Mount Waliguan Observatory

The Mount Waliguan Observatory is on the Tibetan Plateau at Latitude 36.287°N, Longitude 100.896°E, elevation 3810 m. The climate zone is described as snow climate with dry winter and cool summer. Monthly CO_2 concentration data was available for the period August 1990 to December 2017, as shown in Figure 1 below:

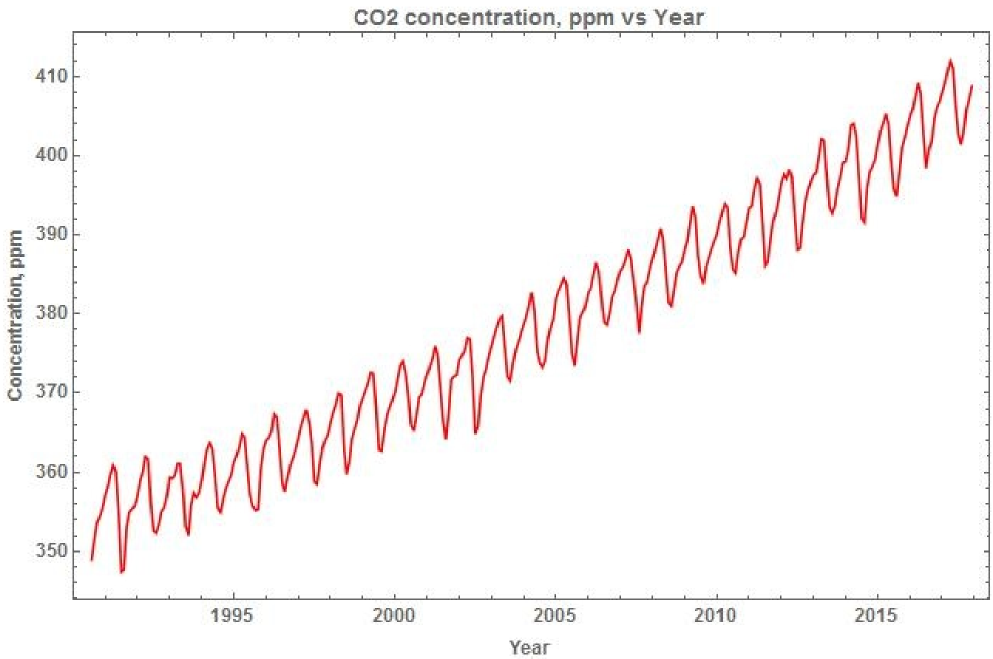

Figure 1

The graph shows a near-linear trend of +1.99 ppm per year over the period of 27 years and 5 months with an average level of 378.3 ppm. Superimposed on the trend is a 12 month seasonal variation which ranges in amplitude from about 8.6 to 13.3 ppm. The local maximum for the seasonal variation occurred, on average, in early April at the beginning of Spring when the temperature rises. The local minimum occurred, on average, in late July at the end of Summer after which the temperature falls through Autumn and Winter. That is, the temperature falls as the CO_2 concentration rises and then the temperature rises as the CO_2 concentration falls, the complete opposite to the UN IPCC proposition that increased CO_2 concentration causes an increase in temperature.

The fall in CO_2 concentration during Spring is attributed to photosynthesis associated with the growth of annual vegetation. The Winter rise in CO_2 concentration is attributed to the decay of that vegetation. That is, the atmospheric CO_2 concentration is determined, at least in part, by the climate.

For comparison, the Mt Waliguan Observatory was 4017 km North of the Equator while Cape Grim, Tasmania, was 4505 km South of the Equator. For the identical period, the rate of increase at Cape Grim was +1.91 ppm per year, the average CO_2 concentration was 375.0 ppm and the seasonal variation ranged between about 0.68 ppm and 1.77 ppm. The marked difference in seasonal variation is attributed to the far greater land area in the Northern Hemisphere providing a much greater biological mass as a source and sink for CO_2.

The small difference in average CO_2 concentration and its rate of increase between the two stations appears to be contrary to the UN IPCC claim that it is mankind that is the major source of CO_2 concentration. If that was so, the far greater population and industrialisation in the Northern Hemisphere could be expected to have caused a significant difference between the two CO_2 concentrations and their rate of increase. Furthermore, as the average annual increase for the Mt Waliguan location, 1.99ppm, is only a fraction of the seasonal variation, 8.6 to 13.3 ppm, most of the atmospheric CO_2 must arise from natural sources.

Applying the Cramér-von Mises statistical test to the detrended CO_2 concentration data gave a probability of 24.5% that it has a Normal distribution.

The seasonally corrected, monthly satellite lower troposphere land temperature for the Northern Extension zone (20° North to 90° North latitude) from the University of Alabama, Huntsville [ref.1], for the period August 1990 to December 2017, is shown in Figure 2 below:

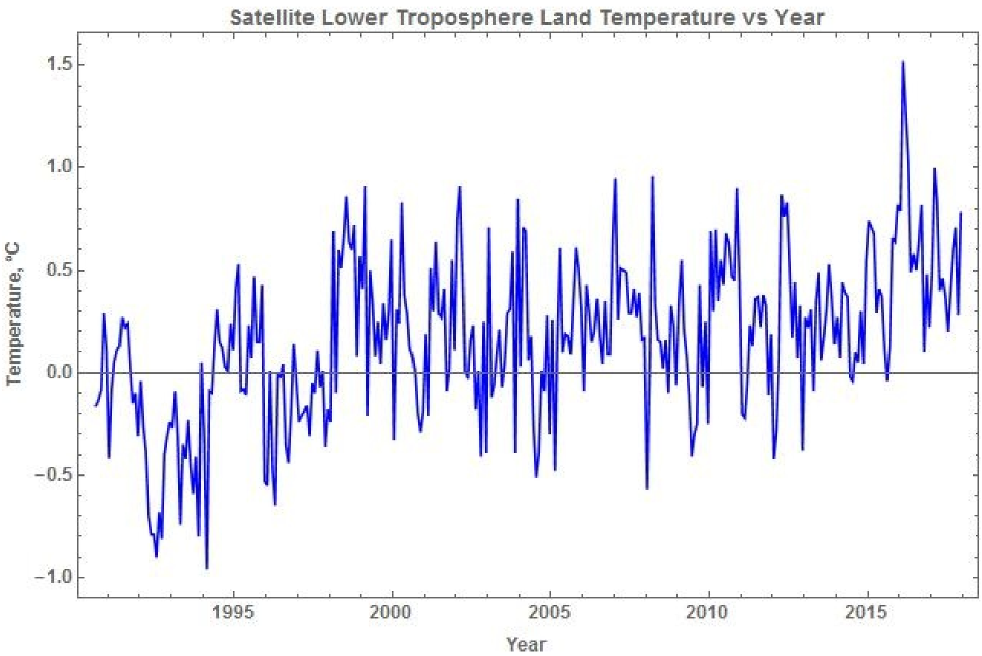

Figure 2

Applying the Cramér-von Mises statistical test to the detrended satellite lower troposphere land temperature for the Northern Extension zone gave a probability of 77% that it had a Normal distribution. The autocorrelation test of the detrended satellite lower troposphere land temperature gave a Ljung-Box statistic of 146.4 with a probability of the order of 10^-29 thereby definitely rejecting the hypothesis that the series in uncorrelated.

Calculation of the Pearson correlation coefficient between the measured pair of time series gave a value of 0.48, apparent in the following Figure 3. The test for zero correlation of the measured pair of time series gave a Spearman Rank value of 0.46 with a probability of 10^-19 thereby rejecting the notion of zero correlation.

For a more direct comparison with the seasonally adjusted satellite lower troposphere land temperature, a weighted 13 point moving average was applied to the CO_2 time series. The Pearson correlation coefficient between the resulting seasonal averaged CO_2 concentration and the satellite land temperature was 0.463. The test for zero correlation gave a Spearman Rank statistic of 0.460 with a probability of the order of 10^-18.

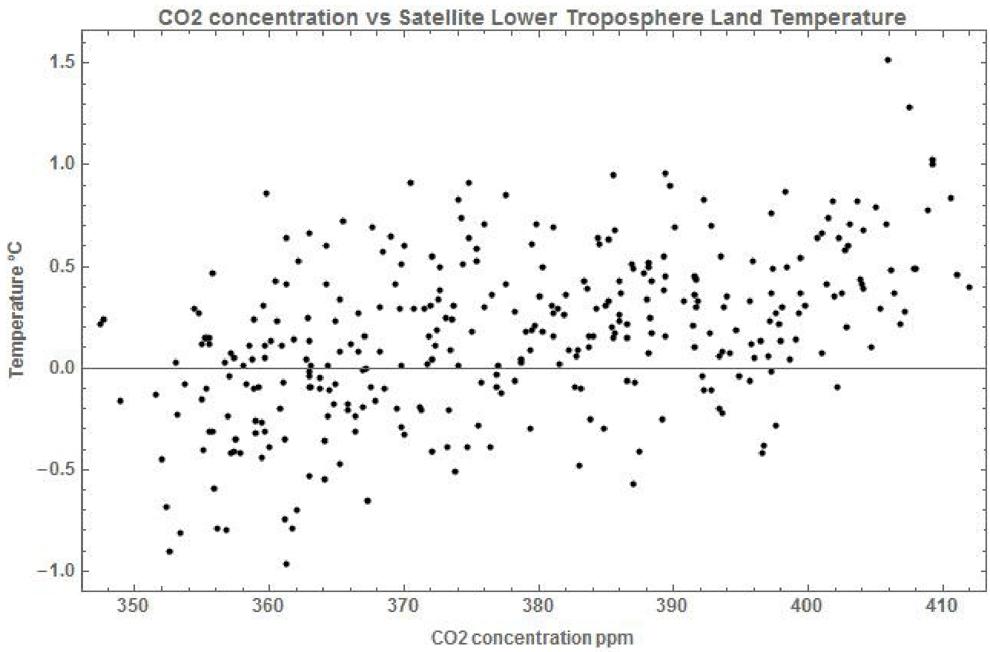

Figure 3

The moderate correlation between the measured CO_2 concentration and temperature is in accordance with past climate data derived from the Antarctic Dome C ice cores, [Ref.10 & 11]. These showed that the CO_2 concentration and temperature moved in unison over the past 800,000 years as the climate fluctuated between warming and cooling periods. This is well before homo sapiens evolved, about 300,000 years ago, so the correlation contradicts the UN IPCC claim of an anthropological cause for recent climate change. Their AR5 Synthesis Report: Climate Change 2014, under Headline Statements declares:

"Observed Changes and their Causes

Human influence on the climate system is clear, ..."

The Pearson correlation coefficient between the detrended CO_2 concentration and the detrended satellite land temperature was 0.054 with a probability of 33% from the test for zero correlation. The correlation between the detrended CO_2 concentration and the detrended

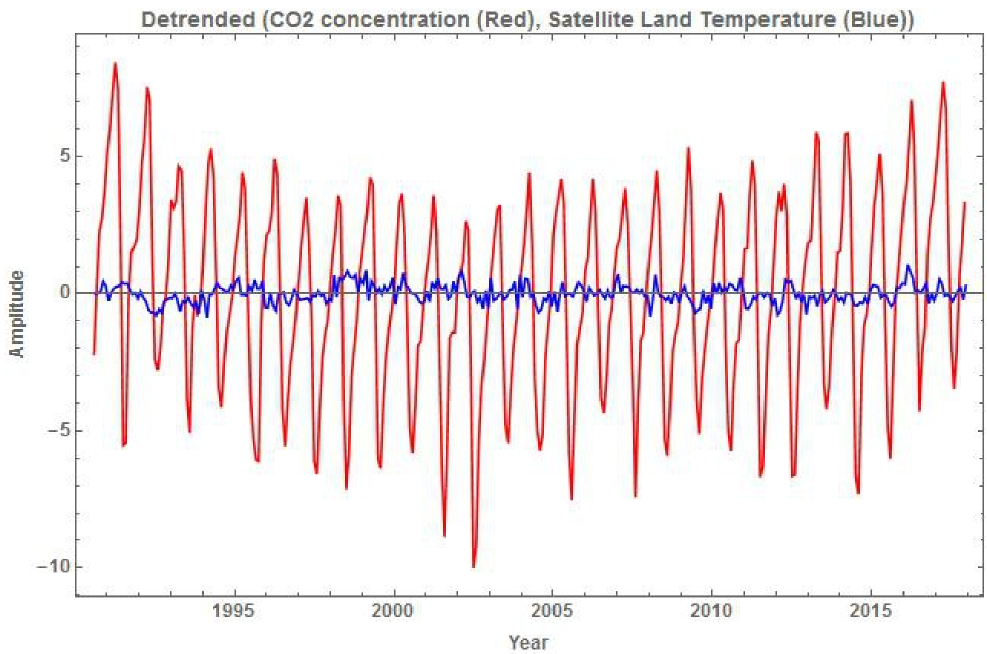

Figure 4

satellite land temperature is shown in Figure 4.

The Pearson correlation coefficient between the detrended seasonal averaged CO_2 concentration and the detrended satellite land temperature was -0.068. The test for zero correlation gave a Spearman Rank statistic of -0.096 with 9% probability, that is, it is possible that increased CO_2 concentration related to decreased temperature. The marked difference in correlation coefficient and probability between the measured time series before and after detrending is attributed to the positive linear trend apparent in each of the series. As a linear trend can be fitted to any time series, correlation between two such series is not necessarily an indication of causation.

Linear regression between the detrended pair of seasonal averaged CO_2 concentration and satellite land temperature gave a rate of change of temperature of -0.021°C per ppm CO_2 (the 'climate sensitivity') and a Durbin Watson D statistic of 1.14 indicating positive autoregression for the predicted temperature. The estimated autoregression of 0.595 was applied to transform the two data series and resulted in a corrected Pearson correlation coefficient of -0.0297. The test for zero correlation gave a Spearman Rank statistic of -0.018 and a probability of 76%, that is, it is likely that there is no causal relationship between CO_2 concentration and temperature. This is apparent in the following Figure 5 showing the transformed data. The result is contrary to the UN IPCC claim that increased CO_2 concentration causes increased temperature.

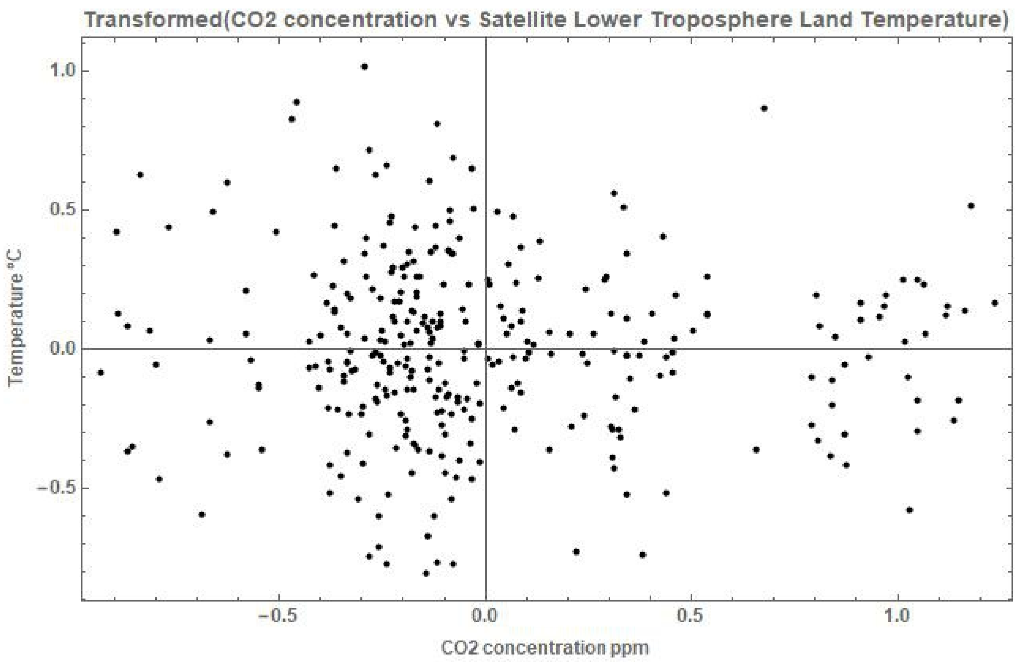

Figure 5

Another method of removing the seasonal effect was to create a time series of the annual rate of change of the CO_2 concentration by taking differences 12 months apart. The Pearson correlation coefficient for the pair of detrended time series, satellite land temperature and the annual rate of change of the CO_2 concentration, was 0.10 with a zero correlation probability of 0.07 indicating that the series were not independent. This is markedly different to the lack of correlation shown above between the detrended pair of seasonal averaged CO_2 concentration and satellite land temperature suggesting that temperature may directly or indirectly determine the CO_2 rate of change.

The Oceanic Niño Index consists of monthly anomaly values from a three month running average of the sea surface temperature departures from the 30 year base temperature over an area of the central Pacific Ocean bounded by 5°S to 5°N latitudes and 120°W to 170°W longitudes, the Niño 3.4 region. The data is provided by the US National Oceanic and Atmospheric Administration as part of its prediction service for El Niño events and covered the period January 1950 to October 2018 [Ref. 9]. A subset, January 1990 to December 2017, was used for a comparison with the annual rate of change of the CO_2 concentration.

The Mount Waliguan Observatory is 12,154 km from the centre of the Niño 3.4 region and 4017 km north of the Equator.

The Pearson Correlation Coefficient for the two detrended series was 0.08. However a maximum correlation of 0.23 occurred with the CO_2 rate lagging the Oceanic Niño Index by 7 months. The independence test with the 7 month lagged CO_2 rate gave a Spearman Rank statistic of 0.27 with probability of the order of 10^-6 thereby definitely rejecting independence. The correlation is shown below in Figure 6. For comparison, the annual rate of change of the CO_2 concentration at Cape Grim, distant 8,360 km from the centre of the Niño 3.4 region, gave a maximum Pearson Correlation Coefficient of 0.56 for a 5 month lag. At least in part, the differences in the distance from the centre of the Niño 3.4 region, the altitude (3810m at Mount Waliguan and 94m at Cape Grim) and the climate may account for the differences in correlation coefficients.

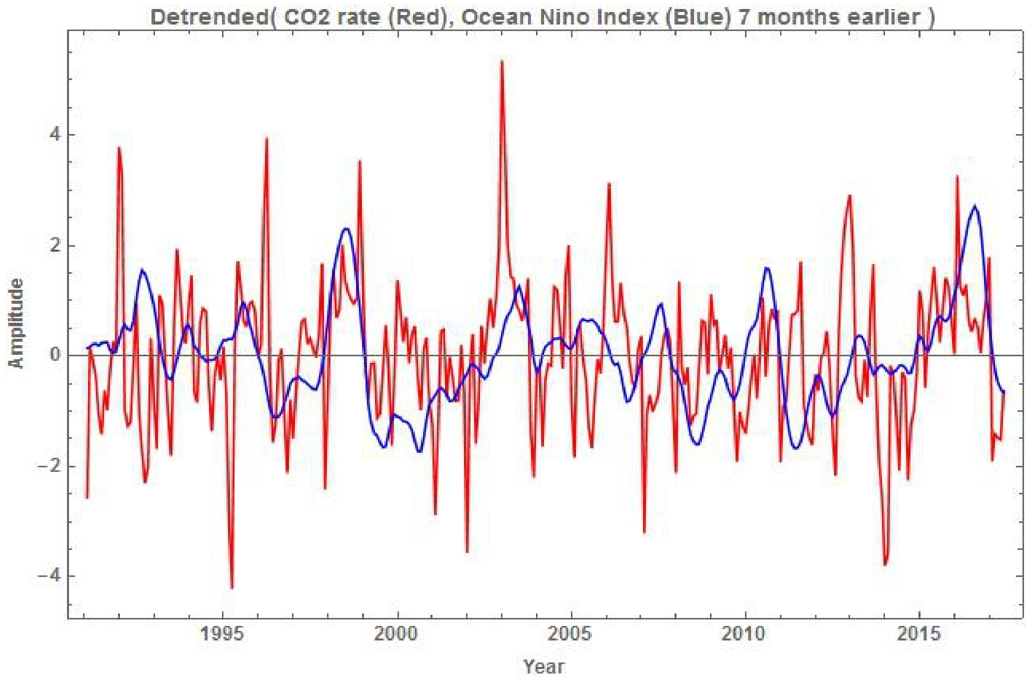

Figure 6

The Niño 3.4 region falls within the UAH satellite Tropics zone (20°S to 20°N latitude) and covers a small part, about one thirtieth, of that area. The Pearson Correlation Coefficient for the detrended pair, the 3 month moving average satellite Tropics Land temperature relative to the CO_2 annual rate of change, was at a maximum of 0.22 for a one month lag. The independence test with the 1 month lagged CO_2 rate gave a Spearman Rank statistic of 0.22 with probability of the order of 10^-4 thereby definitely rejecting independence. The relationship is shown in Figure 7.

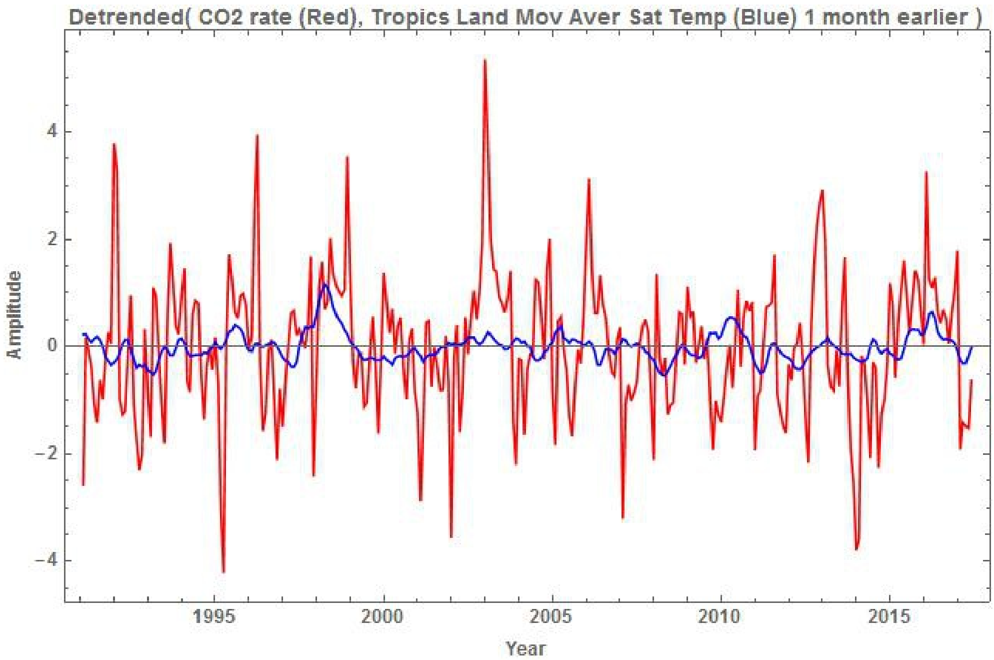

Figure 7.

The result is in marked contrast with that from Cape Grim. Here the Pearson Correlation Coefficient for the detrended pair, the 3 month moving average satellite Tropics Land temperature relative to the CO_2 annual rate of change, was at a maximum of 0.59 with no lag. The independence test for the pair of variables gave a Spearman Rank statistic of 0.52 with probability of the order of 10^-34, even more definitely rejecting independence. For the case of the comparison with the detrended 3 month moving average satellite Tropics Ocean temperature, the Pearson Correlation Coefficient was at a maximum of 0.18, again at a one month lag.

In addition to the amplitude of the seasonal variation, an obvious difference between the Mt Waliguan and Cape Grim time series is the standard deviation and range of the CO_2 annual rate of change. For Mt Waliguan these were 1.363 ppm pa and 9.964 ppm pa respectively while for Cape Grim they were much smaller at 0.575 ppm pa and 3.143 ppm pa respectively.

Another pronounced difference between the annual CO_2 rate of change between Mt Waliguan and Cape Grim is evident in the amplitude spectra. Figure 8 shows the amplitude spectrum for Mt Waliguan after applying a Hamming Window to the 371 data points for the annual CO_2 rate of change and padding the series with zero values to 512 data points before calculating the amplitudes for the Fourier Transform.

The maximum on Figure 8 is at x = 29 representing a frequency of 0.05664 cycles per month, that is, a period of 17.66 months or about 537 days. In astronomy terms, this is close to the joint conjunction of Mercury, Venus and the Earth of about 579 days. Elsewhere, both the CO_2 annual rate of change and the temperature time series have displayed a prominent maximum at 42 months attributed to the cycle of El Niño events, including at Cape Grim. Here the maxima attributed to El Niño is third in order of amplitude. The difference in spectra is not likely to be due to the altitude of the Mt Waliguan Observatory at 3810m as the Mauna Loa Observatory is at an altitude of 3397m.

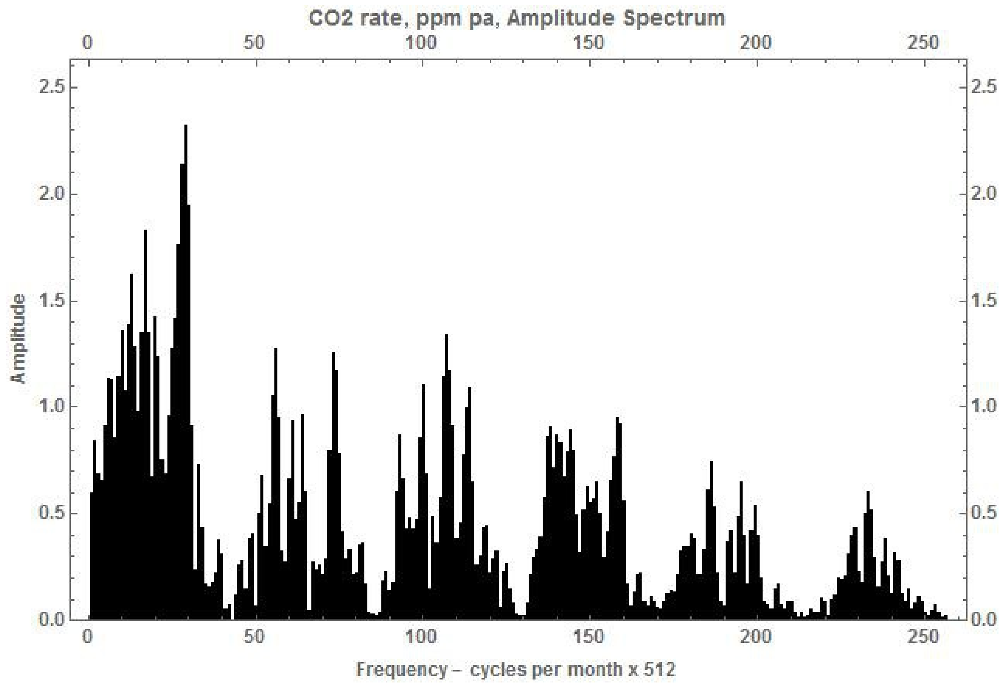

Figure 8

In conclusion, the basic CO_2 data from the Mt Waliguan Observatory is similar to that seen elsewhere in level and average rate of change. The finding of independence between satellite lower troposphere atmospheric temperature and CO_2 concentration and that of temperature correlating with the annual rate of change of CO_2 concentration also mirrors that found elsewhere. However the spectrum for the annual rate of change of CO_2 concentration is markedly different from the result obtained at other stations. The reason for the spectral peak being at 17.66 months instead of the 42 month El Niño cycle common across the globe lacks an explanation at this point in time.