

Climate Throughout Geologic Time Has Been Controlled Primarily by the Balance Between

Cooling Caused by
Major Explosive
Eruptions of
Evolved Magmas
Typical of
Island Arcs

and

Warming Caused by
Voluminous Effusive
Eruptions of Basaltic Magma
Typical of Subaerial Ocean
Ridges, Island Chains, and
Continental Flood Basalts



1815: Mt. Tambora, Indonesia

Largest volcanic eruption in recorded history, VEI = 7

**A 14,000 foot mountain
160 km³ of ejecta
>71,000 people died**

**Lowered world temperatures
0.4 to 0.7 °C**



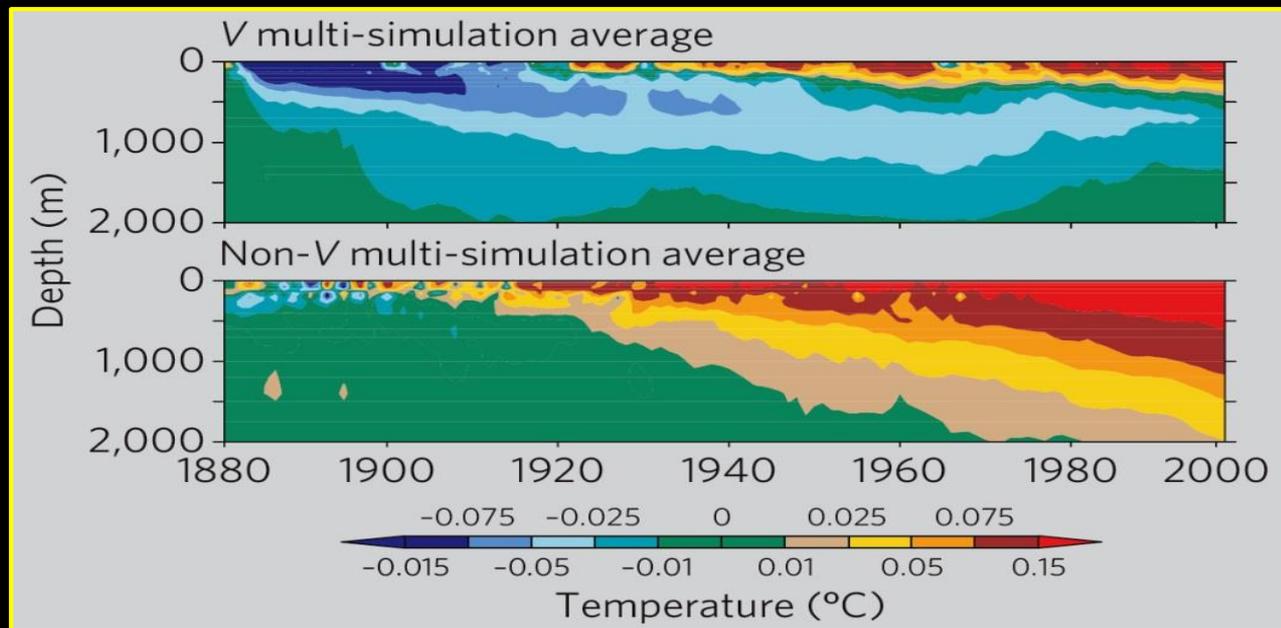
**1816
Year There Was No Summer
Year Without a Summer
Summer that Never Was
Poverty Year**

Krakatau	1883	(6)
Santa Maria	1902	(6?)
Novarupta	1912	(6)
Agung	1963	(5)
El Chichón	1982	(5)
Pinatubo	1991	(6)

Thermal Effects Last a Long Time and Cummmulate

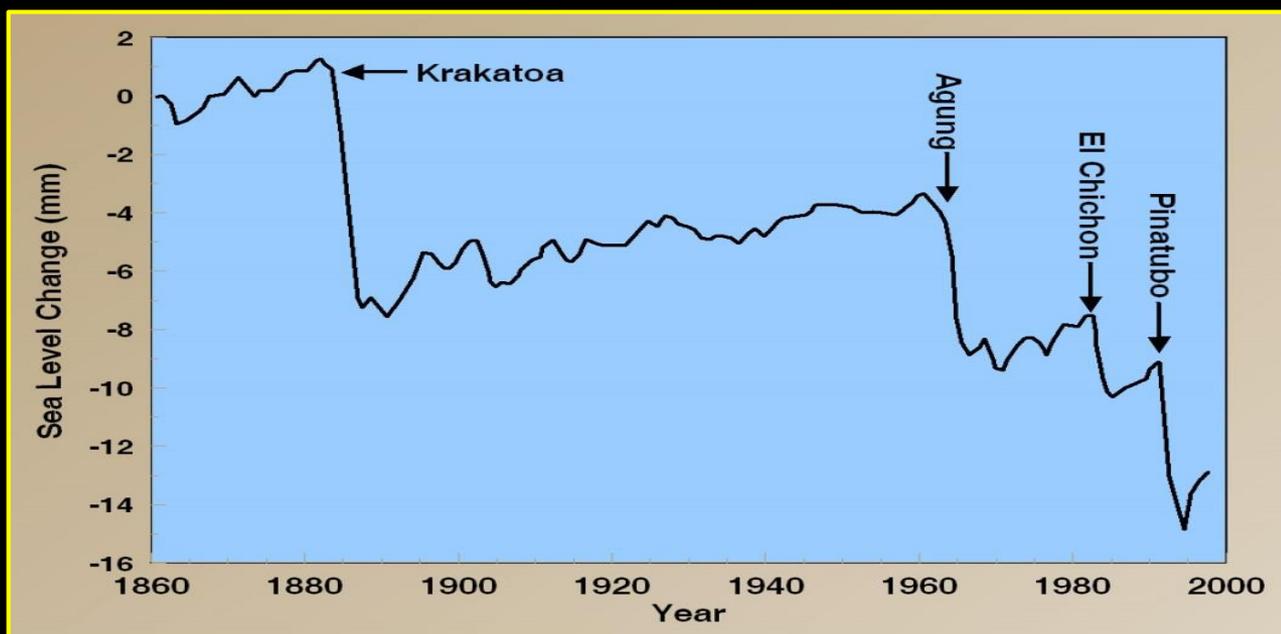
Modelled global ocean heat content following the 1883 eruption of Krakatoa with volcanic effect and without

Gleckler et al., 2006

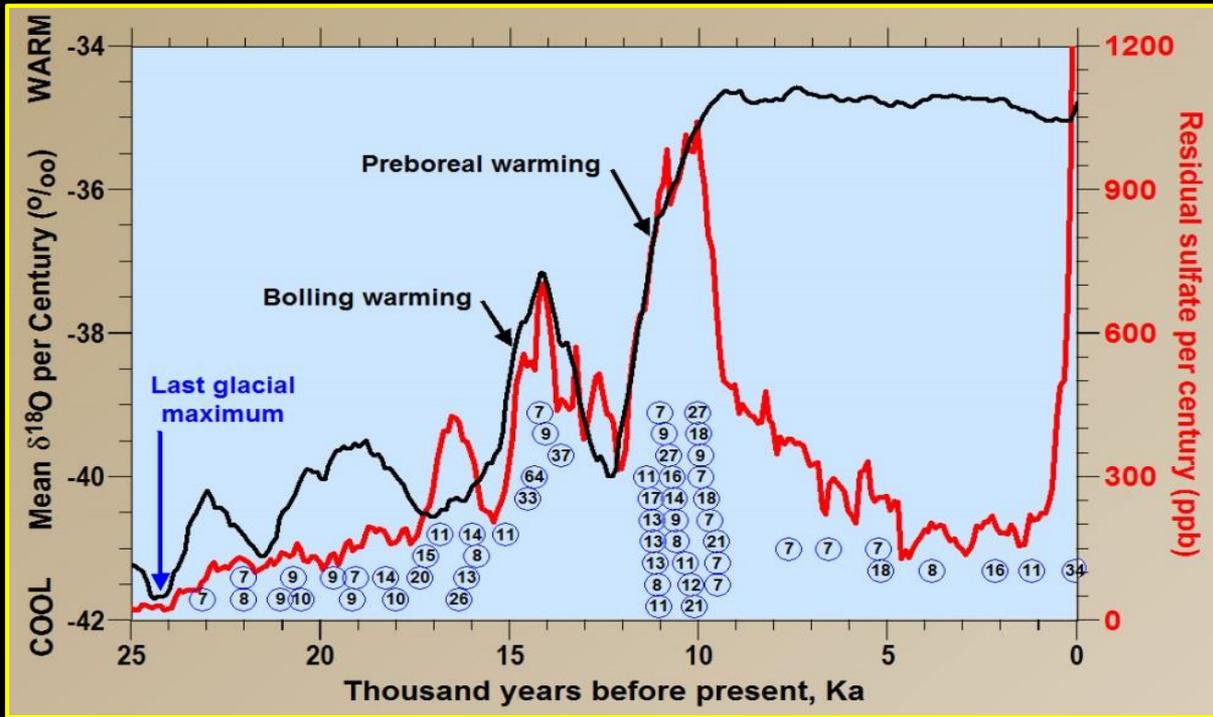


Modelled sea level change following the larger volcanic

Gregory et al., 2006

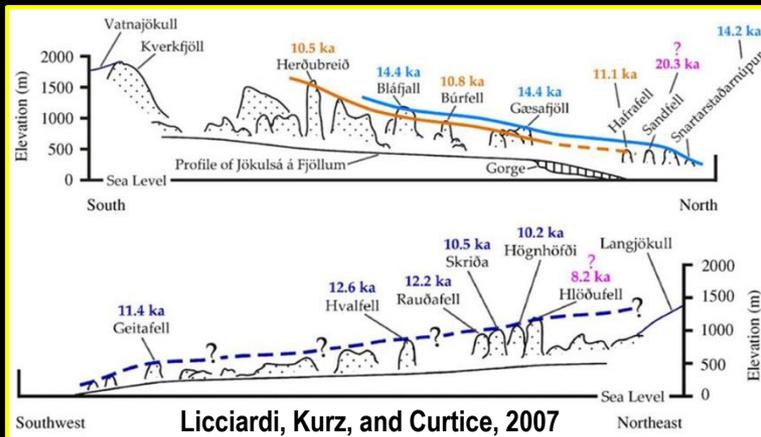


Last Ice Age Ended During Massive Volcanism in Iceland from 11,750 to 9,375 years BP



Basaltic, effusive volcanism was substantial and nearly continuous in Iceland during the Bolling and Preboreal warmings

12 of the 13 dated tuyas in Iceland had their final eruptive phase during the Preboreal warming



³He exposure ages and ice surface at end of last ice age



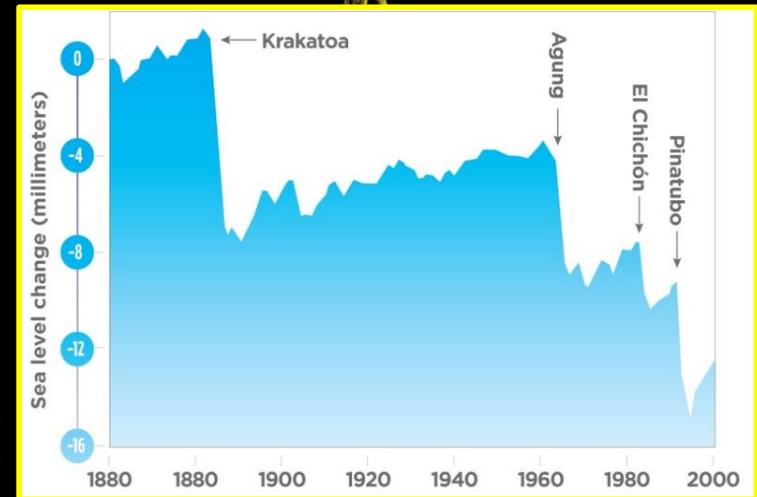
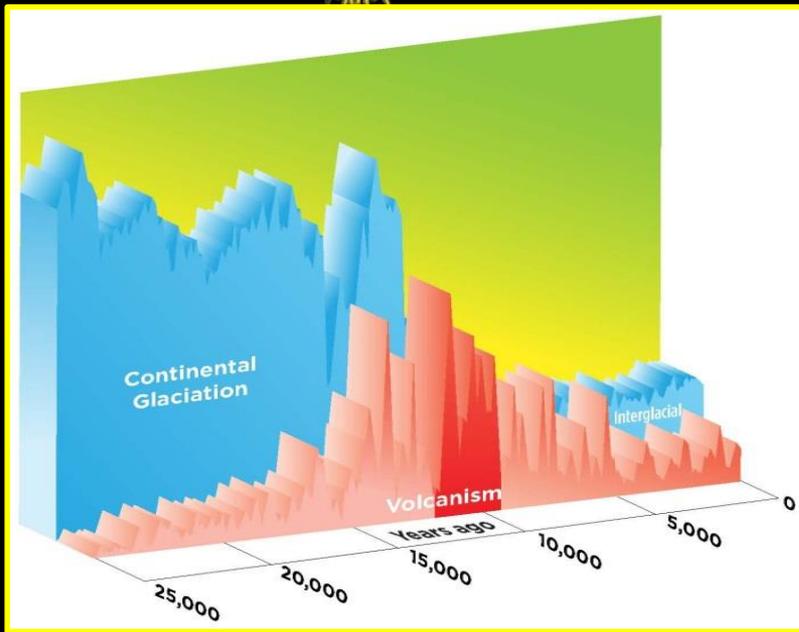
A tuya or table mountain formed by eruption of basalt under ice

The Delicate Balance Between

Global Warming

and

Global Cooling



Effusive volcanism

Basaltic

Eruption height: generally < 2 km

Duration: years to millennia

Explosive volcanism

More evolved magmas

Eruption height: up to 36 km

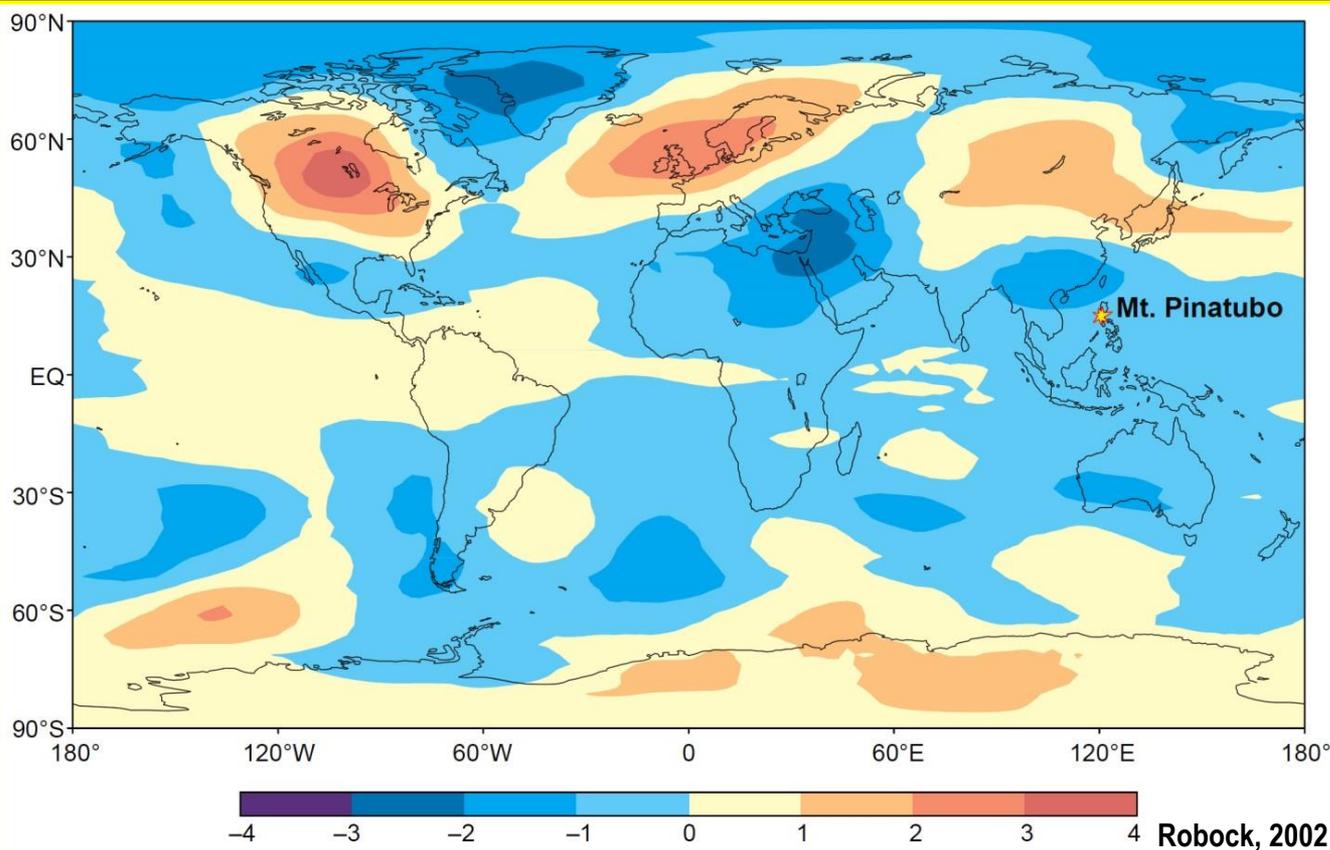
Duration: hours to days

Forms an aerosol in the

lower stratosphere

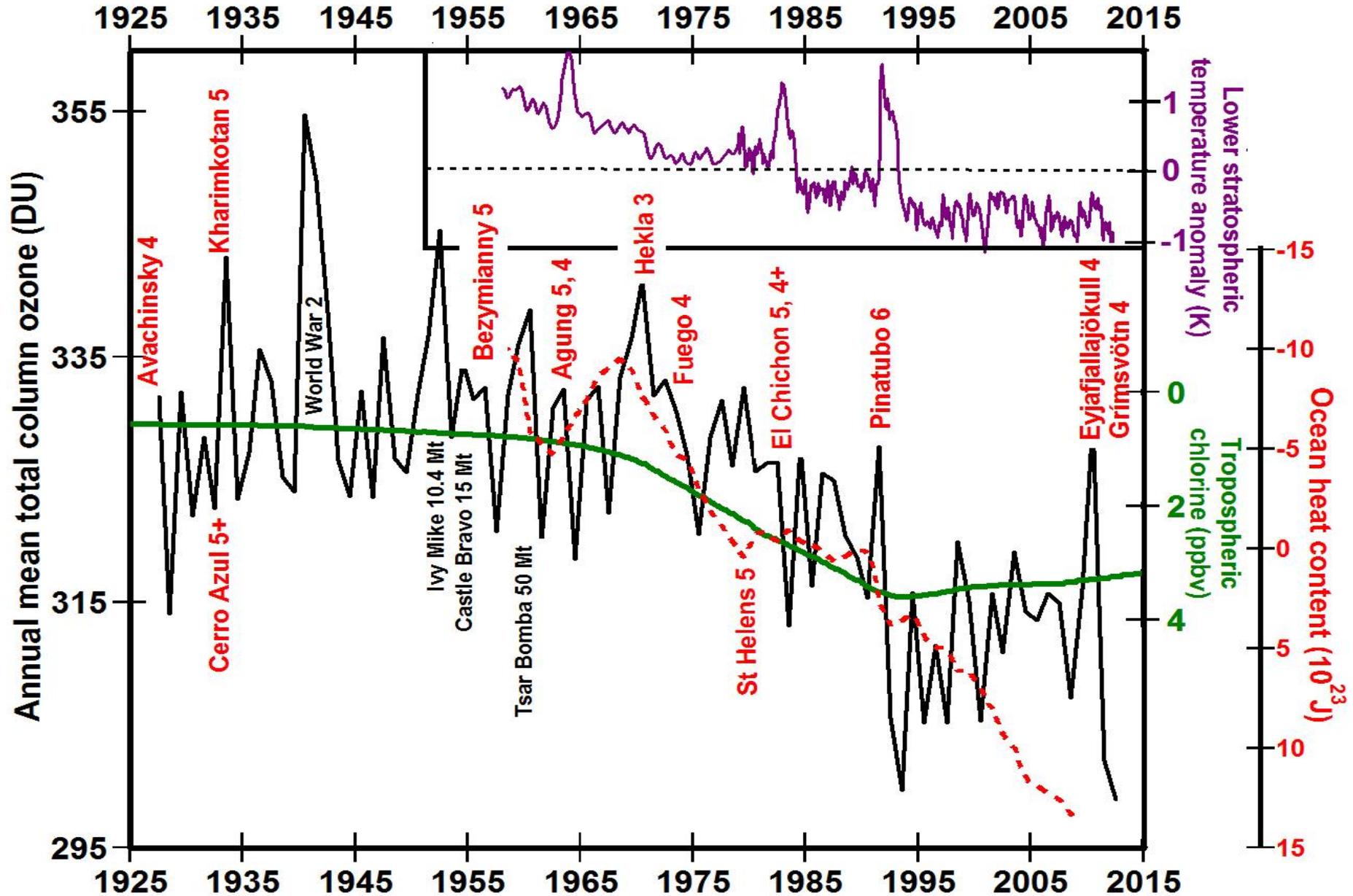
Large, Explosive Eruptions Form Aerosols in the Stratosphere cooling Earth $\sim 0.5^{\circ}\text{C}$ for ~ 3 years

But also deplete ozone leading
to mid to late winter warming



Lower tropospheric
temperature
anomalies from
December 1991 to
February 1992 after
the eruption of Mt.
Pinatubo in June
1991

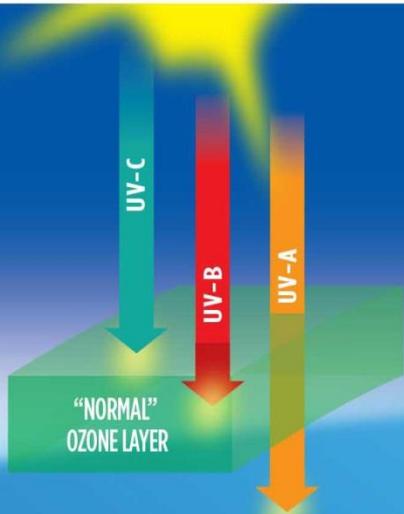
Average Annual Ozone Measured at Arosa, Switzerland



Effects of Ozone Depletion and Aerosols

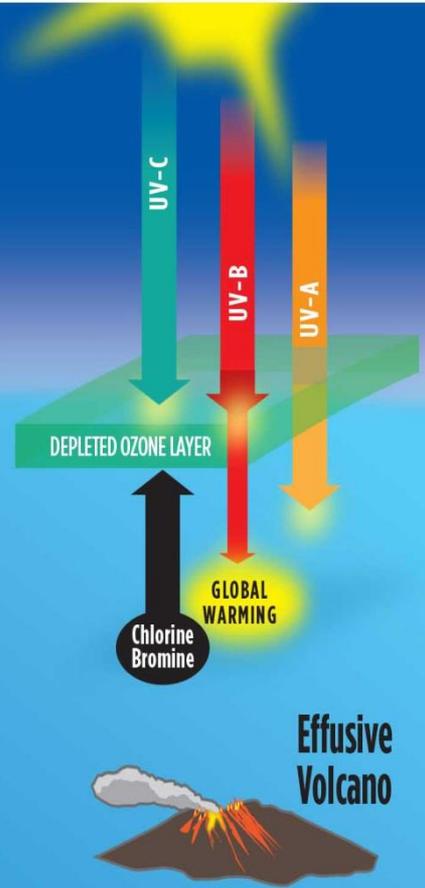
NORMAL CONDITIONS

- UV-C** keeps atmosphere warm
- UV-B** keeps ozone layer warm
- UV-A** & sunlight keeps Earth warm



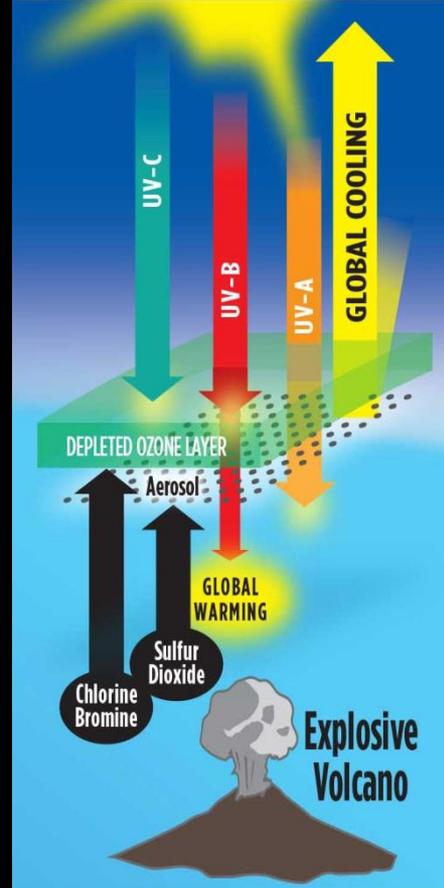
GLOBAL WARMING

Volcanoes release **Chlorine & Bromine** depleting ozone cooling ozone layer & warming Earth



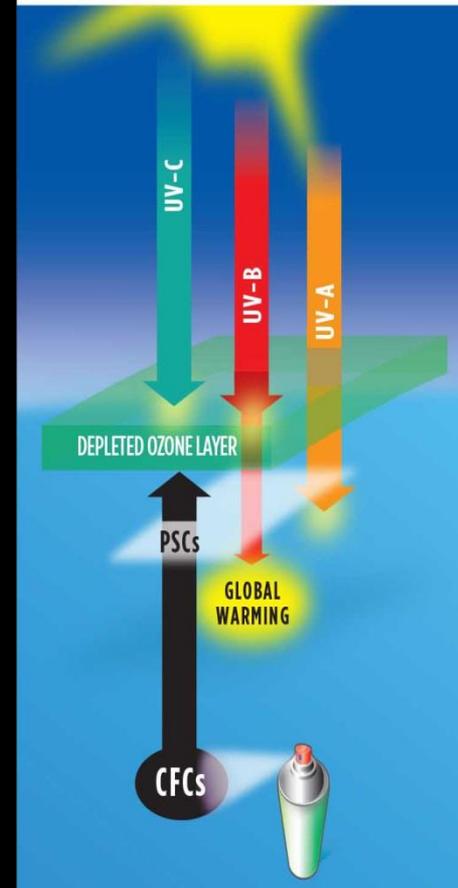
GLOBAL COOLING

Explosive volcanoes also eject **Sulfur Dioxide** into stratosphere forming aerosols that reflect & disperse sunlight causing net cooling of Earth

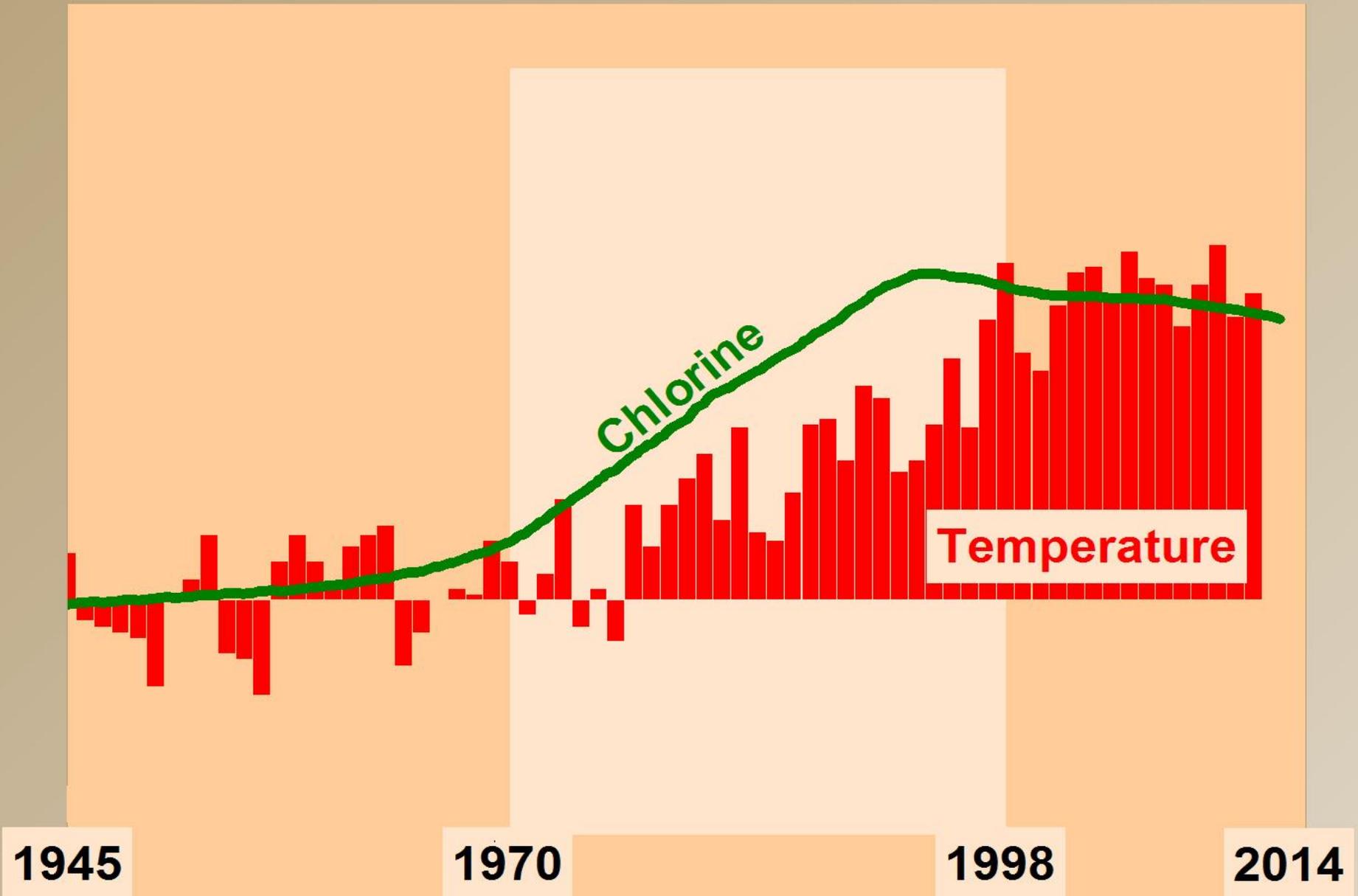


GLOBAL WARMING

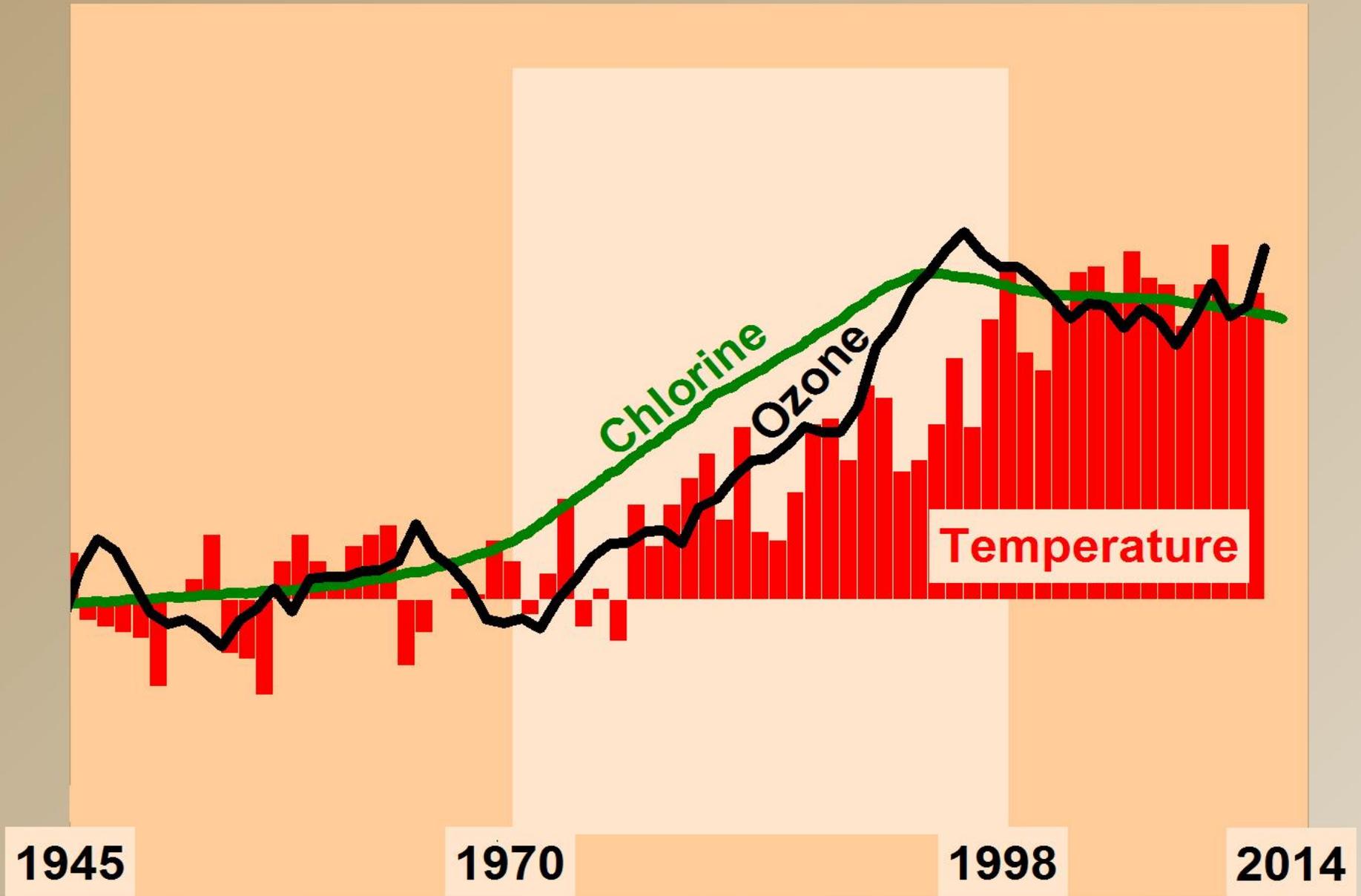
CFCs in polar stratospheric clouds (PSCs) release chlorine depleting ozone cooling ozone layer & warming Earth



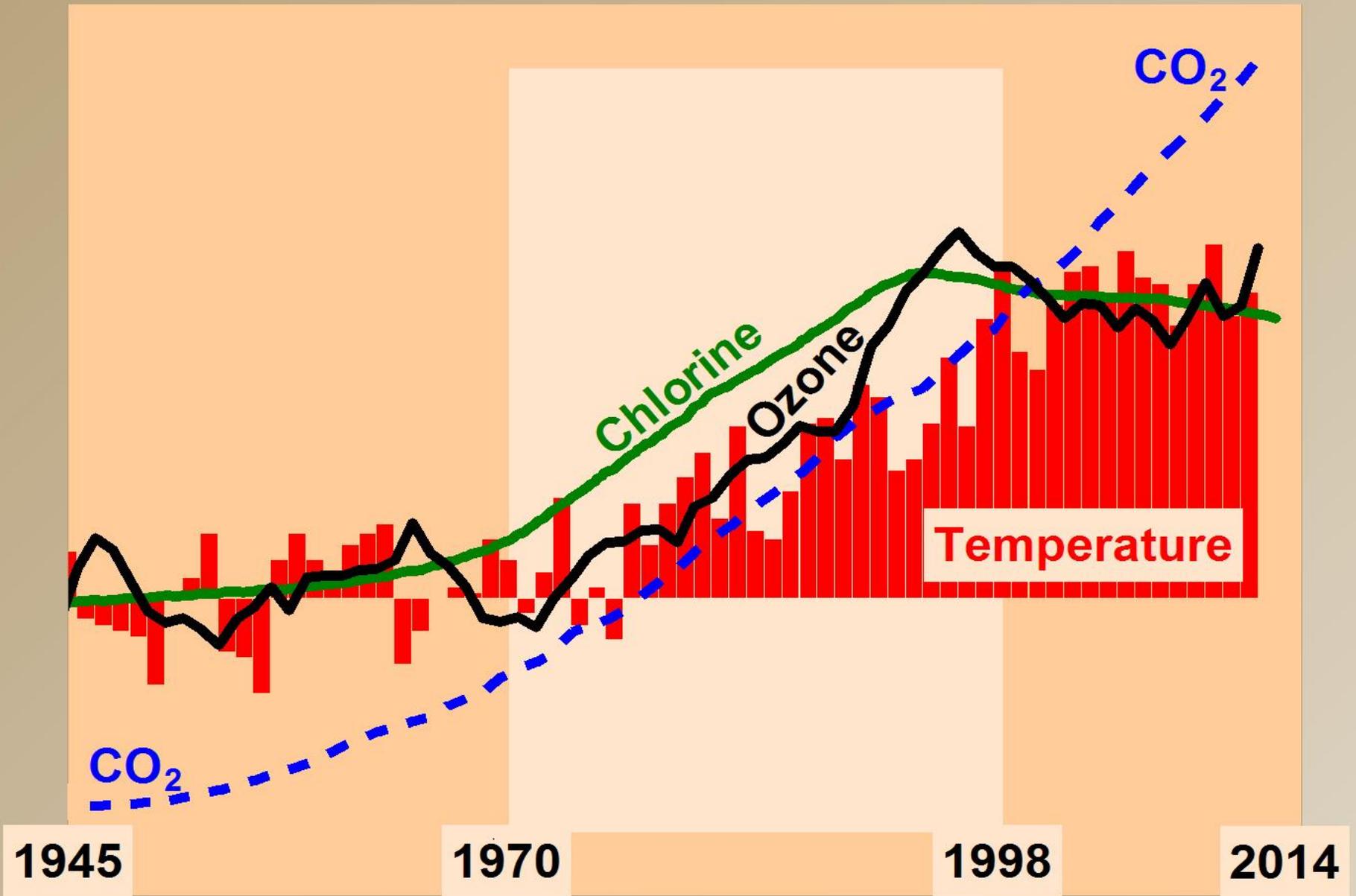
Global Warming 1970 to 1998



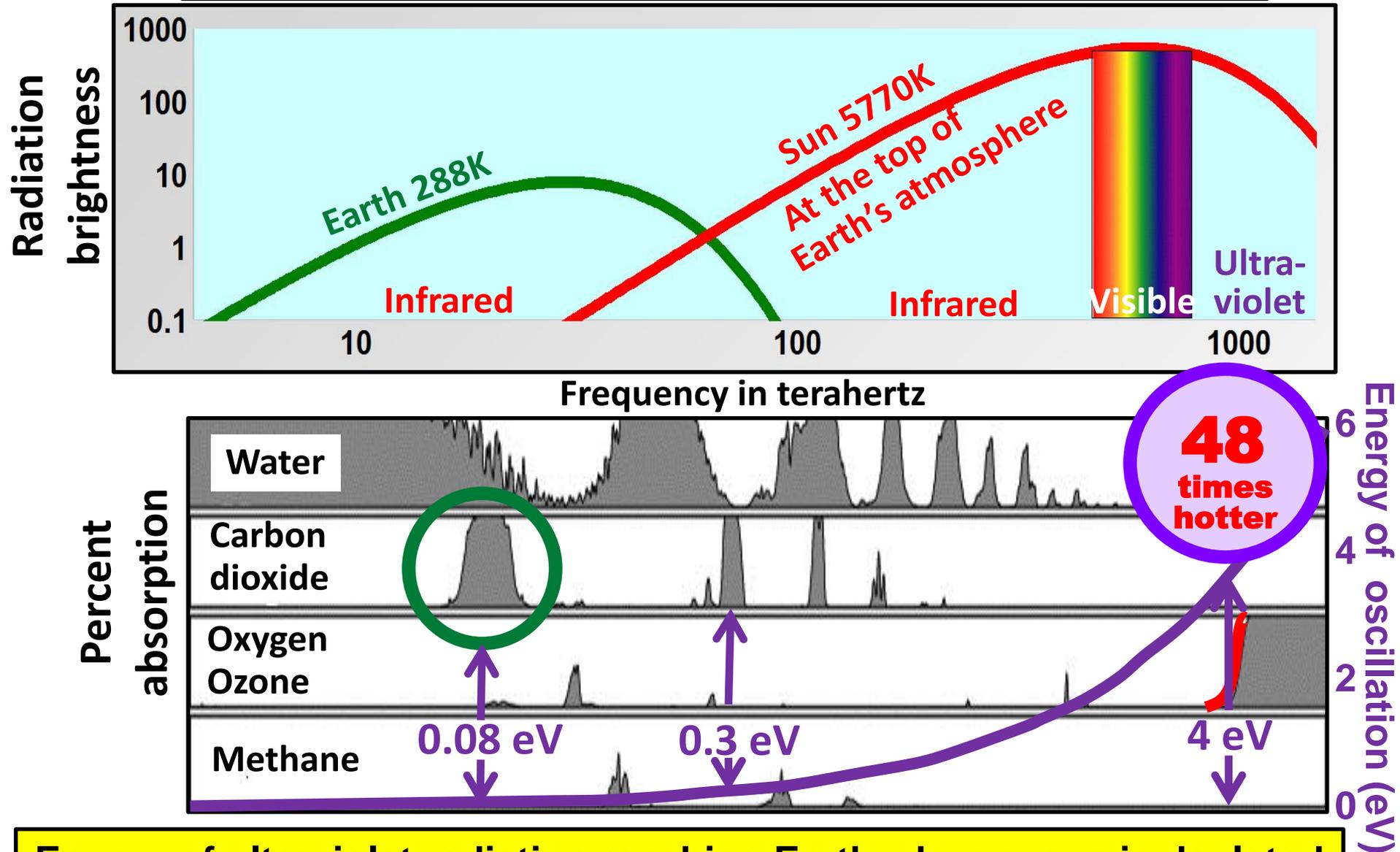
Global Warming 1970 to 1998



Global Warming 1970 to 1998



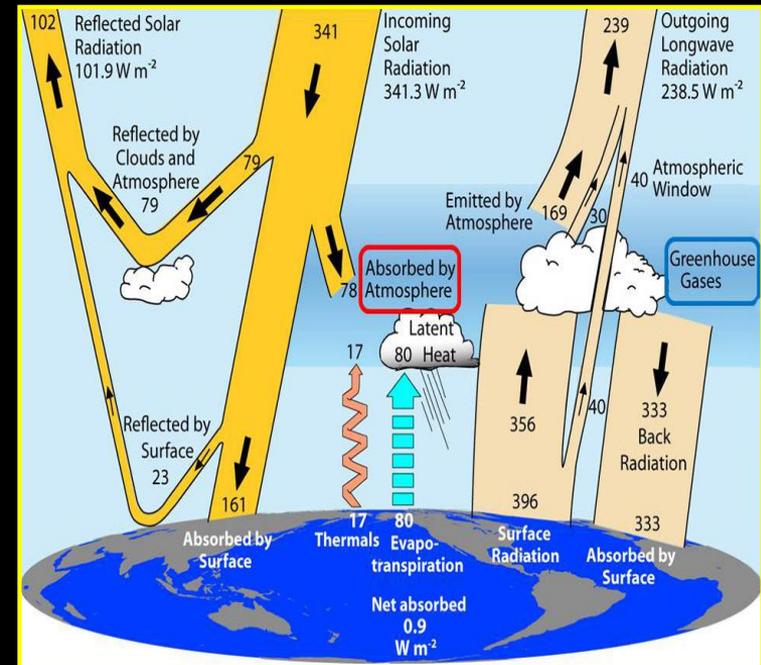
Energy Absorbed by Greenhouse Gases



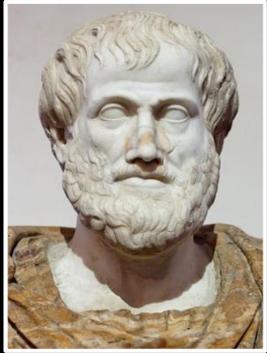
Energy of ultraviolet radiation reaching Earth when ozone is depleted is at least 48 times hotter than energy absorbed by greenhouse gases

Greenhouse Gas Theory is Simply Wrong

1. There is not enough energy absorbed by greenhouse gases
2. The bonds holding greenhouse gases together are clearly observed to absorb radiation, but not to raise temperature
3. The assumption that greenhouse gases slow cooling of Earth ignores the fact that heat is transferred through the troposphere primarily by convection
4. The assumption that greenhouse gases radiate heat back to Earth breaks the Second Law of Thermodynamics
5. You do not stand next to a cold stove to warm up
6. A thermal body cannot warm itself



Wave



Aristotle 340 BC



Descartes 1630



Huygens 1678



Hooke 1680



Fresnel 1814



Young 1803

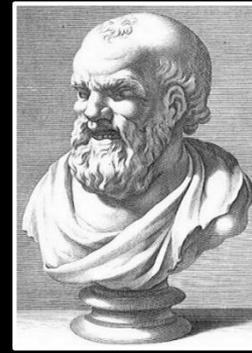


Faraday 1830

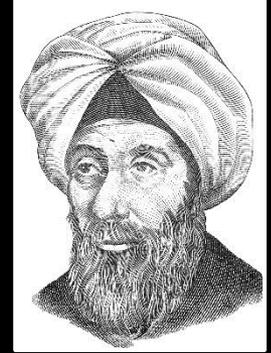


Maxwell 1865

Particle



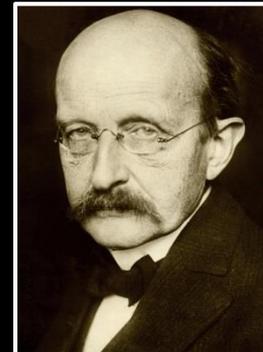
Democritus 410 BC



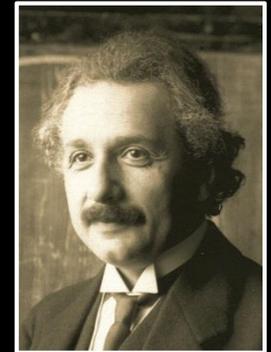
Alhazen 1000



Newton 1670

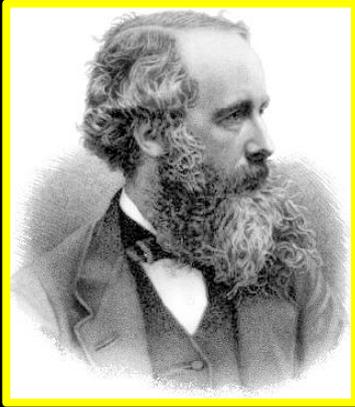


Planck 1900



Einstein 1905

Electromagnetic Radiation



**James Clerk Maxwell
published in 1865**

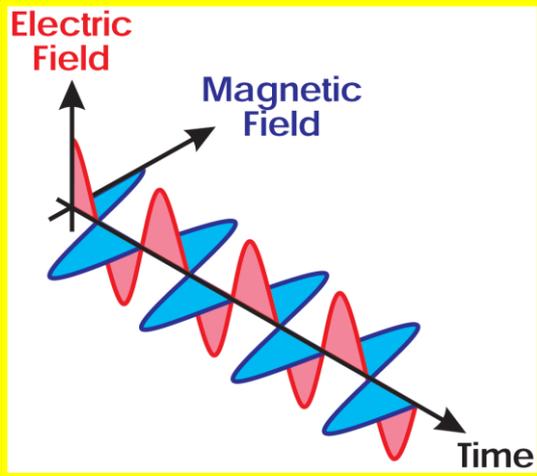
*A Dynamical
Theory of
the
Electromagnetic
Field*

But waves and particles are things we can see

We cannot see light

**Light is frequency, not waves, particles or
wave-particle duality**

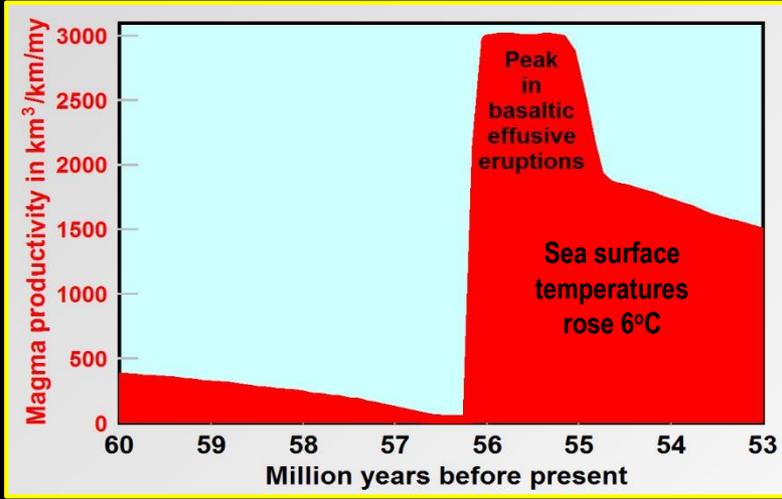
Just like the frequency of a radio station



Transverse waves

**Paper on “The Thermodynamics of Climate Change”
is available at OzoneDepletionTheory.info**

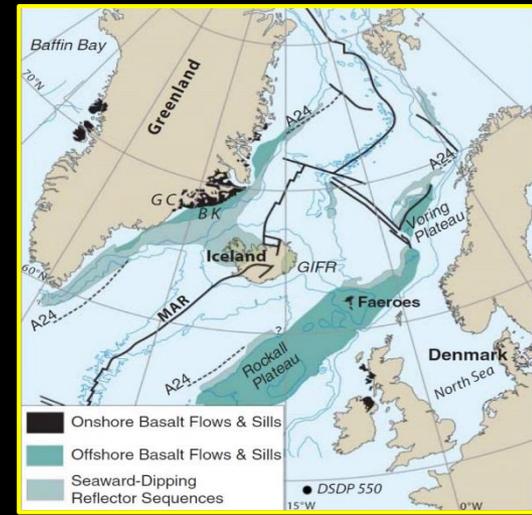
Major Temperature Change During Major Volcanism



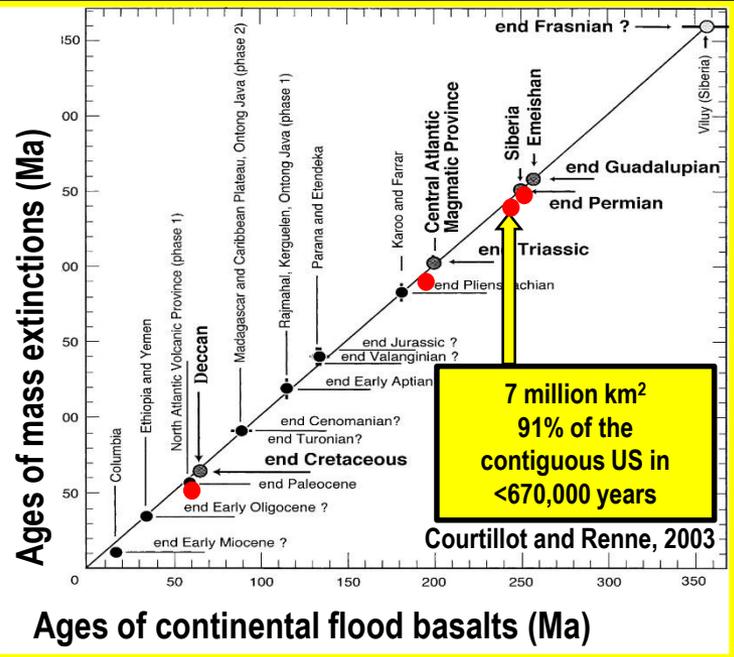
Paleocene Eocene Thermal Maximum

Extrusion of basaltic magma reached a peak 55 to 60 million years ago during the opening of the Greenland-Norwegian Sea. Temperature also reaches a peak.

Storey et al., 2007

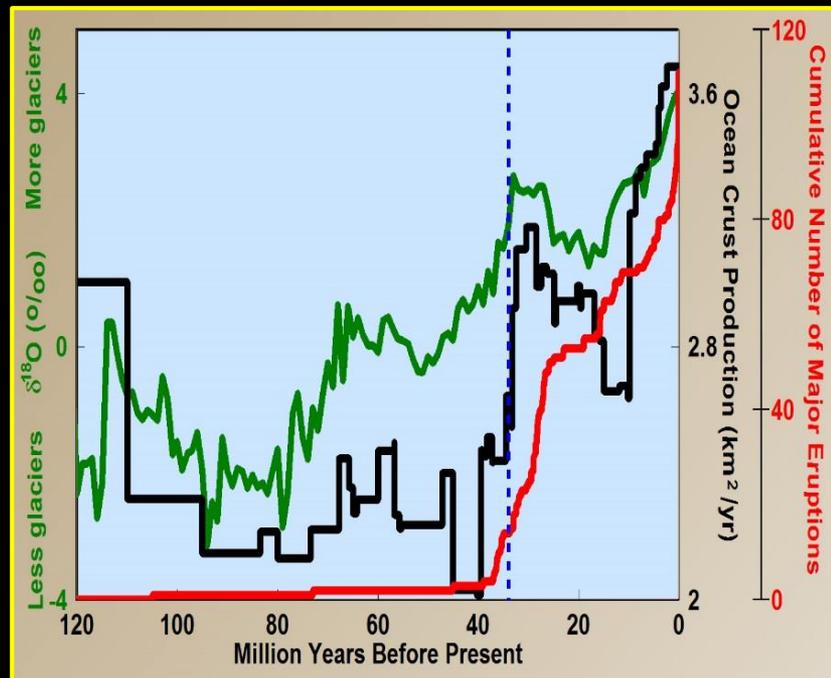


Flood Basalts and Mass Extinctions

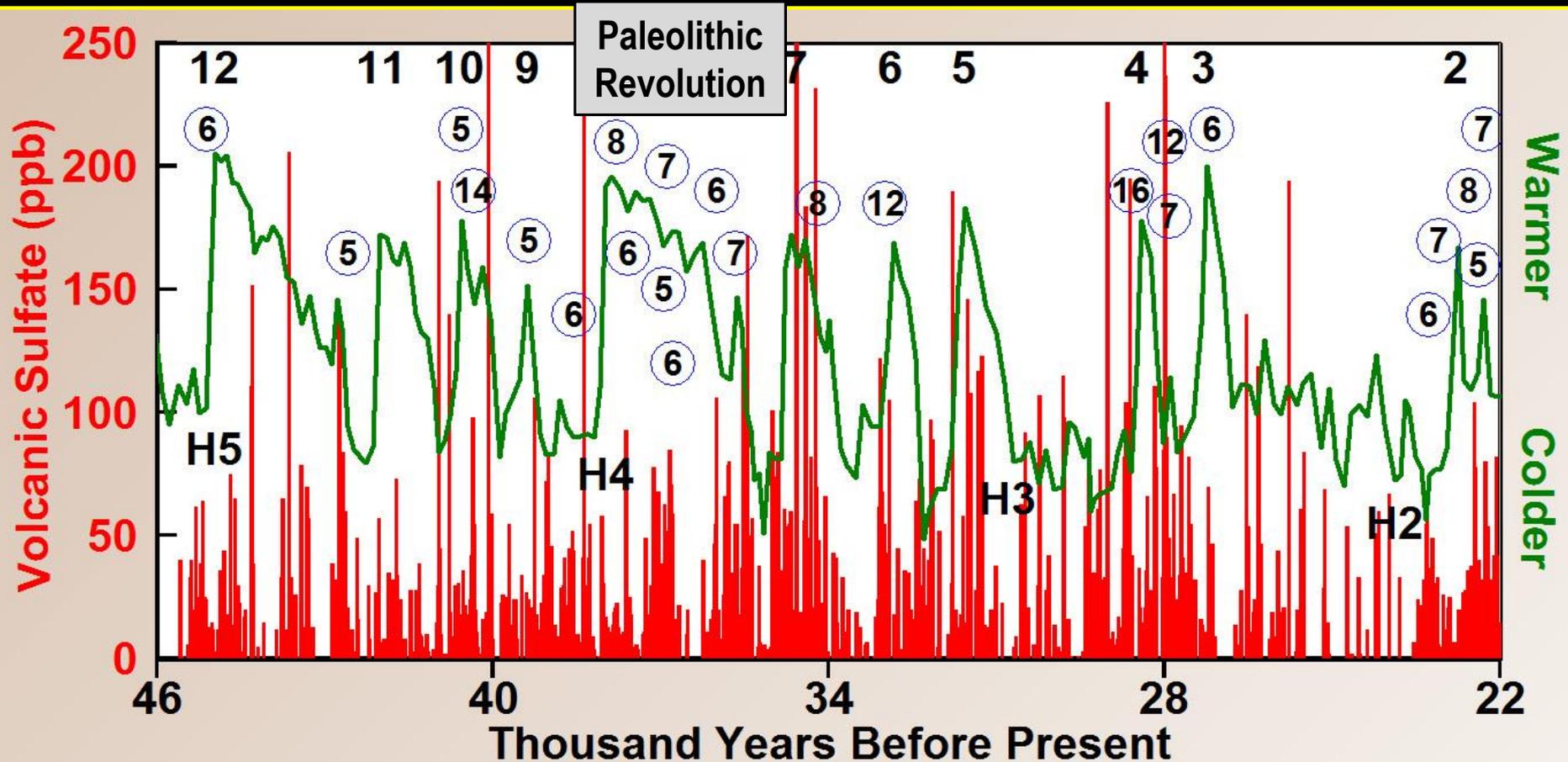


Flood basalts
lead to:
 Ozone depletion
 Lethally hot climate
 Acidic oceans
 and plant mutations
 Mass extinctions

Massive Expansion of Ice in Antarctica at 34 Ma

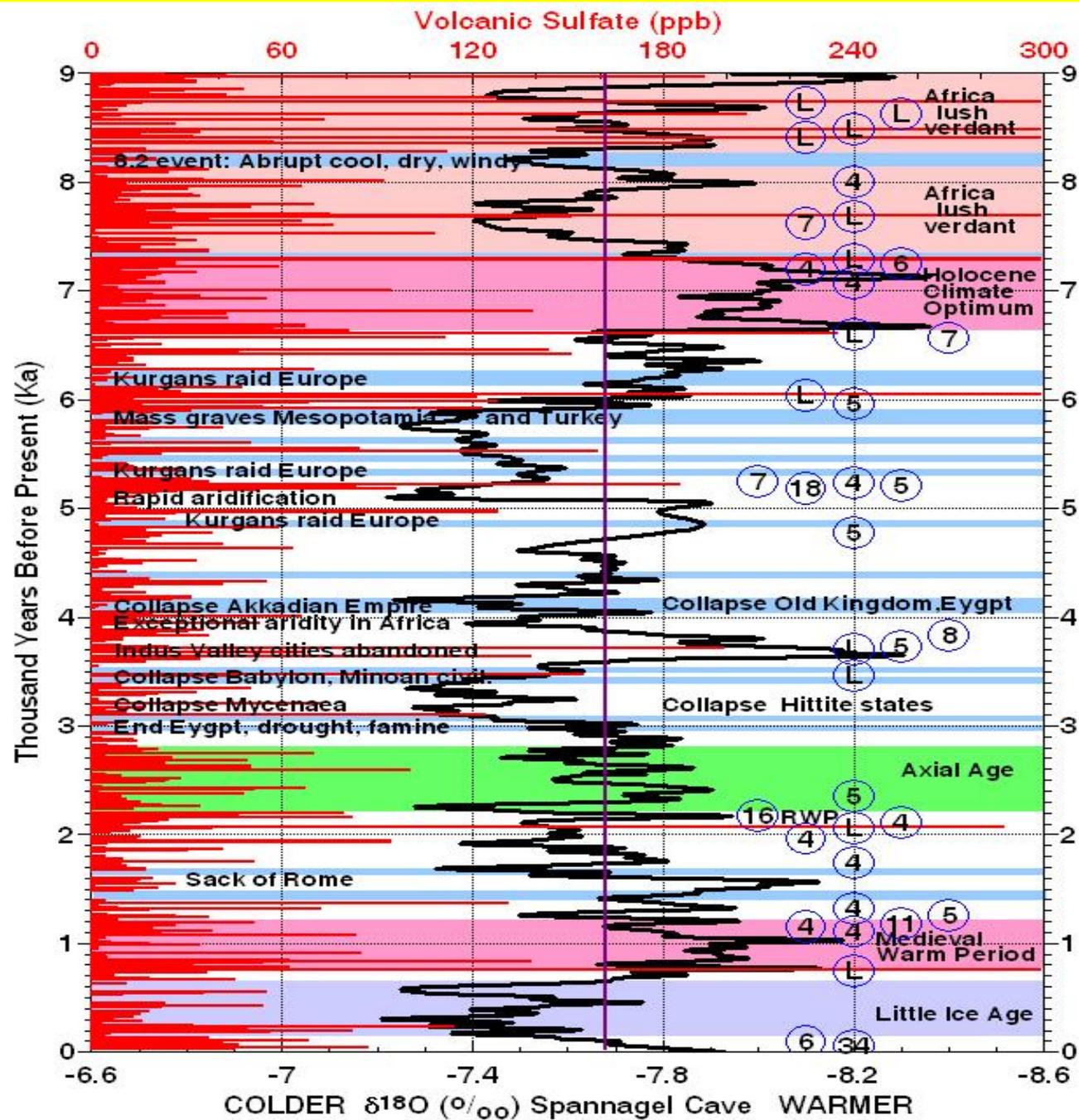


Dansgaard-Oeschger Sudden Warmings Caused by Effusive Volcanism Primarily in Iceland?



25 times in the last 120,000 years, local temperatures in Greenland rose 10 to 16°C in less than 40 years, returning to ice-age conditions within a century or more

In the last 9000 years
 volcanism (red)
 shows a close
 relationship to
 temperature (black)
 and to
 human history



Stalagmite temperatures from Vollweiler et al., 2006

**Every living thing spends every moment of life
adapting to changes in the physical environment
and in the social environment**

**Climate changes in the physical environment
are determined primarily by volcanism,
leading to changes in the social environment**

Conclusions

1. Explosive volcanoes form aerosols in the lower stratosphere, reflecting sunlight, cooling Earth
2. Effusive, basaltic volcanoes deplete ozone, warming Earth
3. The balance between cooling and warming is controlled by plate tectonics
4. Sudden changes in volcanism show a close relationship to sudden changes in geologic epochs, ages, and evolution of life on Earth

Volcanoes rule!

OzoneDepletionTheory.info