Increasing Carbon Dioxide Concentration in Atmosphere Has Negligible Effect on North Atlantic Sea Surface Temperature

Ari Okkonen, MSc EE, independent consultant, email:ari.okkonen@gmail.com

Abstract

Increased concentration of carbon dioxide in atmosphere seems to have only negligible effect, if any, on North Atlantic sea surface temperature. This suggests that warming effect of CO_2 on global temperatures may not be very strong, either, because temperatures of sea surface and atmosphere are strongly connected. Finding is based on analysis of data set "N. Atlantic SST averages, unsmoothed & not detrended (1856 to present)" from NOAA website. Linear combination of linear trend, sine shaped cycle, and exponential (τ = 50 a) is determined to minimize mean squared deviation from measured yearly mean temperatures. Resulting model combination had annual increase of 0.003 K/a, amplitude of sine shaped 63 a cycle +/- 0.18 K, and an exponential function for response to increasing CO_2 concentration having negligible value of -0.014 K for 2018 temperatures. Based on control system theory, the effectively non-existent exponential shaped warming response of North-Atlantic SST to exponential shaped increment of the logarithmic warming effect of atmospheric CO_2 concentration strongly suggests that warming effect of increased CO_2 to atmosphere may be negligible in general.

Introduction

CO_2 contents of atmosphere had increased a couple of hundreds of years so that its logarithmic warming effect [Schneider] had an exponential shaped increment having time constant (τ) roughly 50 years. [Burton].

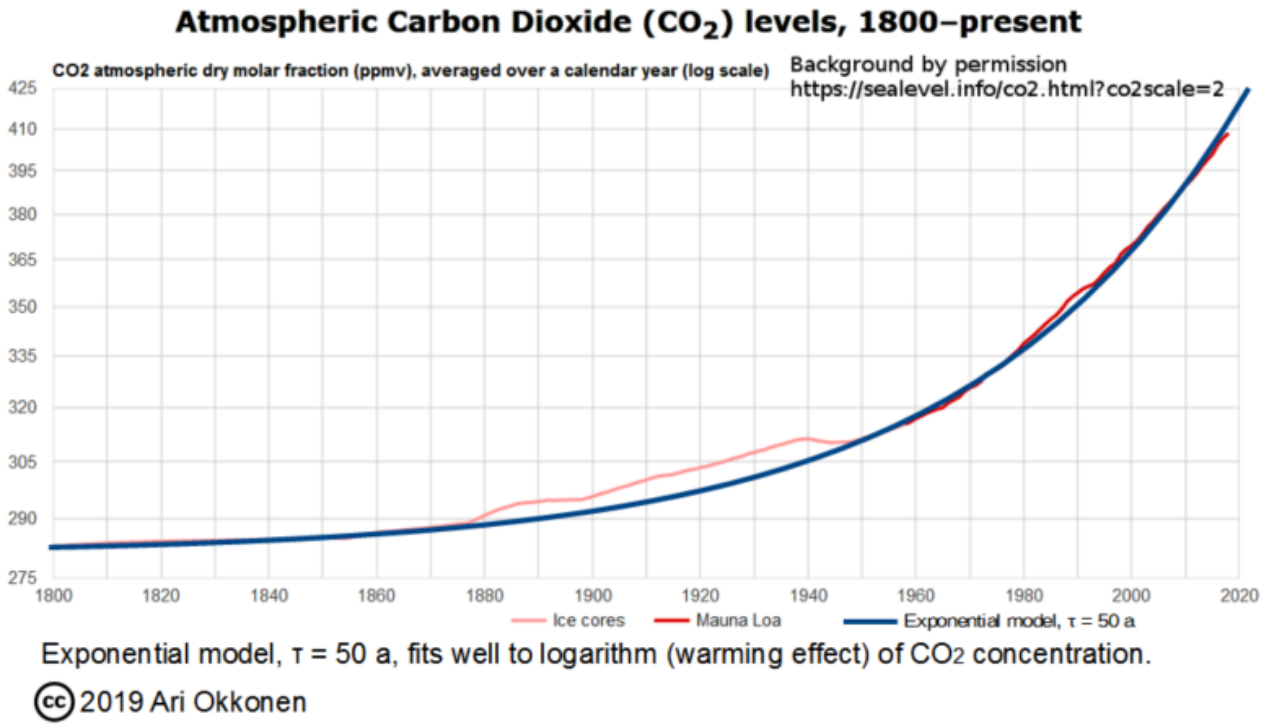

Figure 1: Atmospheric Carbon Dioxide (CO_2) levels in logarithmic scale, 1800-present, overlaid with an exponential model having τ = 50 a in linear scale.

In general any linear time-invariant system has exponential response for exponential stimulus, if any [Aström&]. (However, resonance is an impropable special case.) Climate is neither linear nor time-invariant.

However, a time-variant [sub]system can be approximated by a sequence of time-invariant systems where state of the system is transferred from the previous configuration to the next, e.g. when a major airflow changes direction, the temperature and humidity in the flowing air are preserved but head to a new direction. A non-linear [sub]system can be approximated for small changes by a linear system for current operating point. Anyway, an exponential response to an exponential stimulus is common attribute to all system configurations and also to almost all operating points. This means that the coefficient to the exponential response may change depending of the state and configuration of the system. If the coefficient of the response is mainly positive, the response is noisy but can be found from the output signal. However, in the special case that the coefficient varies around zero, the effect would be increased oscillation around otherwise determined temperature.

Methods

The data set "N. Atlantic SST averages, unsmoothed & not detrended (1856 to present)" from NOAA website [NOAA_NASST] is modeled using least-squares best fit for a linear combination of

1. linear trend for recovery from the "little ice age",
2. a sine shaped cycle of 63 years for Atlantic Multidecadal Oscillation (AMO), and
3. an exponential change having time constant of 50 years for roughly similar shaped increase in atmospheric CO_2 content.

Trapezoidal window function tapered 30 years at both ends is used to dampen effect of [weather] changes lasting only few years.

The ODS spreadseet used in calculations is attached.

Results

The following signal amplitudes were found from the data:

1. Linear trend 0.003 K/a,
2. Sine shaped 63 year cycling 0.36 K peak to peak (~AMO), and
3. Exponential response to CO_2 (τ = 50 a) having near to zero current value -0.01 K (negligible cooling!).

Moreover, visual inspection of the best-fit model-function (linear + sine + exponential) on top of the temperature graph does not suggest e.g. increasing variance around the model in later years. That excludes the possibility that increasing CO_2 without affecting the mean temperature increases the temperature variability.

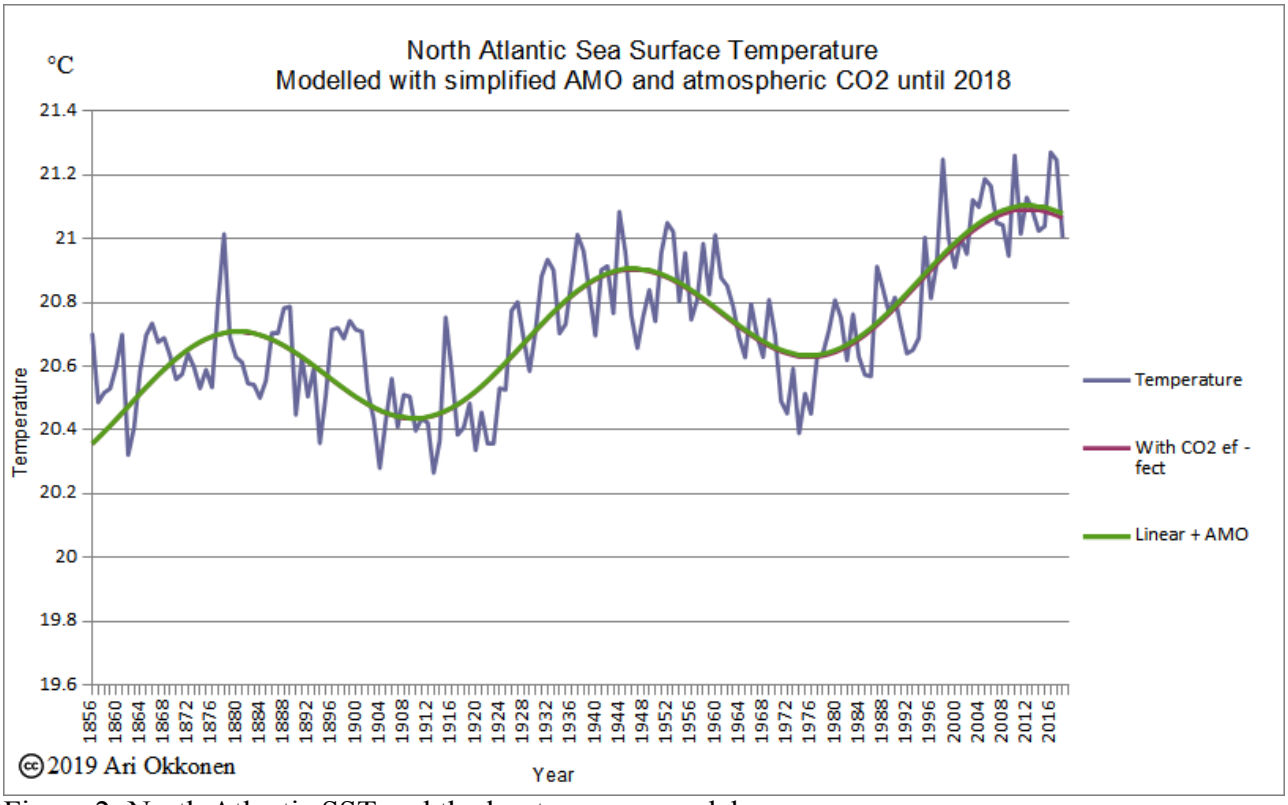

Figure 2: North Atlantic SST and the least-squares model

Discussion

North Atlantic is connected to the atmosphere via its surface of tens of millions of square kilometers. This connects temperatures of the sea surface and the atmosphere very strongly.

This measurement based finding that increased atmospheric CO_2 concentration does not cause global warming is in conflict with current model based paradigm [Hansen&] of warming effect of increased CO_2. The fact requires careful consideration of possible sources of error in analysis.

However, a more recent paper [Stallinga] treats effects of CO_2 using analytical mathematical models of radiative energy transfer in gases. The paper concludes: "Continuing with the reasoning, we find that the alleged greenhouse effect cannot explain the empirical data — orders of magnitude are missing.", and "We thus reject the anthropogenic global warming (AGW) hypothesis, both on basis of empirical grounds as well as a theoretical analysis."

Application of the theory of linear time-invariant systems to time-dependent non-linear global climate is quite bold stretching of applicability of the theory. However, the main finding, missing effect of carbon dioxide increment to global temperature, seems independent of these theoretical gaps and supports findings of Stallinga's paper.

Acknowledgments

I thank the Finnish Skeptikko magazine for giving me first reasons to suspect the anthropogenic global warming and giving me first pointers to The Heartland Institute website, The Heartland Institute of publishing reports contradictory to the catastrophic anthropogenic global warming (CAGW) paradigm. Also, I thank the contributors of several websites for giving me more information, encouragement to search alternate views about CAGW, relevant keywords for data searching, and pointers to relevant data. These websites include but are not limited to Watts Up With That?, JoNova, Climate Etc., and CFACT. I thank NOAA for providing in their website the North Atlantic SST data set needed for analysis.

References

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[Stallinga]	Stallinga, P. (2020) Comprehensive Analytical Study of the Greenhouse Effect of the Atmosphere. Atmospheric and Climate Sciences, 10, 40-80. https://doi.org/10.4236/acs.2020.101003 [link]

Attachments

Spreadsheet used in the analysis