**Volcanoes and the Climate**

**Learning Objectives**:

* The difference between weather and climate.
* Both weather and climate are always changing.
* Many things can affect the weather.
* Volcanoes can trigger extreme weather and alter climate.
* There have been colder and warmer periods in the last 1000 years in the UK.

*Northern Hemisphere Annual Mean Temperature Anomaly (this is difference in temperature from the 1961-1990 mean or average – so if the value is over 0°C, it is warmer than average and if it is less than 0°C, it is colder than average)*

Find out about the following major, explosive (Plinian) volcanic eruptions which occurred during 1900-2000, and identify the years they erupted on the graph:

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| --- | --- | --- | --- |
| Volcano  | Country | Month, Year of eruption | Latitude |
| El Chichón | Mexico | March - April, 1982 | 17°N |
| Mount St Helens | USA | May, 1980 | 46°N |
| Agung | Indonesia | February, 1963 | 8°S |
| Pinatubo | Philippines | June, 1991 | 15°N |
| Katla | Iceland | October, 1918 | 63°N |

Compare the eruptions of **Agung** and **Pinatubo**:

What do the locations of the volcano have in common? They are both in the Tropics.

What happened to northern hemisphere temperatures in the two years following the eruptions?

Temperatures fell by over 0.2°C (this doesn’t sound a lot, but remember it’s an average – some places will cool more than others, and some times will be cooler than others).

Now Consider **Mount St. Helens**:

What happened to the temperature in the year after the eruption?

The temperature rose.

What is the key difference about the location of Mount St. Helens compared to Agung and Pinatubo? It is much further from the equator.

Now Consider **Katla**

How does its latitude compare to that of Agung and Pinatubo? It is furthest from the equator.

Would you expect it to have an impact on the climate? No.

What happens to the climate of the northern hemisphere after the eruption? It warms. This was nothing to do with the eruption – the climate varies for all sorts of reasons from year to year.

Now Consider **El Chichón**

How does its latitude compare to that of Agung and Pinatubo? It is in the Tropics as they are.

Would you expect it to have an impact on the climate? Yes, you’d expect the climate to cool

What happens to the climate of the northern hemisphere after the eruption? It warms in the year immediately after the eruption, and then cools for two years.

The eruption of El Chichón coincided with a strong El Niño event – find out more about another El Niño event at <http://www.bbc.co.uk/newsround/32721573>. In general, global temperatures are warmer during an El Niño – in 1982 the warming effect of the El Niño was in part reduced by the eruption of El Chichón.

More advanced information is available at <https://www.metoffice.gov.uk/learning/learn-about-the-weather/what-is-el-nino-la-nina> and <https://rgsweather.com/2015/11/01/el-nino-how-does-it-impact-uk-winter-weather/>

*English Temperatures (°C) From Tree Ring Data (these are actual temperatures rather than differences from the mean)*

**Look at the range of the graph:** How does it compare to the year to year fluctuations of Northern Hemisphere temperatures you were looking at before? The year to year fluctuations of the temperature in England are much bigger.

Now look at the years in which El Chichón, Mount St. Helens, Agung, Pinatubo and Katla erupted.

Do any of the eruptions stand out as being in years which are immediately followed by cold spells? No.

Use your own words to describe why that is, based on the flow charts below:

Tropics – really sunny England – not all that sunny

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Sun’s light warms the ground a lot Sun’s light warms the ground a bit

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Volcanic dust reflects the Sun’s light Volcanic dust reflects the Sun’s light

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Much less light reaches the ground A bit less light reaches the ground

 ↓ ↓

Ground is much colder than normal Not much change in the temperature

Tropical eruptions cool the climate by making the atmosphere more reflective – more of the Sun’s light is reflected back out to space – less makes it down to the Earth’s surface to warm the Earth up. …

This has the biggest impact in latitudes where it is normally really sunny – where most sunshine can be lost. In England, it’s not that sunny most of the year anyway, and so losing some of that light doesn’t make as big a difference.

Globally, the year or two following an explosive, tropical eruption may be colder, but, in the UK, the main effects are that it is wetter and less sunny.