CSS-45a

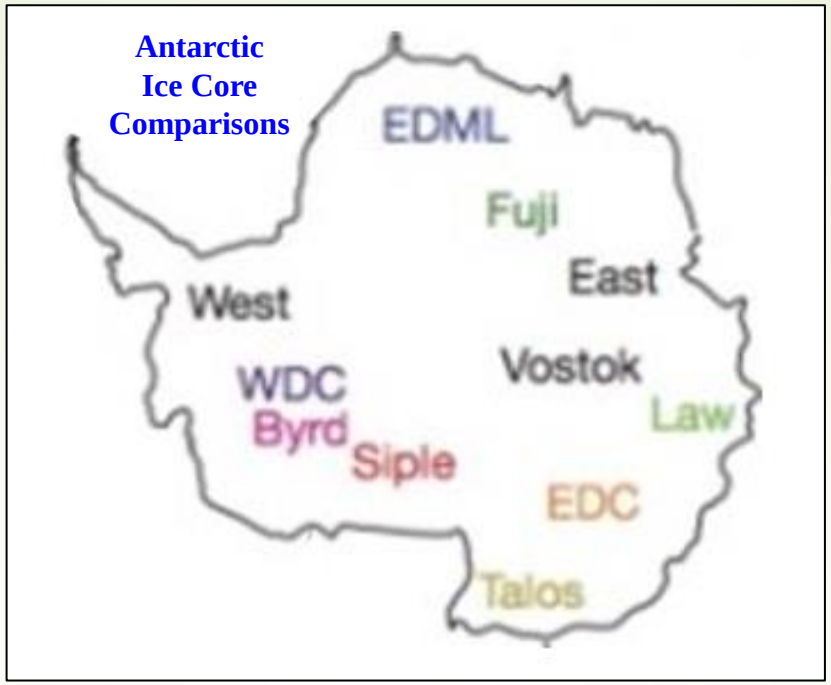
Antarctic Average Ice Core Temperatures – Holocene-1

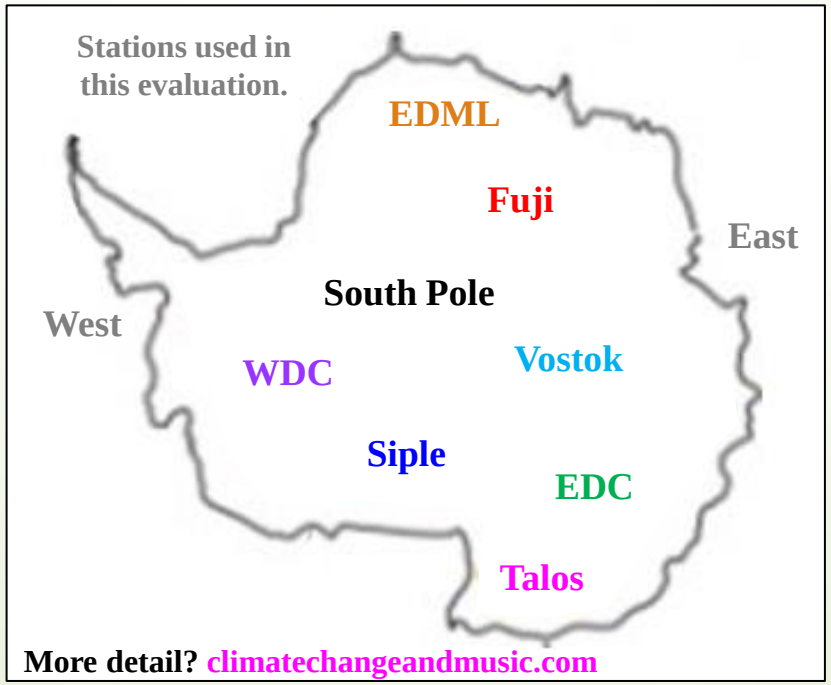
GSM – Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!

Ice Core Temperature Comparison-1

In my evaluations to date I have generally used the EPICA Dome C data set to represent Antarctica. Earlier on I used the Vostok data set. I switched when an online friend sent me the chart (shown to the far right). The Vostok data does not have the noticeable temperature drop around 8,000 years ago that is present in many of the ice cores. That (and data availability) prompted me to switch to the EPICA Dome C data set. The EPICA Dome C temperature profile also happens to correlate to both the Total Solar Irradiance and the Global Atmospheric CO_2 concentration. I find that interesting and reeking of common sense. Would it be all that surprising to see CO_2 concentrations decrease, then increase in response to a temperature decrease followed by a temperature increase all initiated by a TSI decrease, followed by an TSI increase? Remember TSI is just a proxy for solar activity. There is a whole lot more to solar activity than just TSI (Cosmic Ray Flux, High Energy Particles, Electromagnetic Field Strength, etc.).

In a more recent exchange, I was asked about an average temperature curve from the Antarctica Ice Core data. After a lengthy search, I finally came across some work by Buizert et al (2021) that put together temperature reconstructions for 7 locations across the Antarctic continent (shown to the right). I have added the Vostok location to the analysis and put together an average temperature anomaly curve. The Buizert et al data (Antarctica 40,000 Year Temperature and Elevation Reconstructions) is available on NOAA's Paleo Data Search site. The Buizert et al study did not include the Law Dome or Byrd ice core data, but they did add in the South Pole. The purpose of this exercise is to produce an average normalized curve that would be representative of the entire continent. Going forward my evaluations will include the average curve.





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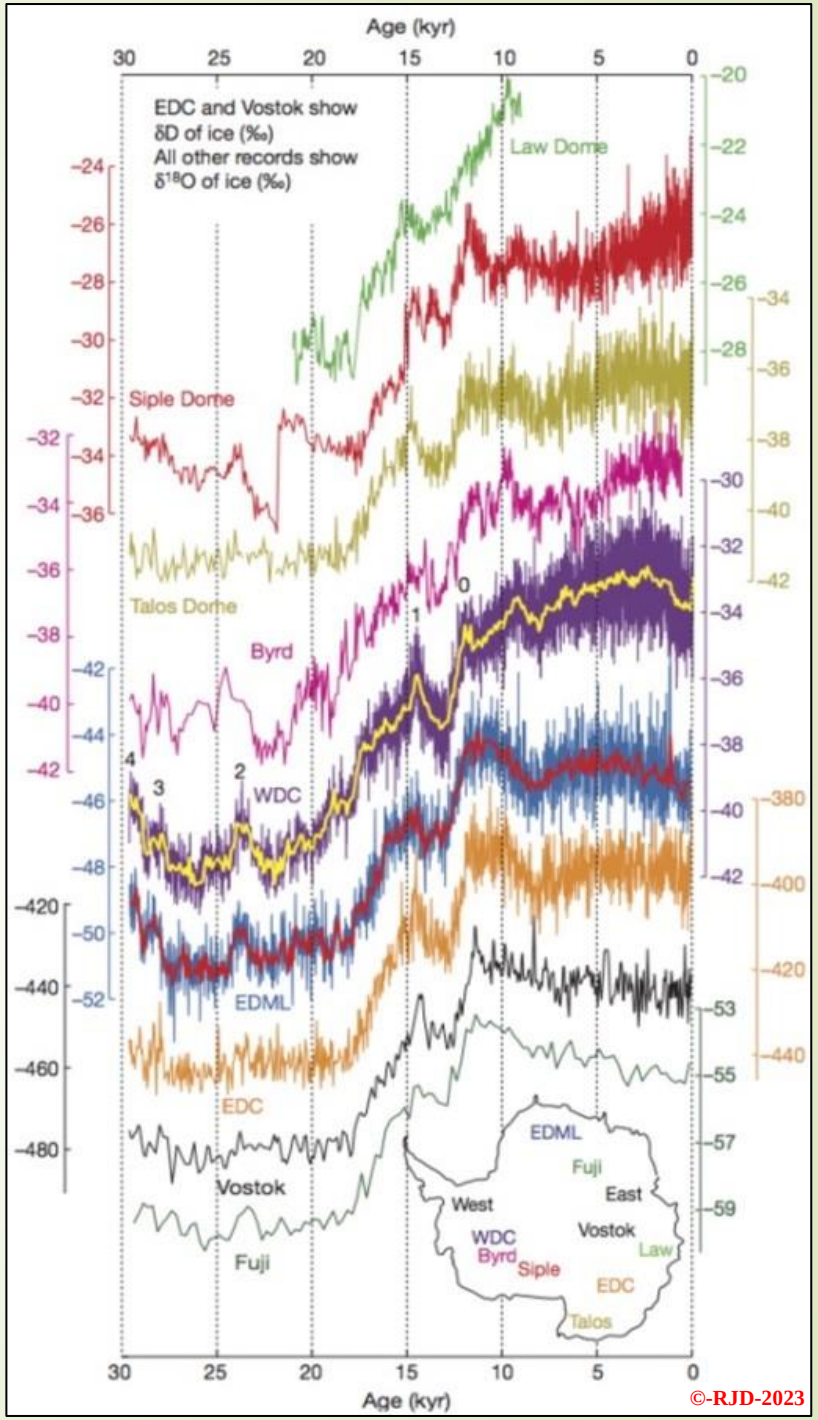
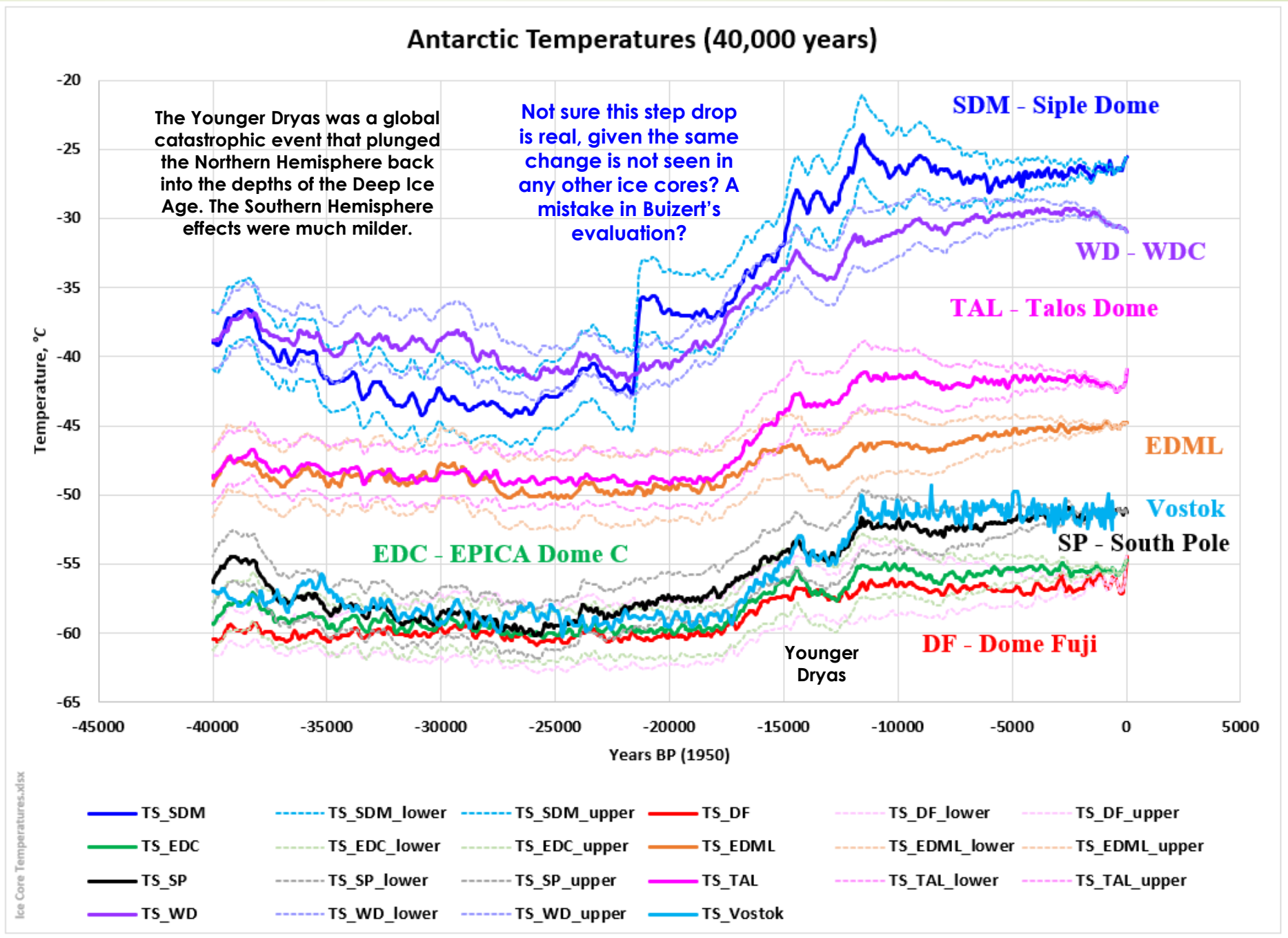


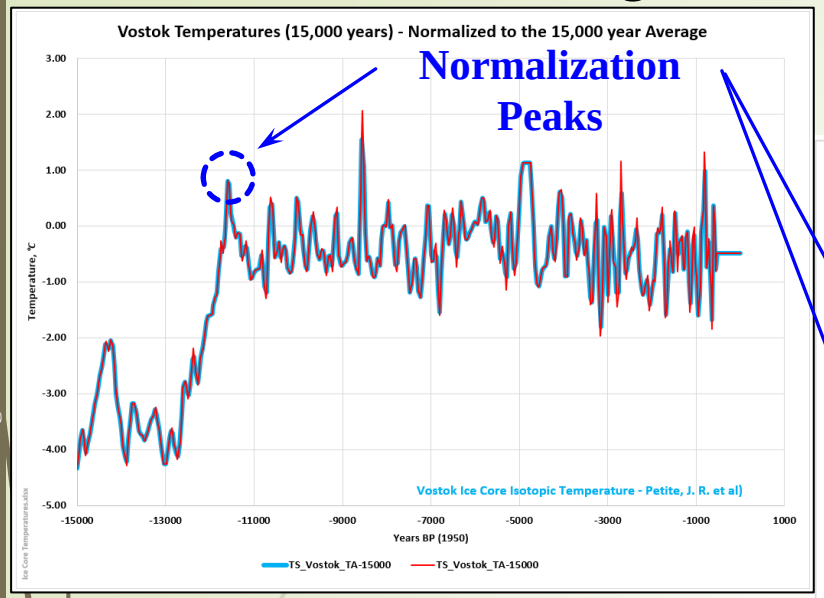
Antarctic Average Ice Core Temperatures – Holocene-2

Ice Core Temperature Comparison-2

The Buizert et al temperature reconstructions (and their 95% low and high confidence levels) are shown on the plot to the right. The Vostok confidence levels were not available, but they would be consistent with the other Ice Core locations. The Buizert et al study covers the 40,000 years pre-1950. A data point was generated every 40 years. The Vostok data was converted to a similar format to allow some direct comparisons. All the curves show the same general trends. Temperatures around 40,00 years ago were gradually declining to the deepest part of the Last Glacial Maximum (20,000 to 30,000 years ago). The temperatures then started climbing out of the deep ice age, hitting a snag around 14,000 years ago (the Younger Dryas), causing the temperatures to drop for a while before recovering and rising to the early Holocene interglacial warm period peak. Most of the reconstructions then show a decline, followed by a long incline. There are some small profile differences beginning around 5,000 years BP. The one point I would question is the temperature step drop (between 21,000 and 22,000 years ago in the Buizert et al's Siple Dome reconstruction. That 7 °C temperature drop does not make sense. This evaluation is focused on the warmer temperatures of the Holocene.



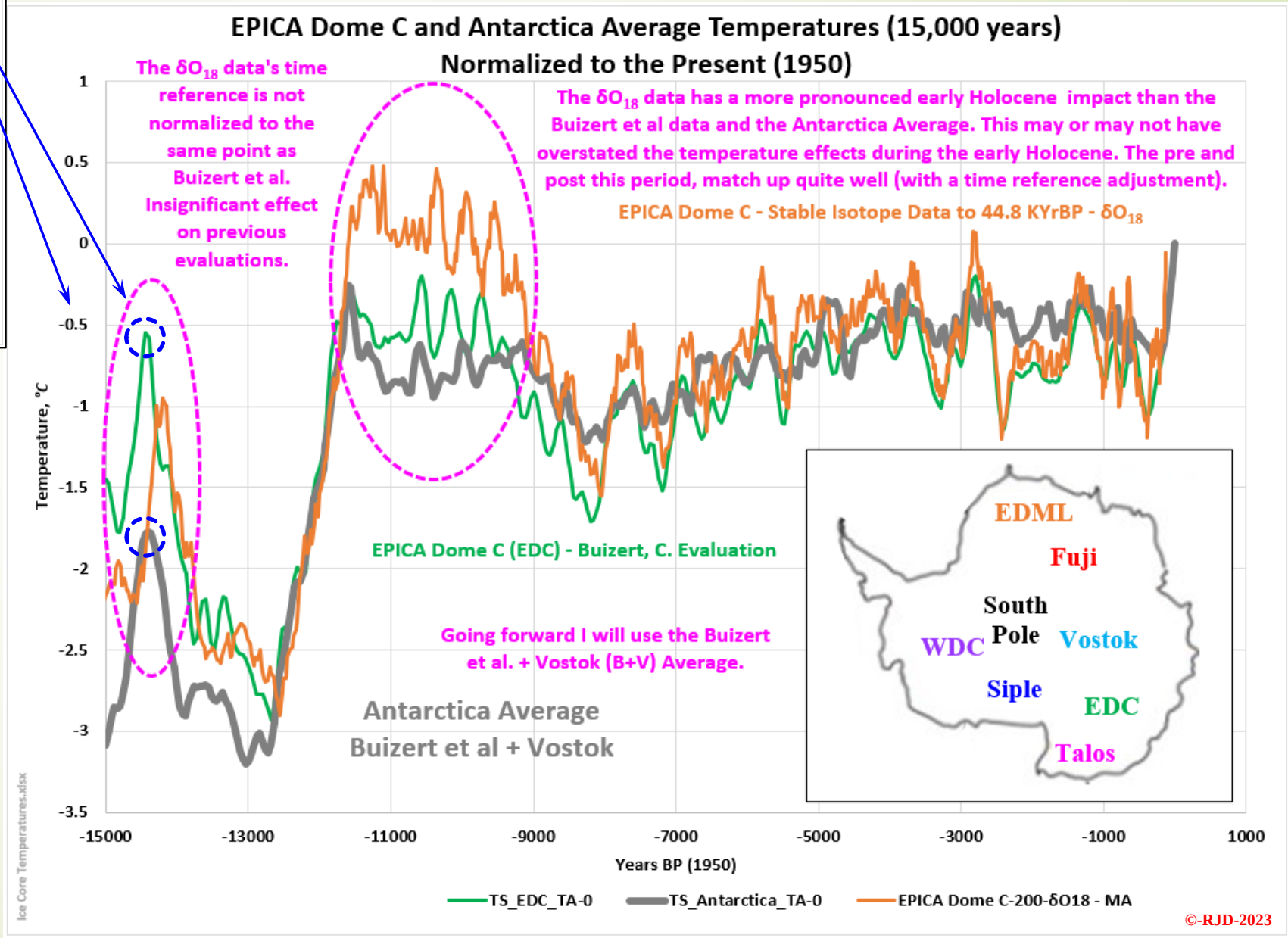
Antarctic Average Ice Core Temperatures – EPICA Dome C - Vostok



As I mentioned I have been using the Vostok and EPICA Dome C data sets. The data I was using was not laid out on 40-year time steps. The original EPICA Dome C δO_{18} isotope data is compared to Buizert et al's EPICA Dome C reconstruction and the Average (spoiler alert) Antarctica Consolidation (AAC). Over the Holocene, the Buizert et al and AAC look very similar. The isotope data only deviates from the other curves over the early Holocene. This deviation would not change earlier post discussions significantly. The Vostok data was normalized to the peak temperatures visible on the other temperature reconstructions (14,400 years BP).

Ice Core
EPICA Dome C
Vostok

With the time normalization, the more recent data was arbitrarily set at the current annual average temperature (as per Wikipedia). The plot shown above shows the difference between the original data and the adjusted data (required to conform to the Buizert et al reconstruction parameters (i.e.: 40-year time steps)). The highs and lows in the adjusted data are slightly compressed but are minimal and will have no measurable impact on the average Antarctic temperature anomaly estimates. There may be a small-time adjustment required in the EPICA Dome C δO_{18} isotope data, but the changes are not significant.



Antarctic Average Ice Core Temperatures – Normalized 40,000 Years

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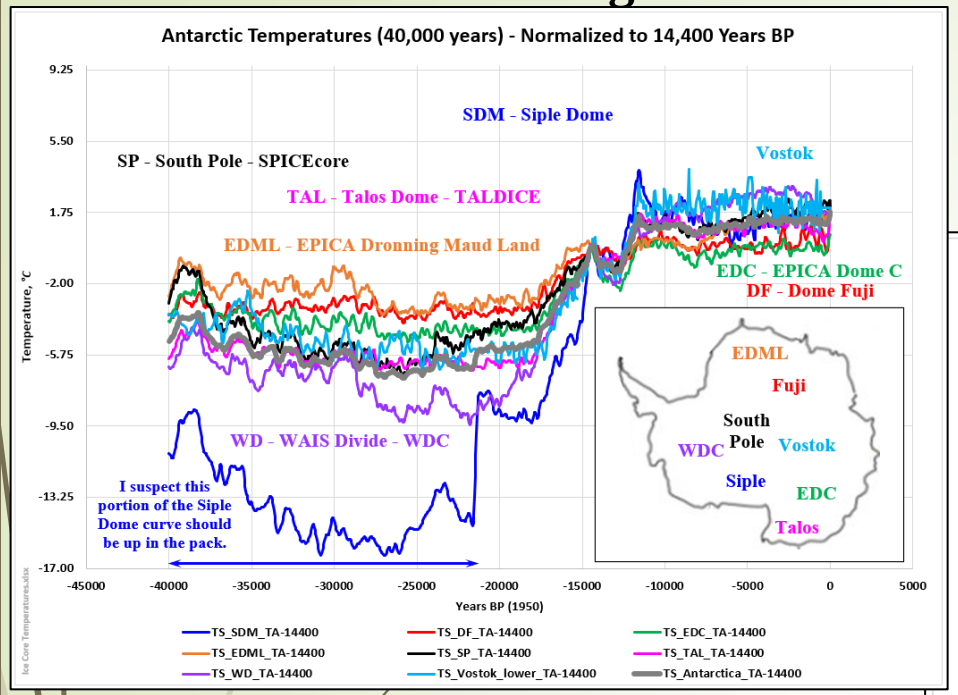
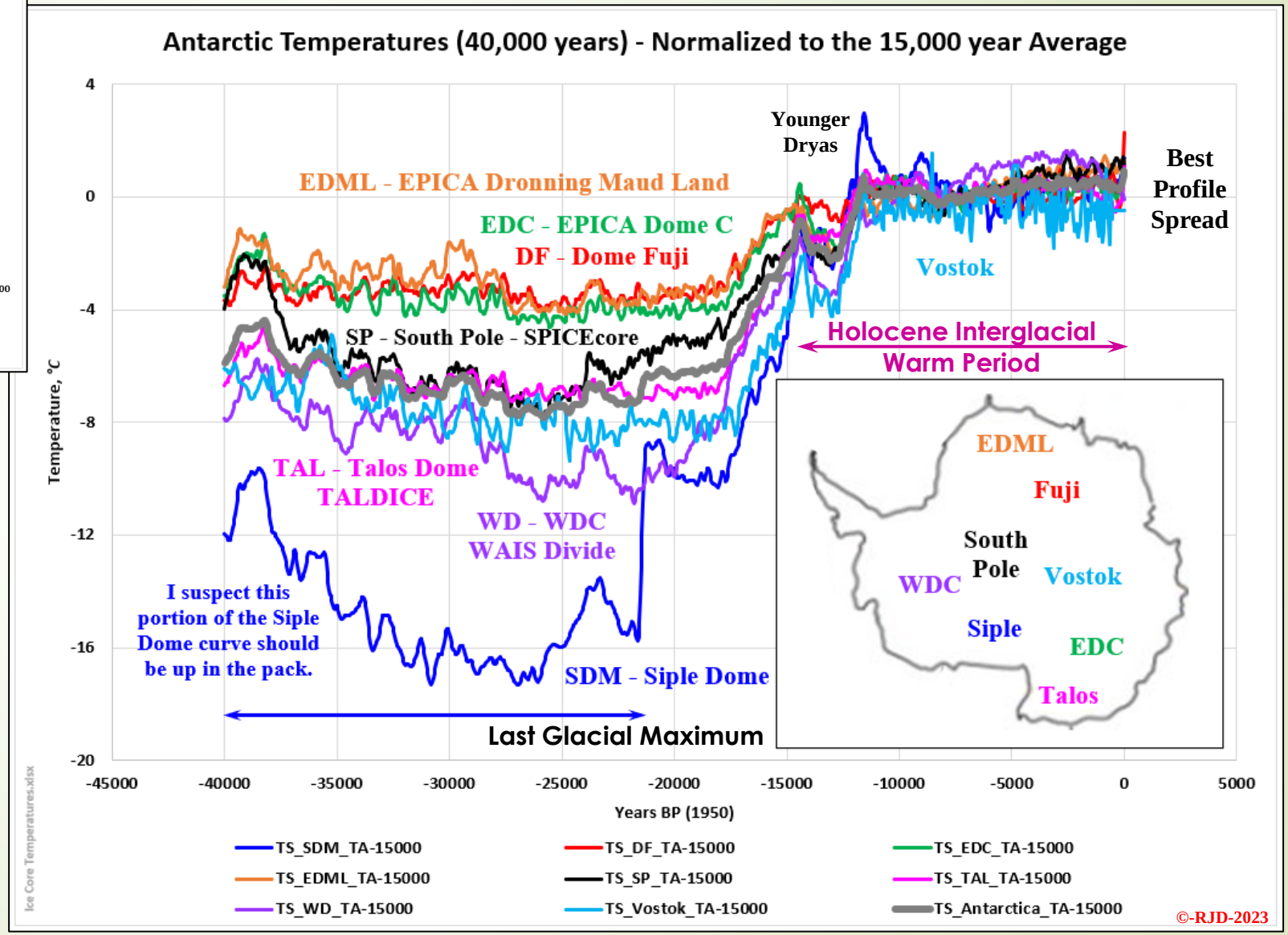
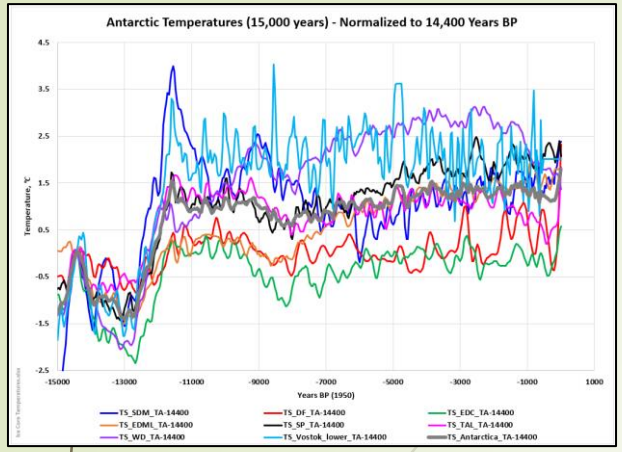


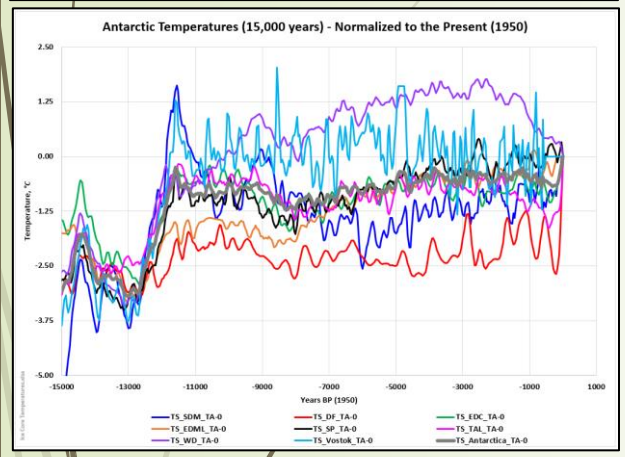
The temperature data ranges from around -25.4 to -60.2 °C depending on location and timing. The data needs to be normalized to allow some profile comparisons. I looked at three different options for normalization. The first option (not shown here) was to normalize based on recent temperatures (1950). The noticeable increase in the recent data is inconsistent with the general longer-term trends leading to a wide, non-optimal profile spread. And no, the increase has little to do with human emissions. The second option was normalizing to the 14,400 years BP temperature peak that is present in all the ice cores. This also produced a rather significant profile spread. That leaves us with normalizing to a temperature datum. In this case, I have chosen to reference the temperature to each location's average over the last 15,000 years (the entire Holocene). That method tightens up the profile spread and gives us our best option. I would suggest that the Siple Dome data and therefore, the Antarctica Average Consolidation (AAC) be ignored pre-21,000 years BP, pending a proper review. So, although there is some spread in the normalized data, the AAC does appear to reasonably represent the continent's temperature history. The focus of this discussion is the Holocene Interglacial Warm Period. The profile spread over that period is relatively tight, especially after the Younger Dryas. The rest of the post will look at the last 15,000 years. This is the most relevant period in human history (from early civilizations to ours, such as it is).

Ice Core TA Normalized 40,000 years



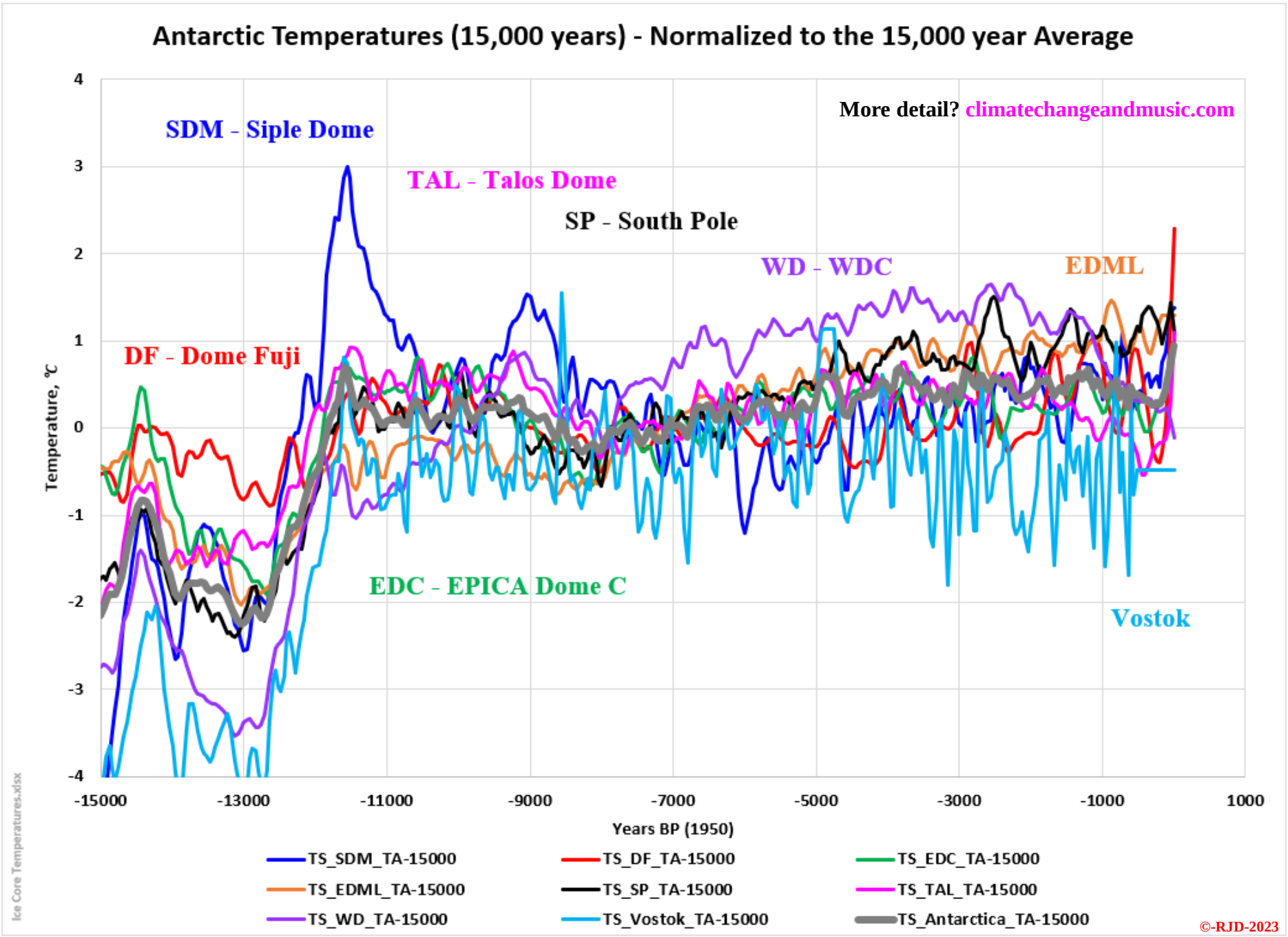
Antarctic Average Ice Core Temperatures – Normalized – 15,000 Years





Ice Core TA Normalized 15,000 Years

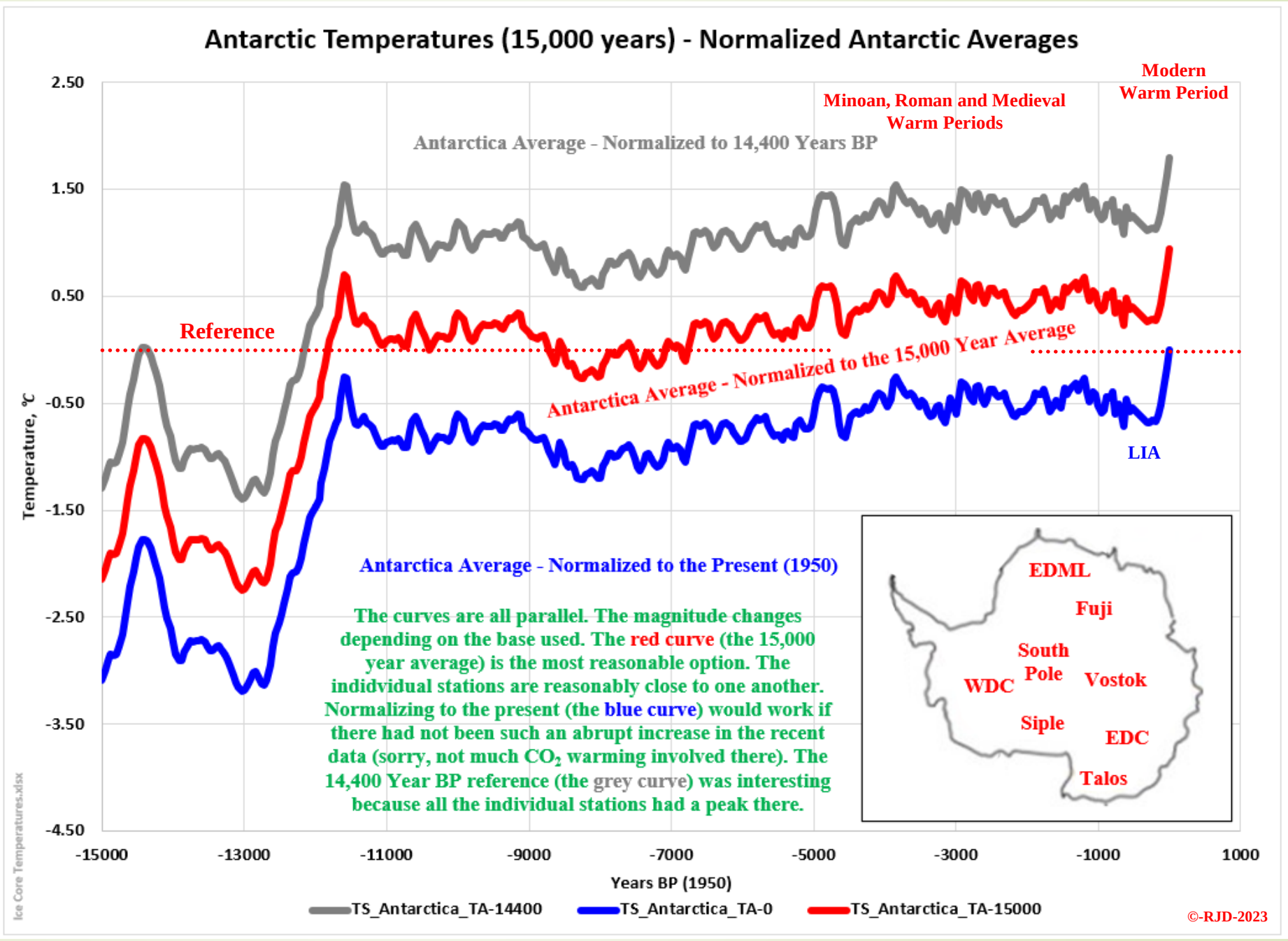
The larger graph to the right is the 15,000-year average normalization. Vostok, Siple Dome and the WAIS Divide (WD) have the most notable deviations with the EDML and Dome Fuji providing most of the recent sharp temperature increase visible in the AAC. The two plots above are from top down, the 14,400 years BP temperature peak and the present day (1950) temperature. The normalizations (post-Younger Dryas are reasonably tight and provide a good average.



Antarctic Average Ice Core Temperatures – Normalized Average

Ice Core TA Normalized Averages

The three AAC normalizations discussed earlier are plotted here. All three curves are parallel, so realistically any datum will produce the same curve. The 15,000-year average provides a reference that can be related directly to most of humanity's modern technological evolution. The warm weather of the Holocene allowed our society to advance to our advanced state of technology (for better or worse). There are some notable exceptions (cold periods like the Little Ice Age, the Dark Ages and the Greek Dark Ages). Those periods are much more pronounced in the Northern Hemisphere data, but they are still visible in the AAC. The Medieval Warm Period and Little Ice Age are very visible just before temperatures start rising out of that LIA around 1750 (centuries before humanity had any noticeable emissions). Remember 86%+ of humanity's emissions happened after 1950 (i.e.: after this dataset ends). Natural forcings are mostly responsible for the very noticeable temperature increase from 1750 to 1950. Human CO_2 emissions would have played, at best, a minor role in this recent two century Antarctic temperature increase. You can argue that this data is localized, but 90% of land ice on the planet is located here.



CSS-45g

Antarctic Average Ice Core Temperatures - TSI

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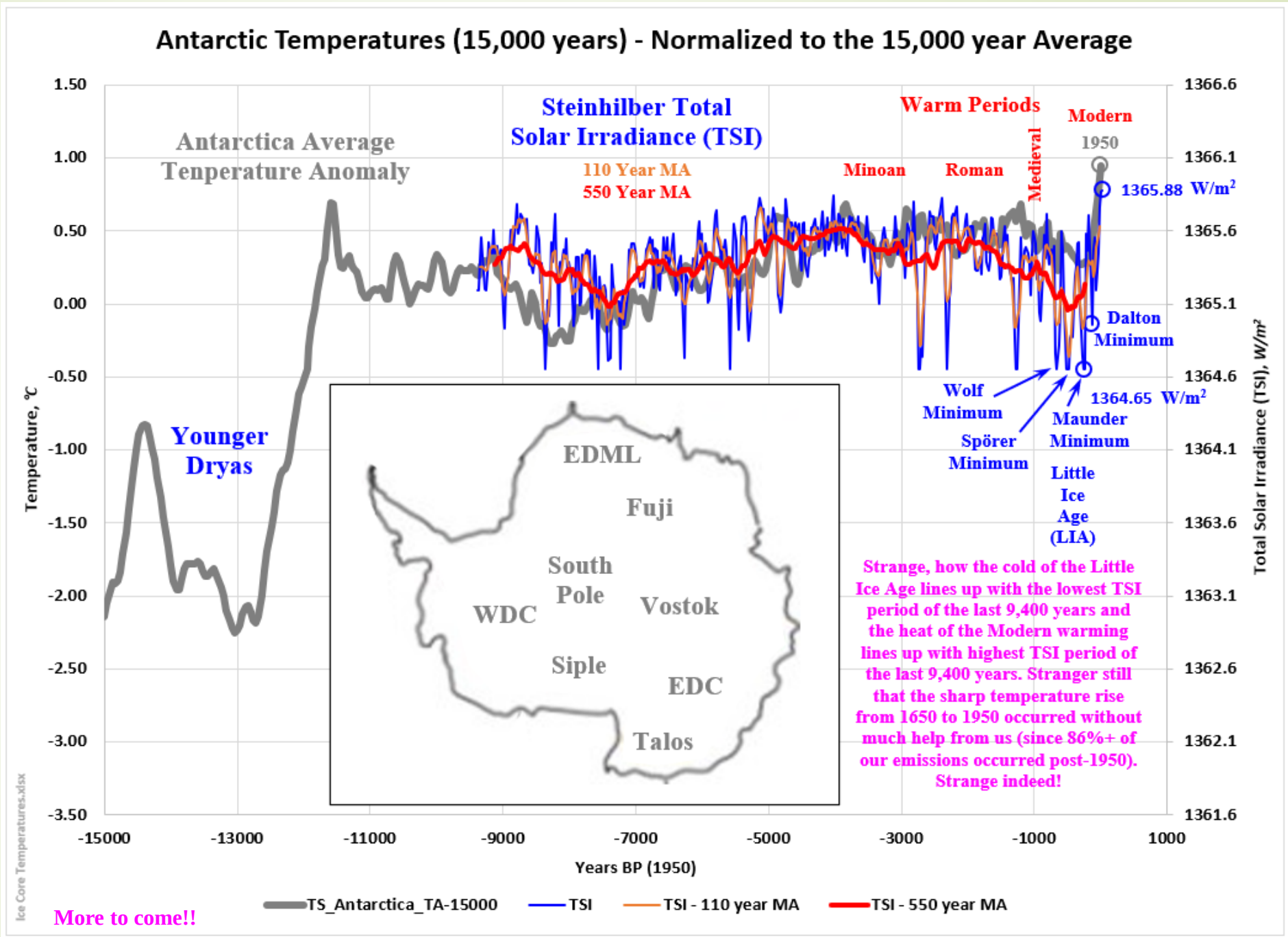
GSM – Grand Solar Minimum. The real "Climate Change" existential threat is right around the corner. Do the Research!

Ice Core TA 15,000 Year & TSI

This plot is a bit of a teaser for a near future Climate Short Story (CSS). With a representative Antarctica average temperature curve, I can start plotting other data sets (CO_2, TSI, etc.) against that data to look for the correlations that the CAGW alarmist community loves to ignore. Here, the Steinhilber Total Solar Irradiance (TSI) data was laid over the Atlantic Average Consolidated Temperature (AACT) profile. There is some very interesting correlation there. Especially given that the pre-1850 atmospheric CO_2 concentrations were virtually flat when viewed from the alarmist perspective (i.e.: the 1.07 °C rise is equivalent to the 135 ppm CO_2 increase over pre-industrial levels). The Little Ice Age (the convenient starting point for the alarmist narrative) happens to correspond to the lowest TSI levels of the last 9,400 years. What happened at the end of the LIA? Solar Activity (i.e.: TSI) soared to its highest levels in 9,400 years. Any chance that the sun may have played a larger role in the pre-1950 Antarctic temperature increases than our less than 14% of total human emissions? If 14% of our emissions were able to warm Antarctica by roughly 0.75 °C, imagine how much warming 86% of our emissions must have caused since 1950? Trick question?



More to come!!