy

Period: December 2015 – February 2016

Site-based: 3 month outlook

Issued on 08.12.2015 using data to the end of November

These figures provide insight into the hydrological analogue methodology for a set of sites from across the UK.

In each of the time series graphs the bold black line represents the observed flow during the past nine months. The grey band indicates the normal flow range (the normal band includes 44% of observed flows in each month). The selected analogues are shown as thin lines and the trajectories that flows took in the following three months are also shown. The forecast is shown as the dashed red line, and in each plot it states whether this has come from the analogues or has been generated on the basis of persistence.

The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Overview

These forecasts are produced by using five members of the Met Office rainfall forecast ensemble as input to a water balance hydrological model to provide the five estimates of river flows shown on the left for one month and three months ahead.

Regional forecast monthly-mean river flows are derived from the average of 1km river flow estimates within each region and ranked in terms of 49 years of historical flow estimates (1962 – 2010).

The five maps illustrate the wide range of possible flows and while there is a 50% chance of flows between the 1st and 3rd quartiles, actual flows may be more extreme than the flows derived using the highest or lowest rainfall forecasts.

The percentile range of historic values for relevant month:

<table>
<thead>
<tr>
<th>Percentile Range of Historic Values for Relevant Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceptionally high flow</td>
</tr>
<tr>
<td>Notably high flow</td>
</tr>
<tr>
<td>Above normal</td>
</tr>
<tr>
<td>Normal range</td>
</tr>
<tr>
<td>Below normal</td>
</tr>
<tr>
<td>Notably low flow</td>
</tr>
<tr>
<td>Exceptionally low flow</td>
</tr>
</tbody>
</table>

Percentile range of historic values for relevant month:

- > 95
- 87-95
- 72-87
- 28-72
- 13-28
- 5-13
- < 5

SCOTLAND
- HR Highlands Region
- NER North East Region
- TR Tay Region
- FR Forth Region
- CR Clyde Region
- TWR Tweed Region
- SR Solway Region

ENGLAND
- N Northumbria
- NW North West
- Y Yorkshire
- ST Severn Trent
- A Anglian
- T Thames
- S Southern
- W Wessex
- SW South West

WALES
- WEL Welsh

NORTHERN IRELAND
- This method cannot currently be used in Northern Ireland

Period: December 2015 – February 2016

Issued on 02.12.2015 using data to the end of November

SUMMARY: This month, following above average November rainfall for much of Britain it is likely that river flows will be in or above the Normal range for November, and to the North and West there is a high chance of above normal flows, possibly reaching exceptionally high flows in many places. North East Region is the exception, where, following low rainfall in November, it is more likely that river flows will be in or below the Normal range.

Over the next 3 months
There is a high chance of river flows being Normal or above for all regions, except for North East Region where there is a high chance of river flows being Normal or below.

1-month flow outlook

<table>
<thead>
<tr>
<th>Lowest rainfall forecast</th>
<th>1st quartile</th>
<th>Median</th>
<th>3rd quartile</th>
<th>Highest rainfall forecast</th>
</tr>
</thead>
</table>

3-month flow outlook

<table>
<thead>
<tr>
<th>Lowest rainfall forecast</th>
<th>1st quartile</th>
<th>Median</th>
<th>3rd quartile</th>
<th>Highest rainfall forecast</th>
</tr>
</thead>
</table>
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Outlook based on Modelled Flow from Rainfall Forecasts

Period: December 2015 – February 2016

Issue date: 02.12.2015

The regional maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the lowest or highest members of the rainfall ensemble.

The bar charts (below) give further insight into the range of river flow forecasts by considering all members of the forecast rainfall ensemble. The regional bar charts show the percentage of ensemble forecasts falling in each of the flow categories as generated by the monthly-resolution water-balance model. As before results are averaged by region then ranked in terms of 49 years of historical regional flow estimates (1962 – 2010).

SUMMARY: This month, following above average November rainfall for much of Britain it is likely that river flows will be in or above the Normal range for November, and to the North and West there is a high chance of above normal flows, possibly reaching exceptionally high flows in many places. North East Region is the exception, where, following low rainfall in November, it is more likely that river flows will be in or below the Normal range.

Over the next 3 months
There is a high chance of river flows being Normal or above for all regions, except for North East Region where there is a high chance of river flows being Normal or below.

1- and 3-month variability

1-month

3-month

RIVER FLOW FROM RAINFALL FORECASTS

December 2015

SUMMARY: This month, following above average November rainfall for much of Britain it is likely that river flows will be in or above the Normal range for November, and to the North and West there is a high chance of above normal flows, possibly reaching exceptionally high flows in many places. North East Region is the exception, where, following low rainfall in November, it is more likely that river flows will be in or below the Normal range.

Over the next 3 months
There is a high chance of river flows being Normal or above for all regions, except for North East Region where there is a high chance of river flows being Normal or below.
Outlook based on Modelled Flow from Rainfall Forecasts

Period: December 2015 – February 2016
Issue date: 02.12.2015

The maps illustrating the regional river flows for five members of the Met Office ensemble of rainfall forecasts give some indication of the range of possible river flows in the coming months. As noted previously, the actual flows could be more extreme than the flows generated by either the lowest or highest members of the rainfall ensemble.

The tables below give further insight into the range of river flow forecasts by considering all members of the forecast rainfall ensemble.

<table>
<thead>
<tr>
<th>Summary</th>
<th>1-month ahead</th>
<th>3-months ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A NW N ST SW S T Welsh Y CR FR HR NER SR TR TWR</td>
<td>A NW N ST SW S T Welsh Y CR FR HR NER SR TR TWR</td>
</tr>
<tr>
<td>Exceptionally high flow</td>
<td>0 8 28 3 0 0 3 8 0 13 0 10 0 0 10 8 13</td>
<td>0 3 8 0 16 13 3 3 13 3 8 16 13 5 3 16 13 8</td>
</tr>
<tr>
<td>Notably high flow</td>
<td>20 13 13 20 30 15 8 3 13 28 10 25 10 8 18 28 28</td>
<td>13 42 18 42 37 32 21 29 39 37 24 39 26 11 37 26 29</td>
</tr>
<tr>
<td>Above normal</td>
<td>28 30 10 52 25 25 30 43 28 35 43 35 40 20 35 15 10</td>
<td>74 37 45 39 37 55 61 45 45 39 50 37 63 39 34 37 47</td>
</tr>
<tr>
<td>Normal range</td>
<td>50 48 48 23 38 58 58 45 58 25 48 30 48 43 35 48 50</td>
<td>11 11 13 11 11 16 8 11 8 8 3 21 11 5 3</td>
</tr>
<tr>
<td>Below normal</td>
<td>3 3 3 3 8 3 3 3 3 0 0 0 3 23 3 3 0</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>Notably low flow</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>Exceptionally low flow</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
<td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

1- and 3-month variability

The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Period: December 2015 – November 2016

SUMMARY

After the heavy rainfall of November in Northern England, there is an increased likelihood of above normal flows in that region for the next 3 months, while flows are generally expected to be in the normal range elsewhere.

The bar plot maps show the outlook distribution for 3, 6 and 12-month period for 28 catchments across England and Wales. Each bar plot represents the probabilistic distribution of the simulated river flow compared to the historical river flow, for the same n-month period. The probabilities fall within five categories, classified as: low, below normal, normal, above normal and high.

This outlook is based on modelled flow from historical climate

This outlook is based entirely on historical sequences and is therefore not a forecast. It does not contain any knowledge of the state of the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Overview

This outlook is based entirely on historical sequences and is therefore not a forecast. It does not contain any knowledge of the state of the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.

This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to hydrological models. The outputs are probabilistic simulations of the average river flow over the forecast period (1 to 12 months ahead), at each location. The simulations are generated by conceptual rainfall-runoff models from CEH (PDM and CLASSIC) and the EA (CATCHMOD) calibrated on observed or naturalised flows.

The stack diagrams show the variation over time of the outlook distribution for a number of individual catchments. Each graph represents variation over time of the number of simulated river flows, in each month ensemble, that fall within each of seven categories: exceptionally low, notably low, below normal, normal, above normal, notably high and exceptionally high. The categories represent cumulative flow conditions, for example, for 3-month, the simulated total 3-month flow compared to the historical 3-month flow distribution. The monthly variations can be compared to the long-term average distribution of river flows (shown as columns on the right of each timeline graph).

This outlook is based entirely on historical sequences and is therefore not a forecast. It does not contain any knowledge of the state of the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Overview

Wet conditions in the North West had already raised groundwater levels in the North West, and with the rainfall already fallen in the first week of December exceptionally high groundwater levels are likely in this area, although groundwater in these aquifers only has a small role in flooding. Over 3 months we expect a > 50% chance of above normal or notably high levels in several aquifers across England.

These forecasts are produced by running five members of the Met Office ensemble climate forecast through groundwater models of observation borehole hydrographs at 42 sites across the country. The sites are distributed across the principal aquifers.

Based on the distribution of observed historical groundwater levels in a given month, seven categories have been derived for each site: very low, low, below normal, normal, above normal, high, and very high. The forecast groundwater level is assigned to one of these seven categories depending on where it falls within the distribution of the historically observed values.

Key Percentile range of historic observed values for relevant month

- Exceptionally high levels > 95
- Notably high levels 87-95
- Above normal 72-87
- Normal 28-72
- Below normal 13-28
- Notably low levels 5-13
- Exceptionally low levels < 5
The Hydrological Outlook UK provides an outlook for the water situation for the UK over the next three months and beyond. For guidance on how to interpret the outlook, a wider range of information, and a full description of underpinning methods, please visit the website: www.hydoutuk.net

Outlook based on modelled groundwater from historical climate

Period: December 2015 – November 2016

The long term outlook for groundwater levels in most aquifers is Groundwater levels over the next year is very similar to climatology. The effect of intense recent rain will be to shift towards above normal conditions in the North West, but the rain largely fell after the base period for forecast generation, so isn’t reflected in the plot.

This outlook is based on monthly ensembles of historical sequences of observed climate (rainfall and potential evapotranspiration) that form input to hydrological models. The outputs are probabilistic simulations of the average groundwater level over the forecast horizon (3 to 12 months ahead), at each location.

The graphs show variation over time of the number of simulated groundwater levels in each monthly ensemble, that fall within each of the seven categories: exceptionally low, notably low, below normal, normal, above normal, notably high and exceptionally high. The monthly variations can be compared to the long-term average distribution of levels, which are shown as columns on the left and right of each graph.

This outlook is based entirely on historical sequences and therefore, this is not a forecast. It does not contain any knowledge of the state of the atmosphere and ocean. It is hence possible that some of the historical sequences used might be inconsistent with current large-scale atmospheric conditions and would therefore be unlikely to occur in the next few months.

The long term outlook for groundwater levels in most aquifers...