

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

CSS-12a Cosmic Ray Flux and Solar Activity – CAGW’s Mistresses

More detail? climatechangeandmusic.com

Following the “Climate Change” story in the mainstream media shows just how married to Anthropogenic Global Warming (i.e.: CO₂) the political, academic and media establishment are. They focus almost exclusively on their long term relationship with CO₂. Not surprisingly, they never want to discuss the other “Climate Change” relationships in their lives. To do so would ruin the idyllic fantasy world they have set up for themselves. Solar Activity and Cosmic Ray Flux are homewreckers and they (the Catastrophic Anthropogenic Global Warming (CAGW) alarmists) know it.

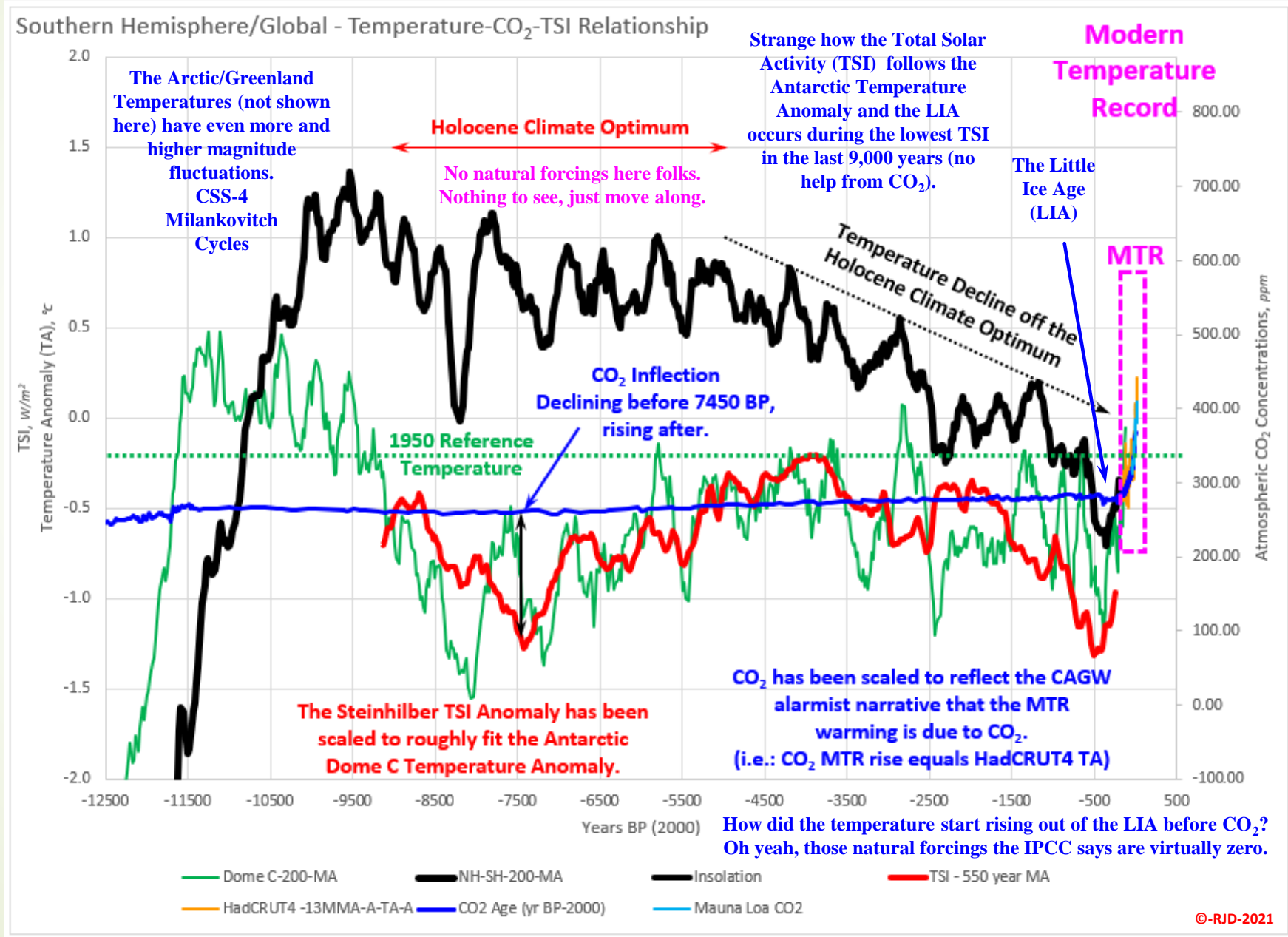
The simplistic and unscientific viewpoint that CO₂ is the only significant climate driver would be laughable if it was not so dangerous. There is no empirical Temperature/CO₂ data showing CO₂ driving the climate on any statistically significant historical time scale. No empirical data, no scientific proof. This CSS will go through the historical data showing the relationships that Temperature has with Solar Activity and Cosmic Ray Flux. Those relationships exist on many different time scales and the CAGW alarmist crowd ignores them all by focusing on the Modern Temperature Record (MTR, 1850 to the present).

CO₂ is not a Significant Climate Driver

The Computer Models have essentially set the natural forcings to zero (OPS-22 – Computer Models – Real Simple). Does the data justify the IPCC’s natural forcing assumption? No!!!

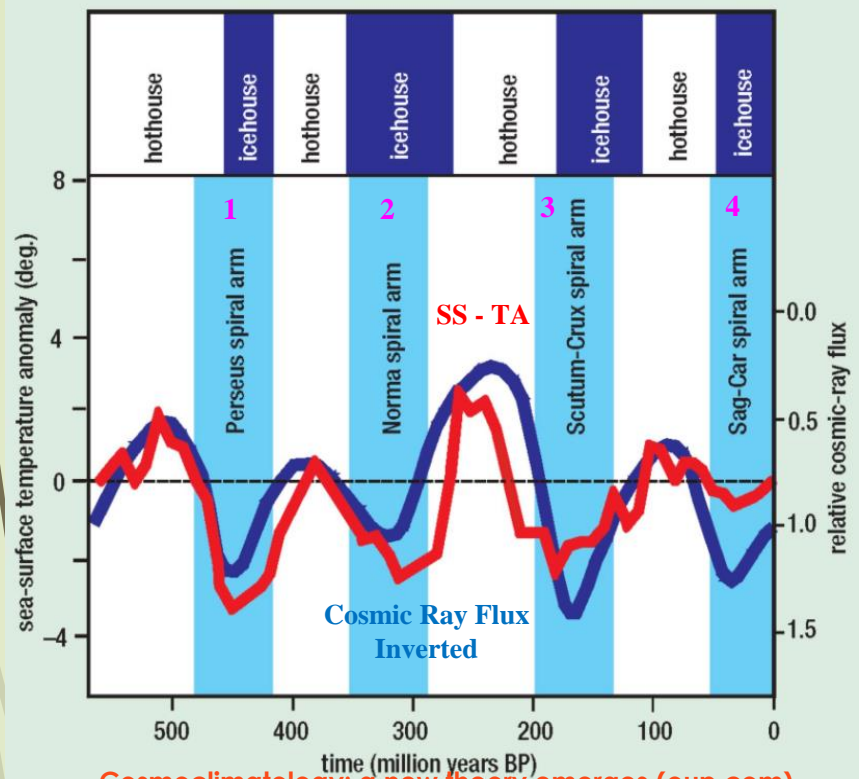
This slide starts things off by showing just how ridiculous the concept of CO₂ being the only significant climate driver really is. CO₂ has been plotted on a scale that reflects that CAGW alarmist narrative. Through the entire Holocene, CO₂ was essentially flat. All of those Holocene temperature fluctuations are caused by natural (i.e.: direct solar and indirect solar (ocean cycles, cosmic ray flux, etc.) forcings). Those natural forcings have not been turned off just because the IPCC computer modellers have decreed it to be so.

Cosmic Ray Flux (CRF) is primarily a function of Solar Activity on time scales that affect our lives. When the solar winds are strong, cosmic ray flux is low and vice versa. High cosmic ray flux cools the planet by stimulating additional low cloud cover. As we move further into the Grand Solar Minimum (GSM) and solar winds are weakening, the CRF will rise and global temperatures will fall. GSMs have not been kind to human life!



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

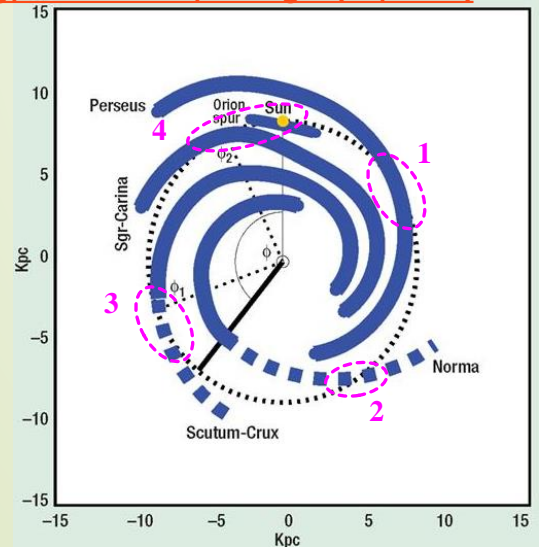
CSS-12b Phanerozoic – Cosmic Ray Flux



Cosmoclimate: a new theory emerges (oup.com)

Phanerozoic Cosmic Ray Flux

The solar system/earth are moving in and out of the Milky Way Galaxy's spiral arms and can be above or below (or within) the galaxy plane as well. All conditions that affect the Cosmic Ray Flux.



[Henrik Svensmark The Cloud Mystery](#)

The Cosmic Ray Flux effects are noticeable on a variety of historical time scales. Looking back over the Phanerozoic is probably the best place to start. Over that 500 million plus year period, life has been abundant but subject to many global catastrophes. This discussion will focus on the deep ice ages and their relationship to Cosmic Ray Flux. Effectively, as the earth moves in and out of the Milky Way Galaxy's spiral arms, temperatures appear to move up and down (inversely) with the Cosmic Ray Flux. When the earth is within the spiral arms, Cosmic Ray Flux is high and ice ages/colder periods are initiated as shown in the plots on either side of this discussion. Generally, the earth passes through a spiral arm every 150 million years and they last for tens of millions of years. The Ordovician/Silurian Period (#1) corresponds to the Perseus Spiral Arm. This was a deep cold period but relatively short. The latest Scotese 2021 Phanerozoic temperature estimates are included on the following page for more context. The Permian Ice Age (#2, around 300 million years ago) was a much more pronounced cold period. That ice age was deep and long and lined up with our transit through the Norma Spiral Arm. The high Super Novae (SN) rates (to the right) are directly associated with the Permian cold. The next spiral arm transit was through the Scutum-Crux Arm (#3). The response here was muted when compared to the other ice age periods. However, the periods around 150 million years ago were subjected to some brief periods of cold. Our solar system may have been above or below the galactic plane during this transit (which would have tempered the Cosmic Ray Flux). We are currently transiting the Sagittarius-Carina Spiral Arm (#4). And yes, we are in a deep ice age (despite our geologically brief interglacial warm period, the Holocene). There are no indications that we will be leaving the Pleistocene Ice Age anytime soon. And no, CO₂ will not miraculously save us or our descendants from that fate. The natural forcings mentioned on the previous slide are much stronger than the CO₂ forcing. Refer to CSS-7 – CO₂ – The FECKLESS GreenHouse Gas and CSS-10 – A Ride through the Cenozoic.

More detail? [climatechangeandmusic.com/1210.2963.pdf \(arxiv.org\)](https://climatechangeandmusic.com/1210.2963.pdf) ©-RJD-2021

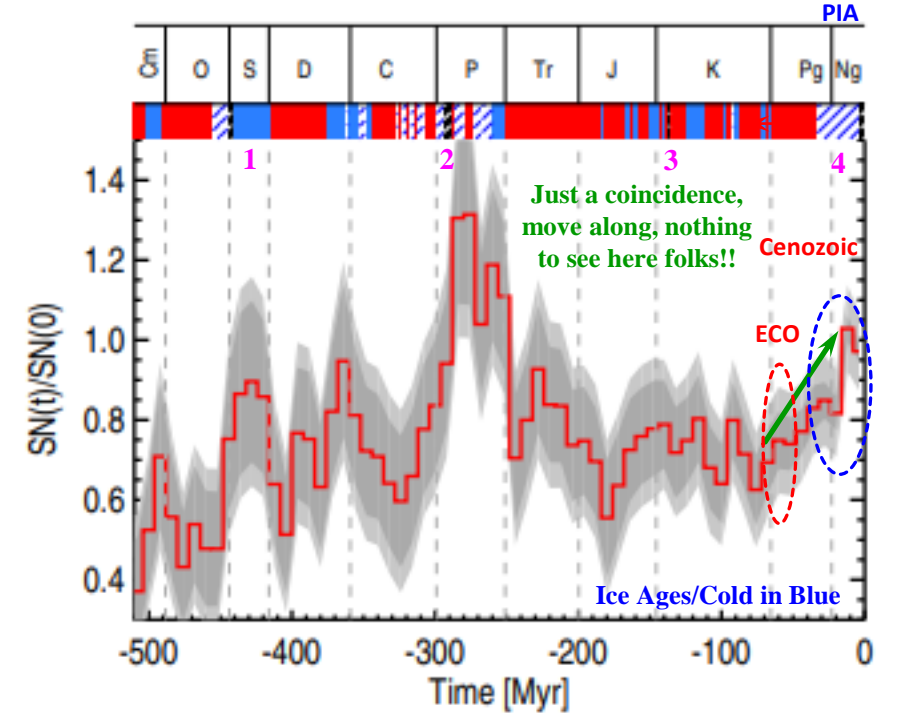


Figure 17. Variations in SN rates during the past 500 Myr (red curve) together with a $\pm 1-\sigma$ uncertainty (dark grey band) and $\pm 1-\sigma$ uncertainty including Poisson noise (light grey band). The vertical dashed lines are the separation between geological periods. The coloured band indicates climatic periods as given in Table 3: warm periods (red), cold periods (blue), glacial periods (white and blue hatched bars), and finally peak glaciations (black and white hatched bars). Notice the correspondence between high SN activity and cold/glacial climate. Abbreviations for geological periods are: Cm, Cambrian; O, Ordovician; S, Silurian; D, Devonian; C, Carboniferous; P, Permian; Tr, Triassic; J, Jurassic; K, Cretaceous; Pg, Palaeogene; Ng, Neogene. Plot starts at -510 Myr.

Eocene Climate Optimum (ECO), a low cosmic ray flux
Pleistocene Ice Age (PIA), a high cosmic ray flux

Cosmic Ray Flux generally increasing over the Cenozoic, more Cosmic Rays, more cloud cover, more cooling/glaciation.

[PDF] [The Sun's Role in Climate Change | Semantic Scholar](#)

CSS-12c Phanerozoic Data Analysis

This slide was included to add to the discussion on the previous slide. I was able to find the updated electronic data sets for both the GEOCARB ([GEOCARBSULF \(2005\)](#)) and Scotese Temperature ([Scotese \(2021\)](#)) and no longer have to rely on screenshots from the internet for this time period. I had been using GEOCARB III and a temperature image from [Dr. Scotese's website](#). The cosmic ray flux (CRF) from Svensmark's work was overlain above the Phanerozoic Temperature/CO₂ plot showing the correlation between CRF and Temperature. Note that CRF correlates much better to temperature than the CO₂ levels. The Permian Ice Age (during the Norma Spiral Arm transit) is the most prominent cold period. Followed by our current Sagittarius Spiral Arm transit (the Pleistocene Ice Age). The late Ordovician/Silurian Ice Age is very noticeable but the deep ice age duration was relatively short. The temperature and CRF fluctuations both stayed within some relatively tight ranges (not too hot or too cold after the deep ice age recovery, consistent with the relatively minor CRF fluctuations). That tight range carried right through the trip between Perseus and Norma. The Scutum-Crux Spiral Arm was relatively uneventful with respect to major cooling, but there was some visible minor cooling.

As mentioned on the previous slide, our solar system may have been above or below the galactic plane for this Spiral Arm transit (limiting the CRF magnitudes). This same situation may have applied to the Perseus Spiral Arm transit (just to a lesser extent). The data does show that CO₂ reached its lows before temperature, but those lows occurred many millions of years before the temperature. If you believe that CO₂ is responsible for the low ice age temperatures you also have to believe that the lag is millions of years.

Temperature Cosmic Ray Flux and CO₂

If the lag is millions of years, CO₂ is not a problem, let alone a "Climate Emergency".

Cosmic Rays increase when the earth passes through the spiral arms (more stars), initiating the big ice ages (1, 2, 3 and 4 in these figures) roughly every 150 million years. CO₂ is obviously not controlling the temperatures during the Phanerozoic. As with every other time scale, CO₂ may be affecting the temperature but natural forces dominate and hide any CO₂ effect.

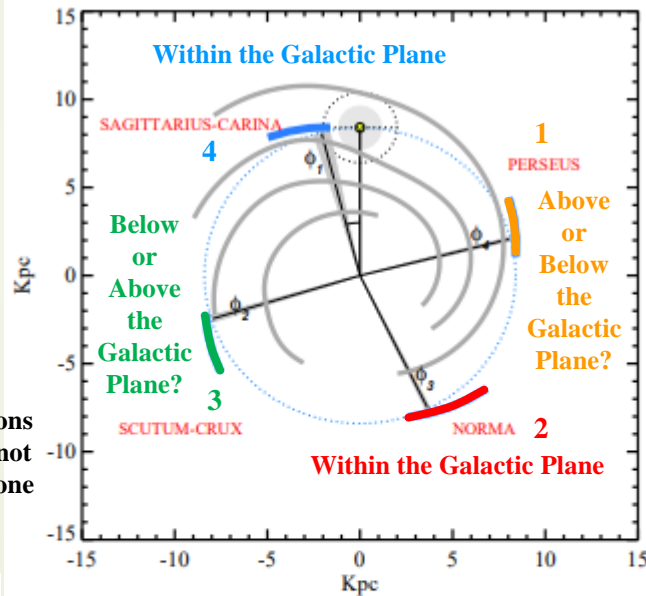
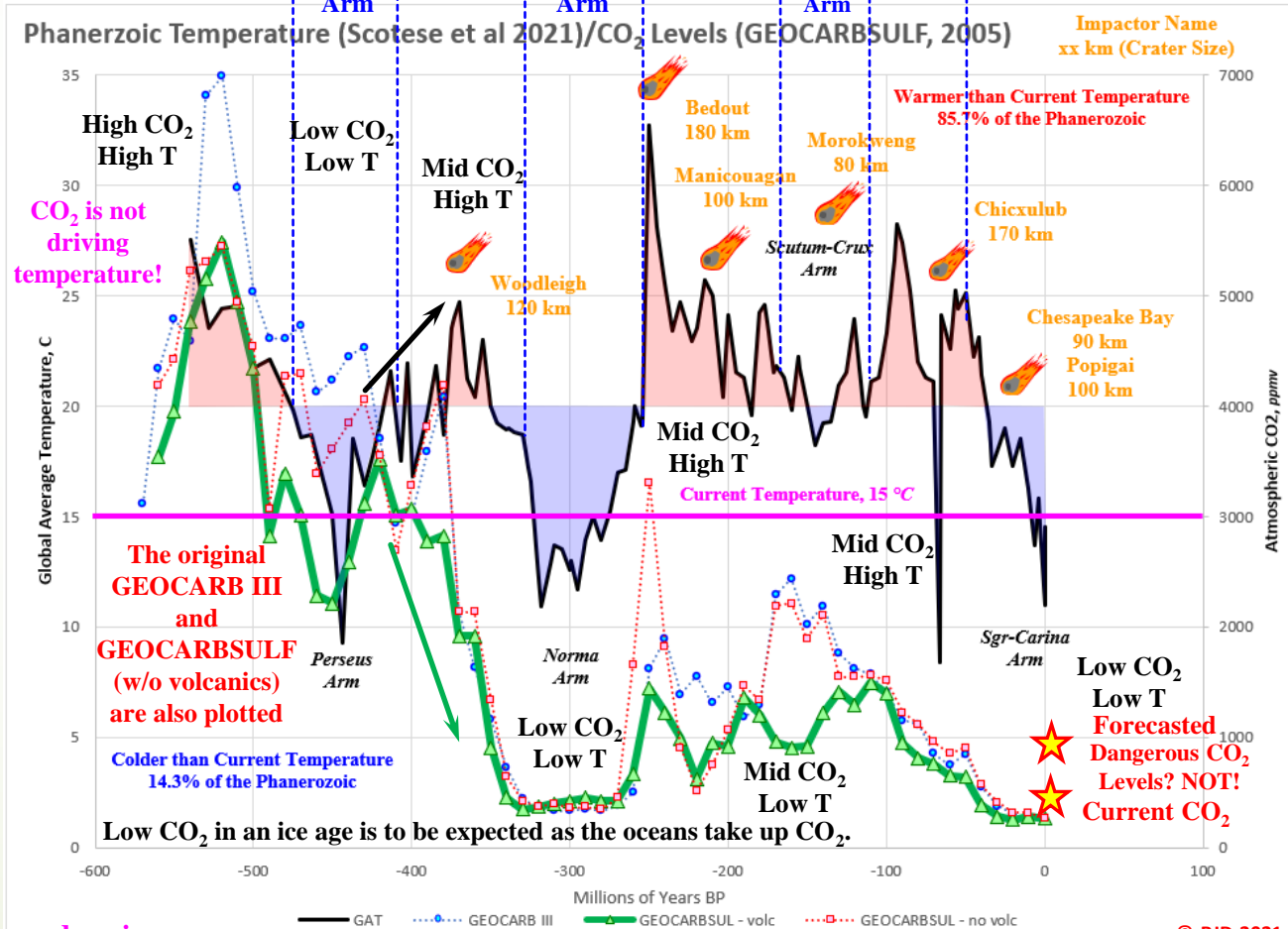
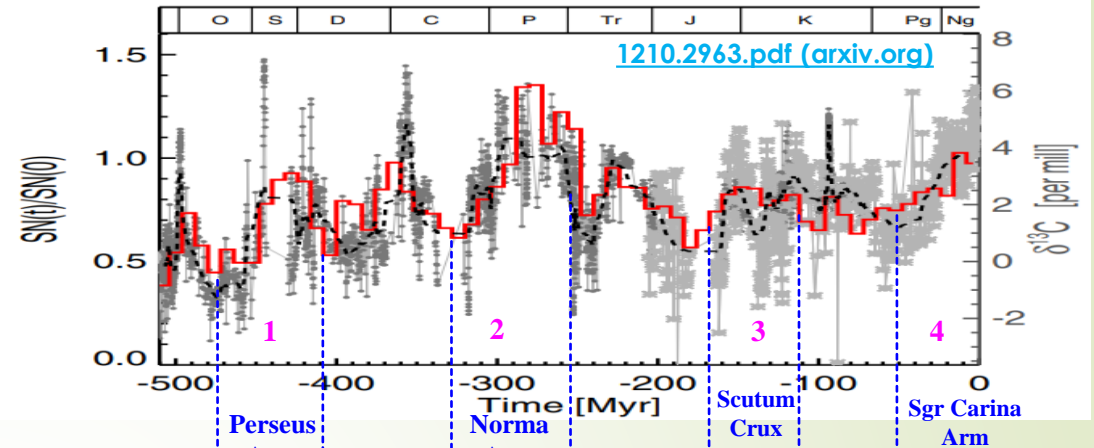


Figure 5. Overview of the Milky Way. The known parts of the spiral arms are shown as the grey lines (Taylor & Cordes 1993). The Solar System is represented by the small yellow circle, surrounded by a grey area denoting the solar neighbourhood out to a distance of 1 kiloparsec (kpc). The two thin dotted semi-circles around the Solar System are the areas used to compare the star formation histories inside and outside the solar circle, which is shown as a blue dotted line of radius 8.5 kpc from the Galactic centre. The blue curves and the angles ϕ_i are the zones and positions where the Solar System encountered the maximum SN rates in front of the spiral arms (see Sect. 3). The narrow grey segments show the estimated uncertainties in the maximum SN positions.

More detail? climatechangeandmusic.com

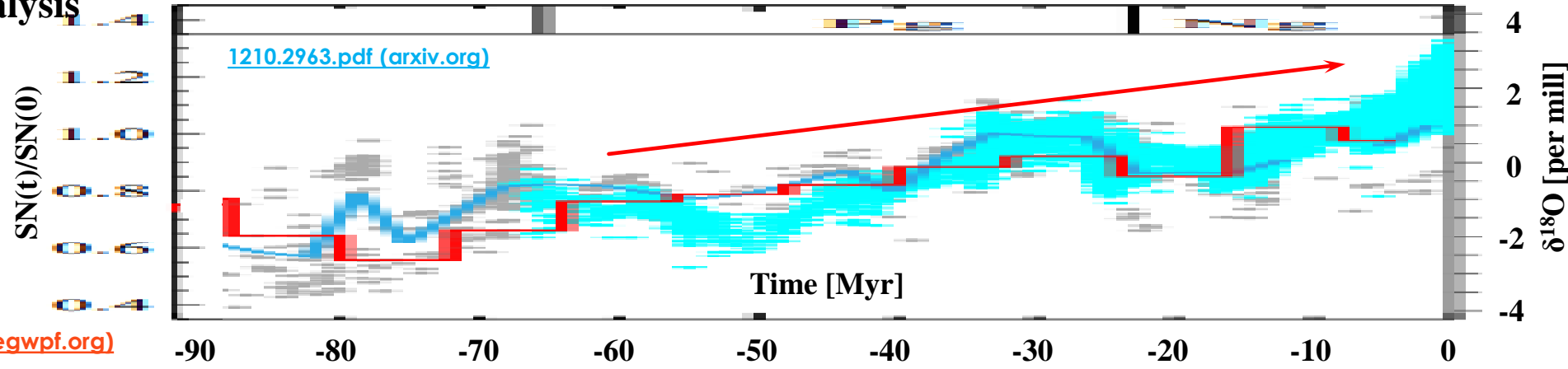


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Cenozoic Data Analysis

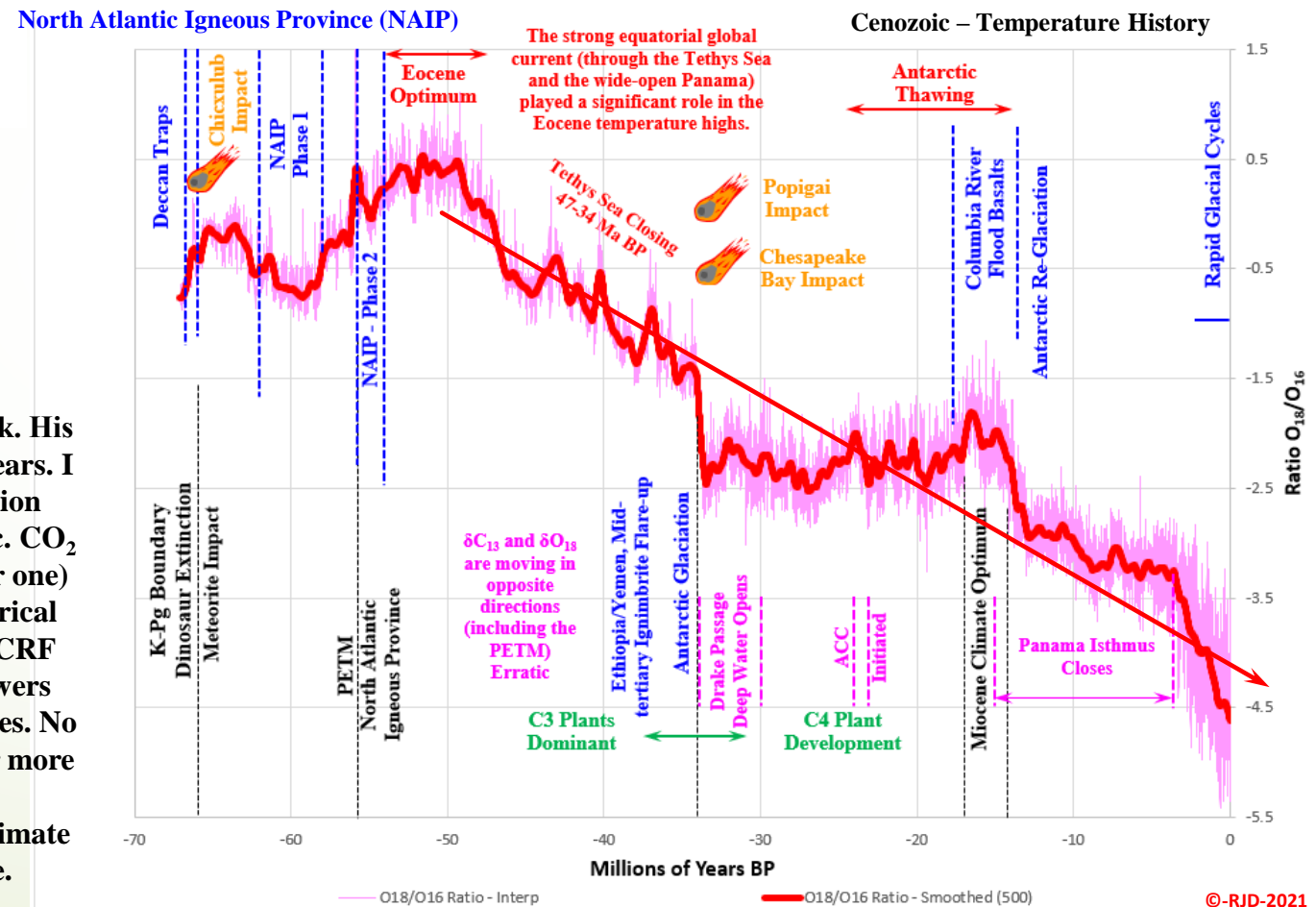
Figure 18. Measurements of $\delta^{18}\text{O}$ over the last 200 Myr (coloured points) compared with SN history over the same period (red curve). Light blue data points are from Zachos et al. (2001) and grey circles are from Prokoph et al. (2008). The dark blue curve is an average of the grey points. The light blue points are offset by -2.5 per mil relative to the grey data to take account of the provenance of the data from deeper water.



[SvensmarkSolar2019-1.pdf \(thegwpf.org\)](#)

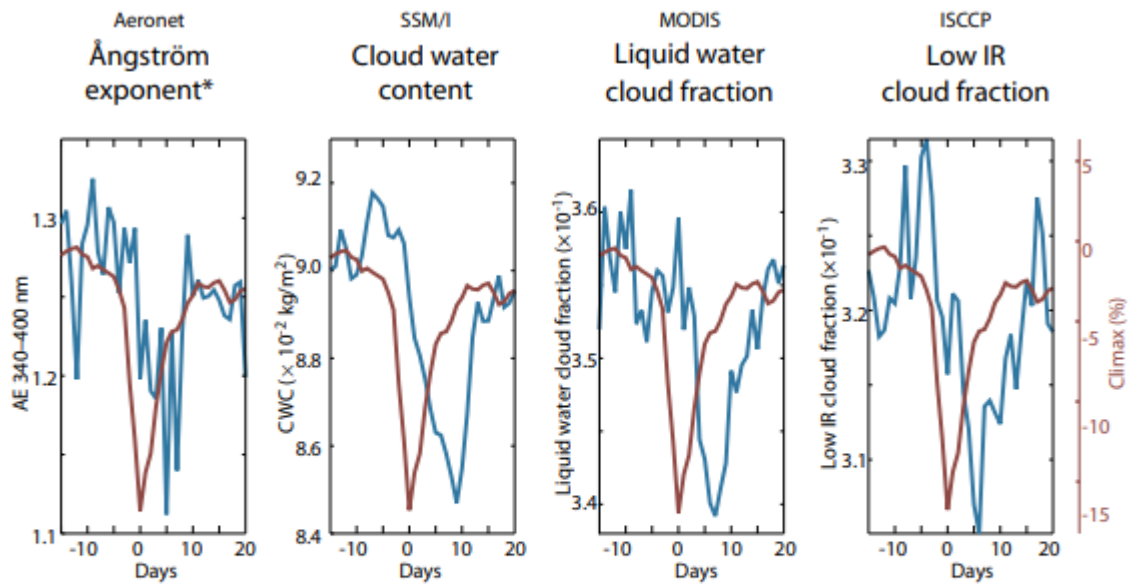
This slide focuses in on the Cenozoic time period. The Super Novae (SN) rate is indicative of the Cosmic Ray Flux (CRF). Throughout the Cenozoic, the CRF (i.e.: SN rates) was generally increasing as the global temperature dropped (as measured by the $\delta^{18}\text{O}$ (Oxygen Isotope Ratio ($\text{O}_{18}/\text{O}_{16}$))). The charts and the discussion are included to emphasize the underlying downward pressure on global temperatures by our transit through the Sagittarius-Carina Spiral Arm. The full Cenozoic climate story involves a whole lot more major and minor events (many of them highlighted on the chart to the right). I laid out a more detailed Cenozoic story in my recent post, CSS-10 – A Ride Through The Cenozoic.

The chart above comes from Henrik Svensmark’s work. His original plot (Figure 18) covered the last 200 million years. I cut and pasted the chart to show just the last 90 million years to fit on the page and fit better with the Cenozoic. CO_2 levels are not plotted here, but their role (a very minor one) is discussed in detail in CSS-10. There is a lot of historical data showing the relationship between solar activity/CRF and the global temperature. The mechanism that powers that relationship will be discussed in the upcoming slides. No correlations are perfect but Solar Activity/CRF are far more important than CO_2 , since there is no empirical Temperature/ CO_2 data set showing CO_2 driving the climate on any statistically significant historical time scale.



Temperature Cosmic Ray Flux

More detail?
climatechangeandmusic.com



— Extent of Forbush decrease — Cloud parameter response

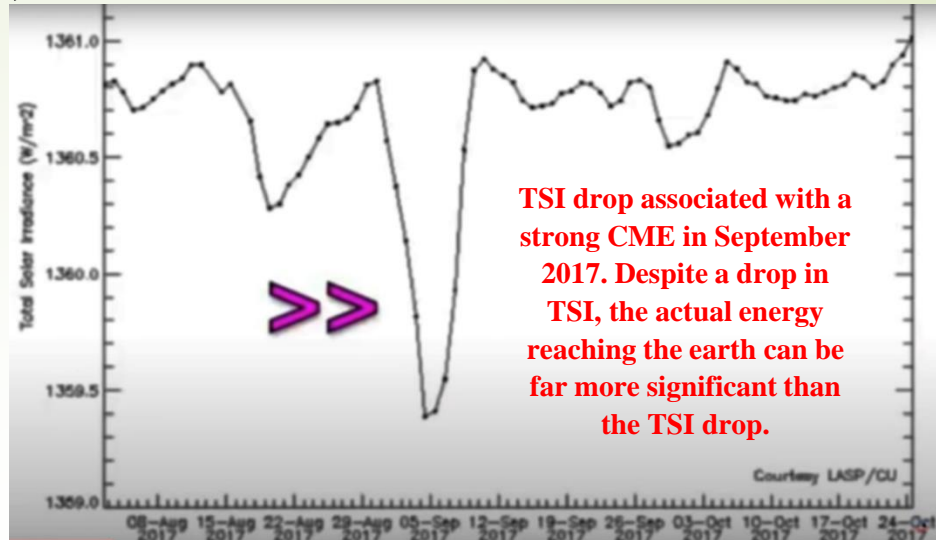
[SvensmarkSolar2019-1.pdf \(thegwfpf.org\)](#)

Figure 14: Changes in cloud parameters before and after Forbush decreases.

Changes in daily averages, averaged over the five strongest events between 1990 and 2005.⁵⁹

The data shows that reductions in the cosmic ray flux translate into changes in cloud properties.

*The Ångström exponent measures the density of aerosols in the atmosphere.



TSI drop associated with a strong CME in September 2017. Despite a drop in TSI, the actual energy reaching the earth can be far more significant than the TSI drop.

ignored. That is a significant issue that the alarmist community has chosen to ignore. Historically, the computer models were physically limited to just the TSI (CMIP5 Protocol). The computer protocol was recently upgraded to CMIP6, which added in the solar forcing associated with Cosmic Rays (to be discussed shortly) and high energy Particles. As an aside, the MTR was modelled accurately during beta testing without any CO₂ contribution (think about that for a minute). But all you alarmists can relax, the programmers are still capable of turning the new solar forcings down (or off). Not surprisingly, that is exactly what happened (i.e.: no sense messing with a good narrative). The IPCC uses a natural forcing of roughly 0.05 W/m² (OPS-22 – Computer Models – Real Simple), effectively ignoring direct solar activity and its indirect influences (cosmic rays, ocean cycles, etc.).

Forbush Decreases are a sharp drop in cosmic ray intensity associated with an increase in solar activity due to an event like a Coronal Mass Ejection. (CME). The chart directly to the left (Figure 2) shows the TSI effect from the September 2017 CME (a drop of roughly 1.4 W/m², twice the simple math rise from 1750 to 2011, 0.7 W/m²). That TSI drop would be recognized by the computer models, but the 1,000 times increase in X-ray energy and the 10,000 times increase in high energy particles would be

Forbush Decreases

The plot directly to the right shows the (CERN) laboratory tests that confirmed Cosmic Rays can initiate aerosol nuclei growth and ultimately cloud growth.

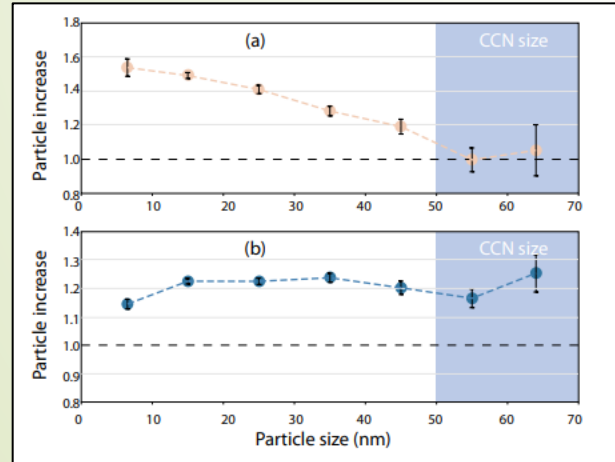
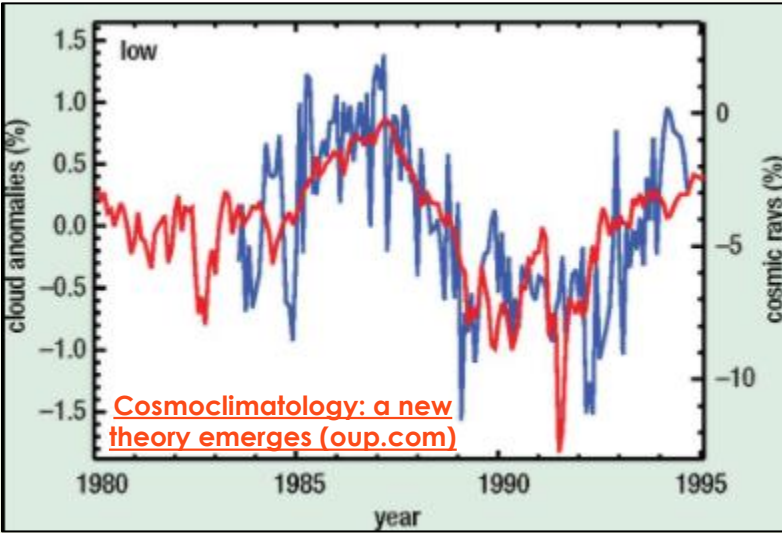
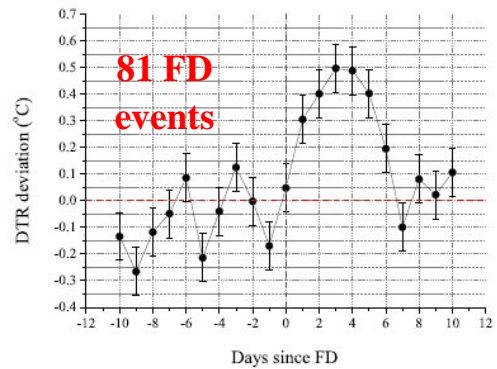
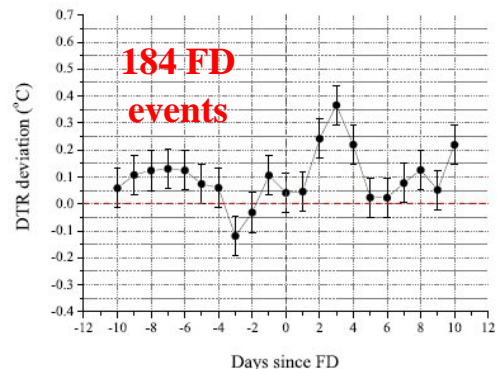


Figure 13: Experimental test of aerosol growth into CCN. (a) Without ionisation; (b) with ionisation. Adapted from Svensmark (2012).⁵⁷



When the sun spits out a CME, the solar wind's speed and density increase, and the Cosmic Ray Flux (CRF) decreases because fewer cosmic rays enter the atmosphere (upper left). Cloud cover in turn decreases in response to the CRF decrease allowing more solar energy into the earth's climate system. So, what happens in the opposite scenario where the sun goes into a prolonged period of lower solar activity (i.e.: can you say Grand Solar Minimum (GSM))? Well, the solar wind strength goes down allowing more cosmic rays to enter the earth's atmosphere. Those cosmic rays create more low-level cloud cover and subsequently reduce the global temperatures. Some recent historical cloud cover and Cosmic Ray data are plotted directly to the left. The Cosmic Ray Flux goes up and down with the sun's 11-year solar cycle. When TSI is high, CRF is low and vice-versa. Those very real effects are being ignored (intentionally and dangerously) by the IPCC CAGW alarmist crowd. Remember GSMs are not kind to humanity.

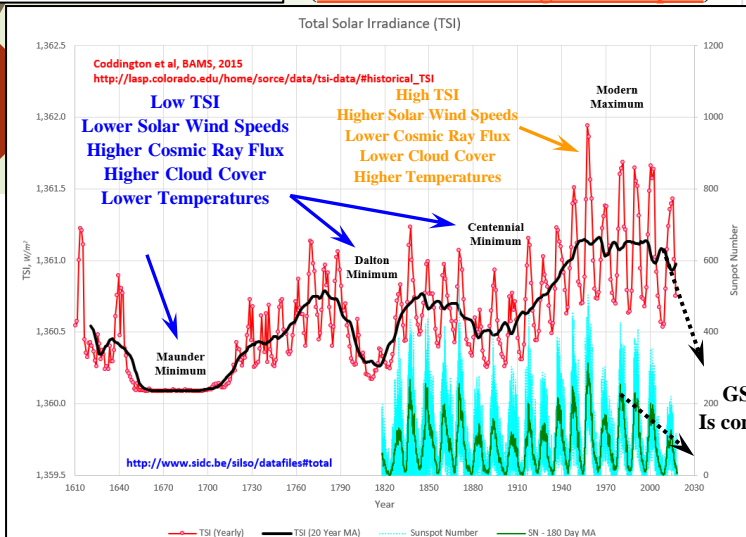
GSM - Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!



Dragić et al. Figure 5

The Forbush Decreases also produce measurable temperature changes. A paper, put forward by [A. Dragić et al](#) looked at the change in Diurnal Temperature Range (DTR). "The rationale for this is the following: if cloudiness is high in the daytime, more sunlight is reflected back to space and the daily temperature maximum is lowered; in the nighttime, less infrared radiation from the earth surface is emitted into outer space and the daily temperature minimum is increased. Therefore - more clouds means lower DTR." Figure 4 to the left shows the average DTR response associated with their list of Forbush Decreases. The upper plot averages all 184 FD events. The lower plot focusses in on the 81 FD events that were greater than 5%. There is an obvious response showing the link between cloud cover and cosmic ray flux. You would think that the IPCC would investigate that link in their quest to understand "Climate Change". Sadly, they prefer to take a simplistic and ideological approach that fits their UN given mandate (and not a principled scientific approach). Focusing on CO₂ is ridiculous (and unscientific). As I pointed out in my [Open Letter Addendum](#), Climate is Complicated. The [Central England Temperature \(OPS-38\)](#) is the longest measured temperature record. Many factors are at play with CO₂

being one of the more minor influences. The Maunder, Dalton and Centennial Minimums are all visible in that data. I am not going to get into detail on the CET here (refer to OPS-38). The solar activity (TSI) was pulled from the chart below. As with the rest of the Holocene, the temperature fluctuations over the last 400 years are not driven by CO₂ exclusively. Even post-1950, the Ocean Cycles and Solar Activity have significant influence (more detail in [CSS-7 - CO₂ - The FECKLESS GreenHouse Gas](#)). The 1970's TSI dip caused "The Ice Age is Coming" scare, record NH Snowfall thru the low SSN cycle 24. What happens in Cycle 26 ([NOAA is forecasting NO sunspots](#))?



CET Diurnal Temps Solar Activity

The solar activity over the last 400 years is shown in a little more detail to the right. More detail in my Open Letter, Addendum and OPS-21. NOAA is forecasting a GSM!

Central England - Temperature-TSI-AMO Comparison

Coddington et al, BAMS, 2015

http://lasp.colorado.edu/home/sorce/data/tsi-data/#historical_TSI

NOAA - AMO Index

<https://www.esrl.noaa.gov/psd/data/correlation/amon.us.long.data>

SUGGESTED DATA CITATION: Monnin, E., et al. 2004. EPICA Dome C Ice Core High Resolution Holocene and Transition CO₂ Data. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series # 2004-055. NOAA/NGDC Paleoclimatology Program, Boulder CO, USA.

Met Office Hadley Centre Central England

Temperature Data Download

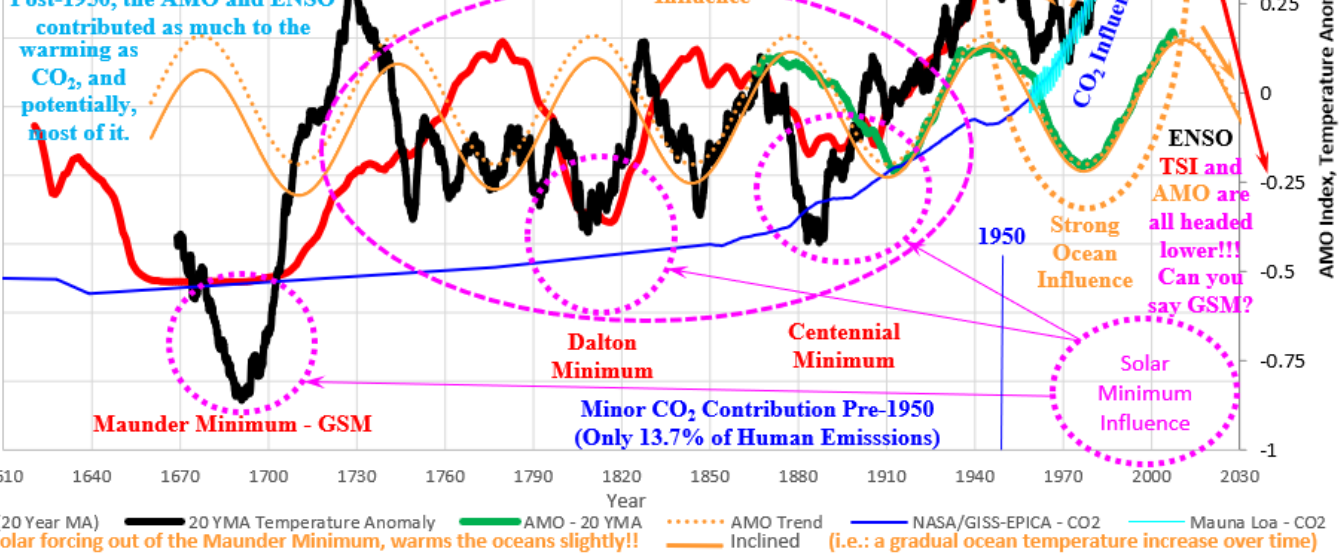
1659-1973 MANLEY (Q.J.R.METEOROL.SOC., 1974)

1974 ON PARKER ET AL. (INT.J.CLIM., 1992)

PARKER AND HORTON (INT.J.CLIM., 2005)

86.3% of Human CO₂ Emissions occurred post-1950.
65.5% of CO₂ Emissions have occurred post-1978 (satellite era)

Human CO₂ emissions pre-1950 would have only minor impacts. Post-1950, the AMO and ENSO contributed as much to the warming as CO₂, and potentially, most of it.



Strong ENSO Influence el Niños (1998, 2010, 2015 and 2018)

How much homogenization was used on these temperatures (1975 - Present)?

Modern Maximum

Strong Ocean/Solar Influence 1910-1945

Strong Ocean Influence

CO₂ Influence??

Strong Ocean Influence

Solar TSI and AMO are all headed lower!!! Can you say GSM?

Solar Minimum Influence

Dalton Minimum

Centennial Minimum

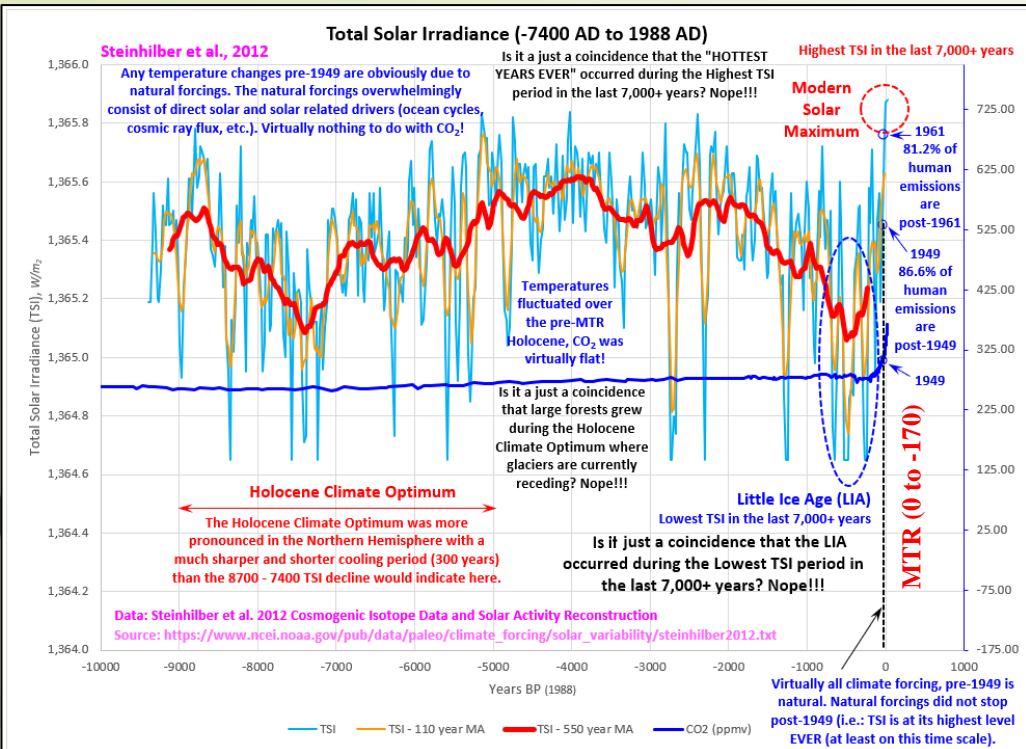
Minor CO₂ Contribution Pre-1950 (Only 13.7% of Human Emissions)

Maunder Minimum - GSM

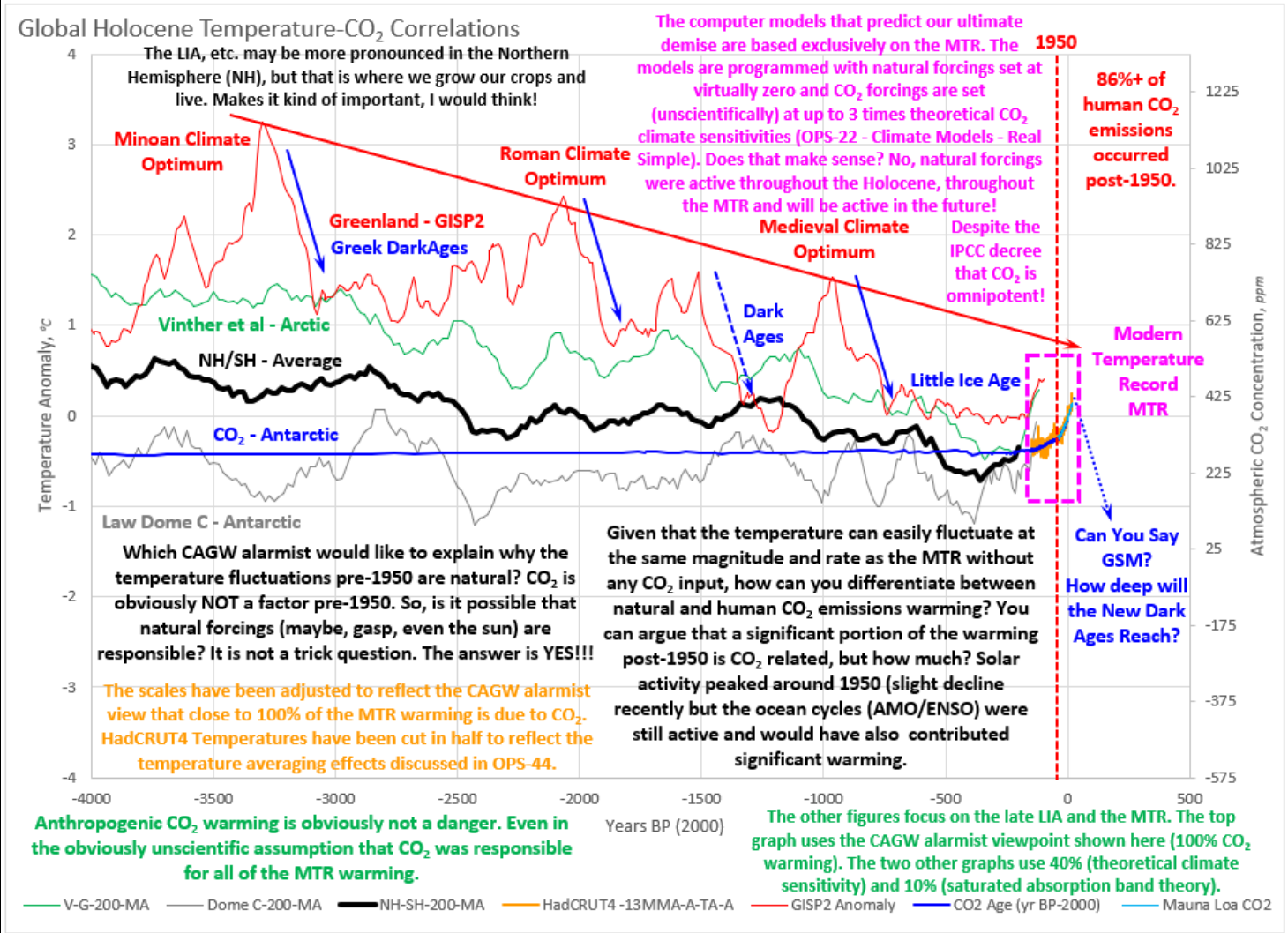
— TSI (20 Year MA) — 20 YMA Temperature Anomaly — AMO - 20 YMA — AMO Trend — NASA/GISS-EPICA - CO₂ — Mauna Loa - CO₂
 Increasing solar forcing out of the Maunder Minimum, warms the oceans slightly!! (i.e.: a gradual ocean temperature increase over time)

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

CSS-12g Holocene - Temperature, CO₂ and Solar (TSI)

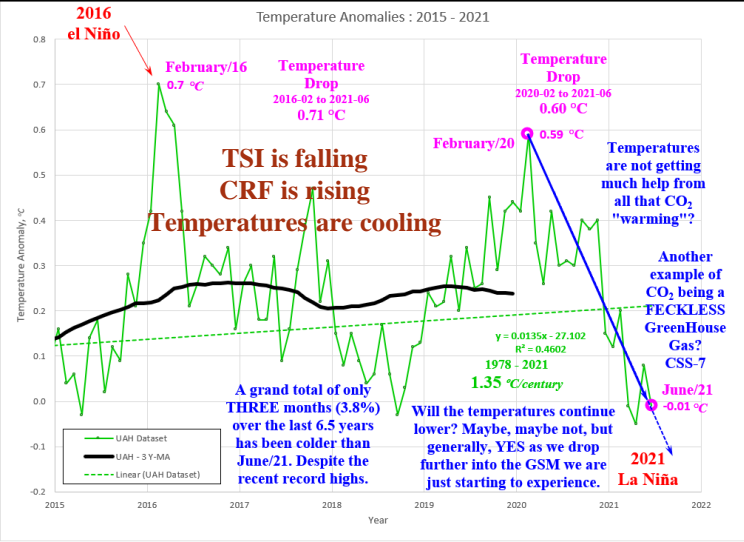


This slide does not include the Cosmic Ray Flux (CRF) data directly. However, the Solar Activity (Total Solar Irradiance, TSI) is a good proxy for the CRF. When TSI goes down, solar winds move to lower speeds and density. As a direct result, the atmospheric CRF increases (i.e.: more cosmic rays can and do enter the atmosphere). And based on the Forbush Decrease evidence, cloud cover (i.e.: albedo) also increases. With increased cloud cover, more solar energy is reflected directly back to space and the planet ultimately cools. So, what are the important climate drivers over the pre-MTR Holocene? Solar Activity (longer term - Milankovitch Cycles, shorter term - CRF, High Energy Particles, Ocean Cycles, certainly not CO₂. The shorter-term items that will continue to affect us are very visible over the last few thousand years. It was not CO₂ that gave us the Holocene, Minoan, Roman and Medieval Climate Optimums or the LIA (Wolf, Spörer, Maunder and Dalton Minimums) or any of the many dark ages. And as shown in the Phanerozoic discussion, the increased CRF is tied directly to the major ice ages.



Holocene CO₂/TSI and Temperature

The June 2021 UAH temperature anomaly update just came in at -0.01 C. That is roughly the same TA as the original "Pause" that ran a full 13 years from 2002 to 2015. CO₂ appears to be a little FECKLESS.

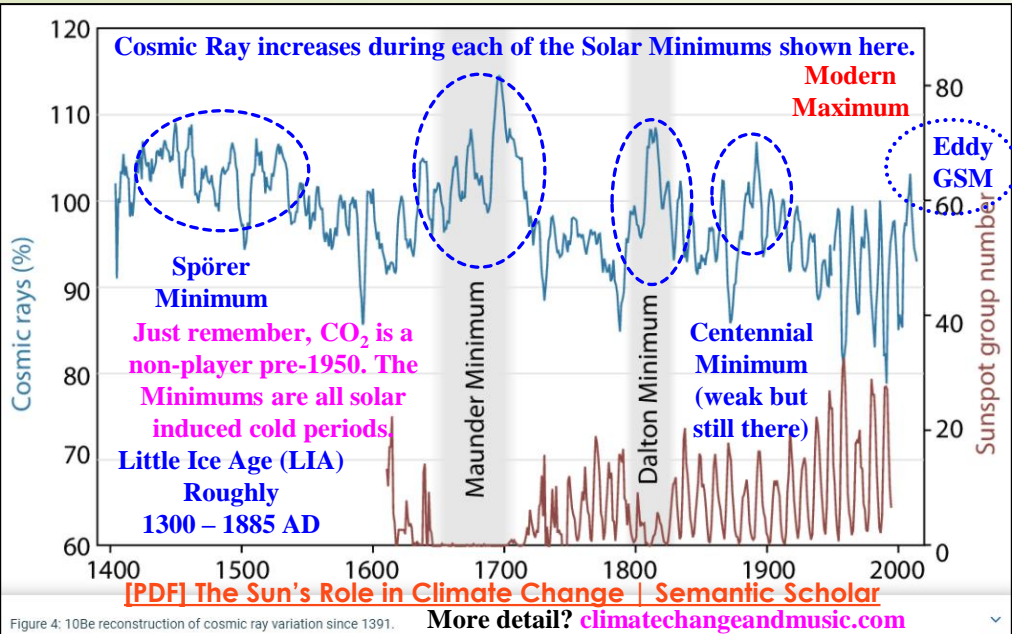


OPS-37 - UAH Nov/20 Update
OPS-40 - UAH Jan/21 Update
More detail? climatechangeandmusic.com

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

CSS-12h Holocene - Temperature, CO₂ and Solar (TSI)

Dr. John Christie put together a good comparison of the CMIP5 and CMIP6 models. I reviewed his video in my CSS-6 - John Christie - January 2021 post.



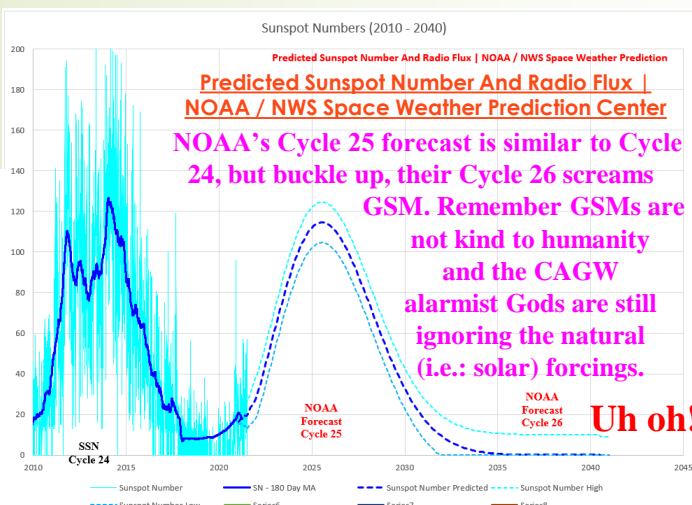
As mentioned on the graph below, the "Climate Change" discussion is very complicated. The simplistic, unscientific CO₂ approach taken by the IPCC/CAGW alarmist crowd is ridiculous, childish and dangerous. This CSS is designed to show that CRF has played and is continuing to play a significant role in climate change. Does CRF act alone? No, but the CAGW alarmist assumption that CRF (and all the natural forcings (solar or otherwise)) is driven by idiotological UN directives that are more akin to religious belief than science. I showed a long time ago that the MTR could be easily modelled using only the AMO and TSI (as a proxy, Open Letter Addendum, OPS-8 - Basic Climate Model). More recently, the CMIP5 protocol was retired (which used the absolute TSI value as their solar forcing). Using the new CMIP6 protocol (which has CRF and High Energy Particle options included), beta test programmers were able to model the MTR with NO CO₂. But you CAGW alarmists can relax, these climate geniuses quickly realized they could turn the solar options off (or at least way down) and save the Narrative.

CAGW alarmists' big failures are their continual compulsion to not address that temperatures fluctuate on many historical time scales with NO CO₂ influence and the old standard, there is no empirical Temperature/CO₂ data set that shows CO₂ driving the climate on any statistically significant historical time scale. No empirical data, no scientific proof. No scientific proof, religious belief, not science. And despite the continued push by the high priests of computer modelling, computer models are not proof.

Holocene CO₂/TSI and Temperature

We do not need to waste our taxpayer money on unnecessary and uneconomic CO₂ emission reduction. Mother Nature already has her plans in place to reduce global temperatures.

#delaythegreen
OPPS-14 and OPPS-9



As outlined in my Open Letter Addendum, Climate Change is Complicated. This is just one more example. I could break this out into multiple comparisons but I want to emphasize the complexity (even in this small portion of the Climate Change discussion). Should I add TSI?

Cosmic Ray Flux - Oulu, New Mexico
UAH Lower Troposphere Temperature
Sunspot Number/CO₂ Concentration

1 Based on the data you can make an argument that the AMO is responsible for the warming from 1975 to the present (with some help from ENSO).

2 CO₂ is the only long-term warming option (minor and continually weakening), with CRF/SSN/TSI short-term warming help.

3 I would suggest that reality is a combination. However, given the dramatic temperature fluctuations, CO₂ appears to be by far the weakest driver (CSS-7 - CO₂ - The FECKLESS GreenHouse Gas). The SSN and CRF generally move in opposite directions (i.e.: the more sunspots, the lower the CRF). Temperature, CRF, SSN and AMO (13 MMA) all have a general correlation with each other prior to 2002 but the ENSO/AMO appear to dominate post-2002. So what is driving the temperatures on this scale?

4 The ocean cycles appear to be the dominant driver (but they are ultimately driven by solar activity, the source of 99%+ of the energy that reaches the planet and powers the ocean and atmospheric circulation). CO₂ will be contributing to the warming but at minor and continually decreasing levels.

5 SSN/TSI will be headed up briefly as we move up Cycle 25 but the general trend will be down as we move further into the GSM.

2 Based on the data you can make an argument that CO₂ is responsible for the warming from 1975 to the present (with some help from ENSO).

Both Cosmic Ray Flux (CRF) and Sun Spot Numbers (SSN) have been shifted left by 1.5 years to show the delayed effects on Temperature.

CO₂ = (CO₂+3.1)*125
AMO = AMO+1
SSN = (SSN-5000)/8

Super el Niño 1998
Super el Niño 2016

The AMO and ENSO appear to be overriding the 11-year solar cycle post-2002. The "PAUSE"

UAH Lower Troposphere Temperature
2021 La Niña

Milankovitch Cycles (eccentricity, obliquity, precession, insolation), AMO, ENSO, PDO, Solar Activity (GSM, TSI), Volcanic activity (aerosol increases), near term cold triggers are all headed cooler

Legend:
Corrected Count Rate
SN - 180 Day MA
UAH - 3 Y-MA
GISS - CO₂
AMO-A - 13 MMA
AMO-A - 20 YMA
UAH - Temperature Anomaly
Mauna Loa - CO₂
Linear (Corrected Count Rate)