UK Centre for Ecology & Hydrology

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

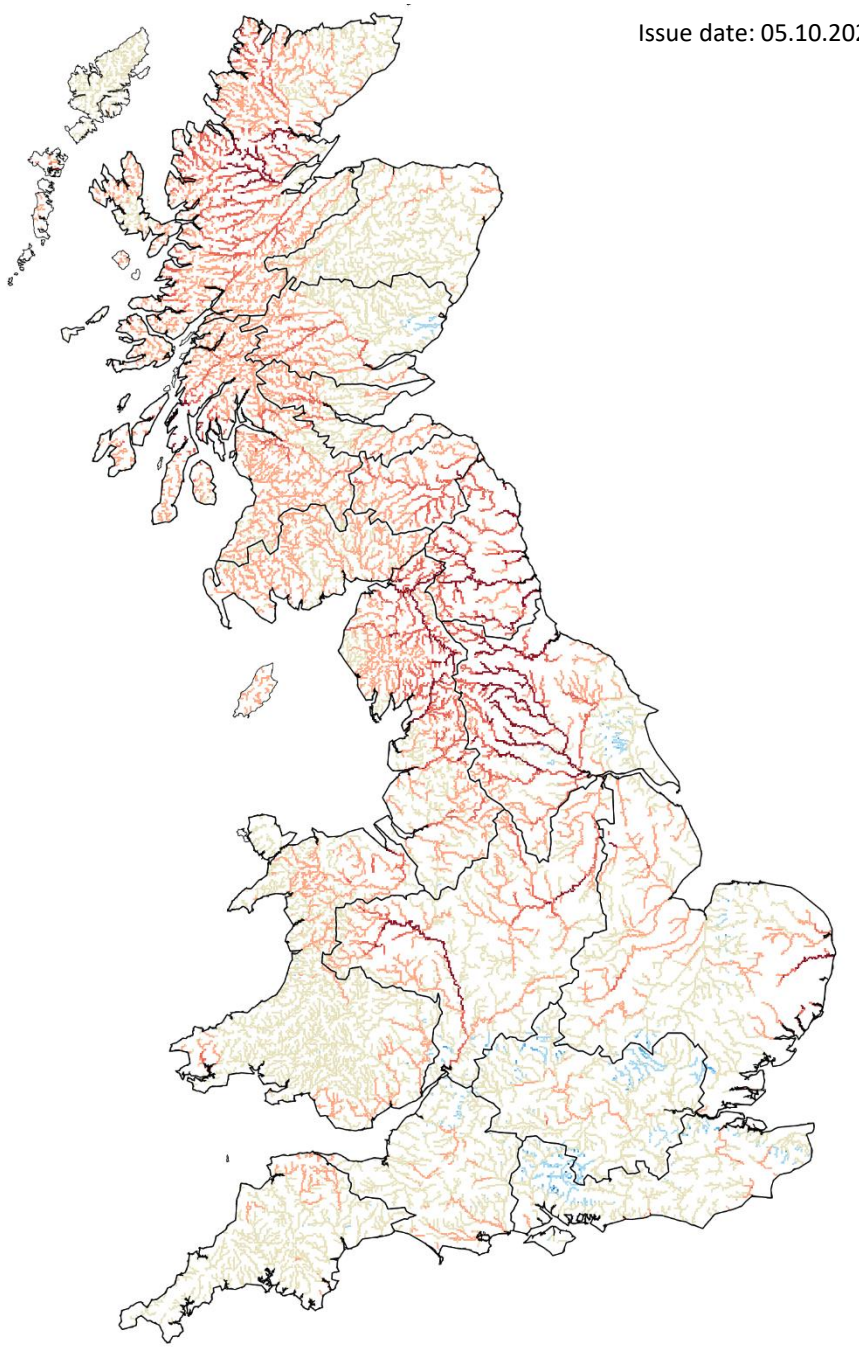
Period: September 2021

Issue date: 05.10.2021

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

These flows are produced by the 1km resolution Grid-to-Grid (G2G) hydrological model, which is run up to the end of each calendar month using observed rainfall and MORECS potential evaporation as input.

Note that the G2G model 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

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OUTLOOK BASED ON CURRENT CONDITIONS

October 2021

UK Centre for Ecology & Hydrology

Current Daily Simulated Subsurface Water Storage Conditions

Based on subsurface water storage estimated for 30th September 2021

Issue date: 05.10.2021

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 the "relative wetness" which combines maps previously shown separately as the "relative wetness" and "relative dryness".

These maps do not provide a forecast and are not maps of soil moisture. Instead they indicate areas which are particularly wet or dry. Rainfall in areas with high positive relative wetness could result in flooding in the coming days/weeks. Areas of negative relative wetness provide an indication of locations which are particularly dry, and little or no rain in these areas could potentially lead to (or prolong) a drought.

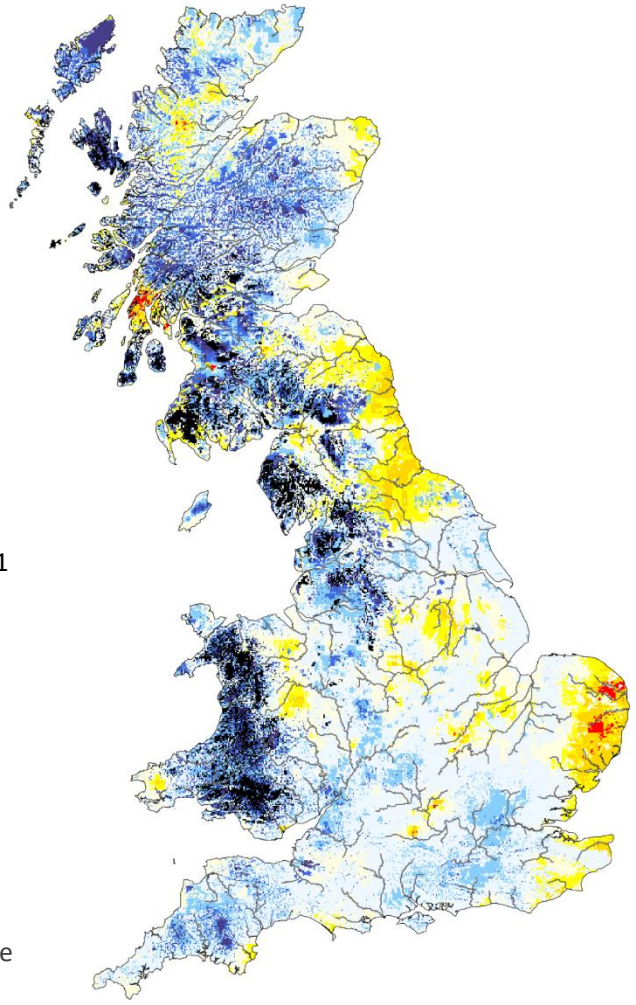
SUMMARY: At the end of September, subsurface water levels were lower (drier) than normal in East Anglia and Northumbria as well as small areas scattered across Britain. Elsewhere subsurface water levels were higher (wetter) than normal, especially so for higher ground in the west (very wet).

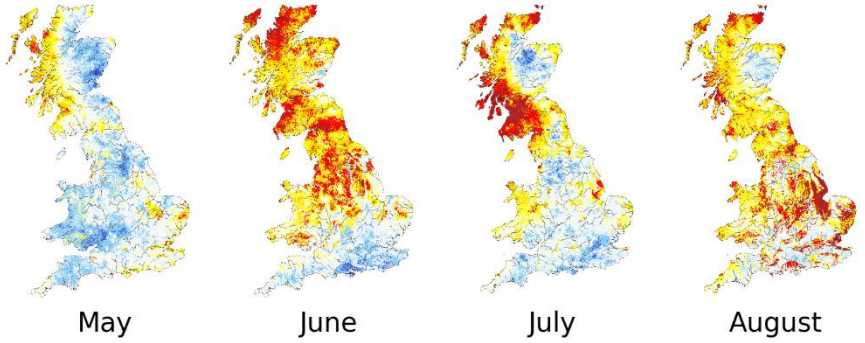
Relative wetness

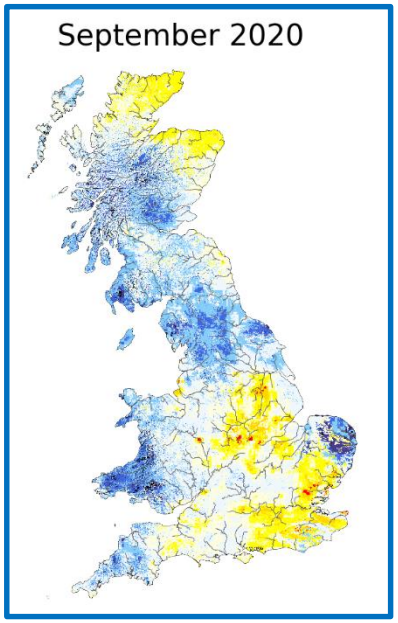
Water storage anomaly as a % of maximum (positive wetness) or minimum (negative wetness) storage anomaly (zero indicates average value)

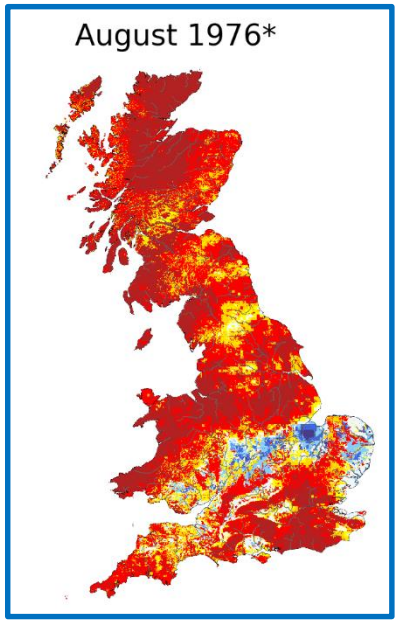
High (very wet)	>100
	75 - 100
Medium wetness	50 - 75
	25 - 50
Low wetness	0.01 - 25
Average conditions	-0.01 - 0.01
Low dryness	-25 - - 0.01
	-50 - -25
Medium dryness	-75 - -50
	-100 - -75
High (very dry)	< -100
Main rivers	

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









*Example month displaying extreme negative wetness

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OUTLOOK BASED ON CURRENT CONDITIONS

October 2021

Current Daily Simulated Subsurface Water Storage Conditions

Relative wetness

- Each month, to highlight areas that are particularly wet or dry, the total daily mean subsurface water storage (S, mm) is presented using a colour scale showing water storage anomaly relative to the historical maximum or minimum anomaly. The "relative wetness" map combines maps previously shown separately as the "relative wetness" and "relative dryness".
- The relative wetness in the sub-surface, R_w (%), is expressed as an anomaly from the monthly mean (1981 – 2010) wetness at that location:

for $S \leq S_{average}$

$$R_w\,(\%) = \frac{(S - S_{average})}{(S_{max} - S_{average})} \times 100$$

$$= \frac{\text{(storage at end of last month - average storage for this month)}}{\text{(historical maximum storage - average storage for this month)}} \times 100$$

for $S > S_{average}$

$$R_w\,(\%) = \frac{(S - S_{average})}{(S_{average} - S_{min})} \times 100$$

$$= \frac{\text{(storage at end of last month - average storage for this month)}}{\text{(average storage for this month - historical minimum storage)}} \times 100$$

- A value of $\mathbf{R_w = 0}$ indicates that the sub-surface water storage in the region matches the monthly average value.
- Places where $\mathbf{R_w > 0}$ and $\mathbf{R_w < 0}$ are wetter or drier, respectively, than is average for that month.
- Values where $\mathbf{|\,R_w\,| > 100}$ indicate the subsurface water storage is higher/lower than the previous maximum/minimum monthly mean storage estimated by the G2G over the period 1971 to 2010 (over all months), and is thus an unusually extreme value.

- These maps **do not provide a forecast**, but the relative wetness can provide an indication of locations which are particularly wet or dry. Rainfall in areas with high positive relative wetness areas **could** result in flooding in the coming days/weeks. Areas of negative relative wetness provide an indication of locations which are particularly dry, and little or no rain in these areas **could** potentially lead to (or prolong) a drought.

UK Centre for Ecology & Hydrology

Return Period of Rainfall Required to Overcome Dry Conditions

Period: October 2021 – March 2022

Issue date: 05.10.2021

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 October to March, Great Britain will not require particularly unusual rainfall (<5 year return periods) to return to average conditions for the time of year.

Oct

Nov

Dec

Jan

Feb

Mar

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

OUTLOOK BASED ON CURRENT CONDITIONS

October 2021

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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.

UK Centre for Ecology & Hydrology

Estimate of Additional Rainfall Required to Overcome Dry Conditions

Based on subsurface water storage estimated for 30th September 2021

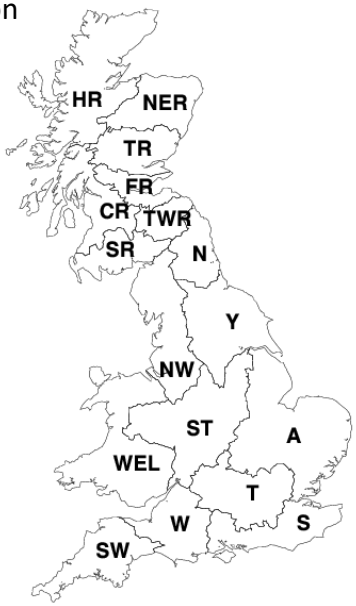
Issue date: 05.10.2021

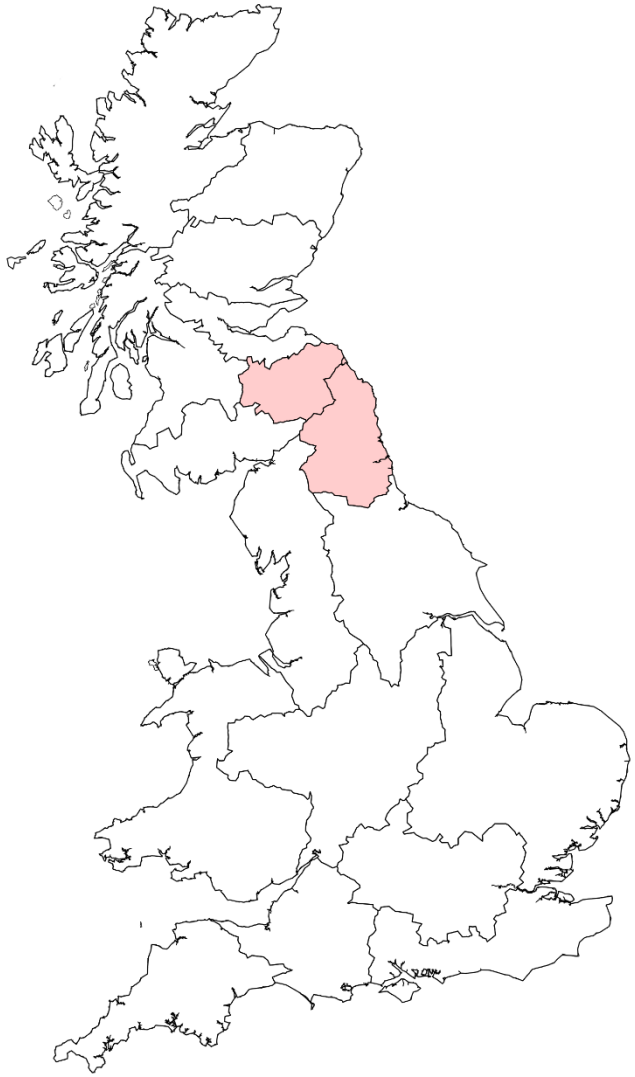
These maps show the Grid-to-Grid (G2G) hydrological model simulated subsurface water storage, expressed as an anomaly from the historical monthly mean (1981-2010), presented on a 1km grid and as regional means.
Subsurface storage deficits, i.e. where the subsurface water storage anomaly is less than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

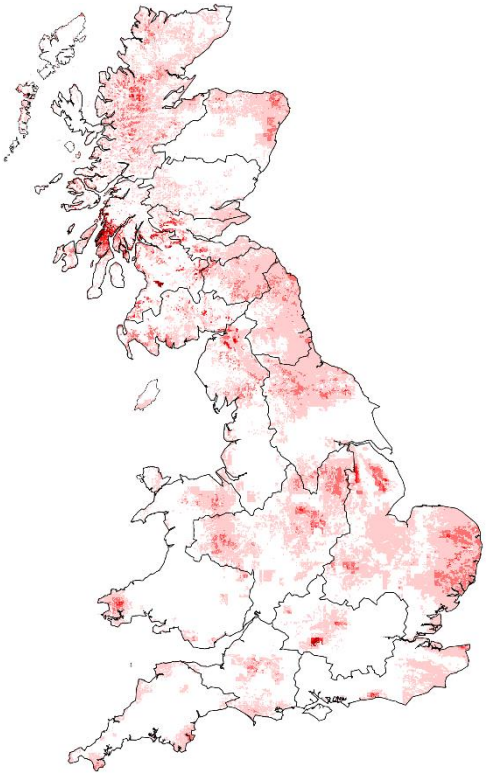
The **subsurface storage deficit (mm)** can be interpreted as an estimate of additional rainfall that would be required in future months to overcome dry conditions (i.e. rainfall in addition to what is expected on average). Regional mean values of additional rainfall required are provided in the table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

Regional estimate of additional rainfall required (mm)

	SCOTLAND	
0	HR	Highlands Region
0	NER	North East Region
0	TR	Tay Region
0	FR	Forth Region
0	CR	Clyde Region
4	TWR	Tweed Region
0	SR	Solway Region
	ENGLAND	
6	N	Northumbria
0	NW	North West
0	Y	Yorkshire
0	ST	Severn Trent
0	A	Anglian
0	T	Thames
0	W	Wessex
0	S	Southern
0	SW	South West
	WALES	
0	WEL	Welsh







Water storage deficit (anomaly, mm)

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

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