An Abrupt Climate Change Scenario and Its Implications for United States National Security

October 2003

By Peter Schwartz and Doug Randall

Imagining the Unthinkable

The purpose of this report is to imagine the unthinkable – to push the boundaries of current research on climate change so we may better understand the potential implications on United States national security.

We have interviewed leading climate change scientists, conducted additional research, and reviewed several iterations of the scenario with these experts. The scientists support this project, but caution that the scenario depicted is extreme in two fundamental ways. First, they suggest the occurrences we outline would most likely happen in a few regions, rather than on globally. Second, they say the magnitude of the event may be considerably smaller.

We have created a climate change scenario that although not the most likely, is plausible, and would challenge United States national security in ways that should be considered immediately.

Executive Summary

There is substantial evidence to indicate that significant global warming will occur during the 21st century. Because changes have been gradual so far, and are projected to be similarly gradual in the future, the effects of global warming have the potential to be manageable for most nations. Recent research, however, suggests that there is a possibility that this gradual global warming could lead to a relatively abrupt slowing of the ocean's thermohaline conveyor, which could lead to harsher winter weather conditions, sharply reduced soil moisture, and more intense winds in certain regions that currently provide a significant fraction of the world's food production. With inadequate preparation, the result could be a significant drop in the human carrying capacity of the Earth's environment.

The research suggests that once temperature rises above some threshold, adverse weather conditions could develop relatively abruptly, with persistent changes in the atmospheric circulation causing drops in some regions of 5-10 degrees Fahrenheit in a single decade. Paleoclimatic evidence suggests that altered climatic patterns could last for as much as a century, as they did when the ocean conveyor collapsed 8,200 years ago, or, at the extreme, could last as long as 1,000 years as they did during the Younger Dryas, which began about 12,700 years ago.

In this report, as an alternative to the scenarios of gradual climatic warming that are so common, we outline an abrupt climate change scenario patterned after the 100-year event that occurred about 8,200 years ago. This abrupt change scenario is characterized by the following conditions:

- Annual average temperatures drop by up to 5 degrees Fahrenheit over Asia and North America and 6 degrees Fahrenheit in northern Europe
- Annual average temperatures increase by up to 4 degrees Fahrenheit in key areas throughout Australia, South America, and southern Africa.
- Drought persists for most of the decade in critical agricultural regions and in the water resource regions for major population centers in Europe and eastern North America.
- Winter storms and winds intensify, amplifying the impacts of the changes. Western Europe and the North Pacific experience enhanced winds.

The report explores how such an abrupt climate change scenario could potentially de-stabilize the geo-political environment, leading to skirmishes, battles, and even war due to resource constraints such as:

1) Food shortages due to decreases in net global agricultural production
2) Decreased availability and quality of fresh water in key regions due to shifted precipitation patters, causing more frequent floods and droughts
3) Disrupted access to energy supplies due to extensive sea ice and storminess

As global and local carrying capacities are reduced, tensions could mount around the world, leading to two fundamental strategies: defensive and offensive. Nations with the resources to do so may build virtual fortresses around their countries, preserving resources for themselves. Less fortunate nations especially those with ancient enmities with their neighbors, may initiate in struggles for access to food, clean water, or energy. Unlikely alliances could be formed as defense priorities shift and the goal is resources for survival rather than religion, ideology, or national honor.

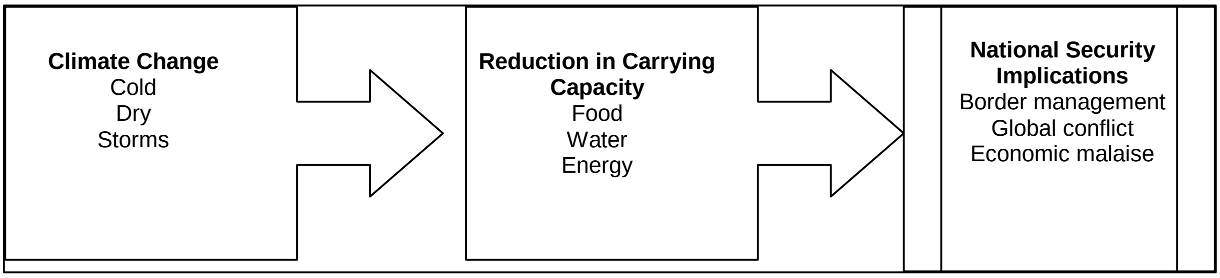
This scenario poses new challenges for the United States, and suggests several steps to be taken:

- Improve predictive climate models to allow investigation of a wider range of scenarios and to anticipate how and where changes could occur
- Assemble comprehensive predictive models of the potential impacts of abrupt climate change to improve projections of how climate could influence food, water, and energy
- Create vulnerability metrics to anticipate which countries are most vulnerable to climate change and therefore, could contribute materially to an increasingly disorderly and potentially violent world.

- Identify no-regrets strategies such as enhancing capabilities for water management
- Rehearse adaptive responses
- Explore local implications
- Explore geo-engineering options that control the climate.

There are some indications today that global warming has reached the threshold where the thermohaline circulation could start to be significantly impacted. These indications include observations documenting that the North Atlantic is increasingly being freshened by melting glaciers, increased precipitation, and fresh water runoff making it substantially less salty over the past 40 years.

This report suggests that, because of the potentially dire consequences, the risk of abrupt climate change, although uncertain and quite possibly small, should be elevated beyond a scientific debate to a U.S. national security concern.



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Introduction

When most people think about climate change, they imagine gradual increases in temperature and only marginal changes in other climatic conditions, continuing indefinitely or even leveling off at some time in the future. The conventional wisdom is that modern civilization will either adapt to whatever weather conditions we face and that the pace of climate change will not overwhelm the adaptive capacity of society, or that our efforts such as those embodied in the Kyoto protocol will be sufficient to mitigate the impacts. The IPCC documents the threat of gradual climate change and its impact to food supplies and other resources of importance to humans will not be so severe as to create security threats. Optimists assert that the benefits from technological innovation will be able to outpace the negative effects of climate change.

Climatically, the gradual change view of the future assumes that agriculture will continue to thrive and growing seasons will lengthen. Northern Europe, Russia, and North America will prosper agriculturally while southern Europe, Africa, and Central and South America will suffer from increased dryness, heat, water shortages, and reduced production. Overall, global food production under many typical climate scenarios increases. This view of climate change may be a dangerous act of self-deception, as increasingly we are facing weather related disasters -- more hurricanes, monsoons, floods, and dry-spells – in regions around the world.

Weather-related events have an enormous impact on society, as they influence food supply, conditions in cities and communities, as well as access to clean water and energy. For example, a recent report by the Climate Action Network of Australia projects that climate change is likely to reduce rainfall in the rangelands, which could lead to a 15 per cent drop in grass productivity. This, in turn, could lead to reductions in the average weight of cattle by 12 per cent, significantly reducing beef supply. Under such conditions, dairy cows are projected to produce 30% less milk, and new pests are likely to spread in fruit-growing areas. Additionally, such conditions are projected to lead to 10% less water for drinking. Based on model projections of coming change conditions such as these could occur in several food producing regions around the world at the same time within the next 15-30years, challenging the notion that society's ability to adapt will make climate change manageable.

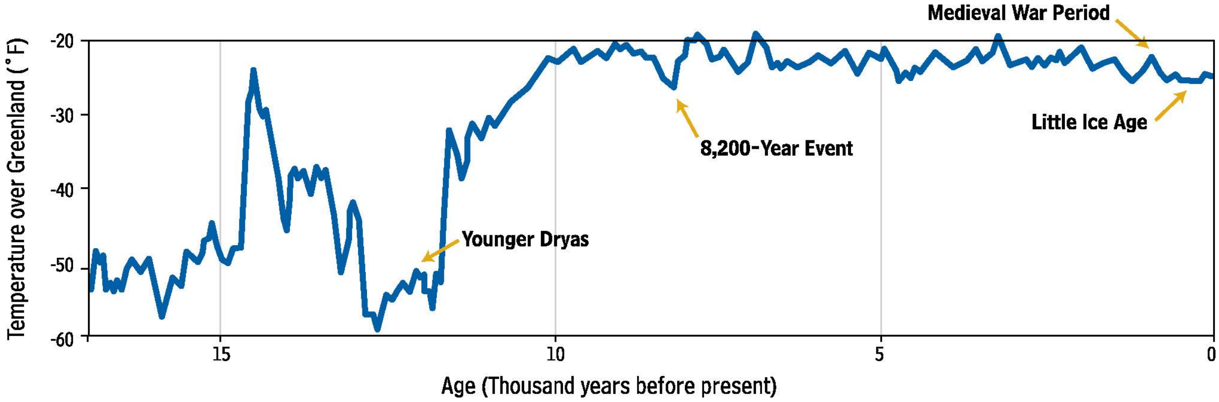
With over 400 million people living in drier, subtropical, often over-populated and economically poor regions today, climate change and its follow-on effects pose a severe risk to political, economic, and social stability. In less prosperous regions, where countries lack the resources and capabilities required to adapt quickly to more severe conditions, the problem is very likely to be exacerbated. For some countries, climate change could become such a challenge that mass emigration results as the desperate peoples seek better lives in regions such as the United States that have the resources to adaptation.

Because the prevailing scenarios of gradual global warming could cause effects like the ones described above, an increasing number of business leaders, economists, policy makers, and politicians are concerned about the projections for further change and are working to limit human influences on the climate. But, these efforts may not be sufficient or be implemented soon enough.

Rather than decades or even centuries of gradual warming, recent evidence suggests the possibility that a more dire climate scenario may actually be unfolding. This is why GBN is working with OSD to develop a plausible scenario for abrupt climate change that can be used to explore implications for food supply, health and disease, commerce and trade, and their consequences for national security.

While future weather patterns and the specific details of abrupt climate change cannot be predicted accurately or with great assurance, the actual history of climate change provides some useful guides. Our goal is merely to portray a plausible scenario, similar to one which has already occurred in human experieince, for which there is reasonable evidence so that we may further explore potential implications for United States national security.

Creating the Scenario: Reviewing History



The above graphic, derived from sampling of an ice core in Greenland, shows a historical tendency for particular regions to experience periods of abrupt cooling within periods of general warming.[1]

The Cooling Event 8,200 Years Ago

The climate change scenario outlined in this report is modeled on a century-long climate event that records from an ice core in Greenland indicate occurred 8,200 years ago. Immediately following an extended period of warming, much like the phase we appear to be in today, there was a sudden cooling . Average annual temperatures in Greenland dropped by roughly 5 degrees Fahrenheit, and temperature decreases nearly this large are likely to have occurred throughout the North Atlantic region. During the 8,200 event severe winters in Europe and some other areas caused glaciers to advance, rivers to freeze, and agricultural lands to be less productive. Scientific evidence suggests that this event was associated with, and perhaps caused by, a collapse of the ocean's conveyor following a period of gradual warming.

Longer ice core and oceanic records suggest that there may have been as many as eight rapid cooling episodes in the past 730,000 years, and sharp reductions in the ocean conveyer--a phenomenon that may well be on the horizon – are a likely suspect in causing such shifts in climate.

The Younger Dryas

About 12,700 years ago, also associated with an apparent collapse of the thermohaline circulation, there was a cooling of at least 27 degrees Fahrenheit in Greenland, and substantial change throughout the North Atlantic region as well, this time lasting 1,300 years. The remarkable feature of the Younger Dryas event was that it happened in a series of decadal drops of around 5 degrees, and then the cold, dry weather persisted for over 1,000 years. While this event had an enormous effect on the ocean and land surrounding Europe (causing icebergs to be found as far south as the coast of Portugal), its impact would be more severe today – in our densely populated society. It is the more recent periods of cooling that appear to be intimately connected with changes to civilization, unrest, inhabitability of once desirable land, and even the demise of certain populations.

The Little Ice Age

Beginning in the 14th century, the North Atlantic region experienced a cooling that lasted until the mid-19th century. This cooling may have been caused by a significant slowing of the ocean conveyor, although it is more generally thought that reduced solar output and/or volcanic eruptions may have prompted the oceanic changes. This period, often referred to as the Little Ice Age, which lasted from 1300 to 1850, brought severe winters, sudden climatic shifts, and profound agricultural, economic, and political impacts to Europe.

[1] R.B. Alley, from The Two Mile Time Machine, 2000.

The period was marked by persistent crop failures, famine, disease, and population migration, perhaps most dramatically felt by the Norse, also known as the Vikings, who inhabited Iceland and later Greenland. Ice formations along the coast of Greenland prevented merchants from getting their boats to Greenland and fisherman from getting fish for entire winters. As a result, farmers were forced to slaughter their poorly fed livestock -- because of a lack of food both for the animals and themselves -- but without fish, vegetables, and grains, there was not enough food to feed the population.

Famine, caused in part by the more severe climatic conditions, is reported to have caused tens of thousands of deaths between 1315 and 1319 alone. The general cooling also apparently drove the Vikings out of Greenland -- and some say was a contributing cause for that society's demise.

While climate crises like the Little Ice Age aren't solely responsible for the death of civilizations, it's undeniable that they have a large impact on society. It has been less than 175 years since 1 million people died due to the Irish Potato famine, which also was induced in part by climate change.

A Climate Change Scenario For the Future

The past examples of abrupt climate change suggest that it is prudent to consider an abrupt climate change scenario for the future as plausible, especially because some recent scientific findings suggest that we could be on the cusp of such an event. The future scenario that we have constructed is based on the 8,200 years before present event, which was much warmer and far briefer than the Younger Dryas, but more severe than the Little Ice Age. This scenario makes plausible assumptions about which parts of the globe are likely to be colder, drier, and windier. Although intensified research could help to refine the assumptions, there is no way to confirm the assumptions on the basis of present models.

Rather than predicting how climate change will happen, our intent is to dramatize the impact climate change could have on society if we are unprepared for it. Where we describe concrete weather conditions and implications, our aim is to further the strategic conversation rather than to accurately forecast what is likely to happen with a high degree of certainty. Even the most sophisticated models cannot predict the details of how the climate change will unfold, which regions will be impacted in which ways, and how governments and society might respond. However, there appears to be general agreement in the scientific community that an extreme case like the one depicted below is not implausible. Many scientists would regard this scenario as extreme both in how soon it develops, how large, rapid and ubiquitous the climate changes are. But history tells us that sometimes the extreme cases do occur, there is evidence that it might be and it is DOD's job to consider such scenarios.

Keep in mind that the duration of this event could be decades, centuries, or millennia and it could begin this year or many years in the future. In the climate change disruption scenario proposed here, we consider a period of gradual warming leading to 2010 and then outline the following ten years, when like in the 8,200 event, an abrupt change toward cooling in the pattern of weather conditions change is assumed to occur.

Warming Up to 2010

Following the most rapid century of warming experienced by modern civilization, the first ten years of the 21st century see an acceleration of atmospheric warming, as average temperatures worldwide rise by .5 degrees Fahrenheit per decade and by as much as 2 degrees Fahrenheit per decade in the harder hit regions. Such temperature changes would vary both by region and by season over the globe, with these finer scale variations being larger or smaller than the average change. What would be very clear is that the planet is continuing the warming trend of the late 20th century.

Most of North America, Europe, and parts of South America experience 30% more days with peak temperatures over 90 degrees Fahrenheit than they did a century ago, with far fewer days below freezing. In addition to the warming, there are erratic weather patterns: more floods, particularly in mountainous regions, and prolonged droughts in grain-producing and coastal-agricultural areas. In general, the climate shift is an economic nuisance, generally affecting local areas as storms, droughts, and hot spells impact agriculture and other climate-dependent activities. (More French doctors remain on duty in August, for example.) The weather pattern, though, is not yet severe enough or widespread enough to threaten the interconnected global society or United States national security.

Warming Feedback Loops

As temperatures rise throughout the 20th century and into the early 2000s potent positive feedback loops kick-in, accelerating the warming from .2 degrees Fahrenheit, to .4 and eventually .5 degrees Fahrenheit per year in some locations. As the surface warms, the hydrologic cycle (evaporation, precipitation, and runoff) accelerates causing temperatures to rise even higher. Water vapor, the most powerful natural greenhouse gas, traps additional heat and brings average surface air temperatures up. As evaporation increases, higher surface air temperatures cause drying in forests and grasslands, where animals graze and farmers grow grain. As trees die and burn, forests absorb less carbon dioxide, again leading to higher surface air temperatures as well as fierce and uncontrollable forest fires Further, warmer temperatures melt snow cover in mountains, open fields, high-latitude tundra areas, and permafrost throughout forests in cold-weather areas. With the ground absorbing more and reflecting less of the sun's rays, temperatures increase even higher.

By 2005 the climatic impact of the shift is felt more intensely in certain regions around the world. More severe storms and typhoons bring about higher storm surges and floods in low-lying islands such as Tarawa and Tuvalu (near New Zealand). In 2007, a particularly severe storm causes the ocean to break through levees in the Netherlands making a few key coastal cities such as The Hague unlivable. Failures of the delta island levees in the Sacramento River region in the Central Valley of California creates an inland sea and disrupts the aqueduct system transporting water from northern to southern California because salt water can no longer be kept out of the area during the dry season. Melting along the Himalayan glaciers accelerates, causing some Tibetan people to relocate. Floating ice in the northern polar seas, which had already lost 40% of its mass from 1970 to 2003, is mostly gone during summer by 2010. As glacial ice melts, sea levels rise and as wintertime sea extent decreases, ocean waves increase in intensity, damaging coastal cities. Additionally millions of people are put at risk of flooding around the globe (roughly 4 times 2003 levels), and fisheries are disrupted as water temperature changes cause fish to migrate to new locations and habitats, increasing tensions over fishing rights.

Each of these local disasters caused by severe weather impacts surrounding areas whose natural, human, and economic resources are tapped to aid in recovery. The positive feedback loops and acceleration of the warming pattern begin to trigger responses that weren't previously imagined, as natural disasters and stormy weather occur in both developed and lesser-developed nations. Their impacts are greatest in less-resilient developing nations, which do not have the capacity built into their social, economic, and agricultural systems to absorb change.

As melting of the Greenland ice sheet exceeds the annual snowfall, and there is increasing freshwater runoff from high latitude precipitation, the freshening of waters in the North Atlantic Ocean and the seas between Greenland and Europe increases. The lower densities of these freshened waters in turn pave the way for a sharp slowing of the thermohaline circulation system.

The Period from 2010 to 2020

Thermohaline Circulation Collapse

After roughly 60 years of slow freshening, the thermohaline collapse begins in 2010, disrupting the temperate climate of Europe, which is made possible by the warm flows of the Gulf Stream (the North Atlantic arm of the global thermohaline conveyor). Ocean circulation patterns change, bringing less warm water north and causing an immediate shift in the weather in Northern Europe and eastern North America. The North Atlantic Ocean continues to be affected by fresh water coming from melting glaciers, Greenland's ice sheet, and perhaps most importantly increased rainfall and runoff. Decades of high-latitude warming cause increased precipitation and bring additional fresh water to the salty, dense water in the North, which is normally affected mainly by warmer and saltier water from the Gulf Stream. That massive current of warm water no longer reaches far into the North Atlantic. The immediate climatic effect is cooler temperatures in Europe and throughout much of the Northern Hemisphere and a dramatic drop in rainfall in many key agricultural and populated areas. However, the effects of the collapse will be felt in fits and starts, as the traditional weather patterns re-emerge only to be disrupted again—for a full decade.

The dramatic slowing of the thermohaline circulation is anticipated by some ocean researchers, but the United States is not sufficiently prepared for its effects, timing, or intensity. Computer models of the climate and ocean systems, though improved, were unable to produce sufficiently consistent and accurate information for policymakers. As weather patterns shift in the years following the collapse, it is not clear what type of weather future years will bring. While some forecasters believe the cooling and dryness is about to end, others predict a new ice age or a global drought, leaving policy makers and the public highly uncertain about the future climate and what to do, if anything. Is this merely a "blip" of little importance or a fundamental change in the Earth's climate, requiring an urgent massive human response?

Cooler, Drier, Windier Conditions for Continental Areas of the Northern Hemisphere

The Weather Report: 2010-2020

- Drought persists for the entire decade in critical agricultural regions and in the areas around major population centers in Europe and eastern North America.
- Average annual temperatures drop by up to 5 degrees Fahrenheit over Asia and North America and up to 6 degrees Fahrenheit in Europe.
- Temperatures increase by up to 4 degrees Fahrenheit in key areas throughout Australia, South America, and southern Africa.
- Winter storms and winds intensify, amplifying the impact of the changes. Western Europe and the North Pacific face enhanced westerly winds.

Each of the years from 2010-2020 sees average temperature drops throughout Northern Europe, leading to as much as a 6 degree Fahrenheit drop in ten years. Average annual rainfall in this region decreases by nearly 30%; and winds are up to 15% stronger on average. The climatic conditions are more severe in the continental interior regions of northern Asia and North America.

The effects of the drought are more devastating than the unpleasantness of temperature decreases in the agricultural and populated areas. With the persistent reduction of precipitation in these areas, lakes dry-up, river flow decreases, and fresh water supply is squeezed, overwhelming available conservation options and depleting fresh water reserves. The Mega-droughts begin in key regions in Southern China and Northern Europe around 2010 and last throughout the full decade. At the same time, areas that were relatively dry over the past few decades receive persistent years of torrential rainfall, flooding rivers, and regions that traditionally relied on dryland agriculture.

In the North Atlantic region and across northern Asia, cooling is most pronounced in the heart of winter -- December, January, and February -- although its effects linger through the seasons, the cooling becomes increasingly intense and less predictable. As snow accumulates in mountain regions, the cooling spreads to summertime. In addition to cooling and summertime dryness, wind pattern velocity strengthens as the atmospheric circulation becomes more zonal.

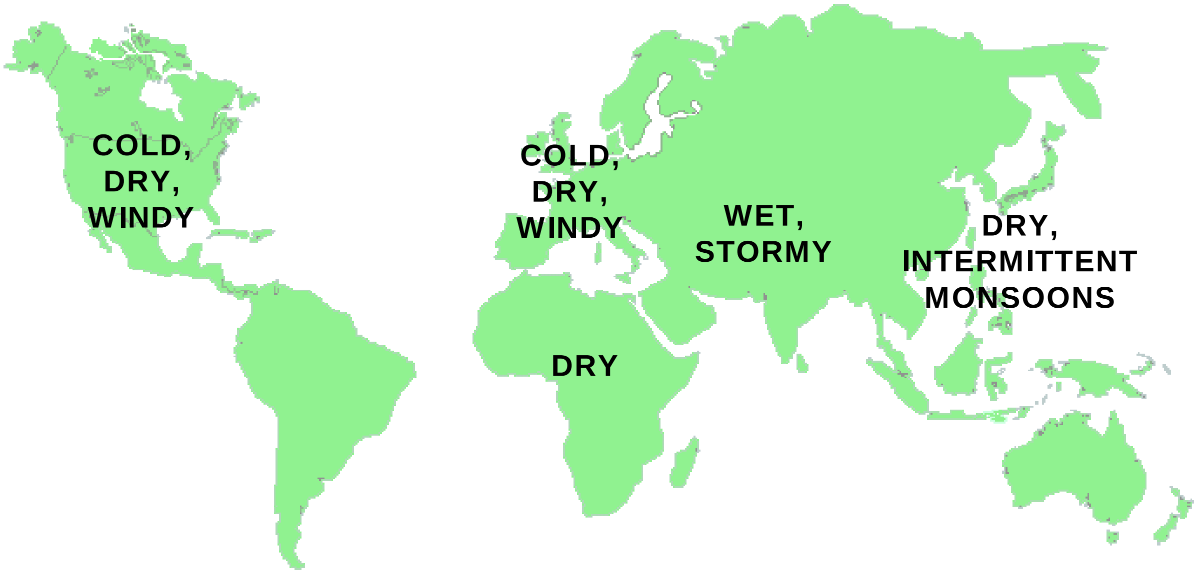
While weather patterns are disrupted during the onset of the climatic change around the globe, the effects are far more pronounced in Northern Europe for the first five years after the thermohaline circulation collapse. By the second half of this decade, the chill and harsher conditions spread deeper into Southern Europe, North America, and beyond. Northern Europe cools as a pattern of colder weather lengthens the time that sea ice is present over the northern North Atlantic Ocean, creating a further cooling influence and extending the period of wintertime surface air temperatures. Winds pick up as the atmosphere tries to deal with the stronger pole-to-equator temperature gradient. Cold air blowing across the European continent causes especially harsh conditions for agriculture. The combination of wind and dryness causes widespread dust storms and soil loss.

Signs of incremental warming appear in the southern most areas along the Atlantic Ocean, but the dryness doesn't let up. By the end of the decade, Europe's climate is more like Siberia's.

An Alternative Scenario for the Southern Hemisphere

There is considerable uncertainty about the climate dynamics of the Southern Hemisphere, mainly due to less paleoclimatic data being available than for the Northern Hemisphere. Weather patterns in key regions in the Southern Hemisphere could mimic those of the Northern Hemisphere, becoming colder, drier, and more severe as heat flows from the tropics to the Northern Hemisphere, trying to thermodynamically balance the climatic system. Alternatively, the cooling of the Northern Hemisphere may lead to increased warmth, precipitation, and storms in the south, as the heat normally transported away from equatorial regions by the ocean currents becomes trapped and as greenhouse gas warming continues to accelerate. Either way, it is not implausible that abrupt climate change will bring extreme weather conditions to many of the world's key population and growing regions at the same time – stressing global food, water, and energy supply.

The Regions: 2010 to 2020



The above graphic shows a simplified view of the weather patterns portrayed in this scenario.

Europe. Hit hardest by the climatic change, average annual temperatures drop by 6 degrees Fahrenheit in under a decade, with more dramatic shifts along the Northwest coast. The climate in northwestern Europe is colder, drier, and windier, making it more like Siberia. Southern Europe experiences less of a change but still suffers from sharp intermittent cooling and rapid temperature shifts. Reduced precipitation causes soil loss to become a problem throughout Europe, contributing to food supply shortages. Europe struggles to stem emigration out of Scandinavian and northern European nations in search of warmth as well as immigration from hard-hit countries in Africa and elsewhere.

United States. Colder, windier, and drier weather makes growing seasons shorter and less productive throughout the northeastern United States, and longer and drier in the southwest. Desert areas face increasing windstorms, while agricultural areas suffer from soil loss due to higher wind speeds and reduced soil moisture. The change toward a drier climate is especially pronounced in the southern states.

Coastal areas that were at risk during the warming period remain at risk, as rising ocean levels continues along the shores. The United States turns inward, committing its resources to feeding its own population, shoring-up its borders, and managing the increasing global tension.

China. China, with its high need for food supply given its vast population, is hit hard by a decreased reliability of the monsoon rains. Occasional monsoons during the summer season are welcomed for their precipitation, but have devastating effects as they flood generally denuded land. Longer, colder winters and hotter summers caused by decreased evaporative cooling because of reduced precipitation stress already tight energy and water supplies. Widespread famine causes chaos and internal struggles as a cold and hungry China peers jealously across the Russian and western borders at energy resources.

Bangladesh. Persistent typhoons and a higher sea level create storm surges that cause significant coastal erosion, making much of Bangladesh nearly uninhabitable. Further, the rising sea level contaminates fresh water supplies inland, creating a drinking water and humanitarian crisis. Massive emigration occurs, causing tension in China and India, which are struggling to manage the crisis inside their own boundaries.

East Africa. Kenya, Tanzania, and Mozambique face slightly warmer weather, but are challenged by persistent drought. Accustomed to dry conditions, these countries were the least influenced by the changing weather conditions, but their food supply is challenged as major grain producing regions suffer.

Australia. A major food exporter, Australia struggles to supply food around the globe, as its agriculture is not severely impacted by more subtle changes in its climate. But the large uncertainties about Southern Hemisphere climate change make this benign conclusion suspect.

Impact on Natural Resources

The changing weather patterns and ocean temperatures affect agriculture, fish and wildlife, water and energy. Crop yields, affected by temperature and water stress as well as length of growing season fall by 10-25% and are less predictable as key regions shift from a warming to a cooling trend. As some agricultural pests die due to temperature changes, other species spread more readily due to the dryness and windiness – requiring alternative pesticides or treatment regiments. Commercial fishermen that typically have rights to fish in specific areas will be ill equipped for the massive migration of their prey.

With only five or six key grain-growing regions in the world (US, Australia, Argentina, Russia, China, and India), there is insufficient surplus in global food supplies to offset severe weather conditions in a few regions at the same time – let alone four or five. The world's economic interdependence make the United States increasingly vulnerable to the economic disruption created by local weather shifts in key agricultural and high population areas around the world. Catastrophic shortages of water and energy supply – both which are stressed around the globe today – cannot be quickly overcome.

Impact on National Security

Human civilization began with the stabilization and warming of the Earth's climate. A colder unstable climate meant that humans could neither develop agriculture or permanent settlements. With the end of the Younger Dryas and the warming and stabilization that followed, humans could learn the rhythms of agriculture and settle in places whose climate was reliably productive. Modern civilization has never experienced weather conditions as persistently disruptive as the ones outlined in this scenario. As a result, the implications for national security outlined in this report are only hypothetical. The actual impacts would vary greatly depending on the nuances of the weather conditions, the adaptability of humanity, and decisions by policymakers.

Violence and disruption stemming from the stresses created by abrupt changes in the climate pose a different type of threat to national security than we are accustomed to today. Military confrontation may be triggered by a desperate need for natural resources such as energy, food and water rather than by conflicts over ideology, religion, or national honor. The shifting motivation for confrontation would alter which countries are most vulnerable and the existing warning signs for security threats.

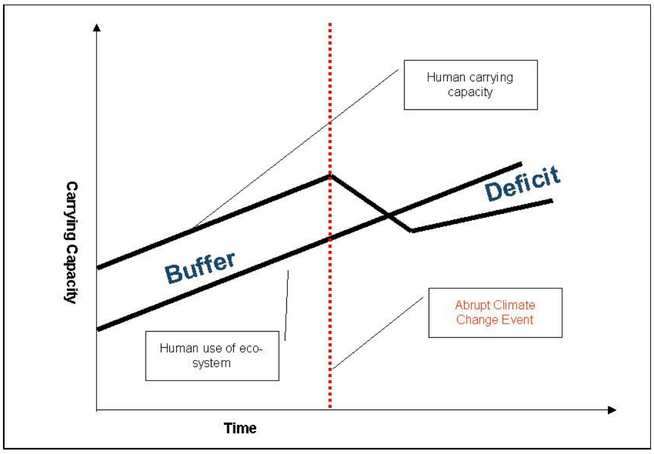
There is a long-standing academic debate over the extent to which resource constraints and environmental challenges lead to inter-state conflict. While some believe they alone can lead nations to attack one another, others argue that their primary effect is to act as a trigger of conflict among countries that face pre-existing social, economic, and political tension. Regardless, it seems undeniable that severe environmental problems are likely to escalate the degree of global conflict.

Co-founder and President of the Pacific Institute for Studies in Development, Environment, and Security, Peter Gleick outlines the three most fundamental challenges abrupt climate change poses for national security:

1. Food shortages due to decreases in agricultural production
2. Decreased availability and quality of fresh water due to flooding and droughts
3. Disrupted access to strategic minerals due to ice and storms

In the event of abrupt climate change, it's likely that food, water, and energy resource constraints will first be managed through economic, political, and diplomatic means such as treaties and trade embargoes. Over time though, conflicts over land and water use are likely to become more severe – and more violent. As states become increasingly desperate, the pressure for action will grow.

Decreasing Carrying Capacity



The graphic shows how abrupt climate change may cause human carrying capacity to fall below usage of the eco-system, suggesting insufficient resources leading to a contraction of the population through war, disease, and famine.

Today, carrying capacity, which is the ability for the Earth and its natural ecosystems including social, economic, and cultural systems to support the finite number of people on the planet, is being challenged around the world. According to the International Energy Agency, global demand for oil will grow by 66% in the next 30 years, but it's unclear where the supply will come from. Clean water is similarly constrained in many areas around the world. With 815 million people receiving insufficient sustenance worldwide, some would say that as a globe, we're living well above our carrying capacity, meaning there are not sufficient natural resources to sustain our behavior.

Many point to technological innovation and adaptive behavior as a means for managing the global ecosystem. Indeed it has been technological progress that has increased carrying capacity over time. Over centuries we have learned how to produce more food, energy and access more water. But will the potential of new technologies be sufficient when a crisis like the one outlined in this scenario hits?

Abrupt climate change is likely to stretch carrying capacity well beyond its already precarious limits. And there's a natural tendency or need for carrying capacity to become realigned. As abrupt climate change lowers the world's carrying capacity aggressive wars are likely to be fought over food, water, and energy. Deaths from war as well as starvation and disease will decrease population size, which overtime, will re-balance with carrying capacity.

When you look at carrying capacity on a regional or state level it is apparent that those nations with a high carrying capacity, such as the United States and Western Europe, are likely to adapt most effectively to abrupt changes in climate, because, relative to their population size, they have more resources to call on. This may give rise to a more severe have, have-not mentality, causing resentment toward those nations with a higher carrying capacity. It may lead to finger-pointing and blame, as the wealthier nations tend to use more energy and emit more greenhouse gasses such as CO_2 into the atmosphere. Less important than the scientifically proven relationship between CO_2 emissions and climate change is the perception that impacted nations have – and the actions they take.

The Link Between Carrying Capacity and Warfare

Steven LeBlanc, Harvard archaeologist and author of a new book called Carrying Capacity, describes the relationship between carrying capacity and warfare. Drawing on abundant archaeological and ethnological data, LeBlanc argues that historically humans conducted organized warfare for a variety of reasons, including warfare over resources and the environment. Humans fight when they outstrip the carrying capacity of their natural environment. Every time there is a choice between starving and raiding, humans raid. From hunter / gatherers through agricultural tribes, chiefdoms, and early complex societies, 25% of a population's adult males die when war breaks out.

Peace occurs when carrying capacity goes up, as with the invention of agriculture, newly effective bureaucracy, remote trade and technological breakthroughs. Also a large scale die-back such as from plague can make for peaceful times---Europe after its major plagues, North American natives after European diseases decimated their populations (that's the difference between the Jamestown colony failure and Plymouth Rock success). But such peaceful periods are short-lived because population quickly rises to once again push against carrying capacity, and warfare resumes. Indeed, over the millennia most societies define themselves according to their ability to conduct war, and warrior culture becomes deeply ingrained. The most combative societies are the ones that survive.

However in the last three centuries, LeBlanc points out, advanced states have steadily lowered the body count even though individual wars and genocides have grown larger in scale. Instead of slaughtering all their enemies in the traditional way, for example, states merely kill enough to get a victory and then put the survivors to work in their newly expanded economy. States also use their own bureaucracies, advanced technology, and international rules of behavior to raise carrying capacity and bear a more careful relationship to it.

All of that progressive behavior could collapse if carrying capacities everywhere were suddenly lowered drastically by abrupt climate change. Humanity would revert to its norm of constant battles for diminishing resources, which the battles themselves would further reduce even beyond the climatic effects. Once again warfare would define human life.

Conflict Scenario Due to Climate Change

	Europe	Asia	United States
2010-2020	2012: Severe drought and cold push Scandinavian populations southward, push back from EU 2015: Conflict within the EU over food and water supply leads to skirmishes and strained diplomatic relations 2018: Russia joins EU, providing energy resources 2020: Migration from northern countries such as Holland and Germany toward Spain and Italy	2010: Border skirmishes and conflict in Bangladesh, India, and China, as mass migration occurs toward Burma 2012: Regional instability leads Japan to develop force projection capability 2015: Strategic agreement between Japan and Russia for Siberia and Sakhalin energy resources 2018: China intervenes in Kazakhstan to protect pipelines regularly disrupted by rebels and criminals.	2010: Disagreements with Canada and Mexico over water increase tension 2012: Flood of refugees to southeast U.S. and Mexico from Caribbean islands 2015: European migration to United States (mostly wealthy) 2016: Conflict with European countries over fishing rights 2018: Securing North America, U.S. forms integrated security alliance with Canada and Mexico 2020: Department of Defense manages borders and refugees from Caribbean and Europe.
2020-2030	2020: Increasing: skirmishes over water and immigration 2022: Skirmish between France and Germany over commercial access to Rhine 2025: EU nears collapse 2027: Increasing migration to Mediterranean countries such as Algeria, Morocco, Egypt, and Israel 2030: Nearly 10% of European population	2020: Persistent conflict in South East Asia; Burma, Laos, Vietnam, India, China 2025: Internal conditions in China deteriorate dramatically leading to civil war and border wars. 2030: Tension growing between China and Japan over Russian energy *	2020: Oil prices increase as security of supply is threatened by conflicts in Persian Gulf and Caspian 2025: Internal struggle in Saudi Arabia brings Chinese and U.S. naval forces to Gulf ,in direct confrontation

	moves to a different country		

The chart above outlines some potential military implications of climate change

The two most likely reactions to a sudden drop in carrying capacity due to climate change are defensive and offensive.

The United States and Australia are likely to build defensive fortresses around their countries because they have the resources and reserves to achieve self-sufficiency. With diverse growing climates, wealth, technology, and abundant resources, the United States could likely survive shortened growing cycles and harsh weather conditions without catastrophic losses. Borders will be strengthened around the country to hold back unwanted starving immigrants from the Caribbean islands (an especially severe problem), Mexico, and South America. Energy supply will be shored up through expensive (economically, politically, and morally) alternatives such as nuclear, renewables, hydrogen, and Middle Eastern contracts. Pesky skirmishes over fishing rights, agricultural support, and disaster relief will be commonplace. Tension between the U.S. and Mexico rise as the U.S. reneges on the 1944 treaty that guarantees water flow from the Colorado River. Relief workers will be commissioned to respond to flooding along the southern part of the east coast and much drier conditions inland. Yet, even in this continuous state of emergency the U.S. will be positioned well compared to others. The intractable problem facing the nation will be calming the mounting military tension around the world.

As famine, disease, and weather-related disasters strike due to the abrupt climate change, many countries' needs will exceed their carrying capacity. This will create a sense of desperation, which is likely to lead to offensive aggression in order to reclaim balance. Imagine eastern European countries, struggling to feed their populations with a falling supply of food, water, and energy, eyeing Russia, whose population is already in decline, for access to its grain, minerals, and energy supply. Or, picture Japan, suffering from flooding along its coastal cities and contamination of its fresh water supply, eying Russia's Sakhalin Island oil and gas reserves as an energy source to power desalination plants and energy-intensive agricultural processes. Envision Pakistan, India, and China – all armed with nuclear weapons – skirmishing at their borders over refugees, access to shared rivers, and arable land. Spanish and Portuguese fishermen might fight over fishing rights – leading to conflicts at sea. And, countries including the United States would be likely to better secure their borders. With over 200 river basins touching multiple nations, we can expect conflict over access to water for drinking, irrigation, and transportation. The Danube touches twelve nations, the Nile runs though nine, and the Amazon runs through seven.

In this scenario, we can expect alliances of convenience. The United States and Canada may become one, simplifying border controls. Or, Canada might keep its hydropower—causing energy problems in the US. North and South Korea may align to create one technically savvy and nuclear-armed entity. Europe may act as a unified block – curbing immigration problems between European nations – and allowing for protection against aggressors. Russia, with its abundant minerals, oil, and natural gas may join Europe.

In this world of warring states, nuclear arms proliferation is inevitable. As cooling drives up demand, existing hydrocarbon supplies are stretched thin. With a scarcity of energy supply – and a growing need for access -- nuclear energy will become a critical source of power, and this will accelerate nuclear proliferation as countries develop enrichment and reprocessing capabilities to ensure their national security. China, India, Pakistan, Japan, South Korea, Great Britain, France, and Germany will all have nuclear weapons capability, as will Israel, Iran, Egypt, and North Korea.

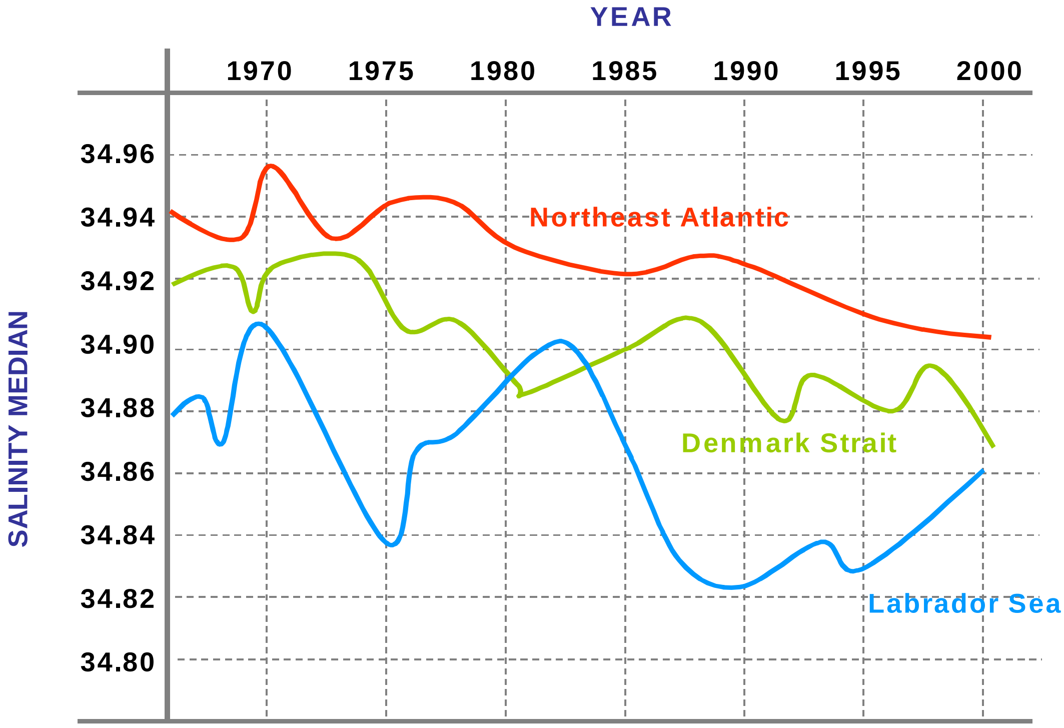
Managing the military and political tension, occasional skirmishes, and threat of war will be a challenge. Countries such as Japan, that have a great deal of social cohesion (meaning the government is able to effectively engage its population in changing behavior) are most likely to fair well. Countries whose diversity already produces conflict, such as India, South Africa and Indonesia, will have trouble maintaining order. Adaptability and access to resources will be key. Perhaps the most frustrating challenge abrupt climate change will pose is that we'll never know how far we are into the climate change scenario and how many more years – 10, 100, 1000 --- remain before some kind of return to warmer conditions as the thermohaline circulation starts up again. When carrying capacity drops suddenly, civilization is faced with new challenges that today seem unimaginable.

Could This Really Happen?

Ocean, land, and atmosphere scientists at some of the world's most prestigious organizations have uncovered new evidence over the past decade suggesting that the plausibility of severe and rapid climate change is higher than most of the scientific community and perhaps all of the political community is prepared for. If it occurs, this phenomenon will disrupt current gradual global warming trends, adding to climate complexity and lack of predictability. And paleoclimatic evidence suggests that such an abrupt climate change could begin in the near future.

The Woods Hole Oceanographic Institute reports that seas surrounding the North Atlantic have become less salty in the past 40 years, which in turn freshens the deep ocean in the North Atlantic. This trend could pave the way for ocean conveyor collapse or slowing and abrupt climate change.

Representational Graph



The above graphic shows early evidence that a thermohaline circulation collapse may be imminent, as the North Atlantic is increasingly being freshened by surrounding seas that have become less salty over the past 40 years.2

Decreasing overflow from the Nordic seas into the Atlantic Ocean through the Faroe Bank channel since 1950

Bogi Hansen*, William R. Turrell† & Svein Østerhus‡

* *Faroese Fisheries Laboratory, PO Box 3051, FO-110 Tórshavn, Faroe Islands*
† *FRS Marine Laboratory, PO Box 101, Aberdeen AB11 9DB, UK*
‡ *Bjerknes Centre for Climate Research and Geophysical Institute, N-5024 Bergen, Norway*

The overflow of cold, dense water from the Nordic seas, across the Greenland–Scotland ridge[1] and into the Atlantic Ocean is the main source for the deep water of the North Atlantic Ocean[2]. This flow also helps drive the inflow of warm, saline surface water into the Nordic seas[1]. The Faroe Bank channel is the deepest path across the ridge, and the deep flow through this channel accounts

Rapid freshening of the deep North Atlantic Ocean over the past four decades

Bob Dickson*, Igor Yashayaev†, Jens Meincke‡, Bill Turrell§, Stephen Dye* & Juergen Holfort‡

* *Centre for Environment, Fisheries, and Aquaculture Science, Lowestoft NR33 0HT, UK*
† *Bedford Institute of Oceanography, Dartmouth, Nova Scotia B2Y 4A2, Canada*
‡ *Institut fur Meereskunde, 22529 Hamburg, Germany*
§ *Marine Laboratory, PO Box 101, Aberdeen AB11 9DB, UK*

The overflow and descent of cold, dense water from the sills of the Denmark Strait and the Faroe–Shetland channel into the North Atlantic Ocean is the principal means of ventilating the deep oceans, and is therefore a key element of the global thermohaline

[2] Adapted from I Yashayaev, Bedford Institute of Oceanography as seen in Abrupt Climate Change, Inevitable Surprises, National Research Council.

The above two headlines appeared in Nature Magazine in 2001 and 2002, respectively. They suggest that the North Atlantic salinity level may lower, increasing the likelihood of a thermohaline circulation collapse.

With at least eight abrupt climate change events documented in the geological record, it seems that the questions to ask are: *When will this happen? What will the impacts be? And, how can we best prepare for it?* Rather than: *Will this really happen?*

Are we prepared for history to repeat itself again?

There is a debate in newspapers around the globe today on the impact of human activity on climate change. Because economic prosperity is correlated with energy use and greenhouse gas emissions, it is often argued that economic progress leads to climate change. Competing evidence suggests that climate change can occur, regardless of human activity as seen in climate events that happened prior to modern society.

It's important to understand human impacts on the environment – both what's done to accelerate and decelerate (or perhaps even reverse) the tendency toward climate change. Alternative fuels, greenhouse gas emission controls, and conservation efforts are worthwhile endeavors. In addition, we should prepare for the inevitable effects of abrupt climate change – which will likely come regardless of human activity.

Here are some preliminary recommendations to prepare the United States for abrupt climate change:

1) Improve predictive climate models. Further research should be conducted so more confidence can be placed in predictions about climate change. There needs to be a deeper understanding of the relationship between ocean patterns and climate change. This research should focus on historical, current, and predictive forces, and aim to further our understanding of abrupt climate change, how it may happen, and how we'll know it's occurring.

2) Assemble comprehensive predictive models of climate change impacts. Substantial research should be done on the potential ecological, economic, social, and political impact of abrupt climate change. Sophisticated models and scenarios should be developed to anticipate possible local conditions. A system should be created to identify how climate change may impact the global distribution of social, economic, and political power. These analyses can be used to mitigate potential sources of conflict before they happen.

3) Create vulnerability metrics. Metrics should be created to understand a country's vulnerability to the impacts of climate change. Metrics may include climatic impact on existing agricultural, water, and mineral resources; technical capability; social cohesion and adaptability.

4) Identify no-regrets strategies. No-regrets strategies should be identified and implemented to ensure reliable access to food supply and water, and to ensure national security.

5) Rehearse adaptive responses. Adaptive response teams should be established to address and prepare for inevitable climate driven events such as massive migration, disease and epidemics, and food and water supply shortages.

6) Explore local implications. The first-order effects of climate change are local. While we can anticipate changes in pest prevalence and severity and changes in agricultural productivity, one has to look at very specific locations and conditions to know which pests are of concern, which crops and regions are vulnerable, and how severe impacts will be. Such studies should be undertaken, particularly in strategically important food producing regions.

7) Explore geo-engineering options that control the climate. Today, it is easier to warm than to cool the climate, so it might be possible to add various gases, such as hydrofluorocarbons, to the atmosphere to offset the affects of cooling. Such actions, of course, would be studied carefully, as they have the potential to exacerbate conflicts among nations.

Conclusion

It is quite plausible that within a decade the evidence of an imminent abrupt climate shift may become clear and reliable. It is also possible that our models will better enable us to predict the consequences. In that event the United States will need to take urgent action to prevent and mitigate some of the most significant impacts. Diplomatic action will be needed to minimize the likelihood of conflict in the most impacted areas, especially in the Caribbean and Asia. However, large population movements in this scenario are inevitable. Learning how to manage those populations, border tensions that arise and the resulting refugees will be critical. New forms of security agreements dealing specifically with energy, food and water will also be needed. In short, while the US itself will be relatively better off and with more adaptive capacity, it will find itself in a world where Europe will be struggling internally, large number so refugees washing up on its shores and Asia in serious crisis over food and water. Disruption and conflict will be endemic features of life.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Climate Change 2007: The Physical Science Basis

Summary for Policymakers

Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

This Summary for Policymakers was formally approved at the 10th Session of Working Group I of the IPCC, Paris, February 2007.

Note:
Text, tables and figures given here are final but subject to copy-editing.

Corrections made as of February 5th, 2007

Drafting Authors:
Richard Alley, Terje Berntsen, Nathaniel L. Bindoff, Zhenlin Chen, Amnat Chidthaisong, Pierre Friedlingstein, Jonathan Gregory, Gabriele Hegerl, Martin Heimann, Bruce Hewitson, Brian Hoskins, Fortunat Joos, Jean Jouzel, Vladimir Kattsov, Ulrike Lohmann, Martin Manning, Taroh Matsuno, Mario Molina, Neville Nicholls, Jonathan Overpeck, Dahe Qin, Graciela Raga, Venkatachalam Ramaswamy, Jiawen Ren, Matilde Rusticucci, Susan Solomon, Richard Somerville, Thomas F. Stocker, Peter Stott, Ronald J. Stouffer, Penny Whetton, Richard A. Wood, David Wratt

Draft Contributing Authors:
Julie Arblaster, Guy Brasseur, Jens Hesselbjerg Christensen, Kenneth Denman, David W. Fahey, Piers Forster, Eystein Jansen, Philip D. Jones, Reto Knutti, Hervé Le Treut, Peter Lemke, Gerald Meehl, Philip Mote, David Randall, Dáithí A. Stone, Kevin E. Trenberth, Jürgen Willebrand, Francis Zwiers

INTRODUCTION

The Working Group I contribution to the IPCC Fourth Assessment Report describes progress in understanding of the human and natural drivers of climate change[1], observed climate change, climate processes and attribution, and estimates of projected future climate change. It builds upon past IPCC assessments and incorporates new findings from the past six years of research. Scientific progress since the TAR is based upon large amounts of new and more comprehensive data, more sophisticated analyses of data, improvements in understanding of processes and their simulation in models, and more extensive exploration of uncertainty ranges.

The basis for substantive paragraphs in this Summary for Policymakers can be found in the chapter sections specified in curly brackets.

HUMAN AND NATURAL DRIVERS OF CLIMATE CHANGE

Changes in the atmospheric abundance of greenhouse gases and aerosols, in solar radiation and in land surface properties alter the energy balance of the climate system. These changes are expressed in terms of radiative forcing[2], which is used to compare how a range of human and natural factors drive warming or cooling influences on global climate. Since the Third Assessment Report (TAR), new observations and related modelling of greenhouse gases, solar activity, land surface properties and some aspects of aerosols have led to improvements in the quantitative estimates of radiative forcing.

Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years (see Figure SPM-1). The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture. {2.3, 6.4, 7.3}

- Carbon dioxide is the most important anthropogenic greenhouse gas (see Figure SPM-2). The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm[3] in 2005. The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice cores. The annual carbon dioxide concentration growth-rate was larger during the last 10 years (1995 – 2005 average: 1.9 ppm per year), than it has been since the beginning of continuous direct atmospheric measurements (1960 – 2005 average: 1.4 ppm per year) although there is year-to-year variability in growth rates. {2.3, 7.3}
- The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land use change providing another significant but smaller contribution. Annual fossil carbon dioxide emissions[4] increased from an average of 6.4 [6.0 to 6.8] [5] GtC

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[1] *Climate change* in IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the Framework Convention on Climate Change, where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

[2] *Radiative forcing* is a measure of the influence that a factor has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the factor as a potential climate change mechanism. Positive forcing tends to warm the surface while negative forcing tends to cool it. In this report radiative forcing values are for 2005 relative to pre-industrial conditions defined at 1750 and are expressed in watts per square metre ($W\ m^{-2}$). See Glossary and Section 2.2 for further details.

[3] ppm (parts per million) or ppb (parts per billion, 1 billion = 1,000 million) is the ratio of the number of greenhouse gas molecules to the total number of molecules of dry air. For example: 300 ppm means 300 molecules of a greenhouse gas per million molecules of dry air.

[4] Fossil carbon dioxide emissions include those from the production, distribution and consumption of fossil fuels and as a by-product from cement production. An emission of 1 GtC corresponds to 3.67 $GtCO_2$.

[5] In general, uncertainty ranges for results given in this Summary for Policymakers are 90% uncertainty intervals unless stated otherwise, i.e., there is an estimated 5% likelihood that the value could be above the range given in square brackets and 5% likelihood that the value could be below that range. Best estimates are given where available. Assessed uncertainty intervals are not always symmetric about the corresponding best estimate. Note that a number of uncertainty ranges in the Working Group I TAR corresponded to 2-sigma (95%), often using expert judgement.

(23.5 [22.0 to 25.0] $GtCO_2$) per year in the 1990s, to 7.2 [6.9 to 7.5] GtC (26.4 [25.3 to 27.5] $GtCO_2$) per year in 2000–2005 (2004 and 2005 data are interim estimates). Carbon dioxide emissions associated with land-use change are estimated to be 1.6 [0.5 to 2.7] GtC (5.9 [1.8 to 9.9] $GtCO_2$) per year over the 1990s, although these estimates have a large uncertainty. {7.3}

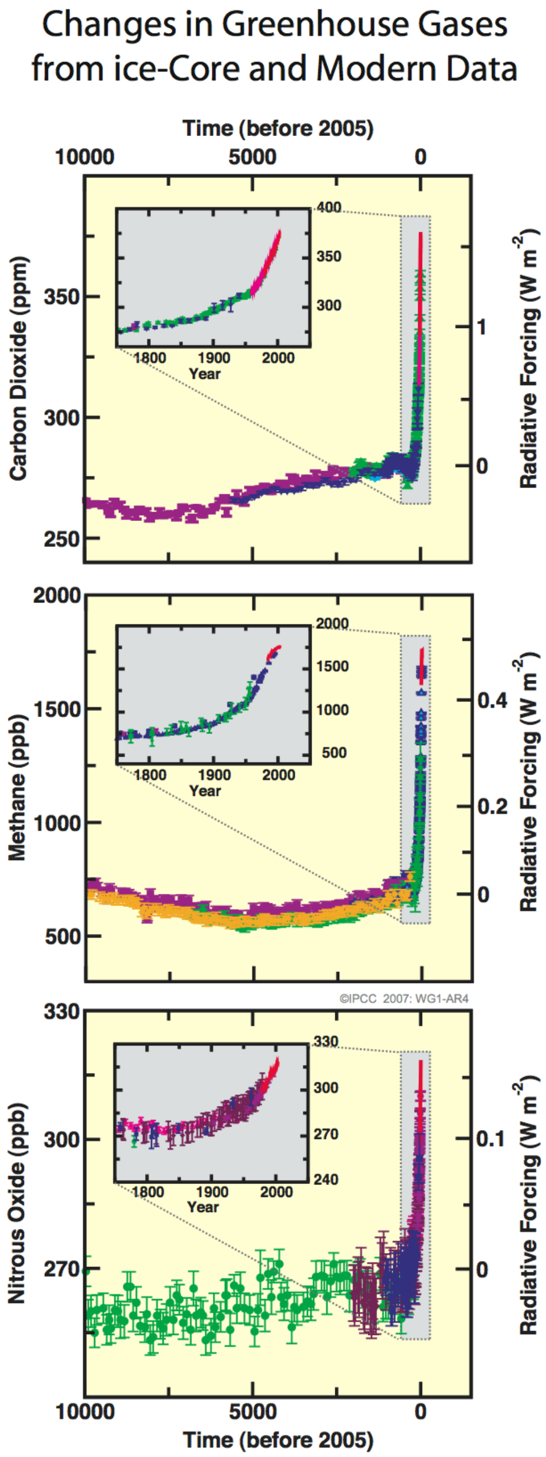

FIGURE SPM-1. Atmospheric concentrations of carbon dioxide, methane and nitrous oxide over the last 10,000 years (large panels) and since 1750 (inset panels). Measurements are shown from ice cores (symbols with different colours for different studies) and atmospheric samples (red lines). The corresponding radiative forcings are shown on the right hand axes of the large panels. {Figure 6.4}

- The global atmospheric concentration of methane has increased from a pre-industrial value of about 715 ppb to 1732 ppb in the early 1990s, and is 1774 ppb in 2005. The atmospheric concentration of methane in 2005 exceeds by far the natural range of the last 650,000 years (320 to 790 ppb) as determined from ice cores. Growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. It is *very likely*[6] that the observed increase in methane concentration is due to anthropogenic activities, predominantly agriculture and fossil fuel use, but relative contributions from different source types are not well determined. {2.3, 7.4}
- The global atmospheric nitrous oxide concentration increased from a pre-industrial value of about 270 ppb to 319 ppb in 2005. The growth rate has been approximately constant since 1980. More than a third of all nitrous oxide emissions are anthropogenic and are primarily due to agriculture. {2.3, 7.4}

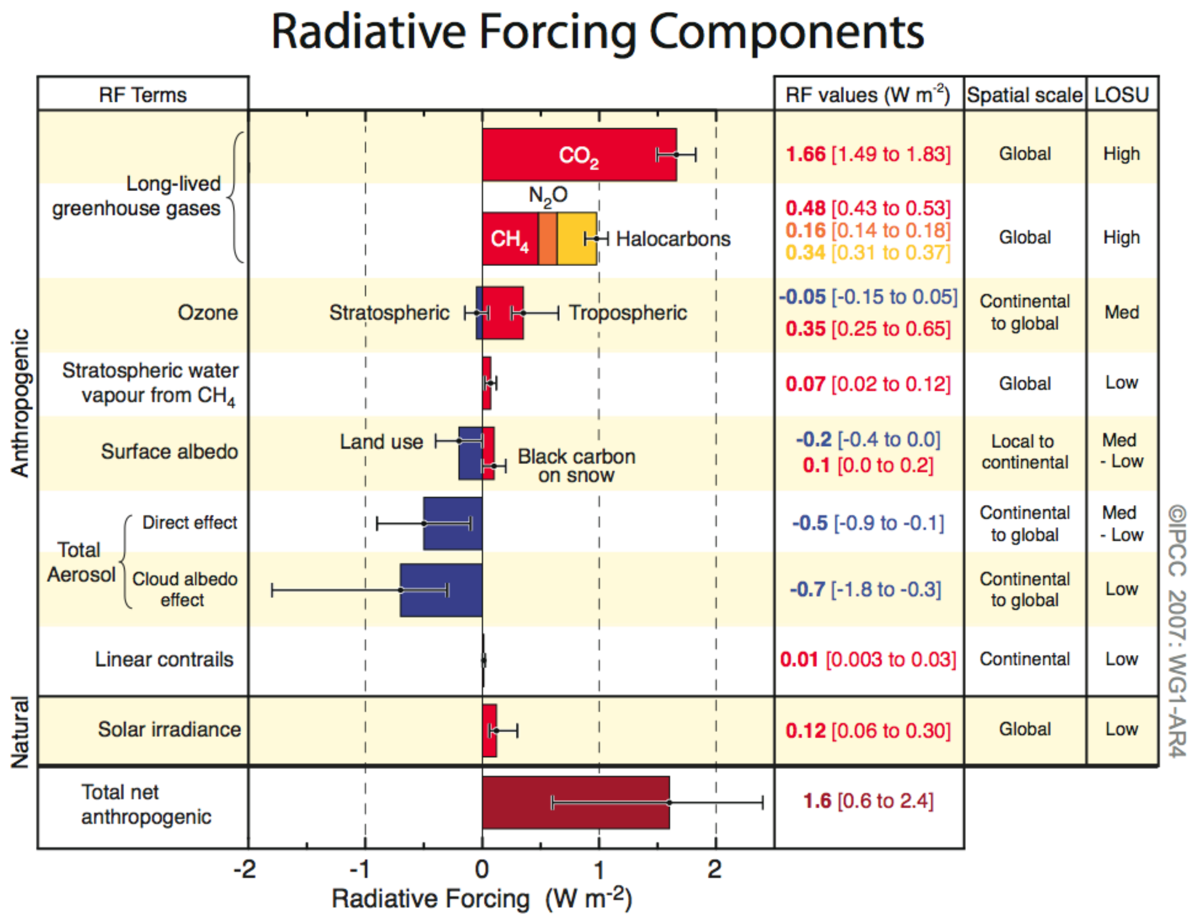

FIGURE SPM-2. Global-average radiative forcing (RF) estimates and ranges in 2005 for anthropogenic carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and other important agents and mechanisms, together with the typical geographical extent (spatial scale) of the forcing and the assessed level of scientific understanding (LOSU). The net anthropogenic radiative forcing and its range are also shown. These require summing asymmetric uncertainty estimates from the component terms, and cannot be obtained by simple addition. Additional forcing factors not included here are considered to have a very low LOSU. Volcanic aerosols contribute an additional natural forcing but are not included in this figure due to their episodic nature. Range for linear contrails does not include other possible effects of aviation on cloudiness. {2.9, Figure 2.20}

[6] In this Summary for Policymakers, the following terms have been used to indicate the assessed likelihood, using expert judgement, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5%. (See Box TS.1.1 for more details).

The understanding of anthropogenic warming and cooling influences on climate has improved since the Third Assessment Report (TAR), leading to *very high confidence*[7] that the globally averaged net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m^{-2}. (see Figure SPM-2). {2.3. 6.5, 2.9}

- The combined radiative forcing due to increases in carbon dioxide, methane, and nitrous oxide is +2.30 [+2.07 to +2.53] W m^{-2}, and its rate of increase during the industrial era is *very likely* to have been unprecedented in more than 10,000 years (see Figures SPM-1 and SPM-2). The carbon dioxide radiative forcing increased by 20% from 1995 to 2005, the largest change for any decade in at least the last 200 years. {2.3, 6.4}
- Anthropogenic contributions to aerosols (primarily sulphate, organic carbon, black carbon, nitrate and dust) together produce a cooling effect, with a total direct radiative forcing of -0.5 [-0.9 to -0.1] W m^{-2} and an indirect cloud albedo forcing of -0.7 [-1.8 to -0.3] W m^{-2}. These forcings are now better understood than at the time of the TAR due to improved *in situ*, satellite and ground-based measurements and more comprehensive modelling, but remain the dominant uncertainty in radiative forcing. Aerosols also influence cloud lifetime and precipitation. {2.4, 2.9, 7.5}
- Significant anthropogenic contributions to radiative forcing come from several other sources. Tropospheric ozone changes due to emissions of ozone-forming chemicals (nitrogen oxides, carbon monoxide, and hydrocarbons) contribute +0.35 [+0.25 to +0.65] W m^{-2}. The direct radiative forcing due to changes in halocarbons[8] is +0.34 [+0.31 to +0.37] W m^{-2}. Changes in surface albedo, due to land-cover changes and deposition of black carbon aerosols on snow, exert respective forcings of -0.2 [-0.4 to 0.0] and +0.1 [0.0 to +0.2] W m^{-2}. Additional terms smaller than ±0.1 W m^{-2} are shown in Figure SPM-2. {2.3, 2.5, 7.2}
- Changes in solar irradiance since 1750 are estimated to cause a radiative forcing of +0.12 [+0.06 to +0.30] W m^{-2}, which is less than half the estimate given in the TAR. {2.7}

DIRECT OBSERVATIONS OF RECENT CLIMATE CHANGE

Since the TAR, progress in understanding how climate is changing in space and in time has been gained through improvements and extensions of numerous datasets and data analyses, broader geographical coverage, better understanding of uncertainties, and a wider variety of measurements. Increasingly comprehensive observations are available for glaciers and snow cover since the 1960s, and for sea level and ice sheets since about the past decade. However, data coverage remains limited in some regions.

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (see Figure SPM-3). {3.2, 4.2, 5.5}

- Eleven of the last twelve years (1995 -2006) rank among the 12 warmest years in the instrumental record of global surface temperature[9] (since 1850). The updated 100-year linear trend (1906–2005) of 0.74 [0.56 to 0.92]°C is therefore larger than the corresponding trend for 1901-2000 given in the TAR of 0.6 [0.4 to 0.8]°C. The linear warming trend over the last 50 years (0.13 [0.10 to 0.16]°C per decade) is nearly twice that for the last 100 years. The total temperature increase from 1850 – 1899 to 2001 – 2005 is 0.76 [0.57 to 0.95]°C. Urban heat island effects are real but local, and have a negligible influence (less than 0.006°C per decade over land and zero over the oceans) on these values. {3.2}

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[7] In this Summary for Policymakers the following levels of confidence have been used to express expert judgments on the correctness of the underlying science: *very high confidence* at least a 9 out of 10 chance of being correct; *high confidence* about an 8 out of 10 chance of being correct. (See Box TS.1.1)

[8] Halocarbon radiative forcing has been recently assessed in detail in IPCC's Special Report on Safeguarding the Ozone Layer and the Global Climate System (2005).

[9] The average of near surface air temperature over land, and sea surface temperature.

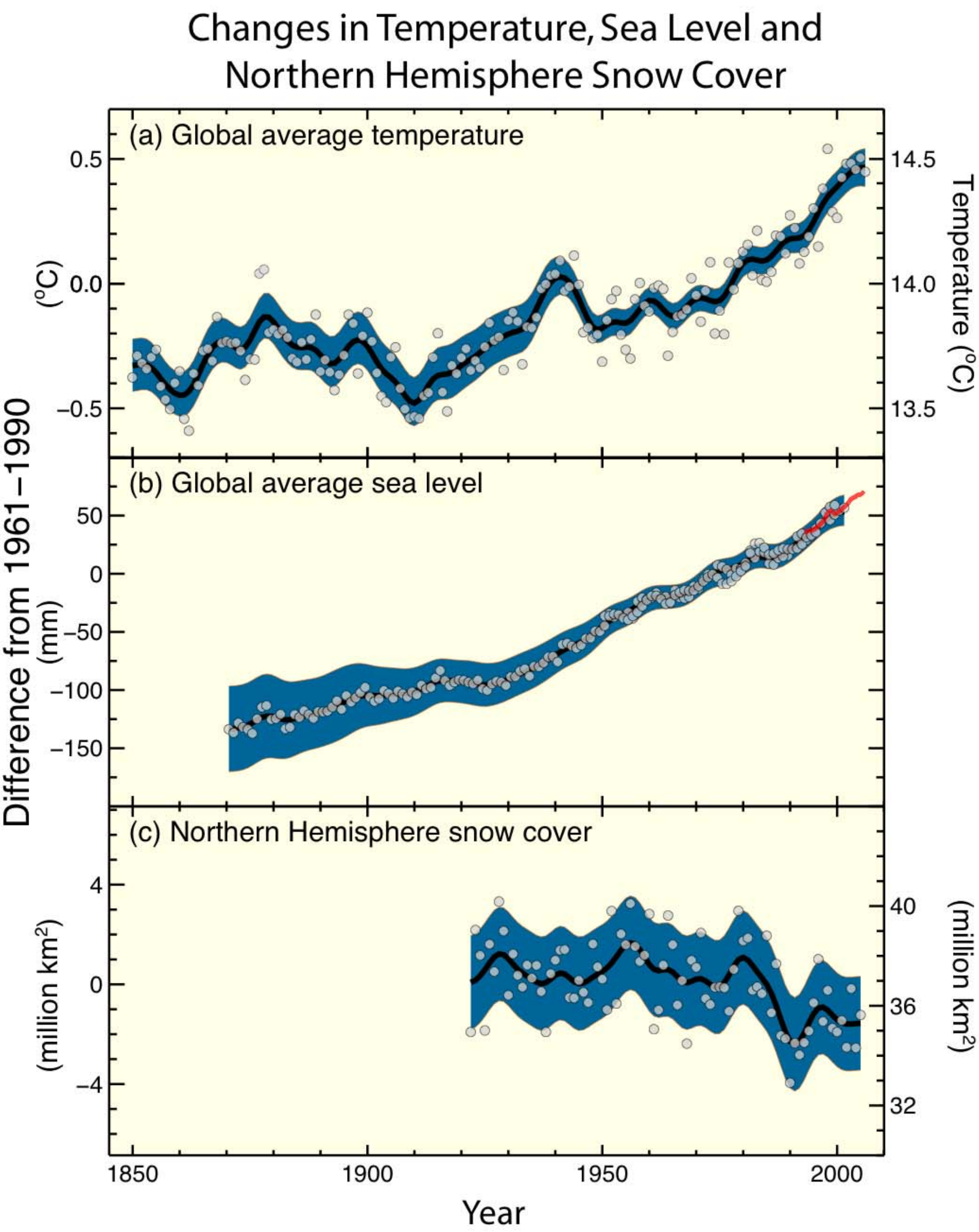

FIGURE SPM-3. Observed changes in (a) global average surface temperature; (b) global average sea level rise from tide gauge (blue) and satellite (red) data and (c) Northern Hemisphere snow cover for March-April. All changes are relative to corresponding averages for the period 1961-1990. Smoothed curves represent decadal averaged values while circles show yearly values. The shaded areas are the uncertainty intervals estimated from a comprehensive analysis of known uncertainties (a and b) and from the time series (c). {FAQ 3.1, Figure 1, Figure 4.2 and Figure 5.13}

- New analyses of balloon-borne and satellite measurements of lower- and mid-tropospheric temperature show warming rates that are similar to those of the surface temperature record and are consistent within their respective uncertainties, largely reconciling a discrepancy noted in the TAR. {3.2, 3.4}

- The average atmospheric water vapour content has increased since at least the 1980s over land and ocean as well as in the upper troposphere. The increase is broadly consistent with the extra water vapour that warmer air can hold. {3.4}
- Observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been absorbing more than 80% of the heat added to the climate system. Such warming causes seawater to expand, contributing to sea level rise (see Table SPM-1). {5.2, 5.5}

Table SPM-1. Observed rate of sea level rise and estimated contributions from different sources. {5.5, Table 5.3}

	Rate of sea level rise (mm per year)	
Source of sea level rise	**1961 – 2003**	**1993 – 2003**
Thermal expansion	0.42 ± 0.12	1.6 ± 0.5
Glaciers and ice caps	0.50 ± 0.18	0.77 ± 0.22
Greenland ice sheet	0.05 ± 0.12	0.21 ± 0.07
Antarctic ice sheet	0.14 ± 0.41	0.21 ± 0.35
Sum of individual climate contributions to sea level rise	1.1 ± 0.5	2.8 ± 0.7
Observed total sea level rise	1.8 ± 0.5[a]	3.1 ± 0.7[a]
Difference (Observed minus sum of estimated climate contributions)	0.7 ± 0.7	0.3 ± 1.0

Table note:
[a] Data prior to 1993 are from tide gauges and after 1993 are from satellite altimetry.

- Mountain glaciers and snow cover have declined on average in both hemispheres. Widespread decreases in glaciers and ice caps have contributed to sea level rise (ice caps do not include contributions from the Greenland and Antarctic ice sheets). (See Table SPM-1.) {4.6, 4.7, 4.8, 5.5}
- New data since the TAR now show that losses from the ice sheets of Greenland and Antarctica have *very likely* contributed to sea level rise over 1993 to 2003 (see Table SPM-1). Flow speed has increased for some Greenland and Antarctic outlet glaciers, which drain ice from the interior of the ice sheets. The corresponding increased ice sheet mass loss has often followed thinning, reduction or loss of ice shelves or loss of floating glacier tongues. Such dynamical ice loss is sufficient to explain most of the Antarctic net mass loss and approximately half of the Greenland net mass loss. The remainder of the ice loss from Greenland has occurred because losses due to melting have exceeded accumulation due to snowfall. {4.6, 4.8, 5.5}
- Global average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003. The rate was faster over 1993 to 2003, about 3.1 [2.4 to 3.8] mm per year. Whether the faster rate for 1993 to 2003 reflects decadal variability or an increase in the longer-term trend is unclear. There is *high confidence* that the rate of observed sea level rise increased from the 19th to the 20th century. The total 20th century rise is estimated to be 0.17 [0.12 to 0.22] m. {5.5}
- For 1993-2003, the sum of the climate contributions is consistent within uncertainties with the total sea level rise that is directly observed (see Table SPM-1). These estimates are based on improved satellite and *in-situ* data now available. For the period of 1961 to 2003, the sum of climate contributions is estimated to be smaller than the observed sea level rise. The TAR reported a similar discrepancy for 1910 to 1990. {5.5}

At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones[10]. {3.2, 3.3, 3.4, 3.5, 3.6, 5.2}

- Average Arctic temperatures increased at almost twice the global average rate in the past 100 years. Arctic temperatures have high decadal variability, and a warm period was also observed from 1925 to 1945. {3.2}
- Satellite data since 1978 show that annual average Arctic sea ice extent has shrunk by 2.7 [2.1 to 3.3]% per decade, with larger decreases in summer of 7.4 [5.0 to 9.8]% per decade. These values are consistent with those reported in the TAR. {4.4}
- Temperatures at the top of the permafrost layer have generally increased since the 1980s in the Arctic (by up to 3°C). The maximum area covered by seasonally frozen ground has decreased by about 7% in the Northern Hemisphere since 1900, with a decrease in spring of up to 15%. {4.7}
- Long-term trends from 1900 to 2005 have been observed in precipitation amount over many large regions[11]. Significantly increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia. Drying has been observed in the Sahel, the Mediterranean, southern Africa and parts of southern Asia. Precipitation is highly variable spatially and temporally, and data are limited in some regions. Long-term trends have not been observed for the other large regions assessed[11]. {3.3, 3.9}
- Changes in precipitation and evaporation over the oceans are suggested by freshening of mid and high latitude waters together with increased salinity in low latitude waters. {5.2}
- Mid-latitude westerly winds have strengthened in both hemispheres since the 1960s. {3.5}
- More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. Increased drying linked with higher temperatures and decreased precipitation have contributed to changes in drought. Changes in sea surface temperatures (SST), wind patterns, and decreased snowpack and snow cover have also been linked to droughts. {3.3}
- The frequency of heavy precipitation events has increased over most land areas, consistent with warming and observed increases of atmospheric water vapour. {3.8, 3.9}
- Widespread changes in extreme temperatures have been observed over the last 50 years. Cold days, cold nights and frost have become less frequent, while hot days, hot nights, and heat waves have become more frequent (see Table SPM-2). {3.8}
- There is observational evidence for an increase of intense tropical cyclone activity in the North Atlantic since about 1970, correlated with increases of tropical sea surface temperatures. There are also suggestions of increased intense tropical cyclone activity in some other regions where concerns over data quality are greater. Multi-decadal variability and the quality of the tropical cyclone records prior to routine satellite observations in about 1970 complicate the detection of long-term trends in tropical cyclone activity. There is no clear trend in the annual numbers of tropical cyclones. {3.8}

[10] Tropical cyclones include hurricanes and typhoons.

[11] The assessed regions are those considered in the regional projections Chapter of the TAR and in Chapter 11 of this Report.

Table SPM-2. Recent trends, assessment of human influence on the trend, and projections for extreme weather events for which there is an observed late 20th century trend. {Tables 3.7, 3.8, 9.4, Sections 3.8, 5.5, 9.7, 11.2-11.9}

Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend [b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely* [c]	*Likely* [d]	*Virtually certain* [d]
Warmer and more frequent hot days and nights over most land areas	*Very likely* [e]	*Likely (nights)* [d]	*Virtually certain* [d]
Warm spells / heat waves. Frequency increases over most land areas	*Likely*	*More likely than not* [f]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Likely*	*More likely than not* [f]	*Very likely*
Area affected by droughts increases	*Likely* in many regions since 1970s	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely* in some regions since 1970	*More likely than not* [f]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis) [g]	*Likely*	*More likely than not* [f, h]	*Likely* [i]

Table notes:

[a] See Table 3.7 for further details regarding definitions.

[b] See Table TS-4, Box TS.3.4 and Table 9.4.

[c] Decreased frequency of cold days and nights (coldest 10%).

[d] Warming of the most extreme days and nights each year.

[e] Increased frequency of hot days and nights (hottest 10%).

[f] Magnitude of anthropogenic contributions not assessed. Attribution for these phenomena based on expert judgement rather than formal attribution studies.

[g] Extreme high sea level depends on average sea level and on regional weather systems. It is defined here as the highest 1% of hourly values of observed sea level at a station for a given reference period.

[h] Changes in observed extreme high sea level closely follow the changes in average sea level {5.5.2.6}. It is *very likely* that anthropogenic activity contributed to a rise in average sea level. {9.5.2}

[i] In all scenarios, the projected global average sea level at 2100 is higher than in the reference period {10.6}. The effect of changes in regional weather systems on sea level extremes has not been assessed.

Some aspects of climate have not been observed to change. {3.2, 3.8, 4.4, 5.3}

- A decrease in diurnal temperature range (DTR) was reported in the TAR, but the data available then extended only from 1950 to 1993. Updated observations reveal that DTR has not changed from 1979 to 2004 as both day- and night-time temperature have risen at about the same rate. The trends are highly variable from one region to another. {3.2}
- Antarctic sea ice extent continues to show inter-annual variability and localized changes but no statistically significant average trends, consistent with the lack of warming reflected in atmospheric temperatures averaged across the region. {3.2, 4.4}

- There is insufficient evidence to determine whether trends exist in the meridional overturning circulation of the global ocean or in small scale phenomena such as tornadoes, hail, lightning and dust-storms. {3.8, 5.3}

A PALEOCLIMATIC PERSPECTIVE

Paleoclimatic studies use changes in climatically sensitive indicators to infer past changes in global climate on time scales ranging from decades to millions of years. Such proxy data (e.g., tree ring width) may be influenced by both local temperature and other factors such as precipitation, and are often representative of particular seasons rather than full years. Studies since the TAR draw increased confidence from additional data showing coherent behaviour across multiple indicators in different parts of the world. However, uncertainties generally increase with time into the past due to increasingly limited spatial coverage.

Paleoclimate information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1300 years. The last time the polar regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 metres of sea level rise. {6.4, 6.6}

- Average Northern Hemisphere temperatures during the second half of the 20th century were *very likely* higher than during any other 50-year period in the last 500 years and *likely* the highest in at least the past 1300 years. Some recent studies indicate greater variability in Northern Hemisphere temperatures than suggested in the TAR, particularly finding that cooler periods existed in the 12 to 14th, 17th, and 19th centuries. Warmer periods prior to the 20th century are within the uncertainty range given in the TAR. {6.6}
- Global average sea level in the last interglacial period (about 125,000 years ago) was *likely* 4 to 6 m higher than during the 20th century, mainly due to the retreat of polar ice. Ice core data indicate that average polar temperatures at that time were 3 to 5°C higher than present, because of differences in the Earth's orbit. The Greenland ice sheet and other Arctic ice fields *likely* contributed no more than 4 m of the observed sea level rise. There may also have been a contribution from Antarctica. {6.4}

UNDERSTANDING AND ATTRIBUTING CLIMATE CHANGE

This Assessment considers longer and improved records, an expanded range of observations, and improvements in the simulation of many aspects of climate and its variability based on studies since the TAR. It also considers the results of new attribution studies that have evaluated whether observed changes are quantitatively consistent with the expected response to external forcings and inconsistent with alternative physically plausible explanations.

Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations[12]. This is an advance since the TAR's conclusion that "most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations". Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns (see Figure SPM-4 and Table SPM-2). {9.4, 9.5}

- It is *likely* that increases in greenhouse gas concentrations alone would have caused more warming than observed because volcanic and anthropogenic aerosols have offset some warming that would otherwise have taken place. {2.9, 7.5, 9.4}
- The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is *extremely unlikely* that global climate change of the past fifty years can be explained without external forcing, and *very likely* that it is not due to known natural causes alone. {4.8, 5.2, 9.4, 9.5, 9.7}

[12] Consideration of remaining uncertainty is based on current methodologies.

- Warming of the climate system has been detected in changes of surface and atmospheric temperatures, temperatures in the upper several hundred metres of the ocean and in contributions to sea level rise. Attribution studies have established anthropogenic contributions to all of these changes. The observed pattern of tropospheric warming and stratospheric cooling is *very likely* due to the combined influences of greenhouse gas increases and stratospheric ozone depletion. {3.2, 3.4, 9.4, 9.5}
- It is *likely* that there has been significant anthropogenic warming over the past 50 years averaged over each continent except Antarctica (see Figure SPM-4). The observed patterns of warming, including greater warming over land than over the ocean, and their changes over time, are only simulated by models that include anthropogenic forcing. The ability of coupled climate models to simulate the observed temperature evolution on each of six continents provides stronger evidence of human influence on climate than was available in the TAR. {3.2, 9.4}

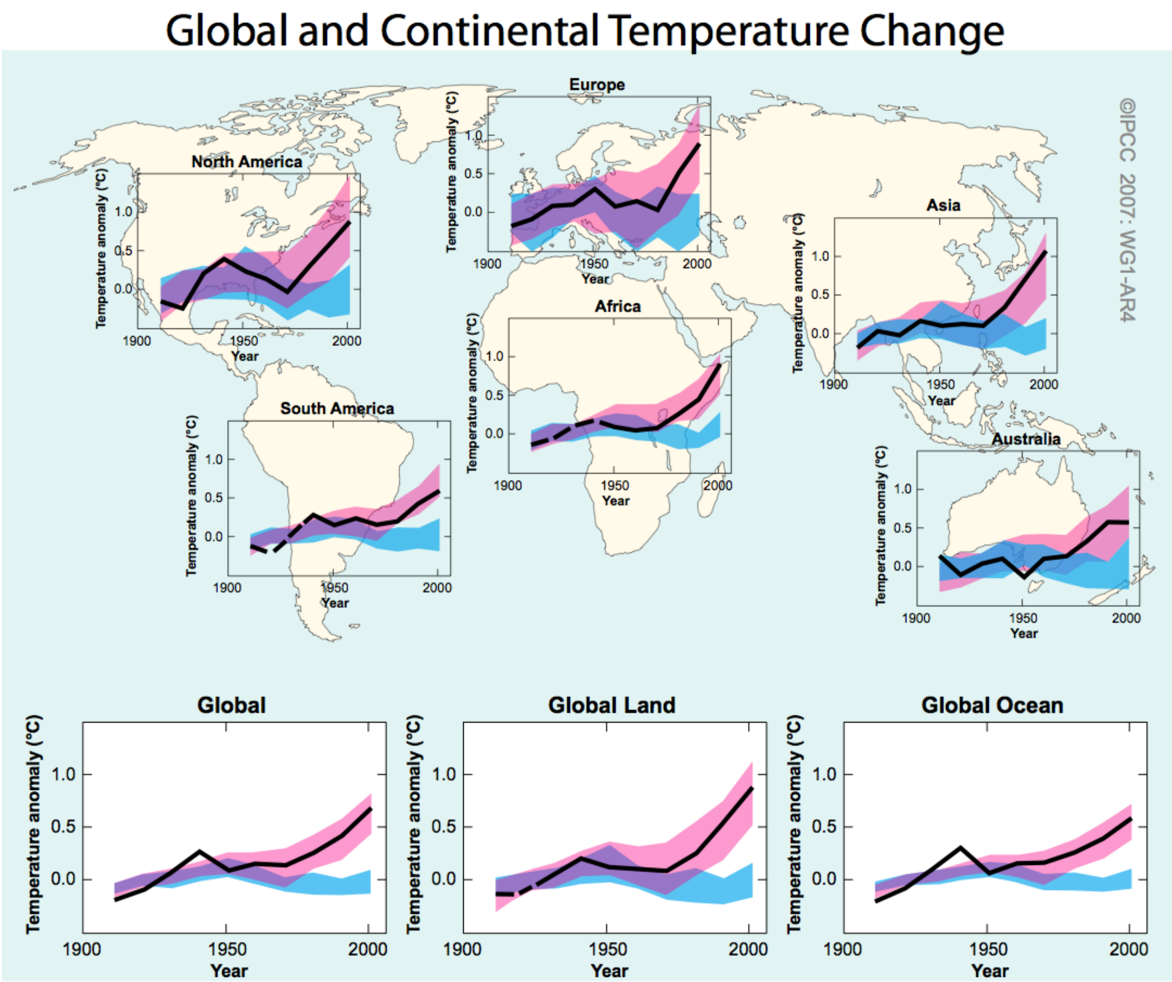

FIGURE SPM-4. Comparison of observed continental- and global-scale changes in surface temperature with results simulated by climate models using natural and anthropogenic forcings. Decadal averages of observations are shown for the period 1906–2005 (black line) plotted against the centre of the decade and relative to the corresponding average for 1901–1950. Lines are dashed where spatial coverage is less than 50%. Blue shaded bands show the 5–95% range for 19 simulations from 5 climate models using only the natural forcings due to solar activity and volcanoes. Red shaded bands show the 5–95% range for 58 simulations from 14 climate models using both natural and anthropogenic forcings. {FAQ 9.2, Figure 1}

- Difficulties remain in reliably simulating and attributing observed temperature changes at smaller scales. On these scales, natural climate variability is relatively larger making it harder to distinguish changes expected due to external forcings. Uncertainties in local forcings and feedbacks also make it difficult to estimate the contribution of greenhouse gas increases to observed small-scale temperature changes. {8.3, 9.4}
- Anthropogenic forcing is *likely* to have contributed to changes in wind patterns[13], affecting extra-tropical storm tracks and temperature patterns in both hemispheres. However, the observed changes in the Northern Hemisphere circulation are larger than simulated in response to 20th century forcing change. {3.5, 3.6, 9.5, 10.3}
- Temperatures of the most extreme hot nights, cold nights and cold days are *likely* to have increased due to anthropogenic forcing. It is *more likely than not* that anthropogenic forcing has increased the risk of heat waves (see Table SPM-2). {9.4}

Analysis of climate models together with constraints from observations enables an assessed *likely* range to be given for climate sensitivity for the first time and provides increased confidence in the understanding of the climate system response to radiative forcing. {6.6, 8.6, 9.6, Box 10.2}

- The equilibrium climate sensitivity is a measure of the climate system response to sustained radiative forcing. It is not a projection but is defined as the global average surface warming following a doubling of carbon dioxide concentrations. It is *likely* to be in the range 2 to 4.5°C with a best estimate of about 3°C, and is *very unlikely* to be less than 1.5°C. Values substantially higher than 4.5°C cannot be excluded, but agreement of models with observations is not as good for those values. Water vapour changes represent the largest feedback affecting climate sensitivity and are now better understood than in the TAR. Cloud feedbacks remain the largest source of uncertainty. {8.6, 9.6, Box 10.2}
- It is *very unlikely* that climate changes of at least the seven centuries prior to 1950 were due to variability generated within the climate system alone. A significant fraction of the reconstructed Northern Hemisphere interdecadal temperature variability over those centuries is *very likely* attributable to volcanic eruptions and changes in solar irradiance, and it is *likely* that anthropogenic forcing contributed to the early 20th century warming evident in these records. {2.7, 2.8, 6.6, 9.3}

PROJECTIONS OF FUTURE CHANGES IN CLIMATE

A major advance of this assessment of climate change projections compared with the TAR is the large number of simulations available from a broader range of models. Taken together with additional information from observations, these provide a quantitative basis for estimating likelihoods for many aspects of future climate change. Model simulations cover a range of possible futures including idealised emission or concentration assumptions. These include SRES[14] illustrative marker scenarios for the 2000–2100 period and model experiments with greenhouse gases and aerosol concentrations held constant after year 2000 or 2100.

For the next two decades a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. {10.3, 10.7}

[13] In particular, the Southern and Northern Annular Modes and related changes in the North Atlantic Oscillation. {3.6, 9.5, Box TS.3.1}

[14] SRES refers to the IPCC Special Report on Emission Scenarios (2000). The SRES scenario families and illustrative cases, which did not include additional climate initiatives, are summarized in a box at the end of this Summary for Policymakers. Approximate CO_2 equivalent concentrations corresponding to the computed radiative forcing due to anthropogenic greenhouse gases and aerosols in 2100 (see p. 823 of the TAR) for the SRES B1, A1T, B2, A1B, A2 and A1FI illustrative marker scenarios are about 600, 700, 800, 850, 1250 and 1550 ppm respectively. Scenarios B1, A1B, and A2 have been the focus of model inter-comparison studies and many of those results are assessed in this report.

- Since IPCC's first report in 1990, assessed projections have suggested global averaged temperature increases between about 0.15 and 0.3°C per decade for 1990 to 2005. This can now be compared with observed values of about 0.2°C per decade, strengthening confidence in near-term projections. {1.2, 3.2}
- Model experiments show that even if all radiative forcing agents are held constant at year 2000 levels, a further warming trend would occur in the next two decades at a rate of about 0.1°C per decade, due mainly to the slow response of the oceans. About twice as much warming (0.2°C per decade) would be expected if emissions are within the range of the SRES scenarios. Best-estimate projections from models indicate that decadal-average warming over each inhabited continent by 2030 is insensitive to the choice among SRES scenarios and is *very likely* to be at least twice as large as the corresponding model-estimated natural variability during the 20th century. {9.4, 10.3, 10.5, 11.2–11.7, Figure TS-29}

Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would *very likely* be larger than those observed during the 20th century. {10.3}

- Advances in climate change modelling now enable best estimates and *likely* assessed uncertainty ranges to be given for projected warming for different emission scenarios. Results for different emission scenarios are provided explicitly in this report to avoid loss of this policy-relevant information. Projected globally-averaged surface warmings for the end of the 21st century (2090–2099) relative to 1980–1999 are shown in Table SPM-3. These illustrate the differences between lower to higher SRES emission scenarios and the projected warming uncertainty associated with these scenarios. {10.5}
- Best estimates and *likely* ranges for globally average surface air warming for six SRES emissions marker scenarios are given in this assessment and are shown in Table SPM-3. For example, the best estimate for the low scenario (B1) is 1.8°C (*likely* range is 1.1°C to 2.9°C), and the best estimate for the high scenario (A1FI) is 4.0°C (*likely* range is 2.4°C to 6.4°C). Although these projections are broadly consistent with the span quoted in the TAR (1.4 to 5.8°C), they are not directly comparable (see Figure SPM-5). The AR4 is more advanced as it provides best estimates and an assessed likelihood range for each of the marker scenarios. The new assessment of the *likely* ranges now relies on a larger number of climate models of increasing complexity and realism, as well as new information regarding the nature of feedbacks from the carbon cycle and constraints on climate response from observations. {10.5}

Table SPM-3. Projected globally averaged surface warming and sea level rise at the end of the 21st century. {10.5, 10.6, Table 10.7}

	Temperature Change (°C at 2090-2099 relative to 1980-1999) [a]		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
Case	Best estimate	*Likely* range	Model-based range excluding future rapid dynamical changes in ice flow
Constant Year 2000 concentrations [b]	0.6	0.3 – 0.9	NA
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59

Table notes:

[a] These estimates are assessed from a hierarchy of models that encompass a simple climate model, several Earth Models of Intermediate Complexity (EMICs), and a large number of Atmosphere-Ocean Global Circulaion Models (AOGCMs).

[b] Year 2000 constant composition is derived from AOGCMs only.

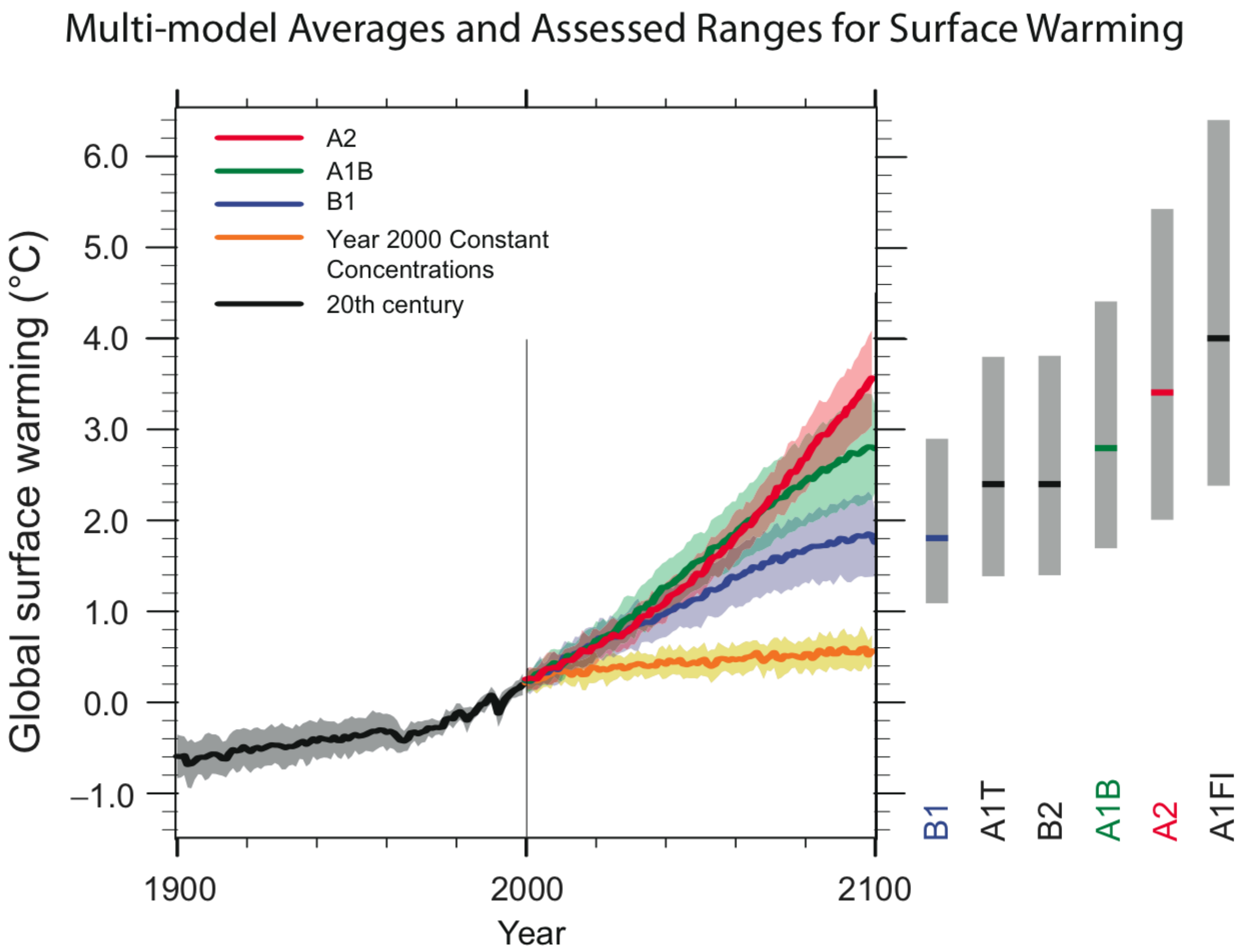

FIGURE SPM-5. Solid lines are multi-model global averages of surface warming (relative to 1980-99) for the scenarios A2, A1B and B1, shown as continuations of the 20th century simulations. Shading denotes the plus/minus one standard deviation range of individual model annual averages. The orange line is for the experiment where concentrations were held constant at year 2000 values. The gray bars at right indicate the best estimate (solid line within each bar) and the *likely* range assessed for the six SRES marker scenarios. The assessment of the best estimate and *likely* ranges in the gray bars includes the AOGCMs in the left part of the figure, as well as results from a hierarchy of independent models and observational constraints. {Figures 10.4 and 10.29}

- Warming tends to reduce land and ocean uptake of atmospheric carbon dioxide, increasing the fraction of anthropogenic emissions that remains in the atmosphere. For the A2 scenario, for example, the climate-carbon cycle feedback increases the corresponding global average warming at 2100 by more than 1°C. Assessed upper ranges for temperature projections are larger than in the TAR (see Table SPM-3) mainly because the broader range of models now available suggests stronger climate-carbon cycle feedbacks. {7.3, 10.5}

- Model-based projections of global average sea level rise at the end of the 21st century (2090-2099) are shown in Table SPM-3. For each scenario, the midpoint of the range in Table SPM-3 is within 10% of the TAR model average for 2090-2099. The ranges are narrower than in the TAR mainly because of improved information about some uncertainties in the projected contributions[15]. {10.6}

- Models used to date do not include uncertainties in climate-carbon cycle feedback nor do they include the full effects of changes in ice sheet flow, because a basis in published literature is lacking. The projections include a contribution due to increased ice flow from Greenland and Antarctica at the rates observed for 1993-2003, but these flow rates could increase or decrease in the future. For example, if this contribution were to grow

[15] TAR projections were made for 2100, whereas projections in this Report are for 2090-2099. The TAR would have had similar ranges to those in Table SPM-2 if it had treated the uncertainties in the same way.

linearly with global average temperature change, the upper ranges of sea level rise for SRES scenarios shown in Table SPM-3 would increase by 0.1 m to 0.2 m. Larger values cannot be excluded, but understanding of these effects is too limited to assess their likelihood or provide a best estimate or an upper bound for sea level rise. {10.6}

- Increasing atmospheric carbon dioxide concentrations leads to increasing acidification of the ocean. Projections based on SRES scenarios give reductions in average global surface ocean pH[16] of between 0.14 and 0.35 units over the 21st century, adding to the present decrease of 0.1 units since pre-industrial times. {5.4, Box 7.3, 10.4}

There is now higher confidence in projected patterns of warming and other regional-scale features, including changes in wind patterns, precipitation, and some aspects of extremes and of ice. {8.2, 8.3, 8.4, 8.5, 9.4, 9.5, 10.3, 11.1}

- Projected warming in the 21st century shows scenario-independent geographical patterns similar to those observed over the past several decades. Warming is expected to be greatest over land and at most high northern latitudes, and least over the Southern Ocean and parts of the North Atlantic ocean (see Figure SPM-6). {10.3}

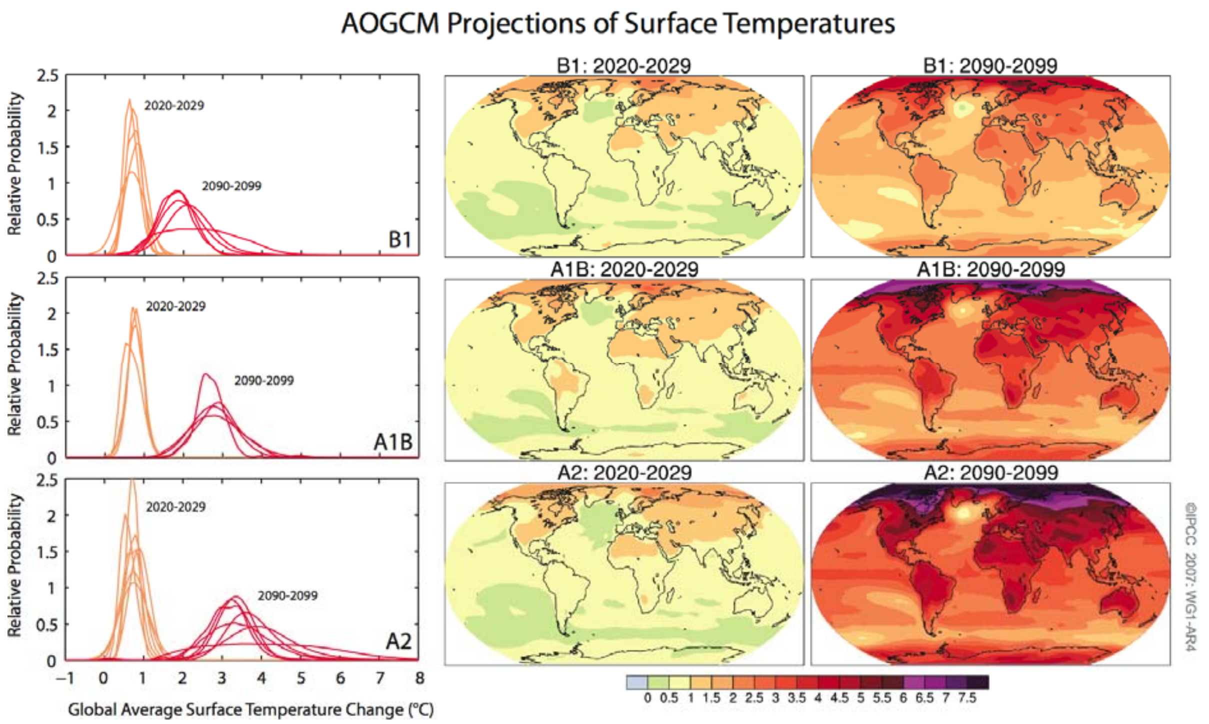

FIGURE SPM-6. Projected surface temperature changes for the early and late 21st century relative to the period 1980–1999. The central and right panels show the Atmosphere-Ocean General Circulation multi-Model average projections for the B1 (top), A1B (middle) and A2 (bottom) SRES scenarios averaged over decades 2020–2029 (center) and 2090–2099 (right). The left panel shows corresponding uncertainties as the relative probabilities of estimated global average warming from several different AOGCM and EMICs studies for the same periods. Some studies present results only for a subset of the SRES scenarios, or for various model versions. Therefore the difference in the number of curves, shown in the left-hand panels, is due only to differences in the availability of results. {Figures 10.8 and 10.28}

[16] Decreases in pH correspond to increases in acidity of a solution. See Glossary for further details.

- Snow cover is projected to contract. Widespread increases in thaw depth are projected over most permafrost regions. {10.3, 10.6}
- Sea ice is projected to shrink in both the Arctic and Antarctic under all SRES scenarios. In some projections, Arctic late-summer sea ice disappears almost entirely by the latter part of the 21st century. {10.3}
- It is *very likely* that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent. {10.3}
- Based on a range of models, it is *likely* that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical SSTs. There is less confidence in projections of a global decrease in numbers of tropical cyclones. The apparent increase in the proportion of very intense storms since 1970 in some regions is much larger than simulated by current models for that period. {9.5, 10.3, 3.8}
- Extra-tropical storm tracks are projected to move poleward, with consequent changes in wind, precipitation, and temperature patterns, continuing the broad pattern of observed trends over the last half-century. {3.6, 10.3}
- Since the TAR there is an improving understanding of projected patterns of precipitation. Increases in the amount of precipitation are *very likely* in high-latitudes, while decreases are *likely* in most subtropical land regions (by as much as about 20% in the A1B scenario in 2100, see Figure SPM-7), continuing observed patterns in recent trends. {3.3, 8.3, 9.5, 10.3, 11.2 to 11.9}
- Based on current model simulations, it is *very likely* that the meridional overturning circulation (MOC) of the Atlantic Ocean will slow down during the 21st century. The multi-model average reduction by 2100 is 25% (range from zero to about 50%) for SRES emission scenario A1B. Temperatures in the Atlantic region are projected to increase despite such changes due to the much larger warming associated with projected increases of greenhouse gases. It is *very unlikely* that the MOC will undergo a large abrupt transition during the 21st century. Longer-term changes in the MOC cannot be assessed with confidence. {10.3, 10.7}

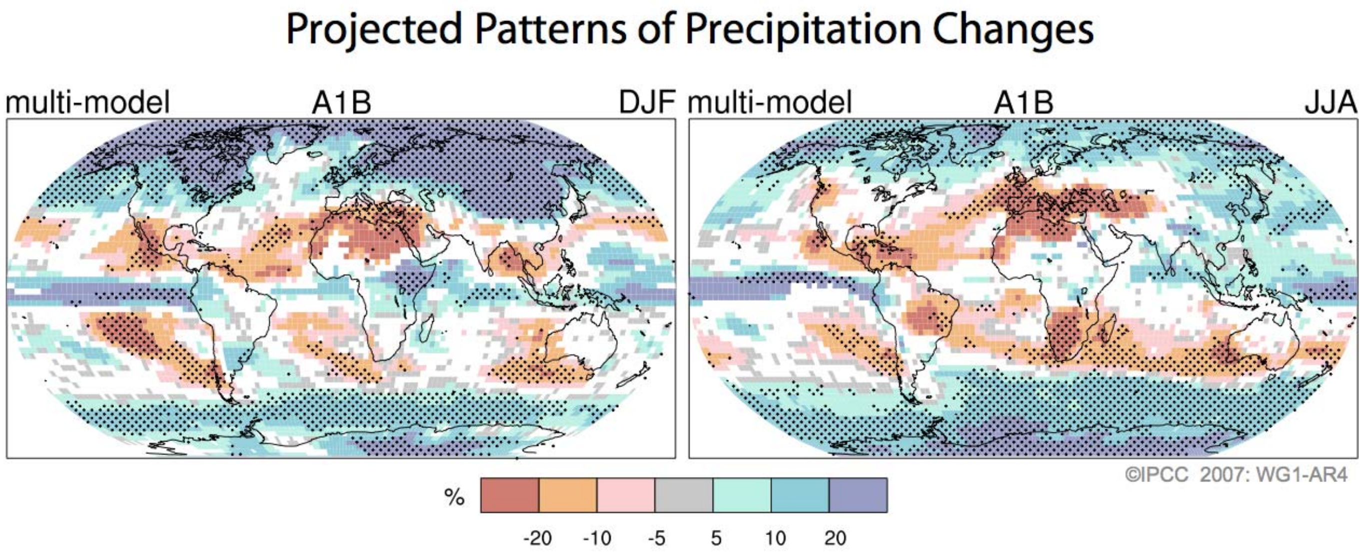

FIGURE SPM-7. Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change. {Figure 10.9}

Anthropogenic warming and sea level rise would continue for centuries due to the timescales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized. {10.4, 10.5, 10.7}

- Climate carbon cycle coupling is expected to add carbon dioxide to the atmosphere as the climate system warms, but the magnitude of this feedback is uncertain. This increases the uncertainty in the trajectory of carbon dioxide emissions required to achieve a particular stabilisation level of atmospheric carbon dioxide concentration. Based on current understanding of climate carbon cycle feedback, model studies suggest that to stabilise at 450 ppm carbon dioxide, could require that cumulative emissions over the 21st century be reduced from an average of approximately 670 [630 to 710] GtC (2460 [2310 to 2600] $GtCO_2$) to approximately 490 [375 to 600] GtC (1800 [1370 to 2200] $GtCO_2$). Similarly, to stabilise at 1000 ppm this feedback could require that cumulative emissions be reduced from a model average of approximately 1415 [1340 to 1490] GtC (5190 [4910 to 5460] $GtCO_2$) to approximately 1100 [980 to 1250] GtC (4030 [3590 to 4580] $GtCO_2$). {7.3, 10.4}
- If radiative forcing were to be stabilized in 2100 at B1 or A1B levels[11] a further increase in global average temperature of about 0.5°C would still be expected, mostly by 2200. {10.7}
- If radiative forcing were to be stabilized in 2100 at A1B levels[11], thermal expansion alone would lead to 0.3 to 0.8 m of sea level rise by 2300 (relative to 1980–1999). Thermal expansion would continue for many centuries, due to the time required to transport heat into the deep ocean. {10.7}
- Contraction of the Greenland ice sheet is projected to continue to contribute to sea level rise after 2100. Current models suggest ice mass losses increase with temperature more rapidly than gains due to precipitation and that the surface mass balance becomes negative at a global average warming (relative to pre-industrial values) in excess of 1.9 to 4.6°C. If a negative surface mass balance were sustained for millennia, that would lead to virtually complete elimination of the Greenland ice sheet and a resulting contribution to sea level rise of about 7 m. The corresponding future temperatures in Greenland are comparable to those inferred for the last interglacial period 125,000 years ago, when paleoclimatic information suggests reductions of polar land ice extent and 4 to 6 m of sea level rise. {6.4, 10.7}
- Dynamical processes related to ice flow not included in current models but suggested by recent observations could increase the vulnerability of the ice sheets to warming, increasing future sea level rise. Understanding of these processes is limited and there is no consensus on their magnitude. {4.6, 10.7}
- Current global model studies project that the Antarctic ice sheet will remain too cold for widespread surface melting and is expected to gain in mass due to increased snowfall. However, net loss of ice mass could occur if dynamical ice discharge dominates the ice sheet mass balance. {10.7}
- Both past and future anthropogenic carbon dioxide emissions will continue to contribute to warming and sea level rise for more than a millennium, due to the timescales required for removal of this gas from the atmosphere. {7.3, 10.3}

The Emission Scenarios of the IPCC Special Report on Emission Scenarios (SRES)[17]

A1. The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies).

A2. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

B1. The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

B2. The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

An illustrative scenario was chosen for each of the six scenario groups A1B, A1FI, A1T, A2, B1 and B2. All should be considered equally sound.

The SRES scenarios do not include additional climate initiatives, which means that no scenarios are included that explicitly assume implementation of the United Nations Framework Convention on Climate Change or the emissions targets of the Kyoto Protocol.

[17] Emission scenarios are not assessed in this Working Group One report of the IPCC. This box summarizing the SRES scenarios is taken from the TAR and has been subject to prior line by line approval by the Panel.

The Liberty Man Special Report

NO NEED FOR PANIC

by

John R. Moore

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NO NEED FOR PANIC
by
John R. Moore (1)
January 2006

In spite of my public persona, I really do have feelings. The only way I can sleep or be able to look you in the eye is if I've tried to warn you. This monograph is for my conscience, so I know that I've done my best to warn those I love. Once I distribute this I've done my duty.

We are at a point in time where most adults have heard the terms "Global Warming" and the matter of the "Gulf Stream slowing 30%". Most even heard the news in August 2005 from NASA about a "Tenth Planet" being found, or the January 15, 2006 edition of the "Parade" Sunday magazine newspaper insert (www.parade.com). Perhaps 1/2 of 1% of the adults in the USA understand what these matters really mean. This monograph is for that 1/2 of 1%. Footnotes, a bibliography, and a list of websites, are listed at the end of this monograph. The primary audience of this article are those who already know and understand these matters to a pretty great extent. Others will not fully comprehend these matters without a thorough briefing, or reading several thousand pages of material as listed in the bibliography.

Just last week, I was asked by a friend who publishes a newspaper to do a four paragraph summary on this subject matter. My first response was to laugh. I've come to understand that between the complexity of the subject matter and the *very effective program of government disinformation(6)* I have quite a challenge to summarize with no constraints, let alone in four paragraphs.

This update is the current and best summary of a six year quest for insight, knowledge and intelligence information concerning the matter of earthchanges, rising ocean levels and extraordinary climate change as a result of a new planetary body entering our solar system.
This planetary body is known as Wormwood, Planet X, the Tenth Planet (and about 20 other names). This topic includes what I call *the deception of Global Warming* (2)

About every 3,600 years the Tenth Planet (Wormwood) makes it's way back to our inner solar system. It's eliptical orbit is about 1,800 years out and 1,800 years back. It's three to five times the size of Earth and travels with a debris field about 1/4 million miles wide on either side of it, plus many other "companion" objects of varying sizes and shapes. As it approaches our solar system (Keeping in mind that it really is part of our solar system) it commences to interact with our nine planets directly as well as with our Sun. This interaction involves both gravitational effects and electrical effects. The bottom line? Earth is receiving vastly increased amounts of new electrical and solar wind energy from the Sun.

I have pretty much ceased even discussing Wormwood for a variety of reasons. Despite a NASA announcement in August of 2005 of the discovery of a Tenth Planet, I have been doing this long enough to know that very few people will take the time to understand the complex nature of solar mechanics, the electrical nature of the universe and what professor James McCanney(2) calls "action at a distance". For those few hardy souls that hunger for knowledge in this area, please see the bibliography.

A Caveat

Giving dates or time frames for events in the future is risky business. That said, I have compiled these time frames from multiple sources I trust and respect. I expect anyone reading this article to do their own homework and act on information they learn on their own, as opposed to strictly relying on this one article. As I mention above, some readers will be quite familiar with this material, many already having access to most of this information. Others will be fresh to these concepts and matters. I expect some readers to be in disbelief, with an outright rejection of this information prior to any further study. Others will be angered or even hostile. That's OK . I have fulfilled my Christian obligation to warn you. I have no control (nor do I want any) over your response.

The North Atlantic Thermohaline Conveyor

A.K.A. the Atlantic Conveyor, or the Gulf Stream. It was publicly announced the week of 11/27/05 that the Gulf Stream has slowed by 30% since 1993. My private sources tell me that it has slowed more than 30%. The 1993 to 2005 dates do not tell you how *short* the time could be for this reduced velocity. It merely tells you *how long* (12 years, the maximum time). Most scientists believe this 30% plus reduction has happened in a much more compressed period of time (three to five years). They also tell me that it's believed that a 50% reduction is the critical point. There are a number of credentialed scientists who believe that the Gulf Stream will completely stop at slightly less than 50% of mass and velocity. Once the Gulf Stream slows below 50 % we will have *Extraordinary Climate Change,* to include average winter temperatures of 15 to 20 degrees fahrenheit *colder* and average summer temperatures 10 to 15 degrees *warmer.* With access to modern HVAC this is no big deal. However, one must keep in mind the other effects (see page 6) which means, more likely than not, the power grid will fail. The failure of the Gulf Stream means a range of possibilities Best Case; more severe winters in the British Isles and Western Europe to worst case; the beginning of a new Ice Age (see attachment "B").

The Time Frame

In January 2005 I did a nationwide speaking tour. The subject matter was Planet-X (Wormwood) and it's expected effects (I must emphasize that no responsible person *has ever said Planet X will hit Earth).* Long before the tour, I had come to understand that seeking the "Date of closest passage" was a holy grail that would not and could not be achieved. I encouraged my audiences not to make my mistake of focusing primarily on that matter. I urged them to instead be aware of the *secondary effects* i.e. increased number and severity of storms, (hurricanes, typhoons, tornadoes) increased number and severity of earthquakes (tidal waves) & volcanoes. An extra bonus: look for *hurricanes forming over land!* I still do not have knowledge of the closest passage of Wormwood. However, I now know the plan of the Federal Government.

Best case scenario: The U.S. Federal Government will commence evacuating *their own people* in **2009**. That said, please keep in mind that these are dynamic matters, subject to change.

Worst case scenario: (other than a completely unexpected major event taking place sooner. Hey, no promises here): mass evacuations taking place in **2008**.

Who will be evacuated? The Federal Government will evacuate their employees and their families. Why? Rising ocean levels. From where? All coastal areas, all of Wisconsin, all of Florida, Louisiana and large parts of other states. Please see attachement "A". To where? Commencing in 1980 the U.S. Gov't. began building shelters to house thousands of federal employees and their families. They used super-fund clean-up sites as the "cover" to accomplish this. These sites are scattered all over the USA. They involve technology that few on this planet understand and received funding in the billions of dollars.

Ocean levels Rising: The Companion Events

Concurrent with (and due to) the same causation (global warming) the ocean levels will be rising. There are differing concepts and models of what this will look like ranging from a gradual rising over 10 to 20 years to a very rapid (four weeks) extremely violent event. How high? Once again the models vary from 32 to 46 feet(5). Here's what to expect. Starting at Maine and working our way down the Eastern seaboard, across the Gulf of Mexico thru the Mid-West and up the West Coast.

The Eastern Seaboard of the U.S. will take damage to the Blue Ridge Parkway. The Blue Ridge Parkway is on the East side of the Appalachian Mountains starting at Waynesboro VA and ending 469 miles away at Sweetwater TN. Please note: it is approximately 125 miles from Waynesboro VA to Chesapeake Bay! In a similar fashion, starting at Maine we have at risk of damage and submersion the entire Eastern Seaboard going inland 100 plus miles in all areas except a few where mountainous areas come close to the ocean. As you get further down the East Coast things get worse.

The Southern half of Georgia and all of Florida will be submerged. Turning West along the Gulf Coast it's expected that at least the lower half of Alabama, most of Mississippi and most of Louisiana will be submerged. Texas will sustain major damage and submersion 100 plus miles inland from the Gulf Coast. The mouth of the Mississippi River will be near the current Arkansas Louisiana state line. Going North, the Mississippi River will be 50 to 100 miles wide with most of Southern Illinois going underwater completely or becoming very swampy. The Great Lakes will inundate all of Wisconsin and merge to become one vast inland sea stretching to Hudson Bay. The West Coast will sustain damage and/or be submerged 25 to 100 miles inland depending on topography and siesmic activity.

The record of this happening in the past as found locked up in stone, bones and frozen mammoths reveals this was a very rapid and extremely violent event(4) & attachment "B". Attachment "A" is a map that comes fairly close to the map the U.S. Navy uses in their classified briefings showing the damage that is expected. *Having shown this map to many people in person, I know what most will do. You will look to see if your home , Florida Condo, or the home of friends or family are at risk. Stop, take a deep breath and listen. Being on high ground is only (Yeah I know, it's a very big only) the beginning of possibly surviving these events!*

In addition: The weight of the water on the Earth's seismic zones will cause all stored energy to be released. In the New Madrid Seismic Zone, *we expect a series of nine point plus earthquakes*. The recent November '05 earthquakes near Boston show that no area is immune.

The U.S. Navy considers all land up to 100 feet above sea level as a total loss. They consider all land up to 400 feet above sea level at risk of loss or damage. We're talking about an area where approximately 100 million plus Americans live and work(5).

The Significant Humanitarian Event

The above is not my choice of words. It is a term coined inside the U.S. Government to refer to these events. The following is what is known: There will be no public admission that the events unfolding are anything that will cause property damage or loss of life. Just prior to it becoming clear that this is not the case, then and only then, martial law will be declared. A really handy scenario would be to have a terrorist related event(s) give the pretext for martial law. The reason? People will respect and go along with orders to protect them from human threats or disease. They will not go along with orders they recognize will not work to protect them i.e. natural disasters. It is now being estimated that a loss of American life up to 50 million people is regarded as an *acceptable loss*. Please note it's the U.S. Government saying this *not John Moore.*

FEMA has a plan. The plan is to move the 100 million people at risk to the known safe areas (keeping in mind that virtually everywhere is at risk for siesmic events). FEMA's plan is fatally flawed. In the time we have (two to four years) the infrastructure to provide housing, potable water, food and medical supplies to 100 million people cannot and will not be put in place. The concept of 100 plus million people being *absorbed* (but believe it or not, that's the plan, really it is) into the existing stock of housing is a fantasy.

The End Of The World As We Know It
TEOTWAWKI

It's happened before, probably multiple times(4). The evidence is clear and convincing that these events will soon be reaching a critical point. Following is a synopsis of how I expect these events to unfold.

I will call these different segments of events "phases". Please be advised that these are very fluid matters and I'm struggling to help all readers have wisdom and insight into these matters as they unfold. The end of one phase and the start of another will more than likely not be all that clear-cut. What's more likely to happen is one will see parts of two phases at work concurrently. Quite frankly, I am already seeing this take place.

Phase One

At this point in time (12/05) we are in Phase One. Events continue to unfold and weather related events continue to become more bizarre. These two to four years of what I'm calling Phase One are what is left for those *in the know* to prepare. Things appear to be and are pretty normal. While those on much of the Gulf Coast would disagree, most Americans have the opportunity to make preparations that will be of great benefit. Of course, *only a tiny percentage*, will do so. I'm already seeing the early stages for Phase Two in the form of increased public awarness of what they call *Global Warming* , the *Gulf Stream slowing* , *bizarre weather events,* plus a drastic increase in the number and severity of *earthquakes, tidal waves* and *volcanoes.* The goal of the "powers that be" is to prolong stage one *as long as possible (6).*

It gives those of us "in the know" more time to prepare and not have to compete with 275 million people for the material we need. Have you ever gone to the grocery store after a snow warning to find milk & bread? If so, multiply that several fold for the scarce items one needs here.

The Fed, Spending money like a drunk sailor

It's become quite well known that the central bank of the United States (The Federal Reserve Bank of the United States) is expanding the money supply as if there was no tomorrow. In addition, the U.S. Congress is spending money in the same manner. The consequences of this level of expansion are well understood by even a freshman in economics.

The historical record of all countries that engage in this type of activity *without exception* has been financial collapse and ruin.

I believe now I know why they are doing this: Because they know that *there is no tomorrow!* Thus, they do not have to worry about the consequences, because well, they simply don't! They are planning on TEOTWAWKI to kick-in before the consequences of their actions have time to take place.

There are a number of major geo-political matters that are playing themselves out i.e. wars (ours in Iraq and Afghanistan, plus a couple of dozen others around the planet). The matter of scarce resources, peak oil and many more points of contention around the globe continue on their merry way. Some are related to the topic of this monograph, some aren't. I believe that the major powers are pre-positioning themselves to come out on top when the Earth stops shaking and the waters have settled at their new levels.

Phase Two

This will be a relatively short period of time. A year? Perhaps a few months, perhaps a few weeks. This will be the time when either rising ocean levels or really bizarre weather events become daily news. You will see the propaganda machine cranking up as needed to reassure the population that these are anomalous events and that everything will be OK. Most will believe the government's lies. *April 2006 update: The propaganda machine is in full swing: see attachment (F). Be advised that the mantra has been and will continue to be: 1.) These are matters caused by human activity. 2.) Human activity can delay or help these matters and (most important of all): 3.) These matters will become noticibly worse commencing in ten years to "later in the century".*

If you remain in a densely populated (or other at risk area) once Phase Two is in effect, you do so at the peril of your life and the lives of your loved ones. A hint: the more the government announces that things are normal and under control, the closer we get to Phase Three. Many (if not most) readers of this article are tied to densely populated areas for economic reasons. Your staying or leaving will at some point (quite literally) become a matter of life or death. As the end of *Phase Two* approach's you will see TV, Radio, Newspaper and news magazines with non-stop daily coverage of: *Global Warming, the Gulf Stream and severe, bizarre weather related matters.*

I have observed quite a few countries slip from Phase Two to Phase Three (or right into complete collapse.) Without exception, every country was able to maintain a facade of normalicy right up to the end. Without exception, every government, up to the moment it collapsed, had issued reassuring news bulletins to the citizens. If you decide to remain in an unsafe area, you must exercise proper judgement and be very wise so as not to end up a victim, trapped by events in an unsafe area.

I conducted my first paid consultation on preparedness in 1977. In these years I have come to learn the expected responses for most people , most of the time. I have had articles published on the topic of denial. I have come to expect that most people most of the time, *will do nothing* until stage three (as described below).

Phase Three

It will arrive *as a thief in the night*. One day you're living your life, enjoying your family, working at your choosen profession, engaging in social , church and civic matters. The next day (Quite literally overnight) it's martial law and your world is upside down!

It's the beginning of the end. Frequently referred to as *The End Of The World As We Know It* or TEOTWAWKI. Those who wait (most will), those who have not prepared (most won't), will be stuck. If you're in a major metropolitan area when martial law is declared, may God have mercy on you and your family! The water is coming and where will you be?

No more Mr. Nice Guy, No more Officer Friendly helping old ladies cross the street.
Having lived in a country under martial law for a year (Republic of Vietnam) I have no illusions about what this means.

1.) National I.D. Cards. You will not be able to do much of anything without one.

2.) Curfews and severe restrictions on travel.

3.) Very likely curtailed sales for firearms, ammunition, alcohol and fuel.

4.) Expect shortages of food products. Very possibly ration cards, or R.F.I.D. chips(7) for basic food items.

The possiblity of an alleged terrorist event(s) is very real. There is a serious danger of a crisis like Bird Flu being either created or exploited (made to appear worse than it really is) to become the pretext for martial law. At Phase Three, the time to escape without possible severe consequences (arrest, or being shot for curfew or travel violations) has passed.

It will be sometime during Phase Three that the *powers that be* plan on implementing their long-awaited *New World Order* or *One World Government*. (3)

Phase Four

Phase Four defined: This will be the status of most of the planet for many years to come. Relatively compact areas with the iron grip of martial law. Fortified towns and villages that have some measure of security and vast areas where the lack of law and order resembles the film "Road Warrior" more than anything else.

Prognostication in this area is difficult. The book Patriots, Surviving the Coming Collapse paints a rather (in my opinion) accurate picture of what the world will look like for many years to come. The film *The Postman* does a pretty good job as well. The first village Costner comes upon has all the trappings of England during the Dark Ages.

Anarchy will reign outside the areas controlled by the New World Order and small cities and villages that have banded together to protect themselves. Thousands of square miles on the Gulf Coast were in Phase Four for many weeks following Katrina.

Phase Four will be Martial Law for some, Anarchy for many and TEOTWAWKI for all!

What will TEOTWAWKI look like?

I'll continue to use popular films to provide analogies that are familiar.

Best Case: Isolated villages that are secure, similar to the secure villages in the film *The Postman.* I expect the Federal government to cease having a very wide reach . The same applies to State governments. I fully expect the county and village governments to be the most functional and of greatest importance. That said, the *powers that be* plan to institute their long awaited *New World Order.* Even if they have very limited ability to control a limited amount of real estate and people, they will believe themselves to be the sovereigns of the land.

Worst Case: Unfortunately, there is very strong evidence of high levels of civilization having been on this planet before (3) that was reduced to barefoot hunter/gatherers at a stone-age subsistance level. In two or three generations the ability to read, write, use complex mathematical processes, refine and work metal was lost. In some cases, never to be recovered. Modern archeology, aided by the current technology, is finding ever more evidence like the complex of several hundred miles of canals and irrigation systems in the Amazon jungle of Brazil. A system that could produce food for millions of people. The same area is now sparsly populated by people living in the stone-age with no written language.

What could cause this? Once again, we have evidence(4). The evidence is that tidal waves *thousands of feet high* washed over entire continents. No, your eyes aren't playing games on you. This has happened in the past and could very well happen again! I know this is difficult to wrap your brain around, it was for me. After reading a couple of thousand pages of documentation, I have no choice but to accept this as fact. *Every* and I repeat *every* civilization on earth has either left written records or an oral tradition of a world-wide flood. The technology to find and explore man-made structures under the oceans has exploded since W W II and new finds are reported every year.

I have photocopied page 132 from the book Earth In Upheaval by Immanuel Velikovsky (attachment "B"). This page is a summary of many thousands of pages of research on the part of Doctor Velikovsky into these matters. In my opinion, based on my own research, it accurately reflects what has transpired previously.

Here are some specifics. Without internal combustion engines and a functional power grid, we cannot live as we have the past 120 years. There is an excellent chance that all major parts of the infrastructure will be either severly damaged , or destroyed. Be advised that all of the following are at risk of complete destruction or severe damage; public water systems, sanitary and storm sewage systems, the power grid, natural gas, telecommunications, rail, barge, seaports, refining and distribution of petroleum products, truck transport and civil aviation. Yes, there are in fact Executive Orders (signed by W.J. Clinton) authorizing the Federal Government to seize everything I list above. However, seizing and controlling a broken infrastructure is pretty pointless. Going back to 1880 without the functional infrastructure and skill sets most people had in that era, is a plan for disaster of apocalyptic proportions! (please see attachment "C")

J.R.'s Short Outline for Survival

Things you will need:

1.) Food: Store what you can and grow or raise your own. Ideally one year (minimum) per person.
A propietary source of potable water.

2.) Shelter: Nearly all (with the possible exception of monolithic concrete domes) structures will be destroyed by 9 point plus earthquakes. Alternatives: Heavy duty military tents, Yurts, school buses, overseas steel shipping containers (CONEX'S) and RV's. Be advised that lightweight nylon tents for casual camping are not meant for long term living and if so used, will fail.

3.) Clothing: Well made natural fabrics (cotton, wool, etc) made for construction workers, hunters and farmers. Most military surplus. Avoid Gore-tex, nylon and other man made fabrics. Boots, really high-quality, all-leather, high top boots.

4.) Transportation: The days of individuals operating motor vehicles with internal combustion engines will end. Think about getting horses, mules, oxen (wagons, buggies), bicycles, steam powered cars, boats, tractors and sailboats.

5.) Medical and Dental : Your access to modern medical attention and dentistry will be at best difficult, at worst non-existent. Access to prescription pharmaceutical products will be in the same catagory.

6.) Family Defense: everyone who did not already know it found out during the aftermath of Hurricane Katrina, one must be prepared to use deadly force to defend innocent human life. This translates into the acquisition of firearms and becoming proficient with same

7.) Communications: Effective, immediate, communications in a crisis is not optional.

One thru seven above is not even close to being comprehensive. The matter of long term survival is a highly complex area of study. The bibliography and websites I provide will be sufficient to get you started.

More than *things* you will need: A very strong *spiritual foundation* and *skills, skills, skills.* I go into these matters in great detail in my two seminars on video: Family Safety In Perilous Times, Surviving Terrorist Attacks Volume One and Volume Two. Each is 2 hours 15 minutes of instruction and training in front of a live audience.

Safe Areas

I have interviewed veterans of the U.S. Submarine Corps and know that the U.S.Navy has been conducting briefings for 20 + years advising that the *Missouri Arkansas Ozarks* are considered to be a *safe area.* There is a lot of research in this area. The two best resources are James Wesley, Rawles at his blog: *www.survivalblog.com* and Mr. Joel Skousen's book Strategic Relocation, North American Guide to Safe Places Be advised that *no area is completely safe.*

J.R.'s brief guide to "safe areas"

While the above sources are excellent, they do not (to my knowledge) take into account the earthchanges to the extent I'm addressing them.

The two most important factors are:

1.) Distance from and elevation above major bodies of water (5). (see attachement "A")

2.) Distance from large concentrations of people.

In dealing with this matter of water, we must hope and pray that we don't get a worst case scenario where multi-thousand foot tidal waves wash over North America! That said, hope for the best and plan for the worst. One would be well -advised to have at least minimal capacity to move people and goods by boat. Some areas look appealing like the Southern part of the Appalachian mountains until you see the relatively close proximaty of tens of millions of future refugees!

168?

A word of caution here: I have come to understand that many married couples (with or without children) believe they can get a small parcel of land in a safe area and set up a secure retreat. I then ask them about the number *168.* They ask: " What's that?" I respond " That's how many hours there are in a week". In addition to all the work and chores of running a small homestead there must be *at least one person awake 168 hours a week!* Obviously, no two human beings can hope to handle that kind of scheduling burden for more than a few weeks, without serious health consequences. The solution is for *six or more adults* to form an alliance, band together and establish a secure retreat.

Footnotes

(1) Meet John Moore: I am a working Private Detective. I have professional training both from the U.S. Military (Intelligence Analyst, U.S. Military Intelligence) and in college (Legal Assistent) as a reseacher. I am in my forth decade of dealing professionally with matters of the most serious nature i.e. literally life and death. My complete bio is at my website: WWW.THELIBERTYMAN.COM

(2) Professor James McCanney MS, a credentialed scientist who began his career at Cornell University. He is highly regarded in his area of expertise. All his books are listed in the bibliography. His website is listed and he has a weekly radio show as well.

(3) The plan calls for Russia and China to play nice. I really believe they won't. Please go to J.R. Nyquist's website for more.

(4) Please refer to Mr. Velikovsky's, Mr. Sitchen's and Mr. Gray's books

(5) To find the altitude of any given location you need a topographical map or GPS with that feature.

(6) As of late 2005, NOAA (National Oceanic and Atomospheric Adminsitration) has discontinued issuing STRATWARM alerts. These alerts were to warn professional meterologists of possible impending anomalous weather, such as strong down drafts. STRATWARM alerts were issued when the stratosphere over Canada warmed a lot in a short period of time.

(7). R.F.I.D. chips Radio Frequency Identification Device. These are electronic devices small enough to be injected thru a hypodermic needle. It can receive a signal and transmit a signal. Already in common veterinary usage, the first human subjects received their RFID chips just after 2000.

Bibliography

Surviving Planet-X Passage By Professor James S. McCanney M.S.
Get this book, keep it in a safe place with other important documents like birth certificates, it's that important. Available from his website below.

Principia Meteorologia By Professor James S. McCanney M.S.
Planet -X Comets and Earth Changes By Professor James S. McCanney M.S.
Atlantis to Tesla By Professor James S. McCanney M.S.
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http://earthchangescentral.com	Earth changes news and discussion
www.rbnlive.com	Talk radio, news, interesting products, John Moore on air here
www.homeland-defense4u.com	Earth changes news & survival products
www.stevequayle.com	News & preparedness
www.jrnyquist.com	J.R. Nyquist's website; geo-political news and preparedness links
www.prophecyclub.com	Bible Prophecy & more
www.survivalblog.com	James Wesley, Rawles Blog: the best place for in-depth serious survival related information
www.topozone.com	A source for topographical maps

Attachment "A"

THE MAP

I'm aware of about 30-(or so) different maps in existence regarding this matter of rising ocean levels. I assure you dear reader I have diligently sought to get my hands on the same map the U.S. Navy has been using in their classified briefings, to no avail. The map depicted on this page has been reviewed and evaluated by several men that have had access to the Navy map. It has been described as very close to the Navy's map. Yes, the flooded areas are drawn by hand. Yes, there are more professional looking versions (that are copyrighted). However, this map comes closest to the one the U.S. Navy has created. In an age where lost dog posters are computer generated and perfect I know a hand-drawn map is out of place. No apologies, this map accurately and fairly depicts very real information.

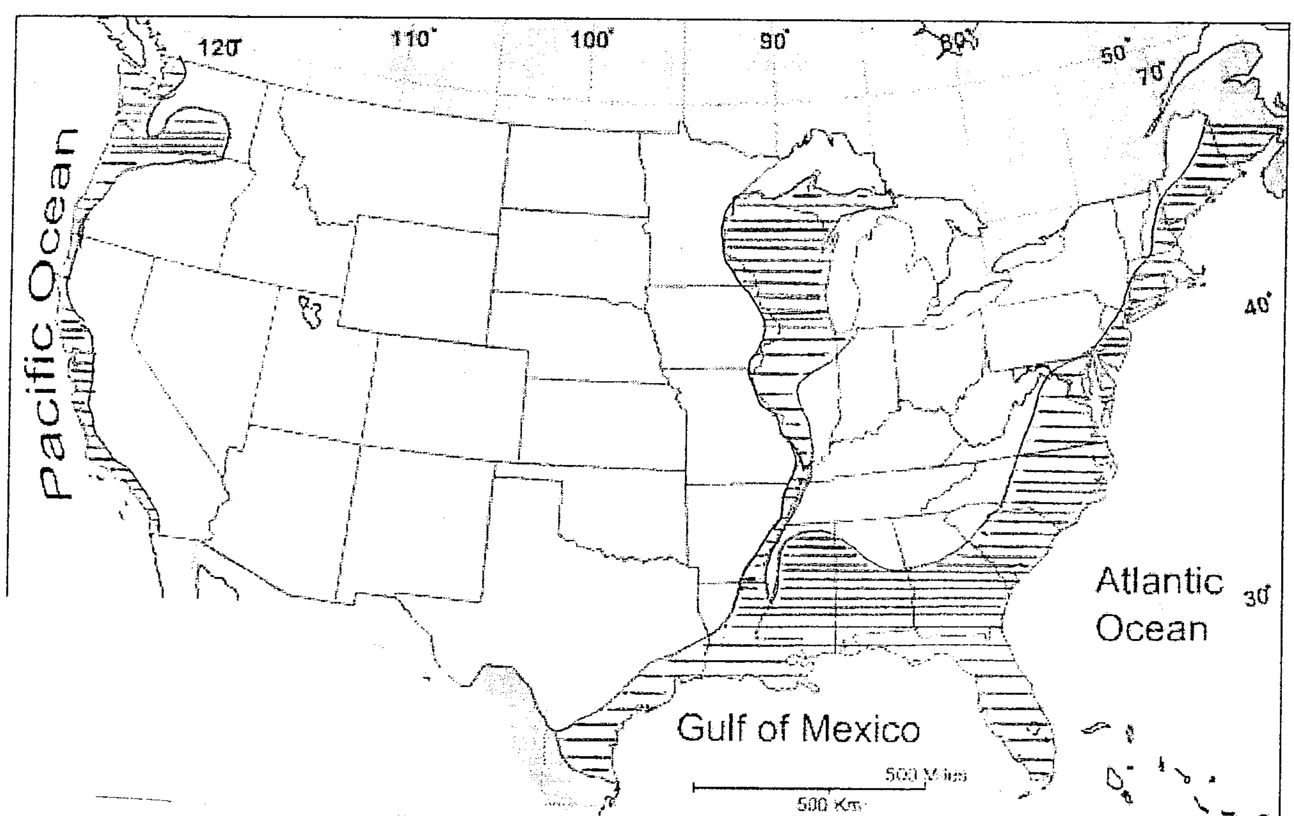
Please be advised that the areas depicted as under water and those above water are *estimates* based primarily on;

1.) Proximatey to large bodies of water.
2.) The altitude above current sea level of these areas.
3.) Any blocking mechanism (Like the Appalachian Mountains)

Finally, (and most important of all) One must consider the *entire North American Continent* at risk of:

A.) Seismic activity
B.) Volcanic Activity (especially the Pacific Northwest and within 600 miles of Yellowstone)
C.) Land based Hurricanes

Be advised: There are *no* absolutely safe places!



Map of the United States of America

Attachment "B"
from: Earth In Upheaval
By Immanuel Velikovsky

A Working Hypothesis

Let us assume, as a working hypothesis, that under the impact of a force or the influence of an agent—and the earth does not travel in an empty universe—the axis of the earth shifted or tilted. At that moment an earthquake would make the globe shudder. Air and water would continue to move through inertia; hurricanes would sweep the earth and the seas would rush over continents, carrying gravel and sand and marine animals, and casting them on the land. Heat would be developed, rocks would melt, volcanoes would erupt, lava would flow from fissures in the ruptured ground and cover vast areas. Mountains would spring up from the plains and would travel and climb on the shoulders of other mountains, causing faults and rifts. Lakes would be tilted and emptied, rivers would change their beds; large land areas with all their inhabitants would slip under the sea. Forests would burn, and the hurricanes and wild seas would wrest them from the ground on which they grew and pile them, branch and root, in huge heaps. Seas would turn into deserts, their waters rolling away.

And if a change in the velocity of the diurnal rotation—slowing it down—should accompany the shifting of the axis, the water confined to the equatorial oceans by centrifugal force would retreat to the poles, and high tides and hurricanes would rush from pole to pole, carrying reindeer and seals to the tropics and desert lions into the Arctic, moving from the equator up to the mountain ridges of the Himalayas and down the African jungles; and crumbled rocks torn from splintering mountains would be scattered over large distances; and herds of animals would be washed from the plains of Siberia. The shifting of the axis would also change the climate of every place, leaving corals in Newfoundland and elephants in Alaska, fig trees in northern Greenland and luxuriant forests in Antarctica. In the event of a rapid shift of the axis, many species and genera of animals on land and in the sea would be destroyed, and civilizations, if any, would be reduced to ruins.

Attachment (C)

In the mid-1980's there was a very popular television show named "Little House on the Prairie" staring Michael Landon. The setting was the American West in the late 19th century. Each episode the viewers were treated to the family living their lives in the manner of the times, using the technology of the era. People of that era in the American West had a fully functional infrastructure that included: a postal system that neither had or needed trucks, aircraft, telephones, computers or electricity. A banking system that used neither electricity, telephones or computers. Fully functional local, state and federal governments that neither had or used electricity, computers or telephones. State militias and Federal Army, Navy and Marines that neither had or needed electricity, computers, radios, telephones or any machines using internal combustion engines. Local and state law enforcement and a Federal Secret Service that had no computers, telephones, electricity or any machine using internal combustion engines. Mines , factories and farms producing raw materials and finished goods, which they packaged, marketed, sold and delivered to their customers nationwide. All this commerce taking place without any electricity, computers, telephones or machinery with internal combustion engines.

The people of the late 19th century had full, happy and productive lives. They had a complete and very functional infrastructure to serve their needs. Other than history books and museums, we have only a very pale shadow of that infrastructure remaining in the 21st century. There may be a dozen, or so, operational steam locomotives. The nationwide telegraph system is defunct. There may be one or two full-size steam boats functional. There are clubs and hobbiests that keep a couple of hundred, or so, steam tractors running. Steam powered cars and trucks? Very few of these exist.

Be advised that every level of government from the smallest village to the Department of Homeland Security is completely dependent on the infrastructure being intact. While the U.S. Military can operate independent of the power gird, long term they will be looking to the private sector for re-supply. Law enforcement at every level is completely dependent on electricity, radios, computers and motor vehicles. All modern medical diagnostic equipment and most life saving equipment is run on electricity.

Finally, in the 21st century, just as in the 19th century, we find that most heavy, bulky, raw material and finished goods are still shipped internationally by ship. The list is extensive including bulk grains, petroleum products, natural gas, coal, lumber, fertilizer, steel, cars, trucks, machinery, manufactured products of every description. When the ocean levels rise, all commerce by ship will cease.

I wanted to paint a picture here. The picture is what will TEOTWAWKI look like? Based on what you read above, you can draw your own conclusions!

Attachment (D)

Sophisticated Disinformation

My bio includes spending a year of my life as an Intelligence Analyst working in the Intelligence Section (S-2) of the 10th Psychological Operations Battalion in the Republic of Vietnam. Most people, if they think about propaganda at all, regard it as pure lies and deception with devious intent. Nothing could be further from the truth! Propaganda is any message delivered in any manner to influence the hopes, fears, beliefs, desires of the target audience. The truthfulness or veracity of the message is secondary.

With the above in mind, I will analyse the attached article: Climate change: On the edge by Mr. Jim Hansen 17 Feb 2006. Published in The Independent Online Edition in the UK.

In order to be believable, have the desired impact on it's readers, whether it be an article (like the attached) an advertisment, or any message, one must :

1.) Have the source be one with veracity: ie. credentials, position, status that is relevant to the message delivered.
2.) The message (or at least most of it) must comport with whatever the existing paradigm is for the audience.

Climate change: On the edge has both of the above elements. First, the author Mr. Hansen is the director of the NASA Goddard Institute for Space Studies. Thus he is part of the Executive Branch of the United States Government. There is a direct chain-of-command linkage to the Oval Office and he is President George Bush's top climate modeller. Quite frankly, these are very serious credentials well targeted on the topic at hand!

Second, the message does comport with the mainstream mantra of these obviously drastic weather and earthchange events becoming ever more frequent, disturbing and alarming. Plus, it reinforces three foundational beliefs:

1.) That the cause of the weather changes and ice melting events is the human production of CO_2 greenhouse gases.

2.) That a crash program to reduce these emissions will save mankind and the planet.

3.) That we have ten years before things start to change drastically and it will be "later in the century" before things really get bad.

The article gives an extra little titilation by giving the appearance that, you the reader, are privy to confidential insider information that the U. S Government wants to keep classified. A bit of irony here because I am doing the same thing with this article "No Need To Panic".

In my opinion, the most important aspect of the article is the time frame for these future events (like ocean levels rising) i.e. (ninth paragraph) "what we expect later this century" and the last paragraph " We have to stabilise emissions of carbon dioxide within a decade, or temperatures will warm by more than one degree". Both of these statements are (to the best of my knowledge and belief) pure fiction, contrived, deceptive lies to deceive the reader into believing and hoping we have *ten years minimum* prior to much of any real significance happening!

Further, I also believe that for Mr. Hansen to be telling the truth, his article should more properly have been the main body of a letter of resignation to his bosses the Director of NASA and the President of the Unitied States! In the real world when one violates their "non-disclose" agreement (as Mr. Hansen clearly admits to doing), their career is toast!

Real Science: Everything else in the article is in agreement with my knowledge, research and understanding of what we are facing regarding climate change and rising ocean levels...............EVERYTHING!

Finally, and in closing this monograph, the final sentence of Mr. Hansen's article: ***We don't have much time left.***

Climate change: On the edge

Greenland ice cap breaking up at twice the rate it was five years ago, says scientist Bush tried to gag

By Jim Hansen

Published: 17 February 2006

A satellite study of the Greenland ice cap shows that it is melting far faster than scientists had feared - twice as much ice is going into the sea as it was five years ago. The implications for rising sea levels - and climate change - could be dramatic.

Yet, a few weeks ago, when I - a Nasa climate scientist - tried to talk to the media about these issues following a lecture I had given calling for prompt reductions in the emission of greenhouse gases, the Nasa public affairs team - staffed by political appointees from the Bush administration - tried to stop me doing so. I was not happy with that, and I ignored the restrictions. The first line of Nasa's mission is to understand and protect the planet.

This new satellite data is a remarkable advance. We are seeing for the first time the detailed behaviour of the ice streams that are draining the Greenland ice sheet. They show that Greenland seems to be losing at least 200 cubic kilometres of ice a year. It is different from even two years ago, when people still said the ice sheet was in balance.

Hundreds of cubic kilometres sounds like a lot of ice. But this is just the beginning. Once a sheet starts to disintegrate, it can reach a tipping point beyond which break-up is explosively rapid. The issue is how close we are getting to that tipping point. The summer of 2005 broke all records for melting in Greenland. So we may be on the edge.

Our understanding of what is going on is very new. Today's forecasts of sea-level rise use climate models of the ice sheets that say they can only disintegrate over a thousand years or more. But we can now see that the models are almost worthless. They treat the ice sheets like a single block of ice that will slowly melt. But what is happening is much more dynamic.

Once the ice starts to melt at the surface, it forms lakes that empty down crevasses to the bottom of the ice. You get rivers of water underneath the ice. And the ice slides towards the ocean.

Our Nasa scientists have measured this in Greenland. And once these ice streams start moving, their influence stretches right to the interior of the ice sheet. Building an ice sheet takes a long time, because it is limited by snowfall. But destroying it can be explosively rapid.

How fast can this go? Right now, I think our best measure is what happened in the past. We know that, for instance, 14,000 years ago sea levels rose by 20m in 400 years - that is five metres in a century. This was towards the end of the last ice age, so there was more ice around. But, on the other hand, temperatures were not warming as fast as today.

How far can it go? The last time the world was three degrees warmer than today - which is what we expect later this century - sea levels were 25m higher. So that is what we can look forward to if we don't act soon. None of the current climate and ice models predict this. But I prefer the evidence from the Earth's history and my own eyes. I think sea-level rise is going to be the big issue soon, more even than warming itself.

It's hard to say what the world will be like if this happens. It would be another planet. You could imagine great armadas of icebergs breaking off Greenland and melting as they float south. And, of course, huge areas being flooded.

How long have we got? We have to stabilise emissions of carbon dioxide within a decade, or temperatures will warm by more than one degree. That will be warmer than it has been for half a million years, and many things could become unstoppable. If we are to stop that, we cannot wait for new technologies like capturing emissions from burning coal. We have to act with what we have. This decade, that means focusing on energy efficiency and renewable sources of energy that do not burn carbon. We don't have much time left.

Jim Hansen, the director of the Nasa Goddard Institute for Space Studies in New York, is President George Bush's top climate modeller. He was speaking to Fred Pearce

Attachment (E)

REAL SCIENCE , MISSING SCIENCE

I'm well into the 4th month of this project (12 March 06). The below article from the very mainstream news source of Rueters fits hand-in-glove with my original document written the first week of December '05. Clearly we have credentialed sceintists giving their professional predictions of near term, alarmingly severe, solar activity beginning possibly as soon as this current calendar year of 06.

The article gives a very good synopsis of both the expected levels of solar activity and the expected effects on manmade infrastructure, etc.

Here's the missing science: They make no mention whatsoever of the effects on weather. This is critical. This is crucial. This (in my opinion intentional) oversight is another important piece of the puzzle. This article is very strong evidence in support of my articles premise.

Sun's Next Eleven-Year Cycle Could Be Fifty Percent Stronger

March 08, 2006 — By Deborah Zabarenko, Reuters

WASHINGTON — Sun-spawned cosmic storms that can play havoc with earthly power grids and orbiting satellites could be 50 percent stronger in the next 11-year solar cycle than in the last one, scientists said.

Using a new model that takes into account what happens under the sun's surface and data about previous solar cycles, astronomers offered a long-range forecast for solar activity that could start as soon as this year or as late as 2008.

They offered no specific predictions of solar storms, but they hope to formulate early warnings that will give power companies, satellite operators and others on and around Earth a few days to prepare.

"This prediction of an active solar cycle suggests we're potentially looking at more communications disruptions, more satellite failures, possible disruptions of electrical grids and blackouts, more dangerous conditions for astronauts," said Richard Behnke of the Upper Atmosphere Research Section at the National Science Foundation.

"Predicting and understanding space weather will soon be even more vital than ever before," Behnke said at a telephone news briefing.

The prediction, roughly analogous to the early prediction of a severe hurricane season on Earth, involves the number of sunspots on the solar surface, phenomena that have been monitored for more than a century.

TWISTED MAGNETIC FIELDS

Every 11 years or so, the sun goes through an active period, with lots of sunspots. This is important, since solar storms -- linked to twisted magnetic fields that can hurl out energetic particles -- tend to occur near sunspots.

The sun is in a relatively quiet period now, but is expected to get more active soon, scientists said. However, there is disagreement as to whether the active period will start within months -- late 2006 or early 2007 -- or years, with the first signs in late 2007 or early 2008.

Whenever it begins, the new forecasting method shows sunspot activity is likely to be 30 percent to 50 percent stronger than the last active period. The peak of the last cycle was in 2001, the researchers said, but the period of activity can span much of a decade.

The strongest solar cycle in recent memory occurred in the late 1950s, when there were few satellites aloft, no astronauts in orbit and less reliance on electrical power grids than there is now.

If a similarly active period occurred now, the impact would be hard to predict, according to Joseph Kunches of the National Oceanic & Atmospheric Administration's Space Environment Center in Colorado.

"It's pretty uncertain what would happen, which makes this work more relevant," Kunches said.

"What we have here is a prediction that the cycle is going to be very active, and what we need and what we're of course working on is to be able to predict individual storms with a couple days or hours in advance so the grids can take the action," Behnke said.

Source: Reuters

SPECIAL REPORT GLOBAL WARMING

TIME

BE WORRIED. BE VERY WORRIED.

Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well

EARTH AT THE TIPPING POINT

HOW IT THREATENS YOUR HEALTH

HOW CHINA & INDIA CAN HELP SAVE THE WORLD—OR DESTROY IT

THE CLIMATE CRUSADERS

Attachment "F"
Time Magazine
Cover April 3, 2006

OCEAN LEVELS
WATER, WATER, EVERYWHERE

An update to "No Need For Panic"

by

John Moore

Since I published this paper in the Fall of 2005, I've haddifficulty understanding (and, in turn, explaining) what my confidential sources had learned in classified government briefings about coming rapid, violent, ocean-related events, including flooding, and tsunamis (tidal waves). The explanation of the source for the water for these events being melting ice simply flew in the face of these events happening in such a short span of time (four weeks).

When I first learned that U.S. Government scientists were stating that the Arkansas Missouri Ozarks could become a series of islands, I had difficulty understanding "Where's all that water coming

As it turns out, the answer is quite common knowledge in the disciplines of geology and oceanography: the water is in the oceans already! It's always been there!

The size of the world's ocean's is a bit difficult to wrap your brain around. Of the 197 million square miles of planetary surface, 139.5 million square miles are oceans!

According to the University of Southern California (USC) Geology Department, the world's oceans vary in their levels by 180 meters (highs to lows) that's 594 feet! This is major part of the puzzle as to where all the water will come from that will cause world-wide tsunamis (tidal-waves) and world-wide flooding! These variations in ocean levels are (I quote from USC): "Caused by gravitational differences resulting from irregularities in the lithosphere." Professor McCanney states that the Earth's rotation is the major factor in this phenomenon.

Here's what this means in plain English. The oceans have *millions of square miles of water above* what we think of as sea level. The oceans also have *millions of square miles of water below* what we think of as sea level. Go back to what the USC says ab*ove.* This accounts for how the water stays in place (gravity & Earth's rotation). What is necessary to cause world-wide tsunamis (tidal waves) and world-wide flooding? New, *outside forces that disrupt the Earth's rotation* that currently keeps the water where it i*s.* Plus vast quantities of water *from space.(2)*

A disruption in the Earth's rotation in either speed (normally 1,000 miles per hour) *or direction (*a pole shift), These possibilities are incorporated in what Professor McCanney calls "action at a distance, caused by very large comet"(2) and the Earth is in deep trouble in a matter of a month (or less). Ladies and gentlemen, *as I state above, the water for world-wide tsunamis & world-wide flooding is already in the world's oceans!*

The records, both in geology and historical(4), reflect that multiple events will be occurring *simultaneously* i.e. melting ice in the Antarctic & Greenland, earthquakes, tsunamis (tidal waves), flooding, torrential rains, abrupt (tropical to arctic minutes!) climate change, 200 MPH winds, volcanism, the Gulf Stream stopping and dare I say: a pole shift!

My best information is that these ocean-related events will take about 30 days to reach North America once the triggering mechanism occurs. *Be advised: It (the triggering event) may not be something you are aware of! Also, the 30 days may end up being 3 hours!*

I advise elsewhere in this paper (and frequently on my radio show) that the time to prepare is *now!* In spirit, in body, in skills, in substance.