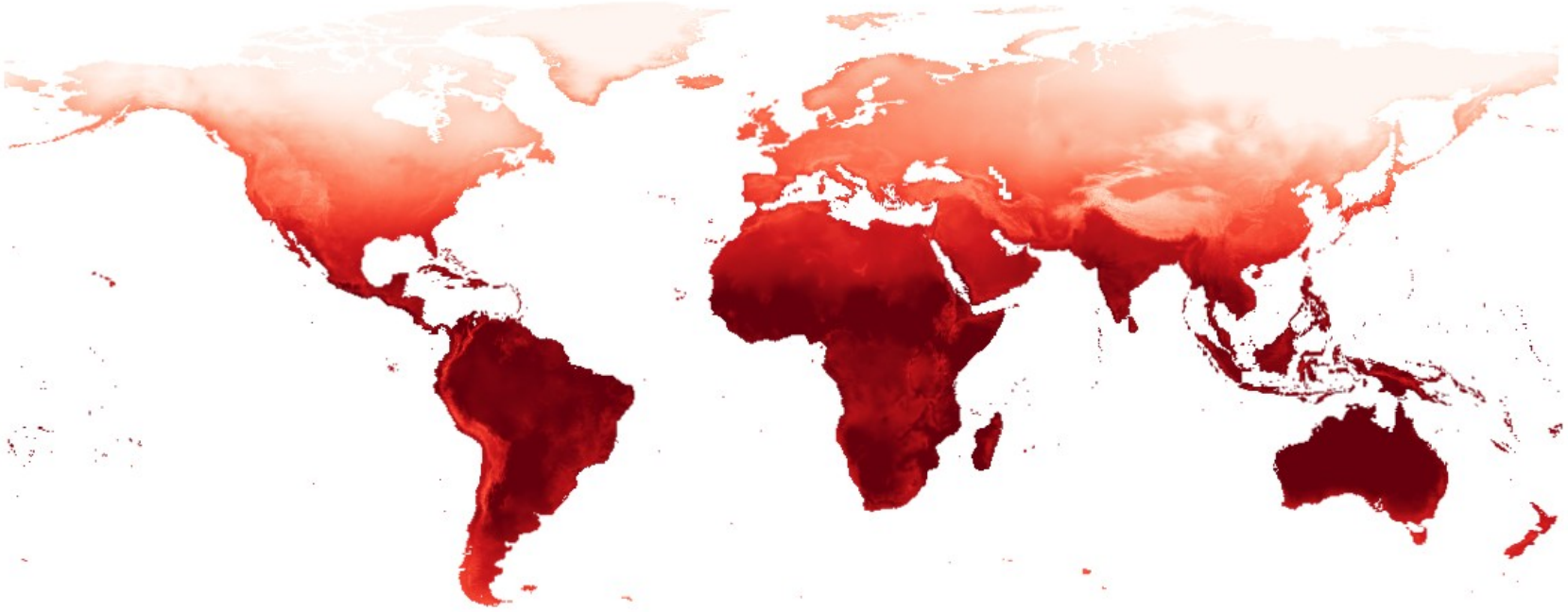
Lesson 5. Interpolating data

These types of interpolated raster maps are very common



- Created by interpolating data from many thousands of weather stations
- This one is Global Temperature Maximums
- Very useful in lots of scenarios

Data provided

- Download the May_data_20_21.csv file from this link….
  - File contains data from 35 Cumbrian weather stations for May average maximum temperatures in 2020 and 2021
  - This data is from private weather stations and is a bit patchy and not ideally distributed. Many stations had poor quality data and were not used.

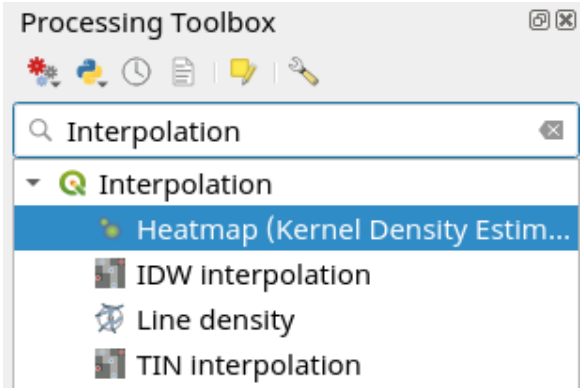
	A	B	C	D	E	F	G	H	I	J	K
1	ID	N	W	H_21	Average_21	Low_21	Rain_21	H_20	Average_20	Low_20	Rain_20
2	ITARSET2	55.19	-2.34	12.91	8.22	2.55		15.34	10.3	4.17	
3	IARLI3	55.11	-2.83	12.98	8.78	4.52		16.7	10.84	5.23	
4	IENGLAND1101	54.93	-2.3	12.8	9.01	4.74		15.86	11.21	6.32	
5	ICARLISL9	54.87	-2.85	14.58	9.83	5.18		17.85	12.04	6.5	
6	ICARLISL2	54.89	-2.97	15.37	10.74	5.74		18.58	13.08	7.35	
7	IWIGTO21	54.91	-3.23	13.45	9.34	5.02		16.08	11.62	6.77	
8	IWIGTO7	54.82	-3.17	15.03	10.25	5.32		17.85	12.31	6.26	
9	IWIGTO14	54.87	-3.36	14.21	9.63	5.41		16.39	11.44	6.19	
10	IWIGTON3	54.76	-3.16	12.26	8.92	6.06		14.96	10.92	7.47	
11	IMARYPOR2	54.7	-3.52	14.94	10.17	6.58		17.12	12.08	7.99	

Start a new QGIS project and set the CRS to WGS 84.

- Import the CSV file into the project by using Layer / Add layer / Add delimited text layer.
- The points should come up and appear as shown here.
- Insert a basemap that you like (OpenStreetMap used here).

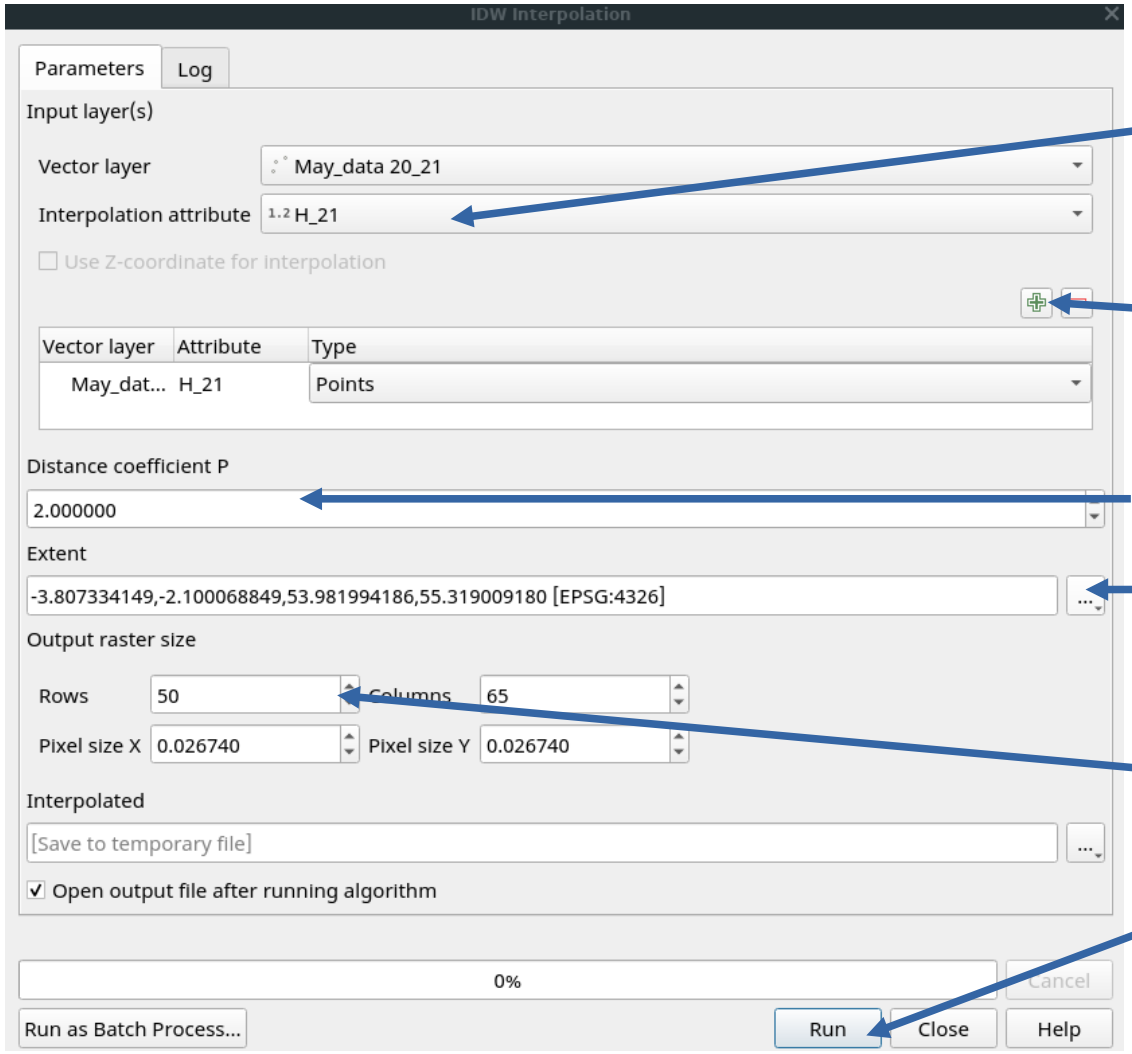
Interpolating the data

- Go to the Toolbox icon  along the top to open the Processing Toolbox.
- The panel will open (probably on the right).
- In the search pane type “Interpolation” .
- The results should look like this...



- Choose IDW interpolation (Inverse Distance Weighting).
- A dialogue box will now appear that we can populate with some details and do a test interpolation.

Setting the parameters for the interpolation



Choose the H_21 column for the interpolation values (High temps).

Press the plus sign. The layer and attribute will then appear in the pane.

Leave coefficient as is for now.

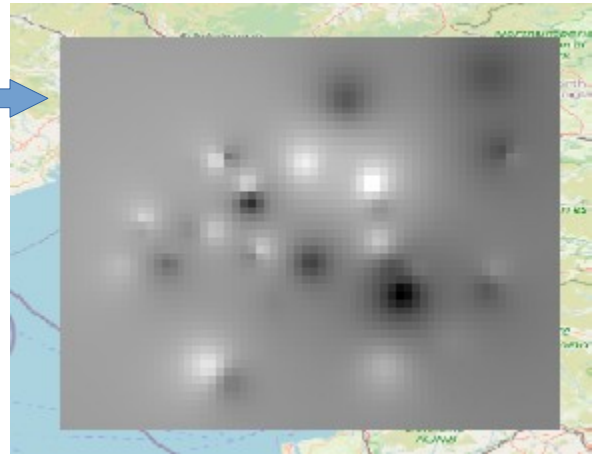
Click here and then use mouse to draw extent on canvas.

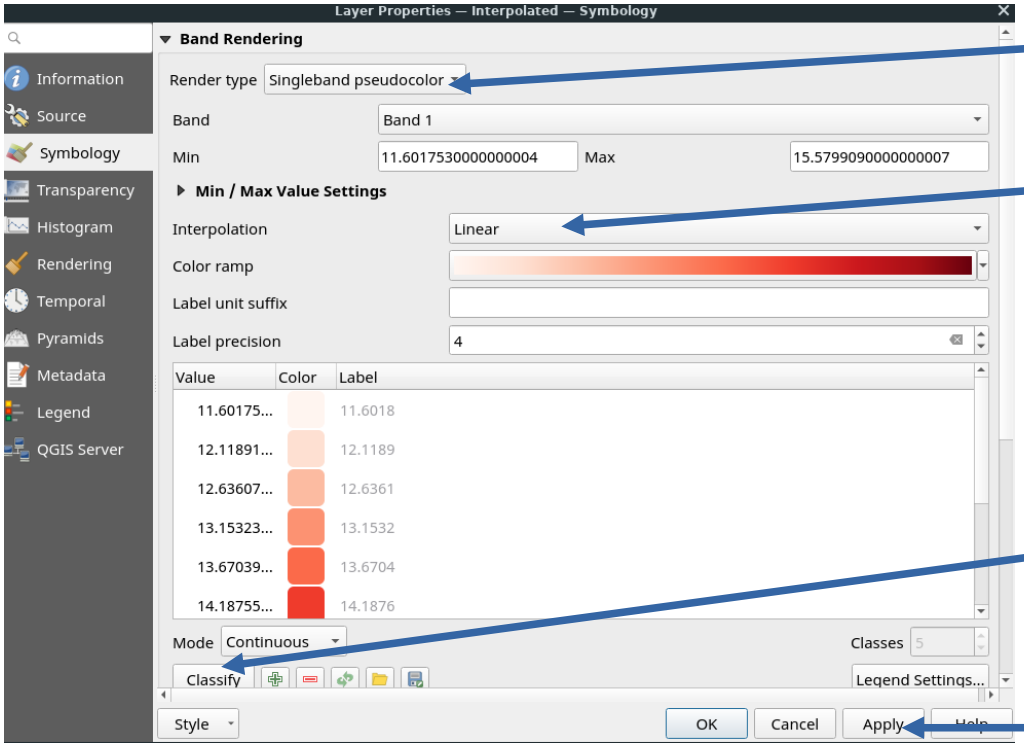
Set rows to about 50. Columns will automatically change.

Press Run and lets see what things look like. Do not close as we may want to run it again if appearance is not up to scratch.

Getting a nice look

- Our first interpolation is somewhat unspectacular but we can improve things.
- Double click on the interpolated layer and then Symbology. Set the parameters to those shown below.





Choose Singleband pseudocolour here.

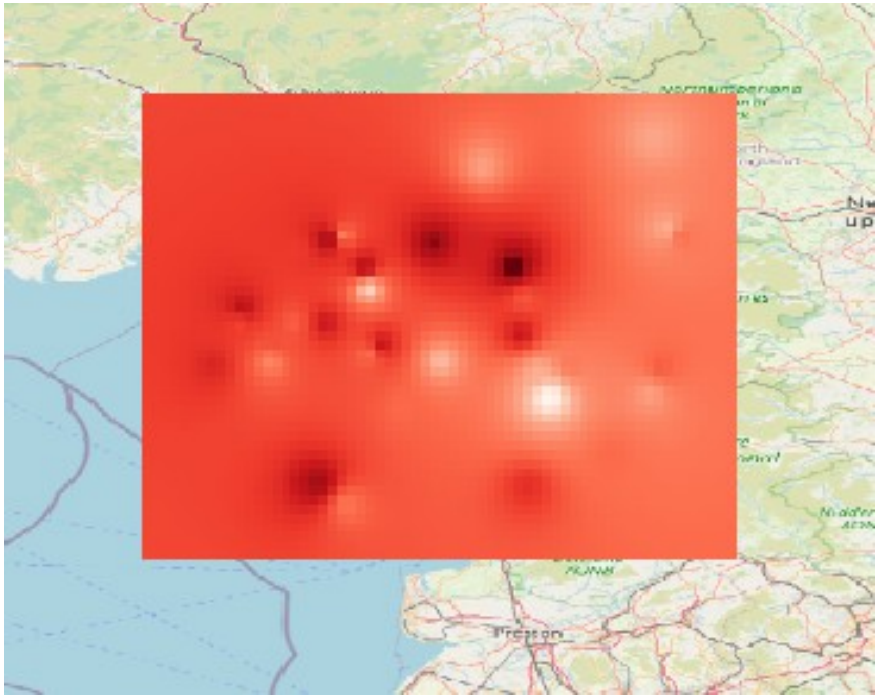
Leave as Linear for now.

Choose a colour ramp (this is Reds).

Press Classify (if necessary) and leave as Continuous for now.

Press Apply and let's see what we have got.

The map is getting better but we are not there yet

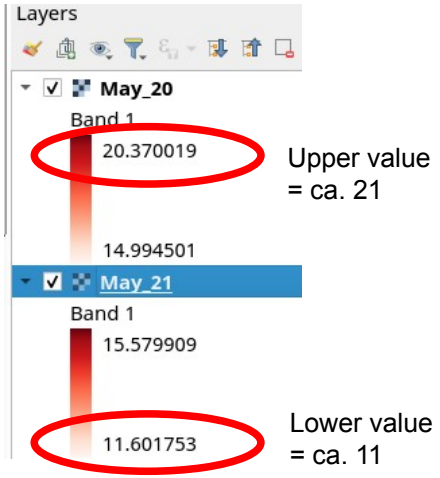


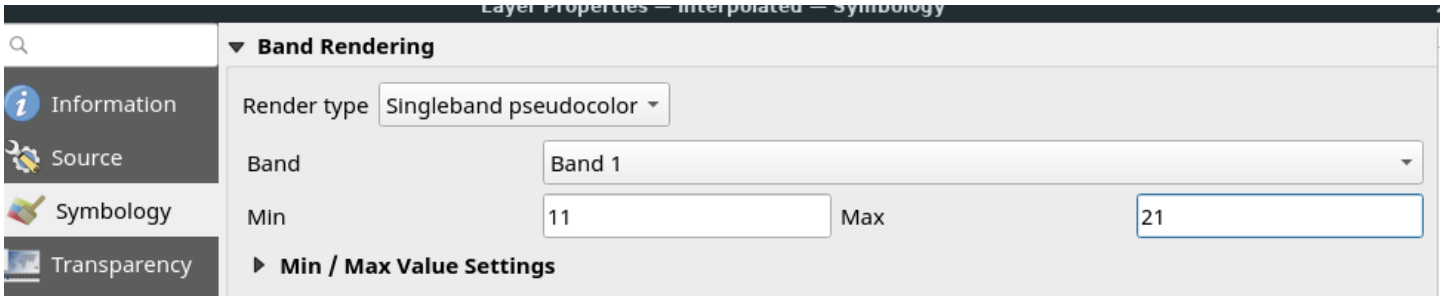
- Now – repeat the process for the 2020 data for May.
- Press  to remove the previous attribute (H_20).
- Change interpolation attribute to H_21 using the drop down list.

- Press  to add it to the pane and then using the same extent run the interpolation.
- A second interpolated map will appear as a new layer. Format this as before.

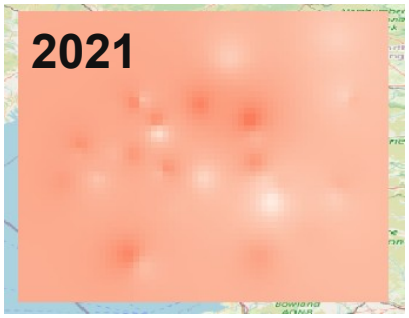
Let's now make the data ranges for each map the same

- Firstly give each layer a name: the first one May_21, the second May_20 (right click on layer to access menus).
- The go to Layer Properties for each and set the Min and Max values as 11 and 21, respectively – aligns the colour ramps for each by using a range from the lowest values in 2021 and the highest values in 2020.





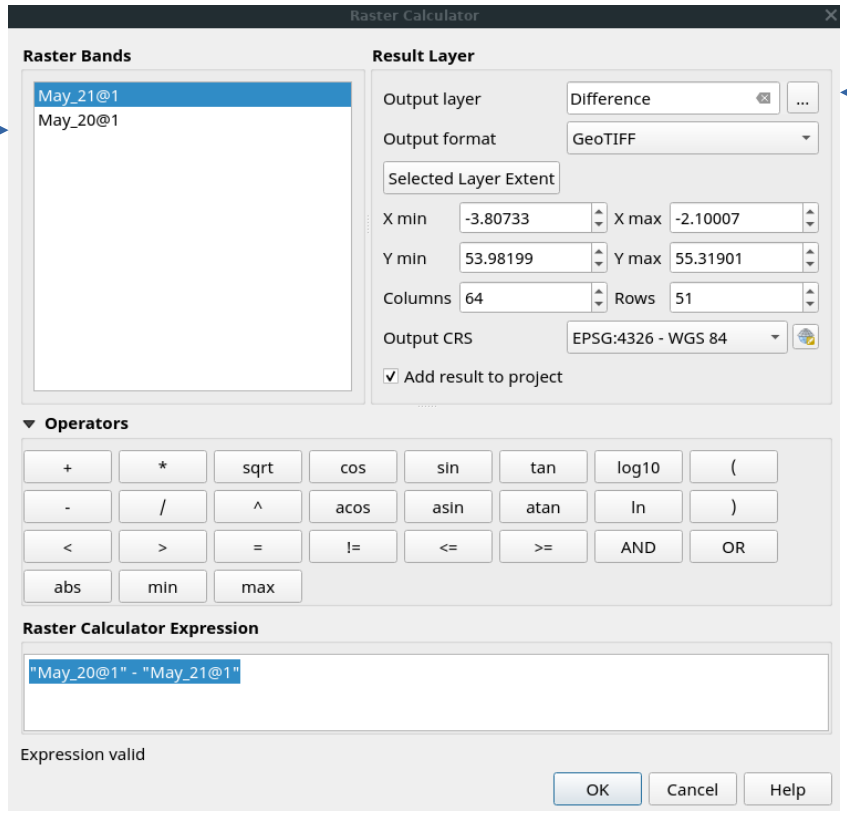
The difference between the two Mays is now apparent – 2020 hotter, 2021 cooler.



Now, lets us make a map of the difference between the two years

Go to the Raster menu and choose Raster Calculator and fill out the box that appears as below. Here we are asking QGIS to subtract the cooler year's data (2021) from the hotter year (2020) using the expression "May_20@1" – "May_21@1".

Click on layers to add to the expression

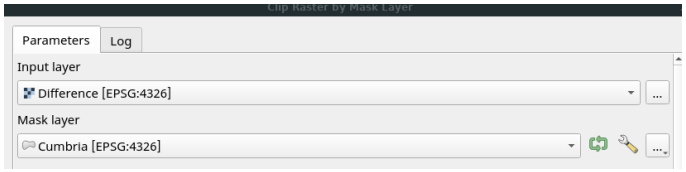


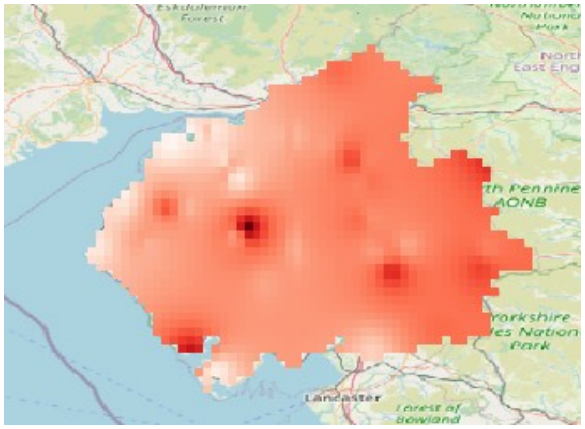
Name the output layer

Press OK and a new layer will appear called Difference

Cut the new map down to the borders of Cumbria

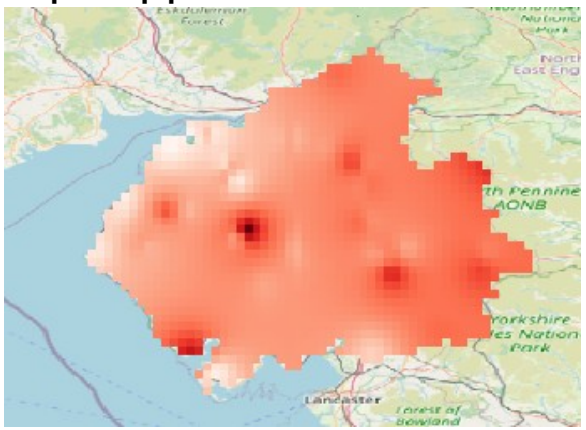
- Firstly, format the map to a colour ramp as before to see what it looks like – it should look a bit like this.
- Bring your Cumbria shapefile into the project (either drag and drop or go via the Layer / Add new layer / add vector layer).
- Go to Raster / Extraction / Clip map by mask layer.
- Set the Input layer to Difference and the Mask layer to Cumbria then press Run.
- A new, clipped map will appear that covers only the area of Cumbria. Format as before and we should have something that looks like this.



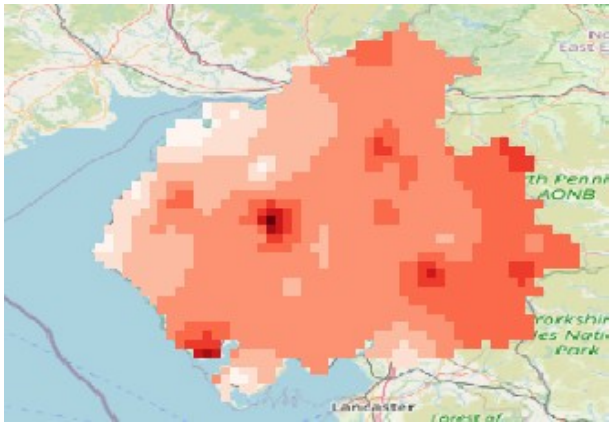


We can play around with the look of the Map

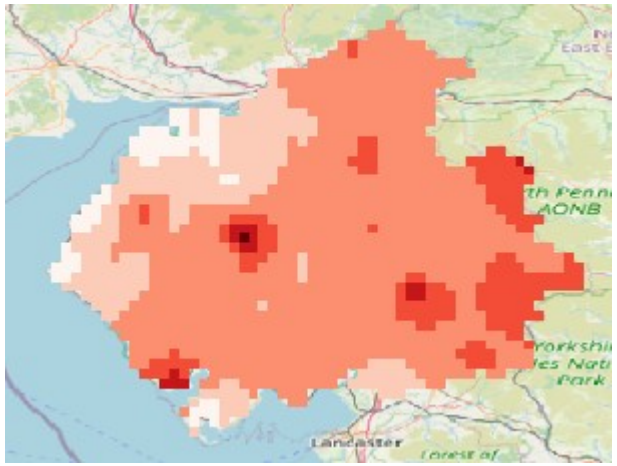
Go to layer properties and explore what a few of the settings do to the maps appearance.



V1 – Interpolation: linear (Mode: Continuous)



V2 – Interpolation: discrete (Mode: Continuous)



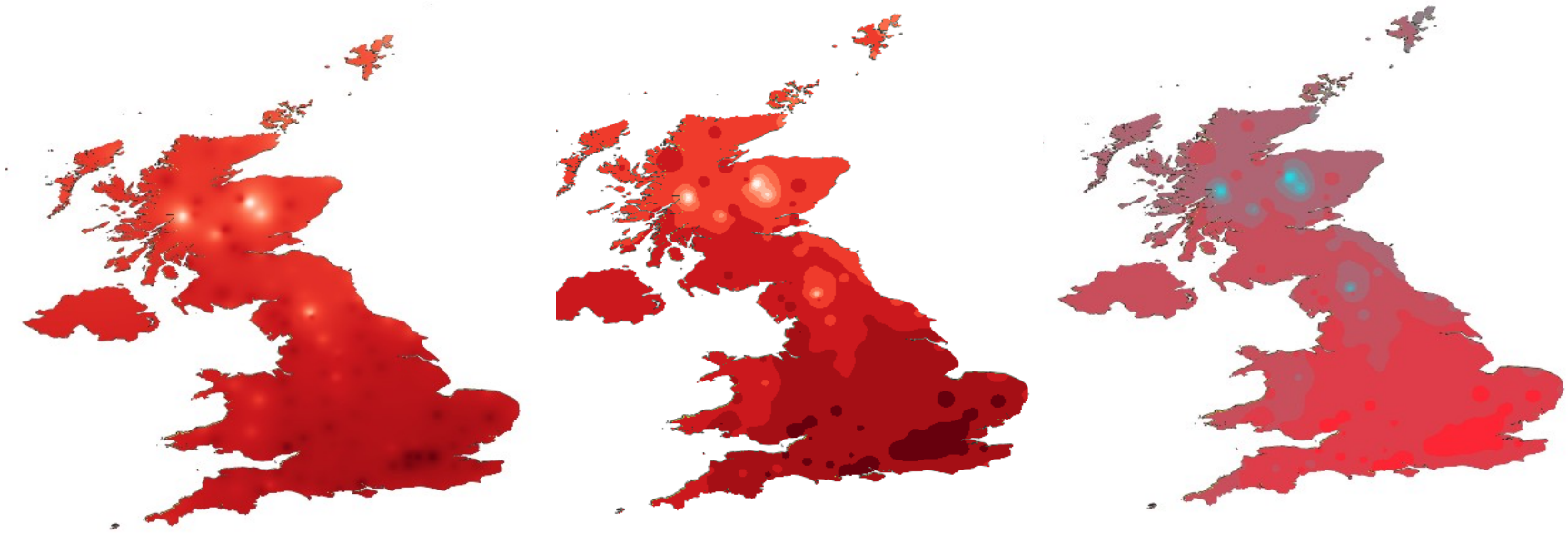
V2 – Discrete interpolation, Mode set to Equal Interval Classes 6

There are lots of options and some work better than others.

Conclusion: The warmer weather in 2020 was most pronounced in the east of the county (generally).

For the enthusiastic (see Lesson 5B video for more details)

If you are really keen, there is a second dataset of the long term maximum monthly temperatures from across the UK (see links at end). This is Met. Office data from about 150 weather stations. Interpolate the data in exactly the same way as previously (more rows/columns required) and see if you can get to maps like this….then let us compare to a professional output (next slide).



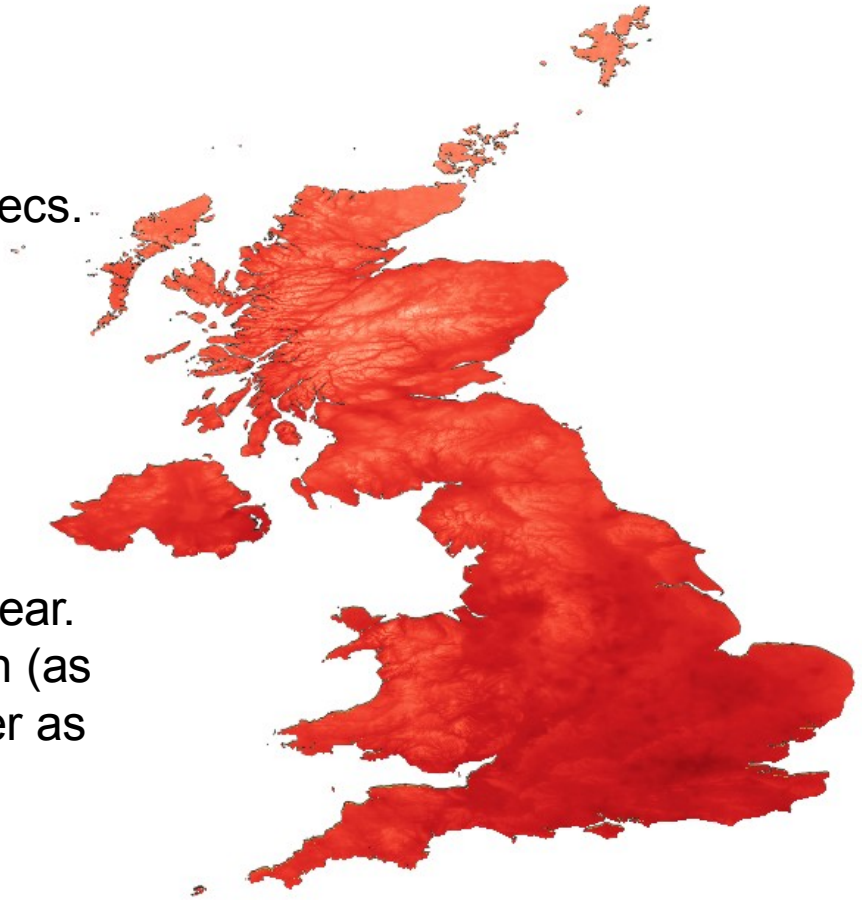
May average maximum temperatures. Long-term average 1981-2010. Same data, different stylings.

You can then make this map from professionally produced data

- Go to **www.Worldclim.org**
- Click on Historical Climate Data.
- Choose Maximum Temperature (30 secs. resolution; Tmax 30s).
- Unzip the downloaded file (it is big).

There are 12 files, one for each month.

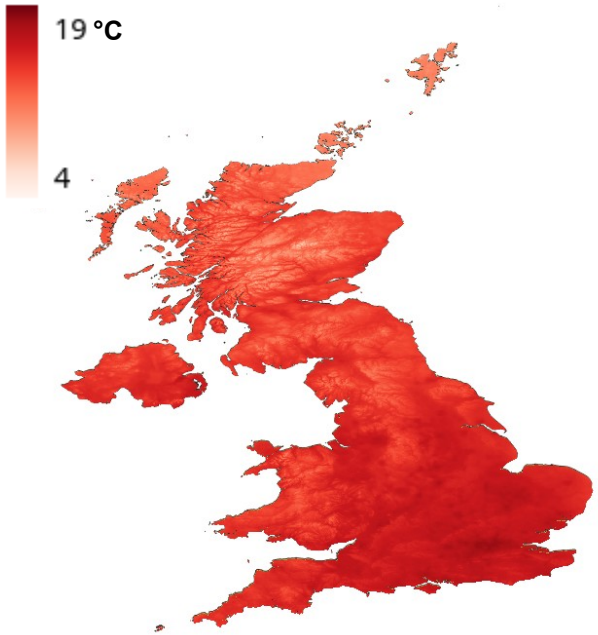
- Find wc2.1_30s_tmax05.tif (May).
- Drag it into QGIS – the world will appear.
- Cut out the UK using raster extraction (as described previously, use the UK layer as the mask).
- Format as usual.



Or, if you want, you can download one prepared earlier from the tutorials webpage but where's the fun in that!

Here is the professional job for comparison

Pro-job made by a supercomputer



WorldClim 2.1
LTA May 1970-2000
Ave. Max. Temp
(www.worldclim.org)

Our linear interpolation

Met Office Data
LTA May 1981-2010
Ave. Max. Temp.

Our linear interpolation - Enhanced

Met Office Data
LTA May 1981-2010
Ave. Max. Temp. + DEM* layer underneath
(this is fakery!)

*Digital Elevation Model

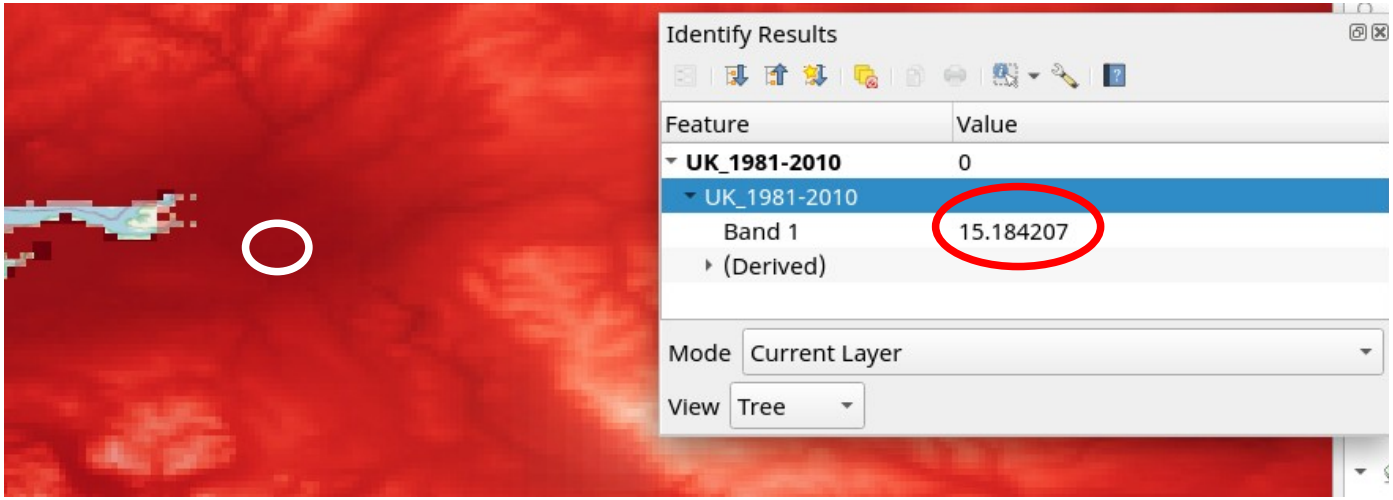
Clearly, elevation data is needed to get a proper Temperature map of the UK. We will address this later.

Selecting points on the map can verify how good our map is...

Use this tool to get values from map

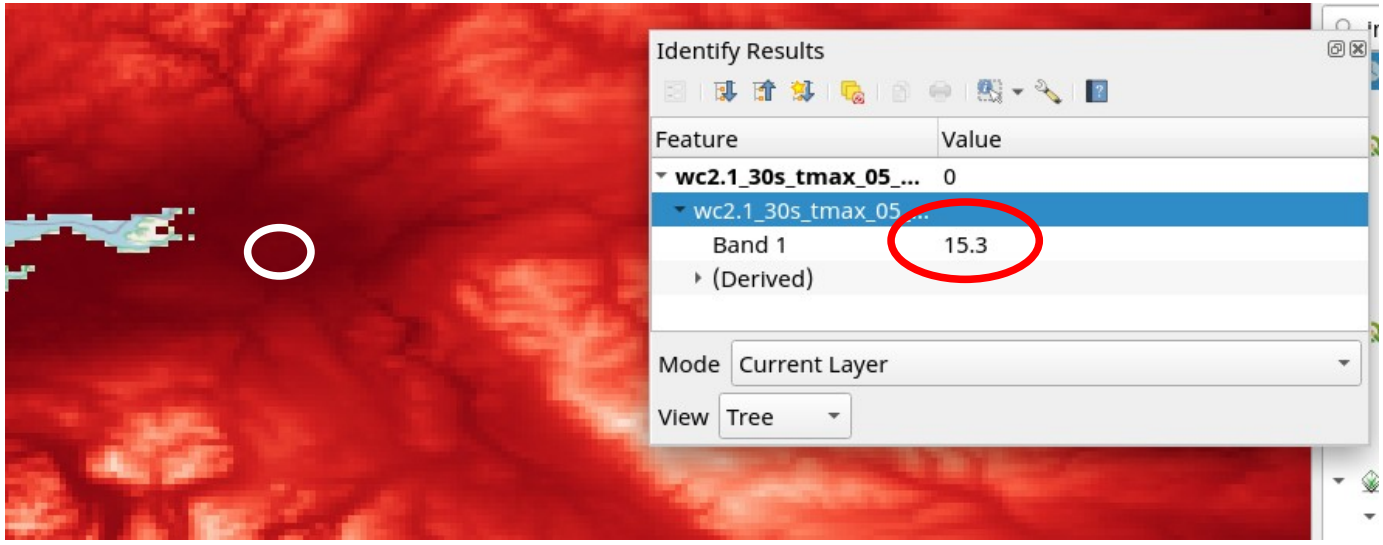
Our interpolation

Area around Carlisle = **15.18 ºC**



WorldClim 2.1

Area around Carlisle = **15.3 ºC**



Resources for this lesson

Cumbria temperature data (a csv text file). Contains average max temperature data for february and May of 2020 and 2021 (two months with quite differing weather patterns over the two years)

Met office UK-wide data (a csv text file). The LTA from 1981-2010 for around 150 weather stations.

WorldClim temperature map of whole planet or UK only (raster extraction of former). Professionally assembled LTA Max temperature climate data by month, 1970-2000)

UK shapefiles (zipped) – use the GBR_adm0.shp file (this is the one with no boundaries).