



An interactive geographical investigation

This project asks the question: **Is the UK really getting warmer?**

This challenge asks students to collect qualitative and quantitative data on climate change in the UK. The qualitative data will be collected through interviews with older relatives or family friends about how the climate has changed over their lifetimes, while the quantitative data will be taken from data sets on temperature and precipitation supplied by the Hadley Centre going back over the last 100 years. At the end of the investigation, students will be able to compare their data with the data collected by the UK Climate Impacts Programme and discuss their findings. To access the UKCIP's findings, follow this link:

www.ukcip.org.uk/climate_change/how_uk_change.asp

How this project links to the geography curriculum

This project focuses on a geographical enquiry outside the classroom and encourages questioning and the use of geographical skills and resources allowing students to:

- collect and record evidence (of temperature and precipitation in their location over time)
- analyse evidence and draw conclusions (about whether the UK is really warming up)
- identify and explain different views that people, including themselves, hold about topical geographical issues (including climate change and global warming)
- by using the Climate Lab website to initiate emails to exchange information with another school
- use appropriate geographical vocabulary (for example, temperature, precipitation, location, qualitative, quantitative)

- use appropriate fieldwork techniques (for example, interviews, taking temperatures, measuring rainfall) and instruments (thermometer, rain gauge)
- use atlases and globes, and maps and plans at a range of scales (for example, using contents, keys, grids)
- use secondary sources of information, including aerial photographs (for example, stories, information texts, the internet, satellite images, photographs, videos)
- draw plans and maps at a range of scales (for example, a sketch map of different locations and temperatures observed by different schools)
- use ICT to help in geographical investigations (for example, creating a data file to analyse fieldwork data)
- demonstrate decision-making skills by deciding who to interview and why

Ways to introduce this project

Climate change is often confused with 'global warming', because people use the terms interchangeably. But while global warming focuses only on the heating of the earth, climate change encapsulates all the changes we are seeing as a result of the rise in temperature. You could initiate a discussion around this and establish the difference between the two – and between 'climate' and 'weather'.

It is now popularly believed that our country is getting warmer – people often joke during a cold winter, "this doesn't feel like global warming to me". What do the students think? Do they believe their country is warming up? What makes them think it might be?

The qualitative investigation

Students should identify two older family friends or relatives who will be happy to be interviewed for the investigation. It is important to find people who have always lived in the UK.



Here are the questions we would like the students to ask:

- Do you think there is more or less snow in wintertime now than two decades ago?
- How about 40 years ago? Do you think we get 'proper winters' now, in comparison to 40 years ago?
- Do you think that the summers are hotter now than they were two decades ago?
- How about 40 years ago?
- Do you think there is more rain now than there was two decades ago? How about 40 years ago?
- Do you think the UK is getting warmer? If so, why?
- Are you worried about global warming? If you are worried, what makes you feel this way?

Students should find a way of neatly writing up the data they collect to make it easier to compare their findings with their classmates.

The quantitative investigation

It would be useful for students to be able to keep a 'temperature & precipitation diary' for their investigations. They can cut out and stick the charts found on the challenge sheets which come with this pack into their diaries, or as an ITC extension, they can design their own.

Every day for one month, students should take the outside air temperature (around the middle of the day if possible – avoid morning and evening) and mark it in their diary. During the same month, they should use a rain gauge to record daily precipitation levels and mark these in their diary.

At the end of the month, they should work out the mean temperature for the month and the total rainfall.

Using the Hadley Centre's Data

The Hadley Centre has provided us with temperature and precipitation data stretching back 300 years. The data here is raw but it should be easy for you to pick out the exact data you would like your students to use. For example, we suggest that they compare their findings with Hadley Centre data for the same month going back 100 years. Since using data for every year would be time-consuming, we suggest you pick out data for the same month every five years.

So if your students have conducted their investigation during April 2007, they would need you to collate and provide them with data from April 2002, April 1997, April 1992 and so forth, back until around 1900. They should then compare what they have collected against the Hadley Centre's Data. Is their month different to the same month during different years? Is it hotter? Wetter? Or colder or drier?

The reason we have not picked out the data for you is that we don't know which years you will want to study. We've provided with you with data since records began because we thought it might be useful if you wanted to go on to discuss changes in weather cycles, for instance.

Graphs and spreadsheets

We encourage the students to use their findings to make graphs and spreadsheets. For example, they could plot a graph which compares temperature and precipitation during a particular month - say March - over the last 100 years, to see whether hotter months have more or less rainfall.

Qualitative data

There are many discussions to be had around qualitative data. To what extent, for instance, has current fear of climate change made people believe that the UK used to be much colder? And to what extent can we prove whether this is true or not? Comparing qualitative and quantitative data can help students build up a picture of the difference between memory and fact.

We encourage you to collect any interesting or funny remembered stories about the weather in the UK given by interviewees. For example, we often hear people complaining 'that we don't get proper winters any more'. Did the interviewees agree?

The end of the project

The UK Climate Change Impacts Panel, funded by DEFRA and based at the University of Oxford, has devised a way of mapping future scenarios for the UK if global warming continues. Give students the opportunity to study these and initiate a discussion around them. From what they have noticed in their own investigations, do they think UKCIP's scenarios could really play out?

The information can be found here:

http://www.ukcip.org.uk/climate_change/how_uk_change.asp



MONTHLY CENTRAL ENGLAND PRECIPITATION (MM)
 DAILY AUTOMATED VALUES USED AFTER 1996
 WIGLEY & JONES (J.CIMATOL.,1987)
 GREGORY ET AL. (INT.J.CLIM.,1991)
 JONES & CONWAY (INT,J,CLIMATOL.,1997)
 ALEXANDER & JONES (ASL,2001).
 VALUES MAY CHANGE AFTER QC

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1873	51.6	32.3	52.3	21.5	59.9	61.2	61.2	66.5	54.2	60.7	45.0	12.1	578.5
1874	34.8	40.3	22.1	29.3	33.3	27.6	28.6	52.3	69.1	57.7	67.8	51.9	514.8
1875	58.6	31.5	16.4	24.6	39.6	79.2	159.7	50.8	71.7	123.0	121.2	32.7	809.0
1876	48.3	64.1	69.4	86.3	23.8	55.5	49.3	49.3	114.2	48.3	82.0	126.0	816.5
1877	80.5	60.5	58.0	80.9	52.2	37.8	82.4	104.7	74.4	44.5	62.6	48.5	787.0
1878	46.4	33.1	20.4	39.3	112.1	61.0	22.3	138.1	53.6	65.8	116.5	50.4	759.0
1879	36.6	66.1	19.9	59.2	83.9	109.9	103.1	112.0	71.9	27.0	38.8	19.5	747.9
1880	6.1	49.8	38.1	44.9	36.2	87.9	157.6	50.2	105.9	142.0	54.2	70.1	843.0
1881	19.1	77.3	48.0	24.7	29.6	47.6	55.5	120.8	59.3	72.9	58.5	70.3	683.6
1882	49.7	39.5	40.7	80.6	48.2	87.2	78.3	63.5	63.5	144.5	89.1	99.8	884.6
1883	60.5	73.6	33.5	45.5	44.5	83.3	83.4	27.9	126.1	69.5	83.9	37.3	769.0
1884	54.9	28.3	36.6	41.8	25.9	25.3	81.4	45.0	46.2	39.5	38.3	55.4	518.6
1885	44.3	61.9	28.8	49.0	68.8	62.3	14.7	61.6	91.0	135.4	76.9	22.2	716.9
1886	73.7	12.7	52.0	43.0	110.6	25.5	90.0	47.6	38.1	90.9	55.6	96.5	736.2
1887	52.8	16.1	36.4	30.7	47.7	21.0	27.3	39.7	53.5	61.2	47.5	32.7	466.6
1888	23.6	40.1	61.0	42.9	21.4	50.8	137.9	67.7	31.2	20.1	90.5	44.4	631.6
1889	26.8	42.5	59.8	72.8	102.2	20.1	71.8	73.4	71.0	87.6	26.0	38.4	692.4
1890	62.2	22.2	49.8	23.5	61.9	61.6	65.5	59.6	23.0	37.5	93.7	16.7	577.2
1891	43.5	3.4	33.3	37.7	84.2	50.6	75.8	98.0	32.3	118.9	57.1	83.0	717.8
1892	31.3	43.7	24.1	35.2	56.4	83.1	62.1	58.6	64.0	125.9	37.7	30.5	652.6
1893	43.3	63.5	8.6	7.6	40.2	36.9	83.3	52.6	32.9	51.6	62.5	48.5	531.5
1894	40.0	44.0	23.5	41.7	52.2	66.1	86.6	56.0	36.2	70.8	72.2	55.2	644.5
1895	79.4	10.9	47.9	36.7	18.9	34.7	81.9	71.1	14.7	71.5	70.7	46.3	584.7
1896	24.4	17.3	67.1	23.3	13.9	54.7	41.5	43.8	105.9	86.2	33.9	82.3	594.3
1897	47.2	70.9	57.2	38.9	26.2	61.4	21.4	83.0	71.8	29.0	41.5	49.8	598.3
1898	23.6	24.1	34.1	46.3	72.5	44.9	28.2	72.7	9.9	63.6	48.4	50.2	518.5
1899	59.3	40.6	25.6	54.0	58.6	37.7	41.6	26.7	76.8	72.4	43.4	47.7	584.4
1900	79.3	91.2	17.8	26.5	37.4	70.0	43.5	94.7	14.7	60.6	55.9	84.6	676.2
1901	25.2	33.5	44.8	48.8	25.9	47.2	66.8	47.6	28.7	49.4	47.3	101.8	567.0
1902	23.8	33.9	32.7	39.9	69.3	56.3	42.6	88.1	32.7	59.0	39.4	36.9	554.6
1903	46.3	19.5	68.7	48.0	71.8	55.3	83.7	106.9	78.9	140.9	48.9	27.5	796.4
1904	49.8	73.0	42.7	25.2	47.7	14.1	67.2	77.5	46.1	21.7	32.9	45.9	543.8
1905	22.0	24.1	56.9	45.1	24.5	69.9	31.0	80.5	46.4	46.5	67.8	19.8	534.5
1906	83.9	54.2	40.5	21.4	46.7	74.2	19.4	44.9	26.5	103.4	86.6	60.9	662.6
1907	26.9	36.1	29.1	54.6	85.6	55.6	50.8	54.6	16.9	97.4	56.8	66.5	630.9
1908	24.9	38.8	61.3	67.3	45.3	37.7	72.7	65.4	46.2	32.4	30.8	42.8	565.6
1909	23.3	14.8	74.0	38.4	35.4	81.8	87.0	73.2	60.2	84.2	18.0	101.8	692.1
1910	47.0	57.1	16.0	47.7	60.7	39.4	72.8	74.0	22.9	53.8	89.1	114.3	694.8
1911	32.2	31.0	46.1	23.9	25.9	72.1	9.8	42.9	45.3	57.2	70.2	102.8	559.4
1912	85.9	34.0	67.2	5.6	51.4	93.8	86.4	174.1	40.2	59.9	63.2	67.5	829.2
1913	82.1	20.1	75.0	60.3	50.0	25.0	29.8	33.8	47.9	88.4	57.5	22.1	592.0
1914	38.3	33.3	70.0	21.9	37.0	57.7	67.8	41.6	24.2	56.2	70.3	137.4	655.7
1915	69.3	69.0	33.0	19.8	47.6	23.5	125.1	65.5	30.8	38.6	66.0	111.6	699.8
1916	29.3	101.3	98.8	34.0	59.5	60.9	43.3	63.0	31.2	59.7	73.0	70.1	724.1
1917	55.0	23.2	48.3	41.7	42.3	47.8	51.4	112.7	40.2	81.0	35.8	27.0	606.4
1918	53.9	33.4	23.2	60.8	55.0	18.9	76.7	46.7	121.5	43.9	47.7	77.6	659.3
1919	82.0	69.9	84.8	55.2	23.1	28.0	64.3	57.7	37.3	58.5	53.2	96.8	710.8
1920	65.2	29.8	51.4	101.3	62.0	56.2	101.9	37.1	51.8	36.5	22.4	65.5	681.1
1921	54.2	8.4	25.6	31.8	35.9	13.0	14.2	61.2	26.6	42.5	48.8	46.1	408.3
1922	90.7	60.4	47.4	61.3	25.8	23.0	131.1	84.1	61.9	24.2	33.0	70.2	713.1
1923	40.9	99.3	42.1	42.0	48.6	16.5	77.9	63.1	63.7	81.8	60.5	82.6	719.0
1924	63.1	27.2	20.1	52.9	93.8	48.8	81.8	69.1	74.6	103.7	48.8	64.1	748.0
1925	35.7	63.8	28.1	49.3	62.1	5.8	54.3	54.0	77.1	69.5	56.4	57.0	613.1
1926	67.7	49.6	12.6	54.0	58.8	63.8	45.8	42.2	39.5	64.0	86.2	19.8	604.0
1927	50.1	54.8	53.6	47.0	25.8	96.6	67.1	94.3	107.7	55.0	81.3	63.9	797.2
1928	95.1	43.2	48.0	28.2	36.2	70.4	42.3	65.6	16.7	94.7	72.9	56.7	670.0
1929	41.5	17.1	3.4	31.3	39.5	30.3	57.3	40.5	17.5	77.6	120.3	111.5	587.8
1930	69.0	16.8	52.1	62.0	62.5	24.4	102.8	59.7	97.5	42.6	86.1	56.3	731.8
1931	47.8	63.3	7.7	86.4	80.9	65.6	92.8	88.5	78.0	19.1	63.6	26.0	719.7
1932	32.2	12.7	41.3	74.7	119.3	15.4	89.0	53.2	53.7	87.2	44.8	17.2	640.6
1933	34.0	64.2	57.3	27.9	43.3	52.0	41.1	20.1	46.4	81.3	43.4	11.6	522.5
1934	41.1	17.9	40.3	57.5	26.2	30.6	40.4	52.7	47.2	39.8	52.5	99.9	546.2
1935	43.3	58.9	15.1	75.1	19.5	73.2	14.9	41.7	99.8	75.1	105.8	64.6	687.1
1936	79.6	53.9	28.6	45.7	29.0	89.2	127.9	19.5	69.8	47.0	61.5	44.9	696.6
1937	85.0	80.0	69.0	71.7	79.1	32.0	66.8	23.3	44.8	58.6	45.0	75.0	730.3
1938	65.7	20.7	7.8	6.0	51.3	31.7	62.6	61.8	54.9	65.3	60.5	87.0	575.3
1939	122.6	20.9	47.0	51.8	27.6	52.1	72.4	77.7	27.2	111.3	94.0	45.1	749.7
1940	52.1	56.3	53.1	47.1	37.7	17.0	88.9	10.9	20.1	82.8	143.4	44.0	653.3
1941	72.8	59.5	78.9	29.1	54.4	22.7	81.7	96.9	14.8	64.6	68.3	23.2	666.8
1942	72.7	29.4	38.7	25.0	69.5	22.0	61.3	45.9	36.1	63.3	44.6	56.3	564.9
1943	98.2	17.6	15.5	23.3	57.3	46.8	25.8	52.1	57.8	41.5	51.8	26.9	514.5
1944	52.4	44.1	10.3	50.3	30.0	47.1	56.7	71.5	83.5	71.0	92.9	33.2	643.0
1945	57.2	43.8	23.3	33.3	55.4	57.6	47.8	65.9	48.9	77.6	14.0	57.6	582.4
1946	46.2	59.9	28.0	31.1	42.2	70.8	71.1	100.5	81.3	33.9	120.1	59.9	745.0
1947	48.6	50.2	119.5	45.7	26.6	46.5	55.0	8.3	27.9	8.3	36.3	55.5	528.3
1948	107.4	29.5	17.2	39.0	65.2	70.0	34.7	95.2	55.3	57.4	31.5	62.8	665.2



1949	29.1	19.6	31.5	48.1	54.0	14.7	58.9	38.6	29.2	100.2	70.8	44.6	539.2
1950	23.9	94.2	20.0	56.0	58.0	42.8	89.9	72.7	74.9	20.0	108.3	45.2	705.9
1951	61.6	71.9	87.9	60.5	79.6	30.8	34.0	110.4	40.6	26.1	112.1	43.4	758.8
1952	47.0	17.2	66.2	39.4	57.1	46.8	22.0	63.9	62.9	66.9	72.9	53.9	616.2
1953	24.6	42.8	20.5	53.8	46.9	72.4	57.0	66.4	37.9	54.8	39.4	23.8	540.2
1954	35.7	55.3	50.0	7.9	72.5	62.3	59.5	112.6	54.3	67.2	106.9	55.8	740.1
1955	52.3	53.4	55.4	21.7	86.7	65.0	21.4	22.6	40.3	59.6	33.0	51.3	562.7
1956	97.6	28.7	21.6	34.3	18.6	70.2	80.4	131.6	44.6	38.9	22.8	58.2	647.5
1957	37.2	57.7	52.0	6.5	31.5	51.9	76.3	69.3	102.6	36.0	49.8	51.7	622.5
1958	64.3	87.0	39.6	22.9	60.0	102.6	92.5	78.7	68.4	56.7	37.0	62.1	771.7
1959	80.0	4.3	54.0	59.8	14.9	32.2	52.0	25.2	3.7	48.2	57.4	89.9	521.6
1960	108.8	50.8	31.5	22.7	26.7	40.0	85.6	78.9	94.2	126.0	93.7	84.9	843.8
1961	66.5	41.7	9.9	62.5	25.5	28.9	55.0	67.0	58.7	69.5	46.6	78.4	610.2
1962	55.5	19.9	29.1	54.9	48.6	7.9	42.7	84.1	76.4	20.8	46.3	45.7	531.8
1963	25.1	18.0	63.8	49.9	41.2	62.0	48.3	100.6	47.5	37.2	90.1	14.4	598.1
1964	19.5	22.5	82.1	53.0	28.6	77.8	32.8	42.0	14.6	31.1	31.2	48.5	483.7
1965	57.5	18.5	58.2	52.3	47.1	51.0	81.0	55.7	117.1	15.0	78.2	120.1	751.8
1966	35.4	89.1	22.6	78.6	46.6	73.2	71.9	93.6	39.7	86.7	62.0	78.5	777.9
1967	27.5	49.9	29.6	45.9	122.1	25.6	40.3	51.2	53.2	105.4	46.0	47.2	643.8
1968	47.5	32.5	24.5	55.5	59.1	77.3	102.1	76.7	117.3	52.9	60.2	52.4	757.9
1969	67.5	58.9	60.5	54.6	120.5	39.4	75.9	61.6	17.4	8.6	89.9	62.8	717.6
1970	59.6	62.0	47.3	70.5	15.2	27.1	52.2	63.1	34.0	29.0	126.4	39.8	626.2
1971	80.5	17.7	47.4	44.4	41.2	71.5	40.6	93.9	24.1	54.1	76.5	29.4	621.2
1972	64.7	38.5	59.0	41.9	48.8	50.3	58.8	27.4	43.0	18.3	56.6	65.5	572.8
1973	22.5	26.1	17.5	51.9	71.8	76.1	89.3	29.7	61.4	42.2	28.1	40.7	557.2
1974	53.0	56.5	28.1	10.3	19.7	55.3	56.1	89.9	78.7	97.0	82.8	35.1	662.4
1975	61.5	21.7	83.8	65.6	49.5	19.9	41.0	24.4	60.2	22.3	51.4	42.1	543.4
1976	43.9	20.3	23.8	14.2	51.6	11.6	23.3	40.9	108.2	106.2	47.9	65.4	557.3
1977	76.4	114.8	43.4	33.0	44.0	69.5	13.0	85.8	19.6	25.8	64.5	63.7	653.4
1978	77.2	50.4	48.6	41.4	50.0	71.2	62.7	58.4	41.7	9.0	27.2	128.6	666.3
1979	67.9	63.0	94.0	57.2	107.1	25.0	27.9	74.0	20.9	56.3	52.3	107.0	752.5
1980	57.8	66.2	69.3	20.1	25.8	96.5	68.7	79.2	34.8	88.1	63.3	41.2	710.9
1981	40.6	40.8	101.2	76.7	65.1	25.3	47.1	48.5	92.2	68.2	34.0	54.5	694.1
1982	40.6	20.9	69.8	18.9	42.3	127.0	24.9	90.6	59.9	81.0	66.3	52.1	694.3
1983	51.6	37.7	43.1	105.9	98.9	25.9	39.5	15.0	80.0	39.2	43.7	61.4	641.9
1984	90.1	43.3	52.0	12.2	66.2	47.5	25.0	61.5	88.8	49.5	97.7	41.6	675.4
1985	56.1	16.9	46.4	51.6	72.7	97.8	60.7	60.4	18.7	34.1	59.4	88.8	663.7
1986	70.3	23.4	58.4	66.0	77.2	28.9	48.8	100.2	21.0	58.0	66.3	81.6	700.0
1987	28.3	37.4	60.9	54.1	40.4	93.9	51.6	73.9	46.1	116.5	51.4	30.6	685.0
1988	101.7	36.4	77.3	32.6	45.6	40.8	108.4	47.4	46.5	49.4	36.6	24.9	647.7
1989	27.1	38.3	53.2	82.4	17.1	52.0	44.6	37.7	29.2	52.6	40.3	107.2	581.8
1990	59.6	79.0	16.2	29.1	17.4	48.5	26.7	32.6	39.2	61.7	53.8	57.7	521.4
1991	52.0	41.1	38.0	51.2	11.5	73.3	39.4	19.8	59.8	35.1	52.2	28.4	501.8
1992	54.4	21.4	59.2	42.9	47.4	34.6	96.6	98.7	85.6	75.4	91.8	44.7	752.6
1993	55.6	14.2	15.7	73.4	55.6	54.0	77.2	48.1	101.9	76.6	75.0	93.2	740.4
1994	80.3	49.8	52.9	50.5	48.5	22.7	41.3	49.8	100.2	64.3	46.4	66.8	673.4
1995	98.3	64.2	50.1	16.9	37.5	18.0	24.1	7.8	98.8	22.1	53.6	73.1	564.4
1996	33.2	49.9	24.2	24.1	30.1	25.2	36.6	67.5	18.6	50.6	86.5	51.3	497.8
1997	14.7	46.2	16.4	24.3	58.3	127.3	58.7	81.9	18.8	55.5	68.6	66.4	637.2
1998	80.6	10.2	57.3	111.4	16.3	96.9	26.5	47.0	62.7	99.3	49.1	75.7	733.0
1999	83.7	35.5	67.8	57.0	42.7	75.5	27.3	99.8	81.8	76.4	40.2	69.2	757.0
2000	18.7	52.7	21.1	103.9	88.2	22.0	57.8	55.2	101.9	104.7	108.0	69.7	804.1
2001	45.9	77.8	72.7	83.1	46.2	35.3	76.8	71.9	84.7	80.0	43.5	27.0	745.0
2002	44.6	59.0	32.0	32.7	54.2	34.2	108.6	57.2	33.1	105.3	96.3	103.2	760.4
2003	67.4	18.6	24.1	28.2	55.6	91.9	59.6	12.9	24.6	49.5	63.8	70.7	567.0
2004	85.4	34.9	31.1	76.5	41.0	47.2	84.6	146.7	38.4	100.6	39.1	24.0	749.3
2005	30.0	42.8	34.4	48.3	40.1	53.8	60.9	70.6	62.5	69.8	45.5	34.1	591.0
2006	18.3	41.5	48.5	37.9	91.9	13.7	36.5	92.5	64.0	-99.9	-99.9	-99.9	444.8

Teachers Factsheet

Hadley Centre

Data - Temperature



GEOGRAPHY KS2

CLIMATE LAB

MONTHLY MEAN CENTRAL ENGLAND TEMPERATURE (DEGREES C)
 1659-1973 MANLEY (Q.J.R.METEOROL.SOC., 1974)
 1974ON PARKER ET AL. (INT.J.CLIM., 1992)
 PARKER AND HORTON (INT.J.CLIM., 2005)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1659	3.0	4.0	6.0	7.0	11.0	13.0	16.0	16.0	13.0	10.0	5.0	2.0	8.83
1660	0.0	4.0	6.0	9.0	11.0	14.0	15.0	16.0	13.0	10.0	6.0	5.0	9.08
1661	5.0	5.0	6.0	8.0	11.0	14.0	15.0	15.0	13.0	11.0	8.0	6.0	9.75
1662	5.0	6.0	6.0	8.0	11.0	15.0	15.0	15.0	13.0	11.0	6.0	3.0	9.50
1663	1.0	1.0	5.0	7.0	10.0	14.0	15.0	15.0	13.0	10.0	7.0	5.0	8.58
1664	4.0	5.0	5.0	8.0	11.0	15.0	16.0	16.0	13.0	9.0	6.0	4.0	9.33
1665	1.0	1.0	5.0	7.0	10.0	14.0	16.0	15.0	13.0	9.0	6.0	2.0	8.25
1666	4.0	5.0	6.0	8.0	11.0	15.0	18.0	17.0	14.0	11.0	6.0	3.0	9.83
1667	0.0	4.0	2.0	7.0	10.0	15.0	17.0	16.0	13.0	9.0	6.0	3.0	8.50
1668	5.0	5.0	5.0	8.0	10.0	14.0	16.0	16.0	14.0	10.0	6.0	5.0	9.50
1669	1.0	4.0	5.0	7.0	11.0	15.0	17.0	16.0	14.0	10.0	6.0	2.0	9.00
1670	3.0	1.0	5.0	8.0	11.0	14.0	16.0	16.0	14.0	10.0	6.0	3.0	8.92
1671	4.0	3.5	5.0	7.5	11.5	13.5	16.0	15.5	13.5	8.5	6.0	4.0	9.04
1672	1.5	1.5	5.0	7.0	12.0	16.0	15.0	14.0	11.0	11.5	6.5	4.5	8.79
1673	5.0	1.5	5.5	7.0	11.0	14.5	15.5	15.5	11.5	7.5	5.0	0.5	8.33
1674	5.0	2.0	1.0	7.5	11.0	13.5	14.0	13.5	10.5	9.0	6.5	3.5	8.08
1675	3.0	2.0	3.0	7.0	10.5	11.5	15.0	14.5	10.5	8.0	4.5	4.5	7.83
1676	5.5	5.0	5.0	7.5	10.5	18.0	16.0	16.5	12.0	7.0	3.5	-0.5	8.83
1677	3.0	3.5	7.0	7.5	10.0	13.0	18.0	15.0	13.0	8.5	4.5	2.0	8.75
1678	1.5	2.0	4.0	6.5	11.0	14.5	16.5	15.0	15.0	8.5	6.0	0.5	8.42
1679	1.0	1.5	4.5	7.0	12.0	15.5	16.0	17.0	13.0	11.0	3.5	2.5	8.71
1680	3.5	3.5	6.0	6.5	10.5	13.0	16.0	15.0	14.5	10.5	6.5	1.0	8.88
1681	0.5	1.5	4.0	8.0	10.5	14.0	15.0	16.0	14.0	11.5	6.5	3.0	8.71
1682	6.0	2.0	4.5	6.5	11.5	14.0	15.0	14.5	13.0	9.5	5.5	6.0	9.00
1683	3.5	2.0	5.5	9.5	11.5	16.0	15.5	13.5	13.0	6.5	4.5	0.5	8.46
1684	-3.0	-1.0	3.0	6.5	13.0	15.0	16.0	15.5	12.0	11.0	3.0	4.0	7.92
1685	0.5	3.5	5.0	8.5	12.5	14.5	14.0	14.5	11.5	11.5	7.0	6.5	9.13
1686	6.5	6.0	7.0	8.5	12.5	15.5	16.5	14.5	13.0	9.0	6.5	6.0	10.13
1687	3.5	4.5	4.5	6.5	11.0	13.0	15.5	15.0	11.0	11.0	6.0	6.0	8.96
1688	3.5	1.5	3.5	5.5	10.5	13.0	15.5	15.0	12.0	7.0	4.0	3.0	7.83
1689	0.5	4.5	5.0	8.0	11.0	12.0	15.5	15.5	13.0	8.0	5.0	4.5	8.54
1690	4.0	4.5	4.5	8.0	9.5	13.5	15.5	15.0	13.0	8.5	6.5	4.5	8.92
1691	1.0	1.0	5.0	6.5	10.0	14.5	15.5	15.5	11.0	9.0	5.0	3.5	8.13
1692	2.0	0.0	4.0	7.5	9.0	13.5	15.0	15.0	11.5	6.5	5.0	3.5	7.71
1693	3.0	5.0	3.0	6.5	9.0	14.5	15.0	15.0	12.0	9.5	6.0	3.0	8.46
1694	0.0	5.0	3.5	7.5	9.0	13.0	15.0	13.0	10.5	7.5	5.5	2.5	7.67
1695	-1.0	0.5	3.5	5.5	9.0	13.0	13.5	13.0	11.5	9.0	5.5	4.0	7.25
1696	5.5	4.5	3.5	5.5	10.5	13.0	15.5	15.5	11.5	9.0	5.5	2.5	8.50
1697	1.0	0.5	5.5	7.0	11.5	13.0	15.5	14.5	12.0	9.0	4.0	2.5	8.00
1698	0.0	0.5	3.5	7.5	8.5	12.0	15.0	15.0	13.0	9.0	4.0	3.5	7.63
1699	3.4	3.4	3.9	6.4	10.0	14.4	17.2	15.0	13.3	9.4	5.6	3.6	8.80
1700	3.9	2.5	3.6	6.4	12.0	13.6	15.0	15.0	12.8	8.9	5.0	4.2	8.57
1701	2.8	2.5	2.8	4.7	10.9	14.2	18.3	16.1	14.7	7.5	6.4	3.6	8.71
1702	5.0	6.7	5.8	5.8	10.6	13.3	15.0	16.1	14.4	10.0	4.4	4.4	9.29
1703	2.2	3.9	5.6	8.3	11.9	13.9	16.1	16.1	10.6	7.8	7.2	5.1	9.06
1704	2.0	3.3	5.3	8.3	11.5	14.4	16.7	16.9	11.9	8.3	6.4	3.6	9.05
1705	2.8	3.9	4.4	7.8	11.2	12.2	15.6	17.5	11.9	8.9	3.9	4.4	8.71
1706	2.8	4.2	6.4	8.9	12.2	15.6	16.1	16.7	12.5	11.2	6.1	4.7	9.78
1707	3.5	3.0	5.0	8.5	11.0	16.0	17.0	16.0	14.0	8.5	6.5	3.5	9.38
1708	6.0	4.0	6.5	9.5	10.5	14.0	15.0	17.0	15.0	8.5	7.0	3.0	9.67
1709	-1.5	2.0	3.0	9.0	12.0	14.5	15.5	15.5	13.5	10.0	7.5	3.5	8.71
1710	2.5	3.5	6.0	6.5	11.5	14.5	15.0	15.5	13.5	9.5	8.0	7.5	9.46
1711	5.0	2.0	5.5	9.5	11.0	15.5	15.5	15.0	13.0	9.5	7.0	4.0	9.38
1712	3.0	4.5	5.0	7.5	11.0	15.0	16.0	15.0	13.0	9.5	6.0	4.0	9.13
1713	3.0	5.5	4.5	5.5	10.5	13.5	14.0	15.0	14.0	9.5	4.5	4.0	8.63
1714	4.0	5.5	5.0	7.5	10.0	14.5	18.0	15.0	13.0	10.5	6.0	4.0	9.42
1715	4.0	5.0	6.5	9.5	11.0	14.0	15.5	15.0	14.0	10.5	6.5	1.5	9.42
1716	-2.0	3.0	4.5	9.0	10.5	14.0	15.5	15.5	12.5	9.5	5.5	3.0	8.38
1717	4.5	2.5	4.5	7.5	11.0	14.0	15.0	15.5	13.5	9.5	5.5	5.0	9.00
1718	1.5	3.0	5.5	7.5	11.0	14.5	17.0	17.0	14.5	9.5	5.5	4.5	9.25
1719	3.0	4.0	5.0	7.0	11.5	15.0	18.0	17.0	14.0	9.5	6.0	3.5	9.46
1720	4.5	4.0	4.0	7.5	11.0	13.0	16.0	15.0	13.5	9.0	6.0	5.5	9.08
1721	4.0	2.0	3.5	8.5	9.5	14.0	15.5	16.0	14.0	9.0	6.0	4.5	8.88
1722	4.0	5.0	6.0	7.5	10.5	14.0	15.0	15.0	13.5	10.0	7.8	3.9	9.35
1723	1.1	4.4	7.5	8.9	11.7	15.0	15.3	15.6	13.3	11.1	7.5	5.8	9.77
1724	5.6	4.2	4.7	7.2	11.4	15.3	15.0	16.2	14.4	8.6	5.3	3.3	9.27
1725	4.4	3.3	5.0	8.1	10.8	12.2	13.8	13.3	12.8	9.4	6.9	3.9	8.66
1726	1.1	4.2	4.2	8.4	13.4	16.4	16.0	15.6	14.7	10.2	6.1	1.8	9.34
1727	4.2	5.0	5.1	9.2	13.6	14.9	16.9	16.9	14.4	10.8	4.7	3.6	9.94
1728	3.9	2.4	7.1	8.3	12.5	16.4	16.9	16.0	12.8	9.1	7.2	1.6	9.52
1729	1.2	2.3	2.8	7.1	10.3	15.1	16.8	15.7	16.6	10.1	8.1	5.0	9.26
1730	4.1	4.7	6.2	8.7	12.4	14.0	15.3	16.3	15.3	10.9	9.2	3.4	10.04
1731	1.9	2.2	6.0	6.8	12.1	15.6	16.3	16.7	15.3	12.3	7.8	5.2	9.85
1732	2.4	6.4	6.1	8.9	11.4	14.6	16.0	16.6	14.5	10.9	6.3	2.2	9.69
1733	6.9	6.0	5.9	10.0	11.2	15.2	18.3	16.1	12.8	9.1	6.5	7.6	10.47
1734	4.3	6.4	8.1	9.3	11.1	14.1	16.2	16.2	13.3	8.4	6.2	4.0	9.80
1735	4.4	4.0	5.8	8.9	10.9	13.3	14.8	16.2	14.2	10.3	6.3	5.4	9.54



1736	6.4	3.1	6.9	8.6	10.6	15.7	16.4	17.8	14.4	10.4	6.9	6.4	10.30
1737	6.2	4.2	6.1	8.8	12.5	15.9	17.4	13.8	14.2	8.9	6.1	4.9	9.92
1738	4.6	4.6	5.5	9.9	11.4	14.2	16.4	16.0	12.5	10.2	6.3	6.1	9.81
1739	4.0	6.8	5.8	6.7	11.6	15.2	16.0	14.7	13.1	9.6	3.7	3.2	9.20
1740	-2.8	-1.6	3.9	6.4	8.6	12.8	15.3	14.7	14.0	5.3	3.3	2.2	6.84
1741	1.7	4.4	4.2	7.1	9.3	15.2	15.6	16.7	14.7	11.0	7.8	3.9	9.30
1742	1.9	3.6	4.1	6.6	10.6	15.0	15.8	15.8	12.2	9.2	4.4	1.1	8.36
1743	3.6	5.4	5.3	5.4	13.3	15.6	14.9	16.9	14.2	8.9	9.3	4.9	9.81
1744	1.4	2.9	4.8	6.7	10.8	14.4	16.4	15.4	12.8	9.4	6.9	3.5	8.78
1745	3.8	2.3	4.4	7.5	11.4	12.2	16.1	15.0	14.2	10.3	5.8	2.7	8.81
1746	2.5	1.4	3.1	6.9	12.8	14.3	15.8	15.9	14.2	7.8	3.3	5.3	8.61
1747	3.3	5.8	2.5	8.1	12.2	14.7	16.9	18.3	14.4	9.4	6.9	5.3	9.82
1748	2.5	1.8	1.8	6.3	10.4	14.8	15.4	15.8	14.2	9.2	7.1	6.0	8.77
1749	5.3	3.6	5.3	6.8	12.3	11.9	17.2	15.6	13.8	10.1	6.7	4.7	9.44
1750	4.0	6.7	8.2	7.7	10.7	14.2	17.2	15.0	15.2	9.2	4.0	4.2	9.69
1751	4.0	1.5	6.2	7.1	9.3	14.9	15.3	14.6	12.6	8.3	4.3	3.0	8.42
1752	3.2	3.1	5.6	6.8	10.3	14.8	15.6	15.7	13.9	10.6	6.5	4.2	9.19
1753	2.2	3.6	6.0	7.5	12.1	14.6	15.2	15.7	13.1	10.0	4.6	4.4	9.08
1754	3.3	2.8	3.4	6.7	12.2	13.6	14.7	15.7	13.9	10.4	5.7	3.6	8.83
1755	2.2	1.2	3.9	10.0	9.4	15.7	15.0	14.6	13.5	8.4	4.7	3.9	8.54
1756	4.4	4.6	6.0	6.7	9.1	13.8	16.1	14.7	13.6	9.4	3.9	2.9	8.77
1757	0.3	4.0	4.9	8.1	10.7	14.0	18.4	15.2	13.3	8.2	7.1	3.2	8.95
1758	2.6	3.8	5.2	7.2	13.8	14.6	14.2	16.4	11.9	8.1	5.7	3.9	8.95
1759	5.9	5.8	6.1	8.6	12.1	15.0	18.2	16.3	13.5	10.9	5.1	2.5	10.00
1760	1.9	3.8	6.6	9.4	11.7	15.2	16.9	15.8	15.7	9.2	5.7	6.1	9.83
1761	5.4	5.8	6.8	9.4	11.9	14.3	15.8	16.4	14.2	9.4	6.2	4.4	10.00
1762	4.7	4.0	3.7	10.0	12.9	16.9	17.8	15.3	13.6	7.9	4.6	3.6	9.58
1763	-0.8	4.9	5.4	8.9	10.2	14.6	15.3	15.3	13.1	8.3	5.8	6.2	8.93
1764	3.7	3.8	3.9	7.2	12.2	13.9	16.1	15.2	12.5	8.9	4.4	2.8	8.72
1765	4.8	0.4	5.0	7.5	11.4	13.8	15.7	15.3	13.3	9.2	3.9	1.7	8.50
1766	0.7	1.7	4.2	8.1	9.7	13.7	15.7	16.6	13.3	9.3	7.2	3.3	8.63
1767	0.1	5.4	4.7	7.3	10.0	12.8	14.4	16.1	14.1	9.2	6.9	3.3	8.69
1768	0.8	4.8	4.7	8.1	12.2	13.9	15.6	16.0	11.7	9.2	5.6	4.6	8.93
1769	2.5	2.7	5.0	7.8	11.3	13.1	16.4	15.0	12.8	8.2	5.7	4.8	8.77
1770	3.7	4.6	2.5	5.4	10.0	13.1	15.3	15.8	13.9	8.9	5.3	3.6	8.51
1771	1.0	3.2	3.1	5.5	12.2	14.3	15.7	14.3	12.2	9.2	6.3	5.6	8.55
1772	1.2	1.9	4.4	6.4	10.1	16.1	16.9	16.1	13.0	11.7	7.2	4.8	9.15
1773	4.0	2.6	6.5	8.3	10.3	14.7	15.9	17.2	12.4	9.9	5.3	3.8	9.24
1774	0.6	4.3	6.4	8.6	10.9	14.7	16.1	16.1	12.5	10.3	4.8	3.5	9.07
1775	4.6	6.1	6.0	9.8	12.6	16.6	16.7	15.8	14.3	9.3	4.8	4.5	10.09
1776	-1.6	3.8	6.4	9.4	10.8	14.1	16.3	15.2	12.9	10.2	6.2	4.4	9.01
1777	1.9	2.3	6.8	7.2	11.7	13.6	15.3	15.9	14.6	10.2	6.9	2.6	9.08
1778	1.9	3.2	4.6	8.2	10.6	15.4	17.3	16.8	12.2	7.4	6.7	6.1	9.20
1779	2.9	7.9	7.9	9.4	11.9	14.4	17.9	17.6	15.2	10.9	5.7	3.1	10.40
1780	-0.9	2.1	7.9	6.3	12.8	14.2	16.8	17.6	15.6	9.1	4.4	3.2	9.09
1781	2.1	4.8	6.6	9.2	12.1	16.2	17.4	17.3	14.2	10.6	6.5	5.4	10.20
1782	5.2	1.9	4.1	5.2	9.0	14.9	15.6	14.2	13.3	7.6	2.3	2.8	8.01
1783	3.4	3.3	3.3	10.1	10.4	14.8	18.8	15.8	12.8	9.8	6.2	2.7	9.28
1784	-0.6	1.4	2.7	5.7	13.5	13.7	15.2	14.0	14.8	7.8	5.5	0.3	7.83
1785	3.4	0.4	1.2	8.4	12.3	16.1	16.1	13.9	13.6	8.7	5.6	2.8	8.54
1786	2.7	3.4	2.1	8.1	11.2	16.1	15.0	15.1	11.7	7.5	3.3	2.8	8.25
1787	3.6	5.9	6.8	7.4	11.5	13.9	15.8	15.6	12.8	9.8	4.5	3.8	9.28
1788	3.9	3.8	3.6	9.4	13.8	15.4	15.8	15.8	13.4	9.8	6.1	-0.3	9.21
1789	1.5	5.0	2.1	7.4	12.5	14.0	15.4	16.6	13.1	8.6	4.6	6.1	8.91
1790	4.3	6.6	6.4	6.1	11.9	14.6	14.9	15.6	12.2	10.3	6.1	4.3	9.44
1791	4.3	4.7	6.5	9.6	10.6	14.7	15.3	15.9	13.8	8.9	5.9	1.1	9.27
1792	2.3	4.5	5.9	10.0	10.2	13.2	15.3	16.9	11.8	8.8	7.1	4.3	9.19
1793	2.8	4.6	4.2	6.2	10.9	13.5	17.6	15.0	11.7	11.3	6.0	5.3	9.09
1794	1.8	7.2	7.0	10.2	11.3	15.7	18.1	15.5	12.5	9.6	6.1	3.7	9.89
1795	-3.1	0.8	3.9	7.7	10.9	13.2	15.2	16.6	16.0	11.7	4.5	6.6	8.67
1796	7.3	4.7	4.2	10.2	10.3	13.9	14.7	15.9	14.6	8.1	4.6	-0.3	9.02
1797	3.5	4.6	4.3	7.4	11.3	13.6	17.3	15.8	12.5	8.2	4.7	4.8	9.00
1798	3.6	4.0	5.1	10.4	12.9	16.9	16.3	16.4	13.6	9.9	4.7	1.5	9.61
1799	1.7	2.8	3.4	5.4	9.6	14.1	15.2	14.4	12.9	8.3	5.6	1.3	7.89
1800	2.8	2.2	4.0	9.3	12.3	13.9	17.7	16.8	13.9	9.2	5.4	3.3	9.23
1801	4.6	4.8	6.7	8.3	12.1	14.8	16.1	17.1	14.2	10.2	4.8	1.5	9.60
1802	1.6	3.7	5.6	8.9	10.6	13.7	13.5	17.2	13.8	10.1	5.1	3.6	8.95
1803	1.8	3.4	6.3	9.1	10.5	13.7	17.6	16.1	11.4	9.3	5.0	4.4	9.05
1804	5.8	2.9	4.7	6.9	13.3	16.1	15.9	15.6	14.2	10.7	6.6	2.1	9.57
1805	2.1	4.1	6.2	8.3	10.2	13.2	16.0	16.4	14.6	8.2	4.8	3.6	8.97
1806	4.2	4.3	5.1	6.8	12.1	14.9	15.4	16.2	13.4	10.6	7.8	6.8	9.80
1807	2.8	3.7	2.9	7.7	11.8	14.2	17.1	16.9	10.5	11.4	2.9	1.9	8.65
1808	2.6	2.8	3.2	5.8	13.7	14.8	18.4	16.7	12.7	7.2	6.0	2.2	8.84
1809	2.0	5.7	6.0	5.2	13.1	13.7	15.1	14.8	12.7	10.2	4.6	4.1	8.93
1810	2.2	3.5	4.9	8.2	9.2	14.6	15.2	14.6	13.9	9.8	5.4	3.6	8.76
1811	1.2	4.6	7.1	8.9	12.8	14.1	16.1	14.4	13.7	12.3	7.7	3.1	9.67
1812	2.6	5.3	3.5	5.5	10.9	13.0	14.2	14.3	13.2	9.3	4.9	1.7	8.20
1813	1.9	5.8	6.8	7.6	11.6	13.6	15.0	14.5	12.5	8.1	4.3	2.8	8.71
1814	-2.9	1.4	2.9	9.6	9.2	12.2	16.0	14.7	12.8	8.1	4.7	4.3	7.75
1815	0.3	6.5	7.3	8.1	12.6	14.3	14.9	15.3	13.4	10.3	3.4	2.3	9.06
1816	2.7	2.1	3.9	6.6	9.9	12.8	13.4	13.9	11.8	10.3	3.9	3.1	7.87
1817	4.5	6.4	5.5	7.6	8.7	15.1	14.1	13.6	13.2	6.4	9.1	2.5	8.89
1818	4.4	2.7	4.5	6.9	11.3	16.4	18.2	15.3	13.3	12.0	9.5	3.6	9.84
1819	4.4	4.3	6.8	8.6	11.5	13.4	16.4	17.4	13.4	9.1	4.1	1.4	9.23



1820	-0.3	3.2	4.7	8.9	11.4	13.6	15.7	14.7	12.3	8.1	5.6	4.7	8.55
1821	3.6	2.1	5.7	9.5	9.4	12.3	14.8	16.4	14.9	10.4	8.6	6.4	9.51
1822	4.7	6.3	7.8	8.3	12.7	17.1	15.6	15.2	12.4	10.7	8.2	1.6	10.05
1823	-0.1	3.1	5.0	6.7	12.2	12.3	14.1	14.4	12.5	8.4	7.1	4.8	8.38
1824	4.3	4.7	4.6	7.4	10.7	13.4	16.0	15.1	13.7	9.5	7.2	5.1	9.31
1825	3.8	3.9	5.0	9.1	11.6	14.1	17.2	16.3	15.1	10.8	5.2	4.6	9.72
1826	0.4	6.4	6.3	8.8	11.2	17.3	17.9	17.6	13.6	11.1	4.4	5.8	10.07
1827	1.7	0.7	5.9	8.9	11.9	14.2	16.5	14.8	13.7	11.4	6.9	6.9	9.46
1828	5.1	5.2	6.6	8.3	12.4	15.4	16.0	15.3	14.3	10.2	7.4	7.4	10.30
1829	0.3	4.3	4.3	6.7	12.5	14.9	15.1	14.3	11.3	8.3	4.5	1.4	8.16
1830	-0.2	2.2	7.7	8.9	12.0	12.7	16.2	13.7	11.9	10.4	6.9	1.8	8.68
1831	1.6	4.8	7.2	9.2	11.5	15.4	16.7	16.9	13.7	12.7	5.6	5.8	10.09
1832	3.1	3.4	5.8	8.6	10.9	15.2	15.9	15.4	13.6	10.7	5.9	5.2	9.47
1833	1.2	5.6	3.9	7.7	15.1	14.6	15.8	14.3	12.1	10.1	6.6	6.9	9.49
1834	7.1	5.6	7.1	7.7	13.0	15.4	16.9	16.2	13.8	10.6	6.7	5.6	10.47
1835	2.9	5.7	5.8	8.6	11.3	15.0	16.4	16.9	13.4	8.9	6.6	3.1	9.55
1836	3.7	3.5	5.8	7.2	11.1	15.3	15.4	14.6	11.7	8.6	5.3	4.1	8.86
1837	2.7	4.7	2.3	4.7	9.9	15.5	16.9	15.7	12.5	10.5	5.2	5.3	8.82
1838	-1.5	0.4	4.9	6.1	10.5	14.4	15.6	15.1	12.7	9.8	4.6	4.0	8.05
1839	2.8	4.1	4.2	6.4	10.2	14.3	14.9	14.6	12.4	9.3	7.3	3.7	8.68
1840	4.1	3.6	3.8	9.7	11.4	14.1	13.8	15.9	11.1	7.5	5.8	1.3	8.51
1841	1.1	2.4	7.5	7.8	12.7	12.9	13.8	14.6	13.4	8.7	5.2	4.4	8.71
1842	0.6	4.2	6.4	7.8	11.4	15.6	14.5	17.1	13.2	7.2	5.5	7.2	9.22
1843	4.0	1.9	5.6	8.5	10.4	12.8	14.8	15.3	14.4	7.9	5.7	7.4	9.06
1844	3.8	1.6	4.7	9.8	10.8	14.7	15.4	13.5	13.3	9.2	5.9	0.4	8.59
1845	3.2	0.9	2.0	8.6	9.5	14.9	14.3	13.5	11.4	9.5	6.7	4.6	8.26
1846	6.3	6.4	6.1	7.8	12.3	18.2	16.5	16.6	14.7	9.5	6.9	0.5	10.15
1847	2.2	2.4	5.6	6.6	12.3	13.9	17.5	15.2	11.5	10.7	7.9	4.8	9.22
1848	1.3	6.1	5.9	8.2	13.9	14.5	15.6	13.6	12.8	9.7	5.8	5.6	9.42
1849	3.9	5.7	6.1	6.4	12.1	13.9	15.4	15.6	13.3	9.2	6.6	3.4	9.30
1850	0.7	6.4	4.7	9.0	10.1	15.4	16.2	14.5	12.3	7.9	7.4	4.6	9.10
1851	5.6	4.7	5.8	7.4	10.4	14.3	14.6	15.5	12.7	10.8	3.1	4.8	9.14
1852	4.9	4.7	5.2	8.2	10.6	13.2	18.7	15.8	12.9	7.8	7.9	7.7	9.80
1853	5.1	0.6	3.4	7.6	10.9	14.3	14.9	14.7	12.3	10.1	5.2	1.3	8.37
1854	3.6	4.3	6.7	9.2	10.3	13.2	15.4	15.2	14.4	9.4	4.9	5.1	9.31
1855	2.4	-1.7	3.3	7.1	8.8	13.3	16.8	15.7	13.2	9.7	5.3	2.4	8.02
1856	3.7	5.3	4.4	8.1	9.4	13.5	15.3	16.9	12.5	10.7	4.8	4.4	9.08
1857	2.6	4.3	5.3	7.5	11.3	15.8	16.4	17.4	14.5	11.3	7.2	7.3	10.07
1858	3.4	1.8	4.9	7.7	10.8	16.8	14.8	15.8	14.7	9.6	4.3	4.8	9.12
1859	4.9	5.7	7.3	7.5	11.7	14.8	18.3	16.2	12.9	9.6	4.8	1.6	9.61
1860	3.5	1.7	4.7	5.9	11.5	12.3	14.5	13.6	11.2	9.8	4.5	1.5	7.89
1861	1.7	4.9	6.3	7.5	10.4	14.8	15.0	15.9	13.1	11.8	4.2	3.9	9.13
1862	3.9	5.1	5.5	8.8	12.3	12.7	14.2	14.6	13.0	10.3	3.2	6.5	9.17
1863	4.9	5.8	6.5	8.8	10.6	13.6	15.2	15.5	11.6	9.9	7.3	6.3	9.67
1864	2.4	2.3	4.7	8.8	12.4	13.6	15.5	14.2	13.3	9.8	5.5	3.7	8.85
1865	2.1	2.3	2.9	10.6	12.6	15.6	16.6	15.1	16.3	9.7	6.7	5.8	9.69
1866	5.8	4.4	4.8	8.6	10.0	15.5	15.5	14.7	12.8	10.7	6.9	6.1	9.65
1867	1.2	6.9	3.1	9.3	11.4	14.1	14.9	16.3	13.6	9.3	4.8	3.4	9.02
1868	3.9	6.3	6.8	8.7	13.5	15.5	18.3	16.8	14.3	8.4	4.9	7.2	10.38
1869	5.6	7.5	3.8	10.1	9.6	13.2	17.3	15.5	14.4	9.7	5.8	2.9	9.62
1870	3.3	2.8	4.7	9.2	11.7	15.2	17.5	15.7	12.9	9.5	4.7	0.6	8.98
1871	0.5	6.1	7.3	8.7	11.3	12.8	15.2	17.2	12.7	9.8	3.4	3.6	9.05
1872	5.0	6.9	6.8	8.2	9.7	14.1	17.1	15.3	13.2	8.4	7.0	5.3	9.75
1873	5.2	1.8	5.4	7.7	9.9	14.2	16.2	15.4	11.8	8.6	6.3	5.3	8.98
1874	5.5	3.9	6.7	9.8	10.0	13.9	17.3	15.1	13.6	10.4	5.6	-0.2	9.30
1875	6.4	2.3	5.1	8.6	12.3	14.2	14.8	16.1	14.9	8.9	5.4	4.2	9.43
1876	3.2	4.8	4.5	7.9	9.6	14.3	17.2	16.5	12.7	11.3	6.1	6.0	9.51
1877	5.5	6.2	4.9	7.0	9.1	15.2	14.7	15.2	11.2	9.3	7.1	4.7	9.17
1878	4.6	5.6	5.4	8.9	11.8	15.1	16.6	16.2	13.3	10.2	3.5	-0.3	9.24
1879	-0.7	3.1	4.7	5.7	8.9	12.9	13.6	14.5	12.6	8.9	4.1	0.7	7.42
1880	0.9	5.8	6.2	7.9	10.4	13.8	15.5	16.4	14.6	7.1	5.4	5.1	9.09
1881	-1.5	3.2	5.3	7.3	11.8	13.7	16.2	13.9	12.7	7.3	8.9	3.9	8.56
1882	5.2	6.1	7.4	8.4	11.5	13.1	15.2	14.9	12.1	9.9	5.7	3.9	9.45
1883	4.7	5.9	1.9	8.1	10.6	13.9	14.5	15.3	13.3	9.7	5.8	4.6	9.02
1884	6.5	5.3	6.5	7.2	11.3	14.1	16.3	17.2	14.5	9.4	5.3	4.4	9.83
1885	2.9	5.8	4.5	7.7	8.9	13.9	16.3	13.6	12.2	7.5	5.9	3.7	8.57
1886	2.1	1.5	4.2	7.6	10.3	13.6	15.9	15.8	13.6	11.3	6.6	1.9	8.70
1887	2.4	3.8	3.3	6.2	9.4	15.3	17.3	15.7	11.8	7.1	4.4	2.6	8.27
1888	3.2	1.8	3.1	6.2	10.7	13.2	13.7	14.1	12.2	7.9	7.7	4.9	8.22
1889	3.4	2.9	4.7	7.1	12.9	15.3	15.3	14.7	12.8	8.6	6.9	3.3	8.99
1890	5.7	3.1	6.2	7.1	11.7	13.5	14.5	14.1	14.6	9.4	5.7	-0.8	8.73
1891	1.3	3.9	3.8	6.2	9.5	14.7	15.1	14.1	14.2	9.4	5.6	4.1	8.49
1892	2.3	3.6	2.7	7.3	11.6	13.4	14.3	15.2	12.4	7.1	6.4	1.8	8.17
1893	2.2	4.7	7.2	10.3	13.1	15.6	16.4	17.4	12.9	9.9	5.2	4.8	9.97
1894	3.4	5.1	6.7	9.7	9.2	13.5	15.9	14.2	11.6	9.3	7.9	5.1	9.30
1895	0.2	-1.8	5.1	8.2	12.4	14.8	15.2	15.8	15.4	7.1	7.5	3.9	8.65
1896	4.8	4.6	6.7	9.1	11.9	16.2	16.2	14.3	13.1	6.9	4.3	3.9	9.33
1897	1.6	5.8	6.5	7.1	10.0	15.1	16.5	16.2	12.1	9.9	7.6	4.7	9.42
1898	6.6	4.8	4.3	8.5	10.2	13.6	15.3	16.5	15.2	11.3	7.2	7.3	10.07
1899	4.9	5.1	5.1	7.8	9.9	15.7	17.3	17.8	13.2	8.8	8.5	2.2	9.69
1900	4.4	2.6	3.7	8.3	10.3	14.7	17.7	15.1	13.6	9.8	7.3	7.2	9.56
1901	3.5	2.3	4.1	8.6	11.5	13.9	18.0	15.6	13.9	9.7	4.8	3.4	9.11
1902	4.7	1.5	6.7	7.5	8.9	13.9	14.7	14.3	12.8	9.6	6.8	4.6	8.83
1903	4.2	7.1	7.1	6.4	11.1	13.0	15.3	14.3	13.1	10.5	6.4	3.3	9.32



1904	4.1	3.4	4.3	8.7	10.9	13.3	17.1	15.1	12.5	9.7	5.2	3.7	9.00
1905	3.6	5.2	6.8	7.3	10.8	14.7	17.2	14.7	12.4	7.1	4.9	4.9	9.13
1906	5.3	3.1	5.1	7.3	10.5	14.3	15.8	16.7	13.9	10.9	7.3	3.0	9.43
1907	3.6	2.8	6.3	7.6	10.5	12.4	14.1	14.3	13.6	9.8	6.5	4.6	8.84
1908	2.5	5.3	4.3	6.0	12.4	14.3	15.8	14.6	12.9	11.8	7.4	3.9	9.27
1909	3.5	2.9	3.7	8.7	11.0	11.8	14.6	15.4	11.9	10.4	4.8	3.9	8.55
1910	3.5	5.1	6.1	7.3	11.2	14.7	14.2	15.2	12.5	10.6	3.2	6.4	9.17
1911	3.8	4.8	5.2	7.5	12.9	14.5	18.2	18.2	13.9	9.3	6.1	6.2	10.05
1912	3.6	5.4	7.2	8.8	12.1	13.9	16.1	12.9	11.1	8.2	6.3	6.7	9.36
1913	4.5	4.8	6.2	8.1	11.4	14.3	14.6	15.2	14.1	10.9	8.4	5.1	9.80
1914	3.7	6.8	6.1	9.8	10.8	14.5	15.8	16.1	13.3	10.3	6.8	4.6	9.88
1915	4.1	4.3	5.2	7.9	10.8	14.4	14.6	15.3	13.4	9.1	2.8	5.3	8.93
1916	7.5	3.8	3.3	8.2	11.6	11.8	15.3	16.4	13.0	10.6	6.8	1.9	9.18
1917	1.6	0.9	3.2	5.4	12.8	15.2	16.1	15.3	14.0	7.5	7.8	2.3	8.51
1918	3.8	6.5	5.7	6.7	13.0	13.3	15.4	16.1	11.9	9.3	5.5	6.9	9.51
1919	2.9	1.9	3.6	7.1	13.5	14.3	13.9	15.7	12.7	7.4	3.3	5.5	8.48
1920	5.2	6.0	7.2	8.2	11.8	14.4	14.1	13.6	13.0	10.4	6.8	4.2	9.57
1921	7.3	4.8	7.4	8.0	11.5	14.7	18.5	15.4	14.1	12.8	4.6	6.5	10.47
1922	3.7	4.4	4.6	5.5	12.7	13.8	13.7	13.6	12.2	8.2	5.9	5.8	8.67
1923	5.6	5.6	6.5	7.6	9.2	12.5	17.5	15.2	12.5	9.7	3.3	3.8	9.08
1924	4.7	3.3	4.1	6.9	11.6	13.9	15.3	14.1	13.3	10.1	7.1	6.8	9.27
1925	5.3	5.2	4.9	7.5	11.6	15.0	16.8	15.4	11.5	10.4	3.6	2.8	9.17
1926	4.6	6.8	6.3	9.3	10.2	13.6	17.1	16.2	14.4	8.1	5.9	4.2	9.72
1927	4.6	3.9	7.3	7.9	11.2	12.6	15.9	15.7	12.5	10.5	6.2	2.1	9.20
1928	5.2	5.8	6.3	8.5	10.9	12.9	16.1	15.3	12.8	10.1	7.6	3.4	9.57
1929	1.3	0.4	6.2	6.8	11.3	13.3	16.0	15.4	15.3	9.6	6.7	5.8	9.01
1930	5.6	2.5	5.3	8.3	10.7	15.3	15.2	15.7	13.6	10.5	6.2	4.3	9.43
1931	3.2	3.9	4.2	7.7	11.4	14.4	15.3	14.4	11.5	8.8	7.8	5.3	8.99
1932	6.3	2.9	4.7	6.9	10.5	14.1	16.1	17.1	12.9	8.8	6.6	5.7	9.38
1933	2.2	4.3	7.3	8.8	12.2	15.6	17.8	17.6	14.9	10.1	5.6	1.6	9.83
1934	4.1	3.8	4.8	8.0	11.3	14.9	18.2	15.4	14.6	10.6	6.1	8.1	9.99
1935	4.5	5.8	6.6	8.2	9.9	15.1	17.1	16.6	13.6	9.5	6.9	2.8	9.72
1936	3.7	2.6	7.1	6.3	11.5	14.7	15.3	16.1	14.4	9.4	5.5	5.3	9.32
1937	5.2	5.6	3.6	9.2	12.2	14.1	16.1	16.9	13.4	10.4	5.1	3.0	9.57
1938	5.7	5.1	9.1	7.6	10.7	14.4	15.2	16.3	13.8	10.5	9.4	4.4	10.18
1939	4.2	5.6	5.8	8.8	11.4	14.2	15.5	16.4	14.2	8.2	8.7	3.2	9.68
1940	-1.4	2.6	6.0	8.7	12.5	16.4	15.1	15.6	12.8	9.6	6.9	3.8	9.05
1941	0.5	3.5	5.1	6.4	9.4	15.1	17.3	14.7	14.5	10.4	6.6	5.6	9.09
1942	0.9	0.1	5.2	9.2	11.1	14.4	15.5	16.6	13.6	10.4	4.9	6.7	9.05
1943	4.9	6.1	6.5	10.5	11.8	14.4	16.4	16.1	13.3	10.6	6.3	3.5	10.03
1944	5.8	3.6	5.2	10.2	11.4	13.5	16.5	17.0	12.5	9.3	6.2	3.6	9.57
1945	0.4	7.1	7.9	10.1	12.2	14.6	16.7	15.9	14.4	11.9	7.2	4.9	10.27
1946	2.7	5.9	5.1	9.9	10.7	13.1	16.3	14.7	14.0	9.8	8.1	3.1	9.45
1947	2.2	-1.9	3.6	8.6	13.5	15.5	17.0	18.6	14.9	10.6	7.2	5.1	9.57
1948	5.4	4.7	8.3	9.0	11.4	13.5	15.8	15.1	13.8	10.1	7.3	5.7	10.01
1949	5.5	5.7	5.1	10.0	11.2	15.3	17.4	16.8	16.3	11.7	6.6	5.8	10.62
1950	4.2	5.3	7.4	7.6	11.3	16.2	15.9	15.6	12.9	9.6	5.7	1.2	9.41
1951	3.9	3.7	4.1	6.8	10.1	14.0	16.3	14.8	14.1	9.4	8.5	5.5	9.27
1952	2.7	3.4	6.6	9.6	13.4	14.4	16.8	15.8	10.7	8.8	4.2	2.8	9.10
1953	3.3	4.3	5.6	7.3	12.6	14.4	15.5	16.2	13.8	9.7	8.5	6.9	9.84
1954	2.9	2.6	5.8	7.6	11.2	13.4	14.2	14.6	12.7	11.9	6.9	6.8	9.22
1955	2.6	1.2	3.2	9.3	9.7	13.8	17.7	18.1	14.2	9.2	7.0	5.4	9.28
1956	3.6	-0.2	6.2	6.9	11.7	13.1	15.8	13.5	14.3	9.4	6.0	5.7	8.83
1957	5.5	5.3	9.2	8.9	10.3	15.2	16.3	15.4	12.5	10.8	6.4	4.5	10.02
1958	3.4	4.7	3.7	7.4	11.1	14.1	15.9	15.8	15.1	10.8	6.4	4.7	9.42
1959	1.6	4.4	7.3	9.4	12.8	15.2	17.3	17.2	14.9	12.6	7.1	6.0	10.48
1960	3.8	4.1	6.4	8.9	12.8	16.1	15.1	15.0	13.1	10.3	7.3	3.9	9.73
1961	3.9	6.9	8.2	10.0	11.0	14.4	15.2	15.4	15.2	10.9	6.0	2.2	9.94
1962	4.3	4.4	2.8	7.7	10.3	13.7	15.1	14.5	12.6	10.4	5.5	1.8	8.59
1963	-2.1	-0.7	6.0	8.7	10.6	14.9	15.2	14.3	12.9	11.1	8.2	2.6	8.47
1964	3.4	4.5	4.3	8.7	13.3	13.8	16.1	15.5	14.1	8.9	7.4	3.6	9.47
1965	3.3	3.1	5.2	8.0	11.7	14.7	14.0	14.9	12.3	11.0	4.5	4.7	8.95
1966	2.9	5.7	6.5	7.2	11.0	15.4	15.0	14.7	13.8	10.1	5.6	5.5	9.45
1967	4.5	5.4	7.0	7.7	10.4	14.0	16.7	15.7	13.5	10.8	5.4	4.2	9.61
1968	4.4	1.9	6.3	8.1	9.8	14.8	15.0	15.4	13.9	12.5	6.5	3.0	9.30
1969	5.5	1.0	3.3	7.4	11.2	13.9	16.8	16.4	13.9	13.0	5.4	3.3	9.26
1970	3.7	2.9	3.7	6.7	13.0	16.4	15.2	16.0	14.4	10.7	7.8	4.3	9.57
1971	4.5	4.5	4.9	7.9	11.6	12.4	16.9	15.6	14.0	11.3	6.0	6.6	9.68
1972	3.9	4.3	6.5	8.2	10.5	11.8	15.6	15.1	11.7	10.6	6.3	5.8	9.19
1973	4.5	4.3	6.2	7.0	11.4	14.8	15.6	16.5	14.3	9.0	6.0	4.9	9.54
1974	5.9	5.4	5.8	8.2	11.0	13.9	15.2	15.2	12.1	7.8	6.8	8.1	9.62
1975	6.8	4.4	4.8	8.3	9.9	14.7	17.4	18.7	13.5	9.9	6.3	5.3	10.00
1976	5.9	4.5	4.8	8.1	12.1	17.0	18.7	17.6	13.4	10.6	6.3	2.0	10.08
1977	2.8	5.2	6.9	7.2	10.6	12.2	15.9	15.2	13.3	11.8	6.6	6.1	9.48
1978	3.4	2.8	6.7	6.5	11.7	13.7	14.8	15.0	14.2	11.9	8.5	3.9	9.42
1979	-0.4	1.2	4.7	7.8	10.0	13.9	16.2	14.9	13.5	11.3	6.8	5.8	8.81
1980	2.3	5.7	4.7	8.8	11.2	13.8	14.7	15.9	14.7	9.0	6.6	5.6	9.42
1981	4.9	3.0	7.9	7.8	11.2	13.2	15.5	16.2	14.5	8.6	7.8	0.3	9.24
1982	2.6	4.8	6.1	8.6	11.6	15.5	16.5	15.7	14.2	10.1	8.0	4.4	9.84
1983	6.7	1.7	6.4	6.8	10.3	14.4	19.5	17.3	13.7	10.5	7.5	5.6	10.03
1984	3.8	3.3	4.7	8.1	9.9	14.5	16.9	17.6	13.7	11.1	8.0	5.2	9.73
1985	0.8	2.1	4.7	8.3	10.9	12.7	16.2	14.6	14.6	11.0	4.1	6.3	8.86
1986	3.5	-1.1	4.9	5.8	11.1	14.8	15.9	13.7	11.3	11.0	7.8	6.2	8.74
1987	0.8	3.6	4.1	10.3	10.1	12.8	15.9	15.6	13.6	9.7	6.5	5.6	9.05



1988	5.3	4.9	6.4	8.2	11.9	14.4	14.7	15.2	13.2	10.4	5.2	7.5	9.77
1989	6.1	5.9	7.5	6.6	13.0	14.6	18.2	16.6	14.7	11.7	6.2	4.9	10.50
1990	6.5	7.3	8.3	8.0	12.6	13.6	16.9	18.0	13.2	11.9	6.9	4.3	10.63
1991	3.3	1.5	7.9	7.9	10.8	12.1	17.3	17.1	14.7	10.2	6.8	4.7	9.52
1992	3.7	5.4	7.5	8.7	13.6	15.7	16.2	15.3	13.4	7.8	7.4	3.6	9.86
1993	5.9	4.6	6.7	9.5	11.4	15.0	15.2	14.6	12.4	8.5	4.6	5.5	9.49
1994	5.3	3.2	7.7	8.1	10.7	14.5	18.0	16.0	12.7	10.2	10.1	6.4	10.24
1995	4.8	6.5	5.6	9.1	11.6	14.3	18.6	19.2	13.7	12.9	7.7	2.3	10.52
1996	4.3	2.5	4.5	8.5	9.1	14.4	16.5	16.5	13.6	11.7	5.9	2.9	9.20
1997	2.5	6.7	8.4	9.0	11.5	14.1	16.7	18.9	14.2	10.2	8.4	5.8	10.53
1998	5.2	7.3	7.9	7.7	13.1	14.2	15.5	15.9	14.9	10.6	6.2	5.5	10.34
1999	5.5	5.3	7.4	9.4	12.9	13.9	17.7	16.1	15.6	10.7	7.9	5.0	10.63
2000	4.9	6.3	7.6	7.8	12.1	15.1	15.5	16.6	14.7	10.3	7.0	5.8	10.30
2001	3.2	4.4	5.2	7.7	12.6	14.3	17.2	16.8	13.4	13.3	7.5	3.6	9.93
2002	5.5	7.0	7.6	9.3	11.8	14.4	16.0	17.0	14.4	10.1	8.5	5.7	10.60
2003	4.5	3.9	7.5	9.6	12.1	16.1	17.6	18.3	14.3	9.2	8.1	4.8	10.50
2004	5.2	5.4	6.5	9.4	12.1	15.3	15.8	17.6	14.9	10.5	7.7	5.4	10.48
2005	6.0	4.3	7.2	8.9	11.4	15.5	16.9	16.2	15.2	13.1	6.2	4.4	10.44
2006	4.3	3.7	4.9	8.6	12.3	15.9	19.7	16.1	16.8	-99.9	-99.9	-99.9	-99.99

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Student Challenge 1

Is the UK really getting warmer?



GEOGRAPHY KS2

CLIMATE LAB

Introduction: Is the UK really getting warmer?

Everyone seems to think the UK is getting warmer. When we have a long hot summer or a mild winter, people say, 'it must be global warming!'

But is it? This challenge asks you to use different kinds of data to draw your own conclusions about climate change.

The first is a qualitative investigation. This means collecting data which is not numerical. In this case, we are asking you to interview two much older relatives or family friends about climate change.

Here are the questions we'd like you to ask:

- Do you think there is more or less snow in wintertime now than two decades ago?
- How about 40 years ago? Do you think we get 'proper winters' now, in comparison to 40 years ago?
- Do you think that the summers are hotter now than they were two decades ago?
- How about 40 years ago?
- Do you think there is more rain now than there was two decades ago? How about 40 years ago?
- Do you think the UK is getting warmer? If so, why?
- Are you worried about global warming? If you are worried, what makes you feel this way?

The second investigation is a quantitative investigation. It asks you to compare data you collect about the weather over a month with data from the Met Office.

How the challenge works:

Spend one month noting down the daily temperature and precipitation in the chart provided. Your teacher will help you.

At the end of the month, work out the mean temperature for the month and the total precipitation and write it on the chart.

In the boxes provided, put in the mean temperature for the same month 5 years ago, 10 years ago, 15 years ago, 20 years ago, 25, 30, 35 etc... until 100 years ago. Your teacher will provide you with the data. Then, in the boxes, put the total rainfall for the same month 5 years ago, 10 years ago, 15 years ago, 20 years ago, 25, 30, 35 etc... until 100 years ago. Your teacher will provide you with the data.

What will this help us find out?

By comparing data over a long period of time, we can see whether the same month has got hotter or wetter over 100 years. Climate change scientists say their data shows that the planet is warming up and that the climate in some parts of the UK is getting wetter. Does your data suggest the same?

At the end of the challenge, compare your qualitative investigation with the findings of your quantitative investigation. Is the UK warming up, or are people just believing everything they see on TV?

Student Challenge 1

Is the UK really getting warmer?



GEOGRAPHY KS2

CLIMATE LAB

Precipitation

This month	Rainfall
Current year	mm
5 years ago	mm
10 years ago	mm
15 years ago	mm
20 years ago	mm
25 years ago	mm
30 years ago	mm
35 years ago	mm
40 years ago	mm
45 years ago	mm
50 years ago	mm
55 years ago	mm
60 years ago	mm
65 years ago	mm
70 years ago	mm
75 years ago	mm
80 years ago	mm
85 years ago	mm
90 years ago	mm
95 years ago	mm
100 years ago	mm

Chosen month: _____

Using the data provided from your teacher, write in the boxes the total rainfall for the same month 5 years ago, 10 years ago, 15 years ago, 20 years ago, 25, 30, 35 etc... until 100 years ago.

What does your data suggest?

Student Challenge 1

Is the UK really getting warmer?



GEOGRAPHY KS2

CLIMATE LAB

Temperature

This month	Temperature
Current year	°C
5 years ago	°C
10 years ago	°C
15 years ago	°C
20 years ago	°C
25 years ago	°C
30 years ago	°C
35 years ago	°C
40 years ago	°C
45 years ago	°C
50 years ago	°C
55 years ago	°C
60 years ago	°C
65 years ago	°C
70 years ago	°C
75 years ago	°C
80 years ago	°C
85 years ago	°C
90 years ago	°C
95 years ago	°C
100 years ago	°C

Chosen month: _____

Using the data provided from your teacher, write in the boxes the average temperature for the same month 5 years ago, 10 years ago, 15 years ago, 20 years ago, 25, 30, 35 etc... until 100 years ago.

What does your data suggest?