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GSA original text in black

2 October 2009

## GENERAL COMMENTS

For a position statement of a scientific society of professional geologists, this statement is remarkably one sided and lacks the kind of depth and scientific analysis that one would expect from GSA. It totally ignores a wealth of well-documented data contrary to many of the statements made in the text and many of the contentions are not supported by any tangible data at all. This would be a much more credible document if it explored both sides of many of the issues and provided supporting evidence. The section on Rationale is shocking in its lack of scientific logic—it essentially claims that because we have had global warming (which no one denies), that in itself proves it is due to CO<sub>2</sub>. That shoddy logic must surely make T.C. Chamberlain and Hoover Mackin turn over in their graves! If two things happen together, that doesn't prove that one is the cause of the other. The period of global warming also coincides with a solar maximum and the present global cooling coincides with a developing solar minimum so the same argument used in the Rationale also applies to a solar cause. The salient point here is that neither constitutes a valid argument for the cause of global warming.

The Position Statement contains so many contentious issues that are not supported by real data and the discussion is so unbalanced that I've inserted comments directly in the text.

## SPECIFIC COMMENTS

### POSITION STATEMENT

The Geological Society of America concurs with key elements of recent assessments by the National Academies and the Intergovernmental Panel on Climate Change (IPCC). Global climate has warmed by ~0.7 °C since the middle to late 1800s, and human activities (mainly greenhouse-gas emissions) account for most of the warming since the middle 1900s. [This statement is easily refuted by data that clearly shows **no correlation** between CO<sub>2</sub> and global climate change.]

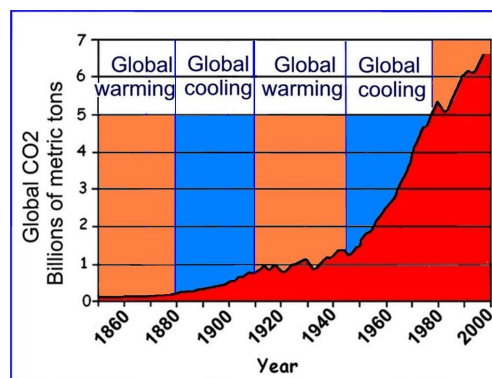


Figure 1. Abrupt increase in post-1945 CO<sub>2</sub> emissions.

Figure 1 demonstrates that possible warming from CO<sub>2</sub> is limited to post-1945 changes and that during the time of greatest rate of increase in CO<sub>2</sub> emissions the Earth experienced 30 years of global cooling, not warming as should have been the case if CO<sub>2</sub> causes global warming.

Figure 2 shows four climate changes during the past 130 years, two periods of global warming and two periods of global cooling. Following the global cool period from 1880 to about 1915, the global climate warming of about 0.5° C from 1915 to about 1945 cannot have been caused by CO<sub>2</sub> because significant increases in CO<sub>2</sub> didn't begin until after 1945. For 30 years after CO<sub>2</sub> emissions began to soar (1945 to 1977), global cooling occurred rather than the global warming that should have occurred if increased CO<sub>2</sub> causes global warming. This lack of correlation between CO<sub>2</sub> and global climate change is illustrated in Figure 3.

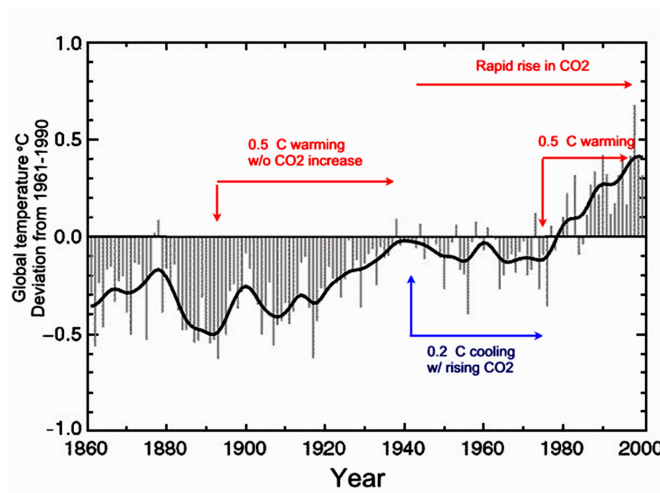
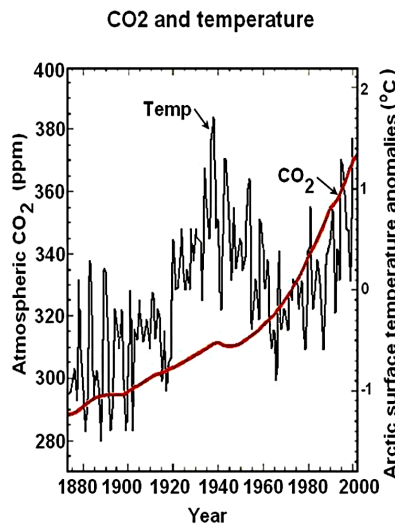


Figure 2. Global climate change and CO<sub>2</sub>



Modified from Soon, 2004

Figure 3. Complete lack of correlation between global climate change and CO<sub>2</sub>

If current trends continue, [The "current trend" is global cooling, not global warming so this statement makes no sense] the projected increase in global temperature by the end of the twenty-first century will result in large negative impacts on humans and other life forms. Addressing the challenges posed by future anthropogenic warming will require a combination of national and international emissions reductions and adaptations to those changes that occur.

#### Purpose

This position statement (1) summarizes the recently strengthened basis for the conclusion that humans are the primary factor responsible for recent global warming; [This position statement contains no data whatsoever that strengthens the conclusion that humans are responsible for recent global warming. Just stating a premise is not proof of its veracity] (2) describes the large effects on humans and ecosystems if greenhouse-gas concentrations and global climate reach projected levels; [The 'large effects on humans and ecosystems' has no meaning if the original assumption is not correct and that assumption is not supported by any evidence] and (3) provides information for policy decisions guiding mitigation and adaptation strategies designed to address the future impacts of anthropogenic warming. [Which is based on an unproven assumption]

#### Rationale

Recent scientific advances have eliminated or greatly reduced previous uncertainties about the size and causes of recent global warming. [This is a completely unwarranted contention that is not supported by any tangible evidence]

Ground-station measurements have shown a rapid warming trend of  $\sim 0.7$  °C since the mid-1800s, and this trend is consistent with (1) retreat of northern hemisphere snow and Arctic sea ice in the last 40 years; [this is really bad logic--global warming and retreat of glaciers is not proof that CO<sub>2</sub> causes warming!! It illustrates the shocking lack of scientific basis for this whole position statement] (2) greater heat storage in the ocean over the last 50 years; [This is true only for the warm period between 1977 and 1999 but is not true for the period between 1945 and 1977 when the oceans were cooler (see Figure 4)]

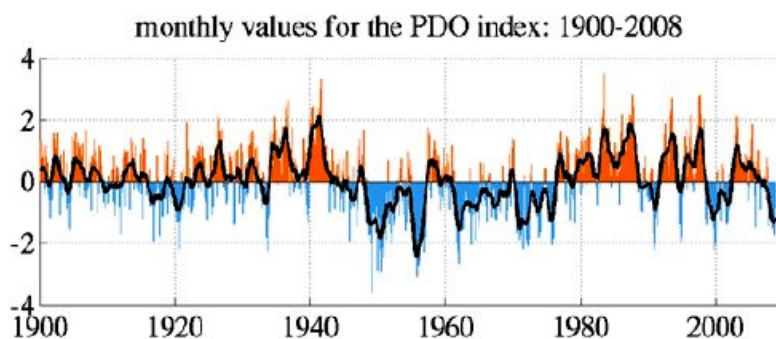
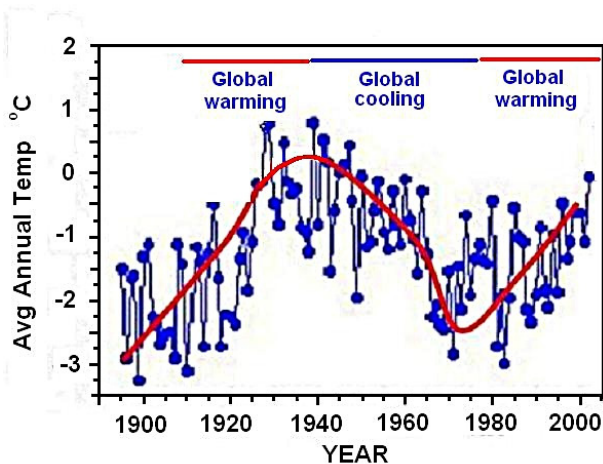


Figure 4. Cooler Pacific Ocean temperatures from 1945 to 1977.

(3) retreat of most mountain glaciers since 1850; [This is unbelievably bad science! To contend that glacier retreat proves warming due to CO<sub>2</sub> is bad enough, but the authors clearly have very poor knowledge of glacier fluctuations since 1850. During the 1890 to 1915 cool period, glaciers extended almost to their Little Ice Age maximums, retreated during the 1915 to 1945 warm period, advanced again during the 1945 to 1977 cool period, and retreated again during the 1977 to 1999 warm period. None of these climate fluctuations prior to 1945 can be due to increase in CO<sub>2</sub> so to contend that retreat of glaciers since 1850 is proof of warming due to CO<sub>2</sub> is incredibly amateurish.]

(4) an ongoing rise of global sea level for more than a century; [Sea levels have been rising about a foot a century since the Little Ice Age about 400 years ago, so 'an ongoing rise of global sea level' proves absolutely nothing! In no way can it be used as evidence for CO<sub>2</sub> as a cause of global warming.]

and (5) proxy reconstructions of temperature change over past centuries from ice cores, tree rings, and corals. Both instrumental records and proxy indices from geologic sources show a temperature rise since 1850 that is far more rapid than any in records extending back at least half a millennium. [This statement is demonstrably false! Temperatures during the 1930s were approximately equivalent to what they are now and perhaps even a bit warmer (see Figure 5). In addition, temperatures during the Medieval Warm Period were warmer than they are now (see Figure 6). Neither of these warm periods could have been a result of anthropogenic CO<sub>2</sub>.]



Temperatures in Angmagssalik, Greenland since 1890, showing the variation followed global warming and cooling trends.

Figure 5. Temperature variation in Greenland since 1890. Note that temperatures in the 1930s were warmer than at present and the rate of warming was greater.

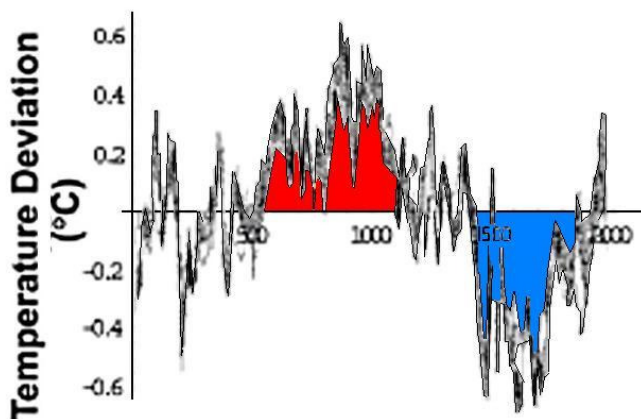


Figure 6. Temperature variations over the past millennium. Note that the warming during the Medieval Warm Period could not have been caused by CO<sub>2</sub>.

Measurements from satellites beginning in 1979 initially did not show a warming trend, but later studies (Mears and Wentz, 2005; Santer et al., 2008) found that the satellite data had not been fully adjusted for losses of satellite elevation through time, differences in time of arrival over a given location, and removal of higher-elevation effects on the lower tropospheric signal. With these factors taken into account, the satellite data are now in basic agreement with ground-station data and confirm a warming trend since 1979. In a related study, Sherwood et al. (2005) found problems with corrections of tropical daytime radiosonde measurements and largely resolved a previous discrepancy with ground-station trends. As a result, the warming of Earth's surface by ~0.7 °C since 1850 is no longer open to serious challenge. [Of course not—but that doesn't prove that it had anything to do with CO<sub>2</sub>!!! This is another example of really bad logic—warming doesn't prove anything].

Several potential causes of this warming trend can be eliminated. Long-term changes driven by changes in Earth's orbit or its tectonism are far too slow to have played a significant role in a 150-year trend. Large volcanic eruptions cooled global climate for a year or two, and El Niño episodes warmed it for about a year, but neither factor dominates multi-decadal trends.

As a result, human influences and solar fluctuations are the only factors that could have changed rapidly enough and lasted long enough to explain the observed changes in global temperature. Although the 3rd (2001) IPCC report allowed that solar fluctuations might have contributed as much as 30% of the warming since 1850, subsequent observations of Sun-like stars (Foukal et al., 2004) and new simulations of the evolution of solar sources of irradiance variations (Wang et al., 2005) have reduced these estimates. [Again, the one-sided approach of this document is apparent—other solar physicists (Svensmark, Scafetti, Soon, Willson) have presented excellent evidence that solar variations can explain 70% or more of the observed warming, yet no mention is made of those papers. In addition, detailed comparison of solar variations with climate change and ocean temperatures show remarkably good correlations and new research by Danish solar physicists (Svensmark and others) have suggested a mechanism of how solar variations affect global climate. Strangely, no mention of any of that important research is made in this document.]

The 4th IPCC report concluded that changes in solar irradiance, continuously measured by satellites since 1979, account for less than 10% of the recent warming. [This conclusion is badly outdated by recent research by solar physicists and is no longer valid]

Greenhouse gases remain as the major explanation. Climate model assessments of the natural and anthropogenic factors responsible for this warming conclude that rising anthropogenic emissions of greenhouse gases have been an important contributor since the mid-1800s and the major factor since the mid-1900s. [The validity of climate models is seriously challenged by their failure to predict the global cooling of the past 10 years. In 2000, published graphs of IPCC models predicted a 1° F warming every 10 years and a 10° F rise in global temperature by 2100. Thus, according to the computer models, global temperatures should now be 1° F warmer than they were in 2000. But global temperatures have not risen beyond 1998 levels and global cooling has occurred. This means that the IPCC models are woefully inadequate and are contradicted by actual global temperatures. Lacking any tangible physical evidence that CO<sub>2</sub> causes global warming, the entire argument for CO<sub>2</sub> rests on these computer models that have proven faulty when compared to actual temperatures.]

The CO<sub>2</sub> concentration in the atmosphere is now ~30% higher than peak levels measured in ice cores for the last 800,000 years, [This is a totally meaningless number—30% of virtually nothing is still virtually nothing. Far more significant is the increase in the amount of CO<sub>2</sub> in the atmosphere. The total change in the amount of CO<sub>2</sub> in the atmosphere is only 0.008% !!



Do the math! The critical number is how much the *actual* atmospheric CO<sub>2</sub> has increased, not the percentage increase—if you start with one atom and add one atom you've doubled the percentage, but still have virtually nothing. The statement above is very bad science and completely meaningless.

In addition, CO<sub>2</sub> accounts for only 3.62% of the greenhouse gas effect (water vapor accounts for about 95% of the greenhouse effect). Verifiable calculations of the possible effect of increased CO<sub>2</sub> on atmospheric temperature shows that the maximum effect of even doubling the amount of CO<sub>2</sub> in the atmosphere is less than 0.1°.

So we are being asked to believe that a change of 0.008% in the amount of a greenhouse gas (CO<sub>2</sub>) that accounts for only 3.6% of the greenhouse effect and which is incapable of changing the temperature of the atmosphere more than 0.1° is going to increase global temperatures by 10°F in the coming century! The argument that a small increase in atmospheric temperature by CO<sub>2</sub> will increase the water vapor content of the atmosphere and cause warming is totally unsupported by existing measurements of atmospheric water vapor and is based entirely on undocumented assumptions.]

and the methane concentration is 2.5 times higher. Half of Earth's warming has occurred through the basic heat-trapping effect of the gases in the absence of any feedback processes. This "clear-sky" part of the response to climate is known with high certainty. The other half of the estimated warming results from the net effect of feedbacks in the climate system: a very large positive feedback from water vapor; a smaller positive feedback from snow and ice albedo; and sizeable, but still uncertain, negative feedbacks from clouds and aerosols. The vertical structure of observed changes in temperature and water vapor in the troposphere is consistent with the anthropogenic greenhouse-gas "fingerprint" simulated by climate models (Santer et al., 2008). [This is *not* true—the temperature increases in the troposphere have *not* appeared where they should have if CO<sub>2</sub> is the cause of warming These data can be verified and the so-called "greenhouse gas fingerprint" is missing.]

Considered in isolation, the greenhouse-gas increases during the last 150 years would have caused a warming larger than the one actually measured, [This is totally contradicted by real-time data and exists only in the virtual world of computer models lacking any physical data]

but negative feedback from clouds and aerosols has offset part of the warming. [This statement is unsupported by any real-time data] and is contradicted by a wealth of real-time data. It completely ignores a vast amount of data showing that natural warming and cooling cycles have been going on for at least the past 500 years, well before any significant increase in human CO<sub>2</sub> emissions.]

In addition, because the oceans take decades to respond fully to climatic forcing, the climate system has yet to register the complete effect of gas increases in recent decades.

[This statement puts the cart before the horse—there is an abundance of excellent real-time data showing that the oceans over that past century have undergone temperature changes that were reflected almost immediately by atmospheric temperature changes. An excellent example of this is the well documented change in Pacific Ocean temperature in 1977 that flipped the Earth out of a 30-year cooling period into the global warming period of 1977-1999. The oceans drive atmospheric temperature, not the other way around.]

These advances in scientific understanding of recent warming form the basis for projections of future changes. [But most of the real-time data from recent advances in scientific understanding have been totally ignored in this document].

If greenhouse-gas emissions follow the current trajectory beyond the twenty-first century, CO<sub>2</sub> levels will reach two to four times pre-industrial levels, for a total warming of 2.4–4.6 °C compared to 1850. This range of changes would substantially alter the functioning of the planet in both positive and negative ways. Several negative changes involve risk to humans and other life forms: (1) continued shrinking of Arctic sea ice [Arctic sea ice declined during the 1977–1999 warm period but has been increasing, not shrinking, since 2007]

with effects on native cultures and ice-dependent biota; (2) less snow accumulation and earlier melt in mountains, with reductions in spring and summer runoff for agricultural and municipal water; (3) disappearance of mountain glaciers [glaciers in Alaska, New Zealand, Scandinavia and other parts of the world have ceased their retreat and have begun advancing]

and their late-summer runoff; (4) increased evaporation from farmland soils and stress on crops; (5) greater soil erosion due to increases in heavy convective summer rainfall; (6) longer fire seasons and increases in fire frequency; (7) severe insect outbreaks in vulnerable forest stands; (8) acidification of the global ocean; and (9) fundamental changes in the composition, functioning, and biodiversity of many terrestrial and marine ecosystems. Melting of Greenland and West Antarctic ice (still highly uncertain as to amount), along with thermal expansion of seawater and melting of mountain glaciers, will cause substantial future sea-level rise along densely populated coastal regions, inundating farmland and dislocating people. [This conclusion is contradicted by measured sea level rise of only about one foot per century over several centuries and the fact that well-documented Greenland temperatures have risen and fallen along with global temperatures over the past century and temperatures were actually higher there in the 1930s than now.]

Because Earth's history shows past examples of large and abrupt changes occurring within decades, the possibility exists for rapid future changes in response to increased greenhouse-gas concentrations. [The logic here is incredibly bad—“large and abrupt changes occurring within decades” have indeed occurred in the geologic past, but during times when they could not possibly have been caused by changes in CO<sub>2</sub>, and in fact contradict the premise that CO<sub>2</sub> is the cause of warming. Thus, to postulate that increased CO<sub>2</sub> in the future will cause large, abrupt temperature changes is totally absurd.]

Carbon-climate model simulations indicate that 10–20% of the anthropogenic CO<sub>2</sub> “pulse” could stay in the atmosphere for thousands of years [The authors of this document are apparently unaware of recent research that indicates the residence time of anthropogenic CO<sub>2</sub> in the atmosphere is less than a decade—the amount is undoubted due to anthropogenic emissions, but it is recycled by the oceans rather quickly. The oceans contain 50 times the amount of CO<sub>2</sub> in the atmosphere so equilibrium between the oceans and atmosphere, which is governed by the temperature of the oceans, will determine the level of atmospheric CO<sub>2</sub>]

, extending the duration of fossil-fuel warming and its effects on humans and other life forms. The acidification of the global ocean, and its effect on ocean life, will last for tens of thousands of years.

## Public Policy Aspects

Recent scientific investigations have strengthened the case for policy action to reduce greenhouse gas emissions and to adapt to unavoidable climate change. To strengthen the consensus for action, this statement from the Geological Society of America is intended to inform policymakers about improved knowledge of Earth's climate systems based on recent advances in climate science. Geoscientific investigations have contributed to this improved understanding of the climate system and strengthened the case for human-caused global warming, providing policymakers with a unique perspective on which to base mitigation and adaptation strategies. Future climate change will pose societal, biological, economic, and strategic challenges that will require a combination of national and international emissions reductions and adaptations. These challenges will also require balanced and thoughtful national and international discussions leading to careful long-term planning and sustained policy actions. [This is also true of global cooling, which may be the direction we are heading in the coming solar minimum. Should we not also consider possible affects of those changes?]

## CONCLUSIONS AND RECOMMENDATIONS

This is a very disappointing document—it contains a great deal of very badly flawed logic (e.g., retreating glaciers prove that climatic warming is caused by  $CO_2$ ) and is entirely one sided with no recognition at all of *any* data contrary to  $CO_2$  as the cause of warming. Many statements are made with no supporting data at all. *GSA* has always been a forum for discussion and debate of contentious issues, but this document is completely dogmatic in its approach.

At this stage in the climate change debate with many contentious issues, a much more open discussion is called for. To embrace a dogma with no attempt to recognize any data contrary to  $CO_2$  is a very unscientific approach—one that *GSA* may deeply regret in the future. In view of the rapidly accumulating data, I would strongly recommend a neutral stance by *GSA* at this point. We should see more clearly which way global climates are heading within only a few years and if the present trend continues, as all indications suggest, nature will have demonstrated that  $CO_2$  is not the cause of global climate change. If global cooling continues for another few decades that will solve the global climate issue and if indeed that happens, *GSA* would lose a great deal of prestige as a scientific organization.

- Public investment is needed to improve our understanding of how climate change impacts society, including on local and regional scales, and to formulate adaptation measures. Sustained support of climate-related research to advance understanding of the past and present operation of the climate system is needed, with particular focus on the major remaining uncertainties in understanding and predicting Earth's future climate at regional and global scales. Focused research is needed to improve our ability to assess the response and resilience of natural and human systems to past, present, and future changes in the climate system.
- National and international planning is needed to address challenges posed by future climate change. Near-, mid-, and long-term strategies for climate-change evolution, adaptation, and mitigation, based in part on knowledge gained from studies of previous environmental changes, should be developed.
- Public policy should include effective strategies for the reduction of greenhouse-gas emissions. Earth has a virtually unlimited supply of low-carbon energy. Cost-effective investments to improve the efficiency of these natural resources can reduce the economic impacts of the needed changes.

## Opportunities for GSA and GSA Members to Help Implement Recommendations

To facilitate implementation of the goals of this position statement, the Geological Society of America recommends that its members take the following actions:



- Actively participate in professional education and discussion activities so as to be technically well informed about the latest advances in climate science. GSA should encourage symposia at national and regional meetings to educate members on mainstream understanding among geoscientists and climate scientists of the causes and future effects of global warming within the broader context of natural variability. These symposia should seek to actively engage members in hosted discussions that clarify issues, possibly utilizing educational formats other than the traditional presentation and Q&A session.
- Engage in public education activities in the community, including at the local level. Public education is a critical element of a proactive response to the challenges presented by global climate change. GSA members are encouraged to take an active part in outreach activities to educate the public at all levels (local, regional, and national) about the science of global warming and the importance of geological research in framing policy development. Such activities can include organizing and participating in community school activities; leading discussion groups in churches or other civic organizations; meeting with local and state community leaders and congressional staffs; participating in GSA's Congressional Visits Day; writing opinion pieces and letters to the editor for local and regional newspapers; contributing to online forums; and volunteering for organizations that support efforts to effectively mitigate and adapt to global climate change.
- Collaborate with a wide range of stakeholders to help educate and inform them about the causes and impacts of global climate change from the geosciences perspective. GSA members are encouraged to discuss with businesses and policymakers the science of global warming, as well as the opportunities for transitioning from our predominant dependence on fossil fuels to greater use of low-carbon energies and energy efficiencies.
- Work interactively with other science and policy societies to help inform the public and ensure that policymakers have access to scientifically reliable information. GSA should actively engage and collaborate with other earth-science organizations in recommending and formulating national and international strategies to address impending impacts of anthropogenic climate change.
- Take advantage of the following list of references for a current scientific assessment of global climate change.

SELECTED REFERENCES [This is a very unbalanced and incomplete list of references—it does not include any of the many papers containing data that doesn't support CO<sub>2</sub> as the cause of global warming.]

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