Climate Change Test 2

Source:
http://www.nps.gov/sama/planyourvisit/images/You-Control-Climate-Change-773583_1.jpg

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Climate Changes
MW 3:10-4:25

1.) Radiative forcing refers to the difference of radiant energy (typically from the suns rays) received by the Earth and the energy sent back to space. Positive forcing is that which sways the Earth towards warmer temperatures due to more incoming energy and negative forcing refers to changes towards cooler temperatures due to less incoming energy. Such causes that are said to contribute to radiative forcing are insolation and more recently talk about greenhouse gases and aerosols. An important idea behind radiative forcing is that these greenhouse gases affect the temperatures of the Earth through how much they contribute to reflecting sunlight or towards trapping it. Different gases have different effects though as aerosols tend to cause cooling from reflecting more light and causing an effect on clouds that causes them to reflect more sunlight. On the other hand you have Carbon dioxide which has the opposite effect by adding more direct heat into the atmosphere it creates its own added heat rather than from the reflection of light and rays from the sun. There are also natural causes for radiative forcing such as when volcanoes erupt they send sulfates high into the atmosphere and the result is cooling. That is something that is uncontrollable by humans, but then there is deforestation, which can happen from natural causes, but is more so human caused and results in less reflection of light and creates heating.

As can be observed there are many different ways that can create some type of radiative forcing that either cools or warms the Earth. One thing that should be duly noted that all these factors have their own uncertainties such as with aerosols there are many different types that attribute to both cooling and warming. It is also no simple to measure the exact amount of forcing since it requires you to measure levels of effects that are not able to be seen and that are so far reaching into the troposphere and around the whole Earth. Overall, it is hard to just add up these effects because some of the factors overlap. “For example, some different greenhouse gases absorb and emit at the same infrared wavelengths of radiation, so their combined warming effect is less than the sum of their individual effects”(Chandler 2010). This basically means that the

tools we have to measure use the same method and the combination is less meaningful as they are actually two separate effects.

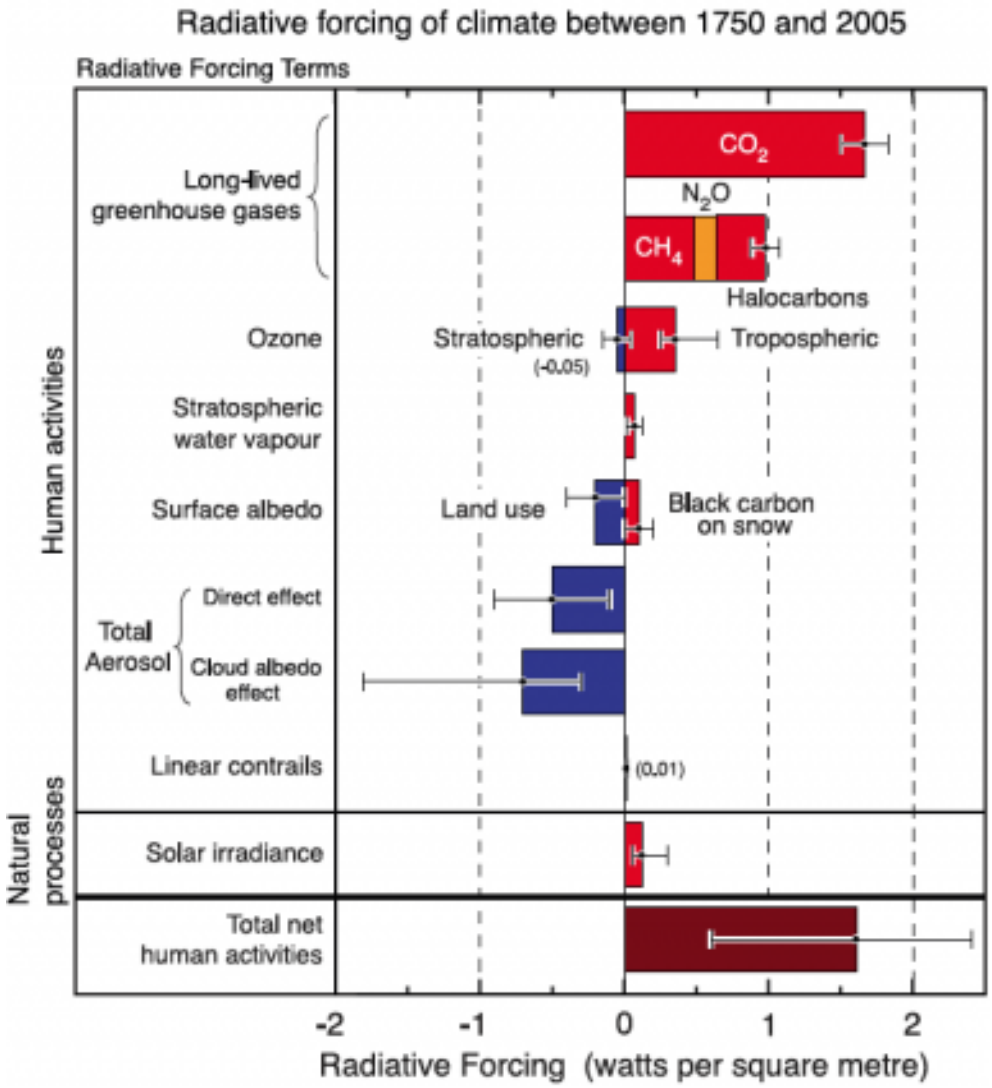

Figure 1: This figure depicts the many factors that attribute to radiative forcing, either in terms of cooling or warming. It shows that factors such as the surface albedo can contribute to each ends and the amount of error in certain effects that result in an estimated total net effect.

http://newsoffice.mit.edu/sites/mit.edu.newsoffice/files/styles/news_article_image_top_slideshow/public/images/2010/20100310094520-2.png?itok=yb3-58jr

Annotated Bibliography

http://wattsupwiththat.com/2013/10/21/radiative-forcing-radiative-feedbacks-and-radiative-imbalance-the-2013-wg1-ipcc-report-failed-to-properly-report-on-this-issue/

- This lays out the main points of the article at the beginning focusing on mainly the idea that there are some difficulties in measuring the radiative forcing of certain factors.

http://newsoffice.mit.edu/2010/explained-radforce-0309

- This was used to explain why it is impossible to simply add up the effects of each factor, but rather requires a system of finding out there actual effect and averaging that in with other factors and just the different factors that contribute and how.

http://en.wikipedia.org/wiki/Radiative_forcing

- This basically just explained how radiative forcing actually works and the general idea behind positive and negative forcing.

2.) The carbon cycle is basically the exchange of carbon within the spheres of the Earth, and is one of the key contributors to sustaining life forms of all kind on Earth. It basically works with carbon molecules getting recycled throughout the atmosphere as well as others. The two main forms of carbon in the atmosphere, where humans exist, is Methane and Carbon Dioxide. Carbon dioxide is more important of the two because of the effect it has as a greenhouse gas and due humans adding the abundance in the atmosphere. The cycle in general is a stable flow of carbon between ocean, sediments and the atmosphere. It usually happens in which this carbon dioxide leaves the atmosphere through photosynthesis where it enters oceans or plants, and more is contributed to the atmosphere by decomposition and respiration as well as other ways. The main idea is that the cycle, without human interaction, is a system that maintains itself to never let too much carbon get into the atmosphere or stored into rocks oceans or sediments, so that the Earth's temperatures remain relatively stable.

In recent years it has been noticed that humans added effect in the carbon cycle has caused an imbalance by increasing the amount of carbon dioxide in the atmosphere. Humans contribute to this by either directly adding in the use of fossil fuel burning or less directly by using land for buildings and removing plant life which otherwise would have removed some of this carbon from the atmosphere. Increasing the carbon dioxide greenhouse effect can contribute to increased heat because they trap and reemit that heat all around the Earth. The more carbon dioxide the more it messes with the natural cycle because it makes it harder for the Earth to naturally store all the extra carbon added and results in some of it adding to the greenhouse effect which we know contributes to heating or trapping heat.

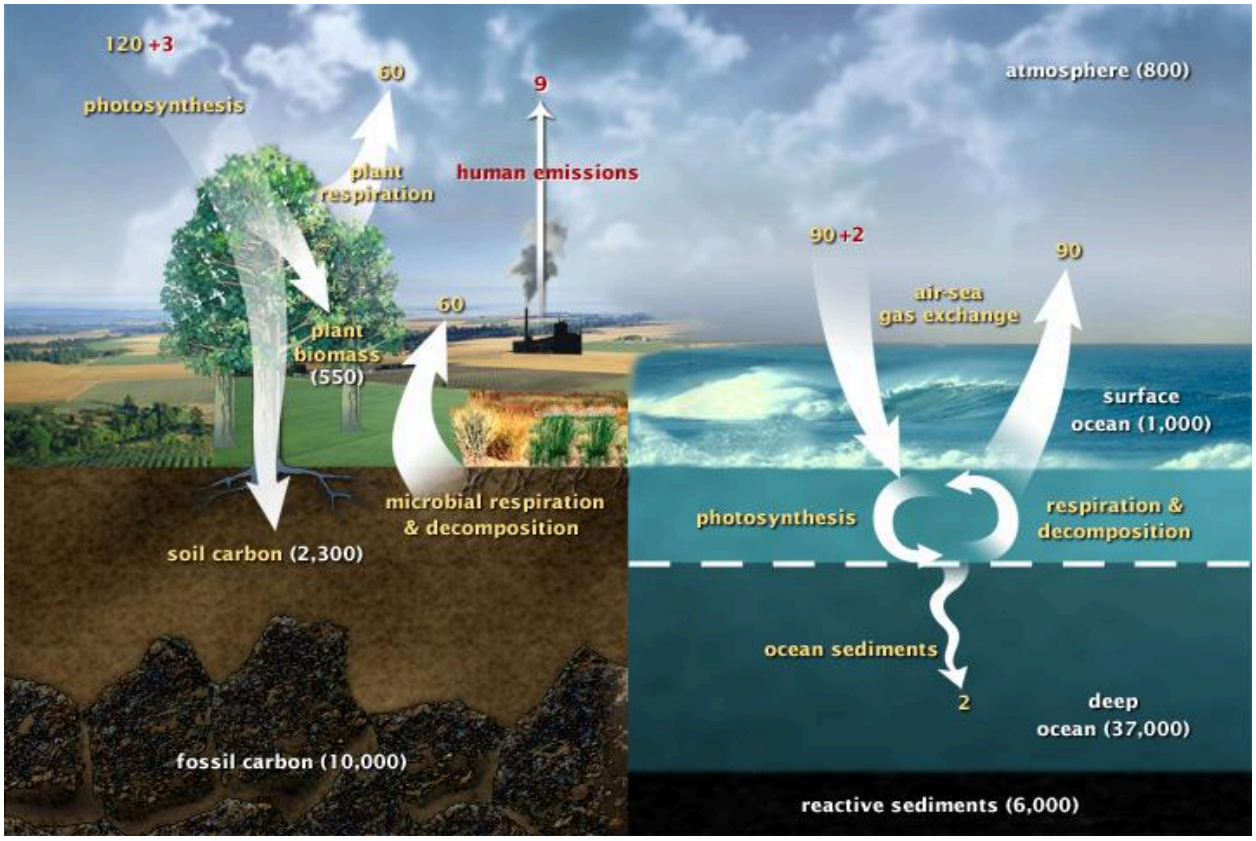

Figure 2: This depicts the carbon cycle. It shows the ways in which the Earth keeps a natural balance through processes such as photosynthesis and decomposition. With added human interaction it throws off the balance and can alter the climate.

http://upload.wikimedia.org/wikipedia/commons/d/d5/Carbon_cycle.jpg

Annotated Bibliography

http://en.wikipedia.org/wiki/Carbon_cycle#Main_components

- This basically framed the whole idea of the carbon cycle and how its processes work naturally to keep a balance of carbon.

http://earthobservatory.nasa.gov/Features/CarbonCycle/

- This was used to understand the effects of throwing off the natural carbon cycle and when humans add too much it cannot be stored. This adds to the greenhouse effect and warming overall.

http://www.sciencemuseum.org.uk/ClimateChanging/ClimateScienceInfoZone/ExploringEarthsclimate/1point7.aspx

- This helped me understand how humans affect the carbon cycle through burning of fossil fuels as well as deforestation.

http://www.learner.org/courses/envsci/unit/text.php?unit=2&secNum=8

- This talks about the question of how much carbon can what they call “sinks” absorb with that added effect of human contribution.

http://www.elmhurst.edu/~chm/vchembook/306carbon.html

- This gives an understanding of how the carbon cycle actually works not just in terms of words and helps in the general understanding.

3.) Ruddiman's main argument is that gas trends, mainly Carbon Dioxide, were changed rather 8,000 years ago as opposed to the idea that it was during the industrial revolution. He suggests that changes in agricultural and farming were the first cause of changing gas trends, pointing out deforestation and crop irrigation were when the actual trends were reversed and continued up into the industrial revolution. Ruddiman says that these changes resulted in a rise of carbon dioxide and rather the industrial revolution just continued and sped up this trend. He points out evidence of the amount of Methane and carbon dioxide in parts per billion where trends of during interglacial periods that number would drop to about 450 ppb, but noticed from an ice core out of the vostok site that the number rose slowly to 700 ppb. This is important to his argument because it shows that the trend did in fact reverse in the time about 5,000 years ago right before the industrial revolution, which points to the fact that a little before that it is entirely possible that the deforestation and irrigation caused the trend reversal. He attributes most of this trend change to rice irrigation in southeast Asia, pointing out the many ways in which this process leads to the increase of Methane.

In my personal opinion this is an interesting point and I personally do not know that much about farming and agriculture. Although it seems unlikely that a single factor contributed to a global climate change pattern, I think it is possible that it is a strong contributor. I think his idea that trends starting changing closer to 8,000 years ago rather than during the industrial revolution is very plausible. The fact that a single factor explains something is hard for me to believe since most things i have personally observed are not that simple to explain in such a way, but I will always keep open the idea that farming was what reversed these trends and that the industrial revolution was more of an accelerator or added to the fact.

Sources:

https://docs.google.com/file/d/0B5OYZdqOzxSLRDJhOUpqdHBEQjQ/edit
https://docs.google.com/file/d/0B5OYZdqOzxSLcUJYTXJ6VHdtTEE/edit
https://docs.google.com/file/d/0B5OYZdqOzxSLZVgxWi1wa2xyM3M/edit

4.) The argument that the Earth was much warmer 1,000 years ago is actually a false statement, because if you look at data from recorded from the past century there is evidence that the temperature was in fact cooler than it is today. This is evidenced by the fact that there was what was called a “little ice age” in which globally the Earth was far cooler and did also go through a “medieval warm period”, which shows that it could not have been warmer in the overall context since it was balanced out from cool and warm periods. Also if you look at todays global temperatures there is actual trend of the temperature increasing at rates much faster than they ever were in the past 1,000 years, reaching upwards of 0.6 degrees celsius warmer than normally observed. Yes the Earth did heat during the era of the Vikings to a point that went off trend from what is to be expected, but that is for many reasons that are uncertain to scientists. Today we can see clear evidence of humans adding to the greenhouse effect through their releases of carbon dioxide and methane into the atmosphere causing rates of increasing global temperature anomalies far greater than were observed during the warm period in which the Vikings settled.

The reason this argument is mainly irrelevant is because the Earth has many differences today as compared to when the Vikings were settling in Greenland. One such difference is the human effect and the amount of humans we have on the Earth today, we are at numbers that are higher by far than any other point in history and they only seem to be rising. Also, the impact that this amount of humans has on the Earth is important because of the added greenhouse effect from the industry and the use of burning fossil fuels to get energy. We rely so heavily on these fossil fuels today which emit levels of carbon dioxide and other gases into the atmosphere that are known to increase warming. Since there is such a large amount of people this number is also exacerbated by that fact meaning we need to burn so much more than ever. The point is that the Earth today is not like that of the past, there are more than just natural factors that affect cycles and trends and gas levels, with human impact we must either try and reduce our effect if we see that as a key contributor or discover that we can actually decrease the rate of increase in other ways.

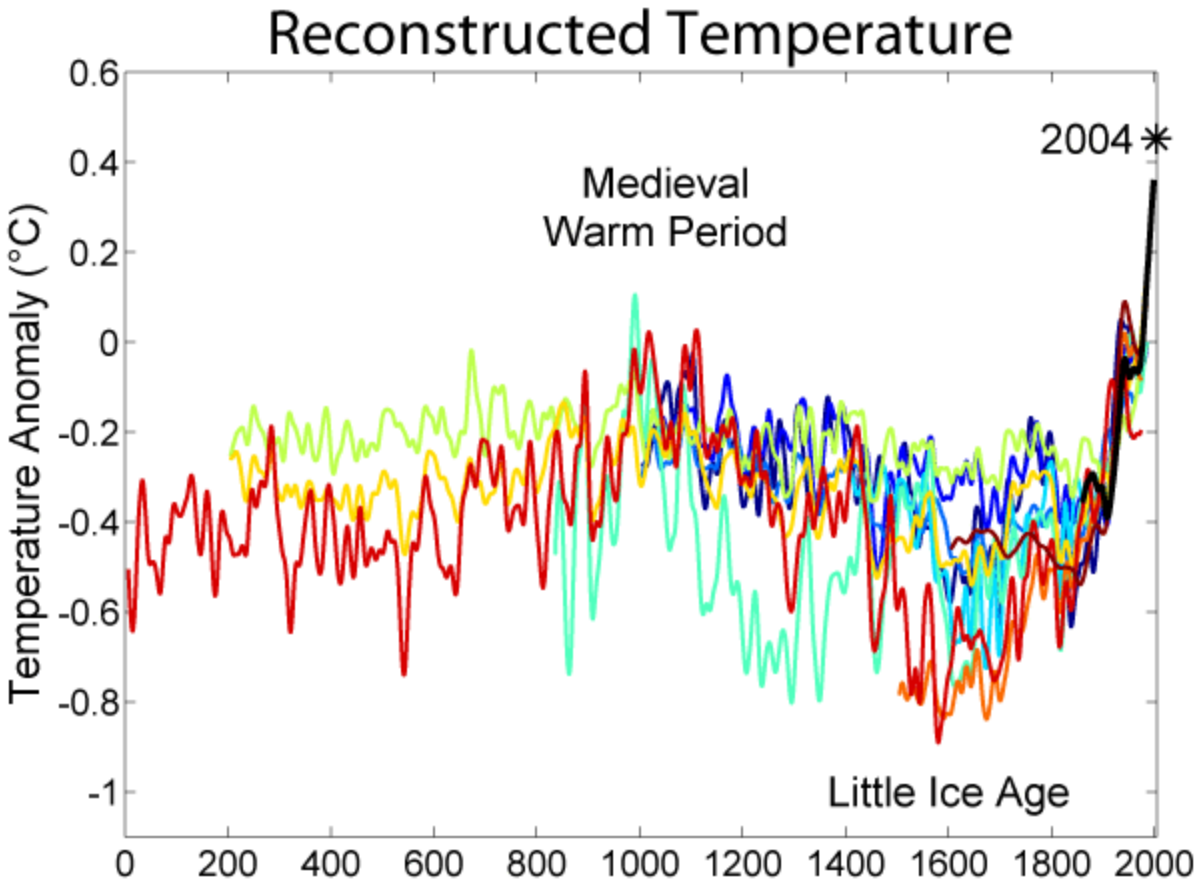

Figure 3: This shows the warming and cooling over the past 2,000 years. As it shows there was a rise in which the Earth warmed, but you can see the rate increase at which the temperatures are rising now is unseen before.

http://upload.wikimedia.org/wikipedia/commons/c/c1/2000_Year_Temperature_Comparison.png

Annotated Bibliography

http://www.skepticalscience.com/global-warming-1860-1880-and-1910-1940.htm

- Although this is only specific areas of temperature records it was a good outline to see that the rates of increase were far greater during the present period than in past periods.

http://earthobservatory.nasa.gov/Features/GlobalWarming/page4.php

- This was good at explaining natural factors that could affect changes, such as volcanoes and sun brightness, but also showed that humans are emitting so much carbon than naturally would be cycled.

http://earthobservatory.nasa.gov/Features/GlobalWarming/page3.php

- This was good at explaining the rates and how the temperature is rising faster than any other ice age recovery in the past.

http://www.ncdc.noaa.gov/cag/time-series/global

- This was mainly used for the graph to see the temperature anomaly compared to the past and how fast and much the Earth is actually warming today.

http://en.wikipedia.org/wiki/Medieval_Warm_Period

- This was used to compare the Medieval warm period changes to today and to see the rates at which the temperature was increasing at both periods.