# On the Existence of a "Tropical Hot Spot "

# &

# The Validity of EPA's $CO_2$ Endangerment Finding

# Abridged Research Report

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# ABSTRACT

**These analysis results would appear to leave very, very little doubt but that EPA's claim of a Tropical Hot Spot (THS), caused by rising atmospheric $CO_2$ levels, simply does not exist in the real world. Also critically important, even on an all-other-things-equal basis, this analysis failed to find that the steadily rising Atmospheric $CO_2$ Concentrations have had a statistically significant impact on any of the 13 critically important temperature time series analyzed.**

**Thus, the analysis results invalidate each of the Three Lines of Evidence in its $CO_2$ Endangerment Finding. Once EPA's THS assumption is invalidated, it is obvious why the climate models they claim can be relied upon, are also invalid. And, these results clearly demonstrate--13 times in fact--that once just the ENSO impacts on temperature data are accounted for, there is no "record setting" warming to be concerned about. In fact, there is no ENSO-Adjusted Warming at all. These natural ENSO impacts involve both changes in solar activity and the 1977 Pacific Shift.**

**Moreover, on an all-other-things-equal basis, there is no statistically valid proof that past increases in Atmospheric $CO_2$ Concentrations have caused the officially reported rising, even claimed record setting temperatures. To validate their claim will require mathematically credible, publically available, simultaneous equation parameter estimation work.**

**The temperature data measurements that were analyzed were taken by many different entities using balloons, satellites, buoys and various land based techniques. Needless to say, if regardless of data source, the results are the same, the analysis findings should be considered highly credible.**

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# Preface

On December 15, 2009, EPA issued its Green House Gas (GHG) Endangerment Finding, which has driven very significant and costly regulations beginning with $CO_2$. Focusing primarily on the time period since 1950, EPA's Endangerment Finding predicated on Three Lines of Evidence, claims that Higher $CO_2$ Emissions have led to dangerously higher Global Average Surface Temperatures (GAST).

The objective of this research was to determine whether or not a straightforward application of the "proper mathematical methods" would support EPA's basic claim that $CO_2$ is a pollutant. Stated simply, their claim is that GAST is primarily a function of four explanatory variables: Atmospheric $CO_2$ Levels ($CO_2$), Solar Activity (SA), Volcanic Activity (VA), and a coupled ocean-atmosphere phenomenon called the El Niño-Southern Oscillation (ENSO.)

Under this assumption of the four explanatory variables, only the atmospheric $CO_2$ levels are deemed anthropogenic, that is, impacted by human activity such as the burning of any fossil fuel. The three other explanatory variables are considered "natural" variables. By natural is meant that each of the variables' values are not impacted by human activity. And, it is also appropriate to call each of these three natural variables "chaotic" here defined to mean that each variable has proven impossible to reliably forecast, say over the next ten years, due to the climate system's chaotic behavior. Thus, any analysis with the objective of climate/temperature change prediction must deal with the chaotic, that is unpredictable, behavior of these three natural climate model input variables. However, this difficulty regarding climate model forecasting does not rule out the mathematically proper validation of EPA's claim regarding $CO_2$.

Stated mathematically, EPA's claim is shown in equation 1 below:

1.) GAST = $F_1(CO_2, SA, VA, ENSO)$

When subjected to Structural Analysis involving the proper mathematical hypothesis testing methods and using relevant and reliable real world temperature data, EPA's claim is that higher atmospheric $CO_2$ levels can be shown to have a positive and statistically significant impact on GAST. Unfortunately, carrying out this structural analysis is anything but straightforward because it requires modeling of a very complicated climate system.

Since mathematical statistics, or more specifically, the mathematical approach used in econometrics, is used throughout this structural analysis work; for those readers not familiar with such techniques, it seemed appropriate to provide an overview of the rationale for analytical approach taken herein.

There are fundamental mathematical issues facing any analyst seeking to validate EPA's claim. In structural analysis using econometric methods, there are two issues every analyst must consider. The first is called Multicollinearity; the second is called Simultaneity. Both can have extremely serious ramifications. In the testing of EPA's claim, both must be considered.

Multicollinearity issues result from the fact that the $CO_2$ variable is essentially just a positively sloped straight line when plotted from 1959 to date. This means that, even if using proper mathematical methods, $CO_2$ were found to have a statistically significant impact on GAST, it would be impossible to be sure that the estimated impact was really due to higher $CO_2$ levels--and, not due to one or more of an infinite number of other straight line like variables highly correlated to $CO_2$, e.g., the positive linear trend component in the Solar Activity's trend cycle over this period. Moreover, even assuming that this multicollinearity hurdle could be overcome analytically, hypothesis-testing challenges do not stop there.

To properly test EPA's hypothesis, it is necessary to also explicitly deal with the simultaneity issue. This issue arises in that it is a

certainty that steadily rising GAST temperatures virtually guarantee ocean temperatures are rising which, other things equal, are well known to lead to higher Atmospheric $CO_2$ levels. Of course, so does burning more fossils fuels.

Mathematically, this may be stated as shown in equation 2:

2.) Annual Change in Atmospheric $CO_2$ Concentration = $F_2$(GAST, Fossil Fuel Consumption, Other Explanatory Variables)

Note that in the two equations above, by assumption, $CO_2$ concentration impacts GAST in 1.) And, higher GAST impacts $CO_2$ concentrations in 2.) Here, $CO_2$ is assumed to be an "independent variable" in equation 1 and the "dependent variable" in equation 2. Of course, the opposite is true of GAST. $CO_2$ may be assumed to be an independent variable in equation 1 because it is a variable not dependent on the other explanatory variables (i.e., ENSO, SA and VA,) but assumed capable of impacting GAST. In statistics, the dependent variable is the variable predicted using, for example, a regression equation. Here, the forecast values of $CO_2$ and GAST must be obtained by solving the two simultaneous equations.

The econometric theory ramifications of ignoring this simultaneity issue are very serious. For example, it would never be mathematically proper to run regressions/direct least squares on equation 1 while ignoring equation 2 in an effort to determine whether $CO_2$ has a statistically significant impact on GAST – a mathematically improper approach that many analysts have used. To do so yields biased and inconsistent (i.e., worthless) parameter estimates. To obtain a statistically meaningful $CO_2$ equation 1 parameter estimate, that is to determine whether or not $CO_2$ has a statistically significant impact on GAST, a

simultaneous equation parameter estimation technique must be applied[1].

Faced with the challenge of properly testing EPA's Tropical Hot Spot (THS) claim, which involved the analysis of many different tropical temperature time series, the authors of this research developed an alternative approach which only **may** work to show that CO2 **does not** have a statistically significant impact on GAST.

Since the Atmospheric $CO_2$ concentration levels are independent of ENSO variable values, removing only the ENSO-related impacts on the temperature time series does not require the specification of a more complicated (i.e., multi-equation) climate model and therefore the use of simultaneous equation parameter estimation techniques – for that matter, neither does removing SA or VA impacts. Importantly, it will be shown that removing "ENSO –related Impacts" in the manner used in this research also removes solar trend cycle impacts.

Hence, to seek validation of EPA's claim that $CO_2$ is a pollutant, the first fundamental question addressed in this research is: do the ENSO-adjusted temperature time series have a statistically significant upward sloping linear trend? If not, then it means that once only the ENSO impacts on temperature are accounted for, there may be no $CO_2$-induced "record setting" warming to be concerned about. Strictly speaking, the ENSO-adjusted

[1] See Theil, Henri. Introduction to Econometrics, Prentice-Hall, 1978, pages 328-342 and Goldberger, A.S., Econometric Theory, 1964, pages 329-348. See also Theil, Henri. Introduction to Econometrics, Prentice-Hall, 1978, pages 346-349 and Goldberger, A.S., Econometric Theory, 1964, pages 354-355.For a paper illustrating the application of such econometric methods to climate modeling see James P. Wallace, III, Anthony Finizza and Joseph D'Aleo, A Simple KISS Model to Examine the Relationship Between Atmospheric CO2 Concentration, and Ocean & Land Surface Temperatures, Taking into Consideration Solar and Volcanic Activity, As Well As Fossil Fuel Use. In: Evidence-Based Climate Science. Elsevier, Oxford, Amsterdam, pp. 353-382. ISBN: 9780123859563, Copyright © 2011 Elsevier Inc. All rights reserved, Elsevier.

temperatures represent the estimated combined impact of $CO_2$ as well as the two natural variables, solar and volcanic activity. For example, Volcanic Activity could be hiding $CO_2$'s impact.

So, for example, if GAST, or any other temperature time series, has a statistically significant, positive linear trend slope and ENSO-Adjusted GAST does not, then the positive trend slope in GAST can be totally explained by the natural ENSO impacts alone. But, if a statistically significant trend slope were to have been found in the ENSO-Adjusted Temperatures, it would have been necessary, as explained above, to use simultaneous equation parameter estimation techniques to sort out $CO_2$ related simultaneity issues. As it turned out, this was not necessary. However, while all the ENSO Adjusted Temperatures analyzed had flat trends, it was still possible that the volcanic activity was hiding $CO_2$'s impact. This turns out not to have been the case with all 13 of the highly relevant temperature time series analyzed in this research.

Finally, it should be noted that every effort was made to minimize complaints that this analysis was performed on so-called "cherry picked temperature time series". To avoid even the appearance of such activity, the authors divided up responsibilities, where Dr. Christy was tasked to provide a tropical temperature data set that he felt was most appropriate and credible for testing the THS hypothesis. All told, thirteen temperature time series (9 Tropics, 1 Contiguous U.S. and 3 Global) were analyzed in this research. The econometric analysis was done by Jim Wallace & Associates, LLC, and when completed, cross checked by the other authors.

## Section I. Relevance of this Research

The assumption of the existence of a "Tropical Hot Spot (THS)" is critical to all Three Lines of Evidence in EPA's GHG/$CO_2$ Endangerment Finding.

Stated simply, first, the THS is claimed to be a fingerprint or signature of atmospheric and Global Average Surface Temperatures (GAST) warming caused by increasing GHG/$CO_2$ concentrations[2].

Second, higher atmospheric $CO_2$ and other GHGs concentrations are claimed to have been the primary cause of the claimed record setting GAST over the past 50 plus years.

Third, this THS assumption is imbedded in all of the climate models that EPA still relies upon in its policy analysis supporting, for example, its Clean Power Plan--recently put on hold by a Supreme Court stay. These climate models are also critical to EPA's Social Cost of Carbon estimates used to justify a multitude of regulations across many U.S. Government agencies.

## Section II. Objectives of the Research

Thus, the first objective of this research is to determine, based on the very considerable relevant and credible tropical temperature data evidence (see Table II-1,) whether or not the assumed THS actually exists in the real world.

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[2] *See* U.S. Climate Change Science Program, Synthesis and Assessment Product 1.1, Temperature Trends in the Lower Atmosphere - Understanding and Reconciling Differences, Chapter 1, p. 18-19, https://www.gfdl.noaa.gov/bibliography/related_files/vr0603.pdf

## Table II-1

**TEMPERATURE DATA ANALYZED**

**Data Window: 1959 to 2015**

| | | | | |
|---|---|---|---|---|
| **Tropics** | | | | |
| | Balloon | Upper Trop. | AV3 | 150 & 200 |
| | Balloon | Lower Trop. | AV3 | TLT & 500 |
| | Buoy | Upper | | NINO 160E/80W |
| | Buoy | Upper | | NINO 3.4 |
| | SFC | Surface | | NOAA |
| **Global** | | | | |
| | Balloon | Lower Trop | AV3 | TLT |
| | SFC | Surface | Hadley | HadCRUT4 |
| **U.S.** | SFC | | NOAA | Contiguous |

**Data Window: 1979 to 2015**

| | | | | |
|---|---|---|---|---|
| **Tropics** | | | | |
| | Satellite | Upper Trop | AV2 | TMT |
| | Satellite | Lower Trop | AV2 | TLT |
| **Global** | | | | |
| | Satellite | Lower Trop | AV2 | TLT |

**NOTE: A Total of 13 Temperature Time Series were analyzed - 9 in the Tropics, 1 for U.S. and 3 Global**

The second related objective is to determine whether, adjusting ONLY for ENSO impacts, anything at all unusual with the Earth's temperatures seems to be occurring in the Tropics, Contiguous U.S. or Globally.

The third objective is to determine whether the rising atmospheric $CO_2$ concentrations alone can be shown to have had a statistically significant impact on the trend slopes of often -quoted temperature data.

## Section III. Research Design

Unlike some research in this area, this research does not attempt to evaluate the existence of the THS in the real world by using the climate models. This would constitute a well-known error in mathematics and econometrics in that such climate models obviously must include all relevant theories, possibly including some not even known today; many, if not all, of which could impact Tropical temperatures.

Thus, it is never mathematically proper to attempt to validate any theory embedded in a model using the model itself. Each such theory needs to be tested outside of the model construct.

## Section IV. Tropical Hot Spot Hypothesis Testing

The proper test for the existence of the THS in the real world is very simple. Are the slopes of the three trend lines (upper & lower troposphere and surface) all positive, statistically significant and do they have the proper top down rank order?

## Section V. Sufficient Conditions for Rejection of the THS Hypothesis

If, after adjusting for the natural ENSO impacts, all relevant temperature time series have linear trend slopes that are not positive and statistically significant; then rising $CO_2$ emissions in combination with Non ENSO related solar and volcanic activity, cannot have had a statistically significant impact on the tropical

temperature data trend slopes in the real world over the past 50 plus years. And, therefore, the THS does not exist. This follows from the fact that $CO_2$ and a positively sloped linear time trend are very highly correlated (0.99 for the period 1959 to 2015.)

If, as it does, the ENSO-only adjustment totally removes any positive statistically significant trend slopes in all of the relevant tropical temperature data; then rising atmospheric $CO_2$ concentrations, together with the Non ENSO–related impacts of the other omitted variables (i.e., Solar and Volcanic Activity) must not be the cause of any statistically significant positive trend slopes in the published data. Blame the Natural ENSO impacts.

## Section VI. El Niño/Southern Oscillation (ENSO) Impact Adjustment using the MEI Index

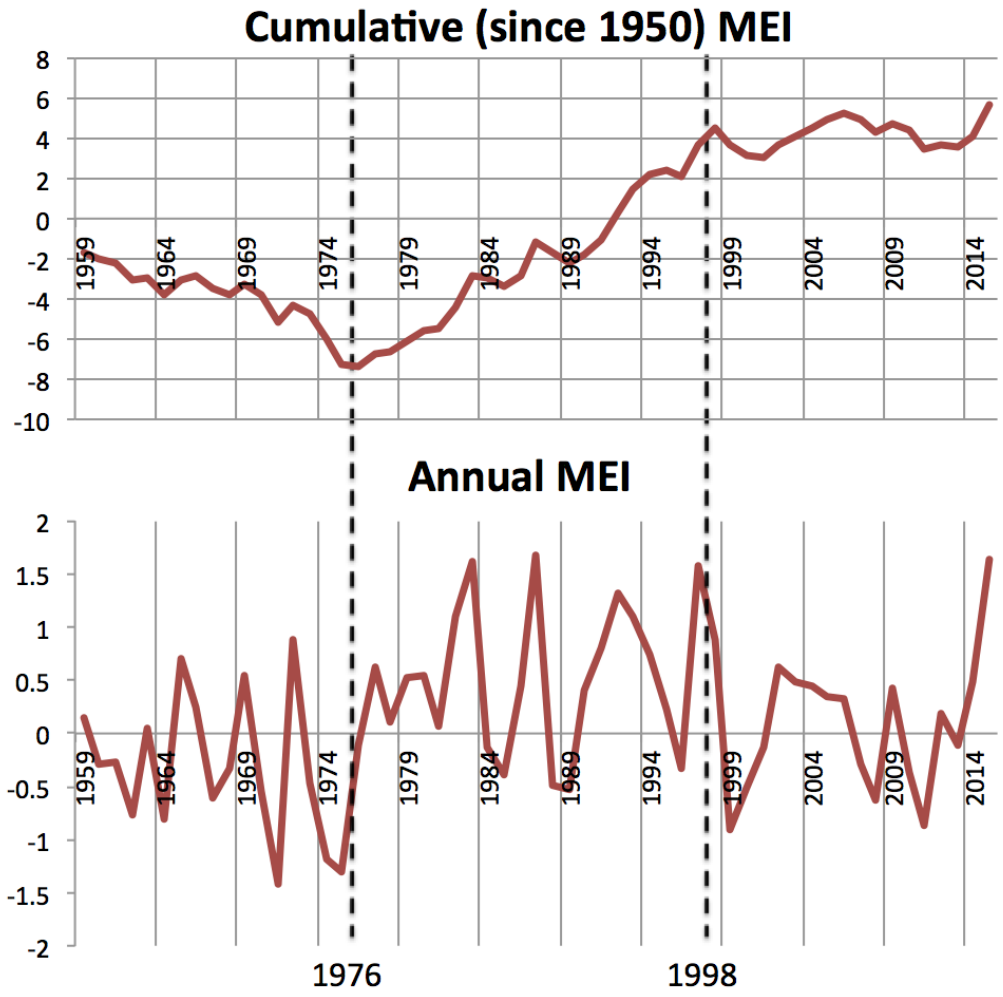
To quote from NOAA, “El Niño/Southern Oscillation (ENSO) is the most important coupled ocean-atmosphere phenomenon to cause global climate variability on inter-annual time scales. Here we attempt to monitor ENSO by basing the Multivariate ENSO Index (MEI) on the six main observed variables over the tropical Pacific. {Emphasis added} These six variables are: sea-level pressure (P), zonal (U) and meridional (V) components of the surface wind, sea surface temperature (S), surface air temperature (A), and total cloudiness fraction of the sky (C). These observations have been collected and published in {International Comprehensive Ocean-Atmosphere Data Set} ICOADS for many years. - - - -”

{See, http://www.esrl.noaa.gov/psd/enso/mei/#discussion.}

Thus, the Multivariate ENSO Index, MEI, at a point in time, is a linear function of six variables, all measured in the Tropics. As a result, it would be expected a priori, that the MEI variable would

be less important in explaining temperature variations outside the Tropics. Note also that, if this MEI variable is used as an exogenous variable in a model designed for forecasting temperature, MEI will be very difficult to forecast – MEI's behavior is chaotic. However, MEI will be shown to be very useful in "Structural Analysis" both as a standalone variable and in Cumulative Form, called Cum MEI. Both are shown in Figure VI-1 below.

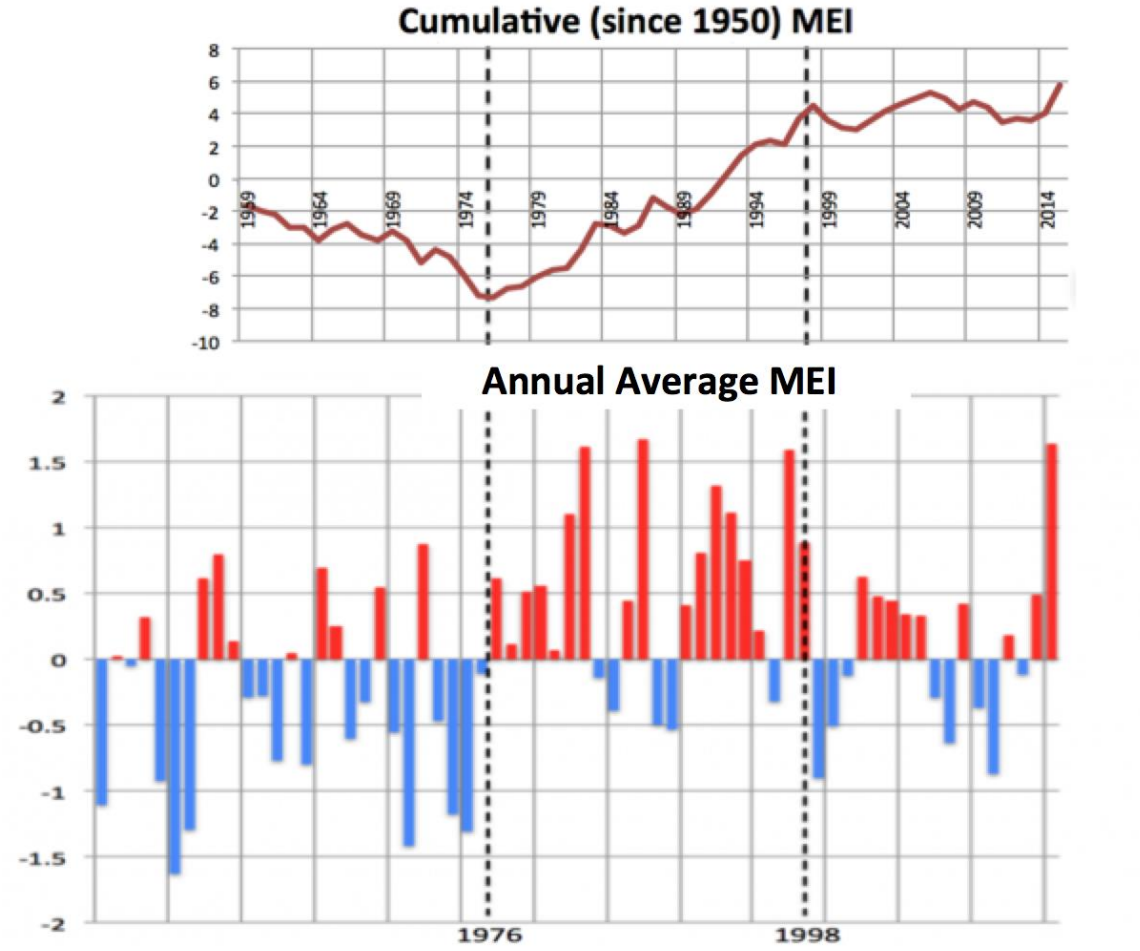
**Figure VI-1**




Source: http://www.esrl.noaa.gov/psd/enso/mei/table.html

It is a well-known meteorological fact that, other things equal, El Ninos lead to a global scale warming and La Ninas a global scale cooling, whose magnitudes are related to their ENSO strengths. If El Ninos and La Ninas simply alternated, ENSO impacts as measured by the MEI would help explain the spikes and dips in GAST but not the behavior of the slope of its trend. However, there are multi-decadal cycles wherein the tropical Pacific Basin takes on a physical state that favors El Ninos alternating with multi-decadal periods favoring La Ninas. See Figure VI-2.

**Figure VI-2**



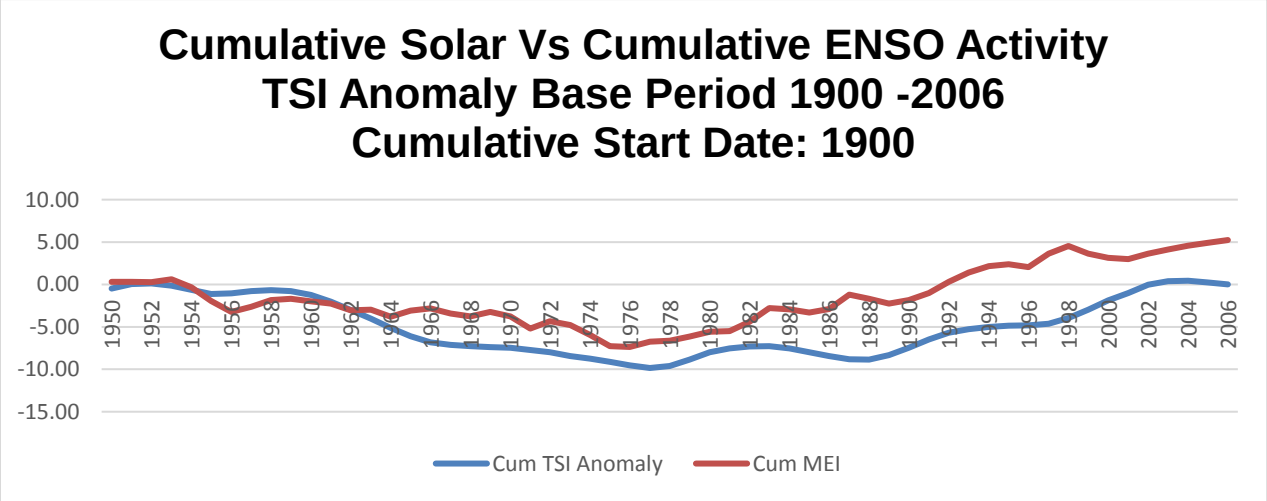

Source: http://www.esrl.noaa.gov/psd/enso/mei/table.html

Indeed from 1947 to 1976, 14 years had La Ninas embedded, while just 6 years had El Ninos. After the 1977 Pacific Climate

Shift during the subsequent period from 1977 to 1998, 10 El Ninos occurred with just 3 La Ninas. Since 1998, the Pacific Basin physical states have been more balanced and 7 El Ninos and 7 La Ninas occurred. Since clearly both the relative number and the relative strength of these ENSO events matter, this strongly suggests the use of a Cum MEI variable to capture such multi-decadal ENSO Trend impacts on temperatures.

Moreover, it is interesting to note, in Figure VI-3 below, that the Cum MEI behavior since 1950, that is, the Cumulative ENSO activity, has been quite similar to that of Cum Solar Activity.

Figure VI -3




Source: [http://www.esrl.noaa.gov/psd/enso/mei.ext/table.ext.html](http://www.esrl.noaa.gov/psd/enso/mei.ext/table.ext.html)

TSI Data: Hoyt and Schatten 1993, scaled to fit ACRIM

It is not surprising that periods of increasing Cumulative Total Solar Intensity Anomaly (Cum TSI Anomaly) would lead to time periods involving more intense and more frequent El Ninos and vice versa. **Thus, inclusion of the natural Cum MEI variable in the ENSO adjustment modeling process can be expected to**

**capture such cumulative solar impacts on ENSO behavioral patterns.**

To demonstrate the truth of this statement, some limited modeling of the relationship between Cum MEI and the Cum TSI Anomaly coupled with the Cumulative 1977 Shift impact was carried out. The results are as depicted in the Figure VI-4 and Table VI-1 below.

Figure VI-4

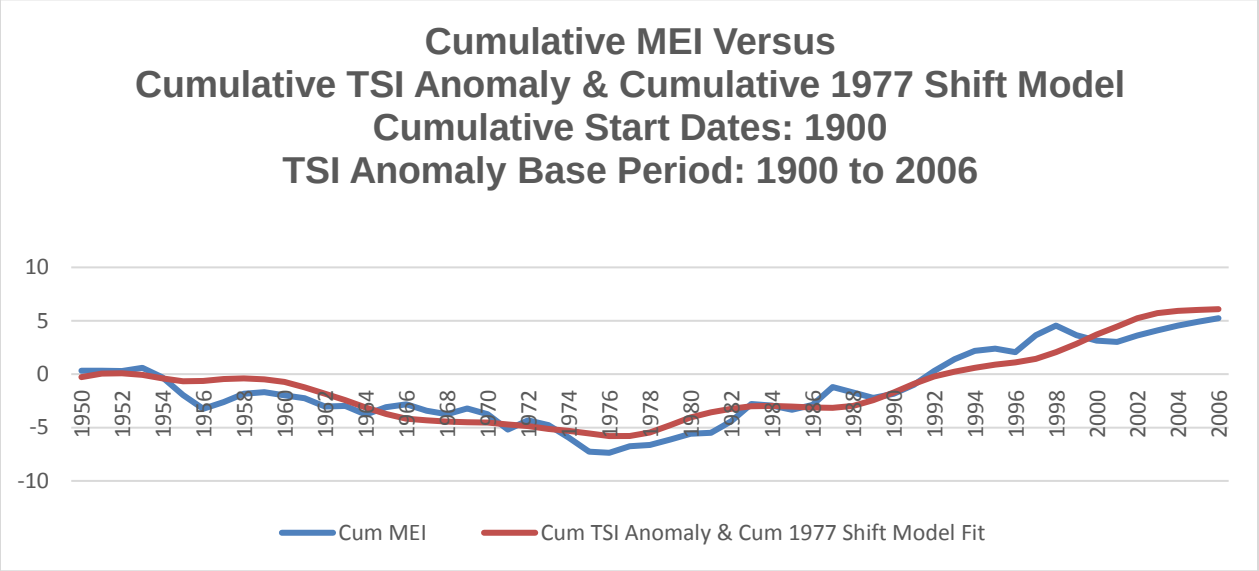



Table VI-1

**SUMMARY OUTPUT**

| Regression Statistics | |
|---|---|
| Multiple R | 0.95 |
| R Square | 0.90 |
| Adjusted R Square | **0.88** |
| Standard Error | 1.22 |
| Observations | 57 |

| | Coefficients | Standard Error | t Stat |
|---|---|---|---|
| Cum TSI Anomaly | 0.609 | 0.030 | **20.54** |
| Cum 1977 Shift | 0.316 | 0.021 | **14.85** |

Cum MEI = j*Cum TSI Anomaly + k* Cum 1977 Shift + €

Not surprisingly, the t Statistics in Table VI-1 overstate the statistical significance of the parameter estimates (The Durban Watson Statistic for this equation is 0.37 where roughly speaking, under 1.0 implies overstatement.) Nevertheless, the results make it very clear that the Cum MEI variable will capture much of the solar trend cycle influence on temperature trend slopes. It is also critical to point out that these two natural explanatory variables explain all of the linear Trend contained in the Cum MEI over the period. That is confirmed by the fact that the slope of the trend in the residuals of the regression model shown in Table VI-1 is not statistically significant. Moreover, it turns out that over this time period the Cum TSIA variable has a statistically insignificant Trend Slope, so that the Cum 1977 Shift variable is totally responsible for the linear trend in the Cum MEI variable, again over this time period.

There is one additional very important point that needs to be made here. From Figure VI-2 above, it is clear that the Cum MEI variable has a Trend Cycle pattern the Trend component of which will have a statistically significant positive slope if the linear regression on a time variable is run over the entire data window 1959 -2015.

The fundamental question addressed now is whether or not it is appropriate that the methodology, used to remove ENSO impacts in doing so, removes this linear Trend impact. The answer is that it is totally appropriate, in fact a must, because the linear trend impact in Cum MEI results from the Natural ENSO related 1977 Pacific Shift[3].

As discussed above, the statistically significant linear trend component of the Cum MEI Trend Cycle over this period is due to the cumulative impact of the 1977 Pacific Shift and it is totally appropriate for ENSO Adjustment to take out its linear trend impact. In fact, it would be totally inappropriate to not take its impact out. However, the CO2 explanatory variable is statistically indistinguishable from a (straight line) linear trend. So, a key question addressed in this research remains whether or not MEI Adjusted Temperatures have a statistically significant positive Trend slope that might be attributed to CO2.

# Section VII. Hypothesis Testing: Analytical Approach

In testing for the existence of a THS, the approach followed in this study used straight forward, even common, econometric techniques of time series analysis and dealt with the time series relevant to measuring temperatures in the Upper and Lower Troposphere as well as the Surface. **These measurements were taken using balloons, satellites, buoys and various land**

[3] This shift shows up as a Step change in the MEI variable in 1977. If this step is removed from the reported MEI data, the 1977 Shift Adjusted MEI has a flat trend as does its Cumulative.

**based techniques. Needless to say, if regardless of data source, the results are the same, the analysis findings would be highly credible. It will be seen below that such is the case.**

Regarding the specific analytical approach used here, the first step was to carry out a very careful time series decomposition of relevant Tropical Temperature time series as well as the MEI time series. This analysis led to some very important and very robust findings. Namely, that a major event occurred in 1977 in all of the tropical temperature data analyzed as well as MEI. Of course, this "1977 Pacific Climate Shift" phenomenon is already well known to climate scientists.

In all MEI Adjustment models, both MEI and Cum MEI are used for the reasons discussed above in Section VI. But, in short, **in the Tropics**, MEI handles the annual specific variations and Cum MEI handles the cumulative impacts, e.g., when there is a run of more and stronger EL Ninos and fewer, weaker La Ninas. Outside the Tropics, the MEI has less power, but its coefficient is always positive.

The 1977 Shift variable is also always used when the data begins prior to that date. Only two parameter estimation data windows are used in this research. (See Table II-1 above.) The annual satellite data starts in 1979, and all of the other data start dates were set at 1959 for two good reasons - including that the balloon data and best $CO_2$ data start there.

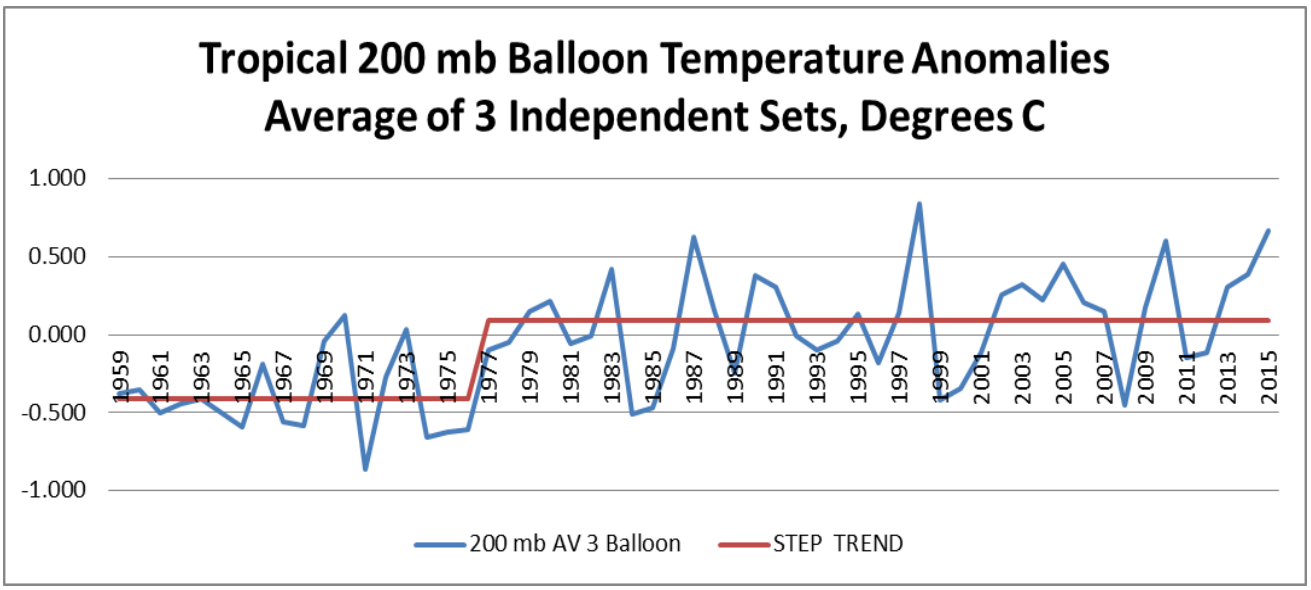
Finally, wild points matter in regression analysis, and in a few test cases, the 1998 El Nino wild point was removed. Its removal resulted in higher t statistics on the MEI variables. However, it is very important to note that no effort was made to optimize each of these models for the particular temperature time series. It was most important to test whether or not the same basic model

worked well for all 13 time series – it did. Nevertheless, limited testing suggests that there is enormous upside potential for reducing the variance of model parameter estimates.

## Section VIII. Tropical Upper Troposphere Balloon Data

The analysis results are shown first for Tropical Upper Troposphere Balloon (1959- 2015) data in Figures VIII 1-4 below. In this analysis, for each temperature time series, the first step was to determine via "time series decomposition" the "best fit trend line" among standard functional forms such as Linear, Ramp Step, Step, Multiple Step, etc. The selected trend lines were best of those tested in the sense that they had the maximum R Bar Squared value. Below the Annual MEI Step Trend rose by 0.66 in 1977.

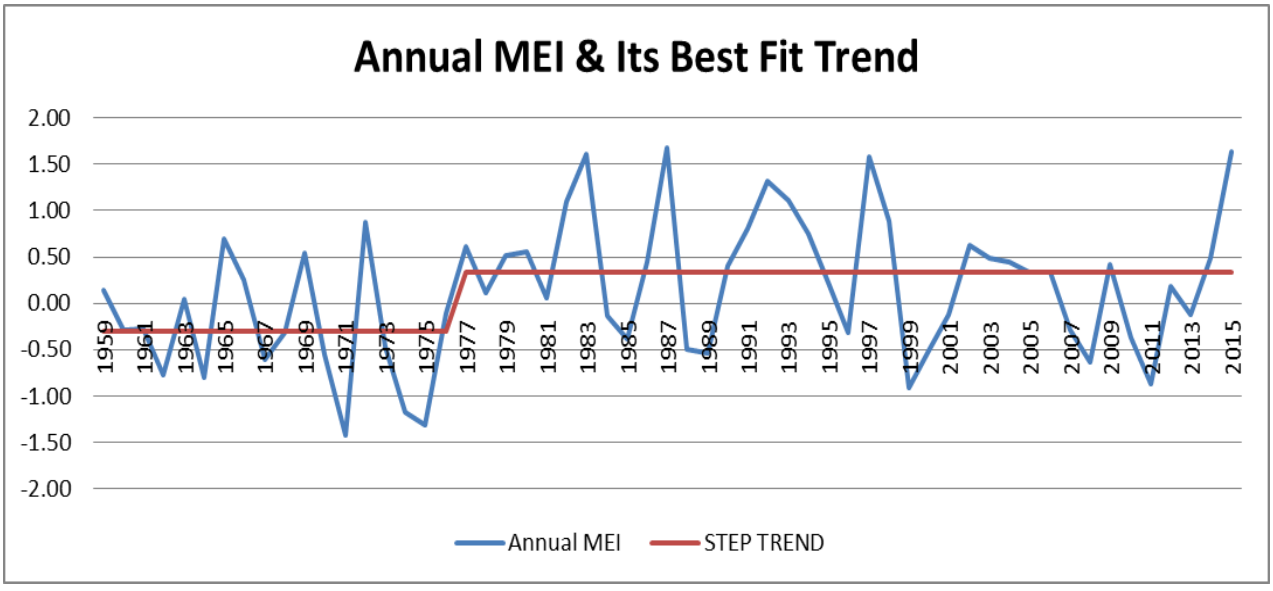
**Figure VIII-1**




Source: "AV3 = (RATPAC + UNSW + (RICH + RAOBCORE)/2)/3, where RICH and RAOBCORE data is produced under a single individual's leadership.

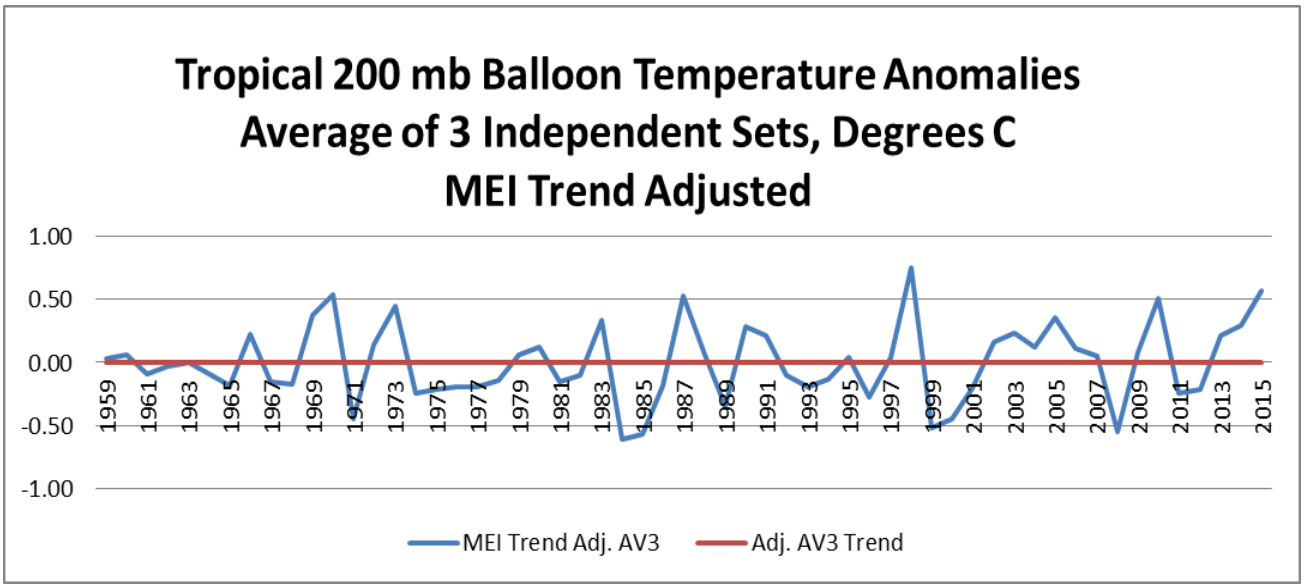
RATPAC: http://www1.ncdc.noaa.gov/pub/data/ratpac/ratpac-a/RATPAC-A-annual-levels.txt
UNSW: Sherwood, S. C. and N. Nishant, 2015: Atmospheric changes through 2012 as shown by iteratively homogenised radiosonde temperature and wind data (IUKv2). Env. Res. Lett., Vol. 10, 054007. The UNSW is not on a public URL, so it is necessary to contact their office and a grad student will put the data set out on an accessible site for 24 hours. This grad student sets up a transfer of the data: n.nidhi@student.unsw.edu.au.
RICH/RAOBCORE: the URLs below provide access to the grid data. Here are the netCDF files for the gridded data.
ftp://srvx7.img.univie.ac.at/pub/v1.5.1/raobcore15_gridded_2015.nc
ftp://srvx7.img.univie.ac.at/pub/v1.5.1/rich15obs_mean_gridded_2015.nc
Most of the URLs do not give a product for a specific need, say for TLT Tropics. It is necessary to download station or gridded data and calculate the tropical and global values from there. Here this process was carried out by Dr. John R. Christy, Distinguished Professor of Atmospheric Science, Alabama's State Climatologist and Director of the Earth Systems Center at The University of Alabama at Huntsville. Appendix H provides that entity specific data for all Balloon Temperature data analyzed herein."

## Figure VIII-2



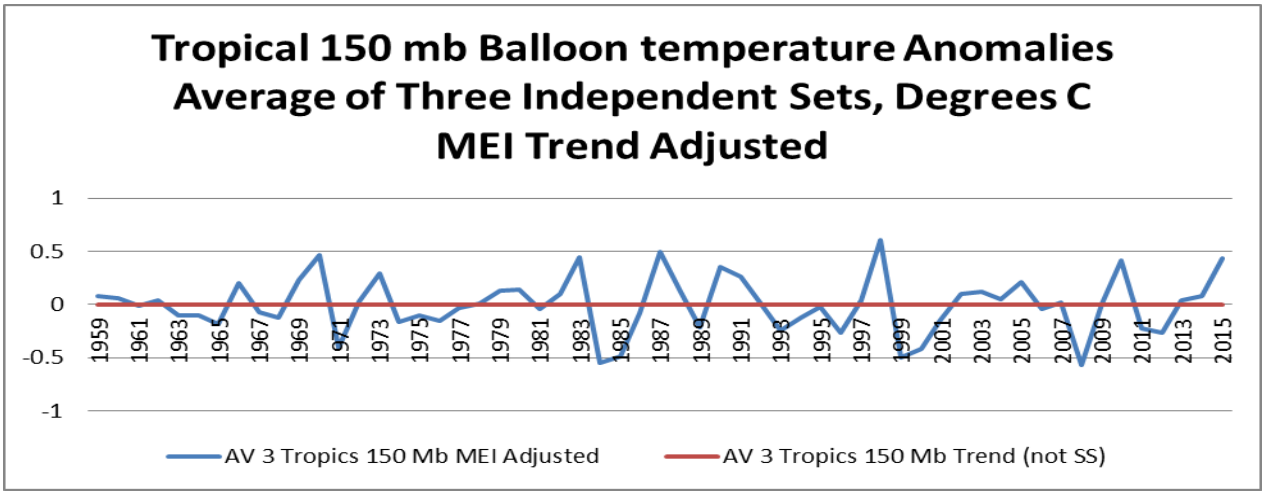

Source: http://www.esrl.noaa.gov/psd/enso/mei/table.html

## Figure VIII-3




Source: See Figure VIII-1 source

## Figure VIII-4




Source: See Figure VIII-1 source

As shown in Figures VIII-3 and VIII-4 above, both the MEI Adjusted Tropical 200 mb and 150 mb temperatures do not have a statistically significant trend line slope. -suggesting that $CO_2$,

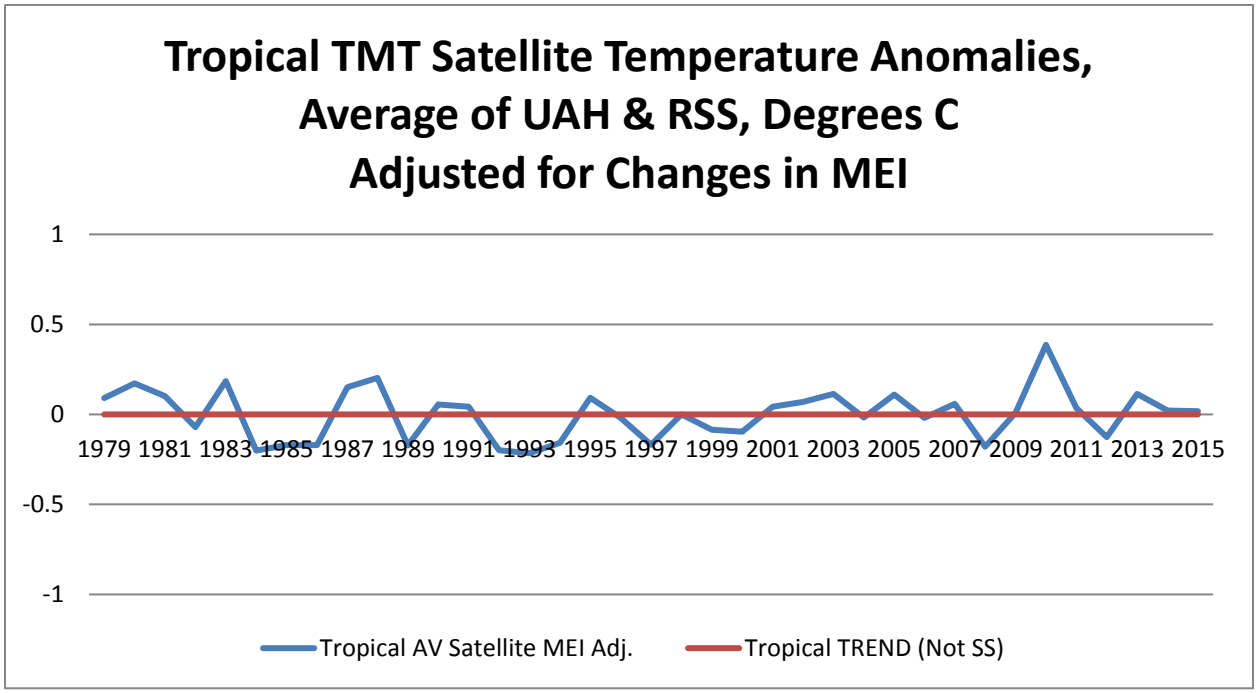
taken together with all other omitted variables, is not the cause of the rise in this Tropical Balloon temperature data.

## Section IX. Tropical Upper Troposphere Satellite Data

In Figures IX 1-3 below are shown the analysis results for the Average of the UAH and RSS Satellite TMT data from 1979 through 2015. As with the balloon data above, the analysis began with time series decomposition and then moved on to removing the ENSO impacts using ONLY MEI-based variables.

Figure IX-1 below shows that the MEI-Adjusted Tropical TMT Satellite Temperature Trend is also flat – again suggesting that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the Tropical Satellite TMT temperature data.

Figure IX-1



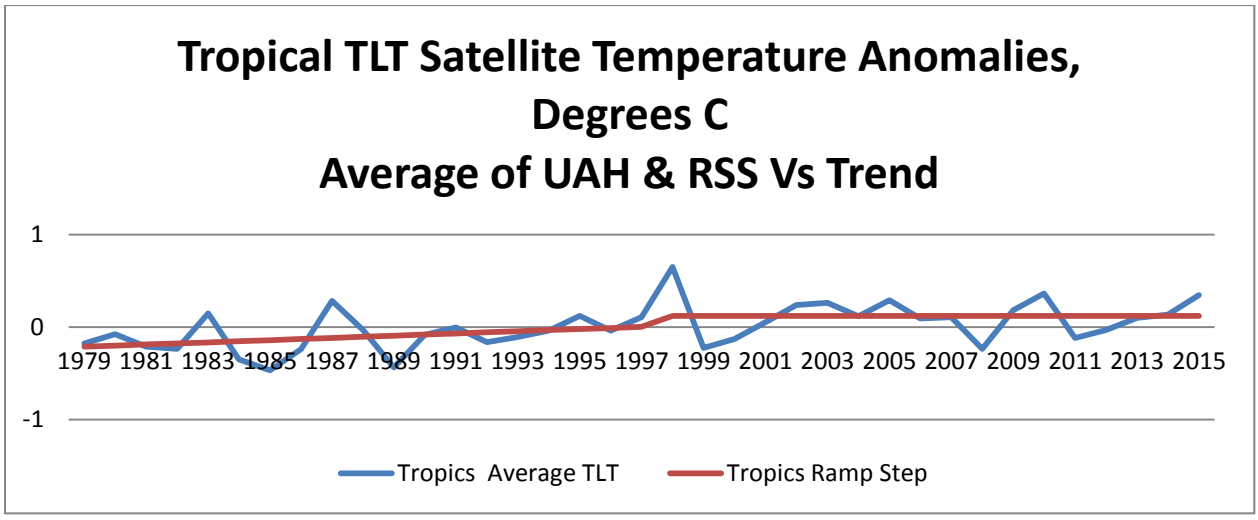
Source:
http://vortex.nsstc.uah.edu/data/msu/v6.0beta/tmt/uahncdc_mt_6.0beta5.txt

http://data.remss.com/msu/monthly_time_series/RSS_Monthly_MSU_AMSU_Channel_TMT_Anomalies_Land_and_Ocean_v03_3.txt

## Section X. Tropical Lower Troposphere Satellite Data

The same MEI-only based model adjustment approach taken above with TMT Satellite data worked very well for TLT Satellite data as shown in Figures X-1-2 below. Note that Figure X-1 shows a flat trend in the Lower Troposphere Temperature over the last 18 years. And again, when the ENSO impacts as measured by MEI variables are removed, the MEI- adjusted temperatures have flat trend lines – again suggesting that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the Tropical Satellite TLT temperature data.

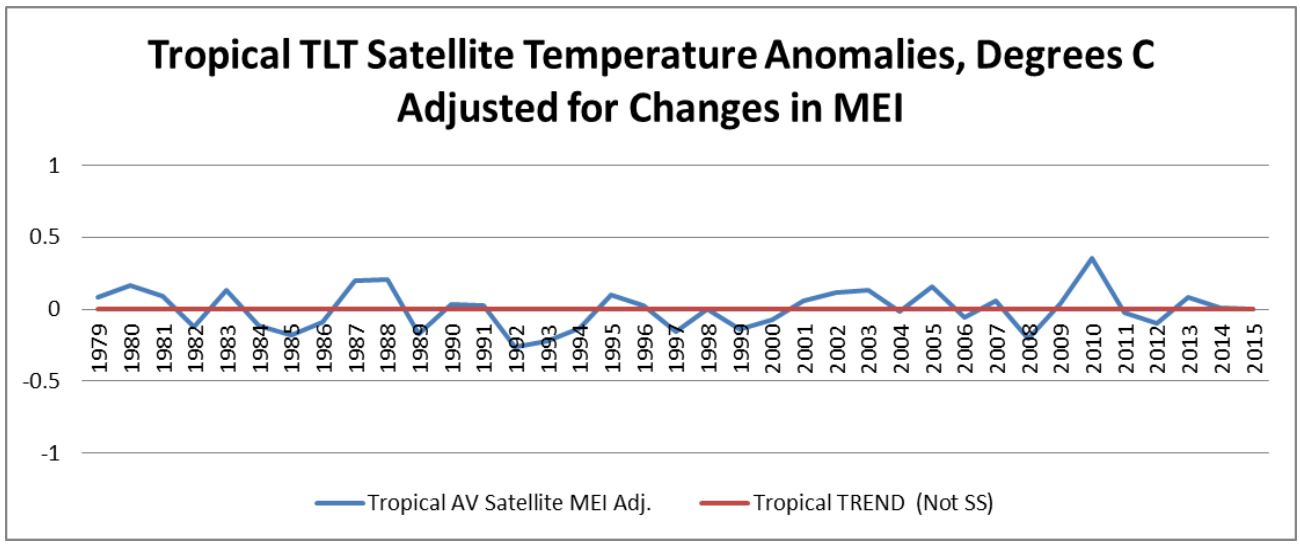
Figure X-1




Source:
http://vortex.nsstc.uah.edu/data/msu/v6.0beta/tlt/uahncdc_lt_6.0beta5.txt

http://data.remss.com/msu/monthly_time_series/RSS_Monthly_MSU_AMSU_Channel_TLT_Anomalies_Land_and_Ocean_v03_3.txt

Figure X-2

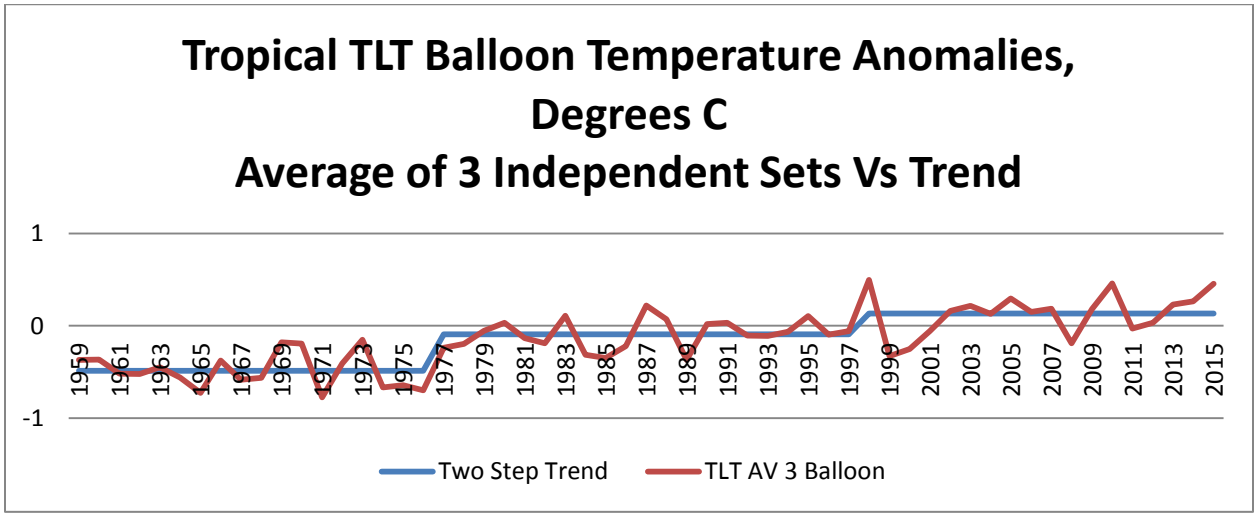



Source: See Figure X-1 source

## Section XI. Tropical Lower Troposphere Balloon Data

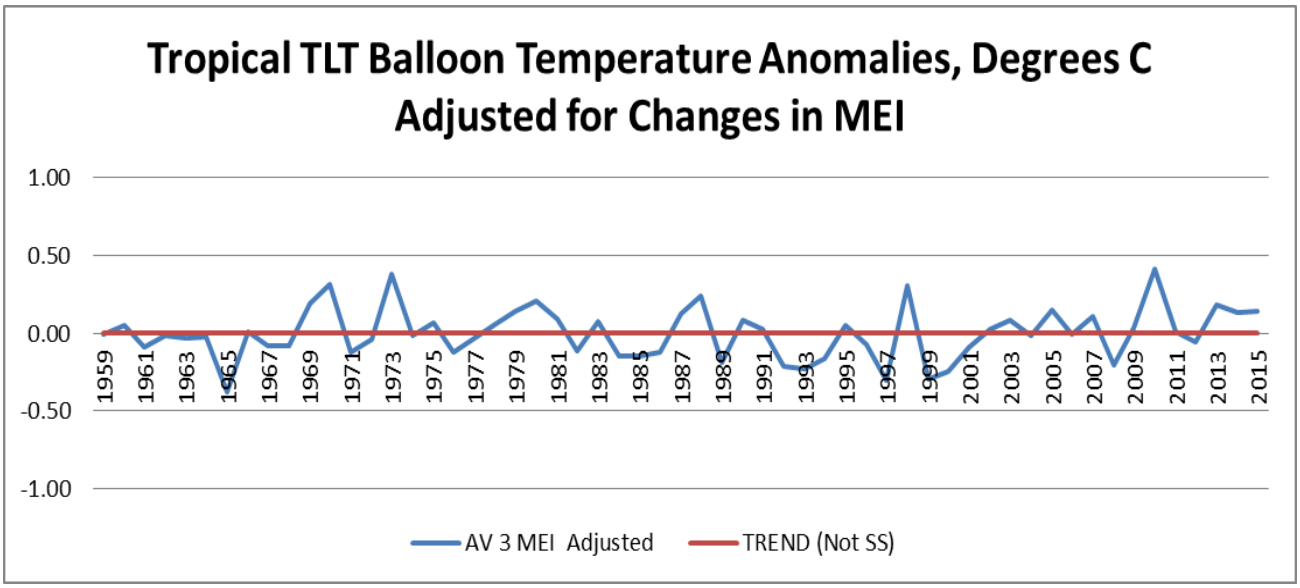
Figures XI-1- 3 and Tables XI-1 below show the results from carrying out the same analysis of the Tropical TLT balloon temperature data. Once again, when the ENSO impacts as measured by MEI variables are removed, the MEI-adjusted temperatures have flat trend lines – again suggesting that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the Tropical TLT balloon temperature data.

Figure XI-1



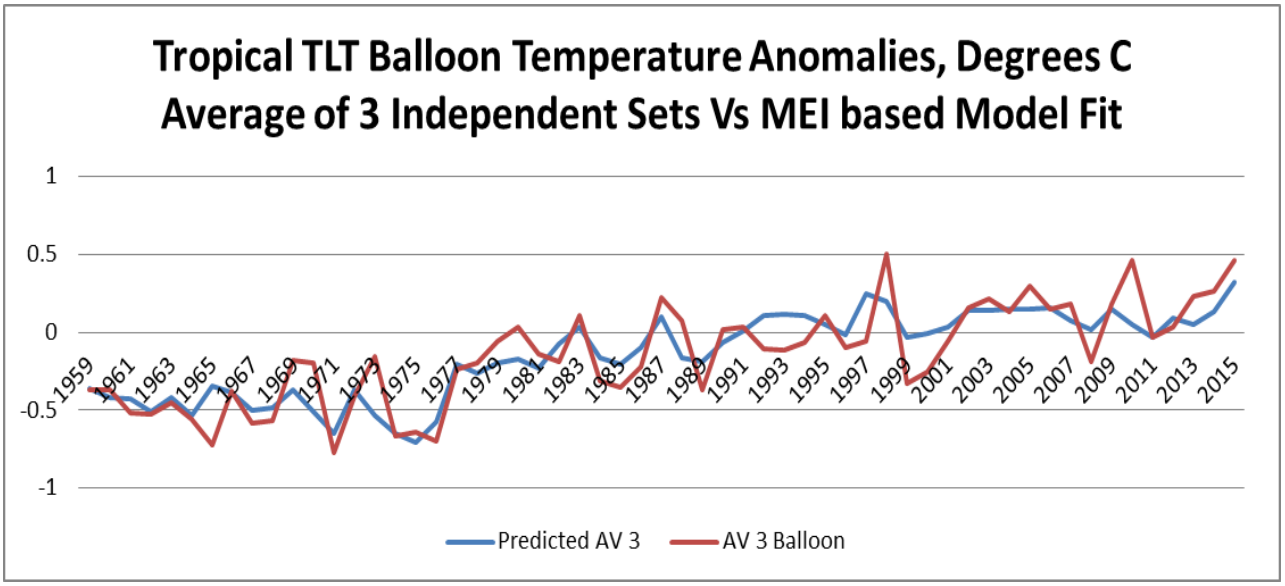

Source: See Figure VIII-1 source

Figure XI-2




Source: See Figure VIII-1 source

Figure XI-3




Source: See Figure VIII-1 source

To illustrate the MEI Adjustment process, Table XI-1 below shows the 3 Variable Model Parameter Estimates & Model Comparison for the Tropical TLT Balloon data.

**Table XI-1**

**3 Variable Model Parameter Estimates & Model Comparison For Tropical TLT Balloon**

| Variable | Parameter Est. | t Statistic |
|---|---|---|
| Intercept | -0.27539 | 4.96096 |
| MEI | 0.11236 | 3.344385 |
| Cum MEI | 0.033169 | 4.845063 |
| 1977 Shift | 0.270434 | 4.318155 |

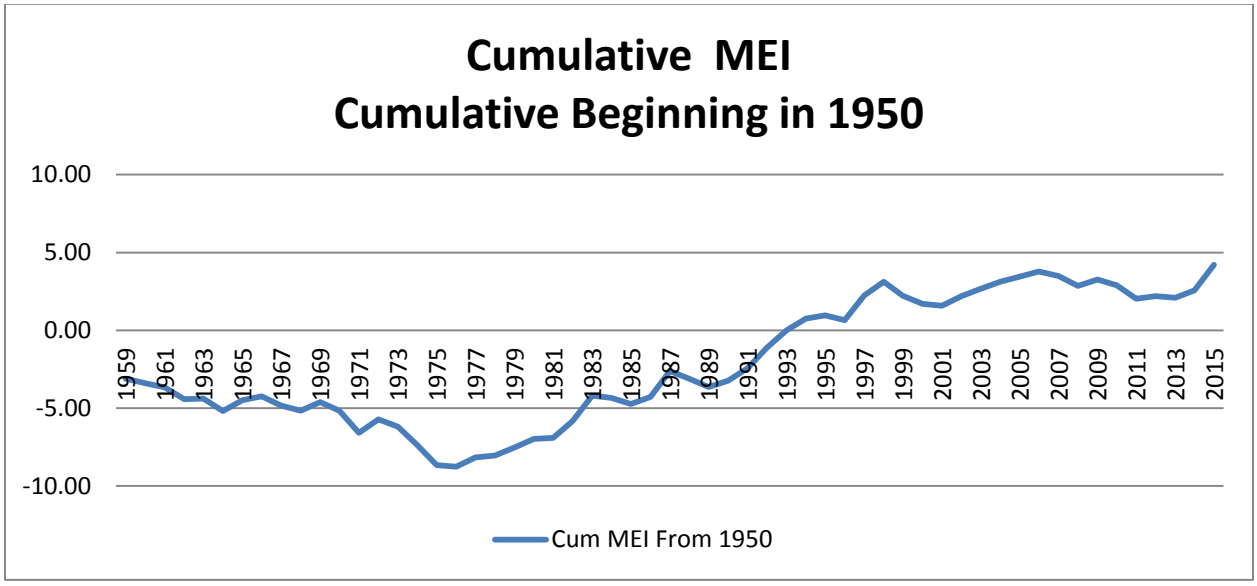
| Models | R BAR SQ |
|---|---|
| Linear | 0.59 |
| 77 & 98 Steps | 0.62 |
| Cum MEI only | 0.48 |
| MEI & Cum | 0.61 |
| MEI, Cum, 1977 Shift | 0.71 |

# Section XII. Illustrative Use of MEI-based Models for Tropical Temperature Scenario Preparation

Table XI-1 above shows the parameters and parameter estimates of the "3 Variable Model." It is clear that to develop temperature outlook scenarios, it is necessary to provide the 3 variable modeling system with well-defined assumptions regarding the future path of annual MEI values. However, it is also obviously not even possible to develop a credible subjective best estimate MEI forecast. But, for example, what can be done is to use the exact same annual MEI pattern that occurred in the past and use it to provide an Outlook Scenario conditioned on that specific MEI pattern reoccurring over, say, the next 15 years.

This has been done below, assuming the 1961–1975 MEI values from 2016 thru 2030. From the Figure XII-1 below, it can be seen that this MEI pattern could be thought of as providing a lower temperature outlook scenario. And, at least, it is a scenario, the basis of which can be clearly specified.

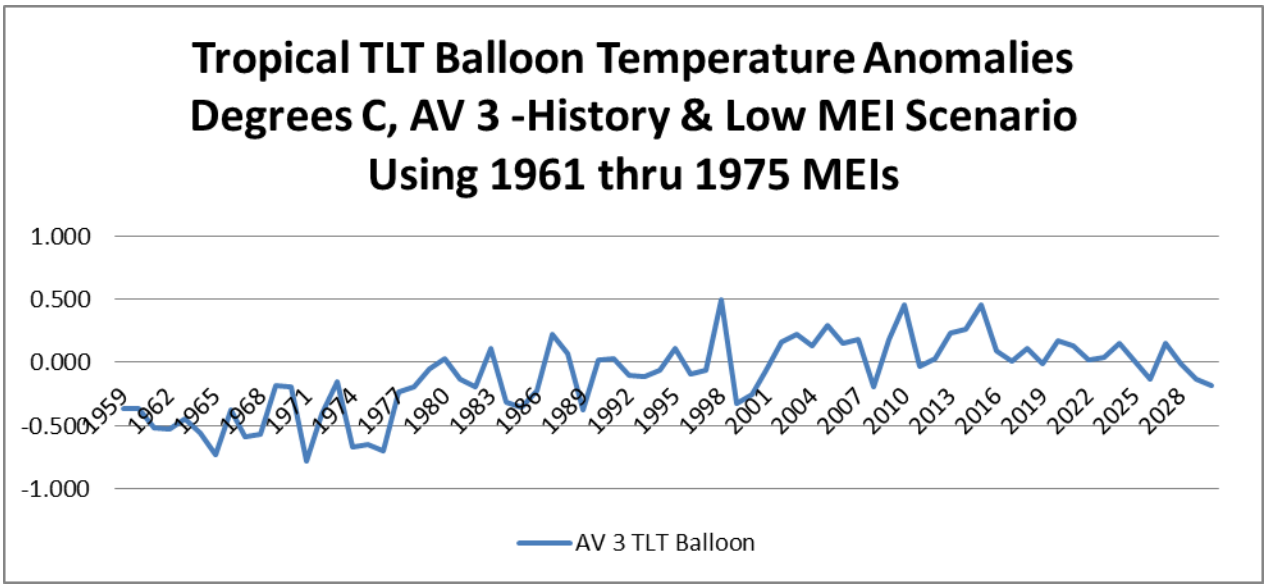
Figure XII-1




Source: http://www.esrl.noaa.gov/psd/enso/mei/table.html

Figure XII-2 shows the results of such an analysis.

Figure XII-2




Source: See Figure VIII-1 source

From Table XI-1 above, it is very interesting to note that should the 1977 MEI shift be reversed, the temperatures would very quickly drop by 0.27 C –another example of the chaotic nature of the climate system!

Finally, it is critically important to note here that the approach discussed above for development of Temperature Outlook Scenarios has major limitations. They include the following:

1.) The variable being “forecast” is actual temperature and is based on an assumed MEI pattern that has zero chance of occurring again. It also assumes that in the future, the ENSO-Adjusted Temperature will have a trend slope of zero. (Below in Section XXIII, it will be shown that CO2, on a standalone basis, has thus far not had a statistically significant impact on temperature trend slopes.) This implies the assumption either that going forward $CO_2$ will have no significant impact on temperature trend slopes or that its impact is offset by Natural factors. But the

approach suggested does facilitate development of upside and downside scenarios conditioned on very well-defined assumptions. Note that as discussed in Section VI, an historical Cum MEI pattern is reflective of an historical Total Solar Intensity (TSI) Anomaly pattern.

2.) The 3 Variable Model defined above does not deal with Non-ENSO related solar or volcanic impacts. Based on selective testing, it proved easy to add the volcanic impacts; and in all cases, it improved the model fit.

3.) However, addition of a solar activity variable (e.g. TSI) must be a feature of models designed for prediction/scenario development when the forecast/scenario time frame is more than a decade or two. Currently, with the high level of uncertainty involving the Solar Intensity outlook, even that time frame is way too long. Econometric climate models do seem to have potential in longer term forecasting[4].

[4] See Page 378, Figure 20, James P. Wallace, III, Anthony Finizza and Joseph D' Aleo, A Simple KISS Model to Examine the Relationship Between Atmospheric C02 Concentration, and Ocean & Land Surface Temperatures Taking into Consideration Solar and Volcanic Activity As Well As Fossil Fuel Use. In: Evidence-Based Climate Science. Elsevier, Oxford, Amsterdam, pp. 353-382. ISBN: 9780123859563 

# Section XIII. Tropical Pacific Temperatures – NINO Buoy Data

As shown in Figures XIII -1-3 below, these NINO buoy temperature data do NOT exhibit statistically significant trend slopes across the Tropical Central Pacific where the THS theory would be expected to show its sea surface temperature impact.

Figure XIII -1

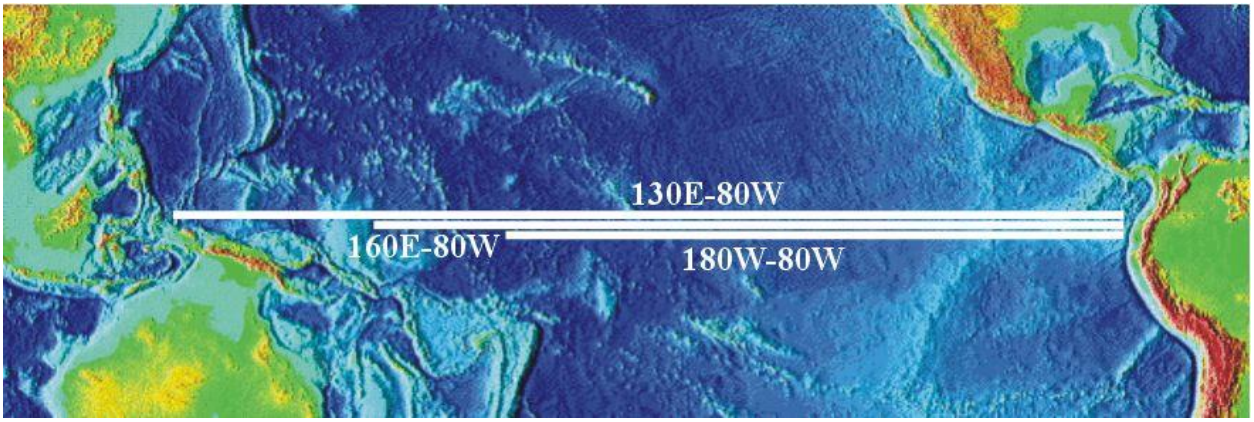
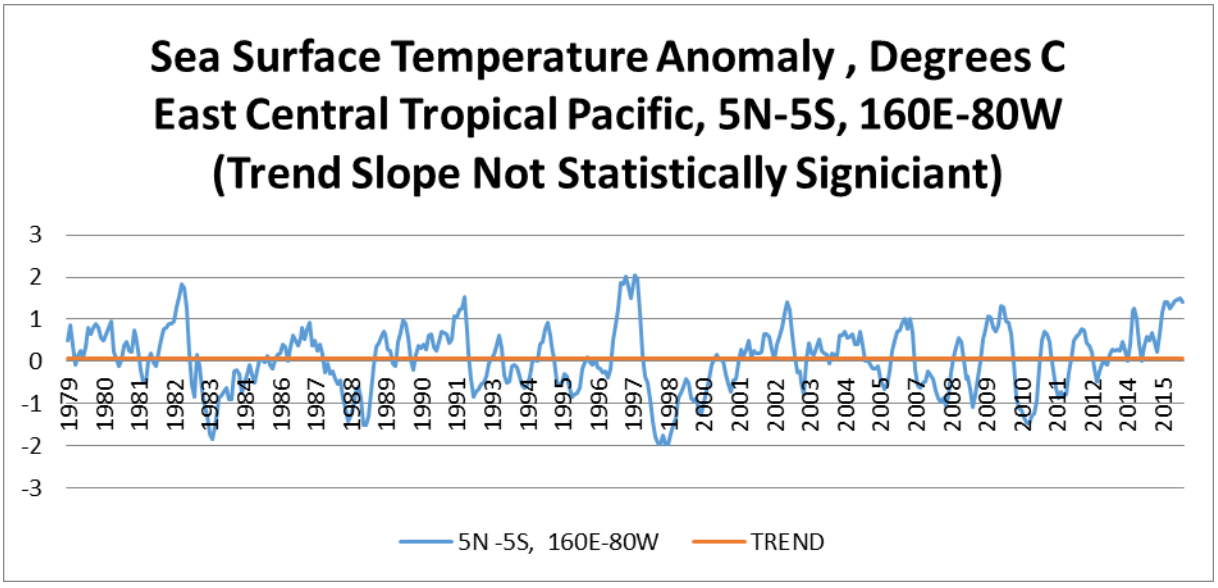


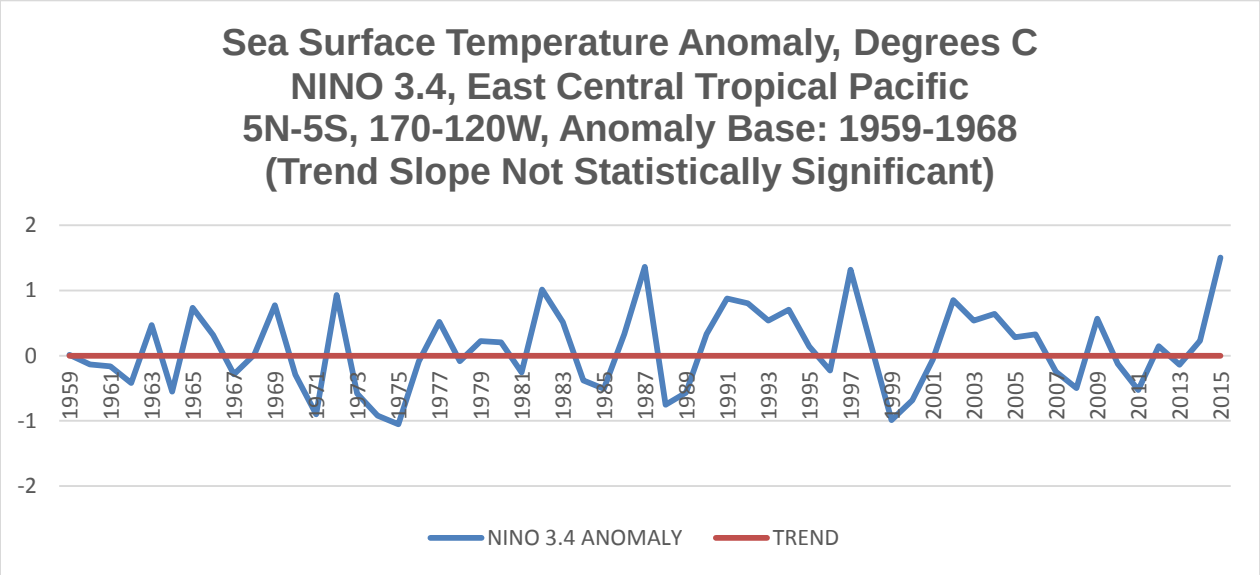

Figure XIII -2



Source:
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/index/heat_content_index.txt

NINO 3.4 Temperature shown in Figure XIII-3 below is considered highly relevant in measuring ENSO impacts but shows no GHG-related influence on its trend slope--which is not statistically significant. (See: http://www.esrl.noaa.gov/psd/data/climateindices/list/)

Figure XIII -3



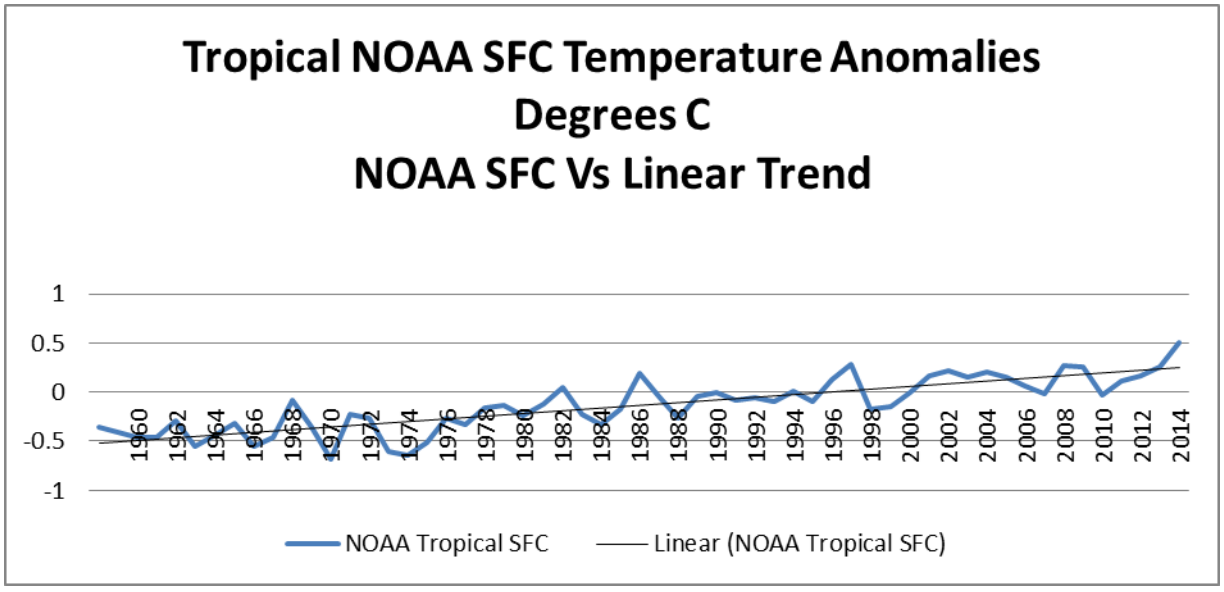

Source: http://www.cdc.noaa.gov/data/correlation/nina34.data

# Section XIV. Tropical Surface Temperatures – NOAA

## Naive versus Model-based Forecasts

The point was made in Section XII above that even model-based forecasts run into very serious problems due to the chaotic nature of the climate system. But climate modelers frequently make another serious, but avoidable error. For example, note the implied “forecast model” shown in Figure XIV-1 below. This Linear Trend Model even has an R Bar squared of 0.692.

Figure XIV-1

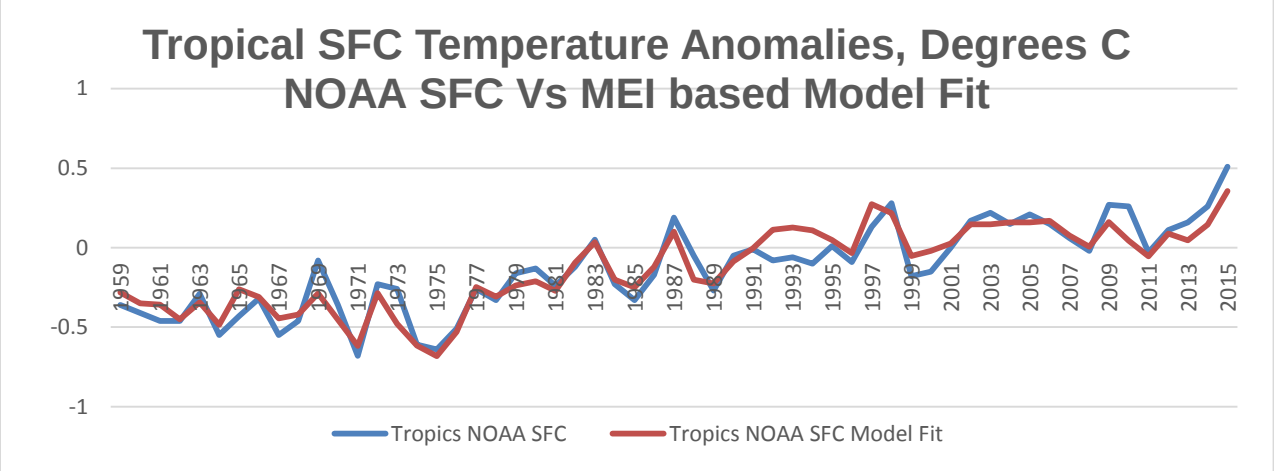



Source: NOAA SFC data: Karl, T.R. et al., 2015: Possible artifacts of data biases in the recent global surface warming hiatus. Sciencexpress, 4 June 2015, doi:10.1126/science.aaa5632

But here, the use of MEI-based modeling is a far superior approach. See below Figure XIV-2 and Table XIV-1 showing that

the MEI-based model's R bar square of 0.863 is 25% higher than for the straight-line naive forecast.

Figure XIV-2




Source: NOAA SFC data: Karl, T.R. et al., 2015: Possible artifacts of data biases in the recent global surface warming hiatus. Sciencexpress, 4 June 2015, doi:10.1126/science.aaa5632

Table XIV-1

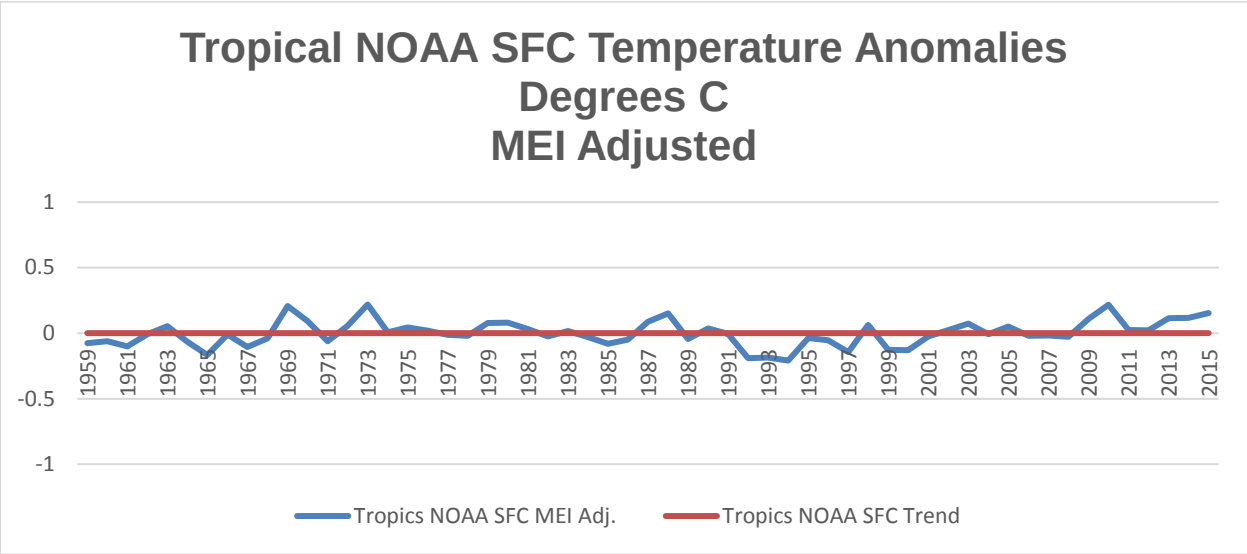
**3 Variable Model Parameter Estimates For Tropical NOAA SFC**

| **R Bar Square: 0.863** | | |
|---|---|---|
| **Parameter** | **t Stat** | **Variable** |
| -0.1828 | -5.62035 | Intercept |
| 0.13089 | 6.649319 | MEI |
| 0.038003 | 9.474421 | Cum MEI |
| 0.165023 | 4.497239 | D 77 |

Once again, it must be noted here that this analysis shows that this MEI-adjusted Tropical NOAA Surface temperature data, shown in Figure XIV-3 below, has a flat trend--again suggesting

that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the Tropical NOAA Surface temperature data.

Figure XIV-3




# Section XV. Temperature Forecasting Alternatives

The analysis above has illustrated two approaches regarding temperature forecasting which can be depicted mathematically as:

1.) T= a + b*Time Trend (or $CO_2$), where b=positive #, or

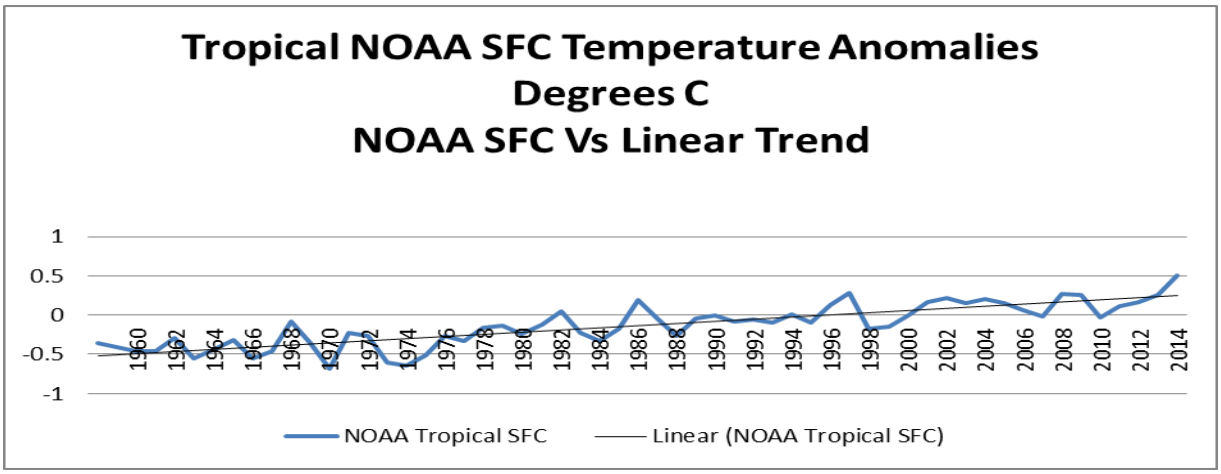
2.) T= c + d*F(MEI), where d = positive #

However, above it has been shown many times over that there is no mathematical/statistical basis for equation 1. None of the ENSO-Adjusted Temperature time series analyzed above had a statistically significant Trend Slope. With the equation 2 approach, it is all about the MEI time series outlook – so long as the

forecaster is willing to assume the ENSO-Adjusted Temperature trends will remain flat.

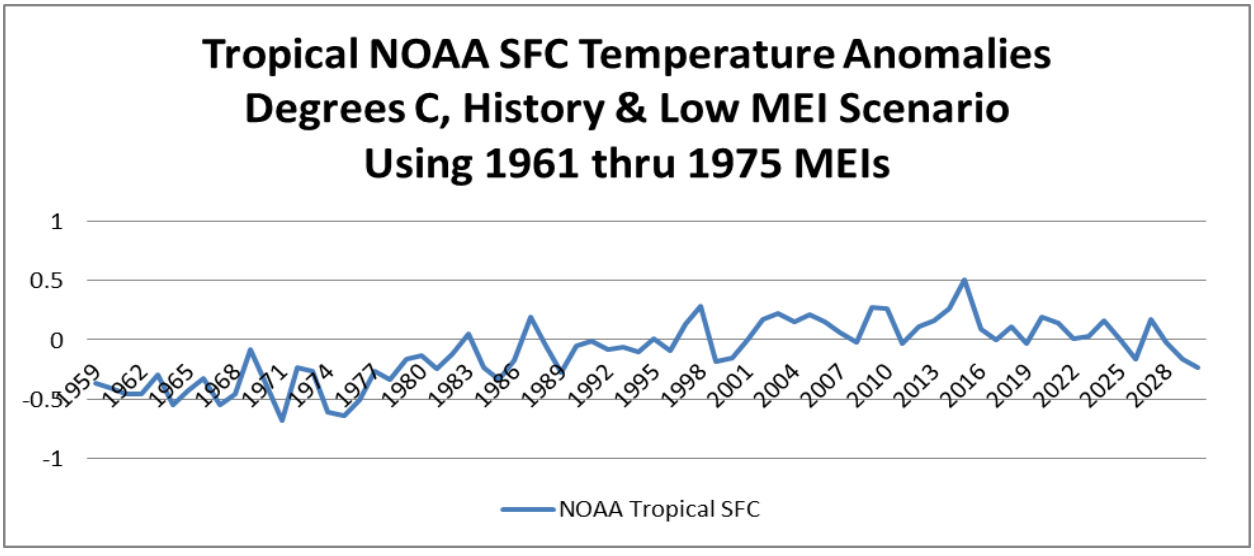
Figure XV-1 below illustrates the issue while Figure XV-2 shows the “Low MEI Scenario” SFC Temperature Outlook. The Low MEI Scenario was defined in Section XII above.

Figure XV-1




Source: See Figure XIV-1 source

Figure XV-2




Source: See Figure XIV-1 source

Note from Table XIV-1 above that should the 1977 ENSO event reverse, a further drop of 0.17 Degrees C could be expected.

## Section XVI. Structural Analysis Results re the THS

Adjusting for just the ENSO impacts via only MEI related variables, **NOT ONE** of the Nine (9) Tropical temperature time series analyzed above were consistent with the EPA's THS Hypothesis.

That is, adjusting for just the natural ENSO Impacts over their entire history; all tropical temperature data analyzed above have non-statistically significant trend slopes—which invalidates the THS theory.

However, this analysis strongly supports the view that MEI is a critical variable and very useful in temperature change analysis over the short/medium term. The longer the term, the more serious the chaotic, that is, difficult to forecast nature of MEI variation becomes and the more critical it is to have an explicit solar activity variable in the model.

Econometric simultaneous equation parameter estimation techniques can be used to determine the relative importance of solar, volcanic and ENSO impacts on Northern Hemispheric Temperatures[5]. This paper reported on research that did not find

[5] see, for example, A Simple KISS {Keep it Simple Stupid} Model to Examine the Relationship Between Atmospheric CO2 Concentration, and Ocean & Land Surface Temperatures, Taking into Consideration Solar and Volcanic Activity, As Well As Fossil

a statistically significant impact of $CO_2$ on the Surface temperatures of three different Northern Hemisphere regions.

## Section XVII. <u>The Tropical Hot Spot– CONCLUSION</u>

The analysis above has shown many times over that the THS simply does not exist. Recall from Section IV:

*The proper test for the existence of the THS in the real world is very simple. Are the slopes of the three trend lines (upper & lower troposphere and surface) all positive, statistically significant and do they have the proper top down rank order?*

And that, quoting from Section XVI above:

*Adjusting for just the ENSO impacts via only MEI variables,* ***NOT ONE*** *of the Nine (9) Tropical temperature time series analyzed above were consistent with the EPA's THS Hypothesis.*

*That is, adjusting for just the natural ENSO Impacts over their entire history; all tropical temperature data analyzed above have non-statistically significant trend slopes -which invalidates the THS theory.*

**In short, if on an-other-things-equal basis, $CO_2$ in fact has had a Statistically Significant impact on tropical**

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Fuel Use. In: Evidence-Based Climate Science. Elsevier, Oxford, Amsterdam, pp. 353-382. ISBN: 9780123859563 Copyright © 2011 Elsevier Inc. All rights reserved.

**temperatures, its impact has been offset by other Non ENSO-related Natural Variables over the past 55 plus years.**

In fact, some climate scientists effectively now claim that, *while the THS apparently cannot be found in the trend slopes of the relevant empirical temperature data, the $CO_2$-generated warming has to be hiding somewhere yet to be found*. This "Missing Heat" subject has been boiling up for some time and this heat has so far not been found.

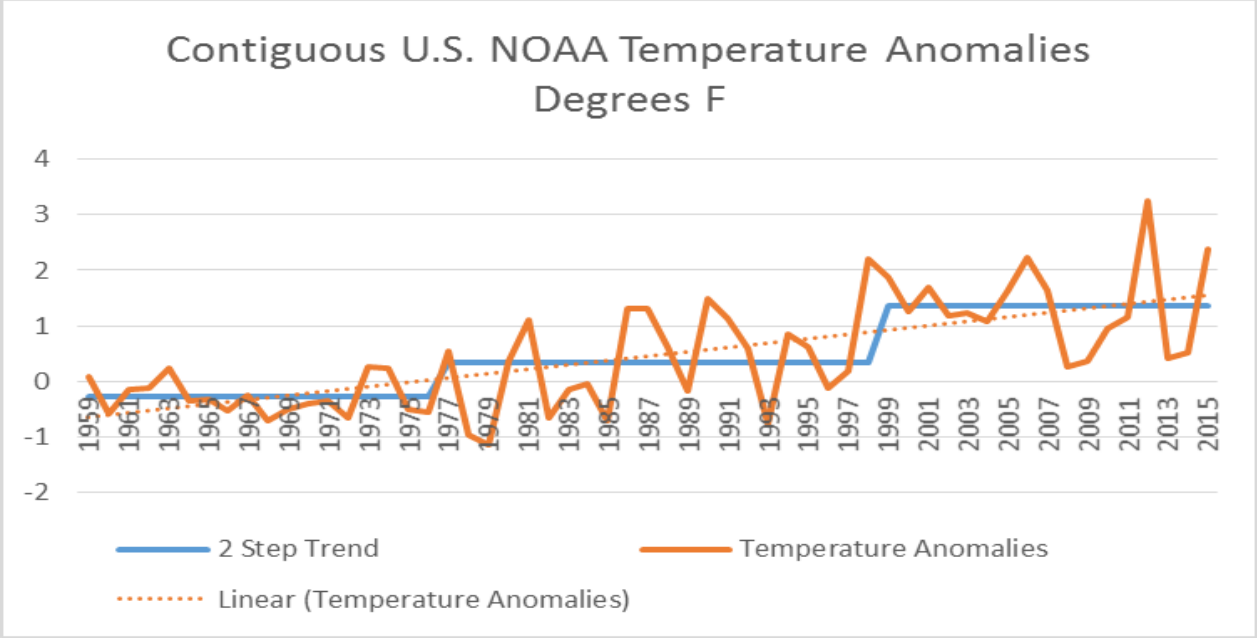
Nevertheless, alarmist scientists are still claiming record-setting warming in the Contiguous U.S. and globally caused by rising $CO_2$ levels. If true, this $CO_2$ -caused missing heat has to be warming the planet by a currently unknown mechanism operating somehow outside the tropics. Therefore, this analysis moved on to test this new, never formally claimed before, hypothesis by ENSO adjusting the relevant Temperature data.

# Section XVIII. Contiguous U.S. NOAA Temperatures

Given its success with Tropical Temperature Data, it seemed reasonable to attempt to extend the same mathematical modelling approach to Contiguous U.S. and then to Global Temperature data. This was done despite the fact that the MEI is solely based on tropical data. The analysis process for the Contiguous U.S. NOAA temperature data was the same as for the Tropics data, where the first step is to apply time series decomposition to get a feel for the best-fit-underlying-trend pattern. Figure XVIII-1 shows two trends – A linear trend and a two-step trend, both having a

nearly identical R Bar Squared. So linear trend projection is particularly precarious here!

Figure XVIII-1



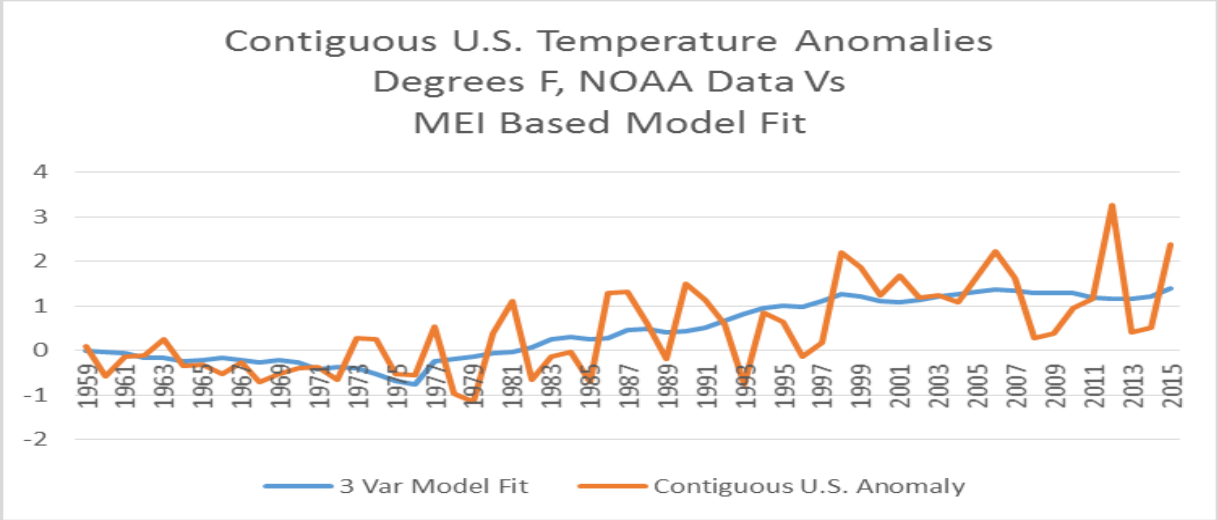

Source:

http://www.ncdc.noaa.gov/cag/time-series/us/110/00/tavg/ytd/12/1895-2016.csv?base_prd=true&begbaseyear=1901&endbaseyear=2000

http://www.esrl.noaa.gov/psd/enso/mei/table.html

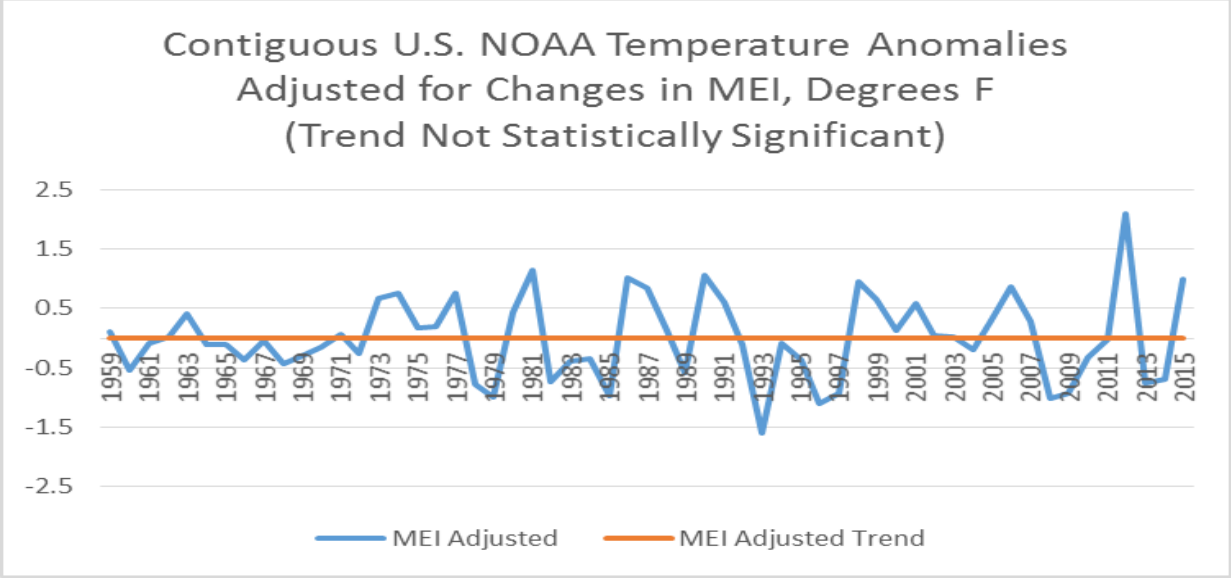
However, applying the same 3 Variable MEI based model leads to the fit shown in Figure XVIII-2 below – and a slightly higher R Bar Squared than either of the two trend model fits.

Figure XVIII-2




Moreover, as shown in Figure XVIII-3 below, the MEI-Adjusted Contiguous U.S. NOAA Temperature has a FLAT trend, again suggesting that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the U.S. Temperature Trend.

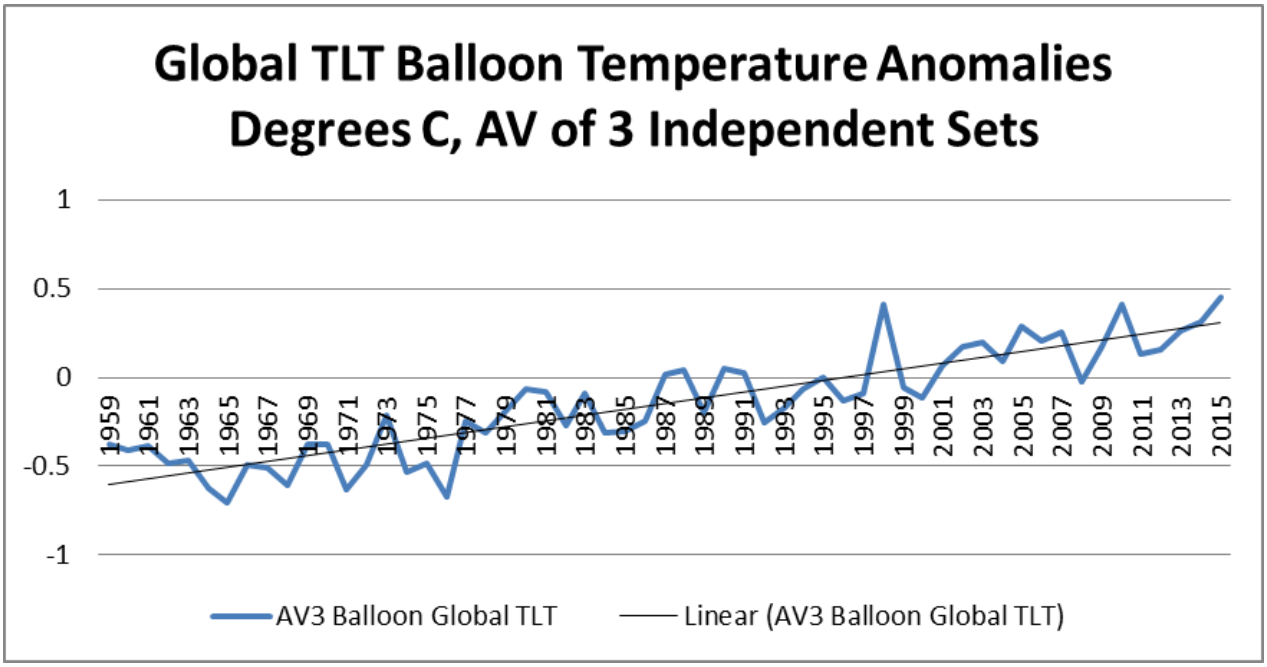
Figure XVIII-3



# Section XIX. Global Temperature Analysis – Balloon

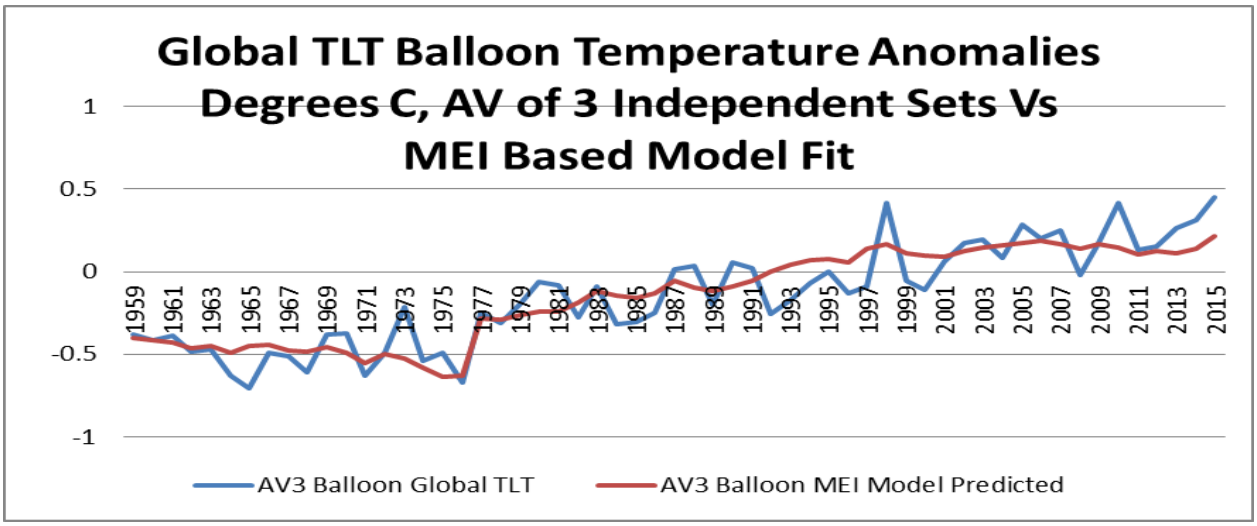
The analytical approach taken for Global temperature data is also exactly the same as that used above for the Tropical data. Figure XIX-1 below shows the hopefully now fully discredited Naïve Forecast Model, while Figure XIX-2 below shows the MEI-Based Model Fit of the Global TLT Balloon Temperature Anomalies.

Figure XIX-1




**Source:** See Figure VIII-1 source

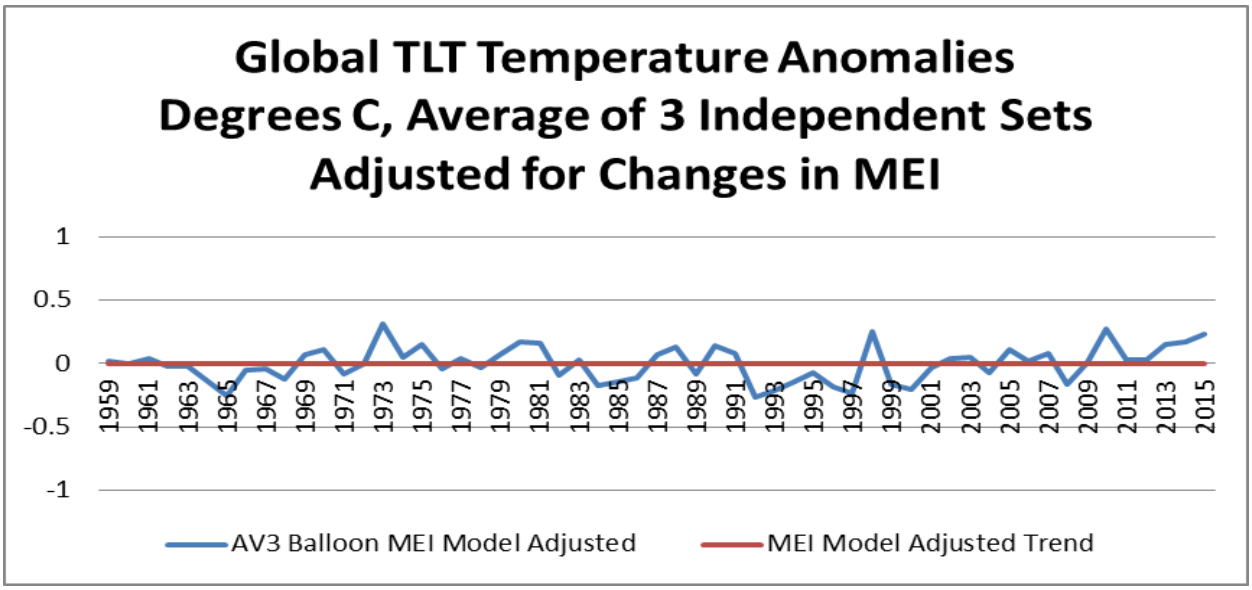
Figure XIX-2




Source: See Figure VIII-1 source

In Figure XIX-3 below, the MEI-adjusted Trend slope is not statistically significant—again suggesting that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the Global TLT Balloon temperature data.

Figure XIX-3




Source: See Figure VIII-1 source

Note that in Table XIX-1 below that MEI itself is not significant, but Cum MEI and D77 are.

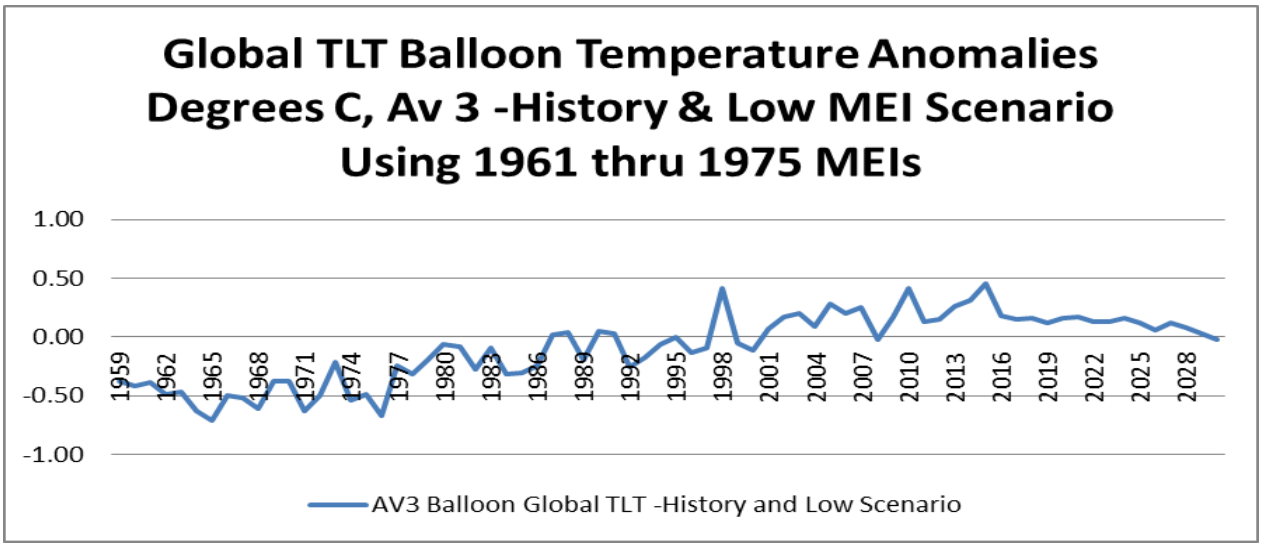
Table XIX-1

**3 Var Model Parameter Estimates For Global Balloon TLT**

| **R Bar Squared** | **0.787** | |
|---|---|---|
| **Variable** | **Coefficient** | **t Statistic** |
| Intercept | -0.27661 | -6.07572 |
| MEI | 0.011037 | 0.400548 |
| Cum MEI | 0.039814 | 7.091103 |
| D77 | 0.309551 | 6.026668 |

Using the equation parameters in the table above and the previously defined Low Scenario MEIs (see Section XII,) provides the associated outlook thru 2030 shown in Figure XIX-4 below. Note from Table XIX-1, that a reversal of the 1977 Pacific Shift ENSO event would be a dramatic 0.31 degrees C drop.

Figure XIX-4

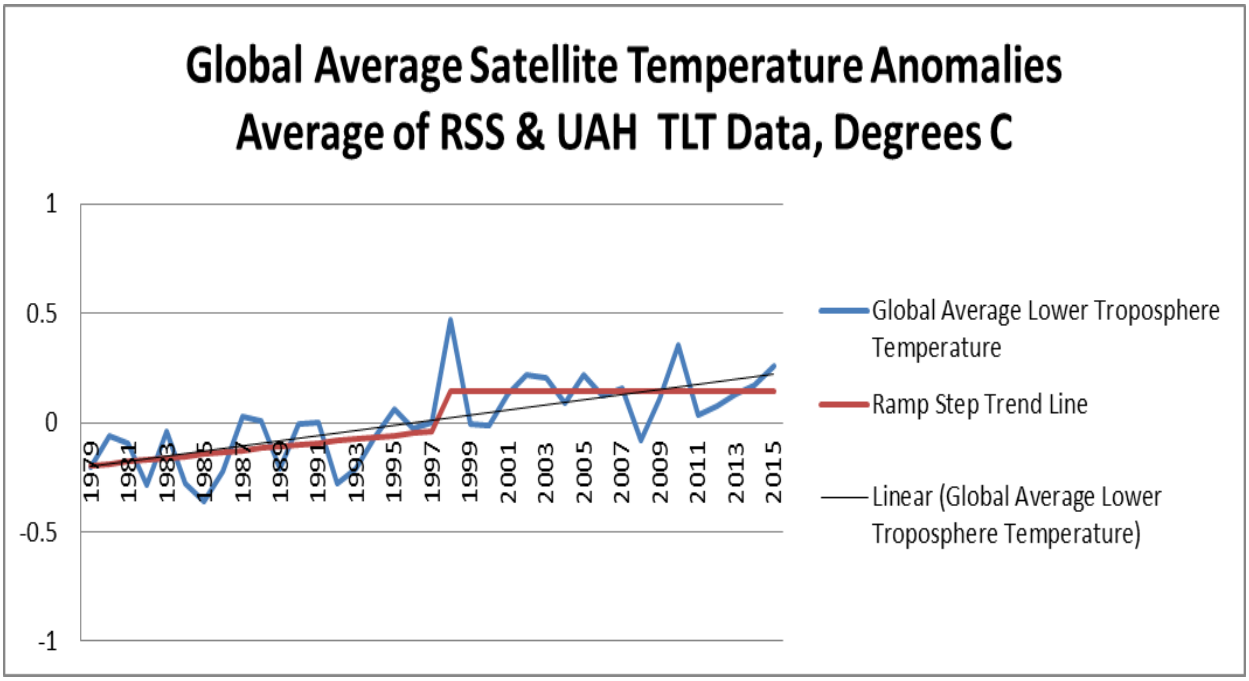



Source: See Figure VIII-1 source

# Section XX. Global Temperature Analysis – Satellite

Figure XX-1 below was specifically designed to depict how far wrong climate scientists can go if they cling to fitting linear trends to temperature time series. Using standard Dummy Variable Regression techniques allows rapid determination of the best fitting standard functional forms.

Figure XX-1

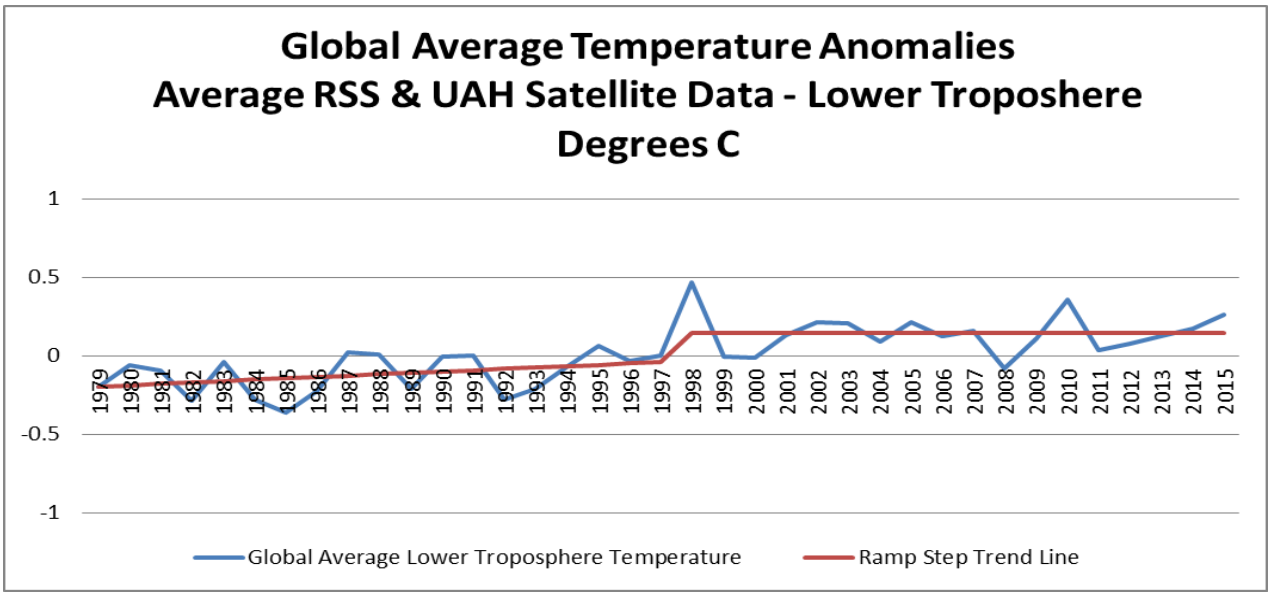



Source:
http://data.remss.com/msu/monthly_time_series/RSS_Monthly_MSU_AMSU_Channel_TLT_Anomalies_Land_and_Ocean_v03_3.txt

http://vortex.nsstc.uah.edu/data/msu/v6.0beta/tlt/uahncdc_lt_6.0beta5.txt

The Satellite data begins in 1979, and the best fit decomposition is the Ramp Step. This implies rather than steadily trended up, Global temperatures have had a flat trend for at least the last eighteen years as shown more clearly in Figure XX-2 below.

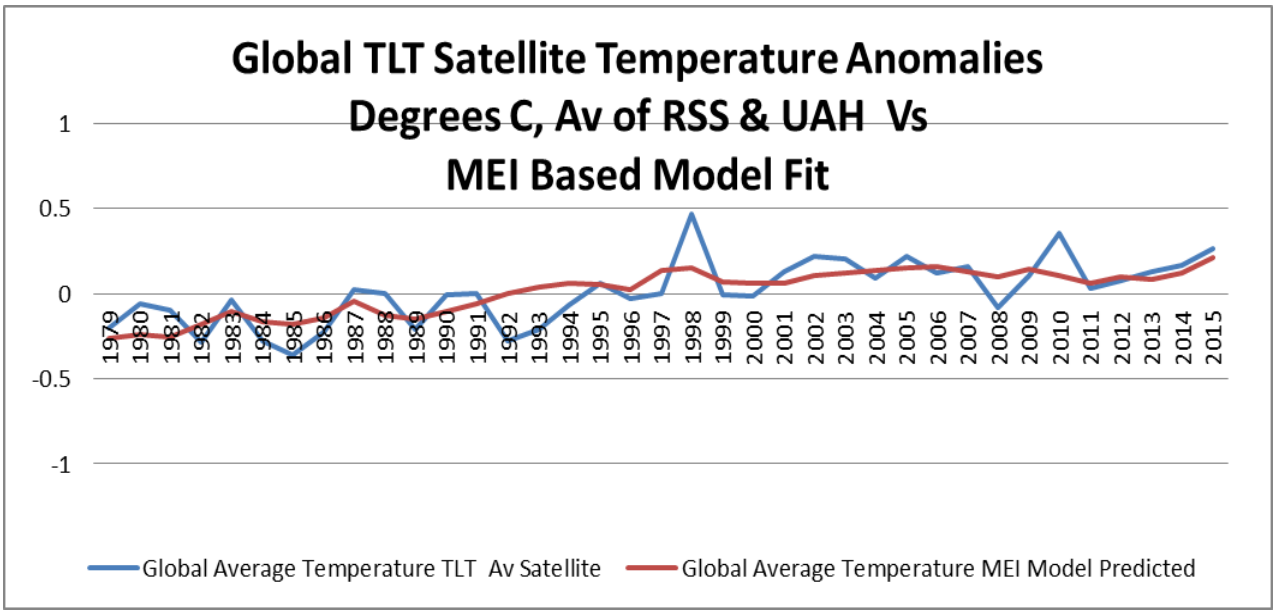
Figure XX-2




Source:
http://data.remss.com/msu/monthly_time_series/RSS_Monthly_MSU_AMSU_Channel_TLT_Anomalies_Land_and_Ocean_v03_3.txt
http://vortex.nsstc.uah.edu/data/msu/v6.0beta/tlt/uahncdc_lt_6.0beta5.txt

But there is no need to stop there. Using the same MEI-only explanatory variable model leads to the results in Figure XX-3.

Figure XX-3

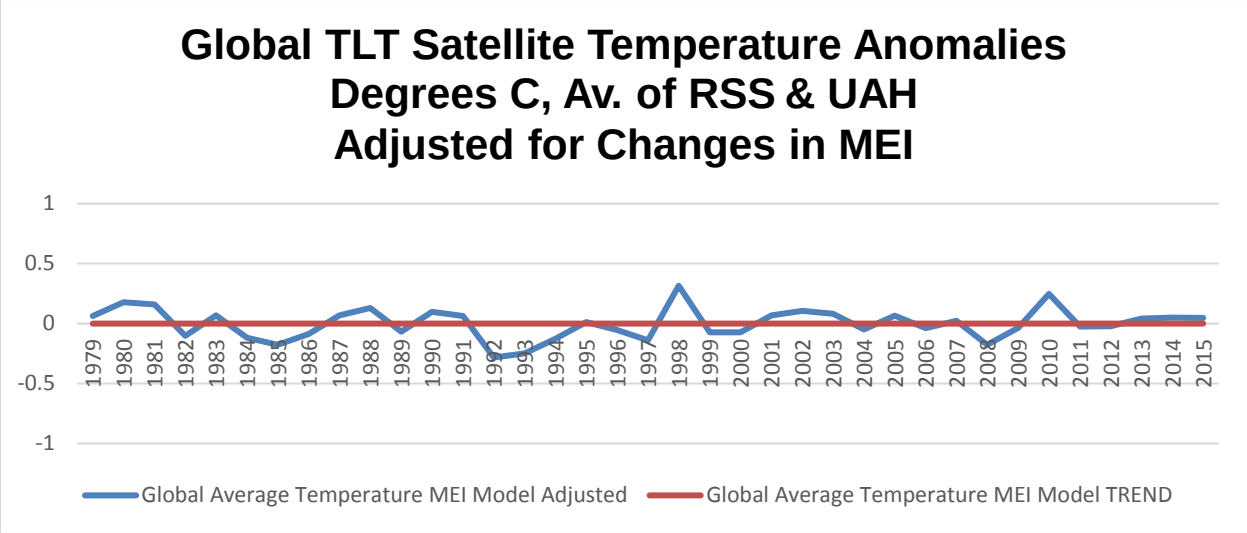



Source:

http://data.remss.com/msu/monthly_time_series/RSS_Monthly_MSU_AMSU_Channel_TLT_Anomalies_Land_and_Ocean_v03_3.txt
http://vortex.nsstc.uah.edu/data/msu/v6.0beta/tlt/uahncdc_lt_6.0beta5.txt

And Figure XX-4, below shows the MEI-Adjusted Global TLT Satellite temperatures to also have a Flat trend—again suggesting that $CO_2$, taken together with all other omitted variables, is not the cause of the rise in the Global TLT Satellite temperature data. Moreover, the unaccounted-for impacts of two major volcanic eruptions and two very strong El Ninos are evident. This has been the case in essentially all of the temperature time series analyzed in this research.

Figure XX-4

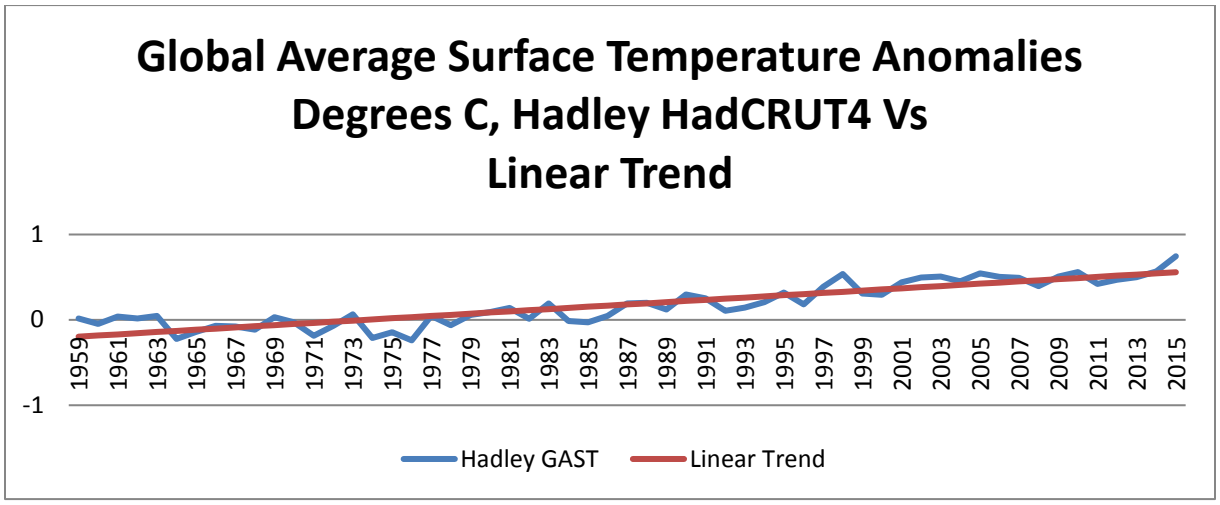



# Section XXI. Global Temperature Analysis – Hadley HadCRUT4 GAST

The analysis of this instrumental surface temperature record data followed exactly the same process as the others discussed above, and the results were the same. (See below Figures XXI-1-3 and Tables XXI-1-2.) Namely, that when the data were adjusted for changes in the MEI, there was no indication that $CO_2$ in combination with Other Omitted Variables together were having a statistically significant linear trend impact on Global temperature.

**With respect to GHG impacts, this should not be surprising, assuming that this surface data is reasonably accurate, given that the EPA-assumed THS mechanism has been proven above to be nonexistent. There would have to be some new, not yet discovered mechanism by which higher atmospheric GHG/$CO_2$ concentration has been impacting GAST – so far no sign of one.**

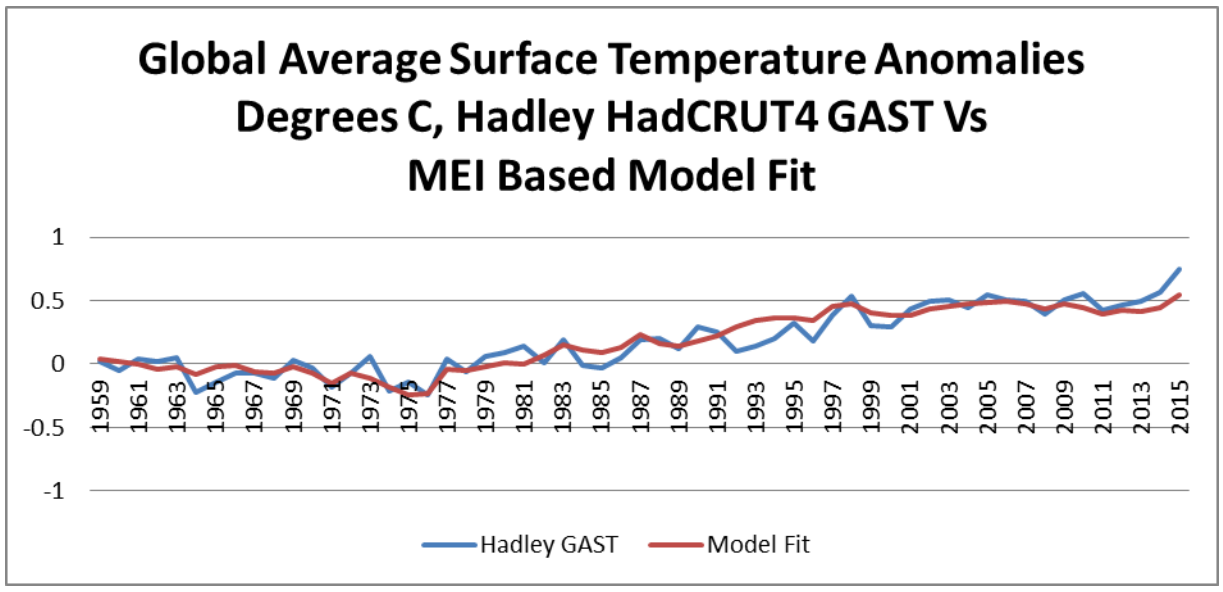
Figure XXI-1




Source:

http://www.metoffice.gov.uk/hadobs/hadcrut4/data/current/time_series/HadCRUT.4.4.0.0.annual_ns_avg.txt

Figure XXI-2




Source:
http://www.metoffice.gov.uk/hadobs/hadcrut4/data/current/time_series/HadCRUT.4.4.0.0.annual_ns_avg.txt

Table XXI-1

**Model Comparison For Hadley GAST**

| Model | R Bar Sq |
|---|---|
| Linear | 0.795 |
| MEI, Cum MEI & 1977 Shift | 0.862 |

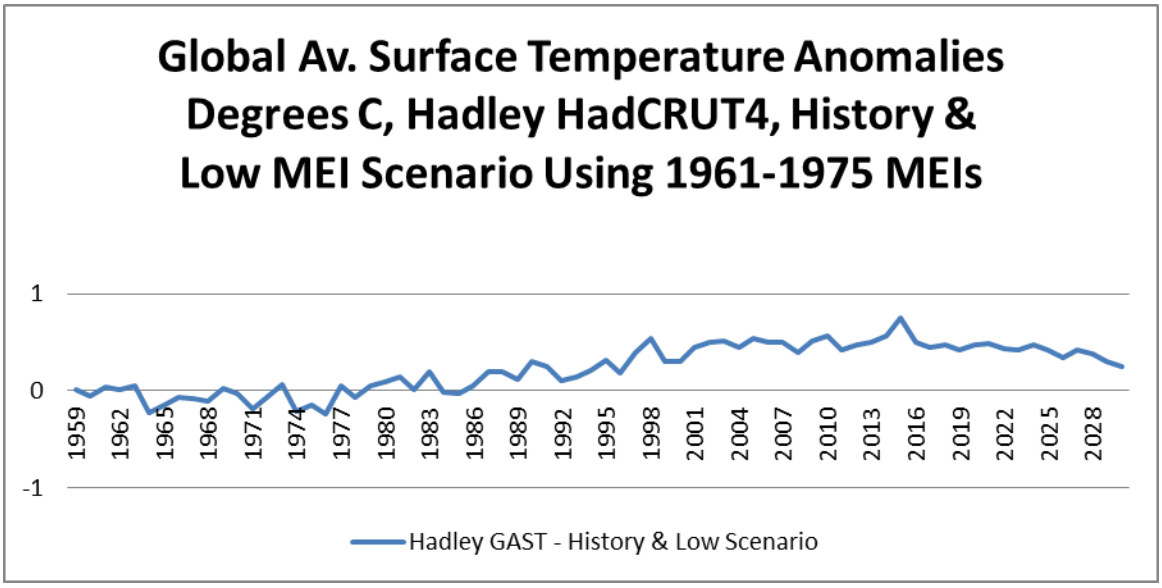
Table XXI-2

**3 Variable Model Parameter Estimates For Hadley GAST**

| | Coefficients | t Statistic |
|---|---|---|
| Intercept | 0.17781 | 5.915271 |
| MEI | 0.019567 | 1.075567 |
| Cum MEI | 0.046172 | 12.45493 |
| 1977 Shift | 0.141137 | 4.161747 |

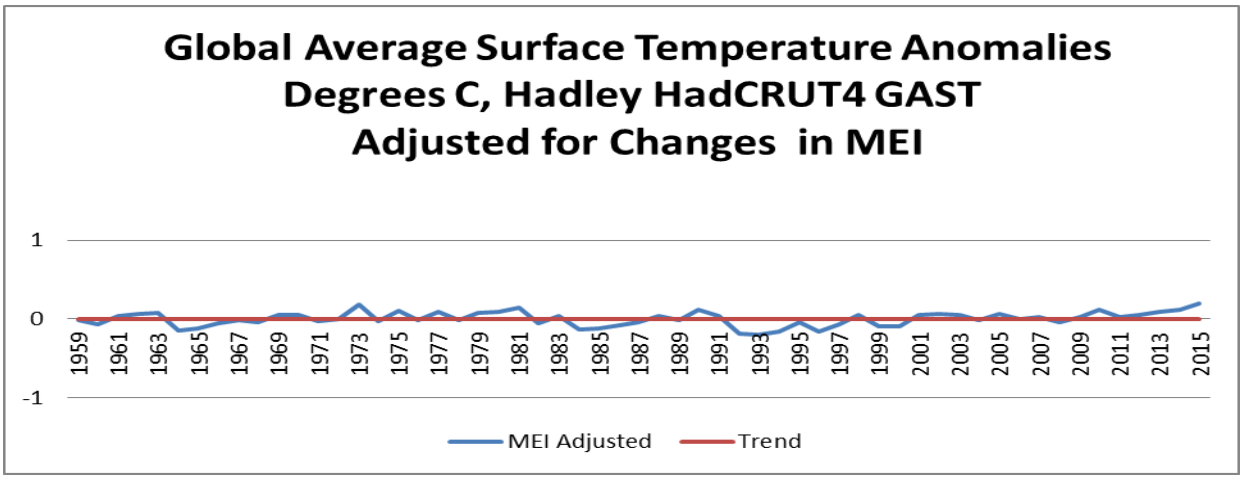
Using the 3 Variable Model coefficients shown in Table XXI-2 above, and the Low Scenario MEI pattern (See Section XII,) leads to the Low Scenario Temperature Outlook shown in Figure XXI-3 below.

Figure XXI-3




Source:
http://www.metoffice.gov.uk/hadobs/hadcrut4/data/current/time_series/HadCRUT.4.4.0.0.annual_ns_avg.txt

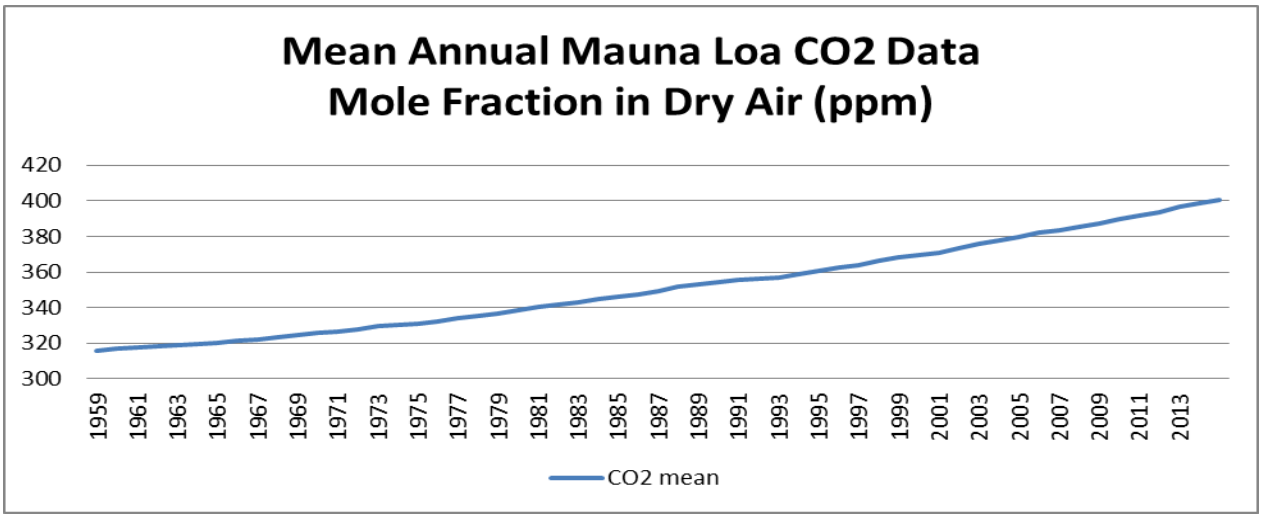
Figure XXI-4




Finally, the MEI-Adjusted Hadley GAST Anomalies shown in Figure XXI-4 above have a flat trend. And, therefore,

like all the other twelve temperature time series discussed above, show no sign yet of an impact from the steadily rising $CO_2$ concentrations shown in Figure XXI-5 below.

Figure XXI-5




Source: ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt

# Section XXII. Global Temperature Analysis Results

The above analysis of Global Balloon & Satellite atmospheric temperature as well as Contiguous U.S. and Hadley Global Average Surface Temperature data turned up no statistical support for suggesting that $CO_2$, taken together with all other omitted variables, is the cause of the positve trend in the reported U.S. and Global temperature data.

**In fact, it seems very clear that the Global Warming that has occurred over the period 1959 to date can be quite easily explained by ENSO impacts alone[6]. Given the number of independent entities and differing instrumentation used in gathering the temperature data analyzed herein, it seems highly unlikely that these findings are in error.**

Finally, while the maximum data window in this analysis was just over 55 years, recent analysis suggests such ENSO impacts have been critical for many years. In fact, researchers at the Australian National University Research School of Earth Sciences have discovered century-scale patterns in temperature, and linked them with ENSO changes over the period.

[6] Recall that is it was shown in Section VII that removing ENSO –related Impacts in the manner used in this research also removes solar trend cycle impacts.

# Section XXIII. $CO_2$'s Impact on Reported Temperature

Thus far in this analysis, it has been shown that simply adjusting for ENSO impacts yields results that very strongly suggest that natural factors alone explain the positive trend slopes in officially reported temperature data over the last 50 years or so. However, the fact all 13 ENSO-Adjusted Temperature time series have flat trends, DOES NOT guarantee that rising atmospheric $CO_2$ concentrations alone (i.e., on an-other-things-equal basis) have not had a Statistically Significant Impact on reported temperatures.

Up to this point, it has only been shown that $CO_2$, in combination with Volcanic Activity and any Non ENSO related Solar (and other omitted variables -known and unknown) have not had a statistically significant impact on the reported data's trend slope. For example, $CO_2$'s actual impact on temperature trend slopes might be hidden by the impact and timing of Volcanic Activity. The impact of $CO_2$ can be tested by regressing each of the ENSO Adjusted temperature time series on $CO_2$ and volcanic activity variables.

However, the analysis of the (13) ENSO-Adjusted Temperature time series using such regression analysis found no credible impact of $CO_2$ as shown in Table XXIII-1 and Table XXIII-2 below. In Table XXIII-1, note that the $CO_2$ variable's impact is not statistically significant, except for the Hadley GAST data. It is also clear that generally the major Volcanic Activity (VA) is impacting reported data as expected.

Table XXIII-1

| CO2 & Volcanic Activity Impact on ENSO Adjusted Temperatures | | | |
|---|---|---|---|
| | | Explanatory Variables | |
| | Regression | Coefficient t Statistics | |
| DATA | R Bar Squared | (Less than 2 not Statistically Significant) | |
| **Tropical Upper Troposphere** | | CO2 | VA (Dust Veil Index) |
| Balloon 150 mb | -0.020 | 0.44 | -0.96 |
| Balloon 200 mb | 0.004 | 0.76 | -1.51 |
| Satellite TMT | 0.076 | 1.00 | -2.28 |
| | | | |
| **Tropical Lower Troposphere** | | | |
| Satellite TLT | 0.103 | 1.10 | -2.54 |
| Balloon 500 mb | 0.051 | 1.11 | -2.27 |
| Balloon TLT | 0.064 | 1.17 | -2.45 |
| | | | |
| **Tropical Surface** | | | |
| NOAA SFC | 0.180 | 1.87 | -3.85 |
| NINO 3.4 | 0.016 | 0.74 | 1.05 |
| NINO 160E-80W | 0.002 | 1.19 | -1.28 |
| | | | |
| **U.S. Surface** | | | |
| NOAA Contiguous U.S. | 0.071 | 0.96 | -2.04 |
| | | | |
| **Global Lower Troposphere** | | | |
| Balloon TLT | 0.171 | 1.81 | -3.75 |
| Satellite TLT | 0.209 | 1.51 | -3.5 |
| | | | |
| **Global Surface** | | | |
| Hadley SFC | 0.262 | 2.29 | -4.78 |
| | | | |

Source: DVI is the ' Weighted' Dust Veil Index from Mann et al 1998

The Hadley GAST does have a statistically significant regression coefficient of 2.29. Table XXIII-2 addresses this issue by showing the ramifications of the $CO_2$ variable's multicollinearity problems first discussed in the Preface. To anticipate the results of the analysis of this particular situation, it is that it is highly unlikely that

the $CO_2$ variable actually had a statistically significant impact on reported GAST over this time period.

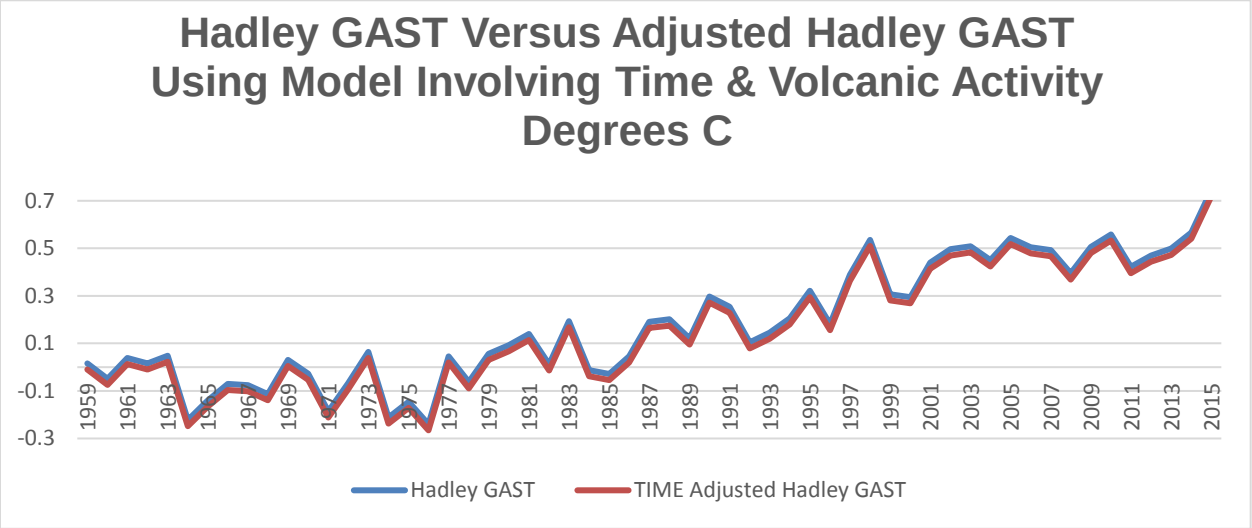
First, as shown in Table XXIII-2 below, replacing the $CO_2$ variable with a simple time trend variable yields very nearly identical results – so which is the correct variable? Second, also shown in the table below, if a Solar Activity Variable (e.g., say TSI itself shown here or other reasonable functions of TSI not shown) is added to the equation including $CO_2$ and Volcanic Activity, then $CO_2$'s t Statistic is no longer statistically significant and even becomes negative!

Table XXIII-2

| | **Analysis of ENSO Adjusted Hadley GAST Temperatures** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **CO2's Multicolinearity Problems** | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | **Explanatory Variables** | | | | | |
| | | | **Regression** | | | **Coefficient t Statistics** | | | | | |
| | | | **R Bar Squared** | | | **(Less than 2 not Statistically Significant)** | | | | | |
| **DATA** | | | | | CO2 | Time | | TSI | DVI | | |
| Hadley SFC | | | 0.262 | | 2.29 | | | | -4.78 | | |
| | | | 0.259 | | | 2.24 | | | -4.74 | | |
| | | | 0.253 | | -0.79 | | | 0.87 | -4.24 | | |
| | | | | | | | | | | | |

Finally, it seemed of interest to show the result of removing the Time variable's impact from the reported GAST. Removing the Time variable's impact is shown, in Figure XIII-1, to yield a small downward shift.

Figure XXIII-1




One additional comment seems in order here. For those who argue that some of the officially reported temperature data has been manipulated by alarmist climate scientists, the obvious question would be does this mathematical approach flag or hide this "errors in the data" problem -as politically correct econometricians would call it. Note that in Table XIII-1, the two highest $CO_2$ variable t Statistics are on Hadley GAST and NOAA Tropical SFC data.

**In conclusion then, a separate analysis of each of the thirteen (13) reported temperature time series has demonstrated that not one of them showed, other things equal, a statistically significant trend slope impact of rising atmospheric $CO_2$ concentrations. And, even if this analysis had found such an impact, it would then have been necessary to utilize simultaneous equation parameter estimation techniques to confirm an unbiased and consistent estimate of $CO_2$'s actual impact.**

# Section XXIV. $CO_2$ Equation -Real World Validation

One final question remains that has not yet been explicitly dealt with herein. It is, can the existence of the $CO_2$ equation really be confirmed so that simultaneous equation parameter estimation techniques must be utilized to confirm, or reject, $CO_2$'s statistically significant impact on temperature? In the Preface, the authors referred to a specific paper for a proof[7]. Below very significant additional proof is provided.

With $CO_2$ determined to be not statistically significant in any of the 13 temperature equations in Section XXIII immediately above, the equation system described in the Preface can be seen to be recursive which permits parameter estimation of the $CO_2$ equation in the system by ordinary or direct least squares[8].

An explicit form of the $CO_2$ equation referred to in the Preface is:

[1] $(\Delta C - c_{fossil})_t = a + b*T_t + c* CO_{2,t-1}$

Where

$(\Delta C - c_{fossil})_t$, is the efflux of Net non-fossil fuel $CO_2$ emissions from the oceans and land into the atmosphere and $c_{fossil}$ is $CO_2$ emissions from Fossil Fuel consumption.

[7] See pages 364-366 & 370, James P. Wallace, III, Anthony Finizza and Joseph D'Aleo, A Simple KISS Model to Examine the Relationship Between Atmospheric CO2 Concentration, and Ocean & Land Surface Temperatures, Taking into Consideration Solar and Volcanic Activity, As Well As Fossil Fuel Use. In: Evidence-Based Climate Science. Elsevier, Oxford, Amsterdam, pp. 353-382. ISBN: 9780123859563, Copyright © 2011 Elsevier Inc. All rights reserved, Elsevier.

[8] See Theil, Henri. Introduction to Econometrics, Prentice-Hall, 1978, pages 346-349 and Goldberger, A.S., Econometric Theory, 1964, pages 354-355.

$T_t$ is UAH Tropical TLT Ocean temperature. The expected sign is positive.

$CO_{2,t-1}$ on the right-hand side is a proxy for Land use. The expected sign is negative, because as $CO_2$ levels rise, other things equal, the $CO_2$ absorption of the flora increase.

As shown in Table XXIV-1, applying ordinary least squares to this equation yields a high adjusted R square (0.64.) The coefficients have the correct signs and are statistically significant at the 95% confidence level.

Table XXIV-1

SUMMARY OUTPUT

| | | | |
|---|---|---|---|
| Adjusted R Square | **0.64** | | |
| Durban Watson | **1.72** | | |
| | Coefficients | Standard Error | t Stat |
| Constant | -311.84544 | 77.270 | -4.0 |
| UAH Tropical Ocean | 1.17650 | 0.285 | 4.1 |
| CO2(-1) | -0.02976 | 0.004 | -7.7 |

There is a useful validation test for all of the estimated parameters of this equation. In equilibrium, if there were no fossil fuel emissions and Tropical TLT Ocean temperatures were assumed to hold steady at their average value (which was 272.9 K) over the 1979 to 2013 model parameter estimation time period; then in equilibrium, there would be no change in the concentration of atmospheric $CO_2$, so that:

[2] $C_t = C_{t-1} = C_{equilibrium}$

Using equation [1], yields:

[3] $0 = a + b*T_0 + c*C_{equilibrium}$

Or, rearranging,

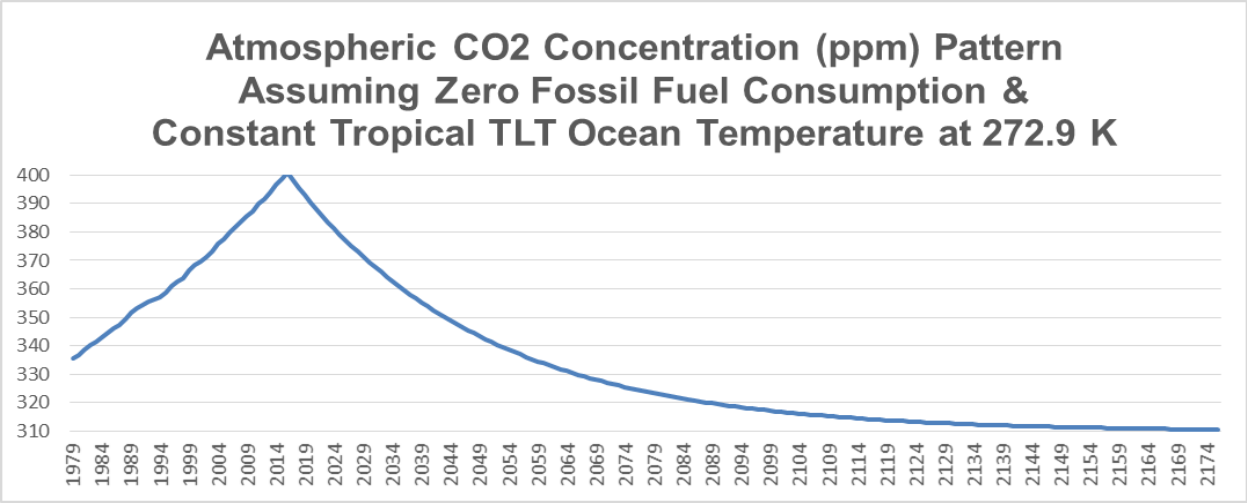
[4] $C_{equilibrium} = (a + b*T_0)/(-c)$

Substituting the estimated coefficients from Table XXIV-1 and substituting the average temperature observed over 1979 -2013 for T (272.9 K) into the equation [4], yields:

$C_{equilibrium} = (-311.845 + 1.1765*272.9)/(0.02976) = 310.1$

Thus, as shown in Figure XXIV, in equilibrium, without any Fossil Fuel consumption, and assuming a constant 272.9 K TLT Tropical Ocean temperature, atmospheric $CO_2$ concentrations would average around 310 ppm. But, it would take 50 years to get back down to just 330 ppm.

Figure XXIV-1

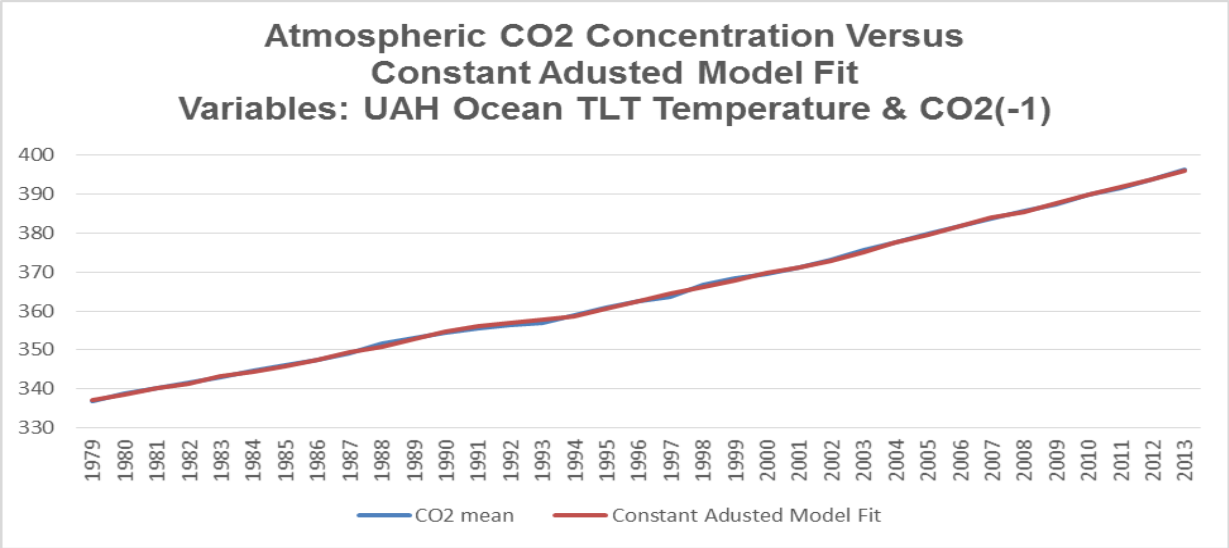



Using the same functional form for the $CO_2$ equation but very different measures of ocean temperature, the "KISS" paper referred to in the Preface calculated the $C_{equilibrium}$ at a very similar 300 ppm. Additionally, to quote from the KISS paper: *As an additional validation of the $CO_2$ equation, it can be shown that the equation suggests that the fraction {%} of $CO_2$ not absorbed by the land and ocean, that is, the fraction of $CO_2$ from fossil fuel emissions that remains in the atmosphere, is about 53%, which*

*roughly speaking, agrees with historical observation* - - - -. Using a totally different temperature variable, this UAH Tropical TLT Ocean Temperature -based model implies a fraction of 53.4 %.

Figure XXIV-2 below shows the Model Fit versus Actual where the constant term has been adjusted up slightly (i.e.,1/4 of one standard error) to improve the fit. Based on all the evidence, the $CO_2$ equation seems quite robust and cannot be ignored.

Figure XXIV-1




Sources: Fossil Fuel CO2 emissions: http://cdiac.ornl.gov/ftp/ndp030/global.1751_2013.ems
ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt
http://vortex.nsstc.uah.edu/data/msu/v6.0beta/tlt/uahncdc_lt_6.0beta5.txt

One final point should be made here, carrying out the same MEI adjustment analysis of this data led to the same results as for the other 13 time series. The MEI Adjusted UAH Tropical Ocean Temperature time series has a flat trend and CO2, on a standalone basis, does not have a statistically significant impact on this temperature data.

Thus, the analysis results shown in this Section, coupled with very similar results shown in the aforementioned KISS paper, should leave little doubt but that had the $CO_2$ variable not been found not statistically significant in all of the temperature equations in Section XXIII above, it would have been necessary to use simultaneous equation parameter estimation techniques to properly mathematically validate that $CO_2$ in fact has had a Statistically Significant Impact on Temperature. Where is that work? Today's Climate Models do not meet this test regarding their parameter estimation.

## Section XXV. Bottom-line: On the Existence of a "Tropical Hot Spot "& The Validity of EPA's GHG Endangerment Finding

Given the potential significance of this research, it is appropriate to question everything about it. Questioning everything is fair game from 1) the selection of the particular 13 temperature time series by one of the authors for this analysis to the 2) econometric parameter estimation methods utilized to 3) the actual models estimated. On all three, the authors have attempted to be completely open.

Regarding the model used for ENSO adjustment, recall that the exact same linear functional form and 3 MEI-related variables were used, except that the 1977 Pacific Shift variable is dropped for the Satellite data modeling since its history begins in 1979.

The econometric modeling process output was remarkable in that, for all 13 temperature time series analyzed, the results were invariably the same:

The identical (3 or 2 MEI-related variables as appropriate) model worked very well for all 13 time series:

1.) All parameter estimates had the correct signs and with high, statistically significant t Statistics; except that the MEI coefficients for U.S. and Global temperatures were positive, but not statistically significant.
2.) However, it was noted a priori that MEI would be expected to have less impact outside the tropics.
3.) Model R Bar Squares were all higher than relevant Naive forecasting models and high for such empirical work.

The 13 time series analyzed constituted a robust test set in that they were produced by many different entities using different technologies involving Surface, Buoy, Balloon and Satellite temperature measurement.

Removing the ENSO impacts using the same MEI-based model resulted in 13 ENSO-adjusted temperature time series each having a flat trend.

**These analysis results would appear to leave very, very little doubt that EPA's claim of a Tropical Hot Spot, caused by rising atmospheric $CO_2$ levels, simply does not exist in the real world. Also critically important, even on an all-other-things-equal basis, this analysis failed to find that the steadily rising Atmospheric $CO_2$ Concentrations have had a statistically significant impact on any of the 13 temperature time series analyzed.**

**Thus, the analysis results invalidate each of the Three Lines of Evidence in its $CO_2$ Endangerment Finding. Once EPA's THS assumption is invalidated, it is obvious why the climate models they claim can be relied upon, are also invalid. And, these results clearly demonstrate--13 times in fact--that once just the ENSO impacts on temperature data are accounted for, there is no "record setting" warming to be concerned about. In fact, there is no ENSO-Adjusted Warming at all. These natural ENSO impacts involve both changes in solar activity and the 1977 Pacific Shift.**

**Moreover, on an all-other-things-equal basis, there is no statistically valid proof that past increases in Atmospheric $CO_2$ Concentrations have caused the officially reported rising, even claimed record setting temperatures. To validate their claim will require mathematically credible, publically available, simultaneous equation parameter estimation work. Where is it?**

# Section XXVI. Research Report Endorsement

**The authors of this research are very much interested in knowing the names and credentials of individuals who would like to add their names to the list of scientists whose names already appear in the report under the following statement: "The Undersigned Agree with the Conclusions of this Report."**

**After reading and thinking about this research report, if you would like to have your name added to such a list, please send your name and credentials in a fashion similar to those listed in the report. Please send this information to the following dedicated email address: frostdoc@aol.com. Individuals asking that their names be added that have substantial and relevant credentials are listed below:**

Dr. Alan Carlin
Retired Senior Analyst and manager, US Environmental Protection Agency, Washington, DC.
Author, *Environmentalism Gone Mad*, Stairway Press, 2015.
Ph.D., Economics, Massachusetts Institute of Technology, Cambridge, MA.
BS, Physics, California Institute of Technology, Pasadena, CA.

Dr. Ruth F. Weiner
Adjunct Professor of Nuclear Engineering, University of Michigan
Member, USNRC Advisory Committee on Nuclear Waste
Member EPA National Air Pollution Control Techniques Advisory
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B.S., M.S. (physics) University of Illinois

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