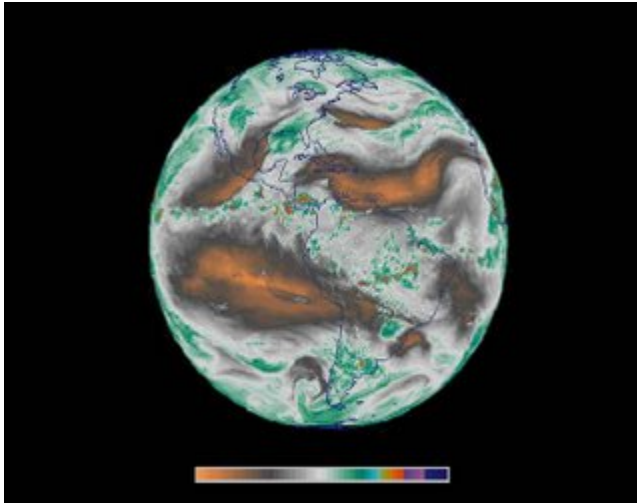


MISSING WATER VAPOR AND MUCH MORE.

THURSDAY, JANUARY 17, 2008

Global Warming...science or politics?



(image courtesy of A. Gruber and R. Achutuni, NOAA National Environmental Satellite Data and Information Service)

The term "global warming" (GW) is one of the most used terms in our language today. Our awareness is heightened everyday via TV, newspapers, magazines, radio, and the internet. Scientists have been "directly" measuring global temperatures for about 150 years, but data taken since the early 1900's indicates an increase of about 0.7°C (5 year moving average) to present. This seems to correlate nicely with the industrialization of our planet. Because of this correlation, projections of future increases and their ramifications have caused great concern. Melting glaciers, increasing frequency of record high temperatures, and milder winters in the Northern Hemisphere all reinforce the indisputable data.

So what is going on? Many experts and non-experts alike, have put the blame mostly on man-made (anthropogenic) green house gases (GHG) such as CO₂, coming from belching power plants and your neighbor's SUV. The documentary, *An Inconvenient Truth*, has raised further awareness and concern. Hurricane Katrina, the 2007 floods in China, and other weather extremes have been blamed on GW. While the reaction to GW has resulted in a global mobilization of resources to reduce levels of CO₂, some skeptics are crying foul.

Climate systems are very complex. There are some facts we know (the earth is warming) and a lot we don't (read on). In spite of what you hear, all scientists are not in agreement on what is causing GW. Are scientists pushing for reductions in CO₂ coming to conclusions based on good science? Is the science unbiased? I offer a prospective. You be the judge.

I am not a climate scientist but have a physics degree and am knowledgeable and practiced in the scientific method. As a casual observer of the GW debate, I often see endless sound bites, ideology, and emotion brought to bear on a very complex topic that requires data and good

science to figure out. Even worse, GW has become very political and a practicing religion by some. Well, I've decided to dig and probe and see if the religion is worth practicing....here we go.

Let's look at the composition of the atmosphere:<http://socrates.berkeley.edu/~budker/Physics138/Alyssa%20Atwood%20Atm%20Spec5.ppt> ; <http://forum.physorg.com/index.php?showtopic=15758> There are many sources for this info:

Nitrogen = 78.1%

Oxygen = 20.9%

Water Vapor = 2% average depending on location, temp, & partial pressure.

Argon + other inert gases = 0.936%

Carbon Dioxide = 370 ppm (0.037%) *

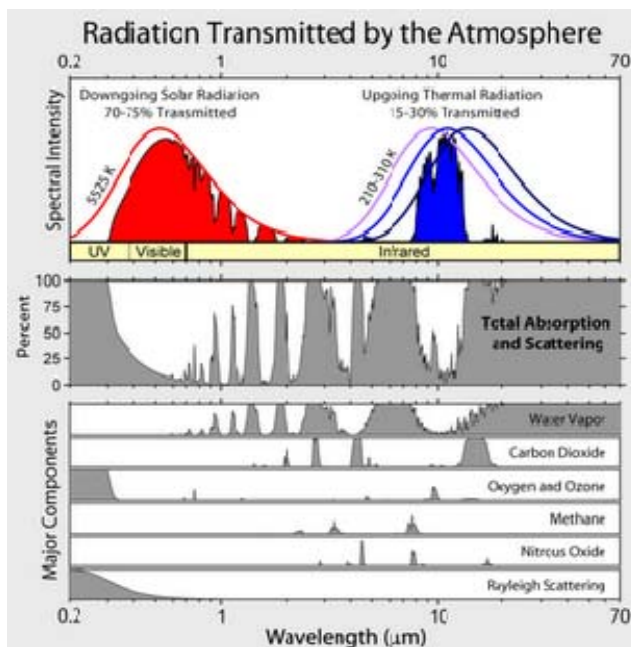
Methane = 1.7 ppm

Nitrous Oxides = 0.35

Ozone = 10^{-8} + other trace gases

* was about 280ppm 100 years ago.

The gases in bold are considered GHGs because they absorb heat from the sun. There is 50 times more water vapor than CO2 in our atmosphere. Water vapor and CO2 absorb heat energy at different rates. It is estimated that CO2 absorbs only about 8% of incoming radiation. WV absorbs about 70-80%. See figure 1.



Figure

1(http://en.wikipedia.org/wiki/Greenhouse_effect)

If you visually compare the amount of grey area on the water vapor and carbon dioxide lines, you will notice that water vapor exhibits more absorption in the infrared region (the wavelengths that heat the atmosphere). However, the infrared absorption spectrum of the atmospheric GHGs is very complex, partly because, in the atmosphere, the individual absorbers do not add linearly. The Energy Information Administration has a good article on GHG spectral overlaps and their significance... worth reading (http://www.eia.doe.gov/cneaf/alternate/page/environment/appd_d.html). They conclude

(with some uncertainty) that given the atmospheric concentration, the heating contribution from wv in the troposphere (0-14km...where we live) is about 95% and 5% for CO₂. In the stratosphere (18-50km, where nothing lives), it is 20% absorption for wv and 80% for CO₂. Also, water vapor concentrations decrease rapidly with altitude to less than 1% in the stratosphere. About half the total wv in the atmosphere is between sea level and 1.5km altitude. Given this info, let's do a quick calculation. If there is 50 times as much wv as CO₂ in the atmosphere and we know that the specific heat of wv is about 2.5 times greater than CO₂ (under similar temp and pressure conditions for an equal amount of incoming energy from the sun), water vapor stores as much as 125 times as much energy as CO₂ in our atmosphere. Even if we are off by a factor of two (due to pressure, wv altitude, different states of wv) we can say wv stores 60 times more energy in our atmosphere than CO₂. So, it seems to me that wv is a bigger factor in the heating of our atmosphere than CO₂.

The American Geophysical Union put together a nice report in 1995 that goes into great detail on the role of wv in the climate system. Since this report was a bit dated, I took the liberty to e-mail Edward T. Olsen at JPL-NASA working on the AIRS project(<http://www-airs.jpl.nasa.gov/>). He graciously replied:

"Yes, water vapor is the major GHG, responsible for at least 80% of the Greenhouse effect. In fact, without it Earth would be an iceball. We understand the basic physical processes controlling the amount of water vapor in our atmosphere, but have trouble modeling the complex system that is the Earth's atmosphere and its interaction with ocean and (especially) land. The models get the vertical distribution of water vapor wrong as well. It is an area of intense ongoing research. Your question about the trend in water vapor content is right on the money. We are attempting to determine that trend, and in particular what the trend is in terms of the vertical distribution. The action of water vapor as a GHG is more complex than CO₂. CO₂ remains in a gaseous state, whereas water changes among vapor, liquid and solid. Clouds are very important and very poorly modeled. If the trend is increasing water vapor (and thus clouds) in the lower troposphere, the effect is a reverse Greenhouse---low clouds are efficient radiators of energy back into space. If the trend is increasing water (ice crystals) in the upper troposphere (cirrus clouds), the effect is to enhance the Greenhouse --- high (and thus cold) clouds are inefficient in radiating energy to space but are good at trapping the IR radiation coming up from below. So, these are areas in which the AIRS data are contributing to improving the modeling of the Earth system, and thus forecasting of the future climate. The coupled climate models have a long way to go yet, and we are providing the data to test, correct and validate them."

Interesting. Does the IPCC (<http://www.ipcc.ch/>) know this....that we have a long way to go to really understand??? And what about the IPCC position on water vapor? They completely ignore water vapor and clouds in their models. They contend that the CO₂ is doing the warming, thus creating more water vapor, therefore increasing the heating effect and so on. There is a great article in *Physics World*, May 2003 by Maurellis and Tennyson entitled, "The climatic effects of water vapour"...a must read for anyone interested in this topic. (<http://physicsworld.com/cws/article/print/17402>). The authors conclude that there are many unresolved issues concerning water vapor in the atmosphere; however, it is clear that water vapor absorbs 70% (close to Olsen) of the sun's incoming infrared radiation. Water vapor concentrations are strongly related to temperature....so as temperature increases, water vapor increases, which also increases the amount of clouds. And, as our NASA consultant Olsen said, depending on the type and altitude of the resulting clouds, we have a positive or negative GH effect.

Ramanathan and Inamdar from the Center for Atmospheric Sciences, Scripps Institution of Oceanography, Univ. of California, San Diego, CA composed a nice paper(<http://www-ramanathan.ucsd.edu/FCMTheRadiativeForcingDueToCloudsandWaterVapor.pdf>) entitled, " The radiative forcing due to clouds and water vapor". The authors verify that the effect of clouds is very dependent on altitude (heard that before!) . Clouds are a major factor in determining the accuracy of global circulation models. More importantly, "the response of water vapor and its

greenhouse effect to surface and atmospheric temperature changes is a fundamental issue in climate dynamics". The authors express the need, not only for better data integrated over spatial scales, but also over time (seasonal and decadal...which are currently not available). There remain fundamental uncertainties like how much solar radiation is really reaching the earth and how clouds regulate the air temperature near the earth's surface. Going further, the authors suggest (and what we want to know as caretakers of the earth) that human activities can influence the radiative forcing of clouds. For instance, SO₂ emissions can significantly reduce the reflectivity of clouds, thus allowing more solar radiation to hit the earth. If this is true and turns out to be a significant GH factor, we might want to put more emphasis on SO₂ reduction rather than CO₂ reduction.

Alright, water vapor is important. So, what about all the water humans put into the atmosphere? I got back with our NASA expert Edward Olsen about anthropogenic water vapor. Here is what he said:

" Water vapor of anthropic origin is so tiny compared to that occurring naturally that it is not a concern. The sun does a very good job of filling our atmosphere with water vapor evaporated from the ocean surfaces, amounting to more than 70% of the surface of the Earth. There are a few giant reservoirs where surface evaporation produces very local increases in humidity. The water cycle is very rapid, in that in the course of only two weeks the natural rainfall precipitates all the water vapor stored in the atmosphere. Thus the solar evaporation must continually replenish the atmospheric water vapor on the same time scale."

Ok, so we can't blame ourselves for all the water we are pulling out of wells and all the deserts we are turning into farms and retirement communities. Also, it appears we need more data and improvements in observations. I have read numerous articles relating to the need to reduce uncertainty of satellite measurements, proper calibration of satellite sensors, and capturing good data from very dynamic systems. Just Google(individually): CERES; TRMM; Terra (NASA-EOS); AIRS; and ERBE-NOAA, to name a few, and you will see why we have a long way to go to reduce uncertainty in our measurements.

If anyone does a lot of reading and searching on this topic, you come to realize that the IPCC has made a BIG assumption here. They describe CO₂ as a "forcing" GHG and water vapor (clouds) as a "feedback" GHG. They also discount clouds in their models because they "believe" that the net forcing from clouds is zero. In other words, once the increased CO₂ has done its heating, the response of the atmosphere is to form more clouds, which cool the planet to a level consistent with what it was prior to the increase in CO₂. Let's think about this for a moment...bear with me here.

Let's duplicate a slice of the earth in the lab (in a large chamber) with 70% ocean and 30% land mass, the appropriate atmospheric make-up, and the correct complement of incoming radiation. If we were to artificially increase the CO₂ concentration (simulating anthropogenic CO₂) in our lab model, we would indeed see an increase in atmospheric temperature of X. The beauty of the experiment is that the only variable is CO₂...easy to understand and grasp. Big power plants and SUVs pump out CO₂...easy to make a compelling documentary showing the evidence....case closed. Taking the same model, let's hold CO₂ constant and increase the amount of water vapor by the same amount as we did the CO₂. The resulting temperature would be about 2.5 times greater and it would happen faster. I could also do a documentary using water vapor as the GHG and achieve even greater shock value. OK, so what's the point?

Here is the point. Humans contribute about 1-5% of the CO₂ to the atmosphere (depending on who is doing the calculation) and it is not evenly distributed. That means that the IPCC assumes the other 95-99% CO₂ contribution is constant (coming from the ocean, decaying matter, agriculture, and geothermal/volcanic activity)! Since when have natural geologic processes been constant? <http://www.pmel.noaa.gov/pubs/outstand/sabi2683/sabi2683.shtml>;

<http://www.radix.net/~bobg/faqs/scq.CO2rise.html> Furthermore, it is generally understood that water vapor is increasing at the rate of about 1 % per year. It is not clear why.http://ktb.engin.umich.edu/RSG/pubs_files/IGARSS2007_Brown_etal_TOPEX_IWV_Trend.pdf; http://luv.dkrz.de/publications_2004/pub_80_248.pdf; Finally, about 33-50% of CO2 (including the anthropogenic portion) is contained in the oceans. The solubility of CO2 is dependent on temperature. If oceans warm, they emit more CO2 (just like our beer). The entire carbon and water cycle is critical to GW. CO2 concentrations have fluctuating up and down for thousands of years without the help of man...and at higher levels.
<http://www.nature.com/nature/journal/v449/n7159/abs/nature06085.html> ;
http://en.wikipedia.org/wiki/Carbon_sink;
<http://science.hq.nasa.gov/strategy/roadmaps/carbon.html>

So much for CO2. The IPCC model does not account for other variables such as natural changes in solar radiation and volcanic/geothermal heating effects, which are just starting to be looked at as possible sources of climate change, and we don't have good data to support findings.

Alright, time to reflect. Does increasing CO2 cause atmospheric heating that, in turn, increases the levels of wv resulting in the GH effect? Or, is it more likely that increases in wv are the cause of what we call GW? Given that it would take roughly 100 times less increase in wv to achieve the same effect of a CO2-based GH effect, and that wv is the vehicle that circulates and keeps our earth warm, I would be inclined to believe that wv has a larger role in GW than CO2 proponents believe.

Here is my hypothesis: Since the oceans make up 70% of the earth's surface, it is solar and geothermal energy heating the oceans that, in turn, increase the levels of wv and CO2, resulting in global warming. Water vapor having the greatest effect. This hypothesis has two things going for it. 1) A very small increase in ocean temperature would release amounts of CO2 much greater than what man is creating. 2) The oceans are a heat sink and reflect the changes in geothermal activity under them (much like a tea kettle on the stove). Let's talk about these factors in more detail. You should also pay particular attention to the following referenced links.

1. Clouds: Sulfate (reflective) and carbonaceous (absorptive) aerosols in the troposphere effect how much solar radiation reaches earth (and oceans) as mentioned above. We do not know, globally, how our annual radiation budget changes. We can determine radiation budgets for specific locations on earth but not globally. For instance, it has been reported (through direct measurements) that warming trends in Asia have been enhanced by 50% due to "brown" aerosols. Brown aerosols absorb incoming radiation and directly transfer the heat to the surrounding atmosphere. This is a different factor than CO2.

<http://atmoz.org/blog/2007/08/01/warming-trends-in-asia-amplified-by-brown-cloud-solar-absorption/>

2. Solar variability: Reliable solar measurements have only been made for 30 years. However, we do know the sun has a natural 11 (Schwabe cycle) and 200 year cycle where sun spot activity ebbs and flows. At the peak of activity (where some scientists think we are), total energy from the sun increases by about 0.1%; however, there are so many variables in our atmosphere, it has been impossible to date to understand the resulting effect on temperature near the surface of the earth.

<http://www.gcrio.org/CONSEQUENCES/winter96/sunclimate.html> ;
<http://www.aip.org/history/climate/solar.htm>

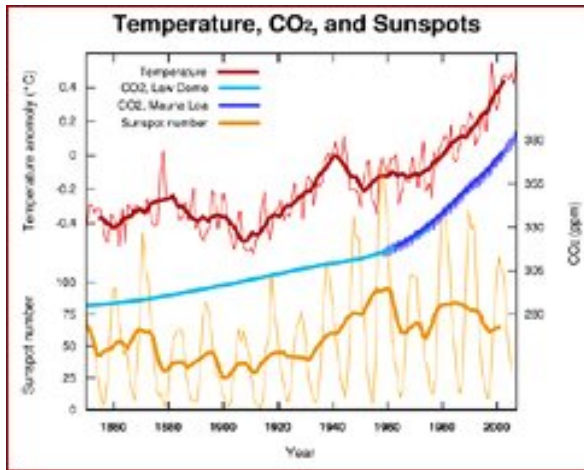


Figure 2

(http://en.wikipedia.org/wiki/Solar_variation)

That being said, looking at Figure 2, there is strong evidence that increased solar activity is a huge factor in GW and that changes in CO2 levels *follow* changes in solar activity, not the other way around. http://en.wikipedia.org/wiki/Solar_variation

3. Volcanos: Interestingly, an overlooked fact is that we seem to forget about the 70% of the earth's surface called oceans... not just the water, but what is under the water. The majority of volcanic activity on Earth is occurring without our knowledge under the sea. Recently, a subglacial volcano in the West Antarctic Ice Sheet is showing rapid changes, resulting in an increase in the flow of the ice sheet.

<http://www.sciencedaily.com/release/2008/01/080120160720.htm> Researchers from Oregon State Univ. have discovered new heat sources off the coast of Deception Island (Antarctic). They have discovered thermal vents on the seafloor and think they may be the cause of the 4 degree F rise in air temperature over the past 40 years around the Western Antarctic Peninsula. Hydrophones placed deep in the water indicate a corresponding increase in volcanic activity.

http://www.iceagenow.com/Sounds_of_Climate_Change.htm Using sonar, researchers have mapped 40 million kilometers (24 million miles) of the ocean floor and have discovered 201,055 volcanoes. Since the sonar data is a small portion of the ocean floor, it is expected that there could be 15 times more volcanoes than already verified.

http://iceagenow.com/Three_Million_Underwater_Volcanoes.htm It should be noted that you will probably not see the last three references in the mainstream media (newspapers, TV news, etc.) . This data is politically incorrect.

Let's wrap this up. My conclusions:

There are no definitive conclusions and lots of reasonable doubt about man's contribution to GW. We do not know what is causing GW. There are lots of factors to investigate but no smoking guns. The IPCC is scientifically derelict in its obligation to put GW into perspective by properly addressing other important factors. What once was probably an honest attempt to create predictable climate models has been misused by scientists and politicians, alike, to gain relevance and funding. They have tried to oversimplify a very complex issue that has satisfied enough journalists and non-scientists to achieve their ends. Shame on Al Gore for producing one of the most self-serving and misleading "documentaries" I have seen. The British Courts have correctly mandated that the documentary be shown with guidance notes to prevent political indoctrination. It is not science. It is disgusting and a disservice to humanity.

For those who have not consumed the Koolaid yet, special attention should be made to the three factors I have mentioned above. Interestingly, only one is controllable by man and that is

our affect on our atmosphere's albedo (reflectivity). It makes more sense to legislate reductions in SO2 and carbonaceous effluents than it does global CO2. Pollution is like politics, it is local. It should be legislated locally(regionally). Why? Because each locality/region has its own special problems/needs. The recent findings about the brown aerosol problem in Asia, above, is a good example. Regarding the sun and heating effects from under the oceans, we are just beginning to take them more seriously and collect more data. I predict over time these two variables will increase in importance (if they can get the funding) and start solving some of the mysteries of cause and effect. It has been said that we know more about the moon and our solar system than we do our oceans. I agree with that statement.

I am appreciative of any constructive feedback or information that might shed more light on this very complex issue.

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<http://zulaufgwwhitepaper.blogspot.com/2008/01/global-warmingscience-or-politics.html>