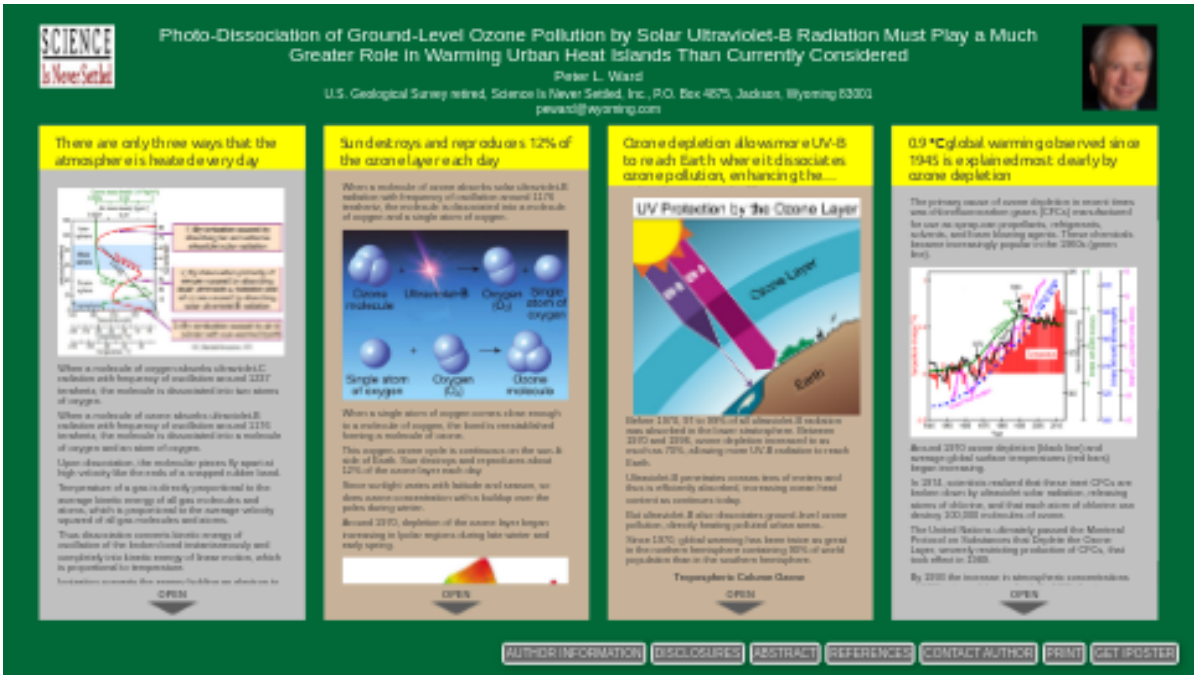
Photo-Dissociation of Ground-Level Ozone Pollution by Solar Ultraviolet-B Radiation Must Play a Much Greater Role in Warming Urban Heat Islands Than Currently Considered



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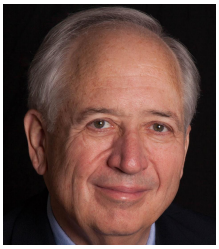

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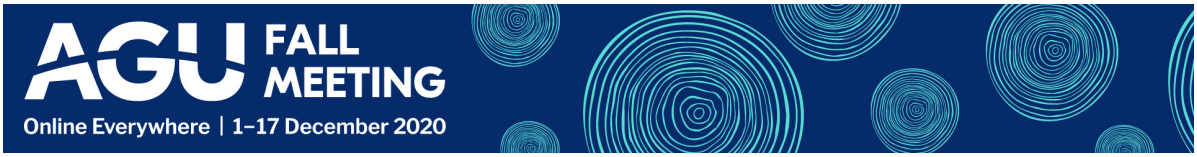
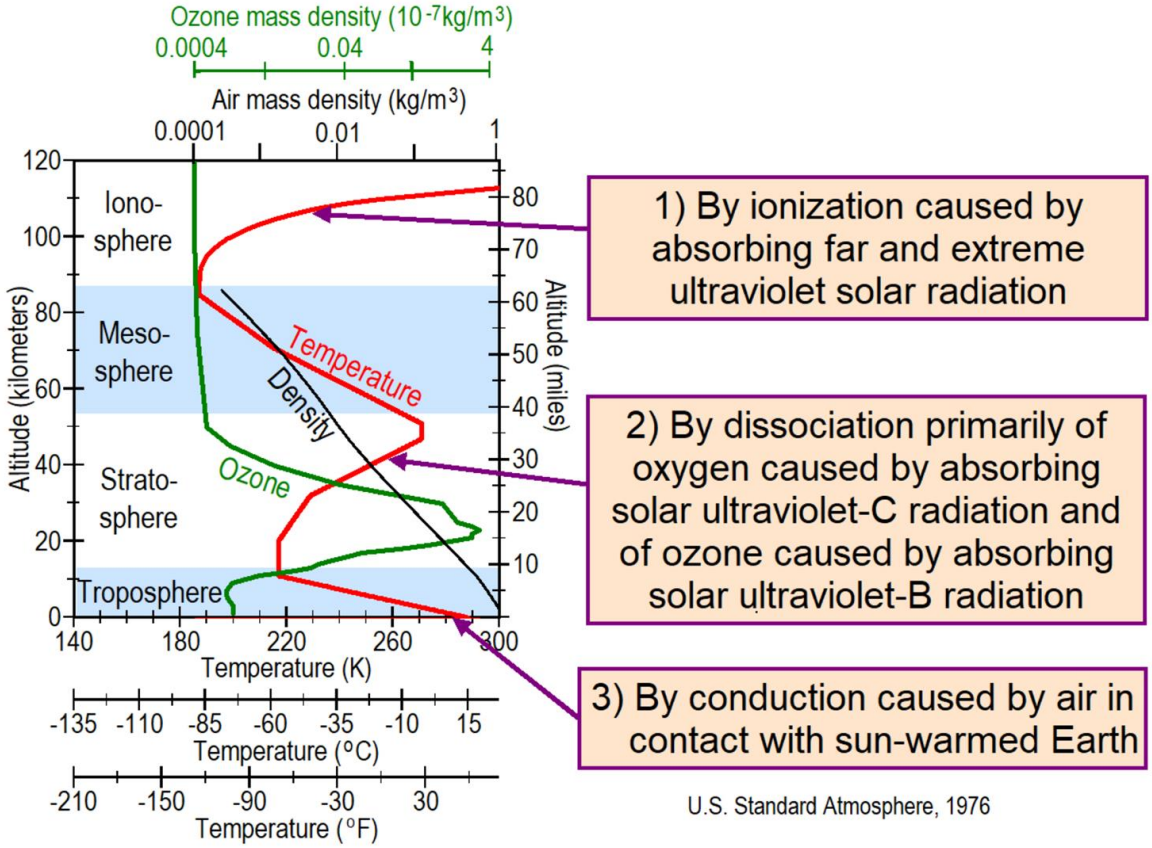


THERE ARE ONLY THREE WAYS THAT THE ATMOSPHERE IS HEATED EVERY DAY



When a molecule of oxygen absorbs ultraviolet-C radiation with frequency of oscillation around 1237 terahertz, the molecule is dissociated into two atoms of oxygen.

When a molecule of ozone absorbs ultraviolet-B radiation with frequency of oscillation around 1176 terahertz, the molecule is dissociated into a molecule of oxygen and an atom of oxygen.

Upon dissociation, the molecular pieces fly apart at high velocity like the ends of a snapped rubber band.

Temperature of a gas is directly proportional to the average kinetic energy of all gas molecules and atoms, which is proportional to the average velocity squared of all gas molecules and atoms.

Thus dissociation converts kinetic energy of oscillation of the broken bond instantaneously and completely into kinetic energy of linear motion, which is proportional to temperature.

Ionization converts the energy holding an electron to a molecule into temperature.

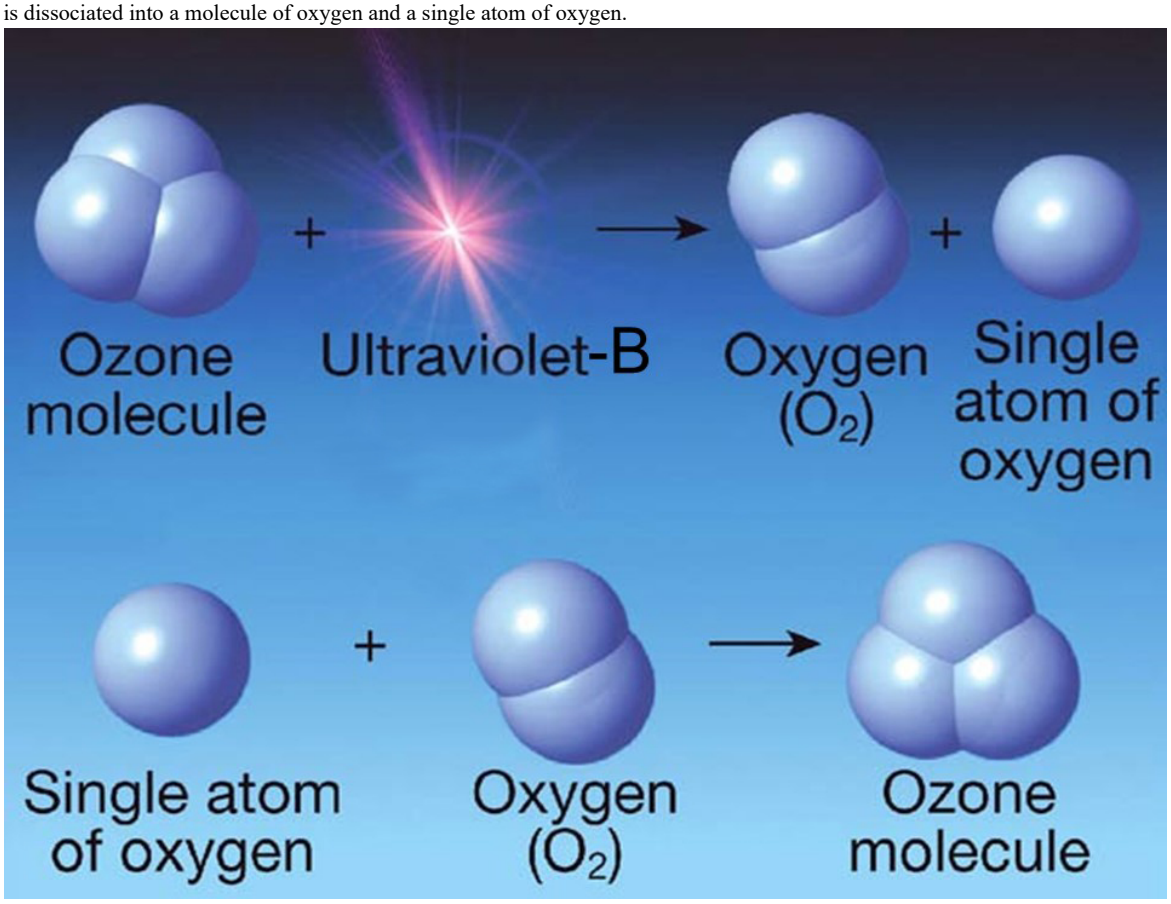
Terrestrial infrared radiation, on the other hand, does not have enough energy to dissociate or ionize anything.

Carbon dioxide absorbs less than 16% of the frequencies radiated by Earth and this energy is absorbed into the bonds holding the molecule together, which has no direct effect on kinetic energy of linear motion nor on gas temperature.

There is no known physical way that greenhouse gases absorbing terrestrial infrared radiation can cause warming of air.

SUN DESTROYS AND REPRODUCES 12% OF THE OZONE LAYER EACH DAY

When a molecule of ozone absorbs solar ultraviolet-B radiation with frequency of oscillation around 1176 terahertz, the molecule is dissociated into a molecule of oxygen and a single atom of oxygen.

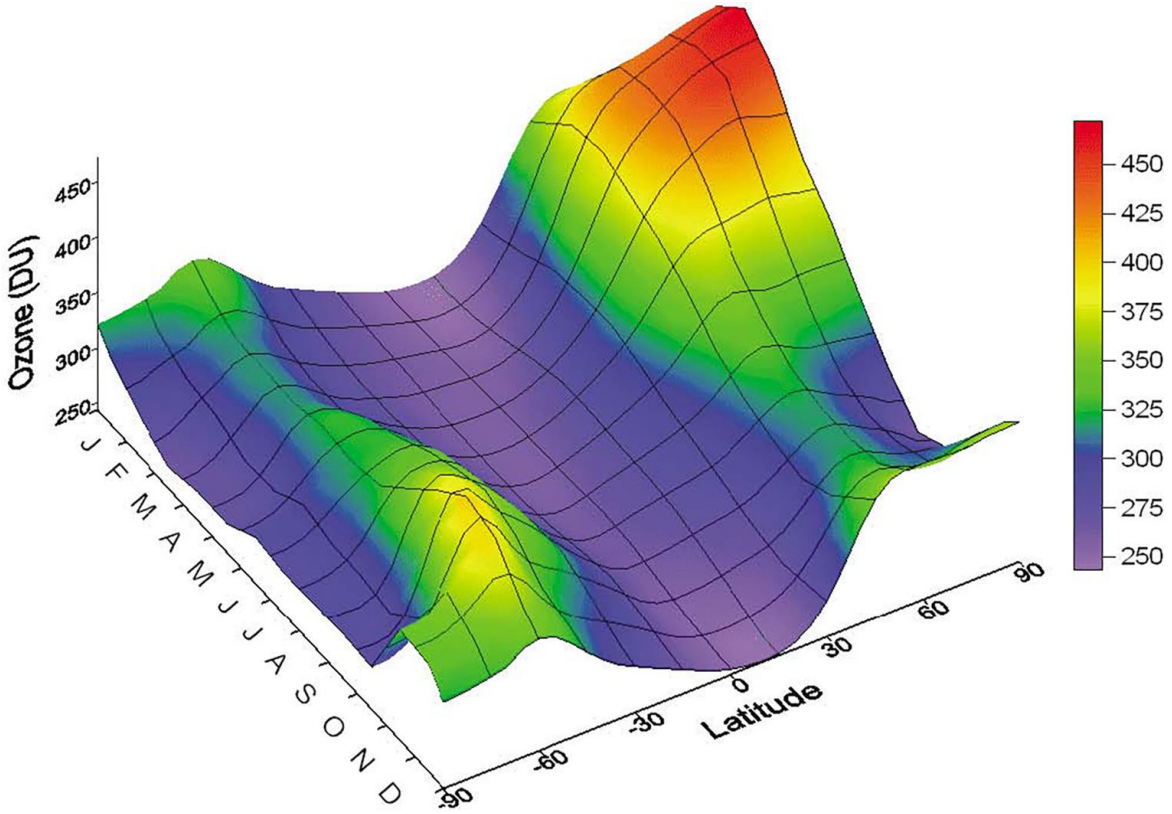


When a single atom of oxygen comes close enough to a molecule of oxygen, the bond is reestablished forming a molecule of ozone.

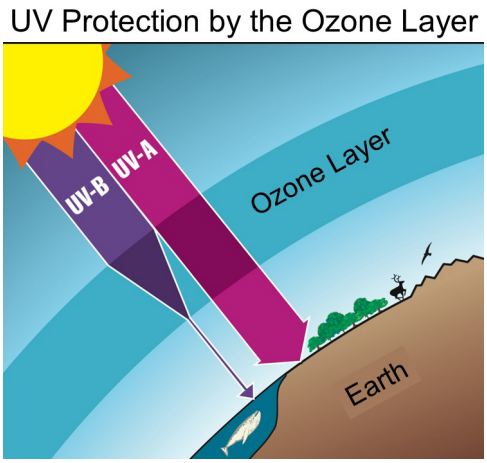
This oxygen-ozone cycle is continuous on the sun-lit side of Earth. Sun destroys and reproduces about 12% of the ozone layer each day.

Since sunlight varies with latitude and season, so does ozone concentration with a buildup over the poles during winter.

Around 1970, depletion of the ozone layer began increasing in lpolar regions during late winter and early spring.



OZONE DEPLETION ALLOWS MORE UV-B TO REACH EARTH WHERE IT DISSOCIATES OZONE POLLUTION, ENHANCING THE URBAN HEAT ISLAND EFFECT



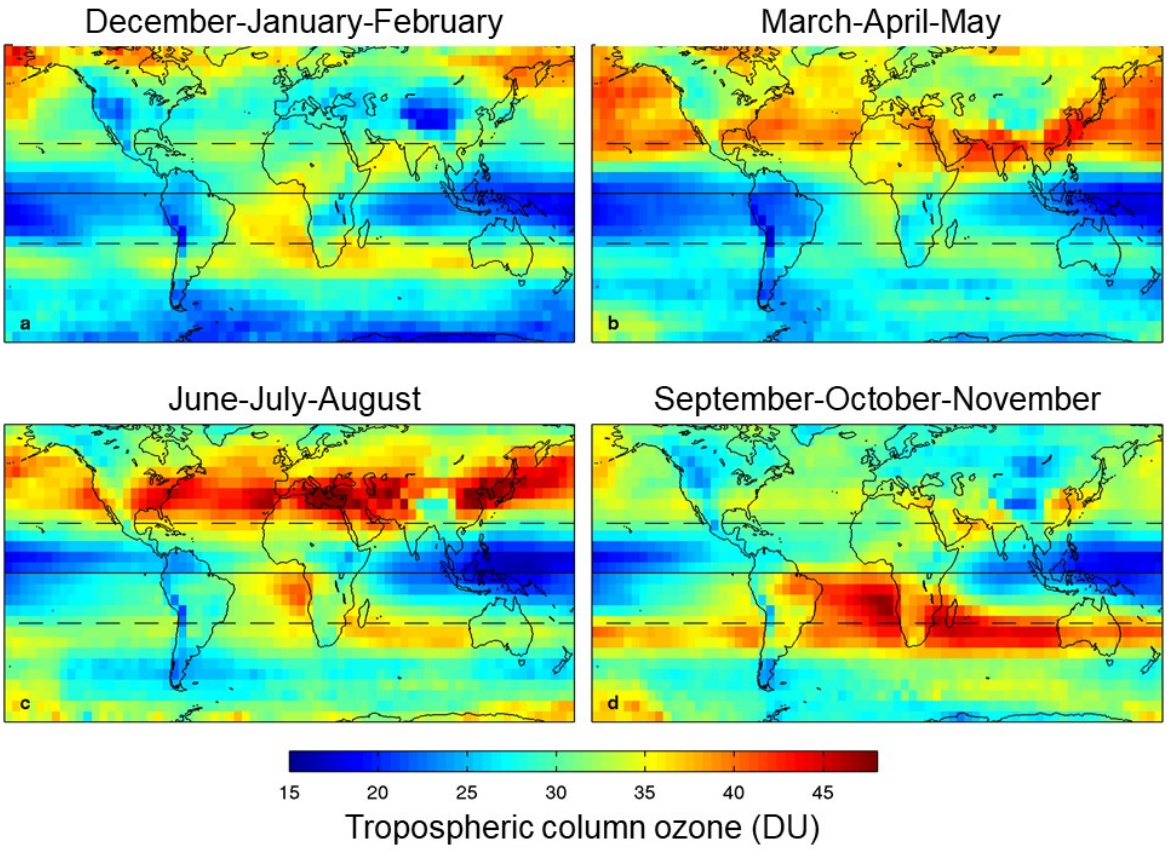
Before 1970, 97 to 99% of all ultraviolet-B radiation was absorbed in the lower stratosphere. Between 1970 and 1996, ozone depletion increased to as much as 70%, allowing more UV-B radiation to reach Earth.

Ultraviolet-B penetrates oceans tens of meters and thus is efficiently absorbed, increasing ocean heat content as continues today.

But ultraviolet-B also dissociates ground-level ozone pollution, directly heating polluted urban areas.

Since 1970, global warming has been twice as great in the northern hemisphere containing 90% of world population than in the southern hemisphere.

Tropospheric Column Ozone



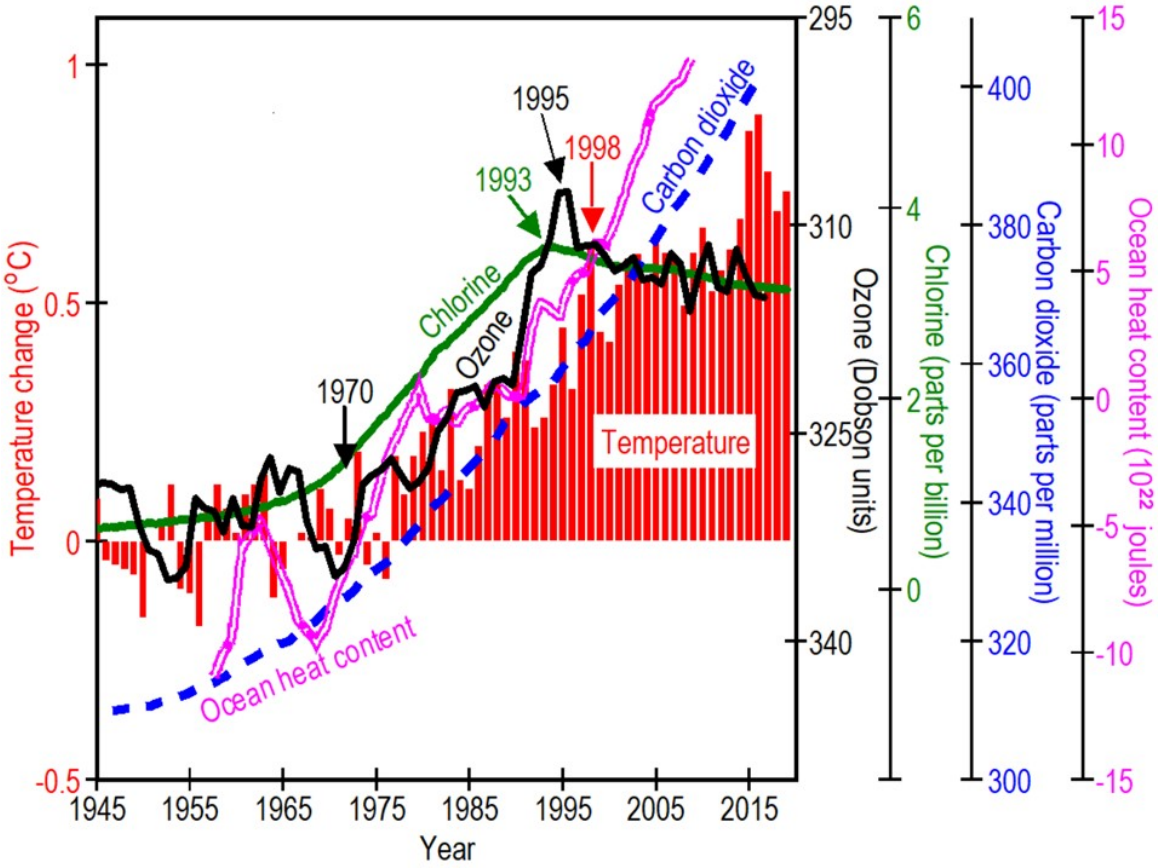
Since 1970, warming has been greater in urban and industrial areas, something known as the Urban Heat Island Effect.

Dissociation of ozone pollution may play a much bigger role warming urban areas than currently thought.

The greatest warming since 1970 was along the Antarctic Peninsula, within the Antarctic Ozone Hole, during the winter, contemporaneous with the greatest ozone depletion. Warming was also great in Arctic regions where ozone depletion was significant but not as great as in the Antarctic.

0.9℃ GLOBAL WARMING OBSERVED SINCE 1945 IS EXPLAINED MOST CLEARLY BY OZONE DEPLETION

The primary cause of ozone depletion in recent times was chlorofluorocarbon gases (CFCs) manufactured for use as spray-can propellants, refrigerants, solvents, and foam blowing agents. These chemicals became increasingly popular in the 1960s (green line).



Around 1970 ozone depletion (black line) and average global surface temperatures (red bars) began increasing.

In 1974, scientists realized that these inert CFCs are broken down by ultraviolet solar radiation, releasing atoms of chlorine, and that each atom of chlorine can destroy 100,000 molecules of ozone.

The United Nations ultimately passed the Montreal Protocol on Substances that Deplete the Ozone Layer, severely restricting production of CFCs, that took effect in 1989.

By 1993 the increase in atmospheric concentrations of CFCs stopped (green line). By 1995, the increase in ozone depletion stopped (black line). By 1998, the increase in global temperatures stopped (red bars). Meanwhile CO_2 concentrations kept increasing (blue dashed line).

The world warmed 0.6℃ from 1970 to 1998. CFCs are extremely inert gases, so their concentrations in the atmosphere and resulting high temperatures will decrease very slowly over many decades until the ozone layer has recovered.

The only other period of warming since 1945 followed the 2014 eruption of Bárðarbunga volcano in central Iceland, the largest eruption of basaltic lavas since 1784.

Global temperatures rose 0.3℃ from 2014 to 2016, the hottest year on record.

Temperatures remained high for two years following the 2018 eruption of lavas from Kilauea volcano in Hawaii, which covered less than half the area as those extruded from Bárðarbunga.

Throughout Earth history, essentially all periods when major basaltic lava eruptions occurred were contemporaneous with global warming—the more extensive the eruption, the greater the resulting warming. At least twice in Earth history, basaltic lavas covered areas of land almost as large as the United States.

DISCLOSURES

All this work was funded by my children's inheritance. I have no competing interests.

AUTHOR INFORMATION

Dr. Peter Langdon Ward earned a BA at Dartmouth College and a PhD at Columbia University in geophysics.

He worked 27 years at the United States Geological Survey, leading a group of more than 140 scientists and staff and playing a lead role in establishing and initially leading a major national research program.

He chaired a committee at the White House, worked on a committee for Vice President Gore, and testified before Congress in 2004 and in 1978.

He earned two national awards for explaining science to the public. He and his work were featured on Good Morning America.

More details about Ward can be found at WhyClimateChanges.com/About (https://WhyClimateChanges.com/About).

Ward has worked full time in retirement, at his own expense, since 2006, carefully reexamining all the evidence and theories for why climate has changed throughout Earth history.

He has discovered that while explosive eruptions cause slow, incremental global cooling, effusive basaltic eruptions cause rapid global warming in highly erratic sequences that average around 4000 years.

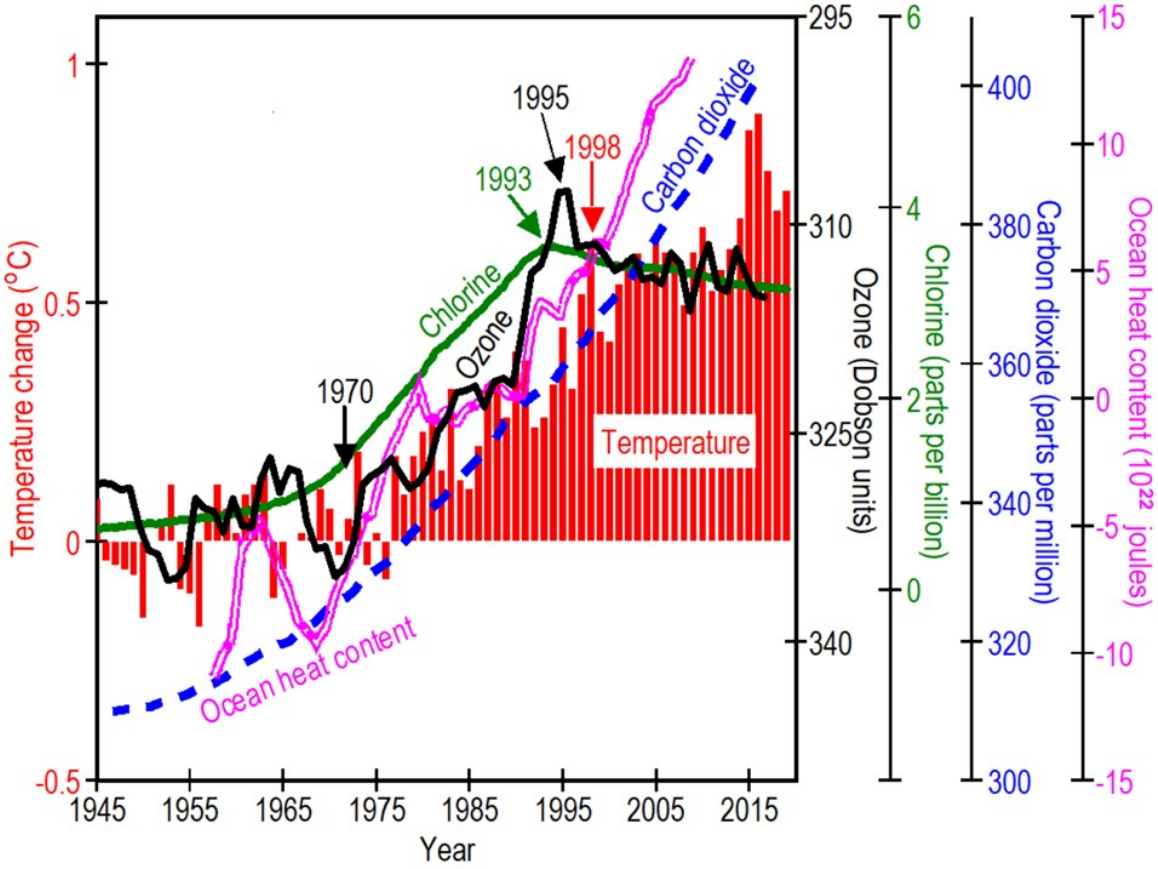
He has also discovered a fundamental error in the physics of heat that shows greenhouse-warming theory is not only mistaken, it is not physically possible.

More information at WhyClimateChanges.com (https://WhyClimateChanges.com), OzoneDepletionTheory.info (https://OzoneDepletionTheory.info), JustProveCO2.com (https://JustProveCO2.com), and Physically-Impossible.com (https://whyclimatechanges.com/impossible/).

ABSTRACT

When a molecule of ozone absorbs ultraviolet-B solar radiation with frequencies of oscillation near 1176 THz, it is dissociated into a molecule of oxygen and an atom of oxygen. Both pieces fly apart at high velocity converting kinetic energy of oscillation of the bond into kinetic energy of linear motion of the molecular pieces. Temperature of air is proportional to average kinetic energy of linear motion, which is proportional to average velocity of linear motion squared. When a molecule and an atom of oxygen collide, the bond can be reestablished and then dissociated again in the well-known oxygen-ozone cycle. Continual dissociation of oxygen by ultraviolet-C radiation with frequencies near 1237 THz warms the upper stratosphere. Continual dissociation of ozone warms the ozone layer in the lower stratosphere. In conditions normal before 1970, 97 to 99% of all ultraviolet-B radiation was absorbed in the lower stratosphere. Between 1970 and 1996, ozone depletion increased to as much as 70%, allowing more ultraviolet-B radiation to reach Earth. Ultraviolet-B penetrates oceans tens of meters and thus is efficiently absorbed, increasing ocean heat content as continues today. But ultraviolet-B also dissociates ground-level ozone pollution, directly heating polluted urban areas. Global warming since 1950 was twice as great in the northern hemisphere containing 90% of world population.

There are only three ways that air in Earth's atmosphere is observed to be warmed every day: when air comes in contact with Earth's sun-warmed surface and rises by convection warming the troposphere from below, when ultraviolet radiation dissociates gas molecules, warming the mesosphere and stratosphere from above, and when extreme ultraviolet, X-ray, and gamma ray frequencies ionize and heat the ionosphere and thermosphere from above. Terrestrial infrared radiation absorbed by greenhouse gases does not have high-enough energy to dissociate any gas molecule. Carbon dioxide absorbs less than 16% of the frequencies radiated by Earth and this energy is absorbed into the bonds holding the molecule together, which has no direct effect on kinetic energy of linear motion nor on gas temperature. It has yet to be shown by experiment that greenhouse gases are the primary cause for observed global warming. Details at WhyClimateChanges.com (https://WhyClimateChanges.com).



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Video: The most expensive mistake ever made in the history of science (https://whyclimatechanges.com/most-expensive-mistake/) (16 videos each 5 to 12 minutes)

Website: Videos of talks at scientific meetings (https://whyclimatechanges.com/videos/talks-about-climate/)