(The thesis rejected by Meteorological Society of Japan for publication)

Increased CO_2 Concentration in the Atmosphere is a Natural Phenomenon I. Higher Temperature is the Real Cause

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Abstract

In 1989, C. D. Keeling reported a fact that the change of global temperature occurs approximately one year prior to that of CO_2 concentration (excluding long-term trend). In Japan, this report raised a controversy that his finding was contrary to the widespread theory of temperature rise caused by anthropogenic CO_2 emission.

Against this, Meteorological Society of Japan made a defending argument for the widespread theory based on the fact that the element of long-term trend was excluded from the aforementioned CO_2 concentration. After this however, Kuniaki Kondo reported a fact that the annual increment of temperature occurs one-year prior to that of atmospheric CO_2 concentration. Since the element of long-term trend of CO_2 concentration was not excluded in his analysis, his assertion proved that temperature change was the cause and CO_2 concentration change was the result on a long-term basis as well, and thus the widespread theory was denied.

Meanwhile, both in Keeling's and Kondo's report, there still remains a question why there is a one-year gap between temperature change and CO_2 concentration change. In this report, the one-year gap problem is solved and the direct relationship between temperature and change rate of atmospheric CO_2 concentration is shown. Also, the 30-year average temperature since 1971 is reported to be approximately 0.6 ℃ higher than the temperature without any increase/decrease of atmospheric CO_2 concentration.

In conclusion, actual increase of atmospheric CO_2 concentration is mainly due to higher temperature, which is a natural phenomenon.

1. Introduction

C. D. Keeling had conducted precise measurement of CO_2 concentration in Antarctic and Hawaii since 1958. Figure 1 shows the secular change of the global average temperature anomaly and 13 month moving average of Antarctic CO_2 concentration observed values. Here, the global average temperature anomaly means the difference from the reference temperature which is the 30-year global temperature average from 1971 to 2000. The period subject to the analysis of this report is 35 years, from 1969 to 2004, which includes the aforementioned 30-year period.

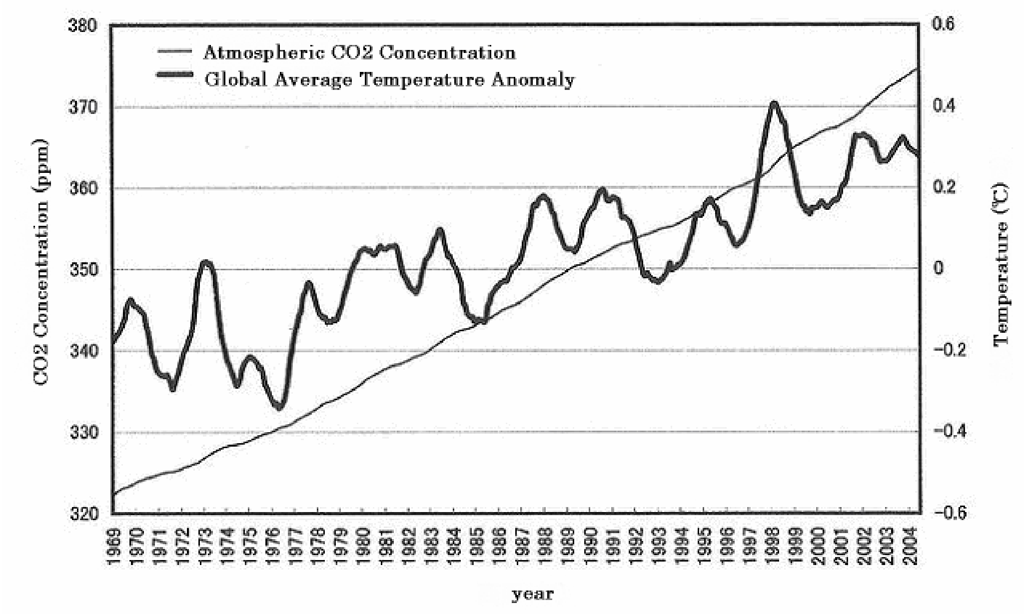

Figure 1. Global Average Temperature Anomaly and Atmospheric CO_2 Concentration

Note that Global average temperature anomaly data are obtained from http://www.data.kishou.go.jp/climate/cpdinfo/temp/list/mon_wld.html, and Atmospheric CO_2 concentration data are obtained from http://cdiac.ornl.gov/ftp/trends/co2/sposio.co2

According to Figure 1, we can see that the temperature rose approximately by 0.4 ℃ from 1969 to 2004 while CO_2 concentration rose approximately by 50ppm. Most CO_2 global warming theory proponents think that the temperature rise is caused by anthropogenic CO_2 emission accumulated in the air but according to this figure, the theory cannot be immediately confirmed. Contrary to the CO_2 global warming theory, we cannot deny the possibility that CO_2 concentration has increased as a result of warmer temperature.

In Figure 1, the temperature is fluctuating wildly in approximately 4-year cycle. Meanwhile, CO_2 concentration is gradually increasing. Therefore, having excluded the element of long-term trend of CO_2 concentration, Keeling created Figure 2 in which the temperature change and CO_2 concentration are corresponding to each other. (Keeling, 1989 [1])

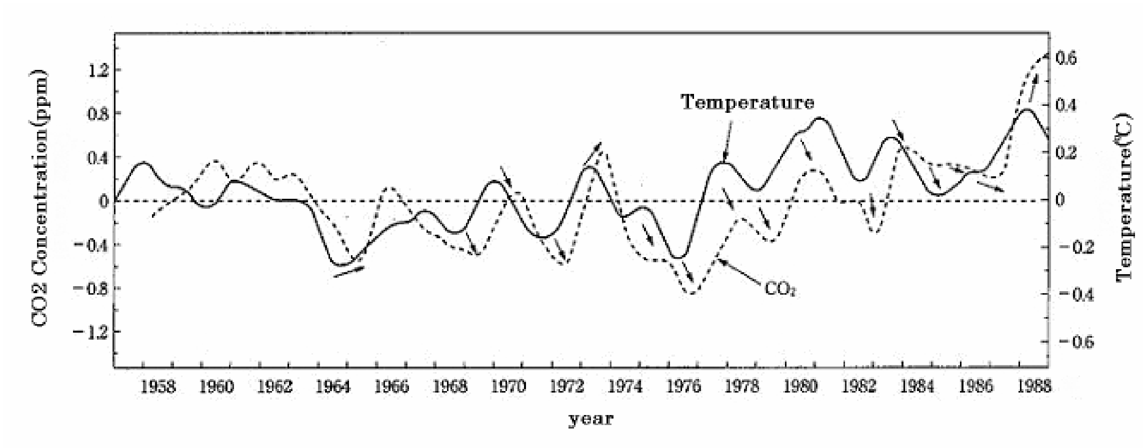

Figure 2 Relation between Changes of Temperature and CO_2 Concentration

Extracted from "Extraordinary Abnormal Climate" by Jyunkichi Nemoto (1994), Chukou-shinsho, p213

As a result, a very close correlation of the temperature change and CO_2 concentration change is shown, in which the temperature change precedes the CO_2 concentration change by approximately one year. Keeling assumed that this was due to the effect of alternation of surface ecosystem caused by the temperature change. Whether such an alternation have occurred either on land or in the ocean, Keeling showed that the CO_2 concentration had been changed due to the temperature change.

Meanwhile, CO_2 change in Figure 2 came to be thought as a result of El Nino phenomena. In 1993, Sarmiento discussed this problem (Sarmiento 1993 [2]), and in 1994, Nemoto added the years of El Nino on the figure created by Sarmiento as in Figure 3 below, which was shown in his book Extraordinary Abnormal Climate. (Nemoto, 1994)

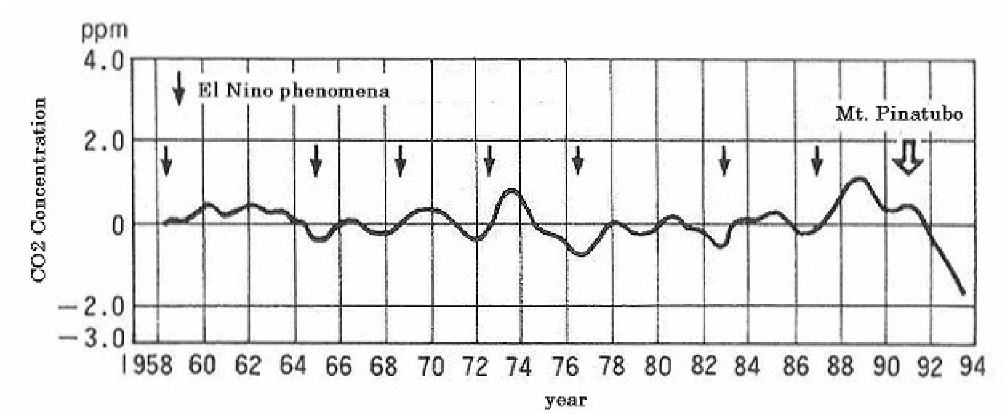

Figure 3 El Nino and Atmospheric CO_2 Concentration

"Extraordinary Abnormal Climate" by Jyunkichi Nemoto, Chukou-shinsho, p215

Nemoto added the arrows on the original figure by Sarmiento (Nature 365 (1993) 697)

Here, the CO_2 concentration values were observed in Mauna Loa, Hawaii. Seasonal change and long-term trend are excluded.

According to this figure created by Sarmiento and Nemoto, El Nino surely seems to have a correlation with increased CO_2 concentration. However, nobody clearly knows why El Nino occurs. In 1993. Nitta and Yoshimura discussed the relation between El Nino and temperature (Nitta 1993). However, they didn't make any argument as to the relation between El Nino and CO_2 concentration.

As for the relation between temperature/El Nino and CO_2 concentration, most meteorologists argue that CO_2 is the cause and temperature is the result, but there has been no consideration in regard to the possibility of the reversed relation of the above. That is, temperature is the cause and CO_2 concentration is the result.

However, in Japan, Figure 2 by Nemoto gained some attention and the argument of temperature as the cause and CO_2 as the result began spreading. (e.g. Tsuchida 2002)

Regarding this issue, a question was raised to the editing committee of Meteorological Society of Japan: "why does the temperature change precede CO_2 change?" To this question, Kawamiya answered, "The cause of global warming exists in long-term increase trend. Since the consideration of the long-term trend element was excluded from this figure, it merely shows fluctuations caused by natural phenomena. Therefore, this figure is relatively not much linked to the global warming caused by human activities" (Kawamiya 2005). In short, Kawamiya stated that factors of global warming hide themselves in long-term trend. However, his answer neither gives any evidence against the counterargument of the global warming theory nor can prove the correctness of the CO_2 global warming theory.

2. Relation between Temperature Change Rate and Atmospheric CO_2 Concentration Change Rate

It is true that long-term trend cannot be discussed in Keeling's Figure 2 since the element of the CO_2 long-term trend is excluded. Therefore, Kondo came up with an idea to examine this issue without excluding the element of long-term trend (Kondo 2006 [3)]). Instead of directly comparing the temperature anomaly and CO_2 concentration, Kondo compared the annual change rate of temperature anomaly (℃/year) and that of CO_2 concentration (ppm/year).

The Figure 4 shows the annual change rate of global average temperature anomaly by Meteorological Society of Japan and the annual change rate of CO_2 concentration observed in the Antarctic by Keeling.

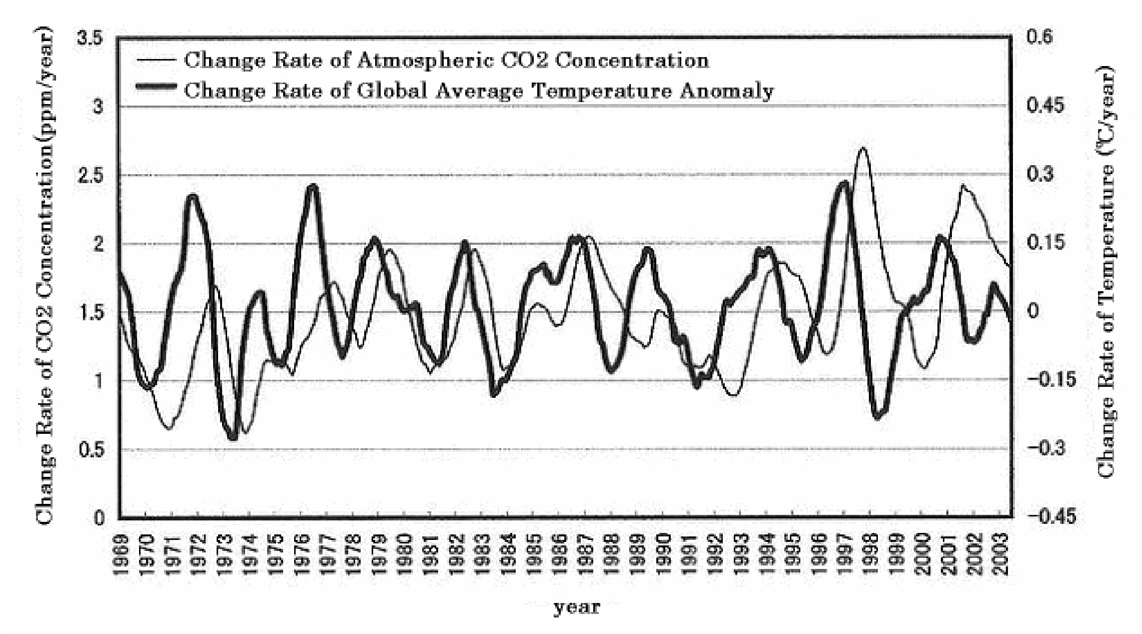

Figure 4 Change Rate of Global Average Temperature Anomaly and Atmospheric CO_2 Concentration (13-month average)

Global average temperature anomaly http://www.data.kishou.go.jp/climate/cpdinfo/temp/list/mon_wld.html

Atmospheric CO_2 concentration http://cdiac.ornl.gov/ftp/trends/co2/co2/sposio.co2

Through Figure 4, it was shown that the atmospheric CO_2 concentration change rate occurs approximately one year behind the average temperature anomaly change rate. From this anteroposterior relation between the temperature and CO_2 concentration in Figure 4 alone, we can see that temperature is the cause and CO_2 concentration is the result.

Since the annual change rate of temperature and CO_2 concentration are directly compared in Figure 4, there is no arbitrary manipulation to exclude the long-term trend of atmospheric CO_2 concentration. The long-term trend excluded by Keeling fluctuates around approximately 1.5ppm/year in Figure 4. In other words, the integration of the curve, which is the area between the curve and the reference axis, shows the long-term trend of CO_2 concentration.

Referring to Figure 4 created by Kondo, Tsuchida submitted an article called, "Counterargument against the Causal Relation between CO_2 Concentration and Temperature," to a magazine, Weather (Tenki), arguing against the explanation made by Kawamiya in the same magazine (Tsuchida 2006). In there, Tsuchida mentioned that CO_2 was released from the ocean due to higher temperature. He also explained El Nino as a remnant of high temperature release, showing the fact that CO_2 concentration in the ocean was lowered after El Nino phenomenon (Feely 1999 [4]).

However, editing committee of Weather did not publish Tsuchida's counterargument, and Tsuchida complained about it in Members' Square column in Weather, demanding for the publication of his counterargument. (Tsuchida, 2008)

Also in Physical Society of Japan, the Figure 4 by Kondo became a subject of controversy. Again referring to this, Tsuchida submitted an article, "Can Global Warming be Prevented Through CO_2 Reduction?" to Buturi(Journal of Physical Society of Japan(Japanese)). (Tsuchida, 2007)

In addition, Tsuchida submitted his article to Members' Voice page in Journal of Physical Society of Japan, pointing out the following. "According to Figure 4, one year after the rise of temperature anomaly by 0.1 ℃, atmospheric CO_2 concentration increased by 2ppm. Also, one year after the decrease of temperature anomaly by 0.1 ℃, CO_2 concentration increased by 1ppm. When the temperature anomaly stayed the same, CO_2 concentration increased by 1.5ppm. From these, we can see that the relation between the temperature anomaly change and one-year-after CO_2 change can almost be shown in a linear expression. CO_2 concentration stayed the same when the temperature anomaly was minus 0.3 ℃. From this, the 30 year average temperature since 1971 has become 0.3 ℃ higher compared to the reference temperature without any CO_2 intake/release from land and ocean, and thus we can assume that CO_2 has continued to be released from the land and ocean." (Tsuchida 2007a [5)])

3. Cause-and-Effect Relation between Temperature and CO_2 Concentration Change Rate

There seems to be some problem if we conclude that the temperature is the cause and CO_2 is the result, because there is almost one-year delay of the change of CO_2 concentration after the temperature. That is, if the atmospheric temperature changes, the temperature of the land and ocean should be changed, leading to immediate change of CO_2 concentration. Why is there such a delay as long as one year?

Therefore, we decided to further examine Figure 4 in detail, and found the following fact. In Figure 4, when the change rate of temperature is 0, the change rate of CO_2 concentration is an extremal value. Since the 0 change rate of temperature also means extremal value of temperature as well, extremal value of the temperature seems to directly correspond to extremal value of CO_2 concentration change rate.

Based on this, Kondo compared the global average temperature anomaly (℃) and atmospheric CO_2 concentration change rate (ppm/year) and created Figure 5. (Kondo 2008 [6)])

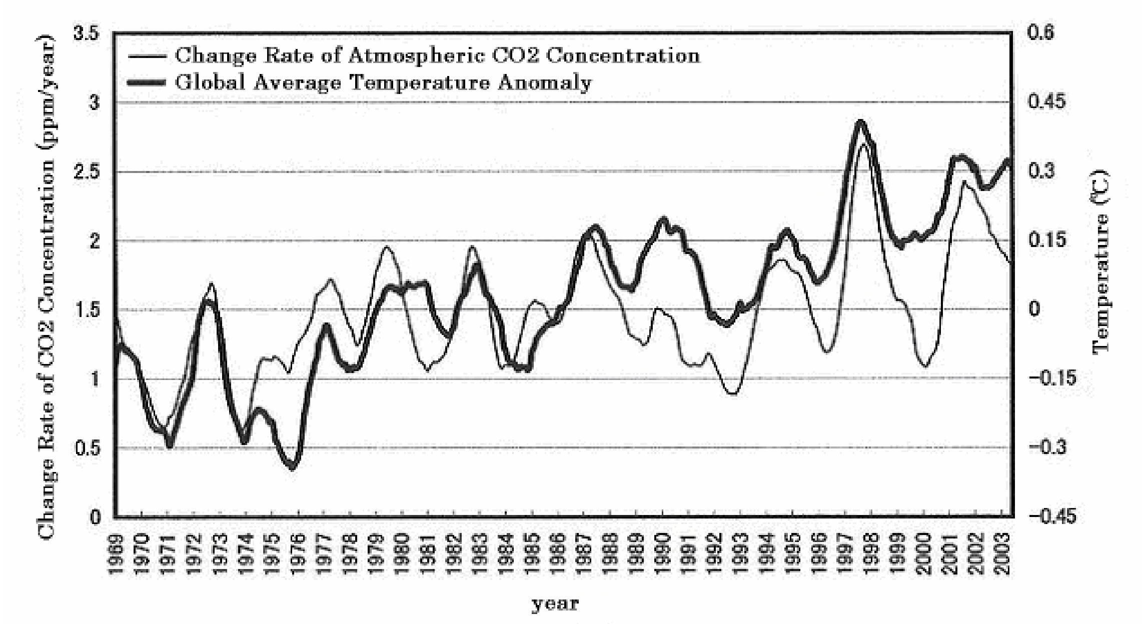

Figure 5　Global Average Temperature Anomaly (℃)
and Atmospheric CO_2 Concentration Change Rate (ppm/year)

Global average temperature anomaly　http://www.data.kishou.go.jp/climate/cpdinfo/temp/list/mon_wld.html

Atmospheric CO_2 concentration　http://cdiac.ornl.gov/ftp/trends/co2/sposio.co2

Though there are some gaps, these two curves amazingly correspond to each other. Keeping the issue of some gaps aside for future consideration, we can conclude that temperature corresponds to CO_2 concentration change rate as the first order of approximation.

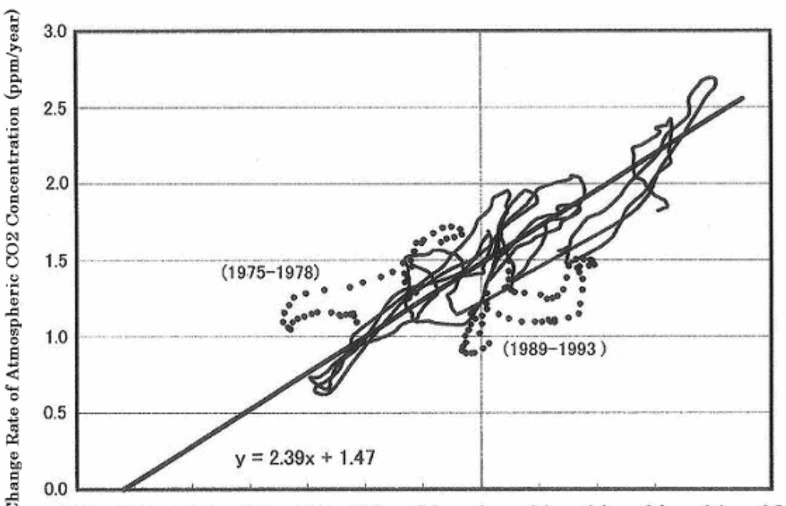

Figure 6　Scatter Chart and Regression Line

Specifically, when the temperature anomaly is 0℃, CO_2 concentration change rate is 1.5ppm/year. Also, when the temperature anomaly is below 0, CO_2 change rate is less than 1.5ppm/year and when the temperature anomaly is above 0, CO_2 change rate increases. Figure 6 shows this relationship in a scatter chart. Here, the solid curves represent the firm correlation, while the dotted line represents some gaps such as in the years of 1975-1978 and in 1989-1993.

In Figure 6, if we draws a regression line using only the solid curves as the first order of approximation, CO_2 concentration change rate becomes 0ppm/year when the temperature anomaly becomes minus 0.6 ℃. From this, it is shown that the 30-year global average temperature since 1971 is 0.6℃ higher compared to the temperature without any movement of CO_2 between the atmosphere and land/ocean. As a conclusion from Figure 6, we can see that the atmospheric CO_2 concentration is increasing every year.

Therefore, we can conclude that the increased atmospheric CO_2 concentration is mainly due to the higher temperature, which is a natural phenomenon.

As for the issues such as insufficient correlation of CO_2 concentration increase, the relationship of cause and result, upwelling ocean area such as near the equator and flaws of anthropogenic CO_2 global warming theory etc will be discussed in the thesis II following this thesis I.

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