Collection of Papers in Response to NOAA's "State of the Climate in 2009"

by Science and Public Policy Institute

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In a "Highlights" report of the National Oceanic and Atmospheric Administration's State of the Climate in 2009 document, which was prepared under the direction of the U.S. National Climatic Data Center, we can read the principal findings of what the document describes as the work of "more than 300 scientists from 48 countries." Their primary conclusion, as stated in the Report's first paragraph, is that "global warming is undeniable," and the Report goes on from there to describe "how we know the world has warmed." But this, and all that follows, tells us next to nothing about what has caused the warming, which is the crux of the whole contentious matter.

The Report next states, for example, that "recent studies show the world's oceans are heating up," which is fine; but then -- as if hoping no one will question them -- the Report says the oceans are warming, "as they absorb most of the extra heat being added to the climate system from the build-up of heat-trapping gases," which contention is far from a proven fact, and is -- in fact -- merely an hypothesis ... and a bad one at that, as we shall soon see.

Another fault of the Report is its hyping of "melting Arctic sea ice," while it remains silent on the state of Antarctic sea ice, which has been doing just the opposite as it has grown in extent. Likewise, a major inconsistency of the Report is its stating, with respect to temperature, that "a particular year can experience record-breaking highs and lows in any given location," while, "as a whole, global climate continues to warm." This is very true; and it can also do so while, as a whole, global climate cools or remains unchanged. And it implies the same thing for all types of weather phenomena (such as droughts, floods, hurricanes, etc.), which means that the occurrence of any unusually dramatic weather phenomenon in any "particular year" should imply nothing about the long-term trend of that phenomenon or the presumed trajectory of the global climate within which it is embedded. Yet the Report goes on to describe six such extreme events that occurred in the "particular year" of 2009, which would have to have been done for no other reason than to imply that these weather extremes were caused by global warming, which flies in the face of their earlier contention that record-breaking low temperatures in any year say nothing about the long-term thermal tendency of the planet.

Last of all, the Report states that "people have spent thousands of years building society for one climate and now a new one is being created -- one that's warmer and more extreme," which leads us to wonder ...
warmth "go away," the Center for the Study of Carbon Dioxide and Global Change has for quite some time now posted a review of a different research project every single week that testifies to the reality of the Medieval Warm Period. And that ever-growing body of research is demonstrating beyond any doubt that there was a several-hundred-year interval of warmth back then that was at many different times (stretching from decades to centuries), and in numerous places (throughout the entire world), significantly warmer than the Report's highly-touted first decade of the 21st century, and at a time when the atmosphere's CO2 concentration was far less than it is today.

What makes this particular failure of the Report so doubly damning is the fact that it claims that each of the "more than 30 different climate indicators" it has analyzed "is placed into historical context." That is obviously not true. And for a parameter so central to the core of the global warming discussion as temperature to not be put into proper long-term context is inexcusable, although quite understandable, especially when one realizes the implications it would hold for the Report's unfounded contentions about the present state of earth's climate.
COMMENTS ON THE NOAA/MET OFFICE
STATE OF THE CLIMATE REPORT 2009

by Dennis Ambler  I  August 2, 2010

SUMMARY STATEMENT OF REPORT CLAIMS

"The report is the first to collate 11 different indicators – from air and sea temperatures to melting ice – each one based on between three and seven data sets, dating back to between 1850 and the 1970s.

Publishing the newly collated data in London, Peter Stott, the head of climate modeling at the UK Met Office, said despite variations between individual years, the evidence was unequivocal: "When you follow those decade-to-decade trends then you see clearly and unmistakably signs of a warming world".

SOME OF THE CLAIMS EXAMINED

1. NEAR SURFACE AIR TEMPERATURE, (TROPOSPHERE), IS RISING.

Satellite measurements began in 1978, at the start of a period of warming following a cold period from around 1940 to 1977, so we are only at the end of a first 30 year period. We have no satellite data from known cold periods for comparison and it is stretching science to claim that long-term warming will continue from such a short record.

Climate models predict that as the surface warms, the global troposphere should warm about 1.2 times more than the surface and in the tropics, the troposphere should warm about 1.5 times more than the surface. This tropical hot spot has not happened.

According to Dr Roy Spencer, at University of Alabama, Huntsville, “1998 still leads with the daily average for 1 Jan to 30 June being +0.64 C in 1998 compared with +0.56 C for 2010. As of 30 June 2010, there have been 181 days in the year. From our calibrated daily data, we find that 1998 was warmer than 2010 on 122 (two-thirds) of them."

The satellite data was preceded by radio-sonde balloon data from the late 1950’s. There was no warming trend from 1958 to 1976, during which time atmospheric CO2 rose by 18ppm.
2. **LAND SURFACE TEMPERATURE IS RISING.**

The whole question of the land surface temperature record was the main issue with the de-bunked Mann Hockey Stick and the recent Climategate affair.

There are serious flaws in the surface temperature record, as identified by meteorologist Anthony Watts at WUWT in his Surface Stations Project and further described here by Dr Don Keiller, of Anglia Ruskin University, in evidence to the Science and Technology Committee of the House of Commons.

“National Oceanic and Atmospheric Administration (NOAA)’s National Climatic Data Center (NCDC), NASA’s Goddard Institute for Space Studies (GISS) and CRU databases are not independent as they all rely on the same basic ground-station data.”

“Global terrestrial temperature data are compromised because more than three-quarters of the 6,000 stations that once existed are no longer reporting.”

“There has been a bias towards removing higher-altitude, higher-latitude and rural stations, leading to a further overstatement of warming.”

“A very large proportion of recording sites are contaminated by urbanization, changes in land use, improper siting, and inadequately-calibrated instrument upgrades.”

The Alaska Climate Research Centre notes that in 1976, a stepwise shift appears in the temperature data, which corresponds to a phase shift of the Pacific Decadal Oscillation from a negative phase to a positive phase.” Alaskan temperatures rose by 2 deg F in one year.

The UK Central England Temperature record extends back to 1659 and shows that the IPCC model period of 1961-1990 was colder than the earlier period from 1931-1960, in spite of a rise of 37 ppm, or 12%, in atmospheric CO2. The 1961-90 period is used as a base-line period for many of the IPCC projections.

3. **GLACIERS ARE MELTING WITH ASSOCIATED RISE IN SEA LEVEL.**

The United Nations Environment Program had this to say about glaciers in the Himalayas: “In general, the majority of Himalayan glaciers are shrinking in area and thickness and the extent and nature of shrinkage has not changed significantly over the last 100 years.”

(1997) Pollen and plant macrofossil data from the Colorado Rocky Mountains demonstrate that from 9000 to 4000 yr B.P. the sub-alpine forest occupied a greater elevational range than it does today. Upper timberline was 270 m above its modern limit, suggesting that mean annual and mean July temperatures were 1–2 °C warmer than today.
In September, 2006, the remains of timber-sized spruce trees were found (*Picea engelmannii*) on the floors of melting ice patches at altitudes of 3465—3480 m in the Mummy Range of north-central Colorado.

(2008) Glaciers in Garibaldi Park were smaller than at present in the early Holocene, although some evidence exists for minor, short-lived advances at this time.

4. **SEA ICE IS DISAPPEARING AT AN ACCELERATING RATE.**

Researchers from the Norwegian Component of the Ecosystem Studies of Sub-Arctic Seas said earlier this year that:

“The dramatic changes in the extent of Arctic sea ice in recent years have mainly been caused by atmospheric circulation patterns that have tended to reduce ice cover, combined with a slow process of climate change. Variations in the circulation patterns are part of the natural fluctuations in the weather.

Significantly, the researchers say the extent of the ice cover around the North Pole should not be used as a barometer for whether climate change is affecting the ice coverage, and whether climate change is occurring in the Arctic at all.

They also believe that the recent decrease in ice cover should not be used as an indicator that the Arctic will be ice free in 10 to 20 years.”

In 2004, K R Wood of the Arctic Research office and J Wood of the Pacific Marine Environmental Laboratory examined explorer's logs from large naval expeditions from 1818 to 1859 and found that ice thickness and navigation channels were surprisingly like today. Explorers encountered both warm and cool conditions and came within about 90 miles of completing the North West passage. The passage was navigated by Amundsen in 1905.

A 2004 Norwegian study covering 100 years in the Arctic, showed the temperature was generally increasing up to the 1930s, decreasing from the 1930s to the 1960s, and increasing from the 1960s to 2000. The temperature level in the 1990s was still lower than it was during the 1930s.
5. **Claims of reduced Spring snow cover.**

Norwegian research in 2001 showed that there was thirty per cent less snow cover in the period 1930-1979, than in the period 1990 to 1999.

Figures for the Scottish Skiing Industry demonstrated no long-term trend in the snow data, which includes snow data back to 1928/9 - well before the skiing industry existed in Scotland.

This newspaper report shows that there was no shortage of Spring snow cover in Scotland this year:

**June 9, 2010, Last day of skiing in Scotland**, “The last time skiing was available at this time in June was 1992. Last year 159,000 skier days were recorded across all the resorts Scotland. This season Cairngorm, up until the middle of May, had 144,000 skier days. Its average is about 55,000 skier days.”

Of course that’s weather, not climate.

6. **Claims of increased atmospheric surface humidity.**

“Holocene climate change, Uinta Mountains, north-eastern Utah - Large floods, as much as 10%–15% greater than modern, dominated from 8500 to 5000 calendar yr B.P., and again from 2800 to 1000 cal yr B.P.

The early Holocene record indicates that larger than modern bankfull floods coincide with warmer than modern mean annual temperature. We hypothesize that an increased range of magnitude for seasonal solar radiation during the early Holocene favored the accumulation and rapid melting of deep snowpacks in the high Uinta Mountains, thus producing large floods despite warmer mean annual temperatures.”

7. **Sea level rise is accelerating.**

There is no significant increase in the rate of sea level change over the past century. In 2007 S. J. Holgate of the Proudman Oceanographic Laboratory, Liverpool, UK, showed that the rates of sea level change observed over the past 20 years were not particularly unusual when compared to nearly continuous sea level records around the world for 1904–2003.” It was published in Geophysical Research Letters, vol 34, 2007.

**During the 1997/1998 El Niño, sea level fell 35 cm below average, the trend actually went negative, and remained so for the next three years.**

**Recovery from that is counted in the short-term trend, giving the deceptive figure of 5 mm.**

**Current sea level is still below that of 1995.**

His research demonstrated that “The rate of sea level change was larger in the early part of last century in comparison with the latter part.” Mean sea level rise was 1.74 mm per year, or just under seven inches for the whole century.”
There is much talk of “drowning” Pacific islands and it is claimed sea level rise in Tuvalu is 5 mm per year. In fact, during the 1997/1998 El Niño, sea level fell 35 cm below average, the trend actually went negative, and remained so for the next three years. Recovery from that is counted in the short-term trend, giving the deceptive figure of 5 mm. Current sea level is still below that of 1995.

The longer, 21 year record, shows only 0.9 mm per year. Thirty year records show no rising trend. A 2009 paper in the American Journal of Applied Sciences states that “visually at least and at this stage, there is no clear evidence for acceleration in sea level trends over the course of the last century based upon the long-term data elsewhere.” Many of the Pacific Islands are actually sinking because they are in the tectonic subduction zone.

**Flawed Satellite Data**

It is claimed that new observations, which became available for the first time from the TOPEX/Poseidon satellite in 1992, can measure global sea level to millimeter accuracy. The rate of increase suspiciously went up in one fell swoop on their introduction, to double that of the tide gauges. There are major problems with the satellite measurements:

“The T/P satellite cannot measure sea level when there is any land within the footprint because T/P cannot tell land echoes from sea echoes and gives a false result.

This means that all sea areas within 3 to 5 kilometres of continental coasts, islands, even atolls, are not covered. Also not covered is all oceanic area north of 66°N or south of 66°S, due to the angled track of the satellite. This results in the Arctic Ocean and the high-latitude part of the North Atlantic being excluded. Also excluded is much of the oceanic area surrounding Antarctica.

Yet the claim of 3.2 mm is the one being advanced as demonstrating increasing sea level rise.

8. **Sea Surface Temperatures (SST) are rising.**

No, they are not. Dr Roy Spencer shows that the opposite is currently happening.

"Sea Surface Temperatures (SSTs) measured by the AMSR-E instrument on NASA’s Aqua satellite continue the fall which began several months ago. Updated figures through July 29, 2010 show that the cooling in the Nino34 region in the tropical east Pacific continues to be well ahead of the cooling in the global average SST, something we did not see during the 2007-08 La Nina event."

The biggest database of SST’s comprises data collected over many decades of the 20th century from buckets thrown over the side of ships, or from engine intake valves. It is thought there could be errors of up to half a degree in those records.

They say “New technology also means it is possible to measure the temperature of the oceans, which absorb 90 per cent of the world's heat.”

In 2003 the Argo system of buoys that can dive 3,000 feet down and measure ocean temperature was fully deployed. Since then it has **recorded no warming** of the global oceans. This causes problems,
because the false sea level rise requires a warmer ocean to justify it, so they talk of “missing heat”, which could be “lurking “ in the ocean depths to come back and bite us at some future point.

9. **Ocean Heat Content is Increasing.**

Dr Robert E Stevenson, an eminent Scripps Institute and NASA oceanographer who died in 2001, wrote in 2000 that, **“the entire heat in the overlying atmosphere can be contained in the top two meters of the oceans.”** This enormous heat storage capacity enables the oceans to "buffer" any major deviations in temperature, moderating both heat and cold waves alike. Anomalous heat associated with changing solar irradiance is stored in the upper 100 meters. The heat balance is maintained by heat loss to the atmosphere, not to the deep ocean.

In 2007, Dr Kevin Trenberth, Head of Climate Analysis at NCAR and a major figure in the IPCC, expressed his dissatisfaction with climate models in a Nature Science Blog posting:

“None of the models used by IPCC are initialized to the observed state and **none of the climate states in the models correspond even remotely to the current observed climate.**

In particular, the state of the oceans, sea ice, and soil moisture has no relationship to the observed state at any recent time in any of the IPCC models.

There is **neither an El Niño sequence nor any Pacific Decadal Oscillation that replicates the recent past;** yet these are critical modes of variability that affect Pacific rim countries and beyond.”

In a paper from last year, (Trenberth, K. E., 2009: An imperative for adapting to climate change: Tracking Earth’s global energy. Current Opinion in Environmental Sustainability), he commented:

“**The global mean temperature in 2008 was the lowest since about 2000. Given that there is continual heating of the planet, referred to as radiative forcing, by accelerating increases of carbon dioxide and other greenhouses due to human activities, why isn’t the temperature continuing to go up?**”

Trenberth is baffled that warming hasn’t been happening when his models told him it should have been, yet he still says anthropogenic warming is unequivocal. With so many unknowns and outright assumptions, how can long term modelling results drawn from them have any credence?
His frustration continued in this October 2009 e-mail comment to a colleague:

“How come you do not agree with a statement that says we are no-where close to knowing where energy is going or whether clouds are changing to make the planet brighter. We are not close to balancing the energy budget.

The fact that we can not account for what is happening in the climate system makes any consideration of geo-engineering quite hopeless as we will never be able to tell if it is successful or not! It is a travesty!”

So on the basis of such inadequate models we have the claims of “undeniable human-induced global warming” from NOAA and the Met Office.

The final word should go to Peter Stott of the Met Office when he said “That's a very remarkable result, that all those data sets agree.”

He is absolutely right.

**Dennis Ambler** is an independent researcher and writer from the UK and has been involved with environmental matters since 1999. He has a long career background in agriculture, including teaching, business management and business ownership, with technical qualifications in biology and related subjects. Later interest in politics and studies in sociology, led to his current concerns about public policy relating to environmental matters and environmental legislation. Accordingly he has spent considerable research time on the work of the IPCC and the politics of anthropogenic global warming.
WORLD HAS BEEN WARMING FOR 250 YEARS, BUT NOT SINCE 2001

by Dr. David Evans | July 30, 2010

INTRODUCTION

By choosing tendentious and corrupt temperature measures (such as placing official thermometers near air conditioner outlets), ignoring unbiased temperature measures (such as satellites), processing data opaquely on their computers (science should be open and transparent, but the climate establishment even evades FOIs), the recently released State of the Climate in 2009 report claims that the world has been getting ever hotter, even during the last decade.

The situation is more nuanced:

1. The world has not been warming for the last decade. This is proven by our best data sources: satellites (for air temperatures) and the Argo network (for ocean temperatures). As leading senior warmist Dr. Phil Jones, Director of the Climate Research Unit at the University of East Anglia in the UK, said recently in an interview on the BBC: “from 1995 to the present there has been no statistically-significant global warming”.

2. The world has been warming since the depths of the little ice age in about 1750. There is a pattern of warming and cooling periods of about 30 years apiece around a constant underlying warming. The last warming period was 1975 to 2001, and if the pattern persists there will be mild cooling until at least 2025. But human emissions of carbon dioxide have nearly all occurred since WWII, were insignificant before 1850, and are now accelerating—so they cannot be the main cause of global warming.

The State of the Climate report overwhelms its reader with detail that is difficult for a layperson to decode. Basically its message is authoritarian: we are the experts, it is very complicated, you can’t understand it, so just accept what we say. Nonsense. Everyone is familiar with temperature, and the main issues here are easily understood by laypeople. The reality is that the temperature picture is not favorable to their climate theory, so they hide behind complexity and authority instead of simply telling you what is going on.

2 BBC interview February 2010: news.bbc.co.uk/2/hi/8511670.stm.
This document is a brief scientific commentary on the 2009 *State of the Climate* report by Dr. David Evans.

Dr. David Evans worked for the Australian Greenhouse Office (now the Department of Climate Change) from 1999 to 2005, modelling Australia’s carbon in plants, debris, mulch, soils, and forestry and agricultural products. Evans is a mathematician and engineer, with six university degrees including a PhD from Stanford University in electrical engineering. The evidence supporting the idea that CO₂ emissions were the main cause of global warming reversed itself from 1998 to 2006, causing Evans to move from being a warmist to a skeptic.

**SATELLITES SHOW THAT GLOBAL AIR TEMPERATURES HAVE NOT RISEN IN THE LAST DECADE**

Global air temperatures at the earth’s surface are best measured by satellites, because they measure the temperature 24/7 over broad swaths of land and ocean, across the whole world except the poles, and they do not suffer from distortions due to thermometer siting problems or “adjustments”. While satellites had some calibration problems early on, those problems have long since been fully fixed to everyone’s satisfaction. Satellites are mankind’s most reliable, extensive, and unbiased method for measuring surface temperatures.

Warmists quote land-based thermometer data instead of satellite data; there are major problems with land-based data—more on that shortly.

There are two satellite temperature records, graphed here in their entirety (back to 1979), and graphed in a similar format for easy comparison:

![Figure 1: From Remote Sensing Systems (RSS) in California.](www.junkscience.com/MSU_Temps/RSSglobe.html)
The main features of both global satellite temperature records are:

- An unusually large El Nino spike in 1998. During an El Nino surface temperatures are high for about a year then come back to their previous level.
- A large El Nino spike in 2010, that peaked in January to March and is now (July 2010) on the way back down.
- A slightly cooling trend from about 2002.

The El Nino spikes complicate the picture, obviously. Notice that the large 2010 El Nino is slightly cooler than the large 1998 El Nino, which has never been surpassed. So it is correct to say that “global (surface) temperatures have been level to declining since 1998”. Even simpler to say there has been “no warming since 1998”.

A leading warmist, Dr. Phil Jones, Director of the Climate Research Unit (CRU) at the University of East Anglia (UEA) in the UK, in a recent interview on the BBC, agreed that “from 1995 to the present there has been no statistically-significant global warming”\(^3\) (that is, over the last 15 years). Jones also pointed out that it has been cooling since 2002, but that this trend was too short to be statistically significant.

**WHY WARMISTS PREFER LAND-BASED THERMOMETERS**

What’s the story with the land-based thermometers, and why do warmists persist in quoting them? Part of the answer is that satellite-based temperatures only go back to 1979, but the main part is pure spin – the land-based thermometers show more warming, and *that’s not by accident*.

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\(^3\) BBC interview February 2010: [news.bbc.co.uk/2/hi/8511670.stm](http://news.bbc.co.uk/2/hi/8511670.stm).
Land-based thermometers are frequently compromised by the *urban heat island* effect—the microclimate around a land-based thermometer can change due to urban encroachment, such as nearby asphalt, concrete, buildings, air conditioners, cars, electrical appliances, or changes in vegetation.

Global warming is measured in tenths of a degree per century, so any little artificial nudge to the thermometer is important.

![Cell Tower](Image)

*Figure 3:* The land-based thermometer at Marysville California, used to gather official temperature data. The thermometer is in the “MMTS Shelter”; it gets extra warming from car engines in the parking bays, air conditioners, asphalt, wind breaks, and even a cell transmitter. [www.surfacestations.org](http://www.surfacestations.org).

Anthony Watts, a 25-year broadcast meteorology veteran, recruited 650 volunteers to inspect and document the 1,221 land-based thermometers overseen by the National Oceanic and Atmospheric Administration (NOAA) in the US. Of the 860 thermometers inspected by early 2009, 89% fail to meet NOAA's *siting requirements* that they be more than 30 meters from an artificial heating or radiating/reflecting heat source.4

**Why don’t NOAA move their thermometers or put new ones in proper locations (level, open clearings over ground that is typical of the region)? Why do they persist in measuring the official temperature record from thermometers near air conditioner outlets?**

Tough measures are being proposed to curb emissions, so measuring temperatures is crucial to the economy. Yet NOAA are doing a conspicuously poor job—if they are trying accurate measure temperature in the US. The annual budget for NOAA is over $4 billion5, so money is hardly the issue.

Let’s turn to the *global* land-based data. It comes from 1,079 land-based thermometers (134 of them in the US from the NOAA network above), more than half of which are at airports—typically near tarmac, and often in the exhaust of planes.6 Could they perhaps be measuring the growth in air traffic more than temperature?

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Another problem with land-based thermometer data are the welter of adjustments made to the raw data, the vast majority of which increase the appearance of recent warming. For example, at Darwin in Australia, part of the global official land thermometer network, the adjustments turn a century of mild cooling into a century of strong warming:

Figure 4: Ciampino Airport in Rome, Italy. The two thermometers (in the Stevenson screens) get affected by planes, the tarmac, and the truck parking lot.

Another problem with land-based thermometer data are the welter of adjustments made to the raw data, the vast majority of which increase the appearance of recent warming.

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Figure 5: The raw (blue) temperature data at Darwin airport had adjustments (black) added to make the official temperature record (red). Official reasons for the adjustments are not given, but include issues like moving the thermometer site and missing records. wottsupwiththat.com/2009/12/08/the-smoking-gun-at-darwin-zero.

Because it comes from sites with individual histories and problems, land-based thermometer data is endlessly “adjustable”. The adjustments and the reasons for them are not made public, and there is no body or organization to check or audit the adjustments. The problems discussed here are just those in the US and Australia: reported problems elsewhere appear worse, especially in Siberia and China.

The adjustments and the reasons for them are not made public, and there is no body or organization to check or audit the adjustments.

So what are the effects of all these thermometer shenanigans? One of the two main surface-thermometer-based global temperature records is the GISS record:
Figure 6: From the Goddard Institute for Space Studies (GISS) at NASA, run by Jim Hansen, the “father of global warming”. From land-based thermometers and a few ocean thermometers, but no satellite data (despite the “Space” in GISS).  


This is the global temperature data the warmists like to use. Notice the differences with the satellite data:

- The warmest year appears to be 2006, not 1998.
- The warming trend appears to continue through 2010.

Given all the problems with the land-based thermometers, how do we know it has actually warmed at all in the last 60 years? The US has the widest and highest quality land-based thermometer network in the world; here is the land-based temperature record for the US from GISS:
Looks like warming in the US over the last century, right? But here are the adjustments made to the raw data by NOAA in order to get that temperature record:

The adjustments to the raw data in 1934 were minimal, but by 2000 the raw data was “corrected” upward by about 0.3°C. Yet the smoothed US temperature reported by GISS was only 0.2°C higher in 2000 than in it was in 1934. So the smoothed raw temperature was 0.1°C higher in 1934 than it was in 2000! Without the “adjustments”, the GISS picture of rising temperatures in the USA over the century largely vanishes. For the rest of the world— who knows?
In science, data should be verifiable and open. The satellite data is taken from two independent sources, and they agree. But the land-based temperature is corrupted by the urban heat island effect and other problems, and the all-important adjustments are kept from public scrutiny. The land-based record now disagrees significantly with the satellite record, and the political implications of the two records are quite different.

**NO RECENT OCEAN WARMING EITHER**

Most of the heat in the climate system (water, air, ice, and snow) is stored in the oceans, so the ocean temperature is a better indicator of climate change than the air temperature. But measuring ocean temperature globally is harder than it sounds. The Argo network finally overcomes many of the problems, but only became operational in mid-2003.

Before Argo, starting in the early 1960s, ocean temperatures were measured with bathythermographs (XBTs). They are expendable probes fired into the water by a gun, that transmit data back along a thin wire. They were nearly all launched from ships along the main commercial shipping lanes, so geographical coverage of the world’s oceans was poor—for example the huge southern oceans were not monitored. XBTs do not go as deep as Argo floats, and their data is much less accurate. 

![Figure 9: The Argo network has floats measuring temperature in all of the oceans.](www.argo.ucsd.edu/About_Argo.html)

The Argo network consists of over 3,000 small, drifting oceanic robot probes, floating around all of the world’s oceans. Argo floats duck dive down to 1,000 meters or more, record temperatures, then come up and radio back the results.

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Figure 10: An Argo float descends to cruising depth, drifts for a few days, ascends while recording temperatures, then transmits data to satellites. www.argo.ucsd.edu/smo.html.

The Argo data shows that the oceans have been in a slight cooling trend since at late-2004:

Figure 11: The ocean heat content from mid 2003 to early 2008, as measured by the Argo network, for 0 – 700 meters. The unit of the vertical axis is 10^{22} Joules (about 0.01°C). This shows the recalibrated data, after the data from certain instruments with a cool bias were removed (initial Argo results showing strong cooling). Seasonal fluctuations are because the oceans are mainly in the southern hemisphere. Source: www.ncasi.org/publications/Detail.aspx?id=3152 (Figure 1a), plus private correspondence with the author on the depth and the smoothing.
Josh Willis of NASA’s Jet Propulsion Laboratory, in charge of the Argo data, said in March 2008 on NPR\textsuperscript{9}: “There has been a very slight cooling, but not anything really significant”.

The ocean data that the warmists are relying on to establish their warming trends is all pre-Argo; it all comes from the old, less accurate XBTs. Now that we are measuring ocean temperatures properly, the warming trend has disappeared. And by coincidence, it disappeared just when we started measuring it properly! There is a large ocean temperature rise reported in the two years before Argo became available—might there have been a calibration problem between the old data and the Argo data? Could the old ocean temperature data have been subject to “corrections”, like the GISS air temperature data?

The Argo data originally showed a strong cooling trend. Josh Willis was surprised at the results\textsuperscript{10}: “everybody was telling me I was wrong”, because it didn’t agree with the climate models or satellite observations of net radiation flux. (By the way, Willis, who has written a paper with the father of alarmism James Hansen, had an “eye-opening” brush with Rush Limbaugh over the original data.\textsuperscript{11}) Willis decided to recalibrate the Argo data by omitting readings from some floats that seemed to be giving readings that were too cold. The Argo results shown above are for the new, current data, after those recalibrations were made.

There is a problem with data in the politicized world of climate science: alarmists have all the authority positions in climate science and own (manage) all the datasets. Datasets that contradict the warmist theory have a habit of being recalibrated or otherwise adjusted for technical reasons, and the changes to the datasets always make them more supportive of the theory of man-made global warming. It has happened several times now—but by chance alone you would expect technical adjustments to make the data less supportive of any given position about half the time. Don’t be surprised if the Argo data for the last few years is “revised” at some stage to show warming instead of slight cooling.

Finally, the Argo data is extraordinarily difficult to find on the Internet: there is no official or unofficial website showing the latest global ocean temperature. (There is some raw Argo data on the Internet, but the computations to move from there to the global temperature are complex. Basically the only way to get the data is to ask Josh Willis (above). The graphs above come from Craig Loehle, who got the data from Willis, analyzed it, and put the results in a peer reviewed paper available on the Internet.)

\textsuperscript{10} [earthobservatory.nasa.gov/Features/OceanCooling/page2.php](earthobservatory.nasa.gov/Features/OceanCooling/page2.php).
\textsuperscript{11} [www.usclivar.org/Newsletter/V6N2.pdf](www.usclivar.org/Newsletter/V6N2.pdf).
If the Argo data showed a warming trend, don’t you suppose it would be publicized endlessly?

THE LAST THOUSAND YEARS

Michael Mann’s hockey stick graph is the most prominent and persuasive graph in the global warming debate, and it appeared six times in the IPCC’s Third Assessment Report in 2001:\(^\text{12}\)

\[\text{Figure 12: Michael Mann’s hockey stick, from 1998. For the northern hemisphere. Reconstruction from tree rings in blue, thermometer record in red. cdiac.ornl.gov/epubs/ndp/ushcn/ndp019.html.}\]

It is however quite wrong, and it did not appear at all in the IPCC’s Fourth Assessment Report (the next, in 2007).\(^\text{13}\)

In 2006 the US Congress requested a committee chaired by prominent statistician Edward Wegman to look into Mann’s hockey stick graph. From the findings: \(^\text{14}\)

\(^{12}\) www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar.

\(^{13}\) www.wmo.int/pages/partners/ipcc/index_en.html.

\(^{14}\) www.probeinternational.org/old_drupal/UrbanNewSite/WegmanReport%5B3%5D.pdf, pages 4-5.
“In general, we found [Mann’s methods] to be somewhat obscure and incomplete and the criticisms [by their main critics] to be valid and compelling. ... It is important to note the isolation of the paleoclimate community; even though they rely heavily on statistical methods they do not seem to be interacting with the statistical community. Additionally, we judge that the sharing of research materials, data and results was haphazardly and grudgingly done. In this case we judge that there was too much reliance on peer review, which was not necessarily independent. Moreover, the work has been sufficiently politicized that this community can hardly reassess their public positions without losing credibility. Overall, our committee believes that Mann’s assessments that the decade of the 1990s was the hottest decade of the millennium and that 1998 was the hottest year of the millennium cannot be supported by his analysis.”

The first problem was that although Mann used a large number of tree-ring series, his statistical method ignored anything that was not hockey-stick shaped. The second problem was that the most influential tree ring data in his graph are from bristle-cone pines, which are known to have had a growth spurt in the twentieth century for reasons unconnected to climate.¹⁵ Even using tree rings is problematic, because tree growth depends heavily on water and manure/minerals, as well as on temperature.

(There are also other, minor hockey sticks, similar graphs produced by warmist scientists. The next most prominent was by Briffa, who refused to divulge his tree ring data for 10 years. When finally revealed, his data showed that his hockey stick was based just on a small number of trees in the Yamal peninsula of northern Russia, and relied almost entirely on one freak tree for the blade of the hockey stick—perhaps that special tree found a source of manure and had a growth spurt?¹⁶)

We first mentioned the hockey stick and explained why it is wrong because belief in such a temperature picture is still quite widespread, due to its very widespread distribution a decade ago.

So what does the last thousand years of global temperatures really look like? Using all the available global temperature proxies except for tree rings (namely sediments, boreholes, pollen, oxygen-18, stalagmites, magnesium to calcium ratios, algae, cave formation, etc.) over a wide geographical range:


Notice that the world has been warming since about 1750, and we are almost back to the global temperature of early medieval times.

**The Theory of Man-Made Global Warming Fails Due to Timing**

The theory of man-made global warming attributes global warming mainly to human emissions of carbon dioxide. Simply comparing the timing of our emissions to rises and falls in temperature show that the theory has almost no explanatory power:

Figure 14: Emissions of carbon by humans (the mass numbers are for the carbon in the emitted carbon dioxide). [cdiac.ornl.gov/trends/emis/tre_glob.html](http://cdiac.ornl.gov/trends/emis/tre_glob.html).
The vast bulk of human emissions occurred after 1945, during post-WWII industrialization. Half of all human emissions have occurred since the mid 1970s.

- Temperatures have been rising since 1750 (Figure 13), but human emissions were negligible before 1850. So the theory does not explain global warming.

- Human emissions have been rocketing up ever faster since 1998, but it has not warmed since 1998 (Figures 1 and 2, and leading warmist Dr Phil Jones—“from 1995 to the present there has been no statistically-significant global warming”). So the theory does not explain global cooling episodes.

- The rate of global warming in 1860-1880, 1910-1940 and 1975-1998 were “similar and not statistically significantly different from each other” (Dr Phil Jones again), yet human emissions were vastly different in those periods. So the theory does not explain the rate of warming either.

Leading warmist scientist Kevin Trenberth said in one of the ClimateGate emails, \(^{19}\)

> “The fact is that we can’t account for the lack of warming at the moment, and it is a travesty that we can’t. The CERES data published in the August BAMS 09 supplement on 2008 shows there should be even more warming: but the data are surely wrong. Our observing system is inadequate.”

While human emissions of carbon dioxide theoretically must have some effect on global temperature, it is obviously a smaller effect than whatever other forces are warming and cooling the climate.

**WARMING FOR THE LAST TWO CENTURIES IS A RECOVERY FROM THE LITTLE ICE AGE**

The global temperature has been rising at a steady trend rate of 0.5°C per century since the depths of the little ice age in the 1700s (when the Thames River would freeze over every winter; the last time it froze over was 1804).

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\(^{17}\) BBC interview: [news.bbc.co.uk/2/hi/8511670.stm](http://news.bbc.co.uk/2/hi/8511670.stm) (as per footnote 3).

\(^{18}\) BBC interview: [news.bbc.co.uk/2/hi/8511670.stm](http://news.bbc.co.uk/2/hi/8511670.stm) (again).

\(^{19}\) [www.wired.com/threatlevel/2009/11/climate-hack](http://www.wired.com/threatlevel/2009/11/climate-hack). Trenberth is saying this in a context where he believes global warming is still occurring, but is bemoaning that no one can measure it!
On top of the trend are oscillations that last about thirty years in each direction:

1860 – 1882  Warming
1882 – 1910  Cooling
1910 – 1944  Warming
1944 – 1975  Cooling
1975 – 2001  Warming

Figure 15: The instrumental global temperature record goes back to about 1880. It can be thought of as a steady linear trend with oscillations. Insight and graph from Dr Syun Akasofu. In 2009 we are where the green arrow points. people.iarc.uaf.edu/~sakasofu/pdf/two_natural_components_recent_climate_change.pdf.

The pattern suggests that the world has entered a period of slight cooling until about 2025 – 2030. There was a cooling scare in the early 1970s at the end of the last cooling phase. The current global warming alarm is based on the last warming oscillation, from 1975 to 2001. The IPCC predictions simply extrapolated the last warming as if it would last forever, a textbook case of alarmism. However the last warming period ended after the usual thirty years or so, and the global temperature is now definitely tracking below the IPCC predictions.

The oscillations are thought to be associated with an ocean phenomenon called the “Pacific Decadal Oscillation”.

The pattern suggests that the world has entered a period of slight cooling until about 2025 – 2030.
CONCLUSION

Global temperatures as measured by our best and least biased means, satellites and the Argo network, have been flat to slightly down over the last decade. Consequently, the bandwagon built around the theory of man-made global warming is stalling. The 2009 *State of the Climate* report is an attempt by climate authorities to browbeat the public and politicians.

*While people outside the climate establishment may not understand climate science, they do understand cheating.* As the world becomes familiar with photographs of official thermometers near air conditioning outlets and in the backwash of jet airplanes, let alone the many tricks played by the climate science establishment, the public are becoming increasingly angry.

The 2009 *State of the Climate* report is just another authoritarian attempt to hoodwink the public. If the report was really trying to explain what was going on it would have been simple, direct, easy to understand, it would have included satellite temperatures and Argo results—and it would have admitted, as leading warmist Dr. Phil Jones, Director of the Climate Research Unit at the University of East Anglia in the UK, did recently\(^\text{20}\): “from 1995 to the present there has been no statistically-significant global warming”.

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\(^{20}\) BBC interview February 2010: [news.bbc.co.uk/2/hi/8511670.stm](http://news.bbc.co.uk/2/hi/8511670.stm).
COMMENTS ON NOAA’S 2009 CLIMATE REPORT

by Christopher Monckton  |  August 2, 2010

SUMMARY FOR POLICY MAKERS

The US National Oceanographic and Atmospheric Administration and the UK Meteorological Office joined forces in July 2010 to publish The State of The Climate, 2009, whose central argument was that a dozen separate indicators showed that the world has been getting warmer, and that the decade from 2000-2009 had been the warmest on record.

Dr. Peter Stott, of the UK Meteorological Office, who was an author of the report, told the news media that seven indicators were rising: air temperature over land, sea-surface temperature, marine air temperature, sea level, ocean heat content, specific humidity, and tropospheric temperature in the active-weather layer of the atmosphere closest to the Earth’s surface. Four indicators were declining: Arctic sea ice, glaciers, spring snow cover in the northern hemisphere, and stratospheric temperatures. “The whole of the climate system is acting in a way consistent with the effects of greenhouse gases. ... The fingerprints are clear. The glaringly obvious explanation for this is warming from greenhouse gases.”

The report was not peer-reviewed: it was merely published as a supplement to the Bulletin of the American Meteorological Society. Like the reports of the UN’s climate panel, the IPCC, to which it is presented as an update, it has not been independently scrutinized by competent and qualified reviewers who have the power to require inaccuracies or inappropriate conclusions to be corrected.

If the report had been properly peer-reviewed, the reviewers would surely have criticized it on the following grounds:

- The authors perpetrated the elementary (and, in climate science now near-universal) logical fallacy of assuming that, merely because they had failed to consider any other explanation for recent “global warming”, the only possible explanation was mankind’s emission of CO2 though burning fossil fuels;
- The authors carefully selected only those temperature indicators that suited their desired conclusion, carefully excluding those pointing the other way;
- The authors carefully chose data periods that suited their desired conclusion;
- The authors carefully ignored natural explanations for recent global warming.
THE CLIMATE SCIENTIST’S ARGUMENTUM AD IGNORANTIAM

Dr. Stott, whose testimony in support of the supposed accuracy of Al Gore’s movie *An Inconvenient Truth* did not impress the judge in 2007, when the High Court found that the movie contained nine serious “errors”, made the following unscientific statement to the news media in connection with the report:

“The whole of the climate system is acting in a way consistent with the effects of greenhouse gases. ... The fingerprints are clear. The glaringly obvious explanation for this is warming from greenhouse gases.”

Neither Dr. Stott nor the NOAA/Met Office climate report for 2009 provides any evidence in support of this proposition, except to the trivial and altogether insufficient extent that increasing greenhouse-gas concentrations in the air are expected to cause “global warming”, and that some “global warming” has occurred.

Dr. Stott’s statement of belief is an instance of the climate scientist’s *argumentum ad ignorantiam*, the logically-fallacious and too-frequently-deployed claim that because the scientist does not know of (or elects carefully to ignore) any natural explanation for “global warming”, that warming must have been caused by greenhouse gases.

The logical fallacy known as the argument from ignorance – the notion that a proposition must be true because it has not been proven false or vice versa – is one of the dozen central fallacies of logic propounded by Aristotle almost 2500 years ago. Such fallacies – and particularly the notorious *argumentum ad ignorantiam* – exercise a powerful effect on the minds of those not trained to recognize them.

Any policymaker minded to give credence to the NOAA/Met Office report, or to the widely-quoted apercus of Dr. Stott, should consider the extent to which climate science has provided a rigorous demonstration of his statement to the effect that the world is warming and that mankind is to blame. To prove Dr. Stott’s hypothesis, it would be necessary for climate science to demonstrate that all of the following propositions are true –

1. The world has been warming.
2. The warming commenced when Man’s influence commenced.
3. Today’s absolute global mean surface temperature is unprecedented.
4. The rate at which “global warming” is occurring is unprecedented.
5. The pattern of warming is consistent only with anthropogenic causes.
6. Observed warming is as great as the anthropogenic theory predicts.
7. No natural causes that could explain the warming have been identified.

Let us examine each of these propositions seriatim, using the publicly-available data and the peer-reviewed sources: papers published in the learned literature. We shall refer to the non-peer-reviewed IPCC documents only as sources for inaccuracies, and for the formulae that policymakers currently (and, as we shall see, unwisely) rely upon to predict how much manmade “global warming” may occur in future.
HAS THE WORLD BEEN WARMING?

The global instrumental temperature record dates back only 160 years, to 1850. The version used by the UN’s climate panel is that of the UK Hadley Centre and the Climatic Research Unit of the University of East Anglia:

The linear temperature trend, shown in red, is at +0.4 Kelvin (+0.7 F°) per century. Over the 155 years 1850-2005, therefore, the temperature increase was 1.1 F°. We shall consider later the extent to which this rate of warming is consistent with the change in CO2 concentration over the period. From 2005-2010, global temperature fell somewhat. Therefore, the world has indeed been warming, but total “global warming” over the 160-year period of the instrumental record has been little more than 1 F°.

DID WARMING BEGIN WHEN MAN’S INFLUENCE BEGAN?

The anthropogenic influence on climate is generally taken to have begun in 1750, at the time of the industrial revolution. At that time, atmospheric CO2 concentration is thought to have been approximately 278 parts per million by volume.

However, the current “global warming” trend began in 1695, towards the end of the 70-year period of exceptionally low solar activity known to astronomers as the “Maunder Minimum”. Between 1645 and 1715 very few sunspots were observed: so few, in fact, that astronomers refer to the Maunder Minimum as a “solar Grand Minimum”. During this Grand Minimum, the Sun’s activity – as measured by the number of visible sunspots – is thought to have been less than during any previous similar period in the 11,400 years since the sudden end of the Younger Dryas cooling event that ushered in the current or Holocene warm period:
The smoothed sunspot number (from Hathaway, 2004: vertical axis) was negligible throughout the Maunder Minimum. However, thereafter the sunspot number, which fluctuates on a cycle approximately 11 years long, giving the characteristic dogtooth shape of the graph, rose rapidly, reaching a peak in the 70 years 1925-1995. During that solar Grand Maximum, the Sun’s activity was almost at its greatest in 11,400 years. This rapid increase in solar activity was matched by a rapid global warming: indeed, in the 40 years 1695-1735 the temperature in central England (the oldest instrumental temperature record in the world, which had commenced in 1659) rose by 4 °F, a rate that has not been matched since.

Since this rapid warming was natural, and since by that time the central England thermometers were reasonably reliable, and since temperature changes in that region tend to match global changes, it is possible that that very rapid warming rate – or something approaching it – occurred globally. And yet Man cannot have been to blame for that very rapid warming, because the Industrial Revolution did not begin until 35 years after the end of the 40-year period of rapid warming.

Therefore, the current period of “global warming” began in 1695: but Man’s influence cannot have commenced until more than half a century later, suggesting the possibility that there are sufficient natural influences on the climate, possibly including the Sun, to cause substantial changes such as the 4 °F warming in 40 years observed in Central England. The answer to the question whether “global warming” began when Man’s influence on the climate began is No.
**IS TODAY’S ABSOLUTE TEMPERATURE UNPRECEDENTED?**

The Hadley Centre’s graph showing the global instrumental record shows that temperatures have indeed been greater in the past decade than in any previous decade since 1850. However, after 300 years of “global warming”, during all but the last 30 of which mankind cannot have been significantly responsible, it is not surprising that the highest temperatures in the 160-year global instrumental record are in the past decade.

Furthermore, 160 years is a very short time in the history of our planet. Temperatures have been considerably warmer in the past. Indeed, we only have to go back as far as the medieval warm period, around 800-1000 years ago, to find plenty of evidence in the peer-reviewed literature that the world was warmer then than it is today:

The above temperature reconstruction, obtained from ratios of oxygen-18 to oxygen-16 isotopes in an Antarctic ice-core (Cuffey & Clow, 1997), shows that today’s surface temperature (at left: vertical axis represents a span of 5 C° or 9 F°) is just about the lowest in 10,000 years. In particular, the temperature peaks of the medieval, Roman, Minoan, and Holocene climate optima can be seen 800, 2000, 3000, and 7000-9000 years ago respectively. Today’s temperatures, therefore, are certainly not unprecedentedly high, but – on the evidence of this graph – have not been so low since 10,000 years ago.
IS THE RATE OF “GLOBAL WARMING” UNPRECEDENTED?

The headline graph in the IPCC’s 2007 Fourth Assessment Report, reproduced thrice, large, and in full color in the report, purports to show that the rate of “global warming” has been increasing, and the report states that the reason for the increasing rate of warming is the increased concentration of CO\textsubscript{2} in the atmosphere:

The multiple trend-lines on the graph are intended to show that the linear-regression temperature trends beginning 150, 100, 50, and 25 years ago become progressively steeper as the starting-point comes closer to the present. However, the graph is bogus. The global temperature trend is stochastic, from the Greek word στόχος, meaning “a guess”): it rises and falls in an apparently random fashion, so that one cannot guess which way it will go next. Accordingly, arbitrary selection of start-points or end-points for multiple trend-lines, followed by the drawing of conclusions as to the tendency of the data by reference to the relative slopes of the trend-lines, is an impermissible statistical technique.

If we were to deploy the same technique, but choosing our own arbitrary start-points and end-points, we could demonstrate that the rate of “global warming”, far from accelerating, is in fact decelerating. If we were to start two trend-lines from 1905, carrying one of them forward to 1945 and the other to 2005, the trend-line ending in 2005 would indicate warming half as great as that shown by the line ending in 1945:
We have used the same technique on the same data, but we have come to a conclusion precisely opposite to that which the IPCC had drawn. Is the IPCC right, or are we right? The answer, of course, is that we are both wrong. The technique will produce opposite results depending upon the careful choice of start-points and end-points. It is thus an impermissible technique. Here is the true position:

The three periods of most rapid warming in the global instrumental record – 1860-1880, 1910-1940, and 1975-2001 – show parallel (and hence identical) warming rates at 0.16 °C/decade. There has been no recent increase in the warming rate.
**IS THE PATTERN OF WARMING CONSISTENT WITH THE RATE OF INCREASE IN MAN’S INFLUENCE ON THE CLIMATE?**

There appears to be a cyclical period of rapid warming every 60 years or so, followed by a period of stasis or even cooling. This cycle (upper panel) appears aligned with the warming (red) and cooling (blue) phases of the Pacific Decadal Oscillation Index (center panel), a pattern of naturally-occurring ocean currents:
However, the cycles of warming and cooling do not match the profile of changes in atmospheric CO₂ concentration (ppmv: lower panel), which has been increasing near-monotonically (i.e. each year's concentration is a little higher than the previous years) throughout the 20th century.

In logic, a correlation between two datasets does not necessarily imply causation. Therefore, we may not assume that, merely because the cycles of global temperature change are correlated with the cycles of observed change in the Pacific Decadal Oscillation Index, the latter causes the former (or vice versa). It may be, for instance, that a third force causes both measurements to change simultaneously, or that the correlation is merely coincidental.

Could CO₂ concentration change be the force that drives the cycles of temperature change and of the Pacific Decadal Oscillation Index? No, because in logic the absence of correlation necessarily implies absence of causation. CO₂ concentration changes monotonically, while temperature changes stochastically. It is accordingly impossible for changes in CO₂ concentration to have caused the cyclical ups and downs in the global temperature record.

In a second major respect, the pattern of observed warming simply fails to match the pattern of warming predicted by the computer models so heavily relied upon by the IPCC. In its 2001 Third Assessment Report, as the following altitude-vs.-latitude plots of computer-model-predicted temperature change demonstrate, it was predicted that the atmospheric fingerprints of solar and anthropogenic greenhouse forcings should be broadly identical in the troposphere, with doubling or tripling of the tropical surface warming rate at altitude in the tropics (the tropical upper-troposphere “hot-spot”)

The graphs show computer-predicted fingerprints of temperature change by latitude (horizontal axis) and altitude (vertical axis: measured in hectoPascals of partial pressure) for solar forcing (left) and anthropogenic greenhouse-gas forcing (right).
However, by the 2007 IPCC report, a Dr. Santer of the Lawrence Livermore National Laboratory in the US had updated a paper of 2000 in which he had predicted that solar forcing, in panel (a) at top left below, would lead to a near-uniform distribution of temperature change throughout the tropical troposphere, with no warming differential between the surface and the mid-troposphere (i.e., no “hot-spot”), while anthropogenic greenhouse-gas forcing, in panel (c) at middle left, would exhibit a strong “hot-spot” in the tropical upper troposphere, with warming at close to thrice the surface warming: a pattern so dominant that it would persist even when five separate forcings were combined, in panel (f) at bottom right. The IPCC adopted Dr. Santer’s result as its own –

The graph shows modeled zonal mean atmospheric temperature change (Kelvin/century, 1890-1999) from five distinct forcings (a-e), and from all forcings combined (f). Altitude is in hectoPascals (left scale) and km (right scale) vs. latitude (horizontal axis).

Indeed, all of the models on which the UN relies predict that most of the atmospheric warming that arises from greenhouse-gas enrichment of the atmosphere will occur about six miles up in the tropical upper troposphere. At that altitude, the warming rate is predicted to be 2-3 times that at the tropical surface (Lee et al., 2007) –
The graph, from Lee et al. (2007) shows Zonal mean equilibrium temperature change in Kelvin at a doubling of CO₂ concentration (2x CO₂ – control), as a function of latitude and pressure in hectoPascals for four general-circulation models. All show the projected fingerprint of anthropogenic greenhouse-gas warming: the tropical mid-troposphere “hot-spot” is projected to warm at twice to thrice the surface rate.

Four of the UN’s computer models, shown above, predict the “hot-spot’s” presence. However, the model-predicted tropical upper-troposphere “hot-spot” does not occur in reality, as Figure 8 shows. It has not been observed in 50 years of radiosonde and drop-sonde measurements. It has not been observed in 30 years of satellite observations. It has not been observed at all. It is not there (HadAT, 2006) –
The Hadley Centre’s graph shows an altitude-vs.-latitude plot of observed relative warming rates in the satellite era. The greater rate of warming in the tropical mid-troposphere that is projected by general-circulation models is absent in this and all but one other observational datasets, whether satellite or radiosonde. Altitude units are hectoPascals (left) and kilometers (right).

In a lecture given in 2008, Professor Lindzen of MIT concluded from the absence of the “hot-spot” that –

“... A doubling of CO₂ leads to surface warming of from about 1.5-3.5 C. By contrast, the observed warming over the past century or so amounts to only about 0.6-0.8 C (not all of which need be due to increased greenhouse gases). ... Using basic theory, modelling results and observations, we can reasonably bound the anthropogenic contributions to surface warming since 1979 to a third of the observed warming, leading to a climate sensitivity too small to offer any significant measure of alarm ...”.

In short, the absence of the model-predicted “hot-spot” requires us to divide the UN’s climate-sensitivity estimates by at least 3. Lindzen’s result is in line with that of Scafetta & West (2008), who attribute more than two-thirds of the past half-century’s “global warming” to the Sun.

Douglass et al. (2008) analyzed a dozen different radiosonde and satellite tropical-troposphere datasets, and concluded that the “hot-spot” that Santer and hence the IPCC had determined was the characteristic signature or fingerprint unique to anthropogenic greenhouse warming was not present in any of them. This result was a grave threat to the IPCC’s contention that recent warming must be attributed chiefly to anthropogenic factors. So important was this issue that the US Climate Change Science Program devoted its first lengthy report to a discussion of the discrepancy, concluding that it was possibly attributable to uncertainties in measuring upper-troposphere temperatures. In short, the theoretical computer models that predicted the actually-absent “hot-spot” were preferred to the real-world data.
Dr. Santer swung into action again. First, he and his fellow Climategate emailers conspired with journal editors to prevent publication of the Douglass et al. paper for a year, so that a new dataset could be fabricated with the objective of showing that – contrary to all the other datasets – the tropical upper-troposphere “hot-spot” might perhaps be present after all. Dr. Santer and various fellow-emailers then set about writing a paper unfairly excoriating Professor Douglass and his colleagues for having displayed error-bars on their graphs of model predictions that were too narrow, given that some of the models had only been run once.

Repeatedly in the Climategate emails, Dr. Santer snidely condemned Professor Douglass and his colleagues for having perpetrated a “fundamental statistical error”, which he, Dr. Santer, had heroically pointed out in a rebuttal paper that – thanks to the delay he and his conspirators had occasioned in the publication of Professor Douglass’ paper – appeared almost at the same date as theirs.

However, as is so often the case when the venomous stridency of the Climategate conspirators in condemning diligent researchers who dare to disagree with them reaches a painful pitch of screeching, the bluster conceals the fact that the “fundamental statistical error” is simply irrelevant to the question in hand. The truth is that the models are so unreliable that the error-bars applicable to their outputs are so wide as to be meaningless: Dr. Douglass and his colleagues could, with perfect justification, have omitted them altogether from their paper without in any way undermining the strength of its conclusion, which was that all tropical-temperature datasets obtained by real-world measurement showed that the model-predicted characteristic fingerprint of anthropogenic “global warming” in the form of the tropical upper-troposphere “hot-spot” is simply absent in observed reality.

In this crucial respect, the Douglass paper is fatal to the IPCC’s theory. By questionable methods, as he has done before, Dr. Santer has attempted to rescue the situation for the IPCC: but all the datasets except that which appears to have been brought into being specifically for Dr. Santer’s paper (and which had not been published in any peer-reviewed journal before Dr. Santer found it expedient to rely upon it) show that the IPCC is wrong.

Whatever caused the “global warming” that ceased in the late 1990s, it was not us. The warming, such as it has been, does not fit the predicted fingerprint of Man.

**IS THE OBSERVED RATE OF WARMING CONSISTENT WITH THE RATE OF INCREASE IN MAN’S INFLUENCE ON THE CLIMATE?**

However, the possibility remains that the long-run uptrend in temperatures might have been influenced to some extent by the long-run increase in CO2 concentration. We test that proposition by using the IPCC’s own function for determining the amount of “global warming” to be expected from any given change in CO2 concentration.

During the 160-year global instrumental temperature record, temperature has risen by 1 F°, and CO2 concentration has risen from about 290 ppmv in 1850 via 305 ppmv in 1950 to 390 ppmv today. That is an increase of 15 ppmv from 1850-1950 and 85 ppmv from 1950-2010.
In Fahrenheit degrees, the warming $\Delta T$, that is to be expected from increases in CO$_2$ concentration from $C_0$ to $C$ ppmv over a period of $y < 200$ years is given by the following equation:

$$\Delta T \approx 8.5 \ r \ \ln(C/C_0), \text{ where } r \approx 0.8 + y/1000$$

The variable $r$, the transience factor, makes an approximate allowance for the fact that the full warming from increasing CO$_2$ concentration does not arise at once.

Thus, if the IPCC’s estimate of how much warming CO$_2$ causes were correct, from 1850-1950 the global warming caused by CO$_2$ should have been 0.4 F°, and from 1950-2100 the warming should have been 1.8 F°: a total of 2.2 F° over the 160-year period.

However, no warming at all was observed from 1850-1950, and only 1 F° warming has been observed since then. It appears, therefore, that the IPCC’s predictions are at least doubling the warming to be expected from CO$_2$ concentration. Take away that exaggeration and the “global warming” problem disappears.

**HAS ANY NATURAL CAUSE OF RECENT WARMING BEEN FOUND?**

The final question is whether any natural cause of recent warming has been found. The answer is Yes.

Satellites first measured global surface temperature, cloud cover, and radiant-energy flux leaving the top of the atmosphere in the early 1980s. Pinker *et al.* (2005), finding agreement between those satellite records and the terrestrial data for the first time, reported a strong global brightening from 1983-2001, caused by a naturally-occurring decline in cloud cover. “Global brightening” means that, with fewer clouds in the way, more sunlight reached the Earth, particularly in the tropics. More sunlight means warmer weather.

The graph from Pinker’s paper shows a globally-averaged uptrend of +0.16 W m$^{-2}$ per year in the flux of short-wave solar radiation reaching the Earth’s surface over the 18 years 1983-2001.
Using the IPCC’s methods to determine how much warming this increase of almost 2.6 Watts per square meter in surface solar radiance ought to have caused, and including the predicted effects of CO₂ and other greenhouse gases as well, there should have been 2 F° of warming over the 18-year period. However, only 0.6 F° was observed. Once again, the IPCC’s methods seem to produce a very large exaggeration of the warming that is to be expected.

In any event, it is certainly not true to say – as the apologists for “global warming” catastrophe so often say – that there is no natural explanation for recent warming. There is a natural explanation.

**CONCLUSION**

We conclude that, though the world has been warming, and though the past six months were exceptionally warm because of the now-fading El Niño Southern Oscillation, the warming commenced long before Man’s influence commenced; today’s absolute global mean surface temperature is far from unprecedented, even in recent history; the rate at which “global warming” is occurring is considerably less than what was observed immediately before Man could have had any appreciable influence; the pattern of warming is in two major respect inconsistent with anthropogenic causes; recent observed warming has been only one-third to one-half great as the IPCC’s own theory would predict; and much of the recent warming is known to have been naturally caused.
CLAIM: WINTER SNOWCOVER IS DIMINISHING

This is a blatantly false claim as can be seen using NOAA’s own data as compiled by Rutgers Snow Lab.

The winter snow was claimed to be in decline. Here is the Northern Hemispheric data yearly since record keeping began in 1966. There is no trend (0.0/year).

![Northern Hemisphere Winter Snowcover Graph](image)

Here are the top 10 snowiest winters. 3 occurred in the top 5 this past decade. Number two snowiest was 2009/10, falling only behind 1977/78. 2007/08 was number 3 and 2002/03 was #4.
Here is last winter’s snowcover – with above normal snow for virtually the entire winter from early December through March (source FSU Hart).

The decadal snowcover during the winter months show the last decade had the greatest average snowcover.
The snowfall amounts set all time records in many locations.

In the northern United States and southern Canada, both 2007/08 and 2008/09 saw all time record seasonal snowfall records tumble. Caribou, ME, Concord, NH, Burlington, VT, Madison, WI, Spokane, WA and most all ski areas from the Pacific Northwest through the Rockies to the Great Lakes and northeast.
Spokane’s Top 5 Snow Years:
1 2008-2009 93.6
2 1949-1950 93.5
3 2007-2008 92.6
4 1974-1975 89.0
5 1992-1993 87.3

Another Snowy Winter 2008/09

Bismarck, North Dakota Snowiest Seasons

<table>
<thead>
<tr>
<th>Rank</th>
<th>Season</th>
<th>Snowfall Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1996-1997</td>
<td>101.6</td>
</tr>
<tr>
<td>2</td>
<td><strong>2008-2009</strong></td>
<td><strong>100.2</strong></td>
</tr>
<tr>
<td>3</td>
<td>1993-1994</td>
<td>91.8</td>
</tr>
<tr>
<td>4</td>
<td>1949-1950</td>
<td>86.8</td>
</tr>
<tr>
<td>5</td>
<td>1978-1979</td>
<td>83.0</td>
</tr>
<tr>
<td>6</td>
<td>1981-1982</td>
<td>80.3</td>
</tr>
<tr>
<td>7</td>
<td>1995-1996</td>
<td>80.1</td>
</tr>
<tr>
<td>8</td>
<td>1986-1987</td>
<td>67.9</td>
</tr>
<tr>
<td>9</td>
<td>1994-1995</td>
<td>67.1</td>
</tr>
<tr>
<td>10</td>
<td>1983-1984</td>
<td>66.5</td>
</tr>
</tbody>
</table>
2007/2008

In 2007/08, amazing snow amounts fell in many parts of North America:

- Alyeska, Alaska recorded 826” of snow
- Timberline in Oregon had 780” of snow
- Alta Ski Area in Utah has had 673”
- 8 Colorado ski resorts set new records this season. Snowmass, (450 inches), Beaver Creek (430 inches), Crested Butte (422 inches), Monarch Mountain (482 inches), Powderhorn (320 inches), Silverton (550 inches), Steamboat (489 inches) and Telluride (353 inches)
- Record snows in mountains of the northern New England from Maine to Vermont.

Michael Berry, President of the National Ski Areas Association told the AP that “This could very well be the record year” (it was).

Heavy snow also fell that winter or in 2008/09 in unusual places such as South China, the UK, Saudi Arabia, Iraq, Greece, South America (including Buenos Aires), South Africa (Johannesburg) and parts of Australia.

2009/2010

In China, the coldest weather since 1971 damaged winter wheat. Temperatures reached -2F in Beijing. In Mongolia heavy snows and the extreme cold killed up to 20 million livestock according to Sky News. The heaviest snowfall to hit northern China in nearly six decades stranding thousands of passengers on railways and at airports.
Russia's top weatherman announced that the winter now drawing to a close in Siberia may turn out to be the coldest on record. "The winter of 2009-10 was one of the most severe in European part of Russia for more than 30 years, and in Siberia it was perhaps the record breaking coldest ever," said Dr Alexander Frolov, head of state meteorological service Rosgidromet.

Statistics are still being analyzed in detail, but it is known that in western Siberia the mean temperature was minus 23.2°C, with more colder days than in previous years. Russia's top weatherman today announced that the winter now drawing to a close in Siberia may turn out to be the coldest on record. Some 63 days were colder than minus 25°C and 39 days below minus 30°C.

Many died in Eastern Europe and western Russia from the extreme cold. In China, the coldest weather since 1971 damaged crops and in Mongolia heavy snows and the extreme cold killed up to 20 million livestock according to Sky News.

England has turned back the clock to the early 1800s with cold and snow. In parts of Scotland it was the coldest December and January and for the second year in a row, England got significant snow. In the UK the winter was said to be the coldest since 1977/78 while in Scotland and northern Ireland, it was the coldest since 1962/63. Many other nations reported similar "coldest winter in decades". See [here](#) how worst snow on March 8 since 1962/63 brought Barcelona to a complete collapse.

New seasonal snow records were set in Philadelphia, Baltimore and Washington, DC and surrounding cities. (Source NOAA.)

<table>
<thead>
<tr>
<th>City</th>
<th>Snowfall (in)</th>
<th>Previous Record (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>79.9</td>
<td>62.5&quot; (1995-1996)</td>
</tr>
<tr>
<td>Washington (Dulles International Airport)</td>
<td>72.8</td>
<td>61.9&quot; (1995-1996)</td>
</tr>
<tr>
<td>Washington (Regan National Airport)</td>
<td>55.9</td>
<td>54.4&quot; (1898-1899)</td>
</tr>
<tr>
<td>Wilmington, Del.</td>
<td>66.7</td>
<td>55.9&quot; (1995-1996)</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>71.6</td>
<td>65.5&quot; (1995-1996)</td>
</tr>
<tr>
<td>Atlantic City, N.J.</td>
<td>49.9</td>
<td>46.9&quot; (1966-1967)</td>
</tr>
</tbody>
</table>

Dallas came within one half an inch of their seasonal record set in 1977/78. Des Moines Iowa had 69 inches for the season, right behind the 72 inch all-time record of 1911-12.

Although snowfall the last winter was slightly below normal in Boston, the recent decades have been the snowiest in the 130 year plus record. Note how the recent winters populate the top dozen. And the twelve year running mean reached a new period of record extreme in the period 1993/94 to 2004/05.
Boston’s Snowiest Winters
Season | Snowfall
---|---
1995-96 | 107.6
1873-74 | 96.4
1993-94 | 96.3
1947-48 | 89.2
2004-05 | 86.6
1977-78 | 85.1
1992-93 | 83.9
1915-16 | 79.2
1919-20 | 73.4
1903-04 | 73.1
1886-87 | 73
2002/03 | 71.3

Highest in the entire record 1993/94-2004/05 - 51.3”

Lowest in the entire record 1979/80-1990/91 – 32.2”
CLAIM: RELATIVE HUMIDITY IS INCREASING AS A RESULT OF GLOBAL GHG WARMING

Reality again is otherwise:

Data comes from a paper by Garth Paltridge as described here summarizing the Steve McIntyre posts [http://wattsupwiththat.com/2009/03/05/negative-feedback-in-climate-empirical-or-emotional/](http://wattsupwiththat.com/2009/03/05/negative-feedback-in-climate-empirical-or-emotional/).

CLAIM: OCEAN HEAT CONTENT INCREASING

Willis and Loehle have used Argo buoys to show otherwise.
CLAIM: ARCTIC CHANGES ARE DUE TO MAN-MADE GHGS

The arctic changes are cyclical and since the arctic doesn't suffer from contamination by urbanization, land use changes, bad siting, readings there are more accurate measures of temperatures than where the population is found. The Russians show how they compare.
Willie Soon has shown how temperatures in the arctic correlate far better with solar than CO2.

**The Sun is more likely the dominant driver of the recorded Arctic temperature variations**
In 2007, the NSIDC noted "Igor Polyakov at the University of Fairbanks, Alaska, points out that pulses of unusually warm water have been entering the Arctic Ocean from the Atlantic, which several years later are seen in the ocean north of Siberia. These pulses of water are helping to heat the upper Arctic Ocean, contributing to summer ice melt and helping to reduce winter ice growth."

"Another scientist, Koji Shimada of the Japan Agency for Marine–Earth Science and Technology, reports evidence of changes in ocean circulation in the Pacific side of the Arctic Ocean. Through a complex interaction with declining sea ice, warm water entering the Arctic Ocean through Bering Strait in summer is being shunted from the Alaskan coast into the Arctic Ocean, where it fosters further ice loss."

“Many questions still remain to be answered, but these changes in ocean circulation may be important keys for understanding the observed loss of Arctic sea ice.”

Frances et al. (GRL 2007) showed how the warming in the arctic and the melting was the result of warm water (+3C) in the Barents Sea moving into the Siberian arctic and melting the ice. Positive feedback of changed “albedo” due to open water enhances the warming.

I did a correlation with the warm and cold mode of the decadal oscillations in the Atlantic and Pacific and found this ocean involvement (using Polyakov’s temperatures):

**Smoothed version** – NASA claims to have better arctic coverage and that this June was very warm in the arctic. This is their June plot.

![Smoothed version](image)

However this was using 1200km smoothing. Steve Goddard on WUWT found that with 250 km smoothing, that NASA really has little arctic data.
The Danish Meteorological Institute does. Instead of the warm arctic, their real data shows it was one of the coldest June's in the record, with below normal (normal is green) temperatures.

CLAIM: TEMPERATURES ARE UNEQUIVOCALLY WARMING AND THE WARMEST EVER

Only in the heavily manipulated data with a substantial cooling of the pre 1980 period and a warming post 1990 which combined accounts for virtually all the changes observed the last century.
NOAA USHCN in 2000 was widely regarded as the world's best data set with stable 1221 stations and an adjustment for urbanization/land use changes. James Hansen correctly noted: “The US has warmed during the past century, but the warming hardly exceeds year-to-year variability. Indeed, in the US the warmest decade was the 1930s and the warmest year was 1934.”
However, this inconvenient fact was addressed by NOAA removing the urban heat island adjustment in 2007 resulting now in a very different view.

The changes resulted in a cooling of up to 0.1F in the early to mid 1990s and a warming exceeding 0.2F post 2000.

The raw record highs (50 states, 12 months) suggested the original NCDC UHCN was better. The 1930s was the warmest decade.
See much more detail in Surface Temperature Records, A policy Driven Deception?
The earth has been warming. The NOAA State of the Climate Report plays this up, but this fact has been well known for years, decades, or even longer. This is not a new finding by NOAA.

The earth emerged from a several-century-long cool period known as the Little Age Ice in the mid-1800s. The annual average temperature of the globe has generally (with natural fluctuations superimposed) been rising since.

Current global temperatures are likely about on par with (or perhaps a little above) temperatures during the height of the warm period known as the Medieval Warm Period that characterized the earth’s climate about a millennium ago. About 5,000 to 6,000 years prior to that, earth’s average temperature was also similar to current conditions for an extended period of several thousand years—a warm period known as the Holocene Climate Optimum.

Current global temperatures do not represent unprecedented conditions, nor do they indicate, as the press release from NOAA claims “that human society has developed for thousands of years under one climatic state, and now a new set of climatic conditions are taking shape.” Human societies have long battled the earth’s climate variability. Typically, our worst defeats have come from the hand of cold periods, while human societies have flourished during warm ones (as we are currently).

The role than human have played in the earth’s rising temperatures in recent decades is a complex one, and separating out individual human impacts—which may include land use changes, greenhouse gases, aerosol emission, and other environmental disturbances—from natural variability is not straightforward, if even achievable at all.

Inherent in this difficulty are the challenges of constructing an accurate history of the earth’s temperature—a task which is complicated by poor thermometer siting, local changes in the environment of the thermometer, a lack of consistent long-term observations, uneven distribution of observations, changing observing techniques, etc.—that, when taken together, add uncertainty to our understanding of how the earth’s temperature has evolved over the past century (our uncertainty is even greater for centuries prior).

While the earth has certainly been warming up, we lack the scientific understanding to confidently know the correct answers to questions like “How Much?” “Where?” “When?” and, perhaps most importantly, “Why?”

The NOAA State of the Climate Report downplays these uncertainties and what they may mean for the future.
The NOAA report does not adequately discuss how the lack of global temperature rise during the past 10-15 years may impact our understanding of how the temperatures should be expected to change in the future. For instance, ensemble climate model projections indicate that the earth should be warming faster than it has been observed to be. A potential explanation for this discrepancy is that climate models are too sensitive to changes in the greenhouse effect. Evidence for such a possibility has been accumulating both in the observations (i.e. lack of recent warming) and in model investigations (e.g. independent investigation being led by Dr. Roy Spencer and Dr. Richard Lindzen).

Climate models which are too sensitive to increases in atmospheric greenhouse gases project too much “global warming” in the future.

Natural variability, along with human changes to the earth’s environment, can combine to impact the climate on local, regional, and even global scales. Understanding the interplay between these influences is part of active research throughout the world. The results of this research can help guide us in how to best be prepared for our current and future climate. It is not so much global climate than is important to our daily lives, but rather local and regional climate. That NOAA can inform us about local and regional climate trends, then we can make decisions with that information. However, information about future climate which is not accompanied with the appropriate level of uncertainty (an area in which the NOAA report is deficient) can lead us into wrong decisions—decisions which may ultimately be detrimental to our overall health and welfare.
TALKING POINTS ON NOAA 2009 REPORT

by Willie Soon  |  August 2, 2010

(1) The findings are not new and fully expected, being published for the last 21 years.

(2) The report is supposed to summarize what is observed, highlighting major, non-science meteorological (not climatic!) events for 2009, pushing the “CO2/Global Warming” agenda. The reflected the governments’ inability to accept the fact that the trend and tendency of the surface, atmospheric and oceanic temperature data -- or even the more limited ocean heat content data from ARGO -- consistently point to non-warming stasis for at least the last 10 to 15 years.

   It is important to note that this is supposed to be a weather report not an attribution and conclusion about climate change, especially about rising atmospheric CO2---if indeed we are allowed to do that, then one must surely conclude that atmospheric CO2 did not caused the globe to not warm, period!

   Interestingly, Dr Peter Stott, head of climate monitoring and attribution at the Met Office, said "greenhouse gases are the glaringly obvious explanation" for the 1F (0.56C) rise in average global temperatures over the past 50 years. "Despite the fact people say global warming has stopped, the new data, added on to existing data, gives us the greatest evidence we have ever had," he said.

   Why insist on a 50-year long trend, when the last 10 to 15 years are showing trends of non-global warming? This will continue to be a crucial key question.

(3) It is obvious this "news" was generated due to serious concerns about the public's growing understanding of the socio-political agendas in play.

   A quote from the news release tells suggests the reason the sudden need of publicity for this routine State of the Climate Report: “ Climate change sceptics have questioned global warming in the wake of the ‘climagate’ scandal. It was claimed that emails stolen from the University of East Anglia show scientists were willing to manipulate the land surface temperatures to show global warming. The scientists were cleared in an independent inquiry.” This is, of course, nonsense.

(4) It should be noted that in parallel to NOAA, EPA also released "EPA Rejects Claims of Flawed Climate Science" yesterday (July 29th, 2010). This “news” event is surely not coincidental since all 11 volumes of EPA reply to criticisms and challenges to its Endangerment Findings were already here for at least 3 months -- http://epa.gov/climatechange/endangerment.html #comments.
Another telling aspect of the NOAA Report is the seemingly obligatory pronouncement that the report reflects a high number of contributors from around the world: "The report itself was authored by more than 300 scientists from every continent and from 160 research groups around the world." -- as if that makes it more believable. At the same time, no mention is given of the tens of thousands of science-qualified individuals who reject or question the alarmist claims carried in the report. They include Dr. John Christy of U of Alabama, Huntsville, Dr. Gerald (Gerry) Bell of NOAA CPC, Camp Springs, Maryland, Dr. Stanley Goldenberg of NOAA, Miami, Florida, Dr. Chris Landsea of National Hurricane Center, Miami, Florida. Scientists that are also possibly skeptical include: Dr. Wolfgang Knorr of University of Bristol, UK, Dr. John Lyman and Greg Johnson of NOAA Pacific Marine Environmental Laboratory, Seattle, WA, Dr. Igor Polyakov of IARC, University of Alaska, Fairbank, Dr. Koji Shimada of Institute of Observational Research for Global Change, Japan, Dr. Paul Stackhouse of NASA Langley, Dr. Mary-Louise Timmermans of Yale University and Dr. Ricardo Trigo of University of Lisbon, Portugal.

By contrast, here are some of the countries represented in the report having little or no resources, and little focus on weather and climate science:

Morocco, Turkey, Jamaica, Costa Rica, South Africa, Bolivia, Uruguay, Paraguay, Niger, Ecuador, Iran, Egypt, Numea, Reunion, Solomon Islands, Maurice (check the map!), Mauritius, Madagascar, Seychelles, Comores (check the Map!), and Cuba ...

A relatively large number of the scientists represent these nations: 3 from Comores, 2 from Iran, 2 from Ecuador, 2 from Reunion, 3 from Jamaica, 2 from Mauritius, 2 from Madagascar, 3 from Morocco, 5 from Costa Rica and 7 from Cuba! by sharp contrast: consider only 3 from Italy, 2 from India, 1 from Korea, 1 from Taiwan, 3 from China,1 from Sweden, 1 from France, 1 from Spain, 1 from Denmark, none from Switzerland, none from Norway.
Cover photo: Bird's eye view of NOAA site from msquare.umd.edu.