“Year Without a Summer”

Adapted from Erik Conway, a historian based at NASA’s Jet Propulsion Laboratory in Pasadena, California.

In 1815, Mt. Tambora in Indonesia underwent the most deadly volcanic eruption in recorded history. The “super colossal” eruption measured 7 of 7 on the Volcanic Explosivity Index (VEI). It pumped out enormous amounts of dust and ash and destroyed crops and vegetation. It killed tens of thousands of people and even caused tsunamis.

A century and a half later, in 1979, several scientists published an article in *Scientific American*. In “The Year Without a Summer,” Elizabeth Stommel and her husband, Henry Stommel, suggested that the eruption had caused a severe summertime cold snap in 1816. This cold snap resulted in killer frosts in New England and in Europe. Following the frosts, food prices soared and famine followed.

The Stommels were revisiting an old controversy: Can volcanic eruptions change the climate? The issue had first been taken up by scientists in 1901. This was after a giant eruption on the island of Krakatau (perhaps more commonly known as Krakatoa) in Indonesia in 1883. A pair of Swiss researchers proposed that the dust thrown up by a series of large volcanic eruptions could have caused the ice ages by blocking out the Sun’s rays. However, the researchers had no evidence to support their hypothesis because even though there were many in-depth studies of the event, world temperature data had not been collected.

The 1912 eruption of Mt. Katmai in Alaska motivated a number of others to probe the volcano-climate connection. Charles Greeley Abbott measured the sunlight reduction caused by Katmai’s eruption. , Meanwhile, William Jackson Humphreys went back to the records of the 1883 Krakatoa and 1815 Tambora explosions. He concluded that Tambora was responsible for the subsequent cooling in 1816. But Humphreys's argument was not widely accepted. In the 19th century there were no global observation systems like we have today, so there wasn’t much data available to him. His conclusions were mostly based on speculation.

Eventually, scientists turned back to the subject of dust and climate following the invention of the hydrogen bomb in the 1950s. The dust released was a kind of human-made volcano. The U.S. Defense Department funded studies of bomb effects on the climate until the Limited Test Ban Treaty of 1963 banned above-ground tests. NASA scientists joined the investigations in the late 1970s, just in time for a whole series of large eruptions: Mt. St. Helens (Washington, United States, 1980), El Chichón (Mexico, 1982), and finally the 20th century’s largest, most destructive, and deadliest eruption, Mt. Pinatubo (Philippines, 1991).

All the data from these explosions enabled scientists to come up with the answer: volcanic explosions do cause global cooling, sometimes. Whether or not a specific eruption leads to cooling depends on its size and location, and even chemical composition, as volcanoes release a variety of gases like water vapor, sulfur dioxide, and carbon dioxide. So, Tambora probably did cause the Year Without a Summer.

Even without volcanoes, changes in climate can occur relatively rapidly because of a decrease in light reaching Earth. This is sometimes due to changes in the Sun itself. Solar irradiance is the rate at which light energy from the Sun reaches Earth. It changes on an 11-year cycle during which the Sun brightens and dims slightly. Scientists can observe and predict these changes due to the appearance of sunspots, shown at right. The graph below shows how solar irradiance (yellow) and temperature (red) have changed in the last 140 years.

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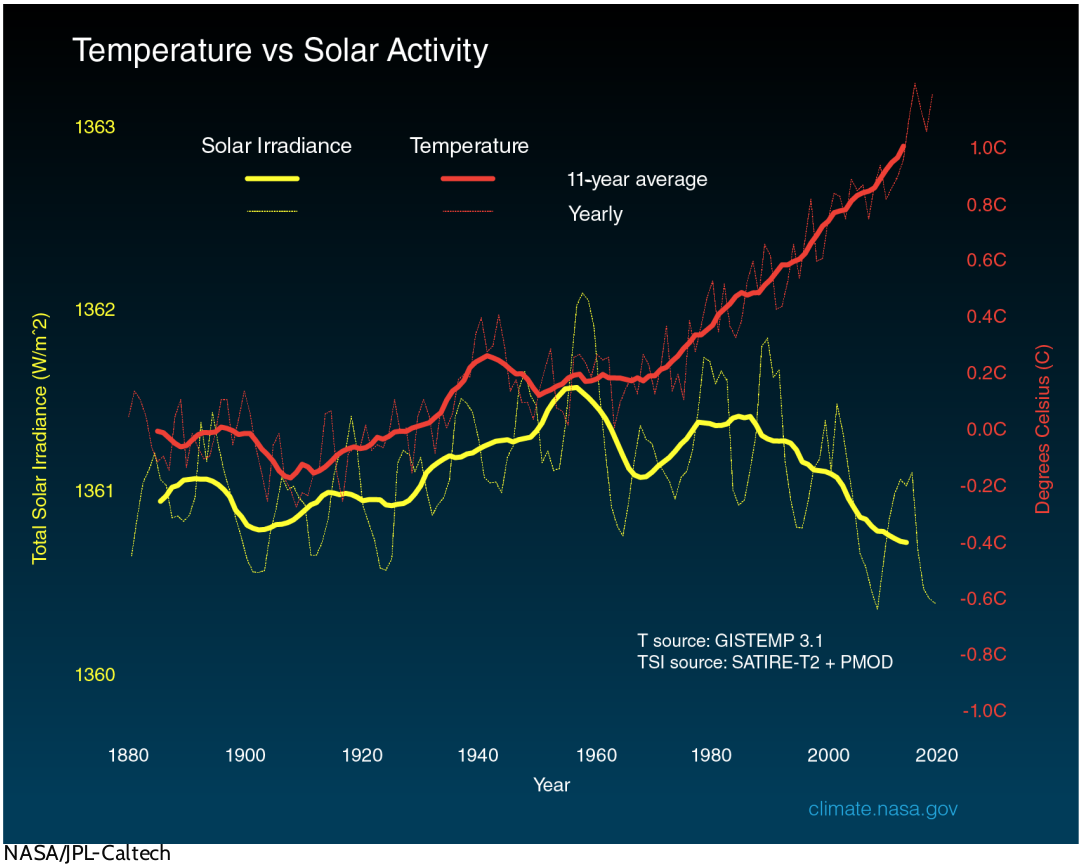

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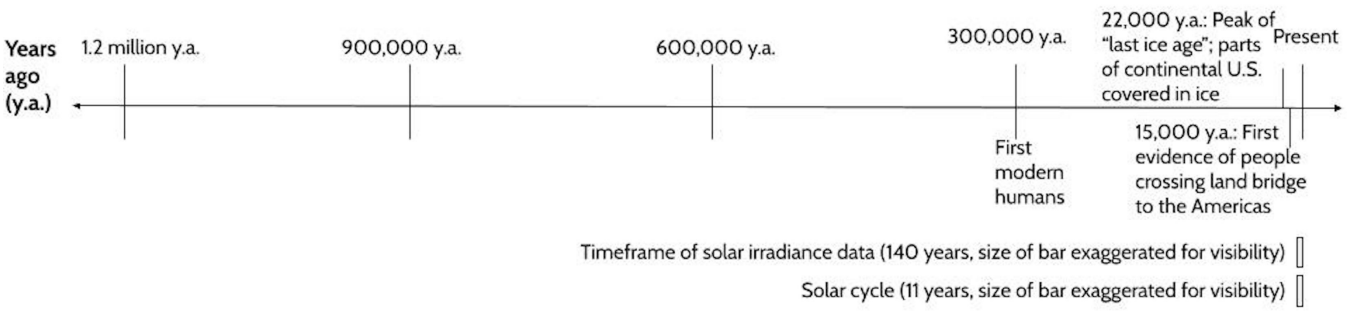

Data shown in the context of history.

References

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