Implications of a New Gridded Dataset of Surface Solar Radiation for the Evolution of Earth's Global Surface Temperature Since 1960

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Abstract

A new data set of measured Surface Solar Radiation (SSR) covering six continents (Yuan et al. 2021) reveals that the Earth surface received annually 6.6 W m^{-2} *less* shortwave energy in 2019 than it did in the early 1960s, and that the average solar flux incident on land decreased by 8.2 W m^{-2} between 1962 and 1985. Since the Sun is the primary source of energy to the climate system, this pattern of SSR change over the past 60 years (oftentimes referred to as *global dimming*) suggests that the early 1960s were much warmer than the present. However, all modern records of global surface air temperature show a net warming of about 1.0 K between 1962 and 2019. We investigate this conundrum with the help of an independently derived model (previously verified against CERES observations) that accurately converts observed SSR anomalies into changes of global surface temperature. Results from the SSR-based temperature reconstruction are compared to observed global surface temperatures provided by UAH 6.0 and HadCRUT5 datasets. We find that the SSR-based global temperature estimates match quite well the UAH satellite record from 1982 to the present in terms of overall trend and interannual variability suggesting that the observed warming of the past 40 years was the result of a decreased cloud albedo and an increased SSR rather than rising atmospheric CO_2 concentrations. The HadCRUT5 record also shows a satisfactory agreement with the SSR-based temperatures over the same time period. However, between 1962 and 1983, the SSR-based temperature reconstruction depicts a steep global cooling reaching a rate of -1.3 K/decade during the 1970s. This is drastically different from the mild warming claimed by HadCRUT5 over this time period. The cooling episode indicated by the SSR data is corroborated by more than 115 magazine and newspaper articles published throughout the 1970s as well as a classified CIA Report from 1974 all quoting eminent climatologists of the day, who warned the public that the observed worldwide drop of temperatures threatened the global food supply and economic security. Based on this, we conclude that researchers in charge of the HadCRUT dataset have likely removed the 1962 – 1983 cooling episode from the records before the publication of HadCRUT1 in 1994 in an effort to hide evidence contradicting the UN Resolution 43/53 from 1988, which proclaimed a *global warming caused by greenhouse gases* as a major societal concern, and urged Governments to treat it as a priority issue in climate research and environmental protection initiatives.

1. Introduction

It is a matter of conventional wisdom now that the Earth was significantly cooler during 1960s compared to the 21st Century. Similarly, no one disputes that the planet's surface temperature was 1.2°C lower in the beginning of the 20th Century compared to the present. This paradigm of climate change is based on surface temperature records maintained by several research teams that show remarkable consistency with one another. Figure 1 portrays global temperature anomalies based on 6 datasets supposedly constructed using different approaches summarized by Morice et al. (2021). All global records depict a nearly continuous warming since 1920 with a brief pause of the temperature rise between 1940 and 1980. No record shows a drop of global temperature between 1960 and 1980, which is at odds with a well-

documented, decade-long discussion in the media about an ongoing rapid cooling during the 1970s currently known as the "*1970s ice-age scare*".

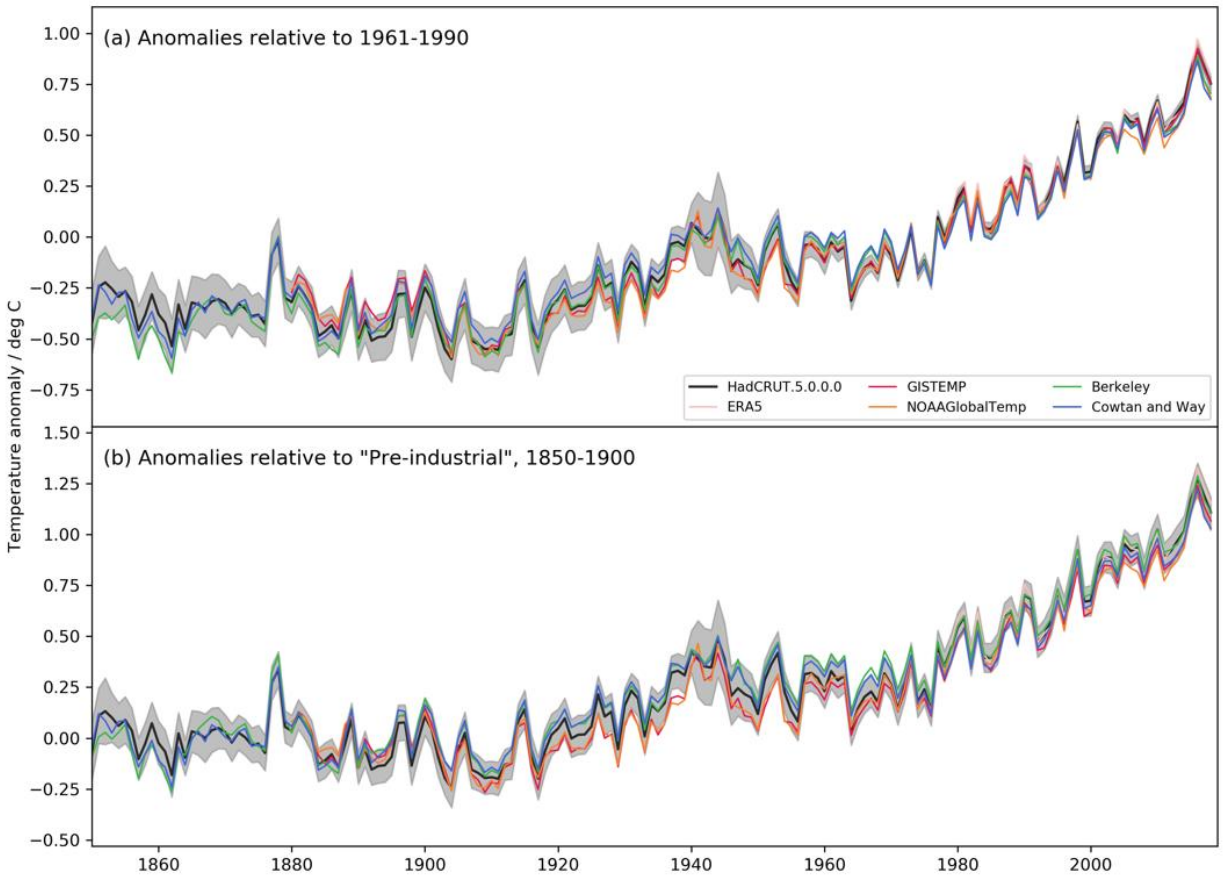


Figure 1. Global surface temperature anomaly from 1850 to 2021 according to 6 official data sets. Note the remarkable consistency among various time series (borrowed from Fig. 8 of Morice et al. 2021).

Modern climate science dismisses as a *myth* the scientific consensus of the 1970s that the Earth was cooling and the widespread belief at the time that a mini-ice age was approaching (Peterson et al. 2008). Based on global temperature records depicted in Fig. 1, which show a 0.4°C *warming* between 1965 and 1980, the "ice-age scare" of 1970s is now explained away as a media hype not supported by actual science. This is in spite of the fact that in 1974, the US Central Intelligent Agency (CIA) issued a classified internal Working Paper/Report, now available at the Digital Library website of the US Department of Homeland Security, addressing an observed global cooling and its impact on the World's food supply. The Paper entitled "*A Study of Climatological Research as it Pertains to Intelligence Problems*" was prompted by national security concerns about future food shortages resulting from ongoing worldwide crop failures in the late 1960s and early 1970s caused by cold and excessively wet weather or unusual draughts, and the emergence of social unrests in some developing countries as a result. We discuss this CIA Paper in more details in Section 4.1 below. During the 1970s, the press quoted numerous eminent climate scientists of the day from Stanford University, MIT, UK's University of East Anglia, and other accredited academic institutions, who warned the Western society about a looming long-term cooling that could lead to a full-scale Ice Age. These facts are now being downplayed using the argument that a global cooling never took

place in the 1970s. However, a new gridded dataset of measured Surface Solar Radiation (SSR) on land spanning the period 1961 – 2019 published in the *Journal of Climate* last year (Yuan et al. 2021) suggests otherwise. SSR is the shortwave flux (W m^{-2}) incident on a horizontal plane at the Earth surface. The time series of globally averaged SSR anomalies estimated by Yuan et al. (2021) indicate the need to *reassess* the evolution of Earth's global temperature from the early 1960s to the mid-1980s.

Yuan et al. (2021) retrieved ground-based SSR data from the *Global Energy Balance Archive* (GEBA) representing 1,486 monitoring stations spread across 6 continents. The authors employed a machine learning method called "random forest" to interpolate the observed monthly SSR anomalies at individual locations to a uniform 0.5° × 0.5° grid covering all land masses except for Antarctica, where no SSR observations were available. *Random forest* uses a multitude of regression decision trees, and has been shown to be vastly superior to conventional deterministic spatial interpolation techniques in terms of prediction accuracy and performance stability (Leirvik & Yuan 2021). The method utilized 15 predictors of SSR to spatially interpolate the point observations including 9 climatic variables, 2 geographical coordinates, and 2 temporal parameters (month and year of observation). The authors found that the diurnal temperature range and cloud coverage provided the greatest explanatory power for the SSR interannual variability. The study produced the first and only land-based gridded global monthly SSR data set spanning a period of almost 60 years. We contacted the lead author Dr. Meghan Yuan and obtained annual time series of SSR anomalies for each continent and the Globe as a whole. Figure 2 depicts these time series, which are also shown in Fig. 5 by Yaun et al. (2021).

The data reveal that SSR decreased significantly between 1961 and 2019 on four out of the six continents. Europe had a moderate SSR increase over this period, while Oceania experienced a nearly zero trend. On a global scale, SSR steeply declined between 1961 and 1985 at a rate of -3.73 W m^{-2} per decade (Fig. 3), which is often referred to as *global dimming*. This was followed by a partial SSR recovery from 1982 to the present at a rate of +0.33 W m^{-2} per decade, which could be characterized as a modest *global brightening*. Measurements depicted in Fig. 3 indicate that the land masses on Earth received on average 6.6 W m^{-2} *more* solar radiation in the early 1960s than they did in the 21st Century. Since the Sun is by far the main source of energy to the climate system, a higher SSR in the early 1960s implies a warmer Earth surface

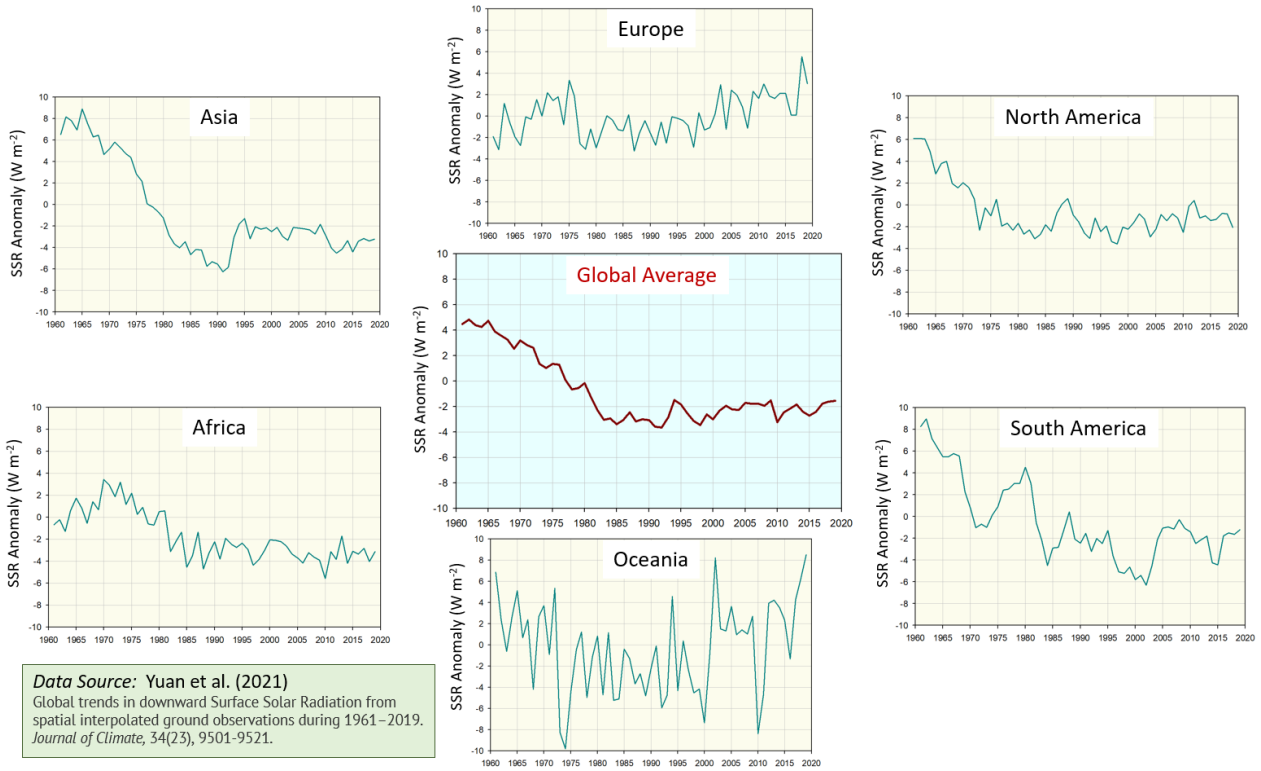


Figure 2. Annual anomalies of Surface Solar Radiation (SSR) over the period 1961–2019 for each continent and the World according to Yuan et al. (2021). SSR is the total shortwave flux (W m^{-2}) reaching a horizontal plane at the land surface.

compared to today. To put the observed net SSR drop of 6.6 W m^{-2} from 1960s to the present into a perspective, consider that climate models predict a 3.0 K warming on average (with a range between 2.5 K and 4.0 K) in response to a 3.74 W m^{-2} radiative forcing attributed to a doubling of atmospheric CO_2 concentration (IPCC AR6: Climate Change 2021: The Physical Science Basis. Summary for Policymakers, p. 11). However, while the CO_2 "radiative forcing" is a *modeled* quantity that has not been observed in reality, SSR is a parameter measured by physical instruments such as pyranometers. Hence, one might ask: What global cooling could be expected from a 6.6 W m^{-2} decrease of *measured* SSR? We will answer this question here with the help of an independently derived, generic model that relates changes of global surface temperature to variations in *absorbed* solar radiation by a planet (Nikolov & Zeller 2022). The model was successfully verified against Earth's reflected solar fluxes measured by the *Clouds and the Earth's Radiant Energy System* (CERES) for the past 20 years (see Figures 3 and 4 in Nikolov & Zeller 2022).

First, we will evaluate the potential of the new global SSR series to explain the observed warming since 1982. This will also serve as a test of whether or not the Nikolov-Zeller (NZ) albedo-temperature model could be trusted to correctly reconstruct the global temperature response to an observed SSR drop of 8.2 W m^{-2} between 1962 and 1985 shown in Fig. 3.

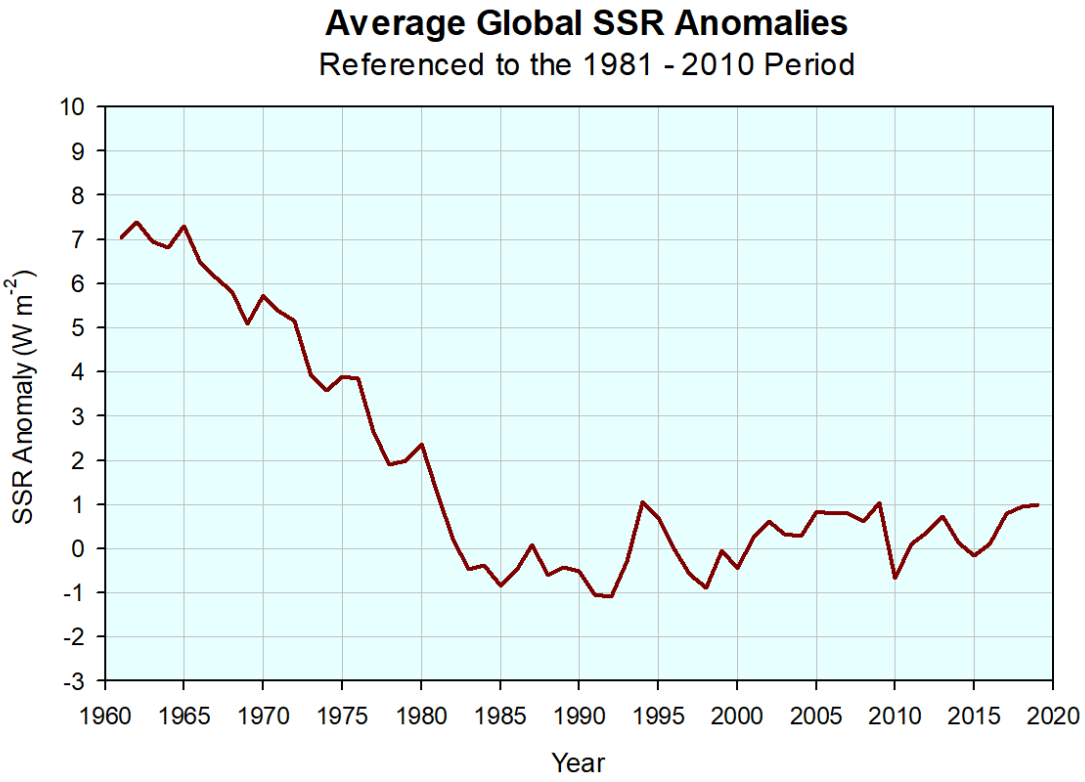


Figure 3. Land-based global annual SSR anomalies with respect to the 1981 – 2010 reference period according to Yuan et al. (2021).

2. Method for Estimation of Global Temperature Variations from Observed Annual SSR Anomalies

Nikolov & Zeller (2022) derived the following analytical formula to compute the equilibrium sensitivity of a planet's global surface temperature to changes in absorbed solar radiation:

$$\Delta T = T_{sb}\left[\left(1+\frac{4\,\Delta s_a}{S(1-\alpha_b)}\right)^{0.25}-1\right] \qquad (1)$$

where ΔT (K) is the departure of surface temperature from a baseline value T_{sb} (K) in response to a change in absorbed solar radiation Δs_a (W m^{-2}); S is the top-of-the-atmosphere total solar irradiance (TSI, W m-2), and α_b is the baseline planetary Bond albedo (faction) corresponding to T_{sb}. Note that, if $\Delta s_a = 0$, then $\Delta T = 0$ as well.

Equation 1 can be used to estimate changes of global surface temperature in response to observed SSR anomalies over land depicted in Fig. 3. To this end, one must know *average* values of the *absolute* global surface temperature T_{sb} and the Earth's Bond albedo α_b during the reference period 1981 – 2010. One must also have a time series of annual TSI data available spanning the period 1961 – 2019. Finally, the SSR anomalies depicted in Fig. 3 must be converted into anomalies of total absorbed solar radiation Δs_a.

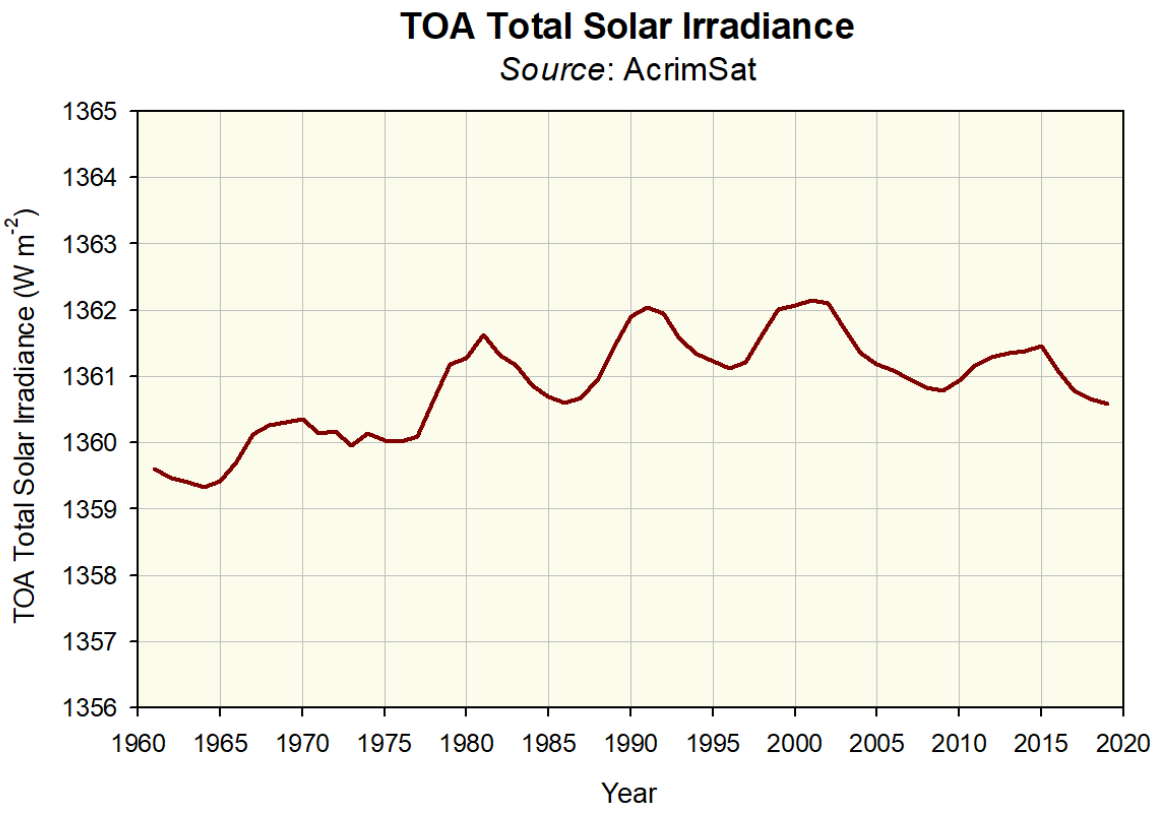


Figure 4. AcrimSat record of total solar irradiance (*S*) at the top of the atmosphere (TOA) employed in this study.

Jones & Harpham (2013) reported that the absolute average surface temperature of the World during the 1981 - 2010 period was between 13.9 and 14.2 °C. Taking the mean of this range we assumed $T_{sb} = 287.2$ K (14.05 °C). Based on an extensive review of Earth's albedo estimates and their history conducted by Stephens et al. (2015), we adopted $\alpha_b = 0.2942$ for the period 1981 – 2010. Annual TSI values shown in Fig.4 were provided by Prof. Nicola Scafetta (personal communication) based on the AcrimSat observational record from 1980 to the present and proxy-based solar reconstructions prior to 1980.

The SSR anomalies (Δs_d) can easily be converted into anomalies of *total absorbed* solar radiation by the Earth-atmosphere system (Δs_a) required in Eq. 1, if one knows the Earth's average surface albedo (α_s) and the atmospheric fraction of absorbed solar radiation (f_a), using the formula:

$$\Delta s_a = \frac{1-\alpha_s}{1-f_a}\,\Delta s_d \qquad (2)$$

Wild et al. (2013) provided global estimates of the Earth's energy budget parameters along with their uncertainty ranges from a surface perspective (see their Fig. 1). Their data suggest $0.116 \le \alpha_s \le 0.145$ and $0.308 \le f_a \le 0.378$. Based on these ranges, the following limits are obtained for the conversion factor in Eq. 2:

$$1.236 \le \frac{1-\alpha_s}{1-f_a} \le 1.421 \qquad (3)$$

Thus, the total absorbed solar radiation by the Earth-atmosphere system is 23.6% to 42.1% greater than the corresponding shortwave flux received on a horizontal plane at the Earth surface. Figure 5 shows annual anomalies of the total absorbed solar radiation estimated by Eq. 2 using the SSR time series depicted in Fig. 3. On average, the Earth absorbed between 9.1 and 10.5 W m^{-2} *more* solar radiation in the early 1960s than it did during the 1981 – 2010 reference period. This was most likely a result of a reduced cloud cover/albedo during the 1960s. Even when compared to 2019, the early 1960s saw 8.5 W m^{-2} *higher* planetary absorption of shortwave radiation than the present. In terms of absolute values, this *measured* solar forcing is more than 2 times *greater* than the *modeled* (but never observed) radiative forcing of 3.74 W m^{-2} attributed to a doubling of atmospheric CO_2 concentration (Gregory et al. 2004). Hence, based on this fact alone, it is reasonable to expect that the early 1960s were globally *much* warmer than the second decade of the 21st Century, and that a rapid and significant cooling took place in 1970s. Figure 6 depicts the dynamics of total absorbed solar radiation by the Earth-atmosphere system, which was obtained by adding the anomalies depicted in Fig. 5 to the average shortwave absorption $S_a = 240.2$ W m^{-2} during the 1981 – 2010 period. This average solar flux was calculated from mean values of TSI (S = 1,361.35 W m^{-2}) and Earth's Bond albedo ($\alpha_b = 0.2942$) during the reference period using the formula:

$$S_a = \frac{S}{4}(1 - \alpha_b) \qquad (4)$$

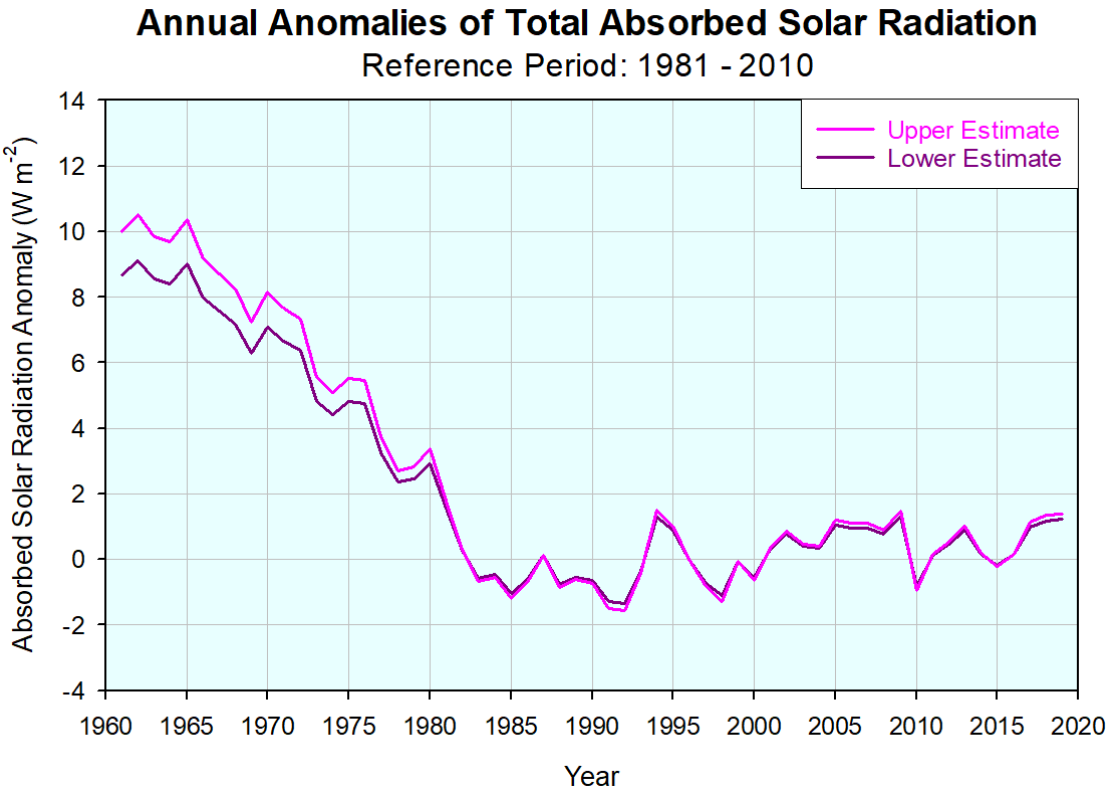


Figure 5. Global annual anomalies of absorbed total solar radiation by the Earth-atmosphere system with respect to the 1981 – 2010 reference period estimated from observed SSR anomalies (Yuan et al. 2021) in Fig. 3 using Eq..2.

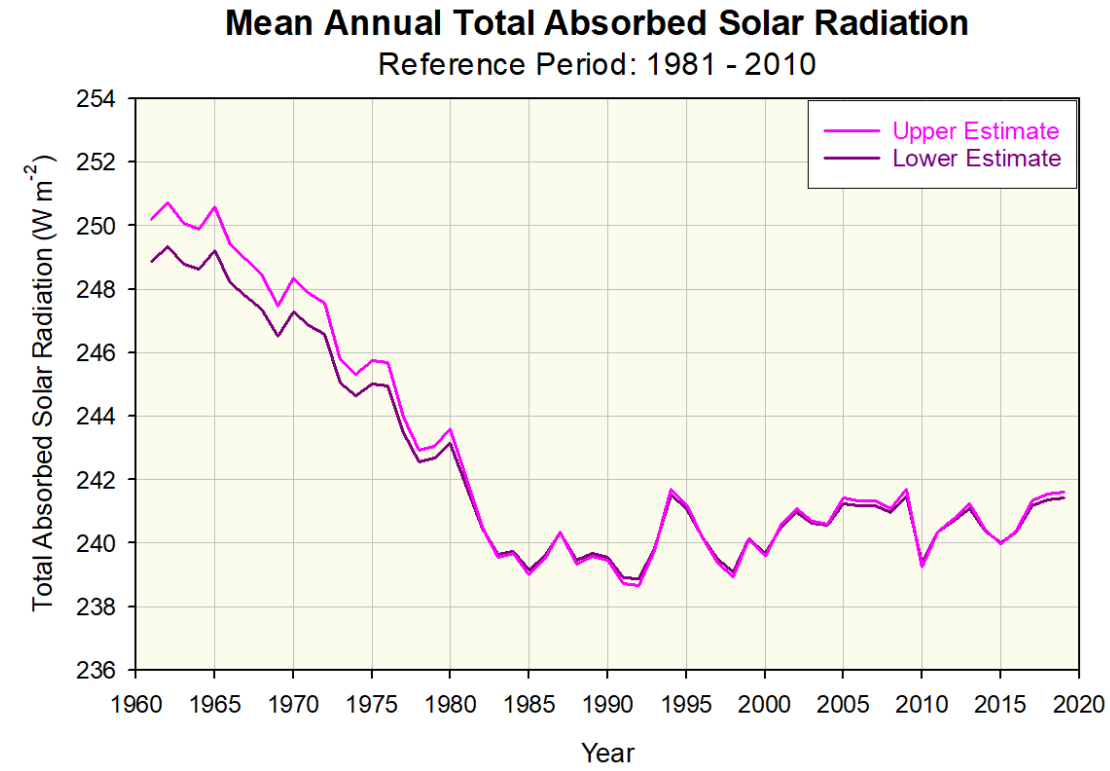


Figure 6. Annual absorbed total solar radiation by the Earth-atmosphere system calculated from anomalies shown in Fig. 5 and an estimated average absorption of 240.2 W m^{-2} during the 1981 – 2010 reference period.

The annual anomalies of absorbed shortwave radiation (Δs_a) depicted in Fig. 5 can be used to reconstruct the dynamics of Earth's Bond albedo implied by the SSR measurements. To this end, one must first compute the albedo anomalies ($\Delta\alpha$) using the relationship from Eq. 17 in Nikolov & Zeller (2022):

$$\Delta\alpha = -\frac{4}{S}\Delta s_a \qquad (5)$$

Next, the albedo anomalies are added to the average Bond albedo during the 1981 – 2010 reference period $\alpha_b = 0.2942$. Figure 7 displays the resulting time series of Earth's total albedo. From these data, one can calculate the reflected solar radiation by the Earth-atmosphere system and compare these estimates to independent measurements by CERES, which we discuss in Section 3.1.

The time series depicted in Fig. 5 were used with Eq. 1 to produce upper and lower estimates of ΔT for each annual anomaly of absorbed solar radiation. The resulting temperature patterns are discussed in Section 3.

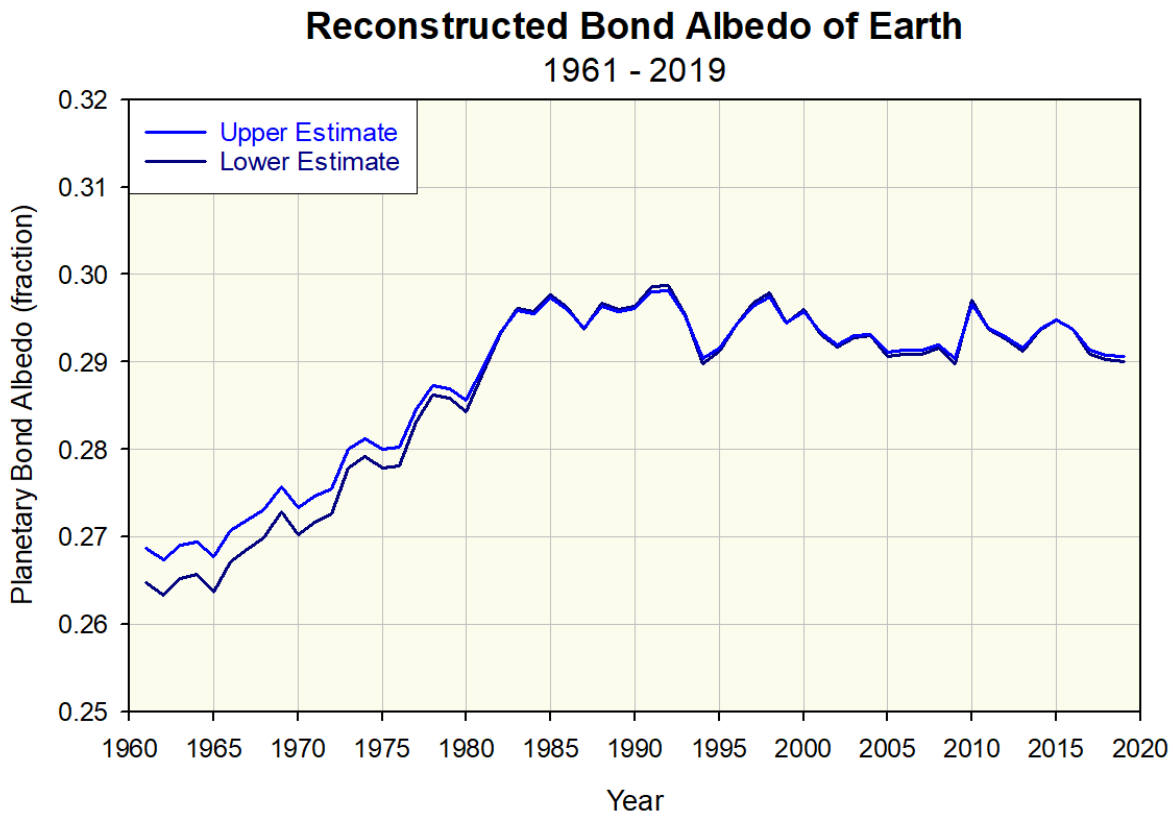


Figure 7. Reconstructed Bond albedo of Earth based on globally averaged SSR data over land reported by Yuan et al. (2021).

3. Results

Since physical and biological processes in Earth's ecosystems are controlled by absolute temperatures rather than temperature anomalies, we converted the ΔT estimates obtained from Eq. 1 to absolute Kelvin temperatures by adding the average absolute temperature of the 1981 – 2010 reference period $T_{sb} = 287.2$ K (Jones & Harpham 2013) to the modeled series of temperature anomalies. We used a similar approach to also convert observed global temperature anomalies in the lower troposphere and at the Earth's surface reported by UAH and HadCRUT5 to absolute surface air temperatures. Thus, all comparisons of temperature series in this Section utilize the absolute Kelvin scale. We begin with a discussion about reconstructed global surface temperatures from SSR anomalies for the period 1982 – 2019.

3.1. Reconstruction of Global Surface Temperature Dynamics During the Satellite Era (1982 -2019)

Figure 8 portrays the reconstructed dynamics of global surface temperature based on SSR data from 1982 to the present. The upper and lower temperature estimates were obtained from the corresponding upper and lower time series of absorbed shortwave-radiation anomalies shown in Fig. 5 using Eq. 1. The difference between the two estimates is rather small over this period, which is also reflected in the 37-year warming trend ranging from 0.12 to 0.14 K/decade.

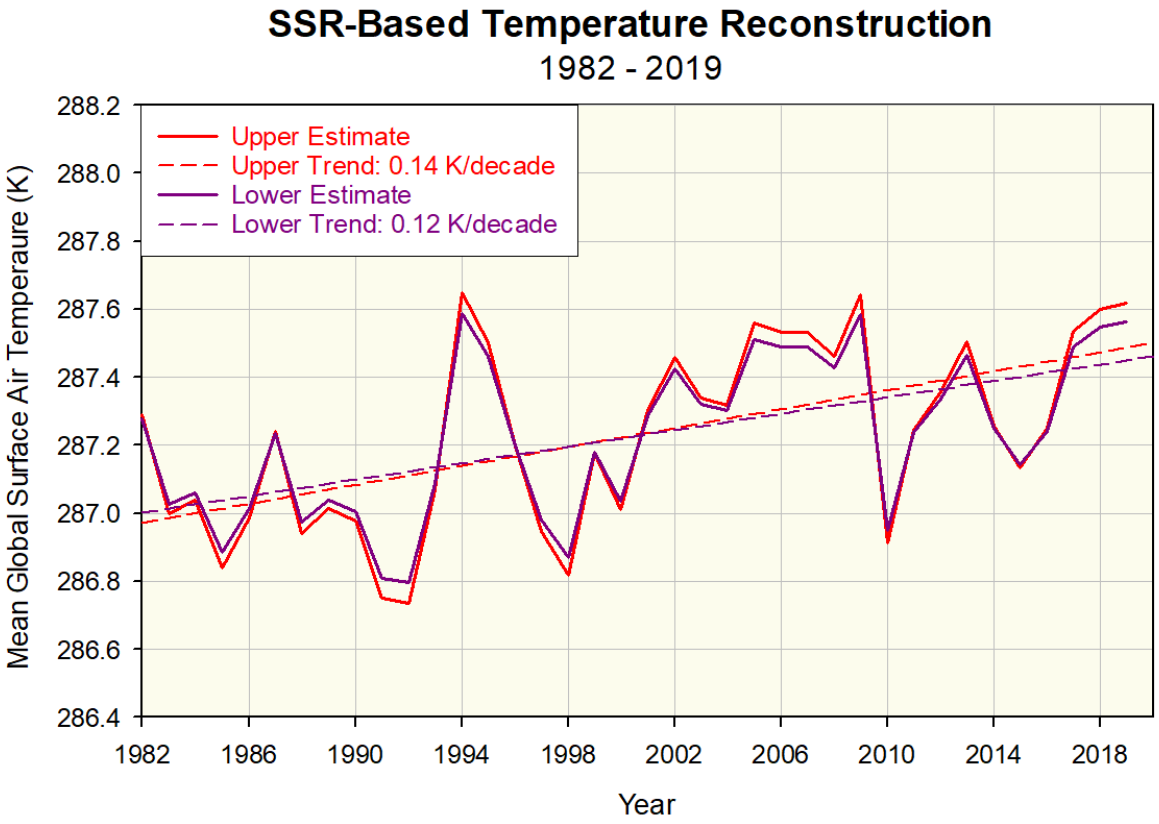


Figure 8. Reconstructed dynamics of the average global surface air temperature during the period 1982 – 2019 based on SSR data provided by Yuan et al. (2021). The upper and lower estimates are calculated from time series of absorbed solar radiation anomalies shown in Fig. 5 using Eq. 1 and then converted to absolute surface air temperatures as described in the text.

Figure 9 compares temperature reconstructions based on SSR data to observed global surface air temperatures inferred from official institutional records provided by UAH (using a satellite-based microwave measurement platform) and HadCRUT5 (utilizing a ground-based network of thermometers). The SSR-based upper temperature estimate has a trend of 0.14 K/decade, which is *identical* to the UAH's trend over this time period. The HadCRUT5 record shows a bit higher warming rate of 0.2 K/decade for the past 37 years. Note that the UAH record is inferred from satellite observation uniformly covering the entire Globe, while the HadCRUT5 series is based on non-uniformly distributed measuring stations mostly located on land with a rather sparse coverage over the ocean especially in the Southern Hemisphere. The steeper warming trend of HadCRUT5 appears to be a result of multiple adjustments done to temperature data after the fact. For example, the rate of global warming from 1950 to the second decade of the 21st Century has increased 28.2% between Versions 3 and 5 of the HadCRUT data set. Altering past temperature anomalies in an effort to generate more warming appears to be a routine practice by the Climate Research Unit (CRU) at the University of East Analia. These periodic "adjustments" helped produce an "observed" global temperature record with a warming trend that matches the one simulated by CO_2-driven climate models. However, a warming rate of 0.2 K/decade over the past 20 years is *inconsistent* with both CERES measurements of reflected solar radiation and land-based SSR data.

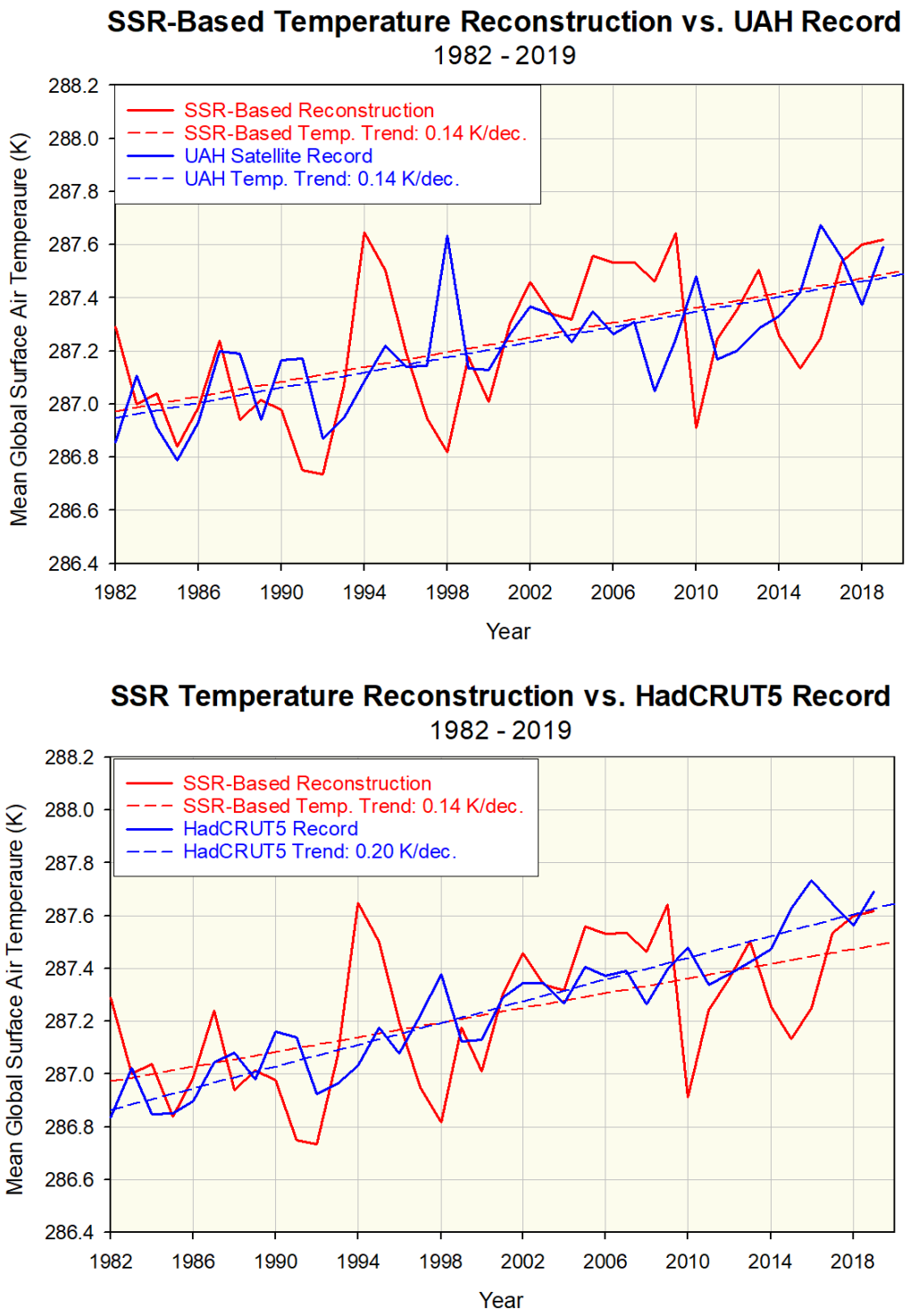


Figure 9. Comparison of 37-year global temperature trends between SSR-based reconstructions of this study and official institutional records based on direct observations. *Upper Panel*: SSR-reconstructed temperature and the UAH satellite record; *Lower Panel*: SSR-reconstructed temperature and the HadCRUT5 surface record.

A close examination of the data series in Fig. 9 reveals that observed global temperatures *lag* the SSR-based reconstructions by 1 to 4 years. This makes physical sense, if SSR were the driver of climate change

for the past 40 years, because the Earth surface has a significant thermal inertia that delays the response of global temperature to perturbations in incoming solar radiation. The larger the interannual SSR perturbation the longer the expected lag as it is indeed observed. Figure 10 illustrates the match of interannual temperature variations between instrumental records and the SSR-based reconstruction after the reconstructed series has been shifted 1 – 3 years *forward* to account for a variable lag.

Notice how well the SSR-based temperature reconstruction describes El Niño and La Niña events over the past 39 years. Yet, the overlap with global temperature records is not perfect, because these records represent averages that include ocean surface air temperatures, while the SSR-based reconstruction only relies on radiation measurements over land. The evidence presented in Figures 9 and 10 collectively points toward the following conclusions:

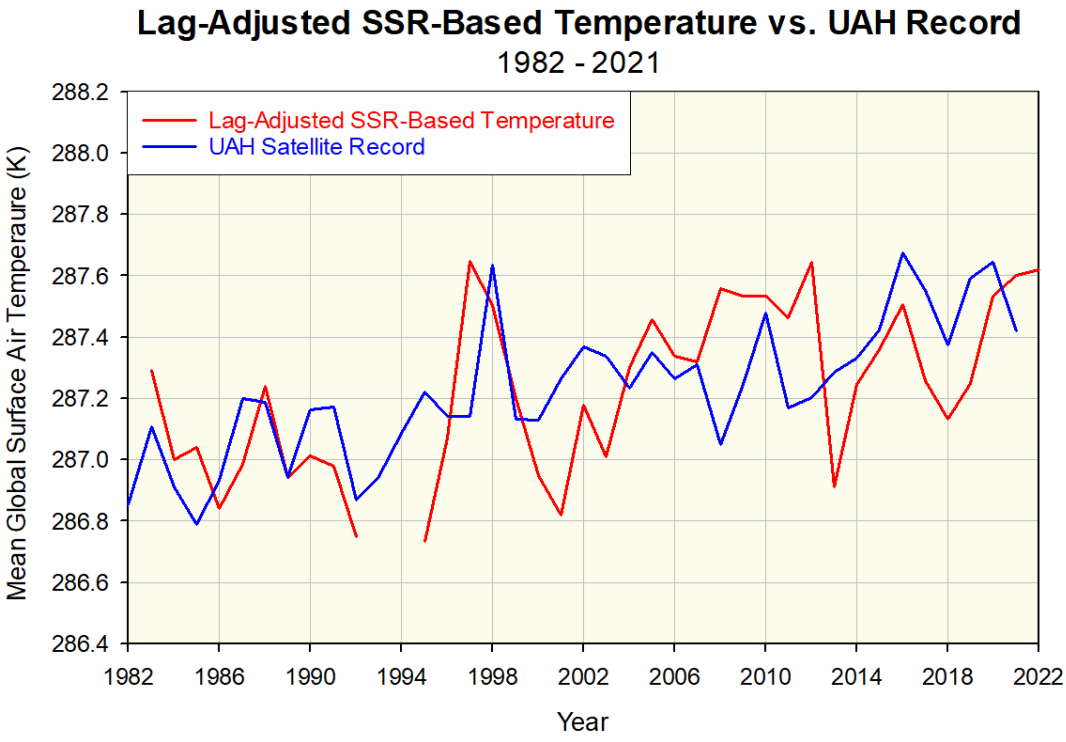
a) The overall upward trend and interannual variability of global surface temperature during the past 40 years have been caused by changes of cloud albedo and the resulting variations of SSR. This is in agreement with results from a previous analysis by Nikolov & Zeller (2022), which compared cloud-albedo variation measured by CERES to global surface temperature changes for the past 20 years;

b) Large El Niño events appear to be induced by synchronous changes of cloud cover and SSR over several continents at once 3 - 4 years before the event is registered by near-surface temperature measurements. Hence, the ENSO cycles are not triggered by heat fluxes periodically released from the Equatorial Pacific as currently believed (see this NASA webpage for a conventional explanation of ESNO), but are a result of changes in absorbed solar radiation by the Planet due to fluctuations of global cloud albedo.

The SSR-based reconstruction of Earth's Bond albedo depicted in Fig. 7 can be used to estimate reflected shortwave radiation by the Planet and the results compared to independent measurements by CERES to provide yet another test of the hypothesis that observed changes in solar fluxes at the surface are caused by variations of cloud albedo. Reflected shortwave radiation (S_r, W m^{-2}) is a product of the albedo (α) and the planet's average insolation ($S/4$), i.e.:

$$S_r = \frac{S}{4}\alpha \qquad (6)$$

Figure 11 (*Upper Panel*) depicts the modeled evolution of reflected solar radiation between 1961 and 2019 based on reported SSR anomalies. The red curve represents independent measurements by CERES obtained after year 2000. The *Lower Panel* of Fig. 11 shows a close-up of the modern global warming period: 1985 - 2019. We chose 1985 as a start of the period, because this year marks an inflection point on the SSR curve between descent (*dimming*) and ascent (*brightening*) (see Fig. 3). Note that the 1985 - 2019 trend of reflected solar radiation derived from SSR data is quite similar to the 19-year trend of reflected shortwave fluxes measured by CERES during the 21st Century. This means that the CERES state-of-the-art observations are fully compatible with and confirm the downward trend of Earth's cloud albedo implied by the SSR data. In addition, the SSR-based estimates of reflected solar radiation after year 2000 fall within 67% of the CERES measurement uncertainty (calibration error). Therefore, the comparison between SSR-inferred and CERES-observed fluxes of reflected shortwave radiation by Earth indicates that the SSR-based albedo estimates are robust, and one should trust the projections of a *low* planetary albedo and a *high* sunlight absorption by Earth during the early 1960s depicted in Figures 6 and 7.



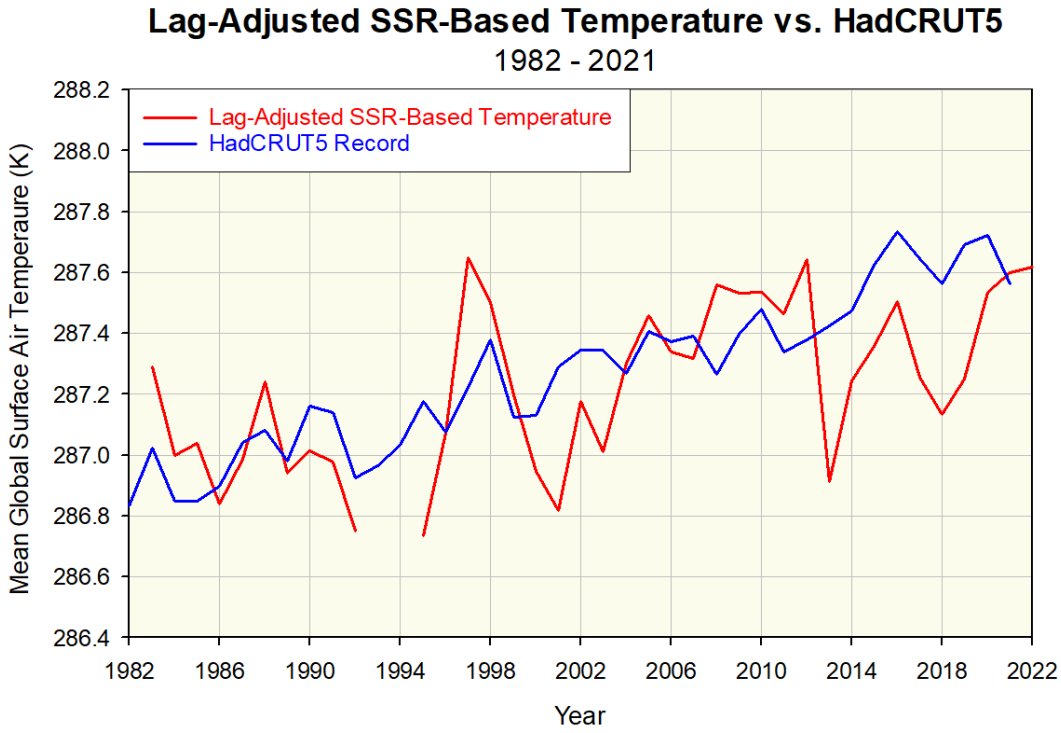


Figure 10. Comparison of interannual variations between instrumental records of global surface temperature and lag-adjusted SSR-based temperature reconstructions. The SSR-derived global temperature series was shifted forward by 1 year between 1982 and 1992 and by 3 years between 1993 and 2019 to reveal its alignment with observations. *Upper Panel*: SSR-reconstructed temperatures and the UAH satellite record; *Lower Panel*: SSR-reconstructed temperatures and the HadCRUT5 surface record.

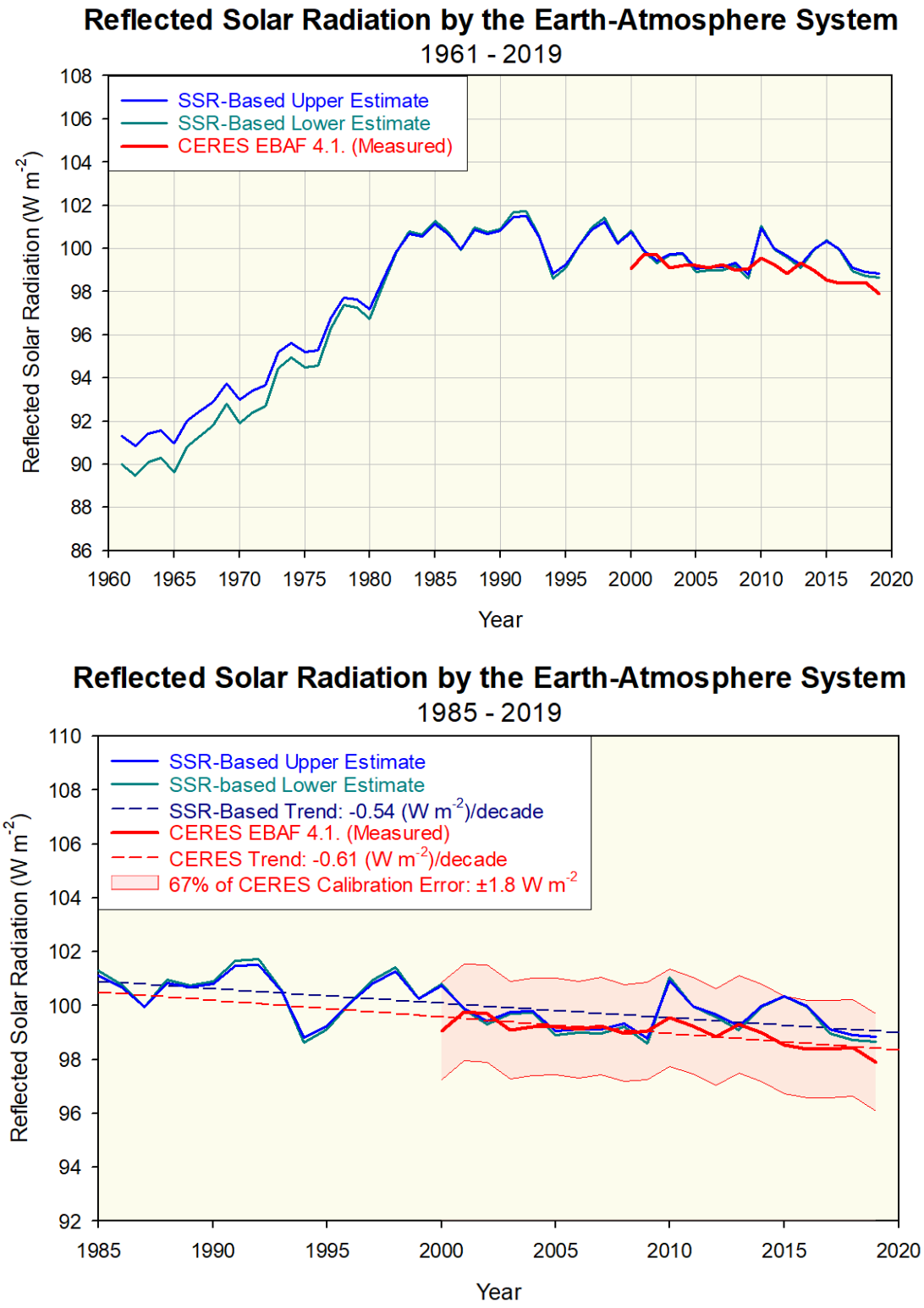


Figure 11. Reflected solar radiation by the Earth-atmosphere system estimated from SSR data and measured by CERES. *Upper Panel*: during the 1961 – 2019 period; *Lower Panel*: during the recent period of global warming (1985 – 2019).

3.2. Reconstruction of Global Surface Temperature Dynamics during the 1962 -2022 Period

The ability of the NZ albedo-temperature model (Equations 1 through 3) to reproduce the overall trend and interannual variability of Earth's global surface air temperature from measured SSR anomalies on land during the satellite era (Figs. 9 and 10) brings forth two conclusions: (*a*) The observed warming of the past four decades was most likely caused by a decrease of cloud albedo and a related increase of surface solar radiation, and not by rising atmospheric greenhouse-gas concentrations; and (*b*) The global temperature dynamics reconstructed from SSR data between 1961 and 1985 is most likely correct and should be taken seriously.

Figure 12 depicts the reconstructed dynamics of the global absolute surface air temperature from 1962 to 2022 based on SSR data. The discontinuity in the time series between 1993 and 1995 is a result of adjustments made to account for a variable time lag (see the caption of Fig. 12 for details). Note that the difference between lower and upper estimates is quite small compared to interannual and decadal temperature variations. SSR measurements suggest that the Earth cooled about 3.0 K between 1963 and 1985 and warmed approximately 0.6 K from 1985 to the present. Thus, the early 1960s were globally 2.4 K *warmer* than the present! This is a drastically different pattern of planetary climate change from the one portrayed in Fig. 1 and promoted by IPCC.

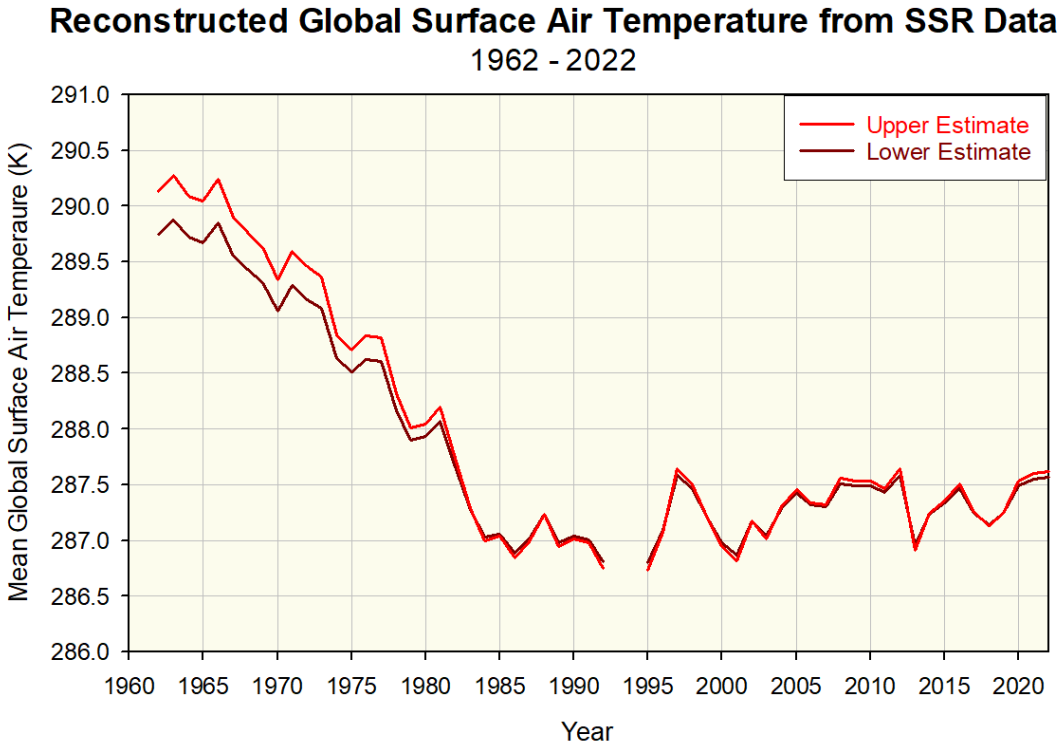


Figure 12. Reconstructed dynamics of the mean global surface air temperature during the 1962 – 2022 period based on SSR data provided by Yuan et al. (2021). The upper and lower estimates are computed from the two series of absorbed solar-radiation anomalies shown in Fig. 5 using Eq. 1. This is followed by a conversion of the resulting temperature anomalies into absolute surface air temperatures as described in the text. The reconstructed temperature series were then shifted forward 1 year between 1961 and 1992, and 3 years between 1993 and 2019 to account for an observed variable lag discussed in Section 3.1. This created a small discontinuity in the data between 1993 and 1995.

Figure 13 compares the reconstructed global temperature dynamics from SSR data to official temperature records from HadCRUT5 and UAH for the 1962 – 2022 period. The SSR-derived temperature series agrees quite well with observed global surface temperatures from 1983 to the present, i.e. over the past 39 years. However, prior to 1983, the SSR-derived estimates dramatically diverge from the HadCRUT5 record. Particularly notable is the rapid cooling evident in the SSR-based reconstruction between 1965 and 1983, which stands in stark contrast to a mild warming claimed by the HadCRUT5 record for the same period. The SSR data suggest a 1.3 K drop of global temperature in a single decade, which gives credence to the "*ice-age scare*" documented in numerous reports by news media and Government agencies throughout the 1970s.

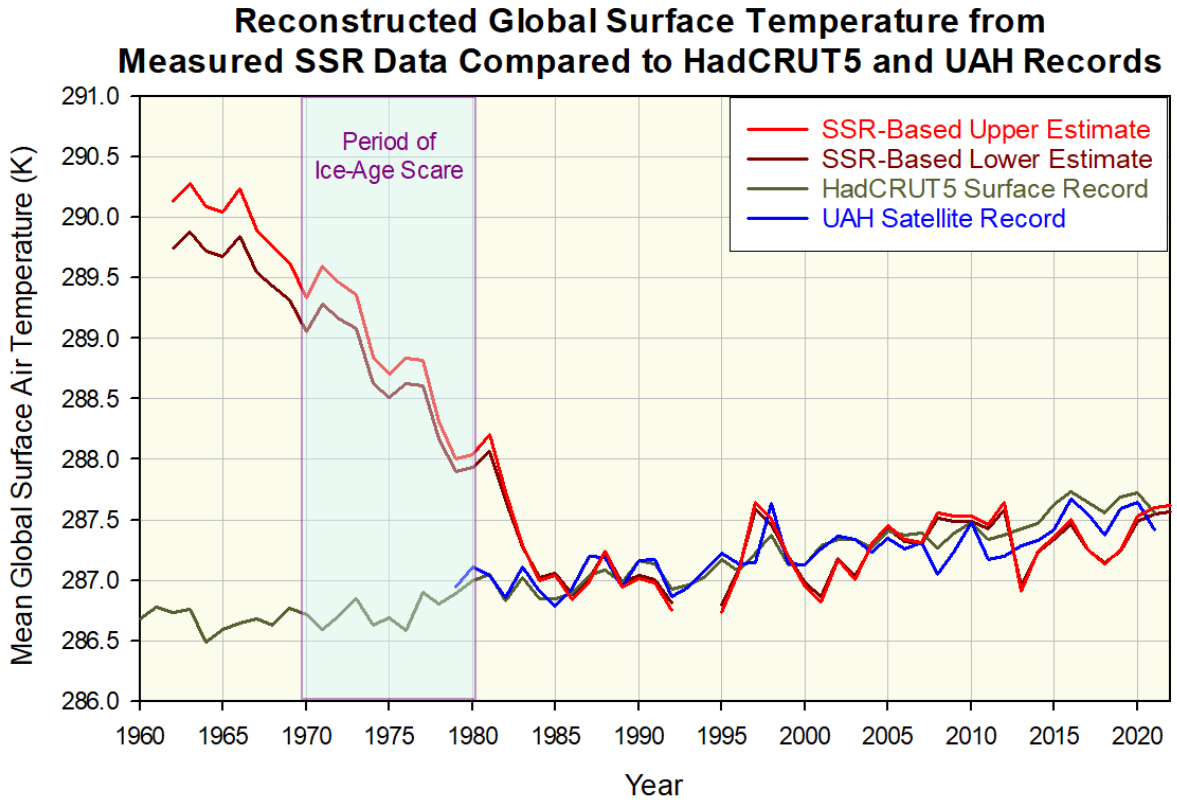


Figure 13. Global temperature dynamics reconstructed from SSR data and reported by UAH and HadCRUT5 datasets during the 1962 – 2022 period. Highlighted in light blue is the period of the "*ice-age scare*", when news media, academic institutions, and Government Agencies intensely discussed an ongoing rapid cooling.

4. Discussion

The analysis of global SSR data provided by Yuan et al. (2021) strongly suggest that the 1960s were significantly warmer that the second decade of the 21st Century, and that a steep worldwide cooling of -1.3 K/decade took place during the 1970s and early 1980s, which is not present in any current official global temperature dataset (see Fig. 1). This begs the following questions: *Is there evidence outside of the SSR data series corroborating this cooling? If such a cooling did occur, how can we explain its total absence from modern institutional temperature records?* The Sections below address these issues.

4.1. Evidence for a Rapid Global Cooling from the Late 1960s through 1982

There are two lines of evidence supporting the occurrence of a major climate cooling between 1960s and 1982: (*a*) discussions in the "public square" about the impact of an ongoing cooling on agricultural production and economy, and (*b*) tree-ring proxy temperature reconstructions.

During the decade of 1970s, more than 115 reports were published in newspapers, popular science magazines and by Government agencies discussing Earth's rapidly cooling climate and a possible descent into a new Ice Age (see also this list of publications). These reports quoted prominent climate scientists of the day, who warned the Western society about the dire consequences of a prolong cooling for the World's food supply. In the early 1970s, the cooling was attributed to human-induced air pollution (such as industrial emissions of particulate matter) blocking the Sun. Based on this belief, some experts called for outlawing of the internal combustion engine for vehicles and a strict control over all forms of fossil fuel burning in order to prevent the Earth from plunging into an Ice Age (e.g. The Owosso, Jan. 26, 1970). Ironically, western Governments now push for severely limiting the combustion of fossil fuels in an effort to "save the Planet" from *overheating* (see IPCC Special Report on 1.5°C Warming 2018)! However, by 1975, scientists admitted that they did not really know, what was driving the observed cooling. Here are two prominent reports from that time that sounded the alarm about a cooling World.

In 1975, *Newsweek* published an article by Peter Gwynne, an Oxford graduate and award-winning science writer, entitled "*The Cooling World*" (see Fig. 14 for the full text of the article). In it, Gwynne quotes climate scientists from NOAA, Columbia University and the University of Wisconsin as well as reports by the National Academy of Sciences all confirming a significant cooling trend that has replaced 75 years of prior "*extraordinary mild conditions*". He states that satellite photos have shown a sudden, large increase of winter snow cover in the Northern Hemisphere and that a NOAA study found a 1.3% reduction in the amount of sunshine reaching the surface of the Continental US between 1964 and 1972. This relative reduction of sunshine corresponds to about 3.25 W m^{-2} decrease in the mean annual SSR. For comparison, the dataset by Yuan et al. (2021) shows a SSR drop of 4.25 W m^{-2} over the North American Continent between 1964 and 1972. Gwynne writes that, although meteorologists may disagree about the cause and extent of the rate of cooling, they are "*almost unanimous in their view that the cooling trend will reduce agricultural productivity for the rest of the century*". These are unusually strong statements, if there had been no cooling during 1960s and 1970s as claimed by modern climate records (Fig. 1).

By 1974, the cooling of the global climate had such a strong impact on the World's economy that it became a national security issue and was addressed by a special classified Report of the US Central Intelligence Agency (CIA) entitled "*A Study of Climatological Research as it Pertains to Intelligence Problems*". The Report is currently available at the Digital Library of the US Department of Homeland Security. According to this document, an unfolding global crisis in the food supply chain triggered by a rapid cooling of Earth's climate since 1965 made it urgent to develop methodologies capable of predicting future climate change. Such techniques were lacking at the time, the Report points out, because prior to 1960 the Planet was so warm and weather conditions so favorable for crop growth that forecasters viewed climate only as a minor factor in their agricultural projections. The 36-page CIA Report summarizes the state of climate science as it existed in the early 1970s by describing 3 main schools of thought (approaches) to understanding and predicting climate change. Notably, none of these schools considered atmospheric greenhouse gases as drivers of Earth's climate!

SCIENCE

The Cooling World

There are ominous signs that the earth's weather patterns have begun to change dramatically and that these changes may portend a drastic decline in food production—with serious political implications for just about every nation on earth. The drop in food output could begin quite soon, perhaps only ten years from now. The regions destined to feel its impact are the great wheat-producing lands of Canada and the U.S.S.R. in the north, along with a number of marginally self-sufficient tropical areas—parts of India, Pakistan, Bangladesh, Indochina and Indonesia—where the growing season is dependent upon the rains brought by the monsoon.

The evidence in support of these predictions has now begun to accumulate so massively that meteorologists are hard-pressed to keep up with it. In England, farmers have seen their growing season decline by about two weeks since 1950, with a resultant over-all loss in grain production estimated at up to 100,000 tons annually. During the same time, the average temperature around the equator has risen by a fraction of a degree—a fraction that in some areas can mean drought and desolation. Last April, in the most devastating outbreak of tornadoes ever recorded, 148 twisters killed more than 300 people and caused half a billion dollars' worth of damage in thirteen U.S. states.

Trend: To scientists, these seemingly disparate incidents represent the advance signs of fundamental changes in the world's weather. The central fact is that after three quarters of a century of extraordinarily mild conditions, the earth's climate seems to be cooling down. Meteorologists disagree about the cause and extent of the cooling trend, as well as over its specific impact on local weather conditions. But they are almost unanimous in the view that the trend will reduce agricultural productivity for the rest of the century. If the climatic change is as profound as some of the pessimists fear, the resulting famines could be catastrophic. "A major climatic change would force economic and social adjustments on a worldwide scale," warns a recent report by the National Academy of Sciences, "because the global patterns of food production and population that have evolved are implicitly dependent on the climate of the present century."

A survey completed last year by Dr. Murray Mitchell of the National Oceanic and Atmospheric Administration reveals a drop of half a degree in average ground temperatures in the Northern Hemisphere between 1945 and 1968. According to George Kukla of Columbia University, satellite photos indicated a sudden, large increase in Northern Hemisphere snow cover in the winter of 1971-72. And a study released last month by two NOAA scientists notes that the amount of sunshine reaching the ground in the continental U.S. diminished by 1.3 per cent between 1964 and 1972.

To the layman, the relatively small changes in temperature and sunshine can be highly misleading. Reid Bryson of the University of Wisconsin points out that the earth's average temperature during the great Ice Ages was only about 7 degrees lower than during its warmest eras—and that the present decline has taken the planet about a sixth of the way toward the Ice Age average. Others regard the cooling as a reversion to the "little ice age" conditions that brought bitter winters to much of Europe and northern America between 1600 and 1900—years when the Thames used to freeze so solidly that Londoners roasted oxen on the ice and when iceboats sailed the Hudson River almost as far south as New York City.

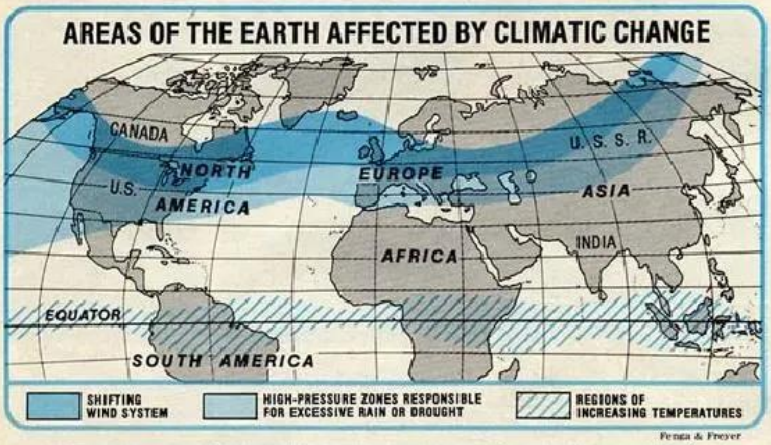
Just what causes the onset of major and minor ice ages remains a mystery. "Our knowledge of the mechanisms of climatic change is at least as fragmentary as our data," concedes the National Academy of Sciences report. "Not only are the basic scientific questions largely unanswered, but in many cases we do not yet know enough to pose the key questions."

Extremes: Meteorologists think that they can forecast the short-term results of the return to the norm of the last century. They begin by noting the slight drop in over-all temperature that produces large numbers of pressure centers in the upper atmosphere. These break up the smooth flow of westerly winds over temperate areas. The stagnant air produced in this way causes an increase in extremes of local weather such as droughts, floods, extended dry spells, long freezes, delayed monsoons and even local temperature increases—all of which have a direct impact on food supplies.

"The world's food-producing system," warns Dr. James D. McQuigg of NOAA's Center for Climatic and Environmental Assessment, "is much more sensitive to the weather variable than it was even five years ago." Furthermore, the growth of world population and creation of new national boundaries make it impossible for starving peoples to migrate from their devastated fields, as they did during past famines.

Climatologists are pessimistic that political leaders will take any positive action to compensate for the climatic change, or even to allay its effects. They concede that some of the more spectacular solutions proposed, such as melting the arctic ice cap by covering it with black soot or diverting arctic rivers, might create problems far greater than those they solve. But the scientists see few signs that government leaders anywhere are even prepared to take the simple measures of stockpiling food or of introducing the variables of climatic uncertainty into economic projections of future food supplies. The longer the planners delay, the more difficult will they find it to cope with climatic change once the results become grim reality.

—PETER GWYNNE with bureau reports



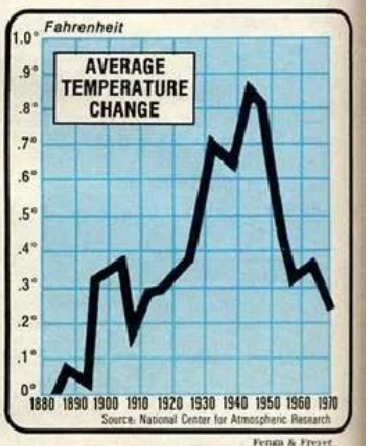


Figure 14. "*The Cooling World*", an article by Peter Gwynne, an award-winning science writer and a former science editor of *Newsweek*, published in *Newsweek* on April 28, 1975.

In fact, the Report does not even mention terms such as "*carbon dioxide*" (CO_2) or "*greenhouse-gas emissions*". This implies that the mainstream climate science of 1970s was not under the influence of the 19th-Century *Greenhouse Theory*, which now dominates academic research in this area. The Report also points out that the rapid cooling during the late 1960s and early 1970s triggered the preparation of a National Climate Plan as a joint effort of several US agencies. The Plan called for allocation of funding by the US Office of Management and Budget to establish a Center for Climate and Environmental Assessment at NOAA, which will be supported by the National Science Foundation and the US National Academy of Sciences. Other countries had also launched Climate Research Programs in response to rapidly deteriorating weather conditions from one year to the next, the Report states. Thus, the modern $2.5B annual climate research budget of the US, now mostly spent on studying *anthropogenic global warming*, originated from an unusually severe *cooling episode* during 1960s and 1970s. It is sobering to realize that, if it was not for the threat posed by a *cooling climate* on the global agricultural production some 50 years ago, we would not now have a lavishly funded climate science!

If the Earth's global temperature followed a trajectory claimed by the HadCRUT dataset, which shows a 0.4 K warming between 1965 and 1980, why would western Governments and our society as a whole have engaged in extensive discussions about a global cooling for a full 10 years during the 1970s? Such discussions only make sense, if the global temperature had been on a trajectory indicated by the SSR-based reconstructions shown in Fig. 13.

The second line of evidence for a steep global cooling during the 1960 – 1980 period comes from proxy temperatures inferred from tree-ring chronologies. This evidence is articulated in email exchanges between top scientists at the University of East Anglia's Climate Research Unit (CRU) as well as US researchers that have become public through the 2009 Climate Gate leak. In 1999, the CRU Director Phil Jones sent an email describing a "trick" he performed on a tree-ring proxy series belonging to the CRU Deputy Director Keith Briffa that showed a sharp decrease of ambient temperature after 1961. In order to hide the unwanted decline, Jones simply decided to truncate the problematic proxy temperature series at 1961 and splice instrumental temperature records to it that showed a continuous warming. This is the infamous "*hide the decline*" email sent by Phil Jones to several leading climate scientists on Nov. 16, 1999. In a 2005 email, Prof. Jonathan Overpeck, an interdisciplinary climate scientist at the University of Michigan, stated that there "*is a real issue*" in "*showing some of the tree-ring data for the period after 1950*" presumably referring to the fact that tree-ring proxy data often show a prolong cooling after 1950, which cannot be explained by the assumed continuous rise of atmospheric CO_2 concentration for the past 70 years. For more details about these and other email exchanges, please review these blog articles: *Hide the Decline*; McIntyre (2011a); McIntyre (2011b);

4.2. Why is the Cooling of 1970s Absent from Modern Global Temperature Records?

The numerical analyses and facts presented above suggest that the 1960 – 1983 global cooling did occur but has been removed from the official surface temperature records. Such a removal was likely greatly facilitated by the deliberate use of temperature *anomalies* in place of absolute temperatures in all global datasets (Fig. 1). Figure 15 illustrates the possible reason for this act: the pronounced multidecadal cooling is incompatible with the smooth, continuous rise of atmospheric CO_2 reported by Charles Keeling and supposedly based on measurements taken at Mauna Loa HI starting in March of 1958. In order to make a case for the *anthropogenic* climate change endorsed by Resolution 43/53 of the UN General Assembly in 1988, atmospheric CO_2 and global temperature had to follow the same trajectory and be highly correlated

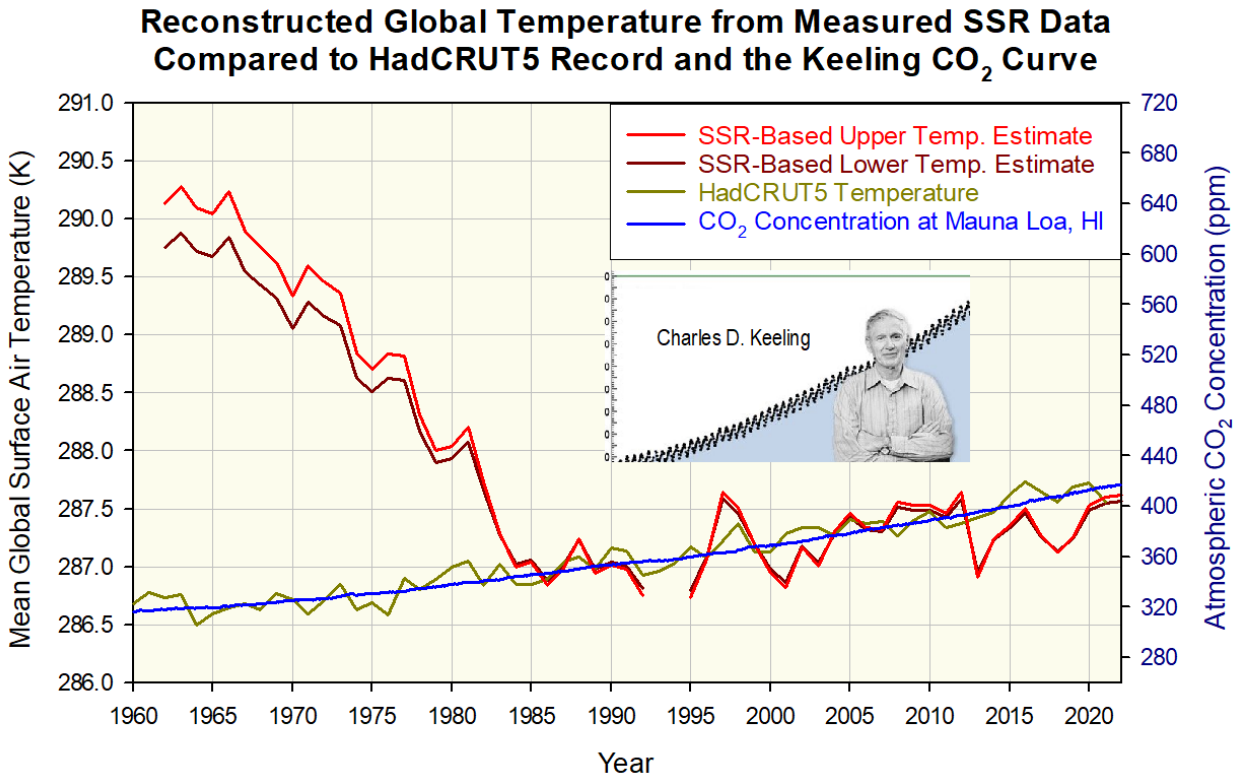


Figure 15. Global temperature dynamics reconstructed from SSR data and reported by HadCRUT5 compared to the Keeling CO_2 curve derived from measurements made at Mauna Loa, HI.

with each other. A 22-year worldwide steep cooling episode during the second half of the 20th Century critically undermines the "Greenhouse" theory, which is at the core of the human-caused global warming concept promoted by the United Nations; hence, such a cooling was likely seen as politically "unacceptable".

Note how closely the HadCRUT5 surface temperature record tracks the Keeling CO_2 curve in Fig. 15. This *tight fit* is a result of numerous after-the-fact "adjustments" made to the HadCRUT dataset over the past 25 years. It appears that the cooling of the 1970s has been removed from the records *prior* to the release of HadCRUT1 in 1994 (Parker et al. 1994). According to Wikipedia, the initial work on assembling a gridded dataset of surface temperature anomalies began at CRU in 1978, but nothing was published until 6 years after the UN's Resolution emphasizing *anthropogenic global warming* and 4 years after the publication of the IPCC First Assessment Report (FAR). Thus, HadCRUT1 was released long after the political winds have shifted toward blaming the industrial greenhouse-gas emissions for climate change.

The following scenario is hypothetical but quite plausible. Since the 1988 UN Resolution on Climate Change and particularly after the establishment of IPCC in 1990, Government funding for climate research in all Western countries became increasingly geared toward programs investigating the effect of atmospheric CO_2 on global temperature. This new research trend could not have remained unnoticed by scientists at the University of East Anglia's Climate Research Unit, who were tasked with the development of the World's first global gridded surface temperature dataset. It is conceivable that these researchers

(now well-funded under the new UN Agenda) quickly realized that the rapid cooling of 1960s and 1970s would create a major scientific and political problem *if* included in the global temperature record and juxtaposed with the ascending Keeling curve of atmospheric CO_2 beginning in 1958. Such an inclusion would have invalidated the "Greenhouse" theory of climate change and compromised the UN Agenda from the start. Thus, the CRU scientists dealt with the issue "appropriately" by simply removing the cooling episode from the global series of temperature anomalies.

5. Conclusion

A new global dataset of Surface Solar Radiation (SSR) published by Yuan et al. (2021) shows a large decrease in the average solar flux reaching Earth's land masses between 1960 and the present. This prompted a reassessment of the known climate-change pattern during the 20th Century. The analysis of globally averaged SSR data revealed a 22-year long steep cooling episode between 1962 and early 1980s that is absent from current institutional global temperature records (Fig. 1), but was a topic of intense public discussions during the 1970s. These findings have profound implications for the "Greenhouse" climate theory and the hypothesis that industrial emissions of carbon dioxide and other "*heat-trapping*" trace gases were responsible for the observed warming in recent decades. The results obtained in our study call for an independent investigation of the methods and procedures employed in the development of global temperature datasets portrayed in Fig. 1. Such an investigation could also shed light on whether or not the recent warming constitutes a "*climate crisis*".