

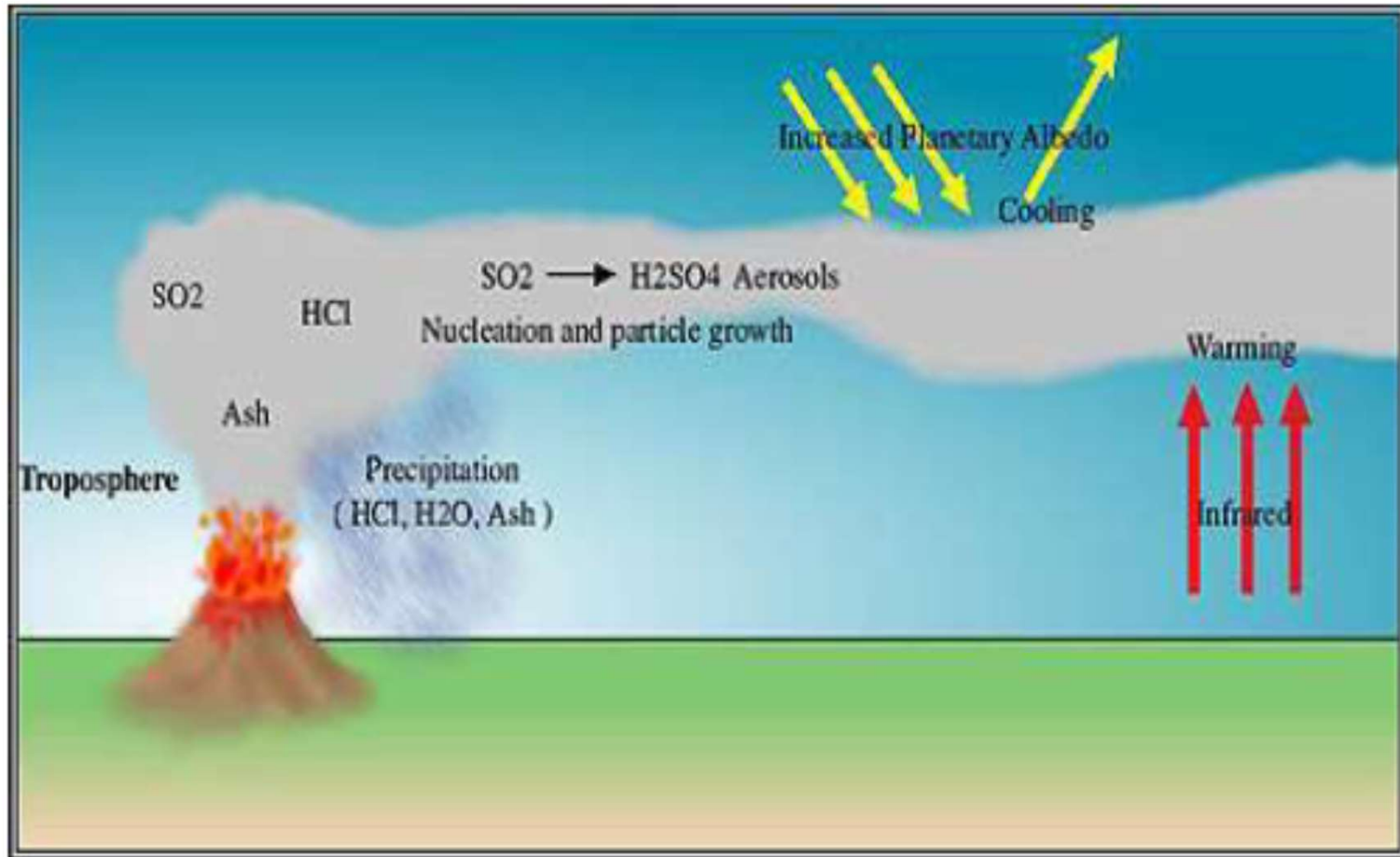
Natural reasons for climate change

## **Natural reasons**

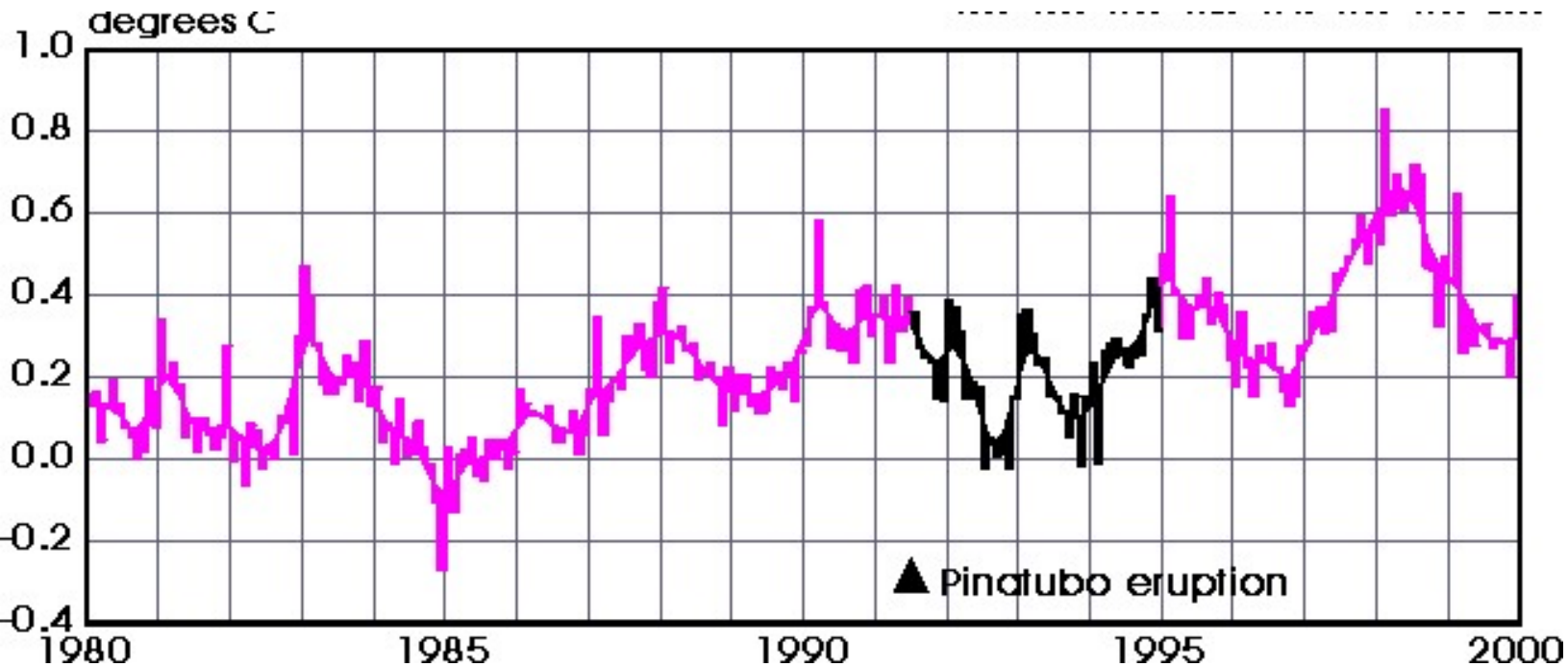
- The earth's climate is influenced and changed through natural causes like volcanic eruptions, ocean currents, the Earth's orbital changes, solar variations and internal variability

### **➤ Volcanic eruptions:**

- Volcanic eruptions pump out clouds of dust and ash, which block out some sunlight
- The ash particles are relatively heavy, they fall to the ground within about three months, so their cooling effect is very short-lived
- But volcanic debris also includes sulfur dioxide. This gas combines with water vapor and dust in the atmosphere to form sulphate aerosols, which reflect sunlight away from the Earth's surface- can lead cooling of Earth's surface
- These aerosols are lighter than ash particles and can remain in the atmosphere for a year or more

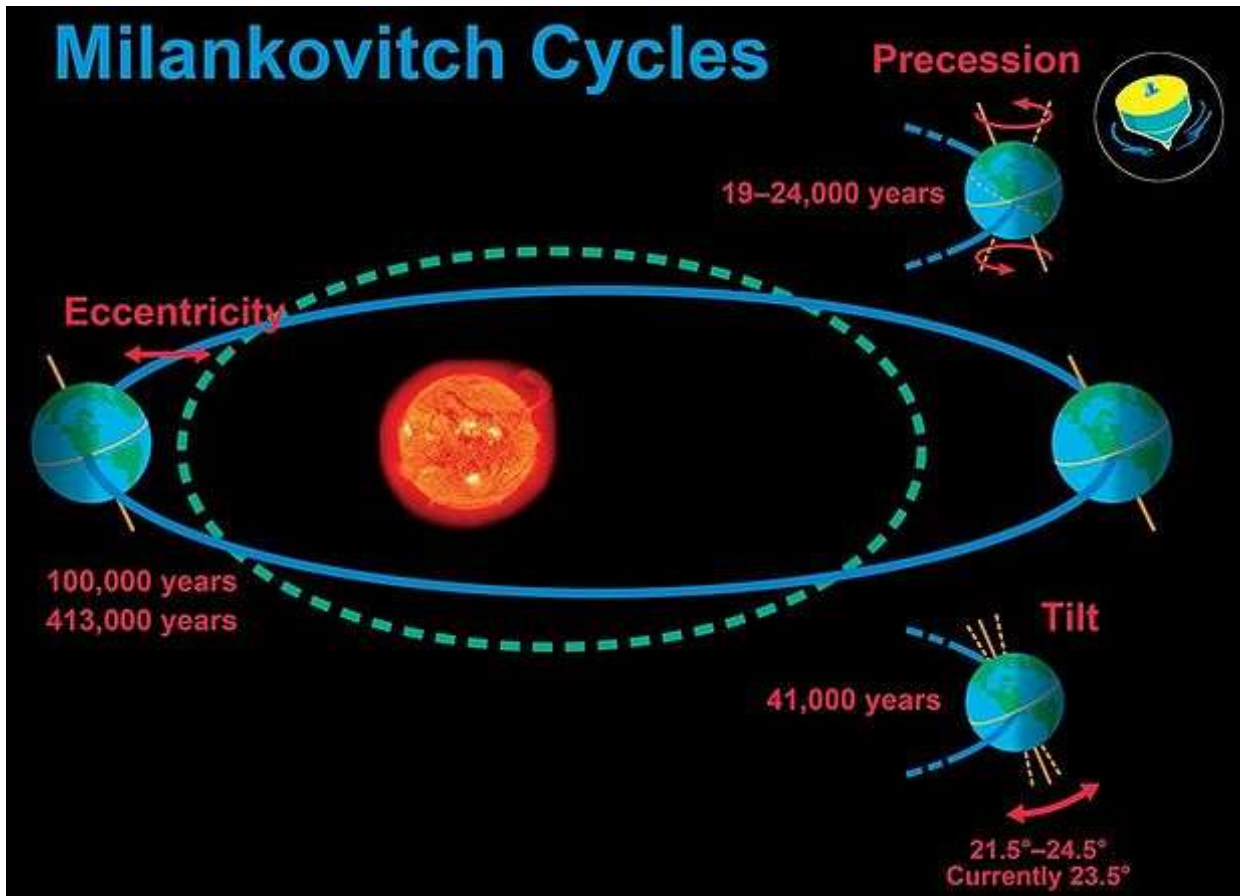


# Mount Pinatubo-1991



- Large volumes of gases and ash can influence climatic patterns for years by increasing planetary reflectivity causing atmospheric cooling
- The eruption of Mount Pinatubo in 1991 caused a 0.5 °C drop in global temperature

## ➤ Earth's orbital changes:



- Milankovitch cycles describe the collective effects of changes in the Earth's movements on its climate over thousands of years

### Cycle includes:

- shape of Earth's orbit, known as **eccentricity**
- angle Earth's axis is tilted with respect to Earth's orbital plane, known as **obliquity**
- direction Earth's axis of rotation is pointed, known as **precession**

## Ice Age: Did it exist ?



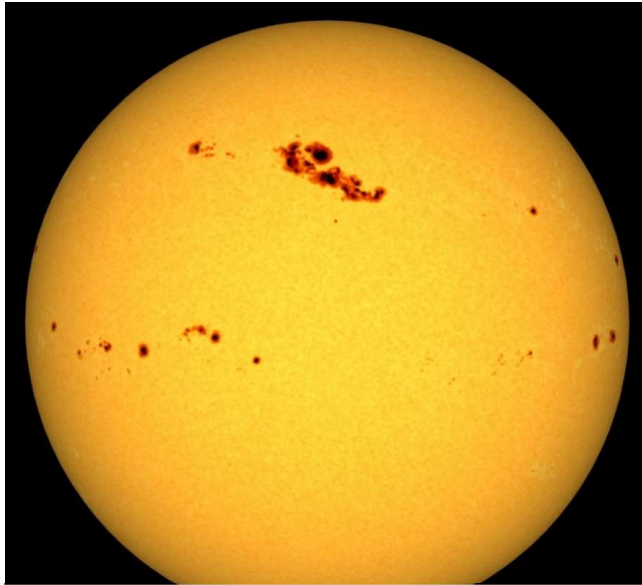
- The last ice age ended about 12,000 years ago and the next cooling cycle may begin in about 30,000 years

- An **ice age** is a long period of reduction in the temperature of Earth's surface and atmosphere, resulting in the presence or expansion of continental and polar ice sheets and alpine glaciers
- *Ice age* implies the presence of extensive ice sheets in both northern and southern hemispheres – **5** major ice ages
- Earth is currently in an interglacial period

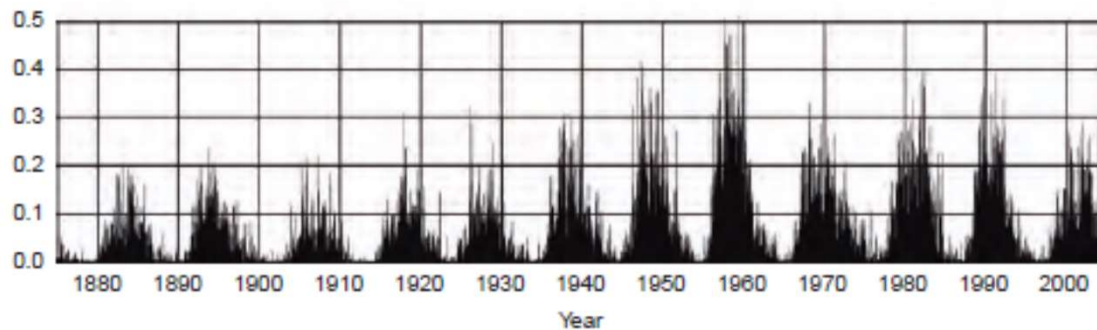


- Orbital changes are so gradual they're only noticeable over thousands of years – not decades or centuries
- The earth makes one full orbit around the sun each year, it is tilted at an angle of **23.5°** to the perpendicular plane of its orbital path
- Changes in the tilt of the earth can lead to small but climatically important changes in the strength of the seasons, more tilt means warmer summers and colder winters; less tilt means cooler summers and milder winters
- Slow changes in the Earth's orbit lead to small but climatically important changes in the strength of the seasons over tens of thousands of years

## ➤ Solar variations:



- Sunspots are temporary phenomena on the Sun's photosphere that appear as spots darker than the surrounding areas
- They are regions of reduced surface temperature caused by concentrations of magnetic field flux that inhibit convection



The fractional area of the surface of the entire solar photosphere (in %) covered by sunspots as a function of time

- That could lead to **fewer solar storms**, as well as a cooler climate on Earth



## Little Ice Age (François E. Matthes in 1939)



- The **Little Ice Age (LIA)** was a period of regional cooling that occurred after the Medieval Warm Period (The time period has been conventionally defined as extending from the 16th to the 19th centuries)
- The [Intergovernmental Panel on Climate Change \(IPCC\) 3<sup>rd</sup> Assessment Report](#): timing and the areas affected by the Little Ice Age suggested largely-independent regional climate changes, rather than a globally-synchronous increased glaciation