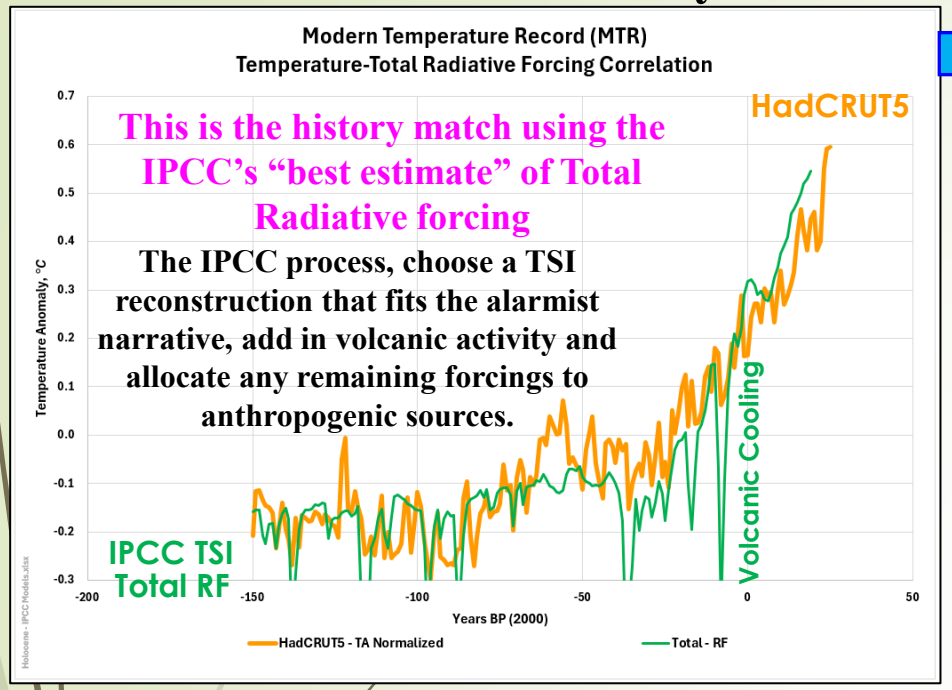
# IPCC Model-Theory Shortcomings – All Anthropogenic?

More Detail: climatechangeandmusic.com

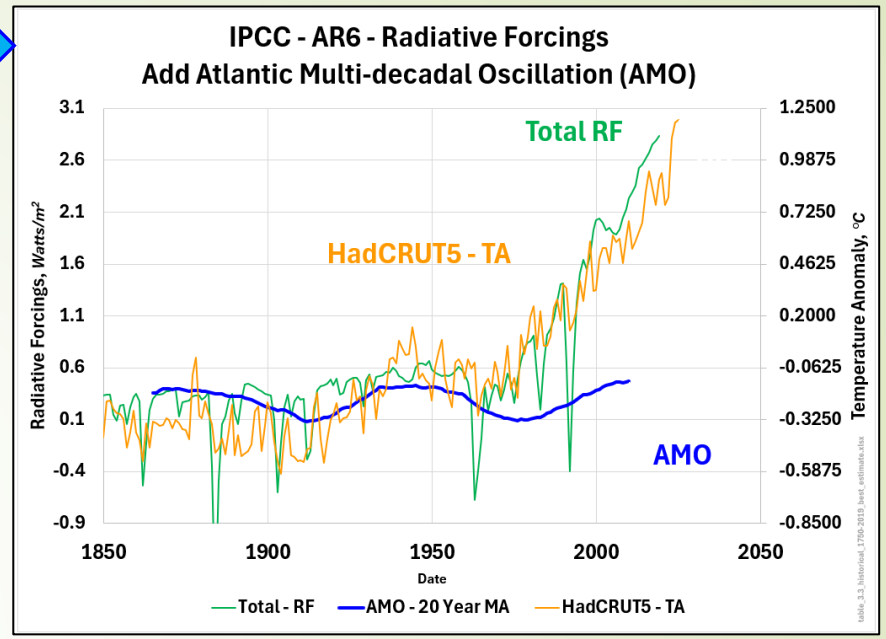




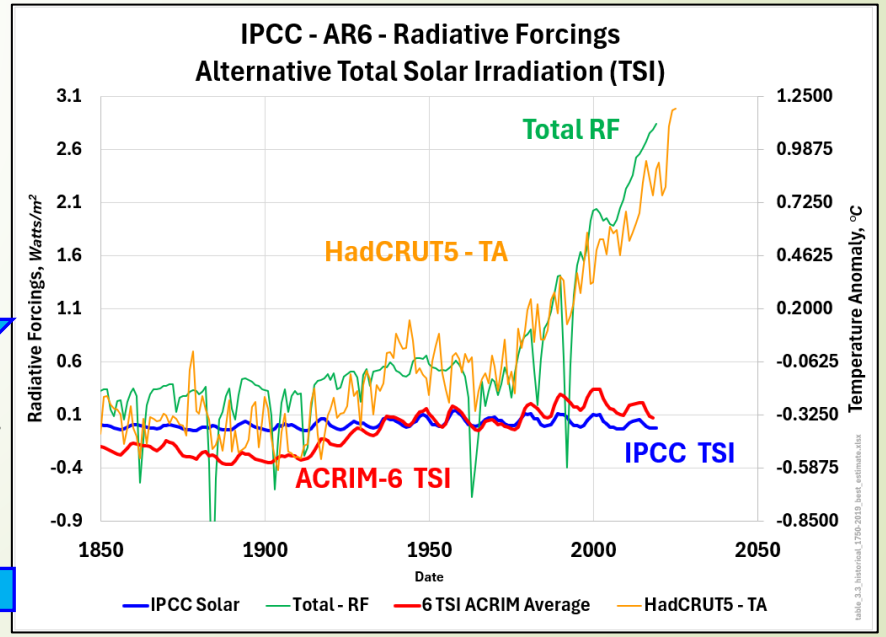



## Add in the AMO

The IPCC alarmist models history match (i.e.: correlate) to the HadCRUT5 surface temperature dataset as shown to the left (Total Radiative Forcing). What the models do not include is the cyclicity intrinsic to the climate system (solar, oceanic, atmospheric, etc.). Given that the models run too hot (even using reasonable emission scenarios (like ssp2-4.5)) and use implausibly high emission scenarios (ssp5-8.5 for example), some refinement is obviously required. The IPCC match can be improved significantly by adding in ocean cycles (note, only the AMO is included in this discussion). Substituting an alternative Total Solar Irradiance (TSI) reconstruction provides needed additional improvement. Acknowledging realistic, recognized solar/ocean cycles, Urban Heat Island, etc. reduces the forcings available for anthropogenic options.

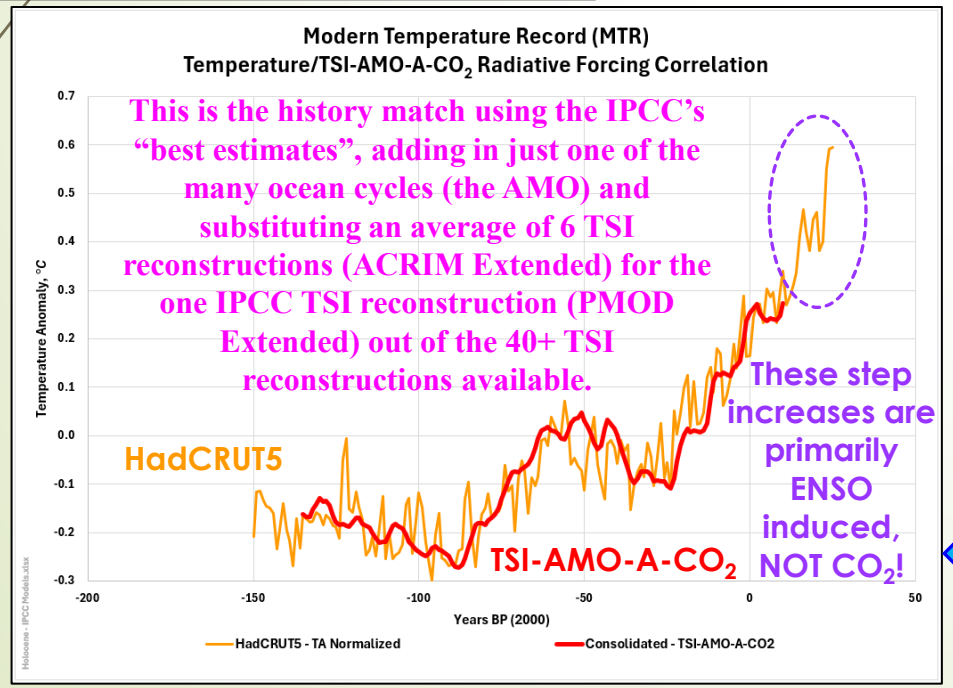



Substitute ACRIM-6 TSI for IPCC TSI




Detail in the following slides

**Model/Theory Shortcomings All Anthro?**




TSI-AMO-A-CO$_2$

## Forcing Weightings

| | |
|---|---|
| Solar-TSI$_{ACRIM}$ | 0.70 |
| AMO | 0.70 |
| Aerosol | 0.10 |
| $CO_2$ | 0.40 |

**Reality is not ALL anthropogenic nor ALL natural. Reality is very likely a combination of natural and anthropogenic forcings weighted to the natural forcings overall.**

# IPCC Model-Theory Shortcomings – All Radiative Forcings

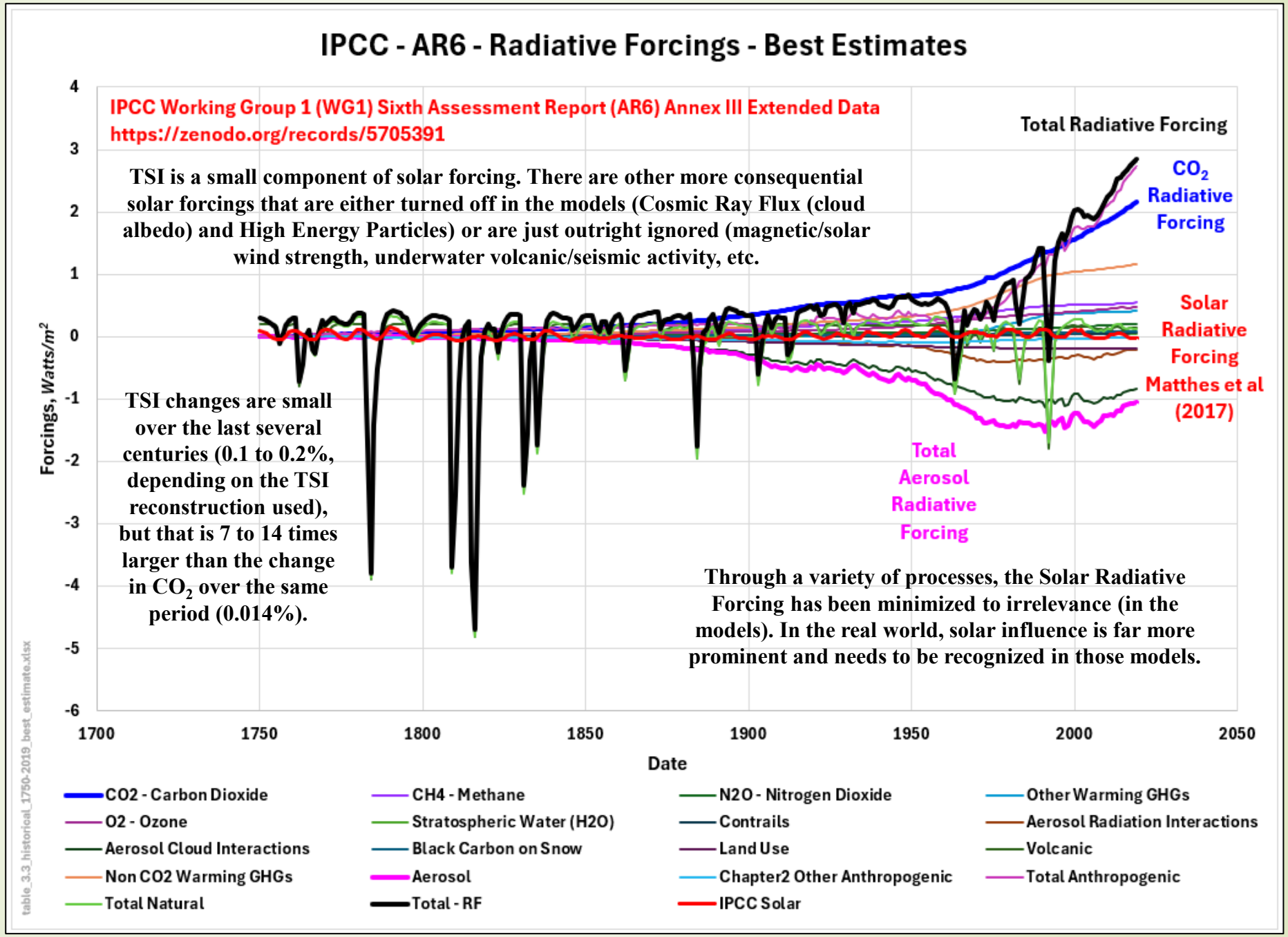
More Detail: climatechangeandmusic.com





The IPCC computer models are the major foundation of the All $CO_2$, All the Time alarmist narrative. They are programmed to recognize anthropogenic forcings above all else. How do we know that? You need only look at the IPCC's "best estimate" forcings plotted to the right. The consolidation of all the individual forcings is the bold black line. The Total Anthropogenic curve (the thin magenta line just below the TRF curve) is only marginally lower (i.e.: primarily anthropogenic). $CO_2$ has been highlighted in bold blue and is by far their primary anthropogenic radiative forcing (warming factor). Aerosol radiative forcing is their other major radiative forcing (but a cooling factor). While prominent, the Aerosol forcings are subject to huge uncertainty (according to the IPCC). The range of possibilities is substantial. The other forcing, highlighted in bold red, is the Solar radiative forcing. The IPCC has chosen to focus on ONE very muted Total Solar Irradiance (TSI) reconstruction (Matthes 2017) out of the 40+ TSI reconstructions available. Using just one TSI reconstruction out of the 40+ available is simplistic, unscientific and dangerous (not unlike proclaiming that 'climate change' (primarily anthropogenic (primarily GHGs (Primarily $CO_2$)) is THE driver. This plot is complicated but will be broken down further.

**Model/Theory Shortcomings All RF**



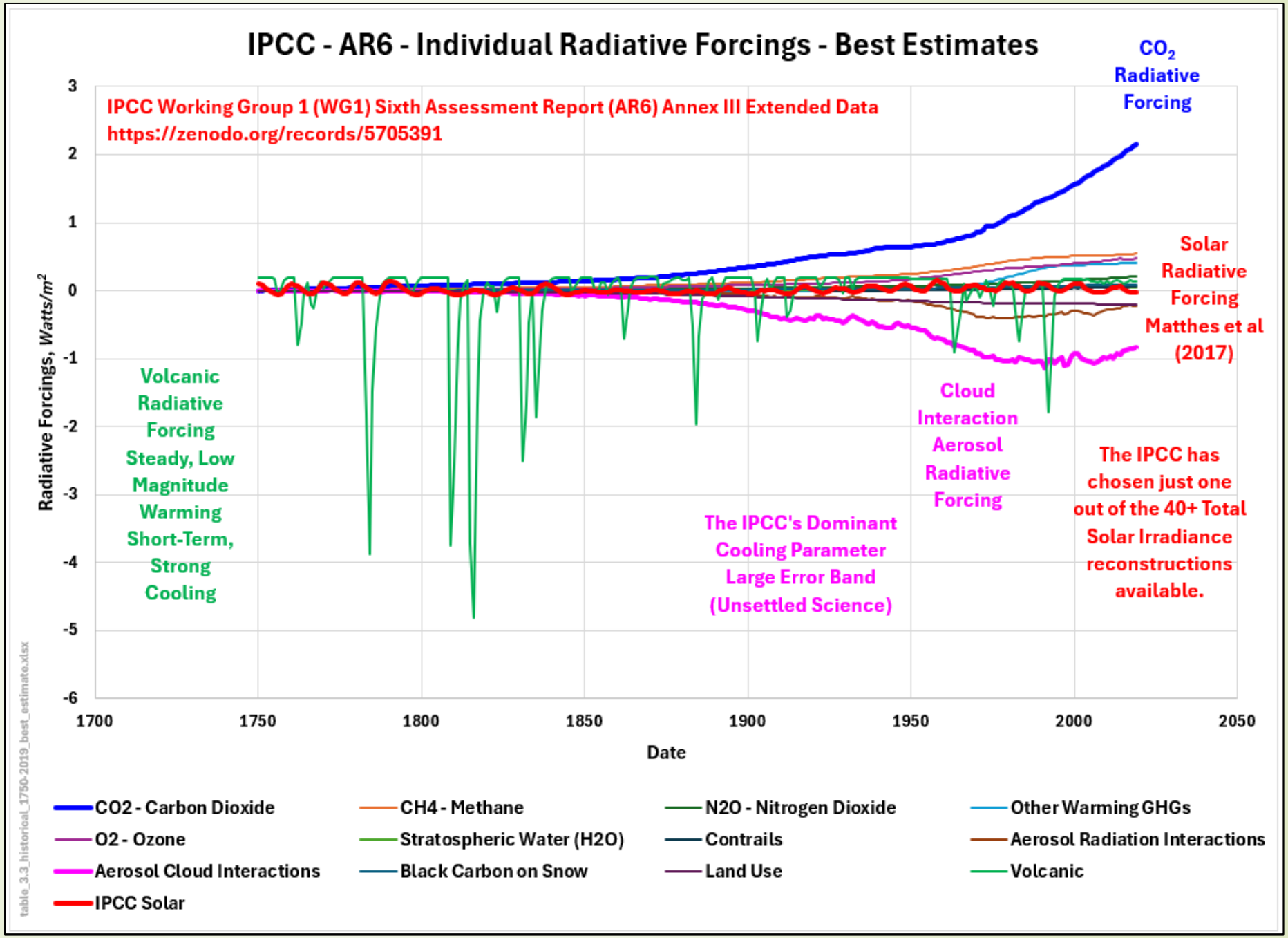
# CSS-71c IPCC Model-Theory Shortcomings – Individual Radiative Forcings

More Detail: climatechangeandmusic.com

This plot shows just the individual radiative forcings. Less complex but will still require some additional breakdown. In general, most model warming is due to Greenhouse gases (primarily $CO_2$). Aerosols (primarily) and some land use produce cooling effects. All other forcing parameters (including solar) produce only minor forcings

produce only minor forcings (cooling and/or warming). GHGs and aerosols generally offset one another prior to 1950. From 1950 to the early 1970s, aerosols dominated slightly (i.e.: indicating minor cooling). Post-1975, aerosol forcing leveled out and recently began declining, leading to GHG domination and an overall warming influence. Remember this is just a model discussion. Solar forcing (based solely on the TSI magnitude of just one of 40+ TSI reconstructions) oscillates between warming and cooling with a very minor warming influence over the period shown. Volcanic activity exhibits a constant minor warming effect (ambient GHG releases) punctuated by volcanic eruptions producing strong but short-lived aerosol influenced cooling events. The models are essentially programmed to respond exclusively to greenhouse gases with $CO_2$ acting as the primary incremental forcing. These models on their own cannot begin to explain all the cyclicity visible in the historical data.

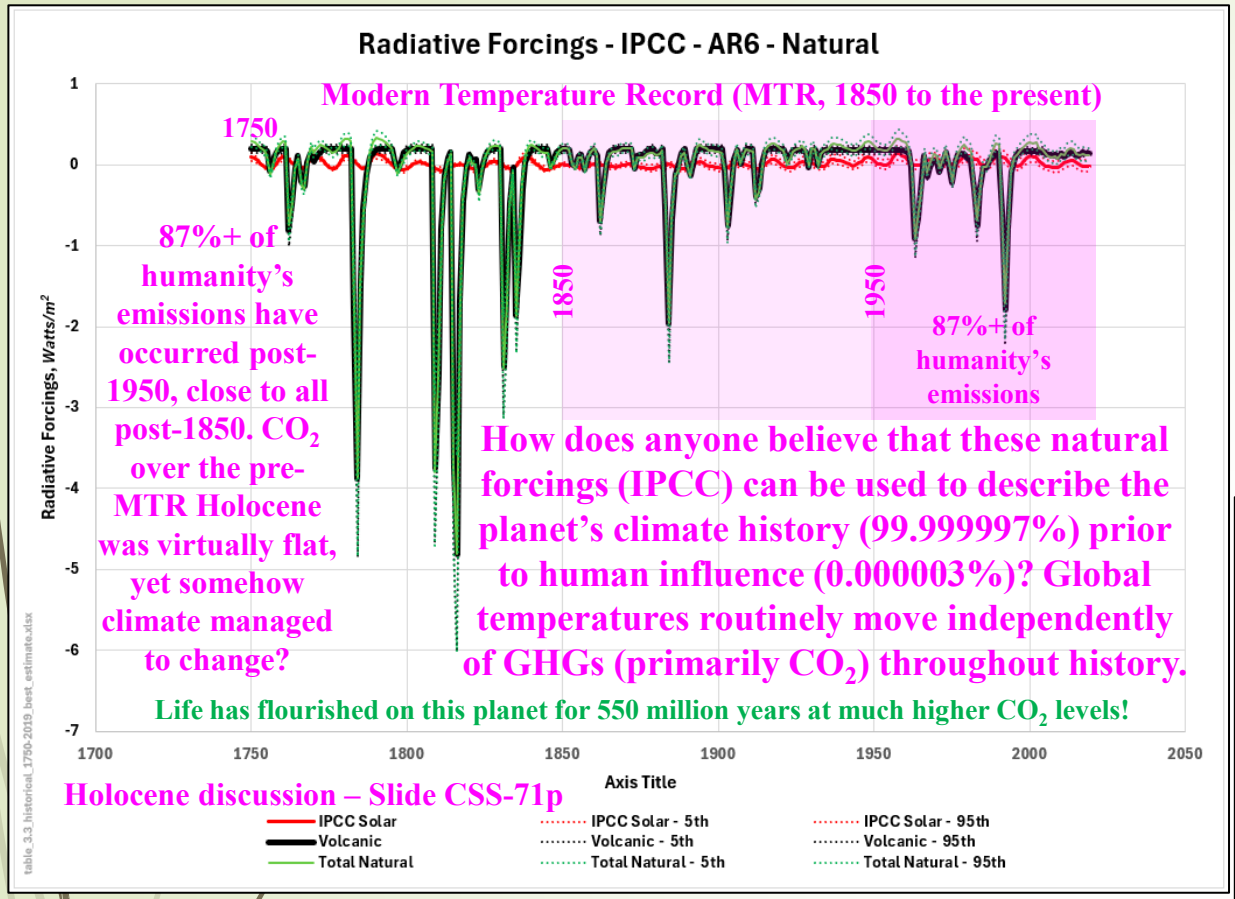
**Model/Theory Shortcomings Single RFs**

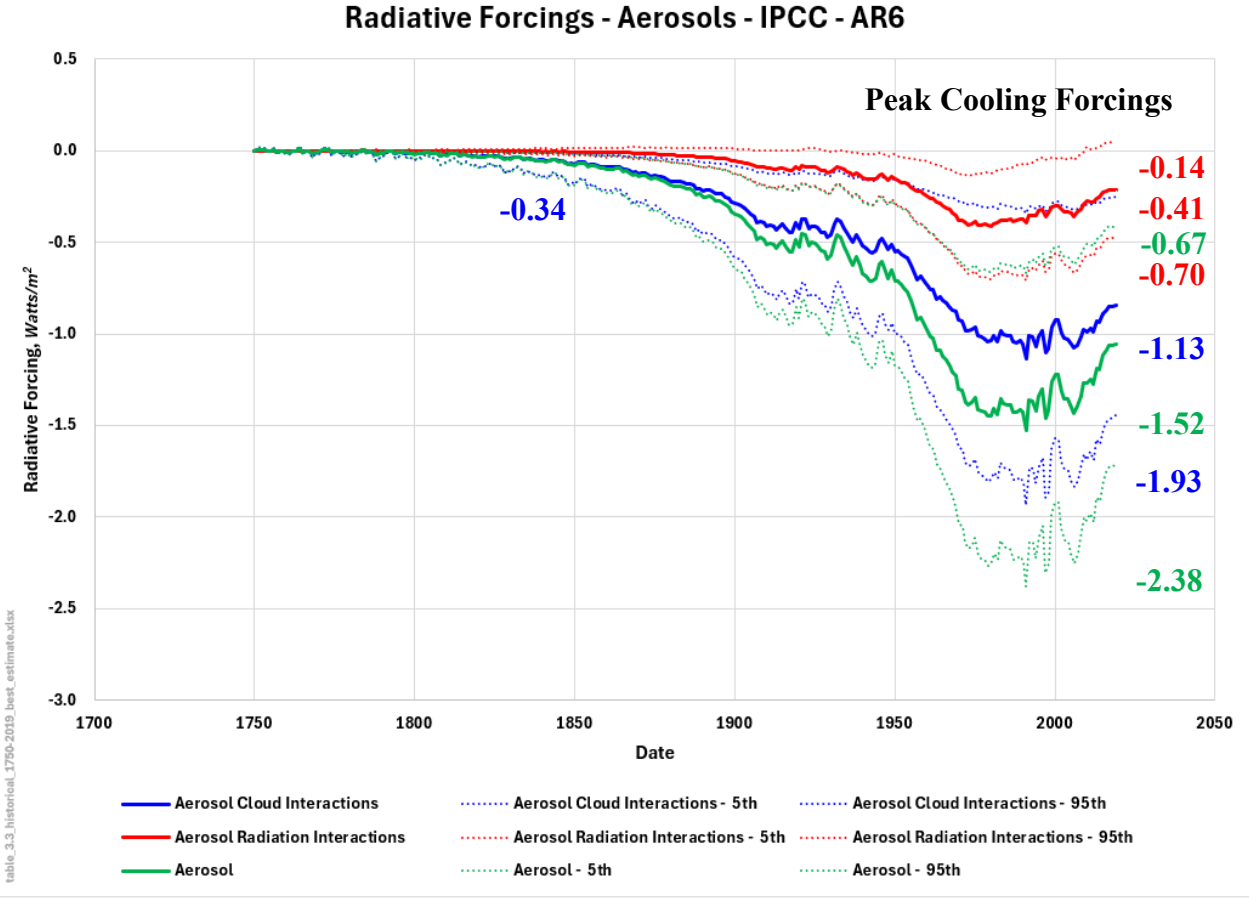



GSM – Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!

# IPCC M-T Shortcomings – Natural/Aerosol RF

**Aerosols (shown in the plot below) are responsible for most of the cooling forcings programmed into the models. The aerosol value ranges are quite large (and obviously not "settled science"). The consolidated aerosol forcing has median forcing of -1.52 Watts/m² with a peak range of ±0.85 Watts/m². There is a lot of interpretation room and uncertainty in those numbers. The model aerosols are divided into two categories (cloud and radiative interactions, with cloud interactions being the more dominant parameter). Cloud interaction forcing has a median forcing of -1.13 Watts/m² with a peak range of ±0.80 Watts/m². Radiative interaction forcing has a median forcing of -0.41 Watts/m² with a peak range of ±0.25 Watts/m². The uncertainty is not surprising given how little the "climate science" community knows about clouds (a parameter on its own is too complex to model).**

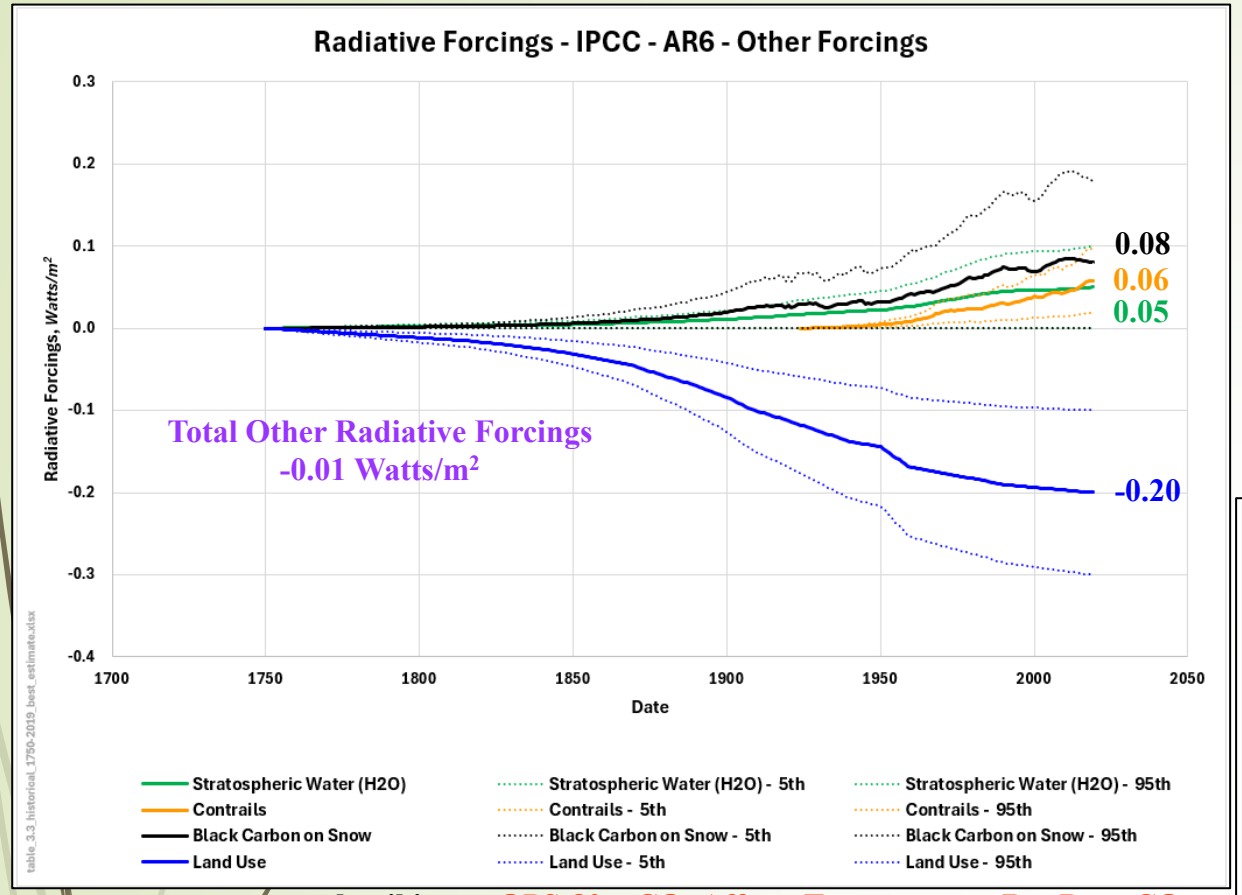


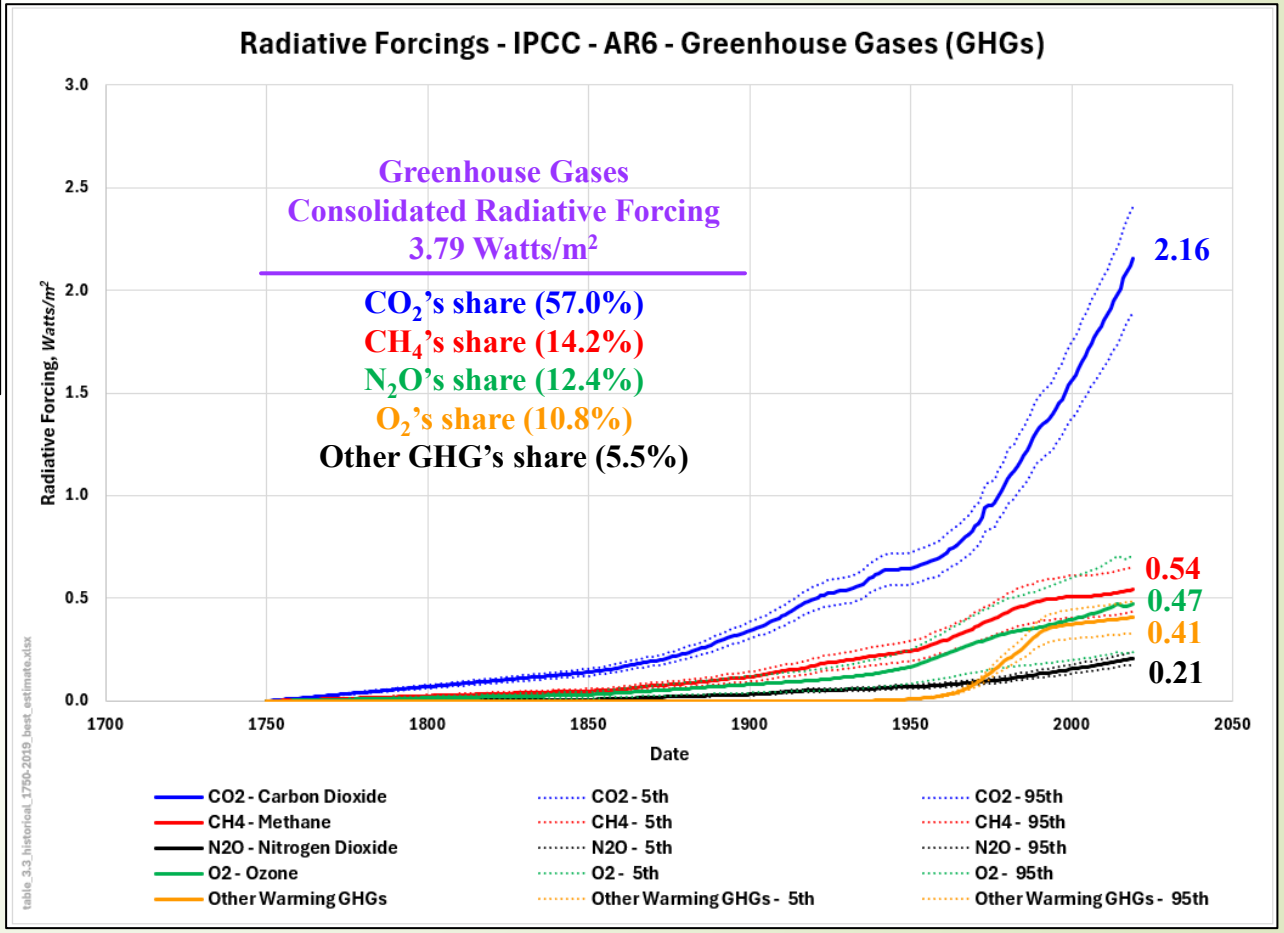

**M-T : SC**
**Natural RF**
**Aerosol RF**

**The plot above shows the natural forcings programmed into the IPCC climate models. I find that hilarious to be honest. Humanity's influence (according to the models) is primarily GHG based. Can the forcing curves shown above realistically explain historical temperature fluctuations? Not a chance but more on that later. The models have virtually no significant natural influence programmed in. Prior to 1950 (just 75 years ago), the climate was dependent almost exclusively on natural forcings. These models do not reflect that very basic truth. The volcanic activity has a minor warming effect (minor GHG releases) combined with strong, but short-lived cooling events (i.e.: volcanic eruption aerosols). The cumulative volcanic forcing has been slightly positive. The solar forcing component has been minimized to the point of insignificance (oscillating between warming and cooling, with a cumulative slight warming over the period shown). Temperatures have fluctuated significantly, independent of $CO_2$ concentrations. Those forcings are not included here.**

# IPCC M-T Shortcomings – GHG/Other RF




**The All $CO_2$, All the Time alarmist narrative relies primarily on Greenhouse Gas emissions. $CO_2$ is the largest contributor of those human emissions. But the one GHG they do not include (at least not directly), water. $H_2O$, that other molecule, along with $CO_2$ and $O_2$ that makes life on this planet possible. To be fair, water vapour is embedded in each of the GHG streams. The basic premise is that any warming that a GHG gas provides is magnified by the additional evaporation of water (by far the largest GHG influence). That magnification in the models averages roughly four times but is no where near "settled science". The models use a very unsettled $CO_2$ Equilibrium Climate Sensitivity (ECS (the warming associated with a doubling of $CO_2$ in the atmosphere), 1.8 to 5.7 °C). $CO_2$'s ECS (Infrared Radiation (IR) forcing only) is very likely less than 1.0 °C (discussed in more**

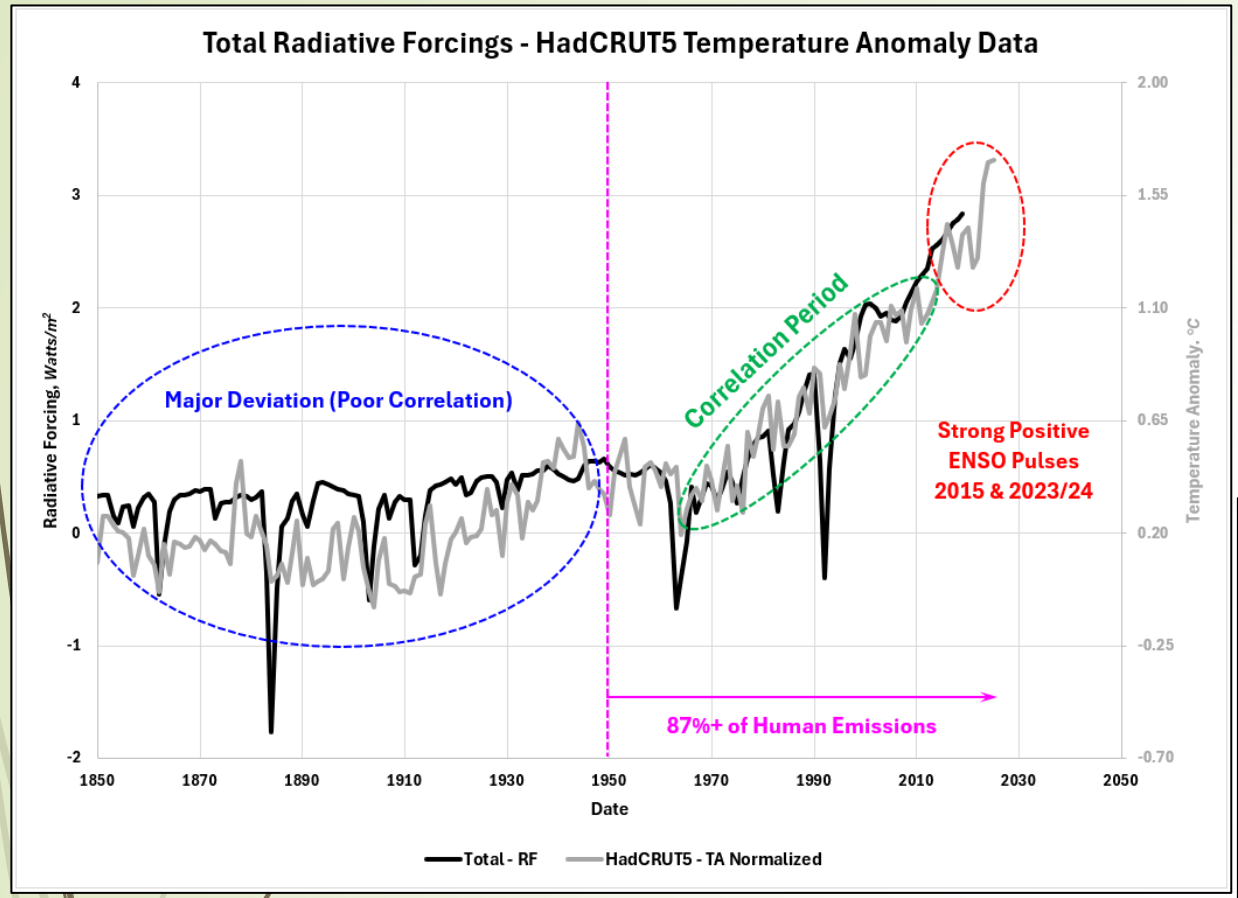



**M-T : SC**
**GHG RF**
**Other RF**

**detail in my OPS-80 – $CO_2$ Affects Temperatures But Does $CO_2$ Drive Climate? post). The additional positive water vapour feedback premise is possible, but the processes are also not "settled science". This thought process would apply to each of the GHG options. We do not understand the water cycle within the atmosphere, we do not understand clouds, we do not fully understand the interactions between the atmospheric/ocean cycles, or the various levels of the atmosphere, etc. The radiative forcings of "GHG" should not include the water vapour component. The water vapour component should be a separate forcing in the model (assuming we could properly represent its actual influence). The actual radiative forcing (IR only) of each of these GHGs is less than that shown in the graph to the right. The chart above shows the remaining radiative forcings within the model. Land use is the largest forcing (cooling), followed by Black Carbon on Snow (warming). These relatively small radiative forcings roughly cancel one another out. Minimal combined impact.**

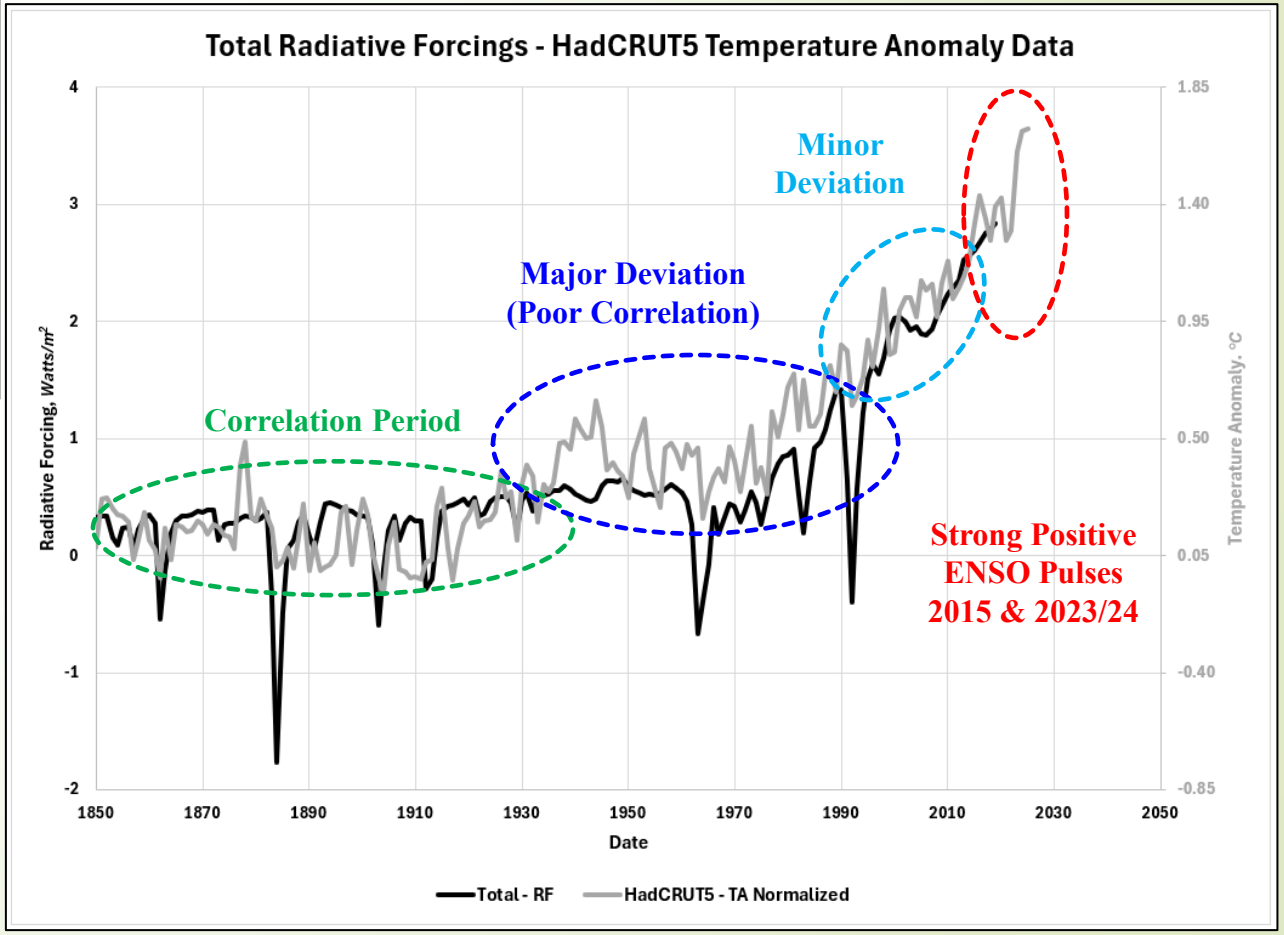
# IPCC M-T Shortcomings – Total RF – HadCRUT5 TA

**These plots show the consolidated radiative forcings plotted against the (in my opinion) over-homogenized HadCRUT5 surface temperature data. The two parameters do indeed show some correlation. We do need to remember that this is a very small portion of our planet's climate history and as such its statistical significance is questionable. In a climate change discussion this 175-year period is roughly just 6 data points. Not nearly enough data points to assign causality to $CO_2$ on its own. The rising $CO_2$ levels will be contributing to the rising temperatures, but that contribution will depend on its climate sensitivity (i.e.: its ECS). The temperatures over the pre-1850 Holocene fluctuated significantly with virtually no $CO_2$ contribution (slide CSS-71p). The forcings responsible for those pre-1850 temperature fluctuations were still active post-1850 and will be in the future (just not in**

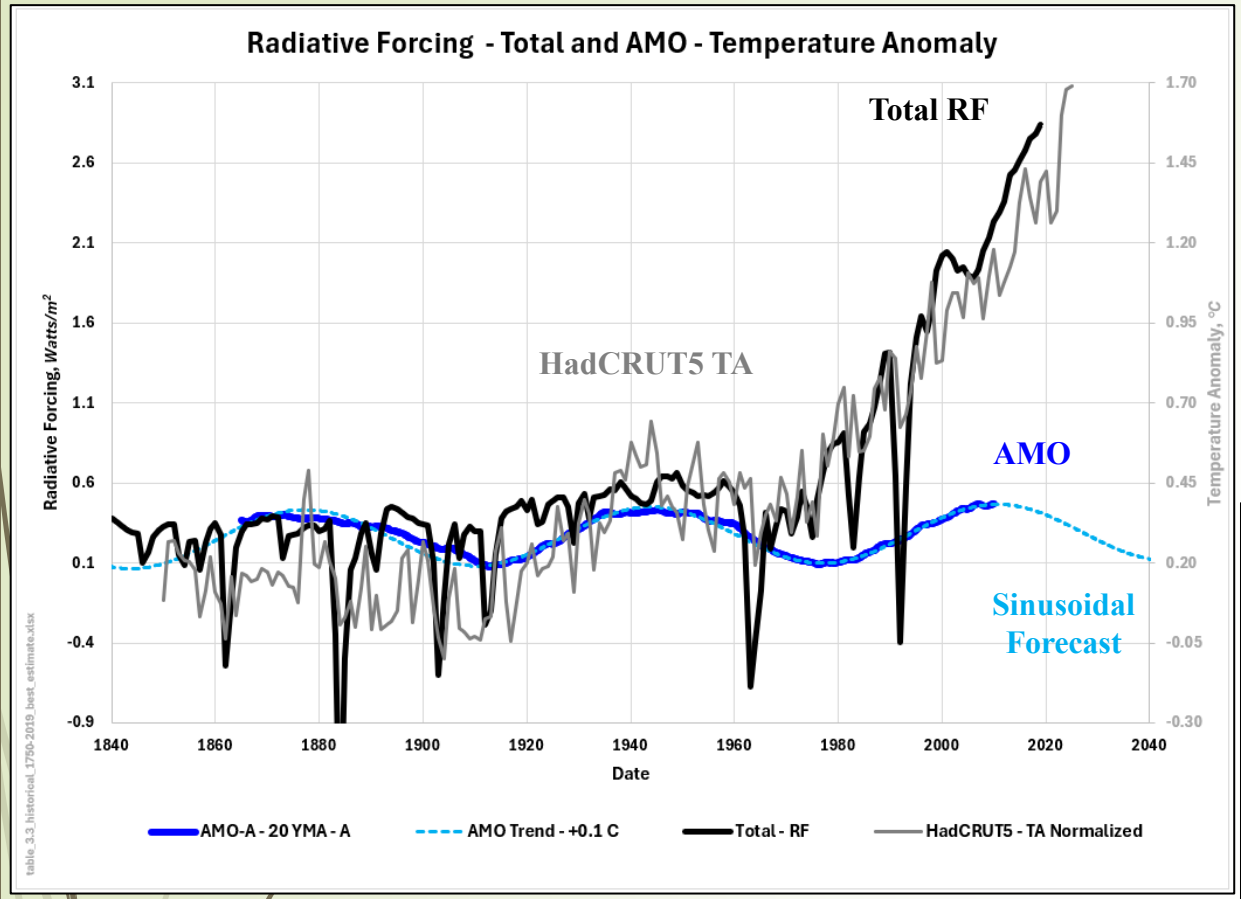



**M-T : SC HadCRUT5 TA Total RF**

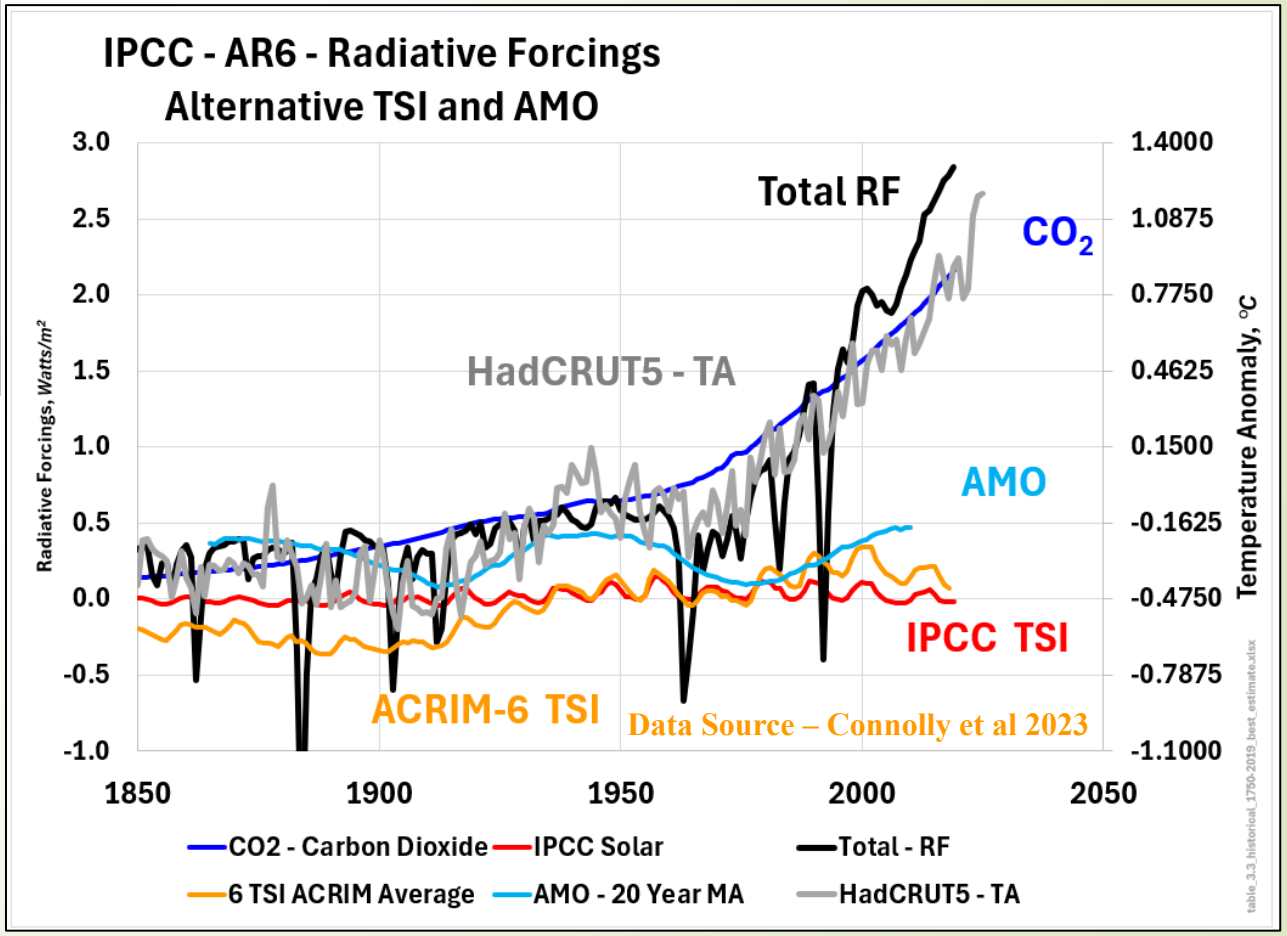
**the models). The two plots just correlate the IPCC's Total Radiative Forcings (TRF) to two different time periods. The plot above correlates the TRF to the recent temperature rise (supposedly associated with humanity's emissions, 87%+ of which are post-1950). This correlation produces a major deviation (poor correlation) prior to 1950. The step increases in HadCRUT5 temperatures in 2015 and 2023/24 are primarily related to strong positive ENSO pulses with warming contributions from the Hunga-Tonga stratospheric water injection, the Sunspot Cycle 25 activity peak, recent shipping aerosol reductions and (possibly) increased volcanic/seismic activity along the mid-Atlantic Ridge and elsewhere. Not $CO_2$! The chart to the right is focused on the pre-1930 period where human influence would have been minimal. This correlation produces some major deviations between 1930 and 1990. Post 1990, there are some minor deviations. A correlation between these two options would just spread the deviations throughout the whole period.**



# IPCC M-T Shortcomings – Total RF – Other Options




**Now that we have an understanding of the radiative forcings programmed into the IPCC computer model and their combined results we can move on to a look at improvements and/or alternatives. The quick option is adding in ocean cycles. The chart to the left shows the Atlantic Multi-decadal Oscillation Momentum ($AMO_M$, 20 Year Moving Average) and its sinusoidal match. The models currently ignore the ocean cycles (there are more than just the AMO) on the premise that they are cycles and do not produce long-term changes. Arguably incorrect since the oceans store the energy the sun delivers (producing a forcing rise along with the sinusoidal forcing). The short term is also important. The AMO is entering its cooling phase which will reduce temperatures over the next few decades. The magnitude of that change is open for discussion but that will happen and should be**




**M-T : SC Other Options Total RF**

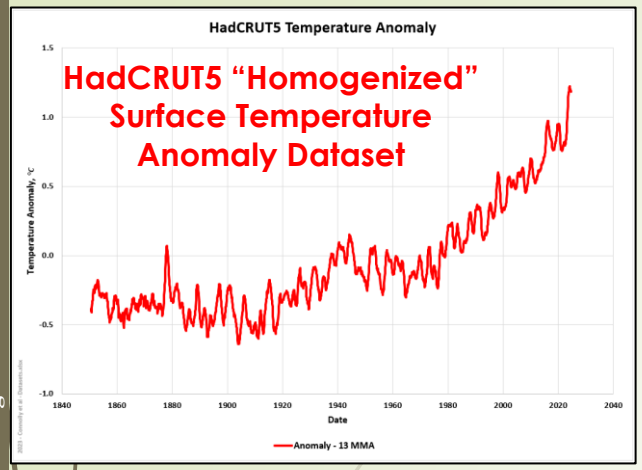
**included. There is also potential for long-term changes that are not included in the models (Heinrich events, the Atlantic Meridional Overturning Current (AMOC), Beaufort Gyre freshwater release into the North Atlantic for example). The current models are focused on just ONE out of the available 40+ Total Solar Irradiance (TSI) reconstructions. Using alternative TSI reconstructions will provide significantly different interpretations. The chart to the right has both the IPCC's single TSI reconstruction (Matthes et al 2017) and an average of 6 other TSI reconstructions (labeled ACRIM-6). ACRIM-6 has a noticeably stronger radiative forcing. Swapping ACRIM-6 for Matthes et al 2017 will produce a significant effect on global temperatures. That effect would be magnified by the other solar forcings not included in the models along with the Cosmic Ray Flux (CRF, cloud albedo) and High Energy Particles (both included in the models but effectively turned off). Focusing on one parameter (All $CO_2$, All the Time) and ONE TSI is not a scientific approach!**

# IPCC Model-Theory Shortcomings – 27 TSI Reconstructions



More Detail: climatechangeandmusic.com



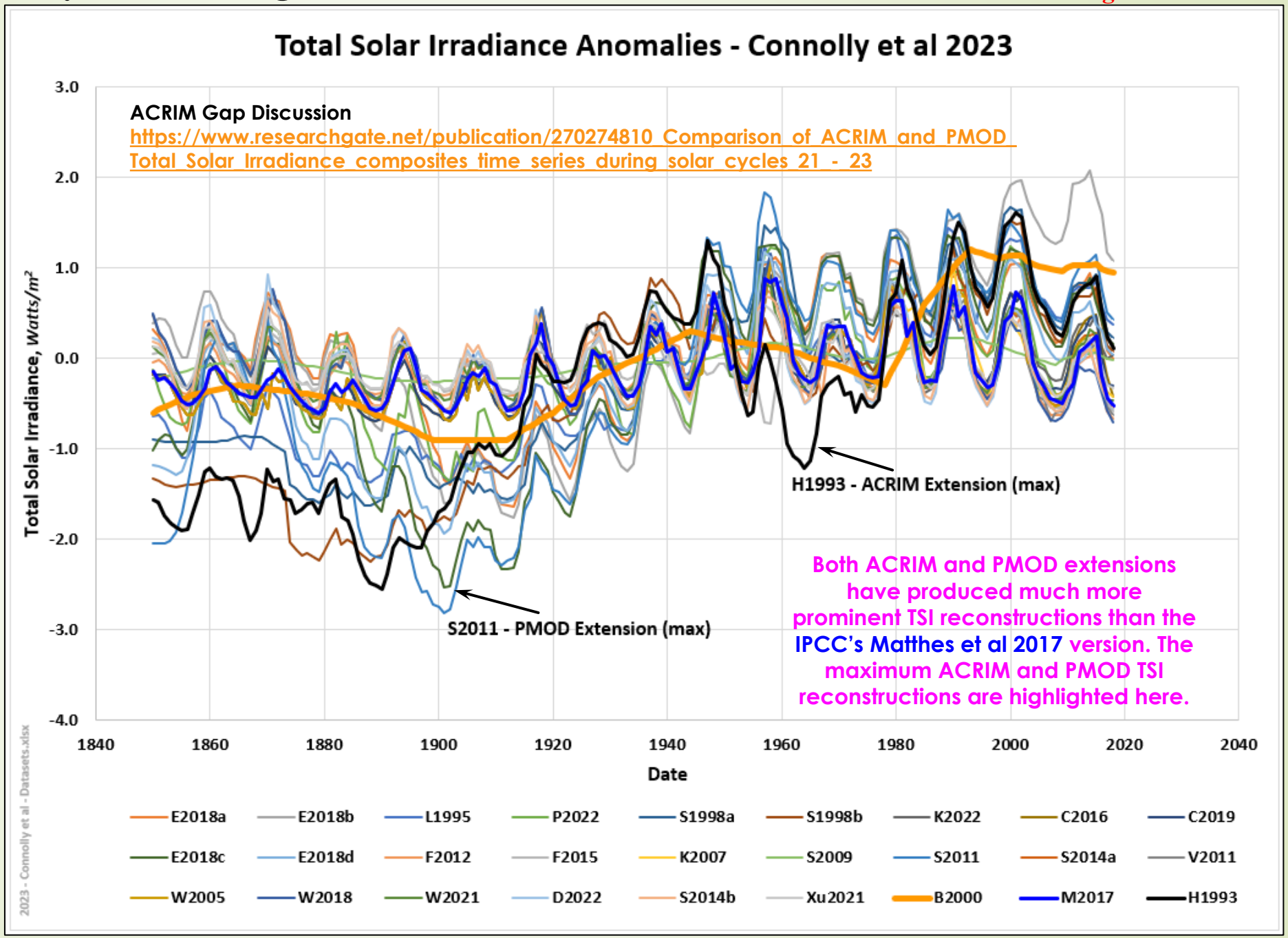



The solar discussion is complex, but it is far more important than the alarmist community lets on. Why do temperatures fluctuate independent of $CO_2$? The HadCRUT5 surface data is shown above. Global temperatures are far more complicated than the relatively steady profile of $CO_2$ (virtually flat through the pre-1850 Holocene, with steady rise post-1850).

**M-T : SC Reconstructions (27 TSI)**

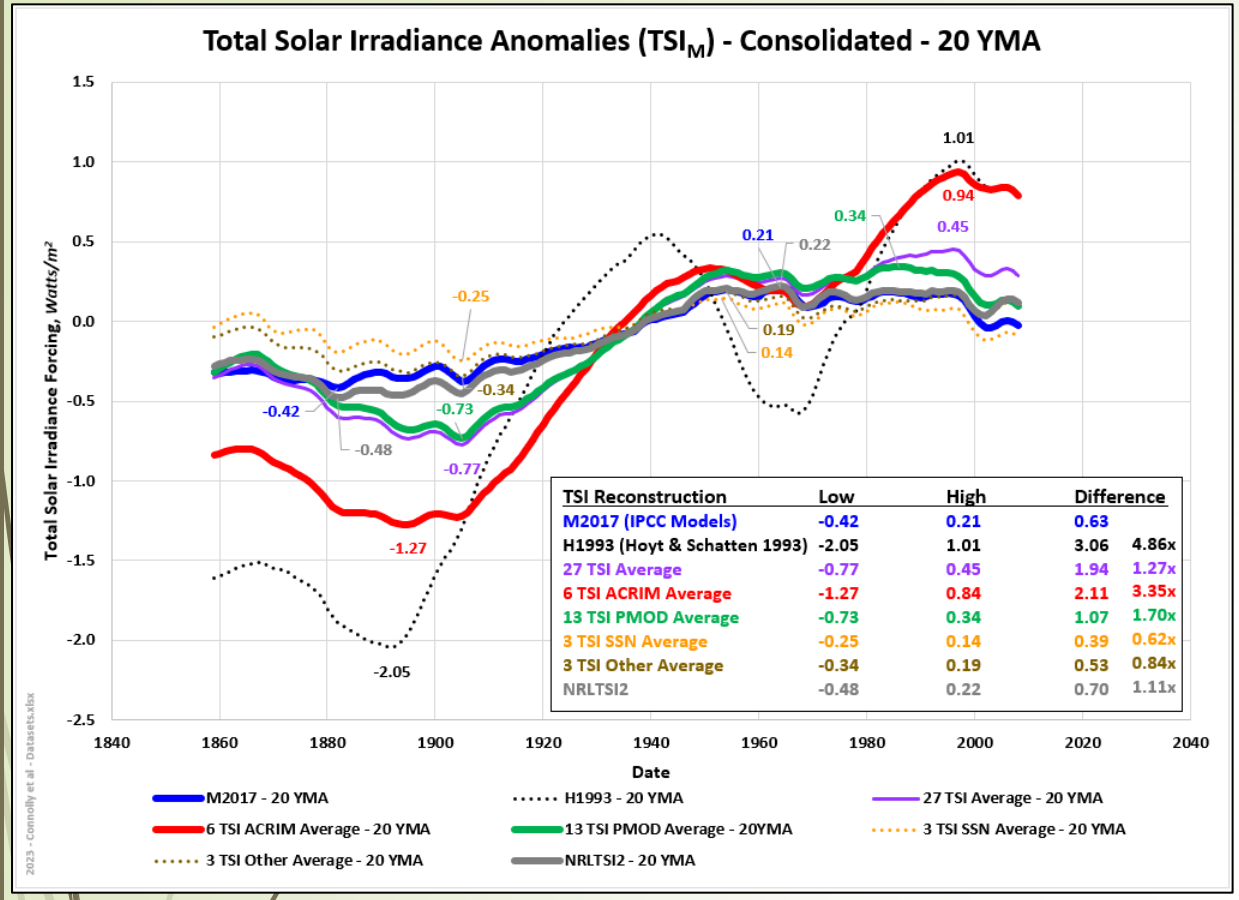
Connolly et al 2023 reviewed 27 TSI reconstructions (shown to the right).

The ONE IPCC TSI reconstruction (Matthes et al 2017) is highlighted in bold blue. TSI is not "settled science". A lack of satellite data (called the ACRIM Gap) has introduced uncertainties into TSI reconstructions. Two primary methods have been proposed for TSI reconstructions that produce different results (ACRIM and PMOD). A proper scientific analysis would include all reasonable options.



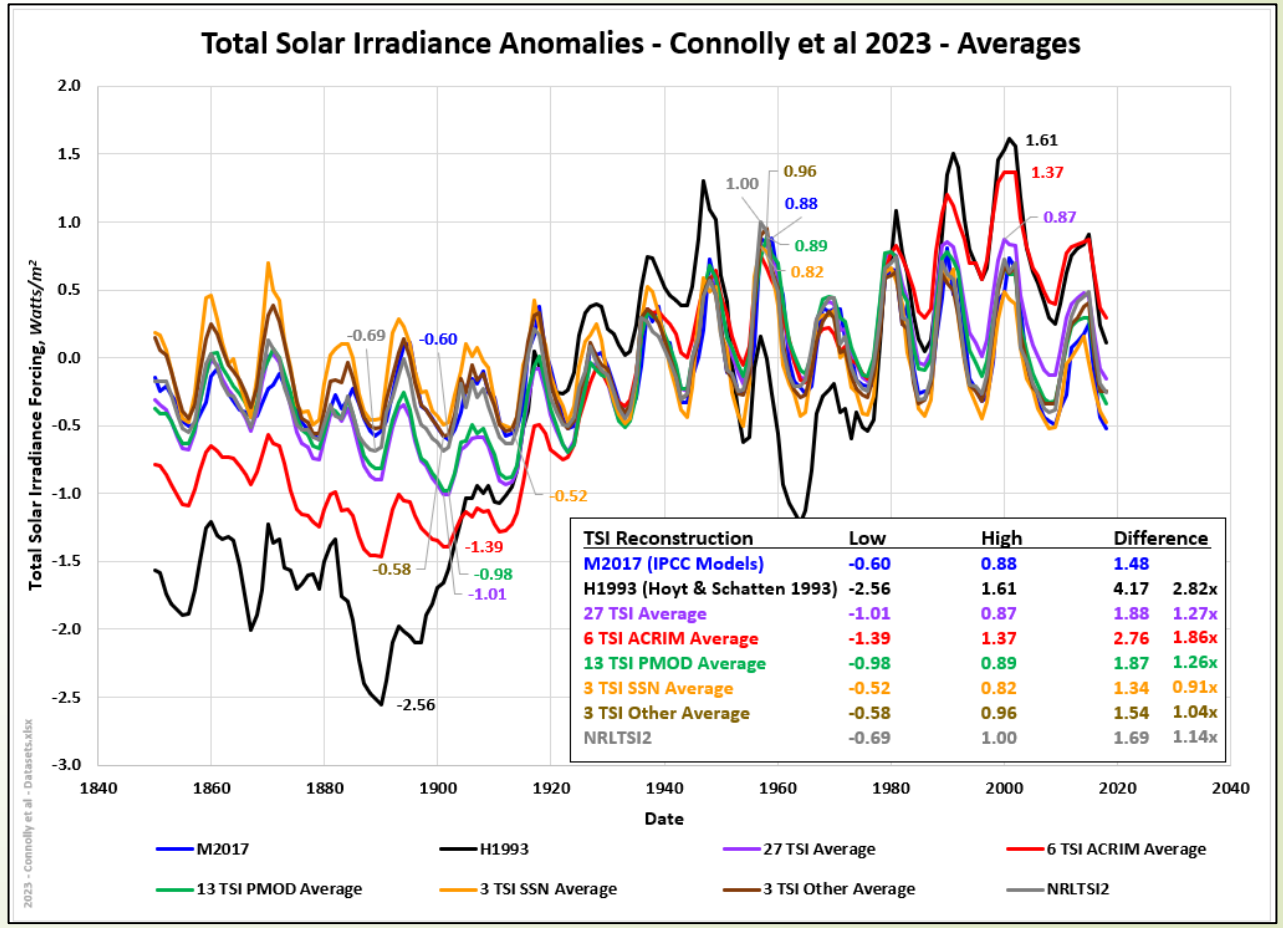
# IPCC M-T Shortcomings – TSI Consolidations

**The chart below has consolidated the different evaluation types to take some of the complexity out of the previous plot. The IPCC Matthes et al 2017 TSI reconstruction is still included in blue. The ACRIM-6 is highlighted in red. The other notable consolidations are an average of all 27 TSI reconstructions, and an average of the 13 PMOD constructions. I also included the Naval Research Laboratories TSI reconstruction, NRLTSI2. Only because I have routinely used NRLTSI2 (as a solar proxy) in my own evaluations. The Hoyt & Schatten 1993 TSI reconstruction was also included to show the maximum interpretation range available (4.17 Watts/m²). That range is 2.82 times larger than the IPCC's Matthes et al 2017 range. The ACRIM-6 range is 2.76 Watts/m² (1.86 times larger). The NRLTSI2 range is 1.69 Watts/m² (just 1.14 times larger). Using different TSI reconstructions**




**M-T : SC Consolidations TSI**

**produces different results. The above chart shows the Total Solar Irradiance Momentum (TSI$_M$) curve (i.e.: the 20 Year Moving Average). The general trends are more visible in the TSI$_M$ curves. 20 years is roughly equivalent to the Hale solar cycle or two Schwabe solar cycles. Any of these curves can be used as solar activity templates for global temperature history matching. This post focuses on the Matthes et al 2017 and ACRIM-6 options. Using the TSIM curves shrinks the TSI ranges for each of the reconstructions. The IPCC's Matthes et al 2017 range is now only 0.60 Watts/m². The ACRIM-6 range is now 2.11 Watts/m² (3.35 times larger). The NRLTSI2 range is 0.70 Watts/m² (just 1.11 times larger). So, my historical choice (NRLTSI2) is very close to the IPCC's choice (Matthes et al 2017). The difference comes down to the use of the two TSI reconstructions. The IPCC assumes that the absolute value of the TSI reconstructions represents the full range of solar activity forcings (i.e.: ignoring other more powerful solar forcings). I use the TSI reconstructions as a proxy.**




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

# IPCC Model-Theory Shortcomings – Normalized TSI Reconstructions

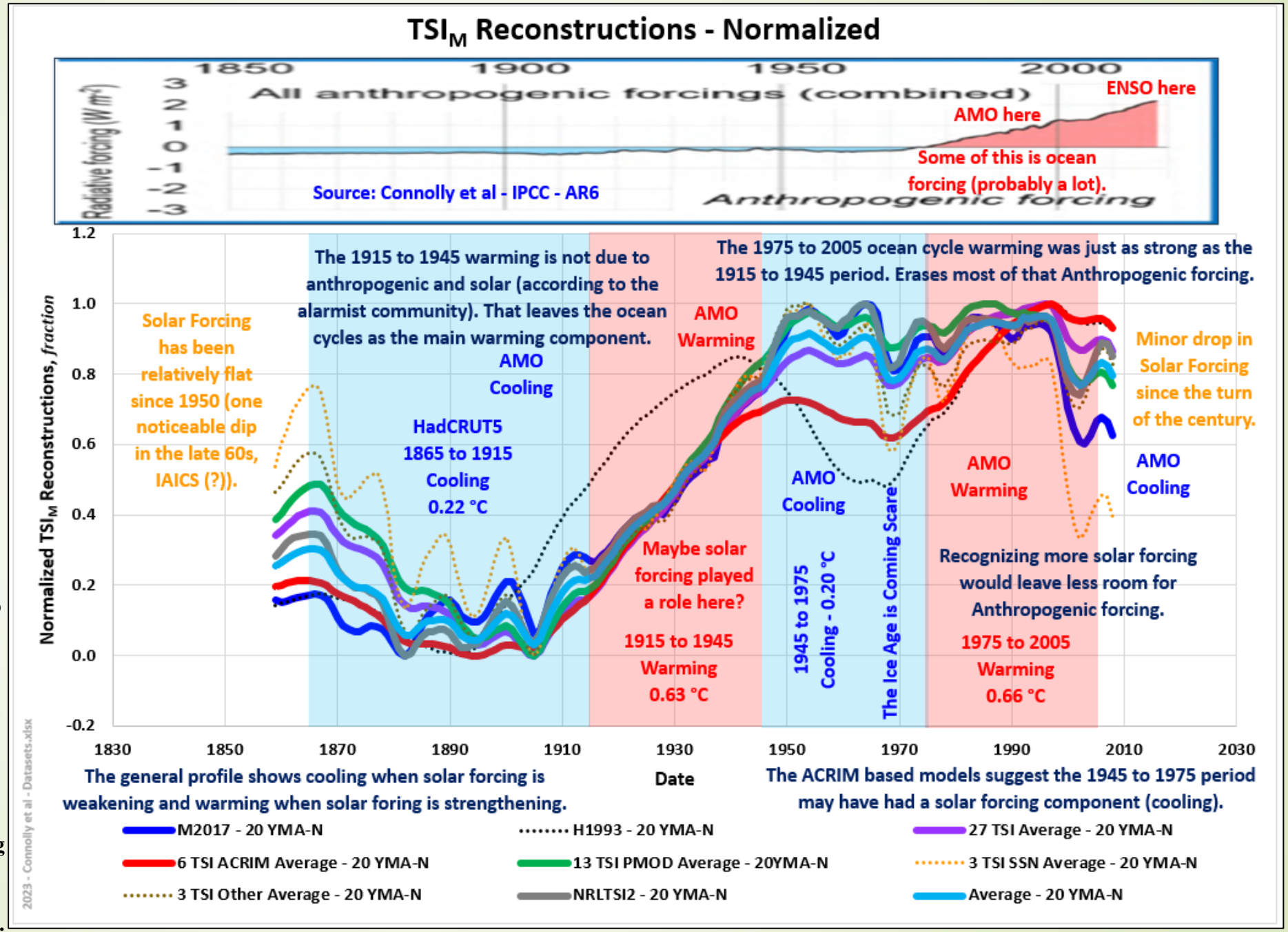


More Detail: climatechangeandmusic.com



The IPCC has chosen to model solar forcings based on just its TSI. But TSI is just a small component of the available solar forcings. Cosmic Ray Flux and High Energy Particles are included in the models but effectively turned off. Other important solar forcings like electromagnetic field and solar wind strengths, underwater volcanic/seismic activity levels, sunshine hours, solar barycentre location, etc. are just outright ignored. Note, the absolute TSI change (±0.15%) is small (but still over 10 times larger than atmospheric $CO_2$'s 0.014% change). But the TSI is still a good indicator of overall solar forcing and can be used as a proxy to represent the solar forcings that the IPCC is ignoring. The large chart (to the right) here has normalized all the TSI curves discussed earlier. These curves all have the same general profile. The $TSI_M$ declined prior to 1905, then increasing sharply to 1950, followed by a more minor decline to 1970 (the Ice Age is Coming Scare), another small rise to the late 1990's, followed by the most recent minor decline. Any of these TSI reconstructions could be used as a solar forcing proxy to better history match the global temperature. The plot top right shows the IPCC's total anthropogenic forcing (most of which is post-1975). But some of that forcing is ocean related (AMO 1975 to 2005, ENSO 2015+) and may have a strong solar component as well based on the ACRIM-6 TSI.

**M-T : SC Normalized TSI - RF**



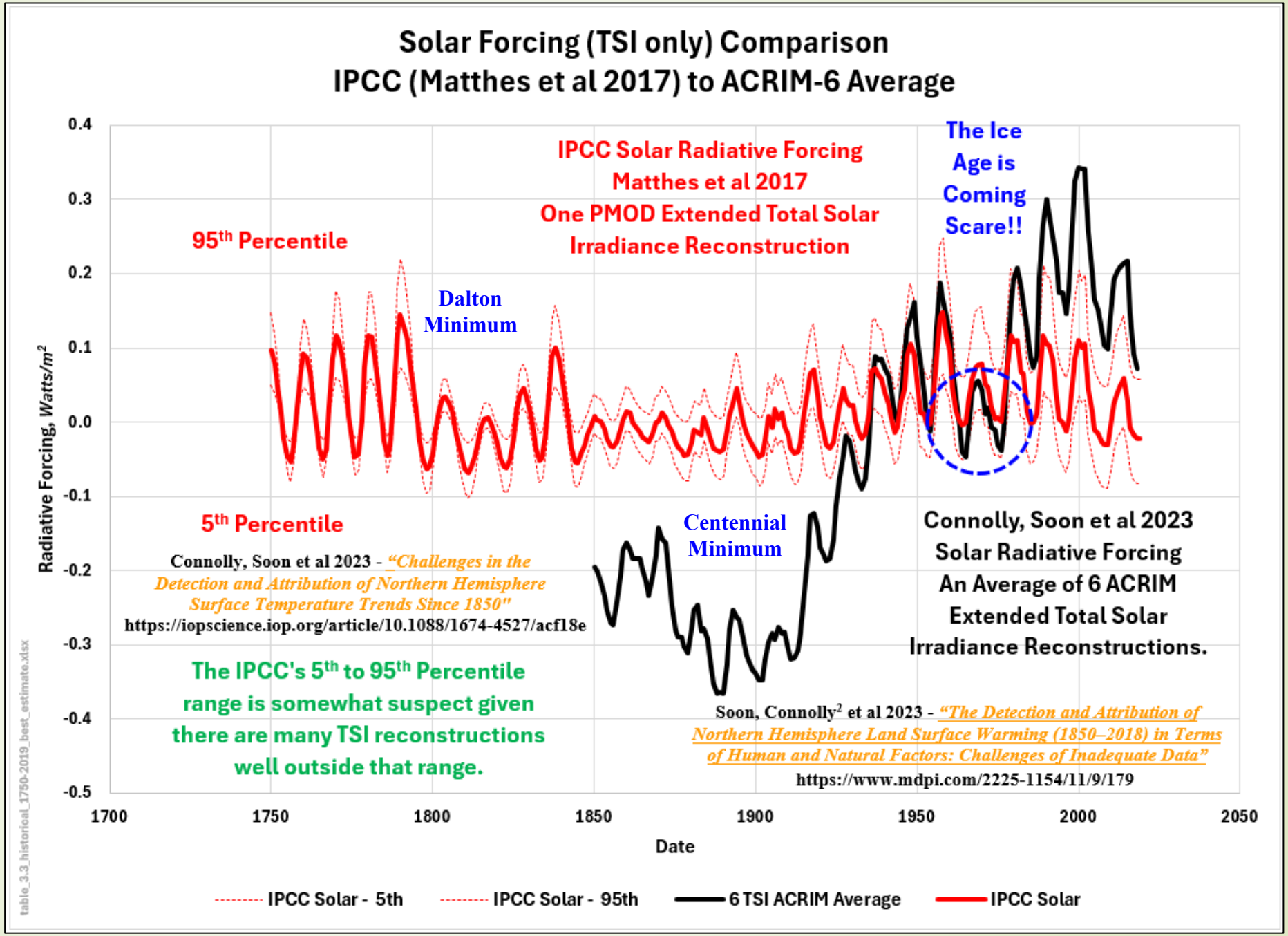
# CSS-71k IPCC Model-Theory Shortcomings – Individual Radiative Forcings

More Detail: climatechangeandmusic.com

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

**M-T : SC Individual TSI-RF**

This plot compares the IPCC's Matthes et al 2017 TSI reconstruction directly and in more detail to the ACRIM-6 TSI reconstruction. Using the IPCC's TSI shows that current TSI levels are at the same levels experienced in the late 1700s. The Matthes et al 2017 TSI reconstruction appears to be chosen for its relatively minor magnitude changes and lower volatility. The Dalton and Centennial Minimums are barely noticeable in the IPCC TSI data. Both curves do show the "The Ice Age is Coming" scare. Given the range of TSI reconstructions, the 5th and 95th percentile ranges of the IPCC TSI reconstruction need to be called into question. There are obviously TSI reconstructions that fall well outside of the IPCC's 5th to 95th percentile range. The Connolly, Soon et al papers referenced here detail 27 of the 40+ available TSI reconstructions. The other 13+ TSI reconstructions are discussed on the Ceres-Science website. Many of these TSI reconstructions can be used to directly (and closely) history match the Modern Temperature Record (MTR, 1850 to the present) without $CO_2$ contribution. All the TSI reconstructions (as a proxy) can be used to closely match the MTR (again with no $CO_2$ contribution). Ocean contributions do tighten up that history match. $CO_2$'s contribution is not required to match the MTR, but it is still a contributor (but at what magnitude)?

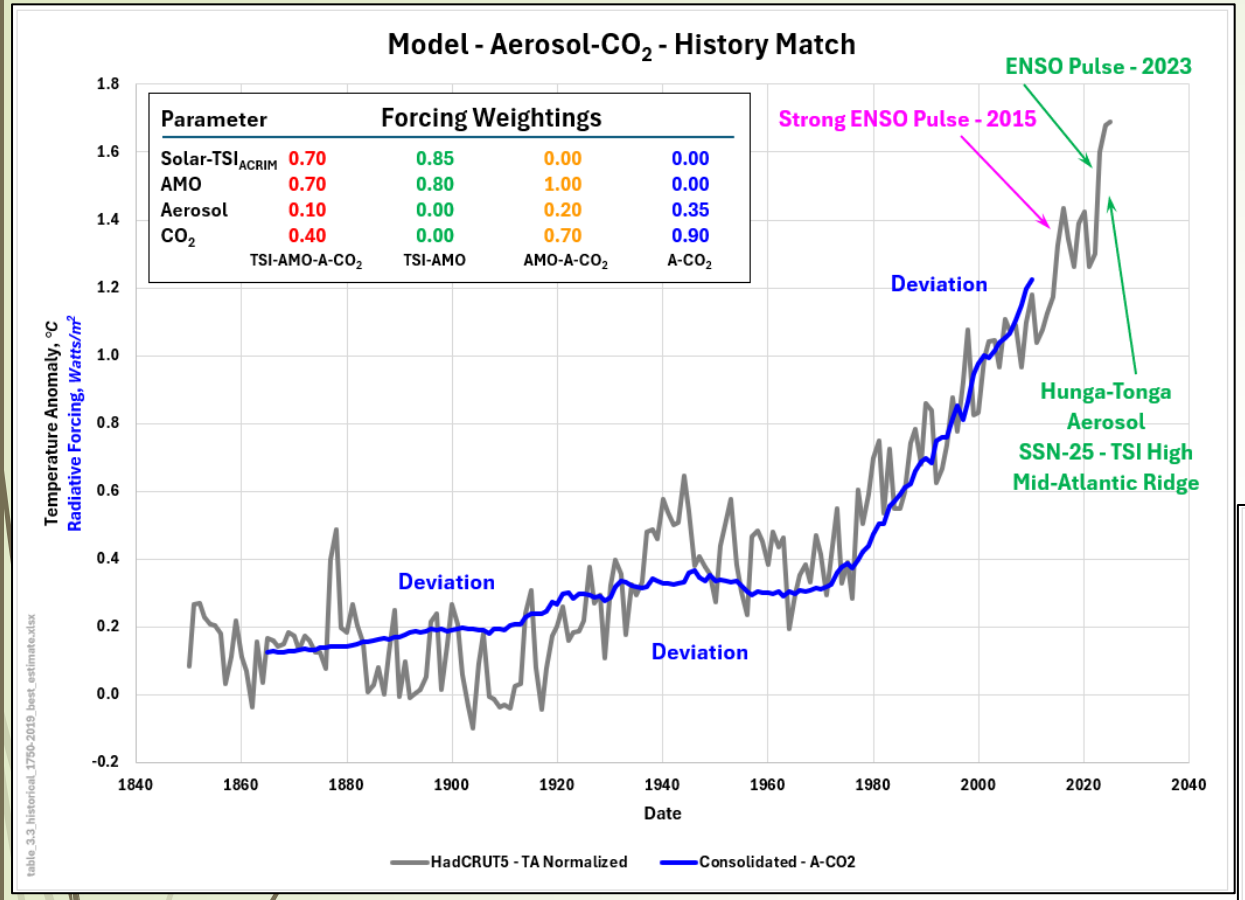


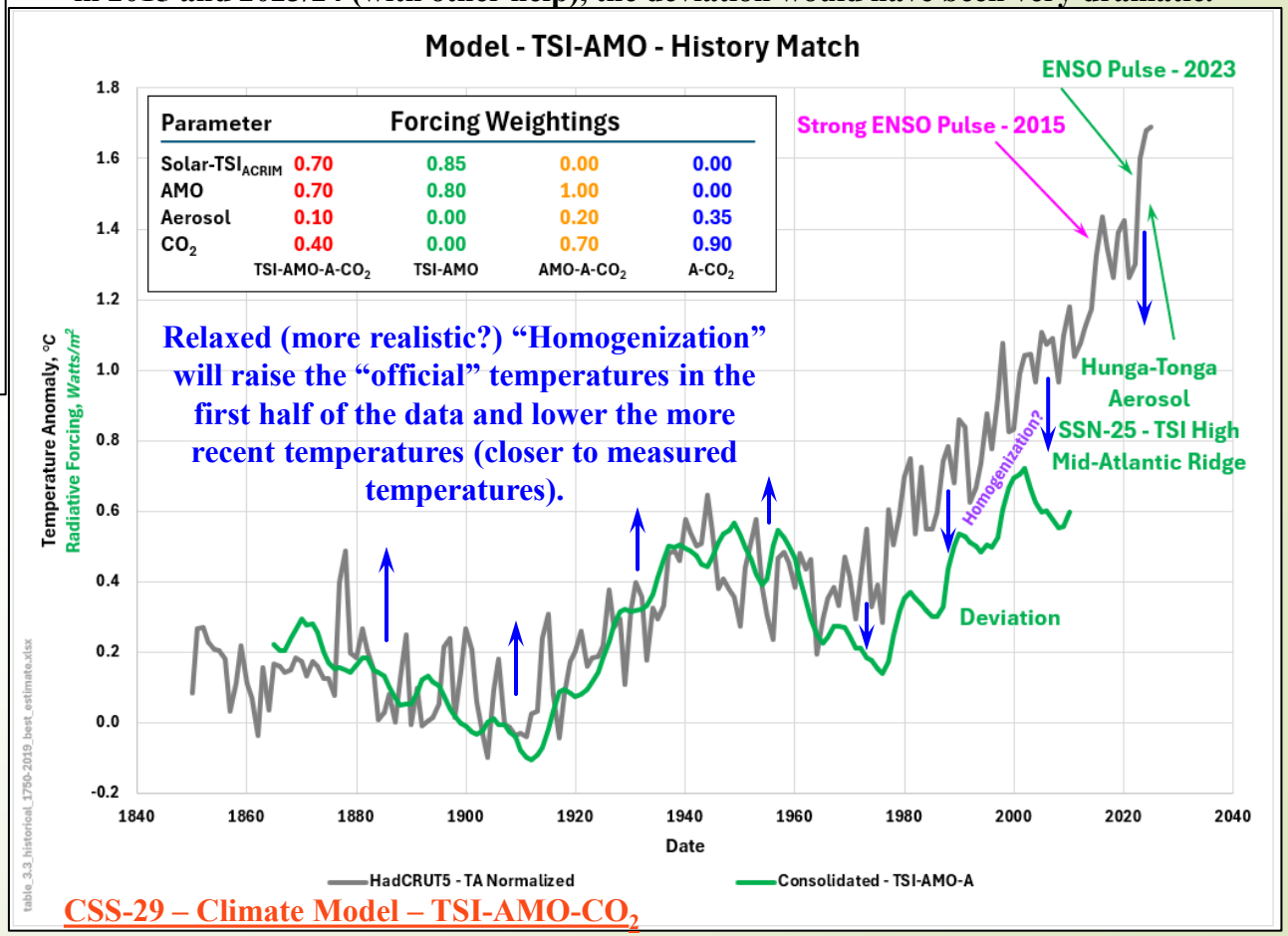
More Detail: climatechangeandmusic.com



# IPCC M-T Shortcomings – Just A-$CO_2$ & TSI-AMO

We are working towards showing that adding in ocean cycles (limited to just the AMO in this post) and substituting out the IPCC's cherry-picked Matthes et al 2017 TSI reconstructions for an average of 6 other TSI reconstructions (ACRIM-6) can be used to closely history match the Modern Temperature Record (HadCRUT5). The plot to the left shows the history match using just the IPCC's aerosol forcings and $CO_2$ (a very similar match to the Total Anthropogenic and Total forcing matches shown earlier). The general correlation is reasonable, but the correlation disappears for the entire pre-1850 Holocene (slide CSS-71p). Realistically the best correlation occurs from 1975 to 2005. The infamous 'PAUSE' began at the turn of the century and if not for the strong ENSO warming pulses in 2015 and 2023/24 (with other help), the deviation would have been very dramatic.




CSS-29 – Climate Model – TSI-AMO-$CO_2$

**M-T : SC**
**Just TSI-AMO**
**Just A-$CO_2$**

The All $CO_2$, All the Time narrative does not begin to explain all the climate change that happens from 1850 to the present, let alone prior to 1850. But neither does just TSI and the AMO on their own. I will include a clarifier here. The HadCRUT5 Temperature Anomaly data has been homogenized (in my opinion over-homogenized). Homogenization typically reduces historical temperatures and elevates more recent temperatures (exaggerating the temperature rise). With a more moderate (and realistic) homogenization, the post-1970 temperature and the TSI-AMO radiative forcings would come into line. Examples of those correlations have been included in the Connolly, Soon et al papers referenced on the previous slides. They still have some post-2000 deviation but those can be largely explained with ocean influence. I have shown that the MTR could be history matched with just TSI and AMO in my Open Letter Addendum and my OPS-8 – Basic Climate Model posts. I expanded that model out to include $CO_2$ (ECS = 0.8 °C) and applied the model to Central England Temps.

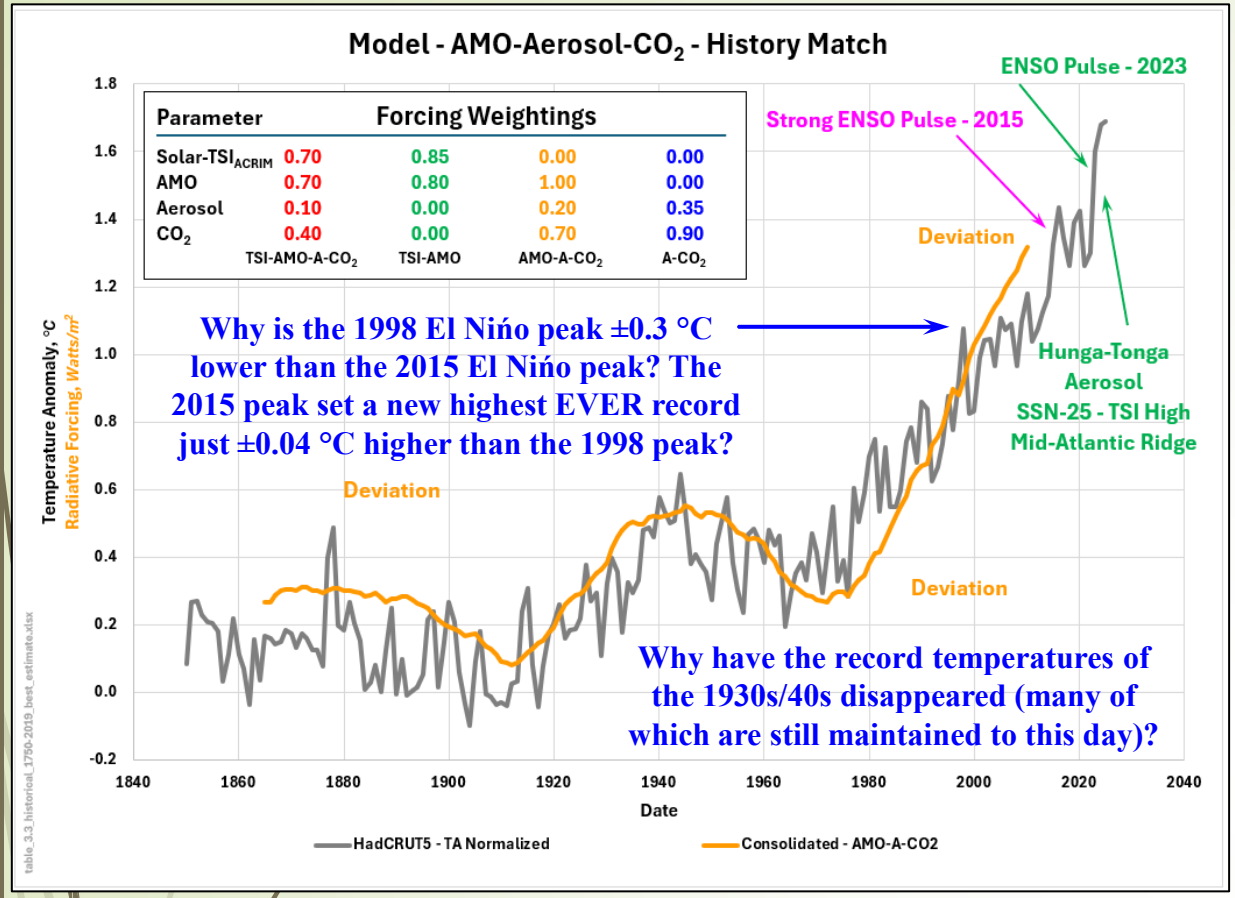
More Detail: climatechangeandmusic.com

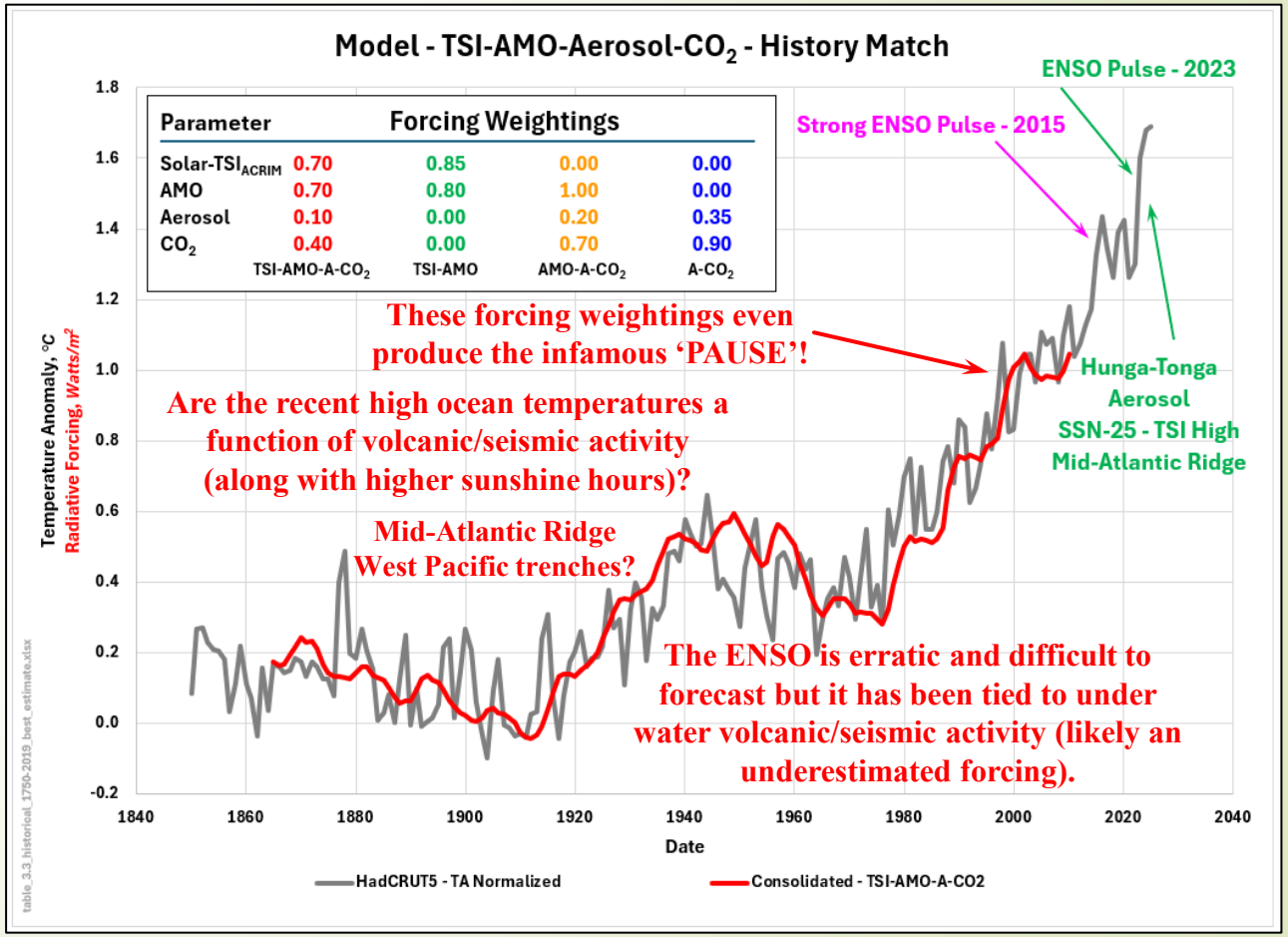


# IPCC M-T Shortcomings
# AMO-A-$CO_2$ & TSI-AMO-A-$CO_2$

**Adding the AMO to the A-$CO_2$ consolidation adds in some of the cyclicity that is missing with just an aerosol and $CO_2$ forcing history match. With the AMO included, the history match does tighten up substantially but still has noticeable deviations from the general HadCRUT5 temperature trends. As an aside, I do wonder if these history match exercises are meaningful given the lack of truly representative temperature data sets. There is a serious lack of weather recording stations in the first half of the period and a lot of ghost stations (no measurements, just estimates) in the recent half. Layer on the "homogenization" that appears to be programmed to fit the alarmist narrative and you must question the legitimacy just a little. What exactly are we history matching? But we (not the IPCC and the alarmist community) must work with what we have. The IPCC et al do not want to work with solar activity and ocean/atmospheric cycles/interactions. Not surprising given their mandate to focus on anthropogenic forcings/influences. They routinely reinforce they are a political, not a scientific organization. What happens when you include ocean cycles or consider alternatives to the one cherry-picked TSI used by the IPCC? You can easily produce a far better history match than the one that falls out of the IPCC's "best estimates" radiative forcing. There is still room to add in other forcings that tighten up the match even further. For example, the El Niño Southern Oscillation (ENSO) is also active throughout this period (although muted due to homogenization). The recent strong ENSO warming pulses are having far more impact than the minor $CO_2$ increases since the 'PAUSE'. Solar activity also peaked around 2015 and 2023/24. It's not just $CO_2$!**

**M-T : SC**
**TSI-AMO-A-$CO_2$**
**AMO-A-$CO_2$**



# IPCC Model-Theory Shortcomings – Solar+ & Total Anthropogenic

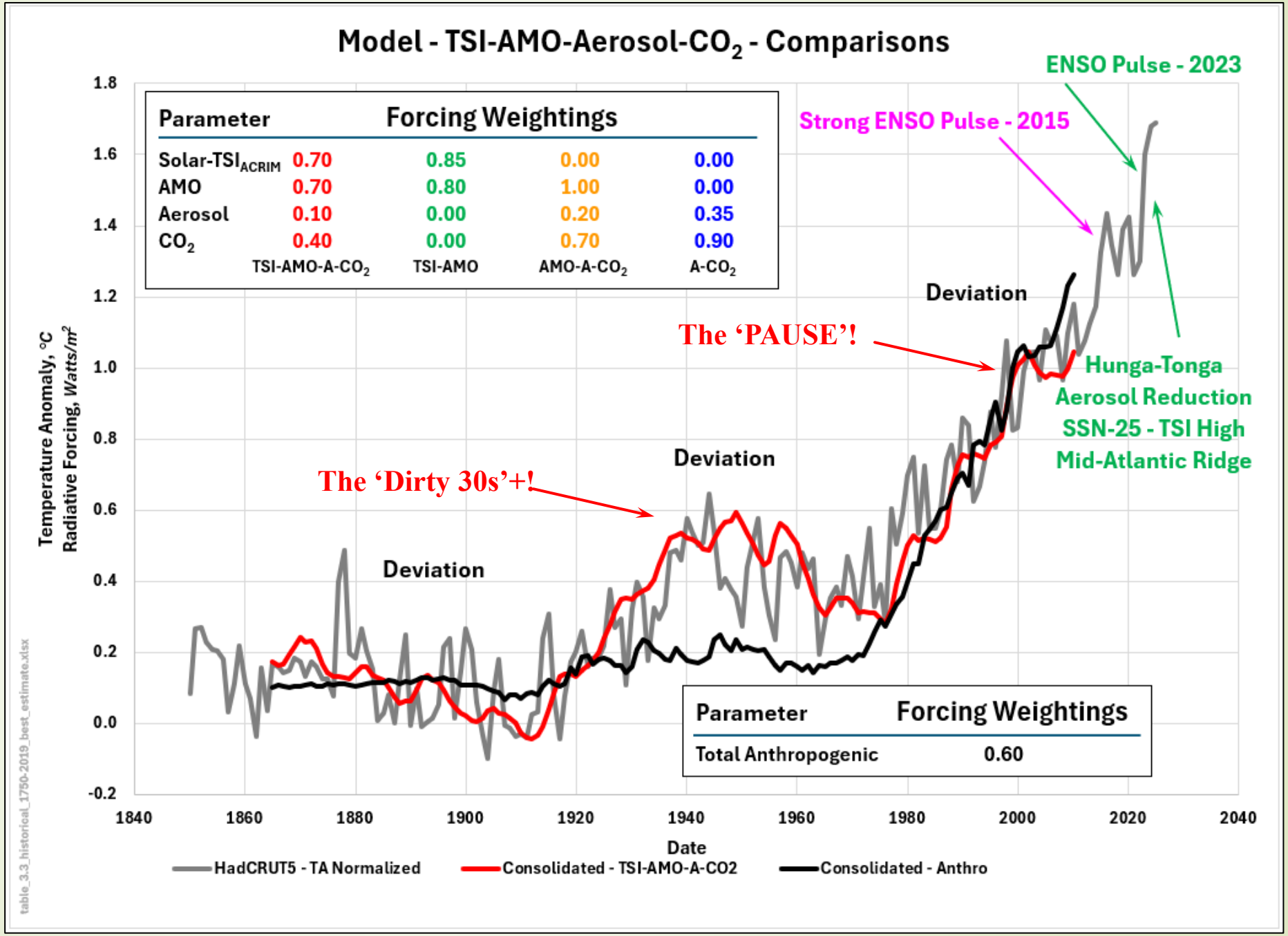


More Detail: climatechangeandmusic.com



Just to close out this section of the discussion, what history match looks better, the IPCC's Total Anthropogenic radiative forcing or the TSI-AMO-Aerosol and $CO_2$ consolidation (weighted to natural not anthropogenic parameters)? Given the anthropogenic bias in the IPCC programming, the IPCC's Total Radiative Forcing curve looks very similar to their Total Anthropogenic Forcing curve (as shown on slide CSS-71b). The two history matches are very similar and correlate well from 1975 to 2005. That is the only similarity between the two curves. Begs the question how much does each parameter contribute to that temperature rise? The Solar+ RF consolidation reflects the temperature decline from 1850 to 1910, the IPCC "best estimates" do not. They are essentially flat. The Solar+ RF consolidation reflects the 1910 to 1945 temperature rise (similar to 1975 to 2005, with very different $CO_2$ contributions), the IPCC "best estimates" do not. The Solar+ RF consolidation reflects the temperature decline from 1945 to 1975, the IPCC "best estimates" do not. The Solar+ RF and IPCC Total Anthropogenic matches began deviating with one another around the turn of the century. That deviation will likely widen as the AMO, and solar activity take temperatures lower over the next few decades, despite continually rising atmospheric $CO_2$ levels.

**M-T : SC Anthropogenic Solar+**

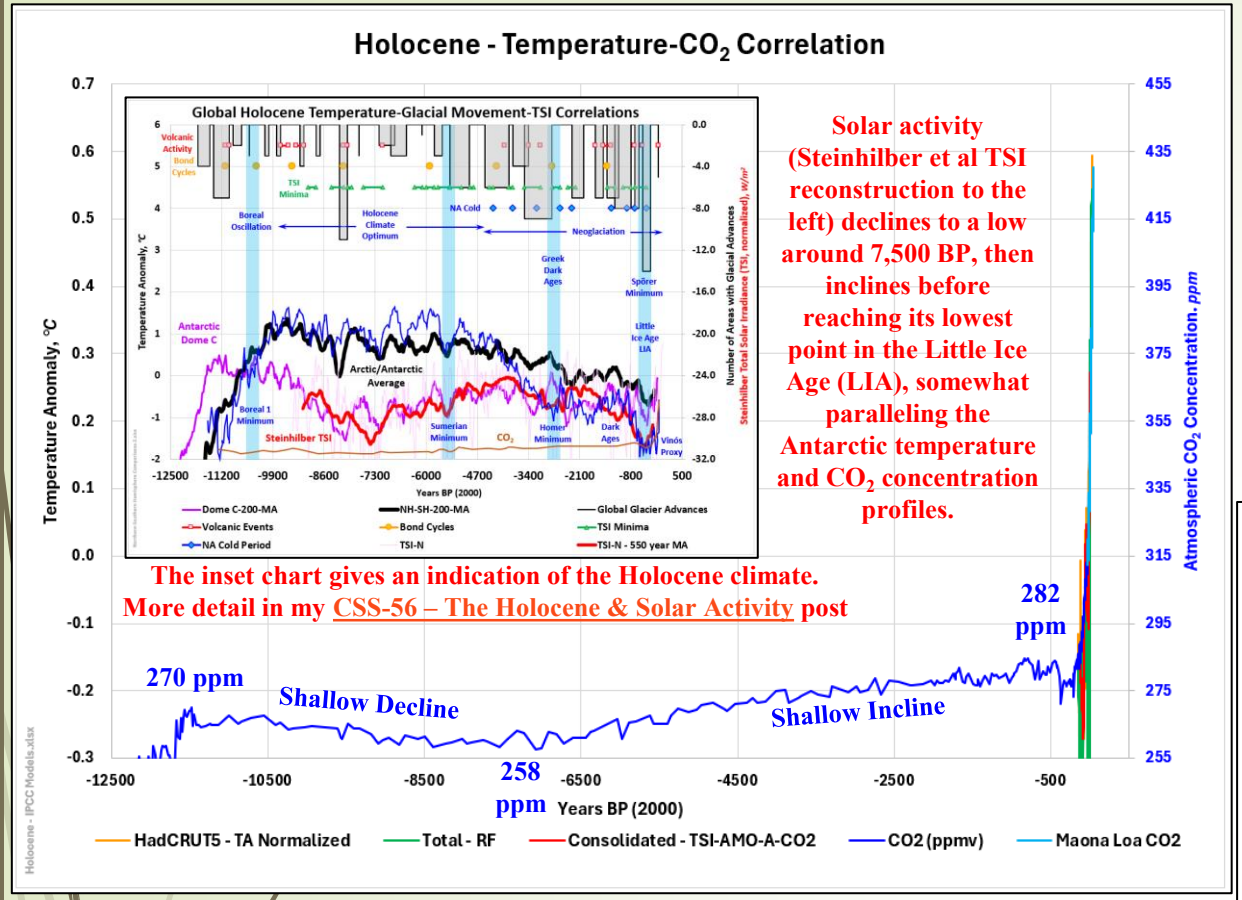


More Detail: climatechangeandmusic.com



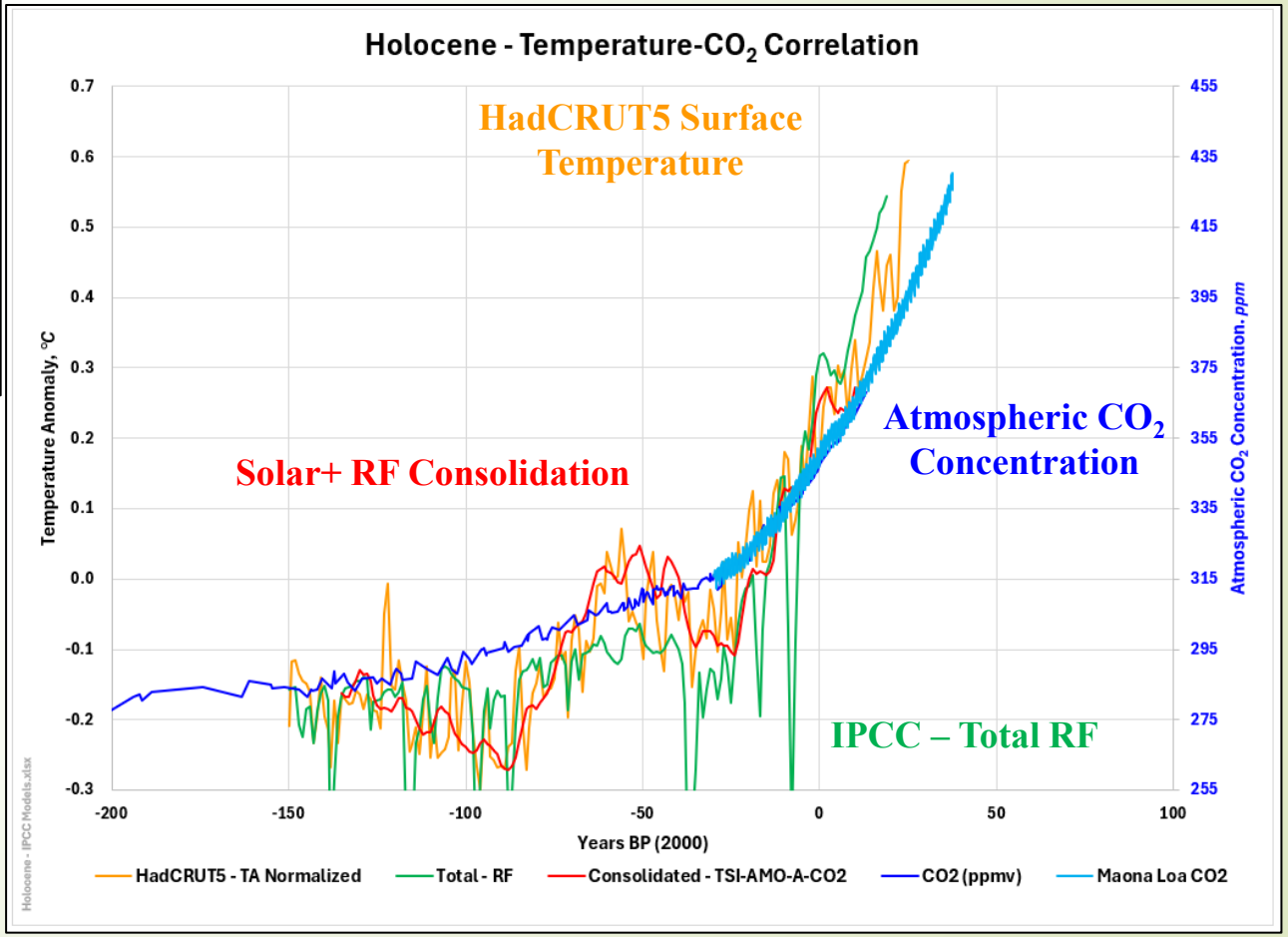
# IPCC M-T Shortcomings
# MTR to Holocene Correlations

None of the IPCC's $CO_2$ (alone), Total Anthropogenic, or Total Radiative forcings history match the Modern Temperature that well. Sure, there is a general correlation, but there is lots of room for improvement. The Solar+ RF consolidation is noticeably superior (as shown in the previous plots and/or below). But for those that are unaware, history existed prior to 1850. What was going on with $CO_2$ concentrations, and temperatures/climate prior to our very recent history (175 years, not quite six data points in a 'climate change' discussion). For simplicity, we will keep the discussion to the Holocene interglacial warm period (which allowed humanity to develop and reach our current state of technology).



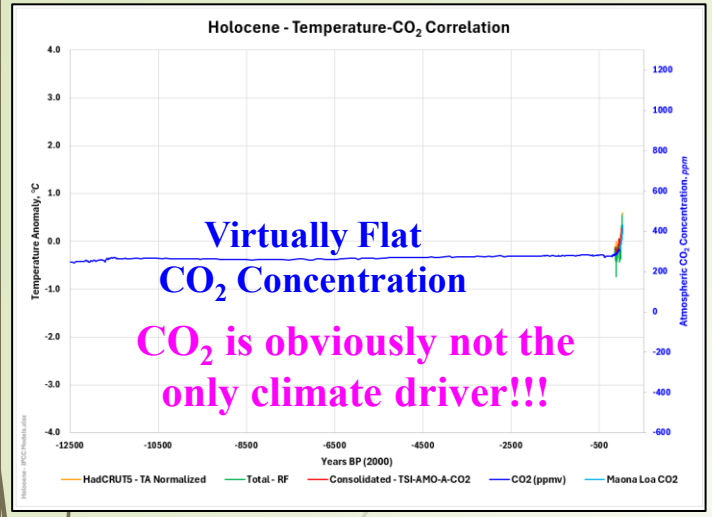

## M-T : SC MTR-Holocene Correlations

Over the last 12,000+ years, Holocene $CO_2$ concentrations hit a low of roughly 258 ppm, before slowly recovering to 282 ppm in 1850. $CO_2$ concentrations began accelerating producing the sharp rise shown above. These plots are the same data, just plotted over different periods. Both plots honour the All $CO_2$, All the Time alarmist narrative that GHG (primarily $CO_2$) emissions are responsible for the 1.07 °C warming (based on the IPCC's 2021 AR6 report) since the pre-industrial era (pre-1850). This is a $CO_2$ chart that the alarmist community loves to publish. Mother Nature was in blissful equilibrium until those horrible humans came along and started using "fossil fuels" leading to sky rocketing $CO_2$ concentrations and catastrophic temperature rise. But there is a little bit more to Mother Nature than just $CO_2$ (one of three molecules ($H_2O$ and $O_2$ being the other two) that are absolutely essential to life on this planet). That 'huge' increase (±140 ppm) is only a 0.014% change in atmospheric concentration. On its own the above chart is meaningless in a 'climate change' discussion.



# IPCC M-T Shortcomings – Holocene Correlations






The chart above is the same data shown on the previous slide and still honours the alarmist narrative (140 ppm = 1.07 °C). The $CO_2$ vertical scale has been compressed so that the 1.07 °C increase can be visualized against the historical temperatures over the Holocene (to the right). The MTR 1.07 °C temperature rise (regardless of why) is not unusual, unprecedented, or dangerous. $CO_2$ is virtually flat, yet temperatures fluctuate significantly throughout the Holocene (in both hemispheres). Obviously, there are natural forcings (NO $CO_2$!) causing those fluctuations. Those natural forcings were still active during the MTR temperature rise and will still be active in the future (just not in the models as shown in this post). The general profiles reflect the longer-term Milankovitch cycles, but the shorter-term fluctuations are solar and/or oceanic/atmospheric cycle interactions (again NOT $CO_2$). The IPCC models are useless for modelling the Holocene (past or future)!!!

**M-T : SC Holocene Correlations**