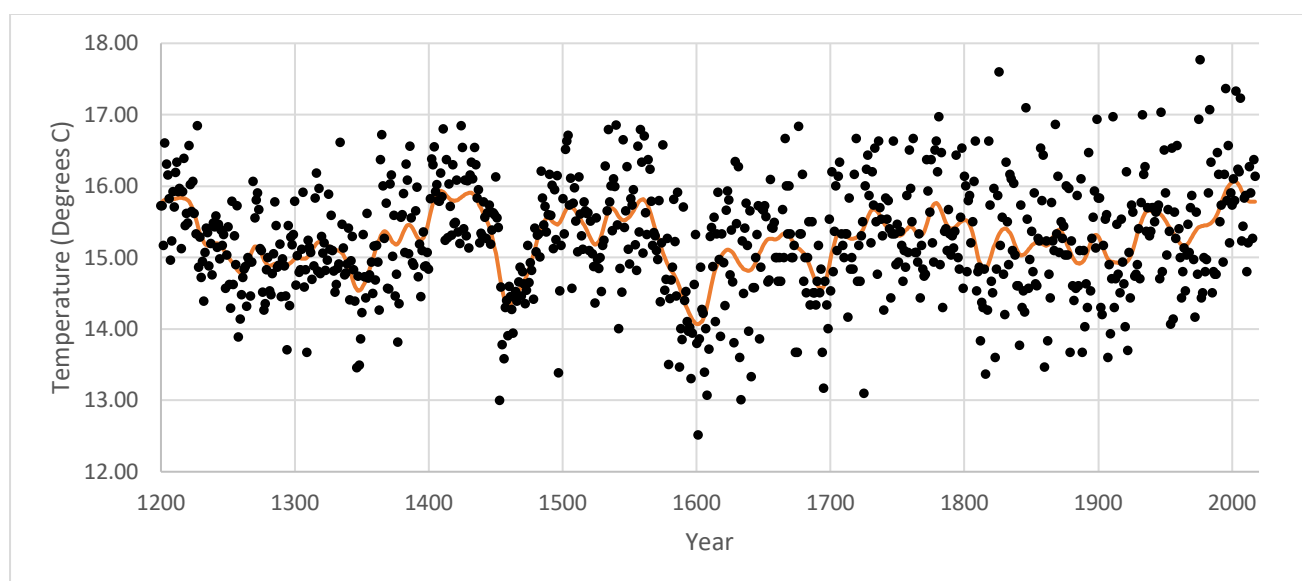


## Climate Change – Sun, Volcanoes and People

This resource is taken from a more general resource on solar, volcanic and anthropogenic climate change which can be found at <http://www.metlink.org/secondary/using-tree-rings-for-past-weather-and-climate/>

### Learning Objectives:

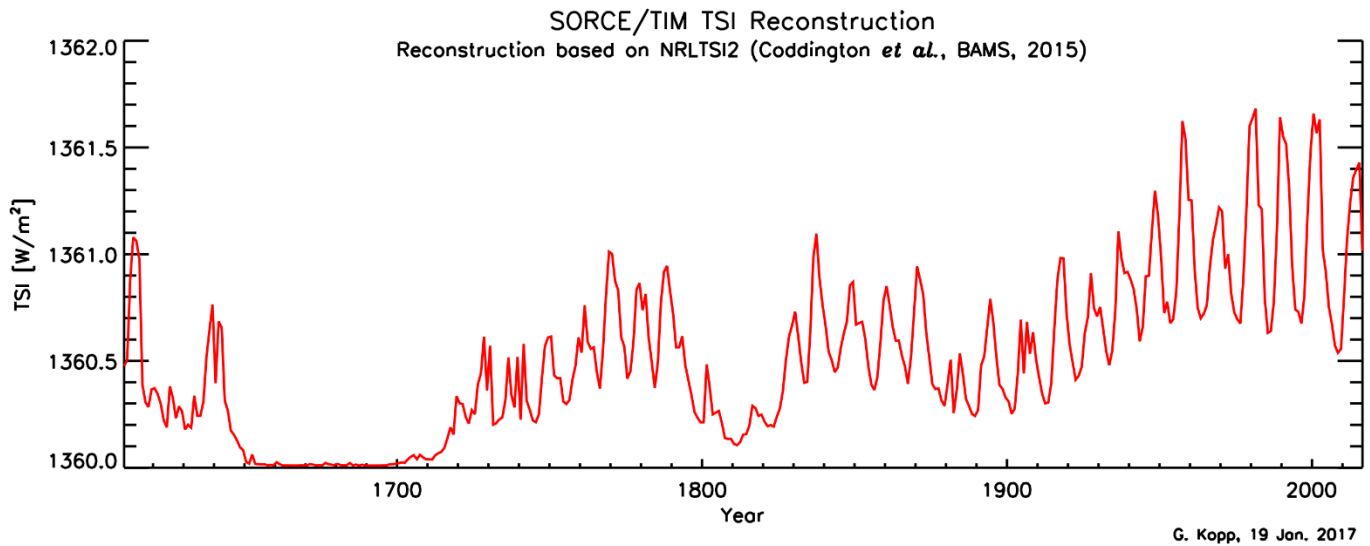
- The difference between weather and climate.
- The weather and climate are continuously changing.
- There have been colder and warmer periods in the past.
- The Sun, volcanoes and greenhouse gases have contributed to the LIA
- Data skills – interpreting line graphs and figures.
- Critical thinking.



*This graph shows summer temperatures in England from 1200 to 2017. This data came from tree rings. The black dots show the 'weather' – the average summer temperature for each year, whereas the orange line shows the 'climate' – the summer weather averaged over 30 years.*

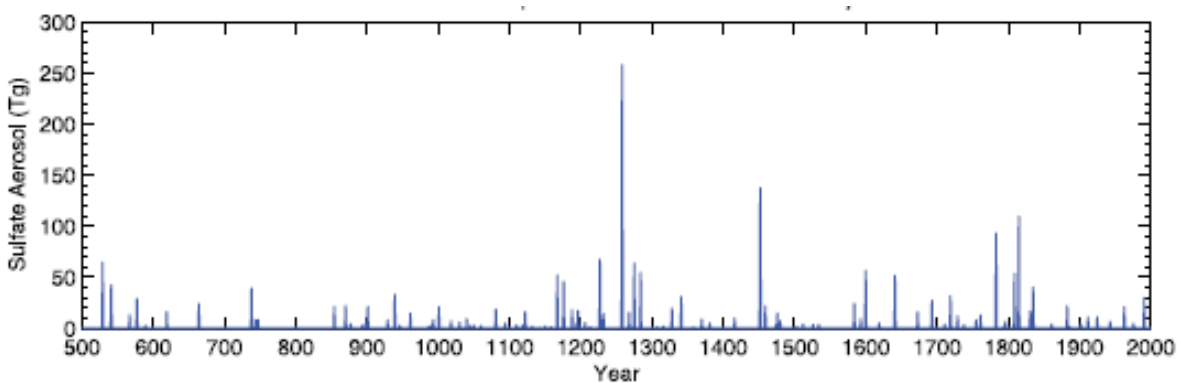
The data in this graph comes from tree rings. Trees only grow in the summer and therefore can't tell us about winter temperatures.

- 1) In which century were the summer temperatures coldest? \_\_\_The 17<sup>th</sup> Century was coldest (the 14<sup>th</sup> was also cold)\_\_\_(1 mark)
- 2) How did the climate change between 1550 and 1600? \_\_\_It got colder by about 1.7°C\_\_\_\_(1 mark)



*This graph shows how much energy the Earth has received from the Sun from 1600 to the present.*

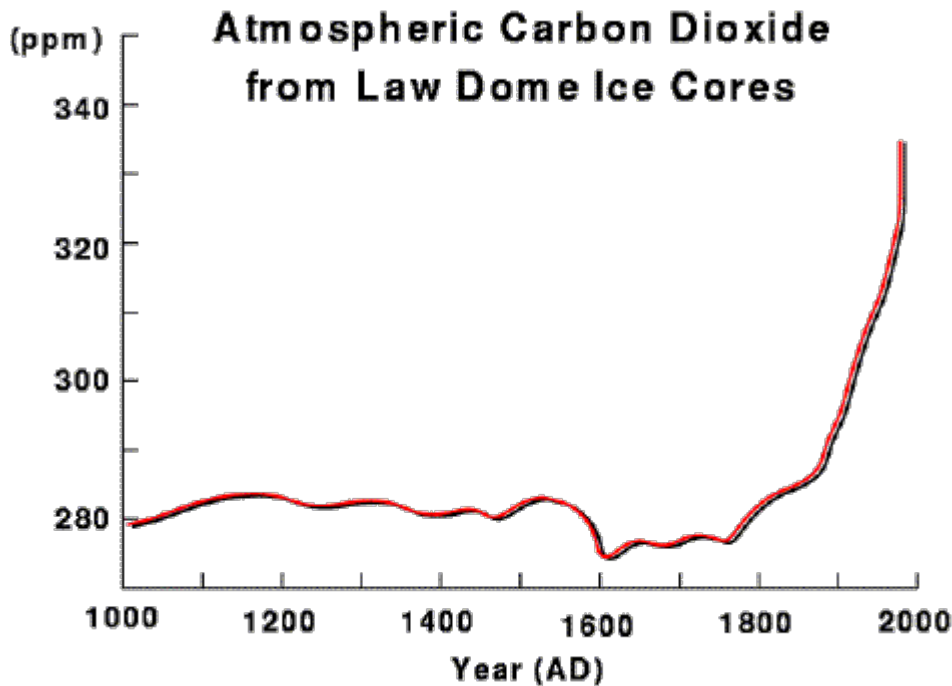
- 3) Can the Sun be used to explain the coldest century you identified in question 1? \_\_ Between 1640 and 1700, the Earth didn't get very much energy from the Sun, this may have contributed to the colder temperatures in that period. \_\_\_\_\_ (1 mark)



*This graph shows the total amount of volcanic material in the upper atmosphere. This sort of material can cool the climate.*

- 4) Which three periods do you think could have been most affected by volcanic activity? \_\_ approximately: 1160-1280, 1450-1500 and 1780-1840 \_\_\_\_\_ (2 marks)
- 5) Is there any evidence that volcanic activity contributed to the temperature changes in England in:
- The coldest century? \_ There were a few fairly large eruptions in the 17<sup>th</sup> century which could have contributed to the colder temperatures \_\_\_\_ (1 mark)
  - Temperature changes in the 15<sup>th</sup> century? \_ Although generally a warm century with very little volcanic activity in the first half, the large eruption in around 1450 clearly shows in the temperature record with rapid cooling. (2 marks)

- c) Between 1550 and 1600?  Yes, there was an increase in volcanic activity towards the end of the century corresponding to the cooling temperatures. \_\_\_\_\_ (1 mark)



*This graph shows the amount of carbon dioxide in the air, as measured from air bubbles trapped in ice at the Law Dome in Antarctica.*

- 6) Describe how the amount of carbon dioxide in the atmosphere has changed from 1000 – 2000AD  
\_\_\_\_\_The amount of carbon dioxide in the atmosphere remained relatively constant at about 280ppm until about 1550 when it fell a little. Since 1750 the amount of carbon dioxide has been rising at an ever increasing rate and was at about 340ppm in 2000. \_\_\_\_\_ (2 marks)
- 7) Can the amount of carbon dioxide in the air explain the climate change between 1550 and 1600?  Yes, with less carbon dioxide in the air you would expect it to be colder, as carbon dioxide is a greenhouse gas. The first graph showed temperatures in England falling by about 1.7°C in this time. (2 marks)

“Pre-Columbian farmers of the Neotropical lowlands numbered an estimated 25 million by 1492, with at least 80% living within forest biomes. It is now well established that significant areas of Neotropical forests were cleared and burned to facilitate agricultural activities before the arrival of Europeans. Demographic pressure on forest resources—such as burning—increased steadily throughout the Late Holocene, peaking when Europeans arrived in the late fifteenth century.

The introduction of Old World diseases (such as small pox) led to recurrent epidemics and resulted in an unprecedented population crash throughout the Neotropics. The rapid demographic collapse was mostly complete by 1650, by which time it is estimated that about 95% of all indigenous inhabitants of the region had perished.

Neotropical lowlands went from being a net source of CO<sub>2</sub> to the atmosphere before Columbus to a net carbon sink for several centuries following the Columbian encounter.”

Adapted from *Annals of the Association of American Geographers*, 100(4) 2010, pp. 755–771 C\_ 2010

- 8) Using all the evidence you’ve seen in the graphs above, explain how the climate changed in the 17<sup>th</sup> Century and the possible contributing factors.