Climate Change Reconsidered

2011 Interim Report of the Nongovernmental International Panel on Climate Change

EXECUTIVE SUMMARY

This volume presents an overview of the research on climate change that has appeared since publication of *Climate Change Reconsidered: The 2009 Report of the Nongovernmental International Panel on Climate Change* (Idso and Singer, 2009, hereafter NIPCC-1). Research published before 2009 is included if it did not appear in the 2009 report or provides context for the new research. Nearly all of the research summarized here appeared in peer-reviewed science journals.

The current report was coauthored by a team of scientists recruited and led by Craig D. Idso, Robert Carter, and S. Fred Singer. Significant contributions were provided by the lead authors and contributors identified on the title page. This team of scientists has been working since the release of NIPCC-1 on a new comprehensive report currently scheduled for release in 2013. Being an interim compilation of research rather than a comprehensive assessment, this volume has not been formally peer-reviewed.

On the most important issue, the IPCC's claim that "most of the observed increase in global average temperatures since the mid-twentieth century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations [emphasis in the original]," we once again reach the opposite conclusion, that natural causes are very likely to be dominant. Once again, we stress we are not saying anthropogenic greenhouse gases (GHG) *cannot* produce some warming or have not in the past. Our conclusion is that the evidence shows they are not playing a substantial role.

On the related question of the effects global warming might have on human health and the natural environment, we find the latest available research shows a warmer world would be a safer and healthier world for humans and wildlife alike. Climate change will continue to occur, regardless of whether human emissions contribute to the process, and some of those effects may be positive and some negative for human health and wildlife in different areas of the world. But the *net* effect of continued warming and rising carbon dioxide concentrations in the atmosphere is most likely to be beneficial to humans, plants, and wildlife.

The report is divided into ten chapters that are briefly summarized here, and then more fully described in the remainder of this summary.

Chapter 1 describes problems that may be intrinsic to the global climate modeling exercise, followed by more detailed documentation of model shortcomings involving precipitation, temperature, El Niño/Southern Oscillation (ENSO), and soil moisture. We find evidence that the models over-estimate the amount of warming that occurred during the twentieth century and fail to incorporate chemical and biological processes that may be as important as the physical processes employed in the models. The models often diverge so greatly in their assumptions and findings that they cannot be said to validate each other, nor can such discordant projections be combined to produce meaningful averages.

Chapter 2 summarizes the latest research on what is known about forcings and feedbacks. While rising levels of atmospheric carbon dioxide (CO_2) would increase global temperatures through its thermal radiative properties, all else being equal, all else is not equal. More CO_2 promotes more plant growth both on land and throughout the surface waters of the world's oceans, and this vast assemblage of plant life has the ability to affect Earth's climate in several ways, almost all of them tending to counteract the heating effects of CO_2's thermal radiative forcing.

Chapter 3 reviews the latest research on paleoclimatology and recent temperatures, finding new evidence that the Medieval Warm Period of approximately 1,000 years ago, when there was about 28 percent less CO_2 in the atmosphere than there is currently, was both global and warmer than today's world. Research also reveals a significant period of elevated air temperatures that immediately preceded the Little Ice Age, during a time that has come to be known as the Little Medieval Warm Period. Other researchers have documented a decade-long cooling period following the record heat of 1998.

Chapter 4 reports the latest observations on changes in the cryosphere, oceans, precipitation, and rivers and streamflow, comparing those observations to projections made by the IPCC. The new research finds less melting of ice in the Arctic, Antarctic, and on mountaintops than previously feared, no sign of acceleration of sea-level rise in recent decades, no trend over the past 50 years in changes to the Atlantic meridional overturning circulation (MOC), and no changes in precipitation patterns or river flows that could be attributed to rising CO_2 levels.

Chapter 5 compares observations concerning extreme weather, such as floods, droughts, storms, and hurricanes, to projections made by the IPCC. Researchers have found extreme and destructive rainfall events were more common in many parts of the world during the Little Ice Age than they have been subsequently, contradicting the forecasts of the IPCC. Regional climate models of North America generate predictions that vary considerably among models and extend well beyond the realm of reality. Similarly, the frequency and severity of floods, droughts, and hurricanes all appear to be determined by natural processes other than anthropogenic climate change.

Chapter 6 compares observations regarding the fate of terrestrial animals to projections made by the IPCC. The IPCC assumes temperatures will rise so rapidly that many animal species will not be able to migrate poleward in latitude or upward in elevation rapidly enough to avoid extinction. New research and observational data contradict this assumption, finding instead that amphibians, birds, butterflies, other insects, lizards, mammals, and even worms benefit from global warming and its myriad ecological effects.

Chapter 7 reviews new research on the effects of rising temperatures and atmospheric CO_2 concentrations on plants and soils. It confirms NIPCC's earlier finding that plants benefit from both trends and increase the amount of carbon they sequester in woody tissue and root systems. Rising temperatures and atmospheric CO_2 concentrations, by increasing crop yields, will play a major role in averting hunger and ecological destruction in the future.

Chapter 8 examines research on the effects of rising temperature and atmospheric CO_2 concentrations on aquatic life. While some corals exhibit a propensity to bleach and die when sea temperatures rise, others exhibit a positive relationship between calcification, or growth, and temperature. The latest research suggests corals and other forms of aquatic life have effective adaptive responses to climate change enabling them to flourish despite or even because of climate change.

Chapter 9 finds global warming is more likely to improve rather than harm human health because rising temperatures lead to a greater reduction in winter deaths than the increase they cause in summer deaths. The result is a large net decrease in human mortality. Climate plays a relatively small role in the spread of viral and vector-borne diseases, which suggests continued warming would not increase the incidence of diseases. Higher atmospheric CO_2 concentrations tend to increase the production of plant nutrients with direct medicinal value, such as antioxidants that protect cells from the damaging effects of oxidation.

Chapter 10 presents data on the economic effects of the global warming of the twentieth century, errors in how the IPCC conducts its impact analyses, and recent studies concerning biofuels and the relationship between climate and war and social unrest. It finds decades-long empirical trends of improving human well-being according to measures that are climate-sensitive, such as hunger, poverty rates, and deaths due to extreme weather events. The IPCC systematically underestimates society's adaptive capacity by failing to take into account the greater wealth and technological advances that will be present at the time for which impacts are to be estimated. Even in worst-case scenarios, mankind will be much better off in the year 2100 than it is today, and therefore able to adapt to whatever challenges climate change presents.

Key Findings By Chapter

Chapter 1. Climate Models and Their Limitations

- Climate models over-estimate the amount of warming that occurred during the twentieth century, fail to incorporate chemical and biological processes that may be as important as the physical processes employed in the models, and often diverge so greatly in their assumptions and findings that they cannot be said to validate each other.
- Climate models fail to correctly simulate future precipitation due to inadequate model resolution on both vertical and horizontal spatial scales, a limitation that forces climate modelers to

parameterize the large-scale effects of processes that occur on smaller scales than their models are capable of simulating. This is particularly true of physical processes such as cloud formation and cloud-radiation interactions.

- The internal variability component of climate change is strong enough to overwhelm any anthropogenic temperature signal and generate global cooling periods (between 1946 and 1977) and global warming periods (between 1977 and 2008), yet models typically underestimate or leave out entirely this component, leading to unrealistic values of climate sensitivity.

- Climate models fail to predict changes in sea surface temperature and El Niño/Southern Oscillation (ENSO) events, two major drivers of the global climate. There has been little or no improvement to the models in this regard since the late-1990s.

- Climate models typically predict summer desiccation of soil with higher temperatures, but real-world data show positive soil moisture trends for regions that have warmed during the twentieth century. This is a serious problem since accurate simulation of land surface states is critical to the skill of weather and climate forecasts.

- While climate models produce a wide range of climate sensitivity estimates based on the assumptions of their builders, estimates based on real-world measurements find that a doubling of the atmosphere's CO_2 concentration would result in only a 0.4° or 0.5° C rise in temperature.

Chapter 2. Forcings and Feedbacks

- All else being equal, rising levels of atmospheric CO_2 would increase global temperatures through its thermal radiative properties. But CO_2 promotes plant growth both on land and throughout the surface waters of the world's oceans, and this vast assemblage of plant life has the ability to affect Earth's climate in several ways, almost all of them tending to counteract the heating or cooling effects of CO_2's thermal radiative forcing.

- The natural environment is a major source of atmospheric aerosols, the output of which varies with temperature and CO_2 concentrations. Aerosols serve as condensation nuclei for clouds, and clouds affect Earth's energy budget through their ability to reflect and scatter light and their propensity to absorb and radiate thermal radiation. The cooling effect of increased emissions of aerosols from plants and algae is comparable to the warming effect projected to result from increases in greenhouse gases.

- Similarly, warming-induced increases in the emission of dimethyl sulfide (DMS) from the world's oceans would offset much or all of the effects of anthropogenic warming.

- New evidence points to a larger role for solar forcing than the IPCC has acknowledged. Likely mechanisms include perturbation of ocean currents, tropospheric zonal mean-winds, and the intensity of cosmic rays reaching the Earth.

- The IPCC underestimated the warming effect of chloroflourocarbons (CFCs) prior to their gradual removal from the atmosphere following the implementation of the Montreal Protocol in 2000. This could mean CO_2 concentrations played a smaller role in the warming prior to that year, and could help explain the global cooling trend since 2000.

- Other forcings and feedbacks about which little is known (or acknowledged by the IPCC) include stratospheric water vapor, volcanic and seismic activity, and enhanced carbon sequestration.

Chapter 3. Paleoclimate and Recent Temperature

- Evidence of a Medieval Warm Period (MWP) approximately 1,000 years ago, when there was about 28 percent less CO_2 in the atmosphere than there is currently, would show there is nothing unusual, unnatural, or unprecedented about recent temperatures. Such evidence is now overwhelming.

- New evidence not reported in NIPCC-1 finds the Medieval Warm Period occurred in North America, Europe, Asia, Africa, South America, Antarctica, and the Northern Hemisphere. Despite this evidence, Mann et al. (2009) continue to understate the true level of warming during the MWP by cherry-picking proxy and instrumental records.

- Research from locations around the world reveals a significant period of elevated air temperatures that immediately preceded the Little Ice Age, during a time that has come to be known as the Little Medieval Warm Period.

- Recent reconstructions of climate history find the human influence does not stand out relative to other, natural causes of climate change. While global warming theory and models predict polar areas would warm most rapidly, the warming of Greenland was 33 percent greater in magnitude in 1919–1932 than it was in 1994–2007, and Antarctica cooled during the second half of the twentieth century.

- Perlwitz et al. (2009) reported "a decade-long decline (1998–2007) in globally averaged temperatures from the record heat of 1998" and noted U.S. temperatures in 2008 "not only declined from near-record warmth of prior years, but were in fact colder than the official 30-year reference climatology … and further were the coldest since at least 1996."

- New research disputes IPCC's claim that it has ferreted out all significant influences of the world's many and diverse urban heat islands from the temperature databases they use to portray the supposedly unprecedented warming of the past few decades.

Chapter 4. Observations and Projections: Cryosphere, Ocean Dynamics, and Hydrology

- The continent-wide snow and ice melting trend in Antarctica since 1979, when routine measurement of the phenomenon via space-borne passive microwave radiometers first began, has been negligible. New research also shows the West Antarctic Ice Sheet (WAIS) is more stable than previously thought.
- After doubling during the early 2000s, annual ice discharge from the Greenland Ice Sheet slowed dramatically beginning in 2006, the result of negative feedback that mitigates against fast loss of ice in a warming climate. Scientists have concluded present-day melting rates "are not exceptional within the last 140 years" and "are not necessarily the result of anthropogenic-related warming" (Wake et al., 2009).

- Glaciers on mountaintops and in mountain valleys have been retreating since the end of the Little Ice Age and there is little evidence the rate of their retreat increased in the twentieth century. Scientists have ruled out any role for rising local air temperature in the loss of ice from the top of Mt. Kilimanjaro, identifying changes in atmospheric moisture due to logging and agriculture at the foot of the mountain as the cause.

- Mean sea level has risen at a constant rate over the past 114 years, even though the air's CO_2 concentration rose about 3.8 times faster over the second half of that period as during the first half. The aerial fertilization effect of CO_2 stimulates biogenic contributions to marsh elevation, counterbalancing sea-level rise. Other studies find "no evidence of large-scale reductions in island area" and "reef islands are geomorphically resilient landforms that thus far have predominantly remained stable or grown in area over the last 20–60 years" (Webb and Kench, 2010).

- No trend has been found over the past 50 years in changes to the Atlantic meridional overturning circulation (MOC), despite predictions by the IPCC that warming would disrupt this important system of heat transportation through ocean basins.

- No changes in precipitation patterns, snow, monsoons, or river flows that might be considered harmful to human well-being or plants or wildlife have been observed that could be attributed to rising CO_2 levels. What changes have been observed tend to be beneficial.

Chapter 5. Observations and Projections: Extreme Weather

- Researchers have found extreme and destructive rainfall events were more common in many parts of the world during the Little Ice Age than they have been subsequently, contradicting the forecasts of the IPCC. Regional climate models of North America generate predictions that vary considerably among models and extend well beyond the realm of reality.

- Flood frequency and severity in many areas of the world were higher historically during the Little Ice Age and other cool eras than during the twentieth century. Climate change ranks well below other contributors, such as dikes and levee construction, to increased flooding.

- Droughts are not becoming more frequent, more severe, or longer-lasting. For example, droughts in the central U.S. since 1895 have not been as severe or as long as earlier droughts, with three of the top ten most severe droughts occurring in the late sixteenth century.

- Hurricane frequency does not fluctuate linearly with global temperatures. Researchers find "no significant [tropical cyclone] trend remains using either an 1878 or a 1900 starting point" (Landsea et al., 2009). Hurricane frequency during the Medieval Warm Period was equivalent to or even greater than that of the recent past.

- Similarly, wildfire frequency and intensity does not increase linearly with global temperatures. The incidence of large forest fires has decreased during the past 150 years in Canada and Russia. Human adaptation during the industrial age appears to have overpowered any natural tendency toward increased wildfires.

Chapter 6. Terrestrial Animals

- The basis of the IPCC's forecasts of impending extinctions and range retractions is an assumption that temperatures will rise so rapidly that many animal species will not be able to migrate poleward in latitude or upward in elevation rapidly enough to avoid extinction. New research and observational data contradict this assumption.

- The shortcomings associated with models predicting the impact of climate on distributions of species "are so numerous and fundamental that common ecological sense should caution us against putting much faith in relying on their findings for further extrapolations" (Dormann, 2007).

- Empirical data on amphibians, birds, butterflies, other insects, lizards, mammals, and even worms find global warming and its myriad ecological effects more often expand than contract animal habitats, ranges, and populations. Many species thrive with warmer temperatures, and while southern borders of ranges may remain stable, northern borders move poleward into previously uninhabitable regions.

- The net effect of climate change on the spread of parasitic and vector-borne diseases is complex and likely to be unpredictable. Rising temperatures increase the mortality rates as well as the development rates of many parasites of veterinary importance, and temperature is only one of many variables that influence the range of viruses and other sources of diseases.

Chapter 7. Terrestrial Plants and Soils

- "The IPCC's failure to report the beneficial effects of rising CO_2 concentrations is surprising when literally thousands of peer-reviewed journal articles exist on the subject. It is also a major defect of the IPCC report and one reason why it is not a reliable summary of the science of climate change" (NIPCC-1).

- Extensive research shows plants sequester greater amounts of carbon in woody biomass, including roots, as CO_2 concentrations rise. For most species studied and in most conditions, this sequestration does not slow or stop with the passage of time. Old-growth forests, for example, can sequester carbon for multiple centuries.

- Higher atmospheric CO_2 concentrations benefit plant growth-promoting microorganisms that help land plants overcome drought conditions, a potentially negative aspect of future climate change. Continued atmospheric CO_2 enrichment should prove to be a huge benefit to plants by directly enhancing their growth rates and water use efficiencies.

- Increased plant growth leads to higher emissions of isoprene, a highly reactive non-methane hydrocarbon that is responsible for the production of tropospheric ozone, which in turn is harmful to plant and animal life. Between 1901 and 2002, climate change at the global scale was responsible for a 7 percent increase in isoprene emissions. However, rising atmospheric CO_2 caused a more-than-offsetting 21 percent *reduction* in those emissions. Combined with anthropogenic cropland expansion, global isoprene emissions fell 24 percent during the twentieth century (Lathiere et al., 2010).

- Rising temperatures and atmospheric CO_2 concentrations, by increasing crop yields, will play a major role in averting hunger without the taking of new land and water from nature. For a nominal doubling of the air's CO_2 concentration, for example, the productivity of Earth's herbaceous plants rises by 30 to 50 percent and the productivity of its woody plants rises by 50 to 80 percent or more. In addition, atmospheric CO_2 enrichment typically increases plant nutrient and water use efficiency.

Chapter 8. Aquatic Life

- While some corals exhibit a propensity to bleach and die when sea temperatures rise, others exhibit a positive relationship between calcification, or growth, and temperature. "Such variable bleaching susceptibility implies that there is a considerable variation in the extent to which coral species are adapted to local environmental conditions" (Maynard et al., 2008).

- The latest research suggests corals have effective adaptive responses to climate change, such as symbiont shuffling, that allow reefs in some areas to flourish despite or even because of rising temperatures. Coral reefs have been able to recover quickly from bleaching events as well as damage from cyclones.

- Bleaching and other signs of coral distress attributed to global warming are often due to other things, including rising levels of nutrients and toxins in coastal waters caused by runoff from agricultural activities on land and associated increases in sediment delivery.

- The IPCC expresses concern that rising atmospheric CO_2 concentrations are lowering the pH values of oceans and seas, a process called acidification, and that this could harm aquatic life. But the drop in pH values that could be attributed to CO_2 is tiny compared to natural variations occurring in some ocean basins as a result of seasonal variability, and even day-to-day variations in many areas. Recent estimates also cut in half the projected pH reduction of ocean waters by the year 2100 (Tans, 2009).

- Real-world data contradict predictions about the negative effects of rising temperatures, rising CO_2 concentrations, and falling pH on aquatic life. Studies of algae, jellyfish, echinoids, abalone, sea urchins, and coral all find no harmful effects attributable to CO_2 or acidification.

Chapter 9. Human Health Effects

- Global warming is more likely to improve rather than harm human health because rising temperatures lead to a greater reduction in winter deaths than the increase they cause in summer deaths. The result is a large net decrease in human mortality.

- Climate plays a relatively small role in the spread of viral and vector-borne diseases, which suggests continued warming would not increase the incidence of diseases. Much bigger players include population growth (of both humans and domestic animals), armed conflicts, displaced populations, urbanization, and lack of reliable water systems.

- Higher atmospheric CO_2 concentrations tend to increase the production of plant nutrients with direct medicinal value, such as antioxidants that protect cells from the damaging effects of oxidation. This effect has been found in wheat, Chinese broccoli, spinach, grapes, and thyme.

Chapter 10. Economic and Other Policy Implications

- Decades-long empirical trends of climate-sensitive measures of human well-being, including the percent of developing world population suffering from chronic hunger, poverty rates, and deaths due to extreme weather events, reveal dramatic improvement during the twentieth century, notwithstanding the historic increase in atmospheric CO_2 concentrations.

- The magnitude of the impacts of climate change on human well-being depends on society's adaptability (adaptive capacity), which is determined by, among other things, the wealth and human resources society can access in order to obtain, install, operate, and maintain technologies necessary to cope with or take advantage of climate change impacts. The IPCC systematically underestimates adaptive capacity by failing to take into account the greater wealth and technological advances that will be present at the time for which impacts are to be estimated.

- Even accepting the IPCC's and Stern Review's worst-case scenarios, and assuming a compounded annual growth rate of per-capita GDP of only 0.7 percent, reveals that net GDP per capita in developing countries in 2100 would be double the 2006 level of the U.S. and triple that level in 2200. Thus, even developing countries' future ability to cope with climate change would be much better than that of the U.S. today.

- The IPCC's embrace of biofuels as a way to reduce greenhouse gas emissions was premature, as many researchers have found "even the best biofuels have the potential to damage the poor, the climate, and biodiversity" (Delucchi, 2010). Biofuel production consumes nearly as much energy as it generates, competes with food crops and wildlife for land, and is unlikely to ever meet more than a small fraction of the world's demand for fuels.

- The notion that global warming might cause war and social unrest is not only wrong, but even backwards – that is, global cooling has led to wars and social unrest in the past, whereas global warming has coincided with periods of peace, prosperity, and social stability.

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