UK Centre for Ecology & Hydrology

Monthly mean river flows simulated by the Grid-to-Grid hydrological model

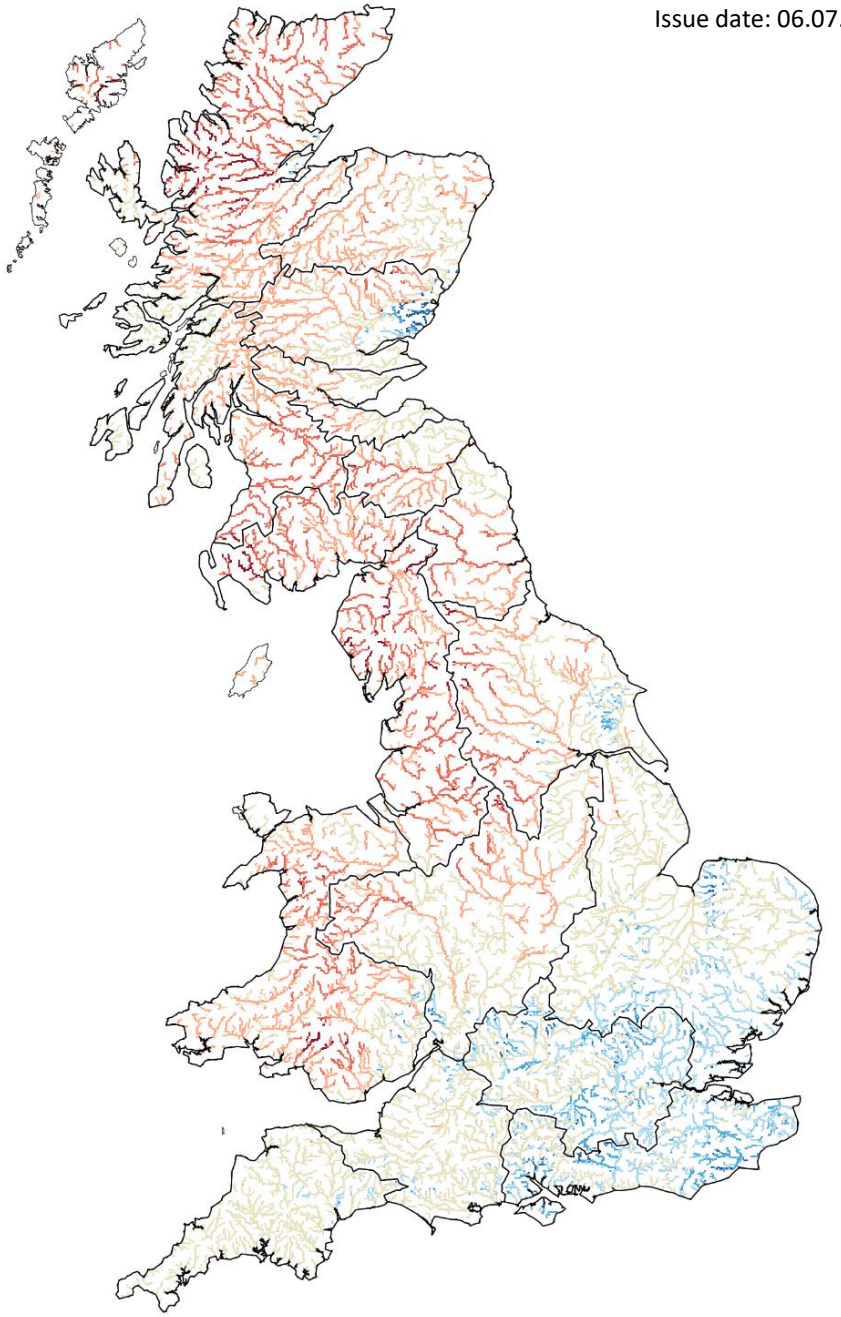
Period: June 2021

Issue date: 06.07.2021

The 1km resolution Grid-to-Grid (G2G) hydrological model is run up to the forecast origin with observed rainfall and potential evaporation to provide the hydrological initial condition for the HOUK seasonal river flow forecasts.

This map shows the simulated monthly mean flow across Great Britain ranked in terms of 54 years of historical flow estimates (1963 – 2016).

Note that the G2G provides estimates of natural flows.



Flow estimate for each river pixel ranked in terms of historic % flow estimates (1963-2016)

Exceptionally high flow	> 95
Notably high flow	87-95
Above normal	72-87
Normal range	28-72
Below normal	13-28
Notably low flow	5-13
Exceptionally low flow	< 5

OUTLOOK BASED ON CURRENT CONDITIONS

July 2021

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Current Daily Simulated Subsurface Water Storage Conditions

Based on subsurface water storage estimated for 30th June 2021

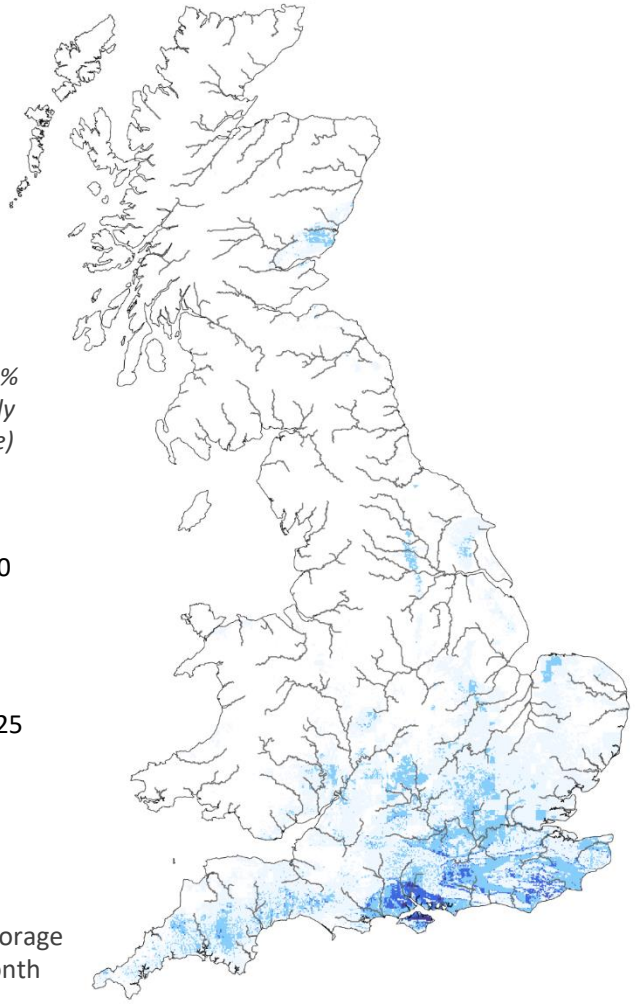
Issue date: 06.07.2021

These maps are based on Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean. To highlight areas that are particularly wet or dry, the storage anomaly is presented here using a colour scale highlighting water storage relative to historical extremes. The maps below show relative wetness.

These maps do not provide a flood forecast and are not maps of soil moisture. Instead they indicate areas where subsurface water storage approaches or exceeds its historical maximum. Rainfall in the high 'relative wetness' areas could result in flooding.

SUMMARY: At the end of June, subsurface water levels were higher than average for this time of year across southern England with low to medium relative wetness.

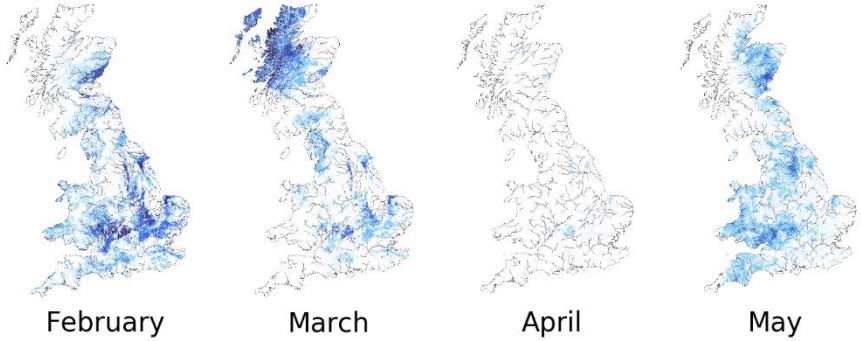
Relative Wetness

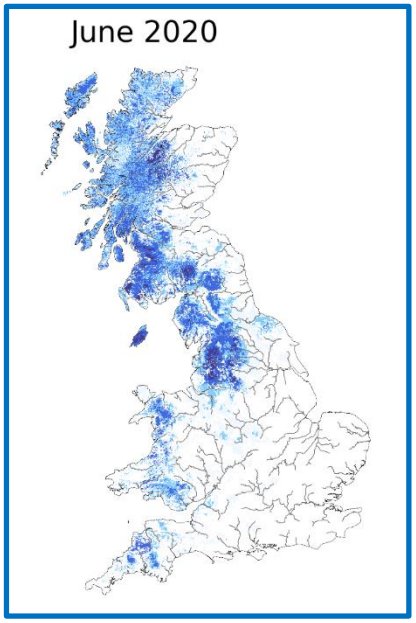


Water storage anomaly as a % of maximum storage anomaly (zero indicates average value)

High (very wet)	>100
	75-100
Medium	50-75
	25-50
Low	0.01-25
(No wetness)	<0
Main rivers	

Labels refer to estimated storage on *final day* of named month





*Example month displaying extreme relative wetness

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Current Daily Simulated Subsurface Water Storage Conditions

Based on subsurface water storage estimated for 30th June 2021

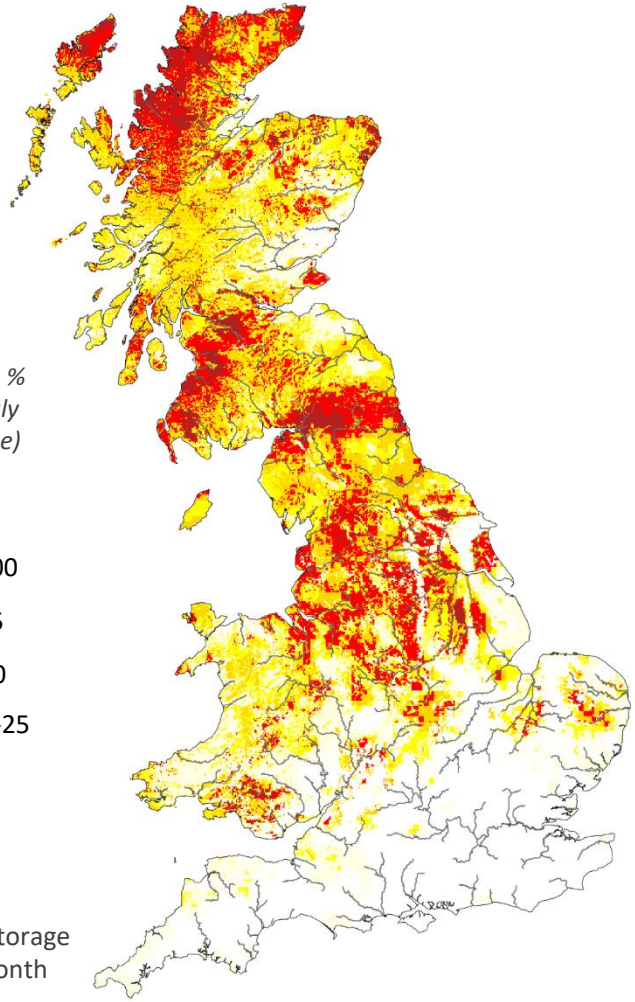
Issue date: 06.07.2021

These maps are based on Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean. To highlight areas that are particularly wet or dry, the storage anomaly is presented here using a colour scale highlighting water storage relative to historical extremes. The maps below show relative dryness.

These maps do not provide a drought forecast and are not maps of soil moisture. Instead they indicate areas where subsurface water storage approaches or exceeds its historical minimum. A lack of rainfall in the high 'relative dryness' areas could lead to (or prolong) a drought.

SUMMARY: At the end of June, subsurface water levels were drier than normal for this time of year in much of Wales and Scotland, northern England and some areas across central England.

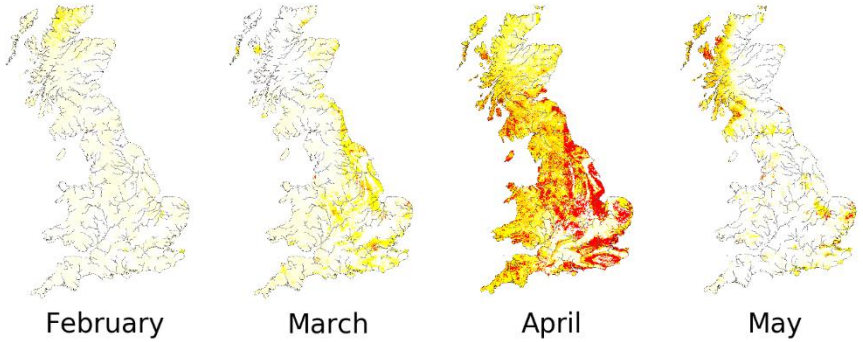
Relative Dryness

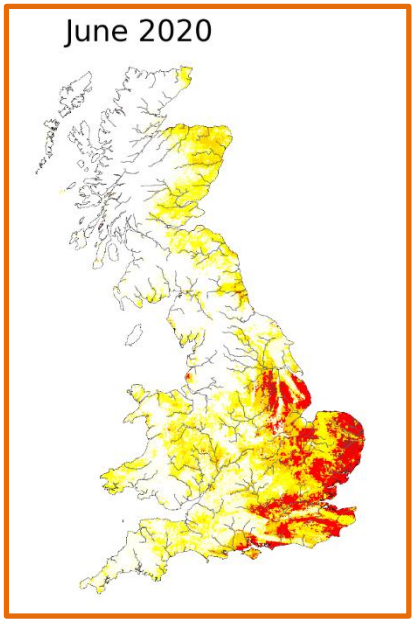


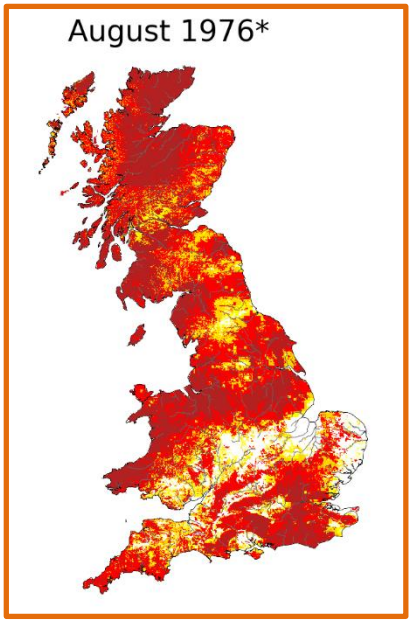
Water storage anomaly as a % of minimum storage anomaly (zero indicates average value)

High (very dry)	>100
	75-100
Medium	50-75
	25-50
Low	0.01-25
(No dryness)	<0
Main rivers	

Labels refer to estimated storage on *final day* of named month







*Example month displaying extreme relative dryness

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July 2021

UK Centre for Ecology & Hydrology

Current Daily Simulated Subsurface Water Storage Conditions

OUTLOOK BASED ON CURRENT CONDITIONS

Relative Dryness

- The relative dryness map highlights areas where current estimates of **subsurface water storage** (from the G2G hydrological model, calculated for the last day of last month) are particularly ***low***.
- The map indicates areas where the ground is dry compared to the monthly **average** storage (for the period 1981 to 2010), and shows this relative to the historical **minimum** storage level (for 1971 to 2010).
- Relative dryness calculation: $R_d\,(\%) = \frac{(S_{average} - S)}{(S_{average} - S_{min})} \times 100$

  $= \frac{\text{(average storage for this month - storage at end of last month)}}{\text{(average storage for this month - historical minimum storage)}} \times 100$
- A value of $\boldsymbol{R_d = 100}$ shows that a region is very dry, and indicates that the storage is as low as the minimum value ever estimated by the model for this month.
- A value of $\boldsymbol{R_d = 0}$ indicates that the storage in the region matches the monthly average value. *Negative relative dryness values will show up as part of the relative wetness map.*
- The map **does not provide a drought forecast**. A lack of rainfall in the high 'relative dryness' areas **could** lead to (or prolong) a drought.

Relative Wetness

- The relative wetness map highlights areas where current estimates of **subsurface water storage** (from the G2G hydrological model, calculated for the last day of last month) are particularly ***high***.
- The map indicates areas where the ground is wet compared to the monthly **average** storage (for the period 1981 to 2010), and shows this relative to the historical **maximum** storage level (for 1971 to 2010).
- Relative wetness calculation: $R_w\,(\%) = \frac{(S - S_{average})}{(S_{max} - S_{average})} \times 100$

  $= \frac{\text{(storage at end of last month - average storage for this month)}}{\text{(historical maximum storage - average storage for this month)}} \times 100$
- A value of $\boldsymbol{R_w = 100}$ shows that a region is very wet, and indicates that the storage is as high as the maximum value ever estimated by the model for this month.
- A value of $\boldsymbol{R_w = 0}$ indicates that the storage in the region matches the monthly average value. *Negative relative wetness values will show up as part of the relative dryness map.*
- The map **does not provide a flood forecast**. Rainfall in the high 'relative wetness' areas **could** result in flooding.

UK Centre for Ecology & Hydrology

Return Period of Rainfall Required to Overcome Dry Conditions

Period: July 2021 – December 2021

Issue date: 06.07.2021

These maps show the **return period** of the rainfall required to overcome dry conditions simulated using the Grid-to-Grid (G2G) hydrological model. The maps are coloured according to the return period of accumulated rainfall required to overcome the estimated current subsurface water storage deficit over the next few months.

These maps do not provide a drought forecast. Instead they indicate the return period of rainfall required to overcome the dry conditions for the following 6 months based on current conditions.

SUMMARY: During July to December, Great Britain will not require particularly unusual rainfall (<5 year return periods) to return to average conditions for the time of year.

Jul

Aug

Sep

Oct

Nov

Dec

Rainfall amount / Probability		*Return period (years)*
Low (this rain is likely to occur)	> 20%	< 5
	< 20%	5 - 10
	< 10%	10 - 25
	< 4%	25 - 50
High (less likely)	< 2%	50 - 100
	< 1%	100 - 200
Extreme (unlikely but still possible)	< 0.5%	> 200

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

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OUTLOOK BASED ON CURRENT CONDITIONS

July 2021

Return Period of Rainfall Required to Overcome the Dry Conditions

Method

- These maps show the **return period** of the rainfall required to overcome dry conditions simulated using the Grid-to-Grid (G2G) hydrological model. The maps are coloured according to the return period of rainfall required to overcome the estimated current subsurface water storage deficit.

- For **dry areas** within a Hydrological Outlook region, i.e. where subsurface water storage anomaly < 0, we estimate ***regional average subsurface water storage deficit*** *(mm)* from the last day of the most recent G2G model run.

- For each region we also estimate the ***regional monthly average rainfall total*** *(mm)* (for the period 1971-2000).

- For each of the next 6 months, we estimate the rainfall total (including what is normally expected for each month) required to overcome the dry conditions.
  - To overcome the dry conditions by the end of month 1:
    rainfall required (mm) = regional monthly average rainfall for month 1 + regional average storage deficit
  - To overcome the dry conditions by the end of month 2 (more likely):
    rainfall required (mm) = regional monthly average rainfall for months 1 and 2 + regional average storage deficit
  - To overcome the dry conditions by the end of month *n* (likely):
    rainfall required (mm) = regional monthly average rainfall for months 1 to *n* + regional average storage deficit

- Using Tabony tables we estimate the return period of the ***rainfall required*** in each region and over the next 1 to 6 months to overcome the dry conditions.

- The return period results are displayed as regional maps with the colour scale based on the return period (years) of the rainfall required to replenish subsurface stores over the next 1, 2, .., 6 months ahead.

- Note: These maps do not provide a drought forecast. Instead they indicate the return period of rainfall required to overcome the dry conditions for the following 6 months based on current conditions.

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Estimate of Additional Rainfall Required to Overcome Dry Conditions

Based on subsurface water storage estimated for 30th June 2021

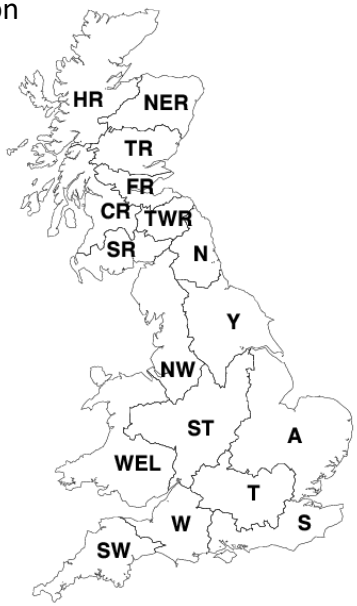
Issue date: 06.07.2021

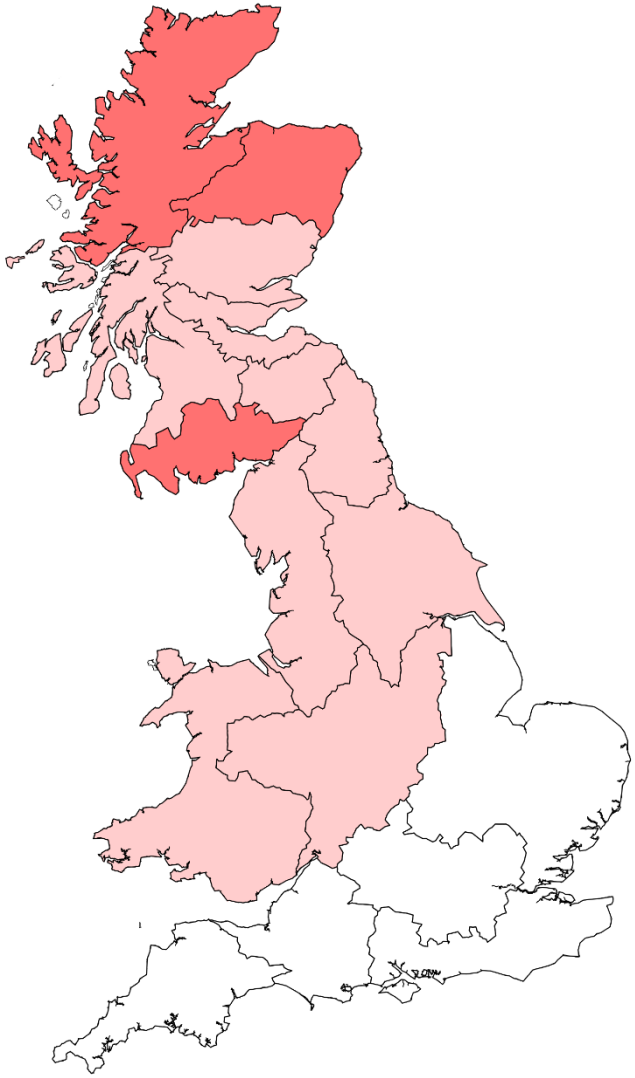
These maps show the Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean (1981-2010), presented on a 1km grid and as regional means.
Subsurface storage deficits, i.e. where the subsurface water storage anomaly is less than zero, **are highlighted by the red/pink colours**.

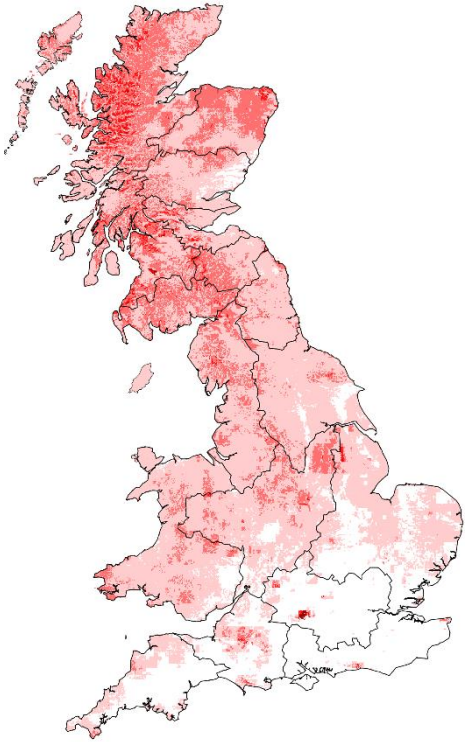
The **subsurface storage deficit (mm)** can be interpreted as an estimate of additional rainfall that would be required in future months to overcome dry conditions (i.e. rainfall in addition to what is expected on average). Regional mean values of additional rainfall required are provided in the table below.

Regional estimate of additional rainfall required (mm)

	SCOTLAND	
29	HR	Highlands Region
25	NER	North East Region
12	TR	Tay Region
20	FR	Forth Region
25	CR	Clyde Region
23	TWR	Tweed Region
26	SR	Solway Region
	ENGLAND	
14	N	Northumbria
20	NW	North West
9	Y	Yorkshire
10	ST	Severn Trent
0	A	Anglian
0	T	Thames
0	W	Wessex
0	S	Southern
0	SW	South West
	WALES	
12	WEL	Welsh







Water storage deficit (anomaly, mm)

- >125
- 100-125
- 75-100
- 50-75
- 25-50
- 0.1-25
- ≤0

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