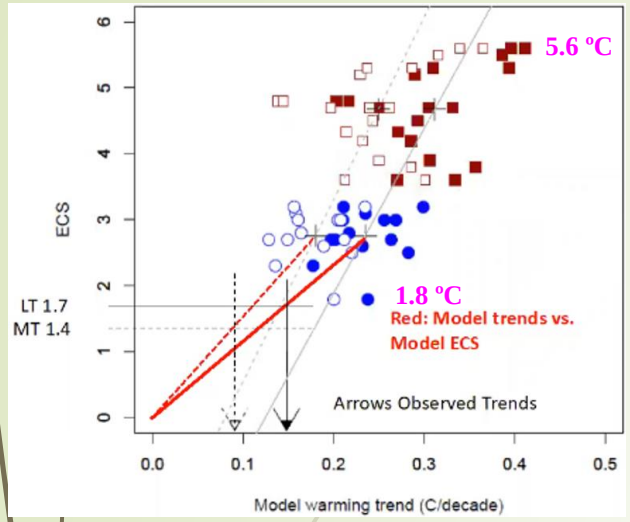
CO_2 – Visualized Temperature Contribution – MODTRAN Data

More detail? climatechangeandmusic.com



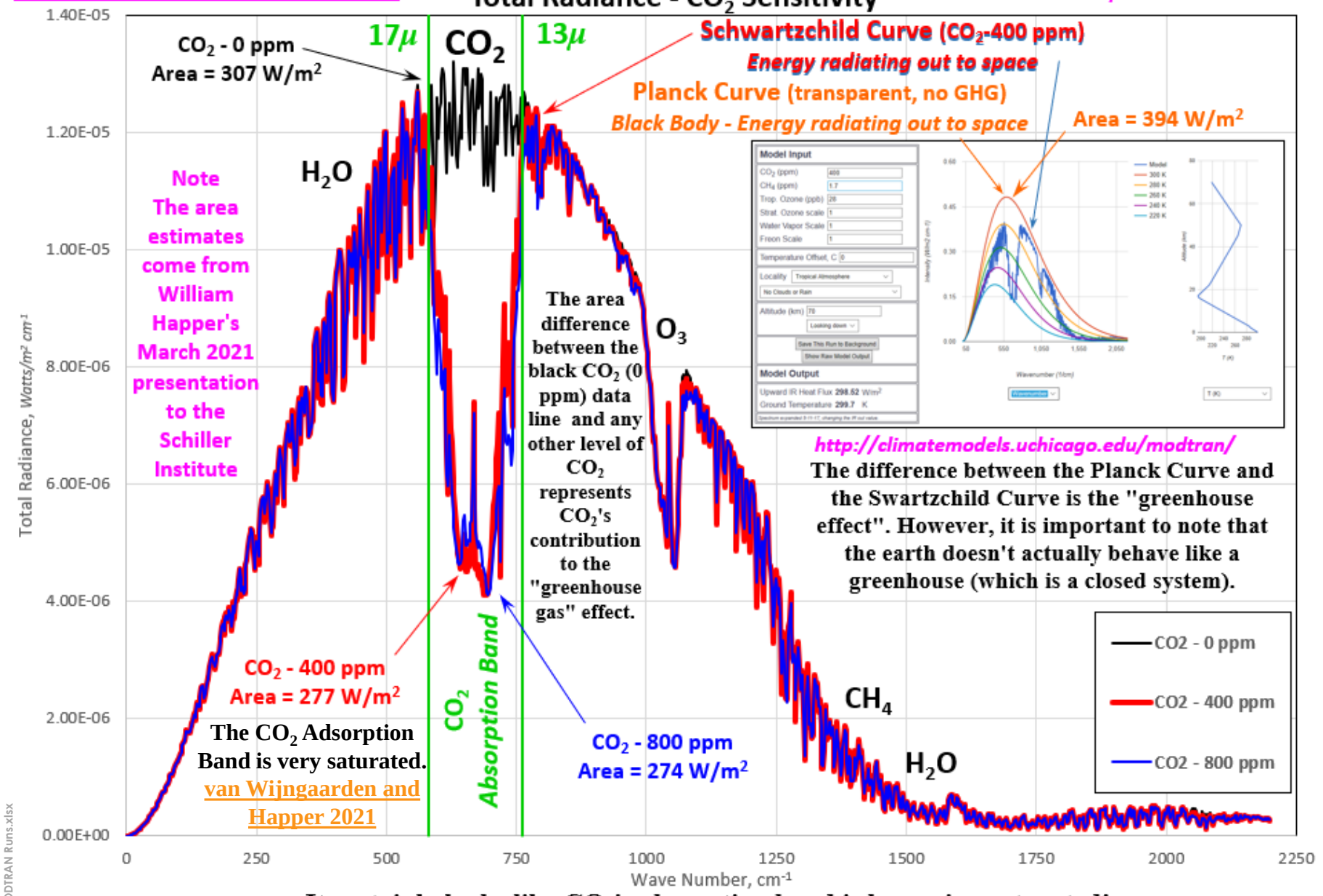
The CO_2 Climate Sensitivity is a very important aspect of climate science. And there is no doubt, that aspect of climate science is no where near settled. Even the IPCC (above) still uses a range of 1.8 to 5.6 °C in their latest CMIP6 models. Perhaps we could get to settled science if the IPCC would accept that the only models that accurately model the global temperature are those that use the low (1.8 °C) ECS and a negative cloud albedo (to approximate solar forcing). There is a reason, the IPCC has acknowledged that their models run too hot. More info in my CSS-6 – John Christy – January 2021 Presentation post. This CSS is focused on the Climate Sensitivity. The discussion starting point is the Schwartzchild Curves to the right, showing the measured energy radiating out to space. The MODTRAN model is calibrated to those measurements and shows the effects of increased atmospheric CO_2 concentrations.

MODTRAN Schwartzchild Curve

CO_2 is not a Pollutant — Exposing the Fraud Behind the Global Reset/Green New Deal - YouTube

Data Source: University of Chicago (MODTRAN) modtran.spectral.com

Total Radiance - CO_2 Sensitivity



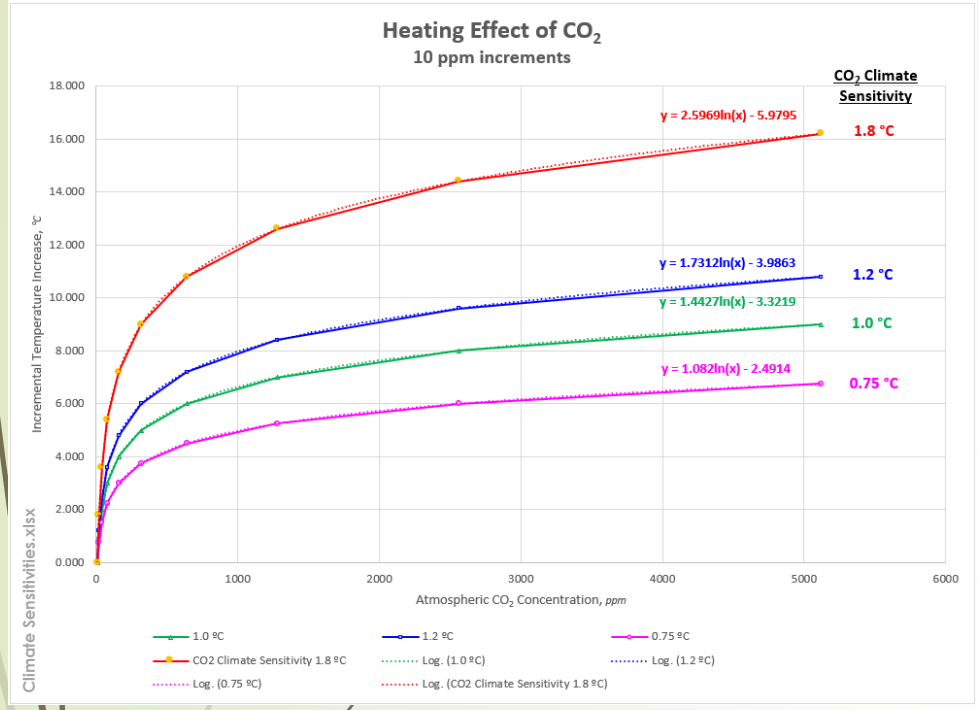
http://climatemodels.uchicago.edu/modtran/

The difference between the Planck Curve and the Swartzchild Curve is the "greenhouse effect". However, it is important to note that the earth doesn't actually behave like a greenhouse (which is a closed system).

It certainly looks like CO_2's absorption band is becoming saturated!

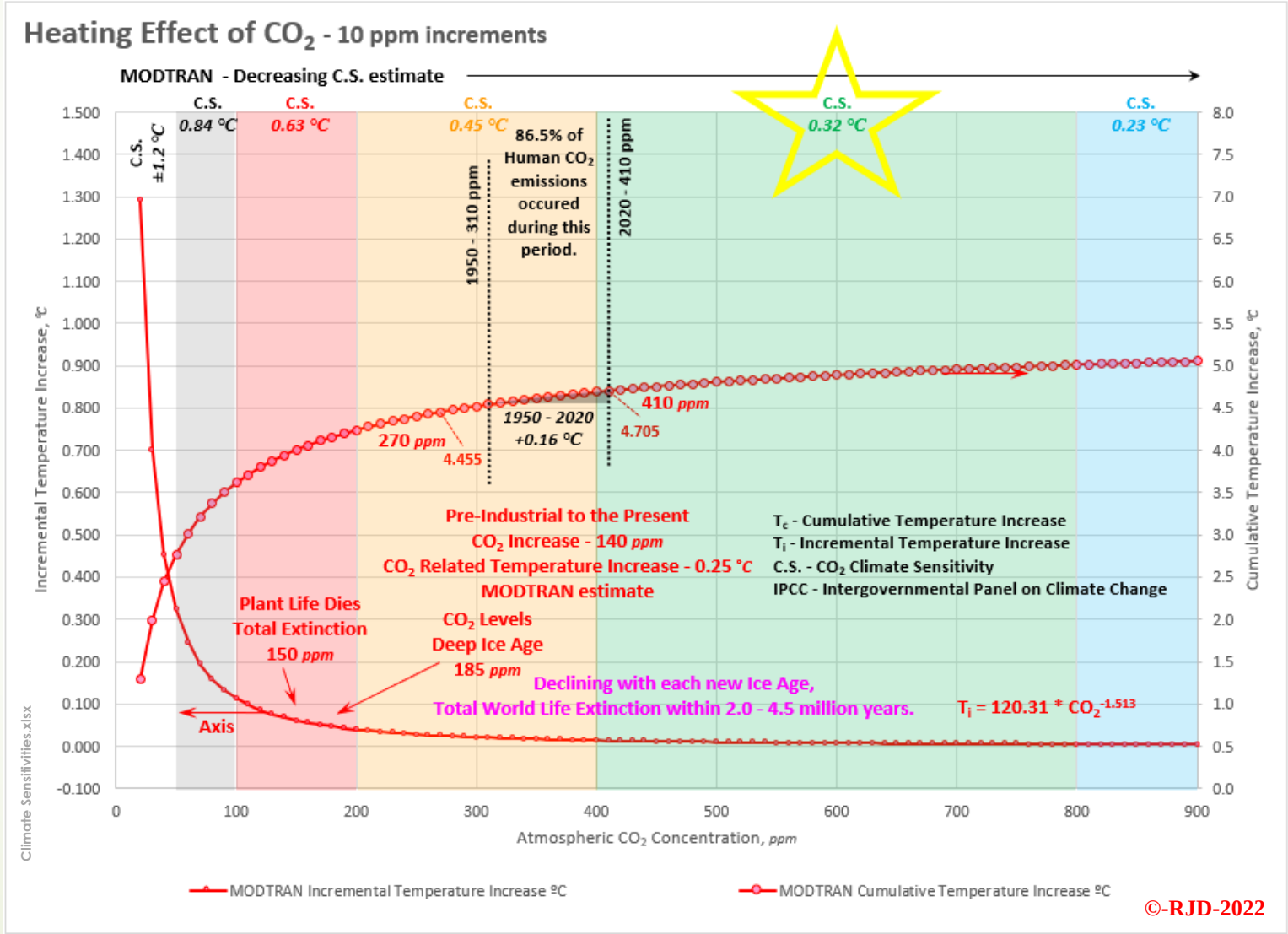
CO_2 – Visualized Temperature Contribution – CO_2 Climate Sensitivities

More detail? climatechangeandmusic.com



The Schwartzchild curves show that the very narrow CO_2 Adsorption Band is becoming saturated. Even at 50 ppm (not shown), CO_2 levels are already approaching a significant % of our current 420 ppm level "greenhouse gas" effect. Doubling from 400 ppm to 800 ppm is barely noticeable. The Schwartzchild curve information has been converted to temperature in the plot below. The lower red curve shows the temperature adds associated with each 10 ppm CO_2 addition. The upper red curve is the cumulative expected temperature rise at various atmospheric CO_2 concentrations. The key takeaways, the CO_2 Climate Sensitivity declines as CO_2 concentrations rise, doubling from our current CO_2 levels will only add roughly 0.32 °C and the CO_2 contribution from 1950 to 2020 (86%+ of human emissions) added just 0.16 °C. Warming from CO_2 has been and will continue to be minor and beneficial. Most discussions on Climate Sensitivity tend to treat the number as a constant. That is not the case. A variety of those constants are shown in the curves above. A couple of those curves will be carried through the CSS for comparison purposes. The plot on CSS-21e shows the historical estimates for both the CO_2 Equilibrium Climate Sensitivity (ECS) and Transient Climate Response (TCR). The upper red curve shows a representative ECS value (1.8 °C, consistent with the only correct IPCC model). The blue curve is consistent with the IPCC's estimate of TCR (1.2 °C, prior to adding in their unsubstantiated water vapor feedbacks). The green curve (1.0 °C TCR) is more realistic, with the magenta curve (0.75 °C TCR, factoring in the Urban Heat Island Effect). The IPCC 1.2 °C and 1.8 °C curves are carried through the rest of the slides.

CO_2 Climate Sensitivities



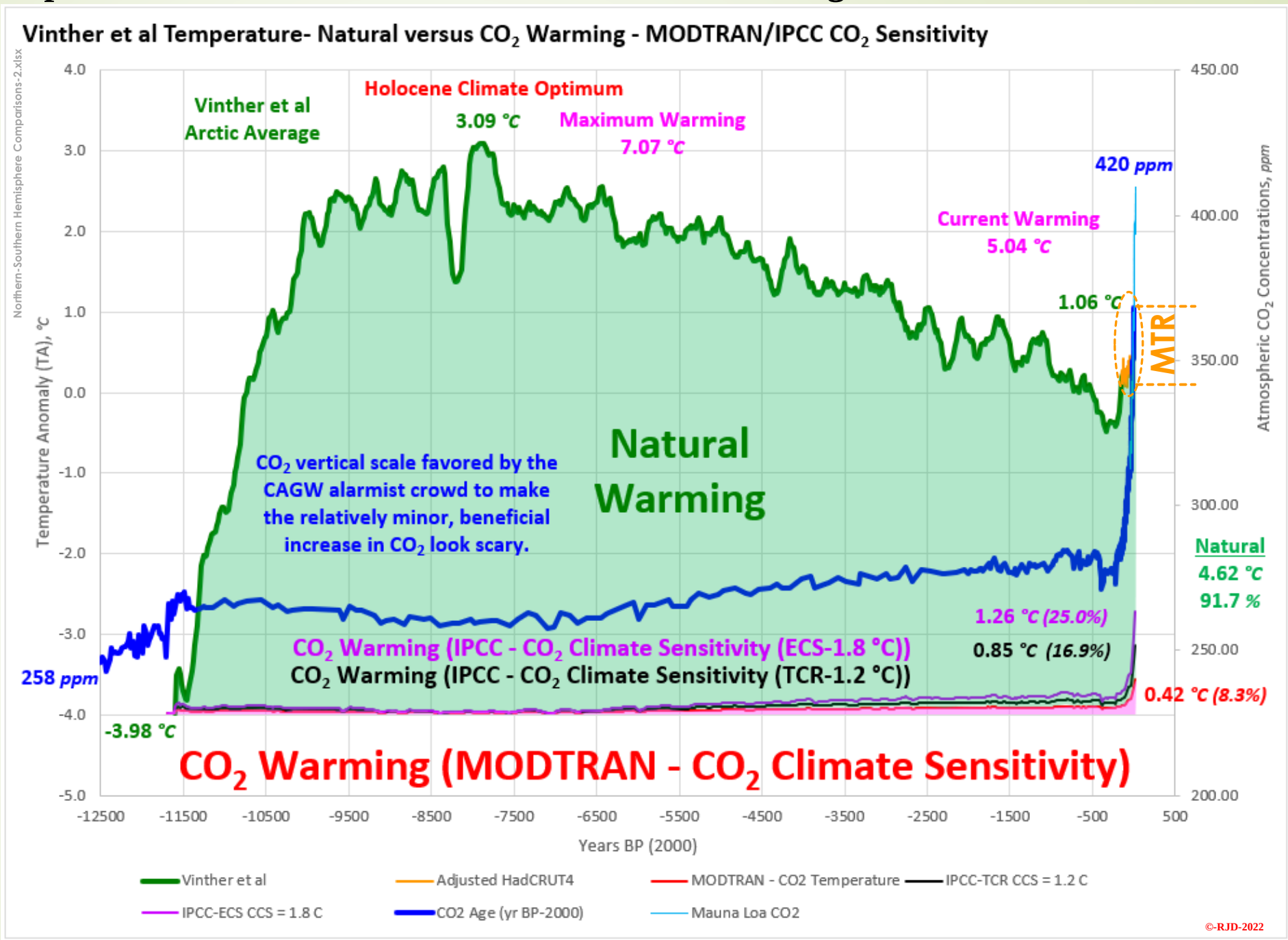
CO_2 – Visualized Temperature Contribution – Vinther et al Arctic Average

More detail? climatechangeandmusic.com

GSM – Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!

Vinther et al Arctic Average

The next plots will provide a visualization process showing the expected CO_2 warming (or cooling) contribution. The first temperature interval we will look at is the Vinther et al Arctic Average. This dataset covers almost all the Holocene interglacial warm period. CO_2 concentrations ranged from a low of 258 ppm to our current level of 420 ppm. Temperature Anomalies ranged from -3.98 °C (deep in the Ice Age to 3.09 °C at the peak of the Holocene Climate Optimum. Note that the CO_2 curve is plotted on a vertical scale that does not represent the relationship between CO_2 and Temperature. But it is much scarier than reality. The proper scaling is shown on the next slide (not as scary). CO_2 accounts for just 0.42 °C (8.3%) of the Holocene warming (based on MODTRAN sensitivities). Natural warming through natural forcings (the sun) dominate, regardless of the sensitivity chosen. For the MODTRAN case (the most likely option) natural (not CO_2) warming accounts for 91.7% of the 7.07 °C increase over this period. Using the IPCC ECS sensitivity (1.8 °C) still shows natural warming accounting for 5.8 °C (75%) of the increase. Over the MTR, the MODTRAN runs showed a 0.25 °C increase. Indicating that CO_2 accounts for ≈23% of the 1.07 °C pre-industrial increase (as per the IPCC AR6 Report).



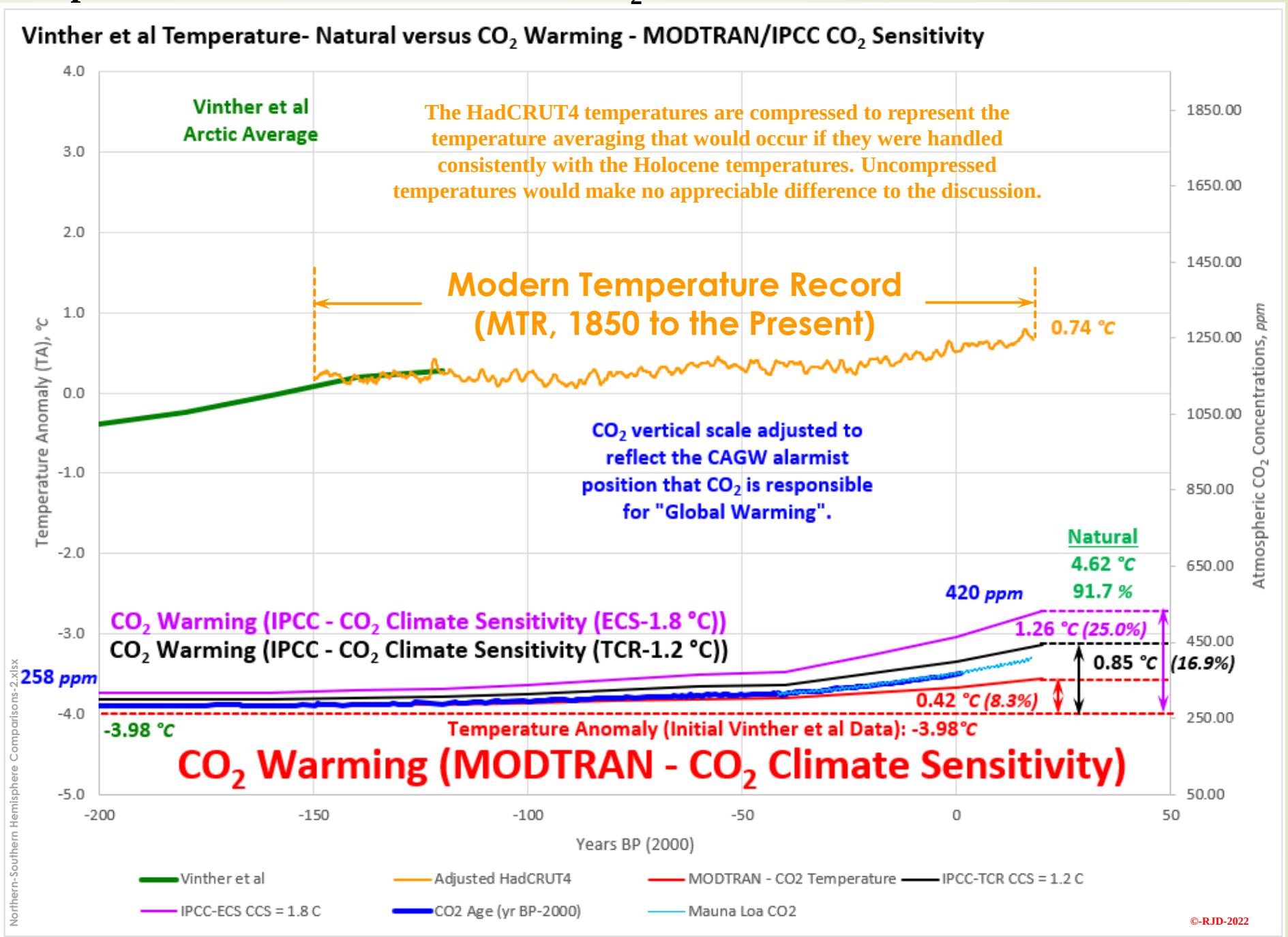
CO_2 – Visualized Temperature Contribution – MTR – CO_2 Scaled

This slide focuses in on the Modern Temperature Record (MTR, 1850 to the present) and plots the CO_2 concentrations on a vertical scale that more closely represents the Catastrophic Anthropogenic Global Warming (CAGW) alarmist position that the MTR warming is a result of human activity (primarily CO_2 (i.e.: 135 ppm ≡ 1.07 °C). The CO_2 curve could be moved up or down a little bit to match the actual climate sensitivities. In the Real world, the 135 ppm CO_2 increase is not responsible for the entire 1.07 °C temperature increase over the MTR (1850 to the present). In fact, half of the MTR warming occurred pre-1950 while human CO_2 emissions were concentrated post-1950 (i.e.: 86%+ of human emissions have occurred after 1950). That just means that the CO_2 curve needs to be compressed even further. The concept of properly scaling the CO_2 concentration has been examined in many of my previous posts, as outlined below.

MTR - CO_2 Properly Scaled

OPS-44 – Temperature Averaging Effects
OPS-51 – Late Holocene – CAGW CO_2-Temperature
OPS-54 – CO_2-Temperature – Properly Scaled

There are other posts that routinely use the properly scaled concept.



CO_2 – Visualized Temperature Contribution – Vinther CO_2 Sensitivity

This plot shows a longer CO_2 history, with the CO_2 properly scaled. The Vinther et al Temperature data did not go back to the depths of the Last Glacial Maximum (LGM). Both Temperature and CO_2 concentrations were lower during the LGM. That does not affect the current analysis. I also included a chart that shows the historical estimates of climate sensitivity (both ECS and TCR) as they have progressed through time (so much for "settled science"). In just 15 years, the ECS estimates have dropped by over 50% and TCR estimates are down by around 40%. Those downward trends have continued and based on the work laid out by van Wijngaarden and Happer (among others), those downward trends will continue. The CO_2 warming effectiveness decreases very quickly as CO_2 concentrations rise. The rule of thumb is a logarithmic decrease. In reality, the decline is much quicker as the CO_2 absorption band becomes increasingly saturated (van Wijngaarden and Happer 2021). CO_2 plays a role in the global temperature changes, but that role is minor (at best), beneficial and generally lost in the historical data since the natural (solar – directly or indirectly) forcings have been and will continue to be dominate.

Vinther - CO_2 Climate Sensitivity

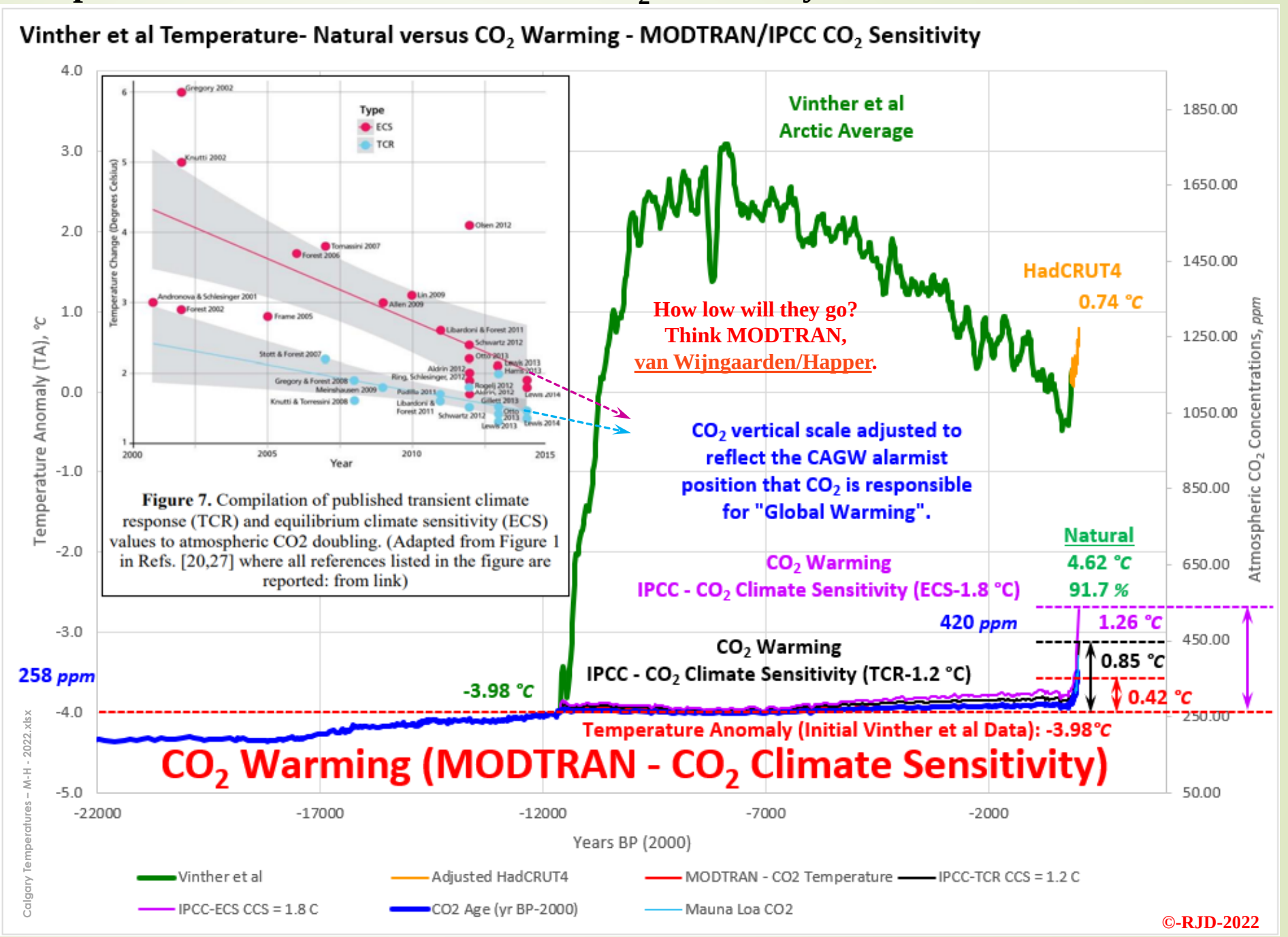


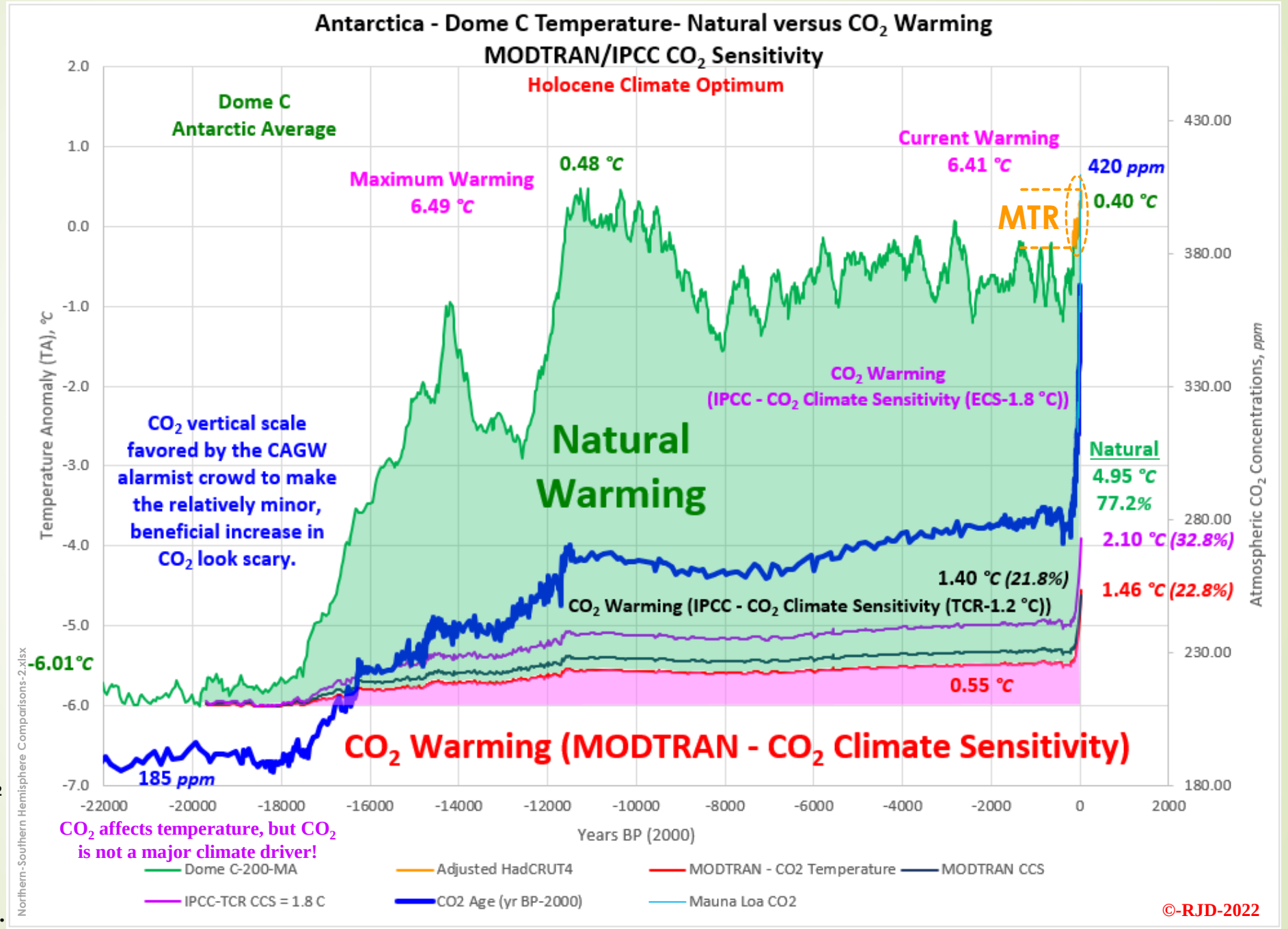
Figure 7. Compilation of published transient climate response (TCR) and equilibrium climate sensitivity (ECS) values to atmospheric CO2 doubling. (Adapted from Figure 1 in Refs. [20,27] where all references listed in the figure are reported: from link)

CO_2 – Visualized Temperature Contribution – Antarctica - Dome C

More detail? climatechangeandmusic.com

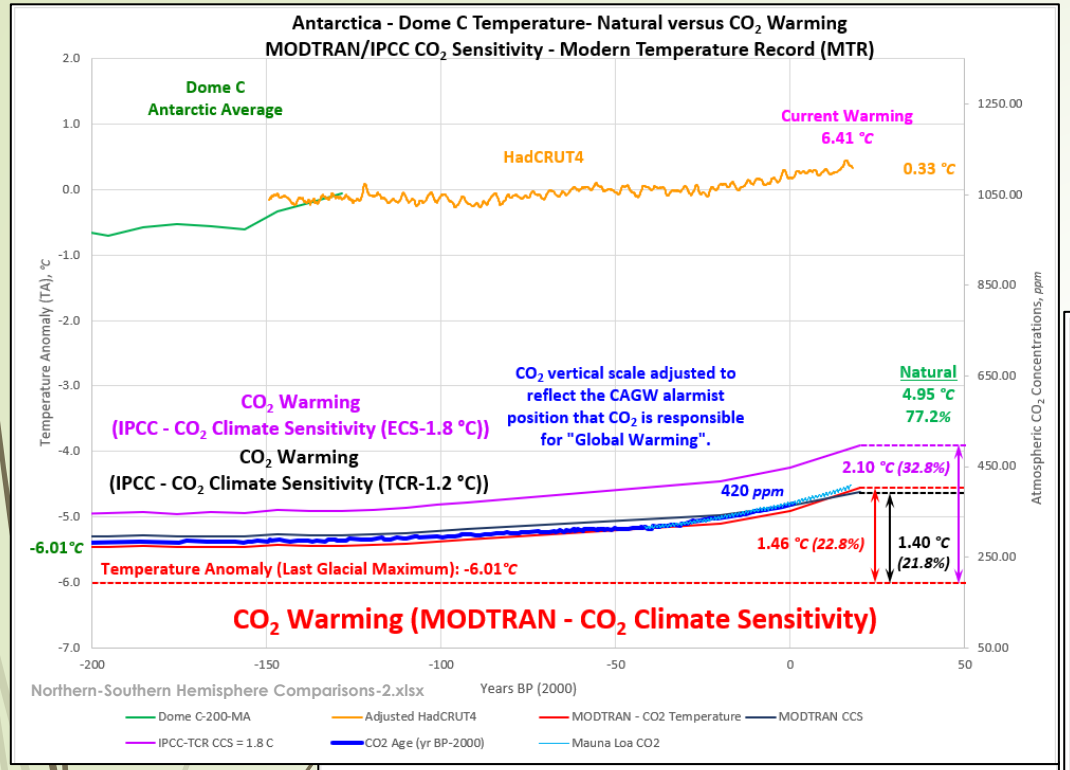
Antarctica Dome C

The analysis can be applied to any CO_2/Temperature data set. The Vinther et al data covered the Arctic temperatures. The Greenland GISP2 ice cores would show a similar but more erratic result given the exaggerated temperature fluctuations (due to solar cycle influences) in Greenland specifically. The chart shown here looks at Antarctica (specifically Dome C). The response is a little stronger in Antarctica for a couple of reasons. The response to solar activity cycles is muted in the southern hemisphere due to larger areal ocean coverage. The temperature rise out of the LGM is also therefore muted. The data also goes back further resulting in a much lower CO_2 concentration (185 ppm versus 258 ppm in the Vinther case). CO_2 has stronger warming tendencies at lower concentrations. The MODTRAN CO_2 contribution comes in at 1.46 °C (22.8% of The 6.49 °C rise). The ECS (1.8 °C) rise is 2.10 °C (32.8%). So, once again, total domination from the natural (solar (directly and indirectly) forcings). As with the first Vinther et al data plot, I have initially plotted the CO_2 on the scary scale. As before, that "huge" rise in CO_2 is not plotted on a scale that reflects the warming capacity of CO_2. The following slide makes that scale correction. Changing CO_2 levels affect the temperature, but those changes have and will be minor and beneficial.

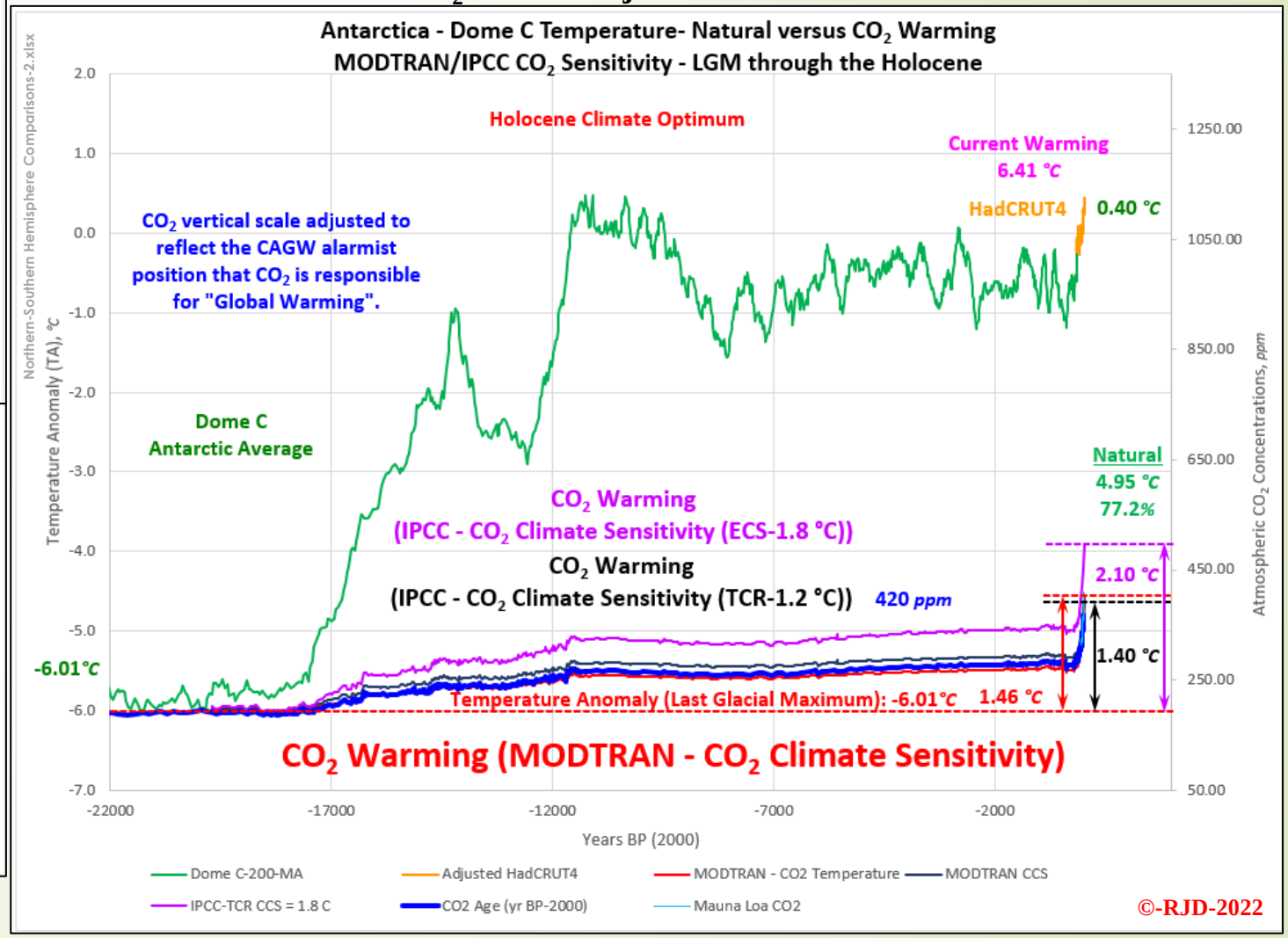


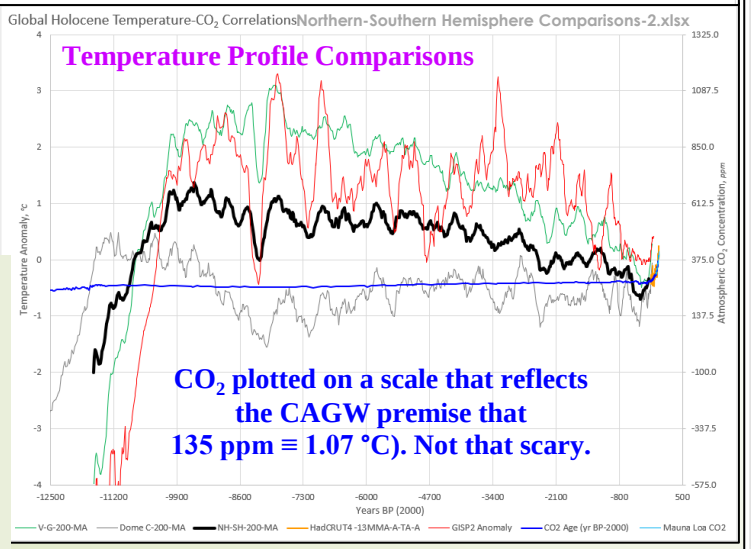
CO_2 (Properly Scaled) – Visualized Temperature Contribution – Dome C

More detail? climatechangeandmusic.com



The same analysis used on the Vinther et al data was used on the Antarctica Dome C data. When plotted on a scale that represents the Climate Sensitivity properly, that large scary CO_2 rise is not nearly as noticeable. Note: these CO_2 scales do not reflect the CAGW Narrative as I have discussed before. They add another level of CO_2 curve suppression that more closely reflects reality (i.e.: they correspond to the actual climate sensitivity). Like the Vinther et al data, The Antarctica Dome C data also confirms that CO_2 is not a major climate driver.





Dome C CO_2 Properly Scaled

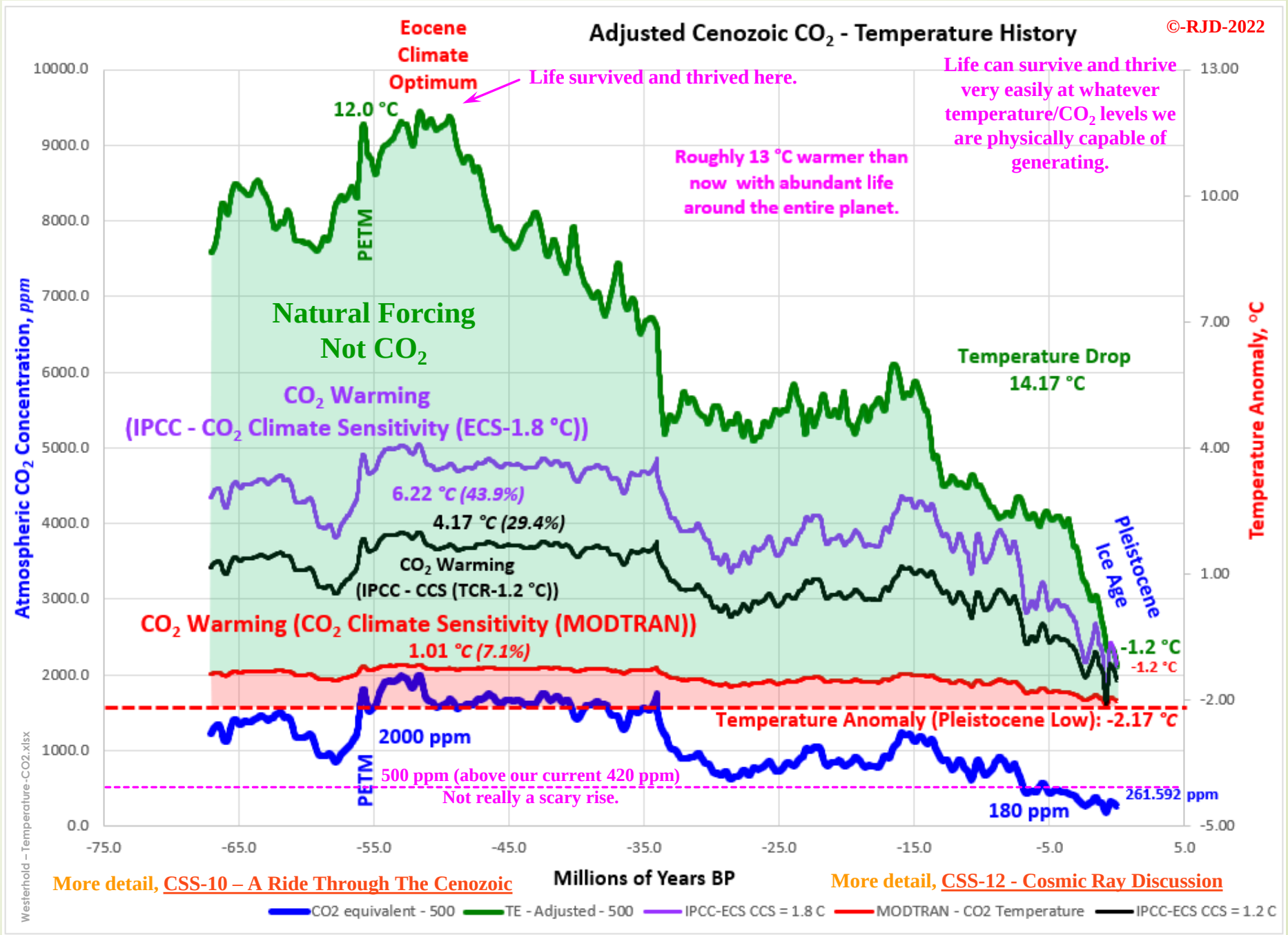
I have added the curve to the right to compare the different Holocene CO_2/Temperature datasets (Vinther, GISP2, Dome C and a Vinther/Dome C average).

GSM – Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!

CO_2 – Visualized Temperature Contribution – Cenozoic

Cenozoic – CO_2 Temperature Contribution

This slide expands the time scale dramatically from 11,500 years before the Present (covering the Holocene interglacial warm period) back to the Cretaceous. This period is called the Cenozoic and covers roughly 67 million years. CO_2 levels peaked around 2,000 ppm (with some higher short-term spikes (the Paleocene Eocene Thermal Maximum (PETM) is the most prominent example). The CO_2 levels declined to around 180 ppm in the depths of the LGM. The same story plays out on longer time scales. Most of the Warming (or in this case, Cooling) is based on natural forcings (again, not CO_2). CO_2's contribution comes in at 1.01 °C (7.1% of the 14.2 °C Temperature drop from the Eocene Climate Optimum to the depths of the LGM) based on the MODTRAN data. The CO_2 contribution goes up to 6.22 °C (43.9%) if the IPCC ECS (1.8 °C) values are used. The CAGW alarmists like to say that the general decline in both Temperature and CO_2 is "proof" that CO_2 is driving the climate over this period. But that assumption (not proof) ignores theoretical CO_2 climate sensitivities, solar activity and the many large scale geological and celestial influences that act over these long-term time scales (all promoting cooling). Cosmic Ray Flux, Plate Tectonics, Ocean Cycle Changes (Tethys Sea, Panama Isthmus, etc. closures/openings, impacts, etc.)

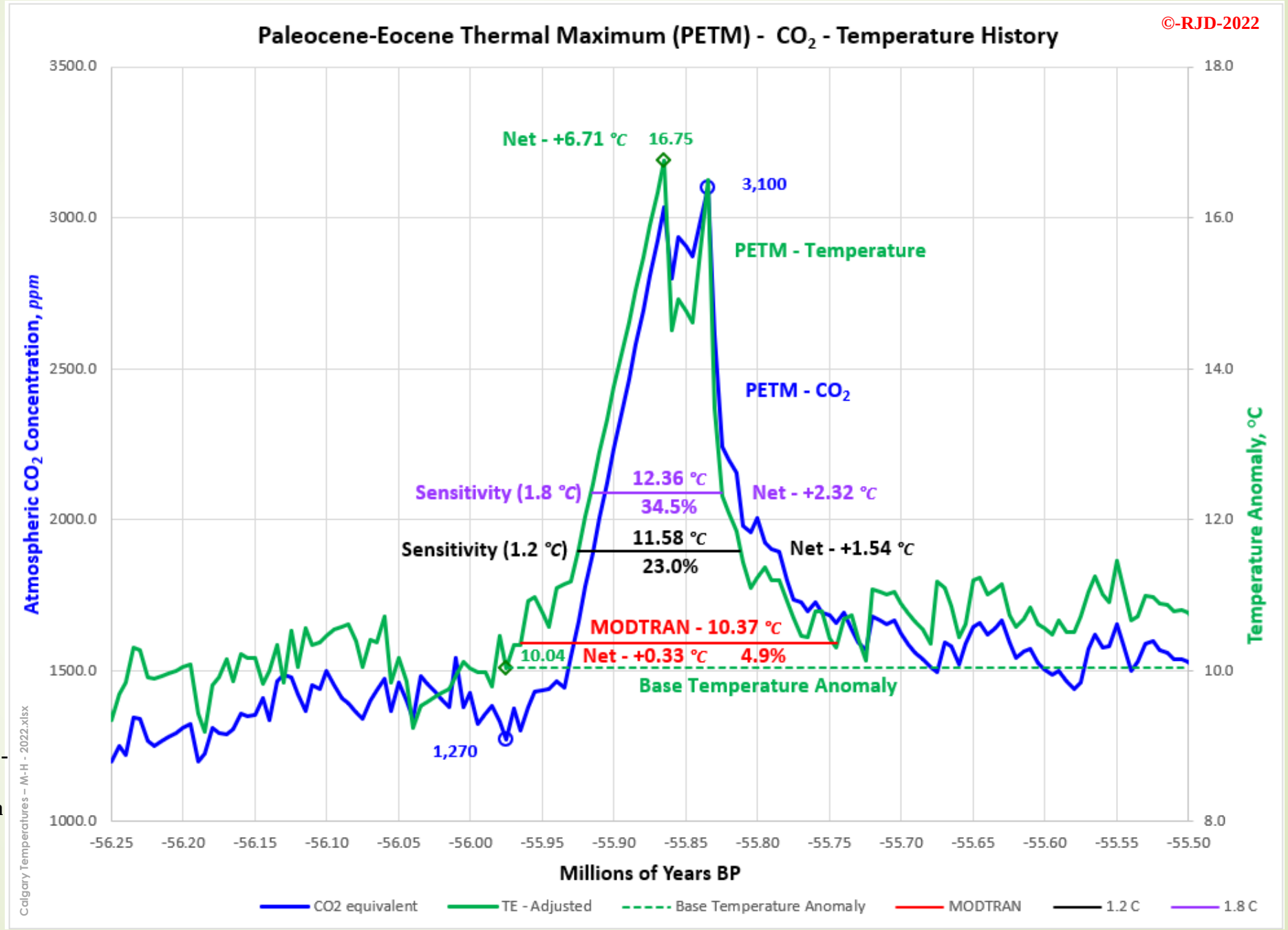


CO_2 – Visualized Temperature Contribution – PETM

This slide focuses on the Paleocene-Eocene Thermal Maximum (PETM). Another CAGW alarmist talking point. Something very dramatic happened here, something that has not to date been explained. Both temperature (6.7 °C) and CO_2 (1830 ppm) rose (and fell dramatically). Which one moved first? Looks like the temperature but there are some question marks on the precision of these older proxy data sets. More than likely, the event caused a change in temperature that caused a corresponding change in CO_2 concentration. That corresponding CO_2 contribution is shown in the plot. Using MODTRAN estimates, the CO_2 temperature increase is just 0.33 °C (4.9% of the 6.71 °C temperature rise). The IPCC ECS (1.8 °C) contribution option goes up to 2.32 °C (or 34.5%). Although all the scenarios show that CO_2 is not the mammoth driver that the CAGW alarmists make CO_2 out to be, the most likely scenario (in my opinion) is the MODTRAN option.

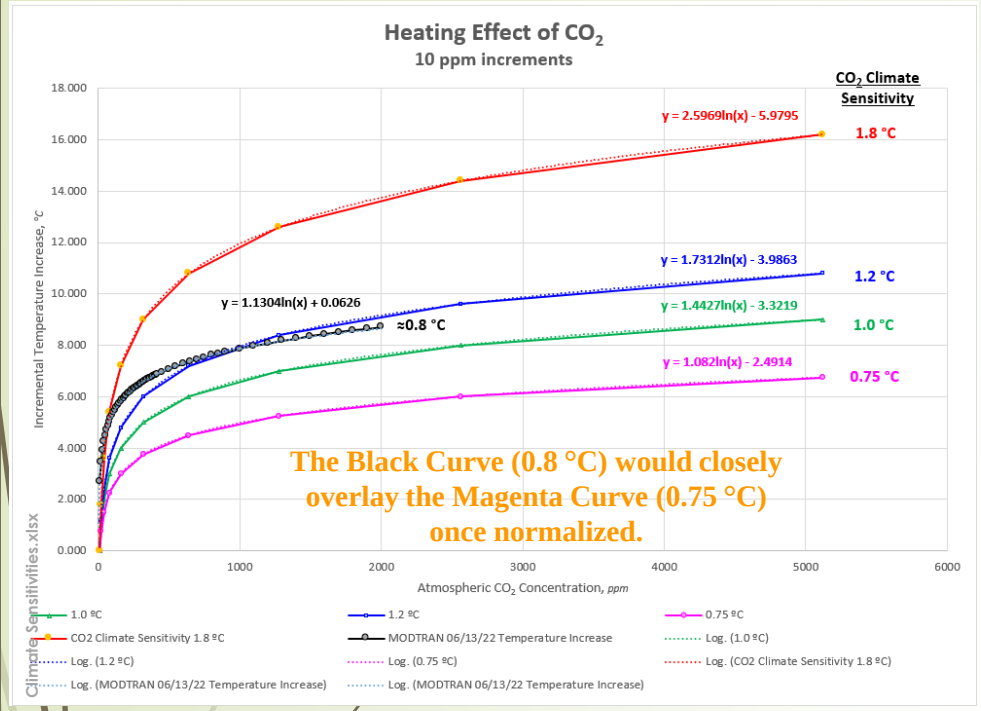
PETM – CO_2 Temperature Contribution

MODTRAN is based/calibrated on satellite measurements of the energy radiating out to space. The various sensitivities (shown on CSS-2e) tend to be based on specific time periods and unless those time periods have factored in all the potential climate drivers before arbitrarily assigning the whole temperature change to CO_2, I would have questions about their accuracy. The trend is definitely lower.

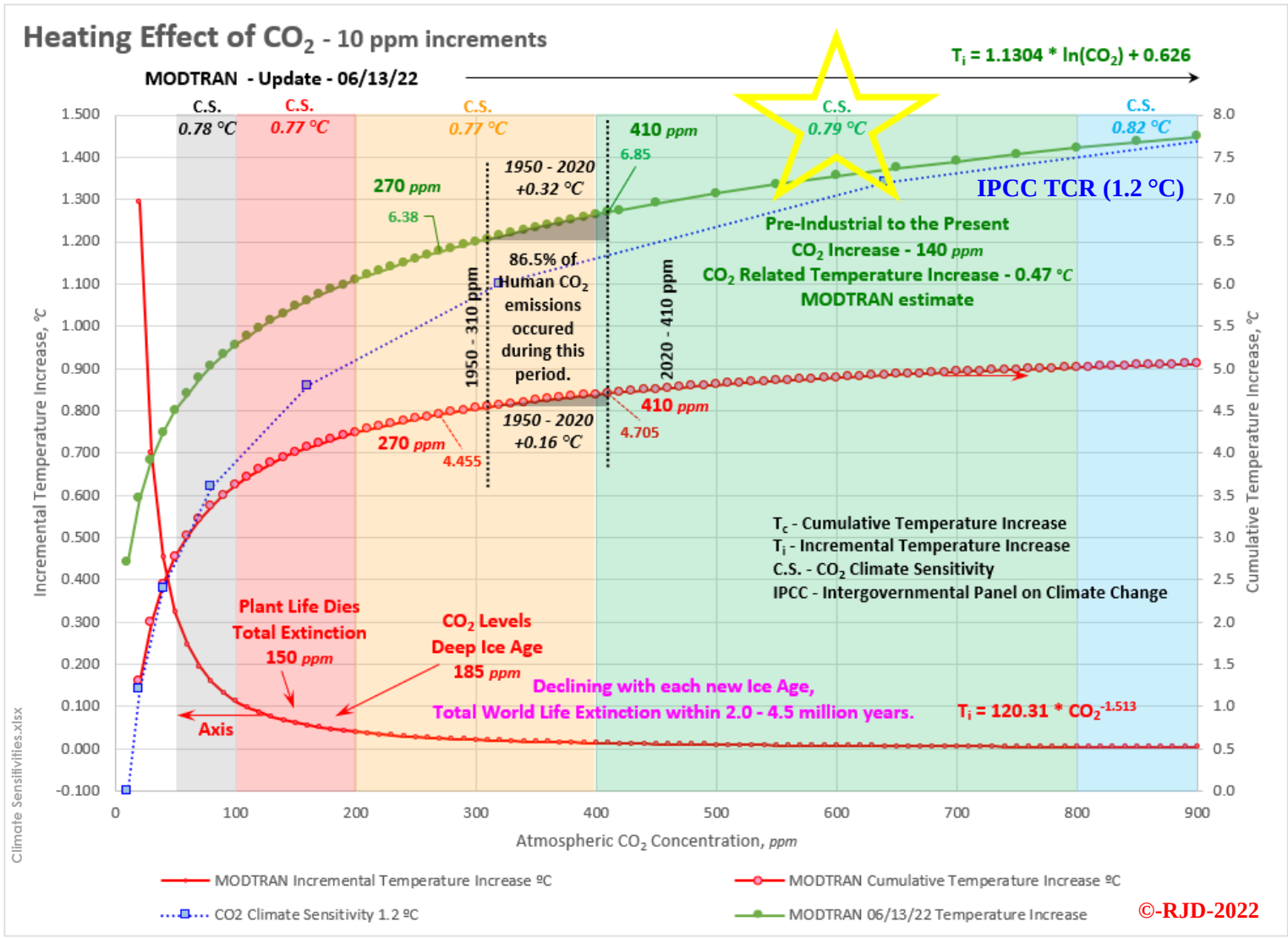


CO_2 – Visualized Temperature Contribution – MODTRAN Alternative

More detail? climatechangeandmusic.com



As I mentioned earlier, the Climate Sensitivity discussion is not settled science. For the MODTRAN Temperature data, I have been using temperature data generated by other researchers. As an exercise, I generated my own temperature data, using the University of Chicago's recommended procedure. I have shown those results here. The overall temperature increase is much higher, but most of that temperature increase is based on CO_2 levels well below the 200 ppm level. The discussion changes very little. The CO_2 contribution will still be a small percentage of the overall warming/cooling. Adding this curve to the previous plots would make very little difference on the Holocene curves (since they would be between the MODTRAN case plotted and the IPCC TCR (1.2 °C). Going forward, the Climate Sensitivity is in the 0.8 °C range (increasing gradually). That is consistent with the 0.75 °C value I mentioned earlier (based on incorporating UHIE). Over the Cenozoic, the effect is a bit more pronounced, but the overall percentages are still relatively small (less than 20%). This CSS tried to lay out a reasonable range of Climate Sensitivities. Feedback is welcome. I just explored this technique and as with most climate science, this area is complicated on its own. There could be subtleties that come into play. The analysis does fit with William Happer's comments. He has mentioned that a doubling of CO_2 from 400 ppm to 800 ppm would likely produce a temperature increase of around 0.8 °C. I will bring forward an updated version of this concept once I get some of that feedback and have had more time to think about it. In the meantime, the discussion changes very little. The premise laid out here still shows the minor role CO_2 plays.



CO_2 Climate Sensitivities