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Research Article

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A 1,470-Year Astronomical Cycle and Its Effect on Earth's Climate

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Abstract

Earth's millennial climate warming cycle has been studied by scientists for decades, but its cause has been lacking. It warms the Earth for several hundred years and melts some of the ice sheets in Greenland and Antarctica. This analysis found that the cycle is caused by the astronomical conjunction of the planets Jupiter, Saturn and Neptune. The current cycle started warming the Earth in the year 1791 and will probably reach peak temperature in approximately year 2060 at the next Jupiter, Saturn and Neptune conjunction. Then it will cause cooling oscillations for the rest of the cycle when the heat from the cycle is reduced.

Key Points

- A 1,470-year astronomical cycle causes the Earth to rapidly warm for several centuries.
- Earth's current warming is one of these rapid warming cycles. It might continue to the year 2060 and then start to cool for the rest of the 1,470-year cycle.
- CO^2 and Sun irradiance changes are not the cause of the 1,470-year rapid warming cycle.

1. Introduction

Scientists generally agree that Earth's long-term Milankovitch (Figure 6) and seasonal (annual) temperature cycles are caused by astronomical orbital changes [1].

They have also identified a millennial temperature cycle but have not, until now, determined its physical cause [2-4]. The historical millennial temperature cycles are recorded in temperature proxies from ice cores in Greenland and Antarctica, as well as many other sources. The cycle is very obvious in Greenland (Figure 1), especially at the left of the figure where there are very large temperature increases. It is logical to assume that an astronomical cycle might be causing these rapid warmings, since they have a predictable pacing. The millennial cycle is not as obvious in Antarctica (Figure 6).

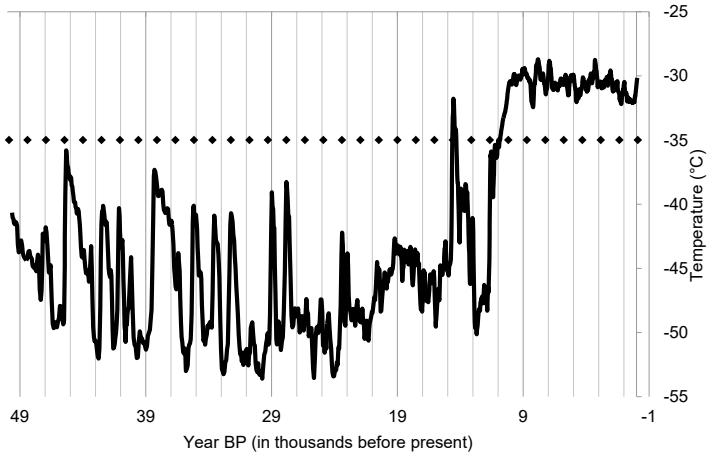

Figure 1: Greenland Temperature from GISP2 Ice Cores (Alley, 2004). Millennial temperature peaks (line peaks) correlate very well with the 1,470-year cycle peaks periodicity (small diamonds). The correlation is most noticeable where there are large temperature increases. (Note: NOAA dataset was updated to include year 2010 temperature).

2. Materials and Methods

This paper investigates several possible causes of the 1,470-year temperature cycles to determine their cause. Some causes considered are:

- An astronomical cycle
- Increase in carbon dioxide (CO2)
- Increase in Sun radiation

The method used was studying available historical ice core temperature proxy and thermometer data.

3. The Cause: An Astronomical Cycle

The historical data shows there is a 1,470-year temperature cycle (Figure 1 and 2).

	cycle conjunct date	1,470 year cycle marker		rapid bottom date	rapid peak date	temp rapid years	cycle peak less temp pk years	. bottom temp	. top temp	top less bottom temp	temp per 100 years	
	49.87	-35										
	48.4	-35		48.499	48.251	0.248	0.149	-44.3731	-43.6391	0.734	0.295968	
	46.93	-35		47.345	47.184	0.161	-0.254	-47.4681	-42.2936	5.1745	3.213975	
	45.46	-35		45.558	45.321	0.237	0.139	-49.3578	-35.8003	13.5575	5.720464	
	43.99	-35		44.093	43.925	0.168	0.065	-44.0774	-43.5679	0.5095	0.303274	
	42.52	-35		42.751	42.349	0.402	0.171	-52.0284	-40.1223	11.9061	2.961716	
	41.05	-35		41.471	41.129	0.342	-0.079	-50.9275	-40.2957	10.6318	3.108713	
	39.58	-35		39.63	39.469	0.161	0.111	-51.9367	-49.9803	1.9564	1.215155	
	38.11	-35		38.677	38.307	0.37	-0.197	-49.7758	-37.319	12.4568	3.366703	
	36.64	-35		36.574	36.414	0.16	0.226	-46.6361	-43.8125	2.8236	1.76475	
	35.17	-35		35.423	35.185	0.238	-0.015	-50.5098	-40.1122	10.3976	4.368739	
	33.7	-35		33.829	33.558	0.271	0.142	-49.3373	-40.8868	8.4505	3.118266	
	32.23	-35		32.476	32.221	0.255	0.009	-50.8868	-40.6933	10.1935	3.997451	
	30.76	-35		30.852	30.536	0.316	0.224	-52.5587	-49.2049	3.3538	1.061329	
	29.29	-35		29.187	28.979	0.208	0.311	-50.5404	-39.0725	11.4679	5.513413	
	27.82	-35		28.255	27.828	0.427	-0.008	-51.3661	-38.267	13.0991	3.067705	
	26.35	-35		26.455	26.242	0.213	0.108	-49.8471	-47.3905	2.4566	1.153333	
	24.88	-35		25.294	25.037	0.257	-0.157	-50.0407	-47.4312	2.6095	1.01537	
	23.41	-35		23.63	23.392	0.238	0.018	-51.2437	-42.2119	9.0318	3.794874	
	21.94	-35		22.3595	22.1865	0.173	-0.2465	-49.47	-47.4719	1.9981	1.154971	
	20.47	-35		20.774	20.621	0.153	-0.151	-47.4719	-44.5055	2.9664	1.938824	
	19	-35		19.382	19.21	0.172	-0.21	-45.0664	-42.6606	2.4058	1.398721	
	17.53	-35		17.776	17.593	0.183	-0.063	-46.3202	-43.5168	2.8034	1.531913	
	16.06	-35		16.274	16.115	0.159	-0.055	-46.1621	-45.2193	0.9428	0.592956	
	14.59	-35		14.788	14.548	0.24	0.042	-44.3043	-31.7737	12.5306	5.221083	
	13.12	-35		13.205	13.035	0.17	0.085	-46.2156	-41.0703	5.1453	3.026647	
	11.65	-35		11.755	11.542	0.213	0.108	-46.8731	-35.8847	10.9884	5.158873	
	10.18	-35	last	10.3502	10.0644	0.2858	0.1156	-32.2957	-30.415	1.8807	0.658048	
	8.71	-35		9.17755	9.06115	0.1164	-0.35115	-30.1407	-29.4456	0.6951	0.597165	
	7.24	-35		7.19745	6.92552	0.27193	0.31448	-31.4364	-28.8252	2.6112	0.960247	
	5.77	-35		5.80773	5.63604	0.17169	0.13396	-30.702	-29.9068	0.7952	0.46316	
	4.3	-35		4.44544	4.25679	0.18865	0.04321	-31.4752	-30.1116	1.3636	0.72282	
	2.83	-35		3.07477	2.85628	0.21849	-0.02628	-30.8804	-30.4556	0.4248	0.194425	
	1.36	-35		1.20624	0.964939	0.241301	0.395061	-32.1876	-30.4628	1.7248	0.714792	
2060	-0.11	-35		0.15938	?			-31.9559	?			
						rapid years	phase shift years			rapid temp increase	temp increase slope/100 years	
	49k-2020 average					0.23119	0.033254			5.457173	2.22351	
	49k-10k average					0.237807	0.021781			6.387852	2.582342	
	10k-2020 average					0.20141	0.08488			1.269117	0.608768	
				49-10k rmax		0.427	0.311			13.5575		
				10k-2020 max		0.271	0.395			2.611		

	49-10k median					0.237	0.042			5.1453	2.961716	
	10k-2020 medain					0.20357	0.088585			1.0794	0.655978	

Figure 2. Greenland Temperature Data from GISP2 Ice Cores (Alley, 2004).

During the last glacial period (left part of Figure 1), the 1,470-year cycle warmed Greenland's temperature by an average of 6.3°C per cycle (and a maximum of 13.5°C). During the most recent 10,000-year interglacial period (right side of Figure 1), it warmed the temperature by an average of 1.2°C per cycle (and a maximum of 2.6°C). For both periods, the average duration of warming was 231 years (and a maximum of 427 years). Each warming ends by cooling off for the rest of the cycle. The current cycle has warmed Greenland by 1.8°C (since year 1791) and the duration is 229 years, so far. Although it is more difficult to see the cycle during interglacial periods (right side of Figure 1), an ice-rafted debris study confirms there is no significant difference in the pacing of the cycles between the current interglacial and the glacial period [6]. Temperature increases in some cycles may seem to almost disappear but, when they return, they return at the correct pacing (as can be seen very clearly at year 14,590 BP and 11,650 BP in Figure 1).

The cycle also occurs in Antarctica (Figure 6), but the rapid temperature increases there are much smaller (maximum increase of 4°C, compared to 13.5°C for Greenland) so they are more difficult to see. This might be because there is less geothermal activity in Antarctica, than Greenland and the Arctic.

The cycle is probably caused by the 1,470-year astronomical conjunction cycle of the planets Jupiter, Saturn and Neptune.

3.1 Historical Data Confirms an Astronomical Cycle Is Warming the Earth

Historical temperature data is very limited, especially from the bottom of the ocean where much of the heat is probably created. But the following data strongly indicates that the 1,470-year cycle is causing a rapid warming cycle.

3.2. Geothermal Warming

There has been an increase in active volcanoes (Figure 3) and earthquakes during the current rapid warming.

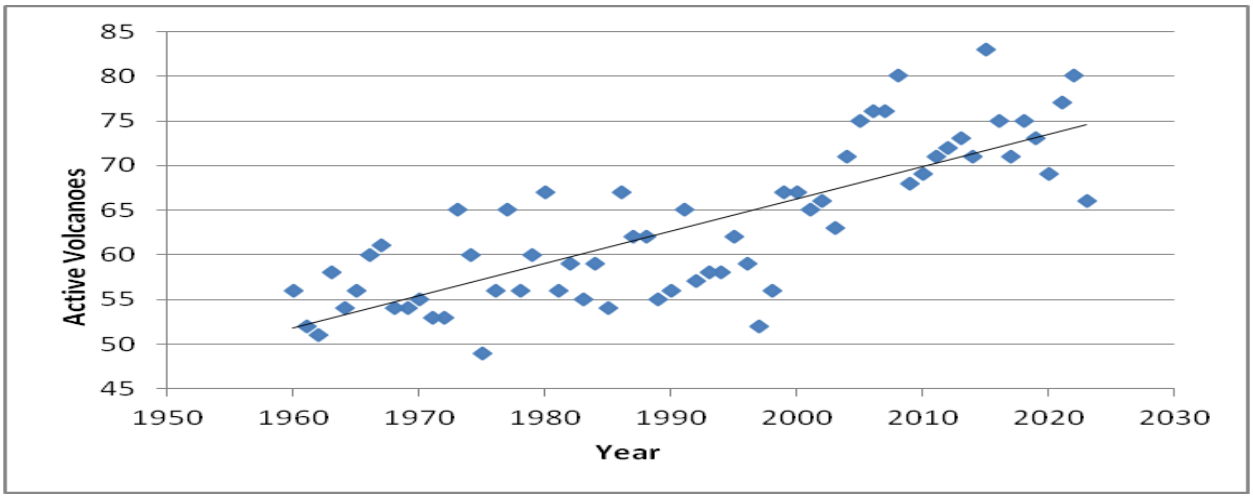

Figure 3: Volcano Eruptions since 1960 (Venzke, 2023). Active volcanoes. A trend line is shown.

The number of active volcanoes on land is increasing during the current rapid warming. There is probably a similar warming occurring deep in the ocean, but it is not measured because the warmed water is less dense and rises to the surface.

3.3. More Warming in Winter

Greenland is warming more in the winter than in the summer (Figure 4). This is probably because geothermal heat has much more effect in the winter when the temperature differential with outside air is greater. Since the year 1880 at Nuuk, the February (winter) temperature trendline increased by 5.1°C, while the July temperature trendline only increased 1.5°C.

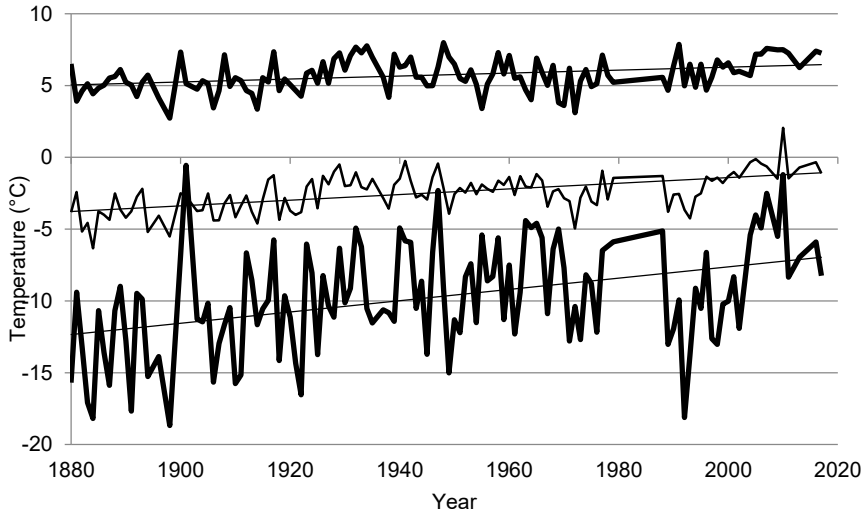

Figure 4: Greenland Air Temperature at Godthud Nuuk [8]. Geothermal heat is causing more warming in winter (bottom line: February), than in summer (top line: July). Middle line is annual mean temperature. Data was not available for some years, (shown as a straight line).

3.4. More Warming in Greenland and Arctic Region

There is more warming in the Arctic and Antarctic regions (dark areas in Figure 5) than in lower latitude locations. This is probably because the spin adjustment causes the mass at Earth's equatorial areas to accelerate sooner than mass at the poles, causing more tidal friction and geothermal heat in the Arctic Region [9].

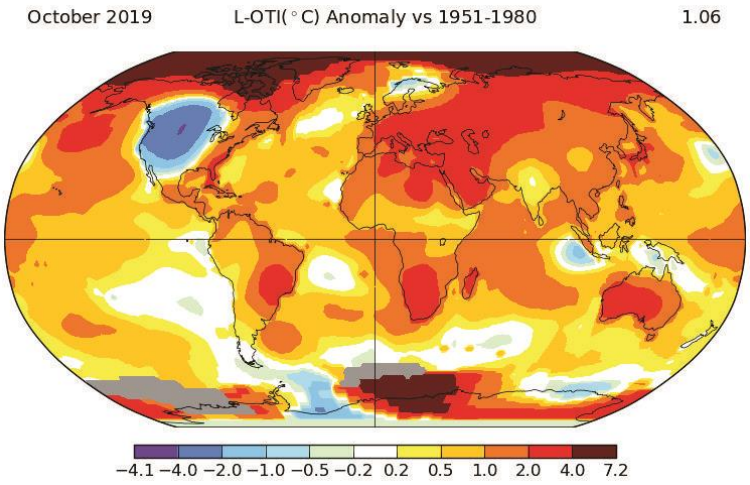

Figure 5: Global Air Temperature Change (GISTEMP Team, 2020). The temperature has increased more in the Arctic and Antarctic regions (dark areas) where there is increased geothermal heat. Map shows temperature change (°C) from average of 1951-1980 to October 2019.

3.5. Ice Shelf Melting From Below

In Greenland, a study found that there are many regions of ice shelf basal melt that is being caused by increased geothermal heat flux [10]. Another study indicates that the flux under the ice sheet is 15 to 30 times greater than normal flux [11]. Another study found that the Greenland Sea deep water is warming ten times faster than global oceans [12]. In Antarctica, most of the ice shelf basal melt is occurring in west Antarctica where there are known geothermal hotspots [13-17]. Conversely, in east Antarctica at Mawson the temperature trendline has not increased since the year 1955 (Figure 8) because there are no geothermal hotspots there.

3.6. Temperature Is Correlated with Earth's Spin Adjustments

A study determined that global temperature is correlated with Earth's excess length of day and geomagnetic declination data [18]. This means that when the cycle adjusts Earth's spin (length of day) it is changing its temperature. Another study determined that Earth's length of day is correlated with the z-axis motion of the center of mass of the solar system relative to the solar equatorial plane [19]. The z-axis motion is primarily caused by the Jovian planets. This means that their gravitation is the primary cause of Earth's spin adjustment and the temperature change.

3.7. Other Astronomical Cycles Also Cause Warming

The winter temperature in Nuuk (Figure 4) and other locations appear to have a very short-term cycle with a 4-year pacing. Historical data shows this in winter temperatures in Greenland, Iceland, Alaska, Russia and probably other locations where there is geothermal activity. The pacing correlates with the astronomical 4-year cycle where Earth's spin and orbit return to their same relative starting alignment every 4-years (where the spin-orbit ratio is a whole number). This is probably where a spin adjustment occurs. It is interesting to note that the average El Niño also has an average pacing of 4 years and so it might be caused by this astronomical 4-year cycle [20].

There are other short-term astronomical conjunction cycles that affect Earth's temperature and cause the temperature to oscillate during the millennial cycle. Some of them are: 19.9-year (Jupiter and Saturn orbit conjunction), 59.6-year (three conjunctions of Jupiter and Saturn orbit where they return to their starting alignment), 179.2-year (nine conjunctions of Jupiter and Saturn where they cause the sun to complete one orbit around the center-of-mass of the solar system). The study of these short-term conjunctions is beyond the scope of this paper.

3.8. 1,470-Year Cycle Causes Heat

How the 1,470-year astronomical cycle warms the Earth is not known with certainty. Historical data (Sections 3.1 - 3.6) suggests that the cycle causes geothermal heat deep in the oceans. For example, the recent large underwater volcanic eruption off of Tonga might have caused the year 2023 to be unusually hot. The most likely cause of the heat is spin-orbit adjustment of Earth.

The 1,470-year cycle is caused by the conjunction cycle of the giant planets Jupiter, Saturn and Neptune. Their 1,470-year conjunction occurs after 124 orbits of Jupiter, 50 orbits of Saturn and 9 orbits of Neptune. Their next conjunction will be in the year 2060. As they approach their conjunction, their combined gravitational forces adjust Earth's orbit and spin to its proper amounts. This change in angular momentum of the Earth causes torque stresses in the Earth that produce more geothermal heat in the Earth (Figure 3) and more earthquakes.

The temperature peaks in Greenland are correlated very well with the 1,470-year astronomical cycle (small diamonds in Figure 1). Figure 2 shows the pacing of the temperature peaks can have phase shifts of ± 350 years. The average temperature cycle phase shift is 33 years (better than the resolution of the historical temperature data) so it is almost an exact match.

As the 1,470-year conjunction approaches, the combined gravitational pull of Jupiter, Saturn and Neptune and the sun have a tug-of-war to control Earth's orbit and spin (to be more accurate, it controls the Earth-Moon system). That gravitational tug-of-war adjusts Earth's orbit and spin to their correct (stable) synchronization. This adjustment occurs during the quadrant of the cycle where it approaches the conjunction and gravitational pull increases. That is probably why Earth's rapid warming occurs during 10 to 30% of the cycle (approximately a quadrant of the cycle). Orbital resonance and spin-orbit resonance stabilize the orbits and spins of planets [21].

When gravitation accelerates or decelerates Earth's rate of spin, Earth's angular momentum resists the spin adjustment. The resistance causes tidal friction and oscillations inside the Earth and increases Earth's geothermal heat and earthquakes [22]. The amount of heat generated varies by the amount of the spin adjustment needed.

According to In-The-Sky.org, there will 21 conjunctions in the year 2060 (an unusual very large number of conjunctions). Spin-orbit adjustment produces a unique temperature wave pattern. The wave consists of a rapid increase in temperature over several hundred years (approximately 25% of the cycle), followed by gradual cooling for the rest of the cycle (as can be seen in Figure 1 and 6).

A study estimated that current global geothermal heat flux is 47 ± 2 terawatts [23]. There is another study that found that oceanic heat flux was 36 ± 6 terawatts through just one location, Fram Strait (between Greenland and Svalbard) [24]. This is almost as large as the other study's estimate of total global flux, so apparently the current understanding of geothermal heat in the ocean is not well understood.

4. Not the Cause: Increase in CO2

The second possible cause of rapid warming cycles is CO2. CO2 is currently a popular rapid warming theory. But the following his-

torical data shows that the rapid warming cycles are not caused by CO2 increases.

4.1. CO2 Lags (Follows) Temperature

Historical data from Antarctica ice cores for the last 800,000 years (Figure 6) shows that CO2 changes do not lead (cause) temperature changes. CO2 increases lag (follow) temperature increases by years as warmer oceans expel CO2 (the dotted line in Figure 6). And CO2 decreases lag (follow) temperature decreases by thousands of years. If the CO2 theory were true, CO2 should always lead temperature. But it does not. This proves that CO2 does not control rapid temperature increase cycles.

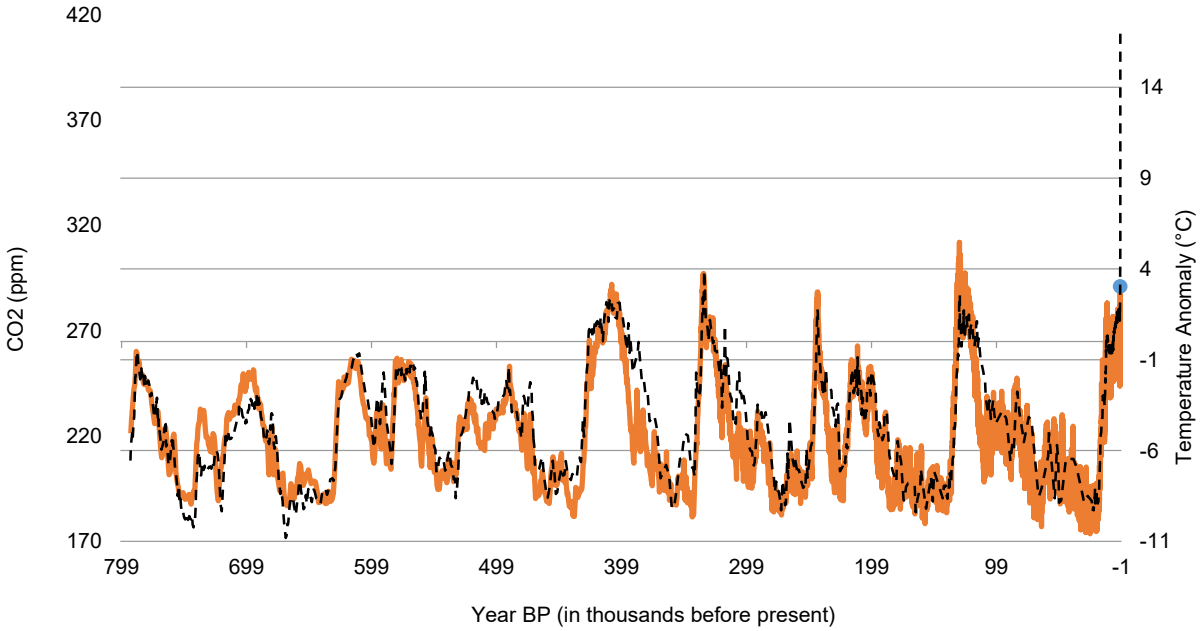

Figure 6: Antarctica Temperature and Carbon Dioxide from EPICA Dome C Ice Cores [25,26]. CO2 (dashed thin line). Temperature (thick line). Current temperature (small circle at far right). (Note: NOAA datasets updated to include 2019 data.)

4.2. Temperature Is Still In Normal Range

Historical data (Figure 6) shows that there were three previous times that Earth's temperature was hotter than the current warming, so the current rapid warming appears to be normal. While the current CO2 level in the air is much higher than normal. This proves that CO2 does not control rapid temperature increase cycles.

4.3. CO2 Is Much Higher Than Normal but Temperature Did Not Follow

Historical data (Figure 6 & 7) shows that CO2 follows temperature. Then 4,000-years ago, the CO2 level began to increase, but temperature did not increase. Then after the year 1837, there has been a rapid increase in CO2, but again temperature did not follow the rapid CO2 increase. Current CO2 (dashed thin line at far right) is approximately 40% above previous CO2 peaks, so it is NOT normal. This suggests that the CO2 rapid warming theory is probably not correct.

The recent CO2 increase is possibly caused by human activities, but the Environmental Protection Agency states that the current CO2 level is not harmful to humans. More CO2 is helpful to plants.

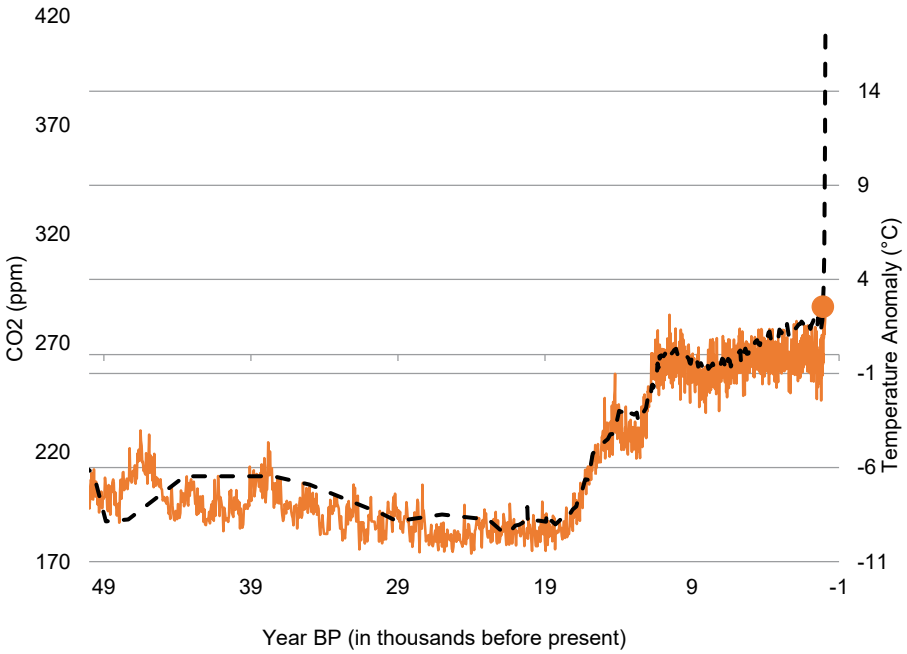

Figure 7: Antarctica Temperature and Carbon Dioxide from EPICA Dome C Ice Cores [25,26]. Carbon dioxide (dashed thick line). Temperature (thin line). Small circle on right is current temperature. (Note: NOAA dataset updated to include 2019 data.)

4.4. Less Warming in Antarctica

Figure 8 shows that there has been no warming at Mawson, Antarctica, since the year 1955, because there are no geothermal hotspots there.

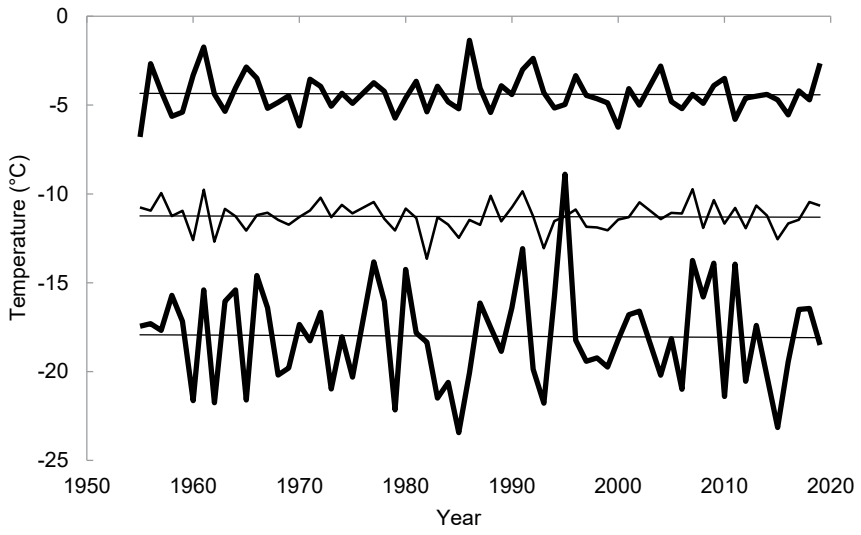

Figure 8: East Antarctica Air Temperature at Mawson [8]. Top line: Summer (February temperature). Middle line: annual mean temperature. Bottom line: Winter (July temperature).

4.5. Computer Climate Models Have Not Been Adequately Tested

IPCC Computer climate models have only been tested over short recent periods of time. They have not been tested over 100,000 years or more. If they were tested over longer times, the models would probably fail.

5. Not the Cause: Increase In Sun Radiation

The third possible cause is sun irradiance. But historical data shows that sun irradiance is not causing the 1,470 year rapid warming cycles.

The gravitation from Jupiter, Saturn and Neptune is so powerful that it moves the sun in a slight orbit and causes changes in the sun's irradiance and geomagnetic field. However, observations of its irradiance and geomagnetic field do not show correlation with the 1,470-year cycle [27-30].

6. Conclusions and Results

Historical data shows that a 1,470-year astronomical cycle is causing Earth's 1,470-year rapid temperature increases and the current rapid warming.

An astronomical cycle is shown to be a feasible cause of the 1,470-year rapid warmings and the recent global climate change. The cycle has warmed Greenland (and probably global temperature) by 1.8°C from the year 1791 to 2020. The current warming might peak in the year 2060 (when the next conjunction of Jupiter, Saturn and Neptune occurs) and might warm Greenland and the Earth by another 0.8°C or more. Since the warming is astronomically forced, it probably can't be stopped.

Historical data shows that CO2 does not cause the 1,470-year rapid warming cycles. Also sun irradiance increases are not the cause of the 1,470-year rapid warming cycles.

7. Data Availability Statement

Datasets for GISP2 and Dome C are available online (https://www.ncdc.noaa.gov/paleo-search/?dataTypeId=7). Datasets for air temperatures are available online (https://data.giss.nasa.gov/gistemp/). Data sets for volcanoes are available online (https://volcano.si.edu/).

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