SQL Queries
To find list of cities in Ireland I submitted the following request in SQL;

```
SELECT city FROM city_data WHERE country = 'Ireland'
```

Since Dublin is the only listed city in Ireland I used that city for my local city average temperature (°C).
To extract city and global average data, two SQL queries were submitted. As only one city is recorded in Ireland, I used Dublin as the city and submitted the following request to gain 271 records.

```
SELECT year, avg_temp FROM city_data WHERE city = 'Dublin'
```

Which resulted in 271 records and downloaded as CSV.

For global data

```
SELECT year, avg_temp FROM global_data
```

Which resulted in 266 records and downloaded as CSV.

Data processing
Data processing occurred in Excel. In Dublin between the years 1746-1749 no average yearly temperature was recorded. While a median could be calculated, the first and third year recorded in Dublin was quite low (See below) compared to the average (8.66°C) so these were removed so records of both global and Dublin temperatures could start from 1750.

	A	B	C	D	E
1	Dublin			Global	
2	year	avg_temp		year	avg_temp
3	1743	6.8			
4	1744	9.28			
5	1745	4.32			
6	1746				
7	1747				
8	1748				
9	1749				
10	1750	9.32		1750	8.72
11	1751	9.12		1751	7.98

Figure 1. Yearly annual temperatures in Dublin in 1743 and 1745 were both low compared to average temperature in Dublin (8.66°C).

Since precipitation data is often recorded in decades, a moving average was conducted in decades for average temperatures (as in Figure 2). For example, for 1759 for Dublin data, the years 1750-1759 (cells B3-B12) were used for moving average calculation. Following this, 1760 was made up of the years 1751-1760 (Cells B4-B13) and each new calculation was made for the next ten years in this manner until all averages were calculated.

C12 =AVERAGE(B3:B12)

	A	B	C	D	E	F	G	H
1	Dublin			Global				
2	Year	Average te	10 Year M.	Year	Average te	10 Year MA		
3	1750	9.32		1750	8.72			
4	1751	9.12		1751	7.98			
5	1752	6.28		1752	5.78			
6	1753	8.63		1753	8.39			
7	1754	8.59		1754	8.47			
8	1755	8.29		1755	8.36			
9	1756	8.75		1756	8.85			
10	1757	8.72		1757	9.02			
11	1758	7.83		1758	6.74			
12	1759	8.82	8.435	1759	7.99	8.03		
13	1760	8.14	8.317	1760	7.19	7.877		
14	1761	8.95	8.3	1761	8.77	7.956		
15	1762	8.32	8.504	1762	8.61	8.239		
16	1763	7.95	8.436	1763	7.5	8.15		
17	1764	8.26	8.403	1764	8.4	8.143		
18	1765	8.08	8.382	1765	8.25	8.132		

Figure 2. Excel screenshot illustrating how moving averages were calculated. For the year 1759, the years 1750-1759 (or cells B3-B12) were used for this calculation.

A resulting line chart showing average temperature in Dublin and global averages is shown below. The Figure axes for temperature were rescaled. In addition, summary statistics were provided below.

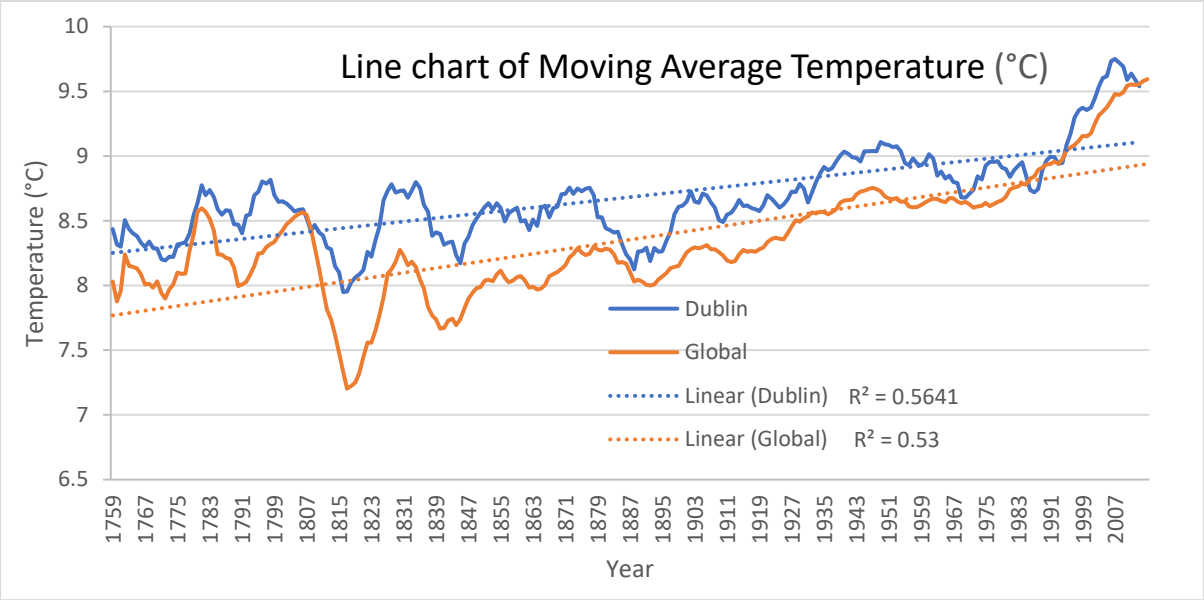

Figure 2. Line chart of yearly average temperature (°C) of Dublin and global data. A linear regression line has also been plotted in addition to the resulting correlation coefficient.

Table 1. Summary statistics of Global data and Dublin data

	Dublin data	**Global data**
n	264	266
Average (°C)	8.69	8.37
Standard deviation (°C)	0.56	0.58
Minimum (°C)	6.28	5.78
Maximum (°C)	10.11	9.83
Median (°C)	8.71	8.38

Observations from data visualization

Several observations can be made about this data visualization including;

- Both Dublin and global data show an increasing moving average of temperature (°C) throughout the years and have similar summary statistics (Table 1)
- The correlation coefficient of both global and Dublin data is strongly positively correlated, highlighting this previous trend.
- On average, average temperatures in Dublin are higher than average global temperatures (8.69±0.56°C for Dublin and 8.37±0.58°C for global).
- Average global temperatures show a sharp increase from 1975 onwards.
- In the year 1816, a low spike was recorded in average temperature (1816 often called the year without a summer) as average temperatures for this year dropped by 0.4-0.7

°C. this has been attributed to the volcanic eruption of Mount Tambora (Indonesia) in the winter of 1815.

Reading material

https://scied.ucar.edu/learning-zone/how-climate-works/mount-tambora-and-year-without-summer