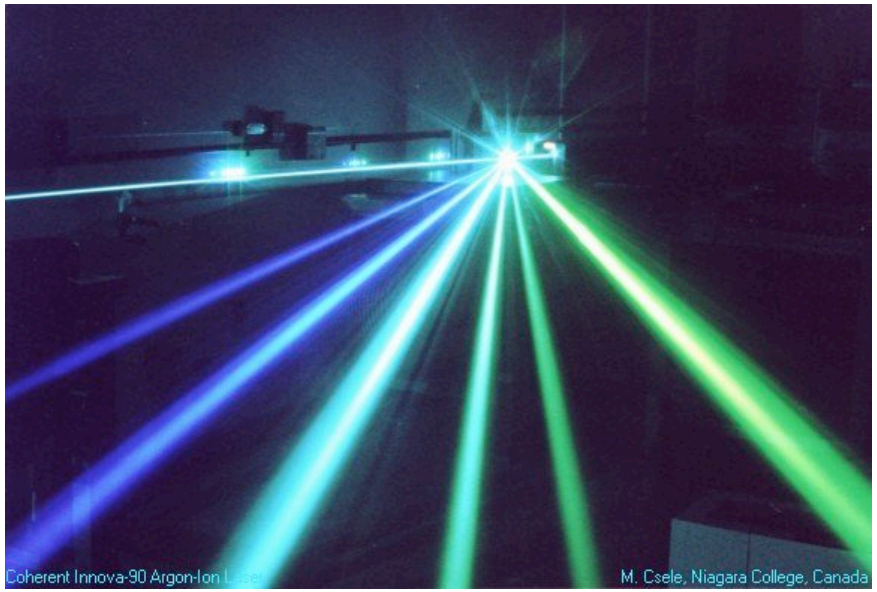
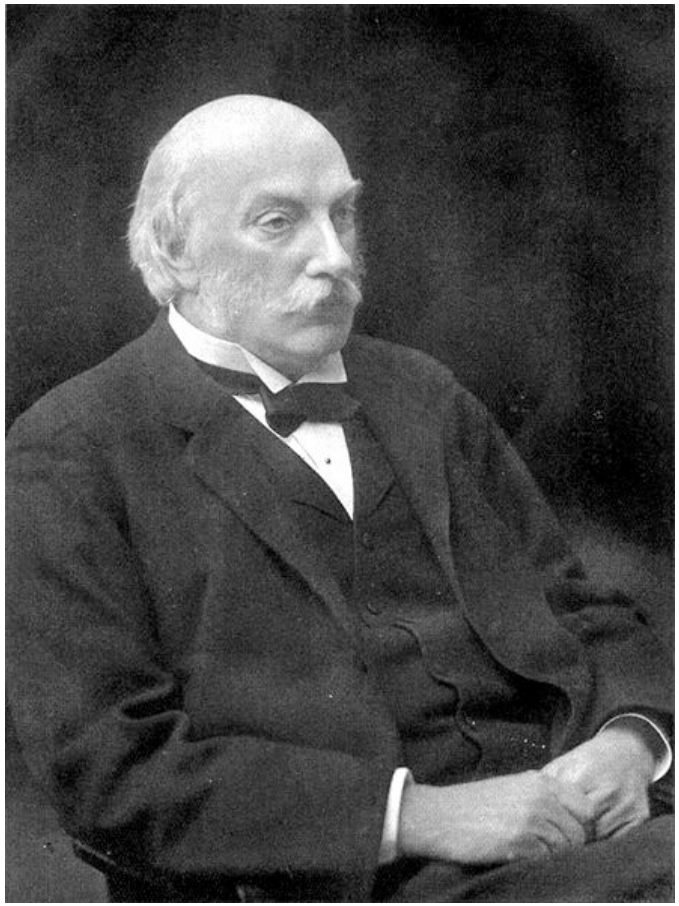
Atmospheric Analysis: The Discovery of Argon.



Argon ion laser



Nobel Prize in Physics (1904)
Also explained why the sky is blue
(Rayleigh Scattering)

John Strutt
Lord Rayleigh
(1842-1919)

Atmospheric Analysis: The Discovery of Argon.

In 1894, Lord Rayleigh lectured the Royal Society on the difference in the weight of Nitrogen gas derived from chemical and atmospheric sources. This difference was explained in terms of a new, hitherto undiscovered element. Sir William Ramsay (an Analytical Chemist who worked for Bunsen) later isolated this element, which he called Argon.

Here are the data that Lord Rayleigh presented:

Atmospheric Nitrogen:

2.3103g by hot copper
2.3100 by hot iron
2.3102 by ferrous hydrate
2.3102 +/- 0.004g

Chemical Nitrogen:

2.3001g from nitric oxide
2.2990 from nitrous oxide
2.2987 from ammonium nitrite purified at red heat
2.2985 from urea
2.2987 from ammonium nitrite purified in the cold
2.2990 +/- 0.008g

From this data, Lord Rayleigh determined that there was 1% of something ELSE in air:

Atmospheric Content:

78 percent nitrogen
21 percent oxygen
1 percent Something Else – Argon!

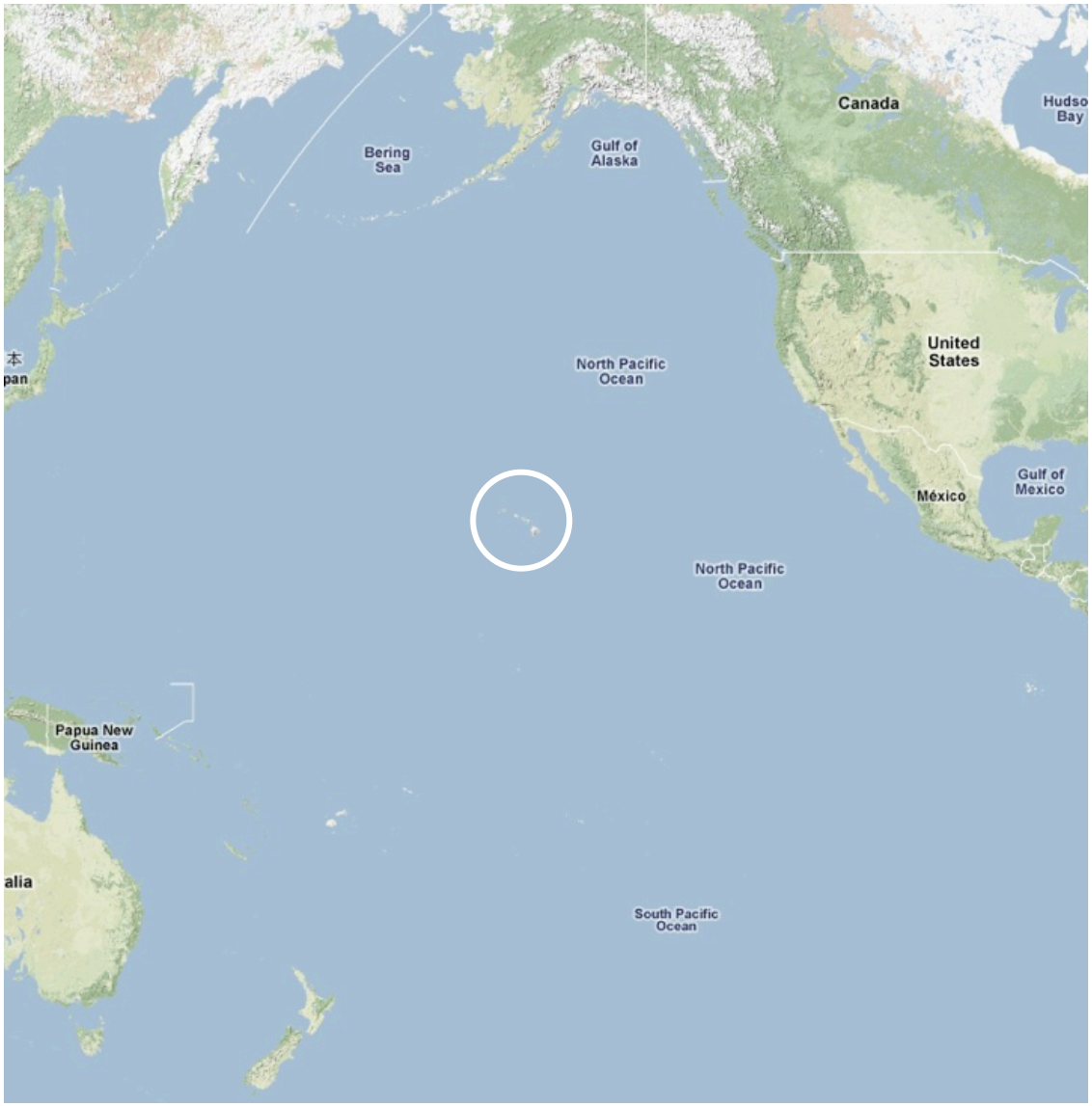
Lord Rayleigh wasn't too far off from the truth:

Real Atmospheric Content:

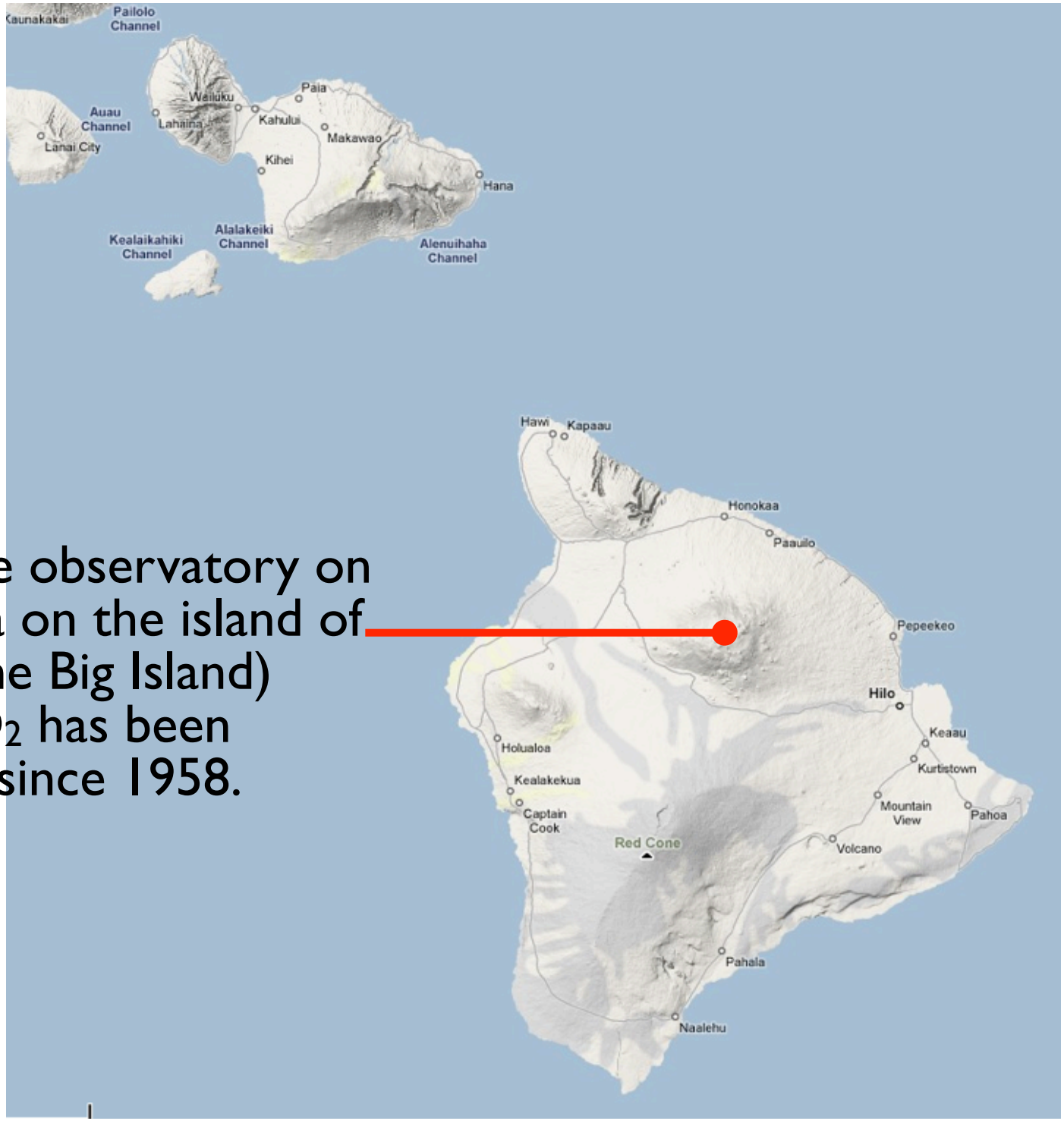
78 percent nitrogen
21 percent oxygen
0.9 percent argon
0.04 percent carbon dioxide
0.06 percent other

The remaining 0.06 percent is a mixture of hydrogen, water, ozone, neon, helium, krypton, xenon, and other trace components.

The Hawaiian islands are a great place to take the pulse of the planet. They are the most geographically isolated islands on planet earth.



Here is the observatory on Mauna Loa on the island of Hawaii (The Big Island) where CO_2 has been measured since 1958.



Carbon Dioxide Research Group, Scripps Institution of Oceanography, University of California, La Jolla, California 92093-0444, U.S.A.

Period of Record
1958-2008

Methods

Air samples at Mauna Loa are collected continuously from air intakes at the top of four 7-m towers and one 27-m tower. Four air samples are collected each hour for the purpose of determining the CO2 concentration. Determinations of CO2 are made by using a Siemens Ultramat 3 nondispersive infrared gas analyzer with a water vapor freeze trap. This analyzer registers the concentration of CO2 in a stream of air flowing at ~0.5 L/min. Every 30 minutes, the flow is replaced by a stream of calibrating gas or "working reference gas". In December 1983, CO2-in-N2 calibration gases were replaced with the currently used CO2-in-air calibration gases. These calibration gases and other reference gases are compared periodically to determine the instrument sensitivity and to check for possible contamination in the air-handling system. These reference gases are themselves calibrated against specific standard gases whose CO2 concentrations are determined manometrically. Greater details about the sampling methods at Mauna Loa are given in Keeling et al. (1982) and Keeling et al. (2002).

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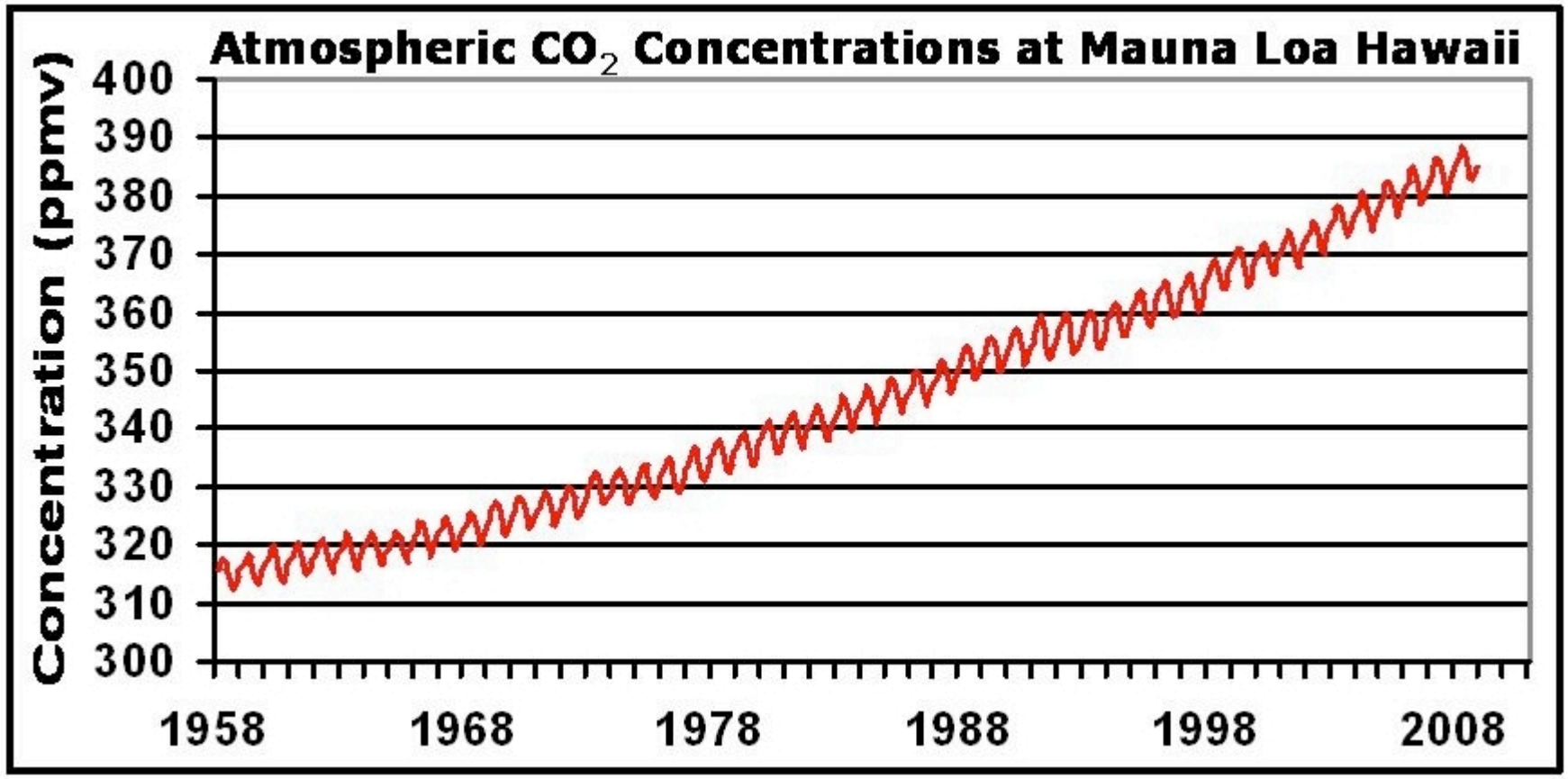
Hourly averages of atmospheric CO2 concentration, wind speed, and wind direction are plotted as a basis for selecting data for further processing. Data are selected for periods of steady hourly data to within ~0.5 parts per million by volume (ppmv); at least six consecutive hours of steady data are required to form a daily average. Greater details about the data selection criteria used at Mauna Loa are given in Bacastow et al. (1985).

References

Bacastow, R.B., C.D. Keeling, and T.P. Whorf. 1985.
Seasonal amplitude increase in atmospheric CO2 concentration at Mauna Loa, Hawaii, 1959-1982.
Journal of Geophysical Research 90(D6):10529-40.

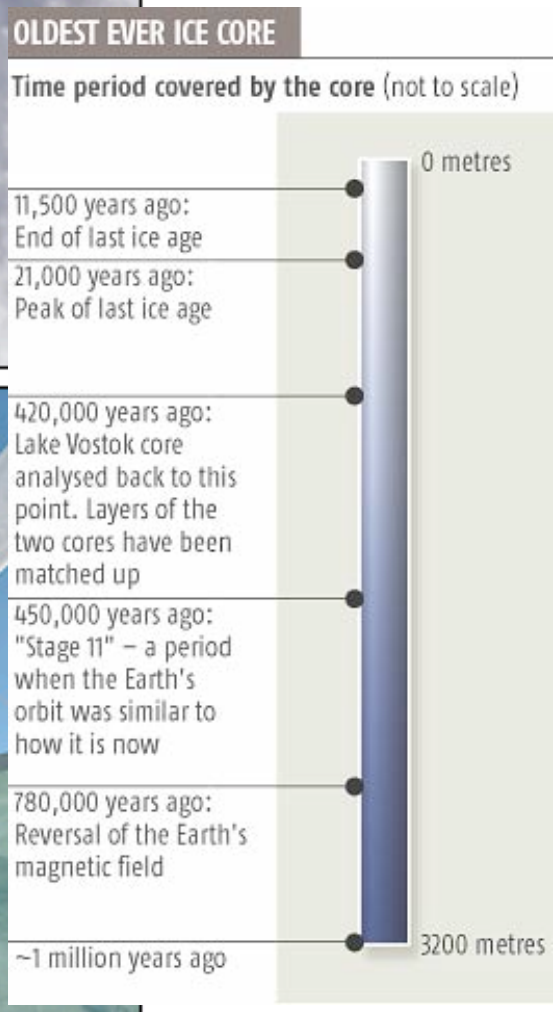
CITE AS: Keeling, C.D. and T.P. Whorf. 2005. Atmospheric CO2 records from sites in the SIO air sampling network. In Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A.



Source: http://cdiac.ornl.gov/trends/co2/sio-mlo.html

August 2011: 390 ppmv (Source: http://co2now.org/)

If you want to know what the CO_2 levels were before 1900, you measure the gases trapped in ice cores...



http://earthobservatory.nasa.gov/Study/Paleoclimatology_IceCores/

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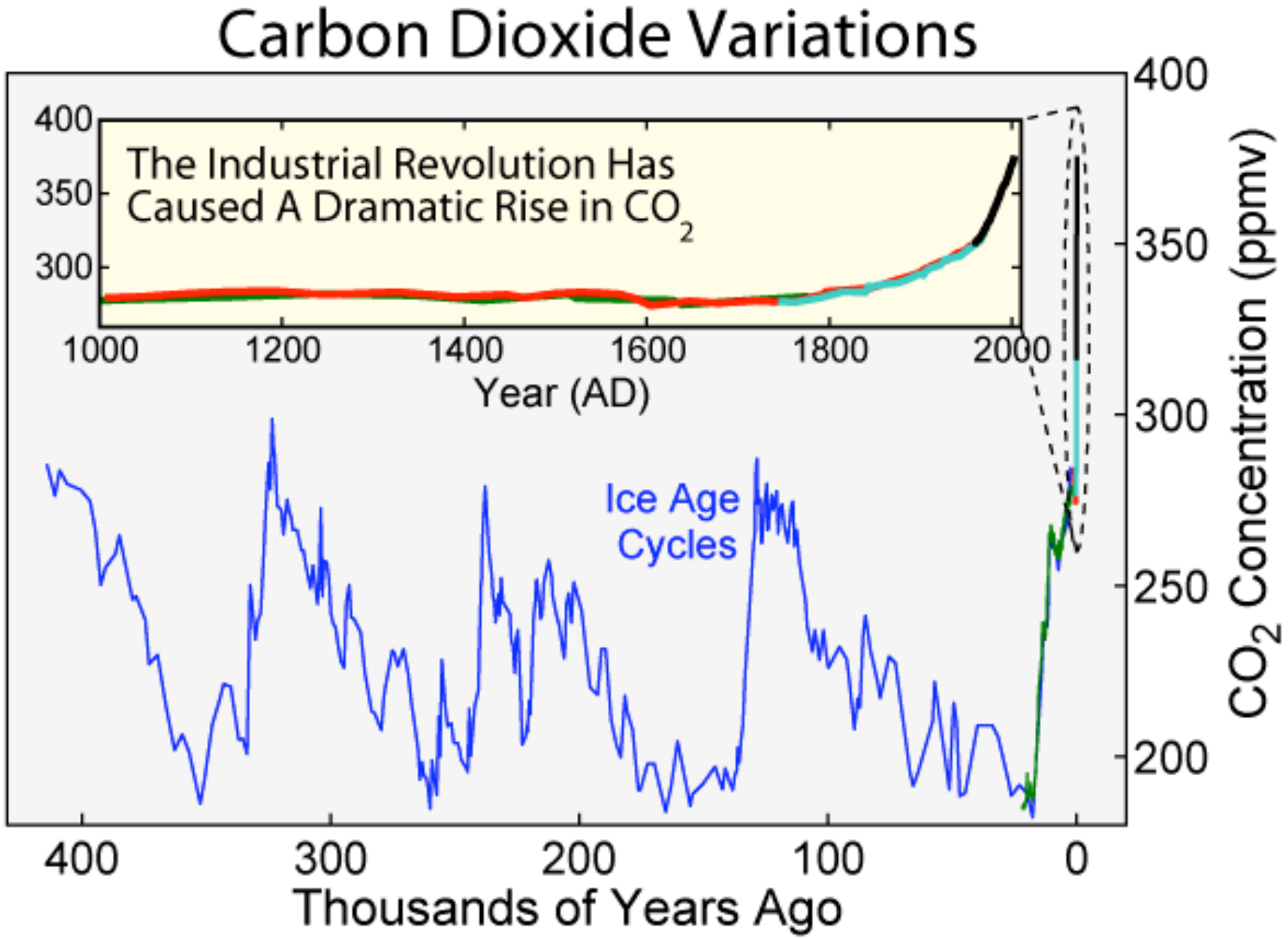
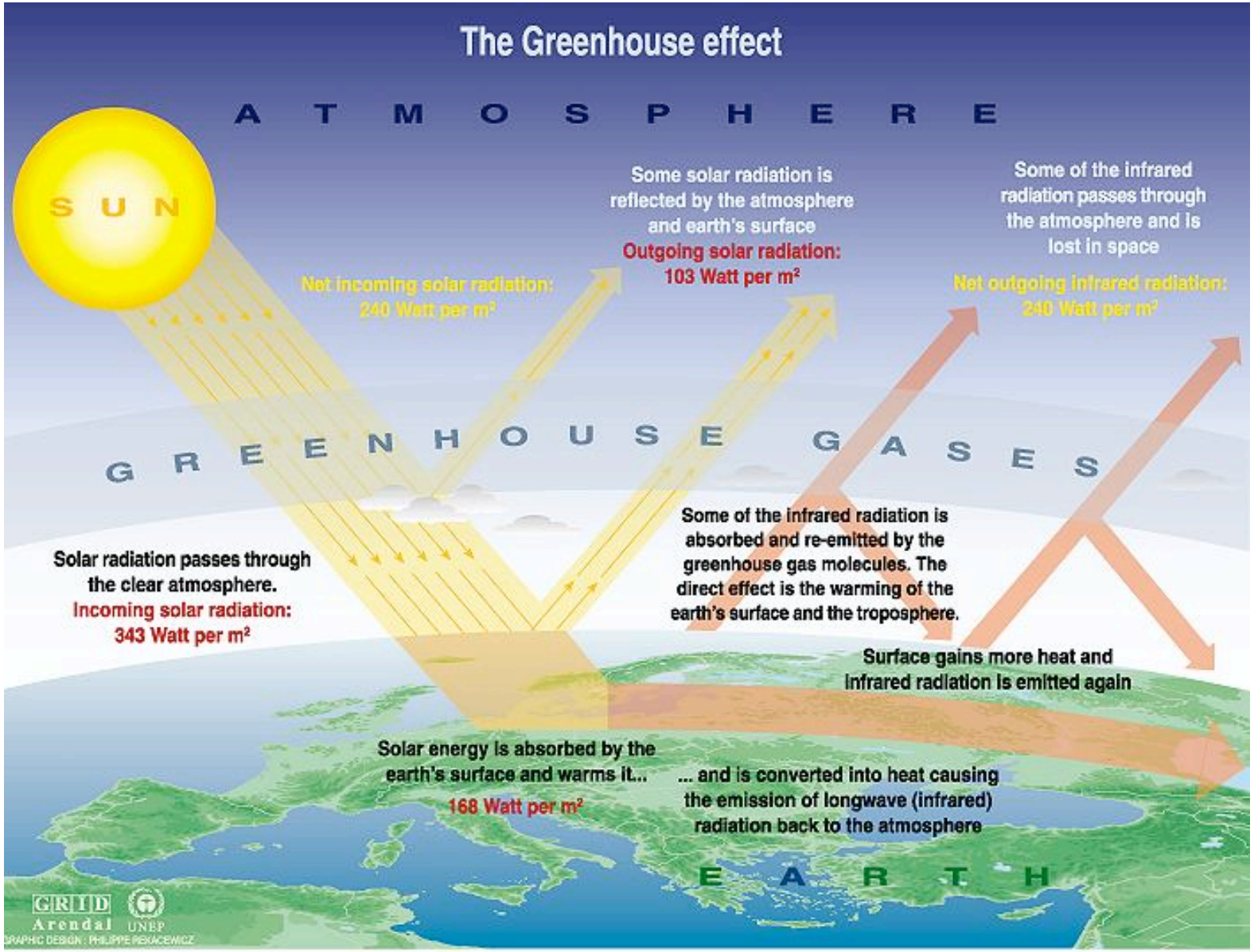


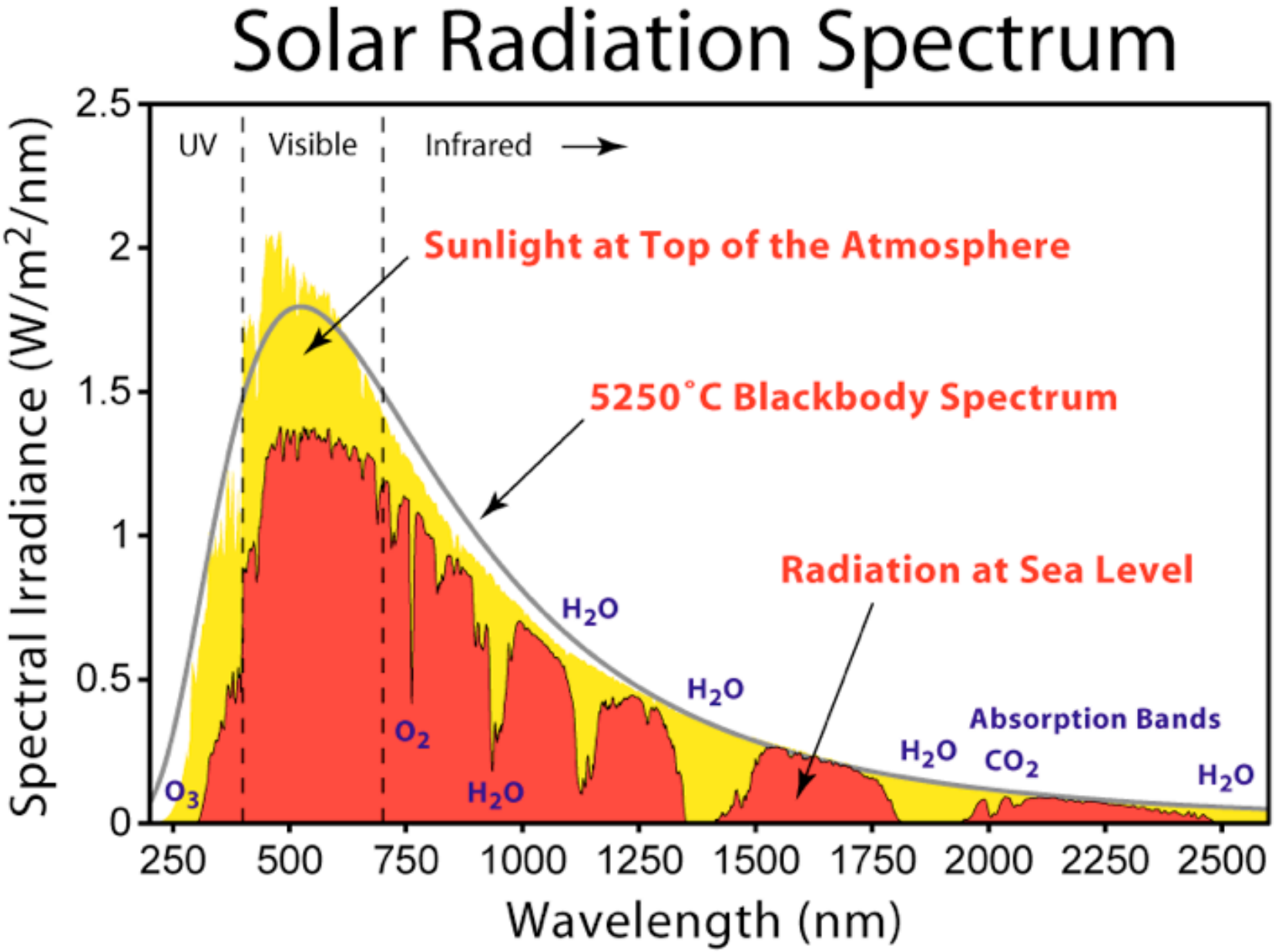
http://www.globalwarmingart.com/images/d/d3/Carbon_Dioxide_400kyr_Rev.png

the greenhouse effect

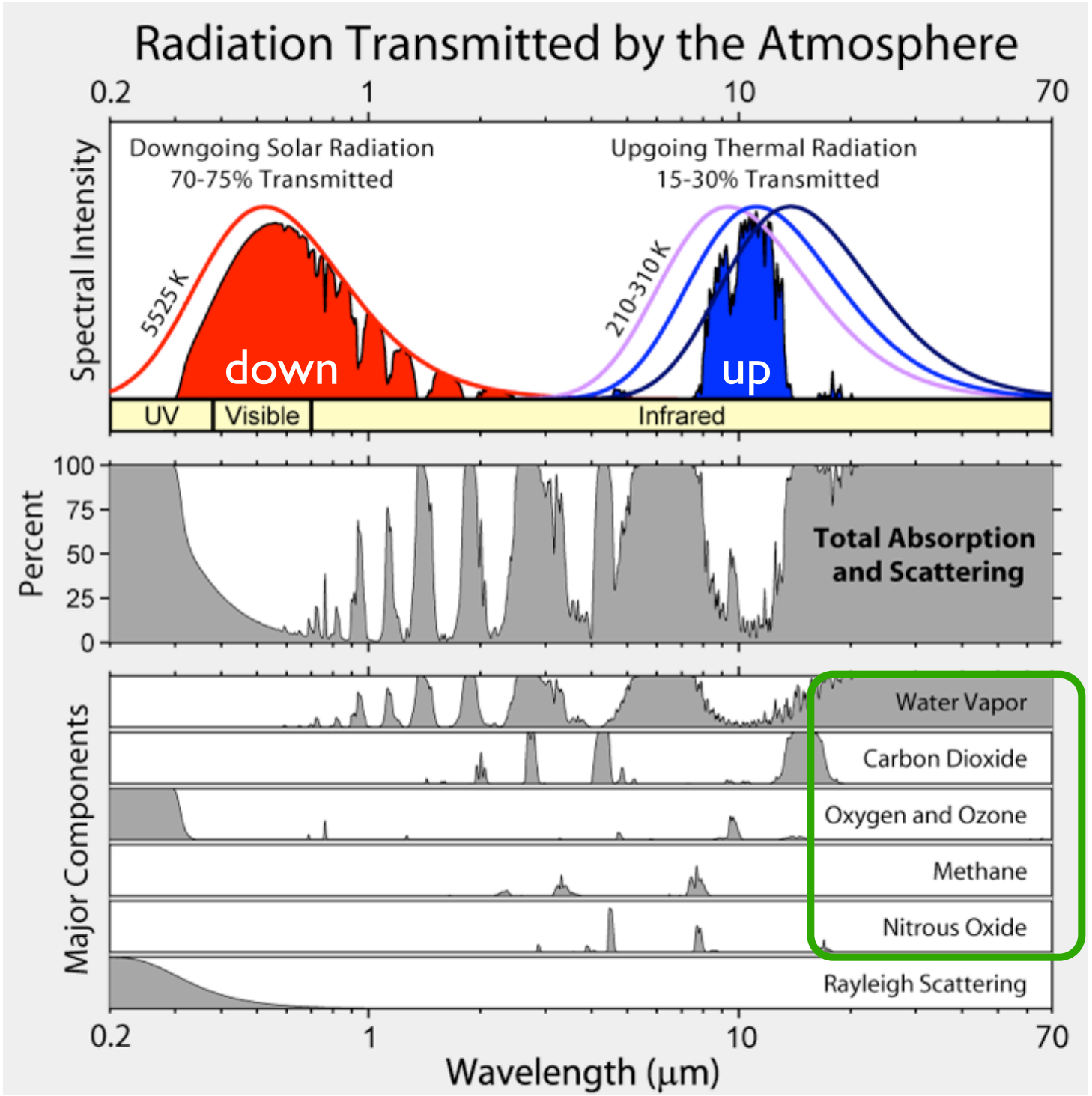


Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

http://oceanworld.tamu.edu/resources/oceanography-book/Images/greenhouseeffect.jpg



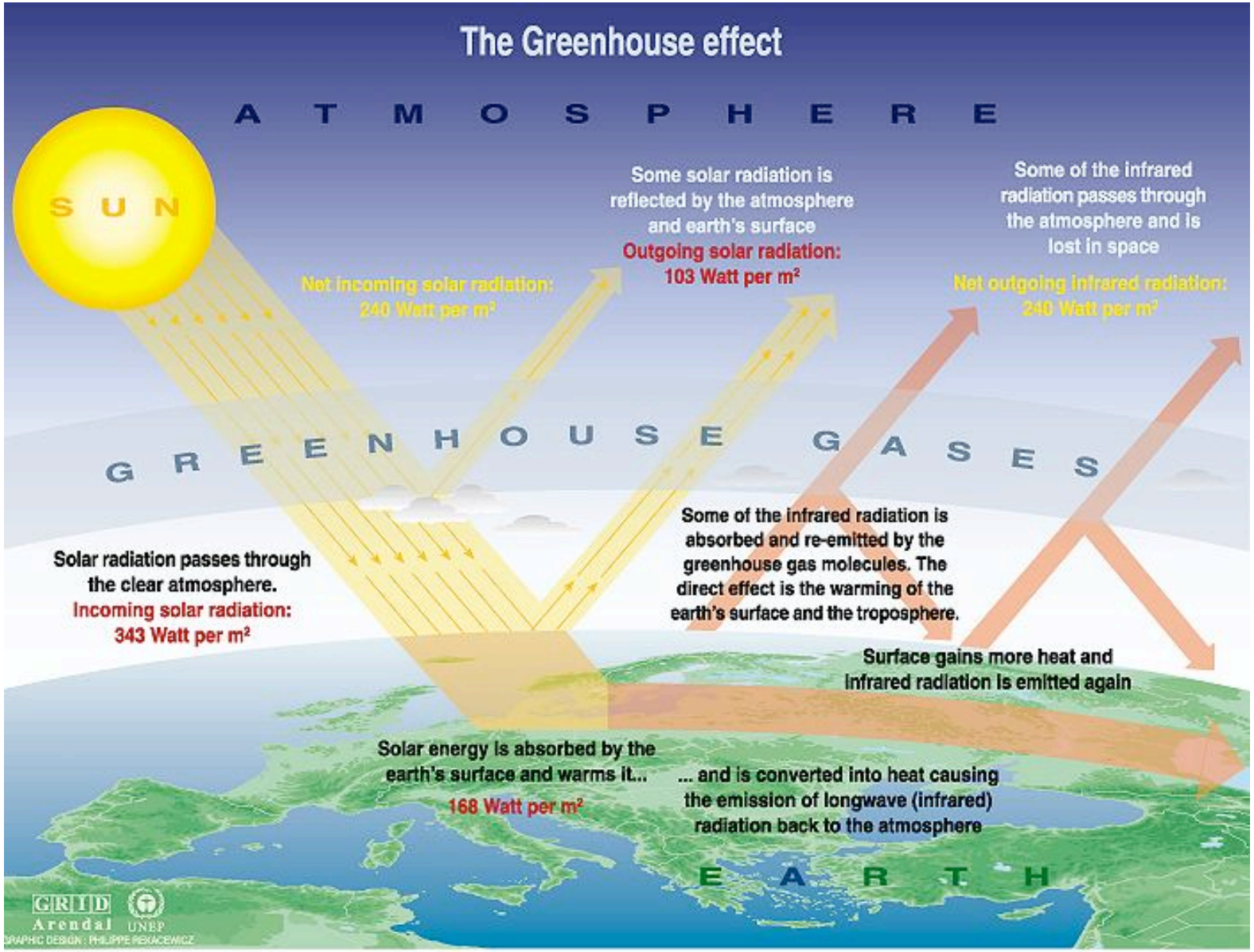
http://upload.wikimedia.org/wikipedia/commons/4/4c/Solar_Spectrum.png



the greenhouse gases

http://upload.wikimedia.org/wikipedia/commons/7/7c/Atmospheric_Transmission.png

the greenhouse effect



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