

Exhibit 5-4 "Climate-Gate."

"Climate-Gate" (also "Climategate") is a derogatory term that refers to an incident that brought international attention on climate-change scientists. The scientists were accused of misrepresenting, deleting, and suppressing data, and not making their computer codes available for examination. The evidence undermined the claim that anthropogenic carbon dioxide emissions were a major cause of catastrophic global warming. The term "Climate-Gate" was derived from the Watergate scandal that destroyed the U.S. presidency of Richard M. Nixon in the early 1970s. The Watergate, a hotel and office complex in Washington, D.C., housed the Democratic National Committee headquarters. On June 17, 1972, five men that were connected to president Nixon broke into the headquarters. The investigation of the break-in led to the discovery of other questionable acts in which the president was involved, eventually leading to his resignation. Since that time, the suffix "gate" has been used to represent a scandal of major significance and ruinous consequences.

As climate models evolved they began to predict that the Earth's future climate could be impacted by human activities, global warming. Because the remedies to prevent this warming also had dire consequences, scrutiny of the climate modeling, and the modelers themselves, became intense. The science behind the models was challenged on many fronts, and skeptics squared-off against the modeling proponents. Most major scientific bodies and individual climatologists defended the predicted warming and its anthropogenic causes. The topic became politicized and both sides sought ways to discredit each other.

The international Intergovernmental Panel on Climate Change (IPCC) was established to objectively evaluate the climate projections and make recommendations to governments. The IPCC supported the idea that anthropogenic activities, especially carbon dioxide emissions, were responsible for global warming, and that immediate action was required.

Although many sources of data on the climate were used by the IPCC, the Climatic Research Unit (CRU) of the University of East Anglia in England supplied some of the key temperature data. In November, 2009 thousands of e-mails and other documents were illegally hacked and distributed worldwide via the Internet. The two sides of the climate warming debate accused each other of misconduct. The contents of some of the e-mails were troublesome. It was clear that the CRU scientists were concerned about attacks on the anthropogenic global warming hypothesis, and they discussed ways of fighting back in their private e-mail messages. Accusers claimed that the e-mails provided evidence of hiding important data, deleting sensitive peer-review process, and not sharing computer codes. The CRU scientists claimed that their private communications had been taken out of context and misrepresented.

Investigations were quickly launched by the University of East Anglia and British police. The CRU Director resigned his position pending the results of the investigation. The IPCC also planned to investigate. The lessons are clear. When a research finding becomes politicized, the normal slow deliberate scientific process that provides for challenge and eventual acceptance (or rejection) is disrupted. Warring sides, interested in winning instead of seeking the truth, can engage in personal attacks, dishonesty, and other destructive and wasteful activities.

climate models. It should be noted that the global radiative forcing by greenhouse gases is positive (about 2.9 ± 0.3 watts/m²), which opposes the apparent cooling effects of particles. Also, although particles tend to reduce the incident solar radiation at the top of the atmosphere, smog can also absorb solar energy and lead to local heating at lower altitudes.

IV. STRATOSPHERIC OZONE

Why is Stratospheric Ozone Important?

Ozone (O₃) has a dual role with respect to its effects on living systems (i.e., microbes, plants, and animals). In the troposphere (the lowest 10 km of the Earth's

atmosphere), inhaled ozone in elevated concentrations has adverse effects on the respiratory tracts of mammals. Thus, tropospheric ozone is sometimes called *bad ozone*. Conversely, in the stratosphere ozone absorbs solar ultraviolet (UV) radiation. If all of the solar UV radiation that falls on the Earth reached the surface, terrestrial life as we know it would vanish. Thus, stratospheric ozone is commonly called *good ozone*. Even at relatively low levels (e.g., normal levels) UV radiation can contribute to skin cancer and eye damage in humans. It is important for people to limit their skin exposure to sunlight by using topical sunscreens, and also to wear UV protective glasses in order to control the adverse effects of UV radiation on their eyes. The "suntan," which became popular in the 20th century, is no longer regarded as a

sign of good health by medical experts. Both basal cell and squamous cell skin carcinomas are known to be produced by sunlight, especially in light-skinned individuals. Eye damage from UV exposure includes, acutely, an inflammation of the tissues, and chronically, cataracts, independent of skin color.

Fortunately, the Earth has a substantial layer of ozone in the stratosphere (Figure 5-5). This layer is very effective in absorbing UV radiation, especially in the shorter wavelengths (Figure 5-6). However, a substantial long-term thinning of the stratospheric ozone "blanket" would pose a threat to life and health. As a result, a considerable amount of effort is being directed toward monitoring, modeling, and otherwise understanding ozone chemistry in the stratosphere.

Ozone Measurement, Formation, and Destruction

Stratospheric Ozone Measurement

The preferred unit of measurement for ozone depends on the location. In the *troposphere*, where ozone levels are small, ppm (parts per million) or ppb (parts per billion) units are used; such units are ratios of the volume fraction of ozone in relation to the total air. So, if one knows the volume of air inhaled, the dose of ozone to the body can be calculated. In the *stratosphere*, although ppm units of measurement are sometimes used, the *Dobson Unit* (DU) is more common because as a *thickness* unit

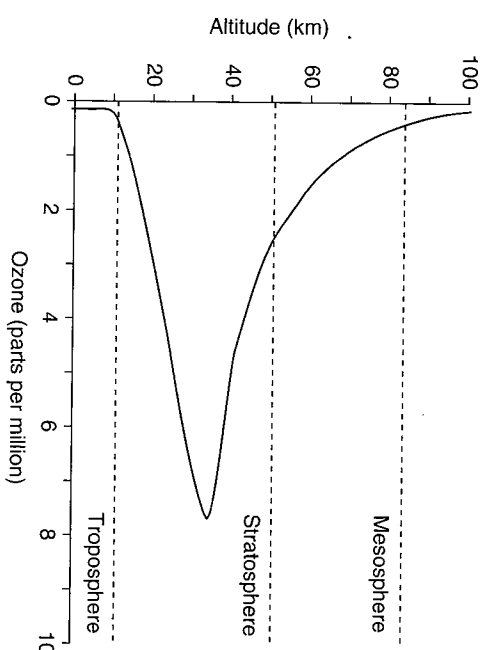


Figure 5-5 Ozone concentration vs altitude. Modified from NASA's "Ozone Facts" (<http://ozonewatch.gsfc.nasa.gov/facts/ozone.html>; accessed 12/26/2009). Source: The University of California Air Pollution Health Effects Laboratory, with kind permission.

it is related more directly to the absorption of solar UV energy.

One Dobson Unit (after G. M. B. Dobson, British physicist and meteorologist, 1889–1976) is the number of molecules of ozone that are needed to form a layer of pure ozone 0.01 mm thick (at 0°C and 1 atm. pressure)

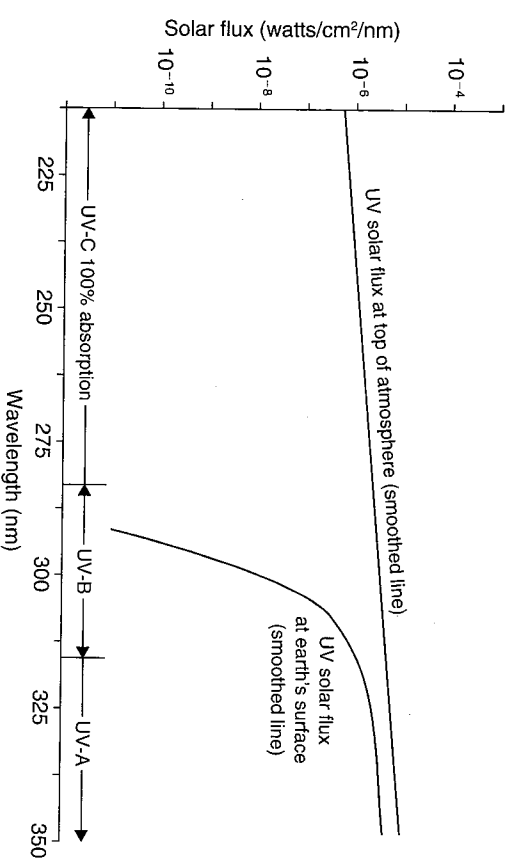


Figure 5-6 The absorption of ultraviolet radiation in the Earth's atmosphere. After NASA's "Ozone Facts" (<http://ozonewatch.gsfc.nasa.gov/facts/ozone.html>; accessed 12/26/2009).

Source: The University of California Air Pollution Health Effects Laboratory, with kind permission.